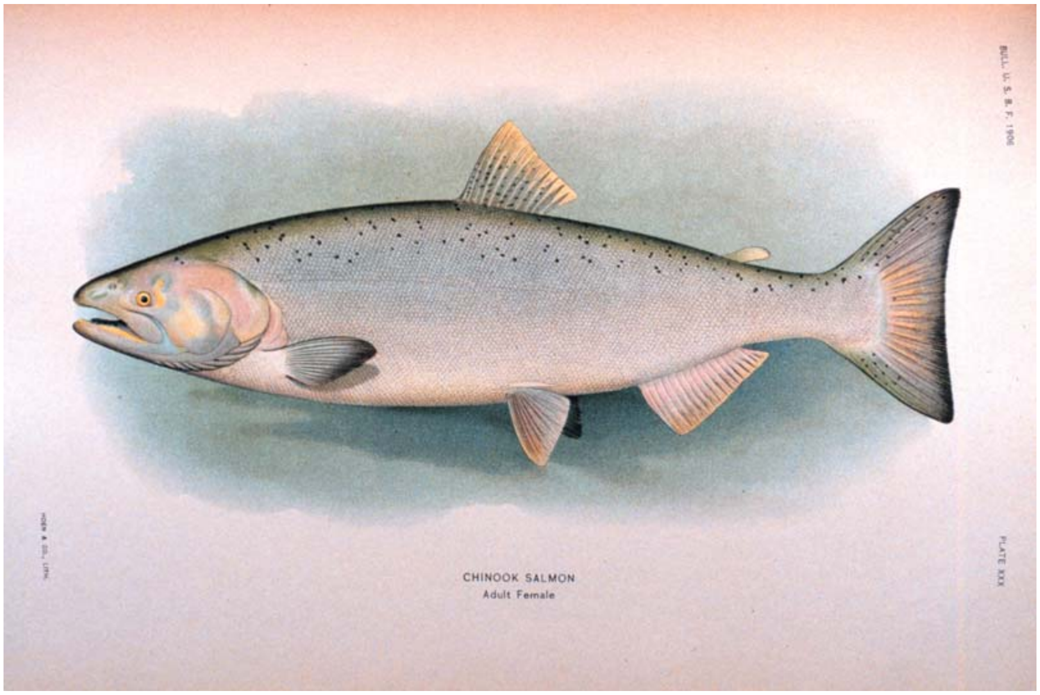
Bering Sea Chinook Salmon Bycatch Management

Draft Environmental Impact Statement/ Regulatory Impact Review/ Initial Regulatory Flexibility Analysis



North Pacific Fishery Management Council

United States Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service, Alaska Region

December 2008

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Abstract: The Environmental Impact Statement/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EIS/RIR/IRFA) provides decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. The alternatives analyzed in this EIS/RIR/IRFA generally involve limits or "caps" on the number of Chinook salmon that may be caught in the Bering Sea pollock fishery and closure of all or a part of the Bering Sea to pollock fishing once the cap is reached. These closures would occur when a Chinook salmon bycatch cap is reached, even if the entire pollock total allowable catch has not yet been harvested. This document addresses the requirements of the National Environmental Policy Act, Executive Order 12866, and the Regulatory Flexibility Act.

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EXECUTIVE SUMMARY

This Draft Environmental Impact Statement/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EIS/RIR/IRFA) provides decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative management measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. The final preferred alternative would be Amendment 91 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP). This EIS/RIR/RIFA is intended to serve as the central decision-making document for the North Pacific Fishery Management Council (Council or NPFMC) to recommend Amendment 91 to the Secretary of Commerce. The EIS/RIR/RIFA would also serve as the central decision-making document for the Secretary of Commerce to approve, disapprove, or partially approve Amendment 91, and for the National Marine Fisheries Service (NMFS or NOAA Fisheries) to implement Amendment 91 through federal regulations.

The proposed action is to amend the FMP and federal regulations to establish new measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery to the extent practicable while achieving optimum yield in the pollock fishery. The proposed action is focused on the Bering Sea pollock fishery because this fishery catches up to 95 percent of the Chinook salmon taken incidentally as bycatch in the Bering Sea and Aleutian Islands (BSAI) groundfish fisheries.

In selecting its preferred alternative, the Council must comply with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and all other applicable federal laws. With respect to the Magnuson-Stevens Act, the Council's preferred alternative must be consistent with all ten national standards. The most relevant for this action are National Standard 9, which requires that conservation and management measures shall, to the extent practicable, minimize bycatch; and National Standard 1, which requires that conservation and management measures prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry. The Magnuson-Stevens Act defines optimum yield as the amount of harvest which will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems. Therefore, the preferred alternative must minimize Chinook salmon bycatch in the Bering Sea pollock fishery to the extent practicable while achieving optimum yield from the pollock fishery. Minimizing Chinook salmon bycatch while achieving optimum yield is necessary to maintain a healthy marine ecosystem, ensure long-term conservation and abundance of Chinook salmon, provide maximum benefit to fishermen and communities that depend on Chinook salmon and pollock resources, and comply with the Magnuson-Stevens Act and other applicable federal law.

This EIS/RIR/RIFA examines four alternatives to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. The EIS/RIR/IRFA evaluates the environmental consequences of each of these alternatives with respect to nine resource categories:

- Pollock
- Chinook salmon
- Chum salmon
- Other groundfish species
- Other prohibited species (steelhead trout, Pacific halibut, Pacific herring, and crab)
- Forage fish
- Marine mammals
- Seabirds
- Essential fish habitat
- Marine ecosystem

Three chapters of this document evaluate the social and economic consequences of the alternatives with respect to four major issues:

- economic impacts and net benefits to the Nation
- Alaska Native, non-native minority, and low income populations
- directly regulated small entities
- fisheries management and enforcement

Bering Sea Pollock Fishery

The pollock fishery in waters off Alaska is the largest U.S. fishery by volume. The economic character of the fishery centers on the products produced from pollock; roe, surimi, and fillet products. In 2007, total first wholesale gross value of retained pollock was estimated to be $1.248 billion. The Bering Sea pollock fishery is divided into two seasons – the winter “A” roe (eggs) season (January 20 to June 10) and the summer/fall “B” season (June 10 to November 1), when pollock generally do not contain roe.

Until 1998, the Bering Sea pollock fishery was managed as an open access fishery, commonly characterized as a “race for fish.” In 1998, however, Congress enacted the American Fisheries Act (AFA) to rationalize the fishery by limiting participation and allocating specific percentages of the Bering Sea directed pollock fishery total allowable catch (TAC) among the competing sectors of the fishery. NMFS apportions the pollock TAC among the inshore catcher vessel (CV) sector, offshore catcher/processor (CP) sector, and mothership sectors after allocations are made to the Community Development Quota (CDQ) Program and incidental catch allowances. In this analysis, the inshore CV sector, offshore CP sector and mothership sector also are collectively referred to as the non-CDQ sectors.

The AFA also allowed for development of pollock fishing cooperatives in the non-CDQ sectors. Ten such cooperatives were developed as a result of the AFA: seven inshore CV cooperatives, two offshore CP cooperatives, and one mothership cooperative. Catcher vessels in the inshore CV sector deliver pollock to shorebased processors. Catcher/processors harvest and process pollock on the same vessel. Catcher vessels in the mothership sector deliver pollock to motherships, which are processing vessels.

The CDQ Program was created to improve the social and economic conditions in western Alaska communities by facilitating their economic participation in the BSAI fisheries, which had developed without significant participation from rural western Alaska communities. These fisheries, including the Bering Sea pollock fishery, are capital-intensive and require large investments in vessels, infrastructure, processing capacity, and specialized gear. The CDQ Program was developed to redistribute some of the BSAI fisheries’ economic benefits to adjacent communities by allocating a portion of commercially important fisheries to those communities as fixed shares of groundfish, halibut, crab, and prohibited species catch. These allocations, in turn, provide an opportunity for residents of these communities to both participate in and benefit from the BSAI fisheries. Currently, NMFS allocates 10% of the pollock TAC and 7.5% of the Bering Sea Chinook salmon prohibited species catch limit to the CDQ Program.

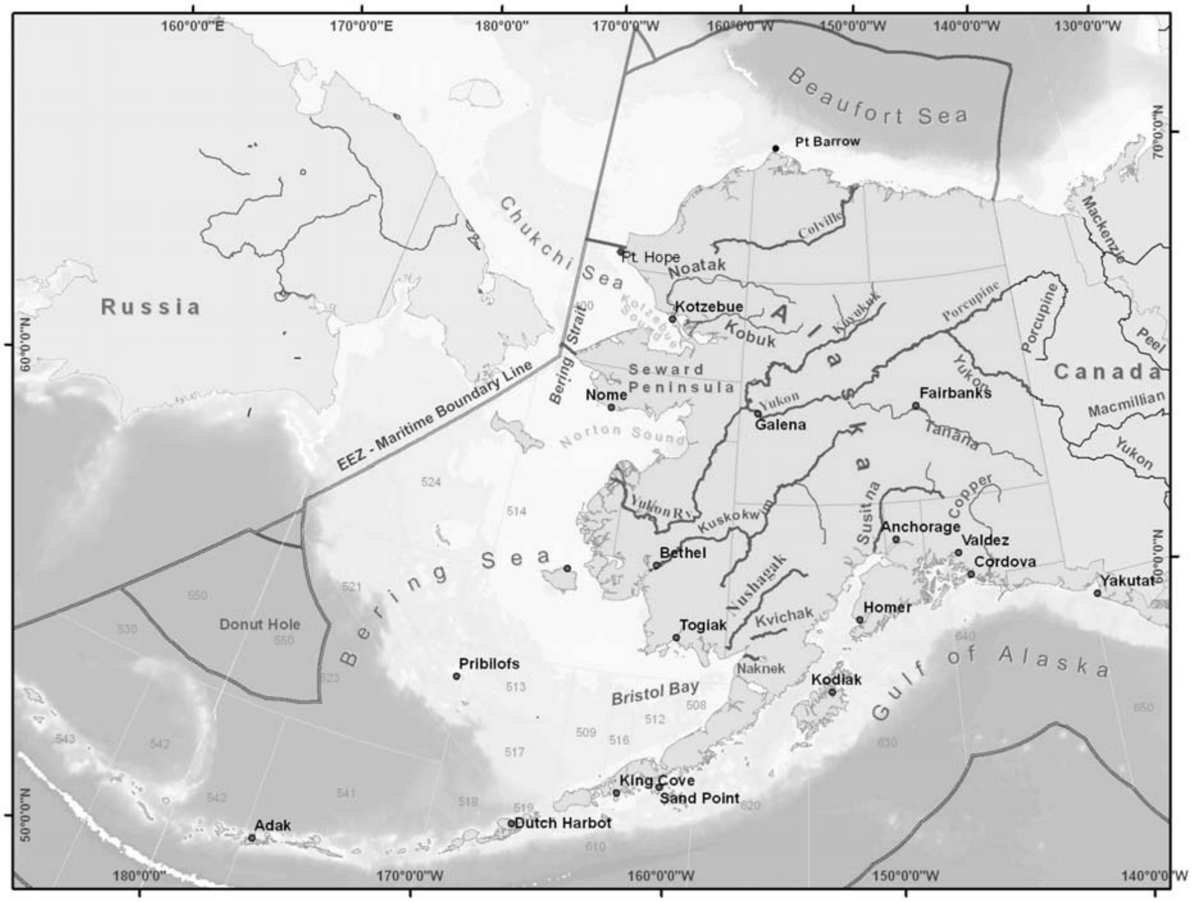

Fig.ES -1 Map of the Bering Sea and major connected salmon producing rivers in Alaska and Northwest Canada

Salmon Bycatch in the Pollock Fishery

Pacific salmon are caught incidentally in the Bering Sea pollock fishery. Of the five species of Pacific salmon, Chinook salmon (*Oncorhynchus tshawytscha*) and chum salmon (*O. keta*) are most often caught incidentally in the Bering Sea pollock fishery. Several management measures are currently used to reduce salmon bycatch in the Bering Sea pollock fishery. The Council and NMFS decided to limit the scope of this action to Chinook salmon, because Chinook salmon is a highly valued species that warrants specific protection measures. The Council will address non-Chinook salmon (primarily chum salmon) bycatch in the Bering Sea pollock trawl fishery with a separate future action. Until then, existing non-Chinook salmon bycatch reduction measures will remain in effect.

From 1992 through 2001, the annual average Chinook salmon bycatch in the pollock fishery was 32,482 Chinook salmon. Chinook salmon bycatch numbers increased substantially after 2002. The average bycatch from 2003 to 2007 was 74,067 Chinook salmon, with peak of approximately 122,000 Chinook salmon taken as bycatch in 2007. Table ES-1 shows the number of Chinook salmon taken as bycatch during the years used in this analysis, 2003 to 2007. Chinook salmon bycatch in the Bering Sea pollock fishery decreased substantially in 2008. The preliminary Chinook salmon bycatch estimate after the fishery closed on November 1, 2008, was 19,477 Chinook salmon (NMFS Alaska Region estimate on 11/6/2008).

Table ES-1 The number of participating vessels in the Bering Sea pollock fishery, the pollock total allowable catch in metric tons (t), and the number of Chinook salmon taken as bycatch, for the years analyzed, 2003 to 2007.

Year	Number of pollock fishing vessels	Pollock TAC (t)	Chinook salmon bycatch (numbers of fish)
2003	112	1,491,760	46,993
2004	113	1,492,000	51,696
2005	109	1,478,000	67,363
2006	106	1,487,756	82,647
2007	109	1,394,000	121,638

Chinook salmon taken incidentally in groundfish fisheries are classified as prohibited species and, as such, must be either discarded or donated through the Prohibited Species Donation Program. In the mid-1990s, the Chinook Salmon Savings Areas, which are large closure areas, and year-round accounting of Chinook salmon bycatch in the trawl fisheries were implemented. After several amendments to the management measures since 1995, the current regulations require that once Chinook salmon bycatch in the Bering Sea pollock fishery reaches 29,000 salmon, the Chinook Salmon Savings Areas are closed to pollock fishing. The savings areas were adopted based on areas of high historic observed salmon bycatch rates and were designed to avoid areas and times of high salmon bycatch.

The Council started considering revisions to salmon bycatch management in 2004 when information from the fishing fleet indicated that it was experiencing increases in Chinook salmon bycatch following the regulatory closure of the Chinook Salmon Savings Area. Contrary to the original intent of the savings area closure, Chinook salmon bycatch rates appeared to be higher outside of the savings area than inside the area. To address this problem, the Council examined other means to minimize salmon bycatch that were more flexible and adaptive.

Since 2006, the pollock fleet has been exempted from regulatory closures of the Chinook Salmon Savings Areas if they participated in a salmon intercooperative agreement (ICA) with a voluntary rolling hotspot system (VRHS). The fleet started the VRHS for Chinook salmon in 2002. It was intended to increase the ability of pollock fishery participants to minimize salmon bycatch by giving them more flexibility to move fishing operations to avoid areas where they experience high rates of salmon bycatch. The exemption to area closures for vessels that participated in the VHRS ICA was implemented in 2006 and 2007 through an exempted fishing permit and subsequently, in 2008, through Amendment 84 to the BSAI FMP.

In light of the high amount of Chinook salmon bycatch in recent years, the Council and NMFS are considering new measures to minimize bycatch to the extent practicable while achieving optimum yield from the pollock fishery. While the VRHS ICA reports on Chinook salmon bycatch indicate that the VRHS has reduced Chinook salmon bycatch rates compared with what they would have been without the measures, concerns remain because of high amounts of Chinook salmon bycatch through 2007.

Description of Alternatives

Chapter 2 describes and compares four alternatives for minimizing Chinook salmon bycatch, including detailed options and suboptions for each alternative.

Alternative 1: Status Quo (No Action)

Alternative 2: Hard cap

Alternative 3: Triggered closures

Alternative 4: Preliminary Preferred Alternative (PPA)

The alternatives analyzed in this EIS/RIR/IRFA generally involve limits or "caps" on the number of Chinook salmon that may be caught in the Bering Sea pollock fishery and closure of all or a part of the Bering Sea to pollock fishing once the cap is reached. These closures would occur when a Chinook salmon bycatch cap is reached even if the entire pollock TAC has not yet been harvested. The Council has identified a preliminary preferred alternative (Alternative 4) which includes a choice between two different overall Chinook salmon cap levels (68,392 Chinook salmon or 47,591 Chinook salmon). The higher cap would be available if some or all of the pollock fishery participates in a private contractual arrangement called an intercooperative agreement (ICA) that establishes an incentive program to keep Chinook salmon bycatch below the 68,392 Chinook salmon cap. The combination of the higher cap and the bycatch reduction incentive program in the ICA is intended to provide a more flexible and responsive approach to minimizing salmon bycatch than would be achieved by a cap alone. The PPA would rely on the cap to limit Chinook salmon bycatch in all years and on the ICA to keep bycatch as far as possible below the cap.

Alternative 1: Status Quo (No Action)

Alternative 1 would retain the current Chinook Salmon Savings Area (SSA) closures and the exemption for vessels that participate in the VRHS ICA. Only vessels directed fishing for pollock are subject to the SSA closures and VRHS ICA regulations. Once the pollock fleet reaches the Chinook salmon prohibited species catch limit of 29,000 Chinook salmon, the SSA areas are closed for the remainder of the season. The Chinook salmon prohibited species catch limit is apportioned to the non-CDQ and CDQ fisheries. The pollock fishery can continue to harvest pollock outside of the closed areas. Pollock vessels participating in the VRHS ICA, under regulations implemented for BSAI FMP Amendment 84, are exempt from these closures.

Alternative 2: Hard cap

Alternative 2 would establish separate Chinook salmon bycatch caps for the pollock fishery A and B seasons which, when reached, would require all directed pollock fishing to cease for the remainder of that season.

Alternative 2 contains components, and options for each component, to determine (1) the total cap amount and how to divide the total cap between the A and B season, and (2) whether and how to allocate the cap to sectors, (3) whether and how salmon can be transferred among sectors, and (4) whether and how the cap is allocated to and transferred among cooperatives.

Setting the Hard Cap

Under this alternative, the Council would choose an annual hard cap from a specified range of eight caps from 29,323 Chinook salmon to 87,500 Chinook salmon (Table ES-2). These possible cap levels were selected because they represent a range of historical averages over specified years, as described in Chapter 2.

Table ES-2 Range of Chinook salmon hard cap options, in numbers of fish

Suboption	Overall fishery cap	CDQ cap	Non-CDQ cap (all sectors combined)
i)	87,500	6,563	80,938
ii)	68,392	5,129	63,263
iii)	57,333	4,300	53,033
iv)	47,591	3,569	44,022
v)	43,328	3,250	40,078
vi)	38,891	2,917	35,974
vii)	32,482	2,436	30,046
viii)	29,323	2,199	27,124

For the analysis, a subset of four caps that include the upper and lower endpoints of the range, and two equidistant midpoints, were used to understand the impacts of Alternative 2 (Table ES-3).

Table ES-3 Range of Chinook salmon hard caps, in numbers of fish, for use in the analysis

	Chinook	CDQ	Non-CDQ
i)	87,500	6,563	80,938
ii)	68,100	5,108	62,993
iii)	48,700	3,653	45,048
iv)	29,300	2,198	27,103

Seasonal distribution of the hard cap

The annual cap would then be divided between the A and B seasons based on one of four percentage splits (Table ES-4). The suboption would allow the “rollover” of unused Chinook salmon bycatch from the A season to the B season. Rollovers are management actions by NMFS to move Chinook salmon bycatch from one account to another. In this case, rollovers could occur when a sector or cooperative has harvested all of its pollock allocation, but has not reached its A season Chinook salmon bycatch cap. With this suboption, NMFS could move that sector’s or cooperative’s unused salmon bycatch from its A season account to that sector’s or cooperative’s B season account.

Table ES-4 Seasonal distribution of caps between the A and B seasons

Seasonal Distribution Options	A season	B season
1-1	70%	30%
1-2	58%	42%
1-3	55%	45%
1-4	50%	50%
Suboption	Rollover unused salmon from the A season to the B season, within a sector and a calendar year	

Apportioning the hard cap

The hard caps could be apportioned as:

- fishery level caps for the CDQ fishery and the non-CDQ fishery;
- sector level caps for the three non-CDQ sectors: the inshore CV sector, the mothership sector, and the offshore CP sector; and
- cooperative level caps for the inshore CV sector.

A fishery level cap would be managed by NMFS with inseason actions to close the fishery once the cap was reached. The CDQ fishery caps would be allocated and managed at the CDQ group level, as occurs under status quo. The hard caps could be apportioned to sectors as sector level caps based on the percentages in Table ES-5. Non-CDQ sector level caps would be managed by NMFS with inseason actions to close the fishery once the cap was reached.

The inshore CV sector level cap could be allocated to cooperatives and the inshore CV limited access fishery. The cooperative transferable allocation amounts would be based on the proportion of pollock allocations received by the cooperatives.

Table ES-5 Sector apportionment options for the Chinook salmon bycatch cap

Options	CDQ	Inshore CV	Mothership	Offshore CP
No sector allocation	7.5 %; allocated and managed at the CDQ group level	92.5 %; managed at the combined fishery-level for all three sectors		
Option 1 (AFA pollock allocations)	10 %	45 %	9 %	36 %
Option 2a (hist. avg. 04-06)	3 %	70 %	6 %	21 %
Option 2b (hist. avg. 02-06)	4 %	65 %	7 %	25 %
Option 2c (hist. avg. 97-06)	4 %	62 %	9 %	25 %
Option 2d (midpoint)	6.5 %	57.5 %	7.5 %	28.5 %

Transfers and Rollovers

To provide sectors and cooperatives more opportunity to fully harvest their pollock allocations, the ability to transfer sector and cooperative allocations and/or rollover unused salmon bycatch could be implemented as part of Alternative 2 (Table ES-6).

If sector level caps are issued as transferable allocations, then these entities could request NMFS to move a specific amount of a salmon bycatch allocation from one entity's account to another entity's account during a fishing season. Transferable allocations would not constitute a "use privilege" and, under the suboptions, only a portion of the remaining salmon bycatch could be transferred. If NMFS issues the sector level cap as a transferable allocation to a legal entity representing all participants in that sector, that entity would then be prohibited from exceeding its allocation and would be subject to an enforcement action if it exceeded its allocation.

With the sector rollover option, rollovers would occur when a sector has harvested all of its pollock allocation but has not reached its seasonal sector level Chinook salmon bycatch cap. NMFS would move the unused portion of that sector's cap to the sectors still fishing in that season.

Table ES-6 Transfers and rollovers options

	Option	Provision		
No transfer of salmon				
Sector transfers	Option 1	Caps are transferable among sectors in a fishing season		
	Suboption	Maximum amount of transfer limited to the following percentage of salmon remaining:	a	50 %
			b	70 %
			c	90 %
Sector rollover	Option 2	NMFS rolls over unused salmon bycatch to sectors still fishing in a season, based on proportion of pollock remaining to be harvested		
Cooperative transfers	Option 1	Lease pollock among cooperatives in a season or a year		
	Option 2	Transfer salmon bycatch in a season		
	suboption	Maximum amount of transfer limited to the following percentage of salmon remaining:	a	50%
			b	70%
			c	90%

Alternative 3: Triggered Closures

Alternative 3 would establish time and area closures that are triggered when specified cap levels are reached. The cap levels for triggered closures would be set in the same way as those described under Alternative 2 and may be apportioned to sectors. Also similar to Alternative 2, the caps may be allocated to sectors as transferable allocations. Closures would be of a single area in the A season and three areas in the B season. Once specified areas are closed, pollock fishing could continue outside of the closure areas until either the pollock allocation is reached or the pollock fishery reaches a seasonal (June 10) or annual (November 1) closure date.

Management

Triggered area closures would be managed either by NMFS or by the industry through a NMFS-approved ICA. Under NMFS management, once the single trigger cap for the non-CDQ pollock fisheries was reached, NMFS would close the trigger areas to directed fishing for pollock by all vessels fishing for the non-CDQ sectors. The trigger cap allocation to the CDQ Program would be further divided among the six CDQ groups as occurs under status quo. Each CDQ group would be prohibited from fishing inside the closure area(s) once the group's trigger cap is reached.

A NMFS-approved ICA would allow the pollock industry to manage, through its contract, any subdivision of the seasonal trigger caps at the sector level, inshore cooperative, or individual vessel level. The ICA would close areas for the designated group or entity when subdivided caps established by the ICA are reached. The subdivision of the trigger caps under the ICA would not be prescribed by federal regulations. The ICA would decide how to manage participating vessels to avoid reaching the trigger closures as long as possible during each season.

Area Closures

One A season and three B season closures areas are proposed for Chinook salmon under Alternative 3. For the A season closure (Fig. ES-2), once the closure is triggered, the area would remain closed for the remainder of the season. For the B season closures (Fig. ES-3), all three areas close simultaneously. If the B season caps are reached before August 15th, the B season areas would not close until August 15th. If triggered anytime after August 15th, the area would close immediately and remain closed for the duration of the season.

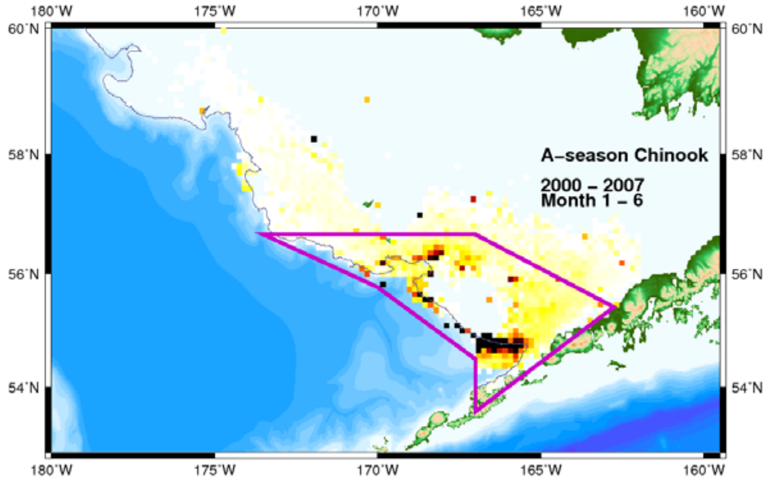

Fig. ES-2 Proposed A season area closure under Alternative 3.

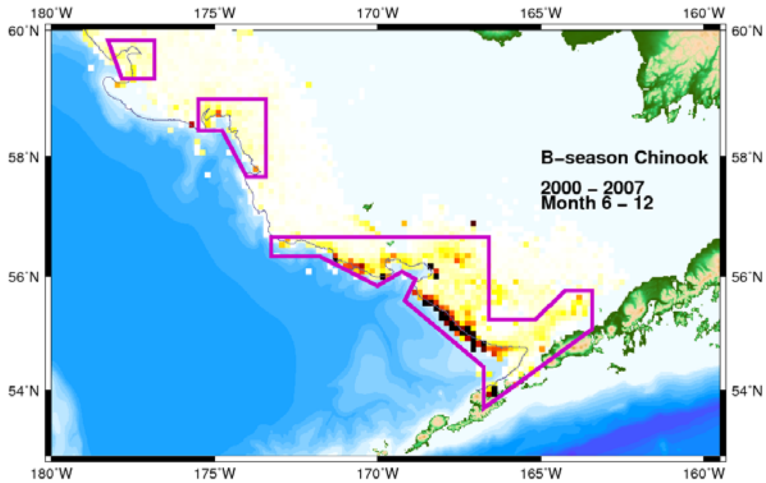

Fig. ES-3 Proposed B season area closures under Alternative 3. Note: all three areas would close simultaneously on or after August 15th.

Alternative 4: Preliminary Preferred Alternative

In June 2008, the Council developed Alternative 4 as its preliminary preferred alternative (PPA). This alternative consists of two different annual scenarios with different caps for each scenario. Under each scenario, a Chinook salmon bycatch cap is established for each pollock fishing season which, when reached, would require all directed pollock fishing to cease for the remainder of that season. Annual scenario 1 (PPA1) contains a dual cap system, with a high cap of 68,392 Chinook salmon for vessels that participate in the NMFS-approved salmon bycatch ICA which provides explicit incentives to avoid Chinook salmon bycatch ICA, and a "backstop" cap of 32,482 Chinook salmon for vessels that do not participate in the ICA. The primary purpose of the ICA is to keep Chinook salmon bycatch as far as practicable below the cap level. Annual scenario 2 (PPA2) contains a cap of 47,591 Chinook salmon and does not contain a provision for an ICA. The prescribed sector level caps (and provisions to allocate the caps as transferrable allocations and divide the sector level caps to the inshore CV cooperative level and among CDQ groups) are identical for both the PPA1 high cap and the PPA2 cap. Each cap would be apportioned seasonally 70 percent to the A season and 30 percent to the B season.

Annual Scenario 1 (PPA1)

If an ICA is in place that provides explicit incentives for each participant to avoid Chinook salmon bycatch in all years, then the overall cap would be 68,392 Chinook salmon. For each season, the high cap would be divided into separate sector level caps for the CDQ sector, the inshore CV sector, the mothership sector, and the CP sector. All Chinook salmon bycatch by vessels in these sectors that were party to the NMFS-approved ICA with incentives to reduce salmon bycatch would accrue against the sector's specific seasonal cap. If a sector forms the necessary legal entity, NMFS would issue that sector's cap as a transferable allocation. Cooperatives and CDQ groups would receive a transferable allocation. When a sector level cap or transferable allocation is reached, the sector, CDQ group, or cooperative would then be prohibited from exceeding its allocation and would be subject to an enforcement action if it exceeded its allocation..

The ICA must meet the following requirements:

- An ICA must provide incentive(s) for each vessel to avoid Chinook salmon bycatch under any condition of pollock and Chinook salmon abundance in all years.
- Incentive measures must include rewards for Chinook salmon bycatch avoidance or penalties for failure to avoid Chinook salmon bycatch at the vessel level.
- The ICA must specify how those incentives are expected to promote reductions in actual individual vessel bycatch rates relative to what would have occurred in the absence of the incentive program.
- Incentive measures must promote Chinook salmon savings in any condition of pollock and Chinook salmon abundance, such that they are expected to influence operational decisions at bycatch levels below the hard cap.
- The ICA must be available for Council and public review and an annual report to the Council would be required and must include:
    1) a comprehensive explanation of incentive measures in effect in the previous year,
    2) how incentive measures affected individual vessels, and
    3) evaluation of whether incentive measures were effective in achieving Chinook salmon savings beyond levels that otherwise would have been achieved in absence of the measures.

Sectors with transferable allocations, CDQ groups, and cooperatives could request NMFS to transfer a specific amount of a salmon bycatch allocation from that entity's account to another entity's account during a fishing season. Allocations would be fully transferable among entities.

Rollovers could occur when a sector, CDQ group, or cooperative has harvested all of its pollock allocation but has not reached its A season Chinook salmon bycatch cap. NMFS would move up to 80 percent of that sector's, CDQ group's, or cooperative's unused salmon bycatch from its A season account to that sector's, CDQ group's, or cooperative's B season account. No rollover would occur from the B season to the A season.

Table ES-7 provides the three cap amounts under Alternative 4 and the associated sector and seasonal allocations.

Table ES-7 A and B season caps, in numbers of Chinook salmon, for Alternative 4 under PPA1 and PPA2, showing both the sector allocation as a percentage and in numbers of Chinook salmon

	Annual scenario 1 (PPA1)				Annual scenario 2 (PPA2) Cap	
	High Cap		Backstop Cap			
Overall cap		**68,392**		**32,482**		**47,591**
A season allocation (70%):		47,874		22,737		33,314
CDQ	9.3%	4,452	7.5%	1,705	9.3%	3,098
Inshore CV	49.8%	23,841			49.8%	16,590
Mothership	8%	3,830			8%	2,665
Offshore CP	32.9%	15,751	92.5%	21,032	32.9%	10,960
B season allocation (30%):		20,518		9,745		14,277
CDQ	5.5%	1,128	7.5%	731	5.5%	785
Inshore CV	69.3%	14,219			69.3%	9,894
Mothership	7.3%	1,498			7.3%	1,042
Offshore CP	17.9%	3,673	92.5%	9,014	17.9%	2,556

Operations that choose not to participate in the ICA would fish under the backstop cap of 32,482 Chinook salmon. The backstop cap would not be allocated to sectors or cooperatives. Instead, it would be divided between the CDQ (2,436) and non-CDQ (30,046) fisheries. Any AFA vessels or CDQ groups not participating in the ICA would be managed as a group under the backstop cap and prohibited by NMFS from directed fishing for pollock once the backstop cap is reached. Chinook salmon bycatch by the CDQ groups, including the CDQ groups participating in the ICA, would accrue against the CDQ portion of the backstop cap. Chinook salmon bycatch by all non-CDQ vessels directed fishing for pollock, including those vessels participating in the ICA, would accrue against the non-CDQ portion of the backstop cap. This means that salmon bycatch by the ICA vessels would accrue against both the high cap and the backstop cap, but the bycatch by non-ICA participants would only accrue against the backstop cap.

During the process of writing this EIS/RIR/IRFA and describing and analyzing the PPA, three issues arose that require either clarification by the Council or modification to the PPA. Chapter 2 describes the following issues and suggests possible options for resolving them:

- Two issues related to the formation and composition of the ICA.
- The potential for the 68,392 Chinook salmon hard cap to be exceeded because, under the PPA, Chinook salmon bycatch accrues to both the high cap and the backstop cap.

Annual Scenario 2 (PPA2)

Under PPA2, the Bering Sea pollock industry would be subject to a hard cap of 47,591 Chinook salmon, regardless of whether the industry operated under an ICA with incentives to avoid salmon bycatch. The PPA2 cap would be subject to the same seasonal apportionments, sector allocations, and rollover and transfer provisions described for the PPA1 cap of 68,392 Chinook salmon (Table ES-7).

Annual Scenario 1 combined with Annual Scenario 2

If the Council chose to combine PPA1 and PPA2, the Bering Sea pollock fleet would be subject to a cap of 47,591 Chinook salmon, unless industry submits and NMFS approves an ICA which provides explicit incentives for salmon avoidance. NMFS would increase the cap to 68,392 Chinook salmon if fishery participant submits and NMFS approves an ICA meeting all of the applicable regulatory requirements. Vessels that choose not to participate in the ICA would be subject to the backstop cap.

Managing and Monitoring the Alternatives

Chapter 2 also describes how management of the pollock fisheries would change under each of the alternatives and how Chinook salmon bycatch would be monitored. Estimated costs and the impacts of these changes on enforcement of regulations governing the pollock fisheries are discussed in Chapter 10.

Each of the three alternatives to status quo include a cap on the amount of Chinook salmon bycatch that may be caught in the pollock fisheries. Under Alternatives 2 and 4, once this cap is reached, pollock fishing must stop. Under Alternative 3, reaching this cap closes certain areas important to pollock fishing. Each of the alternatives include options that would allocate Chinook salmon bycatch caps among the sectors, inshore cooperatives, and CDQ groups participating in the pollock fisheries. The use of transferable Chinook salmon bycatch allocations is a new aspect of managing the pollock fisheries that does not currently exist in these fisheries and represents the largest challenge for management and enforcement. Transferable bycatch allocations are used in other Bering Sea fisheries, such as the CDQ fisheries and the allocations to the non-AFA trawl catcher/processors under Amendment 80 to the BSAI FMP. These fisheries provide the model for NMFS's recommendations about the management and monitoring requirements that will be needed to implement the alternatives analyzed in this EIS/RIR/IRFA.

To ensure effective monitoring and enforcement of transferable Chinook salmon bycatch allocations, NMFS recommends that the following additional monitoring requirements be implemented for the inshore CV sector and the CDQ sector (if CVs that deliver to shorebased processors harvest pollock on behalf of CDQ groups in the future):

- Each CV, regardless of size, must have 100 percent observer coverage.
- Chinook salmon may be discarded at-sea only if first reported to, and recorded by, the vessel observer.
- Shorebased processor monitoring requirements may have to be adjusted to incorporate a higher standard for Chinook salmon bycatch accounting. This could include such changes as modifying observer sampling protocols, increasing the number of observers, or reducing the flow of pollock into the factory to ensure that Chinook salmon do not pass the observer's sampling area without being counted.
- Electronic (video) monitoring in lieu of observers on CVs would only be allowed after a successful, comprehensive assessment of the effectiveness of electronic monitoring to verify that Chinook salmon are not discarded before they were counted.

Existing observer coverage requirements and species composition sampling methods for catcher/processors and motherships participating in the AFA pollock fisheries, including the directed fisheries for pollock CDQ, represent NMFS's current method for estimating Chinook salmon and will be relied upon to account for and transfer allocations among industry sectors. However, the use of observer data to limit pollock fishing or to enforce overages of Chinook salmon bycatch allocations will place increased scrutiny on this bycatch estimation process and additional improvements or revisions may be needed in the future.

Alternative 4, the Council's PPA, is more complicated to manage and enforce than the other alternatives because PPA1 has two different Chinook salmon bycatch caps that could be operating at the same time, and it includes the requirement for an ICA agreement with incentives to reduce Chinook salmon bycatch below the cap levels. Under PPA1, NMFS would be required to identify which cap each of the approximately 120 vessels participating in the pollock fishery is fishing under, prior to the start of each year's fishery, attribute the catch from that vessel to the appropriate sector level cap or transferable allocation account, and monitor compliance with Chinook salmon bycatch caps for up to 36 different groups of vessels fishing under different Chinook salmon bycatch allocations. In addition, NMFS would be required to review a proposed ICA submitted by the pollock industry and approve or disapprove this proposed ICA prior to the start of the pollock fisheries.

Consequences of the Alternatives

The specific components as prescribed in Alternative 1, Alternative 4, the subset of combinations under Alternative 2, and triggered closures under Alternative 3, were analyzed quantitatively for impacts on Chinook salmon, pollock, chum salmon, and the related economic analyses. Chapter 3 describes the methodology for the quantitative analysis. For the remaining resource categories considered in this analysis, marine mammals, seabirds, other groundfish, essential fish habitat, ecosystem relationships, and environmental justice, impacts of the alternatives were evaluated largely qualitatively based on results and trends from the quantitative analysis.

The impact of alternative Chinook salmon bycatch management measures is evaluated by using the actual bycatch of Chinook salmon, by season and sector, for the years from 2003 to 2007 to estimate when alternative cap levels would have been reached and closed the pollock fishery during those years. In some cases, the alternatives and options would not have closed the pollock fisheries earlier than actually occurred during these years and in other cases the alternative and options would have closed the pollock fisheries earlier than actually occurred. This is due to the fact that the inter-annual variability is such that in some years, a sector will close for a season, while other sectors remain open (all sectors within both seasons would need to reach their cap for the fleet to reach the total bycatch cap). When an alternative would have closed the pollock fishery earlier in a given season, an estimate is made of (1) the amount of pollock TAC that would have been left unharvested and (2) the reduction in the amount of Chinook salmon bycatch as a result of the closure. The unharvested or forgone pollock catch and the salmon saved by the reduction in Chinook salmon bycatch is then used as the basis for assessing the impacts of the alternatives.

Results presented in Chapter 5 include both overall changes in Chinook salmon mortality due to alternative management measures, as well as resulting estimates of adult equivalent Chinook salmon that would return to natal rivers as adult fish (AEQ bycatch). Additional information is provided on the relative Chinook salmon and pollock catch inside and outside proposed closures in Alternative 3, however discussion of salmon saved (overall and AEQ) is limited to the cap levels as analyzed in Alternatives 2 and 4. Additional AEQ estimates as a result of continued fishing outside of the triggered closures of Alternative 3 are not evaluated due to the difficulty in modeling the potential effect of displaced effort and the resulting bycatch of specific stocks.

The RIR in Chapter 10 examines the costs and benefits of the alternatives based on the analysis in Chapters 4 and 5 that estimates the likely dates of pollock fisheries closures and thereby retrospectively projects likely forgone pollock harvest, as well as the number of Chinook salmon that may be saved under each of the alternatives due to projected fishery closures. In this way, estimates of direct costs, in terms of potentially forgone gross revenue due to unharvested pollock, may be compared to the estimated benefits, in terms of the numbers of Chinook salmon that would not be taken as bycatch. Potentially forgone pollock fishery gross revenue is estimated by tabulating the amount of pollock historically caught after a closure date and applying established sector and seasonal prices. However, it is not a simple matter to estimate changes in gross revenues due to the changes in Chinook salmon bycatch predicted under the alternatives. The analysis instead relies on AEQ estimates of Chinook salmon saved as the measure of economic benefits of the alternatives and options.

Chinook Salmon

The Chinook salmon taken as bycatch in the pollock fishery originate from Alaska, the Pacific Northwest, Canada, and Asian countries along the Pacific Rim. Estimates vary, but more than half of the Chinook salmon caught as bycatch in the Bering Sea pollock fishery may be destined for western Alaska. Therefore, this document primarily focuses on Chinook salmon bound for western Alaska. Western Alaska includes the Bristol Bay, Kuskokwim, Yukon, and Norton Sound areas, and the Nushagak, Kuskokwim, Yukon, Unalakleet, Shaktoolik and Kwiniuk rivers make up the Chinook salmon index stocks for this region. A general overview of stock status is contained in Table ES-8. Chapter 5 provides an overview of Chinook salmon biology, distribution, and stock assessments by river system or region.

Table ES-8 Overview of western Alaska Chinook salmon stock status for 2008

Chinook Stock	Total run estimated?	2008 preliminary run estimate above or below projected/forecasted	Escapement estimates?	Escapement goals met?	Stock of concern?
Norton Sound	No	NA	Yes	Infrequent	Yield concern (since 2004)
Yukon	Yes	Below	Yes	Most	Yield concern (since 2000)
Kuskokwim	Yes	Below	Yes	Yes	No Yield concern discontinued 2007
Bristol Bay	Yes	Below	Yes	Some	No

As discussed in Chapters 9 and 10, Chinook salmon support subsistence, commercial, personal use, and sport fisheries in their regions of origin. Chinook salmon serve an integral cultural, spiritual, nutritional, and economic role in the lives of Alaska Natives and others who live in rural communities. Many people in western Alaska depend on Chinook salmon as a primary subsistence food. In addition, commercial fishing for Chinook salmon may provide the only source of income for many people who live in remote villages.

Chapters 9 and 10 provide information on the major Chinook salmon fisheries that occur in the Norton Sound region, Kuskokwim area, the Yukon River, and in the Nushagak and Togiak districts of the Bristol Bay region. The State of Alaska Department of Fish & Game is responsible for managing commercial, subsistence, sport, and personal use salmon fisheries. The first priority for management is to meet spawning escapement goals to sustain salmon resources for future generations. Highest priority use is for subsistence under both State and Federal law. Surplus fish beyond escapement needs and subsistence use are made available for other uses. The Alaska Board of Fisheries adopts regulations through a public process to conserve fisheries resources and to allocate fisheries resources to the various users. Yukon River salmon fisheries management includes obligations under an international treaty with Canada. Subsistence fisheries management includes coordination with U.S. Federal government agencies where federal rules apply under the Alaska National Interest Lands Conservation Act. Subsistence salmon fisheries are an important culturally and greatly contribute to local economies. Commercial fisheries are also an important contributor to many local communities as well as supporting the subsistence lifestyle.

Chinook salmon savings

Chapter 5 analyzes the impacts of the alternatives on Chinook salmon. The first step was to predict the number of Chinook salmon saved under each alternative compared to Alternative 1, status quo. Note, these estimates are based on actual numbers of Chinook salmon taken as bycatch per year and do not represent the numbers of adult Chinook salmon expected to return to their rivers of origin (adult equivalents). The analysis of adult equivalents is the second step in the impact analysis. The third step was to analyzes the adult equivalent Chinook salmon returns to rivers of origin.

Table ES-9 shows the predicted changes in the amount of Chinook salmon bycatch under each alternative in the highest (2007) and lowest (2003) bycatch years. For each year, the table indicates the projected fleetwide bycatch, by season and annually, for Alternative 4 (PPA1 and PPA2), and the highest and lowest bycatch combinations of sector and seasonal splits under Alternative 2. The table compares the projected bycatch totals for Alternatives 2 and 4 to the actual bycatch in that year under Alternative 1, and shows the percentage reduction under Alternative 2 and 4 from the actual bycatch. Note that this analysis does not capture changes in fleet behavior since 2007 or estimate changes in behavior expected to occur in response to a hard cap.

Table ES-9 Projected fleetwide Chinook salmon bycatch (in numbers of fish), by season and annually, under PPA 1, PPA2, and the lowest and highest bycatch sector and season combinations for Alternative 2, and percentage reduction from actual bycatch under Alternative 1, for highest (2007) and lowest (2003) bycatch years.

Bycatch year	Alternative	Bycatch cap level	Projected salmon bycatch			Reduction from actual bycatch in that year
			A season	B season	Annual Total	
2007	PPA1	68,392	46,130	20,193	66,323	46%
	PPA2	47,591	32,175	14,208	46,383	62%
Actual bycatch:	Lowest 2007 Alt. 2 bycatch	29,300	2,801	6,557	9,358	92%
121,638	Highest 2007 Alt. 2 bycatch	87,500	40,415	36,828	77,243	37%
2003	PPA1	68,392	33,578	13,113	46,691	1%
	PPA2	47,591	31,520	13,113	44,633	5%
Actual bycatch:	Lowest 2003 Alt. 2 bycatch	29,300	11,550	11,084	22,634	52%
46,993	Highest 2003 Alt 2. bycatch	87,500	33,808	13,185	46,993	0

In 2007, the highest bycatch year analyzed (and the year of highest historical bycatch of Chinook salmon), PPA1 would have resulted in a 46% reduction overall in Chinook bycatch, from the actual amount caught. PPA2, with a lower cap but the same sector and seasonal partitions, would have resulted in a 62% reduction from the actual amount. For comparison against other scenarios analyzed under Alternative 2, a high of 92% reduction in Chinook salmon bycatch would have been estimated under the most restrictive cap of 29,300 Chinook salmon (with seasonal split of 70/30 and an option 2d sector split - the midpoint of historical average options and the AFA pollock allocations), while the least restrictive cap of 87,500 (with seasonal split of 50/50 and option 2a sector split - the historical average from 2004-2006) would have resulted in a 37% reduction from actual bycatch in that year.

In low bycatch years, the majority of caps under consideration have minimal impact on actual bycatch levels, as estimated annually. In 2003, the lowest bycatch year analyzed, PPA1 and PPA2 both result in small reductions from the actual bycatch in that year (1%–5% reduction, respectively), while under the highest cap under consideration (87,500), no change is predicted from Alternative 1, status quo. The lowest cap under consideration of 29,300 (split seasonally 50/50 with an option 1 sector split based on the AFA pollock allocation) provides a 52% reduction in Chinook salmon bycatch from Alternative 1.

Adult Equivalent Chinook salmon savings

The second step in the analysis uses a simulation model to compute adult equivalent impacts (AEQ bycatch) from the hypothetical bycatch numbers calculated in the first step. AEQ bycatch takes into account the fact that some of the Chinook salmon taken as bycatch in each year would not have returned to their river of origin in that year. Based on their age and maturity, they might have returned from one to four years later. Some proportion of the bycatch would not have returned in any year due to ocean mortality. AEQ bycatch estimates provide a means to evaluate the impacts to spawning stocks and future mature returning Chinook salmon.

The pattern of bycatch relative to AEQ is variable. In some years, the actual bycatch may be below the AEQ estimates, due to the lagged impact of catches in previous years. For example, in 2000, actual bycatch is below the predicted AEQ bycatch (Fig. ES-4). This is because from 1996 to 1998, the actual bycatch was high. The impacts from those high bycatch years show up in the AEQ bycatch in subsequent years.

A similar situation is predicted for the AEQ model results for 2008, because of high bycatch in previous years, especially in 2007. Although 2008 Chinook salmon bycatch was very low, compared to previous years, the impacts from 2007 bycatch will continue to be experienced in river systems for several years to come. This impact analysis does not predict impacts past 2007, however authors acknowledge that bycatch during the years 2003-2007 will continue to influence adult equivalent salmon returning to river systems for several years into the future.

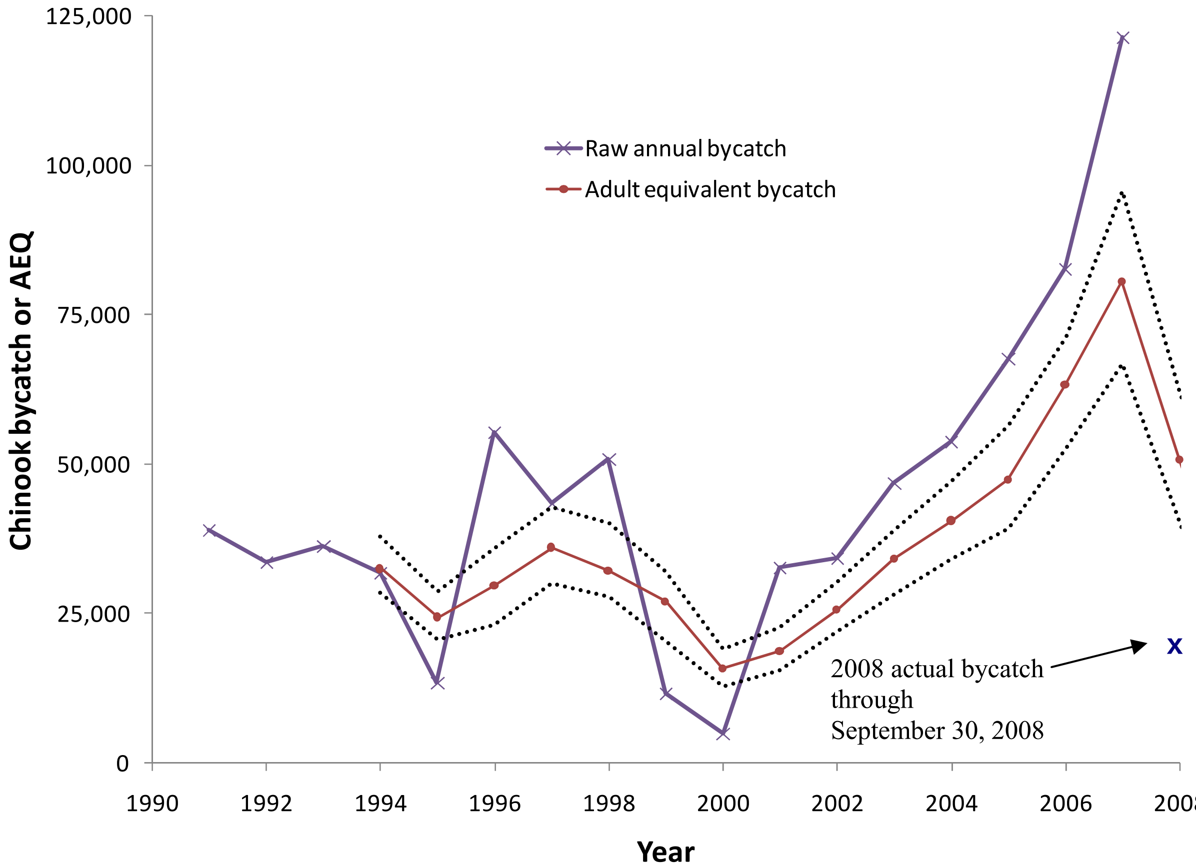

Fig. ES-4 Time series of Chinook actual and adult equivalent bycatch from the pollock fishery, 1991-2007 (2008 to date is also indicated). The dotted lines represent the uncertainty of the AEQ estimate, due to the combined variability of ocean mortality, maturation rate, and age composition of bycatch estimates.

For the PPA scenarios as well as each of the subsets (36 alternatives) analyzed under Alternative 2, if these measures had been in place (and assuming that fleet behavior in the past approximates future behavior), the results indicate that fewer Chinook salmon would have been removed from the system, except in years where bycatch level was already low, like in 2003. Table ES-10 compares the number of Chinook salmon that would have been saved in 2007, if PPA1, PPA 2, or the highest and lowest caps of comparable seasonal and sector combinations of Alternative 2 had been in place.

Table ES-10 Total projected reduction of Chinook salmon bycatch and adult equivalent salmon bycatch from the actual 2007 bycatch estimate of 121,638 Chinook salmon. Compares PPA1, PPA2, and the highest and lowest caps of comparable seasonal and sector combinations of Alternative 2.

	PPA1	PPA2	Alt2 cap 87,500 Opt2d 70/30	Alt2 cap 29,300 Opt2d 70/30
Number of Chinook salmon saved	55,307	75,306	46,766	112,647
Adult equivalent Chinook salmon saved	26,420	40,851	22,417	65,476

AEQ Chinook salmon returns to rivers of origin

The third step in evaluating Chinook salmon bycatch impacts is to relate the total AEQ salmon saved to particular river systems and regions where the Chinook salmon would returned to spawn. Applying available genetics and scale-pattern data showed that the clearest results were for western Alaska river systems. Since the genetics results are limited in the ability to distinguish among these stocks, this analysis uses the results from scale-pattern analyses to provide estimates to western Alaska rivers based on the proportional breakouts of western Alaska Chinook salmon derived from Myers et al. (2003). These values are based on medians from the simulation model and are applied to mean proportional assignments to regions within each stratum - A-season (all areas) and B-seasons (broken out geographically be east and west of 170°W long.). See Chapter 3 for methodology and Chapter 5 for detailed impacts by river system.

For the highest cap level, results suggest that over 3,000 western Alaska AEQ Chinook salmon would have been saved had those measures been in place in 2006 and 2007. Under the lowest cap level, the number of AEQ Chinook salmon saved to western Alaska rivers would have been over 26,000 in 2006 and over 33,000 in 2007. Table ES-11 shows the increases in AEQ Chinook salmon saved by river systems from the estimated AEQ returns under Alternative 1. PPA1 and PPA2 are compared against results from Alternative 2, using the option 2d sector allocations for the highest and lowest cap levels (87,500 and 29,300). The 70/30 seasonal split is used for all scenarios. Table ES-11 indicates the distribution of AEQ salmon saved to selected river systems. This shows an example for one year and a subset of caps only, additional scenarios for different caps, seasonal and sector splits, as compared against the PPA, are included in the analysis.

PPA1 provides neither the highest nor lowest reduction in adult equivalents to individual river systems, based on the range of caps under consideration. Relative impacts to individual river system are highly dependent upon where the fleet fished in a given year, as a river system’s proportional contribution to bycatch varies spatially. Thus, comparative results for the same caps and rivers of origin will be highly variable by year.

In a high bycatch year such as 2007, some management options also result in higher AEQ salmon mortalities for some systems (e.g., for a number of options for the middle Yukon and Upper Yukon rivers). Given that Chinook from these rivers tend to be found most commonly in the northwest Bering Sea during the B season, and that the proportion attributed to that stratum increases from the estimated 8% to over 44% for some options, the relative stock composition of the AEQ bycatch as a whole can change. These complexities reveal the difficulty in predicting how any management action will affect specific stocks of salmon, particularly since their relative effects appears to vary in different years.

Table ES-11 2007 projected adult equivalent Chinook salmon saved, in number of salmon, by region of origin (based on genetic aggregations). Compares PPA1, PPA2, and the Alternative 2 highest and lowest caps with comparable seasonal and sector combinations. Higher numbers indicate a greater salmon "savings", compared to Alternative 1, status quo.

Stocks of Origin[1]	PPA1	PPA2	Alt2 cap 87,500 Opt2d 70/30	Alt2 cap 29,300 Opt2d 70/30
Yukon	5,228	8,840	3,299	14,938
Kuskokwim	3,398	5,746	2,144	9,710
Bristol Bay	4,443	7,514	2,804	12,697
Pacific Northwest aggregate stocks (PNW)	8,489	11,135	9,581	15,507
Cook Inlet stocks	1,042	1,202	1,010	1,284
Transboundary aggregate stocks (TBR)	699	821	670	909
North Alaska Peninsula stocks (N.AK)	2,318	4,389	2,264	8,594
Aggregate 'other' stocks	803	1,203	646	1,837

Benefits of Chinook salmon savings

Chapter 10 analyzes the benefits of the estimated changes in Chinook salmon savings under the alternatives. The AEQ estimates represent the potential benefit in numbers of adult Chinook salmon that would have returned to individual river systems and aggregate river systems as applicable in the years 2003 to 2007. These benefits would accrue within natal river systems of stock origin as returning adult fish that may return to spawn or be caught in subsistence, commercial, or sport fisheries. Exactly how those fish would be used is the fundamental, and exceedingly difficult, question to answer in order to provide a balanced treatment of costs and benefits.

Measuring the potential economic benefit of Chinook salmon saved, in terms of effects on specific subsistence, commercial, sport, and personal use fisheries is difficult. The proportion of AEQ estimated Chinook salmon that might be taken in each of the various fisheries is a function of many variables including overall run strength, subsistence management strategies, commercial management strategies, availability of commercial markets, the effect of weather on catch (e.g. high water), and potentially, on management of other salmon runs as well. Lacking estimates of the proportion of AEQ Chinook salmon that would be caught by each user group, it is not possible to estimate economic benefits in terms of gross revenues or other monetary values for those user groups due to changes in AEQ Chinook salmon under each alternative.

Without an estimate of changes in commercial catches, it is not possible to accurately estimate changes in gross revenue for the commercial Chinook salmon fishermen from changes in AEQ Chinook salmon under the alternatives. Estimating changes in commercial Chinook salmon gross revenues would require two unrealistic assumptions. First, the analysts would have to assume the portion of the AEQ Chinook salmon that would be caught by the commercial fisheries, such as the simple assumption that the commercial fishery would catch all of the returning AEQ Chinook salmon. This assumption would not be realistic because the subsistence use of Chinook salmon has priority over commercial use. Thus, in some river systems, increases in Chinook salmon returns might be caught wholly by subsistence fishermen.

[1] For specific information on stocks included in each stock of origin grouping, see Table 3-7 in Chapter 3.

Second, to estimate changes in gross revenues, one must also make an assumption of average weight per fish and determine an appropriate average price per pound by river system. In some rivers systems, directed commercial Chinook salmon fisheries have not occurred in recent years. Thus, average weight and average price proxy values from other areas would have to be used, which creates additional uncertainty in the estimates of potential commercial value.

Further, the total social and cultural value of subsistence Chinook salmon harvests cannot be evaluated in a way that is directly comparable to the monetary value of potential increases in commercial Chinook salmon catch or forgone gross revenues from the pollock fleet. Estimates of changes to the gross revenues to the commercial Chinook salmon fishery may mask the true subsistence value; tempting the reader to focus on the monetary estimates of commercial value when the non-monetary value of subsistence harvests is very important and not reflected in terms of gross revenues.

For these reasons, this analysis of potential economic benefits is in terms of AEQ estimated Chinook salmon saved and does not provided estimates of a monetary value of the salmon saved. The first step is to evaluate, by year, the overall AEQ salmon saved for the Alternative 2 and 4 cap levels, and season and sector options, as compared to Alternative 1, status quo. Table ES-12 provides this summary comparison by indicating the percentage change in aggregate AEQ estimates of benefits under the alternatives analyzed compared to the estimated historical AEQ by year (2003-2007). This comparison shows that the AEQ benefits of the PPA scenarios range from a less than 1% change in AEQ Chinook salmon estimated for 2003, to a high of 52% more AEQ Chinook salmon estimated for PPA2 in 2007.

Four cap options for Alternative 2 with the same 70/30 seasonal splits and sector divisions (Option 2d) are compared against PPA1 and PPA2. The Alternative 2 cap level considered closest to PPA1 is 68,100 Chinook salmon. Alternative 2 at this cap level would have a similar minor benefit in 2003 but in higher bycatch years, like 2007, it would have an estimated 64% increase in benefit compared with a 34% increase for PPA1. For comparison, the highest cap of 87,500 shows a 28% increase in benefits. As with the PPA scenarios, one can see the range of values that fall in between as bycatch levels generally increased from 2003 through 2007. The highest percentage change from status quo occurs with the lowest cap considered (29,300) in the highest bycatch year (2007) which results in an estimated 83% increase in the AEQ Chinook salmon savings in that year.

Table ES-12 Percentage change in adult equivalent Chinook salmon savings from Alternative 1, status quo, between Alternative 4 (PPA) caps and closely comparable management options in Alternative 2, for the years 2003 to 2007.

	2003	2004	2005	2006	2007
Alt. 1 AEQ Chinook salmon	**33,215**	**41,047**	**47,268**	**61,737**	**78,814**
PPA1	<1%	7%	16%	22%	34%
PPA2	2%	11%	24%	40%	52%
87,500 70/30 opt2d	1%	7%	19%	21%	28%
68,100 70/30 opt2d	<1%	18%	29%	51%	64%
48,700 70/30 opt2d	12%	18%	29%	51%	64%
29,300 70/30 opt2d	42%	45%	51%	67%	83%

These results are for the total AEQ Chinook salmon saved by year to give an overall impression of the relative magnitude of effects for all river systems to compare against the constraints on the pollock fishery. Individual benefits of AEQ Chinook salmon returning to specific river systems is evaluated next, with a particular focus on river systems in western Alaska because proportional break-outs were only possible for western Alaskan-origin Chinook. Our ability to provide results relating salmon saved to specific rivers of origin is limited by the aggregate genetic data employed in this analysis. Further discussion of this is included in Chapter 3.

Table ES-11 provides an overview of the stocks of origin and the relative reduction of AEQ Chinook salmon bycatch by region of origin for a snapshot of one year (2007) for PPA1 and PPA2 compared to two caps options under Alternative 2. Results for aggregate groupings for the Pacific Northwest stocks, the North Alaska Peninsula stocks, Cook Inlet stocks, and Transboundary stocks are shown in the analysis for comparison of their relative trends by alternative. Absolute impacts of aggregate AEQ savings as noted to these rivers systems is not estimable at this time due to the genetic limitations. However results are shown for inference of trends to various regions and areas.

Thus AEQ Chinook salmon savings results are shown individually for the Yukon River, Kuskokwim River and Bristol Bay with comparison made as possible with relative catch by commercial, subsistence, and sport users over the analytical time period considered. Personal use catch is a very small component of the subsistence catch. Just as with estimating the total changes in catches in the commercial Chinook salmon fisheries from AEQ salmon saved discussed above, it is not possible, with presently available information, to determine the proportions of river specific AEQ estimates of returning adult Chinook salmon that would be caught in commercial, subsistence, and sport fisheries in these western Alaska river systems.

While it is very difficult to retrospectively assess the specific impacts or management implications of additional AEQ Chinook salmon to a given river system, it is reasonable to assume that any additional fish would benefit escapement and harvest according to the priorities outlined above. However, management decisions in the lower Yukon and Kuskokwim Rivers must be made long before adequate information on escapements is available and if additional AEQs of unknown stock origin were spread throughout the run, how management actions might specifically provide for greater stock-specific escapements is uncertain. Regardless, any additional fish in the run would presumably help to achieve escapement goals, and there is demonstrable benefit even from missing the escapement goal by a smaller amount of fish. Similarly, it is difficult to predict the impacts of additional fish to particular subsistence fishermen or even to the subsistence harvest as a whole. If escapement goals are projected to be met, it is logical that subsistence fishermen would directly benefit from increased run sizes of any magnitude.

Table ES-13 summarizes some management indices for the Yukon River, Kuskokwim River, and Bristol Bay, in conjunction with the restrictions that were imposed over the time period considered, and discusses what, if any, management changes could have been made given the projected changes in AEQ Chinook salmon returns indicated in this analysis. No subsistence fishery restriction occurred in the Kuskokwim, Yukon, or Bristol Bay from 2003 to 2007; however some fishermen reported that it took them longer to catch their needed number of Chinook salmon. There are direct cost increases associated with the need for increased time, effort, and resources (fuel, equipment wear and tear) necessary to approach individual subsistence needs. Where increases in run size contribute to achieving escapement goals and satisfying subsistence needs, one would expect some benefit to the commercial fishery as well. In the Yukon-Kuskokwim Delta, commercial fishing represents an important economic impact to local communities and in many respects, facilitates the pursuit of subsistence living with needed cash for supplies and equipment. The predicted benefits of additional AEQs to commercial fishermen may depend greatly on when the fish recruit to the fishery in relation to managers' assessments of escapement and subsistence harvest.

Table ES-13 Summary of Chinook salmon escapement goals obtained, restrictions imposed, and potential management changes with additional AEQ Chinook salmon returns to rivers over the time period from 2003 to 2007.

River	Escapement goals met from 2003-2007	Additional restrictions imposed from 2003-2007			Likely management changes if additional AEQ Chinook salmon had been available 2003-2007
		Subsistence	Commercial	Sport	
Yukon	2006-2007 some key goals not met	No	No	No	2006-2007 additional fish would accrue towards escapement; in all years increased potential for higher subsistence and commercial harvest
Kuskokwim	Most	No	No	No	Potential for increased commercial harvests within market constraints
Bristol Bay	2007 goals not met	No	No	2007	If additional Chinook salmon were sufficient to meet escapement then 2007 sport fish restriction would not have been imposed; In all years additional fish towards escapement, increased potential for higher subsistence and commercial harvest

Kuskokwim River

In the Kuskokwim River, most escapement goals were met during the period from 2003 to 2007 and there were no restrictions to subsistence or sport fisheries beyond those provided for in state regulation. If additional fish had returned in these years, the commercial harvest may have been higher in some years, though poor chum salmon markets and lack of buyer capacity may have precluded more commercial fishing. Processor capacity is expected to increase with completion of a large facility in the area in 2009, so future additional AEQ Chinook salmon returns could directly benefit commercial fishermen.

Table ES-14 provides Kuskokwim area specific catch, by harvesting sector and by year, compared to AEQ Chinook salmon estimates for PPA1, PPA2, and for high and low caps under Alternative 2. The Kuskokwim AEQ estimates for the PPA scenarios range indicates that the greatest benefit, in terms of numbers of returning adult Chinook salmon, would occur for the lower bycatch cap in years with the highest Chinook salmon bycatch. This also holds for the cap examples shown for Alternative 2. The greatest benefit, in the Kuskokwim areas, under Alternative 2 would be 9,710 more Chinook salmon returning, which occurs under the lowest cap of 29,300 and in the high bycatch years of 2006 and 2007.

Comparing these numbers to subsistence catches, which have priority over all other uses once escapements have been met, reveals that historic Kuskokwim area subsistence catches are much larger than the estimated increases in AEQ Chinook salmon returns under Alternatives 2 and 4. However, commercial and sport catches are smaller than many of the AEQ estimates, indicating potential benefits to commercial and sport fishermen in the area.

Table ES-14 Kuskokwim Area Annual Chinook Salmon Catch, by Sector, Compared to AEQ Chinook Salmon Savings Estimates for Alternatives 2 and 4 (2003-2007).

Kuskokwim Area					
Catch and AEQ Estimates	**Year**				
	2003	**2004**	**2005**	**2006**	**2007**
Commercial Catch	158	2,300	4,784	2777	179
Subsistence Catch	67,788	80,065	70,393	63,177	72,097*
Sport Catch	401	857	1,092	572	2,543*
Total Catch	68,347	83,222	76,269	66,526	74,819
PPA1	-214	384	1,269	2217	3,398
PPA2	-40	301	1,264	3,849	5,746
Alt. 2, 87,500, opt2d, 70/30	365	824	1,369	2,144	2,144
Alt. 2, 29,300, opt2d, 70/30	2,399	3,243	6,361	9,710	9,710

* 2007 data are preliminary

Note: in years when the actual bycatch was below a given cap level, this could have resulted in negative AEQ salmon savings (i.e., more, not fewer, salmon were prevented from spawning than actually occurred). This can happen when the combined cumulative effect from prior years bycatch levels are low in some seasons and sectors and high in others.

Yukon River

In the Yukon River, for the period from 2003 to 2005, most escapement goals were met and there were no restrictions to subsistence or sport fisheries. Due to generally low run sizes, commercial fisheries were managed conservatively. Any additional fish would have likely increased escapements and contributed to subsistence and commercial harvests. Sport fish harvest is fairly stable and the harvest may be impacted more by water conditions than abundance, unless restricted to meet escapement goals. In 2006 and 2007, some key escapement goals were not met, but there were no restrictions to subsistence or sport fisheries. Additional fish in these years would most likely have accrued to escapement and some additional subsistence harvest. Yukon River Chinook salmon command a high price in commercial markets, but their value to escapement and subsistence fishermen is inestimable.

Table ES-15 provides Alaska Yukon River specific catch, by harvesting sector and by year, compared to AEQ Chinook salmon estimates for PPA1, PPA2, and the Alternative 2 high and low caps. The Yukon AEQ estimates for the PPA scenarios indicates that the greatest benefit, in terms of numbers of returning adult Chinook salmon, would occur under the lower bycatch cap in years with the highest Chinook salmon bycatch. This also holds for the cap examples shown for Alternative 2. The greatest benefit, in the Yukon area, under Alternative 2 would be a savings of 14,938 Chinook salmon, which occurs under the lowest cap of 29,300 and in the high bycatch year of 2007.

Comparing Yukon AEQ numbers to subsistence catches, which have priority over all other uses once escapements have been met, reveals that historic Yukon area subsistence catches are much larger than the projected estimates of AEQ Chinook salmon returns under Alternatives 2 and 4. The same is true of historic Yukon commercial catches. However, both PPA scenarios would result in AEQ Chinook salmon estimates that are more than 10% of the commercial catch in 2007, and considerably larger than sport catch in that year. In 2006, a similar result is seen, although with a slightly smaller percentage. Thus, it is difficult to interpret the magnitude of the benefits from the projected changes to AEQ Chinook salmon.

Table ES-15 Alaska Yukon River Area Annual Chinook Salmon Catch, by Sector, Compared to AEQ Chinook Salmon Savings Estimates for Alternatives 2 and 4 (2003-2007)

Yukon River (Alaska)					
Catch and AEQ Estimates	Year				
	2003	2004	2005	2006	2007
Commercial Catch	40,438	56,151	32,029	45829	33,634
Subsistence Catch	55,109	53,675	52,561	47710	59,242
Sport Catch	2,719	1,513	483	739	960
Total Catch	98,266	111,339	85,073	94278	92,876
PPA1	-329	591	1,952	3409	5,228
PPA2	-61	463	1,944	5,921	8,840
Alt. 2, 87,500, opt2d, 70/30	561	-2	1,267	2,107	3,299
Alt. 2, 29,300, opt2d, 70/30	3,690	3,469	4,989	9,786	14,938

Note: in years when the actual bycatch was below a given cap level, this could have resulted in negative AEQ salmon savings (i.e., more, not fewer, salmon were prevented from spawning than actually occurred). This can happen when the combined cumulative effect from prior years bycatch levels are low in some seasons and sectors and high in others.

Bristol Bay

During the period from 2003 to 2006, escapement goals were achieved and no restrictions were placed on any subsistence, sport, or commercial fisheries in Bristol Bay. Though additional AEQ Chinook salmon returns would not have changed any management decisions made in those years, additional fish would have benefited all uses while providing additional escapement. In 2007, the sport fish bag limit was reduced to a single fish after July 7 for the Nushagak River. The in-river escapement goal was not achieved despite this restriction. Increased AEQ Chinook salmon returns to Bristol Bay would have mainly accrued towards achieving the in-river escapement goal, and probably would have made the Nushagak sport fish restriction unnecessary. These restrictions have immediate and lasting economic impacts due to continued perception of poor fishing and possible future restrictions. Additional fish might have provided benefits to commercial fishermen, though specific impacts are highly dependent upon the run timing of these fish.

Table ES-16 provides Bristol Bay area catch, by harvesting sector and by year, compared to AEQ Chinook salmon savings estimates for PPA1, PPA2, and Alternative 2 high and low caps. The Bristol Bay AEQ estimates for the PPA scenarios indicates that the greatest benefit, in terms of numbers of returning adult Chinook salmon, would occur under the lower bycatch cap in years with the highest Chinook salmon bycatch. This also holds for the cap levels shown for Alternative 2. The greatest benefit, in the Bristol Bay area, under Alternative 2 would be a estimate increase return of 12, 697 Chinook salmon, which occurs under the lowest cap of 29,300 and in the high bycatch year of 2007.

In the Bristol Bay area, in contrast to the Yukon and Kuskokwim areas, commercial fishing takes the largest proportion of harvestable surplus of Chinook salmon, possibly due to the presence of a large sockeye fishery. Comparing Bristol Bay AEQ numbers to catches reveals that historic Bristol Bay area subsistence and sport catches are larger than the Bristol Bay AEQ estimates under Alternatives 2 and 4, but not by as great a margin as evident in the Kuskokwim and Yukon areas. In addition, historic Bristol Bay area commercial catches are considerably larger than the estimates of AEQ Chinook salmon returns to Bristol Bay. As was the case for the Yukon; however, both PPA scenarios would result in AEQ Chinook salmon estimates that approach (PPA1) or exceed (PPA2) 10% of the commercial catch in 2007, and that are considerably larger than sport catch in that year. Thus, it is difficult to interpret just how much benefit the estimated changes in AEQ Chinook salmon returns to Bristol Bay would imply and it is variable by year and option.

Table ES-16 Bristol Bay Area Annual Chinook Salmon Catch, by Sector, Compared to AEQ Chinook Salmon Savings Estimates for Alternatives 2 and 4 (2003-2007).

Bristol Bay Area					
Catch and AEQ Estimates	Year				
	2003	2004	2005	2006	2007
Commercial Catch	46,953	114,280	76,590	106962	62,670
Subsistence Catch	21,231	18,012	15,212	12617	16,002
Sport Catch	9,941	13,195	13,036	10749	15,200
Total Catch	78,125	145,487	104,838	119579	78,672
PPA1	-280	503	1,659	2898	4,443
PPA2	-52	394	1,653	5,033	7,514
Alt. 2, 87,500, opt2d, 70/30	477	-1	1,077	1,791	2,804
Alt. 2, 29,300, opt2d, 70/30	3,137	2,948	4,241	8,318	12,697

Note: in years when the actual bycatch was below a given cap level, this could have resulted in negative AEQ salmon savings (i.e., more, not fewer, salmon were prevented from spawning than actually occurred). This can happen when the combined cumulative effect from prior years bycatch levels are low in some seasons and sectors and high in others.

Western Alaska combined

Table ES-17 combines the AEQ and catch estimates discussed above for each of the three major western Alaska river systems for which AEQ estimates are available in order to compare the aggregate effect of the alternatives on western Alaska Chinook salmon runs. Note, however, that genetic data necessary to provide separate AEQ estimates for the Norton Sound area rivers are not presently available. Thus, these estimates do not include Norton Sound.

The western Alaska total (excluding Norton Sound) AEQ estimates for the PPA scenarios range from a negative 823 Chinook salmon under PPA1, in 2003, to 22,100 Chinook salmon under PPA2 in 2007. Under the Alternative 2 cap of 87,500, the smallest increase in returns would have been 821 Chinook salmon in 2004. The greatest benefit to western Alaska, under Alternative 2, would be an estimated increase in returns of 37,345 Chinook salmon under the lowest cap of 29,300 and in the high bycatch year of 2007.

Comparing the combined total of Chinook salmon catches for western Alaska with combined total AEQ estimates reveals that total catches, which are dominated by subsistence catches, are more than ten times larger than the largest estimate of AEQ Chinook salmon returns under Alternatives 2 and 4, in all years except 2007. However, these AEQ estimates, when compared to sector level commercial harvests, can range between 10% and 40% of the total commercial catch in the highest bycatch year of 2007. Similarly, the AEQ estimates are, in some cases, comparable to sport catches. Thus, while these AEQ estimates appear small relative to the total catch, they may, nonetheless, represent measurable benefit to harvesters. The extent of that benefit is, of course dependent on which option is chosen and what level of bycatch occurred, as well as on the in-season management of the western Alaska salmon fisheries. Further, the aggregate AEQ estimates of all river systems combined produce numbers of AEQ Chinook salmon returns that are much larger than the western Alaska estimates, which represent a subset of the aggregate estimates presented in Table ES-10.

Table ES-17 Total western Alaska (excluding Norton Sound) Annual Chinook Salmon Catch, by Sector, Compared to AEQ Chinook Salmon Estimates for Alternatives 2 and 4 (2003-2007).

Total Kuskokwim, Alaska Yukon, and Bristol Bay					
Catch and AEQ Estimates	Year				
	2003	2004	2005	2006	2007
Commercial Catch	87,549	172,731	113,403	155,568	96,483
Subsistence Catch	144,128	151,752	138,166	123,504	147,341
Sport Catch	13,061	15,565	14,6	12,060	18,703
Total Catch	244,738	340,048	266,180	280,383	262,527
PPA1	-823	1,478	4,880	8,524	13,069
PPA2	-153	1,158	4,861	14,803	22,100
A2, 87,500, opt2d, 70/30	1,403	821	3,713	6,042	8,247
A2, 29,300, opt2d, 70/30	9,226	9,660	15,591	27,814	37,345

Note: in years when the actual bycatch was below a given cap level, this could have resulted in negative AEQ salmon savings (i.e., more, not fewer, salmon were prevented from spawning than actually occurred). This can happen when the combined cumulative effect from prior years bycatch levels are low in some seasons and sectors and high in others.

However, according to the Alaska Department of Fish & Game, in general, the western Alaska Chinook salmon stocks declined sharply in 2007 and declined even further in 2008. In some of these areas, the 2008 Chinook salmon run was one of the poorest on record. The 2008 preliminary total run estimates from each of these river systems were below the projected or forecasted run sizes and despite conservative management, many of the escapement goals were not met. No directed Chinook salmon commercial fisheries occurred in the Yukon River or in Norton Sound, and only small commercial fisheries occurred in the Nushagak and Kuskokwim Rivers. Sport fisheries were restricted in the Yukon, Unalakleet, and Shaktoolik Rivers. More significantly, the subsistence fisheries in the Yukon River and in the Unalakleet and Shaktoolik subdistricts of Norton Sound were restricted.

Comparison of Chinook salmon saved and foregone pollock harvest

Selection of a final preferred alternative will involve explicit consideration of trade-offs between the potential Chinook salmon saved and the forgone pollock catch. Table ES-18 compares Alternative 2 cap levels (with the sector split options from Table ES-5 and season split options from Table ES-4) with PPA1 and PPA2 for both their estimated Chinook salmon saved and the forgone pollock over the highest bycatch year analyzed (2007) and the lowest bycatch year analyzed (2003). Note that this analysis considers changes in actual Chinook salmon bycatch, not changes in AEQ bycatch.

In a high bycatch year like 2007, an estimated 92% percent reduction in Chinook salmon bycatch would have occurred under the cap level of 29,300. However this would be achieved at a reduction of 46% of the annual total pollock catch. The highest cap under consideration (87,500) would have reduced overall salmon bycatch by an estimated 37%, but with only a 22% reduction in pollock catch. The PPA falls between these high and low levels, as indicated. PPA1 would indicate a higher percentage of salmon bycatch saved than the 87,500 cap for a similar reduction in pollock catch. However, in a lower bycatch year (such as 2003), the PPA results in limited reduction in salmon bycatch and limited reduced pollock catch. In low bycatch years, only the lowest cap considered (29,300) was estimated to achieve substantial bycatch reduction.

Table ES-18 Estimated percentage of Chinook salmon saved from actual bycatch compared with the percentage of forgone pollock catch from actual catch for 2003 and 2007.

Year	Bycatch Cap level (results for specific sector and seasonal allocations)	Reduction from actual bycatch in that year	Forgone pollock catch in that year
2007 (highest) **Actual bycatch= 121,638**	68,392 (PPA1)	46%	23%
	47,591 (PPA2)	62%	32%
	Alt 2. 87,500 cap, Opt 2a, 50/50	37%	22%
	Alt. 2 29,300 cap, Opt 2d, 70/30	92%	46%
2003 (lowest) **Actual bycatch= 46,993**	68,392 (PPA1)	1%	0%
	47,591 (PPA2)	5%	4%
	Alt. 2 87,500 cap, all sector and season options	0%	0%
	Alt. 2 29,300 cap, Opt 1, 50/50	52%	22%

The analysis in Chapter 4 and 5 show that impacts of Alternatives 2 and 4, and the combination of sector and seasonal allocations under Alternative 2, on total bycatch numbers and forgone pollock would vary by year. The selection of a final preferred alternative, with specific seasonal and sector caps, will consider the tradeoffs between salmon saved and pollock forgone, understanding that the same option can have very different results in terms of forgone pollock and Chinook salmon saved in a given year compared to other years. This is due to the annual variability in the rate of Chinook salmon caught per ton of pollock and annual changes in Chinook salmon abundance and distribution in the Bering Sea.

Fig. ES-5 illustrates the relative impacts on Chinook salmon bycatch and pollock harvests had PPA1, PPA2, and the various options and suboptions of Alternative 2 been in effect from 2003 to 2007 and shows annual variability in Chinook salmon bycatch and forgone pollock for each cap level. The bottom left-hand corner represents what would be an ideal situation with zero bycatch and zero pollock “forgone” (that is, no amount of the pollock TAC left unharvested) by the commercial fishery. The higher a number or shape is on the vertical axis, the more pollock that the option would require fishermen to forgo because of the restriction on bycatch imposed by that option; the farther to the right a number’s or shape’s position, the greater the amount of Chinook salmon bycatch. Therefore, the optimal options are represented by those shapes nearest the bottom (less pollock forgone) and farthest to the left (less bycatch).

Each number represents the year in which a particular cap level (one of the four Alternative 2 hard cap scenarios in Table ES-3, with the option 2d sector split and the 70/30 season split, and assuming no transfers or rollovers), would have resulted in that level of forgone pollock and Chinook salmon bycatch.

In general, hard cap levels evaluated under Alternative 2 showed a large degree of variability in trade-offs between Chinook salmon bycatch and forgone pollock, with lower cap levels resulting in higher forgone pollock. For Alternative 2, due to other (e.g., sector allocation) constraints, the total annual bycatch caps are never reached.

The analysis shows that, overall, PPA1 (circles) resulted in lower levels of forgone pollock but higher levels of bycatch than PPA2 (triangles). For PPA1, the 68,392 cap would have only been taken in years of high bycatch, 2006 and 2007, and would have resulted in some forgone pollock in those years, although less than under PPA2 and Alternative 2 low cap combinations. In 2003 and 2004, the PPA1 cap would not have been reached, and no pollock would have been forgone. In 2005, the inshore CV sector would have reached its allocation and would have had forgone pollock. For PPA 2, the 47,591 cap resulted in bycatch levels at the hard cap in all years but had variable impact on industry's ability to catch the full pollock TAC. In years of low bycatch, PPA2 would have resulted in little or no forgone pollock. For PPA1 and PPA2, the retrospective examination shows that allowing for transferability among sectors and rollovers between seasons retains the feature of staying below the salmon bycatch cap while reducing the forgone pollock catch levels.

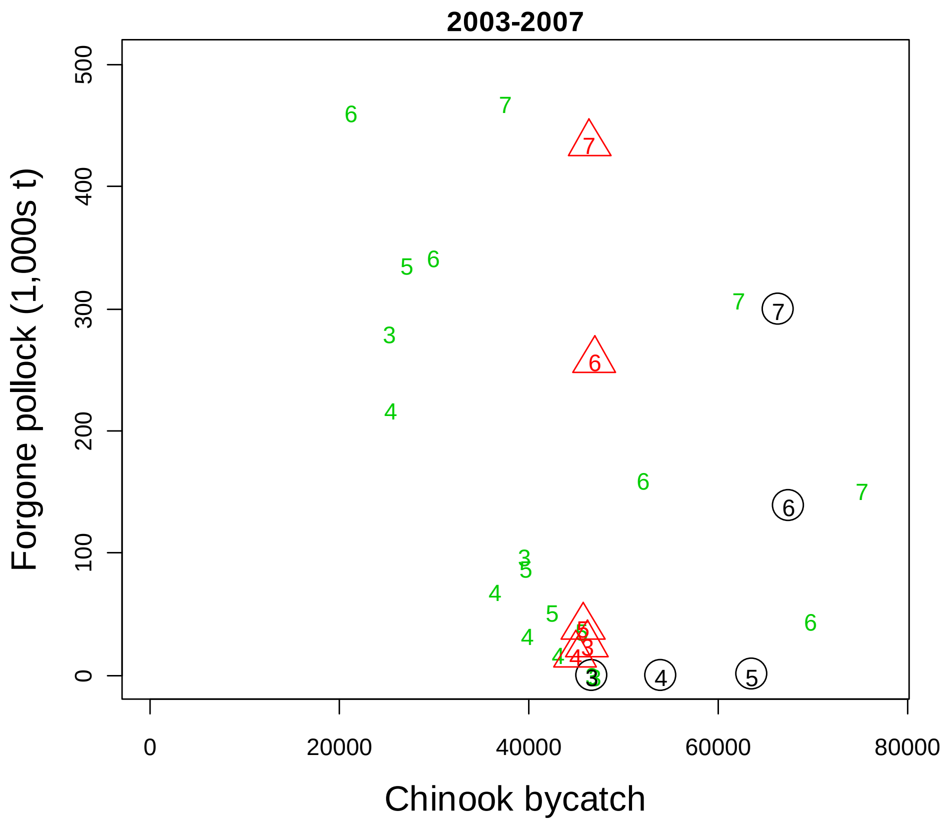

Fig. ES-5 Comparisons of hypothetical Chinook bycatch (numbers, horizontal axis) and forgone pollock (thousands of t, vertical axis) for PPA 1 (circles) and PPA 2 (triangles) assuming 80% rollover and transferability. Numbers represent the year (i.e., 6=2006, 7=2007 etc) and those not enclosed by symbols are from the four Alternative 2 hard cap options with 70/30 A-B season split and sector splits following Option 2d (CDQ=6.5 %, inshore CV=57.5 %, Motherships=7.5 %, and at-sea processors= 28.5 %).

Costs of forgone harvest in the pollock fishery

Chapter 10 provides an analysis of the costs of the alternatives to the pollock industry in terms of forgone pollock gross revenue. This analysis assumes that past fleet behavior appropriately approximates operational behavior under the alternatives and does not estimate changes in behavior. While it is expected that the fleet would change its behavior to mitigate potential losses in pollock gross revenue, explicitly predicting changes in fleet behavior in a reasonable way would require data and analyses that are presently unavailable.

Impacts by hard cap alternative (Alternatives 2 and 4) are summarized by the different components and options that define them (Table ES-19). The components and options projected to cause the greatest changes to the pollock fishery gross revenues are the overall cap level, the sector specific cap allocation, and the seasonal split. Rollovers and transfers are analyzed in conjunction with the PPA scenarios only but comparative information is provided for evaluating rollover impacts under Alternative 2.

Table ES-19 Summary of main options under Alternatives 2 and 4 and their relative scale of impact on pollock fishery gross revenues

Option	Relative economic impact on pollock industry
Cap level: 29,300-87,500	• Lowest cap leads to highest constraint on pollock fishery in all years. • In high bycatch years (e.g. 2007), even the highest cap (87,500) is constraining for the pollock fishery.
Sector allocation	• See Table ES-20 and Table ES-21
Seasonal allocation	• Higher forgone pollock revenue when seasonal allocations are lower in the A season (E.g. 50/50 and 58/42). • 70/30 seasonal split least constraining due to higher roe value in A season.
Rollover	• 80% rollover in PPA scenarios mitigates forgone revenue impacts in B season.
Transferability	• Full transferability mitigates forgone revenue impacts in the A season

Summarizing the relative impacts of sector allocations (comparing Alternative 2 with Alternative 4) is difficult due to the complexity of the sector allocation options in Alternative 2. In order to summarize some of the differences in the Alternative 2 sector splits options and the sector split in Alternative 4, a comparison is made with the Alternative 2 option 2d (midpoint between the AFA pollock allocations and the historical averages). Table ES-20 shows the different the sector split between the two alternatives.

Table ES-20 Comparison of sector allocations under Alternative 2, option 2d and Alternative 4 (PPA)

Alternative	CDQ	Inshore CV	Mothership	Offshore CP
Alternative 2: option 2d (midpoint)	6.5%	57.5%	7.5%	28.5%
Alternative 4 PPA: A season	9.3%	49.8%	8.0%	32.9%
B season	5.5%	69.3%	7.3%	17.9%

The Alternative 2 cap levels of 68,100 Chinook salmon and 48,700 Chinook salmon, with the 70/30 seasonal split and option 2d sector split, are compared with Alternative 4 PPA1 and PPA2. Full A season transferability is assumed for Alternative 4. While transferability is an option under Alternative 2, for this comparison, it was assumed that transferability was not allowed. Impacts on forgone gross revenue (millions $) by sector are shown for 2007 (Table ES-21, Table ES-22).

Table ES-21 2007 estimated forgone gross revenue by sector for Alternative 2, option 2d (70/30 season split, cap 68,100), compared with PPA1 (cap 68,392) (in millions of $).

Sector		**CDQ**	**Inshore CV**	**Mothership**	**Offshore CP**	**Total**
Alternative 2: option 2d						
	A season	$0	$124.7	$20.7	$108.1	$253.5
	B season	$2.2	$37.5	$1.5	$3.6	$44.7
Total Alternative 2		$2.2	$162.2	$22.2	$111.7	$298.2
Alternative 4: PPA1						
	A season	$0	$114.0	$12.0	$105.0	$231.0
	B season	$3.0	$33.0	$2.0	$18.0	$57.0
Total Alternative 4		$3.0	$147.0	$14.0	$123.0	$288.0

Total forgone gross revenue is less under PPA1; however forgone gross revenue for the pollock fleet varies by sector between the two alternatives in terms of overall gains and losses. The CDQ sector has a higher forgone gross revenue under PPA1, due to the lower B season sector allocation. The inshore CV sector has a lower annual forgone gross revenue under PPA1 and lower seasonal forgone revenue in both A and B seasons as compared with Alternative 2, option 2d. The Mothership sector also has a lower annual forgone gross revenue under PPA1, driven substantially lower A season forgone gross revenue. The CP sector has a higher forgone gross revenue under PPA1, driven primarily by the lower B season allocation.

Table ES-22 2007 estimated forgone revenue for Alternative 2, option 2d (70/30 season split, cap 48,700) compared with PPA2 (cap 47,591) (in millions of $).

Sector		**CDQ**	**Inshore CV**	**Mothership**	**Offshore CP**	**Total**
Alternative 2: option 2d						
	A season	$22.2	$185.6	$34.5	$142.4	$384.7
	B season	$3.9	$50.2	$3.1	$11.3	$68.4
Total Alternative 2		$26.1	$235.8	$37.6	$153.7	$453.1
Alternative 4: PPA2						
	A season	$12.0	$160.0	$29.0	$141.0	$341.0
	B season	$4.0	$42.0	$3.0	$26.0	$76.2
Total Alternative 4		$16.0	$202.0	$32.0	$167.0	$417.2

Total forgone gross revenue is less under PPA2 than Alternative 2 option 2d; however forgone gross revenue for the pollock fleet varies by sector between the two alternatives in terms of overall gains and losses. The CDQ sector has a lower forgone gross revenue under PPA2, due to the higher relative A season sector allocation. The inshore CV sector has a lower annual forgone gross revenue under PPA2 and lower seasonal forgone gross revenue in both A and B seasons as compared with Alternative 2, option 2d. The Mothership sector also has a lower annual forgone gross revenue under PPA2, driven by the lower A season forgone gross revenue under the PPA2. The CP sector has a higher forgone gross revenue under PPA2, driven primarily by the lower B season allocation under the PPA.

Effects of Alternative 3 on Chinook salmon savings and pollock fishery gross revenues

Alternative 3 closes a large scale area rather than the whole fishery when specified cap levels are reached. The relative impacts of the cap levels themselves on salmon saved and AEQ by river of origin are equivalent to those described in Alternatives 2 and 4. However, for Alternative 3, there is some potential for the levels of estimated bycatch to be higher than the cap given that once the cap is reached and the area closure is triggered, fishing may continue outside of the closure.

By design, the Alternative 3 trigger areas represent regions where on average (2000-2007) 90% or more of the bycatch by season was taken. In the A season, since 1991, the areas have comprised 72-100% of the bycatch. In the B season since 1991, with the exception of 2000 when there was an injunction on the pollock fishery, the areas have comprised between 68-98% of the Chinook salmon bycatch. In the most recent years evaluated (2006-2007), both A and B season areas have represented between 97-99% of the total Chinook salmon bycatch by season. Thus, while the fleet can continue to fish outside of the closed area and potentially continue to catch Chinook salmon as bycatch, based upon recent averages, it is not anticipated that there will be appreciable bycatch outside of the area following a closure.

To determine the effects of the triggered closure areas on Chinook salmon bycatch, the analysis in Chapter 5 estimates changes to pollock catch and Chinook salmon bycatch within and outside the trigger-closure area in each of the years 2003-2007. That methodology has estimated the numbers of Chinook salmon that are potentially saved by moving effort outside of the closure. These estimates are based on changed catch rates of Chinook salmon inside and outside the area closures. The AEQ analysis presented previously in the discussion of Alternatives 2 and 4 has not been specifically re-created for the trigger-closure analysis at this time, thus it is not possible to relate these savings in Chinook salmon to total AEQ estimates or to specific western Alaska River systems.

Salmon Savings under Alternative 3

The maximum Chinook salmon bycatch reduction under Alterative 3, of 40,311 fish, would come from the lowest cap in the highest bycatch year (2007) and occurs for all but the 70/30 split, which had 36,899 Chinook saved. Thus, the 70/30 split reduces estimated Chinook savings overall in all years under the 29,300 trigger. In the low bycatch year of 2004, the maximum Chinook savings under the trigger-closure with the 29,300 cap is 5,224 fish and is greatest under the 50/50 split option. In general, in the more moderate bycatch years the 50/50 split results in the greatest Chinook savings under both the 29,300 and 48,700 triggers. Note, however, that the 48,700 trigger level is not estimated to save any Chinook salmon in 2004. Further, the higher triggers are only expected to save salmon in the highest bycatch years of 2006 and 2007. Under the high trigger of 87,500, the maximum Chinook salmon saved would have come from the 50/50 split and would have been 12,098 and 15,088 in 2006 and 2007, respectively.

B season Chinook savings show a different pattern than in the A season. As expected, the maximum number of Chinook saved, 36,290 comes from the lowest trigger of 29,300 fish in the highest overall bycatch year (2007), and from the 70/30 split. However, even the 87,500 trigger with the 70/30 split is expected to save Chinook salmon with savings of 2,680, 11,300 and 20,322 expected for 2004, 2005, and 2007 respectively. There are some instances when the trigger closure is shown to produce a negative savings of Chinook salmon. That finding implies that in some years, the catch rate of Chinook outside the B season triggered closure area is actually higher than inside of it. In the 2005 season this would have been the case under a 48,700 trigger with either the 58/42 or 55/45 season splits and with a 70/30 season split under the 68,100 trigger.

Revenue at Risk under Alternative 3

While the hard caps of Alternative 2 have the potential effect of fishery closure and resulting forgone pollock fishery gross revenues, the triggered closures do not directly create forgone earnings, but rather, they place revenue at risk of being forgone. When the closure is triggered, vessels must be relocated outside the closure areas and operators must attempt to catch their remaining allocation of pollock TAC outside the closure area. Thus, the revenue associated with any remaining allocation is placed at risk of not being earned, if the fishing outside the closure area is not sufficiently productive to offset any operational costs associated with relative harvesting inefficiencies outside the closure area.

The data show that in the highest bycatch years and under the most restrictive trigger levels, gross revenue at risk for the pollock industry would be about $485 million in the A season for all vessels combined. That represents 77% of the 2007 estimated total A season first wholesale gross revenue of the pollock fleet. As the trigger amount is increased, the impacts decrease; however, the least restrictive A season trigger (70/30 season split) of 87,500 Chinook salmon cap still results in $125.2 million in gross revenue at risk, or about 21% of the overall first wholesale gross revenue of all pollock vessels combined. In lower bycatch years (e.g., 2003, 2004, and 2005), the larger triggers of 87,500 Chinook salmon cap and 68,100 Chinook salmon cap do not cause triggers to be hit, and thus, there is no gross revenue placed at risk. However, in the low bycatch year of 2004, the lowest trigger of a 29,300 Chinook salmon cap would place $33.2 million (70/30 season split) to $97.4 million (50/50s season split) of gross receipts at risk. These values are 11% and 31% of total pollock gross revenue, respectively.

The gross revenue placed at risk in the B season is greatest under the 70/30 season split and is as much as $117.38 million in the worst case (2006, 29,300, 70/30), or 17% of total B season pollock gross revenue. At the 29,300 trigger, and 70/30 season split, the B season revenue at risk remains above 15% in all years except 2003. Even under the 87,500 trigger with a 70/30 season split, more than $50 million, or 8% of total first wholesale gross revenue, would have been placed at risk in 2007. Ignoring the 2007 year, however, only the 29,300 trigger generates gross revenue at risk in excess of 10% of total first wholesale gross value in the pollock fishery.

Pollock stocks

Chapter 4 analyzes the impacts of the alternatives on pollock stocks. Analysis of Alternatives 2, 3, and 4 indicate that salmon bycatch management measures that would be implemented under each of these alternatives would make it more difficult to catch the full TAC for Bering Sea pollock. Catching less pollock than authorized under the TAC would reduce the total catch of pollock and reduce the impact of fishing on the pollock stock. However, these alternatives are likely to result in fishermen shifting where they fish for pollock to avoid Chinook salmon bycatch. Changes in where pollock fishing occurs may change the size or age of pollock caught which may, in turn, impact the pollock stocks.

Hard caps under Alternatives 2 or 4 may result in the fishery focusing on younger ages of pollock than otherwise would have been taken. Changes in fishing patterns could result in lower acceptable biological catch and TAC levels overall, depending on how the age composition of the catch changed. Seasonal data of the size at age of pollock caught show that early in the season, the lengths-at-age and especially the weights-at-age are smaller. Should the fishery focus effort earlier in the B season then the yield per individual pollock will be lower. Spatially, a similar tendency towards smaller pollock occurs as the fleet ventures further from traditional fishing grounds. However, these changes would be monitored and incorporated in future stock assessments. Conservation goals of maintaining pollock spawning biomass would remain central to the stock assessments that will be used as a basis for setting future pollock TACs. Any changes in the size or age of pollock caught would be eventually accounted for in the stock assessment analysis since updated mean weights-at-age are computed. Smaller fish-at-age would likely result in a lower acceptable biological catch and TAC in future years but this would be accounted for in the present quota management system which is designed to prevent overfishing. Therefore, the risk to the pollock stock from changes in where pollock are caught as a result of any of the alternatives would be minor.

The impact of Alternative 3 (triggered closures) on pollock fishing was evaluated in a similar way. The assumption that the pollock TAC may be fully harvested depends on the difficulty in finding pollock after the closure areas are triggered. The data show that in some years, the catch rate is consistently higher outside of the trigger area whereas in other years it is consistently lower for at-sea processors and inshore CVs and for the fleet as whole. The impact of a triggered area closure depends on when the closure occurs, and the spatial characteristics of the pollock stock, which, based on this examination, appears to be highly variable between years. As with the evaluation of hard caps, under Alternatives 2 and 4, the same impacts under triggered closures (Alternative 3) would apply: it seems likely that the fleet would fish earlier in the summer season and would tend to fish in places further away from the core fishing grounds north of Unimak Island. Both of these effects likely would result in catches of pollock that were considerably smaller in mean sizes-at-age. This impact would, based on future assessments, likely result in smaller TACs since pollock harvests would not benefit from the summer-season growth period.

Chum salmon

Chapter 6 analyzes the impacts of the alternatives on chum salmon. As noted earlier chum salmon is also caught incidentally by the pollock fishery, and while additional management measures will be evaluated at a later time by the Council specific to chum salmon management, alternatives which close the pollock fishery for reaching Chinook salmon caps also potentially impact the amount of chum salmon taken by the fleet. Historical temporal and spatial trends in chum bycatch are described in Chapter 6. Chum salmon are caught almost exclusively in the B season.

As with the pollock and Chinook salmon analysis, chum salmon bycatch levels were tabulated on a fleetwide basis given estimated closure dates for the years from 2003 to 2007. Impacts were evaluated three ways: hard caps alone; caps in combination with triggered area closures; and the possible effect of concentrating effort earlier in the B season so that Chinook salmon bycatch could be minimized.

Alternative 2 and 4 cap levels resulted is some reduction in overall chum salmon catch by year. The overall estimated reduction ranged from 34% in some years under the lowest cap (29,300) to no impact (i.e. no reduction in chum salmon catch) under the highest cap (87,500) in some years. Often impacts of each alternative on actual chum bycatch levels by year and scenario are low due to the fact that the closure constraint on the fishery occurs after the time period in which most of the chum in that year had already been caught. Results for the PPA scenarios indicate that chum bycatch reduction would have been minimal in most years. Results from examinations of planned shortened season lengths were variable, but resulted in about the same overall amounts of bycatch than if the season had not been shortened. Information was not sufficient to carry the impact analysis of chum further than tabulating specific reduction in numbers, i.e. AEQ levels for chum were not estimated at this time.

Other groundfish

Chapter 7 analyzes the impacts of the alternatives on other species caught as bycatch in the pollock fishery; groundfish, prohibited species, and forage fish. Other groundfish species include Pacific cod, flathead sole, rock sole, squid, arrowtooth flounder, Atka mackerel, Pacific ocean perch, yellowfin sole, and rockfish species.

Neither of the hard cap alternatives considered (Alternative 2 or 4) would be expected to drastically change the impact of the pollock fishery on other groundfish as compared to status quo. Groundfish fishery management, which maintains harvests at or below the TAC and prevents overfishing, would remain the same under any of the hard caps under consideration. The rate and type of incidentally caught groundfish are expected to vary largely in the same manner as the status quo. To the extent that the alternatives close the pollock fishery before the TAC is reached, the incidental catch of groundfish could diminish in relative amounts and perhaps in numbers of species. Under the PPA, the fleet would not be expected to fish for extended periods in areas marginal for pollock, and thus is not expected to incur radically different incidental catch. If a hard cap closes the pollock fishery especially early in the fishery year, the fleet may increase focus on alternate fisheries to attempt to make up for lost catch.

Under Alternative 3, assuming that closures are driven by an association of a high concentration of pollock and Chinook salmon, displacing the fleet from that area and allowing the fishery to continue elsewhere may shift incidental groundfish catch from the current patterns. The degree to which incidental groundfish catch will vary in relation to status quo depends on the selected closed areas and the duration of the closures. To the extent that Alternative 3 displaces the pollock fleet away from the center of pollock concentration and into the other groundfish preferred habitat, change would occur in incidental groundfish species catch.

Other prohibited species and forage fish

Chapter 7 also evaluates the impacts of the alternatives on other prohibited species (i.e. besides Chinook and non-Chinook salmon which are examined separately) and forage fish. The extent to which the alternatives would change the catch of steelhead trout, Pacific halibut, Pacific herring, red king crab, Tanner crab, and snow crab is unknown but existing prohibited species catch limits and area closures constrain the catch of these species in the pollock fishery and this limits the impacts on those species.

Forage fish (primarily capelin and eulachon) are not anticipated to be impacted adversely by these alternatives. If Alternatives 2, 3, and 4, constrain the pollock fishery, that would reduce fishing effort and the associated incidental catch of forage fish.

Other marine resources

Chapter 8 analyzes the impacts of the alternatives on marine mammals, seabirds, essential fish habitat, and ecosystem relationships. Potential impacts of the alternatives on marine mammals and seabirds are expected to be limited to incidental takes, effects on prey, and disturbance. Effects on prey could be direct effects by competing with seabirds and marine mammals that depend on pollock and salmon or indirect effects on the benthic habitat that may support benthic prey in areas where seabirds and marine mammals forage in the bottom habitat. The preferred alternative (Alternative 4) as well as other hard cap alternatives under consideration (Alternative 2), would potentially lead to a decrease in the incidental takes of marine mammals and seabirds due to relative constraints by season on the pollock fishery.

Alternative 3 could impact some marine mammals if the fishery were shifted northward outside of the large scale area closure. However, the current protection measures and area closures for marine mammals remain in place, and reduce the interaction with Steller sea lions, and northern fur seals and other marine mammals occurring in the closure areas. The overall effect of shifting the pollock fishery and the resulting incidental takes and disturbance of seabirds and marine mammal species such as ice seals, killer whales, Dall’s porpoise, and whales is unknown given the lack of precise information in these regions. A northward shift in the pollock fishery outside of the triggered closure is not likely to affect the interaction with Steller sea lions as they are taken in both the southern and northern portion of the Bering Sea.

Potential impacts of the alternatives on seabirds are expected to be limited. Alternative 4 and Alternative 2 could potentially lead to a decrease in the incidental takes of seabirds if seasonal caps close the pollock fishery earlier than would have occurred with no cap. Under Alternative 3, the overall effect of shifting the pollock fishery and the resulting incidental takes of seabirds is unknown given the lack of precise information about potential seabird bycatch in these regions.

The total amount of pollock harvested may decrease under the alternatives and options which restrict the pollock fishery. Under each alternative, the impact of the pollock fishery on Essential Fish Habitat is not expected to change beyond those previously identified in the Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska (NMFS 2005).

The alternatives are not predicted to have additional impacts on ecosystem relationships beyond those identified in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007a). The pollock fisheries, as prosecuted under Alternative 1, would have similar ecosystem impacts as analyzed in the Harvest Specifications EIS. Alternatives 2 and 4, to the extent that they prevent the pollock fleet from harvesting the pollock TAC and therefore reduce pollock fishing effort, would reduce the pollock fishery's impacts on ecosystem relationships from status quo. It is not possible to predict how much less fishing effort would occur under Alternatives 2 and 4 because the fleet will have strong incentives to reduce bycatch through other means, such as gear modifications and avoiding areas with high salmon catch rates, to avoid reaching the hard cap and closing the fishery. And, depending on the extent vessels move to avoid salmon bycatch or as pollock catch rates decrease, pollock trawling effort may increase even if the fishery is eventually closed due to a hard cap. Since the total amount of pollock harvested and the total effort would not change under Alternative 3, it is reasonable to conclude that the overall impacts on ecosystem relationships would be similar to Alternative 1. As with Alternative 2, fishing effort may increase as vessels move to avoid salmon bycatch or as pollock catch rates decrease.

Environmental Justice

Chapter 9 analyzes the Environmental Justice impacts of the alternatives. The key factor in an environmental justice analysis is the disproportionality of adverse impacts on identified minority or low-income populations in the U.S., whereas adverse impacts that fall more generally on all populations are not considered for an environmental justice analysis. Significant proportions of the populations in the impacted area are low income and Alaska Native. Minority populations work aboard factory trawlers and in on-shore processing plants. Native American tribes in Northwest Washington, coastal Oregon, and along the Columbia River may be adversely affected by Chinook salmon bycatch. Changes in salmon bycatch and returns may affect populations in western Alaska and the Pacific Northwest; changes in pollock harvests may affect minority populations working in the pollock industry and populations in western Alaska who benefit from CDQ group activities. Populations in western Alaska may also be affected if alternatives induce changes in the way pollock vessels interact with other resources, including chum (and other) salmonid species, marine mammals, seabirds, essential fish habitat, other groundfish species, forage species, and other prohibited species.

As discussed in Chapter 9, Chinook salmon are extremely important to subsistence and commercial fishermen. Alternatives 2 and 4 (hard caps) which restrict the seasonal and annual total removals of Chinook salmon (and resulting AEQ by river system) would benefit subsistence and commercial users on these river systems by increasing the proportion of fish that would have returned in some years and thus potentially increasing the amount available for subsistence and commercial harvest. Actual estimates of AEQ by river system vary by alternative (and by availability of appropriate genetic information). Some alternatives may actually increase the region-specific bycatch by river system in some years depending upon the spatial concentration of the fishing effort in that year.

Directly Regulated Small Entities

Chapter 11 contains an IRFA which evaluates the impacts of alternatives on directly regulated small entities. The IRFA is prepared to comply with the requirements of the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA). The only small entities directly regulated by the action are the six western Alaska CDQ groups. This IRFA is preliminary until NMFS develops the implementing regulations for this action.

Areas of controversy and issues yet to be resolved

Chinook salmon bycatch in the Alaska groundfish fisheries has long been and will remain a highly controversial subject. Chapter 1 and the Scoping Report prepared for this EIS identify the issues with Chinook salmon bycatch in the pollock fishery raised by the public. The scoping report is summarized in Chapter 1 and available on the NMFS Alaska Region web site at:

http://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm

Many of the issues highlight areas of on-going controversy which, though informed by analyses such as this one, are not totally resolved. Differences of opinion exist among various industry, Alaska Native, environmental, management, and scientific groups as to the appropriate levels of Chinook salmon bycatch. Areas of controversy primarily focus on the effects of Chinook salmon bycatch and the pollock fishery on the ten major resource components analyzed in this EIS. The most controversial of these are the effects of Chinook salmon bycatch on Chinook salmon stocks and the people, tribes, and communities that rely on Chinook salmon for their cultural and economic livelihoods.

The predominant area of controversy and issue yet to be resolved revolves around scientific uncertainty regarding the source of origin of Chinook salmon taken as bycatch in the Bering Sea pollock trawl fishery and the relationship of this bycatch to in-river salmon abundance. Chapter 3 describes the best available scientific information used to understand the impacts of the alternatives on Chinook salmon attributed to river or region of origin. Expanded data collection efforts are ongoing to improve the spatial and temporal extent of genetic information from Chinook salmon bycatch to understand how the bycatch composition changes over time and space. The ability to employ genetic methods rapidly to determine the river of origin is also improving. Chinook salmon bycatch data will continue be to collected and analyzed to improve understanding of the origins of this bycatch.

The declining returns of Chinook salmon to most regions of origin and the impacts of ocean survival on abundance are also issues yet to be resolved. The ocean environment is changing and the impacts of those changes on Chinook salmon abundance are unknown and the subject of on-going research and debate. The impacts of marine commercial fisheries on the abundance of Chinook salmon, both directed Chinook salmon fisheries and bycatch of Chinook salmon in other fisheries, are also under debate with some believing that marine fishery removals do not greatly impact Chinook salmon returns, while others believe that marine catches are the only human activity that we can directly control and therefore need to be controlled to mitigate the impacts of declining returns due to the changing environment.

Alaskan communities and communities throughout the Pacific coast of British Columbia, Washington, and Oregon depend on the marine resources for their livelihoods and lifestyles, whether as participants in commercial fisheries or tourism-related businesses or through subsistence or personal use fishing. Public comment expressed concern that the status quo levels of bycatch negatively impact the people and communities that rely on Chinook salmon. Chapters 9 and 10 discuss the social and economic impacts of the alternatives, particularly on Alaskan communities where the majority of the bycatch losses are believed to accrue.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS & ABBREVIATIONS USED IN THE EIS/RIR/IRFA

%	percent
‘	minutes
°	degrees
AAC	Alaska Administrative Code
ABC	acceptable biological catch
ADCCED	Alaska Department of Commerce, Community and Economic Development
ADFG (ADF&G)	Alaska Department of Fish and Game
ADOLWD	Alaska Department of Labor and Workforce Development
AEQ	adult equivalent impacts or adult equivalency
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center (of the National Marine Fisheries Service)
AI	Aleutian Islands
AKFIN	Alaska Fisheries Information Network
ALT	Alaska Local Time
AMBCC	Alaska Migratory Bird Co-Management Council
AMEF	Alaska Marine Ecosystem Forum
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
AP	North Pacific Fishery Management Council’s Advisory Panel
APA	Administrative Procedure Act
APA	At-sea Processors’ Association
APICDA	Aleutian Pribilof Island Community Development Association
AYK	Western Alaska Yukon and Kuskokwim River Systems OR Arctic-Yukon-Kuskokwim
B	biomass
BASIS	Bering-Aleutian Salmon International Survey
BBEDC	Bristol Bay Economic Development Corporation
BCC	Birds of Conservation Concern
BEG	Biological Escapement Goal
BFAL	black-footed albatross
BOF	Alaska Board of Fisheries
BS	Bering Sea
BSAI	Bering Sea and Aleutian Islands
BSIERP	Bering Sea Integrated Ecosystem Research Program
Bx%	biomass that results from a fishing mortality rate of Fx%
BY	brood year
C	celsius or centigrade
C.F.R. / CFR	Code of Federal Regulations
CAS	catch accounting system

CBD	Center for Biological Diversity
CBSFA	Central Bering Sea Fishermen's Association
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CDP	community development plan
CDQ	community development quota
CEQ	council for environmental quality
CEY	constant exploitation yield
CGOA	Central Gulf of Alaska
CI	confidence interval
cm	centimeter(s)
CMCP	catch monitoring and control plan
COBLZ	*C. opilio* bycatch limitation zone
Council	North Pacific Fishery Management Council
CP	catcher processor
CPUE	catch per unit effort
CRITFC	Columbia River Inter-Tribal Fisheries Commission
CTD	conductivity-temperature-depth
CV	catcher vessel
CVM	contingent value method
CVOA	catcher vessel operational area
CVRF	Coastal Villages Region Fund
CWT	coded wire tag
CZMA	Coastal Zone Management Act
DAH	domestic annual harvest
DAP	domestic annual processed catch
DFO	Canadian Department of Fisheries and Oceans
DPS	distinct population segment
DSR	demersal shelf rockfish
E.	east
EBS	eastern Bering Sea
EEZ	exclusive economic zone
EFH	essential fish habitat
EFP	exempted fishing permit
EIS	environmental impact statement
EPIRB	emergency position indicating radio beacon
ELT	emergency locator beacon
EM	electronic monitoring
EO	Executive Order
ESA	Endangered Species Act
ESU	evolutionary significant units
F	fishing mortality rate
FMP	fishery management plan
FOCI	Fisheries-Oceanography Coordinated Investigations
FRFA	Final Regulatory Flexibility Analysis
ft	foot/feet
FIS	Fisheries Information Services
FIT	Fishery Interaction Team (of AFSC)
F_X%	fishing mortality rate at which the SPR level would be reduced to X% of the SPR level in the absence of fishing

GC	General Counsel (of NOAA)
GDP	Gross domestic product
GHL	guideline harvest level
GOA	Gulf of Alaska
GPS	global positioning system
GSI	genetic stock identification
HAPC	habitat area of particular concern
HAPC	Habitat Areas of Particular Concern
HSCC	High Seas Catchers' Cooperative
IAD	initial administrative determination
ICA	inter-cooperative agreement
IFQ	individual fishing quota
IMEG	interim management escapement goal
IPHC	International Pacific Halibut Commission
IQA	Information Quality Act
IQF	Individually Quick Frozen (fillets)
IR/IU	Improved Retention/Improved Utilization Program
IRFA	Initial Regulatory Flexibility Analysis
ITAC	initial total allowable catch
ITS	incidental take statement
IUCN	World Conservation Union
JTC	Joint Technical Committee
JEA	joint enforcement agreements
kg	kilogram(s)
km	kilometer(s)
LAPP	limited access privilege program
lb	pound(s)
LCFRB	Lower Columbia Fish Recovery Board
LCI	Lower Cook Inlet
LCR	Lower Columbia River
LLP	license limitation program
LKMA	Lower Kuskokwim Management Area
LOA	length overall
LOF	List of Fisheries
LYTF	Lower Yukon Test Fishery
m	meter(s)
M	mothership
M	natural mortality rate
Magnuson-Stevens Act or MSA	Magnuson-Stevens Fishery Conservation and Management Act
MHz	megahertz
MLE	maximum likelihood estimates
mm	millimeter(s)
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MRA	maximum retainable amount
MSC	Marine Stewardship Council
MSE	management strategy evaluations
MSM	multispecies statistical model

MSRA	Magnuson-Stevens Reauthorization Act
MSY	maximum sustainable yield
mt	metric ton(s)
N.	north
NAB	North Aleutian Basin (aka Bristol Bay)
NAK Penin	Northern Alaska Peninsula
NEPA	National Environmental Policy Act
nm	nautical mile
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NMCSMP	Nushagak-Mulchatna Chinook Salmon Management Plan
NOAA	National Oceanic and Atmospheric Administration
NPAFC	North Pacific Anadromous Fish Commission
NPFMC	North Pacific Fishery Management Council
NPGOP	North Pacific Groundfish Observer Program
NPPSD	North Pacific Pelagic Seabird Database
NPRB	North Pacific Research Board
NPS	National Park Service
NRSHA	Naknek River Special Harvest Area
NSEDC	Norton Sound Economic Development Corporation
NSF	National Science Foundation
NW	northwest
OCC	ocean carrying capacity program
OCS	outer continental shelf
OEG	optimal escapement goal
OFL	overfishing level
OLE	Office of Law Enforcement (of NOAA-NMFS)
OMB	Office of Management and Budget (of NOAA-NMFS)
OSP	optimal sustainable population
OSM	Office of Surface Mining, Reclamation and Enforcement, Department of the Interior
OSU	Oregon State University
OTF	ADF&G offshore test fishery
OY	optimum yield
P	offshore catcher processor
PBR	potential biological removals
PCC	Pollock Conservation Cooperative
pdf	probability density function
PFMC	Pacific Fishery Management Council
PNW	Pacific Northwest
POP	Pacific ocean perch
PPA	Preliminary Preferred Alternative
PPA1	Preliminary Preferred Alternative Annual Scenario 1
PPA2	Preliminary Preferred Alternative Annual Scenario 2
ppm	part(s) per million
ppt	part(s) per thousand
PRD	Protected Resources Division (of the National Marine Fisheries Service)
PSC	prohibited species catch

PSD	Prohibited Species Donation Program
PSEIS	Preliminary Supplemental Environmental Impact Statement
R/S	returning adults per spawner
REFM	Resource Ecology and Fisheries Management Division, Alaska Fisheries Science Center, National Marine Fisheries Service
RFA	Regulatory Flexibility Analysis
RIR	Regulatory Impact Review
RM	river mile
RO	regional office
RSW	Recirculating Seawater
S	shoreside (inshore catcher vessel)
S.	south
SAFE	Stock Assessment and Fishery Evaluation
SAR	stock assessment report
SBW	Salmon Bycatch Workgroup
SCS	Scientific Certification Systems, Inc
SE	southeast
SEG	sustainable escapement goal
SET	sustained escapement threshold
SSA	salmon savings area
SSC	Scientific and Statistical Committee
SSFP	Sustainable Salmon Fisheries Policy
STAL	short-tailed albatross
TAC	total allowable catch
TBR	transboundary river systems
TINRO	Pacific Scientific Research Fisheries Centre, North Pacific Anadromous Fish Commission
USDA Forest Service	U.S. Dept of Agriculture Forest Service
U.S.	United States
USC (U.S.C.)	United States Code
UCI	Upper Cook Inlet
UKMA	Upper Kuskokwim Management Area
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USSR	United Soviet Socialist Republics
UWR	Upper Willamette River
VMS	vessel monitoring system
VRHS	voluntary rolling hotspot system
W.	west
W/LC TRT	Willamette/Lower Columbia Technical Recovery Team
WAK	western Alaska
WDF	Washington Department of Fisheries
YDFDA	Yukon Delta Fisheries Development Association
YRA	Yukon River Agreement
YRJTC	Yukon River Joint Technical Committee (OR U.S./Canada Joint Technical Committee)

1.0 INTRODUCTION

This Environmental Impact Statement/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EIS/RIR/IRFA) provides decision-makers and the public with an evaluation of the predicted environmental, social, and economic effects of alternative measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. The North Pacific Fishery Management Council's (Council or NPFMC) preferred alternative would be Amendment 91 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP). This EIS/RIR/RIFA is intended to serve as the central decision-making document for the Council to recommend Amendment 91 to the Secretary of Commerce. The EIS/RIR/RIFA would also serve as the central decision-making document for the Secretary of Commerce to approve, disapprove, or partially approve Amendment 91, and for the National Marine Fisheries Service (NMFS or NOAA Fisheries) to implement Amendment 91 through federal regulations. This EIS complies with the National Environmental Policy Act (NEPA). The RIR in Chapter 10 is required by Executive Order 12866, and the IRFA in Chapter 11 is required by the Regulatory Flexibility Act.

The Council developed the following problem statement for Bering Sea Chinook salmon bycatch management:

> *An effective approach to salmon prohibited species bycatch reduction in the Bering Sea pollock trawl fishery is needed. Current information suggests these harvests include stocks from Asia, Alaska, Yukon, British Columbia, and lower-48 origin. Chinook salmon are a high-value species extremely important to western Alaskan village commercial and subsistence fishermen and also provide remote trophy sport fishing opportunities. Other salmon (primarily made up of chum salmon) harvested as bycatch in the Bering Sea pollock trawl fishery also serve an important role in Alaska subsistence fisheries. However, in response to low salmon runs, the State of Alaska has been forced to close or greatly reduce some commercial, subsistence and sport fisheries in western Alaska. Reasons for reductions in the number of Chinook salmon returning to spawn in western Alaska rivers and the Canadian portion of the Yukon River drainage are uncertain, but recent increases in Bering Sea bycatch may be a contributing factor.*
>
> *Conservation concerns acknowledged by the Council during the development of the Salmon Savings Areas have not been resolved. Continually increasing Chinook salmon bycatch indicates the VRHS [Voluntary Rolling Hotspot System] under the salmon bycatch intercooperative agreement approach is not yet sufficient on its own to stabilize, much less, reduce the total bycatch. Hard caps, area closures, and/or other measures may be needed to reduce salmon bycatch to the extent practicable under National Standard 9 of the MSA [Magnuson-Stevens Act]. We recognize the MSA requires use of the best scientific information available. The Council intends to develop an adaptive management approach which incorporates new and better information as it becomes available. Salmon bycatch must be reduced to address the Council's concerns for those living in rural areas who depend on local fisheries for their sustenance and livelihood and to contribute towards efforts to reduce bycatch of Yukon River salmon under the U.S./Canada Yukon River Agreement obligations. The*

> *Council is also aware of the contribution that the pollock fishery makes in the way of food production and economic activity for the country as well as for the State of Alaska and the coastal communities that participate in the CDQ [Community Development Quota] program; and the need to balance tensions between National Standard 1 to achieve optimum yield from the fishery and National Standard 9 to reduce bycatch.*

This EIS/RIR/RIFA examines four alternatives to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. These alternatives are described in detail in Chapter 2. The EIS evaluates the environmental consequences of each of these alternatives with respect to nine major resource categories:

- Pollock
- Chinook salmon
- Chum salmon
- Other groundfish species
- Other prohibited species (steelhead trout, halibut, Pacific herring, and crab)
- Forage fish
- Marine mammals
- Seabirds
- Essential fish habitat
- Marine ecosystem

Three chapters of this document evaluate the social and economic consequences of the alternatives: Chapter 9 Environmental Justice analyzes the impacts of the alternatives on minority and low income populations; Chapter 10 RIR analyzes the economic impacts of the alternatives including a net benefit analysis of the preferred alternative; Chapter 11 IRFA analyzes the economic impacts of the alternatives on directly regulated small entities.

1.1 What is this Action?

The proposed action is to implement new management measures to minimize Chinook salmon bycatch in the Bering Sea pollock fisheries. The Bering Sea pollock fishery annually intercepts up to 95 percent of the Chinook salmon taken incidentally as bycatch in the Bering Sea and Aleutian Islands (BSAI) groundfish trawl fisheries. The Council is considering alternative ways to manage Chinook salmon bycatch, including replacing the current Chinook Salmon Savings Areas and voluntary rolling hotspot system intercooperative agreement (VHRS ICA) in the Bering Sea with salmon bycatch limits or new regulatory closures based on current salmon bycatch information.

1.2 Purpose and Need for this Action

The purpose of Chinook salmon bycatch management in the Bering Sea pollock fishery is to minimize Chinook salmon bycatch to the extent practicable, while achieving optimum yield from the pollock fishery. Minimizing Chinook salmon bycatch while achieving optimum yield is necessary to maintain a healthy marine ecosystem, ensure long-term conservation and abundance of Chinook salmon, provide maximum benefit to fishermen and communities that depend on Chinook salmon and pollock resources, and comply with the Magnuson-Stevens Act and other applicable federal law. National Standard 9 of the Magnuson-Stevens Act requires that conservation and management measures shall, to the extent practicable, minimize bycatch. National Standard 1 of the Magnuson-Stevens Act requires that conservation and management measures prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

Several management measures are currently used to reduce Chinook salmon bycatch in the Bering Sea pollock fishery. Chinook salmon taken incidentally in groundfish fisheries are classified as prohibited species and, as such, must be either discarded or donated through the Prohibited Species Donation Program. In the mid-1990s, NMFS implemented regulations recommended by the Council to control the bycatch of Chinook salmon taken in the Bering Sea pollock fishery. These regulations established the Chinook Salmon Savings Areas and mandated year-round accounting of Chinook salmon bycatch in the trawl fisheries. Once Chinook salmon bycatch in the Bering Sea pollock fishery reaches 29,000 Chinook salmon, the Chinook Salmon Savings Area is closed to pollock fishing for the rest of the year. This prohibited species catch limit is divided between the CDQ and non-CDQ fisheries. The savings areas were adopted based on historic observed salmon bycatch rates and was designed to avoid areas with high levels of Chinook salmon bycatch.

The Council started considering revisions to salmon bycatch management in 2004, when information from the fishing fleet indicated that it was experiencing increases in Chinook salmon bycatch following the regulatory closure of the Chinook Salmon Savings Areas. This indicated that, contrary to the original intent of the savings area closures, Chinook salmon bycatch rates appeared to be higher outside of the savings area than inside the area. While, upon closure, the non-CDQ fleet could no longer fish inside the Chinook Salmon Savings Area, vessels fishing on behalf of the CDQ groups were still able to fish inside the area because the CDQ groups had not yet reached their portion of the Chinook salmon prohibited species catch limit. Much higher salmon bycatch rates were reportedly encountered outside of the closure areas by the non-CDQ fleet than experienced by the CDQ vessels fishing inside. Further, the closure areas increased costs to the pollock fleet and processors.

To address this problem, the Council examined other means that were more flexible and adaptive to minimize salmon bycatch. The Council developed and recommended Amendment 84 to the BSAI FMP to implement in federal regulations the VRHS ICA and an exemption to the Chinook Salmon Savings Areas for vessels that participated in the VRHS ICA. In 2002, participants in the pollock fleet started the VRHS ICA for Chinook salmon. The exemption to area closures for the VRHS ICA was first implemented through an exempted fishing permit in 2006 and 2007 subsequently, in 2008, through Amendment 84 to the BSAI FMP. The VRHS ICA was intended to increase the ability of pollock fishery participants to minimize salmon bycatch by giving them more flexibility to move fishing operations to avoid areas where they experience high rates of salmon bycatch.

From 1992 through 2001, the annual average Chinook salmon bycatch in the pollock fishery was 32,482 Chinook salmon. Chinook salmon bycatch numbers increased substantially after 2002. The average from 2003 to 2007 was 74,067 Chinook salmon, with a bycatch peak of approximately 122,000 Chinook salmon in 2007. Chinook salmon bycatch in the Bering Sea pollock fishery decreased substantially in 2008. The preliminary Chinook salmon bycatch estimate after the fishery closed on November 1, 2008, was 19,477 Chinook salmon (NMFS Alaska Region estimate on 11/6/2008).

In light of the high amount of Chinook salmon bycatch in recent years, the Council and NMFS are considering new measures to minimize bycatch to the extent practicable while achieving optimum yield from the pollock fishery. While the VRHS ICA reports on Chinook salmon bycatch indicate that the VRHS has reduced Chinook salmon bycatch rates compared with what they would have been without the measures, concerns remain because of high amounts of Chinook salmon bycatch through 2007.

The Council and NMFS decided to limit the scope of this action to Chinook salmon, because Chinook salmon is a highly valued species that warrants specific protection measures. The Council will address non-Chinook salmon (primarily chum salmon) bycatch in the Bering Sea pollock trawl fishery with a separate future action. Until then, existing non-Chinook salmon bycatch reduction measures will remain in effect.

1.3 The Action Area

The action area effectively covers the Bering Sea management area in the exclusive economic zone (EEZ), an area extending from 3 nm from the State of Alaska's coastline seaward to 200 nm (4.8 km to 320 km). The Bering Sea EEZ has a southern boundary at 55° N. latitude from 170° W. longitude to the U.S.-Russian Convention line of 1867, a western boundary of the U.S.-Russian Convention Line of 1867, and a northern boundary at the Bering Strait, defined as a straight line from Cape Prince of Wales to Cape Dezhneva, Russia.

Impacts of the action may also occur outside the action area in the freshwater origins of the Chinook salmon caught as bycatch and in the Chinook salmon migration routes between their streams of origin and the Bering Sea. Chinook salmon caught as bycatch in the Bering Sea pollock fishery may originate from Asia, Alaska, Canada, or the western United States.

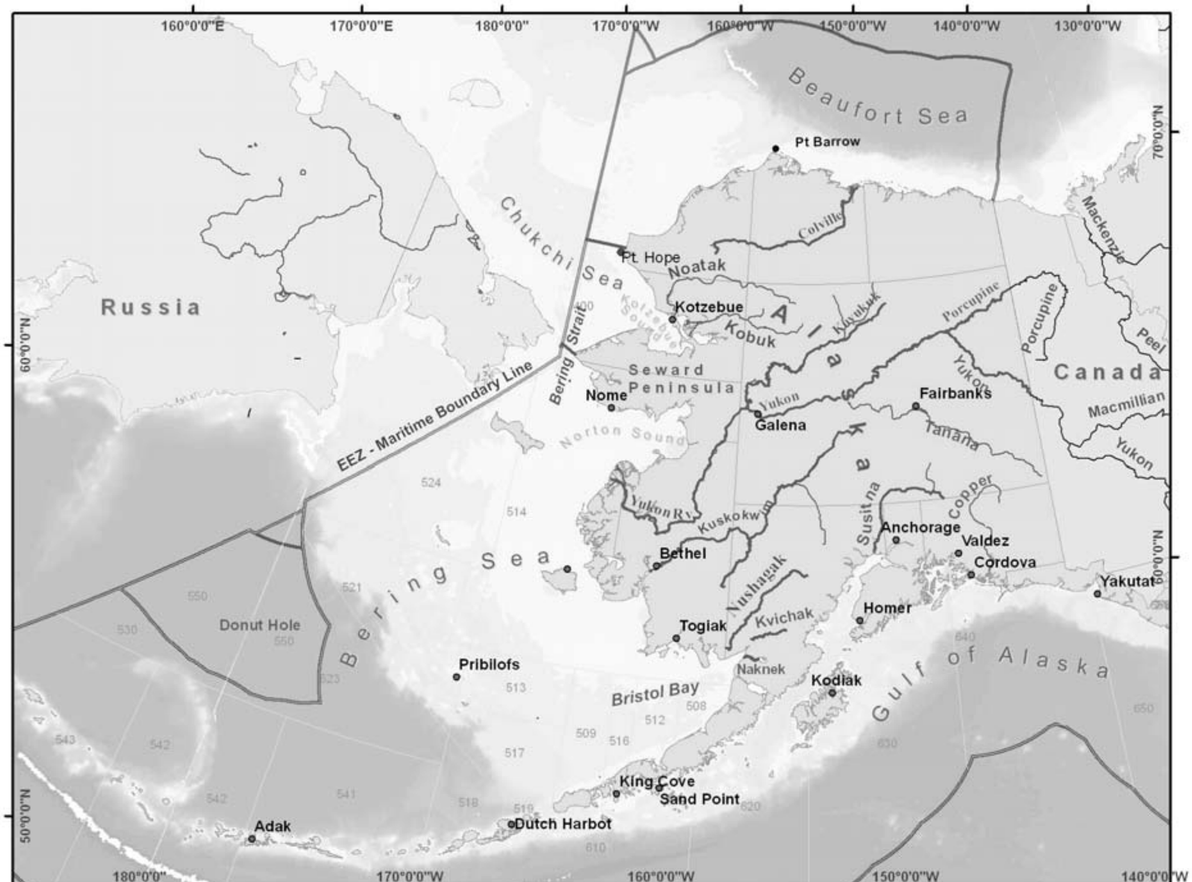

Fig. 1- 1 Map of the Bering Sea and major connected salmon producing rivers in Alaska and Northwest Canada

A comprehensive description of the action area is contained in previous EISs prepared for North Pacific fishery management actions. The description of the affected environment is incorporated by reference from Chapter 3 of the Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries (PSEIS, NMFS 2004) and Chapter 3 of the Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska (EFH EIS, NMFS 2005a). These documents contain extensive information on the fishery management areas, marine resources, habitat, ecosystem, social, and economic parameters of the pollock fishery. Both of these public documents are available on the NMFS Alaska Region website at http://alaskafisheries.noaa.gov/.

A large body of information exists on the life histories and general distribution of salmon in Alaska. The locations of many freshwater habitats used by salmon are described in documents organized and maintained by the Alaska Department of Fish & Game (ADF&G). Alaska Statute 16.05.871 requires ADF&G to specify the various streams that are important for spawning, rearing, or migration of anadromous fishes. This is accomplished through the *Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes* (ADF&G 1998a) which lists water bodies documented to be used by anadromous fish, and the *Atlas to the Catalog of Waters Important for Spawning, Returning or Migration of Anadromous Fishes* (ADF&G 1998b), which shows locations of these waters and the species and life stages that use them. Additional information on salmon streams is available from the ADF&G web site at: http://www.state.ak.us/adfg/habitat.

1.4 The Bering Sea pollock fishery

Until 1998, the Bering Sea pollock fishery was managed as an open access fishery, commonly characterized as a "race for fish." In 1998, however, Congress enacted the American Fisheries Act (AFA) to rationalize the fishery by limiting participation and allocating specific percentages of the Bering Sea directed pollock fishery total allowable catch (TAC) among the competing sectors of the fishery.

The AFA requires allocation of the 10% of the Bering Sea pollock TAC to the Community Development Quota (CDQ) Program. After subtraction of the CDQ Program allocation and an incidental catch allowance for pollock that will be caught in other groundfish fisheries, the AFA requires that the remaining pollock TAC be allocated among the inshore CV sector (50%), offshore CP sector (40%), and mothership sector (10%). These allocations are further divided into two seasons – 40% to the winter A roe season (January 20 to June 10) and the 60% to summer/fall B season (June 10 to November 1). Pollock harvested in the B season generally does not contain roe (eggs).

In 2007, 90 catcher vessels participated in harvesting pollock. Eighty-two of these catcher vessels were members of the inshore CV sector and delivered pollock to seven shorebased processors. Nineteen of these catcher vessels delivered pollock to the three processing vessels in the mothership sector. Sixteen catcher/processors harvested pollock in the offshore CP sector.

In addition to the required sector level allocations of pollock, the AFA also allowed for development of pollock industry cooperatives. Ten such cooperatives were developed as a result of the AFA: seven inshore catcher vessel (CV) cooperatives, two offshore catcher processor (CP) cooperatives, and one mothership cooperative.

Offshore CP cooperatives and mothership cooperatives: Separate allocations of the Bering Sea pollock TAC are made annually to the offshore CP sector and the mothership sector. These sector allocations of pollock are not further subdivided by NMFS among the vessels or companies participating in these sectors. However, through formation of cooperatives and under private contractual arrangement, participants in the offshore CP sector and the mothership sector further subdivide their respective pollock allocations among the participants in their sector. The purpose of these cooperatives is to manage the allocations made under the cooperative agreements to ensure that individual vessels and companies do not harvest more than their agreed upon share. The cooperatives also facilitate transfers of pollock among the cooperative members, enforcement of contract provisions, and participation in the VRHS ICA.

Two fishery cooperatives are authorized by the AFA to form in the offshore CP sector and the offshore catcher vessels sector. A single cooperative may form that includes both CPs and named offshore catcher vessels delivering to CPs, or the CP and CV may form separate cooperatives and enter into an inter-cooperative agreement to govern fishing for pollock in the offshore CP sector. The offshore CP sector elected to form two cooperatives. The Pollock Conservation Cooperative (PCC) was formed in 1999 and is made up of nineteen CPs that divide the sector's overall pollock allocation. The AFA listed 20 eligible CPs by name and also allowed eligibility for any other CP that had harvested more than 2,000 metric tons of pollock in 1997 and was eligible for the license limitation program. One CP, the Ocean Peace, met the requirements for an "unlisted catcher/processor" under the AFA and is part of the offshore CP sector. The Ocean Peace fished for pollock from 1999 through 2001 and again in 2008. Under the requirements of the AFA, unlisted CPs may harvest up to 0.5% of the offshore CP sector's allocation of pollock. The Ocean Peace is not part of the PCC.

The High Seas Catcher Cooperative (HSCC) consists of seven catcher vessels that formerly delivered pollock to CPs. These catcher vessels must either deliver to the PCC or lease their allocation to the PCC. The HSCC has elected to lease its pollock allocation to the PCC.

Under the AFA, fishery cooperatives also are authorized to form in the mothership sector. In addition, if at least 80 percent of the mothership sector catcher vessels enter into a fishery cooperative then the three motherships also are eligible to join the cooperative and retain a limited anti-trust exemption under the Fisherman's Collective Marketing Act. Mothership catcher vessels have formed a cooperative called the Mothership Fleet Cooperative (MFC). The three motherships in this sector have not formed a separate cooperative and are not members of the MFC.

<u>Inshore CV sector</u>: The annual pollock quota for the inshore CV sector is divided up by applying a formula in the regulations which allocates catch to a cooperative or the inshore limited access fishery according to the specific sum of the catch history for the vessels in the cooperative or the limited access fishery. Under 679.62(e)(1), the individual catch history of each vessel is equal to the sum of inshore pollock landings from the vessel's best 2 of the 3 years 1995 through 1997, and includes landings to catcher/processors for vessels that made landings of 500 mt or more to catcher/processors from 1995 through 1997. Each year, fishing permits are issued by cooperative, with the permit application listing the vessels added or subtracted.

<u>Inshore CV cooperatives</u>: Inshore cooperatives are affiliations of catcher vessels and specific inshore processors. Unlike the cooperatives in the offshore CP sector and mothership sector, which are voluntarily formed by their members, inshore CV cooperatives are formed and operated under NMFS regulations because these cooperatives receive specific sub-allocations of the inshore CV sector's overall pollock allocation. The inshore CV cooperatives are required to submit copies of their contracts to NMFS annually. These contracts must contain the information required in NMFS regulations, including information about the cooperative structure, vessels that are parties in the contract, and the primary inshore processor that will receive at least 90 percent of the pollock deliveries from these catcher vessels. Each catcher vessel in a cooperative must have an AFA permit with an inshore endorsement, a license limitation program permit authorizing the vessel to engage in trawl fishing for pollock in the Bering Sea, and no sanctions on the AFA or license limitation program permits. Although the contract requirements are governed by NMFS regulations, compliance with the provisions of the contract (primarily the 90 percent processor delivery requirements) are not enforced by NMFS, but are enforced through the private contractual arrangement of the cooperative. Once an inshore cooperative's contract is approved by NMFS, the cooperative receives an annual pollock allocation based on the catch history of vessels listed in a cooperative contract.

<u>Inshore CV limited-access fishery</u>: Fishing in the limited access fishery is possible should a vessel leave their cooperative, and the inshore CV pollock allocation is partitioned to allow for an allocation to a limited access fishery under these circumstances. An inshore CV limited access fishery could exist if

vessels choose not to join a cooperative in a given year. The TAC for the limited access fishery is based upon the proportion of total sector pollock catch associated with the vessels in the limited access fishery.

1.5 Public Participation

The EIS process provides several opportunities for public participation. Scoping, the term used for involving the public in the NEPA process at its initial stages, is designed to provide an opportunity for the public, agencies, and other interest groups to provide input on potential issues associated with the proposed action. Scoping is used to identify the environmental issues related to the proposed action and identify alternatives to be considered in the EIS. Scoping is accomplished through written communications and consultations with agency officials, interested members of the public and organizations, Alaska Native representatives, and State and local governments.

The formal scoping period began with the publication of a Notice of Intent in the *Federal Register* on December 26, 2007 (72 FR 72994). Public comments were due to NMFS by February 15, 2008. In the Notice of Intent, NMFS requested written comments from the public on the range of alternatives to be analyzed and on the environmental, social, and economic issues to be considered in the analysis. NMFS published a news release on January 17, 2008, to remind people of their opportunity to participate in this scoping process.

A scoping report was prepared to inform the Council and the public of the comments received. The scoping report summarizes the issues associated with the proposed action and describes alternative management measures raised in public comments. The scoping report was presented to the Council at its April 2008 meeting and is posted on the NMFS Alaska Region website at:

http://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm.

Additionally, members of the public participate and comment during the Council process. The Council started considering revisions to salmon bycatch management in 2004. Since then, the Council has notified the public when it is scheduled to discuss salmon bycatch issues. The Council process, which involves regularly scheduled and announced public Council meetings, ad-hoc industry meetings, and Council committee meetings, started before the formal EIS scoping process and will continue as NMFS and the Council develop and refine the alternatives under consideration until the Council makes a recommendation on a preferred alternative to NMFS.

This Draft EIS/RIR/IRFA addresses the relevant issues identified during the scoping and the Council processes and provides another opportunity for public comments and participation.

1.5.1 Community Outreach

One of the Council's policy priorities is to improve Alaska Native and community consultation in federal fisheries management. The Council is developing a draft policy to focus on two specific goals: 1) develop a strategy for improving the Alaska Native and community consultation process; and 2) develop a method for systematic documentation of Alaska Native and community participation in the development of management actions. As a first step, in June 2008, the Council initiated a small committee of Council members and community and Alaska Native representatives to undertake a deliberative process to review a staff discussion paper which proposes several possible approaches and makes recommendations to the whole Council on how to create a policy to improve outreach and participation.

In addition to the stated Council priority, the need to improve the stakeholder participation process has been highlighted during development of this EIS/RIR/IRFA. The Council intends to solicit and obtain as much input as possible on the proposed action from Alaska Natives, communities, and other affected stakeholders. This outreach effort, specific to Chinook salmon bycatch management, will likely dovetail with the Council's overall community and Native stakeholder participation policy.

As the Council chose a preliminary preferred alternative at its June 2008 meeting, it was determined timely to undertake an outreach effort with affected community and Native stakeholders during the development of the draft EIS/RIR/IRFA and prior to final Council action.

The outreach plan for Chinook salmon bycatch management enables the Council to maintain ongoing and proactive relations with Native and rural communities. One of the objectives of the plan is to coordinate with NMFS' tribal consultation efforts, discussed in Section 1.5.2, to prevent a duplication of efforts between the Council and NMFS, which includes not confusing the public with divergent processes or providing inconsistent information. A broad overview of the three primary steps of the outreach plan follows.

Direct mailings to stakeholders

In early September 2008, the Council provided a mailing to stakeholders, including community governments, regional and village Native corporations, tribal entities, and other community or Native entities in communities (e.g., regional non-profits). The mailing was also sent to previous contacts or individuals that have contacted the Council on this issue, and State legislature and Congressional representatives.

The mailing included a letter and a two-page flyer for posting in the communities. The letter solicited input from stakeholders identified as being potentially affected by the proposed action, prior to the release of the DEIS/RIR/IRFA. The letter also provided a website reference to a Council brochure which explains the Council process and how to be involved in the federal fisheries management process (*Navigating the North Pacific Council Process, 2007).* The flyer provided a summary of the proposed action, including a description of the Council's preliminary preferred alternative and its schedule for action. The flyer also outlined how individuals and communities can provide feedback on this action and a schedule of community outreach meetings planned for October 2008.

The Council also plans to send a letter to stakeholders prior to the Council's scheduled meeting for final action on Chinook salmon bycatch management in April 2009, in order to ensure stakeholders are aware of the schedule for final action, the preferred alternative, and opportunities to provide further feedback. The Council will also consider a follow-up mailing to potentially affected entities as to the results of the Council's recommendation for salmon bycatch reduction measures to the Secretary of Commerce, if, at this point, the website and Council newsletter are not considered sufficient means to reach potentially affected stakeholders.

Community outreach meetings (late 2008 – early 2009)

Upon informal consultation with community and Native coordinators, staff determined that the most effective approach to community outreach meetings is to work with established community and Native entities within the affected regions and attend annual or recurring regional meetings. Council staff may convene individual meetings as necessary and appropriate, but this step may only be necessary if it is determined that the action has significant, unique, or substantial direct effects on a particular community. This could also be prompted by strong desires from individual communities that they have an opportunity for face to face discussion of the proposed action outside of the Council meetings.

The outreach plan notes that Council staff could coordinate with NMFS if NMFS conducts a consultation with a tribe or ANCSA corporation. Council staff could provide an overview or background presentation on the proposed action as part of the Council outreach plan, and NMFS could conduct the tribal consultation as a separate part of that meeting.

With regard to community and Native outreach meetings, Council staff consulted with the coordinators of the Federal Subsistence Regional Advisory Councils and the Association of Village Council Presidents (AVCP) in order to schedule time on the agendas for their upcoming meetings. Council staff provided presentations on the proposed action at five separate regional meetings, and two Council members attended four of those five meetings. Council staff documented feedback provided at these meetings, including public testimony. Unfortunately, Council staff and members could not attend the Yukon Kuskokwim Delta Regional Advisory Council meeting (Bethel) and the Seward Peninsula Regional Advisory Council meeting (Nome) due to scheduling conflicts with the October 2008 Council meeting in Anchorage. The Council staff participated in the AVCP meeting in Bethel. The Council does not currently have a meeting scheduled in the Nome area but other potential meeting alternatives in Nome are being pursued. Council staff is currently working with the coordinator for the Seward Peninsula Regional Advisory Council to attend their (tentative) February 2009 meeting as an alternative.

Council staff and members and/or NMFS staff participated in the following meetings:

Southeast RAC	September 23–25, 2008	Juneau
Bristol Bay RAC	October 6 –7, 2008	Dillingham
AVCP meeting	October 8, 2008	Bethel
Eastern Interior RAC	October 14–15, 2008	Nenana
Northwest Arctic RAC	October 16, 2008	Kotzebue
Western Interior RAC	October 28–29, 2008	McGrath

In addition to the above confirmed meetings, Council staff is coordinated with the Yukon River Panel representative to potentially provide a presentation at the Yukon River Panel's December or March/April meeting.

Documenting Results

A short summary to document the outreach process and results of the regional and Native meetings will be prepared and presented to the Council in April 2009, when the Council is scheduled to take final action to recommend Chinook salmon bycatch reduction measures. A summary of this process will also be included in the Final EIS/RIR/RIFA.

1.5.2 Tribal Governments and Alaska Native Claims Settlement Act Regional and Village Corporations

NMFS is obligated to consult and coordinate with federally recognized tribal governments and Alaska Native Claims Settlement Act (ANCSA) regional and village corporations on a government-to-government basis pursuant to Executive Order 13175, the Executive Memorandum of April 29, 1994, on "Government-to-Government Relations with Native American Tribal Governments," and Division H, Section 161 of the Consolidated Appropriations Act of 2004 (Public Law 108-199, 188 Stat. 452), as amended by Division H, Section 518 of the Consolidated Appropriations Act of 2005 (Public Law 108-447, 118 Stat. 3267). More information about Executive Order 13175 and related law is in Section 1.7 on the relationship of this action to federal law.

To start the consultation process, NMFS mailed letters to Alaska tribal governments, Alaska Native corporations, and related organizations on December 28, 2007, when NMFS started the EIS scoping process. The letter provided information about the EIS process and solicited consultation and coordination with Alaska Native representatives. NMFS received 12 letters providing scoping comments from tribal government and Alaska Native corporation representatives, which were summarized and included in the scoping report. Additionally, a number of tribal representatives and tribal organizations provided written public comments and oral public testimony to the Council during the Council meetings where the Council developed the alternatives.

Additionally, NMFS received three letters from tribal representatives requesting a consultation. NMFS responded to the letters and is in the process of working with the tribal representatives to conduct the consultation. This consultation process is ongoing.

Once the Draft EIS/RIR/IRFA was released, NMFS sent another letter to Alaska Native representatives to announce the release of the document and solicit comments concerning the scope and content of the Draft EIS/RIR/IRFA. The letter included a copy of the executive summary and provided information on how they can obtain a printed or electronic copy of the Draft EIS/RIR/IRFA.

1.5.3 Cooperating Agencies

The Council for Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA emphasizes agency cooperation early in the NEPA process. NMFS is the lead agency for this EIS. The State of Alaska Department of Fish and Game (ADF&G) is a cooperating agency and participated in the development of this EIS and provided data, staff, and review for this analysis. ADF&G has an integral role in the development of this EIS because it manages the commercial salmon fisheries, collects and analyzes salmon biological information, and represents the people who live in Alaska.

Additionally, at the October and December 2007 and the February, April, and June 2008 Council meetings, Council and NMFS staff informed representatives of the U.S Coast Guard, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, the U.S. State Department, and the U.S. Fish and Wildlife Service of the development of the Draft EIS/RIR/IRFA.

1.5.4 Summary of Alternatives and Issues Identified During Scoping

NMFS received 42 written comments from the public and interested parties. The scoping report provides a summary of the comments and contains copies of the comments. This section summarizes the alternatives and issues raised during the scoping process.

Chapter 2 describes the alternatives the Council and NMFS determined best accomplish the proposed action’s purpose and need. Chapter 2 also describes the alternatives raised during scoping that were considered but not carried forward, and discusses the reasons for their elimination from further detailed study.

Generally, the comments received suggested that (1) alternatives should comply with the Magnuson-Stevens Act, the Endangered Species Act, and Pacific Salmon Treaty; (2) salmon bycatch management should significantly reduce salmon bycatch; (3) hard caps are necessary to effectively reduce salmon bycatch; (4) hard caps should contain individual vessel accountability; and (5) there should be an exemption for vessels that participate in an ICA such as the one that established the VRHS.

The types of alternative management measures suggested by public comments include the following:

- Hard cap management measures
- Eliminate the prohibited species catch accounting period options
- Monitoring and enforcement measures

- Time/Area closure alternatives
- Pollock fishery management changes

To the extent practicable and appropriate, this EIS/RIR/IRFA addresses the following issues raised during scoping.

Evaluate the effectiveness of existing salmon bycatch management measures

Many comments discussed the effectiveness of existing salmon bycatch management measures; the Chinook and chum salmon savings areas and the exemption from those closures for pollock vessels that participate in the VRHS ICA.

Scientific Issues

Comments suggested that the EIS utilize the best available stock identification data to determine the relevant impacts to salmon stocks from different levels of salmon bycatch under the alternatives. The comments stated that the analysis should address scientific uncertainty regarding the river of origin of salmon caught in the pollock fishery and the relationship between bycatch and abundance. The EIS should consider the long-term impacts that excessive salmon bycatch has on (1) the sustainability of western Alaska salmon stocks, (2) the composition and genetic diversity of those stocks, and (3) the people that rely on salmon.

Alaska Native Issues

Comments explained that salmon are irreplaceable to the cultural, spiritual, and nutritional needs of Alaska Native people and that analysis of the impacts on subsistence users and subsistence resources must include the broad range of values, not simply a commercial dollar value or replacement costs of these fish. Salmon serves an important cultural and economic role in the communities of Alakanuk, Eek, Nanakiak, Nunapitchuk, Emmonak, Kwethluk, Bethel, St. Mary's, Ruby, Nulato, Koyukuk, Kotlik, Galena, Kaltag, Fairbanks, Kongiganak, Quinhagak, Nenana, Minto, Marshall, and Hooper Bay, and throughout western and Interior Alaska.

Comments also stated that salmon bycatch in the Bering Sea pollock fishery is essentially a reallocation of the in-river return of salmon destined for western and Interior Alaska communities and communities in Canada. Comments recommended that the EIS address impacts to federally-protected subsistence users, in-river commercial fisheries, treaty obligations, and environmental justice implications. Comments explained that excessive salmon bycatch (1) threatens the way of life in western Alaska, (2) seriously impacts in-river uses of those stocks, where federal and state law provides subsistence uses the highest priority, and (3) is a serious concern to the people of western and Interior Alaska who depend upon these stocks as a primary subsistence food source.

Additional Issues

Comments encouraged that salmon bycatch management comply with the Magnuson-Stevens Act, the Endangered Species Act, the Pacific Salmon Treaty and Yukon River Agreement, Alaska National Interest Lands Conservation Act, NEPA, Executive Order 13175 on consulting with tribes, and Executive Order 12898 on environmental justice.

Comments stated that the EIS should discuss how monitoring and enforcement activities would need to be changed to comply with the alternatives and develop a research and monitoring plan to identify information needed to establish an "optimal" bycatch level based on improved stock-specific information.

Comments stated that the EIS should analyze the commercial, subsistence, sport, and cultural values of salmon for users throughout Alaska and the Pacific Northwest. The EIS should contain a full economic analysis of the effects that alternative hard caps would have on the fishing industry, coastal communities, Community Development Quota (CDQ) groups, suppliers, consumers, and other groups that derive benefits from a viable pollock fishery.

Because of the complexity of the issues, to adequately comply with the requirements for consultation under E.O. 13175, comments requested that NMFS develop summary materials which, along with the full EIS, can provide a resource to tribes to enable them to adequately participate.

1.6 Statutory Authority for this Action

Under the Magnuson-Stevens Act (16 USC 1801, et seq.), the United States has exclusive fishery management authority over all marine fishery resources found within the EEZ. The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in the regional fishery management councils. In the Alaska Region, the Council has the responsibility for preparing FMPs and FMP amendments for the marine fisheries that require conservation and management, and for submitting its recommendations to the Secretary. Upon approval by the Secretary, NMFS is charged with carrying out the federal mandates of the Department of Commerce with regard to marine and anadromous fish.

The Bering Sea pollock fishery in the EEZ off Alaska is managed under the FMP for Groundfish of the Bering Sea and Aleutian Islands. The salmon bycatch management measures under consideration would amend this FMP and federal regulations at 50 CFR 679. Actions taken to amend FMPs or implement other regulations governing these fisheries must meet the requirements of federal law and regulations.

1.7 Relationship of this Action to Federal Law

While NEPA is the primary law directing the preparation of this EIS, a variety of other federal laws and policies require environmental, economic, and socioeconomic analyses of proposed federal actions. This section addresses the CEQ regulations, at 40 CFR 1502.2(d), that require an EIS to state how alternatives considered in it and decisions based on it will or will not achieve the requirements of sections 101 and 102(1) of NEPA and other environmental laws and policies. This EIS/RIR/IRFA contains the required analysis of the proposed federal action and its alternatives to ensure that the action complies with these additional federal laws and executive orders:

- National Environmental Policy Act (NEPA)
- Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act)
- Endangered Species Act (ESA)
- Marine Mammal Protection Act (MMPA)
- Administrative Procedure Act (APA)
- Regulatory Flexibility Act (RFA)
- Executive Order 12866: Regulatory planning and review
- Information Quality Act (IQA)
- Coastal Zone Management Act (CZMA)
- Executive Order 13175: Consultation and Coordination with Indian Tribal Governments
- Executive Order 12898: Environmental Justice
- Alaska National Interest Lands Conservation Act (ANILCA)
- Pacific Salmon Treaty and the Yukon River Agreement
- American Fisheries Act (AFA)

The following provides details on the laws and executive orders directing this analysis. None of the alternatives under consideration threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

1.7.1 National Environmental Policy Act

NEPA establishes our national environmental policy, provides an interdisciplinary framework for environmental planning by federal agencies, and contains action-forcing procedures to ensure that federal decision-makers take environmental factors into account. NEPA does not require that the most environmentally desirable alternative be chosen, but does require that the environmental effects of all the alternatives be analyzed equally for the benefit of decision-makers and the public.

NEPA has two principal purposes:

1. To require federal agencies to evaluate the potential environmental effects of any major planned federal action, ensuring that public officials make well-informed decisions about the potential impacts.

2. To promote public awareness of potential impacts at the earliest planning stages of major federal actions by requiring federal agencies to prepare a detailed environmental evaluation for any major federal action significantly affecting the quality of the human environment.

NEPA requires an assessment of the biological, social, and economic consequences of fisheries management alternatives and provides that members of the public have an opportunity to participate in the decision-making process. In short, NEPA ensures that environmental information is available to government officials and the public before decisions are made and actions are taken.

Title II, Section 202 of NEPA (42 U.S.C. 4342) created the CEQ. The CEQ is responsible for, among other things, the development and oversight of regulations and procedures implementing NEPA. The CEQ regulations provide guidance for federal agencies regarding NEPA's requirements (40 CFR Part 1500) and require agencies to identify processes for issue scoping, for the consideration of alternatives, for developing evaluation procedures, for involving the public and reviewing public input, and for coordinating with other agencies—all of which are applicable to the Council's development of FMPs.

NOAA Administrative Order 216-6 describes NOAA's policies, requirements, and procedures for complying with NEPA and the implementing regulations issued by the CEQ. This Administrative Order provides comprehensive and specific procedural guidance to NMFS and the Council for preparing and adopting FMPs.

Federal fishery management actions subject to NEPA requirements include the approval of FMPs, FMP amendments, and regulations implementing FMPs. Such approval requires preparation of the appropriate NEPA analysis (Categorical Exclusion, Environmental Assessment, or EIS).

NMFS decided to prepare an EIS to assist agency planning and decision-making. The purpose of an EIS is to predict and disclose the impacts of the proposed action and its alternatives on the human environment. NEPA and the Magnuson-Stevens Act requirements for schedule, format, and public participation are compatible and allow one process to fulfill both obligations.

1.7.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act authorizes the U.S. to manage its fishery resources in the EEZ. The management of these marine resources is vested in the Secretary and in regional fishery management councils. In the Alaska Region, the Council is responsible for preparing FMPs for marine fishery resources requiring conservation and management. NMFS is charged with carrying out the federal mandates with regard to marine fish. The NMFS Alaska Region and Alaska Fisheries Science Center research, draft, and review the management actions recommended by the Council. The Magnuson-

Stevens Act established the required and discretionary provisions of an FMP and created ten National Standards to ensure that any FMP or FMP amendment is consistent with the Act

The Magnuson-Stevens Act emphasizes the need to protect fish habitat. Under the law, the Council has amended its FMPs to identify essential fish habitat (EFH). For any actions that may adversely impact EFH, the Magnuson-Stevens Act requires NMFS to provide recommendations to federal and state agencies for conserving and enhancing EFH. In line with NMFS policy of blending EFH assessments into existing environmental reviews, NMFS intends the analysis contained in Chapter 8 of this EIS to also serve as an EFH assessment. An EFH consultation will be carried out with the NMFS Alaska Region's Habitat Division before the publication of the implementing regulations.

The actions under examination in this EIS are Chinook salmon bycatch minimization measures for the Bering Sea pollock fishery. While each FMP amendment must be comply with all ten national standards, National Standards 1 and 9 are directly guide the proposed action. National Standard 9 of the Magnuson-Stevens Act requires that conservation and management measures shall, to the extent practicable, minimize bycatch. National Standard 1 of the Magnuson-Stevens Act requires that conservation and management measures prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

1.7.3 Endangered Species Act

The ESA is designed to conserve endangered and threatened species of fish, wildlife, and plants. The ESA is administered jointly by NMFS and the USFWS. With some exceptions, NMFS oversees cetaceans, seals and sea lions, marine and anadromous fish species, and marine plant species. USFWS oversees walrus, sea otter, seabird species, and terrestrial and freshwater wildlife and plant species.

The listing of a species as threatened or endangered is based on the biological health of that species. Threatened species are those likely to become endangered in the foreseeable future (16 U.S.C. 1532(20)). Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range (16 U.S.C. 1532(6)). Species can be listed as endangered without first being listed as threatened.

Currently, with the listing of a species under the ESA, the critical habitat of the species must be designated to the maximum extent prudent and determinable (16 U.S.C. 1533(b)(6)(C)). The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. Federal agencies are prohibited from undertaking actions that destroy or adversely modify designated critical habitat.

Federal agencies have a mandate to conserve listed species and federal actions, activities or authorizations (hereafter referred to as federal actions) must be in compliance with the provisions of the ESA. Section 7 of the ESA provides a mechanism for consultation by the federal action agency with the appropriate expert agency (NMFS or USFWS). Informal consultations are conducted for federal actions that have no adverse affects on the listed species. The action agency can prepare a biological assessment to determine if the proposed action would adversely affect listed species or modify critical habitat. The biological assessment contains an analysis based on biological studies of the likely effects of the proposed action on the species or habitat.

Formal consultations, resulting in biological opinions, are conducted for federal actions that may have an adverse affect on the listed species. Through the biological opinion, a determination is made about whether the proposed action poses "jeopardy" or "no jeopardy" of extinction or adverse modification or destruction of designated critical habitat for the listed species. If the determination is that the proposed or on-going action will cause jeopardy or adverse modification of critical habitat, reasonable and prudent alternatives may be suggested which, if implemented, would modify the action to no longer pose the jeopardy of extinction or adverse modification to critical habitat for the listed species. These reasonable and prudent alternatives must be incorporated into the federal action if it is to proceed. A biological opinion with the conclusion of no jeopardy or adverse modification of critical habitat may contain conservation recommendations intended to further reduce the negative impacts to the listed species. These recommendations are advisory to the action agency (50 CFR 402.14(j)). If the likelihood exists of any take[2] occurring during promulgation of the action, an incidental take statement may be appended to a biological opinion to provide for the amount of take that is expected to occur from normal promulgation of the action. An incidental take statement is not the equivalent of a permit to take a listed species.

This EIS contains pertinent information on the ESA-listed species that occur in the action area and that have been identified in previous consultations as potentially impacted by the Bering Sea pollock fishery. Analysis of the impacts of the alternatives is in the chapters addressing those resource components. Impacts on ESA-listed salmon are discussed in Chapter 5 Chinook Salmon. Impacts on ESA-listed marine mammals and seabirds are discussed in Chapter 8 Other Marine Resources. Before approval of the FMP amendment and signing of the Record of Decision, NMFS Sustainable Fisheries, Alaska Region, will conduct an ESA Section 7 consultation on the proposed action with the NMFS Protected Resources Division, Alaska Region, for listed marine mammals, NMFS Northwest Region for listed salmon, and USFWS for listed seabirds based on the analysis contain in this EIS.

1.7.4 Marine Mammal Protection Act

Under the MMPA, NMFS has a responsibility to conserve marine mammals, specifically cetaceans and pinnipeds (other than walrus). The USFWS is responsible for sea otter, walrus, and polar bear. Congress found that certain species and stocks of marine mammals are or may be in danger of extinction or depletion due to human activities. Congress also declared that marine mammals are resources of great international significance.

The primary management objective of the MMPA is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. The MMPA is intended to work in concert with the provisions of the ESA. The Secretary is required to give full consideration to all factors regarding regulations applicable to the “take” of marine mammals, including the conservation, development, and utilization of fishery resources, and the economic and technological feasibility of implementing the regulations. If a fishery affects a marine mammal population, the Council or NMFS may be requested to consider measures to mitigate adverse impacts. This EIS analyzes the potential impacts of the pollock fishery and changes to the fishery under the alternatives on marine mammals in Chapter 8.

1.7.5 Administrative Procedure Act (APA)

The APA requires federal agencies to notify the public before rule making and provide an opportunity to comment on proposed rules. General notice of proposed rule making must be published in the *Federal Register*, unless persons subject to the rule have actual notice of the rule. Proposed rules published in the *Federal Register* must include reference to the legal authority under which the rule is proposed and explain the nature of the proposal including a description of the proposed action, why it is being proposed, its intended effect, and any relevant regulatory history that provides the public with a well-informed basis for understanding and commenting on the proposal. The APA does not specify how much time the public must be given for prior notice and opportunity to comment; however, Section 304 (b) of the Magnuson-Stevens Act provides that proposed regulations that implement an FMP or FMP amendment, or that modify existing regulations, must have a public comment period of 15 to 60 days.

[2] The term “take” under the ESA means “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct” (16 U.S.C. § 1532(19)).

After the end of a comment period, the APA requires that comments received be summarized and responded to in the final rule notice. Further, the APA requires that the effective date of a final rule is no less than 30 days after its publication in the *Federal Register*. This delayed effectiveness, or "cooling off" period, is intended to give the affected public time to become aware of, and prepared to comply with the requirements of the rule. For fishery management regulations, the primary effect of the APA, in combination with the Magnuson-Stevens Act, NEPA, and other statutes, is to allow for public participation and input into the development of FMPs, FMP amendments, and regulations implementing FMPs. Regulations implementing the proposed salmon bycatch reduction measures will be published in the *Federal Register* in accordance with the APA and the Magnuson-Stevens Act.

1.7.6 Regulatory Flexibility Act (RFA)

The RFA requires federal agencies to consider the economic impact of their regulatory proposals on directly regulated small entities, analyze alternatives that minimize adverse economic impacts on this class of small entities, and make their analyses available for public comment. The RFA applies to a wide range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions. The Small Business Administration has established size criteria for all major industry sectors in the United States, including fish harvesting and fish processing businesses.

The RFA applies to any regulatory actions for which prior notice and comment is required under the APA. After an agency begins regulatory development and determines that the RFA applies, unless an agency can certify that an action subject to the RFA will not have a significant economic impact on a substantial number of small entities, the agency must prepare an initial regulatory flexibility analysis (IRFA) to accompany a proposed rule. Based upon the IRFA, and received public comment, assuming it is still not possible to certify, the agency must prepare a final regulatory flexibility analysis (FRFA) to accompany the final rule. NMFS has published revised guidelines, dated August 16, 2000, for RFA analyses; they include criteria for determining if the action would have a significant impact on a substantial number of small entities. The NMFS guidelines can be found at http://www.nmfs.noaa.gov/sfa/prorules.html.

Chapter 11 contains the IRFA for the proposed regulations implementing the Chinook salmon bycatch reduction measures to evaluate the adverse impacts of this action on directly regulated small entities, in compliance with the RFA.

1.7.7 Executive Order 12866: Regulatory planning and review

The purpose of Executive Order 12866, among other things, is to enhance planning and coordination with respect to new and existing regulations, and to make the regulatory process more accessible and open to the public. In addition, Executive Order 12866 requires agencies to take a deliberative, analytical approach to rule making, including assessment of costs and benefits of the intended regulations. For fisheries management purposes, it requires NMFS to (1) prepare a regulatory impact review (RIR) for all regulatory actions; (2) prepare a unified regulatory agenda twice a year to inform the public of the agency's expected regulatory actions; and (3) conduct a periodic review of existing regulations.

The purpose of an RIR is to assess the potential economic impacts of a proposed regulatory action. As such, it can be used to satisfy NEPA requirements and serve as a basis for determining whether a proposed rule will have a significant impact on a substantial number of small entities under the RFA. The RIR is frequently combined with an EIS and an IRFA in a single document that addresses the analytical requirements of NEPA, RFA, and Executive Order 12866. Criteria for determining "significance" for Executive Order 12866 purposes, however, are different than those for determining "significance" for NEPA or RFA purposes. A "significant" rule under Executive Order 12866 is one that is likely to:

- Have an annual effect on the economy (of the nation) of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;
- Create serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in Executive Order 12866.

Although fisheries management actions rarely have an annual effect on the national economy of $100 million or more or trigger any of the other criteria, the Secretary of Commerce with the Office of Management and Budget (OMB), makes the final determination of significance under this Executive Order, based in large measure on the analysis in the RIR. An action determined to be significant is subject to OMB review and clearance before its publication and implementation.

Chapter 10 contains the RIR that identifies economic impacts and assesses of costs and benefits of the proposed salmon bycatch reduction measures.

1.7.8 Information Quality Act (IQA)

The IQA directs the OMB to issue government-wide policy and procedural guidance to all federal agencies to ensure and maximize the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies. The OMB's guidelines require agencies to develop their own guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by the agency. NOAA published its guidelines in September 2002 (available online at http://www.noaanews.noaa.gov/stories/iq.htm). Pursuant to the IQA and the NOAA guidelines, this information product has undergone a pre-dissemination review by NMFS, completed on November 12, 2008.

1.7.9 Coastal Zone Management Act (CZMA)

The CZMA is designed to encourage and assist states in developing coastal management programs, to coordinate State activities, and to safeguard regional and national interests in the coastal zone. Section 307(C) of the CZMA requires that any federal activity affecting the land or water or uses natural resources of a state's coastal zone be consistent with the state's approved coastal management program, to the maximum extent practicable.

A proposed fishery management action that requires an FMP amendment or implementing regulations must be assessed to determine whether it directly affects the coastal zone of a state with an approved coastal zone management program. If so, NMFS must provide the state agency having coastal zone management responsibility with a consistency determination for review at least 90 days before final action. Prior to implementation of the proposed action, NMFS will determine whether this action is consistent to the maximum extent practicable with the enforceable policies of the approved coastal management program of the State of Alaska and submit this determination for review by the responsible state agency.

1.7.10 Executive Order 13175: Consultation and coordination with Indian tribal governments

Executive Order 13175 on consultation and coordination with Indian tribal governments establishes the requirement for regular and meaningful consultation and collaboration with Indian tribal governments in the development of federal regulatory practices that significantly or uniquely affect their communities; to reduce the imposition on unfunded mandates on Indian tribal governments; and to streamline the application process for and increase the availability of waivers to Indian tribal governments. This Executive Order requires federal agencies to have an effective process to involve and consult with representatives of Indian tribal governments in developing regulatory policies and prohibits regulations that impose substantial, direct compliance costs on Indian tribal communities.

Additionally, Congress extended the consultation requirements of Executive Order 13175 to Alaska Native corporations in Division H, Section 161 of the Consolidated Appropriations Act of 2004 (Public Law 108-199; 188 Stat. 452), as amended by Division H, Section 518 of the Consolidated Appropriations Act of 2005 (Public Law 108-447, 118 Stat. 3267). Public Law 108-199 states in Section 161 that "The Director of the Office of Management and Budget shall hereafter consult with Alaska Native corporations on the same basis as Indian tribes under Executive Order No. 13175." Public Law 108-447, in Section 518, amends Division H, Section 161 of Public Law 108-199 to replace Office of Management and Budget with all federal agencies.

In conjunction with the preparation of this EIS, NMFS has initiated a meaningful government-to-government consultation process with affected tribal governments and Alaska Native corporations, as described in Section 1.4.1.

1.7.11 Executive Order 12898: Environmental Justice

Executive Order 12898 requires that federal agencies make achieving environmental justice part of their mission by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low income populations in the United States. Salmon bycatch in the pollock fisheries impacts the in-river users of salmon in western and Interior Alaska, many of whom are Alaska Native. Additionally, a growing number of Alaska Natives participate in the pollock fisheries through the federal CDQ program and, as a result, coastal native communities participating in the CDQ program derive substantial economic benefits from the pollock fishery. This EIS analyzes the effects of this federal action on minority populations in Chapter 9 on Environmental Justice.

1.7.12 Alaska National Interest Lands Conservation Act

Among other things, Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA) creates a priority for "subsistence uses" over the taking of fish and wildlife for other purposes on public lands (16 U.S.C. 3114). ANILCA also imposes obligations on federal agencies with respect to decisions affecting the use of public lands, including a requirement that they analyze the effects of those decisions on subsistence uses and needs (16 U.S.C. 3120).

ANILCA defines "public lands" as lands situated "in Alaska" which, after December 2, 1980, are federal lands, except those lands selected by or granted to the State of Alaska, lands selected by an Alaska Native Corporation under the Alaska Native Claims Settlement Act (ANCSA), and lands referred to in section 19(b) of ANCSA (16 U.S.C. 3102(3)).

The U.S. Supreme Court has ruled that ANILCA's use of "in Alaska" refers to the boundaries of the State of Alaska and concluded that ANILCA does not apply to the outer continental shelf (OCS) region (*Amoco Prod. Co. v. Village of Gambell*, 480 U.S. 531, 546-47 (1987)). The action area for Chinook salmon bycatch management is in the Bering Sea EEZ, which is in the OCS region.

Although ANILCA does not directly apply to the OCS region, NMFS aims to protect such uses pursuant to other laws, such as NEPA and the Magnuson-Stevens Act. This EIS/RIR/IRFA evaluates the consequences of the proposed actions on subsistence uses in Chapter 9 and Chapter 10. Thus NMFS and the Council remain committed to ensuring that federal fishery management actions consider the importance of subsistence uses of salmon and protecting such uses from any adverse consequences. One of the reasons NMFS and the Council have proposed implementing salmon bycatch reduction measures is to protect the interests of salmon subsistence users.

1.7.13 Pacific Salmon Treaty and the Yukon River Agreement

In 2002, the United States and Canada signed the Yukon River Agreement to the Pacific Salmon Treaty. The Yukon River Agreement states that the "Parties shall maintain efforts to increase the in-river run of Yukon River origin salmon by reducing marine catches and by-catches of Yukon River salmon. They shall further identify, quantify and undertake efforts to reduce these catches and by-catches" (Art. XV, Annex IV, Ch. 8, Cl. 12). The Yukon River Agreement also established the Yukon River Panel as an international advisory body to address the conservation, management, and harvest sharing of Canadian-origin salmon between the U.S. and Canada. This proposed action is an element of the Council's efforts to reduce bycatch of salmon in the pollock fishery and ensure compliance with the Agreement. Additionally, in developing the alternatives under consideration, NMFS and the Council have considered the recommendations of the Yukon River Panel. This EIS addresses the substantive issues involving the portion of salmon taken as bycatch in the Bering Sea that originated from the Yukon River and the impacts of salmon bycatch in the pollock fishery on returns of Chinook salmon to the Canadian potion of the Yukon River.

1.7.14 American Fisheries Act (AFA)

The AFA established a cooperative management program for the Bering Sea pollock fisheries. Among the purposes of the AFA was to tighten U.S. vessel ownership standards and to provide the pollock fleet the opportunity to conduct its fishery in a more economically rational manner while protecting non-AFA participants in other fisheries. Since the passage of the AFA, the Council has taken an active role in the development of management measures to implement the various provisions of the AFA. The AFA EIS was prepared to evaluate sweeping changes to the conservation and management program for the Bering Sea pollock fishery and to a lesser extent, the management programs for the other groundfish fisheries of the GOA and BSAI, the king and Tanner crab fisheries of the BSAI, and the scallop fishery off Alaska (NMFS 2002). Under the Magnuson-Stevens Act, the Council prepared Amendments 61/61/13/8 to implement the provisions of the AFA in the groundfish, crab, and scallop fisheries. Amendments 61/61/13/8 incorporated the relevant provisions of the AFA into the FMPs and established a comprehensive management program to implement the AFA. The EIS evaluated the environmental and economic effects of the management program that was implemented under these amendments, and developed scenarios of alternative management programs for comparative use. The AFA EIS is available on the NMFS Alaska Region website at:

http://www.fakr.noaa.gov/sustainablefisheries/afa/eis2002.pdf

NMFS published the final rule implementing the AFA on December 30, 2002 (67 FR 79692). The structure and provisions of the AFA constrain the types of measures that can be implemented to reduce salmon bycatch in the pollock fishery. Chapter 10 contains a detailed discussion of the pollock fishery under the AFA and the relationship between the Chinook salmon bycatch management and the AFA.

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2.0 DESCRIPTION OF ALTERNATIVES

This analysis is focused on alternative measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. This chapter provides a detailed description of the following four alternatives under consideration:

Alternative 1: Status Quo (No Action)

Alternative 2: Hard cap

Alternative 3: Triggered closures

Alternative 4: Preliminary Preferred Alternative

The alternatives analyzed in this EIS/RIR/IRFA represent a complex suite of components, options, and suboptions. However, each of the alternatives involves a limit or “cap” on the number of Chinook salmon that may be caught in the Bering Sea pollock fishery and closure of all or a part of the Bering Sea to pollock fishing once the cap is reached. These closures would occur when a Chinook salmon bycatch cap was reached even if the entire pollock TAC has not yet been harvested.

To best present the alternatives in comparative form, this chapter is organized into sections for each alternative that describe in detail that alternative’s components, options, and suboptions. For each alternative, except Alternative 1, the specific Chinook salmon bycatch cap levels under consideration for each component and option are listed in this chapter. For, Alternatives 2 and 3, eight different cap levels ranging from 29,323 to 87,500 Chinook salmon are available for selection by the Council. Alternative 4 contains three different cap levels. A subset of caps under Alternatives 2 through 4 are used as the basis for the impact analysis in Chapters 4 through 11. To avoid unnecessary repetition, many aspects of the alternatives are presented in this chapter only, and cross-referenced later in the document as applicable. This chapter also discusses potential changes to pollock fishery management and monitoring under each alternative.

These alternatives are not mutually exclusive. The Council may select elements from more than one alternative to formulate its final preferred alternative. In June 2008, the Council selected a preliminary preferred alternative (Alternative 4) by mixing and matching various components and options available under Alternative 2, as well as some additional considerations that are not included under the other alternatives (e.g., a bycatch reduction incentive program developed through an intercooperative agreement). Alternative 4, the Council’s preliminary preferred alternative, is discussed and analyzed separately. Analysts have identified three concerns with Alternative 4 and these issues and some potential solutions are discussed in Section 2.4.3

2.1 Alternative 1: Status Quo (No Action)

Alternative 1 retains the current program of Chinook Salmon Savings Area (SSA) closures triggered by separate non-CDQ and CDQ Chinook salmon prohibited species catch limits (PSC), along with the exemption to these closures by pollock vessels participating in the VHRS ICA under regulations implemented through Amendment 84. Only vessels in the directed pollock fishery are subject to the SSA closures and ICA regulations.

The SSA closures occur upon attainment of Chinook salmon PSC limits, which are specified in federal regulation. These area closures, which close two different Chinook salmon savings areas, are designed to reduce the total amount of Chinook incidentally caught by closing areas with historically high levels of salmon bycatch. Vessels are exempt from savings area closures if they participate in the VRHS ICA described at 50 CFR 679.21(g). The VRHS ICA requires industry to identify and close areas of high salmon bycatch and move to other areas.

2.1.1 Chinook Salmon Savings Areas

Alternative 1 would keep the existing Chinook Salmon Savings Area closures in effect. NMFS would continue to monitor Chinook salmon bycatch based on existing practices and close savings areas to directed fishing for pollock when specified bycatch limits are reached. Federal regulations governing the closure areas are found at 50 CFR 679.21(e).

The two Chinook Salmon Savings Areas close to directed fishing for pollock if 29,000 Chinook salmon are caught by the combined fleet of vessels fishing for pollock in the Bering Sea. The timing of the closure depends upon when the Chinook salmon limit is reached:

1. If the limit is triggered before April 15, the areas close immediately and remain closed through April 15. After April 15, the areas re-open, but are again closed from September 1-December 31.
2. If the limit is reached after April 15, but before September 1, the areas would close on September 1 through the end of the year.
3. If the limit is reached after September 1, the areas are immediately closed through the end of the year.

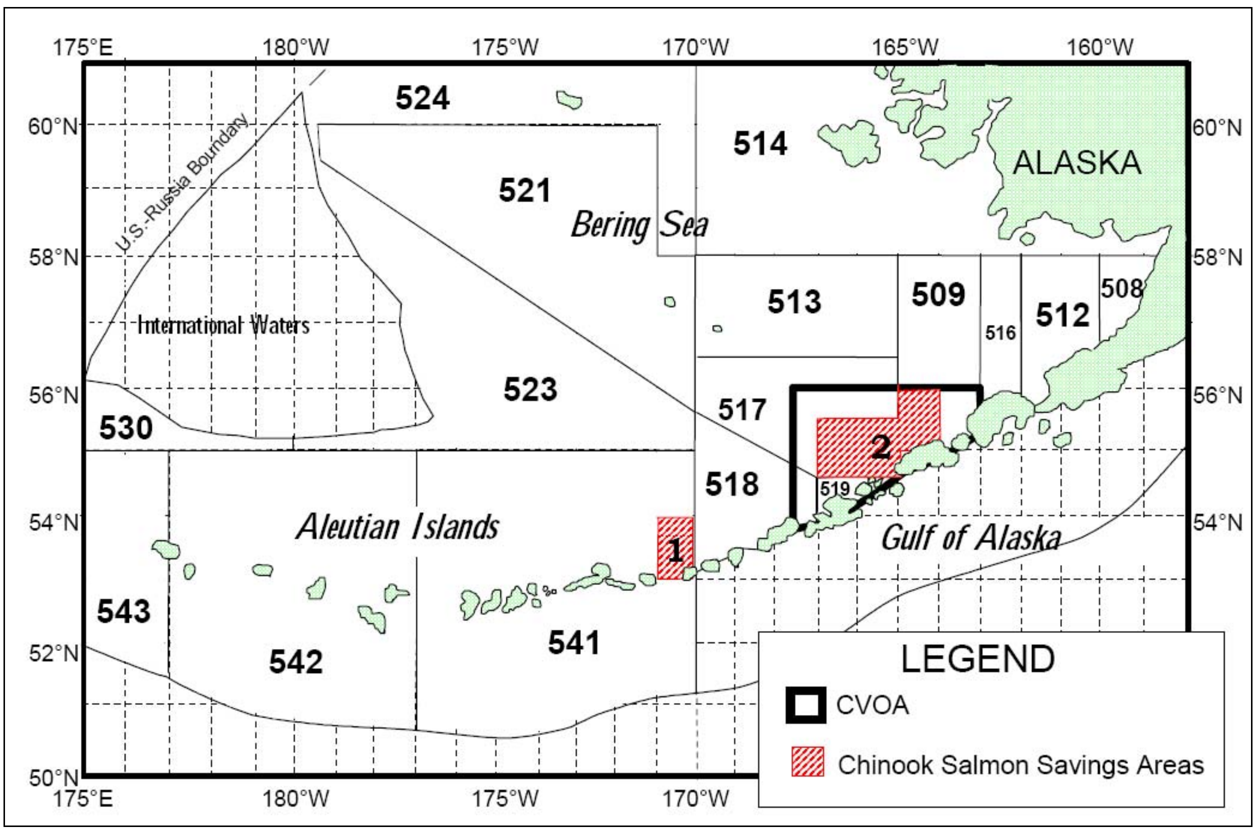

Fig. 2-1 Bering Sea and Aleutian Islands Chinook Salmon Savings Areas.

2.1.1.1 PSC limits for the CDQ Program

Under the status quo, the CDQ Program receives allocations of 7.5 percent of the BS and AI Chinook salmon PSC limits as prohibited species quota (PSQ) reserves. A portion of the PSC limit (7.5%, or 2,175 Chinook salmon) is allocated to the CDQ Program as a prohibited species quota (PSQ) reserve[3], while the remaining 26,825 Chinook salmon are available to the non-CDQ pollock fishery. NMFS further allocates the PSQ reserves among the six CDQ groups based on percentage allocations approved by NMFS on August 8, 2005. For Chinook salmon, the percentage allocations of the PSQ reserve among the CDQ groups are as follows:

- Aleutian Pribilof Island Community Development Association (APICDA) 14%
- Bristol Bay Economic Development Corporation (BBEDC) 21%
- Central Bering Sea Fishermen's Association (CBSFA) 5%
- Coastal Villages Region Fund (24%)
- Norton Sound Economic Development Corporation (NSEDC) 22%
- Yukon Delta Fishery Development Corporation (YDFDC) 14%

Unless exempted because of participation in the VRHS ICA, a CDQ group is prohibited from directed fishing for pollock in the Chinook salmon savings areas when that group's Chinook salmon PSQ is reached. NMFS does not issue fishery closures through rulemaking for the CDQ groups. All CDQ groups are participating in the 2008 salmon bycatch ICA, so they currently are exempt from closure of the Chinook salmon savings area.

2.1.2 Voluntary Rolling Hotspot System Intercooperative Agreement

Amendment 84 to the BSAI FMP exempts vessels directed fishing for pollock from closures of both the Chum and Chinook salmon savings areas if they participate in a VRHS ICA approved by NMFS (NPFMC 2005). The Council developed Amendment 84 to attempt to resolve the bycatch problem through the AFA pollock cooperatives. These regulations were implemented in 2007. A VRHS ICA was approved by NMFS in January 2008. All vessels that participated in the 2008 Bering Sea pollock fishery, except one, participated in this ICA, as well as all CDQ groups.

The VHRS provides real-time salmon bycatch information so that the fleet can avoid areas of high chum or Chinook salmon bycatch rates. Using a system of base bycatch rates, the ICA assigns vessels to certain tiers, based on bycatch rates relative to the base rate, and implements area closures for vessels in certain tiers. Monitoring and enforcement are carried out through private contractual arrangements.

The fleet voluntarily started the VRHS in 2002 for Chinook salmon and in 2001 for chum salmon. The exemption to area closures for vessels that participated in the VHRS was implemented in 2006 and 2007 through an exempted fishing permit. In 2008, NMFS approved an ICA under the regulations implementing Amendment 84 to the BSAI FMP. The 2008 ICA added a fixed Chinook closure area, an adjustable bycatch base rate in the A season, and a larger Bering Sea closure area in the A season.

Parties to the current VRHS ICA include the AFA cooperatives, the CDQ groups, a third-party salmon bycatch data manager, and other entities with interests in Bering Sea salmon bycatch reduction. Inshore cooperatives choose to participate in the ICA, rather than offering this election to individual vessels within a cooperative. Thus, a single vessel in an inshore cooperative cannot elect to opt out of the ICA. Doing so would mean that the cooperative to which they were affiliated would be charged with a

[3] See 50 CFR 679.21(e)(3)(i)(A)(3)(i) .

contractual violation each time the single vessel fished in a closed area (Karl Haflinger, Sea State, personal communication, April 14, 2008).

Federal regulations require the ICA to describe measures that parties to the agreement will take to monitor salmon bycatch and redirect fishing effort away from areas in which salmon bycatch rates are relatively high. It also must include intra-cooperative enforcement measures and various other regulatory conditions. The ICA data manager monitors salmon bycatch in the pollock fisheries and announces area closures for areas with relatively high salmon bycatch rates. The efficacy of voluntary closures and bycatch reduction measures must be reported to the Council annually.

2.2 Alternative 2: Hard Cap (Chinook)

Alternative 2 would establish a hard cap to limit Chinook salmon bycatch in the pollock fishery. When the hard can is reached all directed pollock fishing must cease. Only those Chinook salmon caught by vessels participating in the directed pollock fishery would accrue towards the cap, and fishery closures upon attainment of the cap would apply only to directed fishing for pollock. Several different options as to the scale of management for the hard cap are provided under this alternative: at the fishery level (separate hard caps for the CDQ Program and the remaining three AFA sectors combined); at the sector level (each of the 4 sectors including the CDQ sector receive a sector level cap with the CDQ sector level cap allocated to the individual CDQ groups); and at the cooperative level (the inshore CV sector level cap is further subdivided and managed at the individual cooperative level) (Table 2-1).

In order to select this alternative, the Council must select one of the options under Component 1, setting the hard cap. As described below and shown in Table 2-1, hard caps would be divided by season according to one of the options in Component 1 (Options 1-1 through 1-4). If the hard cap is apportioned by sector (under Component 2), options are provided for the subdivision. Options for sector transfer or rollovers are included in Component 3. Further subdivision of an inshore sector cap to individual inshore cooperatives is discussed under Component 4 (cooperative provisions).

If the Council does not select any options under the Components 2-4, the Alternative 2 hard cap would apply at the fishery level and would be divided between the CDQ and non-CDQ fisheries. The CDQ sector would receive an allocation of 7.5% of a fishery level hard cap. The CDQ allocation would be further allocated among the six CDQ groups based on percentage allocations currently in effect. Each CDQ group would be prohibited from exceeding its Chinook salmon allocation. This prohibition would require the CDQ group to stop directed fishing for pollock once its cap was reached because further directed fishing for pollock would likely result in exceeding the cap.

The remaining 92.5% of a fishery level hard cap would be apportioned to the non-CDQ sectors (inshore CV sector, offshore CP sector, and mothership sector) combined. The inshore CV sector contains seven cooperatives, each composed of multiple fishing vessels associated with a specific inshore processor. There also is a possibility than an inshore limited access sector could form, if one or more catcher vessels does not join an inshore cooperative. All bycatch of Chinook salmon by any vessel in any of these three AFA sectors would accrue against the fishery level hard cap, and once the cap was reached, NMFS would simultaneously prohibit directed fishing for pollock by all three of these sectors.

Under Alternative 2, existing regulations related to the Chinook salmon prohibited species catch limit of 29,000 salmon and triggered closures of the Chinook salmon savings areas in the Bering Sea would be removed from 50 CFR part 679.21. The 700 Chinook salmon trigger cap and Chinook Salmon savings area in the Aleutian Islands would remain in effect. Additionally, the current VRHS ICA regulations would be revised to remove all reference to Chinook salmon. Regulations associated with the non-Chinook salmon elements of the VRHS ICA would remain in regulations.

Per Council direction (February 2008), the impact of implementing a specific cap level for Alternative 2 was analyzed based on a subset of the range of cap levels, as indicated in the tables under each component and option. The Council may select any cap level within the range of cap level options in choosing its preferred alternative.

Table 2-1 Alternative 2 components, options, and suboptions.

<table>
<tr><td rowspan="3">Setting the hard cap (Component 1)</td><td rowspan="2">Option 1: Select from a range of numbers</td><td colspan="4">i) 87,500
ii) 68,392
iii) 57,333
iv) 47,591
v) 43,328
vi) 38,891
vii) 32,482
viii) 29,323</td></tr>
<tr><td colspan="4">Suboption adjust periodically based on updated bycatch information</td></tr>
<tr><td>Divide cap between A and B season</td><td colspan="4">Option 1-1: 70/30 (A season/B season)
Option 1-2: 58/42 (A season/B season)
Option 1-3: 55/45 (A season/B season)
Option 1-4: 50/50 (A season/B season)
Suboption rollover unused salmon from the A season to the B season, with in a sector and calendar year.</td></tr>
<tr><td rowspan="7">Allocating the hard cap to sectors (Component 2)</td><td></td><td>CDQ</td><td>Inshore CV</td><td>Mothership</td><td>Offshore CP</td></tr>
<tr><td>No allocation</td><td>7.5%; allocated and managed at the CDQ group level</td><td colspan="3">92.5%; managed at the combined fishery-level for all three sectors</td></tr>
<tr><td>Option 1 (AFA)</td><td>10%</td><td>45%</td><td>9%</td><td>36%</td></tr>
<tr><td>Option 2a (hist. avg. 04-06)</td><td>3%</td><td>70%</td><td>6%</td><td>21%</td></tr>
<tr><td>Option 2b (hist. avg. 02-06)</td><td>4%</td><td>65%</td><td>7%</td><td>25%</td></tr>
<tr><td>Option 2c (hist. avg. 97-06)</td><td>4%</td><td>62%</td><td>9%</td><td>25%</td></tr>
<tr><td>Option 2d (midpoint)</td><td>6.5%</td><td>57.5%</td><td>7.5%</td><td>28.5%</td></tr>
<tr><td rowspan="3">Sector transfers (Component 3)</td><td colspan="5">No transfers</td></tr>
<tr><td>Option 1</td><td colspan="4">Caps are transferable among sectors in a fishing season.
Suboption: Maximum amount of transfer limited to: a 50%; b 70%; c 90%</td></tr>
<tr><td>Option 2</td><td colspan="4">NMFS rolls over unused salmon bycatch to sectors still fishing in a season, based on proportion of pollock remaining to be harvested.</td></tr>
<tr><td rowspan="5">Allocating the hard cap to cooperatives (Component 4)</td><td>No allocation</td><td colspan="4">Allocation managed at the inshore CV sector level.</td></tr>
<tr><td>Allocation</td><td colspan="4">Allocate cap to each cooperative based on that cooperative’s proportion of pollock allocation.</td></tr>
<tr><td rowspan="3">Cooperative Transfers</td><td>Option 1</td><td colspan="3">Lease pollock among cooperatives in a season or a year</td></tr>
<tr><td>Option 2</td><td colspan="3">Transfer salmon bycatch</td></tr>
<tr><td colspan="4">Suboption Maximum amount of transfer limited to the following percentage of salmon remaining: a 50%; b 70%; c 90%</td></tr>
</table>

2.2.1 Component 1: Setting the Hard Cap

Component 1 would establish the annual hard cap number based upon averages of historical numbers and other considerations, as noted below. Component 1 sets the overall cap; this could be either applied to the CDQ and non-CDQ fisheries, or may be subdivided by sector (Component 2) and cooperative (Component 4). All annual hard caps would be apportioned by season.

2.2.1.1 Range of numbers for a hard cap

Table 2-2 lists the range of numbers considered for the overall Chinook salmon hard caps, in numerical order, highest to lowest. As listed here, the CDQ allocation of the fishery level cap would be 7.5%, with the remainder apportioned to the combined non-CDQ fishery.

Table 2-2 Range of suboptions for Chinook salmon hard caps, in numbers of fish, with breakout for CDQ allocation (7.5 %) and remainder for non-CDQ fleet

Suboption	Overall fishery level cap	CDQ allocation	Non-CDQ cap (all sectors combined)
i)	87,500	6,563	80,938
ii)	68,392	5,129	63,263
iii)	57,333	4,300	53,033
iv)	47,591	3,569	44,022
v)	43,328	3,250	40,078
vi)	38,891	2,917	35,974
vii)	32,482	2,436	30,046
viii)	29,323	2,199	27,124

The following provides the rationale (by suboption number) for each hard cap listed in Table 2-2. Suboption i, a hard cap of 87,500 Chinook salmon, represents the upper end of the recent range of observed bycatch included in the BSAI groundfish fishery Incidental Take Statement (ITS; NMFS 1-11-07 supplemental Biological Opinion). This amount is related to the ESA consultation on the incidental catch of ESA-listed salmonids in the BSAI groundfish trawl fisheries. An ITS specifies the expected take of an ESA-listed species for the activity consulted on. The ESA-listed salmonids originate in the U.S. Pacific Northwest; none are from Alaska or western Alaska stocks. Additional information on the listed stocks, their relative contribution to the overall bycatch of Chinook salmon in the BSAI groundfish fisheries, and the ESA consultation, are covered in Section 5.2.8 on ESA-listed species.

Suboptions ii-vi refer to average bycatch numbers by the Bering Sea pollock trawl fishery over a range of historical year combinations, from 1997 through 2006.

- Suboption ii is the 3-year average from 2004 to 2006.
- Suboption iii is the 5-year average from 2002 to 2006.
- Suboption iv is the 10-year average from 1997 to 2006, with the lowest year (2000) dropped prior to averaging because an injunction on the fishery altered normal fishing patterns in that year.[4]
- Suboption v is the straight 10-year average including all years from 1997 to 2006.
- Suboption vi is the 10-year average from 1997 to 2006, but with the highest year of bycatch (2006) dropped prior to averaging to provide contrast with suboption iv.
- Suboption vii is the 10-year average from 1992 to 2001.
- Suboption viii is the 5-year average from 1997 to 2001.

[4] In connection with an ESA lawsuit pertaining to Steller sea lions, a U.S. Federal Court injunction on the fishery altered normal fishing patterns in that year.

Suboptions vii and viii include year combinations that consider bycatch levels prior to accession to the Yukon River Agreement (signed in 2002). Additional information on the Yukon River Agreement and the Pacific Salmon Treaty are contained in section 1.7.13.

For analytical purposes only, a subset of the cap numbers included in the eight suboptions were used in this document to assess the impacts of operating under a given hard cap. This subset approximates the upper and lower endpoints of the suboption range, and two equidistant midpoints (Table 2-3).

Table 2-3 Range of Chinook salmon hard caps, in numbers of fish, for use in the analysis of impacts

	Chinook	CDQ	Non-CDQ
i)	87,500	6,563	80,938
ii)	68,100	5,108	62,993
iii)	48,700	3,653	45,048
iv)	29,300	2,198	27,103

Suboption: Periodic adjustments to cap based on updated bycatch information.

Under this suboption, the Council would commit to reassess updated salmon bycatch information after a certain number of years, and determine whether adjustments to the hard cap, as implemented under this action, are needed. In selecting this option, the Council would specify when the reassessment of salmon bycatch information would occur. Any revisions to the salmon bycatch management measures would require additional analysis and rulemaking. As a general rule, the Council may reassess any management measure at any time and does not need to specify a particular timeframe for reassessment of the Chinook salmon bycatch management measures.

2.2.1.2 Seasonal distribution of caps

Any hard cap shall be divided between the pollock A and B seasons, according to one of the following seasonal distribution options (A/B season):

Option 1-1 70/30

Option 1-2 58/42 (based on the 2000-2007 average distributional ratio of salmon bycatch between A and B seasons)

Option 1-3 55/45

Option 1-4 50/50

Suboption Unused salmon from the A season would be made available to the recipient of the salmon bycatch hard cap in the B season, within each management year.

The options and suboption for the seasonal division of sector level caps and transferable allocations available under Components 1, 2, 3, and 4 and would be applied at the same seasonal division as the overall hard caps.

Table 2-4 illustrates the intersection of the seasonal distribution of caps, under Options 1-1 through 1-4, using the range of overall fishery hard caps for analytical purposes (from Table 2-3). An annual hard cap with seasonal apportionments means that directed fishing for pollock would close once the A-season apportionment of the annual hard cap was reached. For the analysis, in order to avoid further confusion regarding ranges under consideration, seasonal distribution options are only shown applied to the analytical subset of caps rather than the full range of caps in the eight suboptions. In analyzing Alternative 2, Option 1-3 (55/45) is not evaluated in detail as the effects of this seasonal distribution are similar to 58/42 split. This option would not provide much contrast compared to the other seasonal distribution options.

Table 2-4 Seasonal distribution options as applied to the analytical subset of fishery level Chinook salmon hard caps, in numbers of fish, for CDQ and non-CDQ.

Fishery level cap	Option for A/B distribution	A season cap	B season cap	A season Non-CDQ	A season CDQ	B season Non-CDQ	B season CDQ
87,500	1-1: 70/30	61,250	26,250	56,656	4,594	24,281	1,969
	1-2: 58/42	50,750	36,750	46,944	3,806	33,994	2,756
	1-3: 55/45	48,125	39,375	44,516	3,609	36,422	2,953
	1-4: 50/50	43,750	43,750	40,469	3,281	40,469	3,281
68,100	1-1: 70/30	47,670	20,430	44,095	3,575	18,898	1,532
	1-2: 58/42	39,498	28,602	36,536	2,962	26,457	2,145
	1-3: 55/45	37,455	30,645	34,646	2,809	28,347	2,298
	1-4: 50/50	34,050	34,050	31,496	2,554	31,496	2,554
48,700	1-1: 70/30	34,090	14,610	31,533	2,557	13,514	1,096
	1-2: 58/42	28,246	20,454	26,128	2,118	18,920	1,534
	1-3: 55/45	26,785	21,915	24,776	2,009	20,271	1,644
	1-4: 50/50	24,350	24,350	22,524	1,826	22,524	1,826
29,300	1-1: 70/30	20,510	8,790	18,972	1,538	8,131	659
	1-2: 58/42	16,994	12,306	15,719	1,275	11,383	923
	1-3: 55/45	16,115	13,185	14,906	1,209	12,196	989
	1-4: 50/50	14,650	14,650	13,551	1,099	13,551	1,099

Note: CDQ receives 7.5% of the overall fishery-level cap.

2.2.2 Component 2: Sector Allocation

If this component is selected, the hard cap would be apportioned to the sector level. This would result in separate sector level caps for the CDQ sector, the inshore catcher vessel (CV) sector, the mothership sector, and the offshore catcher processor (CP) sector.

The bycatch of Chinook salmon would be tabulated on a sector level basis. If the total salmon bycatch in a non-CDQ sector reaches the cap specified for that sector, NMFS would close directed fishing for pollock by that sector for the remainder of the season. The remaining sectors may continue to fish until they reach their specific sector level cap. The CDQ allocations would continue to be managed as they are under the status quo, with further allocation of the CDQ salmon bycatch cap among the six CDQ groups, transferable allocations within the CDQ Program, and a prohibition against a CDQ group exceeding its salmon bycatch allocation.

For analytical purposes, a subset of the sector allocation options which provides the greatest contrast will be used for detailed analysis. Option 1, Option 2a, and Option 2d encompass the range of impacts (high, medium, and low) for each sector and therefore are analyzed.

2.2.2.1 Option 1: Sector allocation based on pollock allocation under AFA

Option 1) 10% of the cap to the CDQ sector, and the remaining allocated as follows: 50% inshore CV fleet; 10% for the mothership fleet; and 40% for the offshore CP fleet. This results in allocations of 45% inshore CV, 9% mothership and 36% offshore CP.

This option would set the sector level hard caps based the percentage allocations established for pollock allocations under the AFA. Application of these percentages results in the following range of sector level caps, based upon the range of caps in Component 1, Option 1 (Table 2-5). Note that here the CDQ allocation of salmon is higher than under status quo (10% rather than 7.5%).

Table 2-5 Annual sector level Chinook salmon hard caps, in numbers of fish, resulting from Option 1, percentage allocation - 10% CDQ and the remaining 90% divided 50% inshore CV fleet; 10% for the mothership fleet; and 40% for the offshore CP fleet

Suboption	Overall fishery cap	CDQ	Inshore CV	Mothership	Offshore CP
i)	87,500	8,750	39,375	7,875	31,500
ii)	68,392	6,839	30,776	6,155	24,621
iii)	57,333	5,733	25,800	5,160	20,640
iv)	47,591	4,759	21,416	4,283	17,133
v)	43,328	4,333	19,498	3,900	15,598
vi)	38,891	3,889	17,501	3,500	14,001
vii)	32,482	3,248	14,617	2,923	11,694
viii)	29,323	2,932	13,195	2,639	10,556

Table 2-6 lists the range of sector cap levels under Option 1 for the A season (applying the seasonal allocation options listed in Table 2-4), and Table 2-7 for the B season, which will be utilized to evaluate the impacts of Component 2, Option 1. As noted above, the sector level hard caps in the shaded rows are not analyzed.

Table 2-6 A-season sector level Chinook salmon hard caps, in numbers of fish, under Option 1, percentage allocation, using seasonal distribution options

Fishery level cap	Option for A/B distribution	A season overall cap	CDQ	Inshore CV	Mothership	Offshore CP
87,500	1-1: 70/30	61,250	6,125	27,563	5,513	22,050
	1-2: 58/42	50,750	5,075	22,838	4,568	18,270
	1-3: 55/45	48,125	4,813	21,656	4,331	17,325
	1-4: 50/50	43,750	4,375	19,688	3,938	15,750
68,100	1-1: 70/30	47,670	4,767	21,452	4,290	17,161
	1-2: 58/42	39,498	3,950	17,774	3,555	14,219
	1-3: 55/45	37,455	3,746	16,855	3,371	13,484
	1-4: 50/50	34,050	3,405	15,323	3,065	12,258
48,700	1-1: 70/30	34,090	3,409	15,341	3,068	12,272
	1-2: 58/42	28,246	2,825	12,711	2,542	10,169
	1-3: 55/45	26,785	2,679	12,053	2,411	9,643
	1-4: 50/50	24,350	2,435	10,958	2,192	8,766
29,300	1-1: 70/30	20,510	2,051	9,230	1,846	7,384
	1-2: 58/42	16,994	1,699	7,647	1,529	6,118
	1-3: 55/45	16,115	1,612	7,252	1,450	5,801
	1-4: 50/50	14,650	1,465	6,593	1,319	5,274

Table 2-7 B-season sector level Chinook salmon hard caps, in numbers of fish, under Option 1, percentage allocation, using seasonal distribution options

Fishery level cap	Option for A/B distribution	B season overall cap	CDQ	Inshore CV	Mothership	Offshore CP
87,500	1-1: 70/30	26,250	2,625	11,813	2,363	9,450
	1-2: 58/42	36,750	3,675	16,538	3,308	13,230
	1-3: 55/45	39,375	3,938	17,719	3,544	14,175
	1-4: 50/50	43,750	4,375	19,688	3,938	15,750
68,100	1-1: 70/30	20,430	2,043	9,194	1,839	7,355
	1-2: 58/42	28,602	2,860	12,871	2,574	10,297
	1-3: 55/45	30,645	3,065	13,790	2,758	11,032
	1-4: 50/50	34,050	3,405	15,323	3,065	12,258
48,700	1-1: 70/30	14,610	1,461	6,575	1,315	5,260
	1-2: 58/42	20,454	2,045	9,204	1,841	7,363
	1-3: 55/45	21,915	2,192	9,862	1,972	7,889
	1-4: 50/50	24,350	2,435	10,958	2,192	8,766
29,300	1-1: 70/30	8,790	879	3,956	791	3,164
	1-2: 58/42	12,306	1,231	5,538	1,108	4,430
	1-3: 55/45	13,185	1,319	5,933	1,187	4,747
	1-4: 50/50	14,650	1,465	6,593	1,319	5,274

2.2.2.2 Option 2: Historical average of Chinook salmon bycatch by sector

Under Option 2, sector level caps would be set for each sector based on historical average percent bycatch, by sector, over 3-, 5-, and 10-year time periods, and using a mid-point between these ranges and those under Option 1. Similar to the years included to set the overall cap, the historical years do not consider the most recent (and historical high) year of 2007.

Option 2) Historical average of percent bycatch by sector, based on:

a) 3-year (2004–2006) average: CDQ 3%; inshore CV fleet 70%; mothership fleet 6%; offshore CP fleet 21%.

b) 5-year (2002–2006) average: CDQ 4%; inshore CV fleet 65%; mothership fleet 7%; offshore CP fleet 24%.

c) 10-year (1997–2006) average: CDQ 4%; inshore CV fleet 62%; mothership fleet 9%; offshore CP fleet 25%.

d) Midpoints of the ranges provided by Option 1 and Options 2(a-c) by sector: CDQ 6.5%; inshore CV fleet 57.5%; mothership fleet 7.5%; offshore CP fleet 28.5%

Option 2a uses the historical averages of percent bycatch by sector from 2004 through 2006. This results in the following average percentages by sector: CDQ 3%; inshore CV fleet 70%; mothership fleet 6%; offshore CP fleet 21%. Those percentages are applied to the range of caps under consideration in Component 1, Option 1 (Table 2-8).

Table 2-8 Annual sector level Chinook salmon hard caps, in numbers of fish, resulting from Option 2a, average historical bycatch by sector from 2004-2006

Suboption	Overall fishery cap	CDQ 3%	Inshore CV 70%	Mothership 6%	Offshore CP 21%
i)	87,500	2,625	61,250	5,250	18,375
ii)	68,392	2,052	47,874	4,104	14,362
iii)	57,333	1,720	40,133	3,440	12,040
iv)	47,591	1,428	33,314	2,855	9,994
v)	43,328	1,300	30,330	2,600	9,099
vi)	38,891	1,167	27,224	2,333	8,167
vii)	32,482	974	22,737	1,949	6,821
viii)	29,323	880	20,526	1,759	6,158

Option 2b considers the historical averages of percent bycatch by sector from the 5 year time period from 2002 to 2006. This results in the following average percentages by sector: CDQ 4%; inshore CV fleet 65%; mothership fleet 7%; offshore CP fleet 24%. Those percentages are applied to the range of caps under consideration in Component 1, Option 1 (Table 2-9).

Table 2-9 Annual sector level Chinook salmon hard caps, in numbers of fish, resulting from Option 2b, average historical bycatch by sector from 2002-2006

Suboption	Overall fishery cap	CDQ 4%	Inshore CV 65%	Mothership 7%	Offshore CP 24%
i)	87,500	3,500	56,875	6,125	21,000
ii)	68,392	2,736	44,455	4,787	16,414
iii)	57,333	2,293	37,266	4,013	13,760
iv)	47,591	1,904	30,934	3,331	11,422
v)	43,328	1,733	28,163	3,033	10,399
vi)	38,891	1,556	25,279	2,722	9,334
vii)	32,482	1,299	21,113	2,274	7,796
viii)	29,323	1,173	19,060	2,053	7,038

Option 2c considers the historical averages of percent bycatch by sector from the 10 year time period from 1997 to 2006. This results in the following average percentages by sector: CDQ 4%; inshore CV fleet 62%; mothership fleet 9%; offshore CP fleet 25%. Those percentages are applied to the range of caps under consideration in Component 1, Option 1 (Table 2-10).

Table 2-10 Annual sector level Chinook salmon hard caps, in numbers of fish, resulting from Option 2c, average historical bycatch by sector from 1997-2006

Suboption	Overall fishery cap	CDQ 4%	Inshore CV 62%	Mothership 9%	Offshore CP 25%
i)	87,500	3,500	54,250	7,875	21,875
ii)	68,392	2,736	42,403	6,155	17,098
iii)	57,333	2,293	35,546	5,160	14,333
iv)	47,591	1,904	29,506	4,283	11,898
v)	43,328	1,733	26,863	3,900	10,832
vi)	38,891	1,556	24,112	3,500	9,723
vii)	32,482	1,299	20,139	2,923	8,121
viii)	29,323	1,173	18,180	2,639	7,331

Option 2d considers the midpoint of the ranges for each sector under consideration in Option 1 and Options 2a-c as listed previously. This results in the following average percentages by sector: CDQ 6.5%; inshore CV fleet 57.5%; mothership fleet 7.5%; offshore CP fleet 28.5%. Those percentages are applied to the range of caps under consideration in Component 1, Option 1 (Table 2-11).

Table 2-11 Annual sector level Chinook salmon hard caps, in numbers of fish, resulting from Option 2d, midpoints of sector ranges

Suboption	Overall fishery cap	CDQ 6.5%	Inshore CV 57.5%	Mothership 7.5%	Offshore CP 28.5%
i)	87,500	5,688	50,313	6,563	24,938
ii)	68,392	4,445	39,325	5,129	19,492
iii)	57,333	3,727	32,966	4,300	16,340
iv)	47,591	3,093	27,365	3,569	13,563
v)	43,328	2,816	24,914	3,250	12,348
vi)	38,891	2,528	22,362	2,917	11,084
vii)	32,482	2,111	18,677	2,436	9,257
viii)	29,323	1,906	16,861	2,199	8,357

Table 2-12 - Table 2-15 list the range of sector cap levels for the A season under Options 2a-2d (applying the seasonal allocation options listed in Table 2-4), which will be utilized to evaluate the impacts of Component 2. Shaded rows are omitted from detailed impact analysis.

Table 2-12 A-season sector level Chinook salmon hard caps, in numbers of fish, under Option 2a, sector allocation, using seasonal distribution options

Fishery level cap	Option for A/B division	A season overall cap	CDQ	Inshore CV	Mothership	Offshore CP
87,500	1-1: 70/30	61,250	1,838	42,875	3,675	12,863
	1-2: 58/42	50,750	1,523	35,525	3,045	10,658
	1-3: 55/45	48,125	1,444	33,688	2,888	10,106
	1-4: 50/50	43,750	1,313	30,625	2,625	9,188
68,100	1-1: 70/30	47,670	1,430	33,369	2,860	10,011
	1-2: 58/42	39,498	1,185	27,649	2,370	8,295
	1-3: 55/45	37,455	1,124	26,219	2,247	7,866
	1-4: 50/50	34,050	1,022	23,835	2,043	7,151
48,700	1-1: 70/30	34,090	1,023	23,863	2,045	7,159
	1-2: 58/42	28,246	847	19,772	1,695	5,932
	1-3: 55/45	26,785	804	18,750	1,607	5,625
	1-4: 50/50	24,350	731	17,045	1,461	5,114
29,300	1-1: 70/30	20,510	615	14,357	1,231	4,307
	1-2: 58/42	16,994	510	11,896	1,020	3,569
	1-3: 55/45	16,115	483	11,281	967	3,384
	1-4: 50/50	14,650	440	10,255	879	3,077

Table 2-13 A-season sector level Chinook salmon hard caps, in numbers of fish, under Option 2b, sector allocation, using seasonal distribution options

Fishery level cap	Option for A/B division	A season overall cap	CDQ	Inshore CV	Mothership	Offshore CP
87,500	1-1: 70/30	61,250	2,450	39,813	4,288	14,700
	1-2: 58/42	50,750	2,030	32,988	3,553	12,180
	1-3: 55/45	48,125	1,925	31,281	3,369	11,550
	1-4: 50/50	43,750	1,750	28,438	3,063	10,500
68,100	1-1: 70/30	47,670	1,907	30,986	3,337	11,441
	1-2: 58/42	39,498	1,580	25,674	2,765	9,480
	1-3: 55/45	37,455	1,498	24,346	2,622	8,989
	1-4: 50/50	34,050	1,362	22,133	2,384	8,172
48,700	1-1: 70/30	34,090	1,364	22,159	2,386	8,182
	1-2: 58/42	28,246	1,130	18,360	1,977	6,779
	1-3: 55/45	26,785	1,071	17,410	1,875	6,428
	1-4: 50/50	24,350	974	15,828	1,705	5,844
29,300	1-1: 70/30	20,510	820	13,332	1,436	4,922
	1-2: 58/42	16,994	680	11,046	1,190	4,079
	1-3: 55/45	16,115	645	10,475	1,128	3,868
	1-4: 50/50	14,650	586	9,523	1,026	3,516

Table 2-14 A-season sector level Chinook salmon hard caps, in numbers of fish, under Option 2c, sector allocation, using seasonal division options

Fishery level cap	Option for A/B division	A season overall cap	CDQ	Inshore CV	Mothership	Offshore CP
87,500	1-1: 70/30	61,250	2,450	37,975	5,513	15,313
	1-2: 58/42	50,750	2,030	31,465	4,568	12,688
	1-3: 55/45	48,125	1,925	29,838	4,331	12,031
	1-4: 50/50	43,750	1,750	27,125	3,938	10,938
68,100	1-1: 70/30	47,670	1,907	29,555	4,290	11,918
	1-2: 58/42	39,498	1,580	24,489	3,555	9,875
	1-3: 55/45	37,455	1,498	23,222	3,371	9,364
	1-4: 50/50	34,050	1,362	21,111	3,065	8,513
48,700	1-1: 70/30	34,090	1,364	21,136	3,068	8,523
	1-2: 58/42	28,246	1,130	17,513	2,542	7,062
	1-3: 55/45	26,785	1,071	16,607	2,411	6,696
	1-4: 50/50	24,350	974	15,097	2,192	6,088
29,300	1-1: 70/30	20,510	820	12,716	1,846	5,128
	1-2: 58/42	16,994	680	10,536	1,529	4,249
	1-3: 55/45	16,115	645	9,991	1,450	4,029
	1-4: 50/50	14,650	586	9,083	1,319	3,663

Table 2-15 A-season sector level Chinook salmon hard caps, in numbers of fish, under Option 2d, sector allocation, using seasonal division options

Fishery level cap	Option for A/B division	A season overall cap	CDQ	Inshore CV	Mothership	Offshore CP
87,500	1-1: 70/30	61,250	3,981	35,219	4,594	17,456
	1-2: 58/42	50,750	3,299	29,181	3,806	14,464
	1-3: 55/45	48,125	3,128	27,672	3,609	13,716
	1-4: 50/50	43,750	2,844	25,156	3,281	12,469
68,100	1-1: 70/30	47,670	3,099	27,410	3,575	13,586
	1-2: 58/42	39,498	2,567	22,711	2,962	11,257
	1-3: 55/45	37,455	2,435	21,537	2,809	10,675
	1-4: 50/50	34,050	2,213	19,579	2,554	9,704
48,700	1-1: 70/30	34,090	2,216	19,602	2,557	9,716
	1-2: 58/42	28,246	1,836	16,241	2,118	8,050
	1-3: 55/45	26,785	1,741	15,401	2,009	7,634
	1-4: 50/50	24,350	1,583	14,001	1,826	6,940
29,300	1-1: 70/30	20,510	1,333	11,793	1,538	5,845
	1-2: 58/42	16,994	1,105	9,772	1,275	4,843
	1-3: 55/45	16,115	1,047	9,266	1,209	4,593
	1-4: 50/50	14,650	952	8,424	1,099	4,175

Table 2-16 through Table 2-19 list the range of sector cap levels for the B season under Options 2a-2d (applying the seasonal allocation options listed in Table 2-4), which were utilized to evaluate the impacts of Component 2. Shaded rows were omitted from detailed impact analysis.

Table 2-16 B-season sector level Chinook salmon hard caps, in numbers of fish, under Option 2a, sector allocation, using seasonal distribution options

Fishery level cap	Option for A/B distribution	B season overall cap	CDQ	Inshore CV	Mothership	Offshore CP
87,500	1-1: 70/30	26,250	788	18,375	1,575	5,513
	1-2: 58/42	36,750	1,103	25,725	2,205	7,718
	1-3: 55/45	39,375	1,181	27,563	2,363	8,269
	1-4: 50/50	43,750	1,313	30,625	2,625	9,188
68,100	1-1: 70/30	20,430	613	14,301	1,226	4,290
	1-2: 58/42	28,602	858	20,021	1,716	6,006
	1-3: 55/45	30,645	919	21,452	1,839	6,435
	1-4: 50/50	34,050	1,022	23,835	2,043	7,151
48,700	1-1: 70/30	14,610	438	10,227	877	3,068
	1-2: 58/42	20,454	614	14,318	1,227	4,295
	1-3: 55/45	21,915	657	15,341	1,315	4,602
	1-4: 50/50	24,350	731	17,045	1,461	5,114
29,300	1-1: 70/30	8,790	264	6,153	527	1,846
	1-2: 58/42	12,306	369	8,614	738	2,584
	1-3: 55/45	13,185	396	9,230	791	2,769
	1-4: 50/50	14,650	440	10,255	879	3,077

Table 2-17 B-season sector level Chinook salmon hard caps, in numbers of fish, under Option 2b, sector allocation, using seasonal distribution options

Fishery level cap	Option for A/B distribution	B season overall cap	CDQ	Inshore CV	Mothership	Offshore CP
87,500	1-1: 70/30	26,250	1,050	17,063	1,838	6,300
	1-2: 58/42	36,750	1,470	23,888	2,573	8,820
	1-3: 55/45	39,375	1,575	25,594	2,756	9,450
	1-4: 50/50	43,750	1,750	28,438	3,063	10,500
68,100	1-1: 70/30	20,430	817	13,280	1,430	4,903
	1-2: 58/42	28,602	1,144	18,591	2,002	6,864
	1-3: 55/45	30,645	1,226	19,919	2,145	7,355
	1-4: 50/50	34,050	1,362	22,133	2,384	8,172
48,700	1-1: 70/30	14,610	584	9,497	1,023	3,506
	1-2: 58/42	20,454	818	13,295	1,432	4,909
	1-3: 55/45	21,915	877	14,245	1,534	5,260
	1-4: 50/50	24,350	974	15,828	1,705	5,844
29,300	1-1: 70/30	8,790	352	5,714	615	2,110
	1-2: 58/42	12,306	492	7,999	861	2,953
	1-3: 55/45	13,185	527	8,570	923	3,164
	1-4: 50/50	14,650	586	9,523	1,026	3,516

Table 2-18 B-season sector level Chinook salmon hard caps, in numbers of fish, under Option 2c, sector allocation, using seasonal distribution options

Fishery level cap	Option for A/B distribution	B season overall cap	CDQ	Inshore CV	Mothership	Offshore CP
87,500	1-1: 70/30	26,250	1,050	16,275	2,363	6,563
	1-2: 58/42	36,750	1,470	22,785	3,308	9,188
	1-3: 55/45	39,375	1,575	24,413	3,544	9,844
	1-4: 50/50	43,750	1,750	27,125	3,938	10,938
68,100	1-1: 70/30	20,430	817	12,667	1,839	5,108
	1-2: 58/42	28,602	1,144	17,733	2,574	7,151
	1-3: 55/45	30,645	1,226	19,000	2,758	7,661
	1-4: 50/50	34,050	1,362	21,111	3,065	8,513
48,700	1-1: 70/30	14,610	584	9,058	1,315	3,653
	1-2: 58/42	20,454	818	12,681	1,841	5,114
	1-3: 55/45	21,915	877	13,587	1,972	5,479
	1-4: 50/50	24,350	974	15,097	2,192	6,088
29,300	1-1: 70/30	8,790	352	5,450	791	2,198
	1-2: 58/42	12,306	492	7,630	1,108	3,077
	1-3: 55/45	13,185	527	8,175	1,187	3,296
	1-4: 50/50	14,650	586	9,083	1,319	3,663

Table 2-19 B-season sector level Chinook salmon hard caps, in numbers of fish, under Option 2d, sector allocation, using seasonal distribution options

Fishery level cap	Option for A/B distribution	B season overall cap	CDQ	Inshore CV	Mothership	Offshore CP
87,500	1-1: 70/30	26,250	1,706	15,094	1,969	7,481
	1-2: 58/42	36,750	2,389	21,131	2,756	10,474
	1-3: 55/45	39,375	2,559	22,641	2,953	11,222
	1-4: 50/50	43,750	2,844	25,156	3,281	12,469
68,100	1-1: 70/30	20,430	1,328	11,747	1,532	5,823
	1-2: 58/42	28,602	1,859	16,446	2,145	8,152
	1-3: 55/45	30,645	1,992	17,621	2,298	8,734
	1-4: 50/50	34,050	2,213	19,579	2,554	9,704
48,700	1-1: 70/30	14,610	950	8,401	1,096	4,164
	1-2: 58/42	20,454	1,330	11,761	1,534	5,829
	1-3: 55/45	21,915	1,424	12,601	1,644	6,246
	1-4: 50/50	24,350	1,583	14,001	1,826	6,940
29,300	1-1: 70/30	8,790	571	5,054	659	2,505
	1-2: 58/42	12,306	800	7,076	923	3,507
	1-3: 55/45	13,185	857	7,581	989	3,758
	1-4: 50/50	14,650	952	8,424	1,099	4,175

2.2.3 Component 3: Sector Transfer

The two options under this component may be selected only if the Council recommends apportioning the hard cap among the sectors under Component 2. Options 1 and 2 are mutually exclusive, which means that the Council may select either Option 1 to allow sector level transferable allocations or Option 2 to require NMFS to reapportion salmon bycatch from one sector to the other sectors in a season.

If the Council recommends sector level caps under Component 2, but does not select Option 1 (transfers) or Option 2 (rollovers) under Component 3, the sector level cap would not change during the year and NMFS would close directed fishing for pollock once each sector reached its sector level cap. Because the CDQ sector level cap would allocated to the CDQ groups, the CDQ allocations would continue to be managed as they are under status quo, with further allocation of the salmon bycatch cap among the six CDQ groups, transferable allocations within the CDQ Program, and a prohibition against a CDQ group exceeding is salmon bycatch allocation.

2.2.3.1 Option 1: Transferable salmon bycatch caps

Option 1) Allocate salmon bycatch caps to each sector and allow the entity representing each non-CDQ sector and the CDQ groups to transfer salmon bycatch among the sectors and CDQ groups.

To provide sectors and cooperatives more opportunity to fully use their pollock allocations, the ability to transfer sector allocations could be implemented as part of Alternative 2. If sector are issued transferable allocations, then these entities could request NMFS to move a specific amount of a salmon bycatch allocation from one entity's account to another entity's account during a fishing season. Transferable allocations would not constitute a "use privilege" and, under the suboptions, only a portion of the residual salmon bycatch may be transferred.

Suboption: Limit transfers to the following percentage of salmon that is available to the transferring entity at the time of transfer:

a) 50%
b) 70%
c) 90%

If a transferring entity had harvested all of its pollock without attaining it Chinook salmon bycatch allocation, it could only transfer up to a specified percent of that salmon bycatch allocation to another entity with pollock still remaining for harvest in that season. Under this circumstance, this transfer provision would mean that not all salmon bycatch allocated would be available for use by entities other than the original recipient of the allocation.

Transfers are voluntary requests to NMFS, initiated by the entity receiving a salmon bycatch cap, for NMFS to move a specific amount of a salmon bycatch allocation from one entity's account to another entity's account.

Option 1 would require that each sector receiving a transferable salmon bycatch cap be represented by a legal entity that could:

- represent all vessels eligible to participate in the particular AFA sector and receive an annual permit for a specific amount of Chinook salmon bycatch on behalf of those vessels,
- be authorized by all members of the sector to transfer all or a portion of the sector's Chinook salmon bycatch cap to another sector or to receive a Chinook salmon bycatch transfer from another sector on behalf of the members of the sector,
- be responsible for any penalties assessed for exceeding the sector's Chinook salmon bycatch cap (i.e., have an agent for service of process with respect to all owners and operators of vessels that are members of the legal entity).

Once sector level salmon bycatch hard caps are allocated to a legal entity representing an AFA sector or to a CDQ group, each entity receiving a transferable allocation would be prohibited from exceeding that allocation. NMFS would report any overages of the allocation to NOAA OLE for enforcement action.

Transfers to cover overages of target species allocations ("after-the-fact" or "post delivery" transfers) are allowed under other programs authorized by the Council, including the CDQ Program, Amendment 80, and the GOA Rockfish Program. In addition, the Council recommended transfers to cover overages of halibut prohibited species quota allocations under the CDQ Program, although NMFS has not yet published a proposed rule for this regulatory amendment. However, the Council did not recommend transfers to cover overages of Chinook salmon bycatch allocations as an option for this EIS/RIR/IRFA.

2.2.3.2 Option 2: Rollover unused salmon bycatch to other sectors

Option 2) NMFS manages the sector level caps for the non-CDQ sectors and would rollover unused salmon bycatch to other sectors still fishing in a fishing season based on the proportion of pollock remaining for harvest.

A "rollover" is a management action taken by NMFS to "reapportion" or move salmon bycatch caps from one sector to the remaining sectors through a notice in the *Federal Register*. Rollovers are an alternative to transferable allocations that allow one sector to voluntarily transfer unused salmon bycatch allocation to another sector.

Under this option, if a non-CDQ AFA sector has completed harvest of its pollock allocation without attaining its sector level cap, and sufficient salmon bycatch remains to be reapportioned, NMFS would reapportion the unused amount of salmon bycatch to other AFA sectors, including CDQ groups. Any reapportionment of salmon bycatch by NMFS would be based on the proportion each sector represented of the total amount of pollock remaining for harvest by all sectors through the end of the season.

Successive reapportionment actions would occur as each non-CDQ sector completes harvest of its pollock allocation.

The CDQ groups could receive rollovers of salmon bycatch from other sectors. However, because the CDQ groups will each receive a specific, transferable allocation of salmon bycatch (as occurs under status quo), unused salmon bycatch would not be reapportioned from an individual CDQ group to other CDQ groups or other AFA sectors. CDQ groups with unused salmon bycatch could transfer it to another CDQ group, as is currently allowed in the CDQ Program.

2.2.4 Component 4: Cooperative provisions

Options under this component may be selected only if the Council recommends setting sector level caps under Component 2. Component 4 would further subdivide the inshore CV sector level cap to the inshore cooperatives and the inshore limited access fishery (if the inshore limited access fishery exists in a particular year). Each inshore cooperative would manage its allocation and would be required to stop fishing for pollock once the cooperative allocation is reached. NMFS would close the limited access fishery once that fishery's cap is reached.

The allocation of salmon to a cooperative within the inshore CV fleet or to the limited access fishery would be based upon the proportion of total sector pollock catch associated with the vessels in the cooperative or limited access fishery, respectively. The annual pollock quota for this sector is allocated by applying a formula which allocates catch to a cooperative, or the limited access fishery, according to the specific sum of the catch history for the vessels in the cooperative or the limited access fishery, respectively. Under 50 CFR 679.62(e)(1), the individual catch history of each vessel is equal to the sum of inshore pollock landings from the vessel's best 2 out of 3 years from 1995 through 1997, and includes landings to catcher/processors for vessels that made landings of 500 mt or more in 1995, 1996, or 1997.

Each year, NMFS issues fishing permits to cooperatives based on the cooperative's permit application which lists the vessels added or subtracted. Fishing in the limited access fishery is possible should a vessel leave its cooperative, and the inshore CV quota allocation is partitioned to allow for an allocation to an limited access fishery under these circumstances.

The range of cooperative level allocations in this analysis is based upon the 2008 pollock quota allocations, and the options for the range of sector splits for the inshore CV fleet based upon Component 2, Options 1 and 2 applied to Component 1 Options 1 and 2 (Table 2-5, Table 2-8 to Table 2-11). The cooperative level allocations are listed in Table 2-20 through Table 2-24. All inshore sector catcher vessels have been part of a cooperative since 2005. However, if this component is selected by the Council, regulations would accommodate allocations of an appropriate portion of the salmon bycatch cap to the limited access fishery, if, in the future, a vessel or vessels did not join a cooperative.

The range of cooperative allocations analyzed is a subset of the full range under consideration, as indicated previously. Cooperative allocations as shown in Table 2-20 to Table 2-24 are based upon annual sector level cap suboptions only. However, these annual allocations would be further apportioned by season according to Options 1-1 through 1-4 (Table 2-4). The range of inshore cooperative and limited access fishery level allocations resulting from application of the sector level cap options to the range of seasonal apportionments for the subset of caps for analysis are shown in Table 2-25 through Table 2-29.

Table 2-20 Annual inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, resulting from application of Component 2, Option 1 allocation to the inshore CV fleet (50% of allocation after 10% to CDQ)

Suboption	Overall fishery cap	Resulting inshore CV sector allocation *	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet co-op	2.876% Peter Pan Fleet co-op	12.191% Unalaska co-op	24.256% Unisea Fleet co-op	18.906% Westward Fleet co-op	0.000% limited access AFA vessels
i)	87,500	39,375	12,263	451	3,733	1,132	4,800	9,551	7,444	0
ii)	68,392	30,776	9,585	353	2,918	885	3,752	7,465	5,819	0
iii)	57,333	25,800	8,035	296	2,446	742	3,145	6,258	4,878	0
iv)	47,591	21,416	6,670	245	2,030	616	2,611	5,195	4,049	0
v)	43,328	19,498	6,073	223	1,849	561	2,377	4,729	3,686	0
vi)	38,891	17,501	5,451	201	1,659	503	2,134	4,245	3,309	0
vii)	32,482	14,617	4,552	168	1,386	420	1,782	3,545	2,763	0
viii)	29,323	13,195	4,110	151	1,251	379	1,609	3,201	2,495	0

*(50% inshore CV sector, after CDQ)

Table 2-21 Annual inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, resulting from application of Component 2, Option 2a allocation to the inshore CV fleet (average historical bycatch from 2004-2006)

Suboption	Overall fishery cap	Resulting inshore sector allocation*	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet co-op	2.876% Peter Pan Fleet co-op	12.191% Unalaska co-op	24.256% Unisea Fleet co-op	18.906% Westward Fleet co-op	0.000% limited access AFA vessels
i)	87,500	61,250	19,076	702	5,807	1,762	7,467	14,857	11,580	0
ii)	68,392	47,874	14,910	549	4,539	1,377	5,836	11,612	9,051	0
iii)	57,333	40,133	12,499	460	3,805	1,154	4,893	9,735	7,588	0
iv)	47,591	33,314	10,376	382	3,158	958	4,061	8,081	6,298	0
v)	43,328	30,330	9,446	348	2,876	872	3,697	7,357	5,734	0
vi)	38,891	27,224	8,479	312	2,581	783	3,319	6,603	5,147	0
vii)	32,482	22,737	7,082	261	2,156	654	2,772	5,515	4,299	0
viii)	29,323	20,526	6,393	235	1,946	590	2,502	4,979	3,881	0

*(70% based on 3 year average 2004-2006)

Table 2-22 Annual inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, resulting from application of Component 2, Option 2b allocation to the inshore CV fleet (average historical bycatch from 2002-2006)

Suboption	Overall fishery cap	Resulting inshore sector allocation*	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet co-op	2.876% Peter Pan Fleet co-op	12.191% Unalaska co-op	24.256% UniSea Fleet co-op	18.906% Westward Fleet co-op	0.000% limited access AFA vessels
i)	87,500	56,875	17,714	652	5,392	1,636	6,934	13,796	10,753	0
ii)	68,392	44,455	13,845	509	4,215	1,279	5,419	10,783	8,405	0
iii)	57,333	37,266	11,607	427	3,533	1,072	4,543	9,039	7,046	0
iv)	47,591	30,934	9,634	355	2,933	890	3,771	7,503	5,848	0
v)	43,328	28,163	8,771	323	2,670	810	3,433	6,831	5,325	0
vi)	38,891	25,279	7,873	290	2,397	727	3,082	6,132	4,779	0
vii)	32,482	21,113	6,576	242	2,002	607	2,574	5,121	3,992	0
viii)	29,323	19,060	5,936	218	1,807	548	2,324	4,623	3,603	0

*(65% based on 5 year average 2002-2006)

Table 2-23 Annual inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, resulting from application of Component 2, Option 2c allocation to the inshore CV fleet (average historical bycatch from 1997-2006)

Suboption	Overall fishery cap	Resulting inshore sector allocation*	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet Co-op	2.876% Peter Pan Fleet Co-op	12.191% Unalaska Co-op	24.256% UniSea Fleet Co-op	18.906% Westward Fleet Co-op	0.000% limited access AFA vessels
i)	87,500	54,250	16,896	622	5,143	1,560	6,614	13,159	10,257	0
ii)	68,392	42,403	13,206	486	4,020	1,220	5,169	10,285	8,017	0
iii)	57,333	35,546	11,071	407	3,370	1,022	4,333	8,622	6,720	0
iv)	47,591	29,506	9,190	338	2,798	849	3,597	7,157	5,578	0
v)	43,328	26,863	8,367	308	2,547	773	3,275	6,516	5,079	0
vi)	38,891	24,112	7,510	276	2,286	693	2,940	5,849	4,559	0
vii)	32,482	20,139	6,272	231	1,909	579	2,455	4,885	3,807	0
viii)	29,323	18,180	5,662	208	1,724	523	2,216	4,410	3,437	0

*(62% based on 10 year average 1997-2006)

Table 2-24 Annual inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, resulting from application of Component 2, Option 2d allocation to the inshore CV fleet (midpoint of Option 1 and 2 ranges, resulting in 57.5% allocation to inshore CV fleet)

			Inshore cooperative allocation:							
			31.145%	**1.146%**	**9.481%**	**2.876%**	**12.191%**	**24.256%**	**18.906%**	**0.000%**
Suboption	**Overall fishery cap**	**Resulting inshore sector allocation***	**Akutan CV Assoc**	**Arctic Enterprise Assoc**	**Northern Victor Fleet Co-op**	**Peter Pan Fleet Co-op**	**Unalaska Co-op**	**Unisea Fleet Co-op**	**Westward Fleet Co-op**	**limited access AFA vessels**
i)	87,500	50,313	15,670	577	4,770	1,447	6,134	12,204	9,512	0
ii)	68,392	39,325	12,248	451	3,728	1,131	4,794	9,539	7,435	0
iii)	57,333	32,966	10,267	378	3,126	948	4,019	7,996	6,233	0
iv)	47,591	27,365	8,523	314	2,594	787	3,336	6,638	5,174	0
v)	43,328	24,914	7,759	286	2,362	717	3,037	6,043	4,710	0
vi)	38,891	22,362	6,965	256	2,120	643	2,726	5,424	4,228	0
vii)	32,482	18,677	5,817	214	1,771	537	2,277	4,530	3,531	0
viii)	29,323	16,861	5,251	193	1,599	485	2,056	4,090	3,188	0

*(57.5% to the inshore CV fleet)

Table 2-25 Seasonal inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, using Component 2, Option 1, and seasonal distribution options

Sector and seasonal allocation options	Overall fishery cap level Chinook	Resulting Inshore sector allocation *	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet Co-op	2.876% Peter Pan Fleet Co-op	12.191% Unalaska Co-op	24.256% UniSea Fleet Co-op	18.906% Westward Fleet Co-op	0.000% limited access AFA vessels
Option 1: 70/30 A	87,500	27,563	8,584	316	2,613	793	3,360	6,686	5,211	0
	68,100	21,452	6,681	246	2,034	617	2,615	5,203	4,056	0
	48,700	15,341	4,778	176	1,454	441	1,870	3,721	2,900	0
	29,300	9,230	2,875	106	875	265	1,125	2,239	1,745	0
Option 1: 70/30 B	87,500	11,813	3,679	135	1,120	340	1,440	2,865	2,233	0
	68,100	9,194	2,863	105	872	264	1,121	2,230	1,738	0
	48,700	6,575	2,048	75	623	189	801	1,595	1,243	0
	29,300	3,956	1,232	45	375	114	482	959	748	0
Option 1: 58/42A	87,500	22,838	7,113	262	2,165	657	2,784	5,539	4,318	0
	68,100	17,774	5,536	204	1,685	511	2,167	4,311	3,360	0
	48,700	12,711	3,959	146	1,205	366	1,550	3,083	2,403	0
	29,300	7,647	2,382	88	725	220	932	1,855	1,446	0
Option 1: 58/42B	87,500	16,538	5,151	190	1,568	476	2,016	4,011	3,127	0
	68,100	12,871	4,009	148	1,220	370	1,569	3,122	2,433	0
	48,700	9,204	2,867	105	873	265	1,122	2,233	1,740	0
	29,300	5,538	1,725	63	525	159	675	1,343	1,047	0
Option 1: 50/50 (A and B)	87,500	19,688	6,132	226	1,867	566	2,400	4,775	3,722	0
	68,100	15,323	4,772	176	1,453	441	1,868	3,717	2,897	0
	48,700	10,958	3,413	126	1,039	315	1,336	2,658	2,072	0
	29,300	6,593	2,053	76	625	190	804	1,599	1,246	0

Table 2-26 Seasonal inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, using Component 2, Option 2a, and seasonal distribution options

Cap Suboption and seasonal allocation	Overall fishery cap level Chinook	Resulting Inshore sector allocation*	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet Co-op	2.876% Peter Pan Fleet Co-op	12.191% Unalaska Co-op	24.256% UniSea Fleet Co-op	18.906% Westward Fleet Co-op	0.000% limited access AFA vessels
Option 2a: 70/30 A	87,500	42,875	13,353	491	4,065	1,233	5,227	10,400	8,106	0
	68,100	33,369	10,393	382	3,164	960	4,068	8,094	6,309	0
	48,700	23,863	7,432	273	2,262	686	2,909	5,788	4,512	0
	29,300	14,357	4,471	165	1,361	413	1,750	3,482	2,714	0
Option 2a : 70/30 B	87,500	18,375	5,723	211	1,742	528	2,240	4,457	3,474	0
	68,100	14,301	4,454	164	1,356	411	1,743	3,469	2,704	0
	48,700	10,227	3,185	117	970	294	1,247	2,481	1,934	0
	29,300	6,153	1,916	71	583	177	750	1,492	1,163	0
Option 2a : 58/42A	87,500	35,525	11,064	407	3,368	1,022	4,331	8,617	6,716	0
	68,100	27,649	8,611	317	2,621	795	3,371	6,706	5,227	0
	48,700	19,772	6,158	227	1,875	569	2,410	4,796	3,738	0
	29,300	11,896	3,705	136	1,128	342	1,450	2,885	2,249	0
Option 2a : 58/42B	87,500	25,725	8,012	295	2,439	740	3,136	6,240	4,864	0
	68,100	20,021	6,236	229	1,898	576	2,441	4,856	3,785	0
	48,700	14,318	4,459	164	1,357	412	1,745	3,473	2,707	0
	29,300	8,614	2,683	99	817	248	1,050	2,089	1,629	0
Option 2a : 50/50 (A and B)	87,500	30,625	9,538	351	2,904	881	3,733	7,428	5,790	0
	68,100	23,835	7,423	273	2,260	685	2,906	5,781	4,506	0
	48,700	17,045	5,309	195	1,616	490	2,078	4,134	3,223	0
	29,300	10,255	3,194	118	972	295	1,250	2,487	1,939	0

Table 2-27 Seasonal inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, using Component 2, Option 2b, and seasonal distribution options

Cap Suboption and seasonal allocation	Overall fishery cap level Chinook	Resulting Inshore sector allocation*	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet Co-op	2.876% Peter Pan Fleet Co-op	12.191% Unalaska Co-op	24.256% UniSea Fleet Co-op	18.906% Westward Fleet Co-op	0.000% limited access AFA vessels
Option 2b: 70/30 A	87,500	39,813	12,400	456	3,775	1,145	4,854	9,657	7,527	0
	68,100	30,986	9,650	355	2,938	891	3,777	7,516	5,858	0
	48,700	22,159	4,152	254	2,101	637	2,701	5,375	4,189	0
	29,300	13,332	4,152	153	1,264	383	1,625	3,234	2,520	0
Option 2b : 70/30 B	87,500	54250	5,314	196	1,618	491	2,080	4,139	3,226	0
	68,100	42222	4,136	152	1,259	382	1,619	3,221	2,511	0
	48,700	30194	1,779	109	900	273	1,158	2,303	1,795	0
	29,300	18166	1,779	65	542	164	697	1,386	1,080	0
Option 2b : 58/42A	87,500	32,988	10,274	378	3,128	949	4,022	8,001	6,237	0
	68,100	25,674	7,996	294	2,434	738	3,130	6,227	4,854	0
	48,700	18,360	3,440	210	1,741	528	2,238	4,453	3,471	0
	29,300	11,046	3,440	127	1,047	318	1,347	2,679	2,088	0
Option 2b : 58/42B	87,500	23,888	7,440	274	2,265	687	2,912	5,794	4,516	0
	68,100	18,591	5,790	213	1,763	535	2,266	4,510	3,515	0
	48,700	13,295	2,491	152	1,261	382	1,621	3,225	2,514	0
	29,300	7,999	2,491	92	758	230	975	1,940	1,512	0
Option 2b : 50/50 (A and B)	87,500	28,438	8,857	326	2,696	818	3,467	6,898	5,376	0
	68,100	22,133	6,893	254	2,098	637	2,698	5,368	4,184	0
	48,700	15,828	2,966	181	1,501	455	1,930	3,839	2,992	0
	29,300	9,523	2,966	109	903	274	1,161	2,310	1,800	0

Table 2-28 Seasonal inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, using Component 2, Option 2c, and seasonal distribution options

Cap Suboption and seasonal allocation	Overall fishery cap level Chinook	Resulting Inshore sector allocation*	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet Co-op	2.876% Peter Pan Fleet Co-op	12.191% Unalaska Co-op	24.256% UniSea Fleet Co-op	18.906% Westward Fleet Co-op	0.000% limited access AFA vessels
	87,500	37,975	11,827	435	3,600	1,092	4,630	9,211	7,180	0
	68,100	29,555	9,205	339	2,802	850	3,603	7,169	5,588	0
Option 2c:	48,700	21,136	3,960	242	2,004	608	2,577	5,127	3,996	0
70/30 A	29,300	12,716	3,960	146	1,206	366	1,550	3,084	2,404	0
	87,500	16,275	5,069	187	1,543	468	1,984	3,948	3,077	0
	68,100	12,667	3,945	145	1,201	364	1,544	3,072	2,395	0
Option 2c :	48,700	9,058	1,697	104	859	261	1,104	2,197	1,713	0
70/30 B	29,300	5,450	1,697	62	517	157	664	1,322	1,030	0
	87,500	31,465	9,800	361	2,983	905	3,836	7,632	5,949	0
	68,100	24,489	7,627	281	2,322	704	2,985	5,940	4,630	0
Option 2c :	48,700	17,513	3,282	201	1,660	504	2,135	4,248	3,311	0
58/42A	29,300	10,536	3,282	121	999	303	1,284	2,556	1,992	0
	87,500	22,785	7,096	261	2,160	655	2,778	5,527	4,308	0
	68,100	17,733	5,523	203	1,681	510	2,162	4,301	3,353	0
Option 2c :	48,700	12,681	2,376	145	1,202	365	1,546	3,076	2,398	0
58/42B	29,300	7,630	2,376	87	723	219	930	1,851	1,442	0
	87,500	27,125	8,448	311	2,572	780	3,307	6,579	5,128	0
Option 2c :	68,100	21,111	6,575	242	2,002	607	2,574	5,121	3,991	0
50/50	48,700	15,097	2,829	173	1,431	434	1,840	3,662	2,854	0
(A and B)	29,300	9,083	2,829	104	861	261	1,107	2,203	1,717	0

Table 2-29 Seasonal inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, using Component 2d, Option 1, and seasonal distribution options

			Inshore cooperative allocation:							
			31.145%	1.146%	9.481%	2.876%	12.191%	24.256%	18.906%	0.000%
Cap Suboption and seasonal allocation	Overall fishery cap level Chinook	Resulting Inshore sector allocation*	Akutan CV Assoc	Arctic Enterprise Assoc	Northern Victor Fleet Co-op	Peter Pan Fleet Co-op	Unalaska Co-op	UniSea Fleet Co-op	Westward Fleet Co-op	limited access AFA vessels
Option 2d: 70/30 A	87,500	35,219	10,969	404	3,339	1,013	4,294	8,543	6,658	0
	68,100	27,410	8,537	314	2,599	788	3,342	6,649	5,182	0
	48,700	19,602	6,105	225	1,858	564	2,390	4,755	3,706	0
	29,300	11,793	3,673	135	1,118	339	1,438	2,861	2,230	0
Option 2d : 70/30 B	87,500	15,094	4,701	173	1,431	434	1,840	3,661	2,854	0
	68,100	11,747	3,659	135	1,114	338	1,432	2,849	2,221	0
	48,700	8,401	2,616	96	796	242	1,024	2,038	1,588	0
	29,300	5,054	1,574	58	479	145	616	1,226	956	0
Option 2d : 58/42A	87,500	29,181	9,089	334	2,767	839	3,557	7,078	5,517	0
	68,100	22,711	7,073	260	2,153	653	2,769	5,509	4,294	0
	48,700	16,241	5,058	186	1,540	467	1,980	3,940	3,071	0
	29,300	9,772	3,043	112	926	281	1,191	2,370	1,847	0
Option 2d : 58/42B	87,500	21,131	6,581	242	2,003	608	2,576	5,126	3,995	0
	68,100	16,446	5,122	188	1,559	473	2,005	3,989	3,109	0
	48,700	11,761	3,663	135	1,115	338	1,434	2,853	2,224	0
	29,300	7,076	2,204	81	671	204	863	1,716	1,338	0
Option 2d : 50/50 (A and B)	87,500	25,156	7,835	288	2,385	723	3,067	6,102	4,756	0
	68,100	19,579	6,098	224	1,856	563	2,387	4,749	3,702	0
	48,700	14,001	4,361	160	1,327	403	1,707	3,396	2,647	0
	29,300	8,424	2,624	97	799	242	1,027	2,043	1,593	0

2.2.4.1 Cooperative transfer options

These options would only apply if the Council selected sector level caps under Component 2 and further allocated the inshore CV sector level cap among the cooperatives and the inshore limited access fishery (if the inshore limited access fishery existed in a particular year) under Component 4.

When a salmon cooperative cap is reached, the cooperative must stop fishing for pollock and may:

Option 1) Transfer (lease) its remaining pollock to another inshore cooperative for the remainder of the season or year. Allow inter-cooperative transfers of pollock to the degree currently authorized by the AFA.

Option 2) Transfer salmon bycatch from other inshore cooperatives (industry initiated)

Suboption: Limit transfers to the following percentage of salmon that is available to the transferring entity at the time of transfer:

a) 50%
b) 70%
c) 90%

The Council could select Option 1 or Option 2 or both.

2.3 Alternative 3: Triggered closures

Triggered closures are regulatory time and area closures that are invoked when specified cap levels are reached. Cap levels for triggered closures are the same as those specified under Alternative 2. Closures may involve a single area (A season) or multiple areas (B season). Once specified areas are closed, pollock fishing could continue outside of the closure areas until either the pollock allocation is reached or the pollock fishery reaches a seasonal (June 10) or annual (November 1) closure date.

If the trigger cap is not further allocated among the non-CDQ sectors under Component 3, sector allocation, the CDQ Program would receive an allocation of 7.5 percent of the Chinook salmon trigger cap. This CDQ allocation would be further allocated among the six CDQ groups based on percentage allocations currently in effect. Each CDQ group would be prohibited from directed fishing for pollock inside the closure area(s) when that group's trigger cap is reached.

Five components are included under this alternative. These components describe how the cap is formulated (Component 1), who manages the closures (Component 2), how the cap is subdivided (Component 3), whether and how salmon can be transferred among sectors (Component 4), and the specific area closure options (Component 5). The areas themselves, as described in Component 5, are the same areas regardless of who manages the closure (Component 2).

Under Alternative 3, existing regulations related to the Chinook salmon prohibited species catch limit of 29,000 salmon and triggered closures of the Chinook salmon savings areas in the Bering Sea would be removed from 50 CFR part 679.21. The 700 Chinook salmon trigger cap and Chinook Salmon savings area in the Aleutian Islands would remain in effect. Additionally, the current VRHS ICA regulations would be revised to remove all reference to Chinook salmon. Regulations associated with the non-Chinook salmon elements of the VRHS ICA would remain in regulations.

Table 2-30 Alternative 3 Components and options.

<table>
<tr><td rowspan="1">Setting the cap (Component 1)</td><td colspan="4">Same as Alternative 2, Component 1</td></tr>
<tr><td rowspan="2">Managing the cap (Component 2)</td><td>NMFS closes areas to pollock fishing when cap is reached</td><td>No allocation</td><td>7.5% to CDQ</td><td>92.5%; managed at the combined fishery-level for all three sectors</td></tr>
<tr><td colspan="4">Option 1: ICA manage vessels to avoid the cap and close areas when cap is reached</td></tr>
<tr><td>Allocating the hard cap to sectors (Component 3)</td><td colspan="4">Same as Alternative 2, Component 2</td></tr>
<tr><td>Sector transfers (Component 4)</td><td colspan="4">Same as Alternative 2, Component 3</td></tr>
<tr><td rowspan="2">Area Closures (Component 5)</td><td>A season closure area (Fig. 2-2)</td><td colspan="3">Once triggered, area would close for the rest of the A season</td></tr>
<tr><td>B season closure areas (Fig. 2-3)</td><td colspan="3">If the trigger was reached before August 15, all three areas would close on August 15th for the rest of the B season.
If the trigger was reached after August 15th, all three areas would close immediately for the rest of the B season.</td></tr>
</table>

2.3.1 Component 1: Trigger cap formulation

The trigger cap amount would be set within the range of hard caps established under Alternative 2 (Table 2-2).

Suboption: Distribution of the trigger cap to the A and B season closures shall be as specified under Alternative 2, Component 1, Option 1, seasonal distribution of caps suboptions (Section 2.2.1.2).

2.3.2 Component 2: Management

Triggered area closures could be managed in a number of different ways, depending on the combination of components and options selected by the Council.

Under Component 2, without Option 1 (intercooperative agreement management) or Components 3 and 4, NMFS would manage a single trigger cap for the non-CDQ pollock fisheries. Once the trigger cap was reached, NMFS would close the areas selected by the Council under Component 5 to directed fishing for pollock by all vessels fishing for the non-CDQ sectors. The trigger cap allocation to the CDQ Program would be further divided among the six CDQ groups as occurs under status quo. Each CDQ group would be prohibited from fishing inside the closure area(s) once the group's trigger cap is reached.

If the Council selected sector allocations under Component 3, NMFS would issue closures of the area(s) selected under Component 5 to each non-CDQ sector individually and separately.

If the Council selected transferable sector allocations under Component 4, Option 1, NMFS would not actively manage the pollock fisheries by issuing fishery closures once the trigger cap was reached for each sector. Rather, the trigger closures would be managed similar to current management of the trigger closures under the CDQ Program. Each sector would receive a transferable trigger cap allocation, and vessels participating in that sector would be prohibited from fishing inside the area(s) selected under Component 5 after the sector's trigger cap is reached.

2.3.2.1 Option 1: Allow ICA management of triggered closures

Under Option 1, a NMFS-approved ICA would manage any subdivision of the seasonal trigger caps at the sector level, inshore cooperative, or individual vessel level under its contract and would enforce the area closures to the designated group or entity when subdivided caps established by the ICA are reached. The subdivision of the trigger caps under the ICA would not be prescribed by the Council or NMFS regulations. The ICA would decide how to manage participating vessels to avoid reaching the trigger closures as long as possible during each season. However, NMFS regulations would specify that the ICA would be required to include a closure to the area(s) specified under Component 5 once the overall trigger cap selected under Component 1 is reached.

Vessels participating in the ICA would operate under the same fishery level caps for the A and B seasons as any vessels not participating in the ICA. NMFS would continue to manage triggered area closures for vessels not participating in the ICA as described in Section 2.3.2 above. Vessels participating in the ICA would be exempt from NMFS's area closures, and would instead be subject to the ICA closures. If the Council does not select any sector allocation of the trigger caps under Component 3, the area closures that would result from NMFS management and ICA management would occur at the same time. NMFS's closure would apply to vessels not participating in the ICA and the ICA's closure would apply to vessels participating in the ICA.

Under Component 3, the NMFS-managed seasonal caps may be further subdivided among the inshore, catcher/processor, or mothership sectors. The ICA, however, would operate only under the fishery-level seasonal caps established under Component 1. If the Council selects sector allocations of the trigger caps under Component 3, then NMFS's closures of the area(s) by sector may occur at different times than the ICA's closures because the ICA would not be required to follow the sector allocations of trigger caps that would govern NMFS's area closures.

Any CDQ group that participated in the ICA would bring to the ICA its portion of the trigger cap to be combined with the non-CDQ trigger cap for purposes of the area closures that would apply to all CDQ and non-CDQ vessels participating in the ICA.

2.3.3 Component 3: Sector Allocation

Sector allocations are equivalent to those under consideration for hard caps (Section 2.2.2, Options 1, 2a-2d).

When a sector reaches its salmon bycatch cap, NMFS would close the area(s) specified under Component 5 to directed fishing for pollock by that sector for the remainder of the season. The remaining sectors may continue to fish in the area(s) until they reach their sector level salmon bycatch cap. Pollock fishing could continue outside of the closure areas until either the pollock allocation to the sector is reached or the pollock fishery reaches a seasonal (June 10) or annual (November 1) closure date.

If the Council selected Option 1 for ICA management of the trigger cap, vessels participating in the ICA would not be subject to NMFS's sector-level closures.

If transferable sector trigger caps are selected under Component 4, then each sector would be prohibited from fishing inside the closure area(s) once the sector's trigger cap was reached. NMFS would not issue Federal Register notices closing directed fishing for pollock by a sector under transferable trigger cap allocations.

The CDQ allocations would continue to be managed as they are under status quo, with further allocation of the salmon bycatch cap among the six CDQ groups, transferable trigger cap allocations, and a prohibition against a CDQ group fishing inside the closure area(s) once the group's salmon bycatch cap is reached.

2.3.4 Component 4: Sector Transfer

Options under this component may be selected only if the Council recommends allocating the salmon bycatch trigger cap among the sectors, under Component 3.

Options 1 and 2 are mutually exclusive, which means that the Council may select either Option 1 to allow transferable salmon bycatch trigger caps at the sector level or Option 2 to require NMFS to manage the reapportionment of salmon bycatch trigger from one sector to another.

2.3.4.1 Option 1: Transferable salmon bycatch caps

Option 1) Allocate salmon bycatch trigger caps to each sector and allow the entity representing each non-CDQ sector and the CDQ groups to transfer salmon bycatch trigger caps among the sectors and CDQ groups.

Suboption: Limit salmon bycatch trigger cap transfers to the following percentage of salmon that is available to the transferring entity at the time of transfer:

a) 50%
b) 70%
c) 90%

Transfers are voluntary requests initiated by the entity receiving a salmon bycatch trigger cap for NMFS to move a specific amount of a salmon bycatch trigger cap from one entity's account to another entity's account.

Option 1 would require that each sector receiving a transferable allocation be represented by a legal entity that could:

- represent all vessels eligible to participate in the particular AFA sector and receive an annual permit for a specific amount of salmon bycatch on behalf of all of those vessels,
- be authorized by all members of the sector to transfer all or a portion of the sector's salmon bycatch cap to another sector or to receive a salmon bycatch transfer from another sector on behalf of the members of the sector,
- be responsible for any penalties assessed for exceeding the sector's salmon bycatch cap (i.e., have an agent for service of process with respect to all owners and operators of vessels that are members of the legal entity).

If transferable salmon bycatch trigger caps are allocated to a legal entity representing an AFA sector or to a CDQ group, each entity receiving a transferable trigger cap would be responsible for not fishing within the closure area(s) once the trigger cap was reached. Any fishing in an area closure would be reported to NOAA OLE for an enforcement action against the responsible entity.

If transferable trigger caps were selected, transfers could be allowed between individual CDQ groups and any of the three non-CDQ sectors. A transferable salmon trigger cap would allow a sector or CDQ group to obtain additional salmon bycatch to allow that sector or CDQ group to continue to fish within the areas subject to closure for a longer period of time in a season. It is also possible that a sector or CDQ group could be closed out of the area after reaching its salmon bycatch cap, transfer in more salmon bycatch, and allow the area to reopen again for that sector of CDQ group.

Transferable sector trigger caps likely would not be a viable option if the Council selected Component 2, Option 1 to allow ICA management of triggered closure areas. Transferable salmon bycatch caps at the sector level require a contractual arrangement among all participants in a sector to establish the legal entity required to receive and transfer salmon bycatch allocations. If even one vessel in a sector joined an ICA, then it is unlikely that this vessel also would join with other members of a sector to create the legal entity necessary to manage transferable salmon bycatch caps outside of the ICA.

2.3.4.2 Option 2: Rollover unused salmon bycatch

Option 2) NMFS would rollover unused salmon bycatch from the sector level trigger caps to other sectors still fishing in a season based on the proportion of pollock remaining for harvest by each sector.

Option 2 could apply if the Council selected to allocate the non-CDQ trigger caps among the inshore, catcher/processor, and mothership sectors and the Council decided (1) not to allow ICA management of the trigger caps (Component 2, Option 1), (2) not to allow transferable trigger caps among the sectors (Component 4, Option 1), or (3) the non-CDQ AFA sectors could not form the legal entity necessary to receive transferable salmon bycatch caps. Under Option 2, NMFS would rollover or reapportion the salmon bycatch trigger caps among the sectors. A reapportionment of salmon bycatch would occur if a sector completed harvest of its pollock allocation and had some salmon bycatch trigger cap allocation remaining in a season. That remaining salmon bycatch trigger cap could be reapportioned to other sectors still fishing based on the proportion of pollock remaining to be harvested by each sector.

2.3.5 Component 5: Area options

Chinook closure areas may be triggered for the A season or B season. A season closure area is in Fig. 2-2 and the B season closure areas are in Fig. 2-3. Coordinates for these areas are in Table 2-31 and Table 2-32. These areas are designed to cover where 90% of Chinook bycatch has occurred from the years 2000 though 2007. In the A season, the designated area closes immediately when triggered and remains closed for the duration of the A season. For the B season, the three areas close simultaneously when the trigger is reached and remain closed for the duration of the B season (until December 31st). Unless the trigger for the B season is reached prior to August 15th, then the areas would close on August 15th until December 31st.

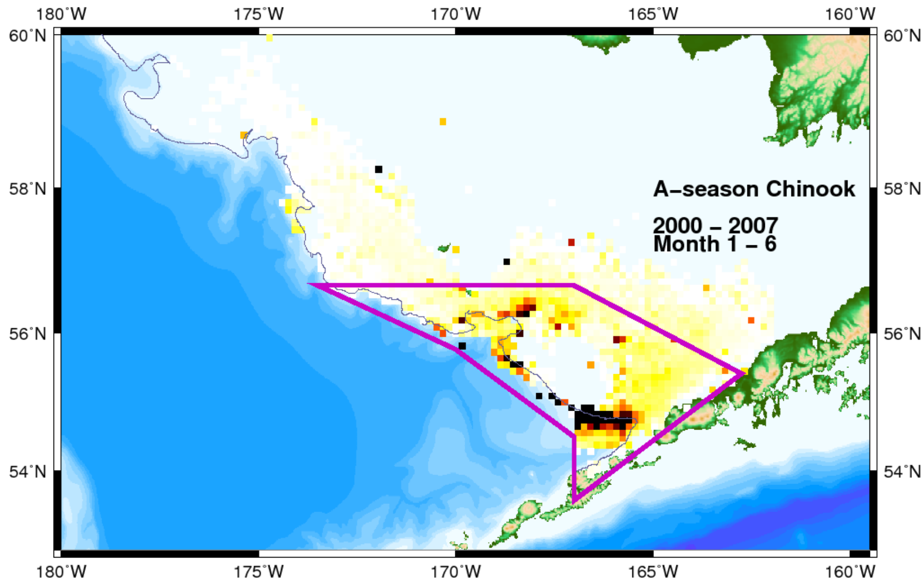

Fig. 2-2 Proposed A-season trigger closure, encompassing 90% of Chinook bycatch in 2000-2007.

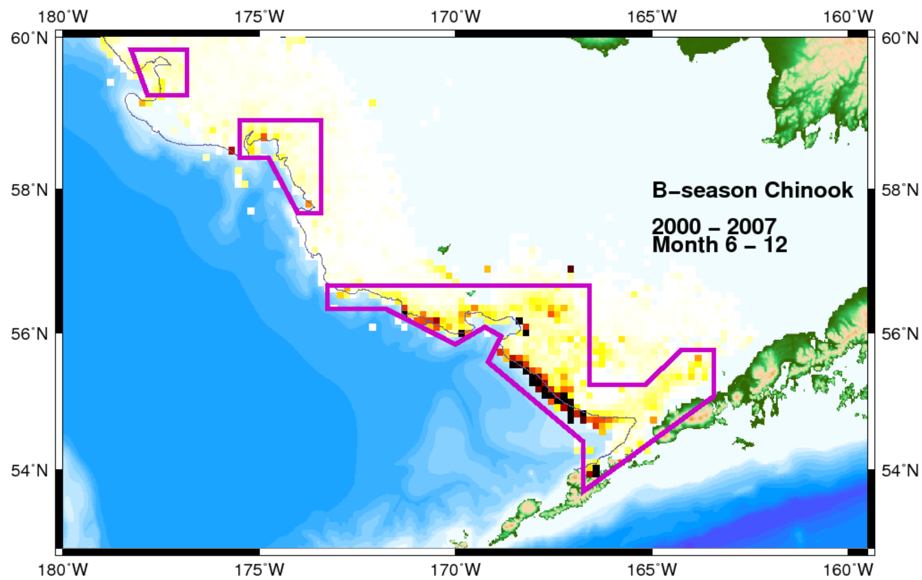

Fig. 2-3 Proposed B-season trigger closures, encompassing 90% of Chinook bycatch in 2000-2007.

Table 2-31 Coordinates for the A-season closure area

Latitude	Longitude
56 40	173 30
55 46	170 00
54 30	167 00
53 33	167 00
55 25	162 45
56 40	167 00
56 40	173 30

Table 2-32 Coordinates for the three B-season closure areas

1) Latitude	Longitude	2) Latitude	Longitude
59 15	176 50	57 40	173 25
59 50	176 50	58 55	173 25
59 50	178 15	58 55	175 30
59 15	177 50	58 25	175 30
59 15	176 50	58 25	174 45
		57 40	174 00
		57 40	173 25

3) Latitude	Longitude		Latitude	Longitude
54 25	166 45		56 40	173 15
53 40	166 45		56 20	173 15
55 05	163 25		56 20	171 45
55 45	163 25		55 50	170 00
55 45	164 15		56 05	169 15
55 15	165 10		55 57	168 50
55 15	166 35		55 35	169 10
56 40	166 35		54 25	166 45

Suboption: Periodic adjustments to areas based on updated bycatch information.

The Council would reassess updated salmon bycatch information after a certain number of years and determine if adjustments to the area closures implemented under this action are needed. If this option is selected, the Council would specify when the reassessment of salmon bycatch information would occur. Any revisions to the salmon bycatch management measures would require additional analysis and rulemaking. As a general rule, the Council may reassess any management measure at any time and does not need to specify a particular time for reassessment of the salmon bycatch management measures.

2.4 Alternative 4: Preliminary Preferred Alternative

In June 2008, the Council identified Alternative 4 as the preliminary preferred alternative. Alternative 4 includes a choice between two different overall Chinook salmon cap levels (68,392 Chinook salmon and 47,591 Chinook salmon). The high cap would be available if some or all of the pollock industry participates in a private contractual arrangement called an ICA that establishes an incentive program to keep Chinook salmon bycatch below the 68,392 Chinook salmon cap. The combination of the high cap and the bycatch reduction incentive program in the ICA is intended to provide a more flexible and responsive approach to minimizing salmon bycatch than would be achieved by a cap alone. The PPA would rely on the cap to limit Chinook salmon bycatch in all years and, if the ICA works as intended by the Council, it would provide incentives to keep bycatch below the cap.

Alternative 4 contains selected provisions under four components:

- Component 1 addresses the Chinook salmon bycatch caps, ICA requirements under the high cap, and seasonal distribution and rollovers of the caps.
- Component 2 specifies the seasonal allocations of the Chinook salmon bycatch caps among the four AFA sectors: the CDQ sector, the inshore CV sector, the mothership sector, and the offshore CP sector.
- Component 3 allows transferability of the Chinook salmon bycatch allocations among the sectors.
- Component 4 allows further allocation of the inshore sector’s Chinook salmon bycatch among the inshore cooperatives and the inshore limited access fishery, if the limited access fishery exists in any particular year. Component 4 also allows transferability of the inshore cooperatives Chinook salmon bycatch allocations with the mothership and catcher/processor sector and the CDQ groups.

2.4.1 Council's June 2008 motion for the preliminary preferred alternative

The Council developed Alternative 4 as the preliminary preferred alternative at the June 2008 Council meeting. The following is the Council's June 2008 motion.

MOTION

The Council directs staff to provide analysis on the preliminary preferred alternative specified below in addition to those in the existing analysis and release the resulting EIS/RIR/IRFA for public review. For a complete description of alternatives in the existing analysis, see Chapter 2 of the BSAI Salmon Bycatch EIS Initial Review Draft (dated May 15, 2008).

Alternative 4: Preliminary preferred alternative

Alternative 4 would establish a Chinook salmon bycatch cap for each pollock fishery season which, when reached, would require all directed pollock fishing to cease for that season. Components 2-4 specify the allocation and transferability provisions associated with the cap.

Component 1: Hard cap with option for ICA regulated incentive system

Annual scenario 1: Hard cap with an ICA that provides explicit incentive(s) to promote salmon avoidance in all years

Hard cap if an ICA is in place that provides explicit incentive(s) for each participant to avoid salmon bycatch in all years:

Overall cap: 68,392, allocated by season and under Components 2-4 as described below

For those operations that opt out of such an ICA, the hard cap will be established as follows:

Overall cap: 32,482
CDQ allocation: 2,436
Non-CDQ cap: 30,046

All salmon bycatch attributed to the AFA pollock trawl fleet will accumulate against this lower cap, but only those operations not in the ICA will be required to stop fishing when the CDQ or non-CDQ cap has been reached. This backstop cap of 32,482 will not be allocated by sector, so all other components in Alterative 4 are not relevant to this backstop cap. (In absence of a sector allocation for this backstop cap a 7.5% allocation applies to the CDQ sector by default, and the remaining 92.5% is set as the non-CDQ cap.)

ICA requirements:

- An ICA must provide incentive(s) for each vessel to avoid salmon bycatch under any condition of pollock and salmon abundance in all years.
- Incentive measures must include rewards for salmon bycatch avoidance and/or penalties for failure to avoid salmon bycatch at the vessel level.[5]
- The ICA must specify how those incentives are expected to promote reductions in actual individual vessel bycatch rates relative to what would have occurred in absence of the incentive program. Incentive measures must promote salmon

[5] NMFS recommends that the term "and/or" not be used in regulation because of the possible confusion about the meaning of this term. NMFS assumes that this requirement means "Incentive measures must include rewards for salmon bycatch avoidance at the vessel level or penalties for failure to avoid salmon bycatch at the vessel level and may include both."

savings in any condition of pollock and salmon abundance, such that they are expected to influence operational decisions at bycatch levels below the hard cap.

Annual reporting:

- The ICA must be made available for Council and public review.
- An annual report to the Council will be required and must include:
  1) a comprehensive explanation of incentive measures in effect in the previous year,
  2) how incentive measures affected individual vessels, and
  3) evaluation of whether incentive measures were effective in achieving salmon savings beyond levels that would have been achieved in absence of the measures.

Annual scenario 2: Hard cap in absence of an ICA with explicit incentive(s) to promote salmon avoidance

Hard cap in absence of an ICA that provides explicit incentive(s) to all participants to avoid salmon bycatch in all years:

Overall cap: 47,591, allocated by season and under Components 2-4 as described below

Seasonal distribution of caps

Any hard cap would be apportioned between the pollock A and B seasons. The seasonal distribution is 70/30, based on the average distributional ratio of salmon bycatch between A and B seasons in the 2000-2007 period.[6]

Seasonal rollover of caps

Unused salmon from the A season would be made available to the recipient of the salmon bycatch hard cap in the B season within each management year at an amount up to 80% of the recipient's unused A season bycatch cap.

Component 2: Sector allocation

Separate sector level caps will be distributed within each season for the CDQ sector and the three remaining AFA sectors, the inshore catcher vessel (CV) sector, the mothership sector, and the offshore catcher processor (CP) sector, as follows:

A season: CDQ 9.3%; inshore CV fleet 49.8%; mothership fleet 8.0%; offshore CP fleet 32.9%

B season: CDQ 5.5%; inshore CV fleet 69.3%; mothership fleet 7.3%; offshore CP fleet 17.9%

This distribution is based on the 5-year (2002-2006) historical average of the annual proportion of salmon bycatch by sector within each season, adjusted by blending the bycatch rate for CDQ and non-CDQ partner sectors. It is also weighted by the AFA pollock allocation for each sector; in each season, the proportional allocation by sector comprises the adjusted 5-year historical average by sector weighted by 0.75 for the salmon bycatch history and the AFA pollock allocation by sector weighted by 0.25.

Component 3: Sector transfers

Allocate salmon bycatch caps to each sector and allow the entity representing each non-CDQ sector and the CDQ groups to transfer salmon bycatch caps among the sectors and CDQ groups. (NMFS does not actively manage the salmon bycatch allocations).

[6] This sentence is not applicable to the 70/30 seasonal distribution. However, it remains in the text because it was part of the Council's June 2008 motion.

Component 4: Cooperative provisions
Each inshore cooperative and the inshore limited access fishery (if the inshore limited access fishery existed in a particular year) shall receive a salmon allocation managed at the cooperative level. If the cooperative or limited access fishery salmon cap is reached, the cooperative or limited access fishery must stop fishing for pollock.

The initial allocation of salmon by cooperative within the inshore CV fleet or to the limited access fishery would be based upon the proportion of total sector pollock catch associated with the vessels in the cooperative or limited access fishery.

Cooperative transfers
When a salmon cooperative cap is reached, the cooperative must stop fishing for pollock and may transfer salmon bycatch from other inshore cooperatives, CDQ groups, or entities representing non-CDQ groups (industry initiated).

2.4.2 Description of Alternative 4

Alternative 4 provides for two different annual scenarios with different caps for each scenario. Annual scenario 1 (PPA1) contains a dual cap system with a high cap of 68,392 Chinook salmon and a backstop cap of 32,482 Chinook salmon. Annual scenario 2 (PPA2) contains a single cap of 47,591 Chinook salmon. The distinction between the scenarios lies in the presence or absence of a NMFS-approved salmon bycatch ICA which provides explicit incentives to avoid salmon. At final action, the Council may choose either PPA1, PPA2, or both PP1 and PPA2, as discussed below. The prescribed sector allocations (and provisions to divide the sector allocations to the inshore CV cooperatives and among CDQ groups) are identical for both the PPA1 high cap and the PPA2 cap. All caps would be partitioned seasonally 70 percent to the A season (January 20 - June 10) and 30 percent to the B season (June 10-November 1). Table 2-33 provides a summary of the features of Alternative 4. Table 2-34 shows the three caps and each cap's seasonal and sector divisions.

Under either PPA1 or PPA2, existing regulations related to the Chinook salmon prohibited species catch limit of 29,000 salmon and triggered closures of the Chinook salmon savings areas in the Bering Sea would be removed from 50 CFR part 679.21. The 700 Chinook salmon trigger cap and Chinook Salmon savings area in the Aleutian Islands would remain in effect. Additionally, the current VRHS ICA regulations would be revised to remove all reference to Chinook salmon. Regulations associated with the non-Chinook salmon elements of the VRHS ICA would remain in regulations.

Table 2-33 Alternative 4 components

<table>
<tr><td rowspan="6">Setting the hard cap (Component 1)</td><td rowspan="2">Annual scenario 1 (PPA 1)</td><td colspan="4">High cap 68,392 Chinook salmon for vessels in a NMFS-approved ICA</td></tr>
<tr><td colspan="4">Backstop cap 32,482 Chinook salmon for vessels not in a NMFS approved ICA.</td></tr>
<tr><td>Annual scenario 2 (PPA 2)</td><td colspan="4">A cap of 47,591, with no ICA.</td></tr>
<tr><td>PPA1 + PPA2</td><td colspan="4">A fleet-wide cap of 47,591, unless industry submits and NMFS approves an ICA agreement which provides explicit incentive for salmon avoidance, then the cap increases to 68,392 Chinook salmon. Vessels not in the ICA would be subject to the backstop cap of 32,482.</td></tr>
<tr><td>A season/B season division</td><td colspan="4">PPA1 high cap and PP2 cap would be divided 70/30 between the A and B season</td></tr>
<tr><td>Seasonal rollovers</td><td colspan="4">NMFS would rollover up to 80 percent of a sector's or cooperative's unused salmon bycatch from its A season account to that sector's or cooperative's B season account. No rollover would occur from the B season to the A season.</td></tr>
<tr><td rowspan="3">Allocating the hard cap to sectors (Component 2)</td><td></td><td>CDQ</td><td>Inshore CV</td><td>Mothership</td><td>Offshore CP</td></tr>
<tr><td>A season</td><td>9.3%</td><td>49.8%</td><td>8.0%</td><td>32.9%</td></tr>
<tr><td>B season</td><td>5.5%</td><td>69.3%</td><td>7.3%</td><td>17.9%</td></tr>
<tr><td>Sector transfers (Component 3)</td><td colspan="5">If sector level caps are issued as transferable allocations, then these entities could request NMFS to move a specific amount of the transferable allocation from one entity's account to another entity's account during a fishing season.</td></tr>
<tr><td rowspan="3">Allocating the hard cap to cooperatives (Component 4)</td><td colspan="5">Each inshore cooperative and the inshore limited-access fishery would receive a transferable allocation of the inshore CV sector level cap and must stop fishing once the allocation is reached.</td></tr>
<tr><td colspan="5">Inshore cooperative allocations would be based on that cooperative's AFA pollock allocation percentage. Inshore limited access allocation would be based on the pollock history of those vessels participating in the limited access fishery.</td></tr>
<tr><td>Cooperative Transfers</td><td colspan="4">Cooperatives could request NMFS to move a specific amount of the transferable allocation from one cooperative's account to another cooperative's account during a fishing season.</td></tr>
</table>

High Cap of 68,392 Chinook salmon – PPA1

For each season, the high cap would be divided into separate sector level caps for the CDQ sector, the inshore CV sector, the mothership sector, and the CP sector according to the percentage allocations in Component 2 of the PPA. All Chinook salmon bycatch by vessels in these sectors that are parties to the NMFS-approved ICA with incentives to reduce salmon bycatch would accrue against the sector's specific seasonal salmon bycatch cap.

The inshore CV sector cap would be divided among the inshore cooperatives and the inshore limited access fishery based on the proportion of total sector pollock catch associated with the vessels in the cooperative or limited access fishery. NMFS would issue transferable allocations to the inshore cooperatives because the inshore cooperatives are legal entities. The inshore limited access fishery cap would be non-transferable and NMFS would close pollock to directed fishing by this fishery once this cap was reached.

The CDQ sector level cap would be allocated as transferable allocations to the CDQ groups because the CDQ groups are legal entities.

NMFS would allocate the sector level cap as a transferable allocation to the catcher/processor sector and the mothership sector if all eligible members of each sector formed the necessary legal entity required to receive and manage a transferrable allocation. If members of the catcher/processor sector or members of the mothership sector were not each able to form their own sector's legal entity, NMFS would close pollock to directed fishing by that sector once the respective sector's Chinook salmon bycatch cap was reached.

For sectors, inshore cooperatives, or CDQ groups with transferable allocations, unrestricted transfers to other legal entities would be allowed within a season. No transfers of A season allocations to the B season or vice versa would be allowed. Transfers would be conducted through NMFS to ensure accurate Chinook salmon bycatch account balances and NMFS would develop regulations to establish the transfer process. No transfers of sector level caps without transferable allocations would be allowed.

Up to 80 percent of a recipient's unused salmon allocation from the A season may be rolled over into that recipient's B season allocation. No rollover is permitted from an entity's unused B season Chinook salmon cap into the following year's A season cap. Rollovers could occur for both transferable allocations and sector level caps.

The PPA does not specify participation or composition requirements for the ICA. Therefore, individual vessels, sectors, inshore cooperatives, or CDQ groups could opt out of the ICA. NMFS would develop regulations to establish the ICA requirements specified in the PPA. The regulations would establish the process for industry to submit an ICA to NMFS and for NMFS approval or disapproval of the ICA. NMFS would establish the appropriate salmon bycatch cap based on whether an approved ICA was in effect. Once approved, the ICA would not need to be re-submitted or approved each year. Provisions would be made in the regulations for the industry to submit amendments to the ICA. The effectiveness of the ICA would be determined by the Council through the annual reporting requirements specified under Component 1 in the PPA.

It is important to note that the high cap of 68,392 Chinook salmon is not a hard cap because the PPA does not include provisions necessary to allow for hard cap management when vessels opt-out of the ICA and fish under the backstop cap of 32,482. The 68,392 cap would be fully allocated among those participating in the ICA and only catch by vessels in the sector or cooperative that is participating in the ICA would accrue against that transferable allocation or sector level cap. The PPA does not have a mechanism for reducing a cooperative's or sector's allocation or sector level cap if some vessels in the cooperative or sector opt out of the ICA and fish under the backstop cap. This means that allocations to the sectors, inshore cooperatives, and CDQ groups participating in the ICA would not be reduced and sector level caps would not be affected by Chinook salmon bycatch from vessels fishing under the backstop cap. To do so would penalize the ICA participants for the bycatch of vessels not fishing in the ICA.

Chinook salmon bycatch by any vessels fishing under the backstop cap would be in addition to bycatch caught under the high cap. Unless some portion of the high cap was not caught (either because of the effectiveness of the ICA's bycatch reduction measures or low Chinook salmon abundance), bycatch by non-ICA vessels fishing under the backstop cap potentially could result in the total annual Chinook bycatch exceeding 68,392 Chinook salmon.

If an entire sector, inshore cooperative, or CDQ group opted out of the ICA, then there would be no vessels accruing catch against the sector level cap for that sector, inshore cooperative, or CDQ group. Under this scenario, the high cap is much less likely to be exceeded, but this still could happen if catch by the opt-out sector, inshore cooperative, or CDQ group exceeded what that entity would have been allocated under the high cap.

Backstop Cap of 32,482 Chinook salmon – PPA1

Entire sectors, inshore cooperatives, or CDQ groups could choose to not participate in the ICA, or any number of individual vessels within the catcher/processor or mothership sectors or the inshore cooperatives could opt out of the ICA and fish under the backstop cap. Any vessels or CDQ groups not participating in the ICA would be managed as a group under the backstop cap and prohibited by NMFS from directed fishing for pollock once the backstop cap was reached.

The backstop cap would not be allocated to sectors or cooperatives. Instead, it would be divided between the CDQ (2,436) and non-CDQ (30,046) fisheries. Chinook bycatch by the CDQ groups, including the CDQ groups participating in the ICA, would accrue against the CDQ portion of the backstop cap. Chinook salmon bycatch by all non-CDQ vessels directed fishing for pollock, including those vessels participating in the ICA, would accrue against the non-CDQ portion of the backstop cap. This means that salmon bycatch by the ICA vessels would accrue against both the high cap and the backstop cap, but the bycatch by non-ICA participants would only accrue against the backstop cap.

The PPA does not provide a mechanism for deducting the salmon bycatch in the "opt-out" fishery from the sector allocations of the high cap. Thus, if the high cap allocations made to the sectors, cooperatives and CDQ groups are reached by the ICA participants, any bycatch in the opt out fishery would result in the total annual Chinook salmon bycatch exceeding 68,392 Chinook salmon.

No transfer or rollover provisions exist for non-ICA participants fishing under the backstop cap. If the Council recommended only PPA1, and no NMFS-approved ICA existed in a given year, the entire pollock fleet would be subject to the backstop cap for that year.

PPA1 combined with PPA2

If the Council selects to combine PPA1 and PPA2, the Bering Sea pollock fleet would be subject to a cap of 47,591 Chinook salmon, unless industry submits and NMFS approves an ICA agreement which provides explicit incentives for salmon avoidance. NMFS would increase the cap to 68,392 Chinook salmon if it approved the ICA. Vessels that did not participate in the ICA would be subject to the backstop cap.

A Cap of 47,591 Chinook salmon – PPA2

Under PPA2 only, the Bering Sea pollock industry would be subject to a cap of 47,591 Chinook salmon, regardless of whether the industry operated under an ICA with incentives to avoid salmon bycatch. The PPA provides the ability to manage this cap as a hard cap. This cap would be subject to the same seasonal apportionments, sector allocations, and rollover and transfer provisions described for the annual PPA1 high cap.

Table 2-34 A and B season caps for Alternative 4 under PPA1 and PPA2

	PPA1				**PPA2 cap**	
	High Cap		**Backstop cap**			
Overall cap		**68,392**		**32,482**		**47,591**
A season allocation (70%):		47,874		22,737		33,314
CDQ	9.3%	4,452	7.5%	1,705	9.3%	3,098
Inshore CV	49.8%	23,841			49.8%	16,590
Mothership	8%	3,830			8%	2,665
Offshore CP	32.9%	15,751	92.5%	21,032	32.9%	10,960
B season allocation (30%):		20,518		9,745		14,277
CDQ	5.5%	1,128	7.5%	731	5.5%	785
Inshore CV	69.3%	14,219			69.3%	9,894
Mothership	7.3%	1,498			7.3%	1,042
Offshore CP	17.9%	3,673	92.5%	9,014	17.9%	2,556

Note: under both PPA1 high cap and PPA2, the inshore sector allocation and CDQ Program allocations would be further allocated among the inshore cooperatives, inshore limited access fishery, and six CDQ groups.

2.4.3 Options for changes to the PPA

During the process of writing this EIS/RIR/IRFA and describing and analyzing the PPA, three issues arose that require either clarification by the Council or modification to the PPA. This section describes these issues and suggests possible options for resolving them. These are issues associated with the PPA that have a bearing on how, and whether, the PPA could be implemented as intended by the Council. They are:

- Two issues related to the formation and composition of the ICA.
- The potential for the 68,392 Chinook salmon hard cap to be exceeded because, under the PPA, Chinook salmon bycatch accrues to both the high cap and the backstop cap.

2.4.3.1 Formation and Composition of the ICA

The PPA specifies some elements of the ICA, but not all. This section addresses two issues related to the ICA: (1) the possibility of more than one ICA being submitted to NMFS for review, and (2) the possibility that some participants could be involuntarily excluded from the ICA.

<u>More than one ICA is submitted</u>: The Council stated at its June 2008 meeting that it intended that only one Chinook salmon bycatch ICA would be approved by NMFS. However, it is possible that more than one proposed ICA could be submitted to NMFS for review. Therefore, NMFS recommends that the regulations clearly allow the submission of only one ICA. If more than one ICA is submitted by the deadline, NMFS would disapprove all proposed ICAs and provide the industry an opportunity to resubmit a single ICA.

<u>Participation in the ICA</u>: The PPA does not require 100 percent participation in the ICA by all eligible AFA vessels, inshore cooperatives, sectors, or CDQ groups. This is evident because the PPA refers to "those operations that opt out of such an ICA" and provides the backstop cap for those operations opting out of the PPA. Analysts assume that reference to "operations" in the PPA means that entire sectors, inshore cooperatives, or CDQ groups could opt to not participate in the ICA, as could any number of

individual vessels within the non-CDQ sectors. A CDQ group must decide whether to opt in or out of the ICA for all of the vessels fishing for pollock on its behalf. The CDQ group is the recipient of the transferable Chinook salmon bycatch under the high cap and it cannot have some vessels fishing on its behalf under the high cap and others fishing under the backstop cap. While the ability to opt out of the ICA could provide participants a stronger negotiating position to demand specific terms as a condition of joining the ICA, it also allows some participants to exclude other participants from the ICA.

Although the PPA does not require 100 percent participation, it also does not specify whether there is a minimum number of participants needed for the ICA to be effective. A significant number of vessels could choose not to participate in a single ICA. Vessel operators could choose not to participate in the ICA if its terms and conditions were so costly or onerous that it would be more advantageous to fish under the backstop cap. In this case, the decision to not participate in the ICA would be voluntary. The fact that the PPA does not prevent a single ICA from having multiple sections each describing a different type of incentive program for different sectors, cooperatives, CDQ groups, or vessel types reduces the possibility that participants would voluntarily opt out of the ICA because they were unable to afford the costs of the bycatch incentive program described in the ICA.

Some participants may voluntarily not participate in the ICA. However, it also is possible that vessel operators, inshore cooperatives, sectors, or CDQ groups could be prevented from participating in the ICA by other participants. In this case, those excluded from the ICA would not be voluntarily opting out of the ICA. Exclusion from the ICA would mean that these operators would be required to fish under the backstop cap and would face the possibility of not being able to harvest the same amount of pollock had they participated in the ICA and fished under the high cap.

NOAA GCAK is concerned about the possibility of involuntary exclusion from the ICA and the resulting inequitable distribution of fishing privileges. National Standard 4 of the Magnuson-Stevens Act requires that, if "it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fisherman; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges." 16 U.S.C. § 301(a)(4). NOAA GCAK is concerned that the possibility of involuntary exclusion from the ICA could make the PPA inconsistent with National Standard 4.

Preventing participants from being involuntarily excluded from the ICA could be addressed by one of the following options:

Option 1: The PPA could be modified to add a requirement that the ICA must allow any AFA eligible vessel, cooperative, or CDQ group to join the ICA. This would be similar to the provision in the GOA Rockfish Program that, upon receipt of written notification that a person is eligible and wants to join a rockfish cooperative, that rockfish cooperative must allow that person to join subject to the terms and agreements that apply to the members of the cooperative as established in the contract governing the conduct of the rockfish cooperative. The following text could be added to the PPA to read:

> Membership in the ICA is voluntary. No person may be required to join the ICA. Upon receipt of written notification that a person wants to join the ICA, the ICA must allow that person to join subject to the terms and agreements that apply to all members of the ICA as established in the contract governing the conduct of the ICA.

This option would require NMFS to allow a participant who believed that they were involuntarily excluded from the ICA to submit a challenge to NMFS's approval of the proposed ICA that provided documentation of violation of above requirement. NMFS would have to review this information and determine whether the assertion was valid. If it were, NMFS would disapprove the proposed ICA. Further resolution of the issue could then occur through NMFS's administrative appeal process. However, an appeal on the issue of involuntary exclusion could be difficult and time consuming to resolve and an on-going appeal would require all participants to fish under whichever cap would apply if no ICA was approved (depending on whether Council decided to implement PPA1 alone or PPA1 and PPA2 together).

Option 2: The PPA could be modified to remove the backstop cap and set a hard cap of 47,591 Chinook salmon unless 100 percent of the vessel owners and CDQ groups eligible to participate in the AFA pollock fisheries form an ICA that meets the requirements of the PPA. If 100 percent of those eligible for the AFA pollock fisheries participate in the ICA, then the cap would be increased to 68,392 Chinook salmon and allocated among the sectors, inshore cooperatives, and CDQ groups as described in the PPA. The choice for participants would be between transferable bycatch allocations under either the 68,392 cap of PPA1 or the 47,591 cap of PPA2. The EIS analyzes the impacts each of these two hard caps on the human environment and modifying the PPA to remove the backstop cap and require 100 percent participation in the ICA does not involve any significant impacts to the human environment that are not currently addressed in this EIS. Note that this option is also presented below as a way to change the PPA to ensure that the 68,392 cap is a hard cap. Therefore, the Council could make this modification of the PPA at final action without requiring additional analysis.

2.4.3.2 Options to ensure that the 68,392 Chinook salmon is a hard cap

The PPA describes the high cap of 68,392 as a "hard" cap, which means that directed fishing for pollock would stop if this cap was reached before all pollock was harvested, thereby ensuring that the Chinook salmon bycatch cap would not be exceeded. However, elements of the PPA as it currently is described do not guarantee that the 68,392 cap is a hard cap. Although unlikely, there are circumstances under which total Chinook salmon bycatch under the PPA could exceed 68,392 Chinook salmon. This does not appear consistent with the Council's intent for the PPA. Therefore, three options are presented later in this section to either clarify the Council's intent or modify the PPA to insure that the 68,392 Chinook salmon cap is a hard cap.

There are two ways the 68,392 cap could be exceeded depending on whether individual vessels opt out of the ICA or entire sectors or cooperatives opt out. These scenarios could occur if any vessel fishes under the backstop cap because Chinook salmon bycatch that accrues against the backstop cap is in addition to the bycatch that accrues against the 68,392 cap. In other words, total Chinook salmon bycatch in a year is the sum of the Chinook salmon bycatch under the 68,392 cap and any Chinook salmon bycatch by vessels fishing under the backstop cap.

- First, if individual vessels within a sector or cooperative opt out of the ICA and fish under the backstop cap, all bycatch by these vessels would be in addition to bycatch caught under the 68,392 cap. When an individual vessel opts out, the sector or inshore cooperative that this vessel belongs to would continue to receive the full allocation of the 68,392 cap allowed for that sector or inshore cooperative. If all of the allocated bycatch under the 68,392 cap was caught, the bycatch by the individual vessel fishing under the backstop cap would be additional bycatch that would make total annual bycatch exceed 68,392 Chinook salmon.

- Second, if an entire sector, inshore cooperative, or CDQ group opted out of the ICA, this group of vessels would fish under the backstop cap with any other vessels opting out of the ICA. The portion of the 68,392 cap that this group of vessels would have been allocated would not be allocated to any other participants and no Chinook salmon bycatch by any other vessels would accrue against this portion of the high cap. Under this scenario, the high cap is much less likely to be exceeded, but this still could happen if the sector, inshore cooperative, or CDQ group fishing under the backstop cap caught more Chinook salmon under the backstop cap than it would have been allocated under the 68,392 cap. If all of the other Chinook salmon bycatch allowed under the high cap was fully caught, the additional bycatch under the backstop cap would make the total Chinook salmon bycatch exceed 68,392 Chinook salmon.

Although it is theoretically possible that total annual Chinook salmon bycatch could exceed 68,392 under the PPA, it is unlikely that this will occur for several reasons. First, the 68,392 cap will be divided seasonally and among the sectors, inshore cooperatives, and CDQ groups into 30 different sub-allocations of the overall cap (2 seasons for each offshore CP sector, mothership sector, 7 inshore cooperatives, and 6 CDQ groups). All of the recipients of the bycatch allocation likely will keep their allocations for as long as needed during the year to maximize their ability to harvest pollock. They are unlikely to transfer significant amounts of bycatch during the A season, preferring to retain that bycatch so that they can roll over 80 percent of it to their B season allocation. Any sector, cooperative, or CDQ group that rolls Chinook salmon bycatch from the A to B season will leave 20 percent of it behind unused at the end of the A season, so this amount of the 68,392 cap would not be harvested. Participants are likely to save their B season Chinook salmon allocations until they have fully harvested their pollock or near to the end of the season to ensure that they have enough bycatch to harvest their pollock. They will only transfer Chinook salmon if they complete their pollock fishing or determine that they will be unable to harvest all of their pollock before the season ends on November 1. Saving Chinook salmon bycatch and not transferring it until late in the year will make it more difficult to match up available pollock and Chinook salmon bycatch and increase the chance that some of the Chinook salmon bycatch will not be caught. Finally, if the ICA is effective in providing incentives for fishermen to reduce Chinook salmon bycatch below the caps, this reduction would mean that the full 68,392 Chinook salmon cap would not be caught.

The only way that the 68,392 cap can be exceeded is if the sum of the Chinook salmon bycatch under the 68,392 cap and the backstop cap exceeds 68,392 Chinook salmon. Vessels would have to choose to not participate in the ICA and to fish under the backstop cap. All of these vessels currently cooperate within their sectors or inshore cooperatives to harvest pollock and manage salmon bycatch under the VRHS system. They have a history of cooperating in situations where cooperation is necessary to maximize their harvests of pollock. It seems unlikely that significant numbers of vessel owners would break with their cooperative to fish under the backstop cap. In addition, the backstop cap is a much smaller cap that will be shared among all vessels fishing under it (with the CDQ and non-CDQ subdivisions). Because bycatch under the 68,392 cap and bycatch by all vessels fishing under the backstop cap accrue against the backstop cap, Chinook salmon bycatch will accrue quickly and there is a high chance that vessels fishing for pollock under the backstop cap will be required to stop fishing before their sector or cooperative is required to stop fishing under the higher 68,392 cap. It is risky to choose to fish under the backstop cap and it is uncertain how many vessels will take this risk just to avoid participation in the ICA. Finally, the fact that the PPA does not prevent the ICA from containing different incentive programs for different groups of vessels allows the components of the pollock fishing industry to design different incentive programs tailored to the needs of particular vessels types or sectors. This type of flexibility in the ICA increases the chance that all vessels would participate in the ICA and no vessels would fish under the backstop cap.

Regardless of all these reasons why it is unlikely that the 68,392 cap will be exceeded, the fact is that the structure of the PPA would allow that to occur. Therefore, the 68,392 Chinook salmon cap described in the PPA cannot be called a hard cap. The exact amount by which the total bycatch could exceed 68,392 Chinook salmon under PPA1 is unknown and depends on many assumptions and circumstances in the fishery. It could range from no additional bycatch beyond the 68,392 cap up to some unknown portion of the 32,482 backstop cap.

The following three options are suggested as ways the Council could address the concern that the 68,392 cap is described as a "hard cap" in the PPA, but the structure of the PPA would allow total annual bycatch to exceed this amount. Other methods for achieving a true "hard cap" also could exist:

Option 1: The Council could clarify that although the high cap of 68,392 Chinook salmon is not a hard cap the Council believes that it is very unlikely that this cap will be exceeded and that the benefits of the current structure of the PPA outweigh concerns about total annual Chinook salmon bycatch exceeding 68,392. The PPA would have to be revised to not refer to the 68,392 cap as a hard cap.

Option 2: Remove the backstop cap from the PPA and set a hard cap of 47,591 Chinook salmon unless 100 percent of the vessel owners and CDQ groups eligible to participate in the AFA pollock fisheries form an ICA that meets the ICA requirements set forth in the PPA. If those conditions are met, then the cap would be increased to 68,392 Chinook salmon and allocated among the sectors, inshore cooperatives, and CDQ groups as described in the PPA. Removal of the backstop cap from the PPA would eliminate the possibility that bycatch under the backstop cap, when added to the bycatch under the 68,392 cap, could cause total annual Chinook salmon bycatch to exceed 68,392. The EIS analyzes the impacts each of these two hard caps on the human environment and modifying the PPA to remove the backstop cap and require 100 percent participation in the ICA does not involve any significant impacts to the human environment that are not currently addressed in this EIS. Therefore, the Council could make this modification of the PPA at final action without requiring additional analysis.

Option 3: The Council could revise the PPA to ensure that the 68,392 cap can be managed as a "hard cap." If the PPA maintains the option for an "opt out" fishery and the concept of a hard cap, it would need to provide guidance on how to allocate the hard cap between ICA participants and the "opt out" fishery so that the cumulative salmon bycatch of these two groups of pollock harvesters does not exceed 68,392. The following section provides an example of one method with two options that could be used.

2.4.3.3 Example of an allocative method to ensure bycatch levels remain below overall annual cap

One way to ensure that the annual cap will not be exceeded as a result of the additional bycatch of vessels, cooperatives, or whole sectors opting out of the ICA and fishing under the backstop cap would be to modify the PPA to:

1. reduce the amount of Chinook salmon bycatch allocated under the 68,392 cap if any vessel, sector, or inshore cooperative opted out of the ICA and fished under the backstop cap,

2. establish the amount of Chinook salmon bycatch available under the backstop cap based on the vessels that are fishing under the backstop cap (the backstop cap could be less than 32,482 Chinook salmon),

3. determine the amount of the Chinook salmon bycatch that would be deducted from the 68,392 cap and used to create the backstop cap based on the proportion of Chinook salmon bycatch associated with each vessel in the offshore CP and mothership sectors or with each inshore cooperative, and

4. accrue only the Chinook salmon bycatch by vessels fishing under the backstop cap against the backstop cap (don't also accrue bycatch from the transferable bycatch allocations under the 68,392 cap against the backstop cap).

There are many options for the amount of Chinook salmon bycatch that could be subtracted from or remain unallocated under the 68,392 cap and used to create the amount of the backstop cap. Following are three of these options:

- *Option A*: Subtract from the 68,392 cap the proportion of the 68,392 cap represented by the vessels opting out of the ICA and fishing under the backstop cap and use this same amount to create the backstop cap,
    - This option would result in the largest possible amount for the backstop cap and the amount used to establish the backstop cap would have to be limited to 32,482 Chinook salmon because if too many vessels opted out, the proportion of the 68,392 cap that would be used to establish the backstop cap could exceed 32,482.

- *Option B*: Subtract from the 68,392 cap the proportion of the 68,392 cap represented by vessels opting out and fishing under the backstop cap, but create the backstop cap using the proportion of 32,482 represented by the vessels fishing under the backstop cap.
    - This option would subtract more from the 68,392 cap than would be added to the backstop cap, thereby resulting in a total cap of less than 68,392 Chinook salmon.

- *Option C*: Subtract from the 68,392 cap the proportion of the backstop cap represented by the vessels opting out of the ICA and fishing under the backstop cap and use this same amount to create the backstop cap,
    - This option would subtract the smallest amount from the 68,392 cap and could result in a very low backstop cap if only a few vessels or vessels with very low proportions of Chinook salmon bycatch fished under the backstop cap.
    - This option also would leave some portion of the Chinook salmon associated with the vessels opting out in the sector allocation under the 68,392 cap. This additional Chinook salmon would be available to those vessels in the sector that participated in the ICA.

Under each of these options, the backstop cap would be some number less than or equal to 32,482 Chinook salmon, depending on the number of vessels that opted out of the ICA and the option used to determine the amount of the backstop cap. If only a few vessels fished under the backstop cap, the amount of Chinook salmon bycatch allocated to this cap could be very small. At some point, the amount of salmon allocated to the backstop cap could be so small that NMFS would not be able to open a directed fishery for pollock under the backstop cap because of the high potential to exceed the cap with only a small amount of fishing effort. However, under Option A, it would be possible for the backstop cap to exceed 32,482 if enough vessels opted out that the proportion of the 68,392 cap represented by these vessels exceeded 32,482 Chinook salmon. In the extreme, if all vessels from all sectors and inshore cooperatives and all CDQ groups opted out of the ICA, the backstop cap would be the full amount of the 68,392 cap. The Council could recommend limiting the amount of the backstop cap under any of these options to 32,482 Chinook salmon.

Examples are provided below to illustrate how to assign an amount of Chinook salmon bycatch and adjust the caps under each of these three options. These are only examples to illustrate on method for making the 68,392 cap a hard cap. Other methods could be developed by the Council to accomplish this goal.

The first example shows the outcome if two inshore cooperatives opted out of the ICA and fished under the backstop cap. These two inshore cooperatives would not receive transferable Chinook salmon bycatch allocations under the 68,392 cap. They would be fishing under the backstop cap and NMFS would issue a closure to directed fishing for these two inshore cooperatives when their Chinook salmon bycatch reached these seasonal backstop caps. The amount of Chinook salmon bycatch assigned to the inshore cooperatives is based on the pollock catch history used to make annual pollock allocations to the inshore cooperatives under current NMFS regulations and is same method used under Alternative 4 to establish the transferable Chinook salmon bycatch allocations to the inshore cooperatives.

Table 2-35 shows the seasonal allocations of the inshore CV sector's allocation of the 68,392 cap (49.8% in the A season and 69.3% in the B season) and the allocations to the seven inshore cooperatives based on their pollock catch history.

Table 2-35 Allocation to the inshore CV cooperatives under PPA 1 that would be deducted from the sector level cap under Options A and B if a cooperative 'opted out' of the ICA

Inshore Cooperative	Percentage allocation of pollock	A season	B season	Total
Akutan CV Assoc	31.15%	7,425	4,429	11,854
Arctic Enterprise Assoc	1.15%	273	163	436
Northern Victor Fleet coop	9.48%	2,260	1,348	3,608
Peter Pan Fleet coop	2.88%	686	409	1,095
Unalaska coop	12.19%	2,906	1,733	4,640
Unisea Fleet coop	24.26%	5,783	3,449	9,232
Westward Fleet coop	18.91%	4,507	2,688	7,196
limited access AFA vessels	0.00%	0	0	0
Total	100.00%	23,841	14,219	38,060

For this example, assume that the cooperatives with the highest and lowest Chinook salmon bycatch allocations opted out of fishing under the ICA. This would be the Akutan CV Association (highest allocation) and Arctic Enterprise Association (lowest allocation). Also assume that vessels fishing for these two inshore cooperatives were the only vessels opting out of the ICA and fishing under the backstop cap. Using this example, the proportion of the inshore sector's allocation of Chinook salmon bycatch under the 68,392 cap represented by these two cooperatives would be 32.30% (31.15% for Akutan and 1.15% for Arctic Enterprise). This represents 12,290 Chinook salmon under the 68,392 cap as shown in the table above (7,698 in the A season (7,425 + 273) and 4,592 Chinook salmon in the B season (4,429 + 436)).

Applying this same percentage of Chinook salmon bycatch associated with these two inshore cooperatives to 32,482 backstop cap is calculated as follows (this assumes inshore sector portion of the backstop cap for the calculation, but the backstop cap is not allocated by sector):

A season: = 22,737 Chinook salmon * 49.8% (inshore A season proportion)
* [(31.15% (Akutan) + 1.15% (Arctic Enterprise)] = 3,657 Chinook salmon

B season = 9,745 Chinook salmon * 69.3% (inshore B season proportion)
* [(31.15% (Akutan) + 1.15% (Arctic Enterprise)] = 2,181 Chinook salmon

The proportion of the backstop cap that is represented by these two inshore cooperatives is 3,657 Chinook salmon in the A season and 2,181 Chinook salmon in the B season for a total of 5,838 Chinook salmon

The following table shows the amount of Chinook salmon that would be subtracted from the inshore sector's allocation of the 68,392 cap under Options A, B, and C; how much Chinook salmon would be available to these two inshore cooperatives under the backstop cap; and the total amount of Chinook salmon bycatch that would be allocated under both of the caps together. This total represents the amount of the hard cap that would be in place under each of the three options. This example assumes that only these two cooperatives would be fishing under the backstop cap.

Table 2-36 Amount allocated to the 68,392 cap the backstop cap under the example of two inshore cooperatives opting out of the ICA, and total amount allocated under both caps.

Option for adjusting caps to create a hard cap	(X) 2 co-ops proportion subtract from 68,392 cap	(Y) Total allocated under the high cap (68,392-X)	(Z) Total backstop cap	Total Chinook salmon bycatch allocated under both caps (Y + Z)
Option A	12,290	56,102	12,290	68,392
Option B	12,290	56,102	5,838	61,940
Option C	5,838	62,554	5,838	68,392

12,290 Chinook salmon represents the 2 inshore cooperatives proportion of the 68,392 cap and 5,838 Chinook salmon represents the 2 inshore cooperatives proportion of the 32,482 backstop cap.

If Option A was used to adjust the caps, the same amount of Chinook salmon would be subtracted from the inshore sector's allocation of the 68,392 cap as would be used to create the backstop cap. That would be 7,698 Chinook salmon in the A season and 4,592 Chinook salmon in the B season for a total of 12,290 Chinook salmon annually. The total amount of Chinook salmon allocated between the two caps would be a hard cap of 68,392.

If Option B was used to adjust the caps, the same amount as for Option A would be subtracted from the amount of Chinook salmon allocated to the inshore sector under the 68,392 cap (12,290). However, Option B would establish the backstop cap as the proportion of the original 32,482 backstop cap instead of as a proportion of the 68,392 cap. Under Option B, the backstop cap would be 3,657 in the A season and 2,181 in the B season for a total of 5,838 Chinook salmon for the year. Subtracting a higher amount from the 68,392 cap than is used to create the backstop cap would reduce the total amount of Chinook salmon allocated between the two caps to 61,940 Chinook salmon, which is reduction of 6,452 Chinook salmon.

If Option C was used to adjust the caps, the two inshore cooperatives proportional amount of the 32,482 backstop cap would be subtracted from the inshore sector's allocation of the 68,392 cap and that same amount would be used to create the backstop cap that these cooperatives would fish under. The amount of the reduction in the 68,392 cap and the amount of the backstop cap would be 3,657 in the A season and 2,181 in the B season for a total of 5,838 Chinook salmon for the year. The total amount of Chinook salmon allocated between the two caps would be a hard cap of 68,392.

Other similar examples could be developed for a vessel or group of vessels from the offshore CP sector or mothership sector opting out of the ICA and fishing under the backstop cap. The methods used to assign pollock to vessels or companies within the offshore CP and mothership sectors are not based on any Federal regulation or previous Council action. They are the methods developed through the cooperatives' private contractual agreements and were available for this analysis through information made publically available by the cooperatives. The following examples show the adjustments that would be made following Option A above. Similar examples could be developed to illustrate the outcome using Options B and C.

For the CP sector, an example of the proportions assigned to vessels is provided in Table 2-37. This example assumes that catch history would be assigned to specific CP vessels rather than to specific companies [as with the Pollock Conservation Cooperation (PCC) membership agreement]. One means of potentially achieving this is to apportion to each vessel based on the vessel's pollock catch history, using an adjusted 2006 pollock catch. The year 2006 was chosen because the American Dynasty fished in both the A and B seasons in 2006, and so the catch in that year might represent a reasonable approximation of the relative harvesting capacity of each vessel in the CP fleet. In this example, the 2006 history has been adjusted from the actual catch in that year, because the catch history of the CP fleet does not match the pollock allocated to PCC members [many PCC member companies also harvest pollock allocated to High Seas Catchers' Cooperative (HSCC) vessels]. The adjustment, as listed in the example, ensures that the CP fleet pollock harvest is equal to the percentage of pollock allocated to each company under the PCC membership agreement. This is just one example of how salmon could be allocated on the basis of adjusted pollock catch, there may be other alternative approaches for apportioning salmon within the CP fleet. In this example, the Ocean Peace is assigned a portion of 0.05% of the CP sector level cap, as per their AFA maximum pollock allocation.

Table 2-37 Hypothetical proportions assigned to vessels in the CP sector under the PPA1 that would be deducted from the CP sector level cap if a vessel 'opted out'

Vessel	Percentage allocation based on adjusted 2006 pollock catch history	A season	B season	total
American Dynasty	4.932%	777	181	958
American Triumph	7.246%	1,141	266	1,407
Northern Eagle	6.070%	956	223	1,179
Northern Hawk	8.449%	1,331	310	1,641
Northern Jaeger	7.384%	1,163	271	1,434
Ocean Rover	6.394%	1,007	235	1,242
Alaska Ocean	7.295%	1,149	268	1,417
Island Enterprise	5.595%	881	206	1,087
Kodiak Enterprise	5.904%	930	217	1,147
Seattle Enterprise	5.476%	862	201	1,064
Arctic Storm	4.579%	721	168	890
Arctic Fjord	4.458%	702	164	866
Northern Glacier	3.121%	492	115	606
Pacific Glacier	5.062%	797	186	983
Highland Light	5.136%	809	189	998
Starbound	3.943%	621	145	766
Ocean Peace	0.500%	79	18	97
Katie Ann	0.0000%	0	0	0
U.S. Enterprise	0.0000%	0	0	0
American Enterprise	0.0000%	0	0	0
Endurance	0.0000%	0	0	0
American Challenger	1.391%	219	51	270
Forum Star		0	0	0
Muir Milach	1.129%	178	41	219
Neahkahnie	1.661%	262	61	323
Ocean Harvester		0	0	0
Sea Storm	2.046%	322	75	397
Tracy Anne	1.155%	182	42	224
Harvester Enterprise	1.076%	169	40	209
Total	100.0000%	15,751	3,673	19,424

Source: Kochin, L.A., Riley, C.C., Kujundzic, A. and Plesha, J.T. Analysis of an Incentive-Based Chinook Salmon Bycatch Avoidance Proposal for the Bering Sea Pollock Fishery. September 29, 2008. Presented in public testimony to the NPFMC at its October 2008 meeting.

If a CP vessel opted out, an example is presented similar to the inshore CV fleet whereby the vessels assigned the highest and lowest proportions opt out of the ICA. Here the vessel with the highest salmon proportion, the Northern Hawk with 1,331 A season and 310 B season, and the vessel with the lowest salmon proportion, the Ocean Peace with 79 A season salmon and 18 B season salmon, opt out of the ICA. Their allocations in the sector would become inactive, and the overall sector level cap is the sum of the remaining allocations, i.e., 17,693. The allocation to an entity such as the Ocean Peace is so small as to be potentially unmanageable, thus further consideration of the management implications of these caps must be evaluated. The resulting backstop cap would then be 1,410 Chinook salmon in the A season 328 Chinook salmon in the B season and the opt out CP vessels would be required to stop fishing once the total fleet bycatch reaches that amount in each season.

Finally, the Mothership sector level cap could potentially be apportioned to vessels in the sector, for purposes debiting the sector level cap if a vessel opts out of the ICA. For illustrative purposes, information from the 2007 Final Report of the Mothership Fleet Cooperative, as provided to the NPFMC, was used to determine relative percentage apportionments. From that report, the cooperative member share percentages and their associated vessels were applied to the Mothership sector level cap (Table 2-38). The proportions do not total exactly in this report (99.939% rather than 100.000%), hence the resulting salmon proportions by season to vessel is slightly lower than the sector level cap.

Table 2-38 Hypothetical proportions assigned to vessels in the Mothership sector under the PPA1 that would be deducted from the Mothership sector level cap if a vessel 'opted out'

Cooperative member	Vessel	Proportion based on cooperative member's pollock allocation	A season	B season	Total
Alaknuk Beauty L.L.C.	American Beauty	6.000%	230	90	320
Pacific Dawn	Pacific Challenger	9.671%	370	145	515
Fury Group, Inc.	Nordic Fury	6.117%	234	92	326
	Pacific Fury	5.889%	226	88	314
Great West Seafoods, Ltd.	Margaret Lyn	5.643%	216	85	301
Katahdin, Inc	Misty Dawn	3.569%	137	53	190
King and Winge, Inc. Futura Fisheries, Inc.	Vanguard	5.350%	205	80	285
Kydaka Corporation	California Horizon	3.786%	145	57	202
Langesatar Fisheries Inc., Reiten Enterprises Inc., Arruela Fisheries, Inc.	Oceanic	7.038%	270	105	375
MarGun Fisheries Inc.	Mar-Gun	6.251%	239	94	333
Mark 1, inc	Mark 1	6.251%	239	94	333
Meddar Corporation	Aleutian Challenger	4.925%	189	74	262
Emmonak Leader, L.L.P.	Ocean Leader	6.000%	230	90	320
Ocean Thunder, Inc.	Papado II	2.953%	113	44	157
Supreme Alaska Seafoods, Inc	Morning Star	3.601%	138	54	192
Traveler Fisheries L.L. P.	Traveler	4.272%	164	64	228
Vesteraalen L.L.C.	Vesteraalen	6.201%	237	93	330
Wa'atch, Inc	Alyeska	2.272%	87	34	121
Western Dawn L.L.C.	Western Dawn	4.150%	159	62	221
Total		99.939%	3,828	1,497	5,325

Source: Information from the 2007 Final Report of the Mothership Fleet Cooperative, as provided to the NPFMC, was used to determine relative proportions.

As with the examples provided for inshore CVs and CP sectors, if the vessels with the highest and lowest proportions were to opt out of the ICA (e.g., the Pacific Challenger and the Alyeska), the resulting sector level cap for the Mothership sector would be an annual total of 4,692 Chinook salmon. The resulting backstop cap would then be 457 Chinook salmon in the A season 179 Chinook salmon in the B season.

The opt out vessels would be required to stop fishing once the total fleet bycatch reached these seasonal backstop caps.

Table 2-39 shows the resulting allocations by sector and the resulting backstop cap if all three of the hypothetical examples discussed above occurred simultaneously, where in each sector the vessels with the highest and lowest allocations choose to opt out. For this example, the resulting backstop cap is a sum of the number of Chinook salmon deducted from the sector level caps.

Table 2-39 Hypothetical sector level caps resulting from example of highest and lowest members of each sector opting out of the ICA in a given year and the recalculated backstop cap.

Sector	Initial annual allocation of the 68,392 cap	Amount deducted due to vessels with the high and low proportions 'opting out'	Resulting Sector total allocation
Inshore CV	38,060	12,290	25,770
Offshore C/P	19,424	1,738	17,693
Mothership	5,328	636	4,692
	Resulting backstop cap	14,664	

2.5 Managing and Monitoring the Alternatives

This section describes how management of the pollock fisheries would change under each of the alternatives and how Chinook salmon bycatch would be monitored. Estimated costs and the impacts of these changes on the enforcement of regulations governing the pollock fisheries is discussed in Chapter 10.

Each of the three alternatives to status quo include a limit, or cap, on the amount of Chinook salmon bycatch that may be caught in the pollock fisheries. Under Alternatives 2 and 4, once this limit is reached, pollock fishing must stop. Under Alternative 3, reaching this limit closes certain areas important to pollock fishing. Each of the alternatives include options that would allocate Chinook salmon bycatch caps among the sectors, inshore cooperatives, and CDQ groups participating in the pollock fisheries. The use of transferable Chinook salmon bycatch allocations is a new aspect of managing the pollock fisheries that does not currently exist in these fisheries and represents the largest challenge for management and enforcement. Alternatives 2 and 4 particularly represent a change in management of the pollock fisheries because if the Chinook salmon bycatch allocations are reached before the full harvest of the pollock quota, then pollock fishing must stop.

Transferable bycatch allocations are used in other Bering Sea fisheries, such as the CDQ fisheries and the allocations to the non-AFA trawl catcher/processors under Amendment 80 to the BSAI FMP. These fisheries provide the model for NMFS's recommendations about the management and monitoring requirements that will be needed to implement the alternatives analyzed in this EIS. To ensure effective monitoring and enforcement of transferable Chinook salmon bycatch allocations, NMFS recommends that the following additional monitoring requirements be implemented for the inshore CV sector and the CDQ sector (if CVs delivering to shoreside processors harvest pollock on behalf of CDQ groups in the future):

- Each CV, regardless of size, must have 100 percent observer coverage.
- Chinook salmon could be discarded at-sea only if first reported to, and recorded by, the vessel observer.

- Shoreside processor monitoring requirements may have to be adjusted to incorporate a higher standard for Chinook salmon bycatch accounting. This could include such changes as modifying observer sampling protocols, increasing the number of observers, or reducing the flow of pollock into the factory to ensure that Chinook salmon do not pass the observer's sampling area without being counted.
- Electronic (video) monitoring in lieu of observers on CVs would only be allowed after a successful, comprehensive assessment of the effectiveness of electronic monitoring to verify that Chinook salmon are not discarded.

Existing observer coverage requirements and species composition sampling methods for catcher/processors and motherships participating in the AFA pollock fisheries, including the directed fisheries for pollock CDQ, represent NMFS's current method for estimating Chinook salmon and will be relied upon to account for and transfer allocations among industry sectors. However, the use of observer data to limit pollock fishing or to enforce overages of Chinook salmon bycatch allocations will place increased scrutiny on this bycatch estimation process and additional improvements or revisions may be needed in the future.

Alternative 4, the Council's preliminary preferred alternative, is more complicated to manage and enforce than the other alternatives because PPA1 has two different Chinook salmon bycatch caps that could be operating at the same time and it includes the requirement for an ICA agreement with incentives to reduce Chinook salmon bycatch below the cap levels. Under PPA1, NMFS would be required to identify which cap each of the approximately 120 vessels participating in the pollock fishery is fishing under prior to the start of each year's fishery, accrue the catch from that vessel to the appropriate sector level cap or transferable allocation account, and monitor compliance with Chinook salmon bycatch caps for up to 36 different groups of vessels fishing under different Chinook salmon bycatch allocations. In addition, NMFS would be required to review a proposed ICA submitted by the pollock industry and approve or disapprove this proposed ICA prior to the start of the pollock fisheries.

2.5.1 Managing and Monitoring Alternative 1

NMFS monitors numerous annual catch limits, seasonal limits, sector allocations, and quotas for many different BSAI groundfish fisheries. NMFS currently uses a combination of vessel monitoring system (VMS) data, industry reported catch information, and observer data to monitor vessel activities in the Chinook Salmon Savings Areas. These data sources are used by NMFS on a daily basis to monitor fishery limits. Information from VMS is useful for determining vessel location in relation to closure areas, but it may not conclusively indicate whether a vessel is fishing, transiting through a closed area, or targeting a particular species.

As part of this monitoring effort, NMFS may detect what appear to be regulatory violations, such as quota overages or closed area incursions. Such incidents are forwarded to NOAA Office of Law Enforcement (OLE) for subsequent investigation. Depending on its findings for each particular case, NOAA OLE may forward cases to NOAA GC for prosecution. The investigation and disposition of regulatory infractions requires considerable staff time from the AFSC's Fisheries Monitoring and Analysis Division, NOAA GC and NOAA OLE.

NMFS's Catch Accounting System (CAS) was developed to receive catch reports from multiple sources, evaluate data for duplication or errors, estimate the total catch by species or species category, and determine the appropriate "bin" or account to attribute the catch. The AFSC's Fisheries Monitoring and Analysis Division provides observer data about groundfish catch and salmon bycatch, including expanded information to NMFS. NMFS estimates salmon bycatch for unobserved catcher vessels using algorithms implemented in its CAS. The haul-specific observer information is used by the CAS to create salmon bycatch rates from observed vessels that are applied to total groundfish catch in each delivery (trip level) by an unobserved vessel. The rate is calculated using the observed salmon bycatch divided by the groundfish weight, which results in a measure of salmon per metric ton of groundfish caught. Salmon bycatch rates are calculated separately for Chinook salmon and non-Chinook salmon. A complete description of the observer sampling methods and the CAS is in section 3.1.

On-board observers monitor catch of pollock and bycatch in the pollock fishery. Observer requirements differ based on the type of operation in the CDQ and non-CDQ pollock fishery. Catcher/processors and motherships are required to carry two NMFS-certified observers during each fishing day. These vessels must also have an observer sampling station and a motion-compensated flow scale, which is used to weigh all catch in each haul. The observer sampling station is required to include a table, motion compensated platform scale, and other monitoring tools to assist observers in sampling. Each observer covers a 12 hour shift and all hauls are observed unless an observer is unable to sample (*e.g.,* due to illness or injury).

Catcher vessels deliver unsorted catch to the three motherships that participate in the AFA pollock fisheries. NMFS does not require these catcher vessels to carry observers because catch is not removed from the trawl's codend (the detachable end of the trawl net where catch accumulates) prior to it being transferred to the mothership. Observer sampling occurs on the mothership following the same estimation processes and monitoring protocols that are described above for catcher/processors.

Catcher vessels in the inshore sector are required to carry observers based on vessel length.

> Catcher vessels 125 feet in length or greater are required to carry an observer during all of their fishing days (100 percent coverage).
>
> Catcher vessels greater than 60 feet in length and up to 125 feet in length are required to carry an observer at least 30 percent of their fishing days in each calendar quarter, and during at least one fishing trip in each target fishery category (30 percent coverage).
>
> Catcher vessels less than 60 feet in length are not required to carry an observer. However, no vessels in this length category participate in the Bering Sea pollock fisheries.

AFA inshore processors are required to provide an observer for each 12 consecutive hour period of each calendar day during which the processor takes delivery of, or processes, groundfish harvested by a vessel directed fishing for pollock in the Bering Sea. NMFS regulates plant monitoring through a permitting process. Each plant that receives AFA pollock is required to develop and operate under a NMFS-approved catch monitoring and control plan (CMCP). Monitoring standards for CMCP are described in regulation at 50 CFR 679.28(g).

2.5.1.1 2007 Chinook salmon bycatch by vessel category

Vessel-specific salmon bycatch information currently exists for catcher/processors, motherships, and observed catcher vessels in the inshore sector. However, a significant component of the inshore sector are vessels in the 30 percent observer coverage category. When these vessels are not observed, salmon bycatch rates from other observed vessels are used to estimate the salmon bycatch associated with the pollock catch by the unobserved vessels (as discussed in section 3.1). For example, Table 2-40 shows the estimated pollock catch and salmon bycatch in the AFA pollock fisheries in the Bering Sea in 2007, by fishery sector and vessel length class. Fifty-six of the 82 vessels participating in the inshore sector in 2007 were in the 30 percent observer coverage category. These vessels caught approximately 20 percent of the pollock catch and an estimated 27 percent of the Chinook salmon bycatch.

Table 2-40 Number of vessels that participated in the 2007 AFA pollock fisheries, pollock catch, and estimated Chinook salmon bycatch, by vessel category.

Vessel category	Number of Vessels	Pollock (mt)	Percent of Pollock Catch	Number of Chinook salmon	Percent of Chinook Salmon
Catcher/processor	16	488,528	41%	32,212	28%
Motherships	3	121,514	10%	6,663	6%
CV 60 ft.-125 ft.	56	240,546	20%	31,381	27%
CV ≥ 125 ft.	26	332,081	28%	45,937	40%
Total	102	1,182,669	100%	116,193	100%

Does not include 8 catcher vessels that deliver only unsorted codends to motherhips and do not require an observer.

2.5.2 Managing and Monitoring Alternative 2

Under Alternative 2, the term “hard cap” refers to an amount of Chinook salmon that, once caught, would require entities regulated under the cap to stop directed fishing for pollock in the Bering Sea. The implementation of salmon bycatch hard caps in the Bering Sea pollock fishery would require various changes to federal regulations and NMFS management practices, when compared to the status quo. Depending on the components and options selected by the Council, these regulatory changes would include changes to monitoring requirements, inseason management, and enforcement responsibilities.

This action proposes several levels of salmon bycatch hard caps, applied to different fishing industry sectors:

- Component 1. Separate hard cap allocations could be made to the CDQ and the non-CDQ fisheries. The CDQ sector level cap would be allocated to the CDQ groups.
- Component 2. The hard cap allocations to the non-CDQ sector could be further subdivided, by sector, into sector level caps or transferable allocations for motherships, catcher/processors, and the inshore sector.
- Component 4. The inshore sector cap could be further subdivided among inshore cooperatives and, potentially, to an limited access sector for catcher vessels not participating in a inshore cooperative.

Note: Component 3 is omitted from this list because it is associated with transfers of salmon cap allocations, not allocations to, and among, sectors.

2.5.2.1 Managing hard caps

Management of hard caps would be the same for all proposed hard cap amounts. Salmon bycatch would be counted using the CAS, as described in Chapter 3. In general, once salmon bycatch approaches the cap established for a fishery, NMFS would close directed fishing for pollock for the applicable fishery.

Component 1 would allocate the salmon hard cap into two hard caps: one for the non-CDQ AFA sectors combined (catcher/processors, motherships, and inshore) and one for the CDQ Program. The annual CDQ salmon hard cap would be further subdivided to each of the six CDQ groups. In addition, under Component 1, salmon bycatch hard caps would be apportioned between the A and B seasons. This would result in 14 separate Chinook salmon bycatch hard caps: two caps in the non-CDQ AFA fisheries and 12 caps in the CDQ Program. This is portrayed in Table 2-41.

Table 2-41 Number of salmon caps, with seasonal splits.

Seasonal allowance	Number of hard caps, non-CDQ fishery	Number of hard caps, CDQ fishery	Total hard caps
A season	1	6	7
B season	1	6	7
Annual Total	2	12	14

Non-CDQ fishery salmon bycatch management a hard cap
The non-CDQ Chinook salmon bycatch hard cap would be managed seasonally. NMFS would issue a closure to directed fishing for pollock by all non-CDQ AFA sectors combined once their A season hard cap was reached. The brief time lag between when observer data is available and when NMFS publishes a closure notice may result in more Chinook salmon being caught than the A season hard cap. In this case, NMFS would subtract the A season overage, likely a relatively small amount of salmon, from the B season hard cap. NMFS would issue a second closure notice once the B season hard cap was reached.

Without seasonal rollover option: If the A season pollock allocation was fully harvested by the non-CDQ AFA sectors before the A season salmon bycatch cap was reached, unused Chinook salmon bycatch would be not be added to the B season hard cap.

With seasonal rollover option: If the A season pollock allocation was harvested by the non-CDQ AFA sectors before the A season salmon bycatch cap was reached, NMFS would add the unused Chinook salmon bycatch to B season hard cap.

Under the status quo, NMFS may have to issue one fishery closure associated with the Chinook salmon bycatch limit each year. If the Chinook salmon bycatch limit is reached, NMFS closes the Chinook Salmon Savings Area to all non-CDQ AFA participants not participating in the ICA. Hard caps create the potential for NMFS to have to issue two fishery closures each year for the non-CDQ fisheries. The first closure would occur if the A season Chinook salmon bycatch cap was reached before all of the A season pollock allocation was harvested. The second closure would occur if the B season Chinook salmon bycatch cap was reached before all of the B season pollock allocation was harvested. This is not a significant increase in the number of fishery closures that NMFS would need to issue.

Under Component 1 alone, no changes to the observer requirements for the non-CDQ participants are needed to monitor seasonal salmon bycatch hard caps allocated to the non-CDQ sectors as a whole. Some changes to NMFS's CAS would be needed to track the additional seasonal salmon bycatch caps. The addition of salmon bycatch hard caps has the potential to add significant constraints to the pollock fisheries. However, as long as NMFS is managing a single hard cap for all of the non-CDQ AFA sectors combined, the current levels of observer coverage and data available to estimate salmon bycatch by the fishery as a whole are adequate to support NMFS issuing fishery closures that apply to all of the non-CDQ AFA sectors at the same time.

CDQ Program salmon bycatch management under a hard cap
Under the status quo, salmon bycatch allocations to the CDQ groups are made to specific entities (the individual CDQ groups) and are transferable across groups within the CDQ Program. Allocations of hard caps of either target species or prohibited catch species are not managed by NMFS with directed fishing closures, primarily because most of these allocations are so small that NMFS could not obtain accurate catch data fast enough to have the appropriate lead time to issue closures notices in time for catch in the fisheries to stay within allocated amounts. Instead of using fishery closures initiated by NMFS, CDQ allocations are managed with a regulatory prohibition against the CDQ group catching in excess of the allocated amount. To avoid such an overage in the present context, the CDQ group would have to stop

directed fishing for pollock, unless they were certain that such fishing could continue to occur with no additional salmon bycatch.

To effectively enforce seasonal salmon bycatch allocations in the CDQ fisheries, each CDQ group would be prohibited from exceeding its A season salmon bycatch allocation. If an overage of a group's A season salmon bycatch hard cap occurred, NMFS would provide this information to NOAA OLE as a potential regulatory violation, subject to subsequent enforcement action. Any overage of an A season hard cap would not be subtracted from a CDQ group's B season hard cap.

If CDQ groups stayed within their A season Chinook salmon cap allocations, different scenarios could exist for how residual amounts of these caps could be used.

Without seasonal Chinook rollover option: If a CDQ group fully harvested its A season pollock allocation before it reached its A season salmon bycatch cap, the CDQ group could transfer all remaining A season salmon bycatch allocation to another CDQ group. This transfer provision follows current practices in the CDQ Program that allow transfers of target species and prohibited species allocations among the CDQ groups. However, if the Council did not select the seasonal rollover suboption, analysts interpret that the Council would intend that a CDQ group could not transfer its unused A season salmon bycatch cap to its own or any other CDQ group's B season salmon bycatch limit.

With seasonal Chinook rollover option: Unused salmon from the A season salmon cap could be transferred to another CDQ group during that same A season or it could be added to the CDQ group's B season salmon cap.

2.5.2.2 Managing caps compared to allocations

PSC monitoring requirements are dependent upon whether NMFS manages PSC limits or caps or whether PSC limits are allocated to entities within a fishery. There are two general types of allocations:

- Fishery or sector-level PSC limits or caps. Management of limits or caps are done through directed fishing closures. For example, a notice is issued in the *Federal Register* when the Chinook salmon savings area closes to directed fishing for pollock as a result of reaching the Chinook salmon PSC limit. Similarly, directed fishing for the deep water and shallow water flatfish complexes in the GOA is closed once the amount of halibut PSC allocated to these fisheries has been reached. These closures apply to all vessels participating in the relevant directed fisheries. Any vessel fishing after the closure is in violation of regulations governing closed areas.

- PSC allocations made to a specific entity. These allocations are enforced through regulatory provisions that prohibit exceeding an allocation. For example, halibut PSC is currently allocated to an Amendment 80 cooperative, six CDQ groups, and GOA Rockfish Program cooperatives. These entities monitor their halibut bycatch relative to their allocation and are prohibited from exceeding their halibut PSC allocations. Similar prohibitions against exceeding allocations to specific entities exist in the CDQ Program and for pollock catch by the inshore cooperatives. NMFS does not issue fishery closures once these allocations are reached. If the entity exceeds an allocation, NMFS would initiate enforcement action against the entity.

Management programs that allocate PSC to entities give recipients more specific control over their fisheries. Therefore, the general management approach changes with such allocations. Entities that receive allocations generally are prohibited from exceeding their allocations. If they exceed an allocation, NOAA may initiate an enforcement action against the entity. This requires a more accurate catch monitoring and accounting system than is required when managing multiple entities at a fishery or sector level. This is particularly true when catch or bycatch data must be used as a basis for enforcement action should an entity exceed an allocation.

The catch of most allocated species is readily determined using observer and landings data. However, PSC catch generally is required to be discarded. This makes it more difficult to establish how much PSC has been caught. Therefore, NMFS must estimate the amount or numbers of PSC that occurs. Much of these estimates are based on observer data. Lacking observer data, NMFS calculates bycatch rates from observed vessels or fisheries to estimate the PSC catch by unobserved vessels. Without at least 100 percent observer coverage, the enforcement of PSC allocations becomes more problematic, as PSC estimates may not be directly associated with a vessel's actual catch. There are two primary problems associated with the use of estimated bycatch rates when enforcing prohibition against exceeding PSC allocations.

- The CAS method of applying information from observed vessels to non-observed vessels assumes that the observed vessel fishes in a manner similar to the unobserved vessel. NMFS has not evaluated this assumption. From a legal perspective, calculated bycatch rates (based on other entities fishing activities) do not reliably represent a vessels fishing behavior and cannot be used as a basis for imposing liability for exceeding a PSC allocation.

- As new observer information becomes available, the CAS continuously updates rates, which are applied to non-observed vessels or hauls. The CAS rate calculation would continuously change account balances (positive or negative) for PSC allocation holders. Thus, an entity may exceed a particular allocation due to the CAS analytical process. This can present several problems for enforcement, including whether the entity was even aware of the overage.

NMFS notes that catch monitoring issues were a large component of the implementation of Amendment 80 Program, which allows non-AFA catcher/processors to form cooperatives. Amendment 80 cooperatives receive allocations of BSAI flatfish and PSC species. The analysis prepared to evaluate the monitoring requirements for the Amendment 80 Program concluded that additional monitoring measures were needed to account for both the target species and the PSC bycatch caught by this fleet.

The use of estimated bycatch rates was not deemed appropriate, due to incentives for Amendment 80 cooperatives to misreport their PSC (i.e., accurate reporting could result in not being able to catch all of their target species). Such estimations also are problematic from an enforcement perspective, since it is difficult to prosecute allocation overages based on calculated rates, rather than actual bycatch. Furthermore, while the Amendment 80 limited access sector was not issued quota, it could be composed of participants that acted like a single entity. The ability for such vessels to collude could allow them to manipulate their bycatch rates to the degree that NMFS would be prevented from collecting and estimating accurate PSC information.

2.5.2.3 Sector Allocations

Under Alternative 2, Component 2, the non-CDQ salmon hard cap would be apportioned among the three non-CDQ AFA sectors as sector level caps. These sector level caps would not be transferable allocations, unless the Council chooses Component 3, option 1. In combination with a seasonal allowance of each annual cap, this would result in 18 separate salmon caps for the CP, mothership, inshore CV, and CDQ sectors. This results in four more caps than considered under Component 1 alone. NMFS would close directed fishing for pollock for each non-CDQ sector once it reached its seasonal sector level cap. If the Component 1 rollover suboption was chosen, NMFS would add a sector's unused salmon bycatch from the A season to that sector's B season sector level cap.

Table 2-42 Number of sector level salmon caps

Season split	Number of caps, non-CDQ fishery			Number of CDQ caps	Total number of caps
	Catcher/processor	Mothership	Inshore CV		
A season	1	1	1	6	9
B season	1	1	1	6	9
Annual total	2	2	2	12	18

The increase in the number of salmon hard caps under seasonal allowances would result in increased complexity in NMFS's management responsibilities. Multiple salmon bycatch caps for the three different non-CDQ AFA sectors would increase NMFS's involvement with allocating bycatch caps, monitoring salmon bycatch, closing directed fishing for pollock when a sector's salmon cap was reached, and, perhaps, implementing seasonal rollovers. Each CDQ group would continue to manage each of its seasonal and annual Chinook salmon caps.

2.5.2.4 Sector Transfers

Component 3 includes options to allow sector level caps either to be transferred from one sector to another (Option 1) or rolled over (Option 2) from one sector to another. If option 1 is chosen, the sector level caps would be issued to legal entities representing each sector as transferable allocations. Chinook salmon transfers would be industry-initiated, whereas for rollovers NMFS would move a quantity of a sector level cap from the sector that has stopped fishing to the sectors still fishing in a season. Both of these options have associated management implications; each of them are discussed below. Option 1 would put more of the burden of managing and accounting for Chinook salmon bycatch on the recipients of the transferable allocation. Option1 would require each sector to have a legal entity to receive the allocation and make the transfers and it would require changes to monitoring requirements for inshore catcher vessels and shoreside processors. Option 2 would increase NMFS's monitoring and management role associated with salmon bycatch caps (see section 2.5.2.9). The transfer and/or rollover options considered under Component 3 would require NMFS to administer the movement of salmon among sectors in a season.

If neither Option 1 or Option 2 were selected, *i.e.*, if Component 3 was not selected, each sector would have to stop directed fishing for pollock once its seasonal sector level cap was reached. There could be no movement of salmon bycatch between the catcher/processor, mothership, inshore sector, or the CDQ sectors. Without transfers or rollovers, prior to each sector's specific cap being reached, NMFS would close fishing for that sector with an inseason closure notice. The short delay associated with inseason closures would require NMFS to closely monitor pollock catch and salmon bycatch in order to project when a sector might reach its salmon hard cap. NMFS would rely on existing observer coverage levels and monitoring requirements to determine the amount of salmon bycatch made by each sector. Thus, as with Component 1, bycatch information from observed fishing vessels would be applied to non-observed fishing vessels.

Under option 1, transfers of Chinook salmon bycatch allocations could occur between the catcher/processor sector, mothership sector, inshore sector, and CDQ groups. Chinook salmon could be transferred between any of these sectors or the CDQ groups. Participants would need to apply to NMFS to formally transfer all or a portion of their Chinook salmon bycatch allocation. Selection of this option would require NMFS to process and approve Chinook salmon bycatch allocation transfer applications. The burden on the agency would increase proportionally with the number of inter-sector transfers that industry chose to request during a given season. Participants in the pollock fishery would face additional costs associated with preparing and submitting Chinook salmon bycatch allocation transfer applications to NMFS.

Option 1 contains a suboption to limit transfers to either 50 percent, 70 percent, or 90 percent of the amount of salmon available to a sector at the time of transfer. If such a level were adopted, NMFS would implement it by incorporating the appropriate limit into the business rules that would be developed to modify the CAS changes.

2.5.2.5 Legal entities necessary to receive transferable allocations

Transferable allocations must be issued to a legal entity that represents all members of the group eligible to receive the transferable allocation. The entity performs the following functions with NMFS:

- applies for and receives any permits for a specific amount of salmon bycatch on behalf of all members of the entity,
- is authorized to transfer all or a portion of the entity's salmon bycatch allocation to another entity or receive a transfer from another entity (authorized to sign transfer request forms), and
- is responsible for any penalties assessed for exceeding the entity's salmon bycatch allocation (i.e., the entity must have an agent for service of process with respect to all owners and operators of vessels that are members of the legal entity).

The legal entity would have to be created by a contract among the group of eligible AFA participants in that sector who are receiving the transferable salmon bycatch allocation.

Some pollock fishery participants already are recognized as legal entities by NMFS:

- Inshore cooperatives are legal entities recognized by NMFS through the pollock permitting process. They file contracts with NMFS and are issued permits for specific amounts of pollock. 50 CFR 679.7(k)(5)(ii) prohibits an inshore cooperative from exceeding its annual allocation of pollock.
- CDQ groups are legal entities recognized by NMFS to receive groundfish, halibut, crab, and PSQ reserves. 50 CFR 679.7(d)(5) prohibits a CDQ group from exceeding its groundfish, crab, and halibut PSC allocations. If a CDQ group receives a transferable salmon bycatch allocation, that allocation would be added to this list of prohibitions.

AFA sectors are not recognized as legal entities by NMFS in the same sense as inshore cooperatives or CDQ groups because there has been no reason to require these groups to be legal entities to receive pollock allocations. These include the:

- <u>AFA catcher/processor sector</u> (which includes all members of the Pollock Conservation Cooperative (PCC), the seven catcher vessels named in the AFA, and the catcher/processor Ocean Peace). Non-transferable allocations of pollock are made to this sector are required by the AFA and are made by NMFS through the annual groundfish specifications process. This fishery can be closed by NMFS through a *Federal Register* notice if the sector exceeds its pollock allocation. In practice, the sector manages its pollock catch within allocations and NMFS has not had to issue pollock fishery closures.
- <u>AFA mothership sector</u>. This includes the three motherships named in the AFA: Excellence, Ocean Phoenix, and Golden Alaska. Non-transferable allocations of pollock are made to this sector as required by the AFA and made by NMFS through the annual groundfish specifications process. This fishery can be closed by NMFS through a Federal Register notice if the sector

exceeds its pollock allocation. In practice, the sector manages its pollock catch within allocations and NMFS has not had to issue pollock fishery closures.

- Inshore CV sector. While NMFS recognizes cooperatives as legal entities, the sector as whole does not have a legal entity. Chinook salmon bycatch allocations would not be issued to the inshore cooperatives under Component 3 alone, so the inshore cooperatives and any catcher vessels not in a cooperative would have to create an umbrella entity that represented all participants in the inshore sector, if Component 4, cooperative allocations, is not chosen.

Existing contracts forming the PCC, the High Seas Catcher Vessel Cooperative, and the Mothership Cooperative could be modified to create the entities required to receive transferable bycatch allocations from NMFS or new legal entities (contracts) could be formed by the owners of these same vessels to address only NMFS's requirements to receive and transfer Chinook salmon bycatch allocations.

Each of the three sectors in the non-CDQ pollock fishery would incur some costs associated with establishing and maintaining the legal entity necessary for the sector as a whole to conduct salmon transfers, although this cost cannot be estimated at this time.

If members of the catcher/processor, mothership, or inshore sectors are unable to form a their respective legal entities to accept their share of the transferable salmon bycatch allocations, then these sectors would fish under a sector level cap. NMFS would manage the sector level caps with directed fishery closures that would apply to all members of the sector once the sector's Chinook salmon sector level cap was reached.

2.5.2.6 Conducting transfers

A Chinook salmon bycatch allocation transfer between different entities in the pollock fishery would require NMFS approval before the transaction could be completed. Per existing agency practice with other fishery programs with transferrable allocations, NMFS would review the transferring entities catch record to ensure sufficient salmon was available to transfer. The time required to complete a Chinook salmon bycatch allocation transfer would depend on a variety of factors, including staff workload, the number of transfers being requested, and the accounting system developed to oversee the transfer process (i.e., electronic and/or paper). Note that the Council did not include the ability for sectors or CDQ groups to conduct post delivery transfers, unlike its recommendations for cooperative allocations under the CDQ Program, GOA Rockfish Program, Amendment 80, and the Crab Rationalization Program.

The Chinook salmon cap that is allocated to the CDQ sector would continue to be subdivided into CDQ group allocations. Each CDQ group allocation may be transferred between CDQ groups as well as between the other three AFA sectors under Component 3. Regulations at 50 CFR 679.30(e) describe the process to transfer allocations between CDQ groups. This process requires each group involved in the transfer to complete a transfer request and submit it to NMFS for review. If the remaining salmon cap is sufficient, NMFS debits the transferring CDQ group's salmon account and credits the receiving group's salmon account, per the amount requested. CDQ transfers are expected to be done electronically by 2009.

Option 1 increases the complexity of the changes that would be required to be made to NMFS's CAS, since it involves both sector level caps and transferable allocations. Transfer provisions would require accounts to be established for entities that receive salmon allocations, including designing accounts that enable NMFS to track and archive transfers and changes in cooperative structure. Transfers between entities would require receipt of transfer information and readjustment of accounts for the transferor and transferee.

NMFS is developing the internal processes that will allow the quota share and allocation holders in various Alaska fisheries to conduct transfers through the internet. Such a process probably would be extended to transferable Chinook salmon bycatch allocations. The transfer process could be automated through an online system that allows entities to log onto a secure NMFS website and make a salmon bycatch allocation transfer. Online transfers probably would reduce the amount of oversight required by NMFS. The costs for an online system would depend on the system developed, but could be shared with other fishery management programs. Another advantage to the online system is that transfers are almost instantaneous. By contrast, paper-based transfers take up to 3 business days to process. The cost of preparing transfer requests could be shared by the transferring entities, since each party to a transfer would have some cost associated with a transfer transaction.

2.5.2.7 Changes to Inshore Catcher Vessel Monitoring Requirements for Sector Transfers

If salmon bycatch is managed under transferable allocations, then salmon bycatch would become very valuable to each pollock fishery sector. Salmon bycatch caps could determine whether a sector's pollock is completely caught or not, as salmon bycatch could become a limiting factor. Salmon bycatch hard caps and transferable allocations would provide an incentive for the industry to attempt to under-report salmon bycatch.

Implementing a hard cap Chinook salmon bycatch management system that specifies allocations of salmon would increase the complexity of both monitoring and managing of the Bering Sea pollock fishery.

Transferable allocations would increase the need for accurate salmon bycatch monitoring. Transferable allocations would require a better system of estimating salmon bycatch for the inshore CV fleet, which is not subject to total observer coverage. The mothership and catcher/processor sectors already have total observer coverage to use for salmon bycatch estimation. The current system of applying data collected from observed CVs to unobserved CVs uses the best information available under current observer coverage levels. Section 3.1 describes the methodology used by NMFS to extrapolate bycatch from observed vessels to non-observed vessels. However, there is considerable uncertainty associated with extrapolating bycatch from observed vessels to non-observed vessels. Plus, economic incentive to under-report Chinook salmon would exist with transferable allocations.

Thus, NMFS's existing use of bycatch rates to estimate salmon bycatch by unobserved catcher vessels would be unacceptable to support a system of transferable salmon bycatch allocations. This is because it could be difficult to enforce penalties that are imposed on an entity for exceeding a salmon bycatch cap in situations where direct empirical evidence of an overage could not be documented. Enforcement of salmon caps would require entity-specific bycatch accounting. Thus, without vessel and trip-based specific bycatch accounting, the agency would likely not be able to enforce Chinook salmon caps, because bycatch rates from observed vessel would be applied to unobserved vessels. Establishing a legal case using data that may not represent a vessel's actual salmon bycatch is difficult, since such data do not necessarily reflect how much salmon the vessel actually caught.

To ensure effective monitoring and enforcement of transferable salmon bycatch, NMFS recommends that Chinook salmon bycatch estimates for the inshore sector be based on a census (a count of salmon) and not be based on extrapolating species composition samples, unless a census cannot be done for a particular delivery. Therefore, NMFS recommends that the following additional monitoring requirements be implemented for the inshore sector and the CDQ sector (if catcher vessels delivering to shoreside processors harvest pollock on behalf of CDQ groups in the future):

- Each catcher vessel, regardless of size, must have 100 percent observer coverage.

- Chinook salmon could be discarded at-sea only if first reported to, and recorded by, the vessel observer.
- Shoreside processor monitoring requirements may have to be adjusted to incorporate a higher standard for salmon bycatch accounting. This could include such changes as modifying observer sampling protocols, increasing the number of observers, or reducing the flow of pollock into the factory to ensure that salmon do not pass the observer's sampling area without being counted.
- Electronic (video) monitoring in lieu of observers on catcher vessels would only be allowed after a successful, comprehensive assessment of the effectiveness of electronic monitoring to verify that salmon are not discarded.

Existing observer coverage requirements and species composition sampling methods for catcher/processors and motherships participating in the AFA pollock fisheries, including the directed fisheries for pollock CDQ, represent NMFS's current method for estimating Chinook salmon and will be relied upon to account for and transfer allocations among industry sectors. However, the use of observer data to limit pollock fishing or to enforce overages of Chinook salmon bycatch allocations will place increased scrutiny on this bycatch estimation process and additional improvements or revisions may be needed in the future.

2.5.2.8 Changes to Processor Monitoring Requirements

Each shoreside pollock processors must annually submit a catch monitoring and control plan (CMCP) to NMFS. Regulations regarding CMCPs requirements are at 50 CFR 679.28(g). These plans are designed to ensure that processing facilities are laid out in a manner that allows for accurate catch accounting. The plans ensure that observers have adequate facilities to conduct their sampling duties efficiently, and obtain adequate estimates of the weight and species composition in each offload. Because plant layouts and operations vary widely between processors, the CMCP regulations were developed as a series of performance-based standards that each processor must meet. Each CMCP describes how a particular processor will meet each standard. Therefore, additional measures would need to be implemented in addition to existing CMCP performance standards in order to ensure that fisheries observers have the means to count all Chinook salmon in each delivery.

CMCP performance standards require that an observer sampling station and an observation area be provided in the vicinity of the first location where catch can be sorted. Salmon and other species that are sorted out by the processor are collected by the observer in this area. Depending on the depth of fish flow, the width and number of belts, and the volume of bycatch, some bycatch (including prohibited species) will pass the sorting area and arrive in the processing area of the plant. Plant personnel bring salmon found in the factory to the vessel's observer so that they can be counted. Salmon found in the shoreside factory, after a vessel has departed (with its observer) are brought to the plant observer.

Sector-level salmon bycatch caps could result in individual salmon significantly limiting pollock fishing. Since each salmon counted against a hard cap could ultimately constrain the full harvest of a sector's pollock allocation, Chinook salmon hard caps may create strong economic incentives to misreport salmon bycatch. This is particularly applicable to shoreside processors. The factory areas of processing plants are large and complex. Preventing observers from seeing Chinook salmon that enter the factory would not be difficult. In order for hard caps to be effective, NMFS needs to ensure that there is a credible salmon bycatch monitoring system in place at shoreside processing plants. This would ensure that observers have access to all salmon, prior to the fish being conveyed into the factory.

NMFS proposes that additional measures may need to be implemented to ensure that no salmon make it into the factory when the vessel observer is monitoring a CV's offload. For example, shoreside processors could be prohibited from allowing salmon to pass from the sorting area and into the factory.

No salmon would be allowed to pass the observer's sampling area. To ensure that an observer may completely sort and count all salmon, the following constraints on processors could be required:

- The depth of fish flowing past the observer on the belt may be no more than one fish deep;
- Belt widths may need to be narrowed to allow observers to access all fish, and;
- Multiple belts in the sorting area would be prohibited in order to ensure that all of the fish in an offload passed a single observation point.

NMFS considered whether the use of video surveillance inside the factory could ensure that salmon did not enter the factory, or could ensure that any salmon that did enter the factory were detected and counted. However, this does not appear to be a reasonable option. This approach was rejected because factories are so complex that it would be logistically impossible to cover all areas where a salmon could appear in the factory. Also considered, but rejected, was the requiring of additional observers, enforcement personnel, or staff at the plant to monitor salmon inside the factory. This approach was also deemed to be too staff intensive, because of the complexity and variety of plant layouts.

The reduction in the flow of fish through the initial catch sorting area could slow pollock processing, since fish would enter the factory at a slower rate. The degree to which processing speed would be reduced is highly variable among the processors, as the infrastructure changes necessary to allow observers access to all salmon depends on the plant's current layout. Further, the sampling methods used by observers would influence sorting requirements and the flow of fish into a plant.

Under existing protocols, observers have the option to either count all of the salmon in a given delivery (census) or to count the salmon in a portion (sample) of the delivery and extrapolate this number to estimate the number of salmon in the entire delivery. Currently, observers attempt a census and only sample the delivery at specific plants or if they become ill or incapacitated during the offload, or if the vessel leaves before sorting is completed and the plant observer is unavailable.

If new monitoring requirements were implemented, the time needed for processors to sort bycatch out of a delivery could increase, due to the reduction in the flow of fish past the plant personnel who sort bycatch from pollock. The extent to which processing time could increase (due to a decrease in the flow of fish entering the factory) also depends on how the shoreside processors modified their factories to allow observers access to all salmon in a delivery. Pollock processing time may not be affected if processors modify the factories in a manner that allows observers to access all salmon in a delivery and continue to allow fish to move into the processing area at the current rate.

NMFS notes that existing observer sampling protocols allow observers to sample for prohibited species only in specific circumstances (i.e., illness, or if the plant observer is unavailable and the vessel leaves before sorting is complete), rather than conducting a complete census of all prohibited species in a delivery. NMFS strives to conduct a census whenever possible, but revising inshore catch monitoring requirements could result in a higher percentage of deliveries being sampled for prohibited species composition. If observers collected samples instead of a census, inshore processors could be able to speed up the flow of fish into the factory once the observer had completed obtaining their sample from the delivery. Conversely, observers may choose to sample such a large fraction of the delivery to the degree that only minimal time savings could be realized relative to conducting a census.

The tradeoff between slowing down the flow of fish to allow for a complete census versus allowing salmon bycatch to be extrapolated from samples must be considered when selecting a monitoring protocol. Whenever possible, NMFS programs its CAS for fisheries managed with allocations or quotas so that catch accounting is based on a complete accounting of allocated species, rather than an estimate derived from sampling. NMFS has found that catch estimates may be questioned by allocation holders who do not believe that such estimates are accurate. To the extent that an estimate of Chinook salmon bycatch is critical to the point that it may determine whether a directed fishing for pollock may continue or not, plant personnel may place additional pressure on the observer to take larger samples, complete a census, or to modify their initial estimate of Chinook salmon bycatch.

2.5.2.9 NMFS rollovers of sector level caps

Rollovers under Option 2 would be selected by the Council if it elects to allocate a hard cap or a trigger cap for salmon bycatch among the AFA sectors, but either:

- decides not to allow salmon bycatch caps to be transferable among the sectors but wants to provide a mechanism to maximize the harvest of pollock for a given cap, or
- the non-CDQ sectors cannot form the legal entity necessary to allow transferability of salmon bycatch among the sectors.

Under Component 3 (sector transfers), the Council may select either Option 1 (to allow transferable salmon bycatch caps) or Option 2 (to have NMFS manage reapportionments or rollovers of unused salmon bycatch among the sectors, inshore cooperatives, or CDQ groups).

Rollovers refer to an action that NMFS would take to reapportion salmon bycatch that remained in a season after a sector had reached its pollock allocation to another AFA sector, the CDQ Program, or the inshore sector limited access fishery. For example, if the catcher/processor sector harvested its entire pollock allocation, but still had some remaining salmon bycatch, and if the mothership sector, inshore sector, and CDQ sector had remaining pollock, NMFS would rollover the catcher/processor sector's remaining salmon bycatch to the other pollock sectors. This is portrayed in the following table, in which there are 1,000 salmon remaining in the catcher/processor sector level cap.

Table 2-43 Example of a salmon bycatch sector level cap rollover to remaining sectors from catcher/processor sector level cap.

Sector	Pollock remaining	Percent of total pollock remaining	Reallocation of 1,000 salmon
Inshore	20,000 mt	77	770
Mothership	5,000 mt	20	200
CDQ Program	1,000 mt	3	30
Total	26,000 mt	100	1,000

Rollovers of salmon caps among AFA sectors could include the CDQ sector as a recipient of rollovers. Any salmon bycatch reapportioned to the CDQ sector during a year would be further allocated among the CDQ groups, based on each group's percentage allocation of salmon bycatch. However, rollovers from the CDQ sector to other AFA sectors are not practicable under the current allocative structure of CDQ Program. A percentage of the current salmon PSC limits currently are allocated to the CDQ Program. These PSC allocations are then further allocated among the six CDQ groups as transferable salmon PSQ. Therefore, once allocated among the CDQ groups, NMFS could not reallocate salmon bycatch away from one or more CDQ groups through a rollover.

Regulatory guidelines would be needed to allow NMFS to conduct salmon bycatch rollovers. For example, the following process could be used for guiding the rollover process:

> *If, during a fishing season, the Regional Administrator determines that a non-CDQ AFA sector has completed harvest of its pollock allocation without reaching its sector level cap and sufficient salmon bycatch remains to be reapportioned, the Regional Administrator would reapportion the projected unused amount of salmon bycatch to other AFA sectors (including CDQ), through notification in the Federal Register. Any reapportionment of salmon bycatch by the Regional Administrator would be*

based on the proportion each sector represents of the total amount of pollock remaining for harvest by all sectors through the end of the season. Successive reapportionments actions would occur as each sector completes harvest of its pollock allocation.

Regulations could also specify that any remaining sector level cap in the A season would be added to the same sector's B season sector level cap under Component 1, seasonal rollover suboption. NMFS would make these inter-sector salmon rollovers through the inseason action process.

Chinook salmon bycatch rollovers from the A season to the B season could complicate the rollovers within a season considered under this option. A given sector might prefer that its remaining A season salmon bycatch not be reapportioned to other sectors during the A season, but rather be rolled over to the sector's B season salmon bycatch cap. Therefore, NMFS recommends that inter-sector salmon rollovers or reapportionments only be allowed in the B season. If a sector still had a portion of its salmon bycatch cap remaining after it harvested all its pollock allocation in the B season, NMFS could then reapportion that sector's remaining B season salmon bycatch to other sectors. The reapportionment would be based on the amount of pollock remaining in each sector, as previously described.

2.5.2.10 Management and monitoring for inshore cooperatives

Component 4 contains additional options for management of inshore cooperatives that would only apply if Component 3, sector allocations, also was selected. This component includes two transfer options (1) pollock could be transferred between cooperatives, or (2) salmon bycatch could be transferred between cooperatives. These types of transfers differ from Component 3, which does not allocate salmon bycatch to cooperatives within the inshore sector. Component 3 only allows salmon bycatch to be transferred between AFA sectors and does not have an option to allow the transfer of pollock between sectors.

Additional caps created for cooperative allocations

Component 4 would allow NMFS to subdivide the inshore CV sector allocation to the seven inshore cooperatives, and potentially to an limited access fishery. The latter allocation would be required under circumstances in which one or more catcher vessels in the inshore sector did not join a cooperative, although in recent years, all AFA eligible catcher vessels have joined a cooperative. If a vessel or vessels decided not a join an inshore cooperative, they would become part of an inshore limited access fishery (this has not happened since 2005). The creation of an limited access fishery would result in the inshore sector allocation of salmon being divided between the cooperatives and, potentially, the inshore limited access fishery. The amount of salmon allocated to the limited access fishery would be based on the pollock catch history by vessels within that fishery. This allocation of salmon would not be transferable and could not rolled over to other sectors.

Allocating salmon to the cooperatives and the limited access sector would result in a potential maximum of 16 seasonal allocations and 32 annual salmon allocations, as depicted in the Table 2-44. Compared with Component 3, which does not include cooperative allocations, selection of Component 4 increases the number of seasonal salmon allocations from 9 to 16 and the annual allocations from 18 to 32.

Table 2-44 Potential number of seasonal salmon bycatch caps under Component 4.

Season	Number of caps, non-CDQ sector				Number of caps, CDQ sector	Total salmon caps
	Catcher/ processor	Mothership	Cooperatives	Limited Access		
A season	1	1	7	1	6	16
B season	1	1	7	1	6	16
Annual total	2	2	14	2	12	32

Inshore cooperatives are affiliations of catcher vessels and specific inshore processors. Cooperatives must adhere to regulatory requirements at 50 CFR 679.61 and 679.62. NMFS annually approves contracts for inshore cooperatives. These contracts contain information about the cooperative structure, including the vessels that are parties in the contract and the primary processor that will receive pollock deliveries. Each catcher vessel in a cooperative must have an AFA permit with an inshore endorsement, LLP permit authorizing the vessel to engage in trawl fishing for pollock in the Bering Sea or Aleutian Islands, and no sanctions on the AFA or LLP permits. Any contractual provisions under the AFA are enforced by the industry, rather than NMFS.

Once a cooperative's contract is approved by NMFS, the cooperative receives an annual pollock allocation based on the catch history of vessels listed in a cooperative contract. The allocation of pollock to each inshore cooperative does not change within a year, unless NMFS reallocates pollock from the Bering Sea pollock incidental catch allowance or from the Aleutian Islands subarea TAC into the Bering Sea pollock TAC. Such reallocations are apportioned among the AFA sectors, including the inshore sector and its associated cooperatives.

The AFA requires an inshore cooperative to deliver at least 90 percent of its annual pollock allocation to the AFA inshore processor designated in the cooperative's contract. These regulations also allow the remaining 10 percent of pollock to be delivered to any AFA inshore cooperative. Within a fishing season, inshore catcher vessels may move between cooperatives through contractual arrangements. Only vessels that are part of an inshore cooperative may contract with other cooperatives. These contracts allow vessels to harvest another cooperative's allocation of pollock, but do not allow the transfer of pollock between cooperatives. For example, a vessel that is a member of cooperative A could harvest pollock allocated to cooperative B, resulting in the vessel becoming a temporary member of cooperative B. However, the catch history of the vessel remains with cooperative A.

Cooperatives wanting to contract with a vessel must submit an application and a copy of the contract to NMFS. The type of information required in the application is described in 50 CFR 679.62. The application process alerts NMFS that some vessels might be reporting pollock catch under an alternate AFA inshore cooperative identification number. The cooperative identification is a unique number that allows pollock catch to be attributed to the proper cooperative account in NMFS's CAS.

Cooperative-level Chinook salmon allocations would be the most complex among the components and options for NMFS to monitor and manage, due to the large number of seasonal and sector salmon bycatch allocations that would be created. The selection of Component 3, Option 1 (sector transfers) and Component 4 (cooperative transfers) would yield the greatest range of possibilities for salmon bycatch transfers among the components and options.

Vessel operators within a cooperative determine which vessel is allowed to catch the cooperative's annual allocation of salmon. These arrangements specify the penalties that members are subject to if they exceed their contracted allowable catch amount. Cooperative members or the co-op's manager are responsible for tracking a cooperative's catch, and may trade or lease the rights to fish within a cooperative without notifying NMFS. The distribution of fishing privileges within a cooperative is enforced through contractual agreements between cooperative members. Contract disputes are settled by the parties in conflict through civil procedures. NMFS is not responsible for resolving such disputes.

Federal regulations at 50 CFR 679.61(e) that govern AFA contracts require contract information to be provided to NMFS on an annual basis. In general, these regulations require the name of the designated cooperative representative who is responsible for filing all reports on its behalf, recognition of a primary contact person for the cooperative, the list of parties to the cooperative contract, and submission of certain types of data on an annual basis. These regulations currently require cooperatives to report on the effectiveness of the salmon VRHS.

If Component 4 were selected, NMFS recommends that salmon bycatch estimates for the inshore sector be based on an census or counts of all salmon. Therefore, NMFS recommends that 100 percent observer coverage be extended to all inshore CVs. Allocating salmon bycatch to the cooperative level would increase the need for more reliable estimates or a census of salmon bycatch by this component of the pollock fishery. The use of bycatch rates to estimate the salmon bycatch by vessels without observers is not accurate or legally sufficient to manage allocations, transfers, or overages. Chinook salmon bycatch data for the inshore sector is affected by existing observer coverage levels (30 percent or 100 percent of fishing days) on catcher vessels and the use of estimated bycatch rates that are used to calculate the amount of salmon caught by unobserved vessels. Furthermore, shoreside monitoring of salmon bycatch would have to be enhanced, as described under Component 3, Option 1.

Existing observer coverage requirements and species composition sampling methods for catcher/processors and motherships participating in the AFA pollock fisheries, including the directed fisheries for pollock CDQ, represent NMFS's current method for estimating Chinook salmon and will be relied upon to account for and transfer allocations among industry sectors. However, the use of observer data to limit pollock fishing or to enforce overages of Chinook salmon bycatch allocations will place increased scrutiny on this bycatch estimation process and additional improvements or revisions may be needed in the future.

Pollock transfers between cooperatives

Component 4, option 1, would allow an inshore cooperative to transfer pollock to another inshore cooperative after the first cooperative's Chinook salmon allocation is reached. This option provides another means in addition to the transfer of the Chinook salmon bycatch allocations to match available pollock and available salmon bycatch for the inshore cooperatives.

Sections 206(a) and (b) of the AFA establish the allocation of the TAC of pollock among the different AFA sectors, including the CDQ Program. Section 213(c) allows the Council to supersede some provisions of the AFA under certain circumstances. However, section 213(c) specifically does not allow the Council to supersede the sector allocations of pollock in sections 206(a) and 206(b). Therefore, the AFA's allocation requirements effectively preclude the transfer of pollock from *one sector to another*. However, the AFA would allow the transfer of pollock among the inshore cooperatives. Such transfers would be subject to the 90 percent processor delivery requirement in section 210(b), which requires that 90 percent of the pollock allocated to an inshore cooperative must be delivered to the inshore processor associated with that cooperative. The AFA specifically requires that this provision be included in the inshore cooperative contracts and NMFS regulations contain this contract requirement in the inshore cooperative permitting requirements at §679.4(l)(6).

Although not prohibited by the AFA, NMFS regulations currently do not authorize the transfer of pollock among the inshore cooperatives. This far, regulations authorizing inter-cooperative transfers of pollock have not been recommended to NMFS by the Council. However, regulations could be amended to allow pollock transfers among inshore cooperatives, subject to the requirement that the inshore cooperative contracts continue to include the 90 percent processor delivery requirement.

The Council also could allow full transferability of pollock among the inshore cooperatives by superseding the 90 percent processor delivery requirements of subsections 210(b)(1) and (b)(6), as long as the findings required in section 213(c)(1) of the AFA are made. To supersede this requirement, the Council would have to provide a rationale that explained why the proposed action mitigated adverse effects on fishery cooperatives and how it took into account all factors affecting the fisheries, including rationale explaining that the action was imposed fairly and equitably, to the extent practicable, among and within the sectors in the pollock fishery. In discussions about this option at its April 2008 meeting, the Council declined to broaden the scope of this option to include superseding the 90 percent processor delivery requirements of the AFA because of the additional complexity associated with this action and the potential impacts on the inshore processors of lifting the 90 percent processor delivery requirement.

Component 4, Option 1 would require NMFS to monitor the pollock harvest for each cooperative and track amounts of transferred pollock among cooperatives. By way of example, NMFS has implemented management programs that allow the transfer of fish among entities in various BSAI and GOA fisheries. These programs use a combination of electronic reporting done by the processing plant, online account access for cooperatives, and NMFS approval and tracking of transfers. Component 4 would be similar to other programs in that annual allocations of pollock would be tracked for each cooperative using the existing NMFS's CAS and electronic reporting system (eLandings). The CAS is configured to track cooperative-specific amounts of pollock, but in its current configuration does not accommodate pollock transfers. Thus, adjustment to the CAS would be needed to accommodate programming complexities associated with transfers, business rules, and CAS account structure.

Pollock transfers would require NMFS approval before the transaction could be completed. Upon receipt of a transfer application, NMFS would review a cooperative's catch to ensure its salmon cap was reached and that an adequate amount of pollock was available. The transfer process could be through eLandings or using a paper application process. NMFS prefers online transfers because paper-based transfers increase staff burden, the time required to complete a transfer, and may only be completed during business hours.

Online accounting of pollock is dependent on the CAS structure, which is the primary repository for catch data. The online interface would need to allow harvesters and NMFS to check account balances, make and accept transfers of pollock, and allow account balances to be updated based on transferred pollock and inseason rollovers of pollock from the ICA and Aleutian Islands, should such rollovers occur. The online system would not allow cooperatives to receive transfers of pollock if they don't have any remaining Chinook salmon bycatch allocation. Thus, pollock allocation amounts and associated CAS account structure is dependent on whether salmon bycatch is allocated to the cooperative level and transferability of salmon is allowed. Any changes to the CAS required for salmon allocation transfers (Option 2) would need to interface with pollock transfer accounting.

Increased administrative costs would be associated with managing the online account system or conducting paper transfers. These costs will be greatest for paper transfers because NMFS staff will need to process and approve each transfer, rather than use automated accounting. Processing of paper transfers requires staff to check applications for completeness, notifying the applicants, and updating account status. Compared with paper transactions, administrative costs for online transfers are reduced because NMFS does not need to physically process applications and update account balances. The online system does have costs associated with online application programming and support. Application development and support is currently conducted by NMFS and an outside contractor. The amount of software support required is proportional on the complexity of the salmon bycatch transfer options selected. However, unlike paper transfers, the time required to administer an online service would likely lessen after initial implementation.

Chinook salmon cap transfers between cooperatives
Component 4, option 2, would allow inshore cooperatives to transfer salmon bycatch to or from other inshore cooperatives. This would allow the inshore sector to match its salmon bycatch allocations, actual salmon bycatch, and pollock catch based on the performance on each member cooperative. Note that the Council did not include the ability for cooperatives to conduct post delivery transfers, unlike its recommendations for cooperative allocations under the CDQ Program, GOA Rockfish Program, Amendment 80, and the Crab Rationalization Program.

If inshore cooperatives are allowed to transfer salmon, then NMFS would monitor salmon at the cooperative level for the inshore sector and the sector level for the mothership and catcher/processor sectors. Each sector would be required to maintain its salmon bycatch below specified seasonal and annual limits. NOAA may impose penalties through an enforcement action against the entity and vessel operator responsible for a particular allocation overage.

The salmon bycatch monitoring requirements that NMFS recommends in conjunction with Component 3 (Sector transfers) are equally applicable to intercooperative salmon bycatch transfers. They may be even more important because of the small amounts of salmon that ultimately be allocated to the cooperative level. Increased monitoring requirement for catcher vessels and shoreside processors would provide more accurate salmon bycatch accounting for the inshore sector.

Salmon bycatch transfers would require a similar process as that described above for intercooperative pollock transfers. Salmon bycatch transfers between inshore cooperatives would require NMFS approval before the transaction could be completed. Approval by NMFS requires cooperative parties to notify the agency prior to a transfer so it may review catch records to ensure catch limits are not exceeded. The time necessary to complete a transfer would depend on a variety of factors, including agency staff workload, the number of transfers being requested, and the tracking system developed to oversee the transfer process (i.e., electronic versus paper). The salmon bycatch transfer process could be similar to the process used for the Amendment 80 groundfish fishery, which is a combination of an electronic database for tracking transfers and paper transfer applications.

The time required to complete a transfer depends on a variety of factors, including staff workload in Alaska Region, the number of transfers being requested, and the system developed to oversee the transfer process (i.e., electronic and/or paper). Under most circumstances, paper-based salmon allocation transfers could be completed within five business days. Electronic transfers could be conducted in real-time and much more quickly, as described under Option 1, pollock transfers.

2.5.3 Managing and Monitoring Alternative 3

The implementation of a triggered Chinook salmon cap on the Bering Sea pollock fishery would require various changes to federal regulations and to NMFS management practices compared to the status quo. These regulatory changes would have to address all facets of a revised trigger cap salmon bycatch management system, including salmon bycatch allocations to different industry sectors, increased monitoring measures, reporting requirements, inseason management functions, and enforcement measures. Whereas Alternative 2 is centered on fishery closures, Alternative 3 focuses on closing specific areas to directed fishing for pollock once a salmon bycatch allocation is reached. This is similar to how the existing salmon savings area system functions, although the components and options associated with triggered closures are much more complicated than the status quo. Alternative 3 embodies many similar implementation requirements as Alternative 2, such as the establishment of caps and subsequent sector splits. Thus, the management and monitoring issues noted in under Alternative 2 are applicable to this alternative as well.

The Chinook salmon trigger caps used to determine area closures would be established within the range of hard caps that are considered under Alternative 2, Component 1. Under Alternative 2, Component 1, the hard caps are automatically divided seasonally. Under Alternative 3, there is a suboption to divide the hard caps seasonally. If so, NMFS would have to modify its catch accounting systems and management practices to accommodate those seasonal allocations, similar to what is described under the management effects described under Alternative 2, Component 1.

2.5.3.1 Management of triggered area closures

Trigger closures would require a sector to stop pollock fishing in certain closure areas when its allocation of Chinook salmon PSC is reached. Different closure areas would be specified for the A season (one closure area) and the B season(three separate areas that would be closed simultaneously). Potential area closures are described under Component 5. Depending on the selection of subsequent components in this alternative, salmon may be allocated at the fishery level (CDQ and non-CDQ) or to each sector (inshore, mothership, catcher/processor, and CDQ).

NMFS would issue pollock fishery closures once either the non-CDQ fishery or a non-CDQ sector reached its salmon bycatch limit. Vessel operators would be prohibited from directed fishing for pollock in a Chinook salmon savings area once NMFS closed the area to a fishery or sector. The CDQ sector would not be subject to pollock fishery closures; instead, CDQ groups would have to stop fishing for pollock once they had reached their Chinook bycatch allocation.

Enforcement of the area closures would be similar to the process currently used to monitor salmon bycatch and issue salmon savings area closures. NMFS would have to determine whether a vessel was directed fishing for pollock and then match that vessel with its fishery component (CDQ or non-CDQ) or sector. This would require NMFS to use several different data sources including VMS, catch and effort information from a vessel’s catch reports, and observer information.

NMFS currently uses a combination of VMS, industry reported catch information, and observer data to monitor vessel activities in special management areas, such as habitat conservation areas and species-specific savings areas (e.g., salmon savings area). These data sources are used by NMFS on a daily basis to monitor fishery limits. Information from VMS is useful for determining vessel location in relation to closure areas, but it may not conclusively indicate whether a vessel is fishing, transiting through a closed area, or targeting a particular species. Existing salmon savings area management measures under Alternative 1. One primary difference between the status quo and triggered area closures is that NMFS would be closing different savings areas, on a seasonally-specific basis, than is current practice under the status quo.

ICA management of triggered closures

Under Option 1, as currently written, a NMFS-approved ICA would manage any subdivision of the seasonal trigger caps at the sector level, inshore cooperative, or individual vessel level. The ICA specifies contractual obligations associated with enforcing the area closures to the designated group or entity when subdivided caps established by the ICA are reached. The subdivision of the trigger caps under the ICA would not be prescribed by the Council or NMFS regulations. The ICA would decide how to manage participating vessels to avoid reaching the trigger closures as long as possible during each season. However, NMFS regulations would specify that the ICA would be required to include a closure to the area(s) specified under once the overall trigger cap is reached.

This option may constitute an unlawful delegation of enforcement authority because NMFS cannot delegate to the ICA the authority to enforce an area closure specified in federal regulations. One way to retain ICA participation in management of the trigger closures is to modify this option to read:

> Under Option 1, a NMFS-approved ICA would manage any subdivision of the seasonal trigger caps at the sector level, inshore cooperative, or individual vessel level under its contract. The subdivision of the trigger caps under the ICA would not be prescribed by the Council or NMFS regulations. The ICA would decide how to manage participating vessels to avoid reaching the trigger closures as long as possible during each season. However, NMFS regulations would specify the overall trigger cap selected under Component 1 and the trigger closure areas selected under Component 5. NMFS would close the specified areas for all vessels once the overall trigger cap was reached.

For ICA management of subdivision of the seasonal trigger caps at the sector level, inshore cooperative, or individual vessel level, NMFS would have to revise the salmon bycatch ICA regulations at 50 CFR 679.21 to incorporate any changes made to the Chinook salmon savings areas proposed under this alternative. As with the status quo, NMFS would annually reviewing and approving ICAs, should the pollock industry use salmon bycatch ICAs. NMFS would approve an ICA if it met applicable regulatory requirements, but would not enforce the contractual conditions of an ICA. Each CDQ groups could opt to participate in an ICA. Vessel operators fishing for pollock CDQ would be then be exempt from salmon savings area closures. If a CDQ group was not part of a salmon bycatch ICA, vessel operators would be prohibited from fishing within a closed Chinook salmon savings area once that group's seasonal or annual Chinook salmon allocation had been caught.

Enforcement of area closures for ICA member vessels would be similar to non-ICA vessels. As previously described for non-ICA vessels, enforcement of area closures would require NMFS to use VMS data, vessel observers, and vessel logbooks.

2.5.3.2 Management of Sector Allocations and Transfers

The management of sector allocations would be the same as under Alternative 2. Allocating salmon caps to individual sectors would increase the complexity of NMFS's salmon bycatch monitoring efforts, as it would increase the number of salmon bycatch caps that NMFS would have to monitor.

The management of sector transfers would be similar to those discussed under Alternative 2, Component 3. Allowing sector transfers would have a bearing on whether an entity or vessel operator could continue to fish in, or re-enter, a salmon savings area, once it was closed. This transfer option would only apply to those sectors or vessels that did not join a salmon bycatch ICA, if any. This could decrease the number potential number transfers, since there would be fewer entities available to conduct transfers.

Transfers would be a complicating factor for NMFS's management of salmon savings areas that had been closed due to a sector's salmon cap being reached. Allowing salmon transfers would allow entities to increase (or decrease) their salmon allocations within a season, which means an entity's status in relation to a prohibited area could change multiple times throughout a season. For example, Components 2 through 4 would increase the complexity of the area closures from two fishery level allocation (CDQ and non-CDQ) to sector and season-specific closure options. Additionally, allowing transfers between sectors, as well as having parallel but different regulations applicable to vessels in an ICA would increasingly complicate NMFS's management of the Bering Sea pollock fishery.

Furthermore, as with Alternative 2, sector transfers would require an increase to the catch monitoring requirements for the inshore CV sector. This includes increased observer coverage for those vessels that currently are subject to 30 percent observer coverage, as well as revisions to shoreside processor monitoring requirements.

The method used to close an area to directed pollock fishing would depend on whether Component 4, transfers among sector entities, is selected. If Component 4 is not selected, then NMFS would close savings areas through closure notices because an allocation of salmon is made to a sector, rather than an entity. Selection of Component 4 would require sectors to form an entity that would be authorized to make transfers. The entity would be allocated a specific amount of salmon that could be adjusted through transfers from other entities. Vessels in a given sector would be prohibited from directed fishing in a closed area once they had reached their salmon bycatch allocation.

2.5.4 Managing and Monitoring Alternative 4

The general management of transferable sector, cooperative, and CDQ group allocations would be similar to those discussed under Alternative 2. The Chinook bycatch allocations would increase the complexity of NMFS's salmon bycatch monitoring efforts due to the increased effort associated with establishing, monitoring, and enforcing additional Chinook salmon caps. As under Alternative 2, transferable salmon bycatch allocations must be issued to a legal entity that represents all members of the group eligible to receive the transferable allocation (see section 2.5.2.5). The legal entity could be created by a contract among the group of eligible AFA participants in that sector who are receiving the transferable salmon bycatch allocation.

2.5.4.1 Salmon Bycatch Intercooperative Agreement (ICA)

The ICA concept includes two components to implement the incentive program to reduce salmon bycatch:

- <u>the ICA contract</u> that contains the elements of the incentive program that all vessel owners and CDQ groups agree to follow in the future, and
- <u>the annual report</u> to the Council on performance under the ICA in the previous year.

The ICA would be required to be submitted to and approved by NMFS prior to fishing under the ICA. Representatives of the ICA would prepare the annual report after the fishing season is over to provide an evaluation of how the measures implemented through the ICA actually worked.

Under Alternative 4, allocations under the high cap of 68,392 Chinook salmon would only be available to sectors, cooperatives, or CDQ groups participating in a salmon bycatch ICA that meets the following requirements:

- An ICA must provide incentive(s) for each vessel to avoid salmon bycatch under any condition of pollock and salmon abundance in all years.
- Incentive measures must include rewards for salmon bycatch avoidance and/or penalties for failure to avoid salmon bycatch at the vessel level.
- The ICA must specify how those incentives are expected to promote reductions in actual individual vessel bycatch rates relative to what would have occurred in absence of the incentive program. Incentive measures must promote salmon savings in any condition of pollock and salmon abundance, such that they are expected to influence operational decisions at bycatch levels below the hard cap.

The Council expressed its intent at its June 2008 meeting that the PPA requires the creation of a single ICA. However, nothing in the PPA would prevent a single ICA from having multiple sections each describing a different type of incentive program for different sectors, cooperatives, CDQ groups, or vessel types as long as each of those sections described an incentive program that complied with all relevant regulations. An ICA with multiple sections would take longer for NMFS to review, which would need to be factored into when industry would have to submit an ICA.

The PPA does not include any specific requirements for the type of incentives that must be included in the ICA other than the general language above. One of the specific components the Council discussed that could be included in an ICA is some type of fee per salmon caught. A fee would impose costs on fishermen for every salmon caught while pollock fishing and would provide cost savings, or benefits, to those fishermen who avoided Chinook salmon bycatch. These costs and benefits would start occurring with the first salmon caught as bycatch. However, the Magnuson-Stevens Act does not provide authority to the Council and NMFS to require a fee per salmon either directly in regulations or indirectly through a regulation that requires a fee to be a component of an ICA. In addition, there may be other, more effective incentives that could be developed by the industry. Therefore, the ICA requirements only specify the end result of what the Council wants the industry to achieve and does not specify how the industry must reach these goals.

Participation in the ICA is voluntary and any vessel, sector, inshore cooperative, or CDQ group could decide to not participate in the ICA, or to “opt out” of the ICA. The PPA uses the term “operations” when it refers to those who can opt out of the ICA, however, the term is not defined. Analysts assume that the term refers to individual AFA eligible vessels (catcher/processors, motherships, catcher vessels) and to inshore cooperatives and CDQ groups. Furthermore, analysts assume that the term “operations” was not limited to AFA cooperatives or the PPA would have specified the option for cooperatives to opt out rather than for “operations” to opt out.

The PPA does not specify participation or composition requirements for the ICA, nor does it require 100 percent participation in the ICA because of inclusion of the backstop cap and language referring to “those operations that opt out of such an ICA.” Therefore, analysts assume that entire sectors, inshore cooperatives, or CDQ groups could opt to not participate in the ICA, or any number of individual vessels within the catcher/processor or mothership sectors or the inshore cooperatives could opt out of the ICA. Vessels fishing on behalf of a CDQ group could not opt out on their own because they are not authorized to make decisions about whether a CDQ group participates in the ICA or opts out. They fish under whatever cap and whatever ICA conditions the CDQ group agrees to and these conditions are part of the contract between the CDQ group and the vessel harvesting pollock on its behalf. In this respect, only a CDQ group could decide whether to participate in an ICA or not, rather than the owners of vessels fishing on behalf of the CDQ group. A CDQ group could not have some vessels fishing under the 68,392 cap and others fishing under the backstop cap. (Note NMFS’s concerns in Section 2.4.3.1 about the PPA’s description of the formation and composition of the ICA)

NMFS would implement the requirements for the ICA in regulation. These regulations would include requirements for the information that must be included in the ICA and a deadline for submission of the ICA. In addition, the regulations would describe the process NMFS would use to review and approve or disapprove the ICA. If NMFS approved the ICA, those participating in the ICA would receive transferable allocations of the 68,392 Chinook salmon cap.

The Chinook salmon bycatch ICA would be required to be submitted to NMFS prior to the start of the fishing year and in enough time for NMFS to review the proposed ICA and provide some time to address any minor issues identified in this review. Because the requirements for the ICA are performance based, i.e., they address what the ICA should accomplish, any number of different incentive programs could meet these objectives. As long as a proposed ICA contains all of the information required in NMFS regulations and it generally describes an incentive program that is designed to accomplish the goals specified in regulation, NMFS would have to approve the ICA. The annual report and evaluation by the Council and the public of how the incentive program is working will be the primary tool to determine whether the ICA is meeting the Council's goal to reduce Chinook salmon bycatch below the cap level.

Approval or disapproval of the ICA by NMFS would be an administrative determination. NMFS would review a proposed ICA by comparing the actual content of a proposed ICA with the information requirements in regulations and decide whether the proposed ICA provides the required information. The information requirements in regulation would be based on the ICA requirements in the PPA, using the exact same words as the PPA unless minor wording changes were necessary for clarity (e.g. NMFS recommends not using the term "and/or" in regulation). NMFS would not develop additional requirements for the ICA beyond those recommended by the Council.

The ICA would be required to explain the incentive program and how it would create the incentives desired by the Council. For example, the ICA would be required to explain how the incentive program provided incentive(s) for each vessel to avoid salmon bycatch under any condition of pollock and salmon abundance in all years; how the incentive program provided rewards for salmon bycatch avoidance and/or penalties for failure to avoid salmon bycatch at the vessel level; how the incentives would promote reductions in actual individual vessel bycatch rates relative to what would have occurred in absence of the incentive program; and how the incentive measures in the ICA promote salmon savings in any condition of pollock and salmon abundance so that these measures influence operational decisions at levels of bycatch below the hard cap. NMFS would approve the proposed ICA if it included this information. NMFS would look for key words and key sections of descriptive text in the ICA that addressed the requirements of the PPA. However, NMFS would not judge the adequacy of the incentives described or whether these incentive measures would, in fact, successfully provide the incentives intended by the Council. Judgments about the efficacy or outcomes of the proposed incentive program would be subjective and the regulations would not provide a legal basis for NMFS to disapprove the proposed ICA because it did not believe that the proposed measures would work as intended. Minor errors or omissions in the ICA likely would be resolved by NMFS contacting the ICA representative and requesting revisions to the ICA. The approved ICA would be made available for Council and public review.

Once submitted and approved, the ICA would not have to be re-submitted each year. If approved, the ICA it would remain in effect unless it had an expiration date specified by the ICA participants or until the participants notified NMFS that the ICA was revoked. Amendments or revisions to the ICA could be submitted to NMFS by the parties to the ICA at any time. NMFS would review whether the amendments would create an ICA that still complied with all of the appropriate regulations. The original, approved ICA would be effective until NMFS approved amendments or revisions. If amendments were disapproved, then the existing, approved ICA would remain in effect. Once party to an ICA, a vessel, sector, cooperative, or CDQ group could not withdraw from the ICA mid-way through the year.

If the regulatory requirements for the ICA were not met, NMFS would issue an initial administrative determination (IAD) explaining the reasons that the proposed ICA did not comply with NMFS regulations. Possible reasons for disapproval would be a complete lack of information that responds in any way to one or more of the ICA requirements or information that did not make sense in such an obvious way as to be clearly not responsive to the requirements. Information that seemed to be somewhat responsive, but did not include sufficient detail or information that was responsive by using the right words but was difficult to understand would not be sufficient reasons for disapproval. If NMFS issued an IAD disapproving a proposed ICA, the ICA representative could then (1) resubmit a revised ICA that addressed the issues identified in the IAD or (2) file an administrative appeal. An administrative appeal likely would not be resolved prior to the fishing year in which the ICA was supposed to be effective.

The Chinook salmon bycatch cap that would be in effect if an ICA is not submitted or approved by NMFS by the start of the fishing year would depend on whether the Council selected PPA1 or PPA1 and PPA2 combined.

If the Council selected only PPA1 and no ICA was submitted or approved, all vessels would be fishing under the backstop cap of 32,482 salmon.

If the Council selected implementing both PPA1 and PPA2 together, NMFS would recommend the following regulatory structure. The 47,591 Chinook salmon cap would be the initial cap specified in regulation. It would be allocated as transferable seasonal Chinook salmon bycatch allocations among the catcher/processor sector, mothership sector, inshore cooperatives, and CDQ groups. This cap would be in effect if no approved ICA existed for any of the following reasons:

- No ICA was submitted for NMFS review,
- An ICA was submitted, but NMFS issued an initial administrative determination to disapprove the ICA because it was inconsistent with regulations, and the appeal was not yet resolved by the time the fishing year started,
- NMFS issued a final agency action to disapprove the ICA (either no appeal was filed or the appeal was resolved in NMFS's favor).

The regulations also would specify that if NMFS approved an ICA, then the 68,392 cap and the 32,482 backstop cap would be in effect and would be implemented as described in this chapter. This regulatory structure would ensure that an initial fixed cap was in place regardless of the outcome of the submission of and approval of an ICA.

An alternative interpretation would be to require implementation of the high cap while an IAD to disapprove the proposed ICA was under appeal. However, this interpretation could create an incentive to submit an ICA that would be disapproved just to have the high cap in place without any ICA in effect that implements the bycatch reduction incentive program. However, such an ICA is an integral component of the Council’s recommendations for reducing Chinook salmon bycatch.

Annual reporting requirements: A second component of the ICA provisions is the requirement for an annual report about performance under the ICA. This report would be required to include:

- a comprehensive explanation of incentive measures in effect in the previous year,
- how incentive measures affected individual vessels, and
- evaluation of whether incentive measures were effective in achieving salmon savings beyond levels that would have been achieved in absence of the measures.

The Council would review an annual report about performance under the ICA. It could initiate FMP or regulatory amendments to revise or remove the ICA requirements if it found that the ICA concept needed improvement or was not performing as intended.

The Council would have no role in NMFS’s review and approval/disapproval of the ICA. That administrative process would be conducted by NMFS based on the regulations implemented for Alternative 4. The Council intends to review industry proposals for the ICA prior to final action on Amendment 91. However, nothing in NMFS’s potential regulations would require the industry to submit exactly the same ICA that was presented to the Council prior to its final action.

2.5.4.2 Catch accounting

Catch accounting would be more complex under Alternative 4 that under the other alternatives because of the potential for two separate caps under PPA1. Under PPA1, all Chinook salmon bycatch by vessels fishing under transferable bycatch allocations (the high cap) would accrue against those allocations. Chinook salmon bycatch by vessels fishing under the backstop cap would not accrue against the transferable bycatch allocations. However, all bycatch by all vessels in the pollock fishery would accrue against the backstop cap, including all of the bycatch from those vessels fishing under transferable allocations of the 68,392 cap and all bycatch by vessels fishing under the backstop cap. Chinook salmon bycatch by vessels fishing on behalf of CDQ groups would accrue against the CDQ portion of the backstop cap and bycatch by vessels fishing in the non-CDQ pollock fisheries would accrue against the non-CDQ portion of the backstop cap. However, only those vessels not participating in the ICA would be managed under the non-CDQ and CDQ backstop caps and prohibited by NMFS from directed fishing for pollock once the backstop cap was reached. This dual system of catch accounting against the backstop cap provides further incentive for vessels to participate in the ICA and fish under the transferable allocations.

NMFS would have to differentiate between ICA and non-ICA participants in order to properly account for Chinook salmon bycatch towards appropriate caps. This could occur by identifying vessels or CDQ groups as either ICA or non-ICA eligible in the Catch Accounting System.

As shown in Table 2-45, seasonal allocations of Chinook salmon caps under PPA1 would require NMFS to monitor up to 18 seasonal and 36 annual Chinook caps. This would occur if all industry sectors and CDQ groups participated in an ICA and were subject to the high Chinook salmon bycatch cap and some vessels or CDQ groups opted out of the ICA and NMFS had to manage two salmon bycatch caps per season under the backstop cap.

Table 2-45 Number of potential seasonal and sector caps under PPA1.

	ICA fishery under high cap				**Opt-out fishery with backstop cap**		**Total salmon caps**
	Catcher/ processor	Mothership	Inshore co-op's (and limited access)	CDQ	Non-CDQ	CDQ	
A season	1	1	8	6	1	1	18
B season	1	1	8	6	1	1	18
Annual total	2	2	16	12	2	2	36

If some operations (i.e., vessels) or CDQ groups did not participate in a Chinook salmon bycatch ICA, then NMFS would have to manage the Chinook salmon bycatch by such entities separately, and in aggregate, from the entities receiving Chinook allocations. With respect to CDQ groups that opt-out of the ICA, this could mean that there would be fewer caps to manage under the hard cap, but the associated complexity of managing annual and seasonal caps under both high and backstop caps would increase NMFS's management burden. The agency would have to account for all Chinook salmon bycatch made by components that had transferrable salmon bycatch allocations against the sectors' salmon bycatch accounts, as well as simultaneously accounting for Chinook salmon bycatch made by all vessels directed fishing for pollock against either of the two potential backstop caps, should such caps be in effect.

The inclusion of the backstop cap also would increase NMFS's inseason management responsibilities. Multiple Chinook salmon bycatch caps for the catcher/processor sector, the mothership sector, seven inshore cooperatives, six CDQ groups, and any operations not in the ICA would increase the effort needed to manage these various caps. This includes incorporating such caps into the annual BSAI groundfish harvest specifications (if needed) either directly or by reference to applicable regulation. NMFS would have to manage both transferrable Chinook bycatch allocations (i.e., monitor for a seasonal allocation being exceeded) and issue directed fishing closures applicable to those vessels fishing under the backstop caps. Directed fishing for pollock by vessels not in the ICA would be prohibited once either the non-CDQ low cap or CDQ low cap was reached, based on the total aggregate Chinook catch by vessels directed fishing for pollock under either the low or high caps.

If the Council elects to implement PPA 2 either alone or as the initial cap in combination with PPA1, the 47,591 Chinook salmon bycatch cap would be set in regulation. It would be allocated among the catcher/processor sector entity, the mothership sector entity, the inshore cooperatives and the inshore limited access fishery, if it existed in a particular year, and the CDQ groups. These caps would be subject to the same seasonal and sector specific apportionments as those described above under the PPA1 high cap. These low caps are portrayed in Table 2-46. There would be four less caps under this scenario than under PPA1.

Table 2-46 Number of potential seasonal and sector caps under PPA2.

	Number of caps by sector				**Total salmon caps**
	Catcher/ processor	Mothership	Inshore co-op's (and limited access)	CDQ	
A season	1	1	8	6	16
B season	1	1	8	6	16
Annual total	2	2	16	12	32

This cap established under PPA2 would be subject to the same seasonal and sector specific apportionments as those described above under the PPA1 high cap. Any Chinook salmon bycatch by these entities would accrue against their respective seasonal salmon bycatch allocation. Each sector or entity receiving a Chinook salmon bycatch allocation would be prohibited from exceeding that allocation.

The monitoring, management, and enforcement issues for the PPA2 47,591 hard cap are essentially the same as described for PPA1 high cap, as well as under Alternative 2. PPA2 would be simpler for NMFS to implement, as it would not have to include the dual accounting that would be required under PPA1. This would put PPA2 on par with the CAS development cost and complexity considered under Alternative 2. Under PPA2, the lower cap could impose additional constraints on some inshore cooperatives relative to their allocations of salmon bycatch. This could require them to solicit a greater amount of Chinook transfers than might be necessary under PPA1.

NMFS's involvement with Chinook salmon transfers under either PPA1 or PPA2 would be limited to adjusting applicable CAS bycatch accounts, per industry notification of the parties involved in the transfer and the amount of salmon bycatch being transferred. The number of transfers that could annually occur between entities is not possible to predict at this time. The need for Chinook bycatch allocation transfers would depend on Chinook salmon abundance, bycatch rates, and the willingness or ability for industry components to transfer Chinook bycatch based on actual or anticipated needs. Presumably, in years of higher Chinook abundance or bycatch, industry components would catch relatively more Chinook and be more interested in receiving Chinook transfers. Conversely, they would be less interested in transferring away amount of Chinook salmon bycatch.

NMFS is unable to estimate the number of transfers that it would have to process. The demand for transfers could vary with salmon abundance. Higher abundance could lead to higher Chinook bycatch, which in turn could increase the demand for Chinook salmon transfers. Under the PPA1 high cap, fewer intercooperative or inter-sector transfers could occur because, in general, each cooperative might have sufficient Chinook bycatch to account for its Chinook bycatch. Furthermore, analysts do not have sufficient information about the transaction costs of potential Chinook salmon bycatch transfers to estimate their cost to industry. Agency costs associated with processing Chinook transfers, aside from the initial development costs associated with ensuring NMFS's CAS is able to perform and track Chinook salmon transfers, probably would be minimal.

2.5.4.3 Observer coverage and monitoring requirements

As was discussed for transferable Chinook salmon bycatch allocations under Alternatives 2 and 3, NMFS recommends the increased monitoring requirements for both PPA1 and PPA2 under Alternative 4. This includes NMFS's recommendations for increased observer coverage for inshore catcher vessels that currently are only subject to 30 percent observer coverage, as well as enhancements to shoreside processor monitoring requirements.

Given the complexity of the dual Chinook accounting envisioned under PPA1 (including Chinook transferability by some sectors and CDQ groups), NMFS recommends 100 percent observer coverage for all inshore catcher vessels, even those fishing with non-transferable allocations under the backstop cap. An additional, and perhaps more significant, a factor associated with the backstop cap is that all of the vessels fishing under this cap will be racing to harvest their pollock before the backstop cap is reached without the limitations that will be placed on those vessels fishing under the ICA. This would increase the incentive for vessels fishing under the backstop cap to discard Chinook salmon that would otherwise accrue against the backstop cap. The earlier the cap was reached, the sooner NMFS would close directed fishing for pollock for the fleet fishing under this cap. The potential discard incentive and fast pace of the pollock fishing conducted under the backstop caps support the need to require 100 percent observer coverage on all inshore catcher vessels.

2.6 Alternatives considered and eliminated from further analysis

The alternatives in this analysis were developed through a public Council and stakeholder process. Many issues were aired and other possible management options, or points within the range of the options, were considered. Through an iterative process, the Council arrived at an extensive suite of management options that best suit the problem statement, that represent a reasonable range of alternatives and options, and also represent a reasonable combination of management measures that can be analyzed and used for decision-making.

The Council and NMFS also concurrently held a formal scoping period which provided another forum for the public to provide input to the development of alternatives. A scoping report was provided which summarized the comments for the Council, and the comments were taken into account in the Council's selection of a final suite of alternatives for this analysis. Chapter 1 includes a detailed discussion of the issues raised in scoping, which is referenced but not repeated here. Many of the comments received from scoping are captured in the current analysis; others were not carried forward for the reasons described below; still others were outside of the scope of this action's purpose and need, and were also not carried forward.

This section discusses the Council's process for developing alternatives, and those alternatives that were originally discussed at the Council level and through the Council's Salmon Bycatch Workgroup, but which, for the reasons noted below, were not analyzed in detail.

The Council, in February 2007, established a Salmon Bycatch Workgroup (SBW) committee, comprising of members representing the interests of western Alaska (4 members) and of the pollock industry (4 members). This committee had two Chairs, one from each of the major interest groups represented in its membership. The Council later (June 2007) appointed an additional member from the Alaska Board of Fisheries (BOF). The Council requested that the SBW provide recommendations to the Council regarding appropriate salmon cap levels, by species (Chinook and chum or 'other' salmon), to be considered for the pollock fishery, as well as to work with staff to provide additional review of and recommendations for the development of alternatives for analysis.

The SBW met 4 times, in March 2007, May 2007, August 2007 and November 2007. These meetings were open to the public and noticed in the Federal Register accordingly. Following each meeting, a report was compiled representing the recommendations and discussions by the committee, and provided to the Council at its subsequent meeting (April 2007, June 2007, October 2007, and December 2007). Based upon the recommendations from the Council's Salmon Bycatch Workgroup in August 2007, the Council initially considered a broader range of numbers for Chinook caps. These numbers ranged from 14,000 to 114,000 fish, based on various methodologies for increasing or decreasing a cap above or below historical averages and highest years of bycatch. At the December 2007 Council meeting, the Council modified the range under consideration so that the highest cap in the alternatives is 87,500 Chinook salmon annually. The Council's intent with this action is to reduce salmon bycatch to the extent practicable in the pollock fishery, and the Council did not believe that including the higher numbers would be a reasonable alternative to consider in light of the purpose of the action. This was also a recommendation by the SBW resulting from its November 2007 meeting. The Council chose to limit the low end of the range of caps under consideration to 29,323 which is representative of the 5 year average prior to 2001. Percentage decreases below this level were initially considered, but the Council felt that including this number was sufficiently conservative to meet the purpose of this action.

At the February 2008 meeting, the Council considered including a three year step down mechanism for the hard cap by starting with a cap at a 20% increase in the highest year pre-2007. This would have meant starting with a Chinook hard cap of 99,908. The cap would start at this number and then move towards the Council's target hard cap in equal increments over three years. This alternative was rejected because it is not consistent with the purpose and need because it would not minimize bycatch to the extent practicable in the first three years of implementation.

Absent from this analysis is a suite of separate management measures for chum salmon. An extensive set of alternative management measures have been developed for chum salmon, including similar measures as considered in this analysis for Chinook salmon, i.e. hard caps on the pollock fishery and triggered time/area closures. The chum salmon alternatives were last modified by the Council in April 2008 in conjunction with finalizing the Chinook alternatives (see April 2008 Council motion at http://www.fakr.noaa.gov/npfmc/current_issues/bycatch/salmonbycatch408motion.pdf). At that time, the Council moved to bifurcate the analysis of management measures by species such that this EIS would focus on Chinook salmon measures while further discussion of chum management measures would occur under a separate analysis. The Council identified the Chinook bycatch issue as a higher priority, and acted to move as expediently as possible towards implementation of revised management measures for the pollock fishery. The Council further discussed chum management measures at the October 2008 Council meeting.

During the development of alternatives, several other alternatives were considered that were not included in the final alternative set. A fixed area closure for Chinook salmon was considered in February 2008 but was not included in the final set of alternatives. Similarly, complex triggered area closures were brought forward in various iterations to the Council via staff discussion papers in December 2007, February 2008 and April 2008, and these likewise were not included in the current set of alternatives. The Council adopted the recommendation of the SSC, as follows. "**[T]he SSC recommends deleting alternatives that do not meet the problem statement's goal of reducing bycatch. To this end, the Council should consider removing alternatives for fixed closed areas and triggered closures that would be similar, in kind, to past implementation of the triggered closures of the Salmon Savings Areas. Over time, these area closures have been found to be insufficient to reduce bycatch.** The rationale for dropping the various types of closed area configurations is that the Bering Sea environment is expected to continue to change in both subtle and remarkable ways, and the spatial and temporal use of this environment by salmon and pollock is also expected to change, such that closure boundaries identified at this time cannot be expected to be effective over the longer term. Compounding this problem is the considerable uncertainty of the effects that will be realized if the pollock fleet is excluded from the most productive grounds. Potential effects include increased effort to achieve the TAC and increased bycatch of smaller pollock, perhaps also of salmon. Unfortunately, the quantitative information on which to base analyses of the effects of fishing outside of the productive grounds is extremely limited. This limitation would be most severe for the large closed area alternatives that encompass large percentages of productive pollock fishing areas."

An option was considered to modify the PSC accounting period to begin with the B season and continue through the A season of the following year. This option more accurately reflects salmon life history, and was included to provide additional conservation benefits to the same cohort of salmon that is on the fishing grounds (and caught) in the B season and then subsequently in the A season of the following year. Modification of the annual accounting period would have a profound effect on both the fleet and the relative amount of salmon taken from any one cohort of salmon if it were applied in conjunction with an annual cap (triggered or hard cap). If this were applied in conjunction with, for example, a hard cap on Chinook, based on historical fishing practices, the fleet (or sectors thereof) would very likely have reached their salmon cap prior to or during the early weeks of the A season. Thus they would be constrained in the A season due to bycatch in the previous B season; as the A season catch is more lucrative, this would increase economic costs to the pollock fishery. While the same number of salmon (depending on the hard cap selected) may be caught absent this option (e.g. in a calendar year), in this case the conservation benefits are improved by constraining catch specifically on a particular cohort of salmon. The Council did not move forward with this option, because it instead chose to adopt seasonal distribution of the annual cap. Seasonal caps would already convey the appropriate conservation benefits to the salmon stocks of restricting catch in any one time period, thus further modifications of the accounting period would be redundant. This was reinforced by the SSC in its April recommendations: "**the SSC recommends removing Option A (modifying the PSC accounting period to begin at the start of the B season) recognizing that seasonal accounting, which is expected to be done, will make this option unnecessary."**

A couple of scoping comments suggested changes to the pollock fishery management such as reducing the pollock "A" and "B" season TACs, changing the timing of fishing activity to reduce bycatch, changing the trawl gear to reduce bycatch, closing the pollock fishery, and shortening the pollock "B" season based on information that suggests that substantial savings could result from closures in the latter part of the "B" season, when Chinook bycatch rates tend to increase drastically (while pollock catches are typically low). While some of these measures, such as changing the timing of fishing activity and shortening the B season may result in Chinook salmon savings, the Council has determine that a hard cap or triggered areas closures are the most direct way to minimize bycatch. Gear modifications to reduce salmon bycatch are already under development by the pollock industry. Reducing the TAC or closing the pollock fishery would not be in compliance with the Magnuson Stevens Act and would not meet the proposed action's purpose and need to minimize bycatch to the extent practicable while achieving optimum yield from the fishery.

In the development of cap alternatives, an index cap was considered previously as an option under this analysis that would framework in regulations a method to set the cap relative to salmon returns. This cap formulation would be based on consideration of run-size impacts and involve a number of uncertain components (e.g., river-of-origin, ocean survival, future expected run size). It thus would have to be derived from estimated probabilities to account for the varying uncertainty. The Council did not feel that the index cap formulation was sufficient developed at this time to include as an alternative.

The Council considered different flexible bycatch accountability mechanisms, such as a hard cap with tradable salmon quotas issued to individual vessels, cooperatives, or sectors, or a hard cap with hybrid quota/fee system. Scoping comments suggested that if the action includes a hard cap, then the action should impose the cap at the sector, cooperative, or individual vessel level for individual vessel accountability to reward good behavior (acceptable bycatch rates) and penalize bad behavior (high bycatch rates). Scoping comments suggested that, absent a system of individual vessel accountability, a hard cap that threatens to shut down the pollock fishery prior to the achievement of the TAC would inevitably result in irresponsible vessel operators (those that make no effort to avoid or reduce bycatch) prospering and the responsible vessel operators (those that alter their fishing behavior in order to reduce bycatch) suffering. Alternatives 2, 3, and 4 contains options for transferable allocations at the sector, cooperative, and CDQ group level and Alternative 4 allows individual vessel accountability through the salmon bycatch ICA. The Council determined that the levels of accountability in the suite of alternatives analyzed in this EIS/RIR/IRFA would provide the flexibility for sectors, cooperatives, and CDQ groups to work to avoid salmon bycatch while harvesting their pollock allocations and that individual vessel allocations were not necessary.

Finally, the Council requested analysis of a fee per salmon caught to provide an incentive to reduce bycatch and to support research assessing impacts and methods to further reduce salmon bycatch. However, the Magnuson-Stevens Act provides NMFS limited authority to impose fees. Section 304(d)(1) specifically limits the amount of fees to “the administrative costs incurred in issuing the permits.” Similarly, in the context of limited access privilege programs, NMFS and the Council must impose fees “that will cover the costs of management, data collection and analysis, and enforcement activities.” Thus, the Magnuson-Stevens Act does not authorize NMFS or the Council to impose a fee on a per-salmon basis or collect fees to support research for reducing salmon bycatch. In addition, NOAA General Counsel also advises that NMFS cannot require that an ICA contain management measures that NMFS does not have the authority to require directly. Therefore, NMFS cannot implement regulations that would expressly require a salmon bycatch ICA to include fees on salmon bycatch, even if such fees were not directly assessed by NMFS.

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3.0 METHODOLOGY FOR IMPACT ANALYSIS

This chapter provides a discussion of the methodology used to conduct the quantitative analysis to understand the impacts of alternatives on pollock catch (Chapter 4), Chinook salmon (Chapter 5), and the economic impacts (Chapter 10). For the remaining resource categories considered in this analysis, marine mammals, seabirds, other groundfish, EFH, ecosystem relationships, and environmental justice, impacts of the alternatives were evaluated largely qualitatively based on results and trends from the quantitative analysis.

The following description of the methodology and subsequent analyses are unavoidably lengthy. We have tried to err on the side of inclusiveness, rather than run the risk of omitting any information or analysis that might aid decision-makers and the public in evaluating the relative merits of the alternatives. Also, the description of modeling methods in Section 3.3 contains highly technical information and mathematical equations that we have seen fit to include in the text rather than consign to an appendix. Although we do not expect that all readers will want to follow these equations, we have placed the methods description prominently to encourage public scrutiny of the scientific rigor with which the analyses have been conducted. Yet, however lengthy, detailed, and technical the analyses, we have tried our best where possible to keep the information accessible to the reader.

This chapter also provides a summary of the reasonably foreseeable future actions for that may change the predicted impacts of the alternatives on the resources components analyzed in this EIS. Relevant and recent information on each of the resource components analyzed in this EIS is contained in the chapter addressing that resource component and is not repeated here in Chapter 3.

3.1 Estimating Chinook salmon bycatch in the pollock fishery

Overall, salmon bycatch levels are estimated based on extensive observer coverage using the NMFS Catch Accounting System (CAS). For the pollock fishery, the vast majority of tows are observed either directly at sea or at offloading locations aboard motherships or at shore-based processing plants. The observer data is used to allow inseason managers to evaluate when to open and close all groundfish fisheries based on bycatch levels of prohibited species, such as salmon and halibut, and catch levels of target groundfish species. The process of using observer data (in addition to other landings information) to set fishery season length relies on a pragmatic approach that expands the observed bycatch levels to extrapolate to unobserved fishing operations. Statistically rigorous estimators have been developed that suggest that for the Eastern Bering Sea pollock fishery, the levels of salmon bycatch are precisely estimated with coefficients of variation of around 5% (Miller 2005). This indicates that, assuming that the observed fishing operations are unbiased relative to unobserved operations, the total salmon bycatch levels are precisely estimated for the fleet as a whole. Imprecision of the total annual Chinook salmon bycatch is considered negligible.

3.1.1 Monitoring Catcher/processors and motherships

Catcher/processors and motherships are required to carry two NMFS-certified observers during each fishing day. These vessels must also have an observer sampling station and a motion-compensated flow scale, which is used to weigh all catch in each haul. The observer sampling station is required to include a table, motion compensated platform scale, and other monitoring tools to assist observers in sampling. Each observer covers a 12 hour shift and all hauls are observed unless an observer is unable to sample (*e.g.,* due to illness or injury).

Estimates of the weight of each species in the catch are derived from sampling. A sample is a specific portion of the haul that is removed and examined by the observer. Catch in the sample is sorted by species, identified, and weighed by the observer. Species counts also are obtained for non-predominant species. Observer samples are collected using random sampling techniques to the extent possible on commercial fishing vessels. Observer samples are extrapolated to the haul level under the assumption that sample composition represents the composition of an entire haul. The sample proportion of each haul in the pollock fishery is relatively high because catch is generally not diverse and excellent sampling tools, such as flow scales and observer sample stations, are available.

Sampling for salmon is conducted as part of the overall species composition sampling for each haul. The observer collects and records information about the number of salmon in each sample and the total weight of each haul. NMFS estimates the total number of salmon in each haul by extrapolating the number of salmon in the species composition samples to the total haul weight. In the rare case that an observer on an AFA catcher/processor or mothership is unable to sample a haul for species composition, NMFS applies species composition information from observed hauls to non-observed hauls.

Catcher vessels deliver unsorted catch to the three motherships that participate in the AFA pollock fisheries. NMFS does not require these catcher vessels to carry observers because catch is not removed from the trawl's codend (the detachable end of the trawl net where catch accumulates) prior to it being transferred to the mothership. Observer sampling occurs on the mothership following the same estimation processes and monitoring protocols that are described above for catcher/processors.

While regulations require vessel personnel to retain salmon until sampled by an observer, salmon that are retained by catcher/processor and mothership crew outside of the observer's sample are not included in the observer's samples and are not used to estimate the total number of salmon caught. However, observers examine these salmon for coded-wire tags and may collect biological samples.

3.1.2 Monitoring catcher vessels delivering to shoreside processors or stationary floating processors

Catcher vessels in the inshore sector are required to carry observers based on vessel length.

Catcher vessels 125 feet in length or greater are required to carry an observer during all of their fishing days (100 percent coverage).

Catcher vessels greater than 60 feet in length and up to 125 feet in length are required to carry an observer at least 30 percent of their fishing days in each calendar quarter, and during at least one fishing trip in each target fishery category (30 percent coverage).

Catcher vessels less than 60 feet in length are not required to carry an observer. However, no vessels in this length category participate in the Bering Sea pollock fisheries.

Observers sample hauls onboard the catcher vessels to collect species composition and biological information. Observers use a random sampling methodology that requires observers to take multiple, equal sized, samples from throughout the haul to obtain a sample size of approximately 300 kilograms. Catch from catcher vessels delivering to shoreside processing plants or floating processors generally is either dumped or mechanically pumped from a codend (i.e., the end of the trawl net where catch accumulates) directly into recirculating seawater (RSW) tanks. Observers attempt to obtain random, species composition samples by collecting small amounts of catch as it flows from the codend to the RSW tanks.

This particular collection method is difficult (and dangerous), as observers must obtain a relatively small amount of fish from the catch flowing out of the codend as it is emptied into the RSW tanks. A large codend may contain over 100 mt of fish. This sampling is typically done on-deck, where the observer is exposed to the elements and subject to the operational hazards associated with the vessel crew's hauling, lifting, and emptying of the codend into the large hatches leading to the tanks. In contrast, the sampling methods used on catcher/processors and motherships allow observers to collect larger samples under more controlled conditions. On these vessels, the observer is able to collect samples downstream of the fish holding tanks, just prior to the catch sorting area that precedes the fish processing equipment. Additionally, the observer is below decks and has access to catch weighing scales and an observer sampling station.

Because the composition of catch in the pollock fishery is almost 100 percent pollock, species composition sampling generally works well for common species. However, for uncommon species such as salmon, a larger sample size is desired; however, large sample sizes are generally not logistically possible on the catcher vessels. Instead, estimates of salmon bycatch by catcher vessels are based on a full count or census of the salmon bycatch at the shoreside processing plant or stationary floating processor whenever possible.

Vessel operators are prohibited from discarding salmon at sea until the number of salmon has been determined by an observer, either on the vessel or at the processing plant, and the collection of any scientific data or biological samples from the salmon has been completed. Few salmon are reported discarded at sea by observed catcher vessels. However, any salmon reported as discarded at sea by the observer are added into the observer's count of salmon at the processing plant. Unlawful discard of salmon at sea may also subject a vessel operator to enforcement action.

3.1.3 Monitoring shoreside processors

AFA inshore processors are required to provide an observer for each 12 consecutive hour period of each calendar day during which the processor takes delivery of, or processes, groundfish harvested by a vessel directed fishing for pollock in the Bering Sea. NMFS regulates plant monitoring through a permitting process. Each plant that receives AFA pollock is required to develop and operate under a NMFS-approved catch monitoring and control plan (CMCP). Monitoring standards for CMCP are described in regulation at 50 CFR 679.28(g).

These monitoring standards detail the flow of fish from the vessel to the plant ensuring all groundfish delivered are sorted and weighed by species. CMCPs include descriptions and diagram of the flow of catch from the vessel to the plant, scales for weighing catch, and accommodations for observations. Depending on the plant, observers will physically remove all salmon from the flow of fish before the scale as it is conveyed into the plant, or supervise the removal of salmon by plant personnel. Observers assigned to the processing plant are responsible for reading the CMCPs and verifying the plant is following the plan laid out in the CMCP. Vessel observers complete the majority of a salmon census during an offload, with the plant observer providing breaks during long offloads.

One performance standard required in CMCPs is that all catch must be sorted and weighed by species. The CMCP must describe the order in which sorting and weighing processes take place. Processors meet this performance standard in different ways. Some processors choose to weigh all of the catch prior to sorting and then deduct the weight of non-pollock catch in order to obtain the weight of pollock. Other processors choose to sort the catch prior to weighing and obtain the weight of pollock directly. No matter how the weight of pollock is obtained, it will only be accurate if bycatch is effectively sorted, and methods must be in place to minimize the amount of bycatch that makes it past the sorters into the factory. CMCPs were not designed to track individual fish throughout the shoreside processor and the focus of the performance standards is on monitoring the large volumes of species such as pollock, not on monitoring small quantities of bycatch. Currently, the practice of deducting bycatch from the total catch weight of pollock provides an incentive for processors to report bycatch, including salmon.

3.1.3.1 Salmon accounting at shoreside processors

When a catcher vessel offloads at the dock, prohibited species such as crab, salmon, and halibut are identified and enumerated by the vessel observer during the offload. The observer monitors the offload and, with the assistance of the plant's processing crew, attempts to remove all salmon from the catch. Salmon that are missed during sorting will end up in the processing facility, which requires special treatment by the plant and the observers to ensure they are counted. These "after-scale" salmon (so called because they were initially weighed along with pollock) creates tracking difficulties for the plant and the observer.

Although after scale salmon are required to be given to an observer, there is no direct observation of salmon once they are moved past the observer and into the plant. Observers currently record after scale salmon as if they had collected them. However, such salmon can better be characterized as plant reported information. Further complications in plant based salmon accounting occur when multiple vessels are delivering simultaneously, making it difficult or impossible to determine which vessel's trip these salmon should be assigned to. Currently, plant personnel are very cooperative with saving after-scale salmon for observers at this stage of sampling and after scale salmon numbers are relatively low. However, if management measures create incentives for not reporting salmon, this reportedly high level of cooperation could be reduced. Additionally, complications occur when multiple vessels are delivering in quick succession to a plant because it is often impossible to assign salmon to a vessel. To ensure that processors continue to report salmon and avoid the confusion that after scale salmon may create, no salmon would be allowed to pass the observer's sampling area and the following constraints could be required:

- The depth of fish flowing past the observer on the belt may be no more than one fish deep;
- Belt widths may need to be narrowed to allow observers to access all fish, and;
- Multiple belts in the sorting area would be prohibited in order to ensure that all of the fish in an offload passed a single observation point.

3.1.4 NMFS Catch Accounting System

NMFS determines the number of Chinook salmon caught as bycatch in the Bering Sea pollock fishery using the NMFS's CAS. The CAS was developed to receive catch reports from multiple sources, evaluate data for duplication or errors, estimate the total catch by species or species category, and determine the appropriate "bin" or account to attribute the catch. Historically, these accounts have been established to mirror the myriad combinations of gear, area, sector, and season that are established in the annual groundfish harvest specifications. In general, the degree to which a seasonal or annual allocation requires active NMFS management is often inversely related to the size of the allocation. Typically, the smaller the catch limit, the more intensive the management required to ensure that it is not exceeded.

The CAS account structure is different for each major regulatory program, such as the Amendment 80 Program, the GOA Rockfish Program, the AFA pollock fishery, and the CDQ Program. For example, separate accounts are used to monitor Atka mackerel caught by Amendment 80 vessels and non-Amendment 80 vessels. To monitor this catch, accounts are created for all Atka mackerel caught, separate accounts if the vessel is in a cooperative or limited access sector, separate accounts for fish caught in or outside special harvest limit areas, and finally, seasonal accounts for all scenarios combined. This results in 10 separate accounts that had to be created by programmers for use by NMFS fisheries managers.

The AFSC's Fisheries Monitoring and Analysis Division provides observer data about groundfish catch and salmon bycatch, including expanded information to NMFS. NMFS estimates salmon bycatch for unobserved catcher vessels using algorithms implemented in its CAS. The haul-specific observer information is used by the CAS to create salmon bycatch rates from observed vessels that are applied to total groundfish catch in each delivery (trip level) by an unobserved vessel. The rate is calculated using the observed salmon bycatch divided by the groundfish weight, which results in a measure of salmon per metric ton of groundfish caught. Salmon bycatch rates are calculated separately for Chinook salmon and non-Chinook salmon.

The CAS is programmed to extrapolate information from observed vessels to unobserved vessels by matching the type of information available from observed vessels with that of an unobserved vessel. Surrogate bycatch rates are applied using the most closely available data from an observed catcher vessel by:

- processing sector (in this case, inshore sector)
- week ending date,
- fishery (pollock),
- gear (pelagic trawl),
- trip target,
- special area (such as the catcher vessel operational area), and
- federal reporting area.

If no data are available for an observed vessel within the same sector, then rates will be applied based on observer data from vessels in all sectors in the target fishery. If observer data are not available from the same week, then a three-week moving average (if the reporting area or special area is the same) or three-month moving average (if data with the same reporting or special areas are not available) is applied. Similarly, if data from the same Federal reporting area is not available, then observer data from the pollock fishery in the Bering Sea, as a whole, will be applied. However, this latter methodology is rarely used. NMFS generally receives adequate information to calculate bycatch rates for the inshore sector based on bycatch rates on observed catcher vessels that operate in a similar time and place as the unobserved catcher vessels.

In fisheries besides the inshore pollock fishery, estimates of salmon, crab, and halibut bycatch rely on at-sea sampling. To estimate the bycatch of these species, at-sea observers take several "within haul" samples that are extrapolate to obtain an estimate of specie-specific catch for a sampled haul. The haul-specific estimate is used by NMFS to calculate a bycatch rate that is applied to unobserved hauls. Thus, there are several levels of estimation: (1) from sample to haul, (2) sampled hauls to unsampled hauls within a trip, and potentially, (3) sampled hauls to unsampled hauls between vessels.

The sampling and extrapolation method for prohibited species, such as halibut, salmon, and crab are generally the same for observed vessels in the inshore pollock sector. Sampling of prohibited species for this sector is conducted by observers both at-sea and shoreside. The majority of catch is assessed by observers when a vessel offloads catch at a plant (shoreside). During an offload, observers count all prohibited species as they are removed from the vessel. Catch that is discarded at-sea is assessed by onboard observers. The total amount of at-sea discard is added to the shoreside census information to obtain a total amount of specie-specific discard for a trip. NMFS uses the total discard information (inshore discards plus at-sea discards) to create a bycatch rate that is applied to unobserved vessels. The catch accounting system uses the shoreside information for salmon bycatch only if the offloading vessel also had an observer onboard. As a result, only salmon bycatch data from observed trips are used when calculating a bycatch rate.

3.2 Estimating Chinook salmon saved and forgone pollock catch

The first step in the impact analysis was to estimate how Chinook salmon bycatch (and pollock catch) might have changed in each year from 2003 to 2007 under the different alternatives. This analysis assumes that past fleet behavior appropriately approximates operational behavior under the alternatives and does not estimate changes in behavior. While it is expected that the fleet would change its behavior to mitigate potential losses in pollock revenue, explicitly predicting changes in fleet behavior in a reasonable way would require data and analyses that are presently unavailable.

The impact of alternative Chinook salmon bycatch management measures is evaluated by using the actual bycatch of Chinook salmon, by season and sector, for the years 2003-2007 to estimate when alternative cap levels would have been reached and closed the pollock fishery during those years. This allows the alternatives to be compared to Alternative 1 status quo (no hard cap). The years 2003 to 2007 were chosen because that is the most recent 5 year time period and most reflective of recent fishing patterns. Chinook salmon bycatch increased dramatically after 2002 and catch accounting changed after 2002 and thus starting in 2003 the most consistent and uniform data set was available from NMFS on a sector-specific basis for analysis.

In some cases, the alternatives and options would not have closed the pollock fisheries earlier than actually occurred during these years and in other cases the alternative and options would have closed the pollock fisheries earlier than actually occurred. When an alternative would have closed the pollock fishery earlier, an estimate is made of (1) the amount of pollock TAC that would have been left unharvested and (2) the reduction in the amount of Chinook salmon bycatch as a result of the closure. The unharvested or forgone pollock catch and the reduction in Chinook salmon bycatch is then used as the basis for assessing the impacts of the alternative. This estimate of forgone pollock catch and reduction in Chinook salmon bycatch also is used as a basis for estimating the economic impacts of the alternatives.

The analysis used actual catch of Chinook salmon in the Bering Sea pollock fishery, by season, first at the fleet level (CDQ and non-CDQ), and then at the sector-level (inshore CV (S), Mothership (M), offshore CP (P), and CDQ) for the years 2003-2007. Weekly data from NMFS Alaska Region were used to approximate when the potential cap would have been reached. The day when the fishery would have closed was estimated by interpolating the week-ending totals that bracketed the fleet- or sector-specific seasonal cap. This date was then used to estimate the total pollock that was taken by that date and compared against total pollock catch by fleet or sector during the whole season, to provide an estimate of pollock catch that would have been forgone had a sector or fleet been closed down by the cap. Using an interpolated value for the date a cap would be reached gives a better approximation of the procedure inseason management uses to notify the fleet of a closure resulting from reaching a PSC limit (whereby caps are rarely exceeded because closure notifications are issued when PSC limits/caps are projected to be reached).

Tables of when caps would have been reached under each scenario (fleetwide and then separately by sector) are included in Chapter 5. The date upon which the cap would have been reached was estimated by taking the interpolated midpoint between week-ending dates based on the level of catch at the next week-ending date (when the cap was exceeded) and the one preceding that week. With this date, the remaining salmon caught by the fleet (or sector, depending upon the option under investigation) was computed as the sum from that date until the end of the year. For example, to compute the expected number of Chinook that would have been caught under a particular a cap in a given year:

1) Evaluate the cumulative daily bycatch records of Chinook salmon and find the date that the cap was exceeded (e.g., September 15);
2) Compute the number of pollock and Chinook salmon that the fleet (or sector) caught from September 16 through the end of the season.

Tables indicting the fleet-wide and sector specific amount of salmon saved (in absolute numbers of salmon) were constructed and are included in Chapter 5. Corresponding levels of pollock that was forgone under these scenarios is presented in Chapter 10. The impact of the forgone pollock on the pollock population is discussed in Section 4.3.

Chapter 4 analyzes the affect on the anticipated take of pollock within seasons and areas under the alternative hard caps and options for season and sector splits. This was illustrated by analyzing historical fishing patterns (among sectors and in space) and accounting for changes in the bycatch when sector-specific caps were reached. To illustrate this effect, tables were constructed and are included in Chapter 4 to show how the percentage of bycatch within each of the section and area strata would change.

Alternative 2

For the range of cap options under Alternative 2, a subset of the options under consideration was selected for detailed impact analysis. These include the following seasonal A/B percentage allocation options: 70/30, 58/42, 50/50. To facilitate the examination of the options, seasonal split Option 1-3 (55/45) is not evaluated in detail as the effects of this seasonal distribution are similar to 58/42 split and thus would not provide much contrast in comparison with other options. The following sector split allocations were examined in detail:

	CDQ	inshore CV	Mothership	Offshore CP
Option 1	10%	45%	9%	36%
Option 2a	3%	70%	6%	21%
Option 2d	6.5%	57.5%	7.5%	28.5%

Sector split allocations are constant across seasons in Alternative 2. Results for Alternative 2 do not incorporate a rollover provision from A to B season.

The seasonal cap allocations influence the extent to which different overall fishery cap levels would be constraining. The extent to which seasonal allocations impact salmon mortality is evaluated explicitly since the age and stock composition are also broken out by season. Seasonal distributional effects are evaluated individually at the fleet-wide level (Chapter 5.3.2.1) as well as in conjunction with the broad range sector split options in Alternative 2 for magnification of specific effects at the sector level (Chapter 5.3.2.2).

Cooperative provisions for the inshore CV fleet are examined qualitatively. Cooperative provisions apply under Alternatives 2 and 4 and do not apply for Alternative 3, triggered caps.

Alternative 4

For the PPA scenarios under Alternative 4, the following options, as indicated in Chapter 2, were examined:

1) Sector split (by season):

A season: CDQ 9.3%; inshore CV fleet 49.8%; mothership fleet 8.0%; offshore CP fleet 32.9%
B season: CDQ 5.5%; inshore CV fleet 69.3%; mothership fleet 7.3%; offshore CP fleet 17.9%

2) Seasonal split (70/30)
3) Rollover 80% within sectors from A to B seasons
4) Unrestricted transferable quotas

The analysis uses sector specific information with the option of transferability and other options as follows. If the catch within a sector is below its cap, the catch remains the same. If the cap for a specific sector is reached, the cap gets adjusted by the sum of the difference of other caps (which may be zero). This assumes that information about transfer levels exists during the season so that the amount of salmon that would be remaining from the other sectors at the end of the season is known. If a sector's catch is below the cap, the remaining allowance is allocated to the other sectors based on their relative salmon allocation specified by the alternative and season. In practice, the reallocation of salmon may be done by perceived needs relative to pollock quota remaining. For generality, a transferability factor was added such that when set to 1.0, all sectors donate their remaining salmon bycatch to an inseason reserve. Non-negative values less than 1.0 indicate that degree that sectors provide their remaining seasonal cap at levels lower than the total available (values of zero indicate no transfers among sectors). The steps to this process can be summarized as:

1) Determine the initial salmon allocation remaining for each year and sector cap, without transfer or rollover (PPA1 and PPA2).
2) Calculate the sector transfer levels for each year for the A-seasons and re-adjust sector caps and recomputed A-season values (allocating reserves when available).
3) Compute updated A-season effective sector-specific caps (with transfers), save these dates.
4) With any salmon cap remaining from A-season, optionally allow 80% to rollover to B-season amounts (from A-season) and provide new sector specific caps for B-season.
5) B-season sector caps invoked with transferability for all cases (though the ability to do calculations with non-transferability is retained).

For the PPA, as with the previous alternatives evaluated, "effective" mean seasonal caps were computed as the mean overall cap that resulted in any years (from 2003-2007) when a sector reached its pre-transfer, within season cap. This resulted in a mean value of 46,561 for the "A" season and 20,372 salmon for the "B" season (for PPA1, with 80% A-season rollover and sector transferability). For the same scenario with no A-season transferability, the mean "cap" for the A-season drops to 44,974 Chinook salmon (the B season was the same). The purpose of this approach was to simplify computation of the adult equivalent values that would be expected (since stock-of-origin and age composition information wasn't available at sector-specific levels). Note that the "effective cap" described here is based on a mean value and that seasonal and sector-specific bycatch patterns create inter-annual variability in the anticipated bycatch constraint level.

In order to estimate the relative impact of an 80% rollover from the A to B seasons, a sensitivity analysis was conducted by comparing results for 80% against two alternative scenarios: no rollover (0%) or full rollover (100%). The ability to have transferable quotas within each season is evaluated by making two different fleet behavior assumptions in the A season to operate under either perfect transferability or no transferability. This provides two contrasting sets of results for A season catch. In the B season it is assumed that the fleet would have perfect transferability.

Alternative 3

To evaluate cap trigger dates, a database was created which expanded observer data proportionally from within each NMFS statistical area, month, and sector (and CDQ) to match NMFS Alaska Regional statistics, as of April 30th 2008. This allowed for the data to be evaluated with a spatial component, but the data still sum to the official total estimates maintained by the NMFS Alaska Region. The trigger areas considered were different for the A and B seasons, so each observation was classified as falling within or outside these areas as part of the database. The individual haul records were then aggregated to match unique area-month-sector strata, along with inside- and outside-trigger area categorizations. The observer data from 1991-2002 were retained for the analysis, but for clarity, the 2003-2007 period was the focus time period for evaluating trigger closure areas.

The treatment of the data involved finding when some specified trigger salmon bycatch levels would have been reached, then simply summing values from that date onwards through the end of the season. For example, to compute the expected number of Chinook that would have been caught under a particular cap in a given year:

1) Evaluate the cumulative daily bycatch records of Chinook and find the date that the cap was exceeded (e.g., September 15th);
2) Compute the number of pollock that the fleet (or sector) caught from September 16th till the end of the season;
3) Compute the average Chinook divided by tons of pollock ***outside of trigger area*** from September 16th onwards in that year (the Chinook rate)
4) Multiply the Chinook rate by the pollock from (2) to get expected total Chinook, given trigger closure date from (1).

Since this procedure implies that the pollock *could have* been caught outside of trigger area, it is useful to evaluate the catch rate of pollock from these same data. For this purpose, the pollock catch per tow and catch per hour towed (relative to observed values inside trigger areas) was examined.

To evaluate the consequence of these triggered closures on catch composition to river-of-origin, qualitative comparisons were made drawing from results on the impacts of hard caps. The genetics data and accounting methods were unavailable at the level required to evaluate the impact of closing a trigger at different times of the year.

3.3 Estimating Chinook salmon adult equivalent bycatch

To understand impacts on Chinook populations, a method was developed to estimate how the different bycatch numbers would propagate to adult equivalent spawning salmon. Estimating the adult equivalent bycatch is necessary because not all salmon caught as bycatch in the pollock fishery would otherwise have survived to return to their spawning streams. Currently, accurate in-season Chinook salmon abundance levels are unavailable. Therefore, this analysis relies on analyses of historical data. Developing regulations designed to reduce the impact of bycatch requires methods that appropriately assess the impact of bycatch on the various salmon populations. A stochastic “adult equivalence” model was developed, which accounts for sources of uncertainty. The model is an extension of Witherell et al.’s (2002) evaluation, and relaxes a number of that study’s assumptions.

Adult-equivalency (AEQ) of the bycatch was estimated to translate how different hard caps may affect Chinook salmon stocks. This is distinguished from the annual bycatch numbers that are recorded by observers each year for management purposes. The AEQ bycatch applies the extensive observer datasets on the length frequencies of Chinook salmon found as bycatch and converts these to the ages of the bycaught salmon, appropriately accounting for the time of year that catch occurred. Coupled with information on the proportion of salmon that return to different river systems at various ages, the bycatch-at-age data is used to pro-rate, for any given year, how bycatch affects future potential spawning runs of salmon.

Evaluating impacts to specific stocks was done by using historical scale-pattern analysis (Myers et al.1984, Myers and Rogers 1988, Myers et al. 2003) and preliminary genetics studies from samples collected in 2005, 2006 and 2007 (Seeb et al. 2008). While sample collection issues exist (as described in section 3.3.2) and different methodologies were employed (scale pattern analyses and genetic analyses), these stock estimates nonetheless provide similar overall proportions of between 54-60% for western Alaska. The consistency of these results from these different methodologies lends credibility to this general estimate. Where possible, historical run sizes were contrasted with AEQ mortality arising from the observed pollock fishery Chinook bycatch to river of origin.

3.3.1 Estimating Chinook salmon catch-at-age

In order to appropriately account for the impact of salmon bycatch in the groundfish fisheries, it is desirable to correct for the age composition of the bycatch. For example, the impact on salmon populations of a bycatch level of 10,000 adult mature salmon is likely greater than the impact of catching 10,000 salmon that have just emerged from rivers and only a portion of which are expected to return for spawning in several years time. Hence, estimation of the age composition of the bycatch (and the measure of uncertainty) is critical.

Chinook salmon length and age composition, and their variance, were estimated using a two-stage bootstrap method. In the first stage, for a given year, length samples, with replacement, were taken among all tows from which salmon were measured. In the second stage, given this collection of tows, the individual fish measurements were resampled with replacement, and all stratum-specific information was carried with each record. A separate process was carried out on the samples from which age data were collected, following a similar two-stage approach. Once samples of lengths and ages were obtained, age-length keys were constructed and applied to the catch-weighted length frequencies to compute age composition estimates. This process was repeated 100 times, and the results stored to obtain a distribution of both length and age composition

Three years of length-at-age data are available from Myers et al. (2003). These data are based on salmon scale samples collected by the NMFS groundfish observer program from 1997-1999 and processed for age determination (and river of origin) by scientists at the University of Washington (Table 3-1).

Table 3-1 Summary of Chinook salmon bycatch age data from Myers et al (2003) used to construct age-length keys for this analysis.

Year	A	B	Total
1997	842	756	1,598
1998	873	826	1,699
1999	645	566	1,211
Total	2,360	2,148	4,508

Extensive salmon bycatch length frequency data are available from the NMFS groundfish observer program since 1991 (Table 3-2). The age data were used to construct age length keys for nine spatio-temporal strata (one area for winter, two areas for summer-fall, for each of three fishery sectors). Each stratum was weighted by the NMFS Alaska Region estimates of salmon bycatch (Table 3-3). To the extent possible, sex-specific age-length keys within each stratum were created and where cells were missing, a “global” sex-specific age-length key was used. The global key was simply computed over all strata within the same season. For years other than 1997-1999, a combined-year age-length key was used (based on all of the 1997-1999 data). This method was selected in favor of simple (but less objective) length frequency slicing based on evaluations of using the combined key on the individual years and comparing age-composition estimates with the estimates derived using annual age-length keys. The reason that the differences were minor is partially due to the fact that there are only a few age classes caught as bycatch, and these are fairly well determined by their length at-age distribution (Fig. 3-1).

The bootstrapped distributions of salmon length frequencies are shown in Fig. 3-2 and the resulting application of bootstrapped age-length keys is shown in Fig. 3-3 with mean values given in (Table 3-4). For modeling purposes, it's necessary to track the estimated numbers of salmon caught by age and season (Table 3-5). The estimates catch-age uncertainty (Table 3-6) were propagated through the analysis and includes covariance structure (e.g., as illustrated in Fig. 3-4).

Table 3-2 The number of Chinook salmon measured for lengths in the pollock fishery by season (A and B), area (NW=east of 170°W; SE=west of 170°W), and sector (S=shorebased catcher vessels, M=mothership operations, CP=catcher-processors). *Source: NMFS Alaska Fisheries Science Center observer data.*

Season	**A**	**A**	**A**	**B**	**B**	**B**	**B**	**B**	**B**	
Area	**All**	**All**	**All**	**NW**	**NW**	**NW**	**SE**	**SE**	**SE**	
Sector	**S**	**M**	**CP**	**S**	**M**	**CP**	**S**	**M**	**CP**	**Total**
1991	2,227	302	2,569		25	87	221	10	47	5,488
1992	2,305	733	889	2	4	14	1,314	21	673	5,955
1993	1,929	349	370	1	11	172	298	255	677	4,062
1994	4,756	408	986	3	93	276	781	203	275	7,781
1995	1,209	264	851		8	31	457	247	305	3,372
1996	9,447	976	2,798		17	161	5,658	1,721	493	21,271
1997	3,498	423	910	12	303	839	12,126	370	129	18,610
1998	3,124	451	1,329		38	191	8,277	2,446	1,277	17,133
1999	1,934	120	1,073		1	627	1,467	97	503	5,822
2000	608	17	1,388	4	40	179	564	3	120	2,923
2001	4,360	268	3,583		25	1,816	1,597	291	1,667	13,607
2002	5,587	850	3,011		23	114	5,353	520	494	15,952
2003	9,328	1,000	5,379	258	290	1,290	4,420	348	467	22,780
2004	7,247	594	3,514	1,352	557	1,153	8,884	137	606	24,044
2005	9,237	694	3,998	4,081	244	1,610	10,336	45	79	30,324
2006	17,875	1,574	5,716	685	66	480	12,757	3	82	39,238
2007	16,008	1,802	9,012	881	590	1,986	21,725	2	801	52,807

Table 3-3 Chinook salmon bycatch in the pollock fishery by season (A and B), area (NW=east of 170°W; SE=west of 170°W), and sector (S=shorebased catcher vessels, M=mothership operations, CP=catcher-processors). *Source: NMFS Alaska Region, Juneau.*

Season	**A**	**A**	**A**	**B**	**B**	**B**	**B**	**B**	**B**	
Area	**All**	**All**	**All**	**NW**	**NW**	**NW**	**SE**	**SE**	**SE**	
Sector	**S**	**M**	**CP**	**S**	**M**	**CP**	**S**	**M**	**CP**	**Total**
1991	10,192	9,001	17,645	0	48	318	1,667	103	79	39,054
1992	6,725	4,057	12,631	0	26	187	1,604	1,739	6,702	33,672
1993	3,017	3,529	8,869	29	157	7,158	2,585	6,500	4,775	36,619
1994	8,346	1,790	17,149	0	121	771	1,206	452	2,055	31,890
1995	2,040	971	5,971		35	77	781	632	2,896	13,403
1996	15,228	5,481	15,276		113	908	9,944	6,208	2,315	55,472
1997	4,954	1,561	3,832	43	2,143	4,172	22,508	3,559	1,549	44,320
1998	4,334	4,284	6,500		309	511	27,218	6,052	2,037	51,244
1999	3,103	554	2,694	13	12	1,284	2,649	362	1,306	11,978
2000	878	19	2,525	4	230	286	714	23	282	4,961
2001	8,555	1,664	8,264	0	162	5,346	3,779	1,157	4,517	33,444
2002	10,336	1,976	9,481	0	38	211	9,560	1,717	1,175	34,495
2003	16,488	2,892	14,428	764	864	2,962	6,437	1,076	1,081	46,993
2004	12,376	2,092	9,492	2,530	1,573	2,844	21,171	503	1,445	54,028
2005	14,097	2,111	11,421	8,873	744	4,175	26,113	144	168	67,847
2006	36,039	5,408	17,306	936	175	1,373	21,718	25	178	83,159
2007	35,458	5,860	27,943	1,672	3,494	4,923	40,079	50	2,225	121,704

Table 3-4 Calendar year age-specific Chinook salmon bycatch estimates based on the mean of 100 bootstrap samples of available length and age data. Age-length keys for 1997-1999 were based on Myers et al. (2003) data split by year while for all other years, a combined-year age-length key was used.

Year	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Total**
1991	5,624	15,901	13,486	3,445	347	38,802
1992	5,136	9,528	14,538	3,972	421	33,596
1993	2,815	16,565	12,992	3,673	401	36,446
1994	849	5,300	20,533	4,744	392	31,817
1995	498	3,895	4,827	3,796	367	13,382
1996	5,091	18,590	26,202	5,062	421	55,366
1997	5,855	23,972	7,233	5,710	397	43,167
1998	19,168	16,169	11,751	2,514	615	50,216
1999	870	5,343	4,424	1,098	21	11,757
2000	662	1,923	1,800	518	34	4,939
2001	6,512	12,365	11,948	1,994	190	33,009
2002	3,843	13,893	10,655	5,469	489	34,349
2003	5,703	16,723	20,124	3,791	298	46,639
2004	6,935	23,740	18,371	4,406	405	53,858
2005	10,466	30,717	21,886	4,339	304	67,711
2006	11,835	31,455	32,452	6,636	490	82,869
2007	16,174	66,024	33,286	5,579	357	121,419

Table 3-5 Age specific Chinook salmon bycatch estimates by season and calendar age based on the mean of 100 bootstrap samples of available length and age data.

Year/season	Age 3	Age 4	Age 5	Age 6	Age 7	Total
1991	**5,624**	**15,901**	**13,486**	**3,445**	**347**	**38,802**
A	5,406	14,764	12,841	3,270	313	36,593
B	218	1,137	646	174	34	2,209
1992	**5,136**	**9,528**	**14,538**	**3,972**	**421**	**33,596**
A	1,017	4,633	13,498	3,798	408	23,355
B	4,119	4,895	1,040	174	13	10,241
1993	**2,815**	**16,565**	**12,992**	**3,673**	**401**	**36,446**
A	1,248	3,654	7,397	2,778	290	15,368
B	1,567	12,910	5,595	895	111	21,078
1994	**849**	**5,300**	**20,533**	**4,744**	**392**	**31,817**
A	436	3,519	18,726	4,211	326	27,218
B	413	1,781	1,807	533	66	4,599
1995	**498**	**3,895**	**4,827**	**3,796**	**367**	**13,382**
A	262	1,009	3,838	3,534	327	8,969
B	236	2,885	989	263	40	4,413
1996	**5,091**	**18,590**	**26,202**	**5,062**	**421**	**55,366**
A	863	7,187	23,118	4,431	349	35,947
B	4,228	11,403	3,085	632	71	19,418
1997	**5,855**	**23,972**	**7,233**	**5,710**	**397**	**43,167**
A	456	2,013	3,595	3,899	271	10,234
B	5,399	21,958	3,638	1,811	126	32,933
1998	**19,168**	**16,169**	**11,751**	**2,514**	**615**	**50,216**
A	1,466	2,254	8,639	2,079	512	14,950
B	17,703	13,915	3,112	435	103	35,266
1999	**870**	**5,343**	**4,424**	**1,098**	**21**	**11,757**
A	511	1,639	3,151	898	18	6,217
B	360	3,704	1,272	200	3	5,540
2000	**662**	**1,923**	**1,800**	**518**	**34**	**4,939**
A	365	1,167	1,406	453	26	3,416
B	298	757	395	66	8	1,522
2001	**6,512**	**12,365**	**11,948**	**1,994**	**190**	**33,009**
A	2,840	3,458	9,831	1,798	171	18,098
B	3,672	8,907	2,117	196	19	14,910
2002	**3,843**	**13,893**	**10,655**	**5,469**	**489**	**34,349**
A	1,580	5,063	9,234	5,328	478	21,683
B	2,263	8,830	1,421	141	11	12,666
2003	**5,703**	**16,723**	**20,124**	**3,791**	**298**	**46,639**
A	2,941	9,408	17,411	3,437	267	33,464
B	2,763	7,315	2,713	354	31	13,175
2004	**6,935**	**23,740**	**18,371**	**4,406**	**405**	**53,858**
A	1,111	5,520	13,090	3,763	354	23,838
B	5,824	18,220	5,282	643	51	30,020
2005	**10,466**	**30,717**	**21,886**	**4,339**	**304**	**67,711**
A	1,407	6,993	15,563	3,361	226	27,550
B	9,059	23,724	6,323	978	78	40,161
2006	**11,835**	**31,455**	**32,452**	**6,636**	**490**	**82,869**
A	3,604	17,574	30,447	6,404	465	58,494
B	8,231	13,881	2,005	232	25	24,374
2007	**16,174**	**66,024**	**33,286**	**5,579**	**357**	**121,419**
A	5,791	29,269	28,648	5,059	317	69,084
B	10,384	36,755	4,638	520	40	52,336

Table 3-6 Estimates of coefficients of variation of Chinook salmon bycatch estimates by season and calendar age based on the mean of 100 bootstrap samples of available length and age data.

A season	Age 3	Age 4	Age 5	Age 6	Age 7
1991	14%	6%	6%	10%	31%
1992	20%	9%	4%	9%	27%
1993	22%	9%	5%	10%	37%
1994	27%	12%	3%	10%	30%
1995	25%	12%	5%	6%	22%
1996	19%	6%	2%	9%	21%
1997	35%	12%	6%	7%	28%
1998	16%	9%	3%	10%	23%
1999	19%	10%	5%	11%	91%
2000	25%	9%	6%	9%	27%
2001	10%	6%	3%	7%	22%
2002	15%	6%	3%	4%	16%
2003	14%	6%	3%	8%	21%
2004	15%	6%	2%	5%	20%
2005	18%	6%	3%	7%	23%
2006	17%	5%	3%	7%	22%
2007	22%	5%	4%	8%	25%
B season	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**
1991	23%	8%	12%	27%	67%
1992	9%	9%	25%	69%	87%
1993	19%	4%	9%	20%	65%
1994	17%	6%	6%	14%	27%
1995	21%	5%	12%	23%	48%
1996	6%	3%	7%	11%	29%
1997	12%	3%	10%	12%	39%
1998	5%	6%	9%	23%	36%
1999	16%	3%	8%	22%	149%
2000	9%	5%	8%	25%	49%
2001	7%	3%	8%	20%	52%
2002	6%	2%	8%	17%	43%
2003	8%	3%	5%	15%	32%
2004	6%	2%	5%	12%	30%
2005	5%	2%	5%	10%	23%
2006	4%	3%	8%	15%	33%
2007	6%	2%	7%	13%	28%

3.3.2 Estimating genetic composition of Chinook salmon bycatch

This section provides an overview the best available information used to determine the region or river of origin of the Chinook salmon caught as bycatch in the Bering Sea pollock fishery. The AEQ model uses genetic estimates of Chinook salmon taken as bycatch in the Bering Sea pollock fishery to determine where the AEQ Chinook salmon would have returned. To determine the stock composition mixtures of Chinook salmon in the Bering Sea, the model uses best available genetics analysis from ADF&G scientists (Templin et al. 2008). This analysis identified 15 regional groups with minor components in the bycatch are combined into the “other” category for clarity, which results in a total of 9 stock units (Table 3-7).

A scale pattern analysis completed in 2003 estimated age and stock composition of Chinook salmon in the 1997-1999 BSAI groundfish fishery bycatch samples from the NMFS Groundfish Observer Program database (Myers et al. 2003). Results indicated that bycatch samples were dominated by younger (age 1.2) fish in summer and older (age 1.3 and 1.4) fish in winter (Myers et al. 2003). The stock structure was dominated by western Alaskan stocks, with the estimated overall stock composition of 56% western Alaska, 31% Cook Inlet, 8% Southeast Alaska-British Columbia and 5% Russia. Here “western Alaska” included the Yukon River, Kuskokwim River, and Bristol Bay (Nushagak and Togiak) rivers. Within this aggregate grouping, the proportion of the sub-regional stock composition estimates averaged 40% Yukon River, 34% Bristol Bay and 26% Kuskokwim Chinook salmon (Table 3-8, Myers et al. 2003).

For comparison against previous estimates, results from Myers and Rogers (1988) scale pattern analysis of bycatch samples from 1979-1982 (collected by U.S. foreign fishery observes on foreign or joint venture vessels in the Bering Sea EEZ) indicated that stock structure was dominated by western Alaskan stocks with estimated overall stock composition of 60% western Alaska, 17% South Central, 13% Asia (Russia) and 9% Southeast Alaska-British Columbia. Within the aggregated western Alaskan group, 17% were of Yukon River salmon, with 29% Bristol Bay and 24% Kuskokwim salmon.

As indicated in Myers et al. (2003), the origin of salmon also differs by season. In the winter, age-1.4 western Alaskan Chinook were primarily from the subregions of the Yukon and Kuskokwim. In the fall, results indicated that age-1.2 western Alaskan Chinook were from subregions of the Kuskokwim and Bristol Bay with a large component of Cook Inlet Chinook salmon stocks as well.

The proportions of western Alaskan subregional stocks (Yukon, Kuskokwim and Bristol Bay) appear to vary considerably with factors such as brood year, time and area (Myers et al. 2003). Yukon River Chinook are often the dominant stock in winter while Bristol Bay, Cook Inlet and other Gulf of Alaska stocks are often the dominant stocks in the eastern BSAI in the fall (Myers et al. 2003). Additional studies from high seas tagging results as well as scale pattern analyses from Japanese driftnet fishery in the Bering Sea indicate that in the summer immature western Alaskan Chinook are distributed further west in the Bering Sea than other North American stocks. For the scale-pattern analyses, freshwater-type (age 0.1, 0.2, etc) Chinook were omitted. Although the proportion of these samples were relatively small, the extent that Chinook bycatch could be attributed to southern stocks where this type is more common (e.g., from the Columbia River) may be underestimated in the Myers et al. (2003) analysis.

More recent analyses of bycatch samples are underway (Templin et al. 2008). For purposes of evaluation of impacts of alternatives on individual river systems, the most recent estimates (Seeb et al. 2008) are the main reference for evaluating the impact of bycatch on the 9 sets of river systems. Scientists at ADF&G developed a DNA baseline to resolve the stock composition mixtures of Chinook salmon in the Bering Sea (Templin et al. 2008). This baseline includes 24,100 individuals sampled from over 175 rivers from the Kamchatka Peninsula, Russia, to the central Valley in California (see Table 3-7 for list of rivers).

The Templin et al. (2008) genetic stock identification (GSI) study used classification criteria whereby the accuracy of resolution to region-of-origin must be greater than or equal to 90%. This analysis identified 15 regional groups for reporting results and for purposes of this analysis these were combined into nine stock units. The nine stock units are: Pacific Northwest (PNW, comprised of baseline stocks across BC, OR, WA and CA); Coastal western Alaska (Coast WAK comprised of the lower Yukon, the Kuskokwim River and Bristol Bay (Nushagak) river systems); Cook Inlet; Middle Yukon; Northern Alaska Peninsula (NAK Penin); Russia; Southeast and Transboundary River Systems (TBR); and Upper Yukon, while minor components in the bycatch are combined into the “other” category for clarity. Consistent with previous observations regarding the seasonal and regional differences in stock origin of bycatch samples (Myers et al. 2003), bycatch samples were stratified by year, season and region (Table 3-9).

This Templin et al. (2008) study analyzed samples taken from the bycatch during the 2005 B season, both A and B seasons during 2006, and a sample from an excluder test fishery during the 2007 A season. Where possible, the genetics samples from the bycatch were segregated by major groundfish bycatch regions. Effectively, this entailed a single region for the entire fishery during winter (which is typically concentrated in space to the region east of 170°W) and two regions during the summer, a NW region (west of 170°W) and a southeast region (east of 170°W). The genetic sampling distribution varies considerably by season and region compared to the level of bycatch (as reported by the NMFS Alaska Region, Table 3-3).

The samples used in the Templin et al. (2008) analysis were obtained during a feasibility study to evaluate using scales and other tissues as collected by the NMFS observer program for genetic sampling. Unfortunately, during this feasibility study, the collected samples failed to cover the bycatch in groundfish fisheries in a comprehensive manner. For example, in 2005 most sampling was completed prior to the month (October) when most of the bycatch occurred (Fig. 3-5). Nonetheless, these samples were corrected to their stratum-specific bycatch levels (Table 3-11) for application in the model (Fig. 3-6). An important feature of this analysis is that bycatch is accounted for by location and season and this was shown to affect the relative contribution of bycatch from different salmon regions (e.g. Fig. 3-7).

For the purposes of assigning the bycatch to region of origin, the level of uncertainty is important to characterize. While there are many approaches to implement assignment uncertainty, the method chosen here assumes that the stratified stock composition estimates are unbiased and that the assignment uncertainty based on a classification algorithm (Seeb et al. 2008; Table 3-9) adequately represents the uncertainty (i.e., the estimates and their standard errors are used to propagate this component of uncertainty). Inter-annual variability is introduced two ways: (1) by accounting for inter-annual variability in bycatch among strata; and (2) by using the point estimates (and errors) from the data (Table 3-11) over the different years (2005-2007) while weighting appropriately for the sampling intensity. The procedure for introducing variability in regional stock assignments of bycatch followed a Monte Carlo procedure with the point estimates and their variances used to simulate beta distributed random variables (which have the desirable property of being bounded by 0.0 and 1.0) and applied to the catch weightings (for the summer/fall (B) season) where areas are disaggregated. Areas were combined for the winter fishery since the period of bycatch by the fishery is shorter and from a more restricted area.

Application of GSI to estimate the composition of the bycatch by reporting region suggests that, if the goal is to provide estimates on the stock composition of the bycatch, there is a need to adjust for the magnitude of bycatch occurring within substrata (e.g., east and west of 170°W during the B season, top panels of Fig. 3-6). Applying the stock composition results presented in Table 3-11 over different years and weighted by catch gives stratified proportions that have similar characteristics to the raw genetics data (Table 3-9). Importantly, these stratified stock composition estimates can be applied to bycatch levels in other years which will result in overall annual differences in bycatch proportions by salmon stock region. These simulations can be characterized graphically in a way that shows the covariance structure among regional stock composition estimates. This application extrapolates beyond the current analysis of these genetic data however and additional investigation of the temporal variation in stock composition is recommended.

The preliminary stock composition estimates for this more recent study based on the genetics are shown broken out by regions, year and season for the 9 stock units identified (Table 3-9). Accounting for sampling variability, the mean stock compositions by strata are shown in Table 3-11. While stock units differ from previous studies in levels of aggregation, results are similar to the scale-pattern study presented by Myers and Rogers (1988) and Myers et al. (2003; Table 3-12). The three studies indicate similarities in overall estimates of stock composition by river system even though aggregation levels, years of samples, and methodologies differ (Table 3-12).

The procedure for introducing variability in regional stock assignments of bycatch followed a Monte Carlo procedure with the point estimates and their variances used to simulate beta distributed random variables (which have the desirable property of being bounded by 0.0 and 1.0) and applied to the catch weightings (for the summer/fall (B) season) where areas are disaggregated. Areas were combined for the winter fishery since the period of bycatch by the fishery is shorter and from a more restricted area and results are illustrated in Fig. 3-8. The mean apportionments of the bycatch to stock (region) of origins by area and season of the pollock fishery are given in Table 3-11.

Additional funding and research focus is being directed towards both collection of samples from the EBS trawl fishery for Chinook salmon species as well as the related genetic analyses to estimate stock composition of the bycatch. Additional information on the status of these data collections and analysis programs will be forthcoming.

Table 3-7 Chinook baseline collections used in analysis of bycatch mixtures for genetics studies (from Templin et al. 2008).

No.	Region	Location	Years	N
1	Russia	Bistraya River	1998	94
2		Bolshaya River	1998, 2002	77
3		Kamchatka River (Late)	1997, 1998	119
4		Pakhatcha River	2002	50
5	Norton Sound	Pilgrim River	2005, 2006	82
6		Unalakleet River	2005	82
7		Golsovia River	2005, 2006	111
8	Coast W AK (Lower Yukon)	Andreafsky River	2002, 2003	236
9		Anvik River	2002	95
10		Gisasa River	2001	188
11		Tozitna River	2002, 2003	290
12	Middle Yukon	Henshaw Creek	2001	147
13		S. Fork Koyuk	2003	56
14		Kantishna River	2005	187
15		Chena River	2001	193
16		Salcha River	2005	188
17		Beaver Creek	1997	100
18		Chandalar River	2002, 2003, 2004	175
19		Sheenjek River	2002, 2004, 2006	51
20	Upper Yukon	Chandindu River	2000, 2001, 2003	247
21		Klondike River	1995, 2001, 2003	79
22		Stewart River	1997	99
23		Mayo River	1992, 1997, 2003	197
24		Blind River	2003	134
25		Pelly River	1996, 1997	140
26		Little Salmon River	1987, 1997	100
27		Big Salmon River	1987, 1997	117
28		Tatchun Creek	1987, 1996, 1997, 2002, 2003	369
29		Nordenskiold River	2003	55
30		Nisutlin River	19,871,997	56
31		Takhini River	1997, 2002, 2003	162
32		Whitehorse Hatchery	1985, 1987, 1997	242
33	Coast W AK (Kuskokwim)	Goodnews River	1993, 2005, 2006	368
34		Arolik River	2005	147
35		Kanektok River	1992, 1993, 2005	244
36		Eek River	2002, 2005	173
37		Kwethluk River	2001	96
38		Kisaralik River	2001, 2005	191
39		Tuluksak River	1993, 1994, 2005	195
40		Aniak River	2002, 2005, 2006	336
41		George River	2002, 2005	191
42		Kogrukluk River	1992, 1993, 2005	149
43		Stony River	1994	93
44		Cheeneetnuk River	2002, 2006	117
45		Gagaryah River	2006	190
46		Takotna River	1994, 2005	176
47	Upper Kuskokwim	Tatlawiksuk River	2002, 2005	191
48		Salmon River (Pitka Fork)	1995	96
49	Coast W AK (Bristol Bay)	Togiak River	1993, 1994	159
50		Nushagak River	1992, 1993	57
51		Mulchatna River	1994	97
52		Stuyahok River	1993, 1994	87
53		Naknek River	1995, 2004	110
54		Big Creek	2004	66
55		King Salmon River	2006	131
56	N. AK Peninsula	Meshik River	2006	42
57		Milky River	2006	67
58		Nelson River	2006	95
59		Black Hills Creek	2006	51
60		Steelhead Creek	2006	93
61	S. AK Peninsula	Chignik River	1995, 2006	75
62		Ayakulik River	1993, 2006	136
63		Karluk River	1993, 2006	140

Table 3-7 (continued) Chinook baseline collections used in analysis of bycatch mixtures for genetics studies (from Templin et al. 2008).

No.	Region	Location	Years	N
64	Cook Inlet	Deshka River	1995, 2005	251
65		Deception Creek	1991	67
66		Willow Creek	2005	73
67		Prairie Creek	1995	52
68		Talachulitna River	1995	58
69		Crescent Creek	2006	164
70		Juneau Creek	2005, 2006	119
71		Killey Creek	2005, 2006	266
72		Benjamin Creek	2005, 2006	205
73		Funny River	2005, 2006	220
74		Slikok Creek	2005	95
75		Kenai River (mainstem)	2003, 2004, 2006	302
76		Crooked Creek	1992, 2005	306
77		Kasilof River	2005	321
78		Anchor River	2006	200
79		Ninilchik River	2006	162
80	Upper Copper River	Indian River	2004, 2005	50
81		Bone Creek	2004, 2005	78
82		E. Fork Chistochina River	2004	145
83		Otter Creek	2005	128
84		Sinona Creek	2004, 2005	157
85	Lower Copper River	Gulkana River	2004	211
86		Mendeltna Creek	2004	144
87		Kiana Creek	2004	75
88		Manker Creek	2004, 2005	62
89		Tonsina River	2004, 2005	75
90		Tebay River	2004, 2005, 2006	68
91	Northern SE AK	Situk River	1988, 1990, 1991, 1992	143
92		Big Boulder Creek	1992, 1993, 1995, 2004	178
93		Tahini River	1992, 2004	169
94		Tahini River (LMH) Pullen Creek Hatchery	2005	83
95		Kelsall River	2004	96
96		King Salmon River	1989, 1990, 1993	144
97	Coast SE AK	King Creek	2003	143
98		Chickamin River	1990, 2003	56
99		Chickamin River - Little Port Walter	1993, 2005	126
100		Chickamin River - Whitman Lake Hatchery	1992, 1998, 2005	331
101		Humpy Creek	2003	94
102		Butler Creek	2004	95
103		Clear Creek	1989, 2003, 2004	166
104		Cripple Creek	1988, 2003	143
105		Genes Creek	1989, 2003, 2004	95
106		Kerr Creek	2003, 2004	151
107		Unuk River - Little Port Walter	2005	150
108		Unuk River - Deer Mountain Hatchery	1992, 1994	147
109		Keta River	1989, 2003	144
110		Blossom River	2004	95
111	Andrew Cr	Andrews Creek	1989, 2004	152
112		Crystal Lake Hatchery	1992, 1994, 2005	397
113		Medvejie Hatchery	1998, 2005	273
114		Hidden Falls Hatchery	1994, 1998	155
115		Macaulay Hatchery	2005	94
116	TBR Taku	Klukshu River	1989, 1990	174
117		Kowatua River	1989, 1990	144
118		Little Tatsemeanie River	1989, 1990, 2005	144
119		Upper Nahlin River	1989, 1990	130
120		Nakina River	1989, 1990	141
121		Dudidontu River	2005	86
122		Tahltan River	1989	95

Table 3-7 (continued) Chinook baseline collections used in analysis of bycatch mixtures for genetics studies (from Templin et al. 2008).

No.	Region	Location	Years	N
123	BC/WA/OR	Kateen River	2005	96
124		Damdochax Creek	1996	65
125		Kincolith Creek	1996	115
126		Kwinageese Creek	1996	73
127		Oweegee Creek	1996	81
128		Babine Creek	1996	167
129		Bulkley River	1999	91
130		Sustut	2001	130
131		Ecstall River	2001, 2002	86
132		Lower Kalum	2001	142
133		Lower Atnarko	1996	144
134		Kitimat	1997	141
135		Wannock	1996	144
136		Klinaklini	1997	83
137		Nanaimo	2002	95
138		Porteau Cove	2003	154
139		Conuma River	1997, 1998	110
140		Marble Creek	1996, 1999, 2000	144
141		Nitinat River	1996	104
142		Robertson Creek	1996, 2003	106
143		Sarita	1997, 2001	160
144		Big Qualicum River	1996	144
145		Quinsam River	1996	127
146		Morkill River	2001	154
147		Salmon River	1997	94
148		Swift	1996	163
149		Torpy River	2001	105
150		Chilko	1995, 1996, 1999, 2002	246
151		Nechako River	1996	121
152		Quesnel River	1996	144
153		Stuart	1997	161
154		Clearwater River	1997	153
155		Louis Creek	2001	179
156		Lower Adams	1996	46
157		Lower Thompson River	2001	100
158		Middle Shuswap	1986, 1997	144
159		Birkenhead Creek	1997, 1999, 2002, 2003	93
160		Harrison	2002	96
161		Makah National Fish Hatchery	2001, 2003	94
162		Forks	2005	150
163		Upper Skagit River	2006	93
164		Soos Creek Hatchery	2004	119
165		Lyons Ferry Hatchery	2002, 2003	191
166		Hanford Reach	2000, 2004, 2006	191
167		Lower Deschutes River	2002	96
168		Lower Kalama	2001	95
169		Carson Stock - Mid and Upper Columbia spring	2001	96
170		McKenzie - Willamette River	2004	95
171		Alsea	2004	93
172		Siuslaw	2001	95
173		Klamath	1990, 2006	52
174		Butte Creek	2003	96
175		Eel River	2000, 2001	88
176		Sacramento River - winter run	2005	95

Table 3-8 Maximum likelihood estimates (MLE) of the western Alaska subregional (Yukon, Kuskokwim, and Bristol Bay) stock composition of Chinook salmon in incidental catches by U.S. commercial groundfish fisheries in the eastern Bering Sea portion of the U.S. exclusive economic zone in 1997-1999 (from Myers et al. 2003). The estimates are summarized by (a) brood year (BY) 1991-1995 and (b) for the fishery area east of 170°W by fishery season, year, and age group. Fishery season: fall = July-December, winter = January-June. Numbers in parentheses are 95% confidence intervals (CI) derived from 1000 bootstrap runs (random sampling with replacement). An estimate of zero without a confidence interval indicates that the stock was not present and the data were re-analyzed without those baseline groups. Percentages represented by 0.0 are small numbers, less than 0.05 but greater than zero. Dashes indicate that no baseline data were available for that regional stock group.

Sample			Kamchatka		Yukon		Kuskokwim		Bristol Bay		Cook Inlet		SE Alaska		British Columbia	
Description	Age(s)	N	MLE	(95% CI)	MLE	(95% CI)	MLE	(95% CI)	MLE	(95% CI)	MLE	(95% CI)	MLE	(95% CI)	MLE	(95% CI)
(a) Summary by brood year:																
BY91	1.4-1.5	373	4.1	(0.0-10.0)	37.2	(17.2-56.1)	27.0	(4.4-47.4)	4.2	(0.0-12.1)	27.5	(18.3-37.5)	-	-	0	
BY92	1.3-1.5	530	6.0	(2.5-9.6)	29.7	(16.6-39.9)	5.5	(0.0-22.1)	21.0	(12.4-29.2)	33.4	(24.6-41.3)	-	-	4.4	(1.5-8.2)
BY93	1.2-1.4	1111	5.9	(3.0-9.5)	12.7	(4.0-23.2)	24.5	(11.4-37.3)	17.9	(11.1-25.3)	28.5	(21.8-34.1)	8.5	(5.7-11.2)	2.0	(0.0-4.1)
BY94	1.1-1.3	762	0		20.2	(12.3-30.4)	0		41.7	(33.9-49.7)	30.0	(20.5-37.5)	8.1	(5.1-11.8)	-	-
BY95	1.1-1.2	481	4.4	(0.1-10.2)	12.2	(4.2-20.7)	15.8	(6.7-24.1)	10.6	(0.0-28.1)	41.9	(28.4-52.4)	15.1	(9.2-22.0)	-	-
(b) Summary for the fishery area east of 170°W by fishery season, year, and age group:																
Fall 1998	1.1	134	0		6.1	(0-15.0)	3.9	(0-9.4)	0		57.7	(37.1-74.8)	32.3	(16.5-47.9)	-	-
Fall 1997	1.2	286	3.8	(0.0-8.7)	0.0	(0-13)	16.1	(1.7-25.4)	17.6	(9.5-28.5)	49.2	(37.1-58.5)	8.5	(3.7-14.5)	4.8	(0.2-10.5)
Fall 1998	1.2	249	0		10.2	(2.5-21.4)	0		41.4	(29.8-51.6)	38.7	(25.5-50.2)	9.7	(4.7-16.2)	-	-
Fall 1999	1.2	222	5.8	(0.0-12.9)	13.0	(2.0-25.3)	18.3	(5.6-33.3)	27.2	(4.5-50.2)	31.3	(16.3-44.7)	4.4	(0.0-9.8)	-	-
Winter 1997	1.3	240	5.7	(1.5-10.4)	24.6	(10.2-38.3)	5.9	(0.0-27.6)	28.0	(14.5-39.5)	30.0	(18.2-40.8)	-	-	5.8	(1.3-11.3)
Winter 1998	1.3	428	4.6	(0.8-9.7)	23.1	(11.2-36.9)	22.8	(6.7-38.8)	17.3	(8.8-27.3)	18.2	(9.9-26.4)	11.9	(7.5-16.3)	2.1	(0-6.3)
Winter 1999	1.3	279	0		34.7	(23.0-47.4)	0		37.6	(27.4-47.8)	18.5	(8.9-28.3)	9.2	(5.3-13.5)	-	-
Winter 1997	1.4	327	3.9	(0.0-9.7)	34.6	(14.8-53.7)	28.4	(6.8-48.9)	4.7	(0.0-13.4)	28.4	20.3-34.6)	-	-	0	
Winter 1998	1.4	178	10.9	(3.8-18.6)	35.0	(17.4-49.9)	12.8	(0.0-34.9)	10.1	(0.0-21.0)	31.2	(19.3-41.9)	-	-	0	
Winter 1999	1.4	122	22.0	(9.1-36.4)	9.9	(0.0-31.2)	32.2	(8.6-50)	2.9	(0-13.5)	28.2	(11.2-44.4)	4.8	(0-10.4)	0	

Table 3-9 ADF&G preliminary estimates of stock composition based on genetic samples stratified by year, season, and region (SE=east of 170°W, NW=west of 170°W). Standard errors of the estimates are shown in parentheses and were used to evaluate uncertainty of stock composition. Source: Seeb et al. 2008.

Year / Season / Area	PNW	Coast W AK	Cook Inlet	Middle Yukon	N AK Penin	Russia	TBR	Upper Yukon	Other
2005 B SE	45.3%	34.2%	5.3%	0.2%	8.8%	0.6%	3.3%	0.0%	2.4%
N = 282	(0.032)	(0.032)	(0.019)	(0.003)	(0.021)	(0.005)	(0.016)	(0.001)	(0.015)
2005 B NW	6.5%	70.9%	2.2%	4.7%	6.7%	2.0%	3.5%	2.8%	0.7%
N = 489	(0.012)	(0.047)	(0.011)	(0.013)	(0.042)	(0.007)	(0.012)	(0.009)	(0.008)
2006 B SE	38.4%	37.2%	7.5%	0.2%	7.0%	0.6%	4.3%	0.1%	4.7%
N = 304	(0.029)	(0.032)	(0.020)	(0.004)	(0.019)	(0.005)	(0.017)	(0.002)	(0.020)
2006 B NW	6.4%	67.3%	3.0%	8.0%	2.1%	3.3%	0.5%	8.0%	1.4%
N = 286	(0.016)	(0.035)	(0.020)	(0.020)	(0.016)	(0.013)	(0.007)	(0.019)	(0.014)
2006 A All	22.9%	38.2%	0.2%	1.1%	31.2%	1.1%	1.1%	2.3%	1.9%
N = 801	(0.015)	(0.038)	(0.004)	(0.005)	(0.039)	(0.004)	(0.007)	(0.006)	(0.011)
2007 A All	9.4%	75.2%	0.1%	0.5%	12.0%	0.2%	0.1%	0.1%	2.4%
N = 360	(0.016)	(0.031)	(0.004)	(0.005)	(0.025)	(0.003)	(0.002)	(0.003)	(0.014)

Table 3-10 NMFS regional office estimates of Chinook salmon bycatch in the pollock fishery compared to genetics sampling levels by season and region, 2005-2007 (SE=east of 170°W, NW=west of 170°W).

			Area			Area	
		Season	SE	NW	Total	SE	NW
Bycatch	2005	B	26,425	13,793	40,217	66%	34%
	2006	B	21,922	2,484	24,405	90%	10%
	2006	A			58,753		
	2007	A			69,261		
Genetic Samples	2005	B	489	282	771	63%	37%
	2006	B	286	304	590	48%	52%
	2006	A			801		
	2007	A			360		

Table 3-11 Mean values of catch-weighted stratified proportions of stock composition based on genetic sampling by season, and region (SE=east of 170°W, NW=west of 170°W). Standard errors of the estimates (in parentheses) were derived from 200 simulations based on the estimates from Table 3-9 and weighting annual results as explained in the text.

Season / Area	PNW	Coast W AK	Cook Inlet	Middle Yukon	N AK Penin	Russia	TBR	Upper Yukon	Other
B SE	45.0%	34.7%	5.1%	0.1%	8.6%	0.6%	3.4%	0.0%	2.4%
	(0.025)	(0.024)	(0.017)	(0.002)	(0.016)	(0.004)	(0.014)	(0.001)	(0.014)
B NW	6.4%	68.9%	2.6%	6.6%	4.4%	2.7%	1.8%	5.6%	1.0%
	(0.010)	(0.023)	(0.012)	(0.011)	(0.019)	(0.007)	(0.006)	(0.012)	(0.008)
A All	12.1%	67.7%	0.1%	0.6%	16.0%	0.4%	0.2%	0.6%	2.3%
	(0.012)	(0.021)	(0.003)	(0.004)	(0.019)	(0.002)	(0.002)	(0.003)	(0.010)

Table 3-12 Comparison of stock composition estimates for three different studies on Chinook bycatch samples taken from trawl fisheries in the eastern Bering Sea.

Study		Myers and Rogers (1988)			Myers et al (2003)			Seeb et al. 2008		
Years sampled		1979-1982			1997-1999			2005-2007[1]		
Stocks and estimated aggregate % composition in bycatch	Western AK	60%			56%					
		Yukon	Bristol Bay	Kusko-kwim	Yukon	Bristol Bay	Kusko-kwim			
		17%	29%	24%	40%	34%	26%			
Smaller scale breakouts (where available) listed to the right (with associated % contrib. of aggregate below)	Coastal WAK							48%		
								Lower Yukon	Kuskokwim	Bristol Bay
								Na	Na	Na
	Middle Yukon							3%		
	Upper Yukon							3%		
	NAK Penin							13%		
	Cook Inlet	17%			31%			4%		
	SEAK/Can	9%			8%					
	TBR							2%		
	PNW[2]							23%		
	Russia	14%			5%			2%		
	Other[3]							3%		

[1]note for purposes of comparison, only 2006 stock composition estimates *averaged annually and across regions* are shown here.

[2]PNW is an aggregate of over 150 stocks from British Columbia, Washington, Oregon and California. For a full list of stocks included see Table 3-7

[3]'other' is comprised of minor components after aggregation to major river systems as described in Table 3-7.

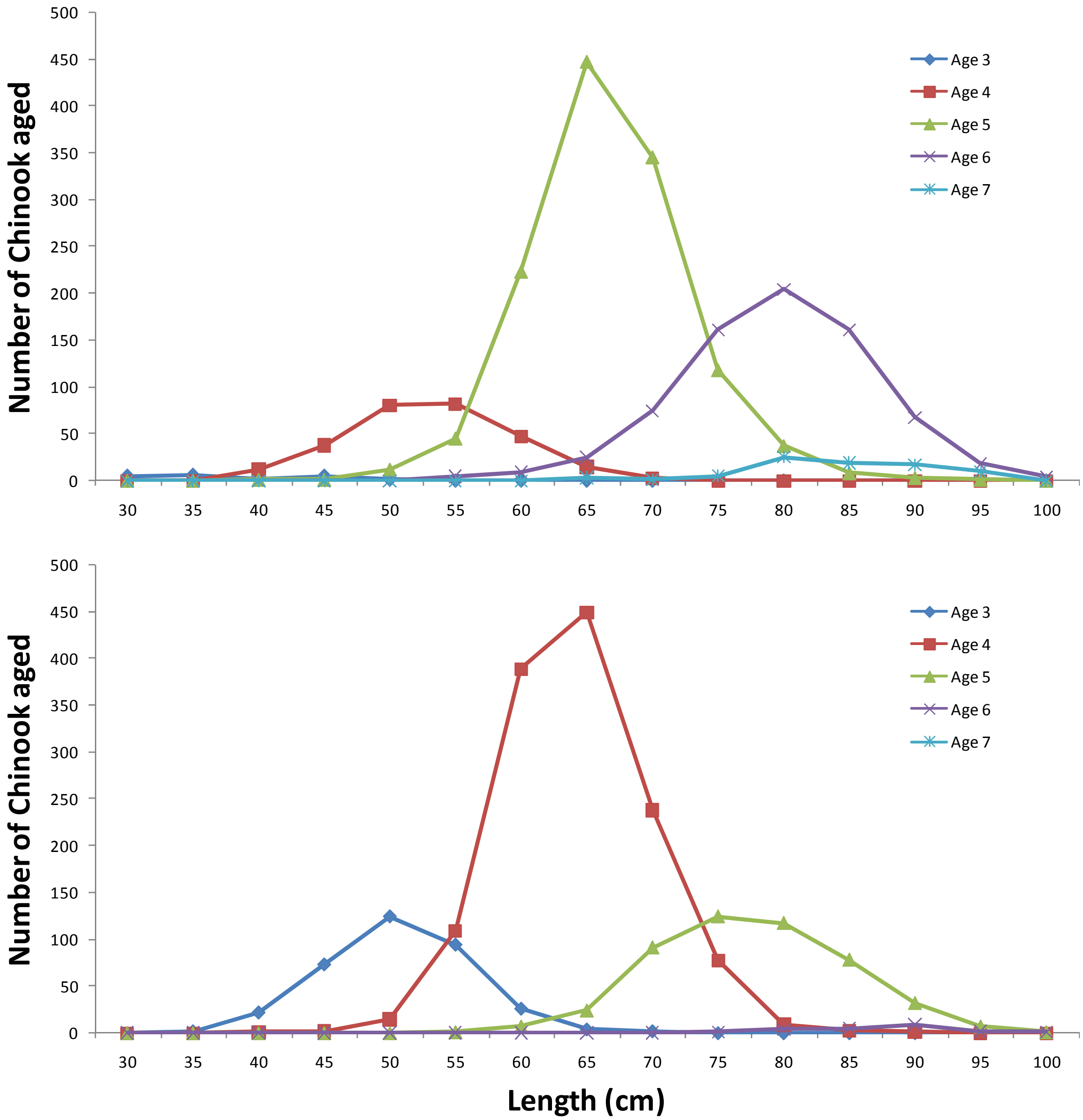

Fig. 3-1 Summary distribution of age samples by length collected by the NMFS groundfish observer program during 1997-1999 and analyzed by University of Washington scientists (Myers et al. (2003) for the A-season (top panel) and B season (bottom panel).

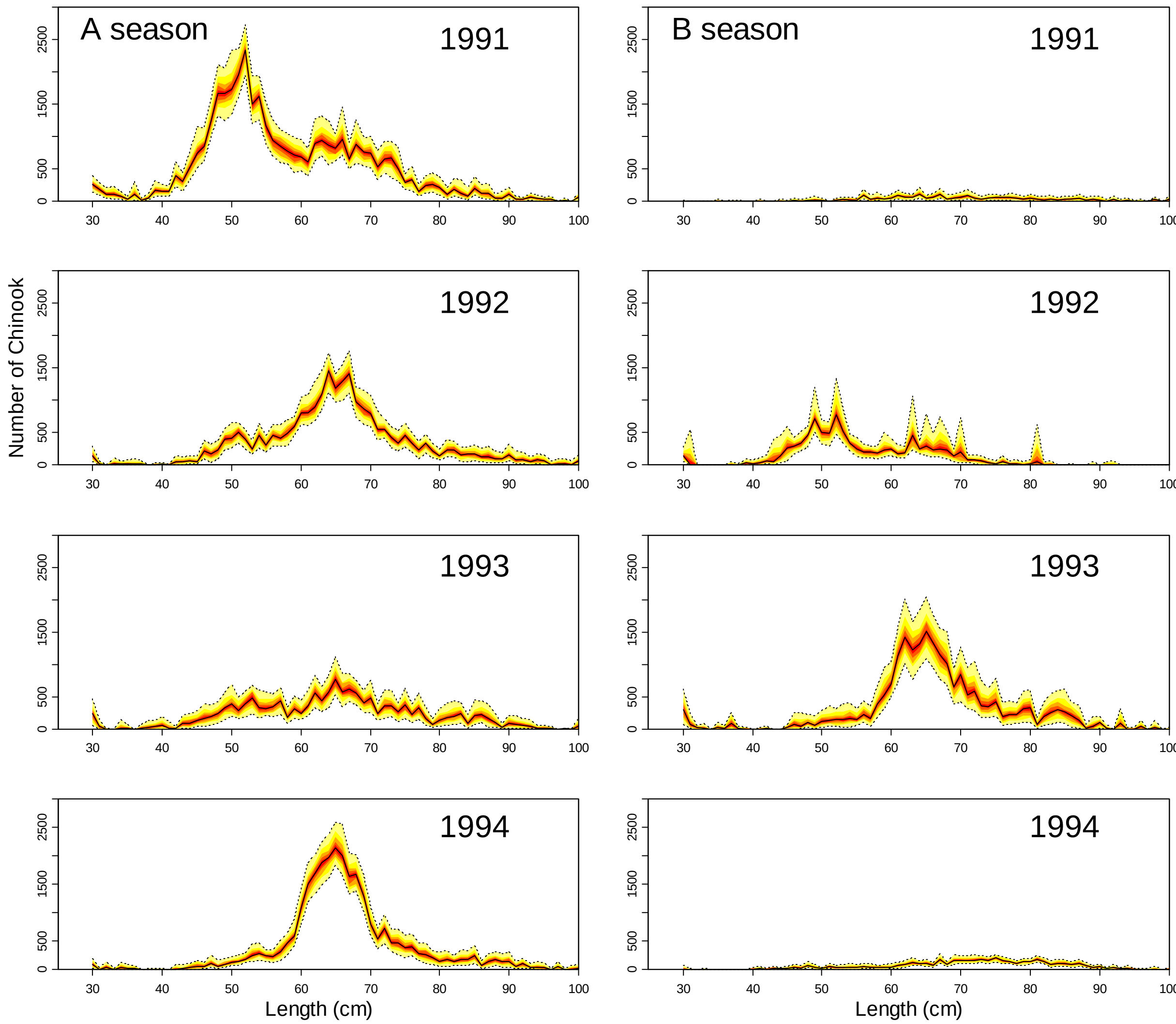

Fig. 3-2 Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

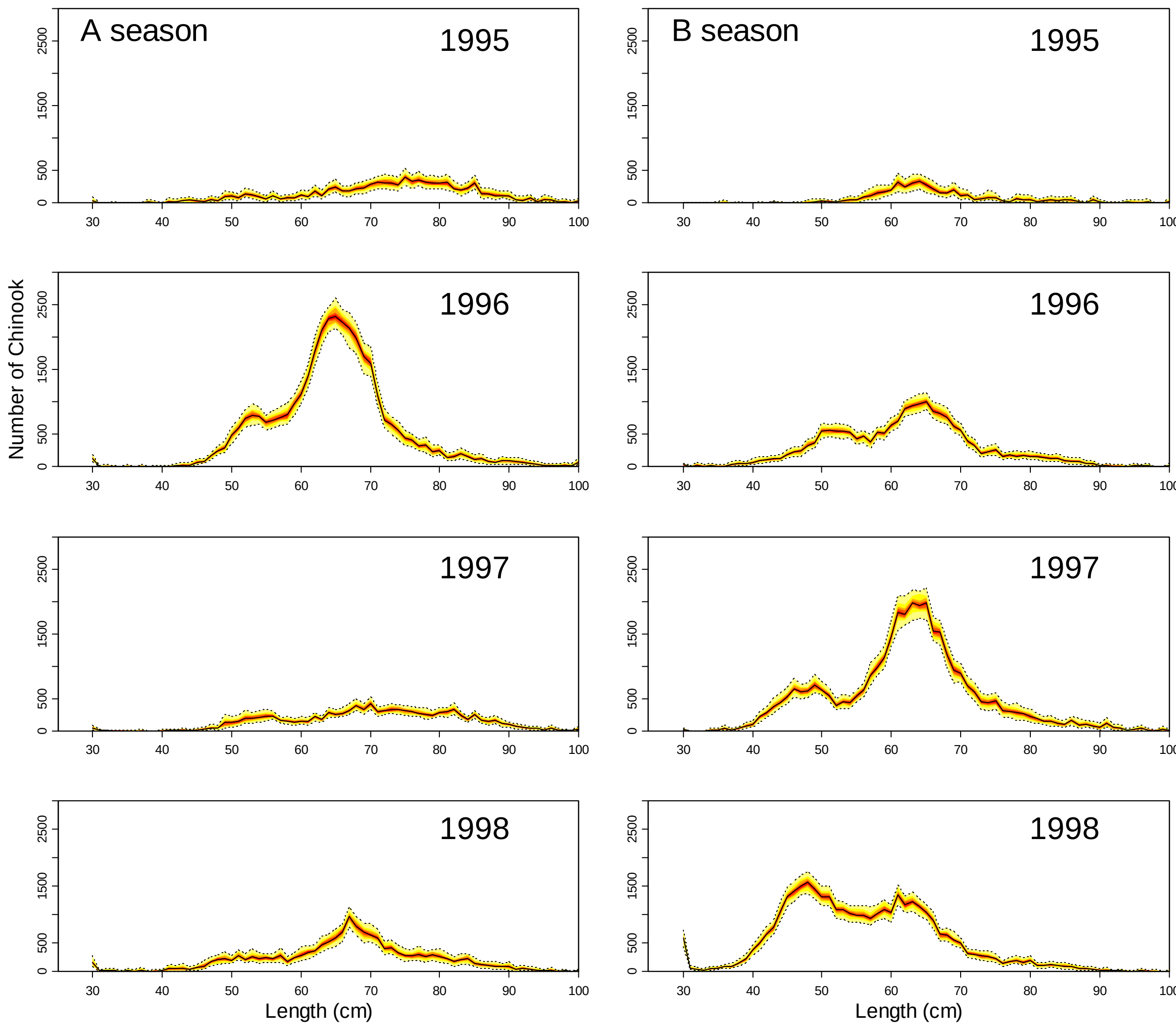

Fig. 3-2 (continued) Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

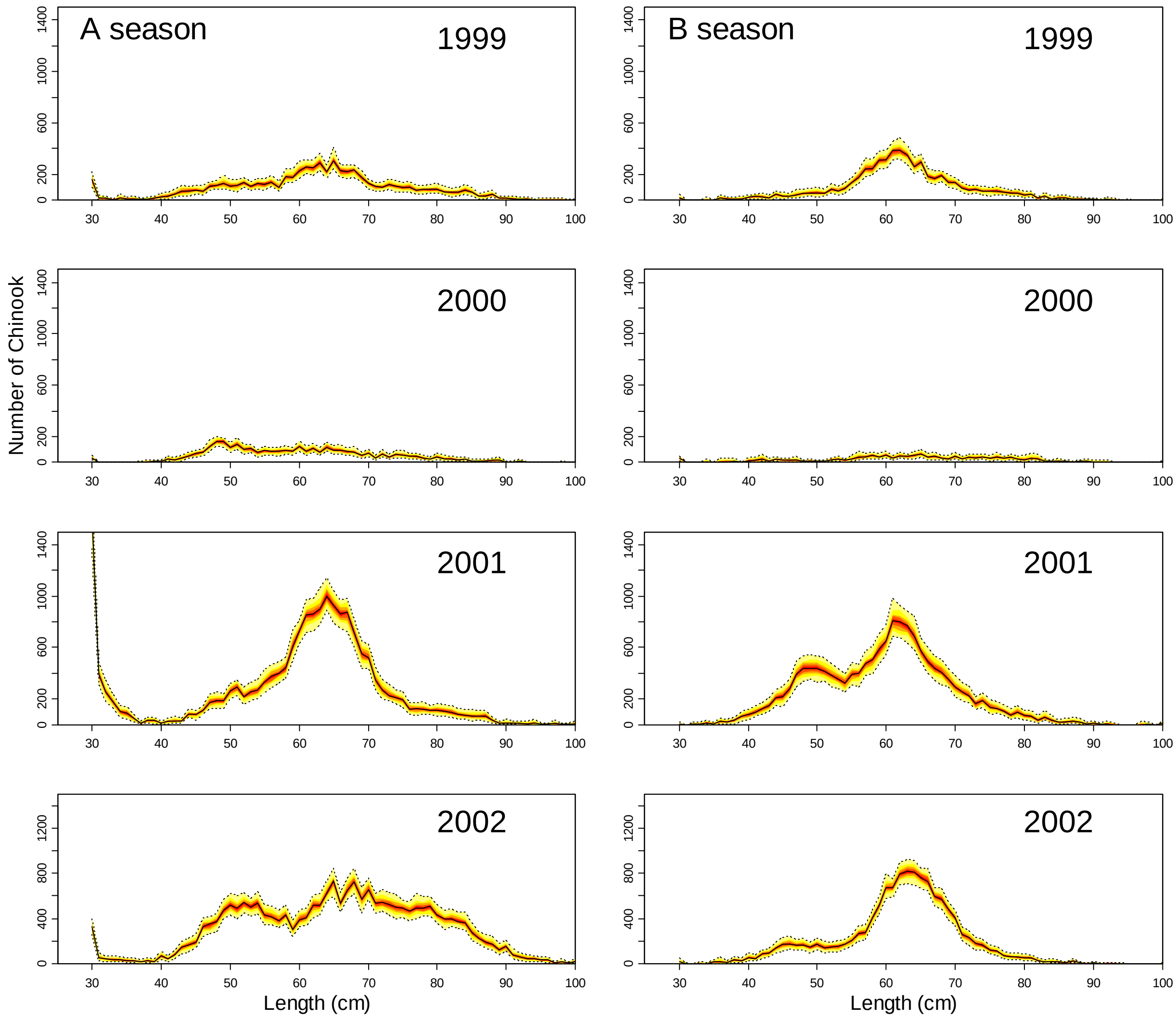

Fig. 3-2 (continued) Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

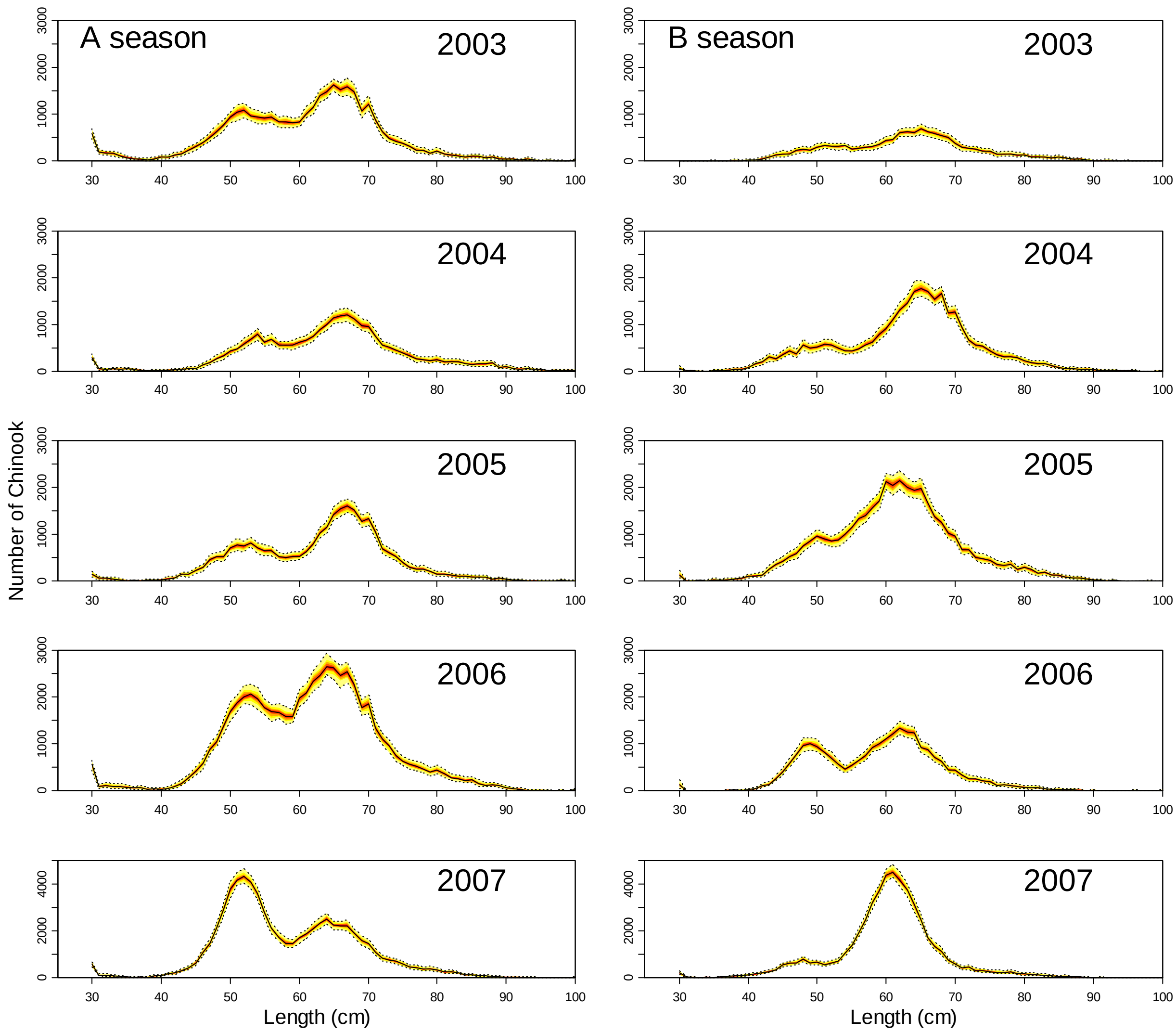

Fig. 3-2 (continued) Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

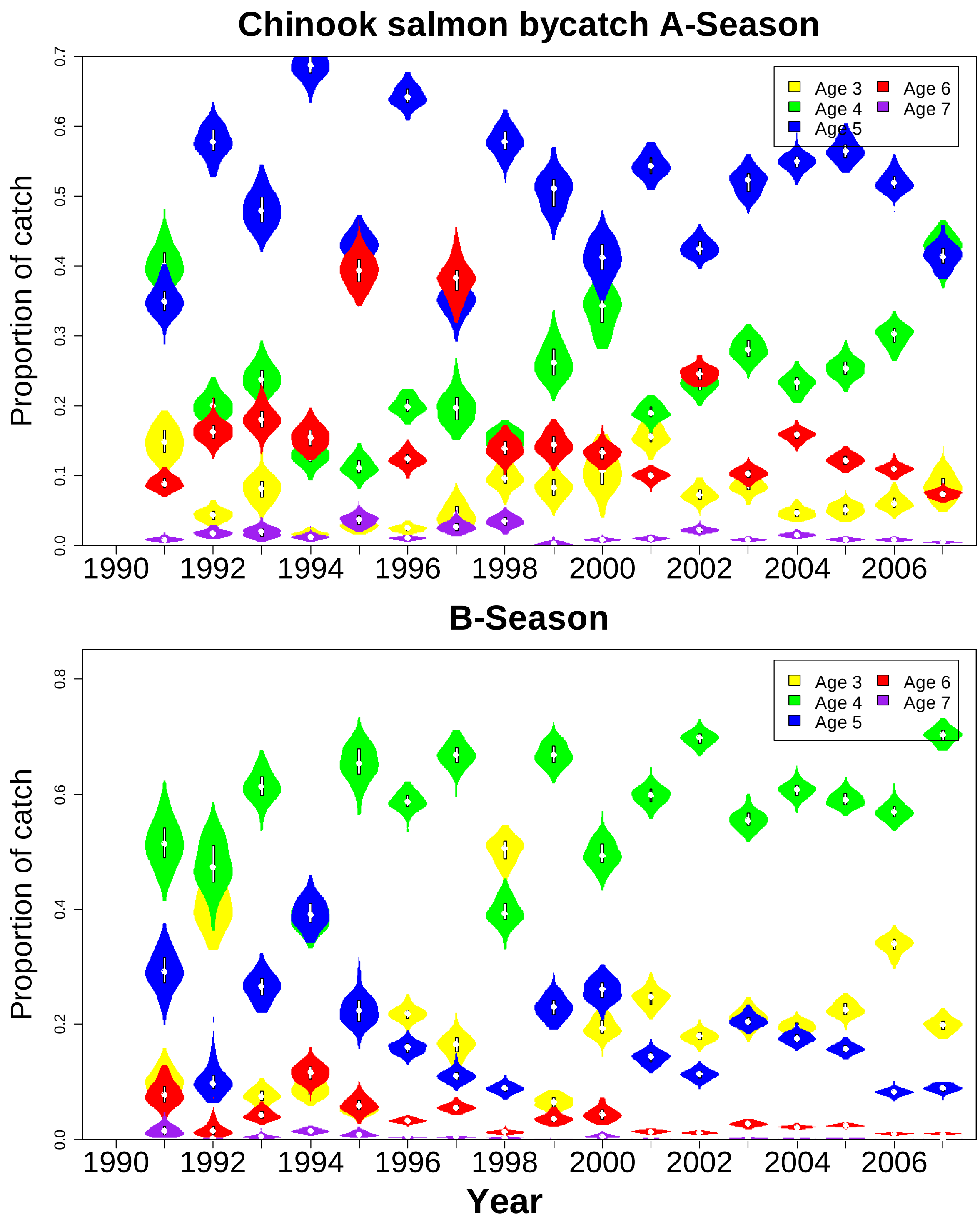

Fig. 3-3 Chinook salmon bycatch age composition by year and A-season (top) and B-season (bottom). Vertical spread of blobs represent uncertainty as estimated from the two-stage bootstrap re-sampling procedure.

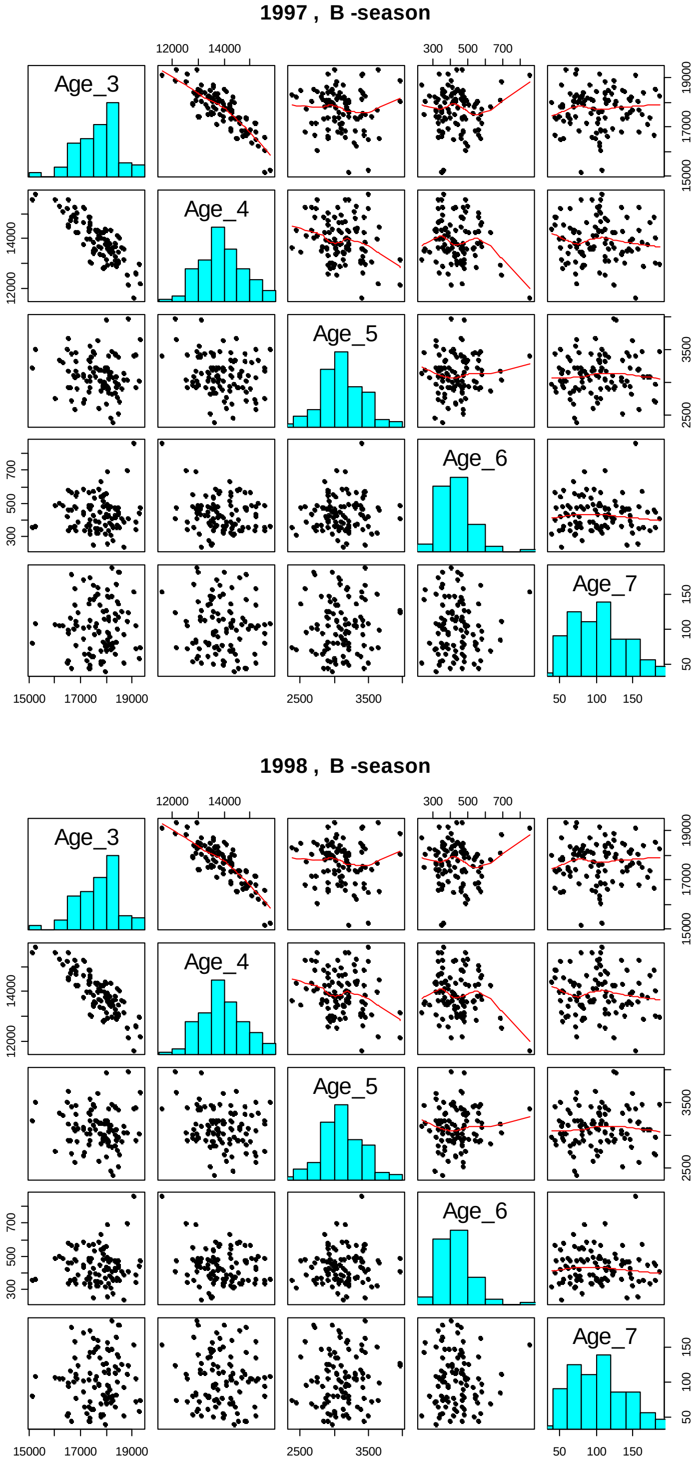

Fig. 3-4 Bootstrap estimates of Chinook salmon bycatch example showing correlation of bycatch at different ages for the B-season in 1997 (top) and 1998 (bottom).

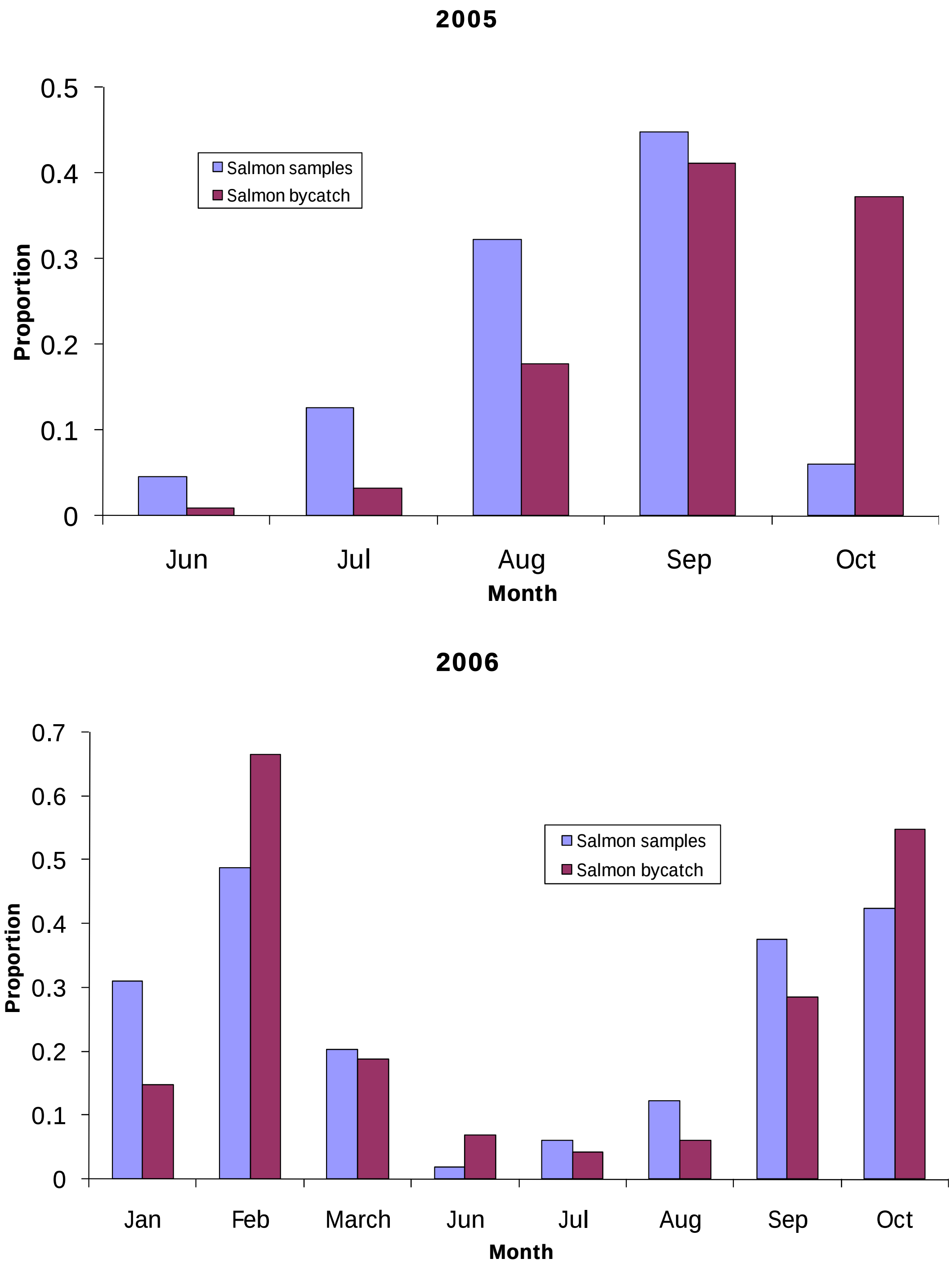

Fig. 3-5 Proportion of Chinook salmon samples collected for genetics compared to the proportion of bycatch by month for 2005 B-season only (top panel) and 2006 A and B season combined (bottom panel).

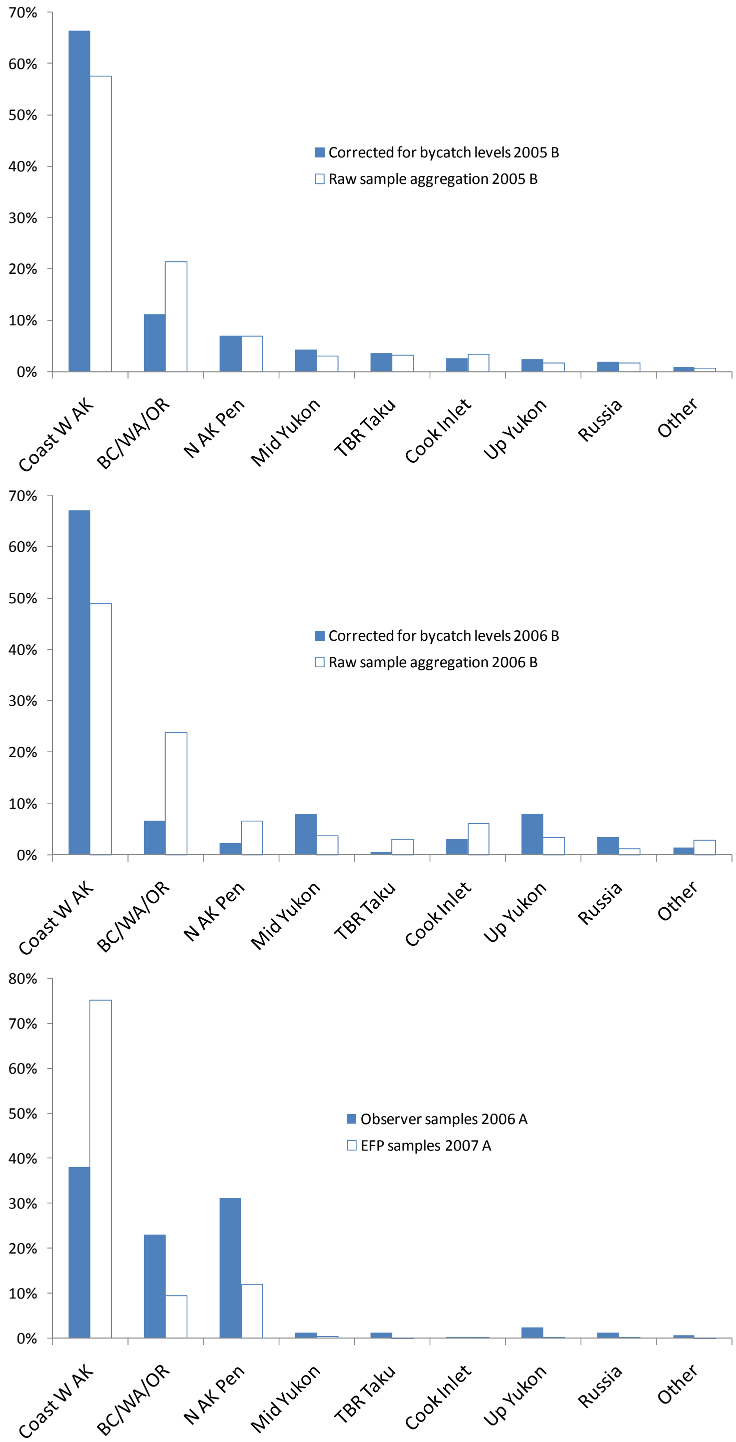

Fig. 3-6 Chinook salmon bycatch results by reporting region for 2005 B season (top), 2006 B season (middle), and the 2006 and (partial sample) of 2007 A seasons (bottom). The top two panels include uncorrected results where bycatch differences between regions (east and west of 170°W) are ignored (empty columns).

3.3.3 Estimating adult equivalence

The impact of bycatch on salmon runs is the primary output statistic. This measure relates the historical bycatch levels relative to the subsequent returning salmon run *k* in year *t* as:

$$u_{t,k} = \frac{C_{t,k}}{C_{t,k} + S_{t,k}} \qquad (1)$$

where $C_{t,k}$ and $S_{t,k}$ are the bycatch and stock size (run return) estimates of the salmon species in question. The calculation of $C_{t,k}$ includes the bycatch of salmon returning to spawn in year *t* and the bycatch from previous years for the same brood year (i.e., at younger, immature ages). This latter component needs to be decremented by ocean survival rates and maturity schedules. This sum of catches (at earlier ages and years) can thus be represented as:

$$C_{t,k} = \sum_{a=1}^{A} c_{i,a,k}\, s_a \gamma_{a,k} \qquad i = t - A + a \qquad (2)$$

where $c_{i,a,k}$ is the catch of age *a* fish in year *i*, *A* is the oldest age of their ocean phase, $s_{i,a,k}$ is the proportion of salmon surviving from age *a* to *a+1*, and $\gamma_{a,k}$ is the proportion of salmon at sea that will return to spawn at age *a*. Maturation rates vary over time and among stocks detailed information on this is available from a wide variety of sources. For the purpose of this study, an average over putative stocks was developed based on a variety of studies (Table 3-13).

To carry out the computations in a straightforward manner, the numbers of salmon that remain in the ocean (i.e., they put off spawning for at least another year) are tracked through time until age 7 where for this model, all Chinook in the ocean at that age are considered mature and will spawn in that year.

Stochastic versions of the adult equivalence calculations acknowledge both run-size inter-annual variability and run size estimation error, as well as uncertainty in maturation rates, the natural mortality rates (oceanic), river-of-origin estimates, and age assignments. The variability in run size can be written as (with $\dot{S}_{t,k}$ representing the stochastic version of $S_{t,k}$):

$$\dot{S}_{t,k} = \overline{S}_k e^{\varepsilon_t + \delta_t} \qquad \varepsilon_t \sim N\left(0, \sigma_1^2\right), \quad \delta_t \sim N\left(0, \sigma_2^2\right) \qquad (3)$$

where σ_1^2, σ_2^2 are specified levels of variability in inter-annual run sizes and run-size estimation variances, respectively.

The stochastic survival rates were simulated as:

$$\dot{s}_{a,k} = 1 - \exp\left(-M_a + \delta\right), \qquad \delta \sim N\left(0, 0.1^2\right) \qquad (4)$$

whereas the maturity in a given year and age was drawn from beta-distributions:

$$\dot{\gamma}_{a,k} \sim B\left(\alpha_a, \beta_a\right) \qquad (5)$$

with parameters α_a, β_a specified to satisfy the expected value of age at maturation (Table 3-13) and a pre-specified coefficient of variation term (provided as model input).

Similarly, the parameter responsible for assigning bycatch to river-system of origin was modeled using a combination of years and "parametric bootstrap" approach, also with the beta distribution:

$$\dot{p}_k \sim B\left(a_k, b_k\right) \qquad (6)$$

again with α_a, β_a specified to satisfy the expected value the estimates and variances shown in Table 3-9. For the purposes of this study, the estimation uncertainty is considered as part of the inter-annual variability in this parameter. The steps (implemented in a spreadsheet) for the AEQ analysis can be outlined as follows:

1. Select a bootstrap sample of salmon bycatch-at-age ($\phi_{t,a}$) for all years and strata;
2. Sum the bycatch-at-age for each year and proceed to account for year-of-return factors (e.g., stochastic maturation rates and ocean survival (Eqs. 2-5);
3. Partition the bycatch estimates to stock proportions (by year and area) drawn randomly from each parametric bootstrap;
4. Sum over all bycatch years and compare with run-size estimates for impact rate calculations;
5. Repeat 1-3 200 times;
6. Based on updated genetics results, assign to river of origin components ($\dot{p}_k$, Eq. 6).
7. Compile results over all years and compute frequencies from which relative probabilities can be estimated;

Sensitivity analyses on maturation rates by brood year were conducted and contrasted with alternative assumptions about natural mortality schedules during their oceanic phase as follows:

Model	3	4	5	6	7
1 - None	0.0	0.0	0.0	0.0	0.0
2 - Variable	0.3	0.2	0.1	0.05	0.0
3 - Constant	0.2	0.2	0.2	0.2	0.0

The pattern of bycatch relative to AEQ is variable and relatively insensitive to mortality assumptions (Fig. 3-9). Notice that in some years, the bycatch records may be below the actual AEQ due to the lagged impact of previous years catches (e.g., in 1999 and 2000). A similar result would be predicted for AEQ model results in 2008 regardless of actual bycatch levels in this year due to the cumulative effect of bycatch prior to 2008, and particularly the impact of bycatch levels in 2007 as that will continue to impact the AEQ (and thus subsequent returns to river systems) for several years.

Overall, the estimate of AEQ Chinook mortality from 1994-2007 ranged from about 15,000 fish to over 78,000 with the largest contribution of the mortality comprised of stocks in the coastal west-Alaska (Table 3-14). Note however that these results are based on the assumption that the genetics findings from the 2005-2007 data represent the historical pattern of bycatch stock composition (by strata).

Evaluations of alternative Chinook salmon caps were done based on re-casting historical catch levels as if a cap proposal had been implemented. Since the alternatives all have specific values by season and sector, the effective limit on Chinook bycatch levels can vary for each alternative and over different years. This is caused by the distribution of the fleet relative to the resource and the variability of bycatch rates by season and years. To capture the effect of an alternative policy, the 2003-2007 mean "effective" cap for each alternative was computed, and used as the seasonal limit for evaluation purposes (Table 3-15). These values were then used in the AEQ simulation model as season-specific caps. This means that the minimum of the historical season-specific bycatch and the effective cap level given in Table 3-15 was applied for estimating the AEQ for each policy.

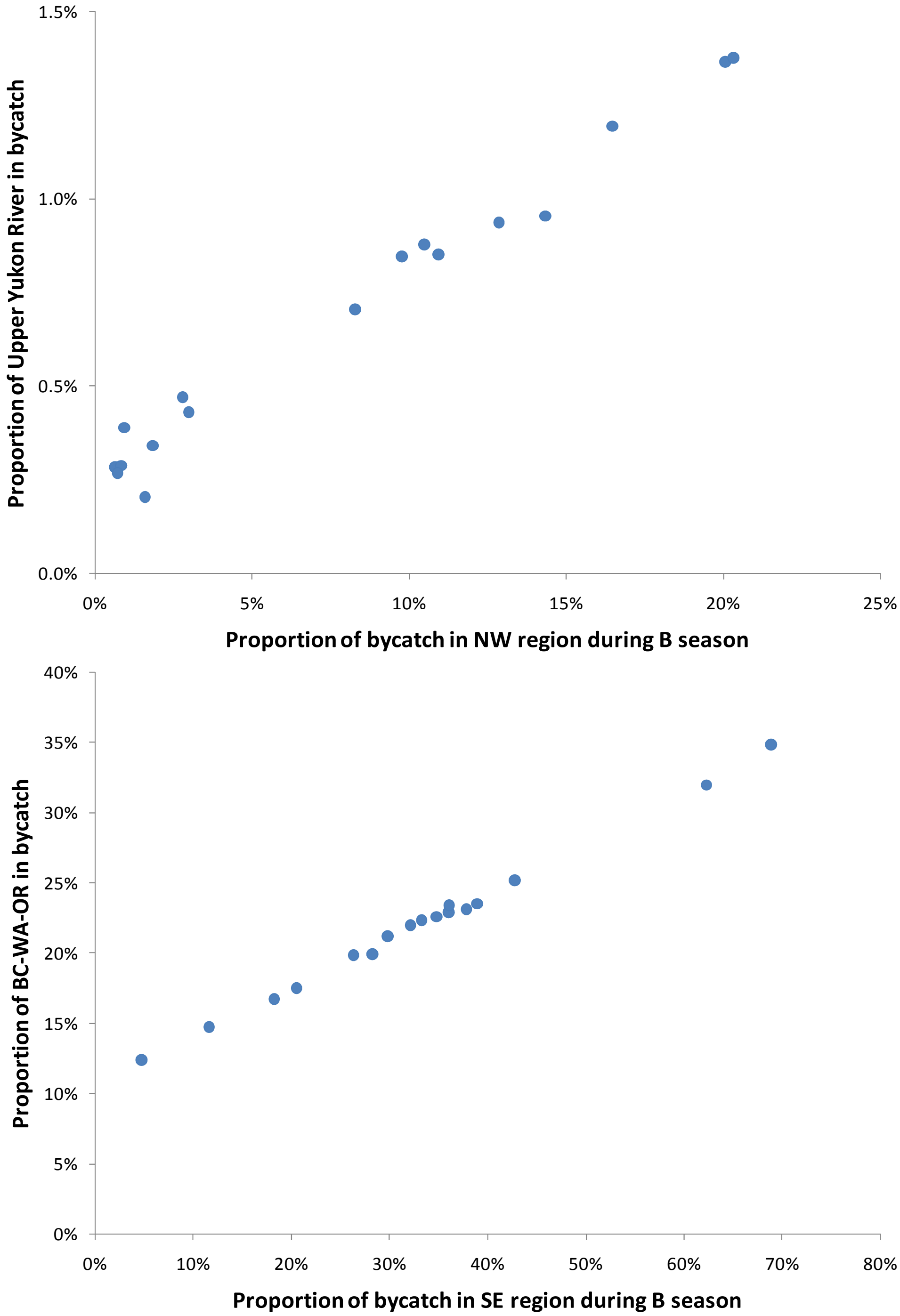

Fig. 3-7 Figure showing how the overall proportion of Upper Yukon River relates to the bycatch proportion that occurs in the NW region (west of 170°W; top panel) and how the proportion of the BC-WA-OR (PNW) relates to the SE region (east of 170°W; bottom panel) during the summer-fall pollock fishery, 1991-2007.

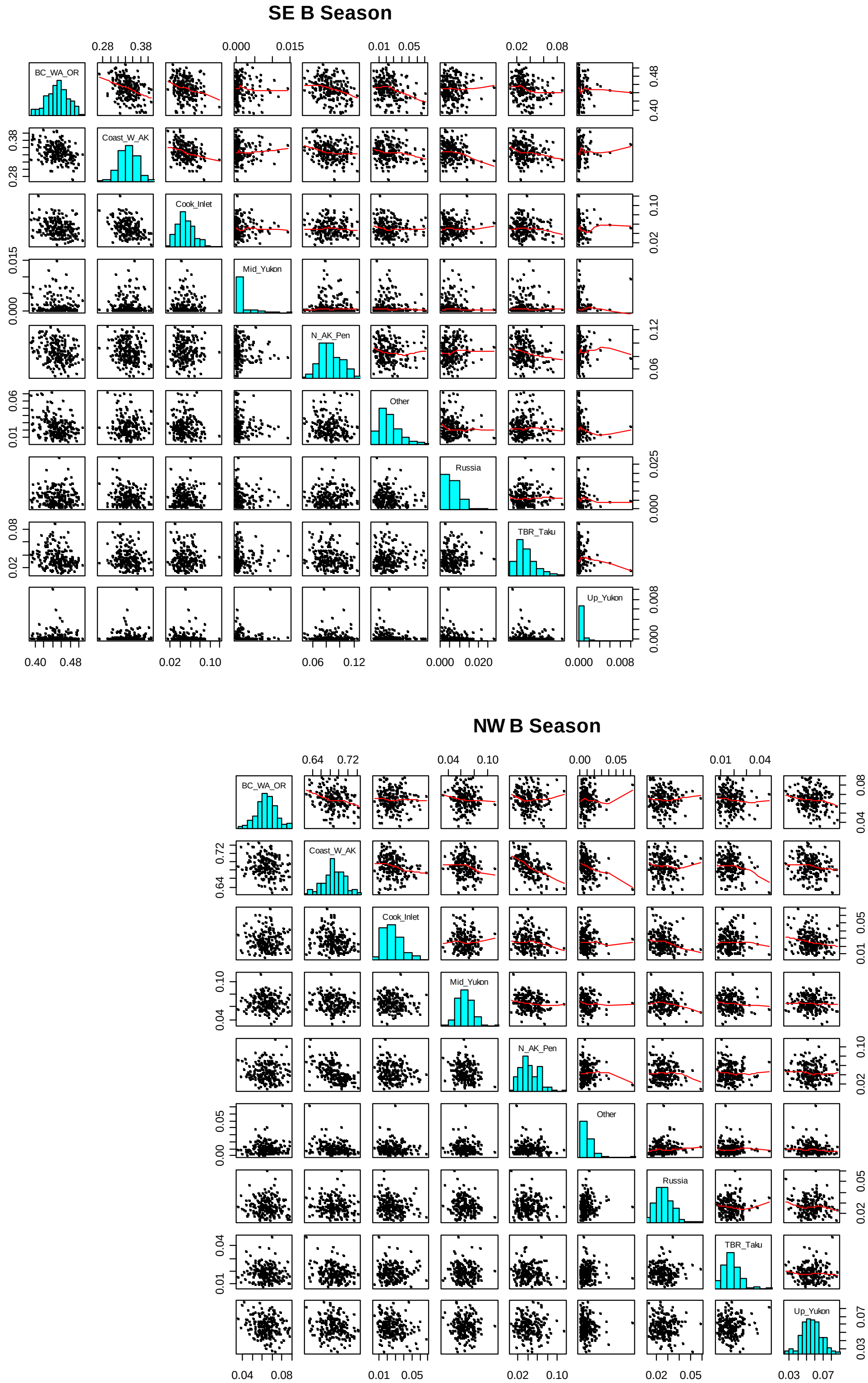

Fig. 3-8 Simulated Chinook salmon stock proportion by region for the B season based on reported standard error values from ADF&G analyses and assuming that the 2006 data has better coverage and is hence weighted 2:1 compared to the 2005 B-season data.

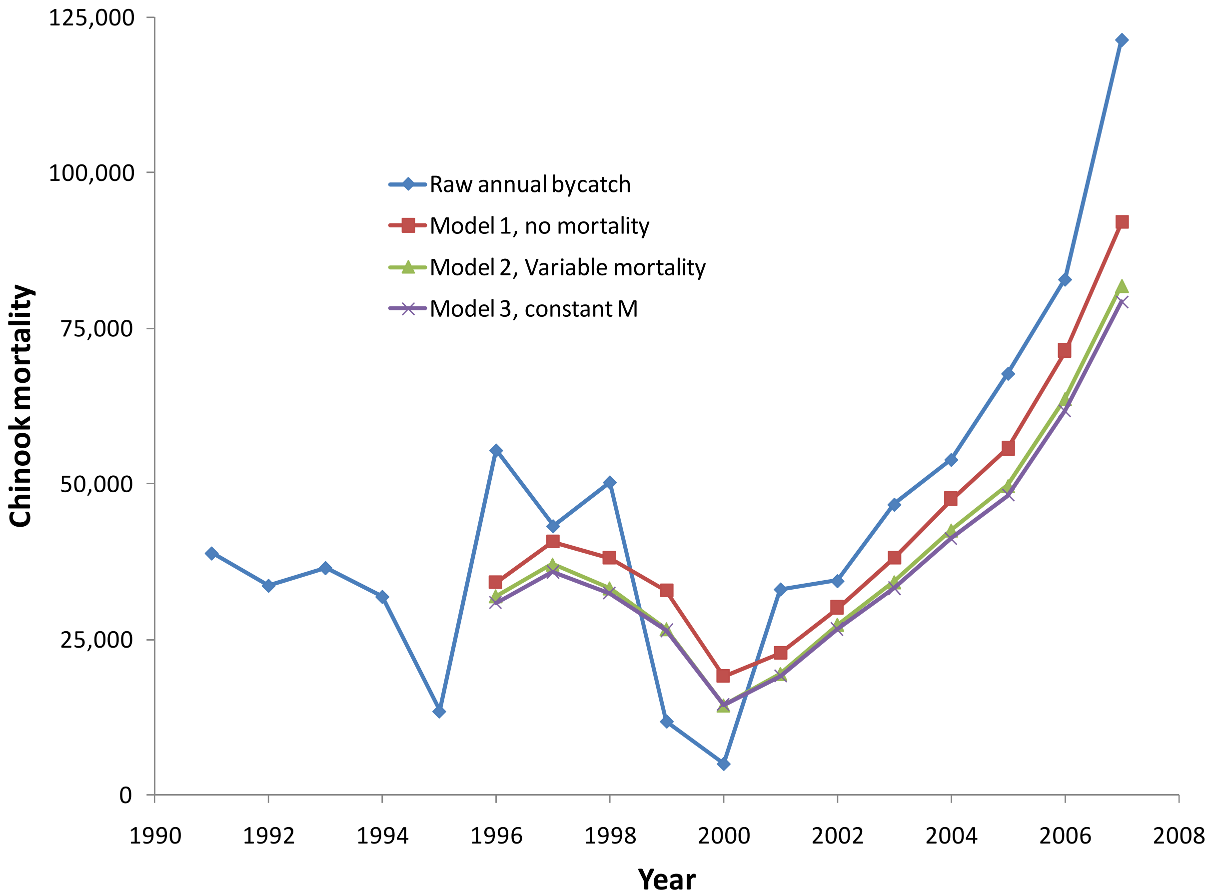

Fig. 3-9 Time series of Chinook adult equivalent bycatch from the pollock fishery, 1991-2007 compared to the annual totals under different assumptions about ocean mortality rates.

Table 3-13 Range of estimated mean age-specific maturation by brood year used to compute adult equivalents. The weighted mean value is based on the relative Chinook run sizes between the Nushagak and Yukon Rivers since 1997. *Sources: Healey 1991, Dani Evenson (ADF&G pers. comm.), Rishi Sharma (CRITFC, pers. comm.).*

	Weight	Age 3	Age 4	Age 5	Age 6	Age 7
Yukon	2.216	1%	13%	32%	49%	5%
Nushagak since 82	1.781	1%	21%	38%	39%	2%
Nushagak since 66	0	0%	17%	36%	43%	3%
Goodnews	0	0%	20%	31%	45%	4%
SE Alaska (TBR)	0.3	0%	18%	40%	37%	5%
BC, WA, OR, & CA	0.7	3%	28%	53%	14%	1%
Weighted mean		1%	18%	37%	40%	3%

Table 3-14 Median values of stochastic simulation results of AEQ Chinook mortality attributed to the pollock fishery by region, 1994-2007. These simulations include stochasticity in natural mortality (Model 2, CV=0.1), bycatch age composition (via bootstrap samples), maturation rate (CV=0.1), and stock composition (as detailed above). NOTE: these results are based on the assumption that the genetics findings from the 2005-2007 data represent the historical pattern of bycatch stock composition (by strata).

	BC, WA, OR, and CA	Coastal W. AK	Cook Inlet	Middle Yukon	N. Alaska Peninsula	Other	Russia	Upper Yukon	TBR (SE)	Total
1994	5,198	21,518	242	201	4,898	714	147	194	198	33,310
1995	5,635	14,084	415	104	3,302	532	112	96	279	24,559
1996	6,974	17,025	520	154	3,939	632	142	137	364	29,886
1997	11,376	16,895	1,276	413	3,364	715	277	343	783	35,442
1998	10,967	14,218	1,110	103	3,382	696	165	87	711	31,439
1999	6,429	15,099	573	297	3,193	561	188	245	387	26,973
2000	2,815	9,383	219	167	2,106	330	99	147	152	15,418
2001	3,694	10,473	349	260	2,141	375	149	221	238	17,899
2002	6,236	14,516	509	106	3,467	609	117	96	341	25,997
2003	5,743	20,065	398	356	4,424	679	207	311	292	32,475
2004	10,164	21,904	1,018	466	4,592	859	305	393	685	40,386
2005	11,169	25,462	1,203	767	5,107	923	439	645	772	46,487
2006	12,719	36,337	892	363	8,355	1,348	290	339	633	61,275
2007	18,079	44,380	1,597	694	9,743	1,688	485	608	1,069	78,344

Table 3-15 Chinook salmon effective bycatch "caps" in the pollock fishery by season (A and B) based on average values of the caps (if they occurred) had they been applied from 2003-2007.

Cap, A/B, sector	A season	B season	Total
PPA Scenario 1 w/ transfer	46,561	20,372	66,933
PPA Scenario 1 w/o transfer	44,974	20,372	65,346
PPA Scenario 2 w/ transfer	33,010	13,500	46,510
PPA Scenario 2 w/o transfer	31,809	13,500	45,309
87,500 50/50 opt2a	31,950	32,844	64,793
87,500 50/50 opt2d	36,899	28,791	65,690
87,500 58/42 opt1	44,118	20,321	64,439
87,500 58/42 opt2a	41,653	30,463	72,116
87,500 58/42 opt2d	42,234	24,258	66,492
87,500 70/30 opt1	49,368	16,277	65,644
87,500 70/30 opt2a	44,665	18,427	63,092
87,500 70/30 opt2d	55,376	17,815	73,191
68,100 50/50 opt1	27,784	18,272	46,056
68,100 50/50 opt2a	26,459	28,264	54,723
68,100 50/50 opt2d	25,196	24,258	49,455
68,100 58/42 opt1	29,569	17,581	47,150
68,100 58/42 opt2a	28,587	21,247	49,834
68,100 58/42 opt2d	32,676	19,997	52,674
68,100 70/30 opt1	41,021	13,253	54,274
68,100 70/30 opt2a	35,980	15,495	51,475
68,100 70/30 opt2d	42,234	14,640	56,874
48,700 50/50 opt1	19,292	16,196	35,488
48,700 50/50 opt2a	18,053	17,439	35,493
48,700 50/50 opt2d	21,242	16,725	37,966
48,700 58/42 opt1	21,142	13,253	34,394
48,700 58/42 opt2a	19,592	15,495	35,087
48,700 58/42 opt2d	23,610	14,640	38,250
48,700 70/30 opt1	27,784	10,225	38,009
48,700 70/30 opt2a	26,459	12,262	38,721
48,700 70/30 opt2d	25,196	11,612	36,809
29,300 50/50 opt1	9,761	10,225	19,985
29,300 50/50 opt2a	10,637	12,262	22,900
29,300 50/50 opt2d	10,070	11,612	21,682
29,300 58/42 opt1	12,725	8,740	21,465
29,300 58/42 opt2a	12,177	10,520	22,697
29,300 58/42 opt2d	12,031	10,634	22,665
29,300 70/30 opt1	15,120	6,885	22,005
29,300 70/30 opt2a	17,010	7,065	24,074
29,300 70/30 opt2d	14,859	6,775	21,634

3.4 Consideration of Future Actions

An environmental impact statement must consider cumulative effects when determining whether an action significantly affects environmental quality. The Council on Environmental Quality (CEQ) regulations for implementing NEPA define cumulative effects as:

> *"the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).*"

In this EIS, relevant past and present actions are identified and integrated into the impacts analysis for each resource component in Chapters 4 through 8. Each chapter also includes a section on consideration of future actions to provide the reader with an understanding of the changes in the impacts of the alternatives on each resource component when we take into account the reasonable foreseeable future actions. The discussions relevant to each resource component have been included in each chapter (1) to help each chapter stand alone as a self-contained analysis, for the convenience of the reader, and (2) as a methodological tool to ensure that the threads of each discussion for each resource component remain distinct, and do not become confused.

This section provides a summary description of the reasonably foreseeable future actions that may affect resource components and that also may be affected by the alternatives in this analysis. These include future actions that may affect the Bering Sea pollock fishery, the salmon caught as bycatch in that fishery, and the impacts of salmon bycatch on the resources components analyzed in this EIS. The actions in the list have been grouped in the following four categories:

- Ecosystem-sensitive management
- Traditional management tools
- Actions by other Federal, State, and international agencies
- Private actions

The "action area" for salmon bycatch management includes the Federal waters of the Bering Sea. Impacts of the action may occur outside the action area in salmon freshwater habitats and along salmon migration routes.

Table 3-16 summarizes the reasonably foreseeable "actions" identified in this analysis that are likely to have an impact on a resource component within the action area and timeframe. Actions are understood to be human actions (e.g., a proposed rule to designate northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). Identification of actions likely to impact a resource component, or change the impacts of any of the alternatives, within this action's area and time frame will allow the public and Council to make a reasoned choice among alternatives.

CEQ regulations require a consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. This is interpreted as indicating actions that are more than merely possible or speculative. Actions have been considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or the publication of a proposed rule. Actions simply "under consideration" have not generally been included because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen.

Table 3-16 Reasonably foreseeable future actions

Ecosystem-sensitive management	• Ongoing Research to understand the interactions between ecosystem components • Increasing protection of ESA-listed and other non-target species • Increasing integration of ecosystems considerations into fisheries management
Traditional management tools	• Authorization of pollock fishery in future years • Increasing enforcement responsibilities • Technical and program changes that will improve enforcement and management • Development of a Salmon Excluder Device
Other Federal, State, and international agencies	• State management of salmon fisheries • Hatchery release of salmon • Future exploration and development of offshore mineral resources • Expansion and construction of boat harbors • Other State actions
Private actions	• Commercial pollock and salmon fishing • CDQ investments in western Alaska • Subsistence harvest of Chinook salmon • Sport harvest of Chinook salmon • Increasing levels of economic activity in Alaska's waters and coastal zone

3.4.1 Ecosystem-sensitive management[7]

3.4.1.1 Ongoing research to understand the interactions between ecosystem components

Researchers are learning more about the components of the ecosystem, the ways these interact, and the impacts of fishing activity on them. Research topics include cumulative impacts of climate change on the ecosystem, the energy flow within an ecosystem, and the impacts of fishing on the ecosystem components. Ongoing research will improve the interface between science and policy-making and facilitate the use of ecological information in making policy. Many institutions and organizations are conducting relevant research.

Recent fluctuations in the abundance, survival, and growth of salmon in the Bering Sea have added significant uncertainty and complexity to the management of Bering Sea salmon resources. Similar fluctuations in the physical and biological oceanographic conditions have also been observed; however, the limited information on Bering Sea salmon ecology was not sufficient to adequately identify mechanisms linking recent changes in ocean conditions to salmon resources. North Pacific Anadromous Fish Commission (NPAFC) scientists responded by developing BASIS (Bering-Aleutian Salmon International Survey), a comprehensive survey of the Bering Sea pelagic ecosystem. BASIS was designed to improve our understanding of salmon ecology in the Bering Sea and to clarify mechanisms linking

[7] The term "ecosystem-sensitive management" is used in this EIS in preference to the terms "ecosystem-based management" and "ecosystem approaches to management." The term was chosen to indicate a wide range of measures designed to improve our understanding of the interactions between groundfish fishing and the broader ecosystems, to reduce or mitigate the impacts of fishing on the ecosystems, and to modify fisheries governance to integrate ecosystems considerations into management. The term was used because it is not a term of art or commonly used term which might have very specific meanings. When the term "ecosystem-based management" is used, it is meant to reflect usage by other parties in public discussions.

recent changes in ocean conditions with salmon resources in the Bering Sea. The Alaska Fisheries Science Center's Ocean Carrying Capacity (OCC) Program is responsible for BASIS research in U.S. waters.

Researchers with the OCC Program have conducted shelf-wide surveys during fall 2002 through 2006 on the eastern Bering Sea shelf as part of the multiyear BASIS research program. The focus of BASIS research was on salmon; however, the broad spatial coverage of oceanographic and biological data collected during late summer and early fall provided insight into how the pelagic ecosystem on the eastern Bering Sea shelf responded to changes in spring productivity. Salmon and other forage fish (e.g., age-0 walleye pollock, Pacific cod, and Pacific herring) were captured with a surface net trawl, zooplankton were collected with oblique bongo tows, and oceanographic data were obtained from conductivity-temperature-depth (CTD) vertical profiles. More information on BASIS is provided in Chapter 5 and is available at the AFSC website at: http://www.afsc.noaa.gov/ABL/occ/ablocc_basis.htm.

In 2008, North Pacific Research Board (NPRB) and National Science Foundation (NSF) began a project for understanding ecosystem processes in the Bering Sea called the Bering Sea Integrated Ecosystem Research Program (BSIERP). Approximately 90 federal, state and university scientists will provide coverage of the entire Bering Sea ecosystem. Scientists will conduct three years of field research on the eastern Bering Sea Shelf, from St. Lawrence Island to the Aleutians, followed by two more years for analysis and reporting. They will study a range of issues, including atmospheric forcing, physical oceanography, and the economic and social impacts on humans and communities of a changing ecosystem. More information on this research project is available on the NPRB web site at: http://bsierp.nprb.org/index.htm.

Additionally, ecosystem protection is supported by an extensive program of research into ecosystem components and the integrated functioning of ecosystems, carried out at the AFSC. The AFSC's Fishery Interaction Team (FIT), formed in 2000 to investigate the ecological impacts of commercial fishing, is focusing on the impacts of Pacific cod, pollock, and Atka mackerel fisheries on Steller sea lion populations (Connors and Logerwell 2005). The AFSC's Fisheries and the Environment (FATE) program is investigating potential ecological indicators for use in stock assessment (Boldt 2005). The AFSC's Auke Bay Lab and RACE Division map the benthic habitat on important fishing grounds, study the impact of fishing gear on different types of habitats, and model the relationship between benthic habitat features and fishing activity (Heifetz et al. 2003). Other AFSC ecosystem programs include the North Pacific Climate Regimes and Ecosystem Productivity Program, the Habitat and Ecological Processes program, and the Loss of Sea Ice program (J. Boldt, pers. comm., September 26, 2005). More information on these research programs is available at the AFSC website at: http://www.afsc.noaa.gov.

3.4.1.2 Increasing protection of ESA-listed and other non-target species

Pollock fishing may impact a wide range of other resources, such as seabirds, marine mammals, and non-target species, such as salmon and halibut. Recent Council and NMFS actions suggest that the Council and NMFS may consider measures for protection for ESA-listed and other non-target species.

Changes in the status of species listed under the ESA, the addition of new listed species, designation of critical habitat, and results of future Section 7 consultations may require modifications to pollock fishing practices to reduce the impacts of this fishery on listed species and critical habitat.

The discussion of ESA-listed salmon is in Chapter 5. We are not aware of any changes to the ESA-listed salmon status or designated critical habitat that may affect the future pollock fishery. The impacts of the pollock fishery on ESA-listed salmon are currently limited to the Upper Willamette and Lower Columbia River stocks. The tracking of coded-wire tagged surrogate salmon for ESA-listed stocks may result in additional ESA-listed salmon stocks being identified as potentially impacted by the pollock fisheries. The possible take of any additional ESA-listed salmon stocks would trigger ESA consultation and may result in additional management measures for the pollock fishery depending on the result of the consultation.

Washington State's Sea Grant program is currently working with catcher-processors in the Bering Sea pollock fishery to study the sources of seabird strikes in their operations and to look for ways fishermen can reduce the rate of strikes (Melvin et al. 2004). Other studies are investigating the potential for use of video monitoring of seabird interactions with trawl and longline gear (McElderry et al. 2004; Ames et al. 2005). This research is especially important because action area has very high seabird densities and potential aggregations of ESA-listed short tailed albatross (NMFS 2007b).

The Council is in the process of considering revisions to the Steller sea lion protection measures applicable to the pollock fishery. Since the Steller sea lion protection measures were implemented, extensive scientific research has been conducted to understand the impacts of fisheries on Steller sea lions and life history and foraging activities of these animals. These studies have changed our understanding of Steller sea lion and groundfish fisheries interactions. On October 18, 2005, the Council requested that NMFS reinitiate consultation on the November 2000 Biological Opinion and evaluate all new information that has developed since the previous consultations, including the 2001 Biological Opinion on the Steller sea lion protection measures for the Alaska groundfish fisheries (NMFS 2006). The March 2008 Steller sea lion recovery plan provides a thorough review of the threats to the recovery to the species, the status of the species, and criteria that must be met to down-list and delist the species (NMFS 2008a). NMFS is preparing a new FMP-level Biological Opinion to thoroughly review and synthesize information regarding potential impacts on Steller sea lions and their prey by the groundfish fisheries identified since the previous FMP-level Biological Opinion, the 2001 Biological Opinion, the 2003 supplement, and the recovery plan. From this new information, revisions to the Steller sea lion protection measures may be proposed so that the best scientific information available is used to ensure the fisheries are not likely to result in jeopardy of extinction and destruction or adverse modification of designated critical habitat and to alleviate any unnecessary restrictions for the fleet to improve efficiency and ensure economic viability for the industry. NMFS and the Council would develop an EIS to analyze the impacts of proposed changes to the Steller sea lion protection measures.

Northern fur seals forage in the pelagic area of the Bering Sea and reproduce on the Pribilof and Bogoslof Islands. On June 17, 1988, NMFS declared the northern fur seal stock of the Pribilof Islands, Alaska (St. Paul and St. George Islands), to be depleted under the Marine Mammal Protection Act (MMPA). The Pribilof Islands population was designated depleted because it had declined to less than 50% of levels observed in the late 1950s, and no compelling evidence suggested that carrying capacity has changed substantially since the late 1950s (NMFS 2007a). The EIS for the annual subsistence harvest of fur seals determined that the groundfish fisheries in combination with the subsistence harvest may have a conditional cumulative effect on prey availability if the fisheries were to become further concentrated spatially or temporally in fur seal habitat, especially during June through August (NMFS 2005). The Northern Fur Seal Conservation Plan recommends gathering information on the effects of the fisheries on fur seal prey, including measuring and modeling effects of fishing on prey (both commercial and noncommercial) composition, distribution, abundance, and schooling behavior, and evaluate existing fisheries closures and protected areas (NMFS 2007a). As more information becomes available regarding the interaction between the groundfish fisheries and northern fur seals, fishing restrictions may be necessary to mitigate potential adverse effects.

NMFS has begun a status review to determine if ribbon seals should be listed as threatened or endangered under the ESA (73 FR 16617, March 28, 2008). NMFS received a petition for listing ribbon seals from the Center for Biological Diversity (2007) and found that the petition presents substantial scientific or commercial information indicating that the petition action may be warranted. Ribbon seals are potentially affected by the diminishing sea ice in the Bering Sea and Arctic regions as they are dependent on sea ice for important activities such as resting and reproduction. Listing of this species would require ESA consultation on federal actions that may adversely affect ribbon seals or any designated critical habitat. One ribbon seal has been observed taken in the pollock trawl fishery between 2000 and 2004 (Angliss and Outlaw 2007), and therefore, any listing of this species may require an ESA consultation for the groundfish fisheries and potential protection measures. Although NMFS has prioritized its review of ribbon seals, it has also announced its intention to initiate status reviews for all ice seals, including bearded, ringed, and spotted seals (73 FR 16617, March 28, 2008). On May 28, 2008, the Center for Biological Diversity petitioned NMFS to list bearded, spotted, and ringed seals under the ESA (CBD 2008). The agency's decision on whether to list these species or not is due May 28, 2009.

3.4.1.3 Increasing integration of ecosystems considerations into fisheries management

Ecosystem assessments evaluate the state of the environment, including monitoring climate–ocean indices and species that indicate ecosystem changes. Ecosystem-based fisheries management reflects the incorporation of ecosystem assessments into single species assessments when making management decisions, and explicitly accounts for ecosystem processes when formulating management actions. Ecosystem-based fisheries management may still encompass traditional management tools, such as TACs, but these tools will likely yield different quantitative results.

To integrate such factors into fisheries management, NMFS and the Council will need to develop policies that explicitly specify decision rules and actions to be taken in response to preliminary indications that a regime shift has occurred. These decision rules need to be included in long-range policies and plans. Management actions should consider the life history of the species of interest and can encompass varying response times, depending on the species' lifespan and rate of production. Stock assessment advice needs to explicitly indicate the likely consequences of alternate harvest strategies to stock viability under various recruitment assumptions.

Management strategy evaluations (MSEs) can help in this process. MSEs use simulation models of a fishery to test the success of different management strategies under different sets of fishery conditions, such as shifts in ecosystem regimes. The AFSC is actively involved in conducting MSEs for several groundfish fisheries, including for several flatfish species in the BS, and for pollock in the GOA.

Both the Pew Commission report and the Oceans Commission report point to the need for changes in the organization of fisheries and oceans management to institutionalize ecosystem considerations in policy making (Pew 2003; U.S. Commission on Ocean Policy 2004). The Oceans Commission, for example, points to the need to develop new management boundaries corresponding to large marine ecosystems, and to align decision-making with these boundaries (U.S. Commission on Ocean Policy 2004).

Since the publication of the Oceans Commission report, the President has established a cabinet-level Committee on Ocean Policy by executive order. The Committee is to explore ways to structure government to implement ecosystem-based ocean management (Evans and Wilson 2005). Congress reauthorized the Magnuson-Stevens Act in December 2006 to addresses ecosystem-based management.

NMFS and the Council are continuing to develop their ecosystem management measures for the fisheries in the EEZ off Alaska. NMFS is currently developing national Fishery Ecosystem Plan guidelines. It is unclear at this time whether these will be issued as guidelines, or as formal provisions for inclusion in the Magnuson-Stevens Act.

The Council has created a committee to research ecosystem developments and to assist in formulating positions with respect to ecosystem-based management. The Council completed a fishery ecosystem plan for the Aleutian Islands ecosystem (NPFMC 2007). An interagency Alaska Marine Ecosystem Forum (AMEF) is improving inter-agency communication on marine ecosystem issues. The Council has signed a Memorandum of Understanding with 10 Federal agencies and 4 State agencies, to create the AMEF. The AMEF seeks to improve communication between the agencies on issues of shared responsibilities related to the marine ecosystems off Alaska's coast. The initial focus of the AMEF will be on the Aleutian Islands marine ecosystem. The SSC has begun to hold annual ecosystem scientific meetings at the February Council meetings.

In addition to these efforts to explore how to develop its ecosystem management efforts, the Council and NMFS continue to initiate efforts to take account of ecosystem impacts of fishing activity. The Council has recommended habitat protection measures for the eastern Bering Sea (73 FR 12357, March 7, 2008). These measures include the Northern Bering Sea Research Area to address potential impacts of shifts in fishing activity to the north.

The Council's Ecosystem Committee discusses ecosystem initiatives and advise the Council on the following issues: (1) defining ecosystem-based management; (2) identifying the structure and Council role in potential regional ecosystem councils; (3) assessing the implications of NOAA strategic planning; (4) drafting guidelines for ecosystem-based approaches to management; (5) drafting Magnuson-Stevens Act requirements relative to ecosystem-based management; and (6) coordinating with NOAA and other initiatives regarding ecosystem-based management. More details are available in the Council's website at http://www.fakr.noaa.gov/npfmc/current_issues/ecosystem/Ecosystem.htm.

The Council is developing Federal fisheries management in the Arctic Management Area. No significant fisheries exist in the Arctic Management Area, either historically or currently. However, the warming of the Arctic and seasonal shrinkage of the sea ice may be associated with increased opportunities for fishing in this region. The Council proposes to develop an Arctic Fishery Management Plan that would (1) close the Arctic to commercial fishing until information improves so that fishing can be conducted sustainably and with due concern to other ecosystem components, (2) determine the fishery management authorities in the Arctic and provide the Council with a vehicle for addressing future management issues, and (3) implement an ecosystem based management policy that recognizes the unique issues in the Alaskan Arctic. The action is necessary to prevent commercial fisheries from developing in the Arctic without the required management framework and scientific information on the fish stocks, their characteristics, and the implications of fishing for the stocks and related components of the ecosystem.

At this writing, while it seems likely that changes in oceans management and associated changes in fisheries management will occur as a result of these discussions and debates, it is not clear what form these new changes will take.

3.4.2 Traditional management tools

3.4.2.1 Authorization of pollock fishery in future years

The annual harvest specifications process for the pollock (and the associated pollock fishery) creates an important class of reasonably foreseeable actions that will take place in every one of the years considered in the cumulative impacts horizon (out to, and including, 2015). Annual TAC specifications limit each year's harvest within sustainable bounds. The overall OY limits on harvests in the BSAI constrain overall harvest of all species. Each year, OFLs, ABCs, and TACs are specified for two years at a time, as described in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007b).

The harvest specifications are adopted in accordance with the mandates of the Magnuson-Stevens Act, following guidelines prepared by NMFS, and in accordance with the process for determining overfishing criteria that is outlined in Section 3.2 of each of the groundfish FMPs. Specifications are developed using the most recent fishery survey data (often collected the summer before the fishery opens) and reviewed by the Council and its SSC, AP, and Plan Teams. The process provides many opportunities for public comment. The management process, of which the specifications are a part, is analyzed in an EIS (NMFS 2007b). Each year's specifications and the status of the environment are reviewed to determine the appropriate level of NEPA analysis.

Annual pollock harvests, conducted in accordance with the annual specifications, will impact pollock stocks. Annual harvest activity may change total mortality for the pollock stock, may affect stock characteristics through time by selective harvesting, may affect reproductive activity, may increase the annual harvestable surplus through compensatory mechanisms, may affect the prey for the target species, and may alter EFH.

The annual pollock harvests also impact the environmental components described in this EIS: salmon, non-target fish species, seabirds, marine mammals, and a more general set of ecological relationships. In general, the environmental components are renewable resources, subject to environmental fluctuations. Ongoing harvests of pollock may be consistent with the sustainability of other resource components if the fisheries are associated with mortality rates that are less than or equal to the rates at which the resources can grow or reproduce themselves.

The on-going pollock fishery employs hundreds of fishermen and fish processors, and contributes to the maintenance of human communities, principally in Alaska, Washington, and Oregon.

The number of TAC categories with low values for ABC/OFL is increasing which tends to increase the likelihood that NMFS will close directed fisheries to prevent overfishing. Currently, the NPFMC is considering separating components of the 'other species' category (sharks, skates, octopus, sculpin). Should that occur, incidental catch of sharks for example could impact management of the pollock fishery. As part of the 2006 'other species' incidental catch of 1,973 mt in the pollock fishery, 504 mt were shark. The tier 6 ABC for shark as part of the 'other species' category in 2006 was 463 mt and OFL 617 mt. If sharks were managed as a separate species group under their current tier, the pollock fishery would likely have been constrained in 2006. Managers closely watch species with fairly close amounts between the OFL and ABCs during the fishing year and the fleet will adjust behavior to prevent incurring management actions. While managing the species with separate ABCs and OFLs reduces the potential for overfishing the individual species, the effect of creating more species categories can increase the potential for incurring management measures to prevent overfishing.

3.4.2.2 Increasing enforcement responsibilities

The U.S. Coast Guard (USCG) conducts fisheries enforcement activities in the EEZ off Alaska in cooperation with NOAA Office for Law Enforcement (OLE). New programs to protect resource components from pollock fishery impacts will create additional responsibilities for enforcement agencies. Despite this likely increase in enforcement responsibilities, it is not clear that resources for enforcement will increase proportionately.

The USCG is expected to bear a heavy responsibility for homeland security and is not expected to receive proportionate increases in its budget to accommodate increased fisheries enforcement. Increased responsibilities for homeland security and for detection of increasing drug-smuggling activities in waters off Alaska have limited the resources available for the USCG to conduct enforcement activities at the same level as in the recent past. Any deterrent created by Coast Guard presence in enforcing fisheries regulations and restrictions would likely be reduced, as would the opportunities for detection of fisheries violations at-sea.

Likewise, the NOAA OLE has not recently received increased resources consistent with its increasing enforcement obligations (J. Passer, pers. comm., March 2008). However, new enforcement assistance has become available in recent years through direct Congressional line item appropriations for Joint Enforcement Agreements (JEAs) with all coastal states. The State of Alaska has received approximately $10 million of this funding since 2001, and has used JEA money to purchase capital assets such as patrol vessels and patrol vehicles. The State has also hired new personnel to increase levels of at-sea and dockside enforcement and used JEA money to pay for support and operational expenses pertaining to this increased effort (J. Passer, pers. comm., March 2008).

Uncertainties about Congressional authorization of increased enforcement funding preclude any prediction of trends in the availability of resources to meet increased enforcement responsibilities. Thus, while an increase in responsibilities is reasonably foreseeable, a proportionate increase in funding is not.

3.4.2.3 Technical and program changes that will improve enforcement and management

Managers are increasingly using technology for fisheries management and enforcement. Managers are likely to increase use of vessel monitoring systems (VMS) in coming years. Vessels fishing for pollock in the Bering Sea are required to operate VMS units (50 CFR 679.7(a)(18)). Managers and enforcement personnel are making extensive use of the information from existing VMS units, and are likely to make more use of it in the future, as they continue to learn how to use it more effectively.

A joint project by NMFS, the State of Alaska, and the IPHC led to electronic landings reporting for groundfish during 2006. When fish are delivered on shore, fishermen and buyers fill out a web-based form with the information on landings. The program generates a paper form for industry and will forward the data to a central repository, where they will be available for use by authorized parties. Electronic reporting allows enforcement staff to look at large masses of data for violations and trends. The web-based input form contains numerous automatic quality control checks to minimize data input errors. The program gets data to enforcement agents more quickly, increases the efficiency of record audits, and makes enforcement activity less intrusive, as agents will have less need to board vessels to review documents onboard, or enter plants to review documents on the premises.

Although rationalization programs increase the monitoring obligations for enforcement, they also improve enforcement and management capabilities by shifting enforcement efforts from the water to dockside for monitoring landings and other records. Moreover, by stabilizing or reducing the number of operations and by creating fishing and processing cooperatives, rationalization reduces the costs of private and joint action by industry to address certain management issues, particularly the monitoring and control of bycatch. For example, in the salmon bycatch monitoring program in the AFA pollock fisheries, fishermen contract together for in-season catch monitoring by a private firm, and agree to restrict fishing activity when bycatch rates rise to defined levels.

Monitoring the catch of pollock and salmon bycatch in the pollock fisheries relies heavily on data collected by NMFS-certified observers. Observer coverage requirements for the pollock fisheries and the use of observer data are described in more detail in the Chapter 10. Observers currently are provided through a system known as “pay-as-you-go” under which vessels operators required to carry a NMFS-certified observer contract directly for observer services with observer providers (businesses who hire and provide observers). The Council and NMFS have been analyzing alternatives for restructuring the North

Pacific Groundfish Observer Program to provide a new system for procuring and deploying observers supported by broad-based user fees and/or direct Federal subsidies, in which NMFS would contract directly for observer coverage and be responsible for determining when and where observers should be deployed. This system would address problems associated with the lack of flexibility in the current system to deploy observers when and where needed to collect needed data and the disproportionately high cost of observers for smaller vessels.

The observer restructuring analysis has been on hold since June 2006 as a result of unanswered questions about the potential costs of the restructured program and because revisions to NMFS's legal authority to collect fees to support a restructured program in the Magnuson-Stevens Act were expected. The Magnuson-Stevens Act was amended in late 2006 to provide the needed revisions to NMFS's fee collection authority. However, questions still exist about the potential costs of the restructured program.

At its April 2008 meeting, the Council tasked staff to develop a discussion paper about the status of the restructuring analysis and as yet unresolved questions so that the Council could provide further direction on observer program restructuring at its December 2008 meeting. Future revisions to the observer program service delivery model could affect the pollock fisheries. However, this fishery has very high observer coverage levels now to monitor sector, cooperative, and CDQ group level allocations of pollock and further increases in observer coverage requirements are recommended by NMFS to better monitor salmon bycatch under some alternatives in this EIS. While some alternatives under consideration in the observer restructuring analysis could result in increased observer coverage costs for vessels that participate in the AFA fisheries, it is unlikely that any future changes in the observer program would lead to a decrease in observer coverage in the Bering Sea pollock fisheries or any reduction in the quality and quantity of observer data that would be collected to support this fishery or any of the salmon bycatch alternatives in this EIS.

NMFS is investigating the use of shipboard video monitoring to ensure compliance with full retention requirements in other regions. In the Alaska Region, NMFS has implemented video monitoring to monitor catch sorting actions of crew members inside fish holding bins and investigating the use of video to monitor regulatory discards. An EFP for continued development of the capability to do video monitoring of rockfish catch in the GOA is currently under consideration by NMFS and Council (73 FR 14226, March 14, 2008). NMFS is hopeful that these investigations could lead to regulations that allow use of video monitoring to supplement observer coverage in some fisheries. Electronic monitoring technology is evolving rapidly, and it is probable that video and other technologies will be introduced to supplement current observer coverage and enhance data collection in some fisheries. Video monitoring has not been sufficiently tested to ensure compliance with a no discard requirement at this time, but NMFS would support and encourage research to explore the feasibility of video for this use.

In addition to the technical aspects of video monitoring, several other issues related to video must be resolved. These include the amount of staff time and resources that would be required to review video footage, curation and storage questions, and the costs to NMFS and the fishing industry. Until these issues are resolved, NMFS will continue to implement existing proven monitoring and catch estimation protocols. Electronic monitoring is discussed in more detail in section 10.5.7.4.

3.4.2.4 Development of the salmon excluder device

Gear modifications are one way to reduce salmon bycatch in the pollock fisheries. NMFS has issued exempted fishing permits for the purpose of testing a salmon excluder device in the pollock trawl fishery of the Bering Sea from 2004 to 2006 and for fall 2008 through spring 2010. The experiment would be conducted from Fall 2008 through Spring 2010. The successful development of a salmon excluder device for pollock trawl gear may result in reductions of salmon bycatch, potentially reducing costs associated with the harvest of pollock and reducing the potential impact on the salmon stocks.

3.4.3 Actions by Other Federal, State, and International Agencies

3.4.3.1 State salmon fishery management

ADF&G is responsible for managing commercial, subsistence, sport, and personal use salmon fisheries. The first priority for management is to meet spawning escapement goals to sustain salmon resources for future generations. Highest priority use is for subsistence under both State and Federal law. Surplus fish beyond escapement needs and subsistence use are made available for other uses. The Alaska Board of Fisheries (BOF) adopts regulations through a public process to conserve fisheries resources and to allocate fisheries resources to the various users. Yukon River salmon fisheries management includes obligations under an international treaty with Canada. Subsistence fisheries management includes coordination with U.S. Federal government agencies where federal rules apply under ANILCA. Subsistence salmon fisheries are an important culturally and greatly contribute to local economies. Commercial fisheries are also an important contributor to many local communities as well as supporting the subsistence lifestyle. While specific aspects of salmon fishery management continue to be modified, it is reasonably foreseeable that the current State management of the salmon fisheries will continue into the future (Section 5.2.1).

3.4.3.2 Hatchery releases of salmon

Hatcheries produce salmon fry and release these small salmon into the ocean to grow and mature before returning as adults to the hatchery or local rivers and streams for harvest or breading. Hatchery production increases the numbers of salmon in the ocean beyond what is produced by the natural system. A number of hatcheries produce salmon in Korea, Japan, Russia, the US, and Canada. The North Pacific Anadromous Fish Commission summarizes information on hatchery releases, by country and by area, where available. Chapter 5, Chinook Salmon, and Chapter 6, Chum Salmon, provide more information on current and past hatchery releases. It is reasonably foreseeable the hatchery production will continue at a similar level into the future.

3.4.3.3 Future exploration and development of offshore mineral resources

The Minerals Management Service (MMS) expects that reasonably foreseeable future activities include numerous discoveries that oil companies may begin to develop in the next 15-20 years in federal waters off Alaska. Potential environmental risks from the development of offshore drilling include the impacts of increased vessel offshore oil spills, drilling discharges, offshore construction activities, and seismic surveys. In an EIS prepared for sales in the OCS Leasing Program, the MMS has assessed the cumulative impacts of such activities on fisheries and finds only small incremental increases in impacts for oil and gas development, which are unlikely to significantly impact fisheries and essential fish habitat (MMS 2003).

On April 8, 2008, MMS published a notice of intent to prepare an Environmental Impact Statement for oil and gas lease Sale 214 which is tentatively scheduled for 2011 in the "program area" of North Aleutian Basin, offshore the State of Alaska. The proposed action is to offer for lease all of the blocks in the program area. The EIS analysis will focus on the potential environmental effects of oil and gas exploration, development, and production on the fish, wildlife, socioeconomic, and subsistence resources in the North Aleutian Basin ''program area'' and neighboring communities.

The North Aleutian Basin underlies the northern coastal plain of the Alaska Peninsula and the waters of Bristol Bay and is believed to be gas-prone. The "program area" consists of approximately 2.3 million hectares (5.6 million acres) and extends offshore from about 10 statute miles to approximately 120 statute miles, in water depths from approximately 40 feet (12 meters) to 120 feet (37 meters). In October 1989, the North Aleutian Basin Planning Area was placed under a congressional moratorium which banned Department of Interior expenditures in support of any petroleum leasing or development activities in the planning area. In 1998, an Executive Order extended the moratorium as a Presidential withdrawal until 2012. In 2004, the congressional moratorium on petroleum-related activities in the North Aleutian Basin was discontinued and in 2007 the Presidential withdrawal was modified to exclude the North Aleutian Basin.

As part of the EIS process, MMS is collaborating with NMFS on a study of the North Pacific right whale in the North Aleutian Basin. The MMS also contracted to modify an ice-ocean circulation model for Alaska's Bristol Bay. Proposed studies for fiscal year 2008 include research on subsistence food harvest and sharing activities, studies of juvenile and maturing salmon, and nearshore mapping of juvenile salmon and settling crab. Additional studies are proposed for fiscal year 2009. Information on the Environmental Studies Program, completed studies, and a status report for continuing studies in the NAB area may be found at the Web site: http://www.mms.gov/alaska.

3.4.3.4 Expansion and construction of boat harbors by U. S. Army Corps of Engineers, Alaska District, Civil Works Division (COE-CW)

COE-CW funds harbor developments, constructs new harbors, and upgrades existing harbors to meet the demands of fishing communities. Several upgraded harbors have been completed to accommodate the growing needs of fishing communities and the off-season storage of vessels. Local storage reduces transit times of participating vessels from other major ports, such as Seattle, Washington. Upgraded harbors include, King Cove, Dutch Harbor, Sand Point, Seward, Port Lions, Dillingham, and Kodiak. Additionally, new harbors are planned for Akutan, False Pass, Tatitlek, and Valdez.

3.4.3.5 Other State of Alaska actions

Several State actions in development may impact habitat and those animals that depend on the habitat. These potential actions will be tracked, but cannot be considered reasonably foreseeable future actions because the State has not proposed regulations. These actions include the following:

- Changes to the residue criteria under the Alaska Water Quality Standards. The State proposes to significantly generalize the language of the residues criterion and increase discretion in determining what constitutes an overage. The Alaska Department of Environmental Conservation's proposed residues criterion eliminates the prohibition on residues that cause leaching of toxic or deleterious substances. Under the new system, any and all residue discharges would be allowed without a permit, unless some type of harm (objectionable characteristics or presence of nuisance species) is discovered. The Environmental Protection Agency (EPA) has provided comments to the State regarding this proposed change and determined that major changes were needed for EPA approval. This proposed regulation change became effective for state purposes on July 30, 2006. The State expects EPA's approval of the State regulations by the end of 2008 (Nancy Sonafrank, Alaska Department of Environmental Quality, pers. comm., March 18, 2008).

- The State has passed legislation to implement State primacy for the National Pollution Discharge Elimination System Program under the Clean Water Act and has submitted a primacy package to EPA. The program is required to be as stringent as the current federal program but the effectiveness of implementation will be the key to whether impacts on habitat may be seen. The State expects to receive control of the program from EPA by the end of 2008 (Hartig 2008).

NMFS will track the progress of these potential actions and will include these in effects analyses in future NEPA documents when proposed rules are issued.

3.4.4 Private actions

3.4.4.1 Commercial pollock and salmon fishing

Fishermen will continue to fish for pollock, as authorized by NMFS, and salmon, as authorized by the State. Fishing constitutes the most important class of reasonably foreseeable future private actions and will take place indefinitely into the future. Chapter 4 Walleye Pollock and Chapter 10 Regulatory Impact Review, provide more information on the Bering Sea pollock fishery.

Commercial salmon fisheries exist throughout Alaska, in marine waters, bays, and rivers. Chapter 5 Chinook Salmon, Chapter 6 Chum Salmon, and Chapter 10 Regulatory Impact Review provide more information on the commercial salmon fisheries.

The Marine Stewardship Council (MSC) is a non-profit organization that seeks to promote the sustainability of fishery resources through a program of certifying fisheries that are well managed with respect to environmental impacts (http://eng.msc.org/). Certification conveys an advantage to industry in the marketplace, by making products more attractive to consumers who are sensitive to environmental concerns. A fishery must undergo a rigorous review of its environmental impact to achieve certification. Fisheries are evaluated with respect to the potential for overfishing or recovery of target stocks, the potential for the impacts on the "structure, productivity, function and diversity of the ecosystem," and the extent to which fishery management respects laws and standards, and mandates "responsible and sustainable" use of the resource (SCS 2004). Once certified, fisheries are subject to ongoing monitoring, and other requirements for recertification.

The MSC has certified the BSAI and GOA pollock, BSAI Pacific cod freezer longline, halibut, and sablefish fisheries. The MSC has also certified the State of Alaska's management of all five salmon species. Because the program requires ongoing monitoring and re-evaluation for certification every five years (SCS 2004), and because the program may convey a marketing advantage, MSC certification may change the pollock industry incentive structure to increase sensitivity to environmental impacts.

3.4.4.2 CDQ Investments in western Alaska

The CDQ Program was designed to improve the social and economic conditions in western Alaska communities by facilitating their economic participation in the BSAI fisheries. The large-scale commercial fisheries of the BSAI developed in the eastern BS without significant participation from rural western Alaska communities. These fisheries are capital-intensive and require large investments in vessels, infrastructure, processing capacity, and specialized gear. The CDQ Program was developed to redistribute some of the BSAI fisheries' economic benefits to adjacent communities by allocating a portion of commercially important BSAI species to such communities as fixed shares, or quota, of groundfish, halibut, and crab. The percentage of each annual BSAI catch limit allocated to the CDQ Program varies by both species and management area. These allocations, in turn, provide an opportunity for residents of these communities to both participate in and benefit from the BSAI fisheries.

Sixty-five communities participate in the CDQ Program. These communities have formed six non-profit corporations (CDQ groups) to manage and administer the CDQ allocations, investments, and economic development projects. Annual CDQ allocations provide a revenue stream for CDQ groups through various channels, including the direct catch and sale of some species, leasing quota to various harvesting partners, and income from a variety of investments. The six CDQ groups had total revenues in 2005 of approximately $134 million, primarily from pollock royalties.

One of the most tangible direct benefits of the CDQ Program has been employment opportunities for western Alaska village residents. CDQ groups have had some successes in securing career track employment for many residents of qualifying communities, and have opened opportunities for non-CDQ Alaskan residents, as well. Jobs generated by the CDQ program included work aboard a wide range of fishing vessels, internships with the business partners or government agencies, employment at processing plants, and administrative positions.

Many of the jobs generated by the CDQ program are associated with shoreside fisheries development projects in CDQ communities. This includes a wide range of projects, including those directly related to commercial fishing. Examples of such projects include building or improving seafood processing facilities, purchasing ice machines, purchasing and building fishing vessel, gear improvements, and construction of docks or other fish handling infrastructure. CDQ groups also have invested in peripheral projects that directly or indirectly support commercial fishing for halibut, salmon, and other nearshore species. This includes seafood branding and marketing, quality control training, safety and survival training, construction and staffing of maintenance and repair facilities that are used by both fishermen and other community residents, and assistance with bulk fuel procurement and distribution. Several CDQ groups are actively involved in salmon assessment or enhancement projects, either independently or in collaboration with ADF&G. Salmon fishing is a key component of western Alaska fishing activities, both commercially and at a subsistence level. The CDQ Program provides a means to support and sustain both such activities.

3.4.4.3 Subsistence harvest of Chinook salmon

Communities in western and Interior Alaska depend on Chinook salmon from the Bering Sea for subsistence and the associated cultural and spiritual needs. Chinook salmon consumption can be an important part of regional diets, and Chinook salmon and Chinook salmon products are distributed as gifts or through barter and small cash exchanges to persons who do not directly participate in the subsistence fishery. Subsistence harvests will continue indefinitely into the future. Chapters 9 and 10 provide more information on subsistence harvests.

3.4.4.4 Sport fishing for Chinook salmon

Regional residents may harvest Chinook salmon for sport, using a State sport fishing license, and then use these salmon for essentially subsistence purposes. Regional sport fisheries, including Chinook salmon fisheries may also attract anglers from other places. Anglers who come to the action area from elsewhere to sport fish generate economic opportunities for local residents. Sport fishing for Chinook salmon will continue indefinitely into the future. Chapters 9 and 10 provide more information on sport harvests.

3.4.4.5 Increasing levels of economic activity in Alaska's waters and coastal zone

Alaska's population has grown by over 100,000 persons since 1990 (U.S. Census Bureau website accessed at http://www.census.gov/ on July 14, 2005). As of June 2005, Alaska's estimated population is about 662,000. The Alaska State Demographer's projection for the end of the forecast period of this analysis (2015) is about 734,000, an 11% increase (Williams 2005).

Alaska's population in its coastal regions is expected to continue to grow (Crossett et al. 2004). Population growth in these regions may have larger impacts on salmon stocks than growth in inland areas. So far, Alaska's total population growth in coastal areas remains low compared to that in other states. Alaska had the second largest percentage change in growth over the period from 1980 to 2002, but this%

was calculated from a relatively low base. Its coastal population grew by about 63%. Alaska has the smallest coastal population density of all the states, with an average of 1.4 persons per square mile in 2003. By comparison, coastal densities were 641 persons per square mile in the northeastern states, 224 on the Atlantic southeastern states, 164 along the Gulf of Mexico, 299 along the West Coast exclusive of Alaska, and 238 in the Great Lakes states (including New York's Great Lakes counties). Maine and Georgia, the states with the next lowest coastal population density, had 60 persons per square mile (Crossett et al. 2004). Crossett et al. project continued population growth in Alaska's coastal regions; however growth in these areas will never approach the levels seen in Hawaii and the lower 48 states.

In Alaska, the success of the CDQ program and the expansion of such community based allocation programs in the future (as discussed under the earlier section on reasonably foreseeable rationalization programs) may lead to increased population in affected communities. A growing population will create a larger environmental "footprint," and increase the demand for marine environmental services. A larger population will be associated with more economic activity from increased cargo traffic from other states, more recreational traffic, potential development of lands along the margin of the marine waters, increased waste disposal requirements, and increased demand for sport fishing opportunities.

Shipping routes from Pacific Northwest ports to Asia run across the GOA and through the BSAI, and pass near or through important fishing areas. The key transportation route between West Coast ports in Washington, Oregon, and British Columbia to East Asia passes from the GOA into the EBS at Unimak Pass, and then returns to the Pacific Ocean in the area of Buldir Island. An estimated 3,100 large vessels used this route in the year ending September 30, 2006. An estimated 853 of these were bulk carriers, and an estimated 916 were container ships (Nuka Research 2006, page 12). The direct routes from California ports to East Asia pass just south of the Aleutian Islands. Continued globalization, growth of the Chinese economy, and associated growth in other parts of the Far East may lead to increasing volumes of commercial cargo vessel traffic through Alaska waters. U.S. agricultural exports to China, for example, doubled between 2002, and 2004; 41% of the increase, by value, was in soybeans and 13% was in wheat (USDA 2005). In future years, this may be an important route for Canadian oil exports to China (Zweig and Jianhai 2005).

The significance of this traffic for the regional environment and for fisheries is highlighted by recent shipping accidents, including the December 2004 grounding of the *M/V Selendang Ayu* and the July 2006 incapacitation of the *M/V Cougar Ace*. The *M/V Selendang Ayu* dumped the vessel's cargo of soybeans and as much as 320,000 gallons of bunker oil, on the shores of Unalaska Island (USCG, Selendang Ayu grounding Unified Command press release, April 23, 2005). On July 23, 2006, the *M/V Cougar Ace*, a 654-foot car carrier homeported in Singapore, contacted the US Coast Guard and reported that their vessel was listing at 80 degrees and taking on water. The *M/V Cougar Ace* was towed to Dutch Harbor where the listing problem was corrected. The vessel was then towed to Portland, Oregon (Alaska Department of Conservation Final situation report, September 1, 2006, available at: http://www.dec.state.ak.us/spar/perp/response/sum_fy07/060728201/sitreps/060728201_sr_10.pdf).

Mining activities in Alaska are expected to increase in the coming years. The Red Dog mine in Northwest Alaska will continue operations and a new deposit in the Bristol Bay region is being explored for possible large-scale strip mining. The continued development and/or expansion of mines, though expected, will be dependent on stable metals prices in the coming years. At present it appears such prices will be stable.

In southwest Alaska copper, gold, and molybdenum may be mined at the prospective Pebble mine (www.pebblepartnership.com). The Pebble mine would be situated in the Bristol Bay region near the northeast end of Iliamna Lake, which feeds directly into Bristol Bay. The Pebble mine is at the pre-feasibility and pre-permitting stage of development, and faces a lengthy and rigorous timeline to production. The Pebble Partnership's proposed mine development plan will be subject to a regulatory review involving 11 state and federal agencies. The Pebble Partnership must provide the required information for an Environmental Impact Statement and be issued more than 60 State and Federal permits. The combined review and permitting process could take three years or more to complete.

Oil and gas development can also be expected to increase due to the currently high oil and gasoline prices. Plans are underway for development of a gas pipeline that may include a shipping segment through the GOA. Exploration and eventual extraction development of the Arctic National Wildlife Preserve is also anticipated. It is also possible that fuel prices may create incentive for oil and gas lease sales on the continental shelf off western Alaska, which is the prime fishing ground of the EBS.

4.0 WALLEYE POLLOCK

The Bering Sea pollock fishery, and potential changes to the prosecution of the pollock fishery to reduce salmon bycatch under the alternatives, impacts the pollock stocks. This chapter provides information on pollock biology, distribution, and current survey and stock assessment information. This chapter analyses the impacts to pollock by estimating the ability of the pollock fleet to catch the full total allowable catch under the alternatives. The description of the pollock fishery and economic impacts to the pollock fishery from the alternatives are discussed in Chapter 10. Chapter 3 provides a description of the methodology used to conduct these analyses.

4.1 Overview of pollock biology and distribution

Overview information in this section is extracted from Ianelli et al. (2007). Other information on pollock may be found at the NMFS website, www.afsc.noaa.gov/refm.

Walleye pollock, *Theragra chalcogramma*, are a member of the order Gadiformes and family Gadidae. They are a semi-demersal, schooling species that are generally found at depths from 30 to 300 meters but have been recorded at depths as low as 950 meters (Mecklenburg *et al.* 2002). Pollock are usually concentrated on the outer shelf and slope of coastal waters but may utilize a wide variety of habitats as nearshore seagrass beds (Sogard and Olla 1993). Their distribution extends from the waters of the North Pacific Ocean off Carmel, California throughout the Gulf of Alaska in the eastern Pacific Ocean, across the North Pacific Ocean including the Bering Sea, Chukchi Sea, and Aleutian Islands, and in the western Pacific Ocean from the Sea of Japan north to the Sea of Okhotsk in the western Pacific Ocean (Mecklenburg *et al.* 2002, Hart 1973).

Pollock are considered a relatively fast growing and short-lived species and currently represents a major biological component of the Bering Sea ecosystem. Adult pollock are visual, opportunistic feeders that diet on euphausiids, copepods, and fish, with a majority of their diet from juvenile pollock (National Research Council 1996). In the eastern Bering Sea, cannibalism is the greatest source of mortality for juvenile pollock (Livingston 1989), but cannibalism is not prevalent in the Gulf of Alaska (GOA) (Bailey *et al.* 1999). Juvenile pollock reach sexual maturity and recruit to the fishery at about age four at lengths of 40 to 45 centimeters (Wespestad 1993). Most pollock populations spawn at consistent times and consistent locations each year, most often in sea valleys, canyons, deep water, or the outer margins of the continental shelf during late winter and early spring (Bailey *et al*. 1999). In the eastern Bering Sea, spawning occurs over the southeastern slope and shelf from March through June and over the northwest slope and shelf from June through August (Hinckley 1987). The main spawning location is on the southeastern shelf while the main rearing ground location is on the northeastern shelf (Ianelli et al. 2007).

For management purposes, pollock in the U.S. waters of the Bering Sea are divided into three stocks: the eastern Bering Sea stock, the Aleutian Islands stock, and the Central Bering Sea-Bogoslof Island stock (Ianelli *et al.* 2007). The extent to which pollock migrate across the boundaries of these three areas, across the boundaries of the Bering Sea U.S. EEZ and the Russian EEZ, and seasonally within the eastern Bering Sea is unclear. General migratory movements of adult pollock on and off the eastern Bering Sea shelf tend to follow a pattern of movement to the outer shelf edge and deep water in the winter months, to spawning areas in the springtime, and to the outer and central shelf during the summer months to feed (Smith 1981).

Japanese mark-recapture studies during the summer/autumn feeding seasons have revealed that pollock migrate across the Bering Sea (Dawson 1989) suggesting the interchange of pollock between Russian and U.S. waters. There are concerns that Russian fisheries may be harvesting U.S. managed pollock stocks resulting in a higher fishing mortality. Although the few tagging studies in the Bering Sea have not provided information on spawning migrations, homing to specific spawning sites, and the characteristic of migrating populations as schools or individuals, tagging studies around Japan have been more informative. Mark-recapture studies in which pollock were tagged during the spawning season (April) in Japanese waters revealed migrations for spawning site fidelity, but diffuse mixing during the summer feeding season (Tsuji 1989).

4.1.1 Food habits/ecological role

In North American waters, pollock are most prevalent in the eastern Bering Sea. Because of their large biomass, pollock provide an important food source for other fishes, marine mammals as Steller sea lions (*Eumetopias jubatus*), northern fur seals (*Callorhinus ursinus*), and fin whales (*Balaenoptera physalus*), and marine birds as the northern fulmars (*Fulmarus glacialis*), kittiwakes (*Rissa tridactyla, Rissa brevirostris*), murres (*Uria aalge, Uria lomvia*), and puffins (*Fratercula corniculata, Lunda cirrhata*) (Kajimura and Fowler 1984). These predator-prey relationships between pollock and other organisms are an integral part of the balance that makes the eastern Bering Sea one of the most highly productive environments in the world.

In comparisons of the western Bering Sea (WBS) with the Eastern Bering Sea using mass-balance food-web models based on 1980-85 summer diet data, Aydin et al. (2002) found that the production in these two systems is quite different. On a per-unit-area measure, the western Bering Sea has higher productivity than the EBS. Also, the pathways of this productivity are different with much of the energy flowing through epifaunal species (e.g., sea urchins and brittlestars) in the WBS whereas for the EBS, crab and flatfish species play a similar role. In both regions, the keystone species in 1980-85 were pollock and Pacific cod. This study showed that the food web estimated for the EBS ecosystem appears to be relatively mature due to the large number of interconnections among species. In a more recent study based on 1990-93 diet data (see Boldt et al. 2007 for methods), pollock remain in a central role in the ecosystem. The diet of pollock is similar between adults and juveniles with the exception that adults become more piscivorous (with consumption of pollock by adult pollock representing their third largest prey item). In terms of magnitude, pollock cannibalism may account for 2.5 million t to nearly 5 million t of pollock consumed (based on uncertainties in diet percentage and total consumption rate).

Regarding specific small-scale ecosystems of the EBS, Ciannelli et al. (2004) presented an application of an ecosystem model scaled to data available around the Pribilof Islands region. They applied bioenergetics and foraging theory to characterize the spatial extent of this ecosystem. They compared energy balance, from a food web model relevant to the foraging range of northern fur seals and found that a range of 100 nautical mile radius encloses the area of highest energy balance representing about 50% of the observed foraging range for lactating fur seals. This suggests that fur seals depend on areas outside the energetic balance region. This study develops a method for evaluating the shape and extent of a key ecosystem in the EBS (i.e., the Pribilof Islands). Subsequent studies have examined spatial and temporal patterns of age zero pollock in this region and showed that densities are highly variable (Winter et al. 2005, Swartzman et al. 2005).

The impact of predation by species other than pollock may have shifted in recent years. In particular, the increasing population of arrowtooth flounder in the Bering Sea is a concern, especially considering the large predation caused by these flatfish in the Gulf of Alaska. Overall, the total non-cannibal groundfish predator biomass has gone down in the Bering Sea according to current stock assessments, with the drop of Pacific cod in the 1980s exceeding the rise of arrowtooth in terms of biomass (e.g., Fig. 4 in Boldt 2007). This also represents a shift in the age of predation, with arrowtooth flounder consuming primarily age-2 pollock, while Pacific cod primarily consume larger pollock. However, the dynamics of this predation interaction may be quite different than in the Gulf of Alaska. A comparison of 1990-94 natural mortality by predator for arrowtooth flounder in the Bering Sea and the Gulf of Alaska shows that they are truly a top predator in the Gulf of Alaska. In the Bering Sea, pollock, skates, and sharks all prey on arrowtooth flounder, giving the species a relatively high predation mortality.

The predation on small arrowtooth flounder by large pollock gives rise to a specific concern for the Bering Sea pollock stock. Walters and Kitchell (2001) describe a predator/prey system called "cultivation/depensation" whereby a species such as pollock "cultivates" its young by preying on species that would eat its young (for example, arrowtooth flounder). If these interactions are strong, the removal of the large pollock may lead to an accelerated decline, as the control it exerts on predators of its recruits is removed—this has been cited as a cause for a decline of cod in the Baltic Sea in the presence of herring feeding on cod young (Walters and Kitchell 2001). In situations like this, it is possible that predator culling (e.g., removing arrowtooth) may not have a strong effect towards controlling predation compared to applying additional caution to pollock harvest and thus preserving this natural control. At the moment, this concern for Bering Sea pollock is qualitative; work on extending a detailed, age-structured, multispecies statistical model (e.g., MSM; Jurado-Molina et al. 2005) to more completely model this complex interaction for pollock and arrowtooth flounder is continuing.

4.1.2 NMFS surveys and stock assessment

NMFS conducts bottom trawl surveys annually and echo-integration trawl surveys every other year. Both occur during summer months and provide a synoptic overview of relative densities of adult and pre-recruit pollock (Fig. 4-1).

Extensive observer sampling is conducted and a complete assessment is done each year for evaluating stock status and to form the basis of catch recommendations. The most recent assessment shows a declining biomass since 2003 and a period of recent below-average recruitment levels (Fig. 4-2; Ianelli et al. 2007). During 2002-2005 the EBS region pollock catch has averaged 1.463 million tons while for the period 1982-2000, the average was 1.15 million tons. The effect of this level of fishing continues to be closely monitored by resource assessment surveys and an extensive fishery observer program.

The assessment reporting process involves reviews done by the Council through the Groundfish Plan Team (which meet on assessment issues twice per year). The Plan Team prepares a summary report of the assessment as the introduction to the Stock Assessment and Fishery Evaluation (SAFE) report which contains separate chapters for each stock or stock complex. These are posted on the internet and can be obtained at http://www.afsc.noaa.gov/REFM/stocks/assessments.htm. Preliminary drafts are presented to the Council in early December where the SSC reviews the documents and makes final ABC recommendations. As part of the review process, the SSC formally provides feedback on aspects of research and improvements on assessments for the coming year. The SSC ABC recommendation is forwarded to the Council where the value represents an upper limit of where the TAC may be set.

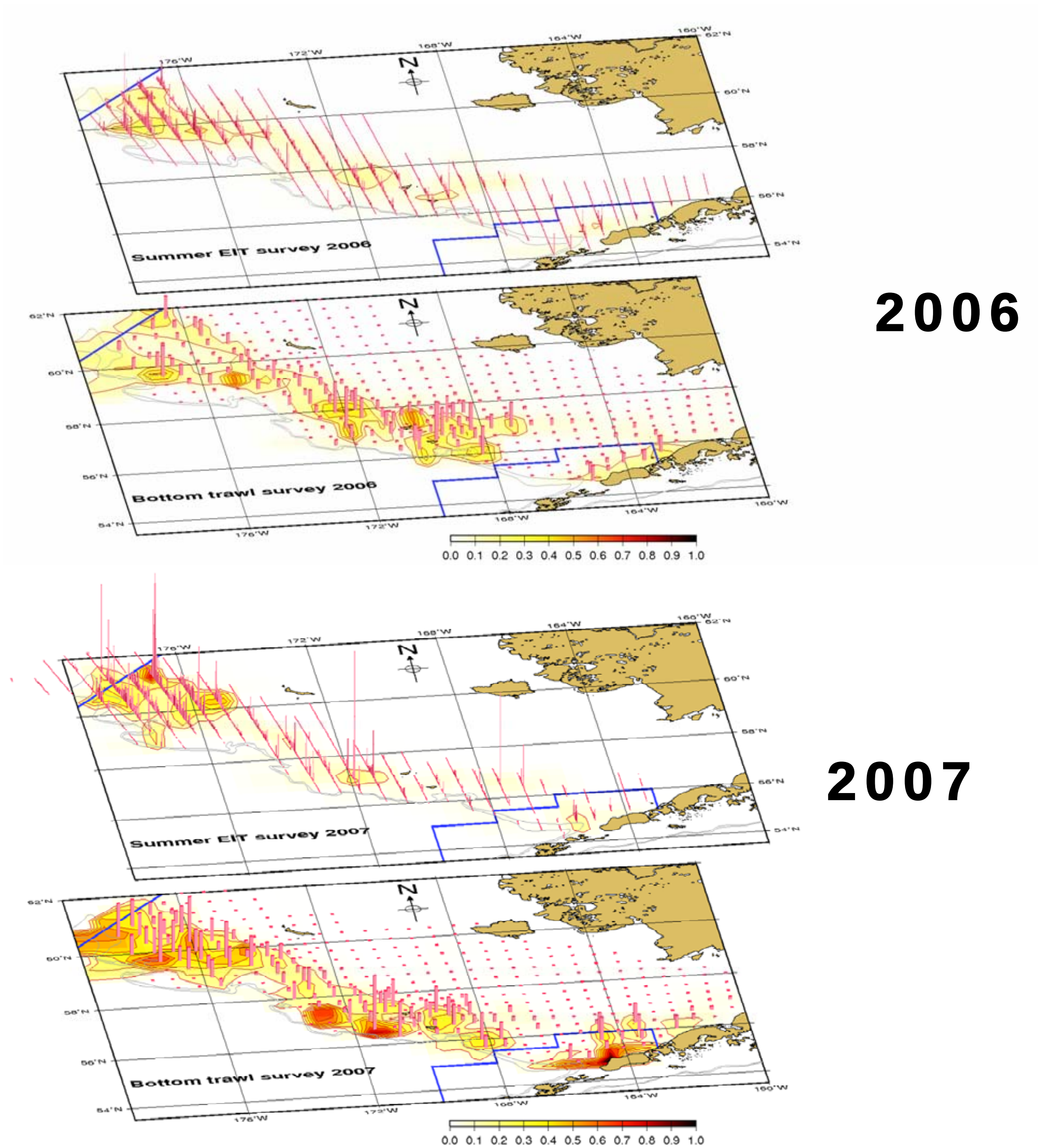

Fig. 4-1 Echo-integration trawl survey results for 2006 and 2007. The lower Fig. is the result from the BTS data in the same years. Vertical lines represent biomass of pollock as observed in the different surveys

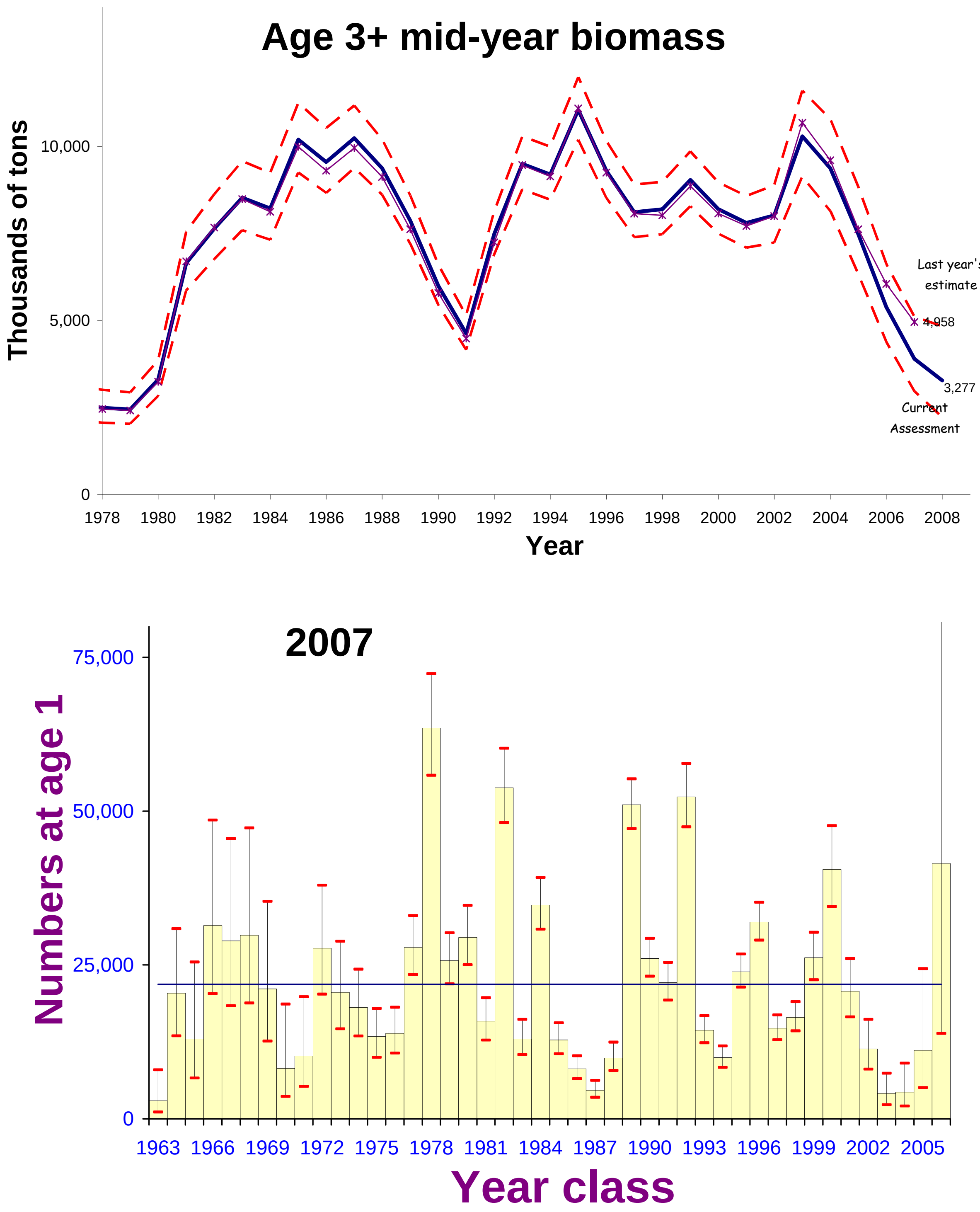

Fig. 4-2 Estimated age 3+ EBS mid-year pollock biomass, 1978-2008 (top) and age-1 year-class strengths. Approximate upper and lower 95% confidence limits are shown by dashed lines and error bars.

4.1.3 Pollock density within the Catcher Vessel Operation Area

The catcher vessel operational area (CVOA) is defined as the area of the Bering Sea east of 167°30' W. longitude, west of 163° W. longitude, south of 56° N. latitude, and north of the Aleutian Islands (Fig. 4-3). Vessels in the CP sector or CVs catching pollock for the mothership sector are prohibited from conducting directed fishing for pollock in the CVOA unless they are participating in a CDQ fishery. The CVOA is in effect during the pollock "B" season, from September 1 until the date that the inshore CV sector has harvested its "B" season allocation and is closed to directed fishing.

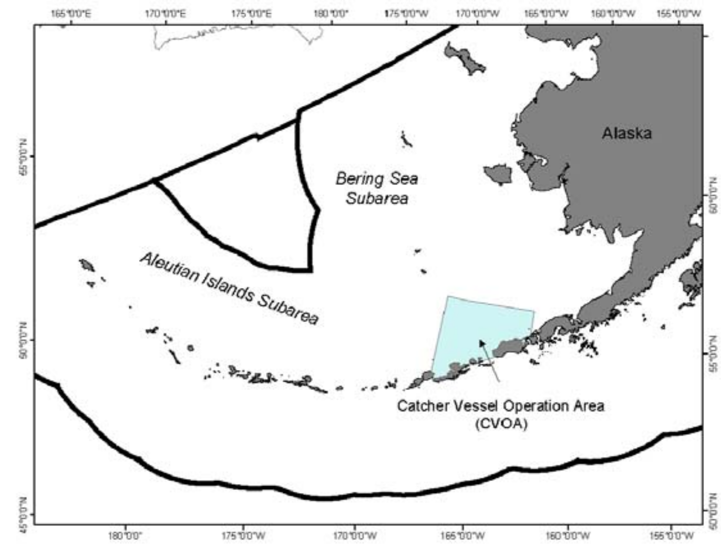

Fig. 4-3 Catcher Vessel Operational Area (CVOA)

Comparison of NMFS survey estimates of pollock biomass in the CVOA with pollock catch within the same region (1998-2007) suggests that expected CPUE in this region may be lower. The historical densities of pollock were evaluated within the CVOA. Based on mid-water acoustic survey data, the relative abundances of pollock in the CVOA has declined in the last three years (Fig. 4-4).

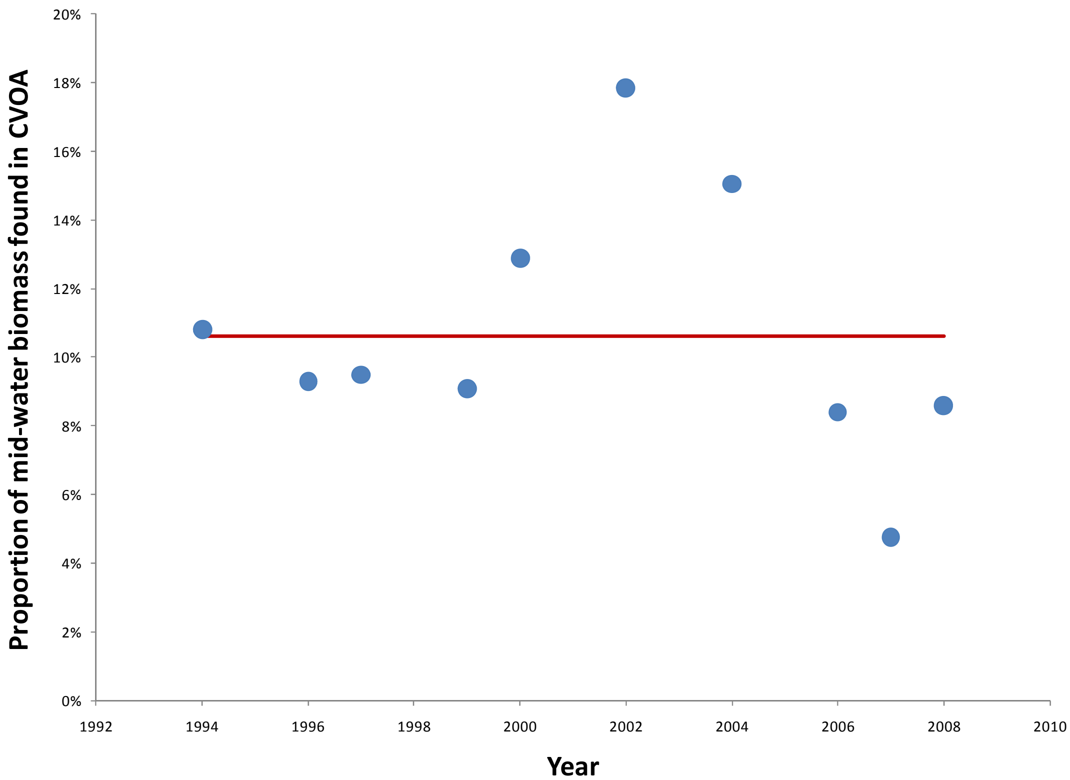

Fig. 4-4 Proportion of pollock found within the CVOA based on the echo-integration mid-water trawl survey (from Ianelli et al. 2008).

4.2 Impact analysis methods

The approach to evaluate the impact of the alternative management measures for Chinook salmon bycatch involved evaluating spatial patterns and the overall reduction in the ability to catch the full pollock TAC. To determine the likely dates when attainment of the salmon bycatch cap would occur under each option, we created a database that expanded observer data proportionately from each reporting area, month, and sector to match NMFS's catch accounting data as of April 30, 2008. This allows us to evaluate spatial components while ensuring that proportionate catch estimates are equivalent to total estimates maintained by NMFS. Additional information on the specific methodology for the impact analysis is contained in Chapter 3.

This analysis assumes that past fleet behavior appropriately approximates operational behavior under the alternatives and does not estimate changes in behavior. While it is expected that the fleet would change its behavior to fully harvest the pollock TAC and mitigate potential losses in pollock revenue, explicitly predicting changes in fleet behavior in a reasonable way would require data and analyses that are presently unavailable.

The area considerations were used to partition historical pollock data for differences in age and size due to either a regulatory closure (to evaluate impacts of Alternative 3) or for a closure that the industry is likely to impose to avoid suspension of fishing activities. Also, for the summer-fall fishery (B season), we examined the "early" with the "later" part of this season since Chinook bycatch rates tend to be higher later in the season. The question that we address is if the spatio-temporal aspects would result in the pollock population being more or less vulnerable to overfishing. For presentation purposes, the area east and west of 170°W was identified, and the summer-fall season was split into pre- and post- August 31st periods.

Alternative 3: Triggered closure areas

Because the areas for which closures were triggered were different for the A and B season, we categorized observer data as falling inside or outside of these areas. The individual haul records were then aggregated up to match unique area-month-sector strata. Observer data from 1991 to 2002 were retained for the analysis, but for clarity we focus our evaluation of triggered closures on the 2003-2007 period only.

The treatment of the data involved finding when each specified trigger salmon bycatch level would have been reached, then summing values from that date onwards till the end of the season. For example, to compute the expected forgone pollock that would have occurred given a cap in a given year the analysis examined the cumulative daily bycatch records of Chinook and found the date that the cap was exceeded (e.g., Sept 15th); and then computed the tons of pollock that the fleet (or sector) caught from Sept 16th till the end of the season. This would be one measure of "forgone pollock" that might have accrued had one of the different salmon bycatch measures been selected.

4.3 Impacts on pollock

Alternatives 2 and 3 both use the same range of caps; the difference between the alternatives is that, when the cap is reached, Alternative 2 would close the fishery completely and Alternative 3 would close only certain areas to directed pollock fishing (see Fig. 2-2 and Fig. 2-3 for Alternative 3 closure areas) and allow fishing to continue in different areas. Alternative 2 would be likely, therefore, to result in more pollock forgone, i.e., in lower pollock harvests. Table 4-1 through Table 4-8 exhibit the effect of the cap in the resulting amount of forgone pollock and, for Alternative 3, the impact of continued fishing outside the closed areas. Parallel impacts are expected to occur under each of the alternatives.

All three alternatives would likely close the fishery earlier than Alternative 1 (the status quo) and, thus, result in lower pollock catches (based on 2003-2007 data and assuming fleet behavior in the past approximates future behavior under each alternative). For the Alternative 2 analysis, it was assumed that transfers and rollovers were not allowed, however, they are options under Alternative 2. For Alternative 2, the A and B season closure dates would have varied considerably in different years under the four different cap level and seasonal split options, respectively (Table 4-9 and Table 4-14, respectively). Under Alternative 2, Table 4-10 shows that in the most constraining option, the A-season forgone pollock would have been a minimum of 182,300 t in 2004 to a maximum of 460,000 t in 2007. Even for the least constraining option, the 2007 A-season forgone pollock level would be nearly 119,000 t. The least constraining option was a cap of 87,500 with a 70/30 season split. Within each fishing sector, the variability of forgone pollock is higher over different scenarios within Alternative 2 than over different years (Table 4-11 through Table 4-13 for the A-season and in Table 4-15 through Table 4-18 for the B-season).

The analysis of Alternative 4 was similar to that for caps in Alternative 2, and retrospective fishery closures were tabulated from 2003-2007. However, for Alternative 4, transfers between sectors within each season and rollovers between seasons were assumed. The Alternative 4 analysis shows that sector specific closure dates for both the A and B seasons (in which sector-specific allowances with and without transferability among sectors and with 80% rollover from any remaining Chinook salmon bycatch from the A season to the B season) result in closure dates that are generally later than for those under Alternative 2 (Table 4-19). For example, under the least constraining cap scenario within Alternative 2, the 70/30 A/B season allocation would have resulted in fleetwide closures around mid-October in 2004, 2005, and 2007. The analogous Alternative 4 scenario (PPA1) would have closed the entire fleet early in 2007, though the CPs and inshore CV sectors would have closed sooner than the under Alternative 2.

The estimated amounts of forgone pollock catch under Alternative 4 are generally lower than under Alternative 2. In 2007, the highest bycatch year, Alternative 4 would have had the highest level of fleetwide forgone pollock, ranging between 300 - 435 thousand t, depending on the PPA cap level and transferability (but assuming 80% rollover allowance; Table 4-20). The different rollover options (no rollover and 100% rollover) change the levels of forgone pollock slightly for the 100% rollover case and, to a greater extent, for the 0% rollover case (Table 4-21). Compared to the 80% rollover in the PPA, the 2003-2007 sum of the forgone pollock for the 0% and 100% rollover options highlights the impacts of the rollover provision Alternative 4 (Table 4-22).

Analysis indicates that Alternatives 2, 3, and 4 would make it more difficult for fishermen to catch the full TAC for EBS pollock without changing their fishing behavior to avoid Chinook salmon bycatch. If the pollock TAC was not fully harvested, fishing would have less impact on the stock, and the pollock fishing mortality rates may be lower than biologically acceptable levels. Hence, the Chinook salmon management measures would not negatively impact the pollock stock in terms of total removals by the fishery.

Given the potential closures, the fishermen may go to greater extremes to avoid salmon bycatch, and the impact of this change in fishing behavior on the pollock stock requires consideration. For example, the measures may result in the fishery focusing on younger (or older) ages of pollock than otherwise would have been taken. Since these changes would be monitored and updated in future stock assessments, the risk to the stock is considered minor since conservation goals for maintaining spawning biomass would remain central to the assessment. However, the change in fishing pattern could result in lower overall ABC and TAC levels, depending on how the age composition of the catch changed. The available length and age data were compiled from 2000-2007 and disaggregated by seasons (and partial seasons) and regions (east and west of 170°W) for analysis. The resulting numbers of samples by age are shown in Table 4-23.

Results indicate that pollock lengths-at-age and weights-at-age are smaller earlier in the season (Fig. 4-5). Should the fishery focus effort earlier in the B-season, then the yield per individual pollock will be lower. This would be reflected in the stock assessment analysis since updated mean weights-at-age would likely result in a lower ABC (and perhaps TAC), if all other factors are equal. Therefore, the potential biological effects of the any of the alternatives are expected to be correctly incorporated in the present pollock quota system.

Spatial effects of the alternatives on the size-at-age of pollock are compounded by seasonal effects, particularly within the summer-fall (B) season, even larger spatial and seasonal effects can be observed on weights-at-age (Fig. 4-6). While 170°W represents a proxy for fleet movement out of areas where salmon bycatch rates are high, this clearly demonstrates spatial consequences for expected size-at-age values assumed for pollock. Based on previous patterns of Chinook bycatch closures observed by the industry, most areas were east of 170°W, where the mean size at age is considerably larger than elsewhere. We can anticipate then that more restrictive closures will result in a general pattern that tends towards harvesting pollock at smaller sizes at age. As mentioned above, this would be reflected in the stock assessment analysis since updated mean weights-at-age are computed but could result in lower ABC and TAC recommendations.

The assumption that harvests may reach the pollock TAC under Alternative 3 depends on how difficult it is for fishermen to find pollock outside the closed areas. The data show that, in some years, the pollock catch rate is consistently higher outside the closed areas, although in other years the pollock catch rate is consistently lower for the CPs and inshore CVs and for the fleet as a whole (Fig. 4-7 - Fig. 4-12). Without evaluating a full catch-rate model that accounts for vessel size and other factors (search time, cooperative catch-rate reporting groups etc), this simple examination suggests that the extra effort required to fully catch the pollock TAC outside the closed area depends on when the closure occurs and where the pollock are, which, based on this analysis, appears to be highly variable between years.

The same impacts identified for the hard caps under Alternative 2 would likely occur under Alternative 3 also—namely, that the fleet would be likely to fish earlier in the summer and tend to fish in areas farther from the core fishing grounds north of Unimak Island. Both of these effects would result in catches of pollock that are considerably smaller in mean size-at-age. This impact would likely result in smaller TACs since pollock harvests would not benefit from the summer growth period.

Table 4-1 Hypothetical closure dates, by year and season, under Chinook salmon hard cap sector allocation Option 1 (Chinook bycatch allocated to sector proportional to pollock allocation).

opt1(AFA)			A					B				
AB Split	Cap	Sect	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
50/50	87,500	CDQ	---	---	---	---	---	---	---	---	---	---
		M	---	---	---	23-Feb	15-Feb	---	---	---	---	---
		P	---	---	---	21-Mar	13-Feb	---	---	---	---	---
		S	---	---	---	10-Feb	2-Feb	---	23-Oct	8-Oct	22-Oct	10-Oct
	68,100	CDQ	---	---	---	---	---	---	---	---	---	---
		M	---	---	---	18-Feb	2-Feb	---	---	---	---	---
		P	15-Mar	---	---	11-Mar	8-Feb	---	---	---	---	---
		S	23-Mar	---	---	7-Feb	29-Jan	---	12-Oct	3-Oct	13-Oct	5-Oct
	48,700	CDQ	---	---	---	---	3-Mar	---	---	---	---	25-Oct
		M	15-Mar	---	---	8-Feb	28-Jan	---	---	---	---	---
		P	19-Feb	---	1-Mar	21-Feb	4-Feb	---	---	---	---	---
		S	27-Feb	17-Mar	24-Feb	5-Feb	25-Jan	---	2-Oct	27-Sep	2-Oct	29-Sep
	29,300	CDQ	12-Mar	---	---	14-Mar	18-Feb	---	27-Sep	---	---	14-Oct
		M	13-Feb	26-Feb	17-Feb	3-Feb	24-Jan	9-Oct	23-Oct	---	---	18-Oct
		P	11-Feb	1-Mar	11-Feb	8-Feb	26-Jan	---	---	---	---	23-Oct
		S	12-Feb	24-Feb	10-Feb	30-Jan	23-Jan	14-Oct	16-Sep	10-Sep	17-Sep	14-Sep
58/42	87,500	CDQ	---	---	---	---	---	---	---	---	---	---
		M	---	---	---	28-Feb	28-Feb	---	---	---	---	---
		P	---	---	---	---	18-Feb	---	---	---	---	---
		S	---	---	---	16-Feb	7-Feb	---	14-Oct	5-Oct	16-Oct	6-Oct
	68,100	CDQ	---	---	---	---	---	---	---	---	---	---
		M	---	---	---	21-Feb	10-Feb	---	---	---	---	---
		P	---	---	---	15-Mar	11-Feb	---	---	---	---	---
		S	---	---	---	9-Feb	31-Jan	---	7-Oct	1-Oct	8-Oct	2-Oct
	48,700	CDQ	---	---	---	---	9-Mar	---	---	---	---	18-Oct
		M	27-Mar	---	---	10-Feb	30-Jan	---	4-Nov	---	---	26-Oct
		P	21-Feb	---	14-Mar	26-Feb	6-Feb	---	---	---	---	---
		S	8-Mar	---	7-Mar	6-Feb	26-Jan	---	28-Sep	22-Sep	26-Sep	21-Sep
	29,300	CDQ	---	---	---	---	21-Feb	---	23-Sep	---	---	12-Oct
		M	17-Feb	3-Mar	25-Feb	5-Feb	25-Jan	7-Oct	15-Oct	---	---	13-Oct
		P	13-Feb	5-Mar	15-Feb	10-Feb	27-Jan	---	---	---	---	18-Oct
		S	15-Feb	1-Mar	13-Feb	1-Feb	23-Jan	8-Oct	12-Sep	1-Sep	13-Sep	12-Sep
70/30	87,500	CDQ	---	---	---	---	---	---	---	---	---	---
		M	---	---	---	---	---	---	---	---	---	---
		P	---	---	---	---	1-Mar	---	---	---	---	---
		S	---	---	---	21-Feb	14-Feb	---	5-Oct	29-Sep	5-Oct	30-Sep
	68,100	CDQ	---	---	---	---	---	---	---	---	---	18-Oct
		M	---	---	---	24-Feb	21-Feb	---	4-Nov	---	---	26-Oct
		P	---	---	---	---	16-Feb	---	---	---	---	---
		S	---	---	---	13-Feb	4-Feb	---	28-Sep	22-Sep	26-Sep	21-Sep
	48,700	CDQ	---	---	---	---	---	---	27-Sep	---	---	14-Oct
		M	---	---	---	18-Feb	2-Feb	9-Oct	23-Oct	---	---	18-Oct
		P	16-Mar	---	---	11-Mar	8-Feb	---	---	---	---	23-Oct
		S	23-Mar	---	---	7-Feb	29-Jan	13-Oct	16-Sep	10-Sep	17-Sep	14-Sep
	29,300	CDQ	---	---	---	---	25-Feb	---	14-Sep	---	---	7-Oct
		M	25-Feb	26-Mar	10-Mar	6-Feb	26-Jan	4-Oct	27-Sep	---	---	25-Sep
		P	16-Feb	11-Mar	21-Feb	15-Feb	1-Feb	10-Oct	---	14-Sep	---	2-Oct
		S	20-Feb	9-Mar	17-Feb	3-Feb	24-Jan	3-Oct	6-Sep	22-Aug	7-Sep	9-Sep

Table 4-2 Hypothetical closure dates by year and season under Chinook salmon hard cap sector allocation Option 2a.

opt2a			A					B				
AB Split	Cap	Sect	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
50/50	87,500	CDQ	6-Mar	---	---	9-Mar	19-Feb	---	30-Sep	---	---	16-Oct
		M	---	---	---	14-Feb	30-Jan	---	---	---	---	---
		P	19-Feb	---	4-Mar	21-Feb	5-Feb	---	---	---	---	---
		S	---	---	---	23-Feb	23-Feb	---	---	28-Oct	---	25-Oct
	68,100	CDQ	26-Feb	12-Mar	3-Mar	1-Mar	12-Feb	---	14-Sep	---	---	8-Oct
		M	6-Mar	---	---	6-Feb	29-Jan	---	---	---	---	---
		P	18-Feb	11-Mar	23-Feb	14-Feb	28-Jan	---	---	---	---	---
		S	---	---	---	22-Feb	7-Feb	---	---	12-Oct	---	17-Oct
	48,700	CDQ	11-Feb	3-Mar	22-Feb	28-Feb	11-Feb	25-Sep	13-Sep	---	---	1-Oct
		M	18-Feb	4-Mar	24-Feb	6-Feb	22-Jan	9-Oct	28-Oct	---	---	25-Oct
		P	10-Feb	3-Mar	8-Feb	6-Feb	21-Jan	---	---	---	---	25-Oct
		S	---	---	---	7-Feb	30-Jan	---	14-Oct	4-Oct	19-Oct	8-Oct
	29,300	CDQ	2-Feb	23-Feb	14-Feb	19-Feb	3-Feb	2-Sep	5-Sep	14-Sep	---	23-Sep
		M	3-Feb	10-Feb	1-Feb	22-Jan	21-Jan	7-Oct	28-Sep	---	---	2-Oct
		P	2-Feb	9-Feb	31-Jan	29-Jan	20-Jan	10-Oct	---	15-Sep	---	2-Oct
		S	26-Feb	18-Mar	24-Feb	5-Feb	22-Jan	---	28-Sep	26-Sep	3-Oct	23-Sep
58/42	87,500	CDQ	14-Mar	---	---	17-Mar	20-Feb	---	22-Sep	---	---	9-Oct
		M	---	---	---	22-Feb	31-Jan	---	---	---	---	---
		P	27-Feb	---	---	1-Mar	5-Feb	---	---	---	---	---
		S	---	---	---	24-Mar	23-Mar	---	---	20-Oct	---	17-Oct
	68,100	CDQ	5-Mar	---	11-Mar	9-Mar	12-Feb	10-Oct	14-Sep	---	---	8-Oct
		M	21-Mar	---	---	7-Feb	30-Jan	17-Oct	5-Nov	---	---	26-Oct
		P	19-Feb	19-Mar	3-Mar	21-Feb	5-Feb	---	---	---	---	2-Nov
		S	---	---	---	23-Feb	15-Feb	---	28-Oct	12-Oct	27-Oct	9-Oct
	48,700	CDQ	11-Feb	11-Mar	23-Feb	28-Feb	11-Feb	17-Sep	6-Sep	30-Sep	---	30-Sep
		M	19-Feb	12-Mar	4-Mar	6-Feb	22-Jan	8-Oct	20-Oct	---	---	17-Oct
		P	11-Feb	3-Mar	15-Feb	6-Feb	28-Jan	---	---	---	---	17-Oct
		S	---	---	---	7-Feb	30-Jan	---	13-Oct	3-Oct	11-Oct	1-Oct
	29,300	CDQ	10-Feb	24-Feb	21-Feb	20-Feb	11-Feb	1-Sep	29-Aug	7-Sep	---	23-Sep
		M	10-Feb	17-Feb	8-Feb	29-Jan	21-Jan	29-Sep	27-Sep	---	---	24-Sep
		P	2-Feb	9-Feb	31-Jan	5-Feb	20-Jan	2-Oct	24-Sep	7-Sep	---	24-Sep
		S	6-Mar	26-Mar	3-Mar	6-Feb	22-Jan	---	27-Sep	18-Sep	25-Sep	16-Sep
70/30	87,500	CDQ	---	---	---	---	21-Feb	3-Oct	14-Sep	---	---	8-Oct
		M	---	---	---	23-Feb	15-Feb	17-Oct	28-Oct	---	---	25-Oct
		P	21-Mar	---	---	16-Mar	6-Feb	---	---	---	---	26-Oct
		S	---	---	---	---	---	---	21-Oct	4-Oct	19-Oct	9-Oct
	68,100	CDQ	13-Mar	---	---	17-Mar	20-Feb	17-Sep	6-Sep	30-Sep	---	30-Sep
		M	---	---	---	15-Feb	31-Jan	8-Oct	20-Oct	---	---	17-Oct
		P	20-Feb	---	11-Mar	1-Mar	5-Feb	---	---	---	---	17-Oct
		S	---	---	---	10-Mar	16-Mar	---	13-Oct	3-Oct	11-Oct	1-Oct
	48,700	CDQ	26-Feb	12-Mar	3-Mar	1-Mar	12-Feb	2-Sep	5-Sep	14-Sep	---	23-Sep
		M	6-Mar	---	---	6-Feb	29-Jan	7-Oct	28-Sep	---	---	2-Oct
		P	18-Feb	11-Mar	23-Feb	14-Feb	28-Jan	10-Oct	---	15-Sep	---	2-Oct
		S	---	---	---	22-Feb	7-Feb	---	28-Sep	26-Sep	3-Oct	23-Sep
	29,300	CDQ	10-Feb	2-Mar	22-Feb	20-Feb	11-Feb	1-Sep	29-Aug	29-Aug	---	1-Sep
		M	11-Feb	25-Feb	16-Feb	29-Jan	21-Jan	29-Sep	12-Sep	22-Sep	---	2-Sep
		P	10-Feb	17-Feb	7-Feb	5-Feb	21-Jan	9-Sep	1-Sep	30-Aug	---	10-Sep
		S	21-Mar	---	---	6-Feb	29-Jan	16-Oct	12-Sep	4-Sep	10-Sep	9-Sep

Table 4-3 Hypothetical closure dates by year and season under Chinook salmon hard cap section allocation Option 2d.

opt 2d			A					B				
AB Split	Cap	Sect	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
50/50	87,500	CDQ	---	---	---	---	9-Mar	---	---	---	---	---
		M	---	---	---	19-Feb	5-Feb	---	---	---	---	---
		P	18-Mar	---	---	11-Mar	8-Feb	---	---	---	---	---
		S	---	---	---	19-Feb	11-Feb	---	---	14-Oct	---	16-Oct
	68,100	CDQ	---	---	---	---	28-Feb	---	---	---	---	20-Oct
		M	28-Mar	---	---	10-Feb	30-Jan	---	---	---	---	---
		P	21-Feb	---	6-Mar	25-Feb	5-Feb	---	---	---	---	---
		S	---	---	---	10-Feb	1-Feb	---	23-Oct	8-Oct	22-Oct	10-Oct
	48,700	CDQ	17-Mar	---	---	---	20-Feb	---	29-Sep	---	---	15-Oct
		M	24-Feb	15-Mar	9-Mar	6-Feb	26-Jan	24-Oct	4-Nov	---	---	26-Oct
		P	15-Feb	9-Mar	18-Feb	13-Feb	31-Jan	---	---	---	---	---
		S	17-Mar	---	24-Mar	6-Feb	27-Jan	---	10-Oct	2-Oct	10-Oct	3-Oct
	29,300	CDQ	21-Feb	10-Mar	25-Feb	1-Mar	13-Feb	---	16-Sep	---	---	8-Oct
		M	10-Feb	18-Feb	10-Feb	30-Jan	23-Jan	7-Oct	14-Oct	---	---	13-Oct
		P	8-Feb	17-Feb	6-Feb	5-Feb	24-Jan	---	---	---	---	14-Oct
		S	17-Feb	5-Mar	15-Feb	2-Feb	24-Jan	---	26-Sep	19-Sep	22-Sep	19-Sep
58/42	87,500	CDQ	---	---	---	---	---	---	---	---	---	24-Oct
		M	---	---	---	22-Feb	13-Feb	---	---	---	---	---
		P	---	---	---	16-Mar	11-Feb	---	---	---	---	---
		S	---	---	---	23-Feb	16-Feb	---	26-Oct	10-Oct	25-Oct	11-Oct
	68,100	CDQ	---	---	---	---	5-Mar	---	---	---	---	17-Oct
		M	---	---	---	18-Feb	1-Feb	---	---	---	---	---
		P	28-Feb	---	---	3-Mar	7-Feb	---	---	---	---	---
		S	---	---	---	16-Feb	6-Feb	---	14-Oct	5-Oct	15-Oct	6-Oct
	48,700	CDQ	---	---	---	---	22-Feb	---	25-Sep	---	---	13-Oct
		M	11-Mar	---	---	8-Feb	27-Jan	11-Oct	27-Oct	---	---	22-Oct
		P	17-Feb	16-Mar	26-Feb	18-Feb	3-Feb	---	---	---	---	26-Oct
		S	27-Mar	---	---	8-Feb	29-Jan	---	5-Oct	28-Sep	5-Oct	30-Sep
	29,300	CDQ	1-Mar	17-Mar	5-Mar	3-Mar	15-Feb	1-Oct	12-Sep	---	---	6-Oct
		M	12-Feb	24-Feb	16-Feb	3-Feb	24-Jan	5-Oct	1-Oct	---	---	3-Oct
		P	9-Feb	28-Feb	9-Feb	7-Feb	25-Jan	---	---	20-Sep	---	6-Oct
		S	21-Feb	13-Mar	18-Feb	4-Feb	25-Jan	17-Oct	18-Sep	14-Sep	18-Sep	15-Sep
70/30	87,500	CDQ	---	---	---	---	---	---	1-Oct	---	---	16-Oct
		M	---	---	---	1-Mar	1-Mar	---	---	---	---	---
		P	---	---	---	---	16-Feb	---	---	---	---	---
		S	---	---	---	17-Mar	22-Mar	---	12-Oct	3-Oct	13-Oct	5-Oct
	68,100	CDQ	---	---	---	---	---	---	25-Sep	---	---	13-Oct
		M	---	---	---	21-Feb	10-Feb	11-Oct	27-Oct	---	---	22-Oct
		P	---	---	---	14-Mar	10-Feb	---	---	---	---	26-Oct
		S	---	---	---	21-Feb	14-Feb	---	4-Oct	28-Sep	5-Oct	30-Sep
	48,700	CDQ	---	---	---	---	28-Feb	---	16-Sep	---	---	8-Oct
		M	28-Mar	---	---	10-Feb	30-Jan	7-Oct	14-Oct	---	---	13-Oct
		P	21-Feb	---	7-Mar	25-Feb	5-Feb	---	---	---	---	13-Oct
		S	---	---	---	10-Feb	1-Feb	---	26-Sep	19-Sep	22-Sep	19-Sep
	29,300	CDQ	7-Mar	---	---	10-Mar	17-Feb	15-Sep	7-Sep	27-Sep	---	30-Sep
		M	17-Feb	3-Mar	26-Feb	5-Feb	25-Jan	30-Sep	22-Sep	13-Oct	---	13-Sep
		P	12-Feb	3-Mar	14-Feb	9-Feb	26-Jan	28-Sep	17-Sep	8-Sep	---	23-Sep
		S	3-Mar	21-Mar	1-Mar	5-Feb	26-Jan	7-Oct	10-Sep	29-Aug	12-Sep	11-Sep

Table 4-4 Hypothetical forgone pollock catch, in mt, by season and sector under Chinook salmon hard cap sector allocation options for 2003.

2003			opt1 (AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0	0	0	20,158	7,826	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	96,403	77,278	21,454	22,130	0	0
		S	0	0	0	0	0	0	0	0	0
	87,500 Total		0	0	0	116,561	85,104	21,454	22,130	0	0
	68,100	CDQ	0	0	0	37,301	21,437	8,343	0	0	0
		M	0	0	0	10,189	2,410	0	19	0	0
		P	22,491	0	0	99,692	97,845	95,074	95,568	76,553	0
		S	1,401	0	0	0	0	0	0	0	0
	68,100 Total		23,892	0	0	147,183	121,693	103,416	95,587	76,553	0
	48,700	CDQ	0	0	0	48,057	47,756	37,294	766	0	0
		M	2,785	28	0	22,209	21,796	10,184	16,153	7,690	16
		P	97,084	94,819	22,466	127,140	125,500	99,679	100,033	98,240	95,550
		S	90,166	37,904	1,389	0	0	0	14,291	831	0
	48,700 Total		190,035	132,750	23,856	197,405	195,053	147,157	131,242	106,761	95,566
	29,300	CDQ	8,148	0	0	51,899	48,624	48,353	44,328	22,243	19,951
		M	28,630	22,088	16,109	37,246	29,542	28,899	29,301	28,765	22,072
		P	126,818	125,127	99,316	155,741	154,835	128,755	129,019	127,681	125,673
		S	158,705	126,121	123,209	91,428	60,538	13,805	124,692	122,211	60,708
	29,300 Total		322,301	273,337	238,633	336,314	293,540	219,812	327,340	300,899	228,404
B	87,500	CDQ	0	0	0	0	0	2,071	0	0	0
		M	0	0	0	0	0	1,158	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	0	0	0	0	0	0	0	0	0
	87,500 Total		0	0	0	0	0	3,229	0	0	0
	68,100	CDQ	0	0	0	0	21	24,610	0	0	0
		M	0	0	0	0	1,059	3,368	0	0	1,188
		P	0	0	0	0	0	0	0	0	0
		S	0	0	0	0	0	0	0	0	0
	68,100 Total		0	0	0	0	1,080	27,978	0	0	1,188
	48,700	CDQ	0	0	0	10,863	24,599	51,807	0	0	0
		M	0	0	3,205	2,939	3,366	4,006	2	1,187	3,606
		P	0	0	0	0	0	339	0	0	0
		S	0	0	1,715	0	0	0	0	0	0
	48,700 Total		0	0	4,920	13,802	27,965	56,153	2	1,187	3,606
	29,300	CDQ	0	0	0	51,792	52,696	54,052	0	1,962	25,243
		M	3,199	3,584	4,163	4,002	7,733	8,144	3,600	3,922	7,888
		P	0	0	254	332	3,769	22,870	0	0	3,851
		S	1,687	14,503	28,900	0	0	2,377	0	927	15,217
	29,300 Total		4,885	18,088	33,317	56,126	64,199	87,444	3,600	6,811	52,199

Table 4-5 Hypothetical forgone pollock catch, in mt, by season and sector under Chinook salmon hard cap sector allocation options for 2004

2004			opt1 (AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	0	0	0	0	0	0	0	0	0
	87,500 Total		0	0	0	0	0	0	0	0	0
	68,100	CDQ	0	0	0	3,925	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	29,340	5,088	0	0	0	0
		S	0	0	0	0	0	0	0	0	0
	68,100 Total		0	0	0	33,266	5,088	0	0	0	0
	48,700	CDQ	0	0	0	13,464	5,064	3,917	0	0	0
		M	0	0	0	5,227	1,698	0	352	0	0
		P	0	0	0	57,292	55,245	29,318	29,907	5,688	0
		S	12,967	0	0	0	0	0	0	0	0
	48,700 Total		12,967	0	0	75,983	62,007	33,235	30,259	5,688	0
	29,300	CDQ	0	0	0	24,655	24,044	14,268	4,378	350	0
		M	11,255	5,016	0	26,232	18,684	11,511	18,339	11,383	4,989
		P	56,891	54,779	28,713	128,084	126,560	100,623	100,940	57,969	55,461
		S	101,177	66,910	36,923	14,112	414	0	64,926	14,899	502
	29,300 Total		169,322	126,705	65,636	193,082	169,701	126,402	188,584	84,601	60,952
B	87,500	CDQ	0	0	0	4,517	15,260	29,375	0	0	2,605
		M	0	0	0	0	0	839	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	1,179	14,423	28,629	0	0	6,791	0	836	15,307
	87,500 Total		1,179	14,423	28,629	4,517	15,260	37,004	0	836	17,912
	68,100	CDQ	0	0	0	27,694	28,868	45,713	0	0	4,442
		M	0	0	7	0	38	3,084	0	0	894
		P	0	0	0	0	0	0	0	0	0
		S	15,167	28,266	37,867	0	1,100	15,792	1,205	14,479	28,652
	68,100 Total		15,167	28,266	37,875	27,694	30,005	64,589	1,205	14,479	33,988
	48,700	CDQ	0	0	3,796	29,784	45,707	47,251	3,205	4,435	28,210
		M	0	7	1,176	987	3,083	9,003	11	892	3,652
		P	0	0	0	0	0	0	0	0	0
		S	28,923	37,863	66,671	14,112	15,782	37,498	15,976	28,647	38,150
	48,700 Total		28,923	37,870	71,643	44,883	64,572	93,752	19,191	33,974	70,012
	29,300	CDQ	3,777	14,487	28,717	47,240	60,298	60,963	28,191	29,286	46,079
		M	1,171	3,649	9,405	8,991	9,652	23,297	3,651	8,785	17,447
		P	0	0	0	0	1,707	24,782	0	0	3,916
		S	66,658	67,412	91,922	37,488	38,074	66,972	38,142	50,469	90,778
	29,300 Total		71,606	85,548	130,044	93,720	109,732	176,014	69,985	88,539	158,220

Table 4-6 Hypothetical forgone pollock catch, in mt, by season and sector under Chinook salmon hard cap sector allocation options for 2005

2005			opt1 (AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	42,708	0	0	0	0	0
		S	0	0	0	0	0	0	0	0	0
	87,500 Total		0	0	0	42,708	0	0	0	0	0
	68,100	CDQ	0	0	0	11,604	2,842	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	71,056	44,828	17,785	18,460	0	0
		S	0	0	0	0	0	0	0	0	0
	68,100 Total		0	0	0	82,660	47,670	17,785	18,460	0	0
	48,700	CDQ	0	0	0	22,548	21,334	11,599	0	0	0
		M	0	0	0	11,464	4,273	0	85	0	0
		P	43,709	1,494	0	120,999	94,852	71,039	92,724	45,408	18,435
		S	92,796	33,715	0	0	0	0	46	0	0
	48,700 Total		136,505	35,209	0	155,010	120,459	82,638	92,855	45,408	18,435
	29,300	CDQ	0	0	0	34,189	24,838	23,743	20,246	3,344	0
		M	19,477	11,189	46	33,508	26,538	19,820	26,360	19,649	4,785
		P	120,586	94,459	70,588	152,222	151,010	123,074	123,413	121,694	95,034
		S	159,298	129,990	127,648	94,569	60,558	0	128,840	126,845	60,768
	29,300 Total		299,361	235,638	198,283	314,488	262,944	166,637	298,859	271,532	160,587
B	87,500	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	21,875	36,695	52,973	1,497	13,078	35,965	19,793	21,325	37,268
	87,500 Total		21,875	36,695	52,973	1,497	13,078	35,965	19,793	21,325	37,268
	68,100	CDQ	0	0	0	0	0	96	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	37,177	38,151	70,555	20,296	21,748	37,583	21,916	36,731	53,000
	68,100 Total		37,177	38,151	70,555	20,296	21,748	37,679	21,916	36,731	53,000
	48,700	CDQ	0	0	0	0	93	5,462	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	27,981	0	0	0
		S	53,331	70,550	88,977	36,493	37,576	53,637	37,702	52,994	70,943
	48,700 Total		53,331	70,550	88,977	36,493	37,669	87,081	37,702	52,994	70,943
	29,300	CDQ	0	0	0	5,455	9,593	13,781	0	0	262
		M	0	0	0	0	0	9,001	0	0	2,215
		P	0	0	27,537	27,942	48,725	73,400	0	13,916	49,121
		S	88,968	125,252	148,561	53,626	70,839	105,794	70,932	88,732	125,524
	29,300 Total		88,968	125,252	176,099	87,022	129,156	201,977	70,932	102,647	177,122

Table 4-7 Hypothetical forgone pollock catch, in mt, by season and sector under Chinook salmon hard cap sector allocation options for 2006

2006			opt1 (AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0	0	0	9,338	1,128	0	0	0	0
		M	7,656	2,436	0	19,404	9,561	8,216	9,057	7,936	2,418
		P	696	0	0	75,155	50,555	8,288	8,658	6,781	0
		S	163,745	130,857	93,329	90,223	538	0	95,770	91,687	11,747
	87,500 Total		172,097	133,293	93,329	194,120	61,783	16,504	113,485	106,405	14,165
	68,100	CDQ	0	0	0	19,866	10,114	1,528	0	0	0
		M	9,519	8,473	6,903	27,576	27,083	19,055	26,806	9,737	8,429
		P	8,857	7,011	0	100,767	76,409	51,445	51,867	49,730	7,607
		S	168,111	165,659	131,854	97,110	93,242	35,663	163,854	130,948	93,484
	68,100 Total		186,487	181,143	138,757	245,319	206,848	107,691	242,527	190,415	109,520
	48,700	CDQ	0	0	0	21,190	20,658	19,860	0	0	0
		M	27,352	26,823	9,512	28,453	28,101	27,572	27,903	27,462	26,801
		P	75,747	51,228	8,843	130,488	129,038	100,756	101,061	76,752	51,852
		S	172,477	170,723	168,093	166,388	163,660	97,082	169,432	167,192	163,831
	48,700 Total		275,575	248,774	186,448	346,520	341,458	245,270	298,396	271,406	242,483
	29,300	CDQ	1,377	0	0	32,319	31,838	31,116	20,181	19,487	9,213
		M	37,947	28,350	27,873	48,257	38,560	38,127	38,397	38,037	28,337
		P	130,203	128,708	100,442	157,797	133,225	131,916	132,150	130,966	129,191
		S	213,627	212,549	210,932	173,179	171,538	169,077	211,755	173,663	171,641
	29,300 Total		383,154	369,607	339,247	411,552	375,160	370,237	402,484	362,154	338,382
B	87,500	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	2,369	16,791	51,273	0	0	15,716	0	1,574	31,642
	87,500 Total		2,369	16,791	51,273	0	0	15,716	0	1,574	31,642
	68,100	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	31,485	33,166	75,284	0	2,185	32,186	2,429	16,844	51,328
	68,100 Total		31,485	33,166	75,284	0	2,185	32,186	2,429	16,844	51,328
	48,700	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	52,005	75,273	102,616	16,494	32,174	52,630	32,391	51,317	100,590
	48,700 Total		52,005	75,273	102,616	16,494	32,174	52,630	32,391	51,317	100,590
	29,300	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	102,596	123,886	137,539	52,606	75,882	123,384	100,564	102,060	124,281
	29,300 Total		102,596	123,886	137,539	52,606	75,882	123,384	100,564	102,060	124,281

Table 4-8 Hypothetical forgone pollock catch, in mt, by season and sector under Chinook salmon hard cap sector allocation options for 2007

2007			opt1 (AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0	0	0	32,259	31,706	30,877	7,668	0	0
		M	20,516	6,362	0	35,056	34,383	20,894	27,895	20,705	6,334
		P	90,321	70,523	52,285	122,086	120,514	118,157	118,578	91,456	88,815
		S	195,946	165,042	131,609	100,269	2,042	0	133,582	130,281	2,198
	87,500 Total		306,783	241,927	183,894	289,670	188,645	169,928	287,723	242,442	97,346
	68,100	CDQ	0	0	0	41,022	40,603	31,950	19,399	8,493	0
		M	34,351	21,068	12,063	35,990	35,465	34,679	35,170	34,515	21,038
		P	118,803	91,672	89,075	148,007	123,040	121,206	121,533	119,873	92,230
		S	199,131	197,342	166,208	164,203	131,538	21,672	196,025	165,148	131,734
	68,100 Total		352,286	310,081	267,346	389,222	330,647	209,506	372,128	328,029	245,002
	48,700	CDQ	8,888	7,725	0	41,768	41,469	41,019	31,548	30,881	19,389
		M	35,751	35,189	34,346	45,051	44,648	35,986	44,421	35,869	35,166
		P	122,536	121,037	118,788	184,499	149,054	148,000	148,188	123,301	121,521
		S	229,763	228,386	199,118	197,874	195,884	164,179	200,095	198,461	196,009
	48,700 Total		396,939	392,337	352,251	469,193	431,055	389,184	424,253	388,512	372,084
	29,300	CDQ	31,858	31,241	19,998	48,575	42,334	42,064	41,200	40,809	32,205
		M	45,296	44,933	44,387	46,054	45,811	45,448	45,675	45,372	44,918
		P	184,265	148,894	147,807	187,474	186,755	185,677	185,869	184,894	183,431
		S	233,193	232,364	231,121	230,315	229,026	199,836	231,754	230,695	229,107
	29,300 Total		494,612	457,431	443,314	512,418	503,927	473,024	504,499	501,770	489,660
B	87,500	CDQ	0	0	0	2,998	5,233	5,443	0	1,167	2,614
		M	0	0	0	0	0	2,619	0	0	0
		P	0	0	0	0	0	5,198	0	0	0
		S	39,362	40,200	53,563	9,415	24,271	39,711	24,475	38,978	52,578
	87,500 Total		39,362	40,200	53,563	12,413	29,504	52,971	24,475	40,146	55,192
	68,100	CDQ	0	0	2,286	5,287	5,396	7,397	1,215	2,465	2,983
		M	0	0	2,269	0	2,432	5,447	0	0	2,675
		P	0	0	0	0	203	14,938	0	0	4,791
		S	52,509	53,245	71,474	24,950	39,274	52,816	39,391	40,224	53,582
	68,100 Total		52,509	53,245	76,029	30,237	47,305	80,598	40,606	42,689	64,032
	48,700	CDQ	1,155	2,283	2,853	7,310	7,397	9,980	2,735	2,981	5,335
		M	0	2,267	5,357	2,770	5,446	9,528	2,286	2,673	5,579
		P	0	0	5,529	5,721	14,932	29,967	0	4,782	15,095
		S	53,819	71,471	85,600	40,065	52,811	61,216	52,906	53,578	71,691
	48,700 Total		54,974	76,021	99,340	55,865	80,585	110,691	57,926	64,015	97,701
	29,300	CDQ	2,849	5,147	5,382	9,978	10,050	13,643	5,333	5,435	7,428
		M	5,353	5,567	12,449	9,525	12,532	22,040	5,576	9,471	18,003
		P	5,510	14,765	29,851	29,956	37,605	58,892	15,081	22,844	37,689
		S	85,594	85,943	86,466	61,212	71,633	85,740	71,685	72,055	86,103
	29300 Total		99,307	111,422	134,148	110,673	131,820	180,315	97,676	109,805	149,222

Table 4-9 A-season fleetwide closure date scenarios by year reflecting when the cap level would have been exceeded in each year

Cap scenario		CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250					6-Mar
	1-2: 58/42	50,750				12-Mar	18-Feb
	1-3: 55/45	48,125				4-Mar	17-Feb
	1-4: 50/50	43,750				25-Feb	16-Feb
68,100	1-1: 70/30	47,670				3-Mar	17-Feb
	1-2: 58/42	39,498				22-Feb	13-Feb
	1-3: 55/45	37,455				21-Feb	12-Feb
	1-4: 50/50	34,050				19-Feb	10-Feb
48,700	1-1: 70/30	34,090				19-Feb	10-Feb
	1-2: 58/42	28,246	12-Mar			12-Feb	6-Feb
	1-3: 55/45	26,785	10-Mar		15-Mar	12-Feb	5-Feb
	1-4: 50/50	24,350	5-Mar		4-Mar	10-Feb	3-Feb
29,300	1-1: 70/30	20,510	22-Feb	14-Mar	26-Feb	7-Feb	31-Jan
	1-2: 58/42	16,994	19-Feb	7-Mar	17-Feb	6-Feb	28-Jan
	1-3: 55/45	16,115	18-Feb	6-Mar	15-Feb	6-Feb	28-Jan
	1-4: 50/50	14,650	16-Feb	2-Mar	14-Feb	6-Feb	28-Jan

Table 4-10 Hypothetical forgone pollock catch estimated from **all vessels** at the time fleetwide A-season closures were invoked on the dates provided in Table 4-9.

Pollock			Sector (All), A season				
Cap scenario		CAP	**2003**	2004	2005	**2006**	**2007**
87,500	1-1: 70/30	61,250					118,839
	1-2: 58/42	50,750				73,600	249,878
	1-3: 55/45	48,125				149,049	256,242
	1-4: 50/50	43,750				223,068	266,316
68,100	1-1: 70/30	47,670				159,612	256,242
	1-2: 58/42	39,498				252,395	298,484
	1-3: 55/45	37,455				262,180	309,889
	1-4: 50/50	34,050				284,894	327,167
48,700	1-1: 70/30	34,090				284,894	327,167
	1-2: 58/42	28,246	106,465			357,833	366,132
	1-3: 55/45	26,785	124,915		37,483	357,833	374,767
	1-4: 50/50	24,350	162,583		139,743	379,588	391,740
29,300	1-1: 70/30	20,510	278,458	66,515	214,138	410,952	430,075
	1-2: 58/42	16,994	306,771	131,587	295,708	420,195	460,173
	1-3: 55/45	16,115	313,744	140,323	312,428	420,195	460,173
	1-4: 50/50	14,650	328,885	182,337	323,323	420,195	460,173

Table 4-11 Hypothetical forgone pollock catch estimated from **at-sea processors** at the time fleetwide A-season closures were invoked on the dates provided in Table 4-9.

Pollock Cap scenario		CAP	At-sea processors, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250					57,380
	1-2: 58/42	50,750				32,495	114,870
	1-3: 55/45	48,125				74,155	117,816
	1-4: 50/50	43,750				102,435	121,417
68,100	1-1: 70/30	47,670				78,162	117,816
	1-2: 58/42	39,498				114,607	133,134
	1-3: 55/45	37,455				119,214	137,803
	1-4: 50/50	34,050				127,007	145,973
48,700	1-1: 70/30	34,090				127,007	145,973
	1-2: 58/42	28,246	61,622			160,555	163,773
	1-3: 55/45	26,785	69,744		12,165	160,555	170,023
	1-4: 50/50	24,350	86,804		63,350	168,087	179,879
29,300	1-1: 70/30	20,510	142,483	29,118	95,696	182,192	192,671
	1-2: 58/42	16,994	153,534	62,258	134,210	187,258	205,379
	1-3: 55/45	16,115	156,707	65,354	142,525	187,258	205,379
	1-4: 50/50	14,650	162,422	85,213	147,369	187,258	205,379

Table 4-12 Hypothetical forgone pollock catch estimated from **shorebased catcher vessels** at the time fleetwide A-season closures were invoked on the dates provided in Table 4-9.

Pollock Cap scenario		CAP	Inshore CV, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250					52,892
	1-2: 58/42	50,750				36,681	113,198
	1-3: 55/45	48,125				66,745	115,146
	1-4: 50/50	43,750				105,560	120,188
68,100	1-1: 70/30	47,670				72,544	115,146
	1-2: 58/42	39,498				118,657	136,116
	1-3: 55/45	37,455				122,460	142,134
	1-4: 50/50	34,050				134,426	150,122
48,700	1-1: 70/30	34,090				134,426	150,122
	1-2: 58/42	28,246	37,427			167,556	168,466
	1-3: 55/45	26,785	46,908		24,503	167,556	169,944
	1-4: 50/50	24,350	64,618		67,047	178,948	175,269
29,300	1-1: 70/30	20,510	114,917	34,006	102,827	192,424	196,449
	1-2: 58/42	16,994	129,926	61,607	136,775	196,527	210,593
	1-3: 55/45	16,115	133,210	66,453	143,189	196,527	210,593
	1-4: 50/50	14,650	142,168	84,355	148,367	196,527	210,593

Table 4-13 Hypothetical forgone pollock catch estimated from **mothership operations** at the time fleetwide A-season closures were invoked on the dates provided in Table 4-9.

Pollock Cap scenario		CAP	**Mothership operations, A season** 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250					8,566
	1-2: 58/42	50,750				4,425	21,811
	1-3: 55/45	48,125				8,149	23,280
	1-4: 50/50	43,750				15,074	24,711
68,100	1-1: 70/30	47,670				8,906	23,280
	1-2: 58/42	39,498				19,132	29,234
	1-3: 55/45	37,455				20,506	29,952
	1-4: 50/50	34,050				23,460	31,071
48,700	1-1: 70/30	34,090				23,460	31,071
	1-2: 58/42	28,246	7,416			29,722	33,893
	1-3: 55/45	26,785	8,263		815	29,722	34,800
	1-4: 50/50	24,350	11,161		9,346	32,553	36,592
29,300	1-1: 70/30	20,510	21,057	3,391	15,615	36,336	40,955
	1-2: 58/42	16,994	23,311	7,723	24,724	36,411	44,201
	1-3: 55/45	16,115	23,827	8,516	26,715	36,411	44,201
	1-4: 50/50	14,650	24,295	12,770	27,587	36,411	44,201

Table 4-14 B-season fleetwide trigger-closure date scenarios by year reflecting when the cap level would have been exceeded in each year.

Cap scenario		CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250		25-Oct	13-Oct		13-Oct
	1-2: 58/42	36,750			30-Oct		26-Oct
	1-3: 55/45	39,375					28-Oct
	1-4: 50/50	43,750					31-Oct
68,100	1-1: 70/30	20,430		12-Oct	7-Oct	22-Oct	9-Oct
	1-2: 58/42	28,602		30-Oct	19-Oct		16-Oct
	1-3: 55/45	30,645			25-Oct		18-Oct
	1-4: 50/50	34,050			28-Oct		23-Oct
48,700	1-1: 70/30	14,610		2-Oct	1-Oct	12-Oct	30-Sep
	1-2: 58/42	20,454		12-Oct	7-Oct	22-Oct	9-Oct
	1-3: 55/45	21,915		14-Oct	9-Oct	26-Oct	10-Oct
	1-4: 50/50	24,350		20-Oct	11-Oct		11-Oct
29,300	1-1: 70/30	8,790	8-Oct	14-Sep	10-Sep	21-Sep	16-Sep
	1-2: 58/42	12,306	14-Oct	27-Sep	24-Sep	3-Oct	23-Sep
	1-3: 55/45	13,185		1-Oct	26-Sep	5-Oct	27-Sep
	1-4: 50/50	14,650		2-Oct	1-Oct	12-Oct	30-Sep

Table 4-15 Hypothetical forgone pollock catch estimated from **all vessels** at the time fleetwide B-season closures were invoked on the dates provided in Table 4-14.

Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		5,380	22,837		71,041
	1-2: 58/42	36,750			648		21,433
	1-3: 55/45	39,375					15,070
	1-4: 50/50	43,750					2,636
68,100	1-1: 70/30	20,430		20,373	34,894	20,338	84,320
	1-2: 58/42	28,602		2,156	14,292		60,036
	1-3: 55/45	30,645			9,693		53,280
	1-4: 50/50	34,050			2,166		31,171
48,700	1-1: 70/30	14,610		39,409	50,710	57,544	111,799
	1-2: 58/42	20,454		20,373	34,894	20,338	84,320
	1-3: 55/45	21,915		15,792	32,648	10,138	80,740
	1-4: 50/50	24,350		8,273	27,731		77,229
29,300	1-1: 70/30	8,790	27,727	138,524	151,247	166,009	152,958
	1-2: 58/42	12,306	12,310	59,879	78,447	96,274	129,625
	1-3: 55/45	13,185		41,154	69,545	87,372	117,657
	1-4: 50/50	14,650		39,409	50,710	57,544	111,799

Table 4-16 Hypothetical forgone pollock catch estimated from **at-sea processors** at the time fleetwide B-season closures were invoked on the dates provided in Table 4-14.

Pollock—at-sea processors			**B season**				
Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		0	0		22,708
	1-2: 58/42	36,750			0		6,776
	1-3: 55/45	39,375					4,176
	1-4: 50/50	43,750					397
68,100	1-1: 70/30	20,430		5	0	998	26,445
	1-2: 58/42	28,602		0	0		19,651
	1-3: 55/45	30,645			0		17,790
	1-4: 50/50	34,050			0		10,108
48,700	1-1: 70/30	14,610		2,685	3,184	12,771	37,642
	1-2: 58/42	20,454		5	0	998	26,445
	1-3: 55/45	21,915		0	0	0	25,335
	1-4: 50/50	24,350		0	0		24,309
29,300	1-1: 70/30	8,790	1,716	42,951	48,891	55,640	54,182
	1-2: 58/42	12,306	0	11,508	14,384	29,896	44,738
	1-3: 55/45	13,185		3,183	11,823	25,413	39,812
	1-4: 50/50	14,650		2,685	3,184	12,771	37,642

Table 4-17 Hypothetical forgone pollock catch estimated from **shorebased catcher vessels** at the time fleetwide B-season closures were invoked on the dates provided in Table 4-14.

Pollock-shorebased catcher vessels					**B season**		
Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		3,140	19,260		37,642
	1-2: 58/42	36,750			648		10,228
	1-3: 55/45	39,375					7,561
	1-4: 50/50	43,750					1,212
68,100	1-1: 70/30	20,430		17,002	28,876	15,175	45,523
	1-2: 58/42	28,602		1,004	13,065		30,396
	1-3: 55/45	30,645			9,693		26,503
	1-4: 50/50	34,050			2,166		15,688
48,700	1-1: 70/30	14,610		32,309	41,402	37,130	57,734
	1-2: 58/42	20,454		17,002	28,876	15,175	45,523
	1-3: 55/45	21,915		12,605	27,273	7,775	43,833
	1-4: 50/50	24,350		5,440	23,340		41,790
29,300	1-1: 70/30	8,790	22,300	69,594	86,112	92,492	75,141
	1-2: 58/42	12,306	10,172	36,317	56,078	55,094	64,100
	1-3: 55/45	13,185		32,662	50,354	51,472	60,425
	1-4: 50/50	14,650		32,309	41,402	37,130	57,734

Table 4-18 Hypothetical forgone pollock catch estimated from **mothership operations** the time fleetwide B-season closures were invoked on the dates provided in Table 4-14.

Pollock—mothership operations					**B season**		
Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		2,240	3,577		10,691
	1-2: 58/42	36,750			0		4,428
	1-3: 55/45	39,375					3,333
	1-4: 50/50	43,750					1,027
68,100	1-1: 70/30	20,430		3,366	6,018	4,165	12,352
	1-2: 58/42	28,602		1,152	1,227		9,989
	1-3: 55/45	30,645			0		8,988
	1-4: 50/50	34,050			0		5,375
48,700	1-1: 70/30	14,610		4,415	6,125	7,644	16,422
	1-2: 58/42	20,454		3,366	6,018	4,165	12,352
	1-3: 55/45	21,915		3,187	5,374	2,364	11,571
	1-4: 50/50	24,350		2,833	4,392		11,130
29,300	1-1: 70/30	8,790	3,711	25,979	16,244	17,877	23,635
	1-2: 58/42	12,306	2,138	12,054	7,985	11,285	20,786
	1-3: 55/45	13,185		5,308	7,368	10,488	17,420
	1-4: 50/50	14,650		4,415	6,125	7,644	16,422

Table 4-19 Alternative 4 (PPA) dates of closures for different scenarios by sector between A and B seasons and assuming no transferability in the A season, 'No', or perfect transferability in the A season, 'Yes' (in all cases perfect B-season transferability was assumed).

PPA	A-season Transfer-Ability	Year	A-Season CDQ	M	P	S	A-B Rollover	B-Season CDQ	M	P	S
1	No	2003	--	--	--	--	80%	--	--	--	--
		2004	--	--	--	--		--	--	--	--
		2005	--	--	--	--		--	--	--	29-Oct
		2006	--	23-Feb	18-Mar	19-Feb		--	--	--	22-Oct
		2007	--	19-Feb	15-Feb	15-Feb		15-Oct	25-Oct	10-Oct	7-Oct
	Yes	2003	--	--	--	--		--	--	--	--
		2004	--	--	--	--		--	--	--	--
		2005	--	--	--	--		--	--	--	29-Oct
		2006	--	27-Feb	--	20-Feb		--	--	--	22-Oct
		2007	--	22-Feb	15-Feb	15-Feb		15-Oct	25-Oct	10-Oct	7-Oct
2	No	2003	--	--	8-Mar	--		--	--	--	--
		2004	--	--	--	--		--	--	--	11-Oct
		2005	--	--	--	--		--	--	25-Sep	5-Oct
		2006	--	18-Feb	5-Mar	9-Feb		--	--	--	10-Oct
		2007	7-Mar	2-Feb	6-Feb	5-Feb		7-Oct	17-Oct	29-Sep	26-Sep
	Yes	2003	--	--	21-Mar	--		--	16-Oct	--	--
		2004	--	--	--	--		--	--	--	11-Oct
		2005	--	--	--	--		--	--	25-Sep	5-Oct
		2006	--	18-Feb	9-Mar	10-Feb		--	--	--	10-Oct
		2007	7-Mar	2-Feb	6-Feb	5-Feb		7-Oct	17-Oct	29-Sep	26-Sep

Table 4-20 Hypothetical forgone pollock by sector and scenario had dates presented in Table 4-19 been invoked as closures by sector with A-B split equal to 70:30 and allowing **80%** rollover from A to B season under the two PPA scenarios, 2003-2007 and summed over these years (last 4 rows).

	A-season Transfer-	A-Season						B-Season					Annual
PPA	ability	Year	CDQ	M	P	S	**A-Total**	CDQ	M	P	S	**B-Total**	**Total**
1	No	2003	0	0	0	0	**0**	0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**	0	0	0	0	**0**	**0**
		2005	0	0	0	0	**0**	0	0	0	648	**648**	**648**
		2006	0	8,212	6,821	129,068	**144,102**	0	0	0	12,604	**12,604**	**156,705**
		2007	0	15,337	89,484	120,188	**225,009**	4,415	2,992	23,408	47,537	**78,351**	**303,361**
	Yes	2003	0	0	0	0	**0**	0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**	0	0	0	0	**0**	**0**
		2005	0	0	0	0	**0**	0	0	0	648	**648**	**648**
		2006	0	4,299	0	122,460	**126,759**	0	0	0	12,604	**12,604**	**139,362**
		2007	0	12,168	89,484	120,188	**221,840**	4,415	2,992	23,408	47,537	**78,351**	**300,191**
2	No	2003	0	0	61,233	0	**61,233**	0	0	0	0	**0**	**61,233**
		2004	0	0	0	0	**0**	0	0	0	17,002	**17,002**	**17,002**
		2005	0	0	0	0	**0**	0	0	9,776	30,374	**40,150**	**40,150**
		2006	0	15,429	50,888	178,948	**245,266**	0	0	0	38,958	**38,958**	**284,224**
		2007	10,281	29,262	119,925	168,466	**327,935**	6,057	5,958	34,921	60,425	**107,362**	**435,296**
	Yes	2003	0	0	23,677	0	**23,677**	0	1,447	0	0	**1,447**	**25,124**
		2004	0	0	0	0	**0**	0	0	0	17,002	**17,002**	**17,002**
		2005	0	0	0	0	**0**	0	0	9,776	30,374	**40,150**	**40,150**
		2006	0	15,429	33,051	170,773	**219,254**	0	0	0	38,958	**38,958**	**258,212**
		2007	10,281	29,262	119,925	168,466	**327,935**	6,057	5,958	34,921	60,425	**107,362**	**435,296**
1	No	Total	0	23,549	96,305	249,256	**369,111**	4,415	2,992	23,408	60,789	**91,603**	**460,714**
	Yes	Total	0	16,467	89,484	242,648	**348,599**	4,415	2,992	23,408	60,789	**91,603**	**440,201**
2	No	Total	10,281	44,691	232,046	347,414	**634,434**	6,057	5,958	44,697	146,759	**203,472**	**837,905**
	Yes	Total	10,281	44,691	176,653	339,239	**570,866**	6,057	7,405	44,697	146,759	**204,919**	**775,784**

Table 4-21 Hypothetical forgone pollock by sector and scenario had dates presented in Table 4-19 been invoked as closures by sector with A-B split equal to 70:30 and allowing 0% and 100% rollover from A to B season under the two PPA scenarios, 2003-2007.

PPA	A-season Transfer-Ability	Year	A-Season CDQ	M	P	S	A total	A-B Roll over	B-Season CDQ	M	P	S	B Total	Annual Total
1	No	2003	0	0	0	0	**0**	0%	0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		15,995	1,152	0	17,002	**34,148**	**34,148**
		2005	0	0	0	0	**0**		0	0	0	28,876	**28,876**	**28,876**
		2006	0	8,212	6,821	129,068	**144,102**		0	0	0	15,175	**15,175**	**159,277**
		2007	0	15,337	89,484	120,188	**225,009**		4,723	2,992	25,391	47,537	**80,643**	**305,652**
	Yes	2003	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		15,995	1,152	0	17,002	**34,148**	**34,148**
		2005	0	0	0	0	**0**		0	0	0	28,876	**28,876**	**28,876**
		2006	0	4,299	0	122,460	**126,759**		0	0	0	15,175	**15,175**	**141,934**
		2007	0	12,168	89,484	120,188	**221,840**		4,723	2,992	25,391	47,537	**80,643**	**302,483**
2	No	2003	0	0	61,233	0	**61,233**		0	1,447	0	0	**1,447**	**62,680**
		2004	0	0	0	0	**0**		37,452	3,187	1,008	30,186	**71,833**	**71,833**
		2005	0	0	0	0	**0**		0	0	37,999	39,247	**77,246**	**77,246**
		2006	0	15,429	50,888	178,948	**245,266**		0	0	0	38,958	**38,958**	**284,224**
		2007	10,281	29,262	119,925	168,466	**327,935**		6,057	6,164	34,921	60,425	**107,567**	**435,502**
	Yes	2003	0	0	23,677	0	**23,677**		0	1,447	0	0	**1,447**	**25,124**
		2004	0	0	0	0	**0**		37,452	3,187	1,008	30,186	**71,833**	**71,833**
		2005	0	0	0	0	**0**		0	0	37,999	39,247	**77,246**	**77,246**
		2006	0	15,429	33,051	170,773	**219,254**		0	0	0	38,958	**38,958**	**258,212**
		2007	10,281	29,262	119,925	168,466	**327,935**		6,057	6,164	34,921	60,425	**107,567**	**435,502**
1	No	2003	0	0	0	0	**0**	100%	0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2005	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2006	0	8,212	6,821	129,068	**144,102**		0	0	0	11,184	**11,184**	**155,286**
		2007	0	15,337	89,484	120,188	**225,009**		4,415	2,992	22,534	47,537	**77,477**	**302,487**
	Yes	2003	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2005	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2006	0	4,299	0	122,460	**126,759**		0	0	0	11,184	**11,184**	**137,943**
		2007	0	12,168	89,484	120,188	**221,840**		4,415	2,992	22,534	47,537	**77,477**	**299,317**
2	No	2003	0	0	61,233	0	**61,233**		0	0	0	0	**0**	**61,233**
		2004	0	0	0	0	**0**		0	0	0	12,605	**12,605**	**12,605**
		2005	0	0	0	0	**0**		0	0	2,936	28,876	**31,812**	**31,812**
		2006	0	15,429	50,888	178,948	**245,266**		0	0	0	37,130	**37,130**	**282,395**
		2007	10,281	29,262	119,925	168,466	**327,935**		6,057	5,958	34,921	60,425	**107,362**	**435,296**
	Yes	2003	0	0	23,677	0	**23,677**		0	0	0	0	**0**	**23,677**
		2004	0	0	0	0	**0**		0	0	0	12,605	**12,605**	**12,605**
		2005	0	0	0	0	**0**		0	0	2,936	28,876	**31,812**	**31,812**
		2006	0	15,429	33,051	170,773	**219,254**		0	0	0	37,130	**37,130**	**256,383**
		2007	10,281	29,262	119,925	168,466	**327,935**		6,057	5,958	34,921	60,425	**107,362**	**435,296**

Table 4-22 2003-2007 sum of additional forgone pollock relative to 80% rollover amounts presented in Table 4-20. E.g., for PPA1 with no transferability and no rollover (first row) the total estimate of forgone pollock catch over they years 2003-2007 was 67,239 mt more than the scenario with 80% rollover whereas with the 100% rollover option, there would have been 2,941 mt *less* forgone pollock (compared to the 80% rollover option).

PPA	Transferability	Rollover	Total	CDQ	M	P	S
1	No	0%	67,239	16,303	1,152	1,983	47,801
	Yes	0%	67,240	16,303	1,152	1,983	47,801
2	No	0%	93,580	37,452	4,840	29,231	22,057
	Yes	0%	92,133	37,452	3,393	29,231	22,057
1	No	100%	-2,941	0	0	-874	-2,068
	Yes	100%	-2,941	0	0	-874	-2,068
2	No	100%	-14,564	0	0	-6,840	-7,723
	Yes	100%	-16,011	0	-1,447	-6,840	-7,723

Table 4-23 Sample sizes for EBS pollock age data broken out by season and region.

	Jan-May	June-Aug			Sept-Dec			
Age	A season	E	W	Subtotal	E	W	Subtotal	Total
3	144	263	210	473	216	136	352	969
4	570	325	814	1,139	228	375	603	2,312
5	1,332	463	977	1,440	330	271	601	3,373
6	1,427	432	596	1,028	338	132	470	2,925
7	997	257	286	543	226	67	293	1,833
8	718	183	199	382	164	35	199	1,299
9	391	114	67	181	67	16	83	655
10+	574	132	73	205	126	12	138	917

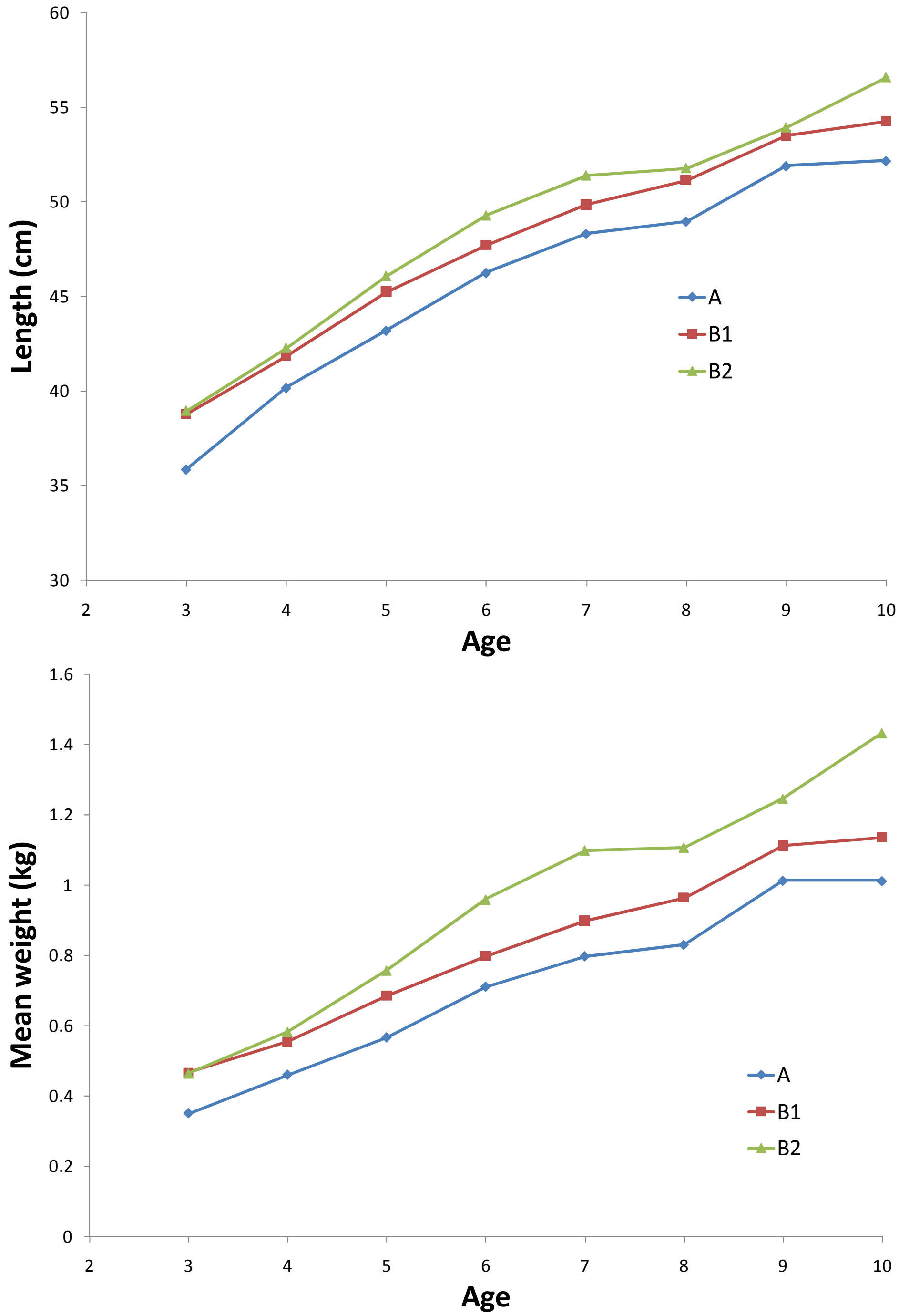

Fig. 4-5 Mean length (top panel) and mean weight (bottom) at age for EBS pollock based on fishery observer data from 2000-2007 broken out by A-season (Jan 20 – May 31) and two B-season time frames: June 1 – August 31 (B1) and September 1 – December 31

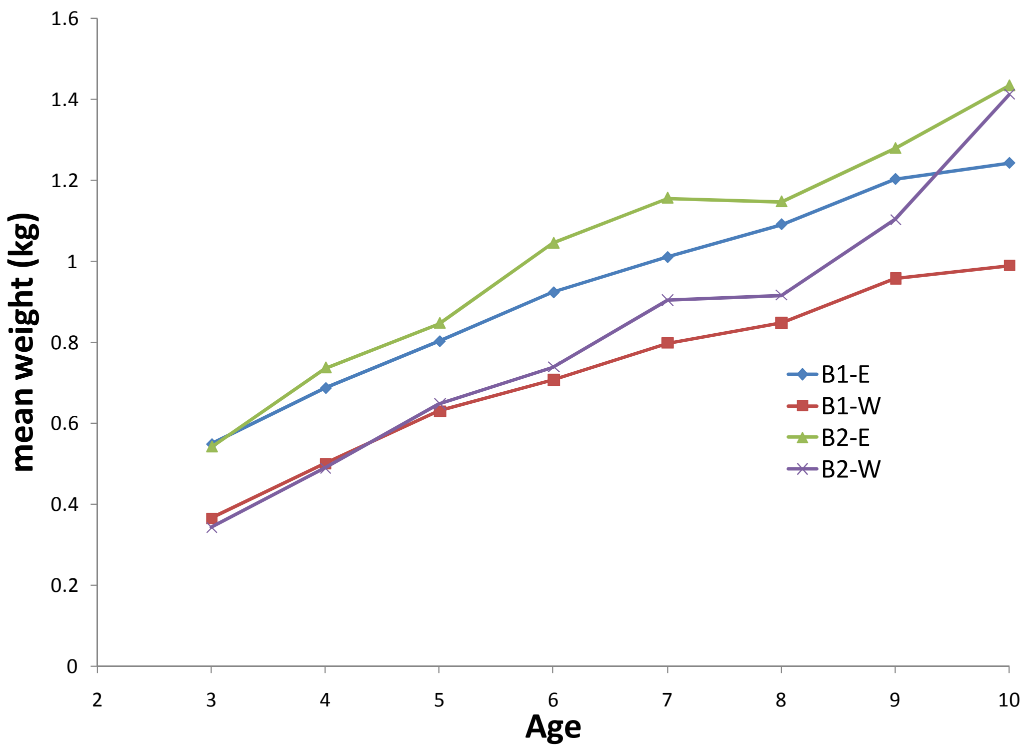

Fig. 4-6 Mean weight at age for EBS pollock based on fishery observer data from 2000-2007 broken out by two B-season time frames: June 1 – August 31 (B1) and September 1 – December 31 and geographically by east of 170°W (E) and west of 170°W (W)

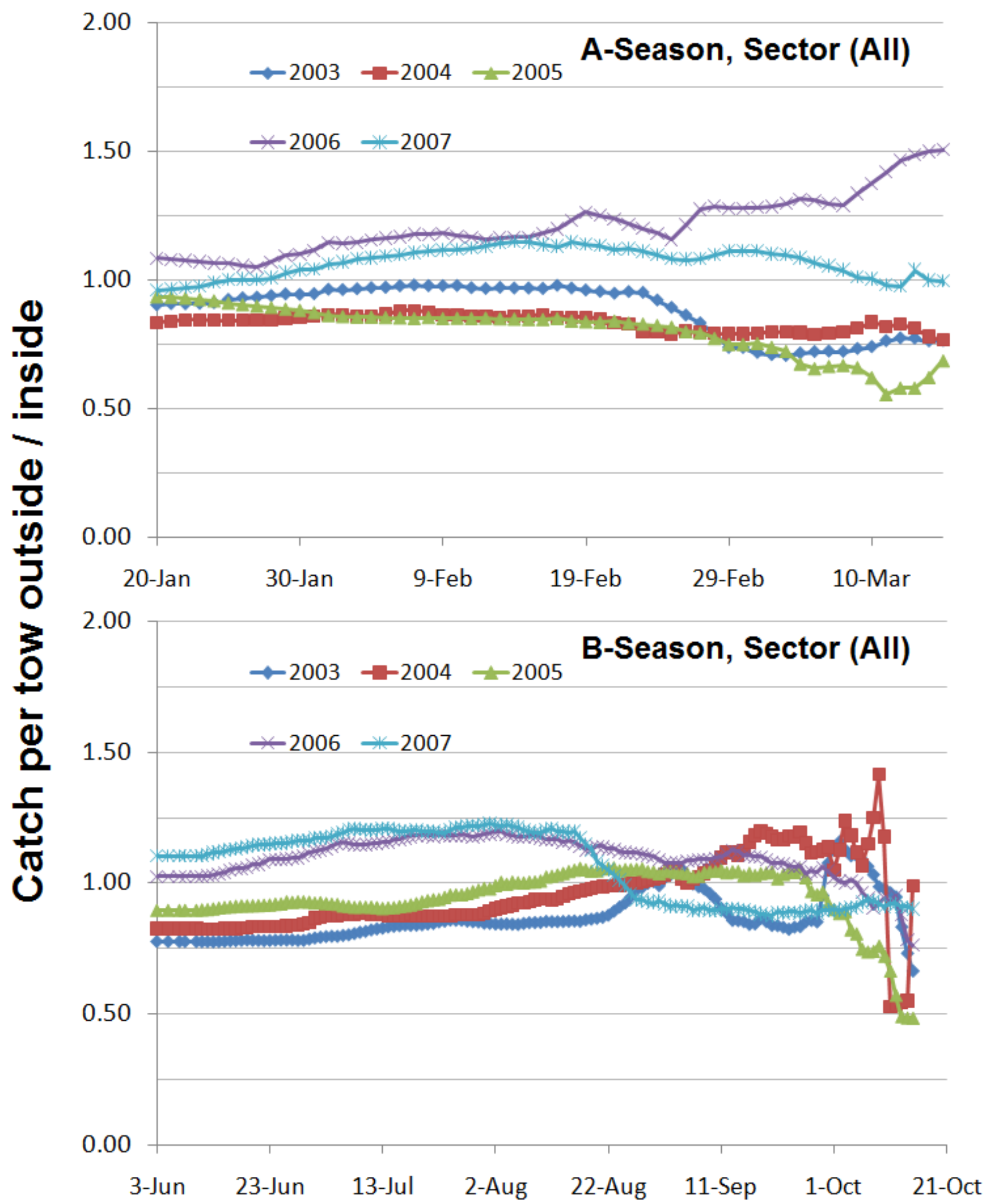

Fig. 4-7 Relative catch rates of pollock for all vessels combined by tow of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season

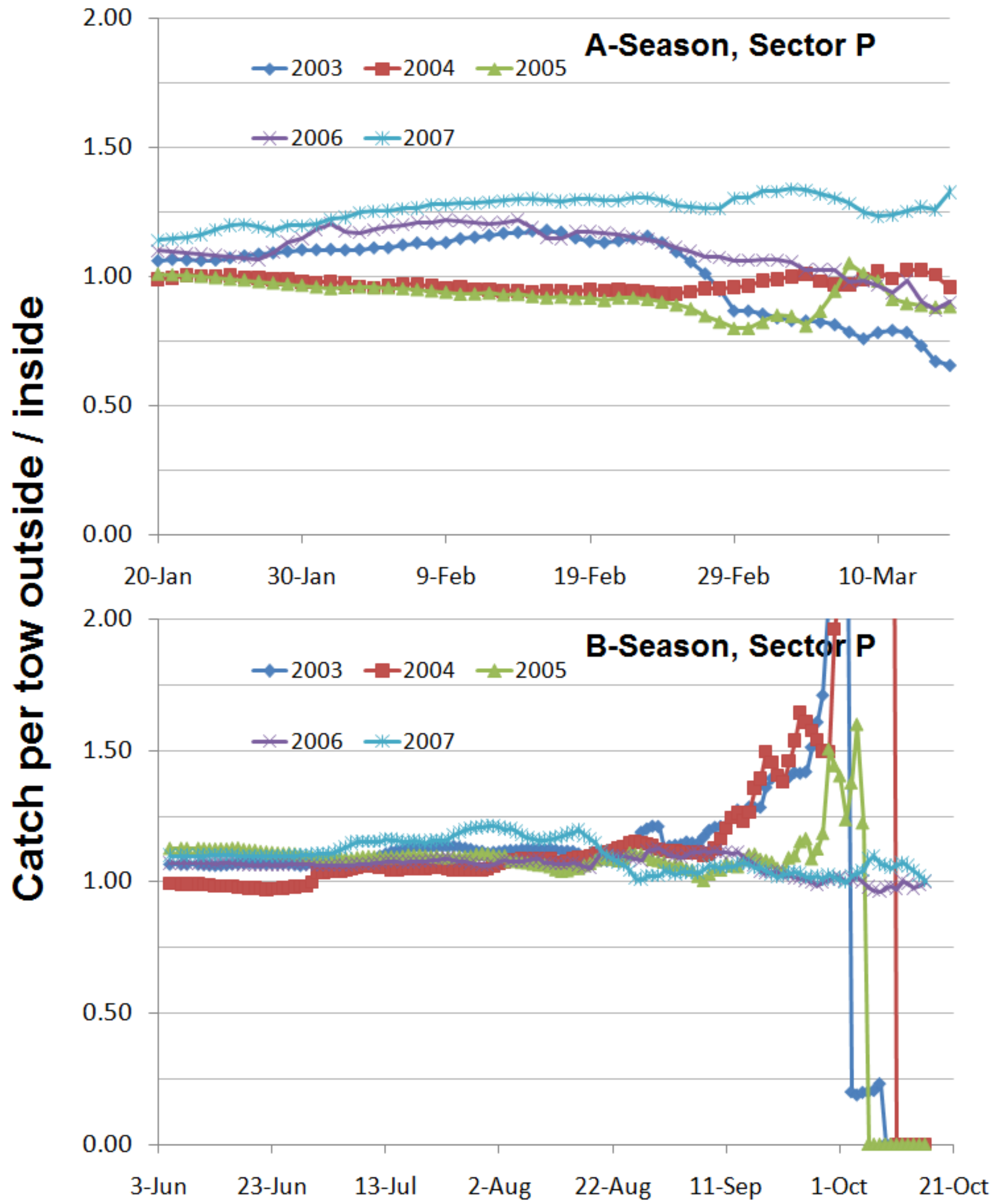

Fig. 4-8 Relative catch rates of pollock for at-sea processors by tow of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season..

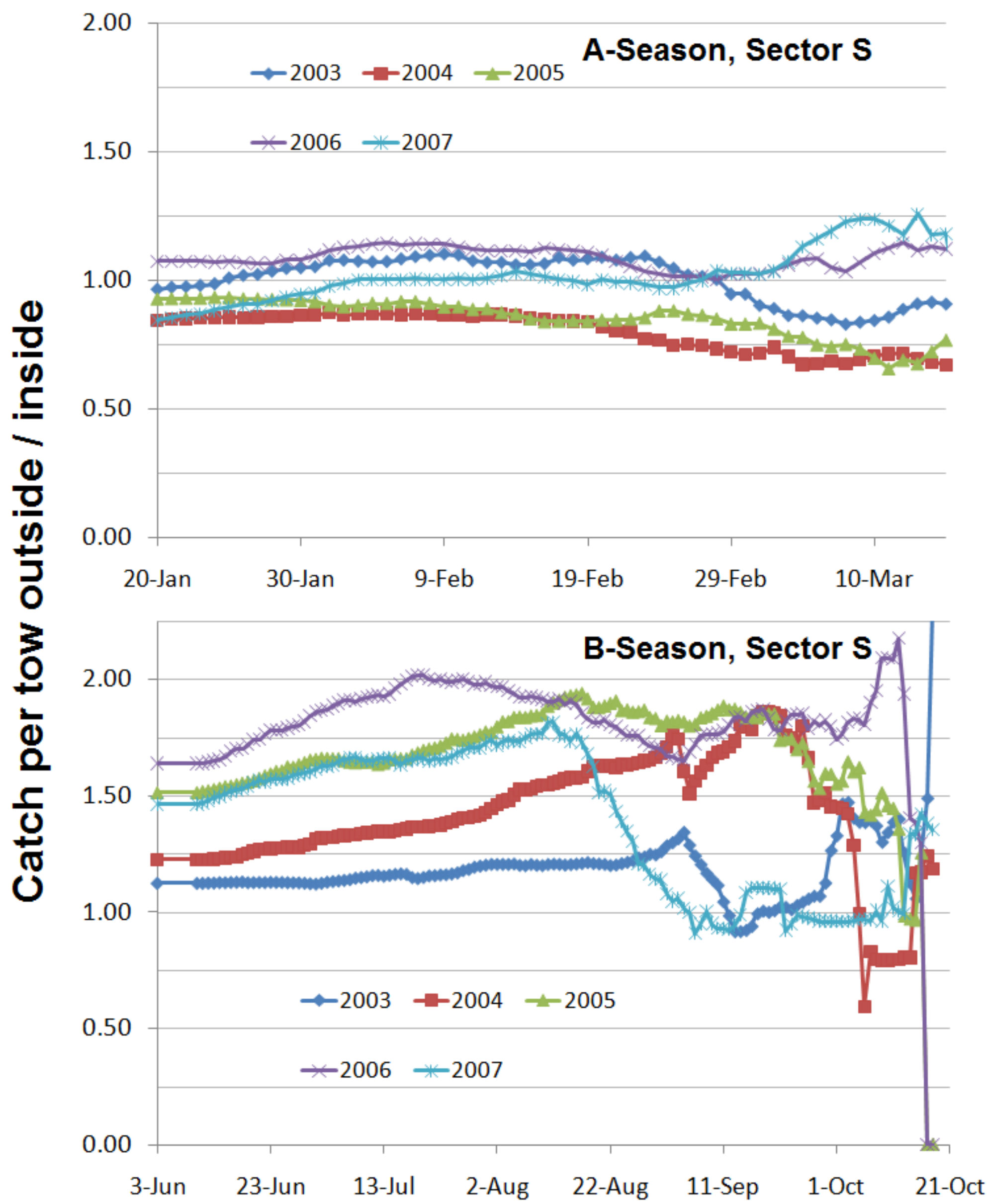

Fig. 4-9 Relative catch rates of pollock for shorebased catcher vessels by tow of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season.

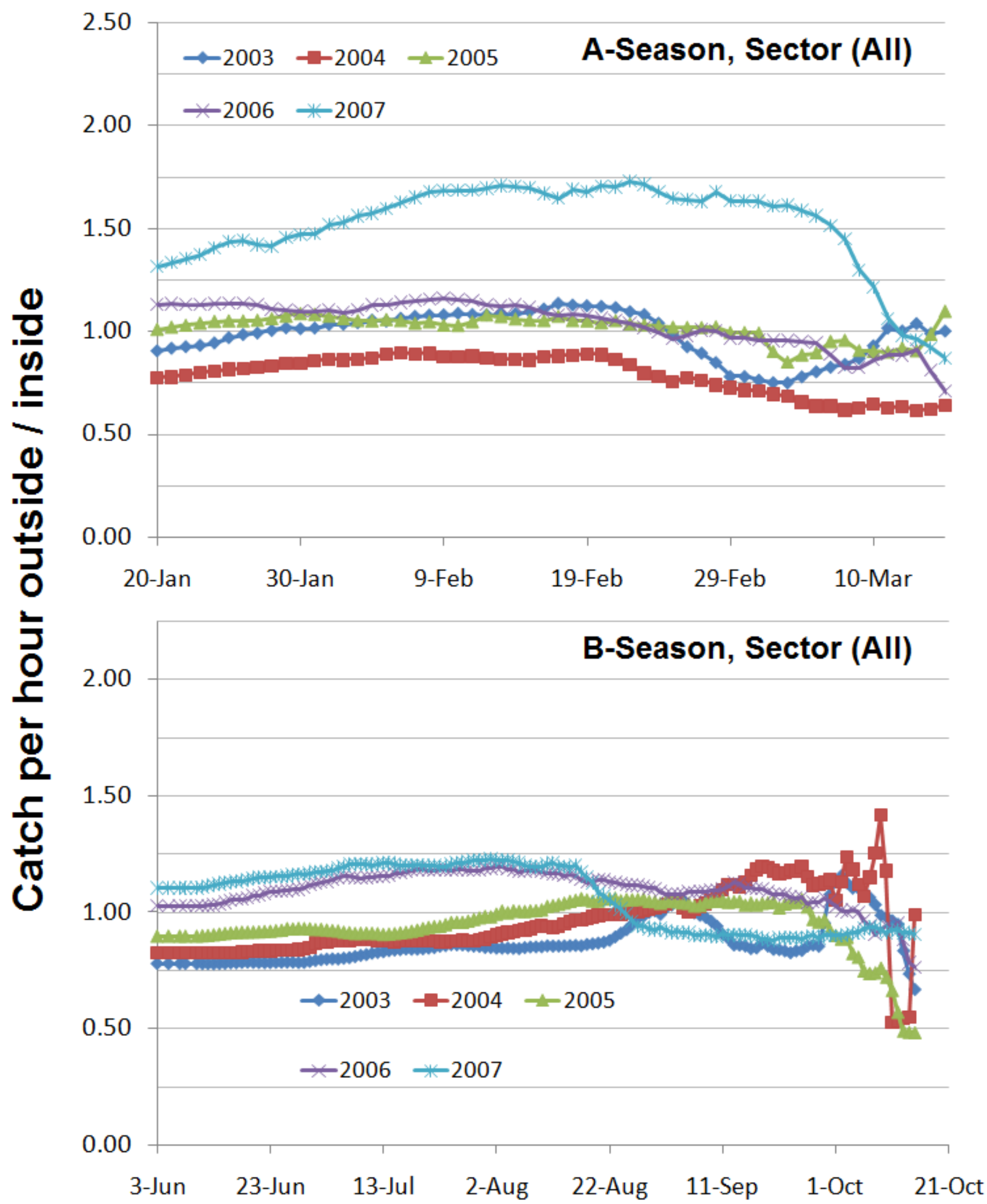

Fig. 4-10 Relative catch rates of pollock for all vessels combined by hour of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season.

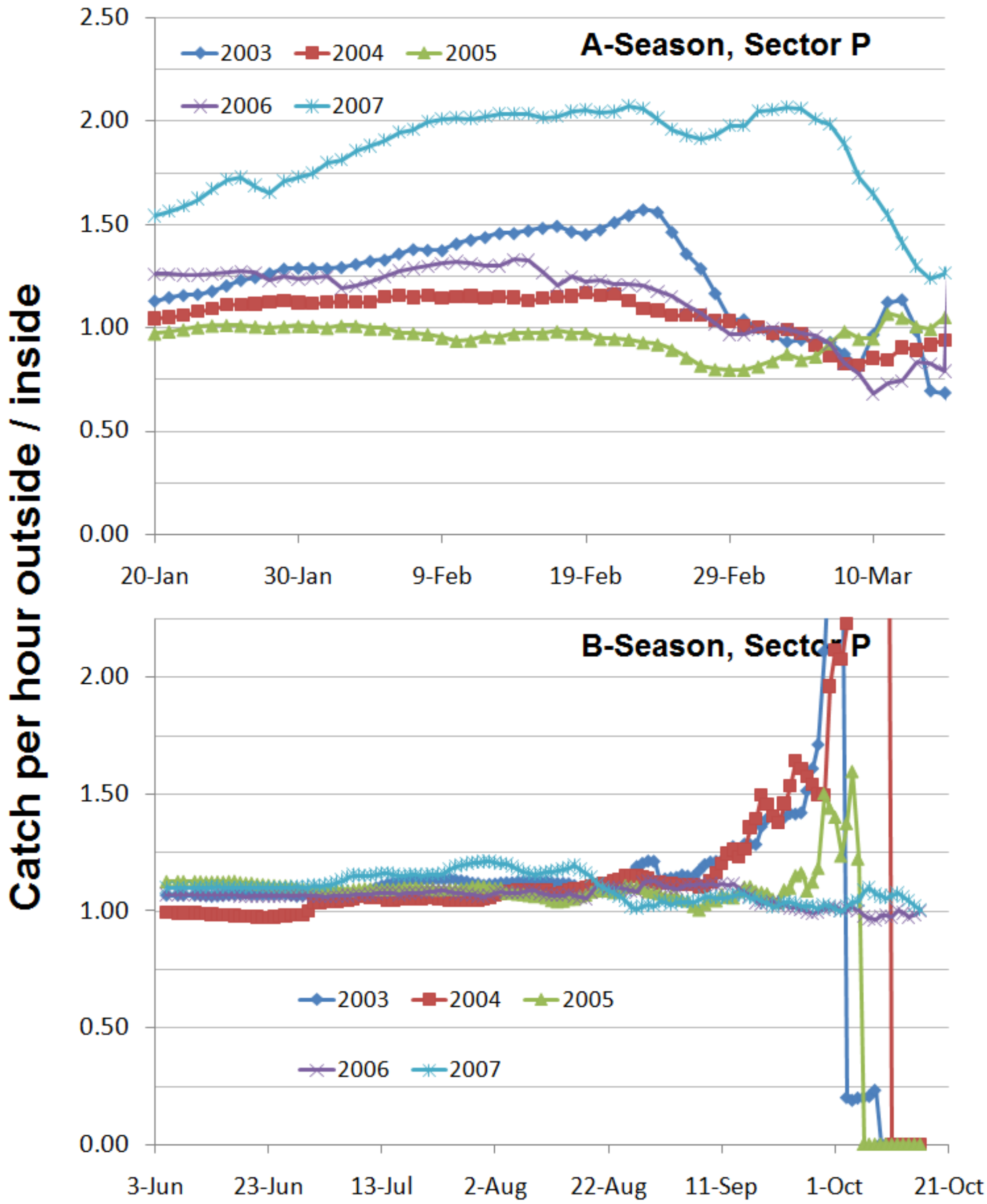

Fig. 4-11 Relative catch rates of pollock for at-sea processors by hour of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season.

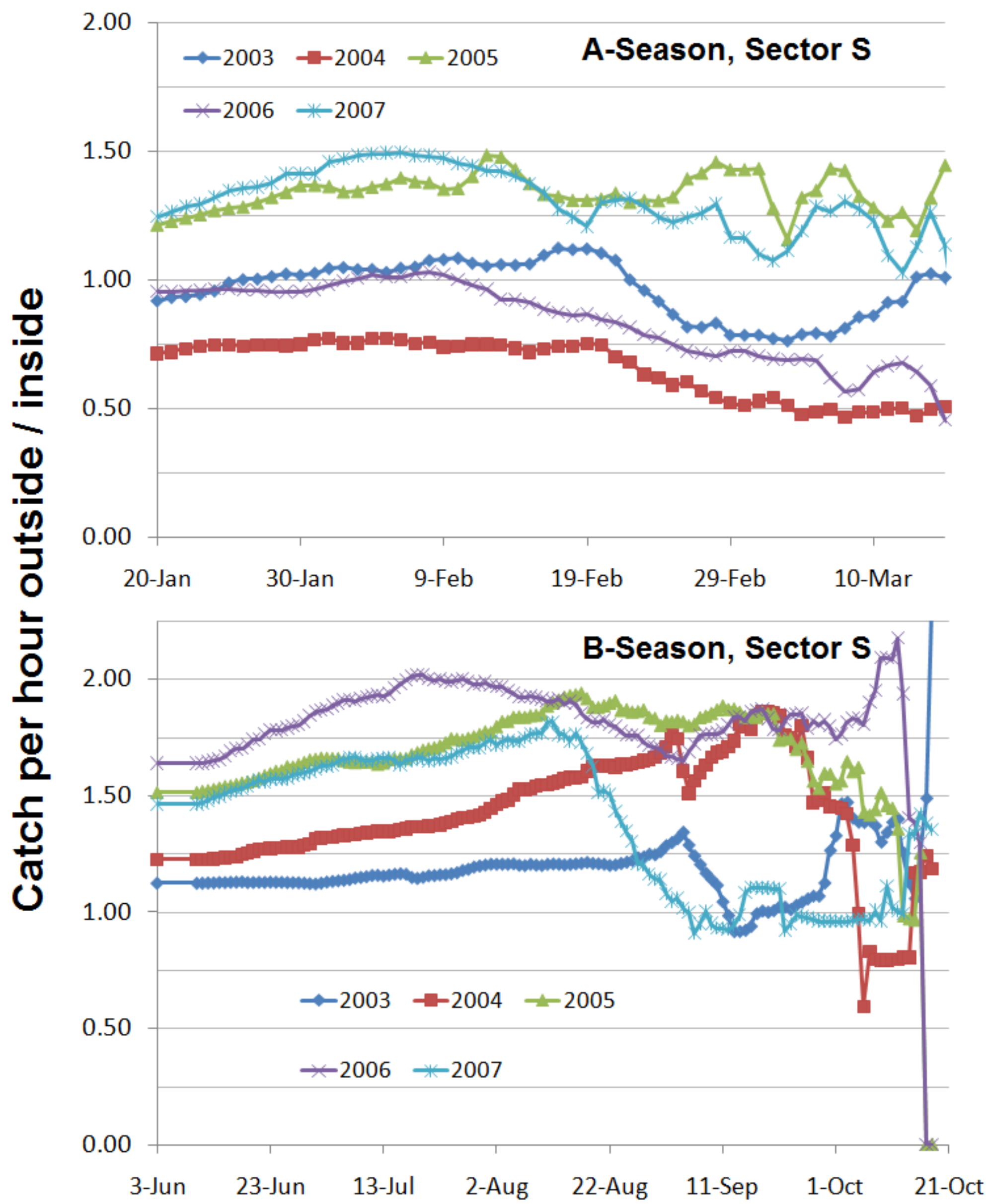

Fig. 4-12 Relative catch rates of pollock for shorebased catcher vessels by hour of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season.

4.4 Consideration of future actions

CEQ regulations require that the analysis of environmental consequences include a discussion of the action's impacts in the context of all other activities (human and natural) that are occurring in the affected environment and impacting the resources being affected by the proposed action and alternatives. This cumulative impact discussion should include incremental impacts of the action when added to past, present, and reasonably foreseeable future actions. Past and present actions affecting the pollock resource have been incorporated into the impacts analysis in this Chapter. Section 3.4 provides a detailed discussion of reasonably foreseeable future actions that may affect the Bering Sea pollock fishery, the

Chinook salmon caught as bycatch in that fishery, and the impacts of salmon bycatch on other resource components analyzed in the EIS.

The reasonable foreseeable future actions that will most impact the pollock fisheries and pollock stocks are changes to the management of the fisheries due to increasing protection of ESA-listed and other non-target species. The Council is considering action on management measure to minimize chum salmon bycatch in the pollock fishery. A suite of alternative management measures was proposed in April 2008, and a discussion paper was presented to the Council in October 2008. In December 2008, the Council developed a range of alternatives for analysis. Because any revised chum salmon bycatch measures will also regulate the pollock fishery, there will be a synergistic interaction between the alternatives proposed in this EIS and those considered under the chum salmon action. Analysis has not yet begun on the chum salmon action, but will be underway before this EIS is finalized, and a further discussion of the impact interactions will be included at that time.

The Council and NMFS may develop additional Steller sea lion protection measures to reduce the pollock fisheries interaction with Steller sea lions. As discussed in section 8.1, NMFS is currently developing a biological opinion on the status quo groundfish fisheries in the BSAI and GOA which is expected to be available in late 2009. Depending on the results of that biological opinion, the Council and NMFS may decide to change the management of the pollock fleet. Additionally, the potential change in listing for the ice seals and northern fur seals could result in management changes. As with new chum salmon measures, analysis of any new management measures for the pollock fleet would consider the impacts of adding those new measures to the existing suite of management measure for the pollock fleet.

The development and deployment of the salmon excluder devise may reduce Chinook salmon bycatch and improve the fleets ability to harvest the pollock TAC under a hard cap.

Future harvest specifications will primarily affect fishing mortality as the other significance criteria for pollock (temporal and spatial harvest, prey availability, and habitat suitability) are primarily controlled through regulations in 50 CFR part 679. The setting of harvest levels each year is controlled to ensure the stock can produced MSY on a continuing basis and to prevent overfishing. Each year's setting of harvest specifications include the consideration of past harvests and future harvests based on available biomass estimates. In-season managers close fisheries to directed fishing as fishermen approach TACs, treat species whose TACs have been taken as prohibited species, and introduce fishing restrictions, or actual fishery closures, in fisheries in which harvests approach OFL. The 2 million mt OY in the BSAI also contributes significantly to preventing overharvests. The controls on fishing mortality in setting harvest specifications ensure the stocks are able to produce MSY on a continuing basis.

The number of TAC categories with low values of ABC/OFL are increasing which tends to increase the likelihood that closures of directed fisheries to prevent overfishing will occur. In recent years management of species groups has tended to separate the constituent species into individual ABCs and OFLs. For example, in 1991 the category 'other red rockfish' consisted of four species of rockfish. By 2007, one of those species (sharpchin rockfish) had been moved to the 'other rockfish' category and northern, shortraker, and rougheye are now managed as separate species. While managing the species with separate ABCs and OFLs reduces the potential for overfishing the individual species, the effect of creating more species categories can increase the potential for incurring management measures to prevent overfishing, such as fishery closures. Managers closely watch species with fairly close amounts between the OFL and ABCs during the fishing year and the fleet will adjust behavior to prevent incurring management actions. Currently the NPFMC is considering separating components of the 'other species' category (sharks, skates, octopus, sculpin). Should that occur, incidental catch of sharks for example could impact management of the pollock fishery. As part of the 2006 'other species' incidental catch of 1,973 mt in the pollock fishery, 504 mt were shark. The tier 6 ABC for shark as part of the 'other species' category in 2006 was 463 mt and OFL 617 mt. If sharks were managed as a separate species group under their current tier, the pollock fishery would likely have been constrained in 2006.

The entire pollock fleet now carries VMS due to VMS requirements introduced in connection with the AFA. In-season managers currently use VMS intensively to manage fisheries so that harvests are as close to TACs as possible. VMS has also become a valuable diagnostic tool for addressing situations with unexpected harvests. It was used as a diagnostic tool in July 2006 to investigate the sources of a sudden and unexpected bycatch of squid in the pollock fishery. As agency experience with VMS grows, it should allow in-season managers to more precisely match harvests to TACs, reducing potential overages, and maximizing the value of TACs to industry.

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5.0 CHINOOK SALMON

This chapter provides information on Chinook salmon biology, distribution, and current stock assessments. This chapter then analyzes the impacts of the alternatives on Chinook salmon. The first part of the analysis estimates the numbers of salmon saved under each alternative. The second part describes the changes in the estimated returns of adult equivalent Chinook salmon on region or river of origin under the alternatives. Chapter 3 provides a description of the methodology and data used to conduct these analyses.

5.1 Overview of Chinook salmon biology and distribution

Overview information in this section is extracted from Delaney (1994). Other information on Chinook salmon may be found at the ADF&G website, http://www.cf.adfg.state.ak.us/geninfo/finfish/salmon/salmhome.php.

The Chinook salmon (*Oncorhynchus tshawytscha*) is the largest of all Pacific salmon, with weights of individual fish commonly exceeding 30 pounds. In North America, Chinook salmon range from the Monterey Bay area of California to the Chukchi Sea area of Alaska. In Alaska, it is abundant from the southeastern panhandle to the Yukon River. Major populations return to the Yukon, Kuskokwim, Nushagak, Susitna, Kenai, Copper, Alsek, Taku, and Stikine rivers. Important runs also occur in many smaller streams.

Like all species of Pacific salmon, Chinook salmon are anadromous. They hatch in fresh water, spend part of their life in the ocean, and then spawn in fresh water. All Chinooks die after spawning. Chinook salmon may become sexually mature from their second through seventh year, and as a result, fish in any spawning run may vary greatly in size. For example, a mature 3-year-old will probably weigh less than 4 pounds, while a mature 7-year-old may exceed 50 pounds. Females tend to be older than males at maturity. In many spawning runs, males outnumber females in all but the 6- and 7-year age groups. Small Chinooks that mature after spending only one winter in the ocean are commonly referred to as "jacks" and are usually males. Alaska streams normally receive a single run of Chinook salmon in the period from May through July.

Chinook salmon migrate through coastal areas as juveniles and returning adults; however, immature Chinook salmon undergo extensive migrations and can be found inshore and offshore throughout the North Pacific and Bering Sea. In summer, Chinook salmon concentrate around the Aleutian Islands and in the western Gulf of Alaska (Eggers 2004).

Juvenile Chinook salmon in freshwater feed on plankton and then later eat insects. In the ocean, they eat a variety of organisms including herring, pilchard, sand lance, squid, and crustaceans. Salmon grow rapidly in the ocean and often double their weight during a single summer season.

North Pacific Chinook salmon are the subject of commercial, subsistence, personal use, and sport fisheries, as discussed in more detail in Chapters 9 and 10. The majority of the Alaska commercial catch is made in Southeast Alaska, Bristol Bay, and the Arctic-Yukon-Kuskokwim areas. Fish taken commercially average about 18 pounds. The majority of the catch is made with troll gear and gillnets. Approximately 90 percent of the subsistence harvest is taken in the Yukon and Kuskokwim rivers.

The Chinook salmon is perhaps the most highly prized sport fish in Alaska and is extensively fished by anglers in the Southeast and Cook Inlet areas. The sport fishing harvest of Chinook salmon is over 76,000 annually, with Cook Inlet and adjacent watersheds contributing over half of the catch.

Unlike "other salmon" species, Chinook salmon rear in inshore marine waters and are, therefore, available to commercial and sport fishermen all year.

5.1.1 Food habits/ecological role

Western Alaskan salmon runs experienced dramatic declines from 1998 through 2002 with a record low in stocks in 2000. Weak runs during this time period have been attributed to reduced productivity in the marine environment rather than an indication of low levels of parent year escapements (Bue and Lingnau 2005). Recent Bering-Aleutian Salmon International Survey (BASIS) evaluations have examined the food habits from Pacific salmon in the Bering Sea in an attempt to evaluate potential interactions between salmon species as well as their dependence upon oceanographic conditions for survival.

Ocean salmon feeding ecology is highlighted by the BASIS program given the evidence that salmon are food limited during their offshore migrations in the North Pacific and Bering Sea (Rogers 1980; Rogers and Ruggerone 1993; Aydin et al. 2000, Kaeriyama et al. 2000). Increases in salmon abundance in North America and Asian stocks have been correlated to decreases in body size of adult salmon which may indicate a limit to the carrying capacity of salmon in the ocean (Kaeriyama 1989; Ishida et al. 1993; Helle and Hoffman 1995; Bigler et al. 1996; Ruggerone et al. 2003). International high seas research results suggest that inter and intra-specific competition for food and density-dependant growth effects occur primarily among older age groups of salmon particularly when stocks from different geographic regions in the Pacific Rim mix and feed in offshore waters (Ishida et al. 1993; Ishida et al 1995; Tadokoro et al. 1996; Walker et al. 1998; Azumaya and Ishida 2000; Bugaev et al. 2001; Davis 2003; Ruggerone et al. 2003).

Results of a fall study to evaluate food habits data in 2002 indicated Chinook salmon consumed predominantly small nekton and did not overlap their diets with sockeye and chum (Davis et al. 2004). Shifts in prey composition of salmon species between seasons, habitats and among salmon age groups were attributed to changes in prey availability (Davis et al. 2004).

Stomach sample analysis of ocean age .1 and .2 fish from basin and shelf area Chinook salmon indicated that their prey composition was more limited than chum salmon (Davis et al. 2004). This particular study did not collect many ocean age .3 or .4 Chinook, although those collected were located predominantly in the basin (Davis et al. 2004). Summer Chinook samples contained high volumes of euphausiids, squid and fish while fall stomach samples in the same area contained primarily squid and some fish (Davis et al. 2004). The composition of fish in salmon diets varied with area with prey species in the basin primarily northern lamp fish, rockfish, Atka mackerel, Pollock, sculpin and flatfish while shelf samples contained more herring, capelin, Pollock, rockfish and sablefish (Davis et al. 2004). Squid was an important prey species for ocean age .1, .2, and .3 Chinook in summer and fall (Davis et al. 2004). The proportion of fish was higher in summer than fall as was the relative proportion of euphausiids (Davis et al. 2004). The proportion of squid in Chinook stomach contents was larger during the summer in years (even numbered) when there was a scarcity of pink salmon in the basin (Davis et al. 2004).

Results from the Bering Sea shelf on diet overlap in 2002 indicated that the overlap between chum and Chinook salmon was moderate (30%), with fish constituting the largest prey category, results were similar in the basin (Davis et al. 2004). However notably on the shelf, both chum and Chinook consumed juvenile walleye pollock, with Chinook salmon consuming somewhat larger (60-190 mm SL) than those consumed by chum salmon (45-95 mm SL) (Davis et al. 2004). Other fish consumed by Chinook salmon included herring and capelin while chum salmon stomach contents also included sablefish and juvenile rockfish (Davis et al. 2004).

General results from the study found that immature chum are primarily predators of macrozooplankton while Chinook tend to prey on small nektonic prey such as fish and squid (Davis et al. 2004). Prey compositions shifts between species and between seasons in different habitats and a seasonal reduction in diversity occurs in both chum and Chinook diets from summer to fall (Davis et al. 2004). Reduction in prey diversity was noted to be caused by changes in prey availability due to distribution shifts, abundance changes or progression of life-history changes which could be the result of seasonal shift in environmental factors such as changes in water temperature and other factors (Davis et al. 2004).

Davis et al. (2004) found that diet overlap estimates between Chinook and sockeye salmon and Chinook and chum salmon were lower than the estimates obtained for sockeye and chum salmon, suggesting a relatively low level of inter-specific food competition between immature Chinook and immature sockeye or chum salmon in the Bering Sea because Chinook salmon were more specialized consumers. In addition, the relatively low abundance of immature Chinook salmon compared to other species may serve to reduce intra-specific competition at sea. Consumption of nektonic organisms (fish and squid) may be efficient because they are relatively large bodied and contain a higher caloric density than zooplankton, such as pteropods and amphipods (Tadokoro et al. 1996, Davis et al. 1998). However, the energetic investment required of Chinook to capture actively swimming prey is large, and if fish and squid prey abundance are reduced, a smaller proportion of ingested energy will be available for salmon growth (Davis et al. 1998). Davis et al. (2004) hypothesized that inter- and intra-specific competition in the Bering Sea could negatively affect the growth of chum and Chinook salmon, particularly during spring and summer in odd-numbered years, when the distribution of Asian and North American salmon stocks overlap. Decreased growth could lead to reduction in salmon survival by increasing predation (Ruggerone et al. 2003), decreasing lipid storage to the point of insufficiency to sustain the salmon through winter when consumption rates are low (Nomura et al. 2002), and increasing susceptibility to parasites and disease due to poor salmon nutritional condition.

5.1.2 Hatchery releases

Commercial salmon fisheries exist around the Pacific Rim with most countries releasing salmon fry in varying amounts by species. The North Pacific Anadromous Fish Commission summarizes information on hatchery releases by country and by area where available. Reports submitted to the NPAFC were used to summarize hatchery information by Country and by US state below (Table 5-1, Table 5-2). For more information see the following: Russia (Anon. 2007; TINRO-centre 2006, 2005); Canada (Cook and Irvine 2007); USA (Josephson 2007; Eggers 2006, 2005; Bartlett 2007, 2006, 2005).

Chinook salmon hatchery releases by country are shown below in Table 5-1. There are no hatchery releases of Chinook salmon in Japan and Korea and only a limited number in Russia. Hatchery releases in each region have decreased in recent years.

Table 5-1 Hatchery releases of juvenile Chinook salmon, in millions of fish

Year	Russia	Japan	Korea	Canada	USA	TOTAL
1999	0.6	-	-	54.4	208.1	263.1
2000	0.5	-	-	53.0	209.5	263.0
2001	0.5	-	-	45.5	212.1	258.1
2002	0.3	-	-	52.8	222.1	275.2
2003	0.7	-	-	50.2	210.6	261.5
2004	1.17	-	-	49.8	173.6	224.6
2005	0.84	-	-	43.5	184.0	228.3
2006	0.78	-	-	41.3	181.2	223.3
2007*	*	*	*	*	*	*

*2007 data not available until Fall 2008

For Chinook salmon fry, the United States has the highest number of annual releases (81% of total in 2006), followed by Canada (18%). In Canada, enhancement projects have been on-going since 1977 with approximately 300 different projects for all salmon species (Cook and Irvine 2007). Maximum production for Chinook releases was reached in 1991 with 66 million fish in that year (Cook and Irvine 2007). Releases of Chinook in 2006 occurred in the following regions: Yukon and Transboundary River, Skeena River, North Coast, Central Coast, West Coast and Vancouver Island, Johnstone Strait, Straits of Georgia, and the Lower and Upper Fraser rivers. Of these the highest numbers were released in the West Coast Straits of Georgia (20 million fish) followed by Vancouver Island area (12.4 million fish) the Lower Fraser River (3.3 million fish) (Cook and Irvine 2007).

Of the US releases however, a breakout by area shows that the highest numbers are coming from the State of Washington (61% in 2006), followed by California (16% in 2006), and then Oregon (11% in 2007) (Table 5-2). Hatcheries in Alaska are located in southcentral and southeast Alaska; there are no enhancement efforts for the AYK region. Since 2004 the number of hatcheries has ranged from 33 (2004–2005) to 31 (2006) with the majority of hatcheries (18–22) located in southeast Alaska, while 11 hatcheries are in Cook Inlet and 2 in Kodiak (Eggers 2005, 2006; Josephson 2007).

Table 5-2 USA west coast hatchery releases of juvenile Chinook salmon, in millions of fish

Year	Alaska	Washington	Oregon	California	Idaho	WA/OR/CA/ID (combined)	TOTAL
1999	8.0	114.5	30.5	45.4	9.7		208.1
2000	9.2	117.4	32.3	43.8	6.8		209.5
2001	9.9	123.5	28.4	45.0	5.4		212.1
2002	8.4					213.6	222.0
2003	9.3					201.3	210.6
2004	9.35	118.2	17.0	27.4	1.7	164.2	173.6
2005	9.46	117.7	19.2	28.8	8.7	174.5	184.0
2006	10.2	110.5	19.2	29.4	12.0	171.0	181.2
2007*	*	*	*	*	*	*	

*2007 data not available until Fall 2008

5.1.3 BASIS surveys

The Bering-Aleutian Salmon International Survey (BASIS) is an NPAFC-coordinated program of pelagic ecosystem research on salmon and forage fish in the Bering Sea.. Shelf-wide surveys have been conducted beginning in 2006 on the eastern Bering Sea shelf (Helle et al 2007). A major goal of this program is to understand how changes in the ocean conditions affect the survival, growth, distribution, and migration of salmon in the Bering Sea. Research vessels from U.S. (F/V Sea Storm, F/V Northwest Explorer), Japan (R/V Kaiyo Maru, R/V Wakatake Maru), and Russia (R/V TINRO), have participated in synoptic BASIS research surveys in Bering Sea since in 2002 (NPAFC 2001).

The primary findings from the past 5 years (2002–2006) indicate that there are special variations in distribution among species: juvenile coho and Chinook salmon tend to be distributed nearshore and juvenile sockeye, chum, and pink salmon tended to be distributed further offshore. In general, juvenile salmon were largest during 2002 and 2003 and smallest during 2006, particularly in the northeast Bering Sea region. Fish, including age-0 pollock and Pacific sand lance were important components of the diets for all species of juvenile salmon in some years; however, annual comparisons of juvenile salmon diets indicated a shift in primary prey for many of the salmon species during 2006 in both the northeast and southeast Bering Sea regions. In addition, the average catch per unit effort of juvenile salmon fell sharply during 2006 in the southeast Bering Sea region. It is speculated that spring sea surface temperatures on the eastern Bering Sea shelf likely impact growth rate of juvenile western Alaska salmon through bottom-up control in the ecosystem. Cold spring SSTs lead to lower growth and marine survival rates for juvenile western Alaska salmon, while warm spring SSTs have the opposite effect (NPAFC 2001).

Fig. 5-1 shows the 2007 juvenile Chinook salmon catches in the U.S. BASIS cruise. Fig. 5-2 shows the relative abundance of juvenile salmon in the Northern Shelf Region of the Bering Sea as determined by the U. S. BASIS cruises from 2002 to 2007. Relative abundance of juvenile Chinook salmon appears to be increasing after 3 straight years of decline (Jim Murphy, NMFS AFSC, personal communication).

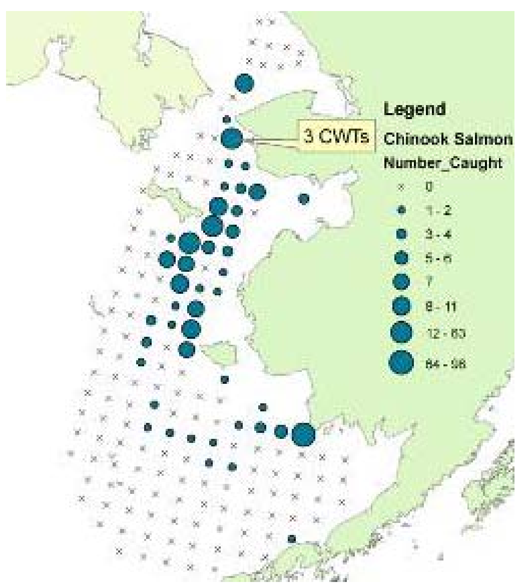


Fig. 5-1 U.S. BASIS juvenile Chinook salmon catches in 2007. The location of three coded-wire tag (CWT) recoveries for Canadian Yukon is noted in the callout box. Source: Jim Murphy and Adrian Celewycz, NMFS AFSC.

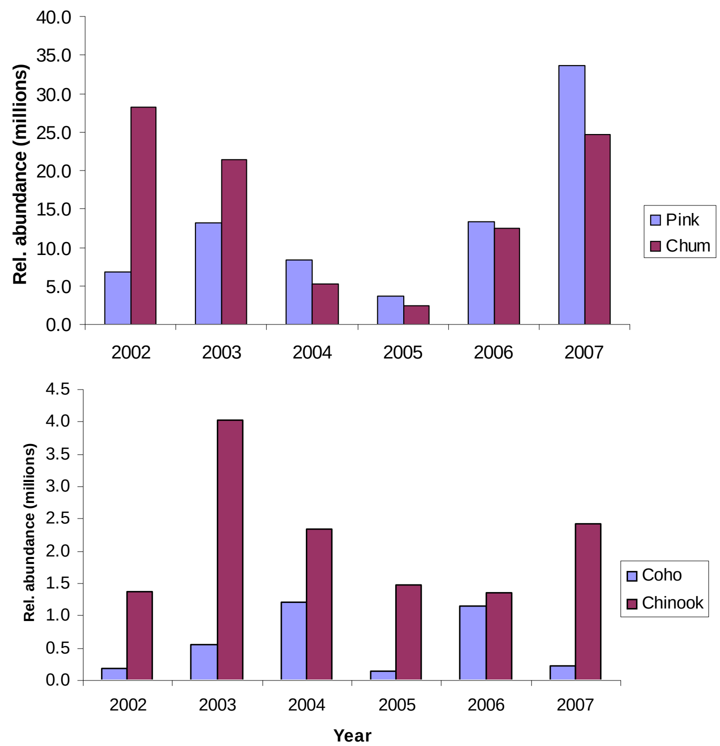


Fig. 5-2 Relative abundance of juvenile salmon in the Northern Shelf Region (60°N-64°N latitude) of the U.S. BASIS survey, 2002-2007. Source: Chris Kondzela, NMFS AFSC.

5.1.4 Migration corridors

BASIS surveys have established that the distribution and migration pathways of western Alaska juvenile salmon vary by species. Farley et al. (2006; Fig. 5-3) reported on the distribution and movement patterns of main species in this region. The Yukon River salmon stocks are distributed along the western Alaska coast from the Yukon River to latitude 60ºN. Kuskokwim River salmon stocks are generally distributed south of latitude 60ºN from the Kuskokwim River to longitude 175ºW. Bristol Bay stocks are generally distributed within the middle domain between the Alaska Peninsula and latitude 60ºN and from Bristol Bay to longitude 175ºW. The seaward migration from natal freshwater river systems is south and east away from the Yukon River for Yukon River chum salmon, to the east and south away from the Kuskokwim River for Kuskokwim River chum, Chinook, and coho salmon, and east away from Bristol Bay river systems for Bristol Bay sockeye salmon stocks.

During the 2007 BASIS cruise, three juvenile Chinook salmon caught off the Seward Peninsula were coded wire tagged in the Canadian Yukon indicating a northward migrating component in juvenile Yukon River Chinook salmon (Fig. 5-4; Farley et al. 2007).

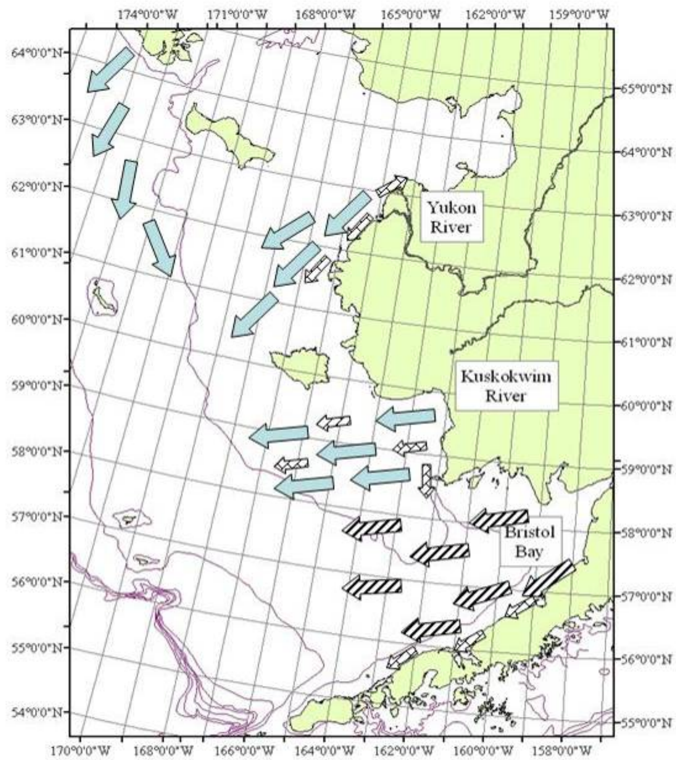
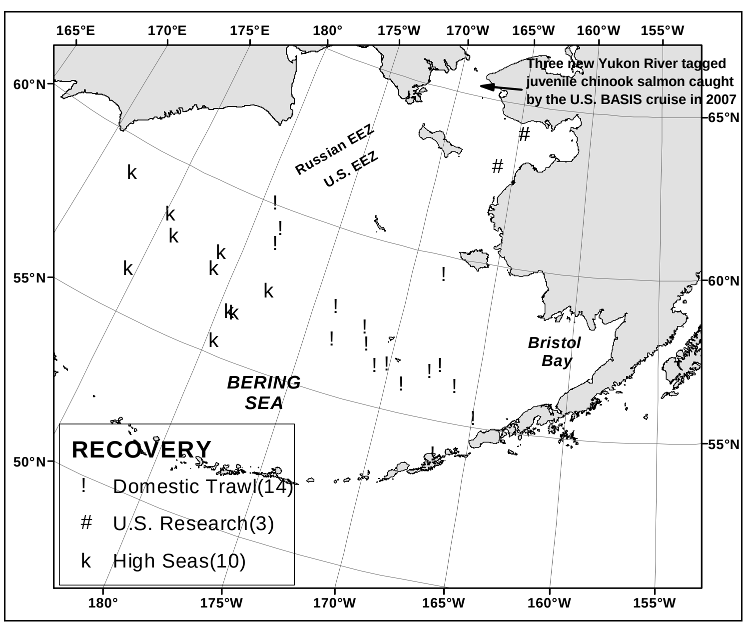


Fig. 5-3 Seaward migration pathways for juvenile chum (solid arrow), sockeye (slashed line arrow), coho, and Chinook (boxed line arrow) salmon along the eastern Bering Sea shelf, August through October. Source: Farley et al 2007.



Note: Three new recoveries were made by the 2007 U.S. BASIS cruise near the Bering Strait.

Fig. 5-4 Coded wire tagged Chinook salmon from the Whitehorse hatchery recovered from the domestic and research catches in the Bering Sea, and high seas tagged Chinook salmon recovered in the Yukon River. Source: Adrian Celewycz, NMFS AFSC.

5.2 Chinook salmon assessment overview by river system or region

5.2.1 Management and assessment of salmon stocks

The State of Alaska manages commercial, subsistence, personal use, and sport fishing of salmon in Alaskan rivers and marine waters and assesses the health and viability of individual salmon stocks accordingly. The catches of Chinook salmon in Southeast Alaska are regulated by quotas set under the Pacific Salmon Treaty. In other regions of Alaska, Chinook salmon fisheries are also closely managed to ensure stocks of Chinook salmon are not overharvested. No gillnet fishing for salmon is permitted in federal (3-200 miles) waters, nor commercial fishing for salmon in offshore waters west of Cape Suckling.

Directed commercial Chinook salmon fisheries occur in the Yukon River, Norton Sound District, Nushagak District, Copper River, and the Southeast Alaska Troll fishery. In all other areas Chinook are taken incidentally and mainly in the early portions of the sockeye salmon fisheries. Catches in the Southeast Alaska troll fishery have been declining in recent years due to U.S./Canada treaty restrictions and declining abundance of Chinook salmon in British Columbia and the Pacific Northwest. Chinook salmon catches have been moderate to high in most regions over the last 20 years (Eggers 2004).

5.2.1.1 Escapement goals and Stock of Concern definitions

The State of Alaska Sustainable Salmon Fisheries Policy (SSFP) 5 AAC 39.222 (ADF&G/BOF 2001) defines three types of escapement goals (from ADF&G 2004):

Biological Escapement Goal (BEG): means the escapement that provides the greatest potential for maximum sustained yield; BEG will be the primary management objective for the escapement unless an optimal escapement or inriver run goal has been adopted; BEG will be developed from the best available biological information, and should be scientifically defensible on the basis of available biological information; BEG will be determined by ADF&G and will be expressed as a range based on factors such as salmon stock productivity and data uncertainty; ADF&G will seek to maintain evenly distributed salmon escapements within the bounds of a BEG.

Sustainable Escapement Goal (SEG): means a level of escapement, indicated by an index or an escapement estimate, that is known to provide for sustained yield over a 5 to 10 year period, used in situations where a BEG cannot be estimated due to the absence of a stock specific catch estimate; the SEG is the primary management objective for the escapement, unless an optimal escapement or inriver run goal has been adopted by the board, and will be developed from the best available biological information; the SEG will be determined by ADF&G and will be stated as a range that takes into account data uncertainty; ADF&G will seek to maintain escapements within the bounds of the SEG.

Sustained Escapement Threshold (SET): means a threshold level of escapement, below which the ability of the salmon stock to sustain itself is jeopardized; in practice, SET can be estimated based on lower ranges of historical escapement levels, for which the salmon stock has consistently demonstrated the ability to sustain itself; the SET is lower than the lower bound of the BEG and lower than the lower bound of the SEG; the SET is established by ADF&G in consultation with the board, as needed for salmon stocks of management or conservation concern.

In general BEGs are established to provide levels of escapement that will produce large returns with large harvestable surpluses on average (ADF&G 2004). Escapements at or below these levels will be sustainable but with a lower surplus for harvest. SEGs are set to provide levels of escapement that will produce runs and harvests that are similar to historical levels. Most escapement goals in the AYK Region are SEGs as data are inadequate to determine total escapement or total returns for given stocks (ADF&G

2004). For stocks where a BEG is not possible due to a lack of stock specific catch estimates, a (SEG) is utilized. An Optimal Escapement Goal (OEG) is a specific management objective for escapement that considers biological and allocative factors and may differ from the SEG or BEG (Menard 2007).

An interdivisional Escapement Goal Team was formed in 2002 and met periodically from 2002-2003 to review escapement goal data for AYK stocks and where possible establish appropriate escapement goals for these stocks. The team felt that the data were insufficient to establish BEGs for most stocks. For those stocks where sufficient escapement data was available but insufficient estimates of total returns, SEGs were recommended. BEGs and SEGs where established by stock (and the methodology by which they were determined) are contained in stock status sections to follow.

The Sustainable Salmon Fisheries Policy (SSFP) 5 AAC 39.222 (ADF&G/BOF 2001) also defined in regulation “stock of concern” as a measure of the stock status declining below threshold levels and requiring additional management measures accordingly. A ‘stock of concern’ is defined as “a stock of salmon for which there is a yield, management or conservation concern”. The terms “yield concern”, “management concern” and “conservation concern” are defined in state regulations under the SSF policy. Here “yield concern” is defined as “a concern arising from a chronic inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above a stock’s escapement needs”. “Management concern” indicates a “concern arising from a chronic inability, despite use of specific management measures, to maintain escapements for a salmon stock within the bounds of the sustainable escapement goal (SEG), the biological escapement goal (BEG), optimal escapement goal (OEG) or other specified management objectives for the fishery”. Finally a “conservation concern” is defined as “concern arising from a chronic inability, despite the use of specific management measures, to maintain escapements for a stock above a sustained escapement threshold (SET)”. It is further noted that “a conservation concern is more severe than a management concern which is more severe than a yield concern” (ADF&G/BOF 2001).

The SSF policy requires that a management plan and an action plan be developed to address the stock of concern. These are developed by the ADF&G and provided to the BOF and the public for the regulatory process to discuss. A part of the action plan process is to review other fisheries that may be harvesting the stock of concerns and whether any regulatory action may be necessary.

5.2.1.2 Precision of management estimates

Annually the ADF&G provides pre-season salmon run and harvest forecasts for the upcoming season as well as an annual report of the forecast and the actual catch (Fig. 5-5). Actual catch is rarely equivalent to projected catch for a variety of reasons including market conditions and precision of escapement estimates. The primary goal of ADF&G managers is to maintain spawning population sizes, not to meet preseason catch projections (Nelson et al. 2008).

Formal run size forecasts are not produced for all Chinook salmon runs; however, local salmon biologists prepare harvest projections or harvest outlooks for all areas. Projections are based on formal forecasts where available and on historical catches and local knowledge of recent events when formal forecasts information is not available (Nelson et al. 2008).

Precision of actual escapement information and river system assessment varies by the methodology utilized to enumerate salmon. To the extent possible, the section by river include information on both the projection for stock status in the upcoming season as well as a discussion of the precision of assessment methods utilized.

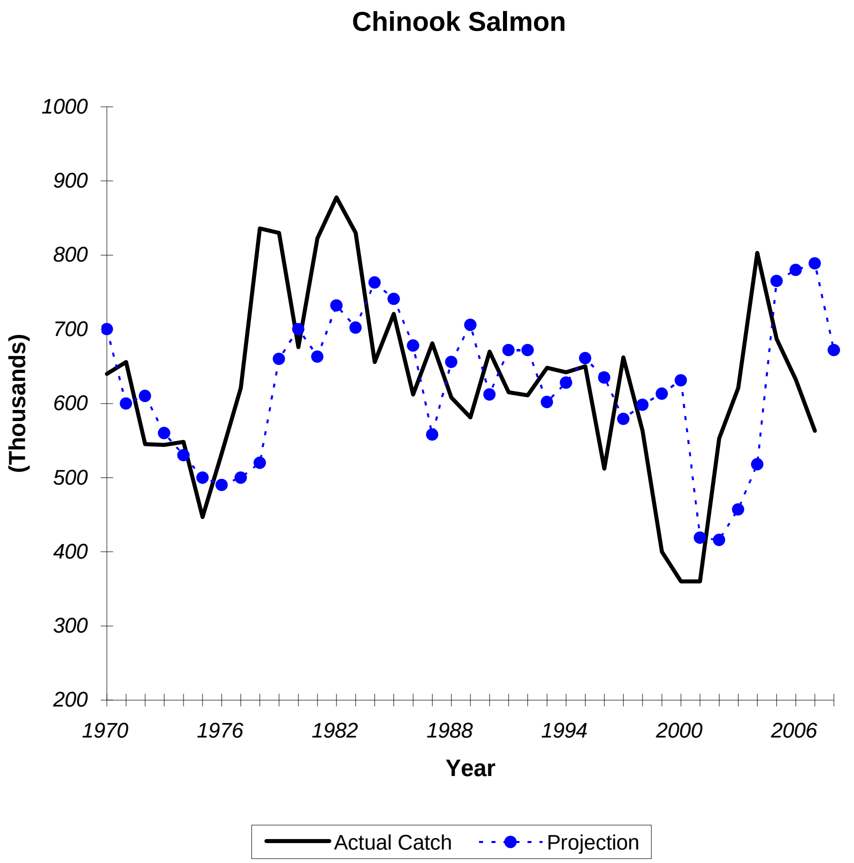


Fig. 5-5 Relationship between actual catch and projected catch in thousands, for Alaskan Chinook salmon fisheries from 1970 to 2007, with the 2008 projection (Nelson et al. 2008).

5.2.2 Overview of western Alaskan stock status

Western Alaska includes the Bristol Bay, Kuskokwim, Yukon, and Norton Sound areas, and the Nushagak, Kuskokwim, Yukon, Unalakleet, Shaktoolik and Kwiniuk rivers make up the Chinook salmon index stocks for this region. In general, these western Alaska Chinook salmon stocks declined sharply in 2007 and declined even further in 2008. In some of these areas, the 2008 Chinook salmon run was one of the poorest on record (ADF&G 2008). A general overview of stock status is contained in Table 5-3. Detailed information by stock is summarized in sections below.

Table 5-3 Overview of western Alaskan Chinook stock status 2008

Chinook Stock	Total run estimated?	2008 preliminary run estimate above or below projected/forecasted	Escapement estimates?	Escapement goals met?	Stock of concern?
Norton Sound	No	NA	Yes	Infrequent	Yield concern (since 2004)
Yukon	Yes	Below	Yes	Most	Yield concern (since 2000)
Kuskokwim	Yes	Below	Yes	Yes	No Yield concern discontinued 2007
Bristol Bay	Yes	Below	Yes	Some	No

5.2.3 Norton Sound Chinook

Norton Sound is comprised of two districts, the Norton Sound District and Port Clarence District. There are few Chinook salmon in the Port Clarence District. In the Norton Sound District, only the eastern area has sizable runs of Chinook salmon and the primary salmon producing rivers are in the Shaktoolik and Unalakleet subdistricts. The Shaktoolik and Unalakleet Subdistricts Chinook salmon stock was classified as a stock of concern in January 2004, and in 2007 the BOF continued this designation. This stock is classified as a stock of yield concern. The classification was in response to decreasing Chinook salmon harvests. The BOF adopted a new management plan in 2007 for Unalakleet River Chinook which incorporates a restrictive subsistence fishing schedule as escapement goals had not been met since 2003 even with commercial fishing closed.

Stock assessment and historical stock estimates

Run sizes are not estimated for Norton Sound Chinook stocks except for the Unalakleet River. Escapement is assessed for major index river systems of Norton Sound. Escapement goals are established for 3 stocks of Chinook in the Norton Sound Area, all are SEGs: Fish River/Boston Creek (SEG= >100), Kwiniuk River (SEG = 300-550) and North River (Unalakleet River) (SEG = 1,200-2,600). Other rivers have either aerial surveys or tower counts for enumeration, but data was deemed insufficient to establish escapement goals for those stocks. While aerial and tower enumeration methods are available on the Niukluk River, an escapement goal for this stock was not established due to the rationale that it was a very small Chinook salmon system and was not representative of the larger Fish River drainage (ADF&G 2004).

Assessments are often qualitative relative to historical escapement goals for indexed areas (Menard 2007). Escapement projects in the district include counting towers on the Kwiniuk and Niukluk Rivers, a test net operated on the Unalakleet River and a weir on the Nome River. Weir projects also exist on the Snake, Eldorado and Pilgrim Rivers while counting towers are used on the North River, and Pikmiktalik River. A weir is also operated at the headwaters of Glacial Creek which flows from Glacial Lake into the Sinuk River. The primary goal of this weir is for operation during the peak sockeye passage. Currently the only escapement project operating specifically for Chinook enumeration is the North River counting tower, located on a tributary of the Unalakleet River (J. Menard, pers. comm.).

The Unalakleet test net catches, the North, Kwiniuk and Niukluk River towers, aerial surveys and subsistence reports are the primary assessment tools for judging run strength of Chinook salmon in Norton Sound. Total escapement for Norton Sound Chinook is a combination of the observed escapements in the Kwiniuk, Niukluk, Nome, Snake Rivers (1995-2007), North River (starting 1996), and Eldorado River (starting 1997) with historical catch data (Table 5-4 and Menard 2007). The escapement goal range for the North River is 1,200 to 2,600 Chinook salmon while the escapement goal for the Unalakleet River and Old Woman River index area is 550 to 1,100 Chinook salmon aerial counts. For a commercial fishery to occur ADF&G must project an escapement minimum of 1,900 Chinook salmon past the North River tower. Norton Sound Chinook salmon are fully exploited and management strives to protect the early portion of the return from overharvesting and to provide adequate escapements (Menard 2005).

Table 5-4 Total escapement for Chinook salmon for Kwiniuk (1995-2008), Niukluk, Nome, and Snake Rivers (1995-2008), North River (1996-2008), and Eldorado River (1997-2008).

Year	Escapement	Escapement and catch (escapement + commercial, subsistence, and sportfish catch)
1995	626	17,198
1996	2,027	14,918
1997	5,550	28,218[a]
1998	3,179	19,493[a]
1999	2,470	11,752
2000	1,324	7,113
2001	1,718	7,778
2002	2,946	9,222
2003	2,466	7,445
2004	2,022	6,977[b]
2005	1,530	5,202[b]
2006	1,256	4,570[b]
2007	2,332	4,997[b]
2008	1,276	3,438[c]

Source: Menard 2008.

[a] Subsistence totals for 1997 and 1998 include data from Savoonga and Gambell.

[b] Subdistrict 4 (Norton Bay) not surveyed for subsistence use; previous 5-year average, 1993-2003, was 423 Chinook salmon harvested.

[c] Data are preliminary.

The 2008 Norton Sound Chinook salmon run is the poorest return on record. At the onset of the season, a directed Chinook salmon commercial fishery was not expected, and early closures to the subsistence and sport fisheries were anticipated for Subdistricts 5 and 6 in early July. There was some optimism about meeting escapement needs while also avoiding an early closure, which was based on a combination of factors. These included: 1) sufficient escapements observed during the predominant parent years (2002 and 2003) for the 2008 return, 2) a restrictive subsistence fishing schedule that provides escapement windows throughout the run, and 3) mesh-size restrictions that were planned for the Unalakleet River on June 30, which were aimed at conserving age-5 and -6 Chinook salmon during their peak migration period.

By July 2nd, it was clear that the Unalakleet River Chinook salmon run had later than average run timing and was a very weak run. Despite proactive restrictions and an eventual early closure, the North River Chinook salmon escapement of 903 fell short of the tower-based SEG range of 1,200-2,600 for the 4th time since 2004 and was a new record low (Fig. 5-6). The tower-based SEG (300-500) at the Kwiniuk River also failed to be reached for the third consecutive year and has not been achieved in 5 of 9 years since 1999. In fact, the Kwiniuk River Chinook salmon escapement of 237 was the 4th lowest on record. Chinook salmon passage at the Niukluk River tower and Pilgrim River weir Chinook salmon escapement were also both below average.

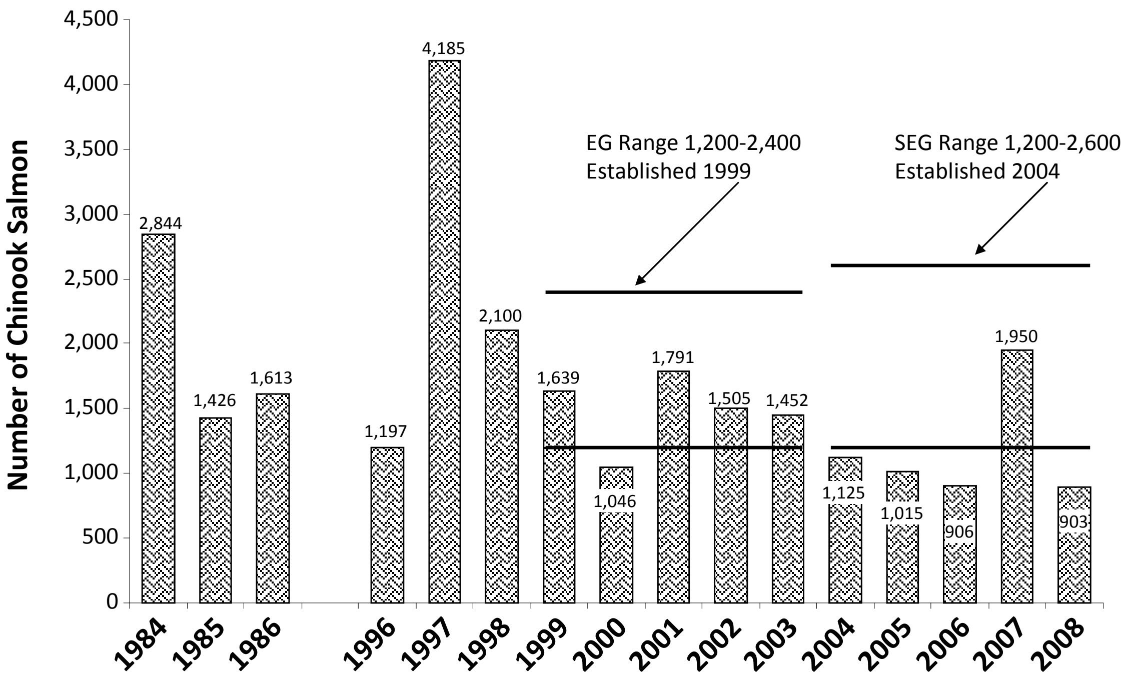


Fig. 5-6 Estimated Chinook salmon passage compared to the escapement goal range 1984-1986 and 1996-2008, North River counting tower, Unalakleet River drainage, Norton Sound.

The magnitude of the Chinook salmon escapement was poor in the Unalakleet watershed. On a positive note, however, mesh-size restrictions in the lower river subsistence fishery appear to have had the desired effect of conserving more age-5 and -6 Chinook salmon, thereby improving the quality of the escapement. Perhaps most notably, 83% of the 2008 test net samples were comprised of age-5 and older Chinook salmon, more than double the 36% age-5 and older observed in 2007 (Fig. 1-22). Samples collected from the Chinook salmon escapement captured in beach seines 28 km up river also showed a similar pattern. In 2007, the escapement was comprised of 27% age-5 and older compared to 62% in 2008 (S. Kent pers. comm.). Sex composition of the 2008 test net samples was only 24% females, which was only a 4% increase from samples collected in 2007, but the percentage of females in the escapement doubled from 11% in 2007 to 22% in 2008. Bank orientation bias associated with the test net site may account for the disparities in percentages of females between the test fishery and escapement. The data suggest that a greater portion of the run comprised of age-5 and -6 and predominantly female Chinook salmon reached spawning areas in the Unalakleet River drainage this season.

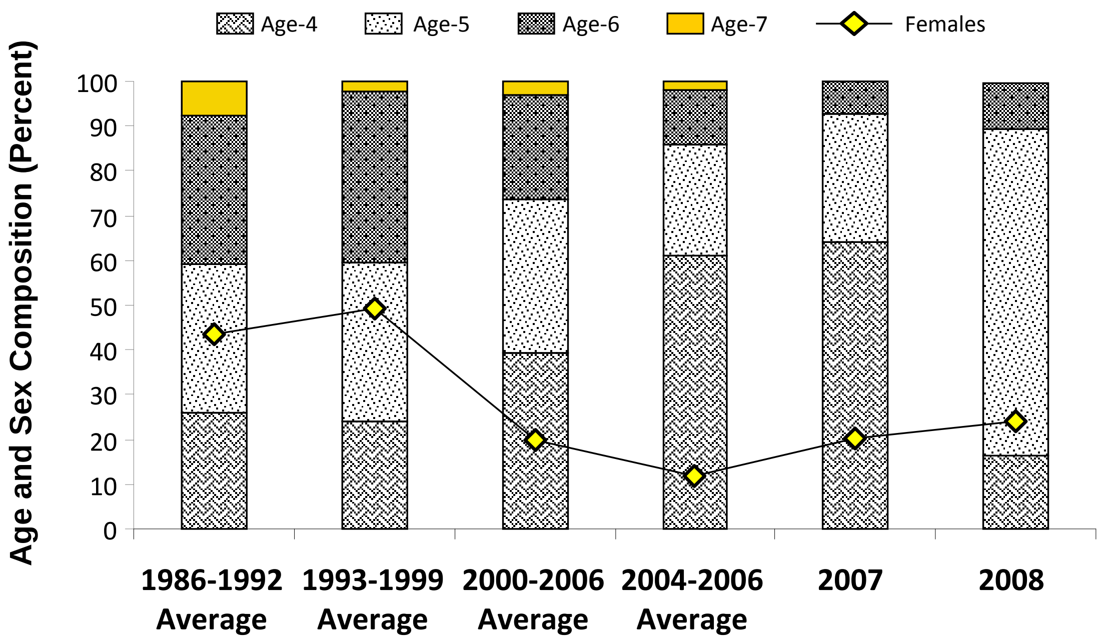


Fig. 5-7 Chinook salmon age and sex composition trends observed in the Unalakleet River test net samples (5 7/8" stretched mesh), 1986-2008, Norton Sound. Source: S. Kent, ADF&G.

Forecasts and precision of estimates

Salmon outlooks and harvest projections for the 2009 salmon season are based on qualitative assessments of parent year escapements, subjective determinations of freshwater overwintering and ocean survival, and in the case of the commercial fishery, the projections of local market conditions. No commercial fishery is anticipated for Chinook salmon in 2009 due to the combination of poor historical run and a new BOF regulation regarding the raised passage goal at the North River tower (increased 50% from previous passage goals for commercial fishery threshold opening). Weak returns of Chinook salmon since 2000 have also precluded the prosecution of a chum salmon fishery in Subdistricts 5 and 6 due to concerns with the incidental harvest of Chinook salmon in early to mid-July. Typically when Chinook salmon runs are poor, chum commercial fishing is prohibited until the third week in July despite improved market conditions and interest in an earlier commercial fishery (S. Kent, pers. comm.). ADF&G anticipates that restrictions and early closures to subsistence and sport fisheries in order to reach Chinook salmon escapement goals in the Unalakleet watershed in 2009. This is based largely on North River tower escapements from the 2004-2005 parent years being below the lower end of the SEG range.

5.2.4 Yukon River Chinook

The Yukon River is the largest river in Alaska, originating in British Columbia and flowing 2,300 miles to the Bering Sea. The Yukon River drainage encompasses about 330,000 square miles, and about one third of the land mass of Alaska. Significant runs of Chinook, chum, and coho salmon return to the Yukon River and are harvested in Alaska by subsistence, commercial, personal use, and sport fishermen as well as in Canada in aboriginal, commercial, sport, and domestic fisheries. Spawning populations of Chinook salmon occur throughout the Yukon River drainage in tributaries from as far downstream as the Archuelinuk River located approximately 80 miles from the mouth to as far upstream as the headwaters of the Yukon River in Canada over 2,000 miles from the mouth (Clark et al 2006).

The Yukon area includes all waters of the U.S. Yukon River drainage and all coastal waters from Point Romanof southward to the Naskonat Peninsula. Commercial fishing for salmon is allowed along the entire 1,200 mile length of the main stem Yukon River in Alaska and in the lower 225 miles of the Tanana River. The Yukon area includes 7 districts, 10 sub-districts, and 28 statistical areas which were established in 1961 and redefined in later years. The Coastal District was established in 1994, redefined in 1996, and is open for subsistence fishing only. The lower Yukon area (Districts 1, 2, and 3) includes some coastal waters near the mouth of the Yukon area and extends upstream to river mile 301 (the boundary between Districts 3 and 4). The upper Yukon area (Districts 4, 5 and 6) is that portion of the Yukon above river mile 301 extending to the U.S.-Canada border and including the lower Tanana River.

Management of the Yukon salmon fishery is difficult and complex because of the often inability to determine stock specific abundance and timing, overlapping multi-species salmon runs, increasing efficiency of the fishing fleet, the gauntlet nature of Yukon fisheries, allocation issues between lower river and upper river Alaskan fishermen, allocation and conservation issues between Alaska and Canada, and the immense size of the drainage (Clark et al 2006). Salmon fisheries within the Yukon River may harvest stocks that are up to several weeks and over a thousand miles from their spawning grounds. Since the Yukon River fisheries are largely mixed stock fisheries, some tributary populations may be under or over exploited in relation to abundance, it is not possible to manage for individual stocks in most areas where commercial and subsistence fisheries occurs (Clark et al 2006). In Alaska, subsistence fisheries have priority over other consumptive uses. Agreements between the U.S. and Canada are in effect that commit ADF&G to manage Alaskan fisheries in a manner that provides a Yukon River Panel agreed to passage of salmon into Canada to both support Canadian fisheries and to achieve desired spawning levels.

Stock assessment and historical run estimates

The Yukon is managed as a single river and catches are reported by district and use (sport, commercial, and subsistence). Postseason subsistence and commercial harvests are allocated by stock, grouping the lower Yukon, Middle Yukon and Upper Yukon (Fig. 5-8) through genetic stock identification. The Upper Yukon is the Canadian-Origin Yukon Chinook stocks. Total run estimates for the Yukon include lower, middle and upper Yukon stocks aggregated together. However, escapement and stock-specific run size estimates are provided only for the Upper (Canadian-origin) stock group.

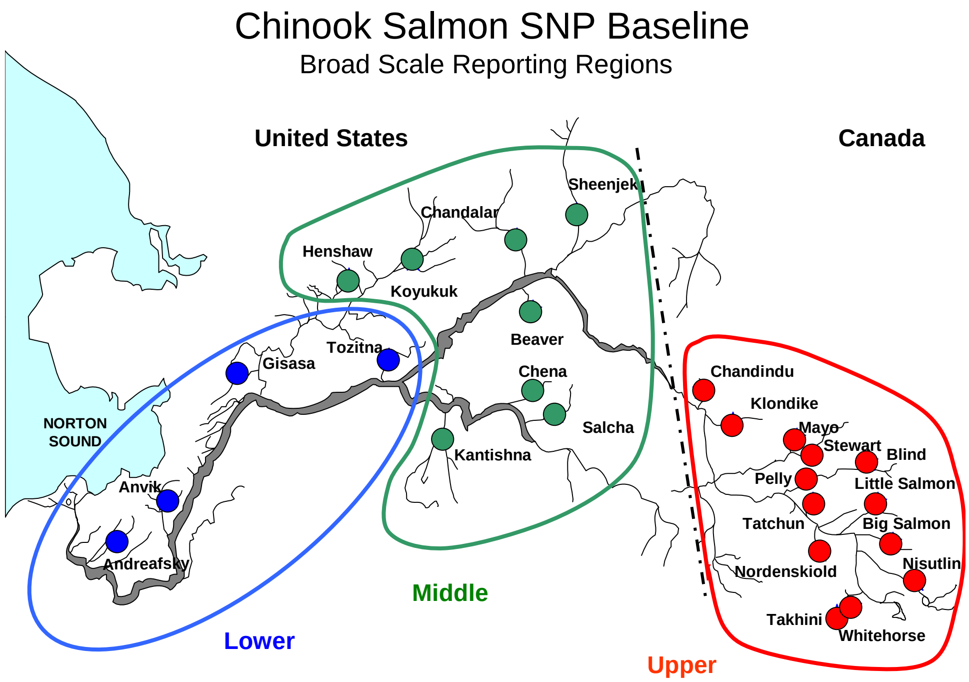


Fig. 5-8 Stock group delineations of the Yukon River: lower, middle and upper. Source: D. Evenson, ADF&G.

Chinook salmon production for many stocks in the Yukon River has been declining in recent years. Yukon Chinook salmon was designated as a Stock of Yield Concern by the BOF. This determination for Yukon River Chinook salmon was made at the September 2000 BOF meeting, continued after review in January 2004, and upheld again after review in January 2007. The Yukon River Chinook salmon stock continues to meet the definition of a yield concern based on low harvest levels from 1998-2008.

The commercial and subsistence salmon fisheries in the Yukon River are managed based upon perceived run strength and Alaska BOF approved fishery management plans. During the fishing season, management is based upon both pre-season and in-season run strength assessment information. Pre-season information involves run forecasts based upon historic performance of parent spawning abundance and is generally expressed as runs that will be below average, average, or above average. In-season run assessment includes: (1) abundance indices from test fishing, (2) sonar counts of passing fish, (3) various escapement assessment efforts in tributaries (e.g. tower counts, aerial surveys, weirs), (5) commercial and subsistence catch data and (5) catch per unit effort data from monitored fisheries (Fig. 5-9) (Clark et al 2006). ADF&G, several Federal agencies, the Canadian Department of Fisheries and Oceans (Canadian DFO), native organizations, and various organized groups of fishermen operate salmon stock assessment projects throughout the Yukon River drainage and fishery managers use this information to manage the Yukon salmon fisheries.

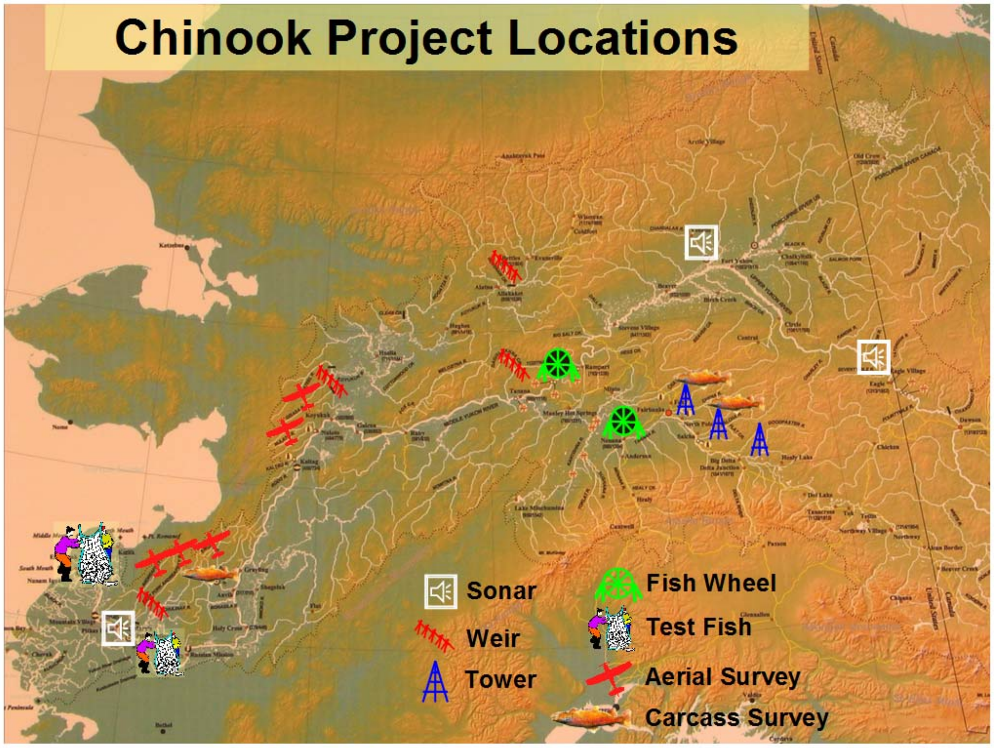


Fig. 5-9 Project location for assessing Yukon River Chinook salmon. Source: L. DuBois, ADF&G

Tributary escapements have been monitored with counting tower projects in the Chena and Salcha rivers and with aerial surveys in the Andreafsky, Anvik, Gisasa, and Nulato rivers. Biological escapement goals (BEGs) have been established for the Chena and Salcha rivers in the Tanana River drainage (Table 5-5). Sustainable escapement goals (SEGs) for aerial survey assessments have been established for the East and West Fork Andreafsky, Anvik, Nulato and Gisasa rivers. Chinook salmon escapement goals were generally met throughout the Alaska portion of the Yukon River drainage the past five years 2003–2007.

Table 5-5 Yukon River Chinook salmon escapement goals, 2008.

Stream	Current Goal	Type of Goal	2008
East Fork Andreafsky River Aerial	960–1,900	SEG	278[1]
West Fork Andreafsky River Aerial	640–1,600	SEG	262[1]
Anvik River Index Aerial	1,100–1,700	SEG	992[1]
Nulato River Aerial (Forks Combined)	940–1,900	SEG	922
Gisasa River Aerial	420–1,100	SEG	487
Chena River Tower	2,800–5,700	BEG	3,080[3]
Salcha River Tower	3,300–6,500	BEG	N/A
Canadian Border	<45,000	IMEG[2]	32,500[3]

[1]Rated as incomplete and/or poor survey conditions resulting in minimal or inaccurate counts.
[2]The US/Canada Yukon River Panel agreed to a one year Canadian Interim Management Escapement Goal (IMEG) of >45,000 Chinook salmon based on the Eagle sonar program. In order to meet this goal, the passage at Eagle Sonar must include a minimum of 45,000 fish for escapement, provide for a subsistence harvest in the community of Eagle of approximately 2,000 fish, and incorporate the US/Canada Yukon River Panel allowable catch (20%-26% of the total allowable catch); this would have resulted in approximately 53,000 fish counted at Eagle Sonar necessary to meet the goal in 2008.
[3]Data are preliminary.

The Chena and Salcha rivers are the major Chinook salmon producing tributaries within the Alaska portion of the Yukon River drainage. The BEG for the stock of Chinook salmon that spawns in the Chena River is 2,800-5,700. Between 1986-2007, the Chena River stock of Chinook salmon failed to meet the established escapement goal only in 1989 (JTC 2008). The annual escapement of Chinook salmon in the Chena River in 2005 was not assessed. The Salcha River stock of Chinook salmon has a BEG of 3,300-6,500. The Salcha River Chinook salmon escapement goal has been met in 20 of the past 21 years (JTC 2008); escapements in 1989 failed to meet the goal (JTC 2008).

Escapement observations for those stocks indexed by aerial surveys (1996-2007) with an established sustained escapement goal are shown in Fig. 5-10 (JTC 2008). The East Fork of the Andreafsky River has an SEG of 960-1,700 fish; escapement observations were not obtained in 1996, 1999, and 2003. The West Fork of the Andreafsky Chinook salmon population has an SEG of 640-1,600 fish; escapement observations were not obtained in 1998 and 1999 (Table 5-6, Table 5-7). In the Anvik River, the SEG is 1,100-1,700 fish; escapement observations were not obtained in 1998, 1999, and 2003. The Chinook salmon SEG in the Nulato River is 940-1,900 fish; escapement observations were not obtained in 1996, 1997, 1999, 2000, 2003, and 2004. The Gisasa River Chinook salmon population has an SEG of 420-1,100 fish; escapement observations were not obtained in 1996-2000 and 2003 (Fig. 5-11, Fig. 5-12). Thus, there are 49 escapement observations out of the possible 60 stream by year cells from 1996-2007. In 39 of the 49 cases (80%), escapements met or exceeded the escapement goals. A full evaluation of escapement goal performance for these rivers is difficult due to incomplete aerial survey records or incomplete counts due to poor survey conditions. The escapements in the Chena and Salcha rivers were within the biological escapement goal ranges in 2007 (Table 5-6).

The rebuilding step escapement target of 28,000 in the Canadian mainstem Yukon River agreed to and adopted by the Panel has been exceeded each year averaging 36,981 fish, based on the Canadian DFO mark and recapture passage estimate, from 2001–2005 (Fig. 5-15). Escapements during this most recent period are approximately 42% higher than the average escapement of 27,858 Chinook salmon during the 1989–1998 period. The 33,000 escapement goal was not met in 2007. In their spring 2008 meeting, the Yukon River Panel agreed to a one year minimum Interim Management Escapement Goal (IMEG) of greater than 45,000 Chinook salmon based on the Eagle sonar project passage estimate (Fig. 5-13, Fig. 5-14).

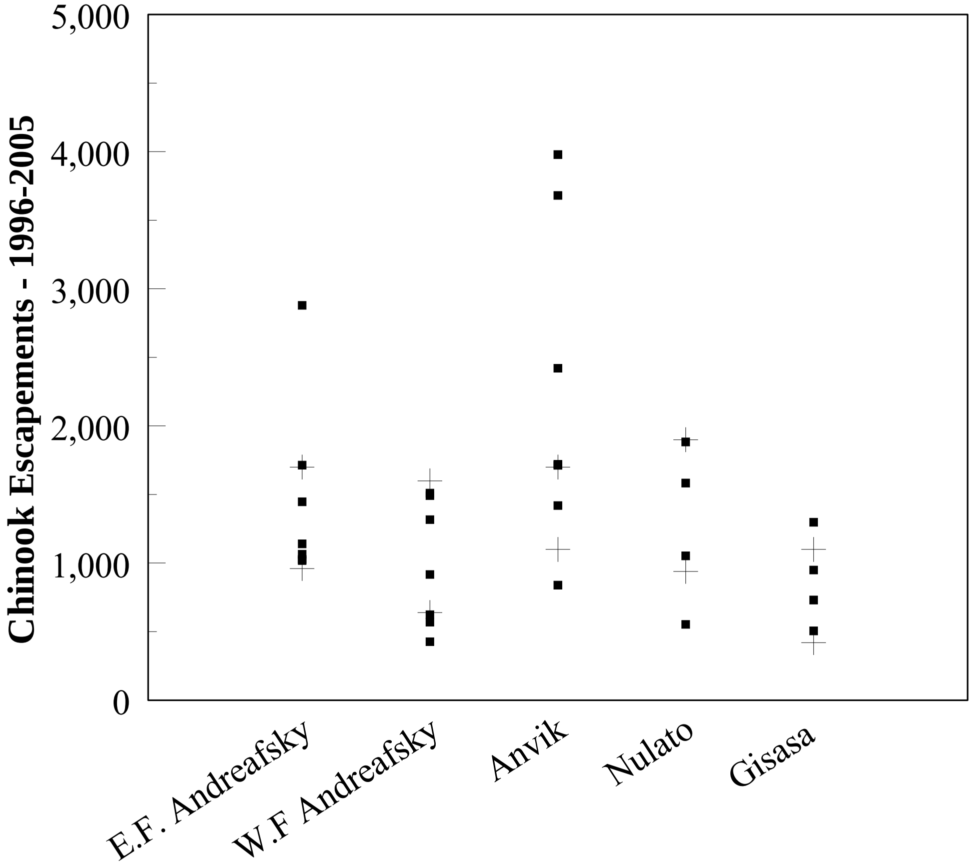


Fig. 5-10 Chinook salmon escapements from 1996-2005 for five Yukon stocks assessed by aerial survey that have sustained escapement goals (annual escapements shown as solid squares, lower and upper ends of sustained escapement goal ranges shown as + signs).

Table 5-6 Chinook salmon aerial survey indices for selected spawning areas in the Alaskan portion of the Yukon River drainage, 1961–2007.

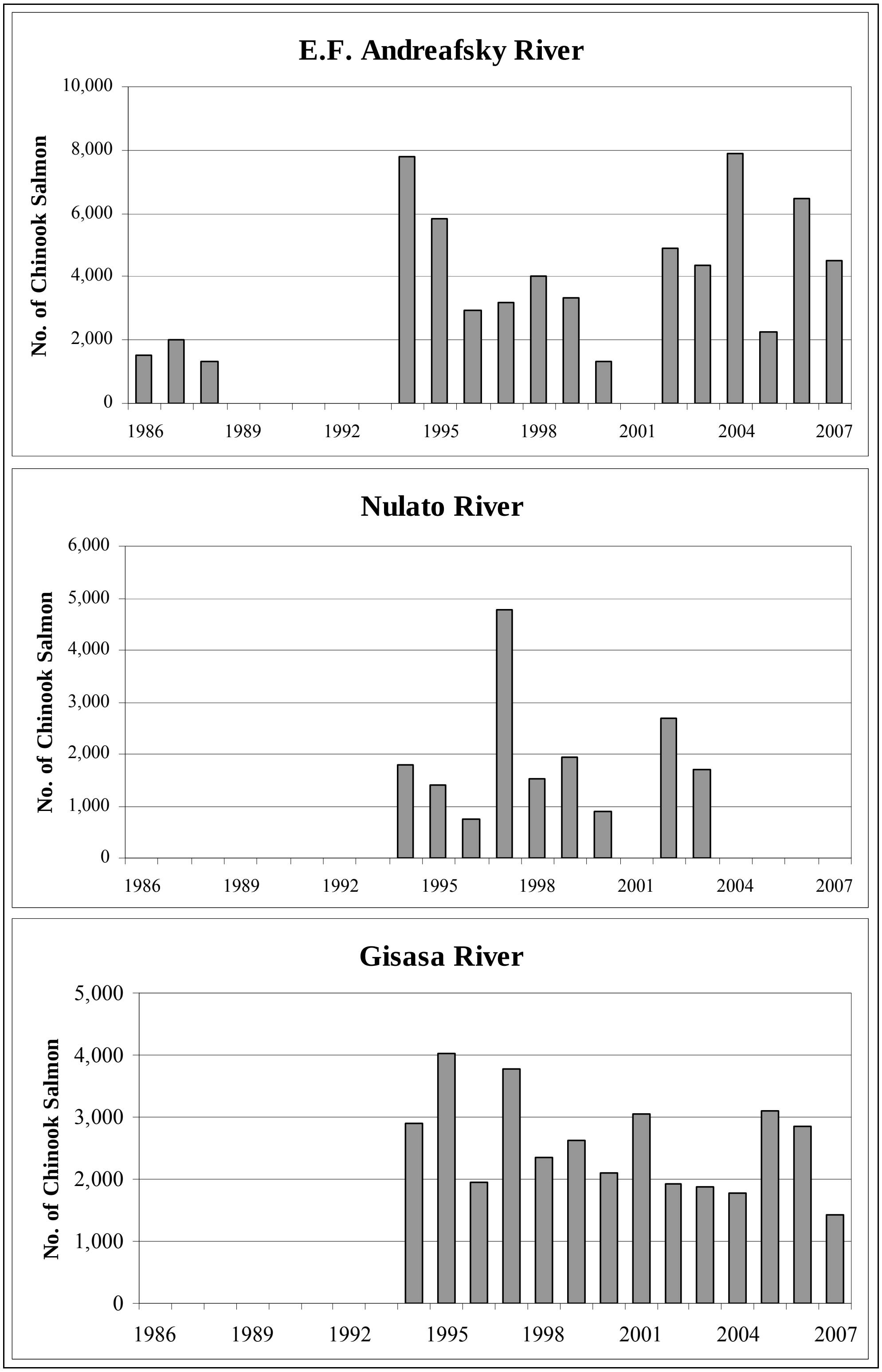
Year	Andreafsky River		Anvik River		Nulato River			Gisasa River
	East Fork	West Fork	Drainage Wide Total	Index Area	North Fork	South Fork	Both Forks	
1961	1,003		1,226		376 a	167		266 a
1962	675 a	762 a						
1963								
1964	867	705						
1965		344 a	650 [a]					
1966	361	303	638					
1967		276 a	336 [a]					
1968	380	383	310 [a]					
1969	274 a	231 a	296 [a]					
1970	665	574 a	368					
1971	1,904	1,682						
1972	798	582 a	1,198					
1973	825	788	613					
1974		285	471 a		55 a	23 a	a	161
1975	993	301	730		123	81		385
1976	818	643	1,053		471	177		332
1977	2,008	1,499	1,371		286	201		255
1978	2,487	1,062	1,324		498	422		45 a
1979	1,180	1,134	1,484		1,093	414		484
1980	958 a	1,500	1,330	1,192	954 a	369 a	a	951
1981	2,146 a	231 a	807 a	577		791		
1982	1,274	851						421
1983			653 a	376 b	526	480		572
1984	1,573 a	1,993	641 a	574 b				
1985	1,617	2,248	1,051	720	1,600	1,180		735
1986	1,954	3,158	1,118	918	1,452	1,522		1,346
1987	1,608	3,281	1,174	879	1,145	493		731
1988	1,020	1,448	1,805	1,449	1,061	714		797
1989	1,399	1,089	442 a	212 a				
1990	2,503	1,545	2,347	1,595	568 a	430 a	a	884 a
1991	1,938	2,544	875 a	625 a	767	1,253		1,690
1992	1,030 a	2,002 a	1,536	931	348	231		910
1993	5,855	2,765	1,720	1,526	1,844	1,181		1,573
1994	300 a	213 a		913 a	843	952		2,775
1995	1,635	1,108	1,996	1,147	968	681		410
1996		624	839	709		100		
1997	1,140	1,510	3,979	2,690				144
1998	1,027	1,249 a	709 a	648 a	507	546		889
1999	a	870 a	a	950 a	a	a		
2000	1,018	427	1,721	1,394	a	a		
2001	1,065	570	1,420	1,172			1,884 b	1,298
2002	1,447	917	1,713	1,329			1,584	506
2003	1,116 a	1,578 a	1,100 a	973 a				
2004	2,879	1,317	3,679	3,475			1,321	731
2005	1,715	1,492	2,421	2,421			553	958
2006	590 a	824	1,876	1,776			1,292	843
2007	1,758	976	1,529	1,580			2,583	593
SEG	960-1,700	640-1,600		1,100-1,700			940-1,900	420-1,100
Average								
1961-2006	1,386	1,137	1,257	1,199	774	564	1,327	781
1997-2006	1,333	1,075	2,069	1,683			1,327	767
2002-2006	1,549	1,226	2,158	1,995			1,188	760

Note: Aerial survey counts are peak counts only. Survey rating was fair or good unless otherwise noted.
[a]Incomplete, poor timing and/or poor survey conditions resulting in minimal or inaccurate counts.
[b]In 2001, the Nulato River escapement goal was established for both forks combined.

Table 5-7 Chinook salmon escapement counts for selected spawning areas in the Alaskan portion of the Yukon River drainage, 1986–2007.

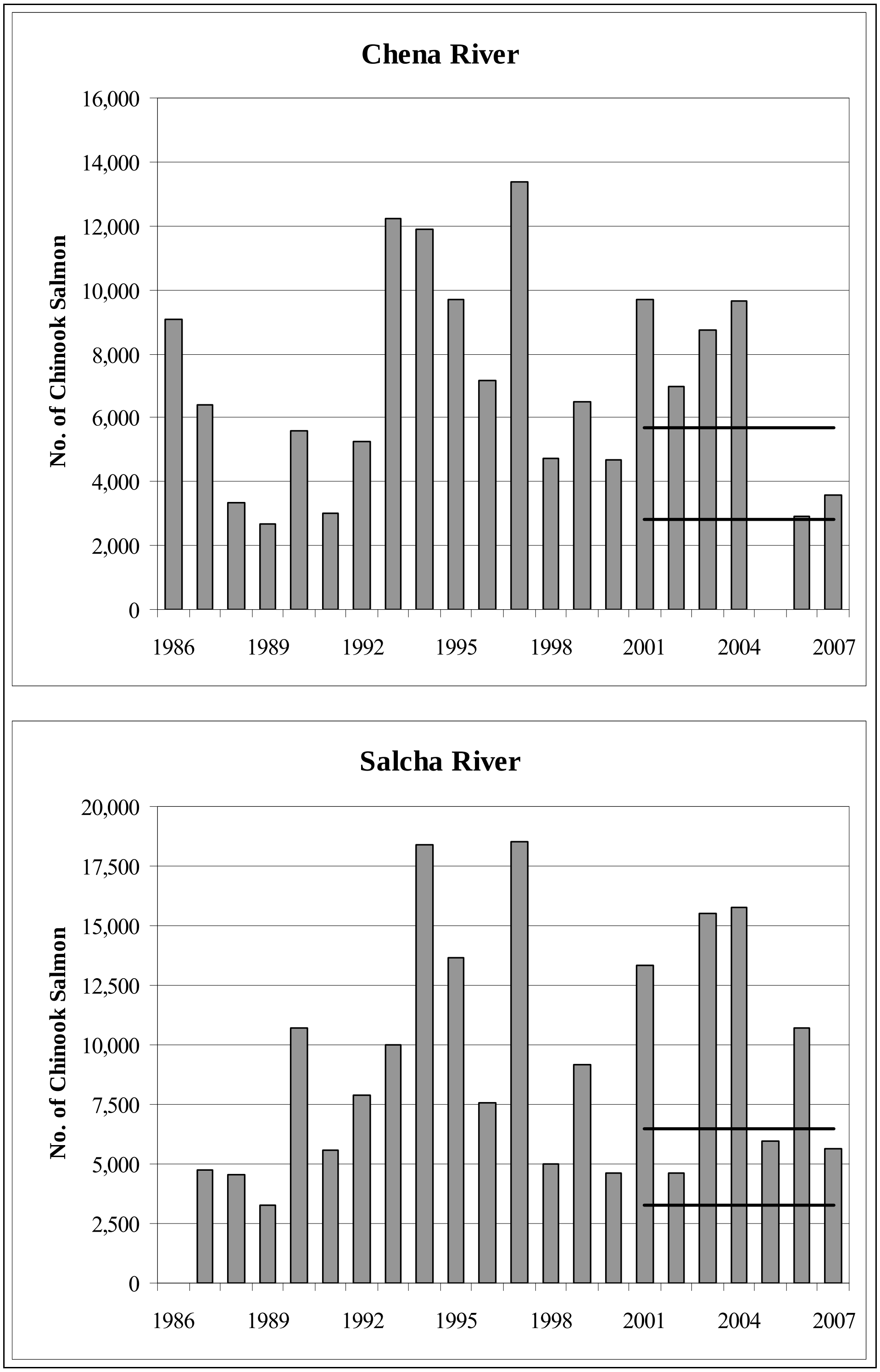
	Andreafsky River		**Nulato River Tower**	**Gisasa River Weir**		**Chena River**		**Salcha River**	
Year	No. Fish	% Fem.	No. Fish	No. Fish	% Fem.	No. Fish	% Fem.	No. Fish	% Fem.
1986	1,530	23.3[a]				9,065	20.0[d]		35.8
1987	2,011	56.1[a]				6,404	43.8[d]	4,771	47.0[d]
1988	1,339	38.7[a]				3,346	46.0[d]	4,562	36.6[d]
1989		13.6				2,666	38.0[d]	3,294	46.8[d]
1990		41.6				5,603	35.0[d]	10,728	35.4[d]
1991		33.9				3,025	31.5[d]	5,608	34.0[d]
1992		21.2				5,230	27.8[d]	7,862	27.3[d]
1993		29.9				12,241	11.9[a]	10,007	24.2[a]
1994	7,801	35.5[b,v]	1,795[c]	2,888	[c]	11,877	34.9[a]	18,399	35.2[a]
1995	5,841	43.7	1,412	4,023	46.0	9,680	50.3	13,643	42.2[a]
1996	2,955	41.9	756	1,991	19.5	7,153	27.0	7,570	26.3
1997	3,186	36.8	4,766	3,764	26.0	13,390	17.0[a]	18,514	36.3[a]
1998	4,034	29.0	1,536	2,414	16.2	4,745	30.5[a]	5,027	22.4[a]
1999	3,444	28.6	1,932	2,644	26.4	6,485	47.0[a]	9,198	38.8[a]
2000	1,609	54.3	908	2,089	34.4	4,694	20.0	4,595	29.9[a]
2001		[c]	[c]	3,052	49.2[c]	9,696	32.4[a]	13,328	27.9[a]
2002	4,123	21.1	2,696	2,025	20.7	6,967	27.0	4,644	34.8[c]
2003	4,336	45.3	1,716[c]	1,901	38.1	8,739	34.0[c]	15,500	31.8[c,e]
2004	8,045	37.3	[f]	1,774	30.1	9,645	47.0	15,761	47.0
2005	2,239	50.2	[f]	3,111	34.0		[c]	5,988	54.3
2006	6,463	42.6	[f]	3,030	28.2	2,936	34.0	10,679	33.0
2007[h]	4,504	44.7	[f]	1,425	39.0	3,564	[h]	5,631	[h]
BEG						2,800-5,700		3,300-6,500	
Average									
1986-2006	3,930	36.2	1,946	2,670	30.7	7,179	32.8	9,484	35.6
1997-2006	4,164	38.4	2,259	2,580	30.3	7,477	32.1	10,323	35.6
2002-2006	5,041	39.3		2,368	30.2	7,072	35.5	10,514	40.2

[a]Tower counts.
[b]Weir counts.
[c]Incomplete count because of late installation, early removal of project or inoperable.
[d]Mark–recapture population estimate.
[e]Expanded counts based on average run timing.
[f]Project did not operate.
[g]Data are preliminary.
[h]Data not available.



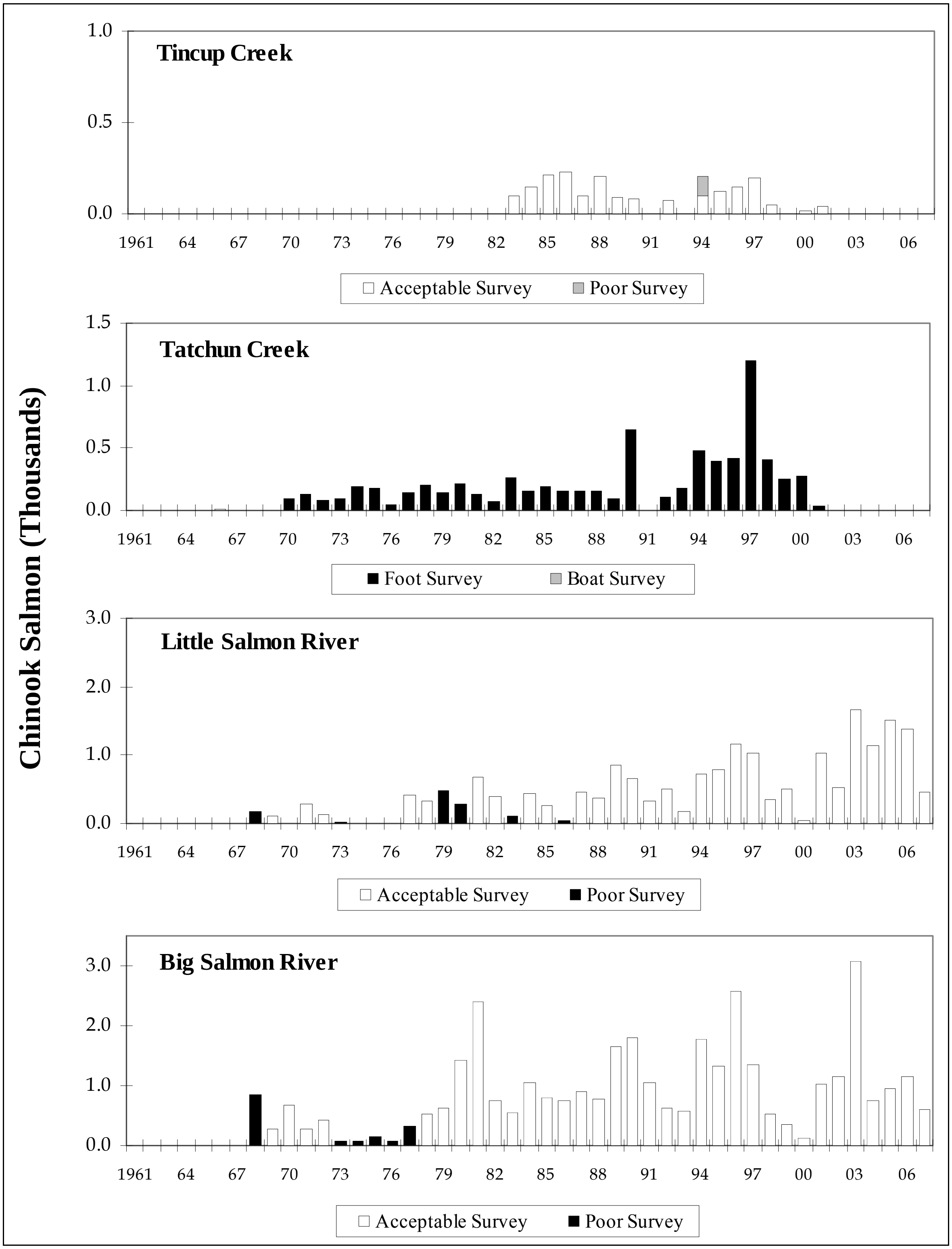
Note: The vertical scale is variable.

Fig. 5-11 Chinook salmon aerial survey based escapement estimates for selected tributaries in the Alaska portion of the Yukon River drainage, 1986–2007.



Note: The BEG range is indicated by the horizontal lines for tributaries with BEGs. The vertical scale is variable.

Fig. 5-12 Chinook salmon ground based escapement estimates for selected tributaries in the Alaska portion of the Yukon River drainage, 1986–2007.



Note: Data are aerial survey observations unless noted otherwise. The vertical scale is variable.

Fig. 5-13 Chinook salmon escapement data for selected spawning areas in the Canadian portion of the Yukon River drainage, 1961–2007

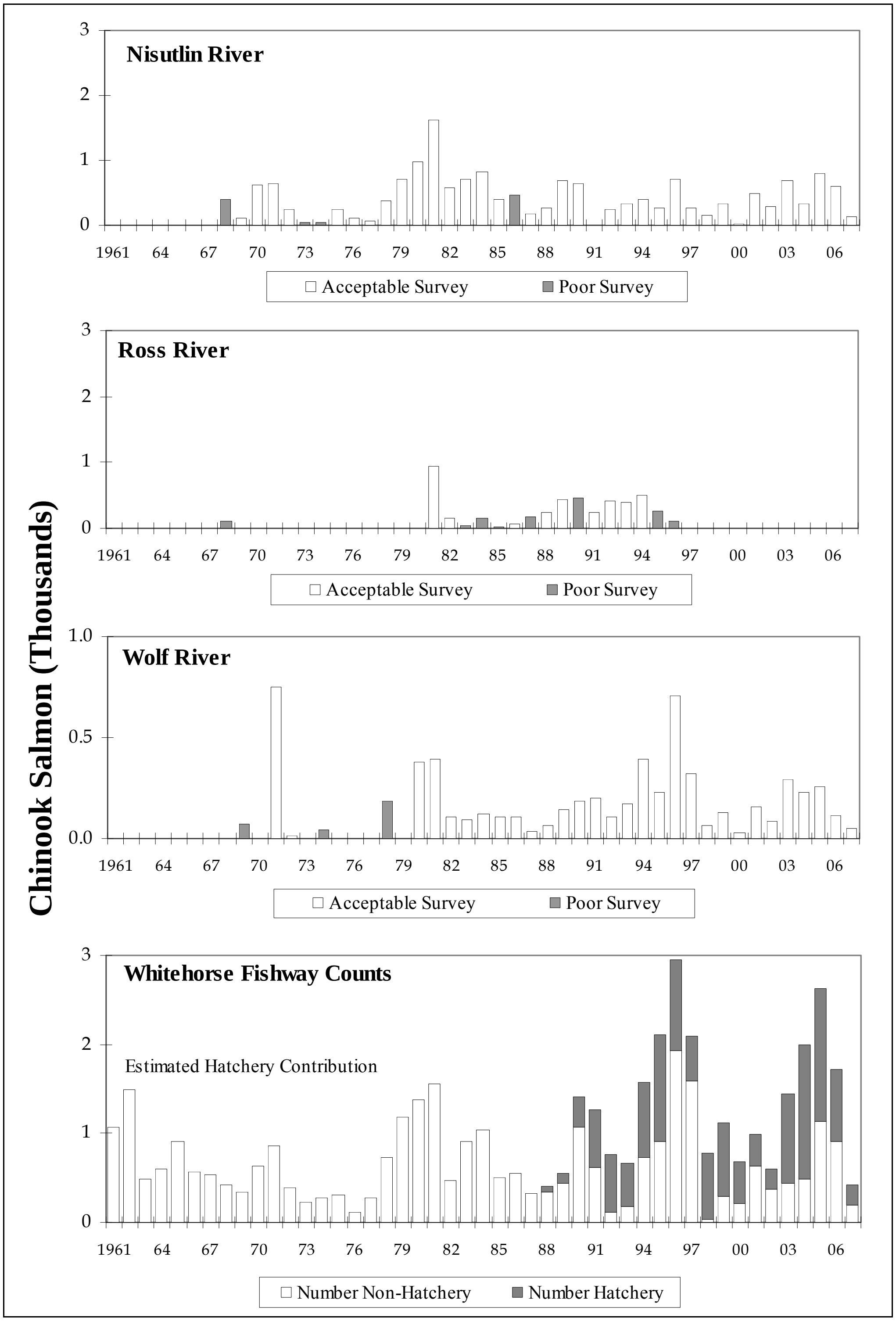


Fig. 5-14 Chinook salmon escapement data for selected spawning areas in the Canadian portion of the Yukon River drainage, 1961–2007.

Total run estimates are provided for the Yukon Chinook salmon population on an annual basis. These estimates are calculated from the sum of the Pilot Station Sonar passage estimates (Table 5-8), harvests below Pilot Station, and 2 times the East Fork Andreafsky weir counts (Table 5-9, D. Evenson, personal communication). Sonar assessment has provided abundance estimates for 1995, 1997-2007; however, problems with species apportionment, technological limitations and bank erosion have, at times, adversely affected the quality of those estimates. New technology (DIDSON sonar in 2005) and more appropriate net selectivity models (Bromaghin 2005), currently in use and applied to the historic data series have greatly improved Chinook salmon population estimates at Pilot Station since 2005. No brood table has been constructed for these data.

Table 5-8 Pilot Station sonar project estimates, Yukon River drainage, 1995, 1997–2007 (Source JTC 2008).

Date	Large Chinook	Small Chinook	Total Chinook	Summer Chum	Fall Chum	Coho	Pink	Others	Season Total
1995	130,271	32,674	162,945	3,556,445	1,053,245	101,806	24,604	1,011,855	5,910,900
1997	118,121	77,526	195,647	1,415,641	506,621	104,343	2,379	621,857	2,846,488
1998	71,177	16,675	87,852	826,385	372,927	136,906	66,751	277,566	1,768,387
1999	127,809	16,914	144,723	973,708	379,493	62,521	1,801	465,515	2,027,761
2000	39,233	5,195	44,428	456,271	247,935	175,421	35,501	361,222	1,320,778
2001 [a]	85,511	13,892	99,403	441,450	376,182	137,769	665	353,431	1,408,900
2002	92,584	30,629	123,213	1,088,463	326,858	122,566	64,891	557,779	2,283,770
2003	245,037	23,500	268,537	1,168,518	889,778	269,081	4,656	502,878	3,103,448
2004	110,236	46,370	156,606	1,357,826	594,060	188,350	243,375	637,257	3,177,474
2005 [b]	142,007	17,434	159,441	2,439,616	1,813,589	184,718	37,932	593,248	5,228,544
2006	145,553	23,850	169,403	3,767,044	790,563	131,919	115,624	875,899	5,850,452
2007	90,184	35,369	125,553	1,726,885	684,011	173,289	71,699	1,085,316	3,866,753
Average (1995–2006)	117,727	27,199	144,925	1,393,492	629,801	151,359	57,358	524,665	2,901,600

Note: Estimates for all years were generated with the most current apportionment model and may differ from earlier estimates.
The Pilot Station Sonar did not operate at full capacity in 1996 and therefore passage estimates do not exist.
Others include sockeye salmon, cisco, whitefish, sheefish, burbot, suckers, Dolly Varden, and northern pike.
Large Chinook salmon >655mm.
Estimates for fall chum and coho salmon may not include the entire run.

[a] Record high water levels experienced at Pilot Station in 2001, and therefore passage estimates are considered conservative.

[b] Estimates include extrapolations for the dates June 10 to June 18, 2005 to account for the time the DIDSON was deployed.

Table 5-9 Chinook run reconstruction for the Yukon based on Pilot Station (from D. Evenson ADF&G). 2006 and 2007 estimates are preliminary

	District 1			District 2		Marshall					
Year	Comm. fishery.	Subsist. fishery	Test Fishery	Comm. fishery	Subsist. fishery	Test Fishery	Comm. fishery	Subsist. fishery	East Fork Andreafsky River	Pilot Station Sonar	Total
1995	76,106	5,960	2,078	41,458	9,037	74	14,744	3,291	5,841	162,945	291,305
1997	66,384	7,550	2,791	39,363	9,350	20	9,800	1,511	3,186	195,647	316,166
1998	25,413	7,242	878	16,806	9,455	48	6,277	1,711	4,011	87,852	147,728
1999	37,161	6,848	1,049	27,133	10,439	156	11,279	2,780	3,347	144,723	220,144
2000	4,735	5,891	275	3783	9,935	322	968	3,279	1,344	44,428	67,810
2001[c]	0	7,089	0	0	13,442	0	0	4,498	3,596	99,403	122,628
2002	11,159	5,603	416	11,434	8,954	34	4,258	2,290	4,896	123,213	164,057
2003	22,750	6,332	561	14,178	16,773	46	4,808	2,059	4,383	268,537	331,076
2004	28,403	5,880	637	24,164	9,724	70	6,481	1,990	7,912	156,606	232,837
2005	16,694	5,058	310	13,413	9,156	0	2,819	1,804	2,239	159,441	203,927
2006	23,748	5,122	817	19,843	8,039	0	4936	1897	6,463	169,403	233,065
2007	18,615	5,353	849	13,302	8,973	0	2521	1897	4,504	125,305	176,987

[a] Includes personal use harvest in District 6
[b] District 2 harvest include fish harvested above and below Pilot Station.
[c] No commercial fishing occurred during the 2001 season.

While included in the total run estimates for the Yukon, the Canadian portion of the stock (Upper Yukon) is also assessed separately in order to evaluate treaty requirements for meeting border passage goals. It is also the only portion along the mainstem of the river whereby reasonably accurate estimates of passage provide the ability to construct a brood table (D. Evenson, personal communication). For the Upper Yukon component, various stock-recruitment datasets were examined including those developed from spawning escapements estimated from mark-recapture data and combinations of estimates derived from sonar, radio telemetry and aerial survey data. The S/R model selected for the 2008 outlook included border passage estimates developed from a combination of Eagle Sonar estimates (2005-2007) and radio-telemetry data (2002-2004). Total spawning escapements for 2002-2007 were calculated by subtracting the Canadian catch from these estimates. Linear regression of the estimated total spawning escapements vs. the 3-Area aerial survey index of Big Salmon, Little Salmon, and Nisutlin rivers for 2002 to 2007 was used to estimate historical spawning escapement estimates back to 1982. This escapement dataset best fit the observed trend in the escapement as depicted by the 3-area index. Age-specific returns were then calculated based on age, harvest and escapement data in the return years (D. Evenson, personal communication).

In 2002–2005 and 2008, preseason management strategies were developed which prohibited commercial fishing until near the midpoint of the Chinook salmon run. This strategy was designed to pass fish upstream for escapement, cross-border commitments to Canada, and subsistence uses in the event of a very poor run as occurred in 2000 (Hayes et al. 2006). Under this approach, however, the harvest is not spread out over the entire run and commercial fishing is concentrated on only those stocks migrating during the latter half of the run. The preferred strategy for managing commercial fisheries is to spread the harvest over the middle 50% of the run, starting near the first quarter point of the run.

Information utilized to assess inseason salmon runs include: Lower Yukon Test Fishery (LYTF) indices, subsistence harvest reports, and Pilot Station sonar passage estimates. As the run progresses upriver, other projects provide additional run assessment information.

2007 Season Summary

Yukon River Chinook salmon return primarily as age-5 and age-6 fish, although age-4 and age-7 fish also contribute to the run[8]. The 4-year-old component in 2006 was below average, whereas the 5-year-old component was above average. The previous 2 years (2005 and 2006) runs have been near average indicating good production from the poor runs of 2000 and 2001. In 2001, the brood year producing 6-year-old fish returning in 2007, successful aerial survey observations were made in all eight Yukon River index tributaries used for escapement assessment (JTC 2008).

Time and duration of the open fishing periods established by ADF&G are dependant upon preseason projections and inseason information. For example, in 2007, the LYTF nets observed the first and largest pulse of Chinook salmon from June 14 through June 17. Based on this pulse, the Chinook salmon run was estimated to be slightly later than average. ADF&G delayed opening the next commercial period targeting Chinook salmon until June 18, 2 days after the first quarter point of the Chinook salmon run at the LYTF in District 1. During the second pulse from June 20 to June 24, it appeared that Chinook salmon were entering the river at a slow, steady rate rather than the more typical pulse-like entry pattern, and the run was not as strong overall as anticipated. A strong first pulse followed by a weaker second pulse is unusual. During the poor runs of 1998 and 2000, the LYTF CPUE and Pilot Station sonar estimates were lower than average throughout the run. As the 2007 run progressed, it became clear that the Chinook salmon run was not developing as expected and was weaker than the run observed in 2006 (JTC 2008).

In 2007, the border passage estimate from the Eagle sonar project was approximately 41,200 Chinook salmon. However, the escapement target into Canada was based on the Canadian DFO fish wheel mark–recapture border passage estimate, and management was targeting a rebuilt escapement level of 33,000–43,000. Using this Canadian assessment project, an escapement estimate of approximately 17,000 Chinook salmon was estimated in Canada, which was well below the Yukon River Panel agreed to escapement level. However, the escapement target had been achieved consistently from 2001–2005. In summary, the 2007 Chinook salmon run was weaker than the run of 2006, and below the recent 10-year average of 210,000 Chinook salmon.

[8] Salmon ages given in this document represent the combined freshwater and saltwater age.

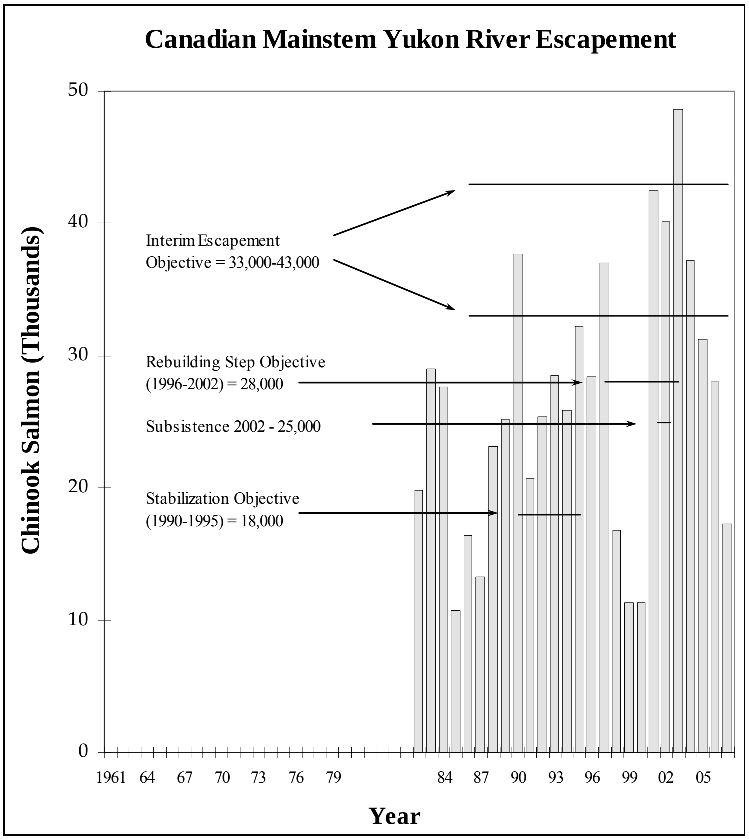


Fig. 5-15 Estimated total Chinook salmon spawning escapement in the Canadian portion of the mainstem Yukon River drainage based on Canadian mark-recapture, 1982–2007. Note: Horizontal lines represent the interim escapement objective range of 33,000–43,000 salmon, the rebuilding step objective of 28,000 salmon and the stabilization objective of 18,000 salmon.

5.2.4.1 Forecasts and precision of estimates

Long-term stock assessment information is needed to assess how various salmon stocks that spawn in the Yukon River drainage can support sustained fisheries. Long-term and accurate estimates of the abundance and composition of spawning stocks are needed along with estimates of the harvests of those salmon in the various fisheries of the Yukon drainage (Clark et al 2006). Much progress toward these objectives has been made since the late 1980s and in particular, over the last decade; however, the time series for many such data sets is relatively short. Obtaining such information in the Yukon is expensive and difficult due to the remoteness of the area (Clark et al 2006).

Assessment using sonar has been attempted over the last two decades, but success in doing so in the lower river has been elusive until 1995 (Hayes et al 2006). Recent efforts to assess Chinook salmon passage at Eagle, below the U.S.-Canada border look promising and coupled with genetic stock identification have provided break-through technology for annual assessment of Chinook salmon in the Yukon River drainage (Hayes et al 2006).

For the Canadian portion of the stock, the S/R model predicts a total run of 111,000 Canadian-origin Chinook salmon in 2008. However, the estimated run size in 2007 was approximately 30% lower than expected for unknown reasons but possibly related to poorer marine survival. If these effects are similar in 2008, a run as low as 80,000 Canadian-Origin Upper Yukon Chinook salmon may be possible.

The performance of run outlooks developed from S/R models for the upper Yukon stock for the 1998 to 2006 period and the average of a S/R and sibling outlook which was used in 2007 are presented in Table 5-10. A review of the performance of preseason outlooks is an attempt to take into account a recent decline in the Upper Yukon Chinook salmon return per spawner values. Despite good brood year escapements, the observed run sizes within the 1998-2001 period and in 2007 were relatively low. Even though the 2001 (age-6) brood year spawning escapements were above average, the 2007 run was weak and the total spawning escapement was below target levels (JTC 2008).

Table 5-10 Observed and expected run sizes based on S/R and sibling relationship models (from D. Evenson, ADF&G 2008).

Year	S/R		Sibling
	Observed	Expected	Expected
2000	52,843	127,777	85,889
2001	85,658	126,631	51,082
2002	81,486	113,688	107,211
2003	149,978	116,895	109,159
2004	119,743	123,469	124,219
2005	124,178	121,743	131,230
2006	119,788	115,939	122,726
2007	82,869	118,497	139,304
2008		111,468	117,442

The 2008 total run of approximately 151,000 Chinook salmon was insufficient to fully support any directed fisheries, including subsistence (ADF&G 2008). The 2008 run was approximately 36% below the recent 5-year (2003-2007) average of 235,000 Chinook salmon and 21% below the 10-year (1998-2007) average of 190,000 (Fig. 5-16). The 2008 run was expected to be below average and similar to the 2007 run of approximately 178,000. However, the run was anticipated to provide for escapements, support a normal subsistence harvest, and a small commercial harvest. By June 20, the historical midpoint of the run, all indicators pointed to a weak Chinook salmon run which was disappointing because of large spawning escapement in the parent years that produced this season's run. At that time, it was clear that there was no surplus available for a directed Chinook salmon commercial fishery and that sport and subsistence fisheries on the mainstem Yukon River would need to be reduced to provide adequate numbers of Chinook salmon on the spawning grounds.

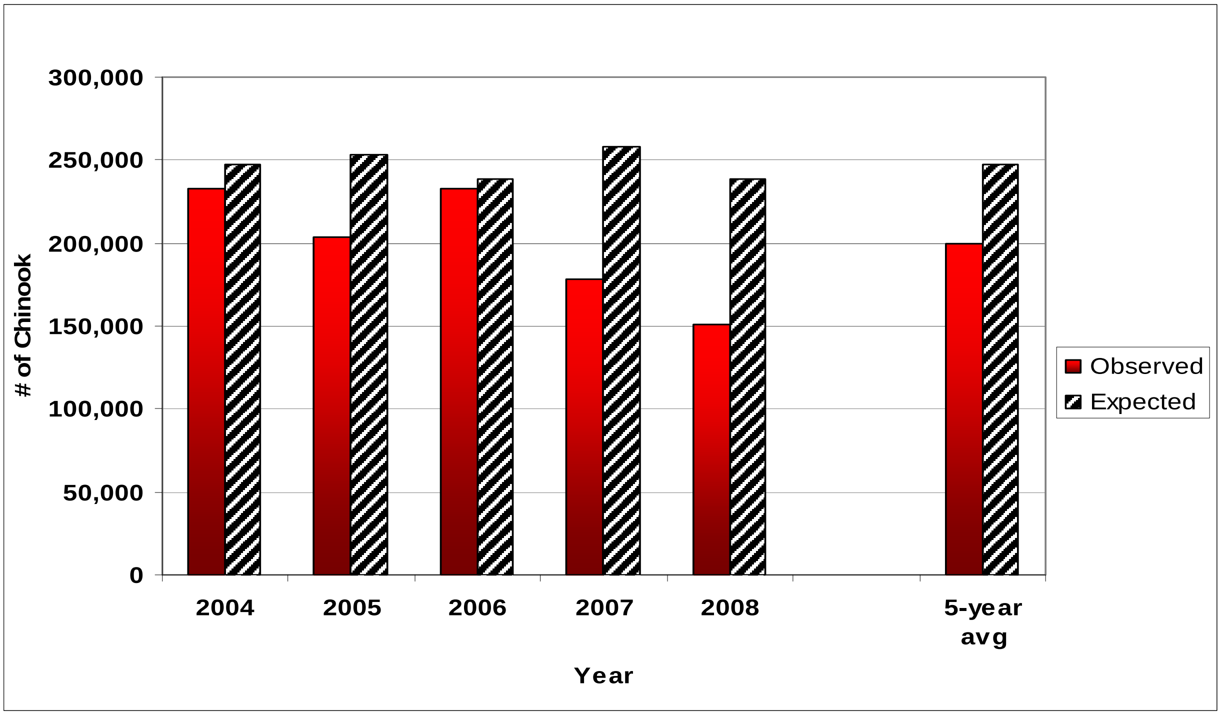


Fig. 5-16 Yukon River Chinook salmon observed versus expected total runs based on S/R and Sibling Relationships, 2004-2008, and 5-year average. 2008 data are preliminary (ADF&G 2008).

Sport fishing bag and possession limits were reduced from 3 to 1 Chinook salmon on the mainstem Yukon River, however, the sport fish harvest only occurs in a few tributaries and is very small (<3000). Additionally, commercial fishing targeting an abundant summer chum salmon run with gillnets restricted to 6 inch maximum mesh size was delayed until July 2 in order to allow most of the Chinook run to pass through. This resulted in reducing what could have been a harvest of greater than 300,000 chum salmon to 126,000. Approximately 4,300 Chinook salmon were taken incidentally.

In an effort to conserve Chinook salmon, it was also necessary to reduce the subsistence fishery (typically around 50,000 fish) throughout the mainstem of the Yukon River. Subsistence fishing time was reduced by half for approximately two weeks implemented chronologically with the Chinook migration and mesh size restrictions (<6-inch mesh) were implemented in the lower river districts. Fishermen were affected from the mouth of the river to across the border into Canada. Fishermen reported harvesting as little as 40% of their needs in some locations in Alaska and the Aboriginal Fishery in Canada harvested half of their average take. Historically, Chinook salmon subsistence fishing restrictions have only been implemented once before, in July of 2000 after the run was nearly over.

High water hampered efforts to accurately assess escapement in 2008 from tower counts and aerial surveys; thus, most escapement goals could not be assessed. Based on the available data, it appears that the lower end of the BEGs in the Chena and Salcha rivers, the largest producing tributaries of Chinook salmon in the Alaska portion of the drainage, were met. Typically, about 50% of the Chinook salmon production occurs in Canada; hence, the US/Canada Yukon River Panel agreed to one year Canadian Interim Management Escapement Goal (IMEG) of >45,000 Chinook salmon based on the Eagle sonar program is a top priority. The preliminary estimated escapement into Canada is approximately 32,500 or 28% below the goal.

5.2.4.2 Exploitation rates

The following is excerpted from an ADF&G memorandum regarding US exploitation rates on Yukon River Canadian-origin Chinook salmon (Evenson 2008). Knowledge of exploitation rates is an essential component for effective management of the Yukon River Chinook salmon fishery. Exploitation rate is defined as that portion of the run that is harvested; hence, total run estimates, escapement and stock-specific harvests, are needed to calculate exploitation rates. Exploitation rates cannot be estimated for Chinook salmon stocks that spawn in the lower or middle regions of the Yukon River in Alaska because total escapement to these regions cannot be estimated. However, total run estimates for the upper river component, or the Canadian component, can be determined based on border passage estimates.

Border passage into Canada has been estimated since 1982 by the Canadian DFO using mark–recapture techniques, and more recently, by ADF&G using radiotelemetry (2002–2004) and sonar (2004–2007).

The Canadian DFO border passage estimates have been derived from mark–recapture estimates using two fish wheels near the border at river mile (RM) 1,224. This border passage estimate formed the basis for the U.S./Canada Yukon River Salmon Agreement. However, recent analyses indicate that the DFO mark-recapture estimates of border passage do not appear to be consistent through time (JTC 2008).

At their recent spring meeting, after examining various relationships between aerial survey indices and other independent border passage estimates, the U.S./Canada Joint Technical Committee (JTC) revised the basis for estimating the number of Chinook salmon that spawn in the mainstem Yukon River drainage in Canada (JTC 2008). Using escapement estimates derived from the radiotelemetry (2002-2004) and sonar (2005-2007) border passage estimates, in conjunction with the combined aerial survey counts of spawning Chinook salmon within the established index areas in the Big Salmon, Little Salmon, and Nisutlin River drainages (3-Area Index), escapements were estimated for the years 1982–2001. These 1982–2006 escapement estimates averaged 48,556 Chinook salmon, ranging from 25,870 in 2000 to 83,594 in 2003 (Fig. 5-17). The JTC also recommended using the Eagle sonar project in the future as the primary assessment of border passage (JTC 2008). Three studies further discuss the radiotelemetry work on the Yukon River; Eiler et al. 2006a, Eiler et al. 2006b, and Eiler et al. 2004.

From 1982–2003 scale-pattern analysis was used to apportion Alaskan Chinook salmon harvests to region of origin, including the Canadian Chinook salmon stock, which was later replaced in 2004 by genetic stock identification techniques. Apportionment of harvest to stock of origin indicates that the Canadian component comprises approximately 50% of the Alaska harvest, and probably, the run. This proportion has remained relatively constant over the years. Because of the gauntlet nature of Yukon River fisheries, it is believed that the exploitation exerted on Canadian fish is most likely the highest of any Yukon River Chinook salmon stock.

Based on harvest apportionment estimates from the two techniques in conjunction with the border passage estimates, the total run size of the Canadian Chinook salmon stock from 1982–2006 has been estimated (Table 5-27). Based on the newly developed escapement database, total run size of the Canadian Chinook salmon run has ranged from approximately 52,843 in 2000 to 182,504 in 1996. Accordingly, the exploitation rate that Alaskan fishermen exert on the Canadian stock was calculated (Fig. 5-18). Associated exploitation rates exerted by Alaskan fishermen on this stock ranged from 39% in 2001 to 76% in 1987 (Fig. 5-18). Average exploitation rates during the period 2001–2005 decreased by 19% from the 1989–1998 average (Fig. 5-18). Recent exploitation rates are therefore low compared to rates during the 1970s, 1980s, and 1990s.

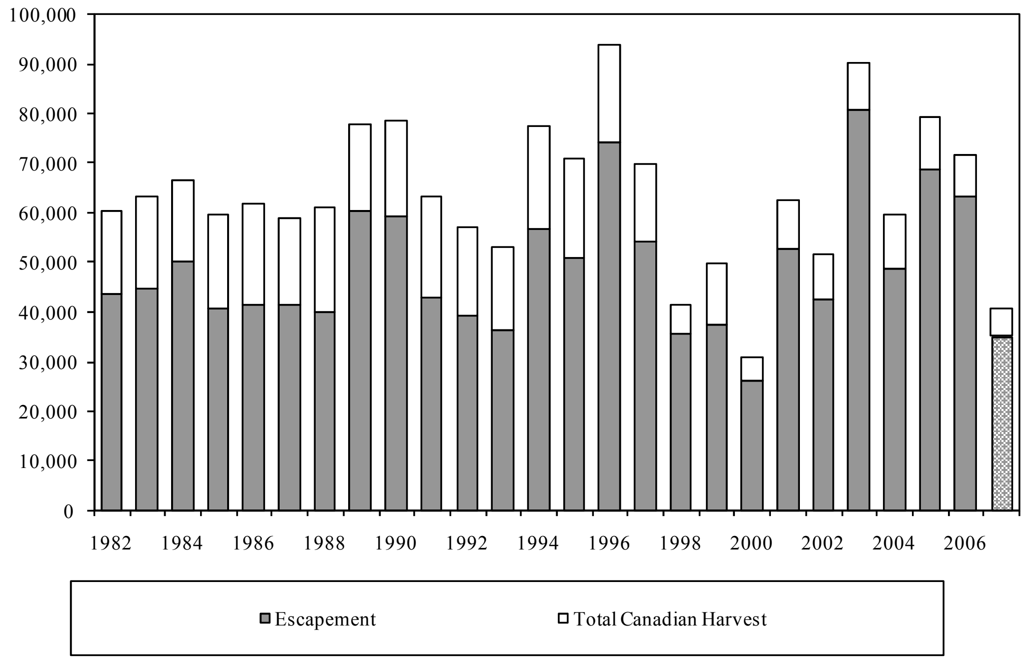


Fig. 5-17 Canadian harvests of Yukon River Chinook salmon and the estimated escapement, 1982-2007.

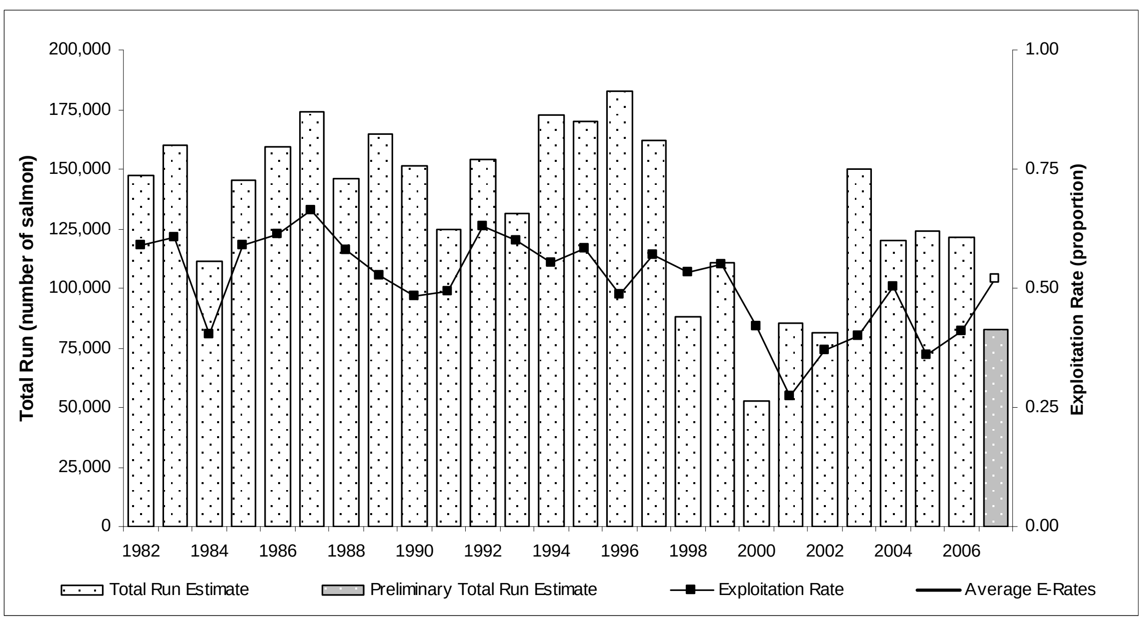


Fig. 5-18 Annual total run estimates and associated U.S. exploitation rates on Canadian-origin Yukon River Chinook salmon, 1982–2007. *Note: All estimates are based on Eagle sonar, radio-telemetry, and a 3-area escapement index. 2007 data are preliminary.*

5.2.4.3 Ichthyophonous

ADF&G began research on the prevalence of *Ichthyophonus* within Yukon River Chinook salmon in response to increasing concerns that this disease was affecting spawning escapement and spawning success. In 1999, Dr. Richard Kocan began a baseline of the disease's overall infection rate entering the Yukon River at Emmonak (Kocan et al. 2003). In 2002, ADF&G directed research to determine management and conservation implications of *Ichthyophonus* in Yukon River Chinook salmon. ADF&G continued to monitor infection prevalence at Emmonak which resulted in infection rates of 22%, 24%, 16% and 17% for the years 2004 through 2007 respectively. Sampling was also continued at two terminal spawning locations including the Chena and Salcha rivers (Hayes et al. 2006).

The research was designed to track changes in the baseline rate, test feasibility of non-lethal sampling techniques, and assess spawning success of infected versus uninfected Chinook salmon. Tissues used for non-lethal sampling did not contain the organism concentrated enough to detect at realistic levels and therefore lethal samples of heart tissue remained the standard. Spawning success was evaluated based on a classification of gamete expulsion including spawned out, partially spawned out and did not spawn. Samples collected (n=654) from female Chinook salmon from the spawning grounds in 2004 through 2006 indicated that 16% of the sample were infected with *Ichthyophonus,* while 84% were uninfected. Of these salmon only 19% of the infected and 15% of the uninfected salmon were classified as partially spawned out and 7% of the infected and 6% of the uninfected were classified as did not spawn. The comparisons between spawning success of infected and uninfected Chinook salmon, based on samples collected from 2004 through 2006, do not appear significantly different (Kahler et al. 2007, Kahler et al. *In Prep*).

In 2007, only Emmonak was sampled to maintain the baseline. Samplings was conducted in both Emmonak and Eagle in 2008 but have not been analyzed at this time.

5.2.5 Kuskokwim Area Chinook

The Kuskokwim management area includes the Kuskokwim River drainage, all waters of Alaska that flow into the Bering Sea between Cape Newenham and the Naskonat Peninsula, as well as Nelson, Nunivak, and St Matthew Islands. The management area is divided into 5 districts. District 1, the lower Kuskokwim District, is located in the lower 125 miles of the Kuskokwim River from Eek Island upstream to Bogus Creek. District 2 is about 50 miles in length and is located in the middle Kuskokwim River from above District 1 to the Kolmokov River near Aniak. An upper Kuskokwim River fishing district, District 3, was defined at Statehood, but was discontinued in 1966. Salmon returning to spawn in the Kuskokwim River are targeted by commercial fishermen in District 1 and 2, although District 2 has been inactive for commercial fishing since the late 1990's. District 4, the Quinhagak fishing district, is a marine fishing area that encompasses about 5 miles of shoreline adjacent to the village of Quinhagak. The Kanektok and Arolik Rivers are the primary salmon spawning streams that enter District 4. District 5, the Goodnews Bay fishing district, a second marine fishing area, was established in 1968. District 5 encompasses the marine water within Goodnews Bay and the Goodnews River is the major salmon spawning stream that enters District 5 (Clark et al 2006). Mainland streams north of the Kuskokwim River and streams of Nelson, Nunivak, and St Matthew Islands are not typically surveyed for salmon.

The BOF designated Kuskokwim River Chinook salmon as stocks of yield concern in 2000 because of the chronic inability to maintain near average yields despite specific management actions taken annually. The designations were discontinued in 2007 as harvestable surpluses of Chinook salmon have been at or above historical averages since 2002.

Management of Kuskokwim area salmon fisheries is complex. Annual run sizes and timing is often uncertain when decisions must be made, mixed stocks are often harvested weeks and hundreds of miles from their spawning grounds, allocative issues divide downriver and upriver users as well as subsistence, commercial, and sport users, and the Kuskokwim area itself is immense. In 1988, the BOF formed the Kuskokwim River Salmon Management Working Group in response to users seeking a more active role in management of fisheries. Working group members represent the various interests and geographic locations throughout the Kuskokwim River who are concerned with salmon management. The Working Group is primarily active in the inseason management of Kuskokwim River salmon fisheries. Over the last 10 to 20 years, the fishery management program in the Kuskokwim area has become both more precautionary and more complex with the addition of several BOF management plans, improved inseason and postseason stock status information, and more intensive inseason involvement by user groups in the salmon fisheries management process (Clark et al 2006). Escapement of salmon stocks have been sustained at a high level, and the large subsistence fishery has been sustained, while the commercial salmon fisheries of the Kuskokwim have been greatly reduced as a result of declining markets and participation and more precautionary management approaches implemented over the last 10 years.

5.2.5.1 Stock assessment and historical run estimates

Inseason management of the various Kuskokwim area salmon fisheries is based on salmon run abundance and timing factors, including data obtained through the Bethel test fishery, subsistence harvest reports, tributary escapement monitoring projects, and when available, commercial catch per unit effort data (Clark et al 2006).

ADF&G, either on its own or in collaboration with other organizations, conducts detailed, on-the-grounds, escapement monitoring of salmon in more than a dozen locations in the Kuskokwim area. Assessment of salmon escapement using aerial surveys has been conducted in the Kuskokwim Area since the late 1950s, and forms the most extensive escapement time series available. Water bodies are typically surveyed only one time each season, and are intended to index relative abundance of salmon escapement, as opposed to providing an estimate of total escapement (Molyneaux and Brannian 2006). Additionally, salmon escapements are monitored in eight streams in the area using weirs and in one stream (Aniak River) using sonar, although sonar does not specifically monitor Chinook salmon. Most of the streams have been monitored for fewer than 10 years, and in some cases the time series includes years in which the monitoring was done with counting towers instead of weirs. Data is also available from two recent radiotelemetry and mark-recapture studies that estimate abundance of Chinook in the Holitna River drainage and the Kuskokwim River from the Aniak River upstream. Fig. 5-19 illustrates the location of escapement projects in the management area.

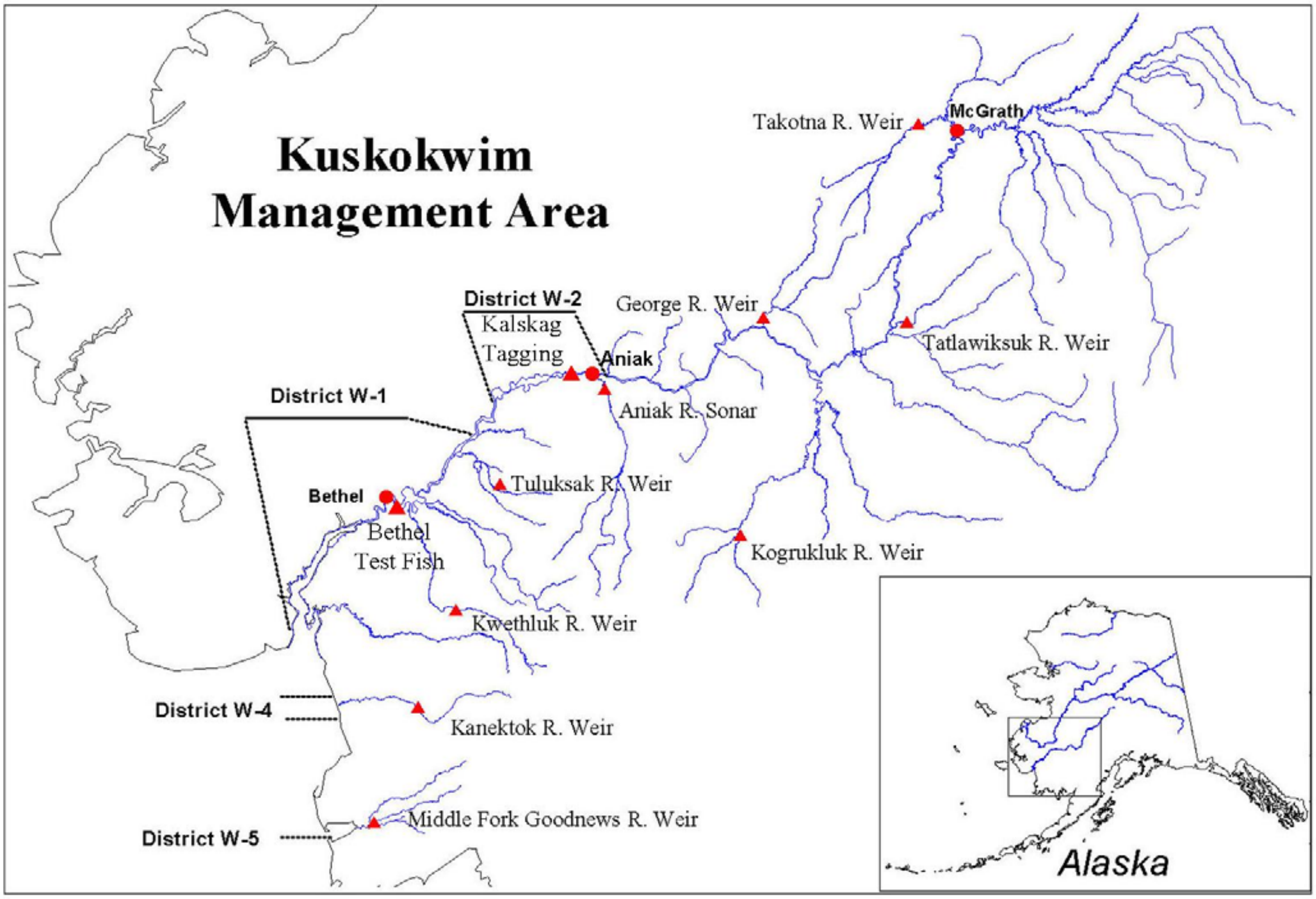


Fig. 5-19 Escapement projects in the Kuskokwim management area.

ADF&G has identified escapement goals for Chinook salmon in the Kuskokwim management area, which are listed in Table 5-11.

Table 5-11 Summary of Kuskokwim area Chinook salmon stocks with escapement goals.

Stock Unit	Enumeration Method	Goal	Type	Year established
Aniak River	aerial survey	1,200-2,300	SEG	2005
Cheeneetnuk River	aerial survey	340-1,300	SEG	2005
Gagaryah River	aerial survey	300-830	SEG	2005
George River	weir	3,100-7,900	SEG	2007
Holitna River	aerial survey	970-2,100	SEG	2005
Kisaralik River	aerial survey	400-1,200	SEG	2005
Kogrukluk River	weir	5,300-14,000	SEG	2005
Kwethluk River	weir	6,000-11,000	SEG	2007
Salmon River (Aniak drainage)	aerial survey	330-1,200	SEG	2005
Salmon River (Pitka Fork)	aerial survey	470-1,600	SEG	2005
Tuluksuk River	weir	1,000-2,100	SEG	2007
Goodnews River (Middle Fork)	weir	1,500-2,900	BEG	2007
Goodnews River (North Fork)	aerial survey	640-3,300	SEG	2005
Kanektok River	aerial survey	3,500-8,000	SEG	2005

Table 5-12 and Table 5-13 provide historical counts of Chinook salmon escapement from aerial surveys and the Kogrukluk weir.

Chinook salmon escapements were evaluated through aerial surveys on 13 index streams, by enumeration at weirs on 6 tributary streams, and through a mark and recapture at the mainstem tagging project near Upper Kalskag. Fig. 5-20 illustrates the Kuskokwim River Chinook salmon index for 1975-2006, which is a composite of median historical escapements for the 13 possible aerial survey index streams. Chinook escapements in 2007 were average to above average at nearly all monitored sites with the exception of Tuluksak River, where escapement was below average. Kogrukluk River Chinook escapement was within the escapement goal range and all aerial survey escapement goals were either exceeded or were within their respective escapement goal ranges. Weir based Chinook salmon escapement goals were established for the Kwethluk, Tuluksak, and George Rivers in 2007. The Kwethluk River escapement goal was exceeded, the Tuluksak River escapement goal was not achieved, and escapement to the George River was within the escapement goal range (ADF&G 2007a).

Table 5-12 Aerial survey counts of Chinook salmon in Kuskokwim River spawning tributary index areas and Kogrukluk weir Chinook salmon passage, 1975 - 2007.

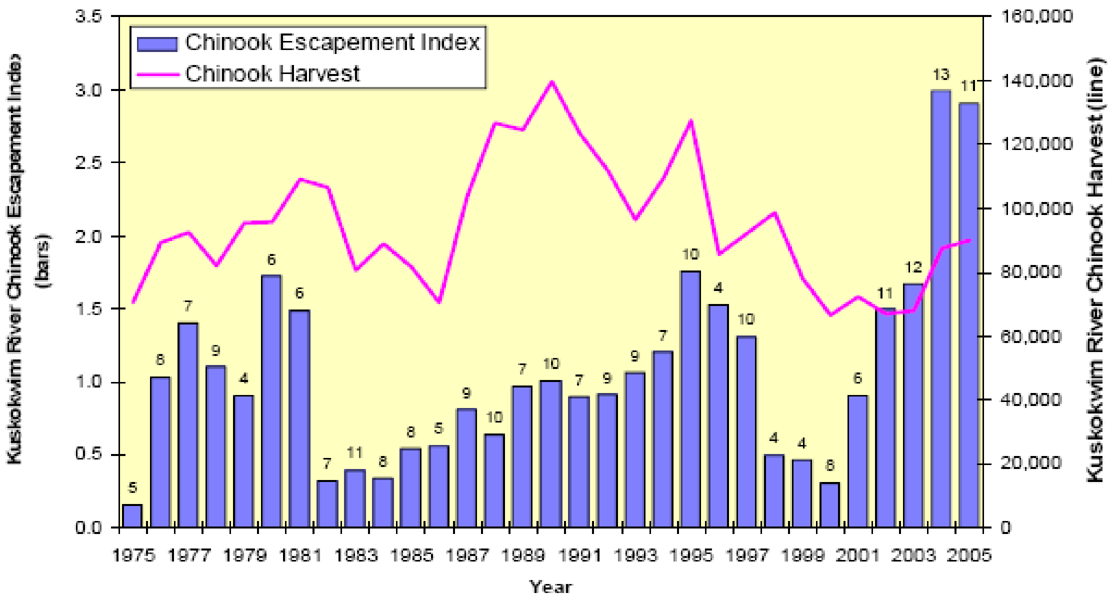
Year	Lower Kuskokwim River [a]				Middle Kuskokwim River [a]							Upper Kuskokwim River [a]		
	Eek	Kwethluk Canyon C.	Kisaralik	Tuluksak	Aniak	Kipchuk (Aniak)	Salmon (Aniak)	Holokuk	Oskawalik	Holitna	Kogrukluk Weir	Gagarayah	Cheeneetnuk	Salmon (Pitka)
1975					202	94								
1976		997								2,571	5,579	663		
1977		1,116		439				60				897	1,407	1,940
1978		1,722	2,417	403			322			2,766	13,667	504		1,100
1979								45			11,338			682
1980	2,378			1,035			1,186							1,450
1981		2,034	672		9,074						16,655			1,439
1982		471	81					42		521	10,993			413
1983	188			202	1,909		231	33		1,069				572
1984											4,926		1,177	545
1985	1,118	51	63	142				135			4,619		1,002	620
1986					424		336	100		650	5,038		317	
1987	1,739					193	516	210	193			205		
1988	2,255		869	188	954		244		80		8,506			473
1989	1,042	610	152		2,109	994	631				11,940			452
1990			631	200	1,255	537	596	157	113		10,218			
1991	1,312		217	358	1,564	885	583				7,850			
1992					2,284	670	335	64	91	2,022	6,755	328	1,050	2,536
1993					2,687	1,248	1,082	114	103	1,573	12,332	419	678	1,010
1994			1,243			1,520	1,218				15,227	807	1,206	1,010
1995			1,243		3,171	1,215	1,446	181	326	1,887	20,630	1,193	1,565	1,911
1996							985	85			14,199			
1997					2,187	855	980	165	1,470	2,093	13,280		345	
1998	522	126	457		1,930	443	557							
1999								18	98		5,570			
2000					714	182	238	42		301	3,181			362
2001							598		186	1,130	9,298	143		1,033
2002		1,795	1,727			1,615	1,236	186	295	1,578	10,059	452		1,255
2003	1,236	2,628	654	94	3,514	1,493	1,242	528	844		11,760	1,095	810	1,241
2004	4,653	6,801	6,913	1,196	5,569	1,868	2,177	539	293	4,842	19,503	670	918	1,138
2005		5,059	4,112	672		1,944	4,097	510	582	2,795	21,993	788	1,155	1,809
2006			4,734		5,639	1,618		705	386	3,924	19,398	531	1,015	928
2007			1,373	173	3,984	2,147	1,458	146			13,070	1,035		1,014
Escapement Goal:			400-1,200		1,200-2,300		330-1,200			970-2,100	5,300-14,000	300-830	340-1,300	470-1,600
Median[b]	1,312	997		280		778		82	103					

[a] Estimates are from "peak" aerial surveys conducted between 20 and 31 July under fair, good, or excellent viewing conditions.
[b] Median of years 1975 through 1994.

Table 5-13 Peak aerial survey counts from Kuskokwim Bay[a] spawning tributaries, 1966 - 2007.[b]

Year	Kanektok River	Middle Fork Goodnews River	North Fork Goodnews River
1966	3,718		
1967			
1968	4,170		
1969			
1970	3,112		
1971			
1972			
1973	814		
1974			
1975			
1976			
1977	5,787		
1978	19,180		
1979			
1980		1,164	1,228
1981			
1982	15,900	1,546	1,990
1983	8,142	2,500	2,600
1984	8,890	1,930	3,245
1985	12,182	2,050	3,535
1986	13,465	1,249	1,068
1987	3,643	2,222	2,234
1988	4,223	1,024	637
1989	11,180	1,277	651
1990	7,914		626
1991			
1992	2,100	1,012	875
1993	3,856		
1994	4,670		
1995	7,386		3,314
1996			
1997		1,447	3,611
1998	6,107	731	578
1999			
2000	1,118		
2001	6,483	3,561	2,799
2002		1,470	1,195
2003	6,206	1,210	2,015
2004	28,375	2,617	7,462
2005	14,202		
2006	8,433		4,159
2007			
Escapement Goal:	3,500 - 8,000		640 - 3,300

[a] Kuskokwim Bay includes mainland coastal streams, excluding the Kuskokwim River, and incorporating commercial fishing District 4 near the community of Quinhagak, and District 5 of Goodnews Bay.
[b] Estimates are from "peak" aerial surveys conducted under fair, good, or excellent viewing conditions.



Note: The Kuskokwim River Chinook salmon escapement index is a composite of median historical escapements for the 13 possible aerial survey index streams (from Sandone 2007).

Fig. 5-20 Kuskokwim River Chinook Salmon Escapement Index, 1975-2005.

Data collected since 2002 are available to estimate the total run of Chinook salmon to the Kuskokwim River (Table 5-14). Annual total run of Chinook salmon for 2002-2005 is estimated as total catch plus drainage-wide escapement upstream of the Eek River confluence (Eek River was excluded because of its proximity downstream of nearly all commercial and subsistence fishing). Escapement was estimated each year from the 2002-2005 radio tag mark-recapture estimates, coupled with the array of escapement projects in the drainage. The estimates provided here likely underestimate the actual total abundance (Doug Molyneaux, pers. comm., 3-16-08). A more formal historical total inriver run reconstruction is currently in development (Doug Molyneaux, pers. comm., 10-23-08).

Kuskokwim River Chinook salmon abundance is generally on a decline following a period of exceptionally high abundance years in 2004, 2005, and 2006 that ranged from 360,000 to 425,000 fish (Fig. 5-21). Abundance is estimated to have decreased in 2007 to about 250,000 fish, and may have declined a bit more in 2008 to about 225,000 fish. The 2007 and 2008 values are preliminary considering that the subsistence harvests estimates are not yet available. Annual subsistence harvest averages about 72,000 fish +/- 9,000. Kuskokwim River Chinook salmon were designated by the BOF as a Stock of Yield Concern in September 2000, but the designation was lifted in January 2007.

Kuskokwim Area Chinook salmon abundance in the 2008 season was expected to be about average, and comparable to 2007; inseason indicators suggested that to be the case, but actual abundance was lower than expected. Achievement of tributary escapement goals was mixed with six of 11 streams falling below goal, six within their respective escapement goal ranges, and two above range. Kuskokwim River subsistence harvest needs are thought to have been met, and there is some speculation that subsistence harvest may have been above average in partial compensation for sharp increases in local fuel and food costs. A modest Kuskokwim River commercial harvest of 8,865 fish was allowed in 2008; of note, managers required use of gillnets with six inch or smaller mesh size, which effectively focused harvest on male Chinook salmon that accounted for about 90 percent of the commercial harvest, plus allowed for optimizing concurrent sockeye harvest. Overall Chinook salmon preliminary estimate of the exploitation rate in 2008 is estimated to have been near 40%, compared to the 10-year average of 29%. Most of the harvest was likely on larger Chinook salmon, which subsistence fishermen tend to select for through the use of gillnets with 8 inch or larger mesh size. Additionally, Chinook salmon commercial harvest in Kuskokwim Bay districts were below average in 2008.

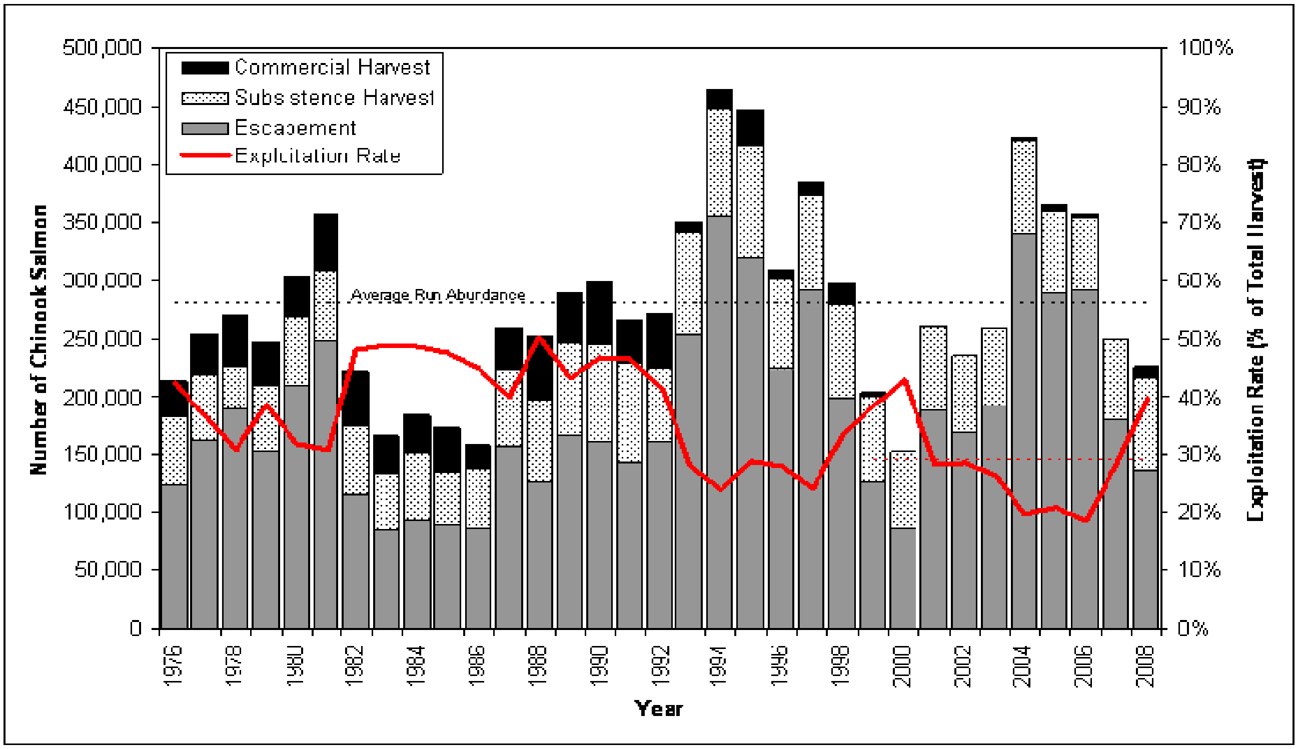


Fig. 5-21 Preliminary Kuskokwim River Chinook salmon run reconstruction and exploitation rate, 1976-2008. 2007 and 2008 data are preliminary.

Table 5-14 Run reconstruction for Kuskokwim River Chinook salmon (from Molyneaux and Brannian 2006)

	Run component	Enumeration Method	2002	2003	2004	2005
Harvest	Subsistence		66,807	67,788	80,065	68,213
	Commercial		72	158	2,300	4,825
	Sport		300	401	330	330
	TOTAL		67,179	68,347	82,695	73,368
Escapement	Kwethluk River	weir	8,502	14,474	28,605	22,217 [a]
	Kisaralik River	estimate [b]	8,500	14,500	28,600	22,200
	Tuluksak River	weir	1,346	1,064	1,479	2,653
	Aniak River	estimate [c]	21,451	21,007	40,981	36,345
	Mainstem upstream of Aniak River	radiotelemetry	100,733	103,161	146,839	144,953
	TOTAL		140,532	154,206	246,504	228,368
Total Abundance Statistics	Total Abundance		207,711	222,553	329,199	301,737
	Annual exploitation (minimum)		32%	31%	25%	24%

[a] Kwethluk River escapement in 2005 was estimated as an expanded aerial survey count.
[b] Chinook salmon escapement into the Kisaralik is estimated to be equal to the Kwethluk River weir count.
[c]Chinook escapement into the Aniak is estimated as 50% of the radiotelemetry estimate for the Holitna River based on subjective judgment.

5.2.5.2 Forecasts and precision of estimates

ADF&G does not produce formal run forecasts for salmon runs in the Kuskokwim region, due to lack of information with which to develop rigorous forecasts. Commercial harvest outlooks are typically based upon available parent year spawning escapement indicators, age composition information, recent year trends, and the likely level of commercial harvest that can be expected to be available from such indicators, given the fishery management plans in place. Fisheries are managed based upon inseason run assessment. The 2008 commercial harvest outlook for the Kuskokwim River was 30,000-50,000 Chinook salmon; for Kuskokwim Bay, the outlook is 17,000-31,000 Chinook salmon (Nelson et al 2008).

5.2.6 Bristol Bay Chinook: Nushagak River

There are five discrete commercial fishing districts in Bristol Bay: the Ugashik, the Egegik, the Naknek-Kvichak, the Nushagak, and the Togiak (Fig. 5-22). Harvests of Chinook salmon predominantly occur in the Nushagak District, because one of the largest runs of Chinook salmon in Alaska spawns in the Nushagak River. However, salmon management in Bristol Bay is primarily directed at the commercially harvested sockeye salmon which are found throughout the Bay.

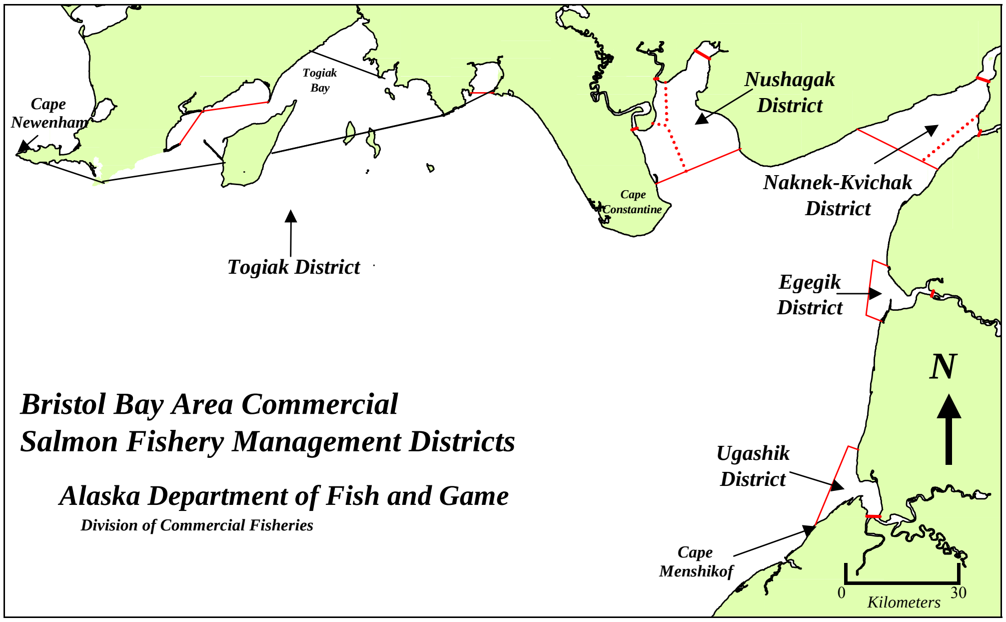


Fig. 5-22 Bristol Bay area commercial salmon fishery management districts.

5.2.6.1 Stock assessment and historical run estimates

Chinook salmon run timing is earlier than the sockeye salmon, and early season fishery management decisions relative to time and area of commercial openings are often based on the status of Chinook salmon runs, particularly in the Nushagak District. The Nushagak River is very large and the water in the lower river is too turbid to visually count salmon from a tower. The River supports large numbers of all five species of salmon. Chinook salmon escapements averaged approximately 100,000 from 1997-2006 (Table 5-15). A side scan sonar-based salmon enumeration program has been used since 1979 to estimate salmon escapements into the Nushagak River near Portage Creek during the summer. Test fishing on site is used to apportion sonar-based counts by species. It is believed that some migration by Chinook salmon takes place further from shore than the sonar beam reaches. Therefore Chinook salmon escapements as estimated by the sonar assessment effort are probably biased low. Inseason information is used on a daily basis to update preseason stock forecasts in an effort to better gauge run strengths and make appropriate decisions regarding openings and closures of the commercial fishery. Postseason assessment involves updating brood tables and determining if management met the stock escapement objectives, while still allowing sufficient fishing opportunity for salmon surplus to escapement needs (Clark et al 2006).

There are three escapement goals for Chinook salmon. A SEG is set for Nushagak River at 40,000-80,000 Chinook salmon counted by sonar. For the Togiak River, a SEG is set at a lower bound of 9,300 and no upper bound. The Naknek River also has a SEG set at a lower bound of 5,000 with no upper bound. Table 5-15 provides a summary of escapement and total run size for Chinook salmon in the Nushagak District, from 1987-2007. Table 5-16 provides the same information for Chinook salmon in the Togiak District. Escapement data is not available for the Naknek River. Data for 2007 is preliminary.

Approximately 63,000 Chinook salmon were harvested in Bristol Bay in 2007, this is 92% of the average harvest for the last 20 years. It is significantly below the preseason expected harvest of 145,000. Chinook salmon harvests in Bristol Bay districts were below average in every district except Nushagak. Directed fishing for Chinook in the Nushagak District in the early part of the season produced approximately 2,100 Chinook until management was switched to sockeye salmon based on the increasing abundance of that species. Several planned directed Chinook openings did not occur because Chinook escapement into the Nushagak River was below desired levels. Catches of Chinook increased in the Nushagak District to the point where a near average harvest was achieved, but this catch was incidental to the directed sockeye fishery. The final Chinook escapement of 60,494 was less than the 75,000 inriver goal established in the Nushagak Mulchatna King Salmon Management Plan, but within the SEG range. Runs of Chinook salmon to all districts were below average and exhibited late run timing (ADF&G 2007b).

Chinook returns to the Nushagak River consist primarily of age 1.2, 1.3, and 1.4 (Table 5-17).

Table 5-15 Chinook salmon harvest, escapement and total runs in the Nushagak District, in numbers of fish, Bristol Bay, 1987–2007 (from Sands et al in prep).

Year	Total Harvest (commercial, sport, subsistence)	Inriver Abundance [a]	Spawning Escapement [b]	Total Run
1987	62,608	84,309	75,924	138,532
1988	29,545	56,905	50,945	80,490
1989	29,373	78,302	72,600	101,973
1990	30,705	63,955	55,931	86,636
1991	38,896	104,351	94,733	133,629
1992	65,906	82,848	74,094	140,000
1993	86,585	97,812	86,705	173,290
1994	145,597	95,954	83,102	228,699
1995	98,595	85,622	77,018	175,613
1996	93,343	52,127	42,227	135,570
1997	82,971		82,000	164,971
1998	135,164	117,495	108,037	243,201
1999	25,187	62,331	54,703	79,890
2000	27,542	56,374	47,674	75,216
2001	44,406	99,155	83,272	127,678
2002	54,447	87,141	79,790	134,237
2003	66,891	80,028	68,606	135,497
2004	123,024	116,400	105,442	228,466
2005	83,265	172,559	161,528	244,793
2006	102,325	124,683	116,088	218,413
20-Year Ave.	**71,319**	**90,440**	**81,021**	**152,340**
1987-96 Ave.	**68,115**	**80,219**	**71,328**	**139,443**
1997-06 Ave.	**74,522**	**101,796**	**90,714**	**165,236**
2007	71,365	60,464	50,594	121,959

Note: Blank cells represent no data.
[a]Inriver abundance estimated by sonar below the village of Portage Creek.
[b]Spawning escapement estimated from the following: 1997 comprehensive aerial surveys. 1986–1996, 1998–2005 - Inriver abundance estimated by sonar minus inriver harvests.
[c]Data unavailable at the time of publication. A 5-year average is reported.

Table 5-16 Chinook salmon harvest, escapement and total runs in the Togiak District, in numbers of fish, Bristol Bay, 1987–2007 (from Sands et al in prep).

Year	Total Harvest (Commercial, Sport[a], Subsistence)	Spawning Escapement[b]	Total Run
1987	18,054	11,000	29,054
1988	16,035	10,000	26,035
1989	12,151	10,540	22,691
1990	11,782	9,107	20,889
1991	6,793	12,667	19,460
1992	14,272	10,413	24,685
1993	11,860	16,035	27,895
1994	12,053	19,353	31,406
1995	13,010	16,438	29,448
1996	9,863	11,476	21,339
1997	7,946	11,495	19,441
1998	15,676	11,666	27,342
1999	13,807	12,263	26,070
2000	9,444	16,897	26,341
2001	12,555	15,185	27,740
2002	3,580	14,265	17,845
2003	5,145	5,668 [c]	10,813
2004	11,792	15,990	27,782
2005	13,867	13,521	27,388
2006	18,919	1,670 [c]	20,589
20-Year Ave.	**11,930**	**12,282**	**24,213**
1986-95 Ave.	**12,587**	**12,703**	**25,290**
1996-05 Ave.	**11,273**	**11,862**	**23,135**
2007	9,981	[c]	9,981

[a]Sport fish harvest estimate only includes the Togiak River Section.
[b]Spawning escapement estimated from comprehensive aerial surveys. Estimates for 1987–1988 are rounded to the nearest thousand fish.
[c]Partial survey.
[d]Estimate.

Table 5-17 Nushagak River Chinook spawning escapement and return, by brood year (expressed as a percentage).

Brood Year	Spawning Escapement	Age Group 1.1	1.2	1.3	1.4	1.5	Total %
1986	33,854	0.0	19.8	41.3	37.0	1.6	100
1987	75,891	0.3	21.8	33.0	41.8	3.0	100
1988	50,946	0.3	17.6	30.2	50.8	1.0	100
1989	72,601	1.0	19.1	38.9	39.2	1.7	100
1990	55,931	0.6	33.5	36.2	29.0	0.6	100
1991	94,733	0.8	27.9	39.7	29.5	2.0	100
1992	74,094	0.5	16.6	29.6	52.7	0.4	100
1993	86,706	0.9	22.2	57.3	18.6	1.0	100
1994	83,103	1.3	24.4	30.7	40.1	3.6	100
1995	77,018	1.1	14.4	26.2	54.9	3.1	100
1996	42,228	0.5	16.8	31.2	49.7	1.6	100
1997	82,000	0.3	24.7	40.7	33.2	1.0	100
1998	108,037	0.3	20.4	37.4	40.6	1.2	100
1999	54,703	0.3	15.6	44.9	38.5	0.7	100
2000	47,674	0.2	21.8	43.1	34.6	0.2	100
2001	83,272	0.1	27.9	52.1	20.0	0.0	
2002	79,790	[a]	[a]	[a]	[a]	[a]	
2003	67,993	[a]	[a]	[a]	[a]	[a]	

[a] Incomplete returns from brood year escapement.

Source: Tim Baker, ADF&G.

5.2.6.2 Forecasts and precision of estimates

The 2008 forecast for Chinook salmon returning to the Nushagak River was 160,000 fish (68% age-1.3 and older). Information on the Nushagak River Chinook salmon forecast is taken from Brazil et al 2007. This forecast is 1.1% less than the 10-year mean; the 80% confidence bounds for the forecast ranged from 87,000 to 233,000. Nushagak River Chinook salmon are managed according to the Nushagak/Mulchatna Chinook Salmon Management Plan. This plan directs the commercial fishery to be managed for an inriver goal of 75,000 Chinook salmon, while the sport fishery is to be managed for a guideline harvest of 5,000 fish, if the projected inriver escapement is between 65,000 and 75,000 fish. Based on the preseason forecast and the inriver goal, 85,000 Chinook salmon should be available for commercial harvest. It is anticipated that actual harvest will be closer to 56,000 based on the average exploitation rate of 36% during the previous five years (2003-2007).

The 2008 age composition of total run was 1% (929) age-1.1, 27% (35,676) age-1.2, 43% (56,260) age-1.3, 28% (36,534) age-1.4 and 1% (1,384) age-1.5%. Age composition of the forecasted run was <1% (<1,000) age-1.1, 33% (53,000) age-1.2, 35% (56,000) age-1.3, 30% (48,000) age-1.4, and 1% (2,000) age-1.5. The forecast is the sum of individual predictions of five age classes, which were calculated from models based on the relationship between adult returns and spawners or siblings from previous years. The number of age-1.1 (929 vs. 1,000), age-1.3 (56,620 vs. 56,000) and age-1.5 (1,384 vs. 2,000) Chinook salmon were similar to the forecast, while the number of age-1.2 (35,676 vs. 53,000) and age-1.4 (36,534 vs. 48,000) were less than the forecast.

The forecasts have varied widely in the last 5 years (2003-2007). The forecast run differences have ranged from 59% below in 2004 to 41% above in 2007. Overall, there has been a tendency for the forecasts to be biased low and expected harvests to be high. The five previous total run forecasts (have averaged 3% below the total run. There is greater uncertainty around the 2008 forecast because of total run being 41% below forecast in 2007.

Chinook salmon run strength in the Togiak River declined between 1994 and 1997, from a total run of 26,000 fish in 1994 down to 18,000 fish in 1997. For the last 5 years of complete surveys, escapement estimates have averaged over 11,300 Chinook salmon and have all exceeded 9,500, within 5% of the 10,000 fish escapement goal. Adequate yearly Chinook escapement can be attributed to reductions in the weekly fishing schedule during late June.

The 2008 total run of Chinook salmon to the Nushagak River was 130,783. The total run was 29,817 (18%) less than the forecast of 160,000 Chinook salmon, 15% less than the recent 20-year (1988-2007) average of 153,358 and 19% less than the recent 10-year (1998-2007) average of 162,179 (Fig. 5-23).

The spawning escapement in the Nushagak River was 88,452 Chinook salmon which exceeded the sustainable escapement goal (SEG) range of 40,000-80,000. A total of 42,331 Chinook salmon were harvested in the commercial (18,618), subsistence (16,642) and sport (7,071) fisheries in the Nushagak District and River. The commercial harvest of 18,618 Chinook salmon was 67% far below the anticipated harvest of 56,000 Chinook salmon. The anticipated harvest was estimated based on an average exploitation rate of 35% in the Nushagak District commercial salmon fishery from 2003-2007. When management of the commercial fishery shifted from being based on the preseason forecast to inseason escapement data, no further directed openings occurred because of the late run timing and indications that the run was less than forecasted. The actual exploitation rate in 2008 was 14%. The commercial harvest in 2008 was one of smallest harvests of Chinook salmon in the Nushagak District since 1966; only Chinook salmon harvests in 1999 (10,893), 2000 (12,055) and 2001 (11,568) have been smaller.

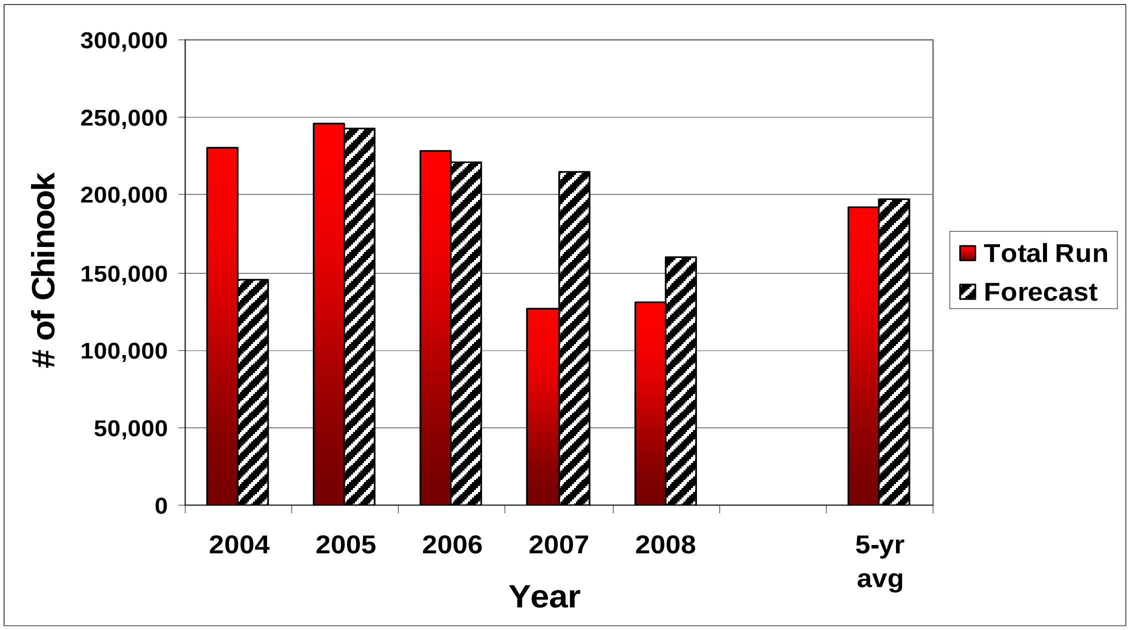


Fig. 5-23 Observed versus forecasted total Chinook salmon runs, Nushagak River, 2004-2008 and 5-year average. 2008 data are preliminary. From ADF&G 2008.

5.2.7 Gulf of Alaska stocks

5.2.7.1 Cook Inlet

The Cook Inlet management area is divided into 2 areas, the Upper Cook Inlet (northern and central districts) and the Lower Cook Inlet (see Fig. 5-24). Inseason management of Cook Inlet commercial salmon fisheries is based upon salmon run abundance and timing indicators. Catch data, catch per effort data, test fish data, catch composition data, and escapement information from a variety of sources is used to assess stock strength on an inseason basis. For Chinook salmon, surveys are made to index escapement abundance (Clark et al 2006).

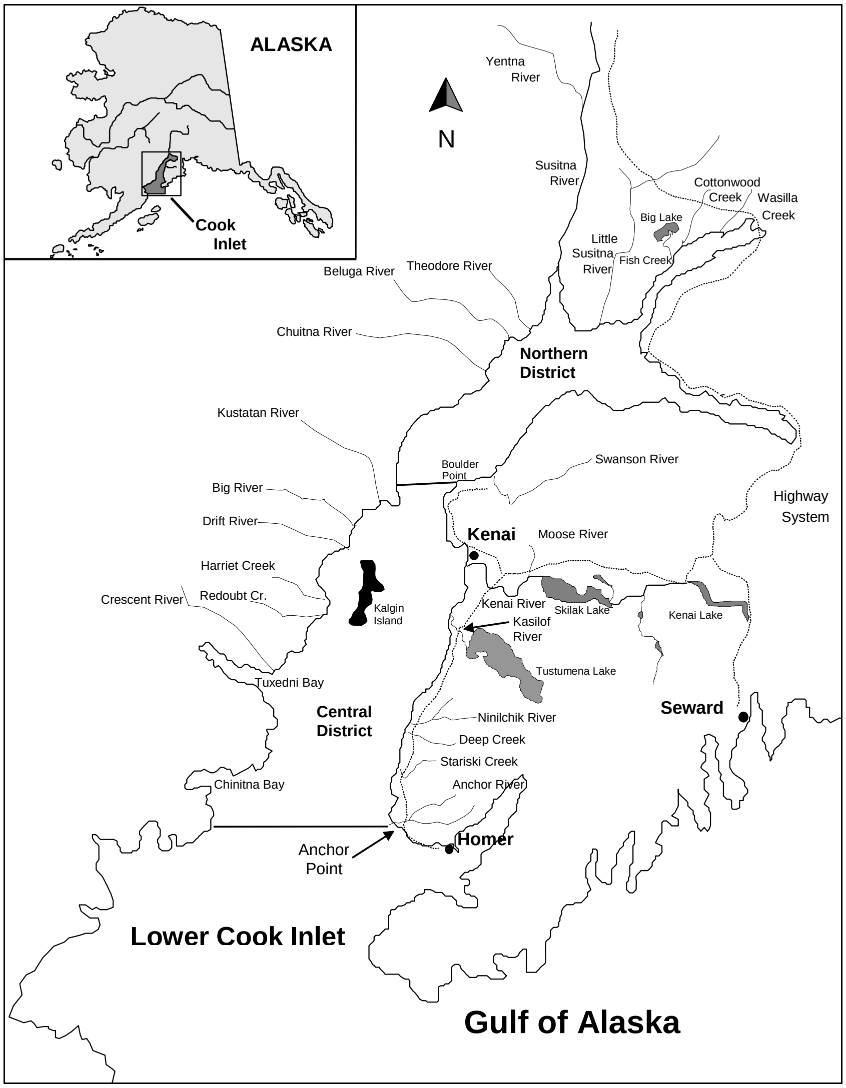


Fig. 5-24 Major Tributaries of the Cook Inlet Basin.

There are three biological escapement goals (Kenai River early and late runs, Deshka River) and 18 sustainable escapement goals in effect for Chinook salmon spawning in Upper Cook Inlet. After experiencing a significant downturn in the early to mid-1990s, Northern District Chinook salmon stocks continue to trend sharply upward and most escapement goals are being met or exceeded. For the years 2000-2004, for the 15 Upper Cook Inlet populations with the most complete escapement observations, 97% of observed escapement exceeded the lower end of the escapement goal range (Clark et al 2006). Late-run Kenai River Chinook salmon runs are estimated by sonar, and have been relatively stable.

The recent 5-year average commercial harvest was used to forecast the harvest of Chinook salmon in 2008 for the Upper Cook Inlet. The commercial harvest estimate for Chinook salmon is 23,000 fish.

There are 3 SEGs in effect for Chinook in the Lower Cook Inlet. Chinook salmon is not normally a commercially important species in the Lower Cook Inlet. The 2007 harvest totaled just under 500 fish, of which virtually all came from the Halibut Cove Subdistrict (Nelson et al 2008). Very little escapement information is available for this area.

5.2.7.2 Southeast Alaska Stocks

Chinook salmon are known to occur in 34 rivers in the Southeast region of Alaska, or draining into the region from British Colombia or Yukon Territory, Canada (known as transboundary rivers). Harvest in Southeast Alaska occurs under the Pacific Salmon Treaty (described further in chapter 1). Eleven watersheds have been designated to track spawning escapement, and counts of these 11 stocks are used as indicators of relative salmon abundance as part of a coast-wide Chinook model. The Taku, Stikine, and Chilkat rivers together make up over 75% of the summed escapement goals in the region. Escapement on the Taku River remains low relative to the 1990-1999 average, but escapement to the Stikine River has increased greatly since 1999 (Pahlke 2007).

Table 5-18 Escapement goals for large Chinook salmon, Southeast Alaska and transboundary rivers, and total escapement as a percentage of escapement point estimates, averaged by decade (from Pahlke 2007).

River	Biological Escapement Goal	Escapement Point Estimate	Average percent of goal (point estimate) achieved 1977-1979	1980-1989	1990-1999	2000-2004
Alsek	5,500-11,500	8,500	163%	122%	159%	89%
Taku	30,000-55,000	36,000	63%	92%	154%	125%
Stikine	14,000-28,000	17,500	59%	140%	166%	265%
Situk	450-1,050	730	175%	148%	215%	158%
Chilkat	1,750-3,500	2,200			228%	175%
Andrew Creek	650-1,500	800	52%	108%	148%	256%
Unuk	3,250-7,000	4,000	111%	178%	103%	157%
Chickamin	2,325-4,650	2,700	45%	126%	60%	132%
Blossom	1,000-2,000	1,200	27%	153%	53%	57%
Keta	750-1,500	900	93%	174%	79%	100%
King Salmon R	120-240	150	89%	145%	141%	92%
TOTAL	59,796-115	75,945	74%	113%	149%	156%
Expanded region total[a]	66,440-128,826	83,383				

[a] Index escapements are expanded by average expansion factors, except weir counts or mark-recapture estimates are not expanded.

The Chinook salmon quota for Southeast Alaska, all gears, was in 2006 was 329,400. In addition, a harvest sharing agreement with Canada under the treaty allows harvest in the Stikine River; the US allocation in 2006 was 13,350 fish. There was no directed fishery for Chinook salmon on the Taku River in 2006 due to low forecast returns (Nelson et al 2008).

5.2.8 Pacific Northwest Stocks - ESA-listed Chinook stocks

There are currently nine ESA-listed Chinook salmon evolutionary significant units (ESUs) listed under the ESA. Of the nine listed Chinook salmon ESUs, only the Upper Willamette River (UWR) and Lower Columbia River (LCR) ESUs have been recovered in the BSAI groundfish fishery. No fish from the seven other ESA-listed ESUs have ever been recovered in the BSAI groundfish fishery. This section is therefore limited to a review of information related to the status of those two ESUs.

NMFS initiated an ESA section 7 formal consultation on the Alaska groundfish fisheries, including the BSAI pollock fishery, regarding the potential incidental take of ESA-listed salmon in 2006. In January 2007, the NMFS Northwest Region completed a biological opinion on the effects of the Alaska groundfish fisheries on ESA-listed salmon (NMFS 2007a). The biological opinion concluded that the BSAI groundfish fisheries, including the Bering Sea pollock fishery, are not likely to jeopardize the continued existence or adversely modify critical habitat for the UWR and LCR ESA-listed Chinook salmon stocks. The biological opinion provides consultation covering ongoing management of the BSAI groundfish fisheries, including the annual harvest specifications and current fisheries management to reduce salmon bycatch.

The information provided here is from the 2007 supplemental biological opinion on effects of the BSAI groundfish fishery on ESA-listed salmon and steelhead (NMFS 2007a) and recent inseason management data on salmon bycatch. Additional information related to the status of UWR and LCR Chinook is summarized in biological opinions (NMFS 1999 and NMFS 2005a), in updated status reports of listed ESUs (Good et al. 2005 and McElheny et al. 2007), and in the Interim Regional Recovery Plan for Washington management units of the listed ESUs in the LCR (LCFRB 2004). No critical habitat is designated in Alaska waters for the UWR and LCR Chinook salmon ESA-listed stocks.

Because of the high number of Chinook salmon taken in the BSAI groundfish fisheries in 2007, the NMFS Alaska Region is currently consulting with NMFS Northwest region on the 2007 incidental take of Chinook salmon. The incidental take of Chinook salmon in the 2007 BSAI groundfish fisheries was 129,978 fish (NMFS inseason management data 6/13/08). Even though the number of Chinook salmon incidentally taken in 2007 was higher than seen in previous years, no coded-wire tagged (CWT) ESA-listed salmon stocks have been recovered from the samples of bycaught salmon analyzed to date. Analysis of coded-wire tags collected during the 2007 BSAI groundfish fisheries will be completed in late 2008.

5.2.8.1 Coded Wire Tag information for ESA-listed Chinook salmon stocks

The primary source of information for the stock specific ocean distribution of Chinook salmon is from CWTs, and particularly their intensive use for management in coast wide salmon fisheries over the last twenty to twenty five years. The NMFS Alaska Region, with assistance from the AFSC Auke Bay Laboratory, recently completed a comprehensive review of CWT recoveries in the BSAI and GOA groundfish fisheries (Mecum 2006a). The CWT analysis was recently updated resulting in some minor revisions to the prior estimates (Mecum 2006b and Balsiger 2008).

In the 2007 biological opinion for Chinook salmon, the incidental take statement for the UWR and LCR ESA-listed Chinook salmon stocks taken by the BSAI groundfish fisheries was based on the range of recent observations of Chinook salmon taken in those fisheries and on the coded-wire tag recoveries of these ESA-listed stocks. Between 2001 and 2006, the incidental take of Chinook salmon in the BSAI groundfish fisheries ranged from 40,547 fish to 87,730 fish (NMFS inseason management data, 6/13/08). Coded-wire tag recoveries for the LCR and UWR ESA-listed Chinook salmon stocks taken in the BSAI groundfish fisheries has ranged from 0 to a few fish between 2001 and 2006 **(**Table 5-19**).** Based on coded-wire tag recoveries of salmon taken in the BSAI groundfish fisheries, salmon from the UWR and LCR ESA-listed Chinook stocks are rarely taken in the BSAI groundfish fisheries.

Chinook salmon from the UWR and LCR ESUs are observed more frequently in the Gulf of Alaska (GOA) groundfish fishery than the BSAI groundfish fishery because the GOA is closer to the streams from which these stocks originate. One observed CWT was recovered from the Upper Columbia River Spring Chinook ESU in the GOA in 1998.

Since 1984 there have been ten and nine observed CWT recoveries in the BSAI groundfish fishery of UWR and LCR Chinook, respectively (Mecum 2006b). This time period (1984-present) includes years before these ESUs were listed under ESA (pre-listing) as well as the years after listing. When observed recoveries are expanded for sampling fraction in the fishery and mark rate (the proportion of the release group that is tagged) the total number of estimated recoveries is 70 UWR Chinook and 17 LCR Chinook (Table 5-19). One or more recoveries were observed in eight out of 24 years for UWR Chinook, and five out of 24 years for LCR Chinook. It is worth noting that these estimated recoveries represent the catch of fish from the ESU that are represented by CWT mark groups, generally from hatchery production. There are often other groups of fish in an ESU that are not represented by marked groups, and thus would not necessarily be observed or represented in the fishery by CWTs. The amount of natural production for the

UWR and spring component of the LCR Chinook ESUs is limited, on the order of 10-12% of the total production (JCRMS 2006).

Table 5-19 The bycatch of Chinook salmon in the BSAI groundfish fishery, observed CWT recoveries and total estimated contribution, for LCR and UWR Chinook. Bycatch data from (NMFS 1999, Mecum 2006a, Balsiger 2008); CWT recovery data from (Mecum 2006b and Balsiger 2008 and Adrian Celewycz, personal communication 3/28/08).

Year	Chinook Bycatch	LCR Spring Chinook		UWR Chinook	
		Observed CWT Recoveries	Total Estimated Contribution	Observed CWT Recoveries	Total Estimated Contribution
1984		0	0	1	2.7
1985		0	0	0	0
1986		0	0	0	0
1987		0	0	0	0
1988		0	0	0	0
1989		0	0	0	0
1990	13,990	0	0	0	0
1991	48,880	0	0	0	0
1992	41,955	0	0	0	0
1993	46,014	0	0	0	0
1994	44,487	0	0	0	0
1995	23,436	0	0	0	0
1996	63,205	0	0	1	2.6
1997	50,530	0	0	0	0
1998	58,971	0	0	0	0
1999	14,599	0	0	1	2.2
2000	8,223	0	0	1	2.5
2001	40,548	1	2.7	1	2.7
2002	36,385	1	2.0	2	24.3
2003	54,911	0	0.0	0	0
2004	60,146	3	5.6	1	14.9
2005	74,805	3	5.0	2	17.7
2006	82,678	1	1.7	0	0
2007 Preliminary	130,139	0		0	
Total	893,902	9	17.0	10	69.7

The LCR Chinook ESU includes both spring-run and fall-run life history types. All of the recoveries from the LCR ESU are from spring-run populations. UWR Chinook also have a spring-run life history. This suggests that spring-run populations from the LCR (the Willamette River is a tributary that enters the lower Columbia River near Portland, Oregon) are distinct in having the most northerly distribution, at least among the ESA-listed Chinook from the southern U.S.

The probability that an ESA-listed Chinook salmon will be taken in the BSAI groundfish fishery depends on the duration of the time period considered and the cumulative total Chinook salmon bycatch over that time. The longer the period of consideration, the more likely that take will occur. During 1990-2007, the total catch of Chinook salmon in the fishery was 893,902 (Table 5-19). Based on this and the total estimated recoveries of Chinook from the listed ESUs (70 and 17), the expected number of UWR and

LCR Chinook caught per 100,000 Chinook in the BSAI fishery is 7.8 and 1.9 fish, respectively.

From Table 5-19, it is also apparent that recoveries of CWTs from listed LCR and UWR Chinook are also a more recent event. All of the recoveries of LCR spring Chinook have occurred since 2001; eight out of ten recoveries from UWR Chinook have occurred since 1999. Reasons for these recent increases in Chinook bycatch and CWT recoveries are unknown. Because of these changes, more recent observation may be a better source for characterizing expected impacts in the future. From 2001-2007, the catch of Chinook salmon in the fishery has ranged from 36,000 to 130,000 fish, totalling 480,000 fish. The estimated number of CWT recoveries in those years has ranged from 0 to 24 per year, and totalled 60 recoveries for UWR Chinook and 17 recoveries for LCR Chinook (Table 5-19). Based on these more recent observations, the expected number of UWR and LCR Chinook caught per 100,000 Chinook in the fishery is 12.5 and 3.5 fish, respectively.

Not all fish caught in the BSAI fisheries would have been expected to survive to return to spawn because of subsequent natural mortality had they not been caught in the fishery. The parameter used to characterize the expected mortality of immature fish is referred to as the adult equivalency rate; this represents the proportion of the fish caught that would be expected to return to spawn absent further fishing. The adult equivalency rate is age specific - about 60% for age-3 fish, and about 85% for age-4 fish (pers. Com. Dell Simmons, Pacific Salmon Treaty, Chinook Technical Committee co-chair, December 12, 2006). The CWT information indicates that half the fish caught in the BSAI fishery are roughly age 3 and half are roughly age 4. So for example, if we estimate that 10 listed fish were caught in the fishery in a given year, the effect on subsequent spawning would be a reduction of 6 to 8 spawning adults depending on the age composition of the fish caught.

5.2.8.2 Upper Willamette River Chinook Salmon

ESU Description

The UWR Chinook salmon ESU includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River and in the Willamette River, and its tributaries, above Willamette Falls, Oregon (NMFS 2005b). These populations include the Clackamas River, Molalla River, North Fork Santiam River, South Fork Santiam River, Calapooia River, McKenzie River, and Middle Fork Willamette River (Myers et al. 2006). The status of each of these populations is described in Good et al. (2005) and McElheny et al. (2007). Of the independent populations, the Willamette/Lower Columbia Technical Recovery Team (W/LC TRT) designated the Clackamas River, North Santiam River, McKenzie River, and Middle Fork Willamette River populations as core populations. Core populations historically represented substantial portions of the ESU's abundance or contained life-histories specific to the ESU. In addition, due to its genetic integrity, the W/LC TRT designated the McKenzie River population as a genetic legacy population (McElhany et al. 2003). Spawning locations and artificial propagation programs for this ESU are described in NMFS 2007a.

Life History Types

The UWR Chinook salmon ESU exhibits one life history type. As cited in Myers et al. (2006), Chinook salmon native to the UWR are considered to be ocean-type. Ocean-type salmon out-migrate to the ocean during their first year and tend to migrate along the coast. Marine recoveries of CWT marked UWR Chinook salmon occur off the British Columbia and Alaska coasts (Myers et al. 2006). Ocean-type Chinook in the UWR historically returned in February and March, but did not ascend Willamette Falls until April and May. UWR Chinook salmon mature during their fourth and fifth years.

Current Viability

Numbers of spring Chinook salmon in the Willamette River basin are extremely depressed (McElhany *et al*. 2007). Historically, the spring run of Chinook may have exceeded 300,000 fish (Myers *et al*. 2003).

The current abundance of wild fish is less than 10,000 fish, and only two populations (McKenzie and Clackamas) have significant natural production. The UWR Chinook have been adversely impacted by the degradation and loss of spawning and rearing habitat (loss of 30 to 40%) associated with hydropower development, and interaction with a large number of natural spawning hatchery fish. Other limiting factors include altered water quality and temperature, lost and degraded floodplain connectivity and lowland stream habitat, and altered streamflow in the tributaries (NMFS 2005c and NMFS 2006). NMFS (2007b) identified degraded flooplain connectivity and function; channel structure and complexity; riparian areas and large wood recruitment; water quality; fish passage; and hatchery impacts as the major factors limiting recovery of this species.

Extinction Risk

In McElhany et al 2007, the scores for abundance and productivity, diversity, and spatial structure criteria were combined to provide a high risk of extinction for UWR Chinook salmon. The Clackamas population exhibited the lowest extinction risk, being most likely in the ‘low’ risk category. Five of the seven populations were clearly in the high risk category. In addition, their ‘high risk’ classification was made with considerable certainty. Overall, these Chinook populations, and therefore the ESU, can be characterized as having a high risk of extinction.

Good et al. (2005) concluded that the Molalla and Calapooia populations were likely extirpated or nearly so, the North Santiam, South Santiam, and Middle Fork Willamette populations were not self sustaining, and that the Clackamas and McKenzie populations had under gone substantial increases in abundance in recent years (NMFS 2007a).

There have been substantial changes in harvest management practices in recent years that affect UWR Chinook resulting in an overall reduction in harvest mortality. Harvest has decreased as a result of reductions in ocean fisheries, particularly as a result of changes made in the Pacific Salmon Treaty in 1999. Greater reductions have occurred in fisheries in the Columbia and Willamette Rivers as a result of efforts to mass mark all hatchery produced fish, and implementation of mark-selective fishery techniques that require the release of all unmarked, and presumably natural origin fish (NMFS 2007a). From 1970-1994 harvest mortality averaged 53%, from 1995-2001 the mortality averaged 28%, and from 2002-2005 when mark-selective fisheries were implemented in the Columbia Basin harvest mortality averaged 18%.

The UWR Chinook ESU is dominated by hatchery production from releases designed to mitigate for the loss of habitat above federal hydroprojects. Recent estimates of the percentage of natural origin fish in the current UWR run are 10-12%, with the majority of the natural production returning to the McKenzie River (JCRMS 2006). This hatchery production is considered a potential risk to the ESU (Good et. al. 2005). However, the status of the habitat is such, particularly given the hyrdoprojects in the basins that production exists in the basins only because of the contribution of hatchery programs.

Limiting Factors

A recent Report to Congress related to the use of Pacific Coastal Salmon Recovery Funds for recovery projects summarizes the status of all of the listed ESUs and the major factors limiting recovery (NMFS 2005c). For UWR Chinook the major limiting factors include:

- Reduced access to spawning/rearing habitat in tributaries
- Altered water quality and temperature in tributaries
- Lost/degraded floodplain connectivity and lowland stream habitat
- Altered streamflow in tributaries
- Hatchery impacts

5.2.8.3 Lower Columbia River Chinook Salmon

ESU Description

The LCR Chinook salmon ESU includes all naturally spawned populations of Chinook salmon from the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, and includes the Willamette River to Willamette Falls, Oregon (excluding spring Chinook salmon in the Clackamas River) (NMFS 2005b). Tule fall Chinook salmon in the Wind and Little White Salmon rivers are included in this ESU.

Seventeen artificial propagation programs releasing hatchery Chinook salmon are considered part of the LCR Chinook salmon ESU. All of these programs are designed to produce fish for harvest, and three of these programs are also intended to augment naturally spawning populations in the basins where the fish are released. These three programs integrate naturally produced spring Chinook salmon into the broodstock in an attempt to minimize the genetic effects of returning hatchery adults that spawn in the wild (NMFS 2005b).

Life History Types

Only the spring component of the LCR ESU is affected by the BSAI fisheries. All of the observed coded wire tag (CWT) recoveries from ESA-listed ESUs in the BSAI fishery are from the spring-run populations. Spring Chinook salmon on the LCR, like those from coastal stocks, enter fresh water in March and April, well in advance of spawning in August and September. Historically, the spring migration was synchronized with periods of high rainfall or snowmelt to provide access to upper reaches of most tributaries, where spring stocks would hold until spawning. Adult salmon returns of the spring component of the ESU are 4 to 5 years of age fish.

Current Viability

The remaining spring-run Chinook salmon stocks in the LCR Chinook salmon ESU are found in the Sandy River, Oregon, and in the Lewis, Cowlitz, and Kalama rivers, Washington. Despite the substantial influence of fish from hatcheries in the UWR ESU in past years, naturally spawning spring Chinook salmon in the Sandy River are included in the LCR Chinook salmon ESU because they probably contain the remainder of the original genetic legacy for that system. Returns of natural origin fish to the Sandy River averaged about 1,400 from 2000 to 2004. The minimum abundance thresholds for Chinook populations in a medium sized basin like the Sandy is 500-1000 (for persistence category 3) measured as a geometric mean over a long time period (e.g., 20 years). Assessing population viability also requires consideration of productivity, spatial structure and diversity, but the abundance and trend information, at least, indicates that the status of the Sandy population is improving.

On the Washington side, spring Chinook salmon were native to the Cowlitz and Lewis rivers and there is anecdotal evidence that a distinct spring run existed in the Kalama River subbasin. The Lewis River spring run was severely affected by dam construction. During the period between the construction of Merwin Dam in 1932 and Yale Dam in the early 1950s, the Washington Department of Fisheries (WDF) attempted to maintain the run by collecting adults at Ariel/Merwin for hatchery propagation or (in years when returns were in excess of hatchery needs) release to the spawning grounds. As native runs dwindled, Cowlitz spring-run Chinook salmon were reintroduced in an effort to maintain them. In the Kalama River, escapements of less than 100 fish were present until the early 1960s when spring-run hatchery production was initiated with a number of stocks from outside the basin. The number of naturally spawning spring Chinook salmon in the Cowlitz, Kalama, and Lewis rivers averaged 854, 495, and 488 from 2000 to 2005, respectively. However, a large proportion of the natural spawners in each system are believed to be composed of hatchery strays. Natural production is likely quite limited relative to the overall abundance of hatchery-origin fish returning to each basin. Although, the Lewis and Kalama hatchery stocks have been mixed with out-of-basin stocks, they are included in the ESU. The Cowlitz River hatchery stock is largely free of introductions.

The Interim Regional Recovery Plan identifies each of the existing spring Chinook populations as high priorities for recovery (LCFRB 2004). Most of Washington's spring Chinook populations occurred historically in habitats upstream of current hydrosystem projects. Recovery will therefore rely on reintroduction efforts. Reintroduction programs have been initiated on the Cowlitz while those on the Lewis River have not yet begun. The best spring Chinook salmon habitat on the Kalama was historically located above Kalama Falls. However, some natural spawning currently occurs, and a hatchery program in the basin provides an opportunity for conservation-based efforts. The LCFRB (2004) highlights the need for better integration of natural spawners into the broodstock as part of a near term recovery effort.

Because of the importance of the hatchery stocks as genetic reserves for each of Washington's spring Chinook populations, it is important that the hatchery stock be maintained and managed to meet current and evolving hatchery production needs designed to meet recovery efforts. As a consequence, fisheries are managed for the time being to ensure that hatchery escapement goals are met. The harvest mortality on spring Chinook has been reduced significantly in recent years in large part due to implementation of mark-selective fisheries. Hatchery escapement goals for these stocks are routinely met.

Harvest estimates for LCR spring Chinook differ between populations, but all have benefited from harvest reductions in recent years. From 1985 to 1995, exploitation rates on the Washington spring Chinook populations ranged from 39% to 62%; in recent years, exploitation rates ranged from 29% to 40%.

Extinction Risk

In McElheny et al. (2007), the abundance and productivity, diversity, and spatial structure criteria scores were combined for all the populations of LCR Chinook salmon, and the results indicated that the risk of extinction for LCR Chinook salmon in Oregon's portion of the ESU is high (NMFS 2007a). On a population by population basis, a most probable classification of moderate was obtained for only two populations, the Sandy River Spring and Sandy River Late Fall populations. Ten of the populations were clearly in the high risk category. In addition, their 'high risk' classification was made with considerable certainty. Overall, these Chinook salmon populations can be characterized as having a high risk of extinction.

Although a final ESU score is not possible without an assessment of Washington Chinook salmon populations using the same methodology, McElheny et al. (2007) expect that the overall finding would be similar to results for the Oregon populations. In all likelihood the extinction risk for the combined LCR Chinook salmon ESU is high.

Limiting Factors

The status of all of the listed ESUs and the major factors limiting recovery is summarized in the recent Report to Congress related to the use of Pacific Coastal Salmon Recovery Funds for recovery projects (NMFS 2005c). For LCR Chinook, the major limiting factors include:

- Reduced access to spawning/rearing habitat in tributaries,
- Hatchery impacts,
- Loss of habitat diversity and channel stability in tributaries,
- Excessive sediment in spawning gravel,
- Elevated water temperatures in tributaries, and
- Harvest impacts to fall Chinook

5.3 Impacts on Chinook salmon

In order to evaluate the impacts of the alternative caps, the analysis looks retrospectively at fleetwide and sector-specific catch levels in 2003-2007. The methodology is described in detail in Chapter 3. Data are compiled in tables to indicate when each cap would have been reached, and how many Chinook would have been 'saved' had the cap been in place. The pollock catch that would have been forgone, had the cap been in place, is summarized separately in Chapter 10.

The approach used to evaluate the impacts of hard cap alternatives and options, for both Chinook salmon and pollock, was to apply the various alternatives to the recent past, from 2003 to 2007. That way the alternatives could be easily compared to Alternative 1, status quo (no hard cap).

As presented in Chapter 3, the treatment of the data involved finding the date when, under the different cap options, salmon bycatch levels would have been reached. With this date, the remaining salmon caught by the fleet (or sector specific levels depending upon the option under investigation) was computed as the sum from that date until the end of the year. For example, to compute the expected number of Chinook that would have been caught given a cap in a given year:

1. Evaluate the cumulative daily bycatch records of Chinook and find the date that the cap was exceeded (e.g., Sept 15);
2. Compute the number of pollock and Chinook that the fleet (or sector) caught from Sept 16 till the end of the season.

Tables indicating the fleet-wide and sector specific amount of salmon saved (in absolute numbers of salmon) were constructed. Corresponding levels of pollock that was forgone under these scenarios is presented in Chapter 10. The impact of the forgone pollock on the pollock population is discussed in Chapter 4.

For evaluating impacts, it is necessary to translate how different catch restrictions may affect salmon stocks. For these analyses, the adult-equivalency (AEQ) of the bycatch was estimated. This is distinguished from the annual bycatch numbers that are recorded by observers and tallied in each year for management purposes. Not all Chinook that is caught as bycatch would otherwise have survived to return as an adult to its spawning stream. The AEQ methodology applies the extensive observer datasets on the length frequencies of Chinook salmon caught in the pollock fishery and convert these to ages, appropriately accounting for the time of year that catch occurred. The age data is coupled with information on the proportion of salmon that return to different river systems at various ages, and the bycatch-at-age data is used to pro-rate how any given year of bycatch affects future potential spawning runs of salmon.

Evaluating impacts to specific stocks was done by using historical scale-pattern analysis (Myers et al.1984, Myers and Rogers 1988, Myers et al. 2003) and preliminary genetics studies from samples collected in 2005-2007 (Seeb et al. 2008, further details are provided in Chapter 3). While sample collection issues exist and different methodologies were employed (scale pattern analyses and genetic analyses), these stock estimates nonetheless provide similar overall proportions of between 54-60% for western Alaska. The consistency of these results from these different methodologies lends credibility to this general estimate. Where possible, historical run sizes were contrasted with AEQ mortality arising from the observed pollock fishery Chinook bycatch to river of origin.

The alternative hard caps and options for season and sector splits affect the anticipated takes of pollock within seasons and areas. This fact was illustrated by analyzing historical fishing patterns (among sectors and by area) with respect to the proposed sector-specific caps. To illustrate this effect, tables were constructed that show how the percentage of bycatch within each of the strata (season, area and sector) would change.

Impacts of Alternatives 2 and 4 are discussed in section 5.3.2 through 5.3.5, and particular attention is devoted to comparing and contrasting impacts between Alternative 4 (PPA) and the range of options analyzed under Alternative 2. Following the comprehensive discussion of Alternatives 1, 2, and 4, a separate section (section 5.3.6) summarizes impacts of Alternative 3 (triggered closures).

5.3.1 Pollock fishery bycatch of Chinook salmon under Alternative 1

Annual bycatch of Chinook salmon in the BSAI groundfish fisheries from 1992–2007 has increased substantially in recent years (Fig. 5-25) with 2007 representing the highest time series with 129,000 Chinook bycatch estimated from all groundfish fisheries. The majority of bycatch of Chinook in BSAI trawl fisheries occurs primarily in the Bering Sea pollock trawl fishery. Bycatch in the pollock fishery has comprised between 64% (in 1994) to 95% (in 2006) of the total Chinook taken in all groundfish fisheries.

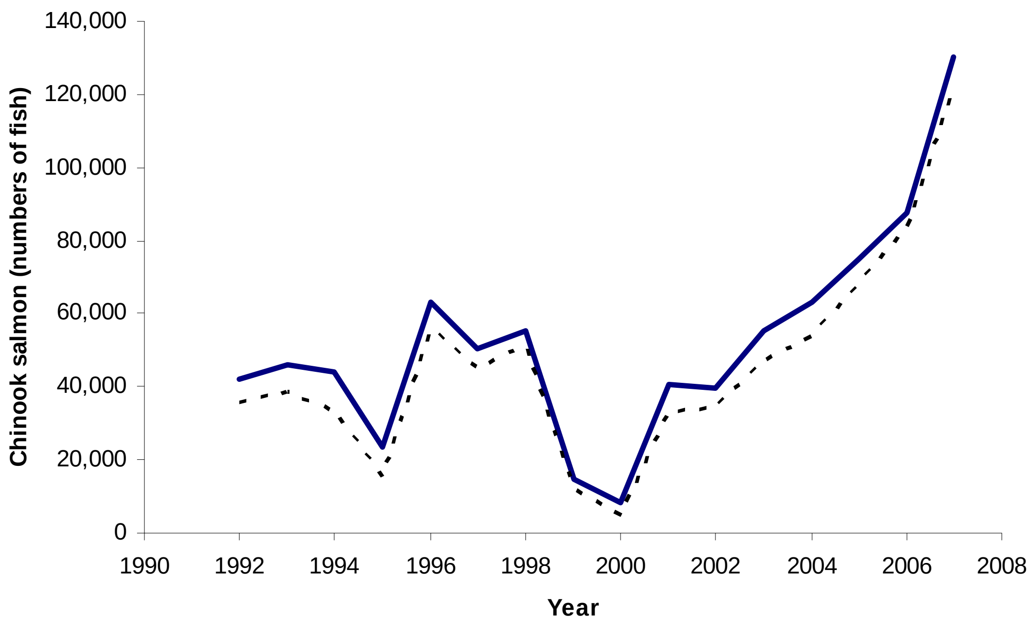


Fig. 5-25 Annual Chinook salmon catch in all BSAI groundfish fisheries (solid line) and pollock trawl fishery only (dotted line) 1992-2007.

Total catch of Chinook bycatch in the pollock fishery reached an historic high in 2007 at 121,638 fish (Fig. 5-26, Table 5-20). Chinook bycatch is taken in both A and B seasons in the pollock fishery. The A season catch in 2007 was the highest historical A season catch at 69,542, while the B season catch was also at an historical high at 52,367 (Table 5-21). Bycatch in the 2008 A season was lower than any year since 2000 (Fig. 5-26, Table 5-21). However, while a positive indication that overall annual bycatch in 2008 may be lower than the high levels of recent years, there have been years where the A season bycatch level did not drive the overall bycatch trend in that year (Fig. 5-26). Specifically, there are years where A season bycatch was low (1997, 1998, 2004, 2005) and B season bycatch of Chinook still led to increased levels from previous years (notably in 1998, 2004, 2005).

Table 5-20 Chinook salmon catch (numbers of fish) in the Bering Sea pollock trawl fishery (all sectors) 1991-2008, CDQ is indicated separately and by season where available. Data retrieval from 9/24/08. 'na' indicates that data were not available in that year.

Year	Annual with CDQ	Annual without CDQ	Annual CDQ only	A season	B season	A season	B season	A season	B season
				With CDQ		Without CDQ		CDQ only	
1991	na	40,906	na	na	na	38,791	2,114	na	na
1992	35,950	na	na	25,691	10,259	na	na	na	na
1993	38,516	na	na	17,264	21,252	na	na	na	na
1994	33,136	30,593	2,543	28,451	4,686	26,871	3,722	1,580	963
1995	14,984	12,978	2,006	10,579	4,405	9,924	3,053	655	1,351
1996	55,623	53,220	2,402	36,068	19,554	34,780	18,441	1,289	1,114
1997	44,909	42,437	2,472	10,935	33,973	9,449	32,989	1,487	985
1998	51,322	46,205	5,118	15,193	36,130	14,253	31,951	939	4,179
1999	11,978	10,381	1,597	6,352	5,627	5,768	4,614	584	1,013
2000	4,961	4,242	719	3,422	1,539	2,992	1,250	430	289
2001	33,444	30,937	2,507	18,484	14,961	16,711	14,227	1,773	734
2002	34,495	32,402	2,093	21,794	12,701	20,378	12,024	1,416	677
2003	46,993	44,428	2,565	33,808	13,185	32,115	12,313	1,693	872
2004	51,696	48,733	2,963	23,093	28,603	21,964	26,769	1,129	1,834
2005	67,363	65,447	1,916	27,346	40,017	26,047	39,400	1,299	617
2006	82,647	80,906	1,741	58,391	24,256	56,806	24,100	1,585	156
2007	121,638	116,009	5,629	69,408	52,230	66,307	49,702	3,101	2,528
2008	17,217	16,577	640	15,475	1,715	14,871	1,679	604	36

Table 5-21 Chinook bycatch by sector for the Bering Sea pollock fleet, 1991-2008 as of August 23, 2008.

	A-season			A	B-season			B	Annual
YEAR	M	P	S	Total	M	P	S	Total	Total
1991	9,001	17,645	10,192	36,838	152	397	1,667	2,216	39,054
1992	4,057	12,631	6,725	23,413	1,766	6,889	1,604	10,259	33,672
1993	3,529	8,869	3,017	15,415	6,657	11,932	2,615	21,204	36,619
1994	1,790	17,149	8,346	27,285	572	2,826	1,207	4,605	31,890
1995	971	5,971	2,040	8,982	667	2,973	781	4,421	13,403
1996	5,481	15,276	15,228	35,985	6,322	3,222	9,944	19,488	55,472
1997	1,561	3,832	4,954	10,347	5,702	5,721	22,550	33,973	44,320
1998	4,284	6,500	4,334	15,118	6,361	2,547	27,218	36,127	51,244
1999	554	2,694	3,103	6,352	374	2,590	2,662	5,627	11,978
2000	19	2,525	878	3,422	253	568	717	1,539	4,961
2001	1,664	8,264	8,555	18,484	1,319	9,863	3,779	14,961	33,444
2002	1,976	9,481	10,336	21,794	1,755	1,386	9,560	12,701	34,495
2003	2,892	14,428	16,488	33,808	1,940	4,044	7,202	13,185	46,993
2004	2,092	9,492	12,376	23,961	2,076	4,289	23,701	30,067	54,028
2005	2,111	11,421	14,097	27,630	888	4,343	34,986	40,217	67,847
2006	5,408	17,306	36,039	58,753	200	1,551	22,654	24,405	83,159
2007	5,860	27,943	35,458	69,261	3,544	7,148	41,751	52,443	121,704

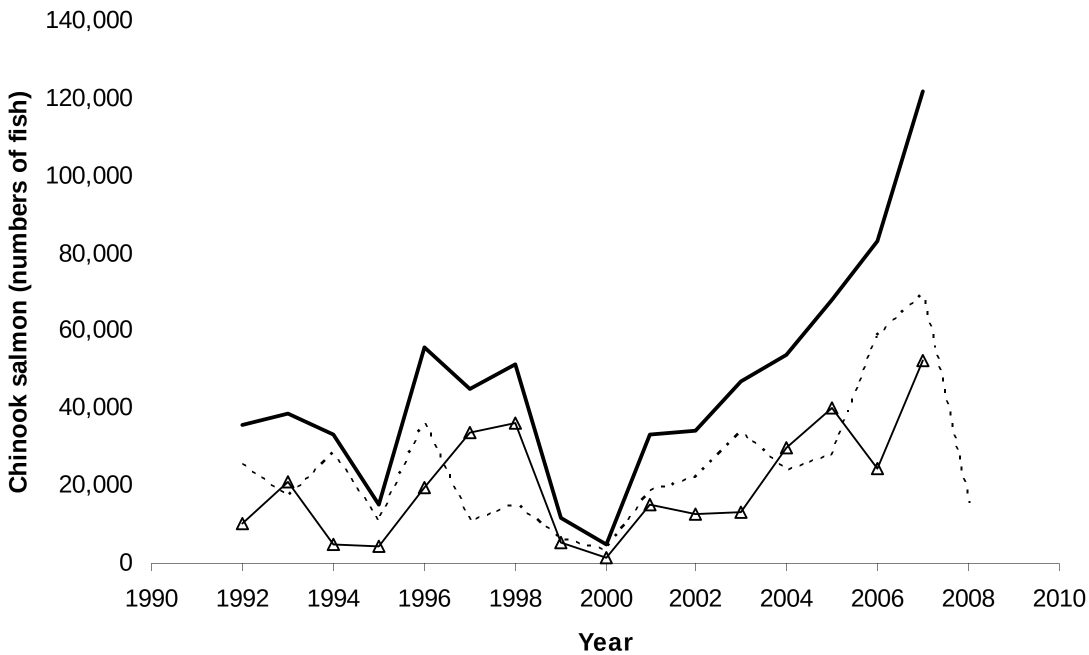


Fig. 5-26 Chinook salmon catch in pollock trawl fishery: annually 1992-2007 (solid line), A season 1992-2008 (dotted line), and B season 1992-2007 (triangles).

Spatially bycatch varies by season and year. For example, from 2005-2007 the pattern of Chinook bycatch shows how quickly hot-spots can be occur and how irregular they are in both time and space (Fig. 5-27 through Fig. 5-30). The pattern for B-season Chinook bycatch rates as a whole is shown in Fig. 5-31. Within years, the seasonal patterns of bycatch rates are highest later in the B-season while for the A-season, the rates are generally lower and show no particular trend early or late in the season (Fig. 5-32)

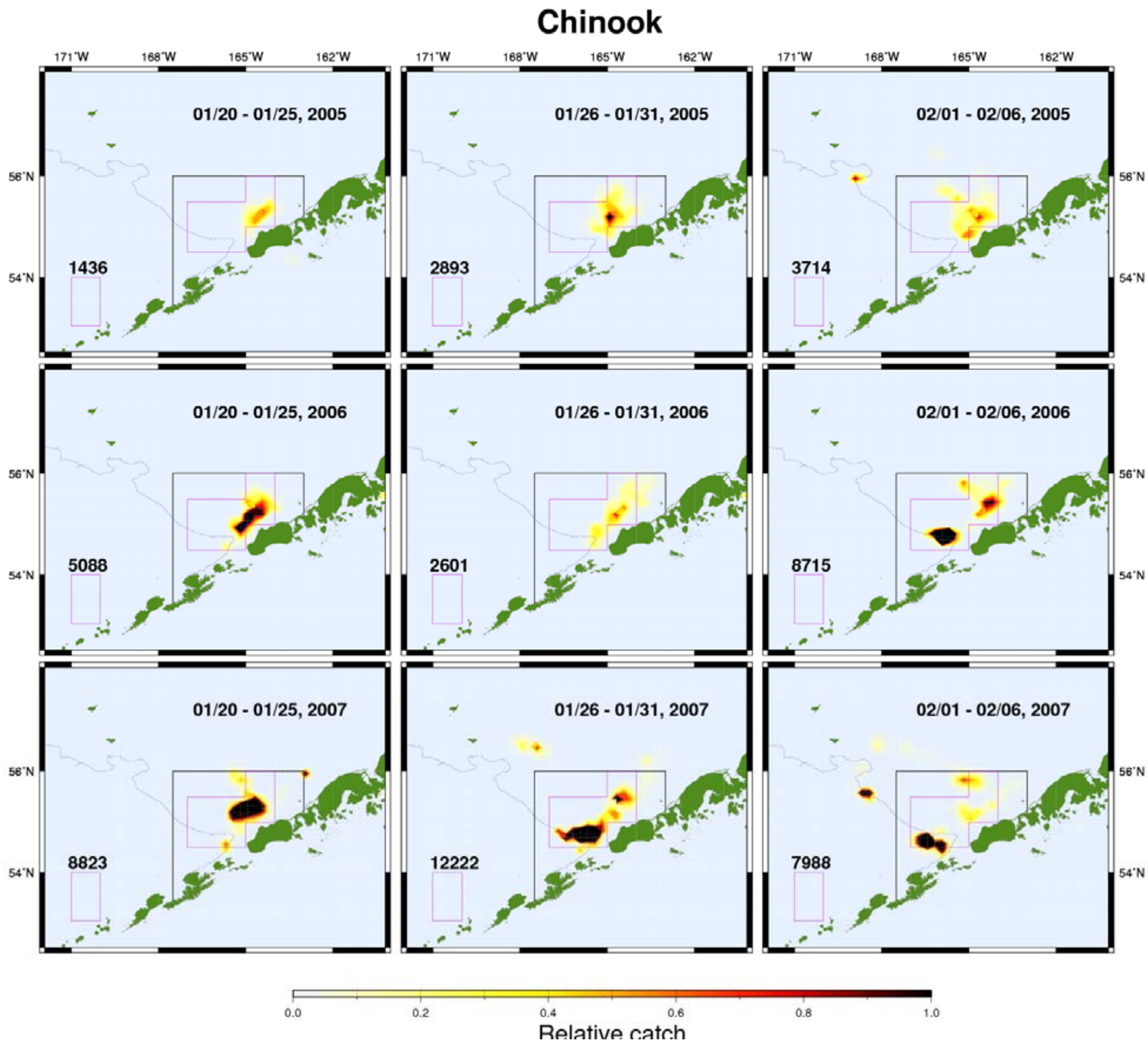


Fig. 5-27 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting Jan 20th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

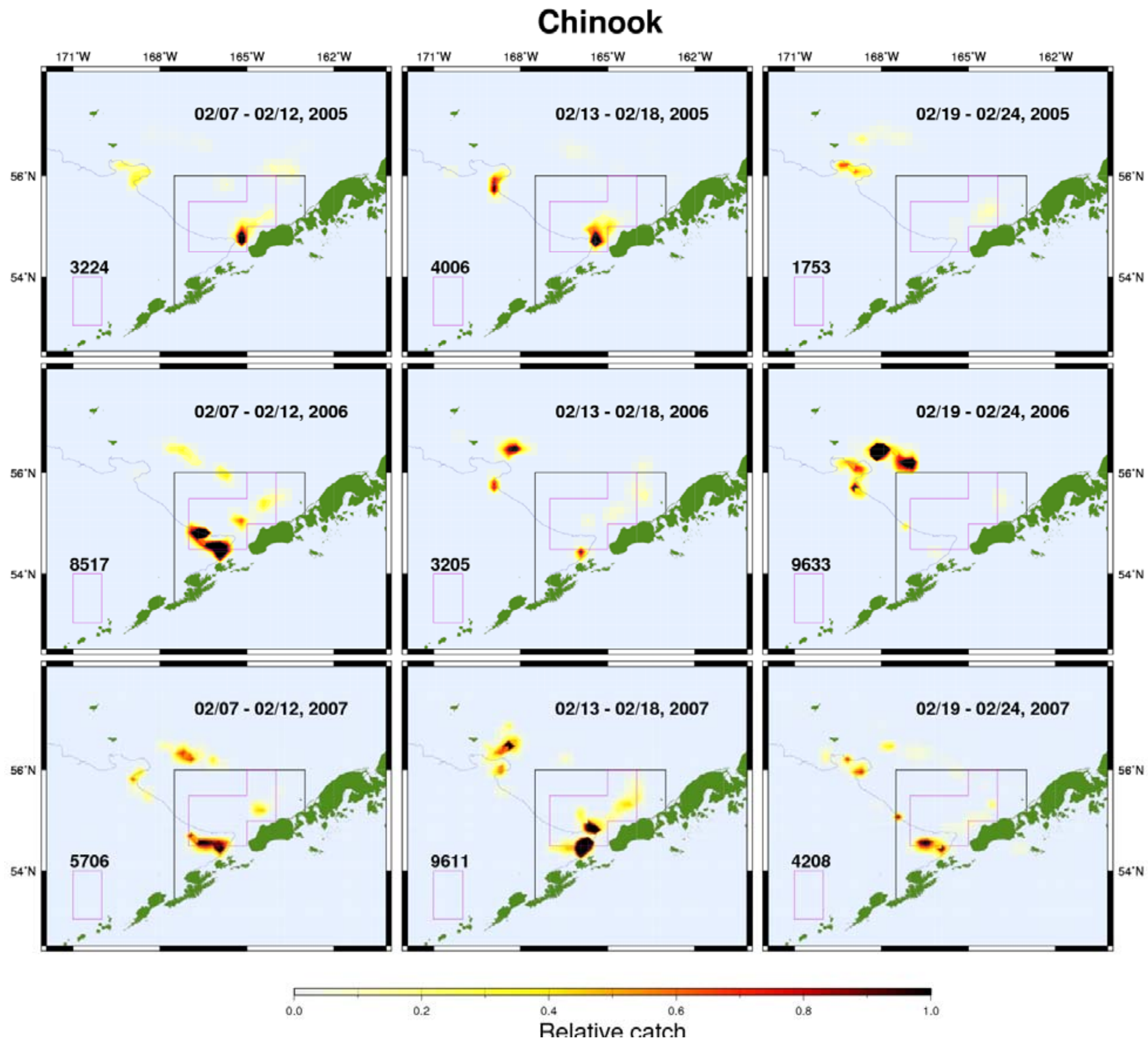


Fig. 5-28 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting Feb 7th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

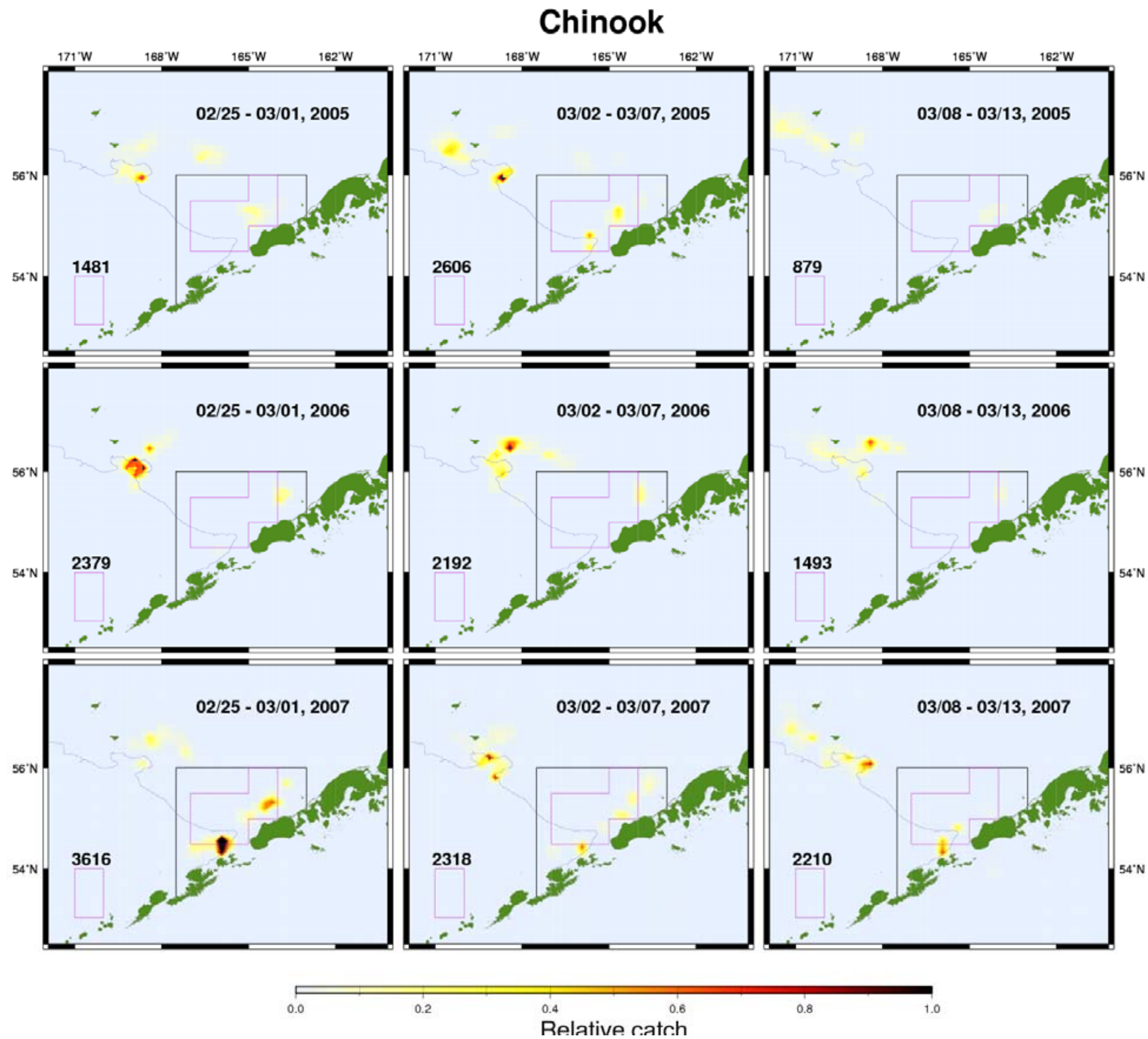


Fig. 5-29 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting Feb 25th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

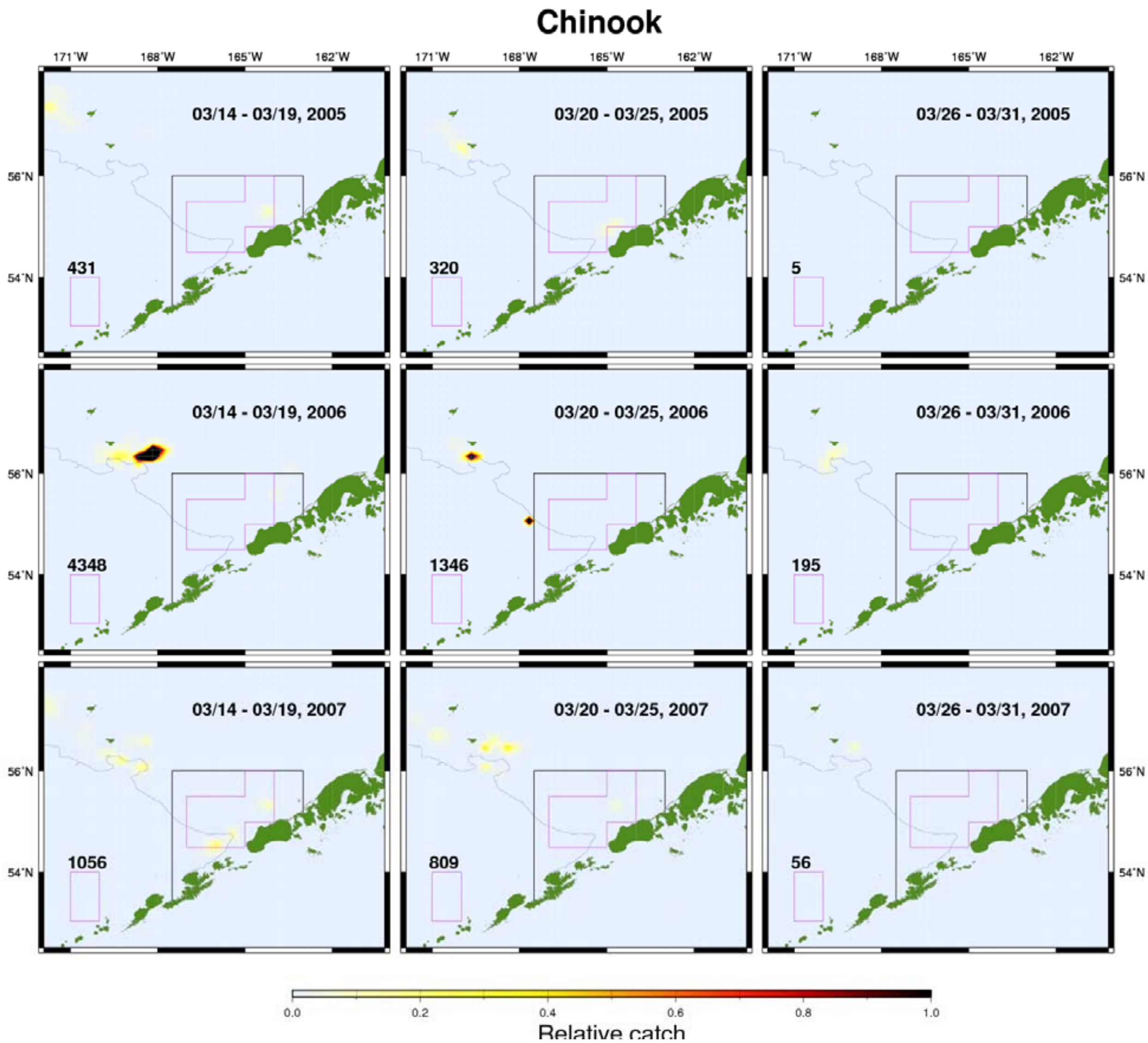


Fig. 5-30 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting March 14th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

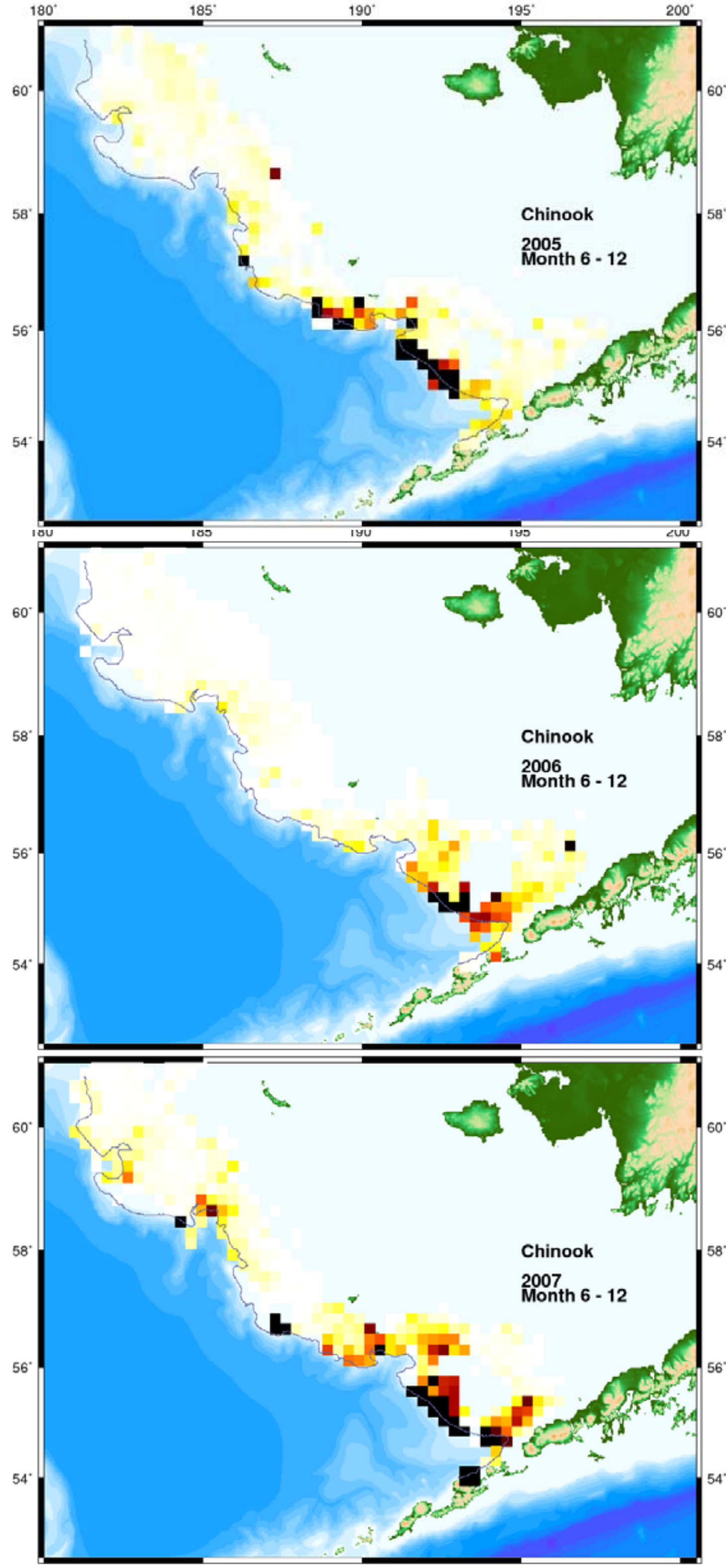


Fig. 5-31 Chinook salmon bycatch rates (darker colors mean higher numbers of Chinook / t of pollock) in the EBS pollock fishery for 2005-2007 B-season.

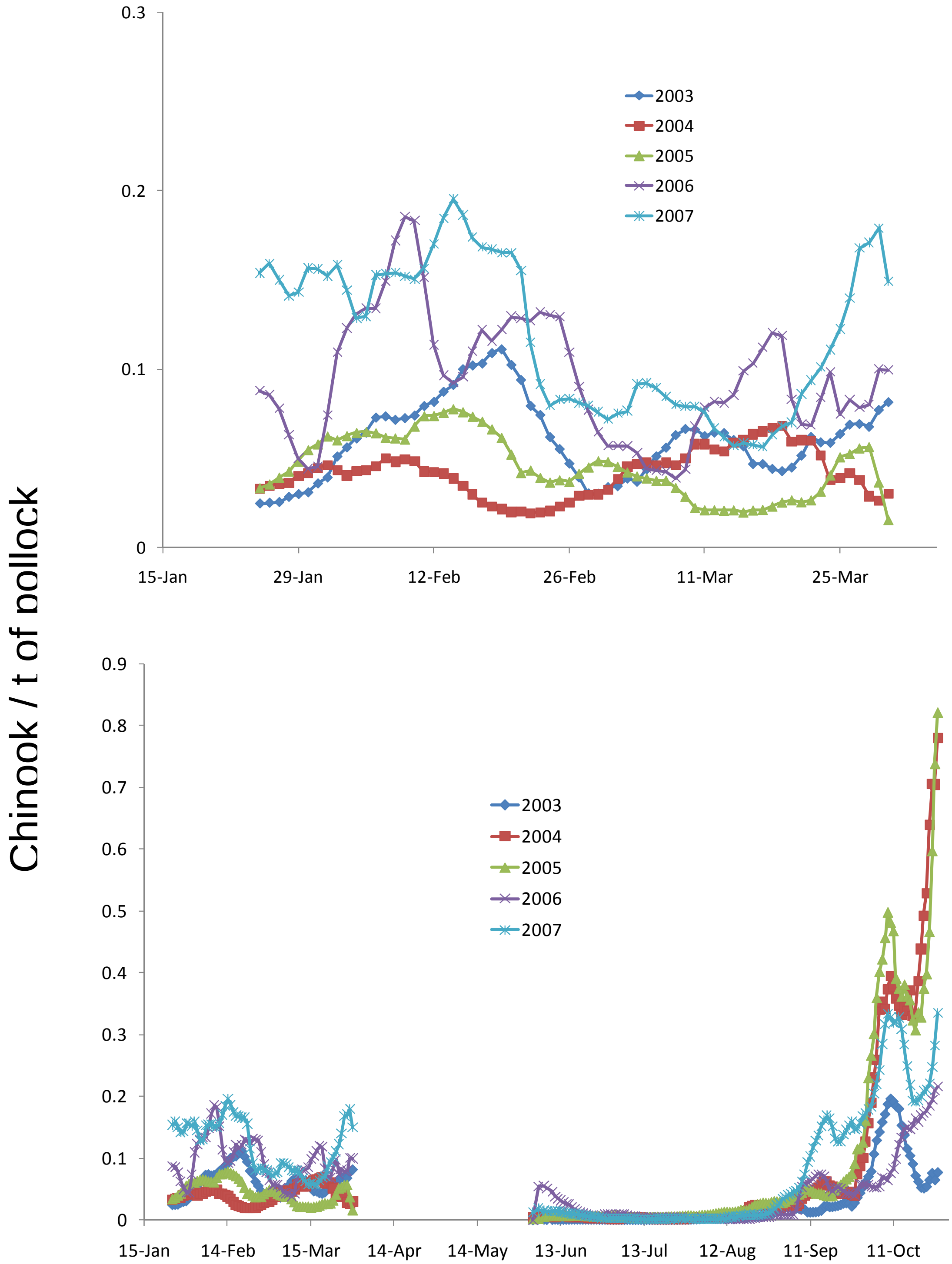


Fig. 5-32 Seasonal trends in Chinook bycatch rates (number / t) for the A-season (top) and for the entire year (bottom) 2003-2007.

To better characterize why bycatch levels vary, it is important to consider patterns in the level of fishing effort. Based on NMFS observer data where tow-duration is considered reliably recorded for the pollock fleet, a measure of total hours towed increased by about 20% in 2006 and 2007. This compares with a nearly three-fold increase in the levels of Chinook bycatch (Fig. 5-9). This suggests that other factors may also be affecting the bycatch levels. Alternative factors may include increased numbers of Chinook found on the pollock fishing grounds due to run-sizes or environmental conditions. Changes in fishing gear depth were examined to be similar through this period. Anecdotally, trawl gear (dimensions, net material etc) has changed over time but information on this is unavailable for analysis. Seasonally, for the period 1991-2007 February averages to be the highest month of bycatch in the pollock fishery even though the average tow duration is relative low whereas October tends to be the second-highest month when bycatch occurs and is also when the average tow duration is the highest (Fig. 5-10). Over time, tow duration in October has steadily increased (Fig. 5-11).

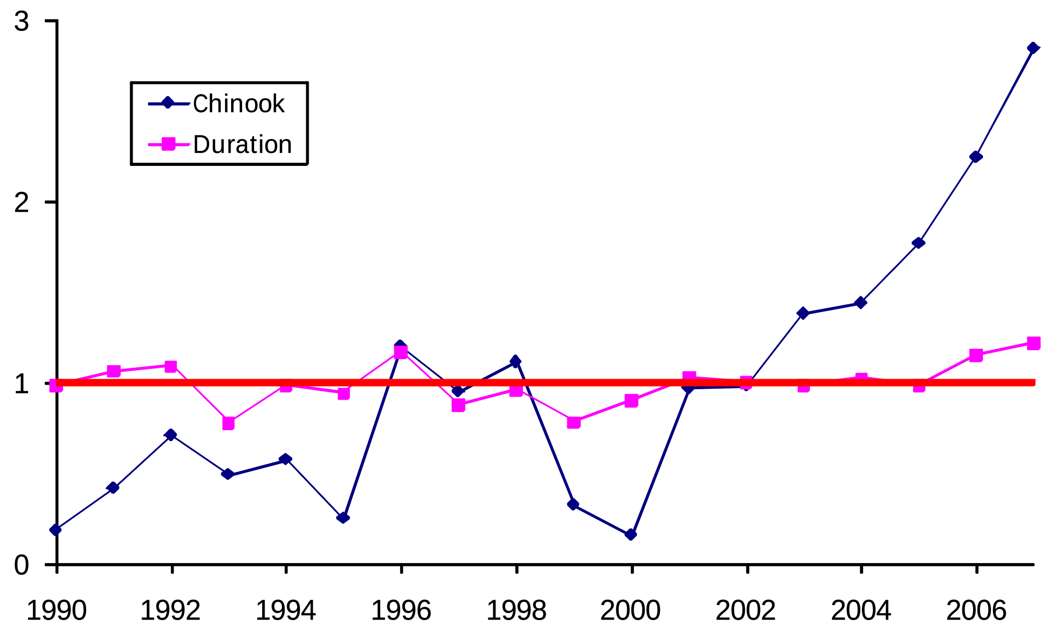


Fig. 5-33 Standardized (to have mean values of 1) relative Chinook catch and pollock fishing effort (annual total hours spent towing).

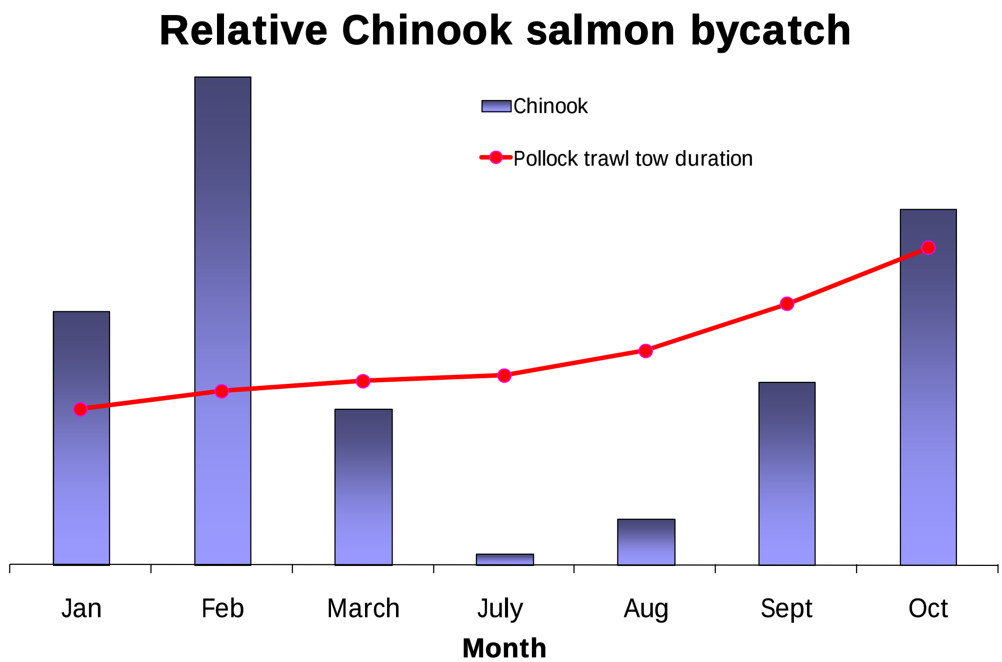


Fig. 5-34 Average relative Chinook bycatch (columns) and tow duration (marked line) by month based on NMFS observer data, 1991-2007.

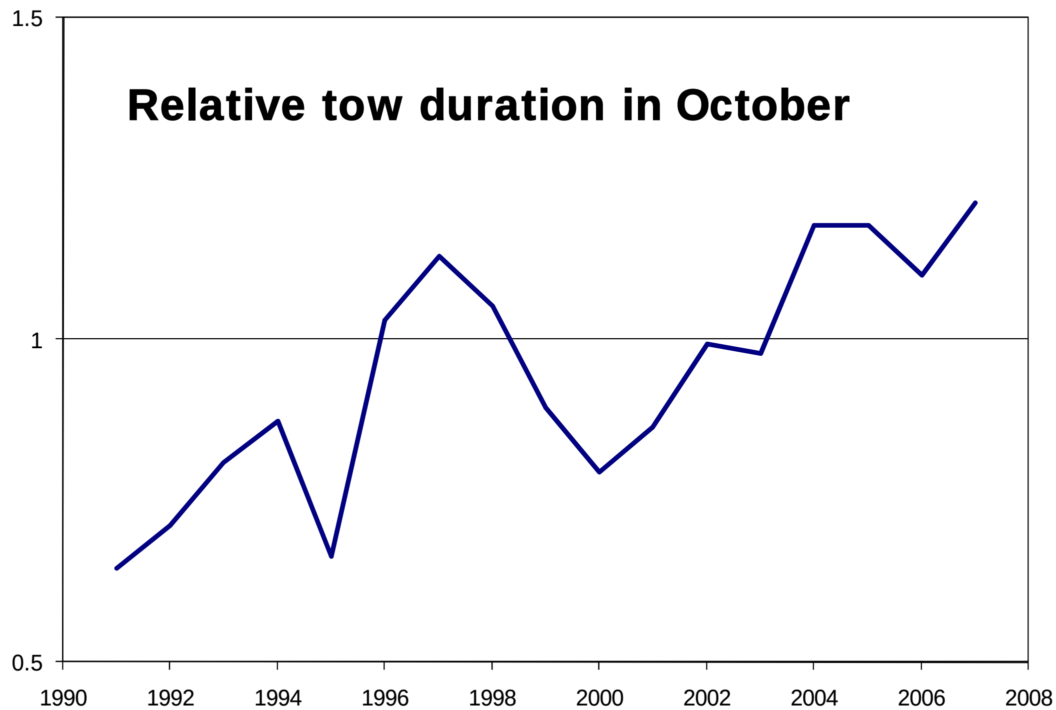


Fig. 5-35 Average relative tow duration (scaled to have mean value of 1.0) for October based on NMFS observer data, 1991-2007.

5.3.1.1 Pollock fishery bycatch of Chinook by sector

Bycatch of Chinook varies seasonally by season and by sector (Fig. 5-36 and Fig. 5-37; Table 5-21). Since 2002 the inshore CV fleet has consistently had the highest bycatch by sector in the A season, but prior to that offshore catcher processor catch was higher on an seasonal basis (Fig. 5-36). Catch by the mothership sector in the A season has always been lower than the other two sectors.

Similarly in the B season, historically the inshore CV fleet has had the highest bycatch by sector since 1996 (except for 2001), followed by the offshore CP fleet (Fig. 5-37). As with the A season, historically the mothership fleet sector catch compared to the total has been low.

In recent years, rates for the inshore catcher vessel fleet have been consistently higher than for the other fleets (Fig. 5-38; Table 5-23). Interestingly while total catch for the mothership fleet was lower than the CP fleet in 2006, their relative rate was higher (Fig. 5-38). In the B season, the inshore fleet has the highest bycatch rates followed consistently in almost all years by the mothership fleet (Fig. 5-39).

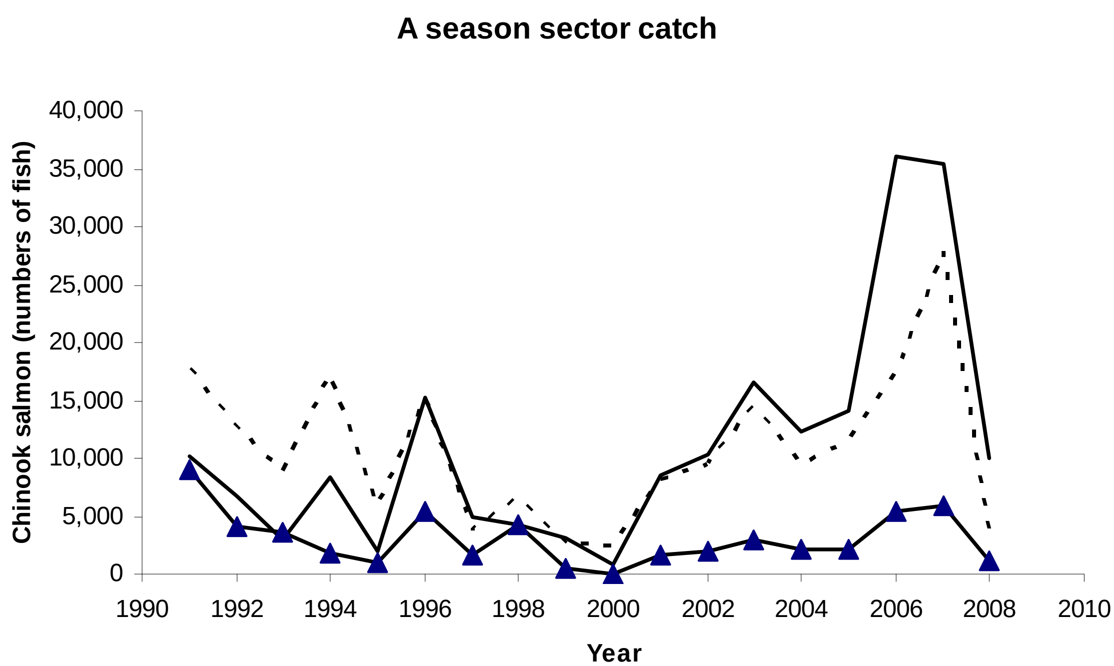


Fig. 5-36 Chinook salmon catch by sector in pollock fishery A season 1991-2007. Data are shown by inshore catcher vessel sector (solid line), offshore catcher processor (dotted line with diamonds) and mothership sector (solid line with triangles).

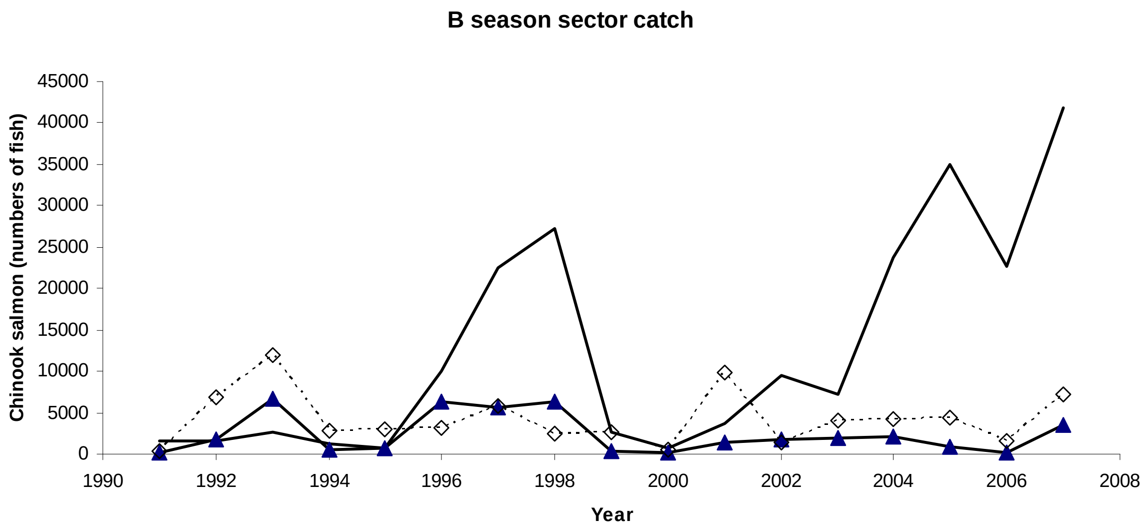


Fig. 5-37 Chinook salmon catch by sector in pollock fishery B season 1991-2007. Data are shown by inshore catcher vessel sector (solid line), offshore catcher processor (dotted line with diamonds) and mothership sector (solid line with triangles).

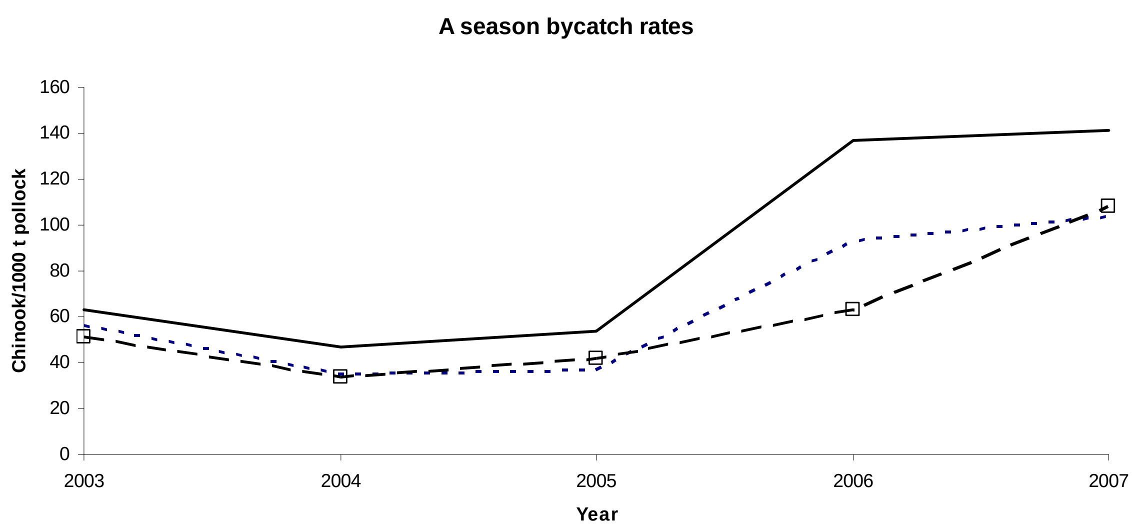


Fig. 5-38 A season bycatch rates by sector (Chinook/1000 t pollock). Inshore catcher vessel (solid line), offshore catch processor (dashed line with squares) and mothership sector (dotted line), 2003-2007.

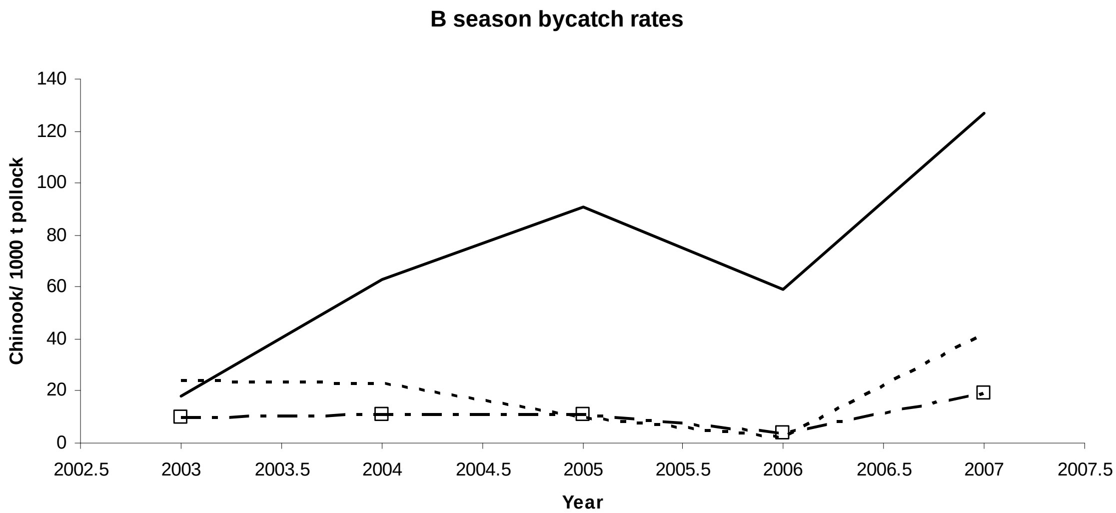


Fig. 5-39 B season bycatch rates by sector (Chinook/1,000 t pollock). Inshore catcher vessel (solid line), offshore catch processor (dashed line with squares) and mothership sector (dotted line), 2003-2007.

Table 5-22 Catch of pollock and Chinook salmon along with Chinook rate (per 1,000 t of pollock) by sector and season, 2003-2007.

Pollock (t)

Season	Year	2003	2004	2005	2006	2007
A	M	51,811	60,222	57,802	58,134	56,526
	P	280,505	275,625	273,977	274,279	257,647
	S	260,212	262,570	259,002	262,997	250,726
A	Sub-total	592,528	598,417	590,780	595,410	564,899
B	M	80,817	90,736	89,225	89,303	84,978
	P	413,512	401,570	403,537	405,586	372,737
	S	393,550	378,855	386,473	381,981	327,962
B	Sub-total	887,879	871,160	879,236	876,870	785,677
	Annual Total	1,480,408	1,469,577	1,470,016	1,472,280	1,350,576

Chinook bycatch

	Year	2003	2004	2005	2006	2007
A	M	2,892	2,092	2,111	5,408	5,860
	P	14,428	9,492	11,421	17,306	27,943
	S	16,488	12,376	14,097	36,039	35,458
A	Sub-total	33,808	23,961	27,630	58,753	69,261
B	M	1,940	2,076	888	200	3,544
	P	4,044	4,289	4,343	1,551	7,148
	S	7,202	23,701	34,986	22,654	41,751
B	Sub-total	13,185	30,067	40,217	24,405	52,443
	Annual Total	46,993	54,028	67,847	83,159	121,704

Chinook / 1,000 t of pollock

	Year	2003	2004	2005	2006	2007	Mean
A	M	56	35	37	93	104	65
	P	51	34	42	63	108	59
	S	63	47	54	137	141	88
	A-season average	57	40	47	99	123	73
B	M	24	23	10	2	42	20
	P	10	11	11	4	19	11
	S	18	63	91	59	127	70
	B-season average	15	35	46	28	67	37
	Average	32	37	46	56	90	52

Table 5-23 Sector and season specific bycatch rate (Chinook / t of pollock) relative to the mean value for the A and B seasons (first 6 rows) and for the entire year (last three rows), 2003-2007.

Season	Year	2003	2004	2005	2006	2007
A	M	98%	87%	78%	94%	85%
	P	90%	86%	89%	64%	88%
	S	111%	118%	116%	139%	115%
B	M	162%	66%	22%	8%	62%
	P	66%	31%	24%	14%	29%
	S	123%	181%	198%	213%	191%
A+B	M	115%	75%	44%	67%	74%
	P	84%	55%	50%	49%	62%
	S	114%	153%	165%	161%	148%

5.3.2 Impacts of Alternative 2 on bycatch levels

5.3.2.1 Fleetwide cap

Alternative 2 contains a wide range of options for prescribing various allocations of salmon bycatch (fleet-wide or by various sector-specific options). As described in Chapter 2, unless the Council chooses sector-specific allocation of the salmon bycatch cap, the cap would be fleetwide and thus divided between the CDQ fleet and the remaining sectors aggregated together. To examine the impact of a fleetwide cap, using the subset range of caps for analysis, constraint tables are provided which indicate hypothetical closure dates by year and season for the range of cap levels and seasonal allocations (Table 5-24). Here a rollover from A to B season of unused salmon was not evaluated thus the constraint in seasonal allocation such as 70/30 is more pronounced than if a rollover were included.

The 70/30 seasonal distribution is more constraining than other seasonal distribution options in the B season, both at the fleet-level as well as when subdivided and applied at the sector level. The combination of seasonal plus sector splits exerts a combined effect to magnify many sector-specific impacts. For instance, while the CDQ seasonal distribution options alone do not generally constrain the CDQ sector, seasonal distribution options combined with sector allocation options have an impact on the CDQ fleet even at the highest cap. For example, Option 2a sector split for CDQ (3%) combined with either a 50/50 A/B split or 58/42 A/B split constrains the CDQ fleet in the A season in 3 of the 5 years considered.

Table 5-24 Hypothetical closure dates by year and season under Chinook bycatch cap options for fleet-wide caps (CDQ receives 7.5% of the Chinook cap)

Fleet-wide caps			A season					B season				
A/B Split	Cap	Sect	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
50/50	87,500	CDQ	---	---	---	---	---	---	---	---	---	---
		NonCDQ	---	---	---	22-Feb	9-Feb	---	---	---	---	25-Oct
	68,100	CDQ	---	---	---	---	5-Mar	---	---	---	---	---
		NonCDQ	26-Mar	---	---	14-Feb	2-Feb	---	---	21-Oct	---	18-Oct
	48,700	CDQ	---	---	---	---	22-Feb	---	---	---	---	17-Oct
		NonCDQ	23-Feb	24-Mar	2-Mar	7-Feb	28-Jan	---	20-Oct	6-Oct	25-Oct	8-Oct
	29,300	CDQ	1-Mar	17-Mar	5-Mar	3-Mar	15-Feb	---	19-Sep	---	---	10-Oct
		NonCDQ	12-Feb	28-Feb	11-Feb	3-Feb	24-Jan	---	30-Sep	23-Sep	6-Oct	26-Sep
58/42	87,500	CDQ	---	---	---	---	---	---	---	---	---	---
		NonCDQ	---	---	---	28-Feb	14-Feb	---	---	24-Oct	---	20-Oct
	68,100	CDQ	---	---	---	---	14-Mar	---	---	---	---	19-Oct
		NonCDQ	---	---	---	19-Feb	6-Feb	---	27-Oct	10-Oct	---	12-Oct
	48,700	CDQ	---	---	---	---	26-Feb	---	29-Sep	---	---	15-Oct
		NonCDQ	7-Mar	---	22-Mar	9-Feb	30-Jan	---	12-Oct	2-Oct	17-Oct	4-Oct
	29,300	CDQ	5-Mar	---	15-Mar	8-Mar	16-Feb	---	15-Sep	---	---	8-Oct
		NonCDQ	15-Feb	4-Mar	15-Feb	4-Feb	25-Jan	13-Oct	25-Sep	16-Sep	30-Sep	19-Sep
70/30	87,500	CDQ	---	---	---	---	---	---	---	---	---	18-Oct
		NonCDQ	---	---	---	22-Mar	25-Feb	---	24-Oct	8-Oct	---	10-Oct
	68,100	CDQ	---	---	---	---	---	---	29-Sep	---	---	15-Oct
		NonCDQ	---	---	---	24-Feb	12-Feb	---	12-Oct	2-Oct	17-Oct	4-Oct
	48,700	CDQ	---	---	---	---	5-Mar	---	19-Sep	---	---	10-Oct
		NonCDQ	26-Mar	---	---	14-Feb	2-Feb	---	30-Sep	23-Sep	6-Oct	26-Sep
	29,300	CDQ	15-Mar	---	---	17-Mar	19-Feb	19-Sep	9-Sep	---	---	2-Oct
		NonCDQ	18-Feb	12-Mar	21-Feb	6-Feb	26-Jan	4-Oct	11-Sep	3-Sep	18-Sep	12-Sep

For the non-CDQ fleet, the fleet would have been constrained in 2006 and 2007 regardless of seasonal distribution of the cap, but the magnitude of the impact varies greatly depending upon when in the A season the fleet is constrained. Table 5-25 projects what Chinook bycatch would have been under the range of caps and seasonal allocations under consideration. For example, in 2006 under the 70/30 allocation, the non-CDQ fleet would have been constrained on March 22nd with forgone pollock of 1,079 mt, whereas with a 50/50 A/B split on the same cap (87,500), the fleet would have been constrained February 22nd, resulting in forgone pollock of 176,014 mt (Table 5-25; Chapter 10).

For overall catches of Chinook, 2007 illustrates the importance of the seasonal allocation option. The non-CDQ fleet is constrained under every seasonal split in both A and B seasons, and the CDQ fleet is constrained in the B season under a 70/30 split. Under the 87,500 cap, projected catches of Chinook in that year would have ranged from 70,367 (50/50 split) to 80,251 (70/30 split). In all cases, projected catch of Chinook under the various seasonal allocation scenarios would have been less than the cap level, because of the relative seasonal constraints on the fleet (Table 5-25).

Table 5-25 Hypothetical Chinook catches, in numbers of fish, from 2003-2007 for fleet wide (with 7.5% designated to CDQ) had different hard caps been in place.

Seas	Cap	Sector	2003			2004			2005			2006			2007		
			50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	1,693	1,693	1,693	1,140	1,140	1,140	1,296	1,296	1,296	1,580	1,580	1,580	3,091	3,091	3,091
		NonCDQ	32,115	32,115	32,115	22,821	22,821	22,821	26,377	26,377	26,377	34,356	45,019	55,427	31,618	41,159	55,903
	87,500 Total		33,808	33,808	33,808	23,961	23,961	23,961	27,673	27,673	27,673	35,936	46,599	57,007	34,709	44,250	58,994
	68,100	CDQ	1,693	1,693	1,693	1,140	1,140	1,140	1,296	1,296	1,296	1,580	1,580	1,580	2,414	2,879	3,091
		NonCDQ	30,226	32,115	32,115	22,821	22,821	22,821	26,377	26,377	26,377	29,090	34,356	34,356	20,939	31,618	41,159
	68,100 Total		31,919	33,808	33,808	23,961	23,961	23,961	27,673	27,673	27,673	30,670	35,936	35,936	23,353	34,497	44,250
	48,700	CDQ	1,693	1,693	1,693	1,140	1,140	1,140	1,296	1,296	1,296	1,580	1,580	1,580	1,309	1,926	2,414
		NonCDQ	21,874	24,434	30,226	22,027	22,821	22,821	20,680	25,913	26,377	14,248	14,248	29,090	20,939	20,939	20,939
	48,700 Total		23,567	26,127	31,919	23,167	23,961	23,961	21,976	27,209	27,673	15,828	15,828	30,670	22,248	22,865	23,353
	29,300	CDQ	1,098	1,098	1,537	1,033	1,140	1,140	1,096	1,246	1,296	653	1,129	1,340	502	502	1,309
		NonCDQ	10,188	15,445	15,445	13,195	13,195	16,558	9,160	13,655	18,218	8,446	14,248	14,248	1,492	1,492	1,492
	29,300 Total		11,286	16,543	16,982	14,228	14,335	17,698	10,256	14,901	19,514	9,099	15,377	15,588	1,994	1,994	2,801
B	87,500	CDQ	872	872	872	1,826	1,826	1,826	637	637	637	157	157	157	2,529	2,529	1,235
		NonCDQ	12,313	12,313	12,313	28,241	28,241	23,133	39,580	31,531	23,771	24,248	24,248	24,248	33,134	33,134	20,022
	87,500 Total		13,185	13,185	13,185	30,067	30,067	24,959	40,217	32,168	24,408	24,405	24,405	24,405	35,663	35,663	21,257
	68,100	CDQ	872	872	872	1,826	1,826	1,294	637	637	637	157	157	157	2,529	1,235	1,235
		NonCDQ	12,313	12,313	12,313	28,241	23,133	16,979	30,136	23,771	17,082	24,248	24,248	16,873	27,361	20,022	14,178
	68,100 Total		13,185	13,185	13,185	30,067	24,959	18,273	30,773	24,408	17,719	24,405	24,405	17,030	29,890	21,257	15,413
	48,700	CDQ	872	872	872	1,826	1,294	1,041	637	637	637	157	157	157	1,235	1,235	777
		NonCDQ	12,313	12,313	12,313	21,007	16,979	11,347	17,082	17,082	11,389	20,632	16,873	11,206	20,022	14,178	12,337
	48,700 Total		13,185	13,185	13,185	22,833	18,273	12,388	17,719	17,719	12,026	20,789	17,030	11,363	21,257	15,413	13,114
	29,300	CDQ	872	872	494	1,041	721	392	637	637	637	157	157	157	777	777	527
		NonCDQ	12,313	10,845	7,699	11,347	11,347	7,843	11,389	9,618	7,889	11,206	11,206	7,152	12,337	9,486	5,261
	29,300 Total		13,185	11,717	8,193	12,388	12,068	8,235	12,026	10,255	8,526	11,363	11,363	7,309	13,114	10,263	5,788

5.3.2.2 Sector-specific bycatch levels

Chapter 4, Table 4-1 through Table 4-3 present the relative closure dates for all sector allocation options examined under Alternative 2. Following the estimation of closure dates, the annual amount of bycatch by sector, under each option, is tabulated as well as the relative salmon "saved" by virtue of the sector being closed out of fishing at that time to the remainder of the season (Table 5-26 to Table 5-30). The latter is presented as a percentage reduction in bycatch compared to actual catch in those years.

Overall, for the years examined (2003-2007), the inshore CV sector is most impacted by sector split constraints in general, and particularly in the A season. Under the PPA (Alternative 4) in high bycatch years (2006 and 2007), Mothership, C/P and CV sectors are all constrained in the A season. Of the three sectors, the Mothership and CV sectors tend to reach their caps sooner in the A season than the C/P fleet under the PPA. For the other alternative scenarios examined under Alternative 2, the offshore C/P fleet experiences the next most significant constraint by sector after CVs, under all options. For the inshore CV fleet, Option 2a sector split (CV allocation is 70%) provides the greatest relief in most years, but still results in a constraint in recent years (2006, 2007) depending upon the seasonal allocation. Under the 70/30 A/B split and the Option 2a allocation. the inshore CV fleet is unconstrained in the A season except in 2007, but constrained in 4 of 5 years in the B season (Table 4-1 through Table 4-3).

For the CP fleet, Option 1 provides the highest allocation (36% CP allocation) with Option 2d providing the next highest at 28.5%. Option 2a is the most constraining for the fleet, constraining in 3 out of 5 years in the A season even in years of low bycatch, particularly when the seasonal allocation is established as 50/50 A/B distribution (Table 4-1 through Table 4-3).

For the mothership fleet and CDQ fleets, Option 2a is the most constraining sector split option. This provides allocations of 6% to the mothership sector and 3% to the CDQ Program. The mothership sector would have been constrained in the A season in 2006 and 2007 even at the highest cap level (Table 4-1 through Table 4-3). In this instance, the sector allocations themselves are the driving aspect for impacts, with the seasonal distributions playing a less important role.

While year to year variability is evident, and individual years are at times inconsistent with general trends, the relative degree of impact of the cap level is more pronounced for all sectors when moving from a cap threshold of 68,100 to 48,700. This is particularly true in evaluating the differences in constraint between cap levels under PPA1 and PPA2. The PPA scenarios are evaluated in Section 5.3.3.

Table 5-26 Hypothetical Chinook bycatch levels and relative reduction from observed Chinook bycatch under different options for sector and season specific caps for 2003. Chinook salmon bycatch provided in numbers of fish.

2003			opt1 (AFA)			opt2a			opt2d			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	1,693	1,693	1,693	1,098	1,362	1,693	1,693	1,693	1,693	---	---	---	35%	20%	---	---	---	---
		M	2,578	2,578	2,578	2,578	2,578	2,578	2,578	2,578	2,578	---	---	---	---	---	---	---	---	---
		P	13,049	13,049	13,049	6,731	10,184	12,164	12,164	13,049	13,049	---	---	---	48%	22%	7%	7%	---	---
		S	16,488	16,488	16,488	16,488	16,488	16,488	16,488	16,488	16,488	---	---	---	---	---	---	---	---	---
	87,500 Total		33,808	33,808	33,808	26,894	30,612	32,923	32,923	33,808	33,808	---	---	---	20%	9%	3%	3%	---	---
	68,100	CDQ	1,693	1,693	1,693	964	1,098	1,362	1,693	1,693	1,693	---	---	---	43%	35%	20%	---	---	---
		M	2,578	2,578	2,578	1,976	2,175	2,578	2,377	2,578	2,578	---	---	---	23%	16%	---	8%	---	---
		P	12,164	13,049	13,049	6,731	6,731	6,731	6,731	10,184	13,049	7%	---	---	48%	48%	48%	48%	22%	---
		S	14,985	16,488	16,488	16,488	16,488	16,488	16,488	16,488	16,488	9%	---	---	---	---	---	---	---	---
	68,100 Total		31,421	33,808	33,808	26,158	26,491	27,158	27,288	30,943	33,808	7%	---	---	23%	22%	20%	19%	8%	---
	48,700	CDQ	1,693	1,693	1,693	475	475	964	1,537	1,693	1,693	---	---	---	72%	72%	43%	9%	---	---
		M	2,175	2,377	2,578	1,412	1,412	1,976	1,737	2,069	2,377	16%	8%	---	45%	45%	23%	33%	20%	8%
		P	6,731	6,731	12,164	4,136	4,136	6,731	6,731	6,731	6,731	48%	48%	7%	68%	68%	48%	48%	48%	48%
		S	9,952	12,669	14,985	16,488	16,488	16,488	13,574	14,985	16,488	40%	23%	9%	---	---	---	18%	9%	---
	48,700 Total		20,551	23,470	31,421	22,510	22,510	26,158	23,579	25,478	27,288	39%	31%	7%	33%	33%	23%	30%	25%	19%
	29,300	CDQ	1,362	1,693	1,693	236	475	475	862	1,098	1,098	20%	---	---	86%	72%	72%	49%	35%	35%
		M	969	1,412	1,737	666	969	969	969	969	1,412	62%	45%	33%	74%	62%	62%	62%	62%	45%
		P	4,136	4,136	6,731	2,104	2,104	4,136	4,136	4,136	4,136	68%	68%	48%	84%	84%	68%	68%	68%	68%
		S	5,083	7,303	7,303	9,952	11,197	13,574	7,303	7,303	11,197	69%	56%	56%	40%	32%	18%	56%	56%	32%
	29,300 Total		11,550	14,544	17,464	12,959	14,745	19,154	13,270	13,506	17,843	66%	57%	48%	62%	56%	43%	61%	60%	47%
B	87,500	CDQ	872	872	872	872	872	777	872	872	872	---	---	---	---	---	11%	---	---	---
		M	1,829	1,829	1,829	1,829	1,829	1,502	1,829	1,829	1,829	---	---	---	---	---	18%	---	---	---
		P	3,283	3,283	3,283	3,283	3,283	3,283	3,283	3,283	3,283	---	---	---	---	---	---	---	---	---
		S	7,202	7,202	7,202	7,202	7,202	7,202	7,202	7,202	7,202	---	---	---	---	---	---	---	---	---
	87,500 Total		13,185	13,185	13,185	13,185	13,185	12,763	13,185	13,185	13,185	---	---	---	---	---	3%	---	---	---
	68,100	CDQ	872	872	872	872	815	494	872	872	872	---	---	---	---	7%	43%	---	---	---
		M	1,829	1,829	1,829	1,829	1,502	790	1,829	1,829	1,502	---	---	---	---	18%	57%	---	---	18%
		P	3,283	3,283	3,283	3,283	3,283	3,283	3,283	3,283	3,283	---	---	---	---	---	---	---	---	---
		S	7,202	7,202	7,202	7,202	7,202	7,202	7,202	7,202	7,202	---	---	---	---	---	---	---	---	---
	68,100 Total		13,185	13,185	13,185	13,185	12,801	11,768	13,185	13,185	12,858	---	---	---	---	3%	11%	---	---	2%
	48,700	CDQ	872	872	872	685	494	77	872	872	872	---	---	---	21%	43%	91%	---	---	---
		M	1,829	1,829	790	790	790	790	1,733	1,502	790	---	---	57%	57%	57%	57%	5%	18%	57%
		P	3,283	3,283	3,283	3,283	3,283	2,836	3,283	3,283	3,283	---	---	---	---	---	14%	---	---	---
		S	7,202	7,202	6,139	7,202	7,202	7,202	7,202	7,202	7,202	---	---	15%	---	---	---	---	---	---
	48,700 Total		13,185	13,185	11,084	11,959	11,768	10,904	13,089	12,858	12,146	---	---	16%	9%	11%	17%	1%	2%	8%
	29,300	CDQ	872	872	872	77	77	77	872	777	494	---	---	---	91%	91%	91%	---	11%	43%
		M	790	790	790	790	499	499	790	790	499	57%	57%	57%	57%	73%	73%	57%	57%	73%
		P	3,283	3,283	2,836	2,836	2,386	1,809	3,283	3,283	2,386	---	---	14%	14%	27%	45%	---	---	27%
		S	6,139	4,073	2,206	7,202	7,202	6,139	7,202	6,139	4,073	15%	43%	69%	---	---	15%	---	15%	43%
	29,300 Total		11,084	9,018	6,704	10,904	10,163	8,524	12,146	10,989	7,452	16%	32%	49%	17%	23%	35%	8%	17%	43%

Table 5-27 Hypothetical Chinook bycatch levels and relative reduction from observed Chinook bycatch under different options for sector and season specific caps for 2004. Chinook salmon bycatch provided in numbers of fish.

2004			**opt1(AFA)**			**opt2a**			**opt2d**			**opt1(AFA)**			**opt2a**			**opt2d**		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	1,140	1,140	1,140	1,140	1,140	1,140	1,140	1,140	1,140	---	---	---	---	---	---	---	---	---
		M	1,846	1,846	1,846	1,846	1,846	1,846	1,846	1,846	1,846	---	---	---	---	---	---	---	---	---
		P	8,598	8,598	8,598	8,598	8,598	8,598	8,598	8,598	8,598	---	---	---	---	---	---	---	---	---
		S	12,376	12,376	12,376	12,376	12,376	12,376	12,376	12,376	12,376	---	---	---	---	---	---	---	---	---
	87,500 Total		23,961	23,961	23,961	23,961	23,961	23,961	23,961	23,961	23,961	---	---	---	---	---	---	---	---	---
	68,100	CDQ	1,140	1,140	1,140	779	1,140	1,140	1,140	1,140	1,140	---	---	---	32%	---	---	---	---	---
		M	1,846	1,846	1,846	1,846	1,846	1,846	1,846	1,846	1,846	---	---	---	---	---	---	---	---	---
		P	8,598	8,598	8,598	6,252	7,633	8,598	8,598	8,598	8,598	---	---	---	27%	11%	---	---	---	---
		S	12,376	12,376	12,376	12,376	12,376	12,376	12,376	12,376	12,376	---	---	---	---	---	---	---	---	---
	68,100 Total		23,961	23,961	23,961	21,254	22,996	23,961	23,961	23,961	23,961	---	---	---	11%	4%	---	---	---	---
	48,700	CDQ	1,140	1,140	1,140	596	779	779	1,140	1,140	1,140	---	---	---	48%	32%	32%	---	---	---
		M	1,846	1,846	1,846	1,349	1,649	1,846	1,822	1,846	1,846	---	---	---	27%	11%	---	1%	---	---
		P	8,598	8,598	8,598	4,829	4,829	6,252	6,252	7,633	8,598	---	---	---	44%	44%	27%	27%	11%	---
		S	9,685	12,376	12,376	12,376	12,376	12,376	12,376	12,376	12,376	22%	---	---	---	---	---	---	---	---
	48,700 Total		21,270	23,961	23,961	19,150	19,633	21,254	21,591	22,996	23,961	11%	---	---	20%	18%	11%	10%	4%	---
	29,300	CDQ	1,140	1,140	1,140	415	415	596	779	1,033	1,140	---	---	---	64%	64%	48%	32%	9%	---
		M	1,195	1,349	1,837	515	948	1,195	948	1,195	1,349	35%	27%	---	72%	49%	35%	49%	35%	27%
		P	4,829	4,829	6,252	2,458	2,458	3,998	3,998	4,829	4,829	44%	44%	27%	71%	71%	54%	54%	44%	44%
		S	6,217	7,017	8,657	9,685	11,666	12,376	7,017	9,685	11,666	50%	43%	30%	22%	6%	---	43%	22%	6%
	29,300 Total		13,380	14,335	17,886	13,073	15,486	18,165	12,741	16,742	18,983	44%	40%	25%	45%	35%	24%	47%	30%	21%
B	87,500	CDQ	1,826	1,826	1,826	1,294	1,041	721	1,826	1,826	1,294	---	---	---	29%	43%	61%	---	---	29%
		M	1,869	1,869	1,869	1,869	1,869	1,279	1,869	1,869	1,869	---	---	---	---	---	32%	---	---	---
		P	2,670	2,670	2,670	2,670	2,670	2,670	2,670	2,670	2,670	---	---	---	---	---	---	---	---	---
		S	19,183	13,331	10,566	23,701	23,701	17,216	23,701	19,183	13,331	19%	44%	55%	---	---	27%	---	19%	44%
	87,500 Total		25,549	19,696	16,932	29,535	29,282	21,886	30,067	25,549	19,164	15%	34%	44%	2%	3%	27%	---	15%	36%
	68,100	CDQ	1,826	1,826	1,826	721	721	392	1,826	1,826	1,294	---	---	---	61%	61%	79%	---	---	29%
		M	1,869	1,869	1,700	1,869	1,700	1,120	1,869	1,869	1,279	---	---	9%	---	9%	40%	---	---	32%
		P	2,670	2,670	2,670	2,670	2,670	2,670	2,670	2,670	2,670	---	---	---	---	---	---	---	---	---
		S	13,331	10,566	8,035	23,701	19,183	13,331	19,183	13,331	10,566	44%	55%	66%	---	19%	44%	19%	44%	55%
	68,100 Total		19,696	16,932	14,231	28,962	24,275	17,513	25,549	19,696	15,810	34%	44%	53%	4%	19%	42%	15%	34%	47%
	48,700	CDQ	1,826	1,826	1,294	721	392	392	1,294	1,294	721	---	---	29%	61%	79%	79%	29%	29%	61%
		M	1,869	1,700	1,279	1,279	1,120	723	1,700	1,279	978	---	9%	32%	32%	40%	61%	9%	32%	48%
		P	2,670	2,670	2,670	2,670	2,670	2,670	2,670	2,670	2,670	---	---	---	---	---	---	---	---	---
		S	10,566	8,035	5,269	13,331	13,331	8,035	13,331	10,566	8,035	55%	66%	78%	44%	44%	66%	44%	55%	66%
	48,700 Total		16,932	14,231	10,512	18,001	17,513	11,820	18,995	15,810	12,404	44%	53%	65%	40%	42%	61%	37%	47%	59%
	29,300	CDQ	1,294	1,041	721	392	151	151	721	721	392	29%	43%	61%	79%	92%	92%	61%	61%	79%
		M	1,279	978	723	723	723	479	978	723	542	32%	48%	61%	61%	61%	74%	48%	61%	71%
		P	2,670	2,670	2,670	2,670	2,515	1,625	2,670	2,670	2,095	---	---	---	---	6%	39%	---	---	22%
		S	5,269	5,269	3,312	8,035	8,035	5,269	8,035	7,000	3,312	78%	78%	86%	66%	66%	78%	66%	70%	86%
	29300 Total		10,512	9,958	7,426	11,820	11,424	7,524	12,404	11,115	6,341	65%	67%	75%	61%	62%	75%	59%	63%	79%

Table 5-28 Hypothetical Chinook bycatch levels and relative reduction from observed Chinook bycatch under different options for sector and season specific caps for 2005. Chinook salmon bycatch provided in numbers of fish.

2005			opt1(AFA)			opt2a			opt2d			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	1,296	1,296	1,296	1,296	1,296	1,296	1,296	1,296	1,296	---	---	---	---	---	---	---	---	---
		M	1,869	1,869	1,869	1,869	1,869	1,869	1,869	1,869	1,869	---	---	---	---	---	---	---	---	---
		P	10,410	10,410	10,410	7,995	10,410	10,410	10,410	10,410	10,410	---	---	---	23%	---	---	---	---	---
		S	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097	---	---	---	---	---	---	---	---	---
	87,500 Total		27,673	27,673	27,673	25,257	27,673	27,673	27,673	27,673	27,673	---	---	---	9%	---	---	---	---	---
	68,100	CDQ	1,296	1,296	1,296	964	1,096	1,296	1,296	1,296	1,296	---	---	---	26%	15%	---	---	---	---
		M	1,869	1,869	1,869	1,869	1,869	1,869	1,869	1,869	1,869	---	---	---	---	---	---	---	---	---
		P	10,410	10,410	10,410	6,969	7,995	9,574	9,574	10,410	10,410	---	---	---	33%	23%	8%	8%	---	---
		S	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097	---	---	---	---	---	---	---	---	---
	68,100 Total		27,673	27,673	27,673	23,899	25,057	26,836	26,836	27,673	27,673	---	---	---	14%	9%	3%	3%	---	---
	48,700	CDQ	1,296	1,296	1,296	459	459	964	1,296	1,296	1,296	---	---	---	65%	65%	26%	---	---	---
		M	1,869	1,869	1,869	1,362	1,537	1,869	1,759	1,869	1,869	---	---	---	27%	18%	---	6%	---	---
		P	7,995	10,068	10,410	3,961	5,309	6,969	5,309	7,995	9,574	23%	3%	---	62%	49%	33%	49%	23%	8%
		S	9,888	12,546	14,097	14,097	14,097	14,097	13,694	14,097	14,097	30%	11%	---	---	---	---	3%	---	---
	48,700 Total		21,048	25,780	27,673	19,880	21,402	23,899	22,058	25,257	26,836	24%	7%	---	28%	23%	14%	20%	9%	3%
	29,300	CDQ	1,296	1,296	1,296	338	459	459	459	1,096	1,296	---	---	---	74%	65%	65%	65%	15%	---
		M	1,128	1,362	1,759	477	952	1,128	952	1,128	1,537	40%	27%	6%	74%	49%	40%	49%	40%	18%
		P	3,961	5,309	6,969	1,844	1,844	3,961	3,961	3,961	5,309	62%	49%	33%	82%	82%	62%	62%	62%	49%
		S	4,246	7,218	7,218	9,888	11,148	14,097	7,218	7,218	11,148	70%	49%	49%	30%	21%	---	49%	49%	21%
	29,300 Total		10,632	15,185	17,242	12,547	14,403	19,646	12,591	13,404	19,290	62%	45%	38%	55%	48%	29%	55%	52%	30%
B	87,500	CDQ	637	637	637	637	637	637	637	637	637	---	---	---	---	---	---	---	---	---
		M	690	690	690	690	690	690	690	690	690	---	---	---	---	---	---	---	---	---
		P	3,904	3,904	3,904	3,904	3,904	3,904	3,904	3,904	3,904	---	---	---	---	---	---	---	---	---
		S	19,272	12,630	9,618	26,937	25,550	12,630	19,272	19,272	12,630	45%	64%	73%	23%	27%	64%	45%	45%	64%
	87,500 Total		24,503	17,862	14,849	32,168	30,781	17,862	24,503	24,503	17,862	39%	56%	63%	20%	23%	56%	39%	39%	56%
	68,100	CDQ	637	637	637	637	637	520	637	637	637	---	---	---	---	---	18%	---	---	---
		M	690	690	690	690	690	690	690	690	690	---	---	---	---	---	---	---	---	---
		P	3,904	3,904	3,904	3,904	3,904	3,904	3,904	3,904	3,904	---	---	---	---	---	---	---	---	---
		S	12,630	12,630	7,537	19,272	19,272	12,630	19,272	12,630	9,618	64%	64%	78%	45%	45%	64%	45%	64%	73%
	68,100 Total		17,862	17,862	12,769	24,503	24,503	17,745	24,503	17,862	14,849	56%	56%	68%	39%	39%	56%	39%	56%	63%
	48,700	CDQ	637	637	637	637	520	419	637	637	637	---	---	---	---	18%	34%	---	---	---
		M	690	690	690	690	690	690	690	690	690	---	---	---	---	---	---	---	---	---
		P	3,904	3,904	3,904	3,904	3,904	2,743	3,904	3,904	3,904	---	---	---	---	---	30%	---	---	---
		S	9,618	7,537	6,455	12,630	12,630	9,618	12,630	9,618	7,537	73%	78%	82%	64%	64%	73%	64%	73%	78%
	48,700 Total		14,849	12,769	11,687	17,862	17,745	13,470	17,862	14,849	12,769	63%	68%	71%	56%	56%	67%	56%	63%	68%
	29,300	CDQ	637	637	637	419	324	260	637	637	520	---	---	---	34%	49%	59%	---	---	18%
		M	690	690	690	690	690	470	690	690	595	---	---	---	---	---	32%	---	---	14%
		P	3,904	3,904	2,743	2,743	1,908	1,633	3,904	3,382	1,908	---	---	30%	30%	51%	58%	---	13%	51%
		S	6,455	4,724	3,531	9,618	7,537	5,753	7,537	6,455	4,724	82%	86%	90%	73%	78%	84%	78%	82%	86%
	29,300 Total		11,687	9,955	7,602	13,470	10,459	8,116	12,769	11,164	7,747	71%	75%	81%	67%	74%	80%	68%	72%	81%

Table 5-29 Hypothetical Chinook bycatch levels and relative reduction from observed Chinook bycatch under different options for sector and season specific caps for 2006. Chinook salmon bycatch provided in numbers of fish.

2006			**opt1(AFA)**			**opt2a**			**opt2d**			**opt1(AFA)**			**opt2a**			**opt2d**		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	1,580	1,580	1,580	1,129	1,340	1,580	1,580	1,580	1,580	---	---	---	29%	15%	---	---	---	---
		M	2,873	4,331	4,877	2,620	2,873	2,873	2,873	2,873	4,331	41%	11%	---	46%	41%	41%	41%	41%	11%
		P	15,281	16,257	16,257	7,939	9,665	12,222	12,222	12,222	16,257	6%	---	---	51%	41%	25%	25%	25%	---
		S	9,410	20,123	23,544	23,544	35,284	36,138	23,544	23,544	33,542	74%	44%	35%	35%	2%	---	35%	35%	7%
	87,500	Total	29,144	42,291	46,257	35,232	49,162	52,813	40,218	40,218	55,709	50%	28%	21%	40%	16%	10%	32%	32%	5%
	68,100	CDQ	1,580	1,580	1,580	653	1,129	1,340	1,580	1,580	1,580	---	---	---	59%	29%	15%	---	---	---
		M	2,873	2,873	2,873	1,323	1,323	2,620	1,323	2,873	2,873	41%	41%	41%	73%	73%	46%	73%	41%	41%
		P	12,222	12,222	16,257	6,347	7,939	9,665	9,665	9,665	12,222	25%	25%	---	61%	51%	41%	41%	41%	25%
		S	9,410	9,410	20,123	23,544	23,544	32,290	9,410	20,123	23,544	74%	74%	44%	35%	35%	11%	74%	44%	35%
	68,100	Total	26,085	26,085	40,833	31,866	33,935	45,916	21,979	34,242	40,218	56%	56%	31%	46%	42%	22%	63%	42%	32%
	48,700	CDQ	1,580	1,580	1,580	653	653	653	1,580	1,580	1,580	---	---	---	59%	59%	59%	---	---	---
		M	1,323	1,323	2,873	1,323	1,323	1,323	1,323	1,323	1,323	73%	73%	41%	73%	73%	73%	73%	73%	73%
		P	7,939	9,665	12,222	3,515	3,515	6,347	6,347	7,939	9,665	51%	41%	25%	78%	78%	61%	61%	51%	41%
		S	9,410	9,410	9,410	9,410	9,410	23,544	9,410	9,410	9,410	74%	74%	74%	74%	74%	35%	74%	74%	74%
	48,700	Total	20,253	21,979	26,085	14,901	14,901	31,866	18,660	20,253	21,979	66%	63%	56%	75%	75%	46%	68%	66%	63%
	29,300	CDQ	1,340	1,580	1,580	400	400	400	653	653	1,129	15%	---	---	75%	75%	75%	59%	59%	29%
		M	933	1,323	1,323	200	933	933	933	933	1,323	81%	73%	73%	96%	81%	81%	81%	81%	73%
		P	3,515	3,515	6,347	2,860	3,515	3,515	3,515	3,515	3,515	78%	78%	61%	82%	78%	78%	78%	78%	78%
		S	4,653	4,653	4,653	9,410	9,410	9,410	4,653	9,410	9,410	87%	87%	87%	74%	74%	74%	87%	74%	74%
	29,300	Total	10,441	11,071	13,903	12,870	14,258	14,258	9,754	14,511	15,377	82%	81%	76%	78%	76%	76%	83%	75%	74%
B	87,500	CDQ	157	157	157	157	157	157	157	157	157	---	---	---	---	---	---	---	---	---
		M	159	159	159	159	159	159	159	159	159	---	---	---	---	---	---	---	---	---
		P	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	---	---	---	---	---	---	---	---	---
		S	19,076	15,499	10,093	22,654	22,654	15,499	22,654	19,076	12,297	16%	32%	55%	---	---	32%	---	16%	46%
	87,500	Total	20,828	17,250	11,844	24,405	24,405	17,250	24,405	20,828	14,048	15%	29%	51%	---	---	29%	---	15%	42%
	68,100	CDQ	157	157	157	157	157	157	157	157	157	---	---	---	---	---	---	---	---	---
		M	159	159	159	159	159	159	159	159	159	---	---	---	---	---	---	---	---	---
		P	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	---	---	---	---	---	---	---	---	---
		S	12,297	12,297	8,509	22,654	19,076	12,297	19,076	15,499	10,093	46%	46%	62%	---	16%	46%	16%	32%	55%
	68,100	Total	14,048	14,048	10,261	24,405	20,828	14,048	20,828	17,250	11,844	42%	42%	58%	---	15%	42%	15%	29%	51%
	48,700	CDQ	157	157	157	157	157	157	157	157	157	---	---	---	---	---	---	---	---	---
		M	159	159	159	159	159	159	159	159	159	---	---	---	---	---	---	---	---	---
		P	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	---	---	---	---	---	---	---	---	---
		S	10,093	8,509	6,220	15,499	12,297	10,093	12,297	10,093	6,220	55%	62%	73%	32%	46%	55%	46%	55%	73%
	48,700	Total	11,844	10,261	7,971	17,250	14,048	11,844	14,048	11,844	7,971	51%	58%	67%	29%	42%	51%	42%	51%	67%
	29,300	CDQ	157	157	157	157	157	157	157	157	157	---	---	---	---	---	---	---	---	---
		M	159	159	159	159	159	159	159	159	159	---	---	---	---	---	---	---	---	---
		P	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	---	---	---	---	---	---	---	---	---
		S	6,220	4,025	3,668	10,093	8,509	4,025	6,220	6,220	4,025	73%	82%	84%	55%	62%	82%	73%	73%	82%
	29,300	Total	7,971	5,777	5,420	11,844	10,261	5,777	7,971	7,971	5,777	67%	76%	78%	51%	58%	76%	67%	67%	76%

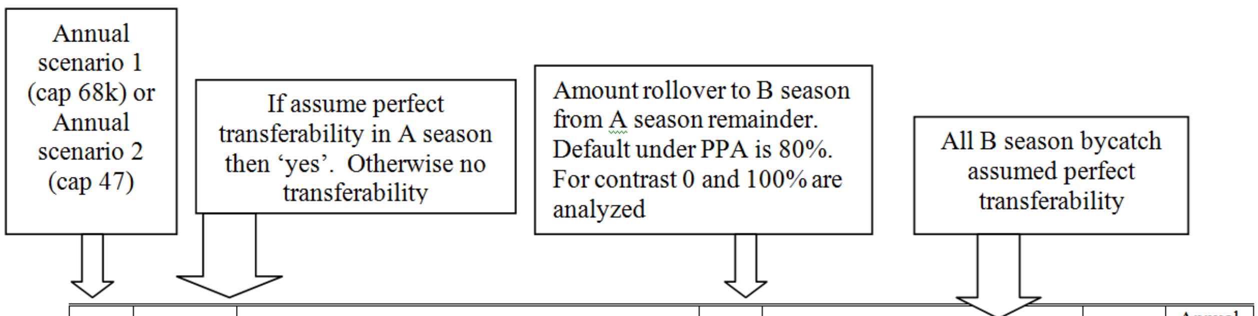
Table 5-30 Hypothetical Chinook bycatch levels and relative reduction from observed Chinook bycatch under different options for sector and season specific caps for 2007. Chinook salmon bycatch provided in numbers of fish.

2007			opt1(AFA)			opt2a			opt2d			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	3,091	3,091	3,091	1,309	1,309	1,309	2,414	3,091	3,091	---	---	---	58%	58%	58%	22%	---	---
		M	3,547	4,417	4,817	1,985	1,985	3,547	3,172	3,547	4,417	26%	8%	---	59%	59%	26%	34%	26%	8%
		P	13,332	17,680	20,290	7,688	7,688	7,688	7,688	13,332	13,332	49%	32%	22%	70%	70%	70%	70%	49%	49%
		S	13,083	20,757	24,280	29,432	34,202	35,714	24,280	24,280	34,202	63%	42%	32%	18%	4%	---	32%	32%	4%
	87,500 Total		33,053	45,945	52,478	40,415	45,185	48,259	37,554	44,250	55,042	52%	34%	25%	42%	35%	31%	46%	36%	21%
	68,100	CDQ	3,091	3,091	3,091	502	502	1,309	1,926	2,414	3,091	---	---	---	84%	84%	58%	38%	22%	---
		M	1,985	3,547	4,029	1,985	1,985	1,985	1,985	1,985	3,547	59%	26%	16%	59%	59%	59%	59%	59%	26%
		P	7,688	13,332	13,332	5,871	7,688	7,688	7,688	7,688	13,332	70%	49%	49%	77%	70%	70%	70%	70%	49%
		S	13,083	13,083	20,757	20,757	24,280	33,028	13,083	20,757	24,280	63%	63%	42%	42%	32%	8%	63%	42%	32%
	68,100 Total		25,847	33,053	41,209	29,115	34,455	44,011	24,682	32,845	44,250	63%	52%	41%	58%	50%	37%	64%	53%	36%
	48,700	CDQ	2,414	2,414	3,091	502	502	502	1,309	1,309	1,926	22%	22%	---	84%	84%	84%	58%	58%	38%
		M	1,985	1,985	1,985	59	59	1,985	59	1,985	1,985	59%	59%	59%	99%	99%	59%	99%	59%	59%
		P	7,688	7,688	7,688	182	5,871	5,871	5,871	7,688	7,688	70%	70%	70%	99%	77%	77%	77%	70%	70%
		S	1,250	1,250	13,083	13,083	13,083	20,757	13,083	13,083	13,083	96%	96%	63%	63%	63%	42%	63%	63%	63%
	48,700 Total		13,338	13,338	25,847	13,826	19,514	29,115	20,321	24,065	24,682	81%	81%	63%	80%	72%	58%	71%	65%	64%
	29,300	CDQ	1,309	1,309	1,926	246	502	502	502	502	1,309	58%	58%	38%	92%	84%	84%	84%	84%	58%
		M	59	59	59	59	59	59	59	59	59	99%	99%	99%	99%	99%	99%	99%	99%	99%
		P	182	5,871	5,871	182	182	182	182	182	182	99%	77%	77%	99%	99%	99%	99%	99%	99%
		S	1,250	1,250	1,250	1,250	1,250	13,083	1,250	1,250	1,250	96%	96%	96%	96%	96%	63%	96%	96%	96%
	29,300 Total		2,801	8,489	9,106	1,738	1,994	13,826	1,994	1,994	2,801	96%	88%	87%	98%	97%	80%	97%	97%	96%
B	87,500	CDQ	2,529	2,529	2,529	1,235	777	777	2,529	2,206	1,235	---	---	---	51%	69%	69%	---	13%	51%
		M	1,956	1,956	1,956	1,956	1,956	1,398	1,956	1,956	1,956	---	---	---	---	---	29%	---	---	---
		P	6,317	6,317	6,317	6,317	6,317	4,526	6,317	6,317	6,317	---	---	---	---	---	28%	---	---	---
		S	15,674	15,674	10,680	27,320	22,278	15,674	22,278	15,674	10,680	62%	62%	74%	34%	47%	62%	47%	62%	74%
	87,500 Total		26,476	26,476	21,482	36,828	31,327	22,375	33,079	26,153	20,188	50%	50%	59%	30%	40%	57%	37%	50%	62%
	68,100	CDQ	2,529	2,529	1,235	777	777	527	2,206	1,235	1,235	---	---	51%	69%	69%	79%	13%	51%	51%
		M	1,956	1,956	1,398	1,956	1,398	1,086	1,956	1,956	1,398	---	---	29%	---	29%	44%	---	---	29%
		P	6,317	6,317	6,317	6,317	5,979	4,108	6,317	6,317	4,526	---	---	---	---	5%	35%	---	---	28%
		S	10,680	10,680	6,800	22,278	15,674	10,680	15,674	15,674	10,680	74%	74%	84%	47%	62%	74%	62%	62%	74%
	68,100 Total		21,482	21,482	15,750	31,327	23,828	16,400	26,153	25,182	17,838	59%	59%	70%	40%	55%	69%	50%	52%	66%
	48,700	CDQ	2,206	1,235	1,235	527	527	354	1,235	1,235	777	13%	51%	51%	79%	79%	86%	51%	51%	69%
		M	1,956	1,398	1,086	1,398	1,086	850	1,398	1,398	1,086	---	29%	44%	29%	44%	57%	29%	29%	44%
		P	6,317	6,317	4,526	4,526	4,108	2,758	6,317	4,526	4,108	---	---	28%	28%	35%	56%	---	28%	35%
		S	10,680	6,800	3,023	15,674	10,680	9,311	10,680	10,680	6,800	74%	84%	93%	62%	74%	78%	74%	74%	84%
	48,700 Total		21,159	15,750	9,869	22,125	16,400	13,272	19,630	17,838	12,771	60%	70%	81%	58%	69%	75%	63%	66%	76%
	29,300	CDQ	1,235	777	777	354	354	178	777	777	527	51%	69%	69%	86%	86%	93%	69%	69%	79%
		M	1,086	1,086	715	850	715	420	1,086	850	586	44%	44%	63%	57%	63%	79%	44%	57%	70%
		P	4,526	4,108	2,758	2,758	2,422	1,763	4,108	3,504	2,422	28%	35%	56%	56%	62%	72%	35%	45%	62%
		S	3,023	3,023	3,023	9,311	6,800	3,023	6,800	6,800	3,023	93%	93%	93%	78%	84%	93%	84%	84%	93%
	29,300 Total		9,869	8,993	7,272	13,272	10,291	5,383	12,771	11,931	6,557	81%	83%	86%	75%	80%	90%	76%	77%	88%

5.3.3 Alternative 4 (PPA) bycatch levels and comparison of options

Alternative 4 prescribes specific combinations of options, as described in Section 2.4. In analyzing this alternative, the retrospective analysis evaluated the prescribed set of options, as well as some variants on these options, as described below. The variation of different options (e.g., percent rollover, transferability) was evaluated to both compare and contrast against alternative combinations in Alternative 2 as well as to indicate which options are driving the observed impacts under Alternative 4.

Tables showing the relative constraints by sector and the relative salmon caught by sector are shown in Table 5-31, Table 5-32 and Table 5-34 through Table 5-37. All tables have a similar format and structure. The first column shows which PPA scenario is under considerations, and the second addresses transferability. The assumption of transferability in the A season is estimated for each scenario as either ‘No’, indicating that no transferability between sectors is assumed for the A season, or ‘Yes’, which assumes perfect transferability during the A season. Perfect transferability is the default assumption for the B season. The following columns provide A season information for the sectors, and then the ‘A-B Rollover’ column describes what percentage of the remaining bycatch cap, by sector, may be rolled over to the B season. Fig. 5-40 provides a key for understanding the construction of the tables for evaluating the PPA and the impact of the rollover provision, given these assumptions and perturbations.



PPA	A-season Transfer-Ability	A-Season Year	CDQ	M	P	S	A total	A-B Roll over	B-Season CDQ	M	P	S	B total	Annual Total
1	No	2003	1,910	2,494	12,867	16,307	**33,578**	0%	889	1,832	3,259	7,132	**13,113**	**46,691**
		2004	1,167	1,843	8,573	12,372	**23,955**		1,180	1,402	2,611	14,490	**19,683**	**43,639**
		2005	1,294	1,858	10,381	14,079	**27,612**		560	689	3,922	14,947	**20,119**	**47,730**
		2006	1,804	3,809	15,048	23,158	**43,819**		157	164	1,431	18,172	**19,923**	**63,742**
		2007	3,634	3,801	15,137	23,557	**46,130**		1,109	1,406	3,568	13,772	**19,855**	**65,986**
	Yes	2003	1,910	2,494	12,867	16,307	**33,578**		Note numbers under ‘yes’ scenario in B season are always equivalent to B season numbers under ‘no’ scenario (above).				**13,113**	**46,691**
		2004	1,167	1,843	8,573	12,372	**23,955**						**19,683**	**43,639**
		2005	1,294	1,858	10,381	14,079	**27,612**						**20,119**	**47,730**
		2006	1,804	3,992	16,194	24,943	**46,932**						**19,923**	**66,855**
		2007	3,634	3,860	15,137	23,557	**46,189**						**19,855**	**66,045**
2	No	2003	1,910	2,494	10,808	16,307	**31,520**		889	1,690	3,259	7,132	**12,971**	**44,491**
		2004	1,167	1,843	8,573	12,372	**23,955**		743	983	2,551	9,811	**14,088**	**38,043**
		2005	1,294	1,858	10,381	14,079	**27,612**		560	689	2,608	10,040	**13,897**	**41,509**
		2006	1,804	2,658	10,819	16,451	**31,732**		157	164	1,431	12,277	**14,028**	**45,760**
		2007	3,058	2,556	10,911	15,650	**32,175**		768	1,029	2,538	9,833	**14,168**	**46,343**
	Yes	2003	1,910	2,494	12,437	16,307	**33,149**		Note numbers under ‘yes’ scenario in B season are always equivalent to B season numbers under ‘no’ scenario (above).				**12,971**	**46,120**
		2004	1,167	1,843	8,573	12,372	**23,955**						**14,088**	**38,043**
		2005	1,294	1,858	10,381	14,079	**27,612**						**13,897**	**41,509**
		2006	1,804	2,658	11,388	17,021	**32,871**						**14,028**	**46,899**
		2007	3,058	2,556	10,911	15,650	**32,175**						**14,168**	**46,343**

Fig. 5-40 Schematic guide for the layout of PPA tables.

Table 5-31 Dates of closures under PPA1 and PPA2, with an 80% A-B season rollover provision.

PPA	A-season Transfer-Ability	Year	A-Season CDQ	M	P	S	A-B Rollover	B-Season CDQ	M	P	S
1	No	2003	--	--	--	--	80%	--	--	--	--
		2004	--	--	--	--		--	--	--	--
		2005	--	--	--	--		--	--	--	29-Oct
		2006	--	23-Feb	18-Mar	19-Feb		--	--	--	22-Oct
		2007	--	19-Feb	15-Feb	15-Feb		15-Oct	25-Oct	10-Oct	7-Oct
	Yes	2003	--	--	--	--		--	--	--	--
		2004	--	--	--	--		--	--	--	--
		2005	--	--	--	--		--	--	--	29-Oct
		2006	--	27-Feb	--	20-Feb		--	--	--	22-Oct
		2007	--	22-Feb	15-Feb	15-Feb		15-Oct	25-Oct	10-Oct	7-Oct
2	No	2003	--	--	8-Mar	--		--	--	--	--
		2004	--	--	--	--		--	--	--	11-Oct
		2005	--	--	--	--		--	--	25-Sep	5-Oct
		2006	--	18-Feb	5-Mar	9-Feb		--	--	--	10-Oct
		2007	7-Mar	2-Feb	6-Feb	5-Feb		7-Oct	17-Oct	29-Sep	26-Sep
	Yes	2003	--	--	21-Mar	--		--	16-Oct	--	--
		2004	--	--	--	--		--	--	--	11-Oct
		2005	--	--	--	--		--	--	25-Sep	5-Oct
		2006	--	18-Feb	9-Mar	10-Feb		--	--	--	10-Oct
		2007	7-Mar	2-Feb	6-Feb	5-Feb		7-Oct	17-Oct	29-Sep	26-Sep

Note: ‘No’ in the ‘A-season Transferability’ column assumes no transferability, ‘yes’ assumes perfect transferability. In all cases, perfect transferability in the B season is assumed.

Table 5-32 Dates of closures under PPA1 and PPA2, with 0 and 100% A-B season rollover provisions

PPA	A-season Transfer-Ability	Year	A-Season CDQ	M	P	S	A-B Rollover	B-Season CDQ	M	P	S
1	No	2003	--	--	--	--	0%	--	--	--	--
		2004	--	--	--	--		23-Sep	29-Oct	--	11-Oct
		2005	--	--	--	--		--	--	--	6-Oct
		2006	--	23-Feb	18-Mar	19-Feb		--	--	--	21-Oct
		2007	--	19-Feb	15-Feb	15-Feb		11-Oct	25-Oct	8-Oct	7-Oct
	Yes	2003	--	--	--	--		--	--	--	--
		2004	--	--	--	--		23-Sep	29-Oct	--	11-Oct
		2005	--	--	--	--		--	--	--	6-Oct
		2006	--	27-Feb	--	20-Feb		--	--	--	21-Oct
		2007	--	22-Feb	15-Feb	15-Feb		11-Oct	25-Oct	8-Oct	7-Oct
2	No	2003	--	--	8-Mar	--		--	16-Oct	--	--
		2004	--	--	--	--		12-Sep	13-Oct	30-Sep	2-Oct
		2005	--	--	--	--		--	--	10-Sep	1-Oct
		2006	--	18-Feb	5-Mar	9-Feb		--	--	--	10-Oct
		2007	7-Mar	2-Feb	6-Feb	5-Feb		7-Oct	16-Oct	29-Sep	26-Sep
	Yes	2003	--	--	21-Mar	--		--	16-Oct	--	--
		2004	--	--	--	--		12-Sep	13-Oct	30-Sep	2-Oct
		2005	--	--	--	--		--	--	10-Sep	1-Oct
		2006	--	18-Feb	9-Mar	10-Feb		--	--	--	10-Oct
		2007	7-Mar	2-Feb	6-Feb	5-Feb		7-Oct	16-Oct	29-Sep	26-Sep
1	No	2003	--	--	--	--	100%	--	--	--	--
		2004	--	--	--	--		--	--	--	--
		2005	--	--	--	--		--	--	--	--
		2006	--	23-Feb	18-Mar	19-Feb		--	--	--	23-Oct
		2007	--	19-Feb	15-Feb	15-Feb		15-Oct	25-Oct	11-Oct	7-Oct
	Yes	2003	--	--	--	--		--	--	--	--
		2004	--	--	--	--		--	--	--	--
		2005	--	--	--	--		--	--	--	--
		2006	--	27-Feb	--	20-Feb		--	--	--	23-Oct
		2007	--	22-Feb	15-Feb	15-Feb		15-Oct	25-Oct	11-Oct	7-Oct
2	No	2003	--	--	8-Mar	--		--	--	--	--
		2004	--	--	--	--		--	--	--	13-Oct
		2005	--	--	--	--		--	--	30-Sep	6-Oct
		2006	--	18-Feb	5-Mar	9-Feb		--	--	--	11-Oct
		2007	7-Mar	2-Feb	6-Feb	5-Feb		7-Oct	17-Oct	29-Sep	26-Sep
	Yes	2003	--	--	21-Mar	--		--	--	--	--
		2004	--	--	--	--		--	--	--	13-Oct
		2005	--	--	--	--		--	--	30-Sep	6-Oct
		2006	--	18-Feb	9-Mar	10-Feb		--	--	--	11-Oct
		2007	7-Mar	2-Feb	6-Feb	5-Feb		7-Oct	17-Oct	29-Sep	26-Sep

Note: ‘No’ in the ‘A-season Transferability’ column assumes no transferability, ‘yes’ assumes perfect transferability. In all cases, perfect transferability in the B season is assumed.

Cap level

Two cap levels are evaluated under this alternative based upon the two annual scenarios as described in Section 2.4. This analysis assumes that the entire fleet is operating under either the high cap (PPA1) of 68,392 or the lower cap of 47,591 (PPA2). A separate section below discusses the implications of 'opting out' of the Intercooperative Agreement under PPA1, and the associated Chinook bycatch and impacts thereof. For purposes of the main impact analysis however, the assumption is that the entire fleet is operating under the same cap, with the prescribed seasonal and sector allocation as detailed in Section 2.4).

Seasonal allocation and sector split

The PPA scenarios include a seasonal allocation of 70/30 A/B season, and the following prescribed sector split by season:

A season: CDQ 9.3%; inshore CV fleet 49.8%; mothership fleet 8.0%; offshore CP fleet 32.9%
B season: CDQ 5.5%; inshore CV fleet 69.3%; mothership fleet 7.3%; offshore CP fleet 17.9%

The alternatives under alternative 2 include neither this specific prescribed sector split, nor a different seasonal sector split as prescribed in the PPA. However, for purposes of comparison, Alternative 2 Option 2d with a 70/30 seasonal split has the following sector allocations:

CDQ 6.5%; inshore CV fleet 57.5%; mothership fleet 7.5%; offshore CP fleet 28.5%

In all tables, for comparative purposes, cap levels 68,100 and 48,700 for Option 2d, 70/30 seasonal split have been shaded to compare the impacts of the change in sector split between similar cap and seasonal thresholds. Notably, however, only the PPA considers a rollover of any portion of the remaining A season cap to be used in the B season. The relative impact of the rollover is described below.

Rollover

The PPA includes a prescribed rollover of 80% from A to B season, which means that each sector receives 80% of remaining salmon at the end of the A season to add to their B season cap. Given that alternative 2 options were analyzed absent a rollover provision, some comparative information was computed for the PPA (only) to evaluate the impact of the rollover. Two additional rollover options were evaluated, 0% (no rollover from A to B) and 100% (all remaining bycatch roll from A to B by sector). One purpose of this presentation is to provide a way to link the no-rollover assumption (for all of the Alternative 2 scenarios) with the Alternative 4 (the PPA scenarios).

In general, the retrospective impact between a 100% rollover and the 80% default rollover level was small for all sectors, except for inshore CVs. The inshore CVs were able to avoid being closed under 100% rollover in 2004 and were able to generally stay open a few days longer in 2005-2007. As expected, the contrast between no rollover (0%) and the 80% level was greater with all sectors suffering shorter season lengths in the B-season (compare Table 5-31 with Table 5-32). Table 5-33 summarizes more detailed impacts by sector on the impacts of different rollover levels. Clearly, allowing more flexibility in rolling over Chinook salmon bycatch allowances between seasons provides the fishery with mechanisms to be less restricted while still staying below the overall cap as specified.

Table 5-34 and Table 5-35 detail the hypothetical Chinook bycatch levels under the PPA, assuming 80%, 0%, 100% rollover scenarios. Table 5-36 and Table 5-37 describe the hypothetical number of salmon that would have been saved, had the PPA caps been in place, and assuming 80%, 0%, 100% rollover scenarios.

Table 5-33 Summary of sector-specific impacts for different rollover allowances (100% and 0%) compared to the 80% (PPA) seasonal rollover levels.

Sector	100% rollover compared to 80%	No rollover compared to default 80% rollover
CDQ	No change	In 2004, not having a rollover would have resulted in closures under PPA1 (September 23) and PPA2 (September 12). These earlier closures have saved an additional 675 salmon (PPA1) and 1,112 (PPA2) at the expense of forgone pollock of 15,995 (PPA1) and 37,452 (PPA2).
Mothership	No change	A season closure on October 16 (PPA2). This results in 142 salmon saved and 1,447 mt of forgone pollock. In 2004, closures are invoked on October 29 (PPA1) and October 13 (PPA2) resulting in 547 salmon saved (PPA1) and 966 salmon saved (PPA2) and forgone pollock of 1,152 mt (PPA1) and 3,187 (PPA2) respectively.
Catcher Processor	There is a 5 day delay in closure in 2005 and a one day delay in the closure in 2007. Chinook salmon bycatch levels increase by 154 fish in 2005 (and allow forgone pollock to decrease by 6,840 mt)	Additional closures in 2004 and 2005 (PPA2) and earlier closure in 2007 (PPA1). 204 fewer salmon caught (2007 PPA1) and 60 and 1,314 fewer salmon under PPA2 Forgone pollock increases by 1,008 mt (2004) 37,999 mt (2005), and 1,983 mt (2007).
Inshore CV	No closure in 2005 (PPA1) and delayed closures by 1-3 days in 2004 and 2006 (PPA2). Chinook salmon bycatch levels increase by 1,949, 1,621, and 674 more salmon in 2004-2006, respectively, with resulting decrease in forgone pollock of 4,397 mt (2004), 1,498 mt (2005) and 1,828 mt (2006) for 100% rollover scenario, compared to 80% rollover	Additional closure in 2004 (October 11) and earlier closures in 2005 and 2006.

Table 5-34 Hypothetical Chinook salmon bycatch levels by sector for PPA1 and PPA2, assuming **80%** allowable rollover from A to B season.

PPA	A-season Transfer-ability	Year	A-Season CDQ	M	P	S	A-total	B-Season CDQ	M	P	S	B-total	Annual Total
1	No	2003	1,910	2,494	12,867	16,307	33,578	889	1,832	3,259	7,132	13,113	46,691
		2004	1,167	1,843	8,573	12,372	23,955	1,855	1,949	2,611	23,575	29,990	53,946
		2005	1,294	1,858	10,381	14,079	27,612	560	689	3,922	30,792	35,963	63,575
		2006	1,804	3,809	15,048	23,158	43,819	157	164	1,431	18,800	20,551	64,370
		2007	3,634	3,801	15,137	23,557	46,130	1,242	1,406	3,773	13,772	20,193	66,323
	Yes	2003	1,910	2,494	12,867	16,307	33,578	889	1,832	3,259	7,132	13,113	46,691
		2004	1,167	1,843	8,573	12,372	23,955	1,855	1,949	2,611	23,575	29,990	53,946
		2005	1,294	1,858	10,381	14,079	27,612	560	689	3,922	30,792	35,963	63,575
		2006	1,804	3,992	16,194	24,943	46,932	157	164	1,431	18,800	20,551	67,483
		2007	3,634	3,860	15,137	23,557	46,189	1,242	1,406	3,773	13,772	20,193	66,383
2	No	2003	1,910	2,494	10,808	16,307	31,520	889	1,832	3,259	7,132	13,113	44,633
		2004	1,167	1,843	8,573	12,372	23,955	1,855	1,949	2,611	14,490	20,905	44,861
		2005	1,294	1,858	10,381	14,079	27,612	560	689	3,523	13,326	18,098	45,710
		2006	1,804	2,658	10,819	16,451	31,732	157	164	1,431	12,277	14,028	45,760
		2007	3,058	2,556	10,911	15,650	32,175	768	1,069	2,538	9,833	14,208	46,383
	Yes	2003	1,910	2,494	12,437	16,307	33,149	889	1,690	3,259	7,132	12,971	46,120
		2004	1,167	1,843	8,573	12,372	23,955	1,855	1,949	2,611	14,490	20,905	44,861
		2005	1,294	1,858	10,381	14,079	27,612	560	689	3,523	13,326	18,098	45,710
		2006	1,804	2,658	11,388	17,021	32,871	157	164	1,431	12,277	14,028	46,899
		2007	3,058	2,556	10,911	15,650	32,175	768	1,069	2,538	9,833	14,208	46,383

Table 5-35 Hypothetical Chinook salmon bycatch levels by sector for PPA1 and PPA2, assuming 0% and 100% allowable rollover from A to B season.

PPA	A-season Transfer-Ability	A-Season Year	CDQ	M	P	S	A total	A-B Roll over	B-Season CDQ	M	P	S	B total	Annual Total
1	No	2003	1,910	2,494	12,867	16,307	33,578	0%	889	1,832	3,259	7,132	13,113	46,691
		2004	1,167	1,843	8,573	12,372	23,955		1,180	1,402	2,611	14,490	19,683	43,639
		2005	1,294	1,858	10,381	14,079	27,612		560	689	3,922	14,947	20,119	47,730
		2006	1,804	3,809	15,048	23,158	43,819		157	164	1,431	18,172	19,923	63,742
		2007	3,634	3,801	15,137	23,557	46,130		1,109	1,406	3,568	13,772	19,855	65,986
	Yes	2003	1,910	2,494	12,867	16,307	33,578		889	1,832	3,259	7,132	13,113	46,691
		2004	1,167	1,843	8,573	12,372	23,955		1,180	1,402	2,611	14,490	19,683	43,639
		2005	1,294	1,858	10,381	14,079	27,612		560	689	3,922	14,947	20,119	47,730
		2006	1,804	3,992	16,194	24,943	46,932		157	164	1,431	18,172	19,923	66,855
		2007	3,634	3,860	15,137	23,557	46,189		1,109	1,406	3,568	13,772	19,855	66,045
2	No	2003	1,910	2,494	10,808	16,307	31,520		889	1,690	3,259	7,132	12,971	44,491
		2004	1,167	1,843	8,573	12,372	23,955		743	983	2,551	9,811	14,088	38,043
		2005	1,294	1,858	10,381	14,079	27,612		560	689	2,608	10,040	13,897	41,509
		2006	1,804	2,658	10,819	16,451	31,732		157	164	1,431	12,277	14,028	45,760
		2007	3,058	2,556	10,911	15,650	32,175		768	1,029	2,538	9,833	14,168	46,343
	Yes	2003	1,910	2,494	12,437	16,307	33,149		889	1,690	3,259	7,132	12,971	46,120
		2004	1,167	1,843	8,573	12,372	23,955		743	983	2,551	9,811	14,088	38,043
		2005	1,294	1,858	10,381	14,079	27,612		560	689	2,608	10,040	13,897	41,509
		2006	1,804	2,658	11,388	17,021	32,871		157	164	1,431	12,277	14,028	46,899
		2007	3,058	2,556	10,911	15,650	32,175		768	1,029	2,538	9,833	14,168	46,343
1	No	2003	1,910	2,494	12,867	16,307	**33,578**	100%	889	1,832	3,259	7,132	**13,113**	**46,691**
		2004	1,167	1,843	8,573	12,372	**23,955**		1,855	1,949	2,611	23,575	**29,990**	**53,946**
		2005	1,294	1,858	10,381	14,079	**27,612**		560	689	3,922	33,023	**38,194**	**65,806**
		2006	1,804	3,809	15,048	23,158	**43,819**		157	164	1,431	19,127	**20,878**	**64,697**
		2007	3,634	3,801	15,137	23,557	**46,130**		1,242	1,406	3,805	13,772	**20,226**	**66,356**
	Yes	2003	1,910	2,494	12,867	16,307	**33,578**		889	1,832	3,259	7,132	**13,113**	**46,691**
		2004	1,167	1,843	8,573	12,372	**23,955**		1,855	1,949	2,611	23,575	**29,990**	**53,946**
		2005	1,294	1,858	10,381	14,079	**27,612**		560	689	3,922	33,023	**38,194**	**65,806**
		2006	1,804	3,992	16,194	24,943	**46,932**		157	164	1,431	19,127	**20,878**	**67,810**
		2007	3,634	3,860	15,137	23,557	**46,189**		1,242	1,406	3,805	13,772	**20,226**	**66,415**
2	No	2003	1,910	2,494	10,808	16,307	**31,520**		889	1,832	3,259	7,132	**13,113**	**44,633**
		2004	1,167	1,843	8,573	12,372	**23,955**		1,855	1,949	2,611	16,439	**22,854**	**46,810**
		2005	1,294	1,858	10,381	14,079	**27,612**		560	689	3,677	14,947	**19,874**	**47,485**
		2006	1,804	2,658	10,819	16,451	**31,732**		157	164	1,431	12,952	**14,703**	**46,435**
		2007	3,058	2,556	10,911	15,650	**32,175**		768	1,069	2,538	9,833	**14,208**	**46,383**
	Yes	2003	1,910	2,494	12,437	16,307	**33,149**		889	1,832	3,259	7,132	**13,113**	**46,261**
		2004	1,167	1,843	8,573	12,372	**23,955**		1,855	1,949	2,611	16,439	**22,854**	**46,810**
		2005	1,294	1,858	10,381	14,079	**27,612**		560	689	3,677	14,947	**19,874**	**47,485**
		2006	1,804	2,658	11,388	17,021	**32,871**		157	164	1,431	12,952	**14,703**	**47,574**
		2007	3,058	2,556	10,911	15,650	**32,175**		768	1,069	2,538	9,833	**14,208**	**46,383**

Table 5-36 Hypothetical Chinook salmon saved (relative to estimated mortalities) by sector for PPA1 and PPA2, assuming **80% allowable** rollover from A to B seasons.

PPA	A-season Transfer-Ability	Year	A-Season CDQ	M	P	S	A **total**	B-Season CDQ	M	P	S	B **total**	Annual **Total**
1	No	2003	0	0	0	0	**0**	0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**	0	0	0	0	**0**	**0**
		2005	0	0	0	0	**0**	0	0	0	2,231	**2,231**	**2,231**
		2006	0	829	1,145	12,822	**14,796**	0	0	0	3,482	**3,482**	**18,278**
		2007	0	824	10,617	11,901	**23,341**	1,268	457	2,358	27,942	**32,025**	**55,366**
	Yes	2003	0	0	0	0	**0**	0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**	0	0	0	0	**0**	**0**
		2005	0	0	0	0	**0**	0	0	0	2,231	**2,231**	**2,231**
		2006	0	646	0	11,038	**11,683**	0	0	0	3,482	**3,482**	**15,165**
		2007	0	764	10,617	11,901	**23,282**	1,268	457	2,358	27,942	**32,025**	**55,307**
2	No	2003	0	0	2,059	0	**2,059**	0	0	0	0	s	**2,059**
		2004	0	0	0	0	**0**	0	0	0	9,085	**9,085**	**9,085**
		2005	0	0	0	0	**0**	0	0	399	19,697	**20,096**	**20,096**
		2006	0	1,980	5,375	19,529	**26,883**	0	0	0	10,004	**10,004**	**36,887**
		2007	576	2,069	14,843	19,808	**37,296**	1,743	794	3,593	31,881	**38,010**	**75,306**
	Yes	2003	0	0	430	0	**430**	0	142	0	0	**142**	**571**
		2004	0	0	0	0	**0**	0	0	0	9,085	**9,085**	**9,085**
		2005	0	0	0	0	**0**	0	0	399	19,697	**20,096**	**20,096**
		2006	0	1,980	4,806	18,959	**25,744**	0	0	0	10,004	**10,004**	**35,749**
		2007	576	2,069	14,843	19,808	**37,296**	1,743	794	3,593	31,881	**38,010**	**75,306**

Table 5-37 Hypothetical Chinook salmon saved (relative to estimated mortalities) by sector for PPA1 and PPA2, assuming **0% and 100% allowable** rollover from A to B seasons.

PPA	A-season Transfer-Ability	Year	A-Season CDQ	M	P	S	A **total**	A-B Roll over	B-Season CDQ	M	P	S	B **total**	Annual **Total**
1	No	2003	0	0	0	0	**0**	0%	0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		675	547	0	9,085	**10,307**	**10,307**
		2005	0	0	0	0	**0**		0	0	0	18,076	**18,076**	**18,076**
		2006	0	829	1,145	12,822	**14,796**		0	0	0	4,109	**4,109**	**18,906**
		2007	0	824	10,617	11,901	**23,341**		1,401	457	2,562	27,942	**32,362**	**55,704**
	Yes	2003	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		675	547	0	9,085	**10,307**	**10,307**
		2005	0	0	0	0	**0**		0	0	0	18,076	**18,076**	**18,076**
		2006	0	646	0	11,038	**11,683**		0	0	0	4,109	**4,109**	**15,793**
		2007	0	764	10,617	11,901	**23,282**		1,401	457	2,562	27,942	**32,362**	**55,644**
2	No	2003	0	0	2,059	0	**2,059**		0	142	0	0	**142**	**2,200**
		2004	0	0	0	0	**0**		1,112	966	60	13,764	**15,902**	**15,902**
		2005	0	0	0	0	**0**		0	0	1,314	22,983	**24,297**	**24,297**
		2006	0	1,980	5,375	19,529	**26,883**		0	0	0	10,004	**10,004**	**36,887**
		2007	576	2,069	14,843	19,808	**37,296**		1,743	834	3,593	31,881	**38,050**	**75,346**
	Yes	2003	0	0	430	0	**430**		0	142	0	0	**142**	**571**
		2004	0	0	0	0	**0**		1,112	966	60	13,764	**15,902**	**15,902**
		2005	0	0	0	0	**0**		0	0	1,314	22,983	**24,297**	**24,297**
		2006	0	1,980	4,806	18,959	**25,744**		0	0	0	10,004	**10,004**	**35,749**
		2007	576	2,069	14,843	19,808	**37,296**		1,743	834	3,593	31,881	**38,050**	**75,346**
1	No	2003	0	0	0	0	**0**	100%	0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2005	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2006	0	829	1,145	12,822	**14,796**		0	0	0	3,155	**3,155**	**17,951**
		2007	0	824	10,617	11,901	**23,341**		1,268	457	2,325	27,942	**31,992**	**55,334**
	Yes	2003	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2005	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2006	0	646	0	11,038	**11,683**		0	0	0	3,155	**3,155**	**14,838**
		2007	0	764	10,617	11,901	**23,282**		1,268	457	2,325	27,942	**31,992**	**55,274**
2	No	2003	0	0	2,059	0	**2,059**		0	0	0	0	**0**	**2,059**
		2004	0	0	0	0	**0**		0	0	0	7,136	**7,136**	**7,136**
		2005	0	0	0	0	**0**		0	0	245	18,076	**18,321**	**18,321**
		2006	0	1,980	5,375	19,529	**26,883**		0	0	0	9,330	**9,330**	**36,213**
		2007	576	2,069	14,843	19,808	**37,296**		1,743	794	3,593	31,881	**38,010**	**75,306**
	Yes	2003	0	0	430	0	**430**		0	0	0	0	**0**	**430**
		2004	0	0	0	0	**0**		0	0	0	7,136	**7,136**	**7,136**
		2005	0	0	0	0	**0**		0	0	245	18,076	**18,321**	**18,321**
		2006	0	1,980	4,806	18,959	**25,744**		0	0	0	9,330	**9,330**	**35,074**
		2007	576	2,069	14,843	19,808	**37,296**		1,743	794	3,593	31,881	**38,010**	**75,306**

Transferability

Transferable bycatch quotas are included in the PPA under both PPA1 and PPA2. The value of having transferable quotas within each season is evaluated by making two different fleet behavior assumptions in the A season: to operate under either perfect transferability or no transferability. This provides two contrasting sets of results for A season catch. In the B season it is assumed that the fleet would have perfect transferability.

Evaluating the contrasting assumptions of transferability in the A season indicates that there is limited impact to the number of Chinook salmon saved from this option. The closure dates by sector and relative bycatch levels in 2006 and 2007 are different between with and without transferability for both high and low cap levels. For example in 2006, the A-season bycatch for PPA1 with transferability was higher for all non-CDQ sectors compared to what would have occurred without transferability (Table 5-34; compare the "No" transferability rows with the analogous "Yes" rows). Over 3,000 more Chinook salmon would have been taken in 2006 with transferable bycatch quotas and allowed the fleet to come close to the 68,000 Chinook salmon cap fleetwide. For the CP sector, differences are more pronounced, particularly under the lower PPA2 cap level, where in 2003, the closure absent transferability would have been 13 days earlier (March 8 rather than March 21; Table 5-31), resulting in a difference of approximately 1,600 fish (Table 5-34). In the Mothership sector, no change is estimated at the lower cap level, while a 3 day earlier closure (Table 5-31) is estimated at the higher cap level in 2006 and results in a difference of approximately 190 fish (Table 5-34).

5.3.4 Comparison of impacts: Alternatives 1, 2, and 4

Information used to compare the impacts of Alternative 1, Alternative 4's PPA1 and PPA2, and those of Alternative 2's components and options, is shown in Table 5-38 and Table 5-40.

In Table 5-38, the estimated impacts from the highest (2007) and lowest (2003) bycatch years are shown. The table indicates the projected fleetwide bycatch, by season and annually, for PPA1, PPA2 and the highest and lowest bycatch combinations of sector and seasonal splits under Alternative 2, for each year. The table compares these projected bycatch totals to the actual bycatch in that year, which is expressed as the percentage reduction from the actual 2007 or 2003 bycatch (under the Alternative 1, Status Quo "No hard cap" scenario).

Table 5-38 Projected fleetwide salmon bycatch, by season and annually, under PPA 1, PPA2, and the lowest and highest bycatch sector and season combinations for Alternative 2, for highest (2007) and lowest (2003) bycatch years[9].

Bycatch year	Alternative	Bycatch cap level	Projected salmon bycatch			Reduction from actual bycatch in that year
			A season	B season	Annual Total	
2007	PPA1[10]	68,392	46,130	20,193	66,323	46%
	PPA2	47,591	32,175	14,208	46,383	62%
Actual	Lowest 2007 bycatch alternative[11]	29,300	2,801	6,557	9,358	92%
bycatch: 121,638	Highest 2007 bycatch alternative[12]	87,500	40,415	36,828	77,243	37%
2003	PPA1[10]	68,392	33,578	13,113	46,691	1%
	PPA2	47,591	31,520	13,113	44,633	5%
Actual	Lowest 2003 bycatch alternative[13]	29,300	11,550	11,084	22,634	52%
bycatch: 46,993	Highest 2003 bycatch alternative[14]	87,500	33,808	13,185	46,993	0

In 2007, the highest bycatch year analyzed (and the year of highest historical bycatch of Chinook), PPA1 would have resulted in a 46% reduction overall in Chinook bycatch, from the actual amount caught. PPA2, with a lower cap but the same sector and seasonal partitions, would have resulted in a 62% reduction from the actual amount. For comparison against other scenarios analyzed under the components and options of Alternative 2, a high of 92% reduction would have been estimated under the most restrictive cap of 29,300 (with seasonal split of 70/30 and a sector split as noted in option 2d), while the least restrictive cap of 87,500 (with seasonal split of 50/50 and sector split of option 2a) would have resulted in a 37% reduction from actual bycatch in that year. Note, these are based on actual numbers of salmon taken in bycatch per year and do not take into account adult equivalents.

In low bycatch years, the majority of caps under consideration have minimal impact on actual bycatch levels, as estimated annually. In 2003, the lowest bycatch year analyzed, neither PPA1 or PPA2 results in large reductions from the actual bycatch in that year (1-5 % reduction, respectively), while under the highest cap under consideration (87,500), no change is evident from Alternative 1. The lowest cap under consideration of 29,300 (split seasonally 50/50 with a sector split under option 1) provides a 52% reduction from the status quo.

Table 5-39 and Table 5-40 compare the alternatives by examining the relative returns of adult equivalents to the river systems, compared to actual 2007 bycatch (see Chapter 3 for methodology and section 5.3.5 for detailed impacts by river system). PPA1 and PPA2 are compared against results from Alternative 2, using the Option 2d sector split for the highest and lowest cap levels (87,500 and 29,300). The seasonal split used is 70/30 for all scenarios. Table 5-39 summarizes total salmon savings in bycatch numbers and adult equivalents, under the scenarios. Table 5-40 indicates the distribution of adult equivalent salmon to

[9] The analysis looks at bycatch in the years 2003-2007.
[10] Assumes no A season transferability
[11] Option 2d sector split, 70/30 seasonal split
[12] Option 2a sector split, 50/50 seasonal split
[13] Option 1 sector split, 50/50 seasonal split
[14] The following sector and seasonal splits all produced similar results: Option 1 sector split [all seasonal splits equivalent]; Option 2a, [58/42]; Option 2d, [58/42, 70/30]

selected river systems. Additional scenarios for different cap, seasonal and sector splits, as compared against the PPA, are included in Sections 5.3.4.1 and 5.3.2.2.

Table 5-39 Total projected reduction of Chinook salmon bycatch levels, and adult equivalent salmon bycatch. Compares PPA1, PPA2, and the highest and lowest caps of comparable seasonal and sector combinations of Alternative 2, using 2007 results.

	PPA1	PPA2	Alt2 cap 87,500 Opt2d 70/30	Alt2 cap 29,300 Opt2d 70/30
Number of salmon bycatch saved	55,307	75,306	46,766	112,647
Adult equivalent salmon saved	26,420	40,851	22,417	65,476

Table 5-40 Projected reduction of adult equivalent salmon bycatch, in number of salmon, by region of origin (based on genetic aggregations). Compares PPA1, PPA2, and the highest and lowest caps of comparable seasonal and sector combinations of Alternative 2, using 2007 results. Higher numbers indicate a greater salmon "savings", compared to Alternative 1.

Stocks of Origin[15]	PPA1	PPA2	Alt2 cap 87,500 Opt2d 70/30	Alt2 cap 29,300 Opt2d 70/30
Yukon	5,228	8,840	3,299	14,938
Kuskokwim	3,398	5,746	2,144	9,710
Bristol Bay	4,443	7,514	2,804	12,697
Pacific Northwest aggregate stocks (PNW)	8,489	11,135	9,581	15,507
Cook Inlet stocks	1,042	1,202	1,010	1,284
Transboundary aggregate stocks (TBR)	699	821	670	909
North Alaska Peninsula stocks (N.AK)	2,318	4,389	2,264	8,594
Aggregate 'other' stocks	803	1,203	646	1,837

PPA1 provides neither the highest nor lowest reduction in adult equivalents to individual river systems, based on the range of caps under consideration. Relative impacts to individual river system are highly dependent upon where the fleet fished in a given year, as a river system's proportional contribution to bycatch varies spatially. Thus, comparative results for the same caps and rivers of origin will be highly variable by year. See Section 5.3.5 for additional results by year and stock of origin.

5.3.4.1 Comparison of 2007 projected bycatch levels under Alternatives 2 and 4

As an indication of the relative amount of Chinook bycatch on an annual basis under each option and seasonal distribution, the annual totals for a single year (2007) are shown by cap level, sector, and season options, for Alternative 2 (Table 5-41) compared with Alternative 4 PPA (Table 5-42). For each sector split option, and seasonal distribution option, the hypothetical catch realized, due to the combination of seasonal constraints by sector, is less than the annual cap specified under each cap scenario.

[15] For specific information on stocks included in each stock of origin grouping, see Table 3-7 in Chapter 3.

Table 5-41 Annual totals of hypothetical Chinook salmon bycatch levels, in numbers of fish, under different Alternative 2 options for sector and season specific caps for **2007**.

	2007		opt1(AFA)			opt2a			opt2d		
	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
Annual Total	87,500	CDQ	5,620	5,620	5,620	2,544	2,086	2,086	4,943	5,297	4,326
		M	5,503	6,373	6,773	3,941	3,941	4,945	5,128	5,503	6,373
		P	19,648	23,996	26,606	14,005	14,005	12,214	14,005	19,648	19,648
		S	28,757	36,431	34,960	56,753	56,480	51,388	46,557	39,954	44,882
	87,500 Total		59,529	72,421	73,960	77,243	76,512	70,633	70,634	70,403	75,230
	68,100	CDQ	5,620	5,620	4,326	1,279	1,279	1,836	4,132	3,649	4,326
		M	3,941	5,503	5,427	3,941	3,383	3,071	3,941	3,941	4,945
		P	14,005	19,648	19,648	12,187	13,667	11,796	14,005	14,005	17,857
		S	23,763	23,763	27,557	43,035	39,954	43,708	28,757	36,431	34,960
	68,100 Total		47,329	54,534	56,959	60,442	58,283	60,411	50,835	58,027	62,088
	48,700	CDQ	4,620	3,649	4,326	1,029	1,029	856	2,544	2,544	2,703
		M	3,941	3,383	3,071	1,457	1,145	2,835	1,457	3,383	3,071
		P	14,005	14,005	12,214	4,708	9,978	8,628	12,187	12,214	11,796
		S	11,930	8,051	16,105	28,757	23,763	30,068	23,763	23,763	19,883
	48,700 Total		34,497	29,088	35,717	35,951	35,915	42,388	39,951	41,904	37,453
	29,300	CDQ	2,544	2,086	2,703	600	856	680	1,279	1,279	1,836
		M	1,145	1,145	774	909	774	479	1,145	909	645
		P	4,708	9,978	8,628	2,940	2,604	1,945	4,290	3,686	2,604
		S	4,273	4,273	4,273	10,561	8,051	16,105	8,051	8,051	4,273
	29,300 Total		12,670	17,482	16,378	15,010	12,285	19,209	14,765	13,925	9,358

Table 5-42 Annual totals of hypothetical Chinook salmon bycatch levels, in numbers of fish, under Alternative 4 PPA scenarios for sector and season specific caps for 2007.

PPA Scenario	Transferability	Sector	Annual total
1	No	CDQ	4,876
		M	5,207
		P	18,910
		S	37,329
		Total	**66,322**
	Yes	CDQ	4,876
		M	5,266
		P	18,910
		S	37,329
		Total	**66,381**
2	No	CDQ	3,826
		M	3,625
		P	13,449
		S	25,483
		Total	**46,383**
	Yes	CDQ	3,826
		M	3,625
		P	13,449
		S	25,483
		Total	**46,383**

5.3.4.2 Comparison of Alternatives 2 and 4 for Chinook salmon saved and forgone pollock

Selection of a final preferred alternative will involve explicit consideration of trade-offs between the potential salmon saved and the forgone pollock catch. As an example, Alternative 2 cap levels (with explicit seasonal and sector splits as noted) are compared with the PPA (PPA1 and PPA2) for both their estimated salmon saved and the forgone pollock over the highest bycatch year analyzed (2007) and the lowest bycatch year analyzed (2003) (Table 5-43). In a high bycatch year (2007) the greatest reduction in salmon would have occurred under the cap level of 29,300 (with the sector and seasonal splits as noted), with a 92% reduction in salmon. However this would be achieved at a cost of 46% of the annual total pollock catch forgone. The highest cap under consideration (87,500) would have reduced overall salmon bycatch levels by an estimated 37%, but with a much lower reduction in pollock catch of 22%. The Council's PPA falls between these high and low levels, as indicated. The Council's PPA1 would indicate a higher percentage of salmon bycatch reduction than the 87,500 cap for a similar reduction in pollock catch. However in a lower bycatch year (such as 2003), the PPA results in limited reduction in salmon bycatch and corresponding reduced pollock catch. In low bycatch years, only the lowest cap considered (29,300) will achieve substantial bycatch reduction.

The Council must balance two objectives: reducing salmon bycatch to the extent practicable, and achieving optimum yield as required under the National Standards of the Magnuson-Stevens Act. These are the considerations that must be taken into account in selecting the final preferred alternative.

Table 5-43 Annual salmon saved compared with annual pollock forgone for the range of caps under consideration (comparison of 2003 and 2007 results).

Year	Bycatch Cap level (results for specific sector and seasonal allocations)	Reduction from actual bycatch in that year	Forgone Pollock catch in that year
2007 (highest)	87,500[16]	37%	22%
	68,392 (PPA1) Council Pref. Alt (high)	46%	23%
Actual bycatch= 121,638	47,591 (PPA2) Council Pref. Alt (low)	62%	32%
	29,300[17]	92%	46%
2003 (lowest)	87,500[18]	0%	0%
	68,392 Council Pref. Alt (high)	1%	0%
Actual bycatch= 46,993	47,591 Council Pref. Alt (low)	5%	4%
	29,300[19]	52%	22%

The combination of sector and seasonal allocations, as presented under Alternatives 2 and 4, show that the impact of the alternative options on total bycatch numbers and numbers forgone pollock vary by year (Fig. 5-41). The selection of a final preferred alternative, with specific seasonal and sector caps, will consider the tradeoffs between salmon saved and pollock forgone, understanding that impacts are variable by year. Figure Y plots the results for the subset of Alternative 2 options that are analyzed, in comparison with the Alternative 4 PPA scenarios, over all years, 2003-2007. The Alternative 2 options are illustrated by open circles, open squares, and open diamonds. PPA1 is illustrated by closed circles, and PPA2 by closed triangles. The figure illustrates the interannual variability: the same option can have very different results in terms of forgone pollock and Chinook saved, on an annual basis.

[16] Option 2a sector split, 50/50 seasonal split
[17] Option 2d sector split, 70/30 seasonal split
[18] The following sector and seasonal splits all produced similar results: Option 1 sector split [all seasonal splits]; Option 2a [58/42]; Option 2d, [58/42, 70/30]
[19] Option 1 sector split, 50/50 seasonal split

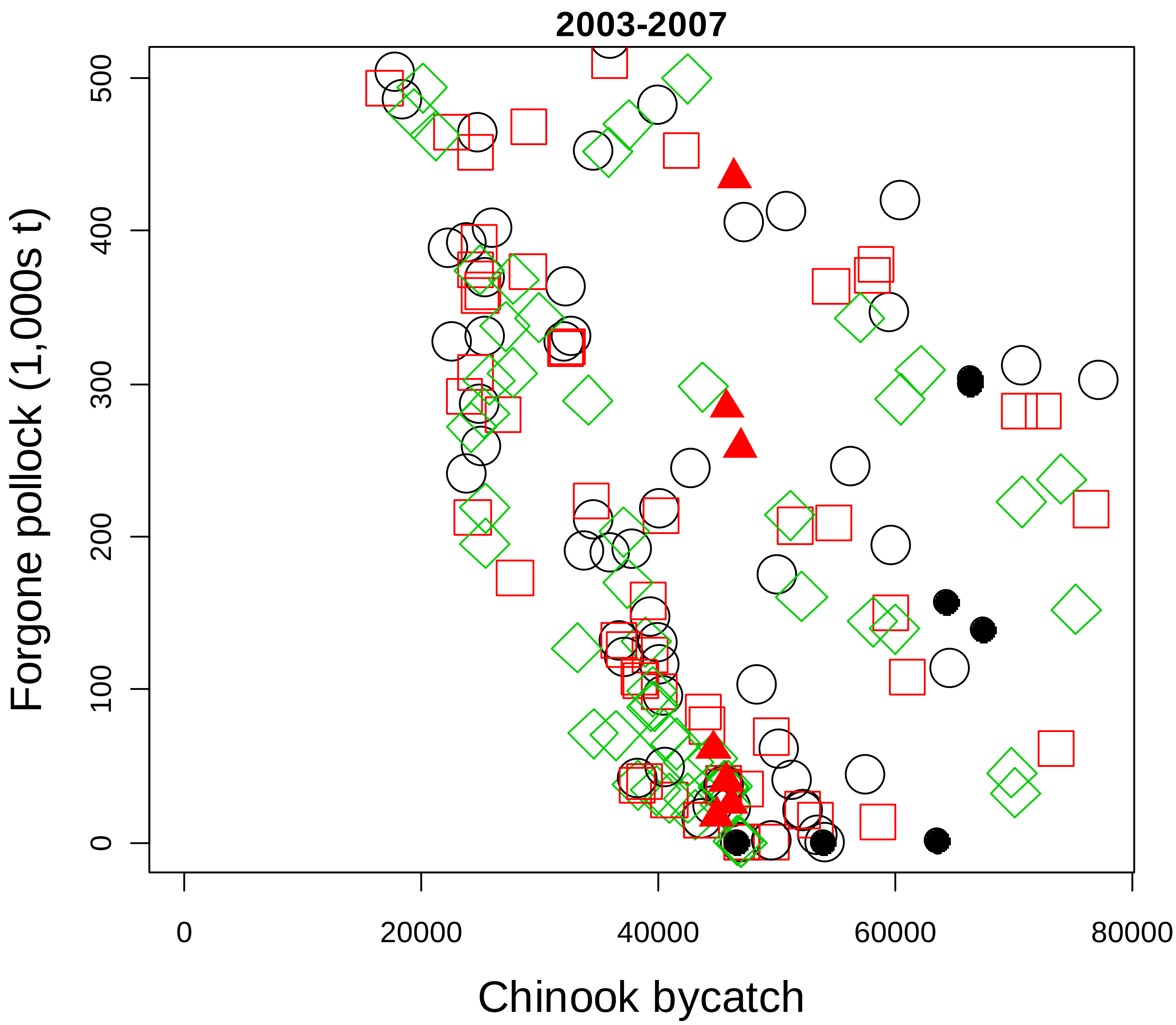


Fig. 5-41 Comparisons of hypothetical Chinook bycatch (numbers, horizontal axis) and forgone pollock (thousands of t, vertical axis) for all Alternative 2 options analyzed (open circles, open squares and open diamonds) as compared to the PPA1 (closed circles) and PPA2 (closed triangles). Results are for all years analyzed (2003-2007).

Fig. 5-42 compares the PPA, by year (open circles or triangles, with the year indicated inside) with the results for the 4 cap levels analyzed under Alternative 2, option 2d, 70/30 seasonal split (numbers alone). These Alternative 2 options represent the closest comparable option to the PPA for sector and seasonal split.

For Alternative 4 (PPA), the retrospective examination shows that allowing for transferability among sectors and rollovers between seasons retains the feature of staying below the salmon bycatch cap while reducing the forgone pollock catch levels (Fig. 5-42). As expected, analysis of PPA 1 resulted in lower levels of forgone pollock but higher levels of bycatch (Fig. 5-42). Results implementing PPA 2 resulted in nearly the same bycatch levels in all years but had more variable impact on the ability to catch the available TAC of pollock.

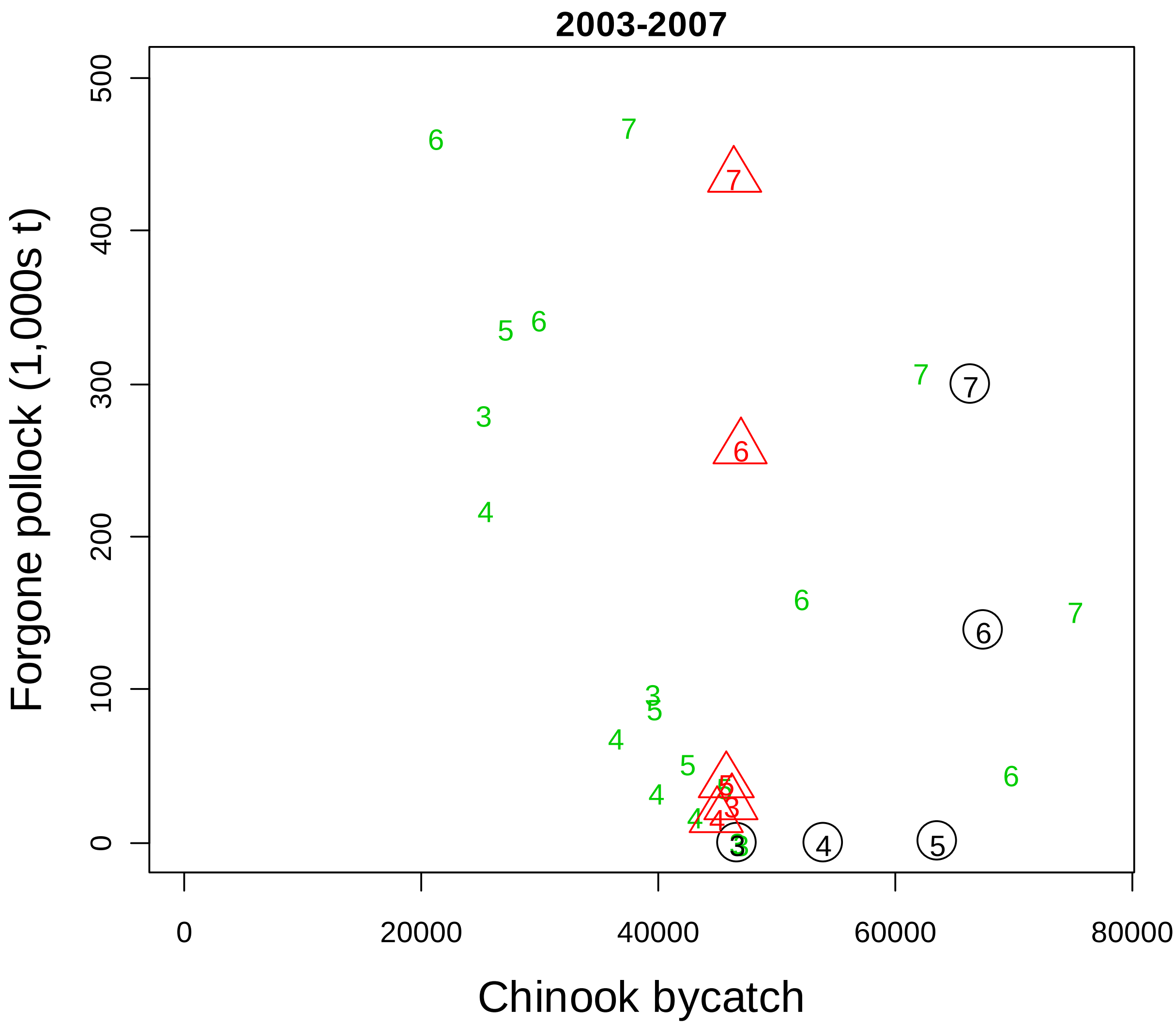


Fig. 5-42 Comparisons of hypothetical Chinook bycatch (numbers, horizontal axis) and forgone pollock (thousands of t, vertical axis) for PPA 1 (circles) and PPA 2 (triangles) assuming 80% rollover and transferability. Numbers represent the year (i.e., 6=2006, 7=2007 etc) and those not enclosed by symbols are from the Alternative 2 options with 70/30 A-B season split and sector splits following Option 2d (CDQ=6.5 %, inshore CV=57.5 %, Motherships=7.5 %, and at-sea processors= 28.5 %).

5.3.5 River of origin AEQ impacts under Alternatives 2 and 4

In this section, the hypothetical bycatch levels, identified for each combination of seasonal and sector salmon cap in the retrospective analysis, are evaluated for their impact on salmon stocks. As described in the methodology in Chapter 3, the adult-equivalency (AEQ) of the bycatch was estimated, to determine both how many of the salmon caught as bycatch would have returned as adults to their spawning streams, and the regional distribution of the bycatch. The bycatch-at-age data is used to pro-rate how any given year of bycatch affects future potential spawning runs of salmon.

Each scenario for seasonal and sector apportionment of the Chinook salmon cap has different regional impacts for salmon. The relative proportion of salmon bycatch originating from different regions (e.g., the

Upper Yukon, the Pacific northwest, the Gulf of Alaska) varies with the season and with the sector (as the sectors fish in different areas). For example, if the inshore CV fleet receives a relatively lower allocation of Chinook bycatch, then the amount of salmon bycatch anticipated to occur in the southeast Bering Sea during the B-season will be lower, which would change the expected stock make-up of the bycatch. To account for this, case-specific apportionments were developed and applied to each of the three spatial-temporal bycatch strata used from the genetics data. Table 5-44 shows the proportion of annual bycatch occurring in the A season, B season/northwest Bering Sea, and B season/southeast Bering Sea, under all of the cap scenarios considered, had the caps been imposed during 2003-2007.

Table 5-44 Proportions of the bycatch occurring within each stratum under the different PPA scenarios in Alternative 4, and management options in Alternative 2 for 2003-2007. The actual observed proportion of the bycatch in each year is shown in the shaded top row. Two other rows are shaded (68,100 70/30 Opt2d and 48,700 70/30 Opt2d), representing the Alternative 2 scenarios that are most similar to the PPA).

	Stratum 1, A-season					Stratum 2, B-season NW					Stratum 3, B-season SE				
	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
No Cap	72%	44%	41%	71%	57%	10%	13%	20%	3%	8%	18%	43%	39%	26%	35%
PPA Scen 1	86%	54%	49%	72%	79%	3%	6%	13%	1%	2%	11%	40%	37%	27%	20%
PPA Scen 2	86%	66%	69%	73%	78%	3%	5%	9%	1%	2%	11%	30%	23%	26%	20%
87,500 70/30 opt2d	72%	56%	61%	80%	73%	2%	13%	17%	7%	15%	26%	31%	23%	13%	12%
87,500 70/30 opt2a	72%	52%	61%	75%	68%	3%	5%	22%	10%	16%	25%	42%	17%	15%	15%
87,500 70/30 opt1	72%	59%	65%	80%	71%	4%	8%	9%	7%	16%	25%	33%	26%	13%	13%
87,500 58/42 opt2d	72%	48%	53%	66%	63%	7%	11%	21%	6%	19%	21%	41%	26%	28%	18%
87,500 58/42 opt2a	70%	45%	47%	67%	59%	8%	16%	24%	10%	14%	22%	39%	29%	23%	27%
87,500 58/42 opt1	72%	55%	61%	71%	63%	2%	9%	18%	8%	17%	26%	36%	21%	21%	20%
87,500 50/50 opt2d	71%	44%	53%	62%	53%	4%	6%	19%	14%	20%	24%	50%	28%	24%	27%
87,500 50/50 opt2a	67%	45%	44%	59%	52%	5%	11%	12%	20%	22%	28%	44%	44%	21%	26%
87,500 50/50 opt1	72%	48%	53%	58%	56%	7%	8%	17%	9%	17%	21%	43%	30%	33%	27%
68,100 70/30 opt2d	72%	60%	65%	77%	71%	5%	3%	15%	8%	13%	22%	36%	20%	15%	16%
68,100 70/30 opt2a	70%	58%	60%	77%	73%	6%	7%	10%	13%	13%	24%	35%	30%	10%	14%
68,100 70/30 opt1	72%	63%	68%	80%	72%	7%	5%	13%	5%	12%	21%	32%	19%	15%	16%
68,100 58/42 opt2d	70%	55%	61%	66%	57%	6%	13%	15%	13%	13%	24%	32%	25%	20%	30%
68,100 58/42 opt2a	67%	49%	51%	62%	59%	2%	16%	22%	17%	15%	30%	35%	27%	21%	25%
68,100 58/42 opt1	72%	59%	61%	65%	61%	4%	5%	15%	14%	15%	24%	37%	24%	21%	24%
68,100 50/50 opt2d	67%	48%	52%	51%	49%	4%	11%	11%	18%	20%	28%	41%	37%	30%	32%
68,100 50/50 opt2a	66%	42%	49%	57%	48%	9%	13%	18%	9%	34%	25%	45%	33%	35%	18%
68,100 50/50 opt1	70%	55%	61%	65%	55%	5%	13%	12%	12%	18%	25%	32%	27%	23%	28%
48,700 70/30 opt2d	69%	66%	68%	73%	66%	5%	7%	7%	11%	13%	26%	27%	25%	15%	21%
48,700 70/30 opt2a	71%	64%	64%	73%	69%	8%	9%	13%	7%	18%	22%	27%	23%	20%	13%
48,700 70/30 opt1	74%	70%	70%	77%	72%	5%	9%	10%	9%	11%	21%	21%	20%	15%	16%
48,700 58/42 opt2d	66%	59%	63%	63%	57%	2%	11%	16%	13%	24%	31%	30%	21%	24%	19%
48,700 58/42 opt2a	66%	53%	55%	51%	54%	4%	4%	23%	18%	26%	30%	43%	23%	30%	20%
48,700 58/42 opt1	64%	63%	67%	68%	46%	4%	6%	8%	10%	35%	32%	31%	25%	22%	19%
48,700 50/50 opt2d	64%	53%	55%	57%	51%	9%	9%	18%	9%	24%	26%	38%	27%	34%	25%
48,700 50/50 opt2a	65%	52%	53%	46%	38%	9%	14%	19%	16%	20%	26%	34%	28%	38%	41%
48,700 50/50 opt1	61%	56%	59%	63%	39%	3%	9%	19%	12%	29%	36%	35%	22%	25%	32%
29,300 70/30 opt2d	71%	75%	71%	73%	30%	8%	6%	13%	6%	39%	22%	19%	16%	22%	31%
29,300 70/30 opt2a	69%	71%	71%	71%	72%	10%	9%	13%	9%	11%	21%	21%	16%	20%	17%
29,300 70/30 opt1	72%	71%	69%	72%	56%	3%	7%	14%	9%	20%	25%	23%	17%	19%	24%
29,300 58/42 opt2d	55%	60%	55%	65%	14%	11%	4%	21%	12%	44%	34%	36%	24%	24%	42%
29,300 58/42 opt2a	59%	58%	58%	58%	16%	9%	7%	10%	24%	42%	32%	36%	33%	18%	42%
29,300 58/42 opt1	62%	59%	60%	66%	49%	10%	7%	14%	9%	25%	28%	34%	26%	26%	26%
29,300 50/50 opt2d	52%	51%	50%	55%	14%	12%	14%	18%	18%	34%	36%	35%	33%	27%	53%
29,300 50/50 opt2a	54%	53%	48%	52%	12%	3%	15%	24%	21%	34%	42%	32%	28%	27%	54%
29,300 50/50 opt1	51%	56%	48%	57%	22%	7%	5%	18%	17%	30%	42%	39%	34%	26%	47%

Expanding the fleet's bycatch to adult equivalents by region shows the degree to which different scenarios might have varied had they been applied historically (2003-2007). Table 5-45 displays the adult equivalent Chinook salmon bycatch mortality totals for the two PPA scenarios, and Table 5-45 displays similar results for the PPA scenarios in conjunction with the other 36 alternatives analyzed as the subset of Alternative 2 components and options. The estimated adult equivalent bycatch with no cap in place (status quo) is listed in the second row of each table. Almost all of the scenarios evaluated result in fewer adult equivalent salmon being removed from the system than under status quo, except in years where the bycatch level was already low (i.e., two scenarios in 2003). On average, for 2003-2007, the different options resulted in AEQ bycatch mortality that was from 88% to 34% of the estimated AEQ mortality under status quo (see 'Mean % of actual' column in Table 5-45). For the PPA scenarios, the average AEQ bycatch mortality was 81% and 69% of the average bycatch mortality with no cap in place.

Table 5-45 Hypothetical adult equivalent Chinook salmon bycatch mortality **totals** under each cap in Alternative 4 (PPA[20]) and cap and management option in Alternative 2, 2003-2007. Numbers are based on the median AEQ values with the original estimates shown in the second row. Right-most column shows the mean over all years relative to the estimated AEQ bycatch.

	2003	2004	2005	2006	2007	Mean % of actual
No Cap	**33,215**	**41,047**	**47,268**	**61,737**	**78,814**	
PPA1	33,629	38,350	39,517	47,971	51,886	81%
PPA2	32,607	36,338	35,986	37,263	37,971	69%
Cap, AB, sector						
87,500 70/30 opt2d	32,903	38,255	38,479	49,058	56,397	82%
87,500 70/30 opt2a	33,081	38,485	38,753	49,986	54,164	82%
87,500 70/30 opt1	32,864	37,582	36,635	43,381	51,106	77%
87,500 58/42 opt2d	33,368	39,856	42,197	47,135	51,981	82%
87,500 58/42 opt2a	32,143	39,887	44,402	54,960	59,119	88%
87,500 58/42 opt1	33,108	38,163	38,153	44,338	51,012	78%
87,500 50/50 opt2d	33,010	40,943	42,928	49,228	51,971	83%
87,500 50/50 opt2a	30,747	38,967	43,140	47,977	53,212	82%
87,500 50/50 opt1	33,151	39,747	41,912	43,139	43,599	77%
68,100 70/30 opt2d	33,162	36,866	36,314	40,583	45,112	73%
68,100 70/30 opt2a	29,981	34,695	36,854	44,290	47,643	74%
68,100 70/30 opt1	32,948	36,791	35,507	39,891	42,666	72%
68,100 58/42 opt2d	32,364	37,417	37,704	40,948	43,194	73%
68,100 58/42 opt2a	30,023	36,658	39,105	43,534	45,139	74%
68,100 58/42 opt1	33,108	37,477	37,402	35,895	38,137	69%
68,100 50/50 opt2d	30,769	37,607	41,249	38,952	38,063	71%
68,100 50/50 opt2a	30,084	37,224	39,182	43,200	45,144	74%
68,100 50/50 opt1	32,342	37,659	38,203	36,334	35,679	69%
48,700 70/30 opt2d	29,249	33,665	33,408	30,077	28,277	59%
48,700 70/30 opt2a	28,798	31,431	31,021	33,765	34,297	61%
48,700 70/30 opt1	30,155	33,547	33,374	31,735	29,376	60%
48,700 58/42 opt2d	29,987	33,692	34,121	30,697	30,120	61%
48,700 58/42 opt2a	27,722	31,175	32,007	28,025	27,065	56%
48,700 58/42 opt1	28,349	33,201	33,788	30,543	25,454	58%
48,700 50/50 opt2d	28,797	33,773	33,600	30,876	29,647	60%
48,700 50/50 opt2a	26,949	30,859	31,139	28,650	27,215	55%
48,700 50/50 opt1	26,854	31,947	31,278	29,530	26,716	56%
29,300 70/30 opt2d	19,200	22,679	23,095	20,513	13,338	38%
29,300 70/30 opt2a	21,115	23,813	23,825	20,612	17,220	41%
29,300 70/30 opt1	19,252	22,524	21,886	19,101	15,220	37%
29,300 58/42 opt2d	18,963	23,646	22,393	20,476	15,041	38%
29,300 58/42 opt2a	19,376	23,043	22,132	20,827	15,039	38%
29,300 58/42 opt1	18,259	21,267	21,286	18,331	14,924	36%
29,300 50/50 opt2d	19,122	22,130	21,382	18,665	14,048	36%
29,300 50/50 opt2a	19,123	21,927	21,513	20,925	16,004	38%
29,300 50/50 opt1	17,104	20,672	19,676	17,542	13,161	34%

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

[20] PPA scenarios have 70:30 A:B season split, 80% rollover from the A to B season, and between season transferability.

The pattern of bycatch relative to AEQ is variable. In some years, the bycatch records may be below the actual AEQ, due to the lagged impact of previous years catches. For example, in 2000, as shown in Fig. 5-43, actual bycatch is below the predicted AEQ bycatch. This is because 1996-1998, the actual bycatch was high. The impacts from those high bycatch years show up in the AEQ bycatch for subsequent years. Some of the Chinook salmon caught as bycatch in those years would not have returned to their river of origin in the year of bycatch. Based on their age and maturity, they might have returned up to one to four years later. Some proportion of the bycatch would not have returned in any year due to ocean mortality.

A similar situation is predicted for the AEQ model results for 2008, because of high bycatch in previous years, especially for 2007. Although to date, 2008 bycatch has been low, compared to previous years, the impacts from 2007 bycatch will continue to be experienced in river systems for several years to come. This impact analysis focuses does not predict impacts past 2007, however we acknowledge that bycatch during the years 2003-2007 will continue to influence adult equivalent salmon returning to river systems for several years into the future.

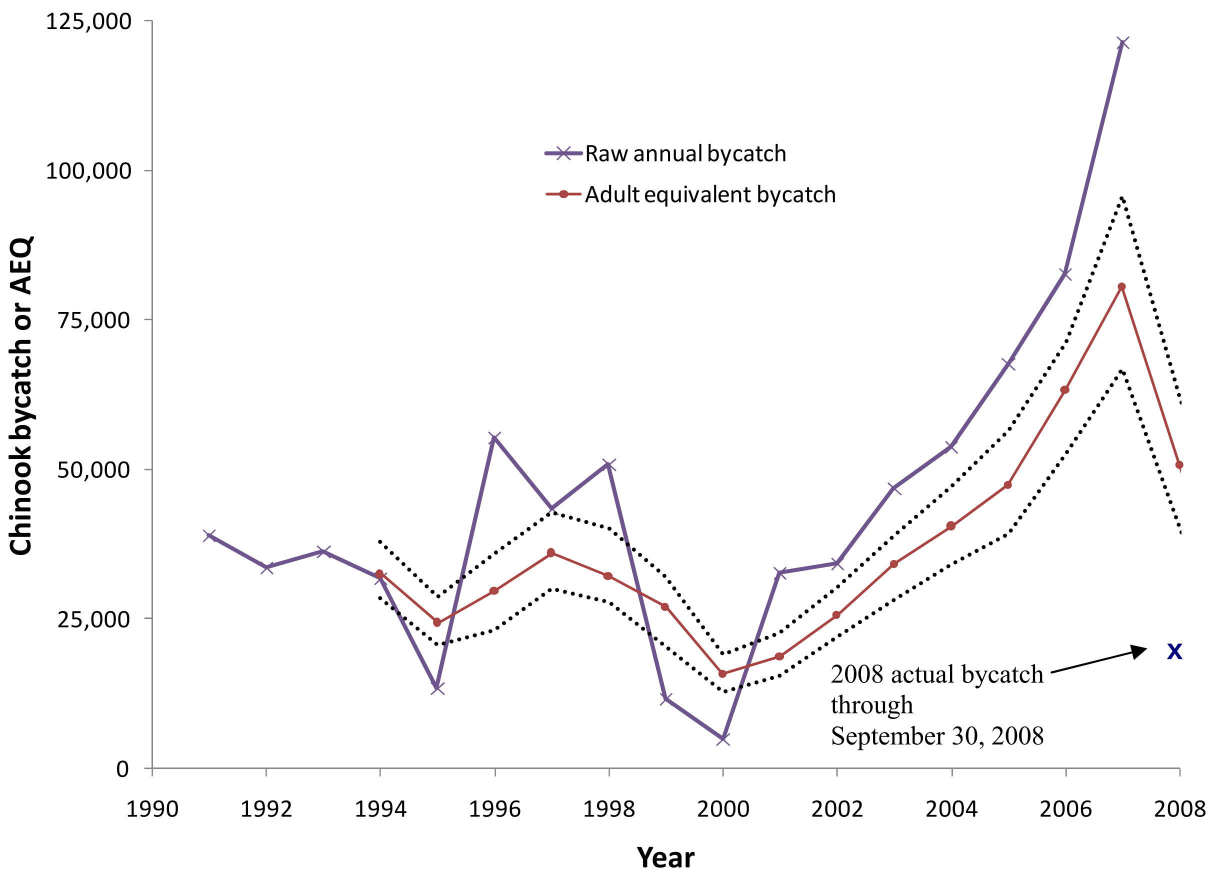


Fig. 5-43 Time series of Chinook actual and adult equivalent bycatch from the pollock fishery, 1991-2007 (2008 to date is also indicated). The dotted lines represent the uncertainty of the AEQ estimate, due to the combined variability of ocean mortality, maturation rate, and age composition of bycatch estimates.

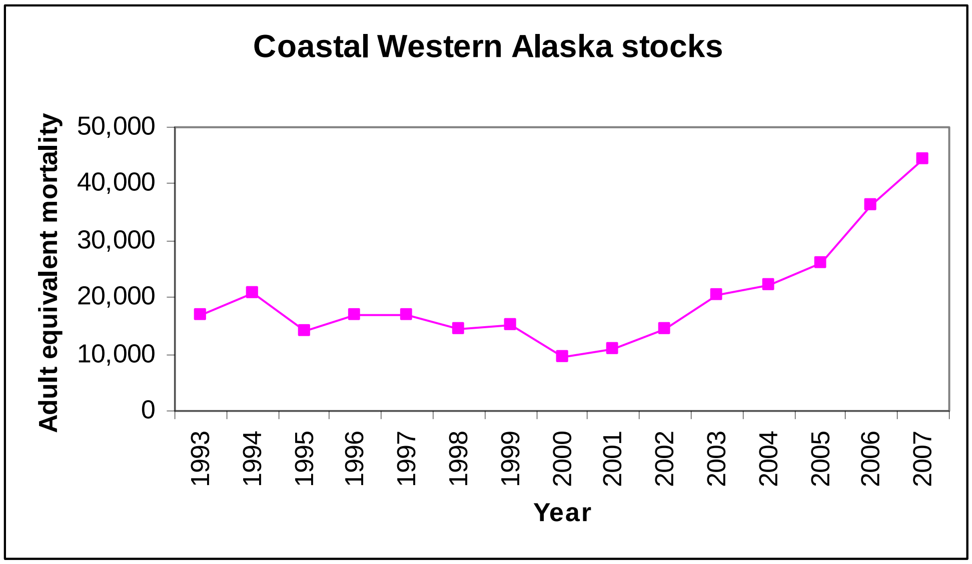


Fig. 5-44 Annual estimated pollock fishery adult equivalent removals on stocks from the Coastal western Alaska returns, 1993-2007.

Estimates of AEQ impacts to specific regions have been developed (Fig. 5-44, Fig. 5-45). Here historical estimates of AEQ are shown for the aggregate coastal western Alaska stocks (Fig. 5-44; which includes the lower Yukon River, Kuskokwim, Bristol Bay and other components) and aggregate Pacific Northwest stocks (Fig. 5-45). A complete listing of stocks included in both aggregate groupings is contained in Table 3-7 in Chapter 3. Note that indicating historical AEQ removals by region implies that the relative distribution of salmon bycatch occurring in space and time would be the same as what was observed during the genetics sampling years (2005-2007). As described previously, the relative intensity of inter-annual patterns of pollock fishing areas and seasons affects the relative contribution of various stocks by year in the bycatch. While these estimates are based on a number of assumptions, alternative approaches (such as assuming a constant fraction of annual bycatch tallies) require even more questionable assumptions.

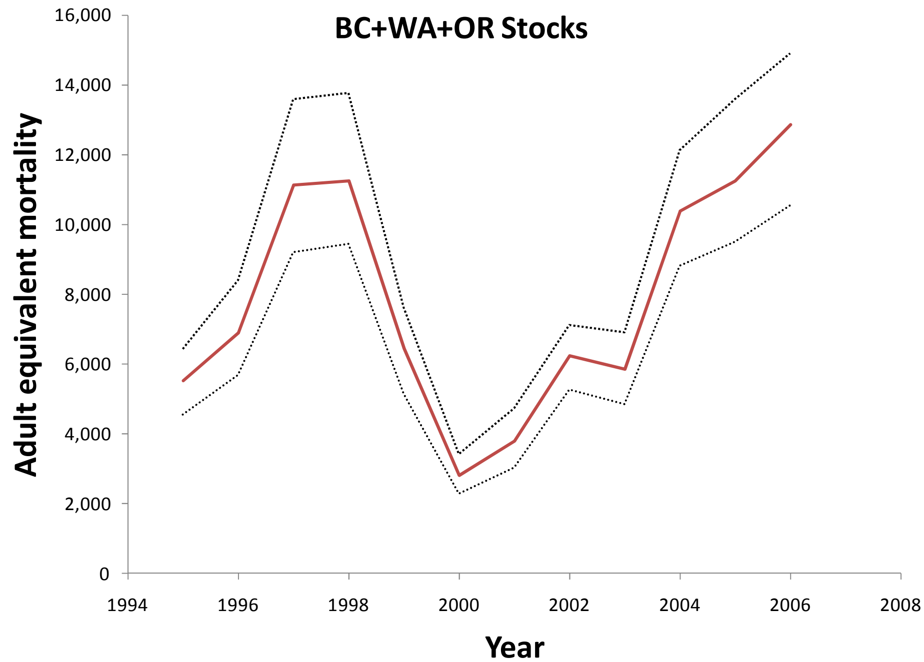


Fig. 5-45 Annual estimated pollock fishery adult equivalent removals on stocks from the Pacific Northwest aggregate stock returns, 1995-2007 with stochasticity in natural mortality (Model 2, CV=0.1), bycatch age composition (via bootstrap samples), maturation rate (CV=0.1), and stock composition.

Breaking the AEQ bycatch to Chinook stock-specific impacts for each stock-specific region, by year, is shown in Table 5-46 for the PPA, which illustrates hypothetical bycatch levels to the river system regions. Table 5-47 through Table 5-51 compare annual AEQ Chinook bycatch for all Alternative 2 scenarios and the PPA, and estimate the number of AEQ Chinook salmon that would have been saved had the management measure been in place. The value is expressed as the baseline AEQ estimate minus the estimate with the management measure in place.

In years when the actual bycatch was below a given cap level, this could have resulted in negative AEQ salmon savings (i.e., more not fewer salmon were prevented from spawning than actually occurred), and the management options appear to actually increase the AEQ bycatch compared to the baseline estimates in some years (shown as negative numbers). This can happen when the combined cumulative effect from prior years bycatch levels are low in some seasons and sectors and high in others. The model has momentum from years prior to 2003 and the restrictions (via caps etc) propagate forward. So even though 2003 is a low bycatch year, the savings from that year is cumulative from previous years as well. There also could be a the contribution due to non-linearities in the simulations. For example, the Pacific northwest (PNW) stocks show an increased AEQ value from the baseline for several of the options for 2003 (Table 5-47).

In a high-bycatch year such as 2007 (Table 5-51), some management options also result in higher AEQ salmon mortalities for some systems (e.g., negative numbers for certain options for the middle Yukon and Upper Yukon rivers). This results because Chinook from these rivers tend to be found most commonly in the NW during the B season, and the proportion attributed to that stratum increases from the estimated 8% shown in Table 5-44 to 14%–22% under those scenarios. These complexities reveal the difficulty in predicting how any management action will affect specific stocks of salmon, particularly since their relative effects appears to vary in different years.

Some stock specific trends are discussed in the sections that follow, and additional tables showing all of the scenarios and impacts by region are included in Table 5-48 through Table 5-51. Results primarily indicate the inter-annual variability in stock specific impacts, and should be considered accordingly.

Table 5-46 Hypothetical adult equivalent Chinook bycatch levels attributed to river system, under the two PPA scenarios with A-B split equal to 70:30, 80% rollover from A to B season, and between sector transferability, 2003-2007.

	PNW	Coast W AK	Cook Inlet	Middle Yukon	N AK Penin	Russia	TBR	Upper Yukon	Other	Total
Scenario 1										
2003	5,229	21,558	244	244	4,990	165	202	230	764	33,625
2004	9,556	20,928	863	291	4,734	237	604	253	867	38,335
2005	9,251	21,722	899	470	4,582	304	628	404	848	39,107
2006	10,038	28,208	708	252	6,661	229	518	234	1,110	47,958
2007	9,696	32,066	597	325	7,496	254	453	304	1,202	52,394
Scenario 2										
2003	5,070	20,903	236	236	4,838	160	196	223	741	32,603
2004	7,924	21,271	627	275	4,855	210	451	246	831	36,690
2005	6,936	21,914	531	371	4,827	236	389	330	802	36,338
2006	7,675	22,034	531	197	5,202	177	391	184	862	37,253
2007	7,050	23,209	437	235	5,425	185	331	220	871	37,963

Table 5-47 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **2003.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005-2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

2003	**PNW**	**Coast WAK**	**Cook Inlet**	**Mid Yukon**	**N AK Pen**	**Russia**	**TBR**	**Up Yukon**	**Other**	**Total**
No Cap	**5,828**	**20,522**	**431**	**366**	**4,485**	**218**	**322**	**321**	**721**	**33,215**
Alt 4 PPA scenarios										
PPA1	599	-1,036	187	122	-505	53	120	91	-43	-410
PPA2	758	-381	195	130	-353	58	126	98	-20	612
Cap, AB, sector										
87,500 70/30 opt2d	-951	1,082	-60	171	-68	55	-38	149	-29	312
87,500 70/30 opt2a	-784	795	-49	138	-75	45	-31	120	-26	134
87,500 70/30 opt1	-730	917	-46	136	-39	44	-29	118	-20	352
87,500 58/42 opt2d	-330	174	-21	49	-54	15	-14	42	-14	-153
87,500 58/42 opt2a	-268	1,091	-34	55	167	18	-20	49	14	1,072
87,500 58/42 opt1	-966	937	-62	165	-93	53	-39	144	-32	108
87,500 50/50 opt2d	-719	801	-51	119	-35	38	-32	104	-20	205
87,500 50/50 opt2a	-609	2,502	-77	126	383	42	-45	112	33	2,468
87,500 50/50 opt1	-290	306	-18	51	-24	16	-12	44	-9	64
68,100 70/30 opt2d	-485	464	-26	91	-65	30	-16	79	-18	53
68,100 70/30 opt2a	-93	2,607	-19	113	436	43	-7	99	54	3,234
68,100 70/30 opt1	-253	430	-16	53	3	18	-10	46	-5	267
68,100 58/42 opt2d	-472	1,097	-46	83	112	27	-27	73	3	851
68,100 58/42 opt2a	-771	3,201	-83	189	435	65	-47	166	37	3,193
68,100 58/42 opt1	-690	692	-44	119	-63	38	-28	104	-23	107
68,100 50/50 opt2d	-665	2,532	-78	139	364	46	-45	123	30	2,447
68,100 50/50 opt2a	-97	2,570	-48	60	533	22	-25	54	63	3,132
68,100 50/50 opt1	-599	1,224	-51	111	89	36	-31	97	-2	874
48,700 70/30 opt2d	-130	3,211	-24	141	534	54	-9	124	66	3,966
48,700 70/30 opt2a	424	3,054	24	87	601	40	22	77	88	4,417
48,700 70/30 opt1	162	2,199	33	126	307	52	25	109	47	3,060
48,700 58/42 opt2d	-851	3,310	-96	189	462	64	-55	167	38	3,228
48,700 58/42 opt2a	-199	4,488	-53	167	806	63	-25	148	97	5,493
48,700 58/42 opt1	-478	4,270	-86	163	759	58	-47	145	83	4,866
48,700 50/50 opt2d	13	3,488	-54	65	756	26	-27	60	93	4,418
48,700 50/50 opt2a	433	4,529	-13	90	970	41	2	81	132	6,266
48,700 50/50 opt1	-531	5,499	-107	196	1,005	70	-58	174	113	6,361
29,300 70/30 opt2d	2,216	8,885	158	181	1,896	100	121	159	299	14,015
29,300 70/30 opt2a	1,929	7,669	128	137	1,677	78	99	120	262	12,100
29,300 70/30 opt1	1,978	9,043	153	236	1,827	118	117	206	286	13,964
29,300 58/42 opt2d	1,506	9,807	30	163	2,167	83	41	146	309	14,252
29,300 58/42 opt2a	1,568	9,405	54	172	2,047	87	55	153	297	13,840
29,300 58/42 opt1	2,034	9,834	103	169	2,161	93	88	151	324	14,956
29,300 50/50 opt2d	1,408	9,793	7	143	2,202	74	26	130	310	14,093
29,300 50/50 opt2a	888	10,237	-15	250	2,101	110	12	223	287	14,093
29,300 50/50 opt1	1,490	11,273	21	221	2,423	106	38	198	342	16,111

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Table 5-48 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **2004.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005-2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

2004	PNW	Coast WAK	Cook Inlet	Mid Yukon	N AK Pen	Russia	TBR	Up Yukon	Other	Total
No Cap	**10,446**	**22,060**	**1,063**	**482**	**4,650**	**323**	**732**	**408**	**882**	**41,047**
Alt 4 PPA scenarios										
PPA1	890	1,132	200	191	-84	86	128	155	15	2,712
PPA2	1,981	4,321	324	304	497	145	213	254	121	8,161
Cap, AB, sector										
87,500 70/30 opt2d	2,215	7	291	-2	8	28	187	-8	66	2,792
87,500 70/30 opt2a	544	1,356	147	201	-57	87	96	171	18	2,562
87,500 70/30 opt1	2,009	661	315	122	-74	74	203	99	56	3,465
87,500 58/42 opt2d	553	357	93	53	-15	28	60	44	17	1,190
87,500 58/42 opt2a	909	70	77	-76	170	-18	50	-66	44	1,159
87,500 58/42 opt1	1,555	670	242	99	-26	59	157	80	47	2,883
87,500 50/50 opt2d	-1,126	1,074	-71	193	-114	62	-45	168	-38	104
87,500 50/50 opt2a	349	1,270	47	63	197	29	33	54	36	2,080
87,500 50/50 opt1	177	773	70	122	-47	50	46	104	5	1,300
68,100 70/30 opt2d	1,641	1,513	313	248	-109	119	203	207	46	4,180
68,100 70/30 opt2a	2,341	2,595	344	188	286	104	226	156	111	6,352
68,100 70/30 opt1	2,260	988	379	194	-134	106	245	159	59	4,255
68,100 58/42 opt2d	2,296	587	294	12	127	34	191	5	83	3,630
68,100 58/42 opt2a	2,142	1,392	224	-40	436	12	148	-38	113	4,389
68,100 58/42 opt1	1,482	1,207	282	215	-121	104	182	179	39	3,570
68,100 50/50 opt2d	1,042	1,643	143	89	240	49	95	75	63	3,440
68,100 50/50 opt2a	730	2,297	62	47	489	28	45	41	82	3,822
68,100 50/50 opt1	2,243	448	289	9	98	32	187	2	78	3,388
48,700 70/30 opt2d	3,504	2,253	503	180	215	116	327	146	137	7,382
48,700 70/30 opt2a	4,047	3,515	530	161	575	116	348	130	195	9,616
48,700 70/30 opt1	4,195	1,687	582	131	170	106	377	102	150	7,500
48,700 58/42 opt2d	3,255	2,537	423	108	431	85	277	86	152	7,354
48,700 58/42 opt2a	2,353	5,345	321	276	809	139	217	234	178	9,872
48,700 58/42 opt1	3,131	2,980	450	210	341	123	295	173	142	7,846
48,700 50/50 opt2d	2,275	3,420	301	165	541	94	200	138	139	7,273
48,700 50/50 opt2a	3,502	4,586	386	80	1,009	76	258	64	227	10,187
48,700 50/50 opt1	3,035	4,116	385	169	711	106	256	140	181	9,099
29,300 70/30 opt2d	6,328	8,145	780	289	1,497	195	519	238	377	18,368
29,300 70/30 opt2a	6,071	7,533	734	237	1,445	171	488	194	361	17,234
29,300 70/30 opt1	6,141	8,466	741	278	1,602	188	494	229	384	18,523
29,300 58/42 opt2d	4,812	8,870	582	328	1,603	191	392	275	347	17,401
29,300 58/42 opt2a	5,049	9,146	583	286	1,756	178	394	240	370	18,004
29,300 58/42 opt1	5,549	10,056	634	303	1,954	191	429	254	409	19,780
29,300 50/50 opt2d	5,383	9,610	566	198	2,051	147	385	165	411	18,917
29,300 50/50 opt2a	5,654	9,510	597	183	2,055	144	405	152	419	19,120
29,300 50/50 opt1	5,349	10,713	607	333	2,061	200	413	281	417	20,375

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Table 5-49 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **2005.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005-2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

2005	PNW	Coast WAK	Cook Inlet	Mid Yukon	N AK Pen	Russia	TBR	Up Yukon	Other	Total
No Cap	**11,232**	**26,043**	**1,223**	**774**	**5,079**	**449**	**841**	**658**	**969**	**47,268**
Alt 4 PPA scenarios										
PPA1	1,981	4,321	324	304	497	145	213	254	121	8,161
PPA2	2,674	8,245	235	156	1,794	93	171	124	288	13,779
Cap, AB, sector										
87,500 70/30 opt2d	4,064	2,801	574	203	311	132	374	164	166	8,789
87,500 70/30 opt2a	4,806	1,935	620	66	364	88	403	45	188	8,515
87,500 70/30 opt1	3,887	4,315	617	396	309	207	404	330	169	10,634
87,500 58/42 opt2d	2,970	1,035	393	50	166	58	255	36	109	5,071
87,500 58/42 opt2a	2,212	114	256	-60	152	4	165	-57	81	2,867
87,500 58/42 opt1	4,347	2,802	594	171	376	123	387	136	180	9,116
87,500 50/50 opt2d	2,602	801	364	75	56	63	235	57	87	4,340
87,500 50/50 opt2a	15	3,074	85	299	183	119	60	257	35	4,128
87,500 50/50 opt1	2,361	1,791	356	166	126	96	232	136	92	5,356
68,100 70/30 opt2d	4,769	3,783	675	263	440	165	441	214	204	10,954
68,100 70/30 opt2a	3,334	4,704	530	388	423	196	349	325	166	10,414
68,100 70/30 opt1	4,968	4,183	724	325	418	192	473	267	210	11,761
68,100 58/42 opt2d	3,946	3,501	571	258	378	153	373	212	173	9,564
68,100 58/42 opt2a	3,514	2,959	422	65	626	71	278	49	181	8,164
68,100 58/42 opt1	4,094	3,603	581	247	426	150	381	202	182	9,867
68,100 50/50 opt2d	1,490	3,081	296	328	129	149	195	278	74	6,019
68,100 50/50 opt2a	2,633	3,697	352	184	573	107	233	153	154	8,087
68,100 50/50 opt1	3,452	3,554	537	317	273	170	351	264	148	9,066
48,700 70/30 opt2d	4,521	6,206	695	477	629	246	458	399	229	13,860
48,700 70/30 opt2a	5,322	7,384	720	385	1,112	220	477	321	306	16,247
48,700 70/30 opt1	5,165	5,631	761	414	609	230	499	343	243	13,894
48,700 58/42 opt2d	5,039	5,261	680	278	786	174	447	228	254	13,147
48,700 58/42 opt2a	5,381	6,686	635	182	1,340	141	422	148	326	15,261
48,700 58/42 opt1	4,522	5,924	686	445	620	234	451	372	227	13,480
48,700 50/50 opt2d	4,523	6,217	575	257	1,070	159	382	213	272	13,669
48,700 50/50 opt2a	4,914	7,788	593	271	1,442	170	397	226	328	16,129
48,700 50/50 opt1	5,485	7,106	682	263	1,286	174	453	216	326	15,991
29,300 70/30 opt2d	7,386	11,597	932	478	1,998	283	623	399	476	24,174
29,300 70/30 opt2a	7,266	11,144	919	461	1,916	275	614	385	462	23,443
29,300 70/30 opt1	7,570	12,385	934	475	2,204	284	626	397	506	25,383
29,300 58/42 opt2d	7,030	12,597	804	377	2,454	239	543	316	516	24,875
29,300 58/42 opt2a	6,308	13,408	780	547	2,318	297	529	463	486	25,137
29,300 58/42 opt1	7,030	13,398	847	493	2,424	285	572	416	517	25,983
29,300 50/50 opt2d	6,547	13,840	749	454	2,615	263	511	384	524	25,886
29,300 50/50 opt2a	6,930	13,413	764	368	2,678	234	520	310	539	25,756
29,300 50/50 opt1	6,841	14,899	771	473	2,846	274	527	401	561	27,593

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Table 5-50 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **2006.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005-2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

2006	PNW	Coast WAK	Cook Inlet	Mid Yukon	N AK Pen	Russia	TBR	Up Yukon	Other	Total
No Cap	**12,712**	**36,453**	**943**	**408**	**8,455**	**322**	**689**	**358**	**1,398**	**61,737**
Alt 4 PPA scenarios										
PPA1	2,674	8,245	235	156	1,794	93	171	124	288	13,779
PPA2	6,471	7,398	860	332	1,229	211	571	259	341	17,672
Cap, AB, sector										
87,500 70/30 opt2d	4,805	5,374	463	-55	1,479	40	311	-53	315	12,679
87,500 70/30 opt2a	4,561	4,955	384	-161	1,583	-5	260	-142	316	11,751
87,500 70/30 opt1	5,724	8,971	516	-7	2,298	70	353	-10	442	18,356
87,500 58/42 opt2d	2,897	8,804	152	2	2,235	37	118	5	351	14,602
87,500 58/42 opt2a	2,160	3,406	92	-189	1,243	-47	69	-161	203	6,777
87,500 58/42 opt1	4,473	9,480	327	-25	2,462	47	233	-21	424	17,399
87,500 50/50 opt2d	3,264	6,936	117	-241	2,245	-54	93	-204	353	12,509
87,500 50/50 opt2a	4,105	7,212	133	-401	2,635	-106	105	-341	417	13,759
87,500 50/50 opt1	3,098	11,831	85	-23	3,053	30	83	-12	453	18,598
68,100 70/30 opt2d	5,969	10,962	503	5	2,779	78	349	3	507	21,154
68,100 70/30 opt2a	6,210	7,887	509	-189	2,387	4	347	-167	459	17,447
68,100 70/30 opt1	6,031	11,402	537	75	2,752	106	372	61	508	21,846
68,100 58/42 opt2d	5,371	11,376	339	-130	3,154	17	245	-110	528	20,789
68,100 58/42 opt2a	4,850	9,918	240	-254	3,030	-39	180	-215	492	18,203
68,100 58/42 opt1	6,190	14,568	392	-76	3,858	48	287	-63	638	25,842
68,100 50/50 opt2d	4,514	13,898	122	-198	3,929	-22	112	-162	592	22,785
68,100 50/50 opt2a	2,799	12,076	45	-13	3,094	30	57	-2	450	18,536
68,100 50/50 opt1	5,797	14,576	365	-30	3,767	61	269	-22	618	25,403
48,700 70/30 opt2d	7,737	17,586	585	47	4,379	117	417	42	751	31,660
48,700 70/30 opt2a	6,505	15,827	497	99	3,829	121	356	86	651	27,971
48,700 70/30 opt1	7,512	16,463	597	70	4,047	123	422	61	706	30,002
48,700 58/42 opt2d	6,784	18,069	433	23	4,549	95	321	25	742	31,039
48,700 58/42 opt2a	6,825	20,214	354	-28	5,196	75	275	-16	818	33,712
48,700 58/42 opt1	6,980	17,955	490	75	4,416	118	357	68	734	31,194
48,700 50/50 opt2d	5,659	18,997	307	108	4,613	114	241	101	720	30,861
48,700 50/50 opt2a	5,957	20,559	252	11	5,204	79	210	20	795	33,087
48,700 50/50 opt1	6,910	18,856	446	54	4,687	109	331	52	764	32,207
29,300 70/30 opt2d	8,831	24,021	664	236	5,637	205	481	207	941	41,224
29,300 70/30 opt2a	8,949	23,852	662	197	5,673	191	480	173	947	41,125
29,300 70/30 opt1	9,306	24,699	692	206	5,869	199	501	181	982	42,636
29,300 58/42 opt2d	8,790	24,150	613	160	5,820	175	450	143	958	41,261
29,300 58/42 opt2a	9,227	23,545	602	5	5,977	119	442	10	983	40,910
29,300 58/42 opt1	9,035	25,577	643	225	6,055	203	472	199	996	43,406
29,300 50/50 opt2d	8,991	25,435	582	117	6,233	160	433	108	1,012	43,071
29,300 50/50 opt2a	8,607	24,066	525	40	6,039	125	394	42	974	40,812
29,300 50/50 opt1	9,271	26,037	616	140	6,341	173	456	127	1,034	44,195

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Table 5-51 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **2007.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005-2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

2007	PNW	Coast WAK	Cook Inlet	Mid Yukon	N AK Pen	Russia	TBR	Up Yukon	Other	Total
No Cap	**18,185**	**44,391**	**1,639**	**739**	**9,814**	**523**	**1,152**	**634**	**1,736**	**78,814**
Alt 4 PPA scenarios										
PPA1	8,489	12,325	1,042	414	2,318	269	699	330	534	26,420
PPA2	11,135	21,182	1,202	504	4,389	338	821	414	865	40,851
Cap, AB, sector										
87,500 70/30 opt2d	9,581	8,379	1,010	-63	2,264	97	670	-69	549	22,417
87,500 70/30 opt2a	9,385	10,379	926	-74	2,793	90	620	-75	606	24,650
87,500 70/30 opt1	10,355	11,829	1,035	-40	3,093	116	694	-47	671	27,708
87,500 58/42 opt2d	9,336	12,215	847	-117	3,345	73	575	-109	668	26,833
87,500 58/42 opt2a	6,167	9,610	549	-22	2,490	70	376	-23	477	19,694
87,500 58/42 opt1	9,230	13,043	853	-41	3,403	101	580	-43	675	27,802
87,500 50/50 opt2d	7,920	13,668	613	-134	3,746	48	427	-117	673	26,843
87,500 50/50 opt2a	7,951	12,706	593	-224	3,681	13	413	-194	662	25,601
87,500 50/50 opt1	9,453	18,683	800	78	4,597	151	558	65	829	35,214
68,100 70/30 opt2d	10,667	16,179	1,071	160	3,800	199	725	127	773	33,702
68,100 70/30 opt2a	10,613	14,242	1,084	104	3,419	177	730	77	724	31,170
68,100 70/30 opt1	11,054	17,709	1,113	218	4,073	227	756	177	820	36,148
68,100 58/42 opt2d	8,944	19,426	783	206	4,530	195	548	176	811	35,619
68,100 58/42 opt2a	9,344	17,537	829	104	4,256	160	574	85	786	33,674
68,100 58/42 opt1	10,887	21,530	982	202	5,074	218	681	169	933	40,677
68,100 50/50 opt2d	10,037	22,513	797	116	5,494	173	564	100	955	40,750
68,100 50/50 opt2a	10,866	16,377	785	-399	4,966	-20	547	-346	893	33,669
68,100 50/50 opt1	10,974	23,424	939	193	5,573	216	657	164	995	43,134
48,700 70/30 opt2d	12,997	27,185	1,209	379	6,159	315	838	321	1,132	50,536
48,700 70/30 opt2a	12,951	22,551	1,212	174	5,392	234	831	141	1,031	44,517
48,700 70/30 opt1	13,227	26,063	1,274	389	5,855	322	878	327	1,103	49,438
48,700 58/42 opt2d	13,073	25,796	1,134	158	6,247	229	789	132	1,135	48,693
48,700 58/42 opt2a	13,559	27,743	1,160	180	6,698	244	809	152	1,204	51,749
48,700 58/42 opt1	14,035	28,639	1,139	72	7,143	207	799	60	1,267	53,359
48,700 50/50 opt2d	12,511	26,731	1,046	176	6,448	229	734	150	1,143	49,167
48,700 50/50 opt2a	11,521	29,594	905	295	6,936	263	649	257	1,178	51,598
48,700 50/50 opt1	12,560	29,053	978	153	7,083	220	696	133	1,220	52,097
29,300 70/30 opt2d	15,507	36,664	1,284	366	8,594	342	909	316	1,495	65,476
29,300 70/30 opt2a	15,241	33,683	1,421	536	7,497	406	989	456	1,365	61,593
29,300 70/30 opt1	15,306	35,266	1,357	481	8,010	385	952	411	1,425	63,593
29,300 58/42 opt2d	14,686	36,190	1,141	280	8,644	297	816	245	1,473	63,772
29,300 58/42 opt2a	14,632	36,228	1,146	304	8,606	306	819	265	1,468	63,775
29,300 58/42 opt1	15,299	35,541	1,328	444	8,154	370	934	380	1,440	63,890
29,300 50/50 opt2d	14,310	37,272	1,132	406	8,667	342	812	353	1,471	64,765
29,300 50/50 opt2a	13,690	36,364	1,047	358	8,533	315	756	313	1,434	62,810
29,300 50/50 opt1	14,766	37,492	1,210	449	8,638	365	862	389	1,482	65,653

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Western Alaska Stocks: Yukon, Kuskokwim, Bristol Bay (Nushagak)

As discussed in Chapter 3, since the genetics results are limited in the ability to distinguish among the specific western Alaska stocks, we used the results from scale-pattern analyses to provide estimates to western Alaska rivers. For each cap alternative and option, the proportional breakouts of western Alaska Chinook based on Myers et al.'s (2003) proportions are shown in Table 5-53 through Table 5-56 for each year and river system, expressed in terms of number of Chinook saved under each scenario. Hypothetical adult equivalent bycatch numbers are provided for the PPA in Table 5-52. To further summarize these tables, we constructed a range of hypothetical reductions in coastal-west Alaska AEQ values. These values are based on medians from the simulation model and are applied to mean proportional assignments to regions within each stratum (A-season (all areas), and B-seasons broken out geographically be east and west of 170°W). For the least constraining option, results suggest that over 3,000 western Alaska AEQ Chinook would have been saved had those measures been in place in 2006 and 2007 (Table 5-50 and Table 5-51). Under the most constraining option, the number of AEQ Chinook saved to these rivers would have been over 26,000 in 2006 and over 37,000 in 2007. For the PPA scenarios these values range from 8,200 to 14,400 in 2006 to 12,300 to 21,182 in 2007. For the Kuskokwim it should be noted that the genetics for Coastal WAK do not include the "upper Kuskokwim" which was included in the Other category. The fractional contribution of this component is likely quite small. Aggregate results for Coastal WAK are also complicated by the inclusion of other components such as Norton Sound stocks. Thus any results as noted for individual river system should be taken as a discussion of trends and not necessary any absolute value. These results are presented solely to characterize the trends in impacts of various alternatives.

Table 5-52 Hypothetical Chinook adult equivalent bycatch levels to western Alaska river systems under the PPA scenarios, using Myers et al. (2003) estimates for Yukon, Kuskokwim and Bristol Bay.

	Total western Alaska	Yukon	Kuskokwim	Bristol Bay
Scenario 1				
2003	22,032	8,813	5,728	7,491
2004	21,472	8,589	5,583	7,300
2005	22,596	9,038	5,875	7,683
2006	28,694	11,478	7,460	9,756
2007	32,695	13,078	8,501	11,116
Scenario 2				
2003	21,362	8,545	5,554	7,263
2004	21,792	8,717	5,666	7,409
2005	22,615	9,046	5,880	7,689
2006	22,415	8,966	5,828	7,621
2007	23,664	9,466	6,153	8,046

Norton Sound Stocks

Due to the limitations in the genetic ability to differentiate Norton Sound stocks separately from other stocks, specific impact assessment for Norton Sound cannot be estimated at this time. Genetically the stocks from Norton Sound are included as an unresolved component of the Coastal western Alaska stocks thus trends for those stocks could be used to approximate trends for impacts to Norton Sound stocks (Table 5-53, expressed in terms of number of Chinook saved under each scenario). The extent to which Norton Sound stocks may differ from the aggregate Coastal western Alaska grouping at this time cannot be determined. Geneticists have noted that the Norton Sound stocks do show some distinction from other western Alaska groups, but the distinctions are not currently sufficient to resolve these groups separately based upon developed threshold criteria. Some uncertainty be resolved by having better representation in sampling of populations from this area and sampling is planned to continue to resolve these distinctions to better estimate the Norton Sound stocks.

Cook Inlet Stocks

Impacts on Cook Inlet stocks are characterized by year in Table 5-57, expressed in terms of number of Chinook saved under each scenario. Here, while the PPA1 and PPA2 show increases in each year in reduced mortality of Cook Inlet AEQ, many of the Alternative 2 options analyzed show a decrease in 2003. Changes in fishing locations due to cap constraints resulted in a higher amount of Cook Inlet stocks being caught and the observed decrease in estimated AEQ to those rivers. Notable results differ for Cook Inlet stocks for those Alternative 2 options with similar cap levels to the PPA1 and PPA2. Cap levels of 68,100 (option 2d, 70/30 seasonal) and 48,700 (option 2d, 70/30 seasonal) are the closest to the

PPA sector and seasonal division yet indicate much higher inter-annual differences than the PPA scenarios. This is primarily due to the differences in seasonal sector specific allocations under the PPA compared with the fixed amounts in Alternative 2, option 2d.

Southeast Alaska Stocks
Southeast Alaska stocks are not individually resolved in the genetics used as the baseline for this impact analysis. These stocks are combined into two different genetic groupings and the ability to differentiate trends in specific Southeast Alaska stocks from the combined aggregate grouping is not possible at this time. Two genetic groupings contain the Southeast Alaska stocks: the Transboundary region (TBR) and the "other" category. The TBR group is represented by collections from trans-mountain Canada stocks (Taku and Stikine rivers) and are genetically distinct from the Andrew Creek wild and hatchery stocks which derive from Andrew Creek at the mouth of the Stikine River (W. Templin, pers. Comm..). The "Other" grouping represents the following stocks: Upper Kuskokwim, South Alaska Peninsula, Upper Cooper River, Lower Cooper river, North Southeast Alaska, Coastal Southeast Alaska and Andrew Creek. Additional information on the river systems within these aggregate groupings is contained in Chapter 3. While estimates are available for the individual reporting groups in the Other category, the contributions are generally below 1% and the 90% confidence intervals include 0.0 (W. Templin, pers. Comm.).

Trends in these two categories (TBR and Other) can be evaluated for an aggregate estimate of the impacts of the alternatives to Southeast Alaska stocks, but given the number of river systems combined to form these categories results should be interpreted with caution as a magnitude of impact to Southeast Alaska stocks (Table 5-58 addresses transboundary stocks, expressed in terms of number of Chinook saved under each scenario). It is not possible at this time to estimate the individual impact to specific Southeast Alaska river systems of the alternatives.

Pacific Northwest Stocks
A single grouping represents the aggregate Pacific Northwest (PNW) stocks including over 200 stocks from British Columbia, Oregon and Washington State. The specific stocks included are listed in Table 3-7 in Chapter 3. As described previously, where (and when) bycatch occurs affects the relative bycatch stock composition as evidence by negative trends for PNW stocks under many alternatives and years (Table 5-59). Impacts of nearly all cap alternatives for PNW stocks in 2003 indicate an increase in AEQ bycatch (as indicated by a negative number in Table 5-56) due to the spatial extent of the bycatch and regional contribution from these stocks in the southeast portion of the Bering Sea.

Table 5-53 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **Coastal WAK** by year **2003-2007.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005–2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

Coastal WAK	**2003**	**2004**	**2005**	**2006**	**2007**
No Cap	20,522	22,060	26,043	36,453	44,391
Alt 4 PPA scenarios					
PPA1	-1,036	1,132	4,321	8,245	12,325
PPA2	-381	789	4,129	14,419	21,182
Alt 2Cap, AB, sector					
87,500 70/30 opt2d	1,082	7	2,801	5,374	8,379
87,500 70/30 opt2a	795	1,356	1,935	4,955	10,379
87,500 70/30 opt1	917	661	4,315	8,971	11,829
87,500 58/42 opt2d	174	357	1,035	8,804	12,215
87,500 58/42 opt2a	1,091	70	114	3,406	9,610
87,500 58/42 opt1	937	670	2,802	9,480	13,043
87,500 50/50 opt2d	801	1,074	801	6,936	13,668
87,500 50/50 opt2a	2,502	1,270	3,074	7,212	12,706
87,500 50/50 opt1	306	773	1,791	11,831	18,683
68,100 70/30 opt2d	464	1,513	3,783	10,962	16,179
68,100 70/30 opt2a	2,607	2,595	4,704	7,887	14,242
68,100 70/30 opt1	430	988	4,183	11,402	17,709
68,100 58/42 opt2d	1,097	587	3,501	11,376	19,426
68,100 58/42 opt2a	3,201	1,392	2,959	9,918	17,537
68,100 58/42 opt1	692	1,207	3,603	14,568	21,530
68,100 50/50 opt2d	2,532	1,643	3,081	13,898	22,513
68,100 50/50 opt2a	2,570	2,297	3,697	12,076	16,377
68,100 50/50 opt1	1,224	448	3,554	14,576	23,424
48,700 70/30 opt2d	3,211	2,253	6,206	17,586	27,185
48,700 70/30 opt2a	3,054	3,515	7,384	15,827	22,551
48,700 70/30 opt1	2,199	1,687	5,631	16,463	26,063
48,700 58/42 opt2d	3,310	2,537	5,261	18,069	25,796
48,700 58/42 opt2a	4,488	5,345	6,686	20,214	27,743
48,700 58/42 opt1	4,270	2,980	5,924	17,955	28,639
48,700 50/50 opt2d	3,488	3,420	6,217	18,997	26,731
48,700 50/50 opt2a	4,529	4,586	7,788	20,559	29,594
48,700 50/50 opt1	5,499	4,116	7,106	18,856	29,053
29,300 70/30 opt2d	8,885	8,145	11,597	24,021	36,664
29,300 70/30 opt2a	7,669	7,533	11,144	23,852	33,683
29,300 70/30 opt1	9,043	8,466	12,385	24,699	35,266
29,300 58/42 opt2d	9,807	8,870	12,597	24,150	36,190
29,300 58/42 opt2a	9,405	9,146	13,408	23,545	36,228
29,300 58/42 opt1	9,834	10,056	13,398	25,577	35,541
29,300 50/50 opt2d	9,793	9,610	13,840	25,435	37,272
29,300 50/50 opt2a	10,237	9,510	13,413	24,066	36,364
29,300 50/50 opt1	11,273	10,713	14,899	26,037	37,492

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Table 5-54 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **Yukon** stocks by year **2003-2007.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005–2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

Yukon.	**2003**	**2004**	**2005**	**2006**	**2007**
No Cap	**8,484**	**9,180**	**10,990**	**14,887**	**18,306**
Alt 4 PPA scenarios					
PPA1	-329	591	1,952	3,409	5,228
PPA2	-61	463	1,944	5,921	8,840
Alt 2Cap, AB, sector					
87,500 70/30 opt2d	561	-2	1,267	2,107	3,299
87,500 70/30 opt2a	421	691	819	1,861	4,092
87,500 70/30 opt1	468	353	2,017	3,581	4,697
87,500 58/42 opt2d	106	182	448	3,524	4,796
87,500 58/42 opt2a	478	-29	-1	1,223	3,826
87,500 58/42 opt1	498	340	1,244	3,774	5,184
87,500 50/50 opt2d	409	574	373	2,597	5,367
87,500 50/50 opt2a	1,096	555	1,452	2,588	4,915
87,500 50/50 opt1	161	400	837	4,718	7,531
68,100 70/30 opt2d	254	787	1,704	4,388	6,586
68,100 70/30 opt2a	1,128	1,176	2,167	3,012	5,770
68,100 70/30 opt1	211	537	1,910	4,615	7,242
68,100 58/42 opt2d	501	242	1,588	4,454	7,923
68,100 58/42 opt2a	1,422	526	1,229	3,780	7,090
68,100 58/42 opt1	366	640	1,621	5,772	8,761
68,100 50/50 opt2d	1,118	723	1,475	5,415	9,092
68,100 50/50 opt2a	1,073	954	1,614	4,824	6,253
68,100 50/50 opt1	572	184	1,654	5,810	9,512
48,700 70/30 opt2d	1,390	1,032	2,833	7,070	11,154
48,700 70/30 opt2a	1,287	1,522	3,236	6,405	9,146
48,700 70/30 opt1	974	768	2,555	6,638	10,711
48,700 58/42 opt2d	1,466	1,093	2,307	7,247	10,434
48,700 58/42 opt2a	1,921	2,342	2,806	8,068	11,230
48,700 58/42 opt1	1,831	1,345	2,696	7,239	11,508
48,700 50/50 opt2d	1,445	1,489	2,675	7,682	10,823
48,700 50/50 opt2a	1,880	1,892	3,314	8,236	12,058
48,700 50/50 opt1	2,348	1,770	3,034	7,585	11,736
29,300 70/30 opt2d	3,690	3,469	4,989	9,786	14,938
29,300 70/30 opt2a	3,170	3,185	4,796	9,689	13,870
29,300 70/30 opt1	3,794	3,589	5,303	10,034	14,463
29,300 58/42 opt2d	4,046	3,789	5,316	9,782	14,686
29,300 58/42 opt2a	3,892	3,869	5,767	9,424	14,719
29,300 58/42 opt1	4,062	4,245	5,723	10,400	14,546
29,300 50/50 opt2d	4,027	3,989	5,871	10,264	15,213
29,300 50/50 opt2a	4,284	3,938	5,636	9,659	14,814
29,300 50/50 opt1	4,676	4,531	6,309	10,522	15,332

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Table 5-55 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **Kuskokwim** stocks by year **2003-2007.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005–2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

Kuskokwim	2003	2004	2005	2006	2007
No Cap	**5,514**	**5,967**	**7,144**	**9,677**	**11,899**
Alt 4 PPA scenarios					
PPA1	-214	384	1,269	2,217	3,398
PPA2	-40	301	1,264	3,849	5,746
Alt 2Cap, AB, sector					
87,500 70/30 opt2d	365	-1	824	1,369	2,144
87,500 70/30 opt2a	274	449	532	1,210	2,660
87,500 70/30 opt1	304	229	1,311	2,328	3,053
87,500 58/42 opt2d	69	118	291	2,291	3,117
87,500 58/42 opt2a	310	-19	-1	795	2,487
87,500 58/42 opt1	324	221	808	2,453	3,369
87,500 50/50 opt2d	266	373	243	1,688	3,488
87,500 50/50 opt2a	712	361	944	1,682	3,195
87,500 50/50 opt1	104	260	544	3,067	4,895
68,100 70/30 opt2d	165	512	1,108	2,852	4,281
68,100 70/30 opt2a	733	764	1,409	1,958	3,750
68,100 70/30 opt1	137	349	1,242	3,000	4,707
68,100 58/42 opt2d	326	157	1,032	2,895	5,150
68,100 58/42 opt2a	925	342	799	2,457	4,609
68,100 58/42 opt1	238	416	1,054	3,751	5,694
68,100 50/50 opt2d	727	470	959	3,520	5,910
68,100 50/50 opt2a	698	620	1,049	3,136	4,064
68,100 50/50 opt1	372	119	1,075	3,776	6,183
48,700 70/30 opt2d	904	671	1,841	4,595	7,250
48,700 70/30 opt2a	837	989	2,103	4,163	5,945
48,700 70/30 opt1	633	499	1,661	4,314	6,962
48,700 58/42 opt2d	953	710	1,499	4,710	6,782
48,700 58/42 opt2a	1,249	1,522	1,824	5,244	7,299
48,700 58/42 opt1	1,190	875	1,753	4,705	7,480
48,700 50/50 opt2d	939	968	1,739	4,994	7,035
48,700 50/50 opt2a	1,222	1,230	2,154	5,353	7,838
48,700 50/50 opt1	1,526	1,150	1,972	4,930	7,628
29,300 70/30 opt2d	2,399	2,255	3,243	6,361	9,710
29,300 70/30 opt2a	2,061	2,071	3,117	6,298	9,016
29,300 70/30 opt1	2,466	2,333	3,447	6,522	9,401
29,300 58/42 opt2d	2,630	2,463	3,455	6,358	9,546
29,300 58/42 opt2a	2,530	2,515	3,749	6,126	9,567
29,300 58/42 opt1	2,640	2,759	3,720	6,760	9,455
29,300 50/50 opt2d	2,617	2,593	3,816	6,672	9,888
29,300 50/50 opt2a	2,784	2,560	3,664	6,279	9,629
29,300 50/50 opt1	3,040	2,945	4,101	6,839	9,966

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Table 5-56 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **Bristol Bay** stocks by year **2003-2007.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005–2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

Bristol Bay	**2003**	**2004**	**2005**	**2006**	**2007**
No Cap	**7,211**	**7,803**	**9,342**	**12,654**	**15,560**
Alt 4 PPA scenarios					
PPA1	-280	503	1,659	2,898	4,444
PPA2	-52	394	1,653	5,033	7,514
Alt 2Cap, AB, sector					
87,500 70/30 opt2d	477	-1	1,077	1,791	2,804
87,500 70/30 opt2a	358	587	696	1,582	3,478
87,500 70/30 opt1	398	300	1,714	3,044	3,993
87,500 58/42 opt2d	90	155	381	2,996	4,076
87,500 58/42 opt2a	406	-24	-1	1,039	3,252
87,500 58/42 opt1	424	289	1,057	3,207	4,406
87,500 50/50 opt2d	348	488	317	2,207	4,562
87,500 50/50 opt2a	932	472	1,235	2,200	4,178
87,500 50/50 opt1	136	340	712	4,011	6,401
68,100 70/30 opt2d	216	669	1,448	3,730	5,598
68,100 70/30 opt2a	959	999	1,842	2,561	4,904
68,100 70/30 opt1	180	456	1,624	3,923	6,155
68,100 58/42 opt2d	426	205	1,350	3,786	6,735
68,100 58/42 opt2a	1,209	447	1,045	3,213	6,027
68,100 58/42 opt1	311	544	1,378	4,906	7,447
68,100 50/50 opt2d	950	615	1,254	4,603	7,728
68,100 50/50 opt2a	912	811	1,372	4,101	5,315
68,100 50/50 opt1	487	156	1,406	4,938	8,085
48,700 70/30 opt2d	1,182	877	2,408	6,009	9,481
48,700 70/30 opt2a	1,094	1,294	2,750	5,444	7,774
48,700 70/30 opt1	828	653	2,172	5,642	9,105
48,700 58/42 opt2d	1,246	929	1,961	6,160	8,869
48,700 58/42 opt2a	1,633	1,991	2,385	6,858	9,545
48,700 58/42 opt1	1,557	1,144	2,292	6,153	9,782
48,700 50/50 opt2d	1,228	1,266	2,274	6,530	9,199
48,700 50/50 opt2a	1,598	1,608	2,817	7,000	10,250
48,700 50/50 opt1	1,996	1,504	2,579	6,447	9,976
29,300 70/30 opt2d	3,137	2,948	4,241	8,318	12,697
29,300 70/30 opt2a	2,695	2,708	4,077	8,235	11,790
29,300 70/30 opt1	3,225	3,051	4,507	8,529	12,294
29,300 58/42 opt2d	3,439	3,221	4,518	8,314	12,483
29,300 58/42 opt2a	3,308	3,289	4,902	8,010	12,511
29,300 58/42 opt1	3,452	3,608	4,865	8,840	12,364
29,300 50/50 opt2d	3,423	3,391	4,990	8,724	12,931
29,300 50/50 opt2a	3,641	3,347	4,791	8,210	12,592
29,300 50/50 opt1	3,975	3,851	5,363	8,944	13,032

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Table 5-57 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **Cook Inlet stocks** by year **2003-2007.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005–2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

Cook Inlet	**2003**	**2004**	**2005**	**2006**	**2007**
No Cap	431	1,063	1,223	943	1,639
Alt 4 PPA scenarios					
PPA1	187	200	324	235	1,042
PPA2	195	436	692	412	1,202
Alt 2Cap, AB, sector					
87,500 70/30 opt2d	-60	7	574	463	1,010
87,500 70/30 opt2a	-49	1,356	620	384	926
87,500 70/30 opt1	-46	661	617	516	1,035
87,500 58/42 opt2d	-21	357	393	152	847
87,500 58/42 opt2a	-34	70	256	92	549
87,500 58/42 opt1	-62	670	594	327	853
87,500 50/50 opt2d	-51	1,074	364	117	613
87,500 50/50 opt2a	-77	1,270	85	133	593
87,500 50/50 opt1	-18	773	356	85	800
68,100 70/30 opt2d	-26	1,513	675	503	1,071
68,100 70/30 opt2a	-19	2,595	530	509	1,084
68,100 70/30 opt1	-16	988	724	537	1,113
68,100 58/42 opt2d	-46	587	571	339	783
68,100 58/42 opt2a	-83	1,392	422	240	829
68,100 58/42 opt1	-44	1,207	581	392	982
68,100 50/50 opt2d	-78	1,643	296	122	797
68,100 50/50 opt2a	-48	2,297	352	45	785
68,100 50/50 opt1	-51	448	537	365	939
48,700 70/30 opt2d	-24	2,253	695	585	1,209
48,700 70/30 opt2a	24	3,515	720	497	1,212
48,700 70/30 opt1	33	1,687	761	597	1,274
48,700 58/42 opt2d	-96	2,537	680	433	1,134
48,700 58/42 opt2a	-53	5,345	635	354	1,160
48,700 58/42 opt1	-86	2,980	686	490	1,139
48,700 50/50 opt2d	-54	3,420	575	307	1,046
48,700 50/50 opt2a	-13	4,586	593	252	905
48,700 50/50 opt1	-107	4,116	682	446	978
29,300 70/30 opt2d	158	8,145	932	664	1,284
29,300 70/30 opt2a	128	7,533	919	662	1,421
29,300 70/30 opt1	153	8,466	934	692	1,357
29,300 58/42 opt2d	30	8,870	804	613	1,141
29,300 58/42 opt2a	54	9,146	780	602	1,146
29,300 58/42 opt1	103	10,056	847	643	1,328
29,300 50/50 opt2d	7	9,610	749	582	1,132
29,300 50/50 opt2a	-15	9,510	764	525	1,047
29,300 50/50 opt1	21	10,713	771	616	1,210

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Table 5-58 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **Transboundary** (TBR) stocks by year **2003-2007.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005–2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

TBR	2003	2004	2005	2006	2007
No Cap	322	732	841	689	1,152
Alt 4 PPA scenarios					
PPA1	120	128	213	171	699
PPA2	126	281	452	298	821
Alt 2Cap, AB, sector					
87,500 70/30 opt2d	-38	187	374	311	670
87,500 70/30 opt2a	-31	96	403	260	620
87,500 70/30 opt1	-29	203	404	353	694
87,500 58/42 opt2d	-14	60	255	118	575
87,500 58/42 opt2a	-20	50	165	69	376
87,500 58/42 opt1	-39	157	387	233	580
87,500 50/50 opt2d	-32	-45	235	93	427
87,500 50/50 opt2a	-45	33	60	105	413
87,500 50/50 opt1	-12	46	232	83	558
68,100 70/30 opt2d	-16	203	441	349	725
68,100 70/30 opt2a	-7	226	349	347	730
68,100 70/30 opt1	-10	245	473	372	756
68,100 58/42 opt2d	-27	191	373	245	548
68,100 58/42 opt2a	-47	148	278	180	574
68,100 58/42 opt1	-28	182	381	287	681
68,100 50/50 opt2d	-45	95	195	112	564
68,100 50/50 opt2a	-25	45	233	57	547
68,100 50/50 opt1	-31	187	351	269	657
48,700 70/30 opt2d	-9	327	458	417	838
48,700 70/30 opt2a	22	348	477	356	831
48,700 70/30 opt1	25	377	499	422	878
48,700 58/42 opt2d	-55	277	447	321	789
48,700 58/42 opt2a	-25	217	422	275	809
48,700 58/42 opt1	-47	295	451	357	799
48,700 50/50 opt2d	-27	200	382	241	734
48,700 50/50 opt2a	2	258	397	210	649
48,700 50/50 opt1	-58	256	453	331	696
29,300 70/30 opt2d	121	519	623	481	909
29,300 70/30 opt2a	99	488	614	480	989
29,300 70/30 opt1	117	494	626	501	952
29,300 58/42 opt2d	41	392	543	450	816
29,300 58/42 opt2a	55	394	529	442	819
29,300 58/42 opt1	88	429	572	472	934
29,300 50/50 opt2d	26	385	511	433	812
29,300 50/50 opt2a	12	405	520	394	756
29,300 50/50 opt1	38	413	527	456	862

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

Table 5-59 Hypothetical reduction in region-specific adult equivalent Chinook salmon bycatch mortality under each cap and management option for **Pacific Northwest stocks** by year **2003-2007.** Values are based on median AEQ values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005–2007. Note that the median estimated adult equivalent bycatch levels are given in the second row.

PNW	2003	2004	2005	2006	2007
No Cap	5,828	10,446	11,232	12,712	18,185
Alt 4 PPA scenarios					
PPA1	599	890	1,981	2,674	8,489
PPA2	758	2,522	4,296	5,037	11,135
Alt 2Cap, AB, sector					
87,500 70/30 opt2d	-951	2,215	4,064	4,805	9,581
87,500 70/30 opt2a	-784	544	4,806	4,561	9,385
87,500 70/30 opt1	-730	2,009	3,887	5,724	10,355
87,500 58/42 opt2d	-330	553	2,970	2,897	9,336
87,500 58/42 opt2a	-268	909	2,212	2,160	6,167
87,500 58/42 opt1	-966	1,555	4,347	4,473	9,230
87,500 50/50 opt2d	-719	-1,126	2,602	3,264	7,920
87,500 50/50 opt2a	-609	349	15	4,105	7,951
87,500 50/50 opt1	-290	177	2,361	3,098	9,453
68,100 70/30 opt2d	-485	1,641	4,769	5,969	10,667
68,100 70/30 opt2a	-93	2,341	3,334	6,210	10,613
68,100 70/30 opt1	-253	2,260	4,968	6,031	11,054
68,100 58/42 opt2d	-472	2,296	3,946	5,371	8,944
68,100 58/42 opt2a	-771	2,142	3,514	4,850	9,344
68,100 58/42 opt1	-690	1,482	4,094	6,190	10,887
68,100 50/50 opt2d	-665	1,042	1,490	4,514	10,037
68,100 50/50 opt2a	-97	730	2,633	2,799	10,866
68,100 50/50 opt1	-599	2,243	3,452	5,797	10,974
48,700 70/30 opt2d	-130	3,504	4,521	7,737	12,997
48,700 70/30 opt2a	424	4,047	5,322	6,505	12,951
48,700 70/30 opt1	162	4,195	5,165	7,512	13,227
48,700 58/42 opt2d	-851	3,255	5,039	6,784	13,073
48,700 58/42 opt2a	-199	2,353	5,381	6,825	13,559
48,700 58/42 opt1	-478	3,131	4,522	6,980	14,035
48,700 50/50 opt2d	13	2,275	4,523	5,659	12,511
48,700 50/50 opt2a	433	3,502	4,914	5,957	11,521
48,700 50/50 opt1	-531	3,035	5,485	6,910	12,560
29,300 70/30 opt2d	2,216	6,328	7,386	8,831	15,507
29,300 70/30 opt2a	1,929	6,071	7,266	8,949	15,241
29,300 70/30 opt1	1,978	6,141	7,570	9,306	15,306
29,300 58/42 opt2d	1,506	4,812	7,030	8,790	14,686
29,300 58/42 opt2a	1,568	5,049	6,308	9,227	14,632
29,300 58/42 opt1	2,034	5,549	7,030	9,035	15,299
29,300 50/50 opt2d	1,408	5,383	6,547	8,991	14,310
29,300 50/50 opt2a	888	5,654	6,930	8,607	13,690
29,300 50/50 opt1	1,490	5,349	6,841	9,271	14,766

Note: Shading indicates Alternative 2 scenarios that are most similar to the PPA.

5.3.6 Alternative 3 impacts

Alternative 3 establishes a salmon bycatch cap, and closes a candidate large scale area (A and B season) when cap levels are reached (i.e., rather than closing the whole fishery). The proposed cap for Alternative 3 includes the same combination of options as described for Alternative 2.

Historically since 1991, this A-season area has comprised between 72-100% of the bycatch in this time period (Table 5-60). Further break-outs show the relative bycatch in the non-CDQ fleets by sector over that time period and the CDQ fleets by sector over that time period (Table 5-61 and Table 5-62).

Table 5-60 Chinook salmon, in numbers of fish, taken as bycatch in the combined (CDQ and non-CDQ) pollock fishery during the A-season, by sector, inside and outside of the proposed closure area

Year	Outside of A-season area			Outside	Inside of A-season area			Inside	Total	Percent
	M	CP	CV	Subtotal	M	CP	CV	Subtotal		Inside
1991	18	3,323	58	3,400	8,727	13,944	10,014	32,685	36,084	91%
1992	186	3,222	9	3,417	3,043	6,546	6,383	15,972	19,390	82%
1993	0	62	3	64	3,442	8,581	3,028	15,050	15,115	100%
1994	0	1,533	17	1,550	1,777	15,422	8,347	25,547	27,096	94%
1995	30	189	5	224	939	5,782	2,031	8,752	8,976	98%
1996	111	700	259	1,070	5,358	14,577	14,995	34,930	36,000	97%
1997	32	73	12	117	1,445	3,765	4,942	10,151	10,268	99%
1998	0	1	39	40	4,284	6,636	4,315	15,234	15,274	100%
1999	15	20	66	101	539	2,673	2,558	5,771	5,872	98%
2000	4	102	0	106	15	2,421	867	3,303	3,408	97%
2001	694	2,310	2,174	5,178	970	5,954	6,320	13,245	18,423	72%
2002	174	1,153	489	1,817	1,802	8,327	9,816	19,946	21,763	92%
2003	836	3,119	3,639	7,594	2,030	11,286	12,668	25,985	33,578	77%
2004	564	2,141	1,328	4,033	1,528	7,350	11,045	19,923	23,955	83%
2005	435	1,339	1,084	2,858	1,677	10,082	12,995	24,753	27,612	90%
2006	40	291	449	780	5,369	16,935	35,531	57,835	58,615	99%
2007	290	981	930	2,200	5,719	27,024	34,528	67,271	69,471	97%
Average 1991-2007	214	1,209	621	2,032	2,863	9,841	10,611	23,315	25,347	92%
Average 2000-2007	379	1,430	1,262	3,071	2,389	11,172	15,471	29,033	32,103	90%

Table 5-61 Chinook salmon, in numbers of fish, taken as bycatch in the non-CDQ pollock fishery during the A-season, by sector, inside and outside of proposed closure areas

Year	Outside of A-season area			Outside	Inside of A-season area			Inside	Total	Percent
	M	CP	CV	Subtotal	M	CP	CV	Subtotal		Inside
1991	18	3,323	58	3,400	8,727	13,944	10,014	32,685	36,084	91%
1992	186	3,222	9	3,417	3,043	6,546	6,383	15,972	19,390	82%
1993	0	62	3	64	3,442	8,581	3,028	15,050	15,115	100%
1994	0	1,533	17	1,550	1,777	15,422	8,347	25,547	27,096	94%
1995	30	171	5	206	611	5,230	1,877	7,718	7,925	97%
1996	111	524	62	697	5,195	14,092	13,870	33,157	33,854	98%
1997	32	73	12	117	1,200	2,807	4,692	8,699	8,815	99%
1998	0	0	39	39	4,270	6,082	4,300	14,652	14,690	100%
1999	15	20	66	101	303	2,288	2,554	5,145	5,246	98%
2000	0	92	0	92	2	2,008	867	2,878	2,970	97%
2001	661	2,130	2,174	4,966	749	4,585	6,320	11,654	16,620	70%
2002	150	834	489	1,474	1,496	7,253	9,816	18,565	20,039	93%
2003	667	2,583	3,639	6,890	1,827	10,284	12,668	24,779	31,669	78%
2004	405	1,752	1,328	3,484	1,438	6,821	11,045	19,304	22,788	85%
2005	326	1,165	1,084	2,575	1,533	9,216	12,995	23,743	26,318	90%
2006	37	222	449	708	4,600	15,972	35,531	56,103	56,811	99%
2007	278	815	930	2,022	4,347	24,940	34,528	63,815	65,837	97%
Average 1991-2007	182	1,090	610	1,871	2,621	9,181	10,520	22,322	24,192	92%
Average 2000-2007	316	1,199	1,262	2,776	1,999	10,135	15,471	27,605	30,381	91%

Table 5-62 Chinook salmon, in numbers of fish, taken as bycatch in the CDQ pollock fishery during the A-season, by sector, inside and outside of proposed closure areas

Year	Outside of A-season area			Outside	Inside of A-season area			Inside	Total	Percent
	M	CP	CV	Subtotal	M	CP	CV	Subtotal		Inside
1995		18		18	328	552	154	1,034	1,051	98%
1996	0	175	197	373	163	485	1,126	1,774	2,146	83%
1997		0		0	245	958	249	1,453	1,453	100%
1998		1	0	1	13	554	15	583	584	100%
1999	0	0		0	236	385	5	625	625	100%
2000	4	10		14	13	413		425	439	97%
2001	32	181		213	221	1,369		1,590	1,803	88%
2002	24	319		343	306	1,074		1,381	1,724	80%
2003	169	535		704	203	1,003		1,206	1,910	63%
2004	160	389		548	90	529		619	1,167	53%
2005	109	175		284	144	866		1,010	1,294	78%
2006	2	70		72	769	964		1,732	1,804	96%
2007	12	166		178	1,372	2,085		3,457	3,634	95%
Average 1995-2007	51	157	99	211	316	864	310	1,299	1,510	86%
Average 2000-2007	64	230		294	390	1,038		1,427	1,722	83%

The B-season closure areas are also proposed based on regions where 90% of the bycatch, on average, has occurred from 2000-2007. Since 1991, with the exception of 2000, when there was an injunction on the fishery, these areas have comprised between 68-98% of the Chinook bycatch in the B season (Table 5-63). Further break-outs show the relative bycatch in the non-CDQ fleets by sector over that time period and the CDQ fleets by sector over that time period (Table 5-64 and Table 5-65).

Table 5-63 Chinook salmon, in numbers of fish, taken as bycatch in the combined (CDQ and non-CDQ) pollock fishery during the B-season, by sector, inside and outside of proposed closure areas

Year	Outside of B-season areas			Outside	Inside of B-season areas			Inside	Total	Percent
	M	CP	CV	Subtotal	M	CP	CV	Subtotal		Inside
1991	30	80	80	190	87	291	1,059	1,438	1,628	88%
1992	0	92	11	103	1,509	6,746	1,549	9,804	9,907	99%
1993	83	2,365	70	2,517	6,417	9,460	2,546	18,423	20,941	88%
1994	164	1,214	107	1,486	402	1,585	1,108	3,095	4,581	68%
1995	70	330	16	416	582	1,128	750	2,460	2,877	86%
1996	1,164	1,506	644	3,314	4,950	1,705	9,294	15,950	19,264	83%
1997	2,117	3,917	1,849	7,883	3,405	1,804	20,681	25,891	33,774	77%
1998	1,341	2,294	1,825	5,460	5,040	1,567	25,582	32,188	37,648	85%
1999	38	725	773	1,537	336	1,862	1,686	3,883	5,420	72%
2000	246	401	392	1,039	0	157	220	377	1,416	27%
2001	5	895	19	918	1,314	8,963	3,738	14,015	14,933	94%
2002	74	95	31	200	1,675	1,291	9,021	11,986	12,186	98%
2003	598	1,422	354	2,375	1,339	2,621	6,778	10,738	13,113	82%
2004	995	1,759	1,393	4,147	1,131	2,530	22,182	25,843	29,990	86%
2005	720	2,466	1,552	4,738	145	1,840	31,471	33,456	38,194	88%
2006	160	619	854	1,633	41	931	21,427	22,399	24,033	93%
2007	958	1,577	1,017	3,553	2,585	5,383	40,697	48,665	52,218	93%
Average 1991-2007	516	1,280	646	2,442	1,821	2,933	11,752	16,507	18,948	87%
Average 2000-2007	470	1,154	702	2,325	1,029	2,965	16,942	20,935	23,260	90%

Table 5-64 Chinook salmon, in numbers of fish, taken as bycatch in the non-CDQ pollock fishery during the B-season, by sector, inside and outside of proposed closure areas

Year	Outside of B-season areas			Outside	Inside of B-season areas			Inside	Total	Percent
	M	CP	CV	Subtotal	M	CP	CV	Subtotal		Inside
1991	30	80	80	190	87	291	1,059	1,438	1,628	88%
1992	0	92	11	103	1,509	6,746	1,549	9,804	9,907	99%
1993	83	2,365	70	2,517	6,417	9,460	2,546	18,423	20,941	88%
1994	164	1,214	107	1,486	402	1,585	1,108	3,095	4,581	68%
1995	66	173	16	254	551	371	746	1,668	1,922	87%
1996	1,164	1,451	644	3,260	4,669	217	9,225	14,111	17,371	81%
1997	2,117	3,701	1,849	7,668	1,367	1,576	20,579	23,522	31,190	75%
1998	704	1,858	1,804	4,366	3,791	221	25,325	29,338	33,704	87%
1999	15	658	773	1,446	48	1,184	1,657	2,889	4,336	67%
2000	169	316	302	787	0	117	192	310	1,097	28%
2001	0	861	19	880	813	8,817	3,738	13,368	14,248	94%
2002	74	69	31	175	1,530	815	9,021	11,366	11,540	98%
2003	573	1,156	354	2,083	1,259	2,104	6,778	10,140	12,224	83%
2004	827	905	1,393	3,124	1,122	1,706	22,182	25,011	28,135	89%
2005	551	2,165	1,552	4,268	138	1,757	31,471	33,366	37,634	89%
2006	137	537	854	1,528	27	893	21,427	22,348	23,876	94%
2007	753	1,520	1,017	3,290	1,110	4,611	40,697	46,418	49,707	93%
Average 1991-2007	437	1,125	640	2,201	1,461	2,498	11,724	15,683	17,885	88%
Average 2000-2007	385	941	690	2,017	750	2,603	16,938	20,291	22,308	91%

Table 5-65 Chinook salmon, in numbers of fish, taken as bycatch in the CDQ pollock fishery during the B-season, by sector, inside and outside of proposed closure areas

Year	Outside of B-season areas			Outside	Inside of B-season areas			Inside	Total	Percent
	M	CP	CV	Subtotal	M	CP	CV	Subtotal		Inside
1995	31	758	4	792	5	158	0	163	955	17%
1996	281	1,488	69	1,838		54		54	1,893	3%
1997	2,038	228	102	2,369		215		215	2,584	8%
1998	1,248	1,346	256	2,850	637	436	21	1,094	3,945	28%
1999	287	678	28	994	23	68		91	1,085	8%
2000	0	40	28	67	77	85	91	252	319	79%
2001	501	146		647	5	34		38	685	6%
2002	145	476		621	0	25		25	646	4%
2003	80	517		598	25	267		291	889	33%
2004	9	824		833	169	854		1,023	1,855	55%
2005	7	83		90	169	301		470	560	84%
2006	14	38		52	23	82		105	157	67%
2007	1,475	772		2,248	205	58		263	2,511	10%
Average 1991-2007	471	569	81	1,077	122	203	37	314	1,391	23%
Average 2000-2007	279	362	28	644	84	213	91	308	953	32%

Analysis of triggered closure impacts focuses on the historical timing and relative impact of reaching the trigger levels under consideration, by fishery (CDQ and non-CDQ), and individual sector (CDQ, inshore CV, mothership, and offshore CP) over the time period 2003-2007.

Table 5-66 and Table 5-76 show the dates for 2003-2007 when retrospective analysis shows that each of the cap scenarios would have invoked a triggered closure area, for A and B seasons, respectively. Table 5-67 and Table 5-77 show the expected Chinook bycatch by all vessels combined had the closure been triggered on these dates, while the numbers of reported salmon saved are provided in Table 5-68 and Table 5-78. Analogous values for forgone pollock are provided in Chapter 4 and show the amount of pollock in each season that was caught after the trigger closure would have been in effect. The sector-specific results are provided in Table 5-69 through Table 5-74 (A season) and in Table 5-80 through Table 5-85 (B season). Note that the numbers in these tables reflect only Chinook bycatch taken by the pollock fleet; the numbers of AEQ salmon would be different.

Table 5-66 A-season trigger-closure date scenarios, by year, reflecting when the cap level would have been exceeded in each year.

Cap scenario		CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250					6-Mar
	1-2: 58/42	50,750				12-Mar	18-Feb
	1-3: 55/45	48,125				4-Mar	17-Feb
	1-4: 50/50	43,750				25-Feb	16-Feb
68,100	1-1: 70/30	47,670				3-Mar	17-Feb
	1-2: 58/42	39,498				22-Feb	13-Feb
	1-3: 55/45	37,455				21-Feb	12-Feb
	1-4: 50/50	34,050				19-Feb	10-Feb
48,700	1-1: 70/30	34,090				19-Feb	10-Feb
	1-2: 58/42	28,246	12-Mar			12-Feb	6-Feb
	1-3: 55/45	26,785	10-Mar		15-Mar	12-Feb	5-Feb
	1-4: 50/50	24,350	5-Mar		4-Mar	10-Feb	3-Feb
29,300	1-1: 70/30	20,510	22-Feb	14-Mar	26-Feb	7-Feb	31-Jan
	1-2: 58/42	16,994	19-Feb	7-Mar	17-Feb	6-Feb	28-Jan
	1-3: 55/45	16,115	18-Feb	6-Mar	15-Feb	6-Feb	28-Jan
	1-4: 50/50	14,650	16-Feb	2-Mar	14-Feb	6-Feb	28-Jan

Table 5-67 Expected Chinook catch by **all vessels** if A-season trigger-closure was invoked.

Chinook catch			Sector (All), A season				
Cap scenario		CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250					64,644
	1-2: 58/42	50,750				51,820	57,563
	1-3: 55/45	48,125				49,879	56,055
	1-4: 50/50	43,750				46,517	54,464
68,100	1-1: 70/30	47,670				49,762	56,055
	1-2: 58/42	39,498				43,667	48,078
	1-3: 55/45	37,455				41,877	46,508
	1-4: 50/50	34,050				37,486	44,606
48,700	1-1: 70/30	34,090				37,486	44,606
	1-2: 58/42	28,246	30,755			33,206	40,441
	1-3: 55/45	26,785	30,049		27,529	33,206	37,400
	1-4: 50/50	24,350	27,919		26,734	29,983	36,192
29,300	1-1: 70/30	20,510	26,228	22,140	24,283	26,373	32,572
	1-2: 58/42	16,994	24,011	20,912	22,055	24,226	29,160
	1-3: 55/45	16,115	23,066	20,140	21,242	24,226	29,160
	1-4: 50/50	14,650	22,034	18,732	20,020	24,226	29,160

Table 5-68 Expected Chinook *saved* by **all vessels** if A-season trigger-closure was invoked.

Chinook Salmon saved			**Sector (All), A season**				
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					4,827
	1-2: 58/42	50,750				6,795	11,908
	1-3: 55/45	48,125				8,736	13,417
	1-4: 50/50	43,750				12,098	15,008
68,100	1-1: 70/30	47,670				8,853	13,417
	1-2: 58/42	39,498				14,948	21,393
	1-3: 55/45	37,455				16,738	22,964
	1-4: 50/50	34,050				21,129	24,865
48,700	1-1: 70/30	34,090				21,129	24,865
	1-2: 58/42	28,246	2,824			25,409	29,031
	1-3: 55/45	26,785	3,530		83	25,409	32,071
	1-4: 50/50	24,350	5,659		878	28,632	33,279
29,300	1-1: 70/30	20,510	7,351	1,815	3,329	32,243	36,899
	1-2: 58/42	16,994	9,568	3,043	5,556	34,389	40,311
	1-3: 55/45	16,115	10,513	3,815	6,369	34,389	40,311
	1-4: 50/50	14,650	11,545	5,224	7,591	34,389	40,311

Table 5-69 Expected Chinook catch by **at-sea processors** if A-season trigger-closure was invoked.

Chinook catch			**At-sea processors, A season**				
Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					25,799
	1-2: 58/42	50,750				13,011	20,624
	1-3: 55/45	48,125				12,179	20,461
	1-4: 50/50	43,750				10,554	20,151
68,100	1-1: 70/30	47,670				12,138	20,461
	1-2: 58/42	39,498				10,115	18,329
	1-3: 55/45	37,455				9,906	17,649
	1-4: 50/50	34,050				9,496	16,977
48,700	1-1: 70/30	34,090				9,496	16,977
	1-2: 58/42	28,246	13,949			8,436	15,717
	1-3: 55/45	26,785	13,743		11,457	8,436	13,616
	1-4: 50/50	24,350	12,887		11,154	7,250	12,364
29,300	1-1: 70/30	20,510	11,888	9,296	9,925	6,369	11,158
	1-2: 58/42	16,994	11,166	8,720	8,750	6,136	10,375
	1-3: 55/45	16,115	10,501	8,594	8,562	6,136	10,375
	1-4: 50/50	14,650	9,639	8,054	8,263	6,136	10,375

Table 5-70 Expected Chinook *saved* by **at-sea processors** if A-season trigger-closure was invoked.

Chinook Salmon saved			**Sector P, A season**				
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					2,206
	1-2: 58/42	50,750				4,216	7,381
	1-3: 55/45	48,125				5,048	7,544
	1-4: 50/50	43,750				6,673	7,854
68,100	1-1: 70/30	47,670				5,088	7,544
	1-2: 58/42	39,498				7,112	9,676
	1-3: 55/45	37,455				7,321	10,356
	1-4: 50/50	34,050				7,731	11,028
48,700	1-1: 70/30	34,090				7,731	11,028
	1-2: 58/42	28,246	456			8,791	12,288
	1-3: 55/45	26,785	662		-36	8,791	14,389
	1-4: 50/50	24,350	1,518		268	9,976	15,641
29,300	1-1: 70/30	20,510	2,517	195	1,496	10,858	16,847
	1-2: 58/42	16,994	3,239	771	2,671	11,091	17,630
	1-3: 55/45	16,115	3,904	897	2,859	11,091	17,630
	1-4: 50/50	14,650	4,766	1,437	3,158	11,091	17,630

Table 5-71 Expected Chinook catch by **inshore catcher vessels** if A-season trigger-closure was invoked.

Chinook catch			**Shore-based catcher vessels, A season**				
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					32,912
	1-2: 58/42	50,750				33,619	31,654
	1-3: 55/45	48,125				32,591	30,486
	1-4: 50/50	43,750				31,683	29,393
68,100	1-1: 70/30	47,670				32,516	30,486
	1-2: 58/42	39,498				29,634	25,460
	1-3: 55/45	37,455				28,312	24,681
	1-4: 50/50	34,050				24,634	23,396
48,700	1-1: 70/30	34,090				24,634	23,396
	1-2: 58/42	28,246	14,688			21,728	20,788
	1-3: 55/45	26,785	14,446		13,923	21,728	19,859
	1-4: 50/50	24,350	13,347		13,463	19,747	19,837
29,300	1-1: 70/30	20,510	12,643	10,594	12,330	17,275	17,960
	1-2: 58/42	16,994	11,352	9,979	11,317	16,023	15,701
	1-3: 55/45	16,115	11,125	9,383	10,686	16,023	15,701
	1-4: 50/50	14,650	10,980	8,733	9,776	16,023	15,701

Table 5-72 Expected Chinook *saved* by **inshore catcher vessels** if A-season trigger-closure was invoked.

Chinook Salmon saved			**Sector S, A season**				
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					2,546
	1-2: 58/42	50,750				2,362	3,804
	1-3: 55/45	48,125				3,389	4,972
	1-4: 50/50	43,750				4,297	6,065
68,100	1-1: 70/30	47,670				3,464	4,972
	1-2: 58/42	39,498				6,346	9,998
	1-3: 55/45	37,455				7,668	10,777
	1-4: 50/50	34,050				11,346	12,062
48,700	1-1: 70/30	34,090				11,346	12,062
	1-2: 58/42	28,246	1,620			14,252	14,670
	1-3: 55/45	26,785	1,862		156	14,252	15,599
	1-4: 50/50	24,350	2,961		616	16,233	15,621
29,300	1-1: 70/30	20,510	3,664	1,778	1,749	18,705	17,498
	1-2: 58/42	16,994	4,956	2,393	2,763	19,957	19,757
	1-3: 55/45	16,115	5,182	2,989	3,393	19,957	19,757
	1-4: 50/50	14,650	5,327	3,639	4,303	19,957	19,757

Table 5-73 Expected Chinook catch by **mothership operations** if A-season trigger-closure was invoked.

Chinook catch			**Mothership operations, A season**				
Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					5,813
	1-2: 58/42	50,750				5,199	5,285
	1-3: 55/45	48,125				5,091	5,099
	1-4: 50/50	43,750				4,210	4,911
68,100	1-1: 70/30	47,670				5,085	5,099
	1-2: 58/42	39,498				3,838	4,284
	1-3: 55/45	37,455				3,575	4,170
	1-4: 50/50	34,050				3,268	4,212
48,700	1-1: 70/30	34,090				3,268	4,212
	1-2: 58/42	28,246	2,556			2,862	3,904
	1-3: 55/45	26,785	2,415		2,143	2,862	3,897
	1-4: 50/50	24,350	2,346		2,083	2,807	3,933
29,300	1-1: 70/30	20,510	2,259	2,125	1,985	2,542	3,388
	1-2: 58/42	16,994	2,127	2,102	1,938	1,912	3,114
	1-3: 55/45	16,115	2,087	2,024	1,933	1,912	3,114
	1-4: 50/50	14,650	2,130	1,823	1,918	1,912	3,114

Table 5-74 Expected Chinook *saved* by **mothership operations** if A-season trigger-closure was invoked.

Chinook Salmon saved Cap scenario		**CAP**	**Sector M, A season 2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					195
	1-2: 58/42	50,750				209	724
	1-3: 55/45	48,125				317	909
	1-4: 50/50	43,750				1,198	1,097
68,100	1-1: 70/30	47,670				323	909
	1-2: 58/42	39,498				1,570	1,724
	1-3: 55/45	37,455				1,833	1,839
	1-4: 50/50	34,050				2,140	1,796
48,700	1-1: 70/30	34,090				2,140	1,796
	1-2: 58/42	28,246	310			2,546	2,105
	1-3: 55/45	26,785	451		-32	2,546	2,111
	1-4: 50/50	24,350	520		28	2,601	2,075
29,300	1-1: 70/30	20,510	607	-33	126	2,866	2,621
	1-2: 58/42	16,994	739	-10	173	3,497	2,894
	1-3: 55/45	16,115	779	67	178	3,497	2,894
	1-4: 50/50	14,650	736	269	193	3,497	2,894

Table 5-75 Remaining pollock catch estimated from **mothership operations** at the time A-season trigger-closures were invoked.

Pollock Cap scenario		CAP	**Mothership operations, A season 2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					8,566
	1-2: 58/42	50,750				4,425	21,811
	1-3: 55/45	48,125				8,149	23,280
	1-4: 50/50	43,750				15,074	24,711
68,100	1-1: 70/30	47,670				8,906	23,280
	1-2: 58/42	39,498				19,132	29,234
	1-3: 55/45	37,455				20,506	29,952
	1-4: 50/50	34,050				23,460	31,071
48,700	1-1: 70/30	34,090				23,460	31,071
	1-2: 58/42	28,246	7,416			29,722	33,893
	1-3: 55/45	26,785	8,263		815	29,722	34,800
	1-4: 50/50	24,350	11,161		9,346	32,553	36,592
29,300	1-1: 70/30	20,510	21,057	3,391	15,615	36,336	40,955
	1-2: 58/42	16,994	23,311	7,723	24,724	36,411	44,201
	1-3: 55/45	16,115	23,827	8,516	26,715	36,411	44,201
	1-4: 50/50	14,650	24,295	12,770	27,587	36,411	44,201

Table 5-76 B-season trigger-closure date scenarios by year reflecting when the cap level would have been exceeded in each year.

Cap scenario		CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250		25-Oct	13-Oct		13-Oct
	1-2: 58/42	36,750			30-Oct		26-Oct
	1-3: 55/45	39,375					28-Oct
	1-4: 50/50	43,750					31-Oct
68,100	1-1: 70/30	20,430		12-Oct	7-Oct	22-Oct	9-Oct
	1-2: 58/42	28,602		30-Oct	19-Oct		16-Oct
	1-3: 55/45	30,645			25-Oct		18-Oct
	1-4: 50/50	34,050			28-Oct		23-Oct
48,700	1-1: 70/30	14,610		2-Oct	1-Oct	12-Oct	30-Sep
	1-2: 58/42	20,454		12-Oct	7-Oct	22-Oct	9-Oct
	1-3: 55/45	21,915		14-Oct	9-Oct	26-Oct	10-Oct
	1-4: 50/50	24,350		20-Oct	11-Oct		11-Oct
29,300	1-1: 70/30	8,790	8-Oct	14-Sep	10-Sep	21-Sep	16-Sep
	1-2: 58/42	12,306	14-Oct	27-Sep	24-Sep	3-Oct	23-Sep
	1-3: 55/45	13,185		1-Oct	26-Sep	5-Oct	27-Sep
	1-4: 50/50	14,650		2-Oct	1-Oct	12-Oct	30-Sep

Table 5-77 Expected Chinook catch by **all vessels** if B-season trigger-closure was invoked on the dates provided in Table 5-76.

Chinook catch				Sector (All), B season			
Cap scenario		CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250		27,311	26,894		31,896
	1-2: 58/42	36,750			37,455		38,628
	1-3: 55/45	39,375					40,366
	1-4: 50/50	43,750					44,721
68,100	1-1: 70/30	20,430		35,452	22,067	20,670	26,714
	1-2: 58/42	28,602		29,133	29,551		33,038
	1-3: 55/45	30,645			31,013		34,914
	1-4: 50/50	34,050			34,076		37,220
48,700	1-1: 70/30	14,610		20,402	16,811	15,496	21,705
	1-2: 58/42	20,454		35,452	22,067	20,670	26,714
	1-3: 55/45	21,915		33,558	23,481	22,403	28,210
	1-4: 50/50	24,350		28,886	25,582		30,149
29,300	1-1: 70/30	8,790	10,706	13,566	13,113	10,451	15,928
	1-2: 58/42	12,306	13,110	16,131	15,162	13,529	19,126
	1-3: 55/45	13,185		18,270	15,757	13,982	20,982
	1-4: 50/50	14,650		20,402	16,811	15,496	21,705

Table 5-78 Expected Chinook *saved* by **all vessels** if B-season trigger-closure was invoked on the dates provided in Table 5-76.

Chinook saved				**Sector (All), B season**			
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		2,680	11,300		20,322
	1-2: 58/42	36,750			739		13,590
	1-3: 55/45	39,375					11,852
	1-4: 50/50	43,750					7,497
68,100	1-1: 70/30	20,430		-5,462	16,127	3,363	25,504
	1-2: 58/42	28,602		858	8,643		19,180
	1-3: 55/45	30,645			7,181		17,304
	1-4: 50/50	34,050			4,119		14,998
48,700	1-1: 70/30	14,610		9,588	21,384	8,537	30,513
	1-2: 58/42	20,454		-5,462	16,127	3,363	25,504
	1-3: 55/45	21,915		-3,568	14,713	1,630	24,008
	1-4: 50/50	24,350		1,105	12,612		22,069
29,300	1-1: 70/30	8,790	2,406	16,424	25,081	13,582	36,290
	1-2: 58/42	12,306	3	13,859	23,032	10,504	33,092
	1-3: 55/45	13,185		11,721	22,437	10,050	31,236
	1-4: 50/50	14,650		9,588	21,384	8,537	30,513

Table 5-79 Remaining pollock catch estimated from **all vessels** at the time B-season trigger-closures were invoked on the dates provided in Table 5-76.

Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		5,380	22,837		71,041
	1-2: 58/42	36,750			648		21,433
	1-3: 55/45	39,375					15,070
	1-4: 50/50	43,750					2,636
68,100	1-1: 70/30	20,430		20,373	34,894	20,338	84,320
	1-2: 58/42	28,602		2,156	14,292		60,036
	1-3: 55/45	30,645			9,693		53,280
	1-4: 50/50	34,050			2,166		31,171
48,700	1-1: 70/30	14,610		39,409	50,710	57,544	111,799
	1-2: 58/42	20,454		20,373	34,894	20,338	84,320
	1-3: 55/45	21,915		15,792	32,648	10,138	80,740
	1-4: 50/50	24,350		8,273	27,731		77,229
29,300	1-1: 70/30	8,790	27,727	138,524	151,247	166,009	152,958
	1-2: 58/42	12,306	12,310	59,879	78,447	96,274	129,625
	1-3: 55/45	13,185		41,154	69,545	87,372	117,657
	1-4: 50/50	14,650		39,409	50,710	57,544	111,799

Table 5-80 Expected Chinook catch by **at-sea processors** if B-season trigger-closure was invoked on the dates provided in Table 5-76.

Chinook catch—at-sea processors			**B season**				
Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		-	-		5,426
	1-2: 58/42	36,750			4,306		6,504
	1-3: 55/45	39,375					6,916
	1-4: 50/50	43,750					-
68,100	1-1: 70/30	20,430		-	-	1,552	5,294
	1-2: 58/42	28,602		-	-		5,558
	1-3: 55/45	30,645			4,306		5,879
	1-4: 50/50	34,050			4,306		5,962
48,700	1-1: 70/30	14,610		4,354	4,354	1,510	5,097
	1-2: 58/42	20,454		-	-	1,552	5,294
	1-3: 55/45	21,915		-	-	-	5,296
	1-4: 50/50	24,350		-	-		5,322
29,300	1-1: 70/30	8,790	3,792	4,095	4,143	1,392	3,940
	1-2: 58/42	12,306	-	4,363	4,192	1,447	4,351
	1-3: 55/45	13,185		4,328	4,243	1,449	4,614
	1-4: 50/50	14,650		4,354	4,354	1,510	5,097

Table 5-81 Expected Chinook *saved* by **at-sea processors** if B-season trigger-closure was invoked.

Chinook saved					**Sector P, B season**		
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250					1,534
	1-2: 58/42	36,750			0		457
	1-3: 55/45	39,375					45
	1-4: 50/50	43,750					
68,100	1-1: 70/30	20,430				-	1,666
	1-2: 58/42	28,602					1,402
	1-3: 55/45	30,645			0		1,082
	1-4: 50/50	34,050			0		998
48,700	1-1: 70/30	14,610		-	-	41	1,863
	1-2: 58/42	20,454		-	-	-	1,666
	1-3: 55/45	21,915		-	-	-	1,664
	1-4: 50/50	24,350		-	-		1,639
29,300	1-1: 70/30	8,790	252	194	163	158	3,020
	1-2: 58/42	12,306	-	-	114	104	2,609
	1-3: 55/45	13,185		-	63	101	2,346
	1-4: 50/50	14,650		-	-	41	1,863

Table 5-82 Expected Chinook catch by **shorebased catcher vessels** if B-season trigger-closure was invoked on the dates provided in Table 5-76.

Chinook catch-shorebased catcher vessels					**B season**		
Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250			23,053		23,206
	1-2: 58/42	36,750			32,284		
	1-3: 55/45	39,375					
	1-4: 50/50	43,750					-
68,100	1-1: 70/30	20,430		25,890	17,452		18,131
	1-2: 58/42	28,602		-	-		23,807
	1-3: 55/45	30,645			25,842		25,074
	1-4: 50/50	34,050			28,904		-
48,700	1-1: 70/30	14,610		15,383	11,778	13,712	13,612
	1-2: 58/42	20,454		25,890	17,452	-	18,131
	1-3: 55/45	21,915		24,485	18,831	-	19,572
	1-4: 50/50	24,350		22,367	21,042		21,733
29,300	1-1: 70/30	8,790	4,882	9,762	8,315	8,943	13,774
	1-2: 58/42	12,306	7,029	12,646	10,379	11,979	14,365
	1-3: 55/45	13,185		13,686	10,942	12,390	13,432
	1-4: 50/50	14,650		15,383	11,778	13,712	13,612

Table 5-83 Expected Chinook *saved* by **shorebased catcher vessels** if B-season trigger-closure was invoked on the dates provided in Table 5-76.

Chinook saved					**Sector S, B season**		
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		-	9,970		18,508
	1-2: 58/42	36,750			739		-
	1-3: 55/45	39,375					-
	1-4: 50/50	43,750					-
68,100	1-1: 70/30	20,430		-	15,570	-	23,583
	1-2: 58/42	28,602		-	-		17,906
	1-3: 55/45	30,645			7,181		16,640
	1-4: 50/50	34,050			4,119		-
48,700	1-1: 70/30	14,610		8,192	21,244	8,570	28,102
	1-2: 58/42	20,454		-	15,570	-	23,583
	1-3: 55/45	21,915		-	14,192	-	22,142
	1-4: 50/50	24,350		1,208	11,981		19,981
29,300	1-1: 70/30	8,790	2,250	13,814	24,708	13,339	27,940
	1-2: 58/42	12,306	103	10,929	22,643	10,302	27,349
	1-3: 55/45	13,185		9,889	22,081	9,891	28,282
	1-4: 50/50	14,650		8,192	21,244	8,570	28,102

Table 5-84 Expected Chinook catch by **mothership operations** if B-season trigger-closure was invoked on the dates provided in Table 5-76.

Chinook catch—mothership operations					**B season**		
Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		1,858	871		3,011
	1-2: 58/42	36,750			-		3,613
	1-3: 55/45	39,375					3,614
	1-4: 50/50	43,750					3,564
68,100	1-1: 70/30	20,430		4,005	874	200	2,889
	1-2: 58/42	28,602		-	865		3,205
	1-3: 55/45	30,645			-		3,408
	1-4: 50/50	34,050			-		3,382
48,700	1-1: 70/30	14,610		1,732	861	202	2,352
	1-2: 58/42	20,454		4,005	874	200	2,889
	1-3: 55/45	21,915		3,952	865	200	2,906
	1-4: 50/50	24,350		1,909	925		2,920
29,300	1-1: 70/30	8,790	1,659	1,267	866	201	1,998
	1-2: 58/42	12,306	1,913	1,345	864	200	2,094
	1-3: 55/45	13,185		1,630	860	202	2,282
	1-4: 50/50	14,650		1,732	861	202	2,352

Table 5-85 Expected Chinook *saved* by **mothership operations** if B-season trigger-closure was invoked on the dates provided in Table 5-76.

Chinook saved				**Sector M, B season**			
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		268	-		533
	1-2: 58/42	36,750			-		-
	1-3: 55/45	39,375					-
	1-4: 50/50	43,750					-
68,100	1-1: 70/30	20,430		-	-	0	654
	1-2: 58/42	28,602		-	0		339
	1-3: 55/45	30,645			-		136
	1-4: 50/50	34,050			-		161
48,700	1-1: 70/30	14,610		394	4	-	1,192
	1-2: 58/42	20,454		-	-	0	654
	1-3: 55/45	21,915		-	-	0	638
	1-4: 50/50	24,350		218	-		624
29,300	1-1: 70/30	8,790	278	860	-	-	1,546
	1-2: 58/42	12,306	24	781	1	0	1,449
	1-3: 55/45	13,185		496	5	-	1,261
	1-4: 50/50	14,650		394	4	-	1,192

5.4 Considerations of future actions

CEQ regulations require that the analysis of environmental consequences include a discussion of the action’s impacts in the context of all other activities (human and natural) that are occurring in the affected environment and impacting the resources being affected by the proposed action and alternatives. This cumulative impact discussion should include incremental impacts of the action when added to past, present, and reasonably foreseeable future actions. Past and present actions affecting the Chinook salmon resource have been incorporated into the impacts discussion above. Section 3.4 provides a detailed discussion of reasonably foreseeable future actions that may affect the Bering Sea pollock fishery, the salmon caught as bycatch in that fishery, and the impacts of salmon bycatch on other resource components analyzed in the EIS.

The reasonable foreseeable future actions that will most impact the western Alaska Chinook salmon stocks are the continuation of the management of the directed commercial, subsistence, and sport fisheries for Chinook salmon and changes to the management of the Bering Sea pollock fishery.

ADF&G is responsible for managing commercial, subsistence, sport, and personal use salmon fisheries. The first priority for management is to meet spawning escapement goals to sustain salmon resources for future generations. Highest priority use is for subsistence under both State and Federal law. Surplus fish beyond escapement needs and subsistence use are made available for other uses. The BOF adopts regulations through a public process to conserve fisheries resources and to allocate fisheries resources to the various users. Yukon River salmon fisheries management includes obligations under an international treaty with Canada. Subsistence fisheries management includes coordination with U.S. Federal government agencies where federal rules apply under ANILCA. Subsistence salmon fisheries are an important culturally and greatly contribute to local economies. Commercial fisheries are also an important contributor to many local communities as well as supporting the subsistence lifestyle. While specific aspects of salmon fishery management continue to be modified, it is reasonably foreseeable that the current State management of the salmon fisheries will continue into the future.

The Council is considering action on management measure to minimize chum salmon bycatch in the Bering Sea pollock fishery. A suite of alternative management measures was proposed in April 2008, and a discussion paper was presented to the Council in October 2008. In December 2008, the Council developed a range of alternatives for analysis. Because any revised chum salmon bycatch measures will also regulate the pollock fishery, there will be a synergistic interaction between the alternatives proposed in this EIS and those considered under the chum salmon action. Analysis has not yet begun on the chum salmon action, but will be underway before this EIS is finalized, and a further discussion of the impact interactions will be included at that time. As with new chum salmon measures, analysis of any new management measures for the pollock fleet would consider the impacts of adding those new measures to the existing suite of management measure for the pollock fleet and analyzing those impacts on non-target species, such as Chinook salmon.

The development and deployment of the salmon excluder devise may reduce Chinook salmon bycatch and improve the fleets ability to harvest the pollock TAC under a hard cap.

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6.0 CHUM SALMON

Five species of salmon occur in Alaskan waters. The remaining four species, after Chinook, are managed together in the 'other salmon' management category and reported for accounting purposes as "non-Chinook salmon". The category includes chum salmon (*Oncorhynchus keta*), sockeye salmon (*Oncorhynchus nerka*), coho salmon (*Oncorhynchus kisutch*), and pink salmon (*Oncorhynchus gorbuscha*). As chum salmon represent over 95% of 'other salmon' caught as bycatch in the groundfish fisheries, this section will focus on chum salmon.

6.1 Overview of Chum salmon biology and distribution

The overview information in this section is extracted from Bukliss (1994). Other information on Chum salmon may be found at the ADF&G website, http://www.cf.adfg.state.ak.us/geninfo/finfish/salmon/salmhome.php.

Chum salmon have the widest distribution of any of the Pacific salmon. They range south to the Sacramento River in California and the island of Kyushu in the Sea of Japan. In the north they range east in the Arctic Ocean to the Mackenzie River in Canada and west to the Lena River in Siberia.

Chum salmon often spawn in small side channels and other areas of large rivers where upwelling springs provide excellent conditions for egg survival. They also spawn in many of the same places as do pink salmon, i.e., small streams and intertidal zones. Some chum in the Yukon River travel over 2,000 miles to spawn in the Yukon Territory.

Chum do not have a period of freshwater residence after emergence of the fry as do Chinook, coho, and sockeye salmon. Chum fry feed on small insects in the stream and estuary before forming into schools in salt water where their diet usually consists of zooplankton. By fall they move out into the Bering Sea and Gulf of Alaska where they spend one or more of the winters of their 3- to 6-year lives. In southeastern Alaska most chum salmon mature at 4 years of age, although there is considerable variation in age at maturity between streams. There is also a higher percentage of chums in the northern areas of the state. Chum vary in size from 4 to over 30 pounds, but usually range from 7 to 18 pounds, with females usually smaller than males.

Chum salmon are the most abundant commercially harvested salmon species in arctic, northwestern, and Interior Alaska, but are of relatively less importance in other areas of the state. There they are known locally as "dog salmon" and are a traditional source of dried fish for winter use. Sport fishermen generally capture chum salmon incidental to fishing for other Pacific salmon in either fresh or salt water. After entering fresh water, chums are most often prepared as a smoked product. In the commercial fishery, most chum are caught by purse seines and drift gillnets, but fishwheels and set gillnets harvest a portion of the catch. In many areas they have been harvested incidental to the catch of pink salmon. The development of markets for fresh and frozen chum in Japan and northern Europe has increased their demand.

Chum salmon are generally caught incidental to other species and catches may not be good indicators of abundance. In recent years chum salmon catch in many areas has been depressed by low prices (Eggers

2004). Directed chum salmon fisheries occur in Arctic-Yukon-Kuskokwim area and on hatchery runs in Prince William Sound and Southeast Alaska. Chum salmon runs to Arctic-Yukon-Kuskokwim rivers have been declining in recent years. Chum salmon in the Yukon River and in some areas of Norton Sound have been classified as stocks of concern (Eggers 2004).

6.1.1 Food habits/ecological role

Chum salmon diet composition in summer appeared to be primarily euphausids and pteropods with some smaller amounts of amphipods, squid, fish and gelatinous zooplankton (Davis et al. 2004). Chum from the shelf region contained a higher proportion of pteropods than the other regions while AI chum contained higher proportions of euphausids and amphipods and basin chum samples had higher amounts of fish and gelatinous zooplankton (Davis et al. 2004). Fish prey species consumed in the basin included northern lampfish and juvenile Atka mackerel, sculpins and flatfish while shelf samples consumed juvenile rockfish, sablefish and Pollock (Davis et al. 2004).

6.1.2 Hatchery releases

Commercial salmon fisheries exist around the Pacific Rim with most countries releasing salmon fry in varying amounts by species. The North Pacific Anadromous Fish Commission summarizes information on hatchery releases by country and by area where available. Reports submitted to the NPAFC were used to summarize hatchery information by Country and by US state below (Table 6-1, Table 6-2). For more information see the following: Russia (Anon. 2007; TINRO-centre 2006, 2005); Canada (Cook and Irvine 2007); USA (Josephson 2007; Eggers 2006, 2005; Bartlett 2007, 2006, 2005); Korea (SRT 2005, 2006). Chum salmon hatchery releases by country are shown below in Table 6-1.

For Chum salmon, Japanese hatchery releases far exceed releases by any other Pacific Rim country. This is followed by the US and Russia. A further break-out of hatchery releases by area in the US show that the majority of chum salmon fry releases occur in the Alaska region (Table 6-2).

Combined Asian hatchery releases in 2006 (Russia, Japan, Korea) account for 76% of the total releases while Alaskan chum releases account for 24% of the total releases. Chum enhancement projects in Alaska are not active in the AYK region.

Table 6-1 Hatchery releases of juvenile chum salmon in millions of fish

Year	Russia	Japan	Korea	Canada	US	Total
1999	278.7	1867.9	21.5	172.0	520.8	2,860.9
2000	326.1	1817.4	19.0	124.1	546.5	2,833.1
2001	316.0	1831.2	5.3	75.8	493.8	2,722.1
2002	306.8	1851.6	10.5	155.3	507.2	2,831.4
2003	363.2	1840.6	14.7	136.7	496.3	2,851.5
2004	363.1	1817.0	12.9	105.2	630.2	2,928.4
2005	387.3	1844.0	10.9	131.8	596.9	2,970.9
2006	344.3	1858.0	7.3	107.1	578.8	2,895.5
2007	*	*	13.8	*	*	

*2007 data not yet available

Table 6-2 US west coast hatchery releases of juvenile chum salmon in millions of fish

Year	Alaska	Washington	Oregon	California	Idaho	Combined WA/OR/CA/ID	Total
1999	460.9	59.9	0	0	0		520.8
2000	507.7	38.8	0	0	0		546.5
2001	465.4	28.4	0	0	0		493.8
2002	450.8	56.4	0	0	0		507.2
2003	435.6	60.7	0	0	0		496.3
2004	578.5					51.7	630.2
2005	549.0					47.9	596.9
2006	541.2					37.6	578.8

6.1.3 BASIS surveys

The Bering-Aleutian Salmon International Survey (BASIS) is an NPAFC-coordinated program of pelagic ecosystem research on salmon and forage fish in the Bering Sea. Information on BASIS can also be found in Section 5.1.3.

Stock mixtures of salmon from BASIS surveys in the Bering Sea have provided new information on oceanic migration and distribution of regional stock groups in the Bering Sea. Recent results from Japanese surveys indicate that 81% of the immature chum salmon in the Bering Sea basin were from Asian (Russia and Japan) populations during August-September in 2002. Results from U.S. surveys on the Bering Sea shelf and Aleutian chain indicate considerable spatial variation in stock mixtures; however, when pooled over location mixtures were very similar to mixtures present in the basin with 80% of the immature chum salmon from Asian populations. Immature chum salmon from western Alaska comprised 2% and 8% of immature chum salmon on the southern Bering Sea shelf and northern Bering Sea shelf, respectively. Stock mixtures of juvenile chum salmon have identified where migratory routes of western Alaska and Russian chum salmon stocks overlap and has helped identify the contribution of Russian stocks to the total biomass of juvenile chum salmon on the eastern Bering Sea shelf (JTC 2008).

During the June-July 2005 BASIS survey chum salmon was the most dominant fish species in upper epipelagic layer in the survey area (52 % from overall fish biomass estimates; NPAFC 2006). Chum salmon was a dominant Pacific salmon species in terms of its quantity (46% from overall Pacific salmon quantity). The rate of chum salmon occurrence in trawl catches was highest (92%) among all fish species (NPAFC 2006). During the survey period age 0.1 chum salmon has just started entering Bering Sea along the major pathway of Central Bering Sea Current. Age 0.2 chum salmon was distributed in the Aleutian and Commander Basins. This age group of chum salmon migrated into the Russian EEZ earlier than 0.1 along the major pathway of Central Bering Sea Current (NPAFC 2006). Near Navarin Cape and Kronotsky Capes age 0.2 chum was most proximate to the shore as compared with other areas (NPAFC 2006). Large-size (FL>53 cm) immature chum salmon was numerous in the northwestern Aleutian Basin and Navarin Shelf area (NPAFC 2006). Age 0.3 and higher was distributed almost throughout entire survey area (rate of occurrence in catches – 73%), except for inshore areas (NPAFC 2006). Maturing chum salmon individuals were noted in a high percentage of trawl catches (87 %). The overall biomass of chum salmon in the survey areas was estimated as 311.59 thousand tons (49% - immature and 51% - mature chum). Overall quantity estimates were 138.96 million individuals (57% - immature and 43% - mature chum salmon) (NPAFC 2006)

In 2007, the U.S. BASIS program sampled in the Bering Straits and the Chukchi Sea, and found water temperatures warmer than in the Bering Sea (Fig. 6-1). Substantial numbers of juvenile pink and chum salmon were caught that were larger than those caught south of the Bering Straits. Juvenile chum salmon in this area and from the Chukchi Sea may also originate from the Yukon River (JTC 2008). Auke Bay Laboratories are currently conducting genetic stock identification on these samples to determine river of origin.

Fig. 5-2 shows the relative abundance of juvenile salmon in the Northern Shelf Region of the Bering Sea as determined by the U. S. BASIS cruises from 2002 to 2007. The very low numbers of chum juveniles in 2004 may explain the relatively low chum salmon bycatch in the BSAI groundfish fishery in 2007. The numbers of juvenile chum salmon appear to be rebounding in 2006 and 2007 (Chris Kondzela, AFSC, personal communication).

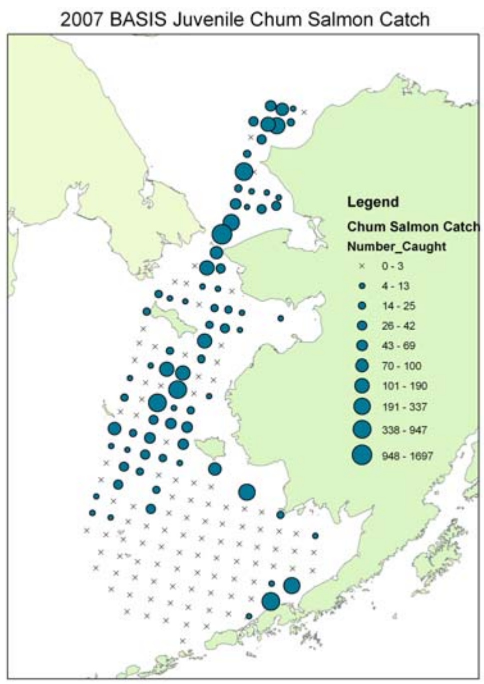

Fig. 6-1 U.S. BASIS juvenile Chum salmon catches in 2007. Source: Chris Kondzela, AFSC

6.1.4 Migration corridors

Migration corridors for western Alaska juvenile salmon are discussed in Section 5.1.4.

6.2 Salmon assessment overview by river system or region

6.2.1 Management and assessment of salmon stocks

The State of Alaska manages commercial, subsistence and sport fishing of salmon in Alaskan rivers and marine waters and assesses the health and viability of individual salmon stocks accordingly. No gillnet fishing for salmon is permitted in Federal (3-200 miles) waters, nor commercial fishing for salmon in offshore waters west of Cape Suckling.

Major chum stocks in western Alaska include Norton Sound, Yukon (Summer and Fall runs), Kuskokwim, Bristol Bay and Kotzebue. An overview of stock status and stock of concern designations for these stocks is provided in Table 6-3.

Table 6-3 Western Alaskan chum stocks and current stock of concern designations.

Chum Stock	Stock of concern?
Norton Sound	Yield concern
Yukon Fall and Summer	Yield concern discontinued 2007 for both fall and summer
Kuskokwim	Yield concern discontinued 2007
Bristol Bay	No
Kotzebue	No

6.2.2 Norton Sound Chum

Norton Sound is comprised of two districts, the Norton Sound District and Port Clarence District. Chinooks stocks are managed in the Norton Sound District. Poor market conditions exist in the Norton Sound chum fishery combined with declining runs

Stock assessment and historical stock estimates

Table 6-4 summarizes escapement assessments for the major index river systems of the Norton Sound and Port Clarence Districts in 2007. These assessments are often qualitative and relative to historical escapement sizes. Most of the chum salmon assessments are described relative to a Sustainable Escapement Goal (SEG) for an index area. An SEG is a level of escapement that is known to provide for sustained yields over a 5-to-10 year period, and is used in situations where a Biological Escapement Goal (BEG) cannot be estimated due to the absence of a stock specific catch estimate. A BEG is based on spawner-recruit relationships estimated to provide maximum sustained yield. An Optimal Escapement Goal (OEG) is a specific management objective for escapement that considers biological and allocative factors and may differ from the SEG or BEG.

ADF&G escapement projects in Norton Sound include counting towers on the Kwiniuk and Niukluk Rivers, a test net operated on the Unalakleet River, and a weir on the Nome River. Norton Sound Economic Development Corporation (NSEDC) provides essential support for these projects.

Six additional counting projects were also operated in the management area this season. The Snake, Eldorado, and Pilgrim River had weir projects which were setup and operated by Kawerak Corporation and the North River counting tower project was a cooperative project operated by Fish & Game in June and Unalakleet IRA for the remainder of the summer. NSEDC provided essential support to all organizations. The Pikmiktalik River counting tower, near Stebbins, is a cooperative project by Kawerak and U.S. Fish & Wildlife Service. Fish & Game and NSEDC operated a weir at the headwaters of Glacial Creek which flows from Glacial Lake into the Sinuk River for two weeks during peak sockeye salmon passage. Except for the Pikmiktalik River and the Glacial Lake project, most projects have been operational since the mid-1990s. All projects supplied important daily information to ADF&G that was very useful to the management of local salmon resources and will become more important the longer they operate.

Aerial survey assessment conditions were fair to good in most of Norton Sound for the 2007 season. However, the lack of aircraft hampered surveying a number of rivers. In addition, weather deteriorated after the first week of September and some rivers were not surveyed for coho salmon escapements during peak escapement periods. As usual, the Nome Subdistrict streams received the most intensive assessment efforts because salmon stocks local to the Nome area are strictly regulated, easily accessed by road system, and are exposed to intensive subsistence and sport fishing pressure.

Table 6-4 Chum salmon counts of Norton Sound rivers in 2007 and associated salmon escapement goal ranges (SEG, BEG or OEG) Source Menard and Kent 2007

	Chum			
Stream Name	Weir/ Tower Count	Escapement Goal Range	Aerial Survey Count	Escapement Goal Range
Salmon L.				
Grand Central R.				
Pilgrim R.	35,588			
Agiapuk R.				
American R.				
Glacial L.				
Sinuk R.		4,000 - 6,200 b	7,210	
Cripple R.			349	
Penny R.			14	
Snake R.	8,144	1,600 - 2,500 c	1,702	
Nome R.	7,034	2,900 - 4,300 c	1,449	
Flambeau R.		4,100 - 6,300 b	4,452	
Eldorado R.	21,312	6,000 - 9,200 c	6,315	
Bonanza R.		2,300 - 3,400 b	2,628	
Solomon R.		1,100 - 1,600 b	673	
Fish R.				
Boston Cr.				
Niukluk R.	50,994	30,000		
Ophir Cr.				
Kwiniuk R.	27,756	11,500 - 23,000 d	2,190	
Tubutulik R.		9,200 - 18,400 b, d	7,045	
Inglutalik R			9,283	
Ungalik River				
Pikmiktalik R	21,080			
Shaktoolik R.			3,531	
Unalakeet R.			1,807	Combined
Old Woman R.			95	2,400 - 4,800
North R.	8,046		295	

Chum salmon escapements were well above average in most areas in 2007. The Nome River weir passage was a record since the weir began operations in the mid-90s as 7,034 chum salmon were counted in 2007. The Eldorado River weir passage was the second best on record with 21,312 chums counted and was second only to last year when 41,985 chum salmon were counted. The Snake River weir passage of 8,144 chum salmon was the second best since counting began in 1995 and exceeded the minimum escapement goal of 1,600 chum salmon for the seventh year in a row. The 21,080 chums enumerated at the Pikmiktalik tower this season was record setting and nearly doubled last year's previous record passage of 12,711 chums. The Kwiniuk River tower counts of 27,756 chum salmon ranked fourteenth highest in the 43-year project history and the Niukluk River tower counts of 50,994 ranked fourth best since counting began in 1995. The Unalakleet River chum escapements were above average based on test net catches, but the North River chum salmon passage of 8,046 was below the 5-year average, but above the 10-year average. The Pilgrim River weir passage of 35,588 chums was over three times the 2004 and 2005 weir passage and over two times the 2003 weir passage, but behind last year's record passage of over 45,000 chum salmon.

Forecasts and precision of estimates

Salmon outlooks and harvest projections for the 2008 salmon season are based on qualitative assessments of parent year escapements, subjective determinations of freshwater overwintering and ocean survival, and in the case of the commercial fishery, the projections of local market conditions. Weak returns of Chinook salmon since 2000 have precluded the prosecution of a chum salmon fishery in Subdistricts 5 and 6 due to concerns with interceptions of Chinook in early to mid-July. Typically when Chinook runs are poor, chum commercial fishing is prohibited until the third week in July despite improved market conditions and interest in an earlier commercial fishery (S. Kent, pers. comm.).

6.2.3 Kotzebue Chum

The Kotzebue District includes all waters from Cape Prince of Wales to Point Hope. The Kotzebue District is divided into three subdistricts. Subdistrict 1 has six statistical areas open to commercial salmon fishing. Within the Kotzebue District chum salmon are the most abundant anadromous fish.

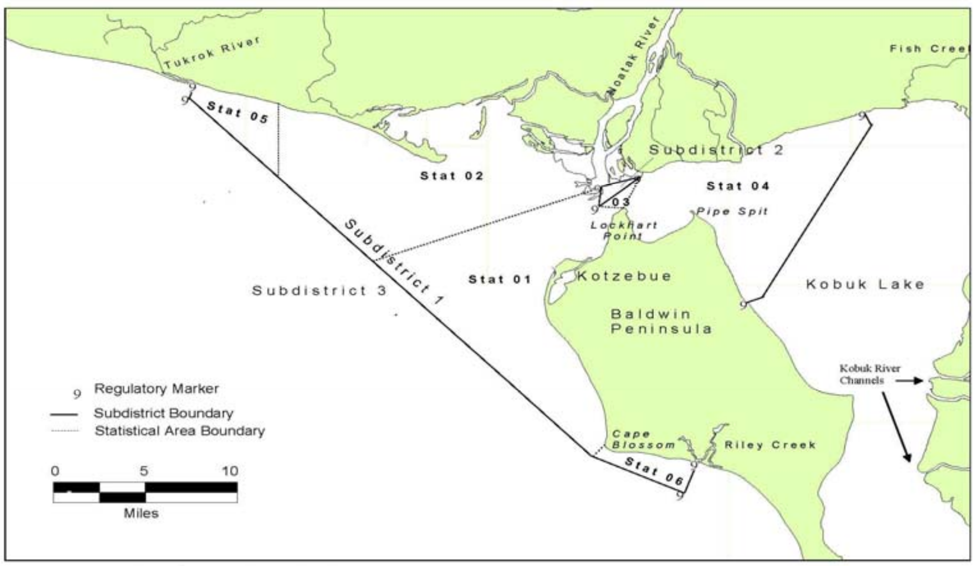

Fig. 6-2 Kotzebue Fishery Management Area

The Kotzebue fishery is primarily a chum salmon fishery, with some Chinook, sockeye, and Dolly Varden taken incidentally. The overall chum salmon run to Kotzebue Sound in 2007 was estimated to be above average based on the commercial harvest rates, subsistence fishermen reporting average to above average catches, and the Kobuk test fish index being above average. No stocks in the Kotzebue area are presently identified as being of management or yield concern and the commercial fishery is allowed to remain open continuously with harvest activity regulated by buyer interest.

Escapement is monitored by a test fish project on the Kobuk River. The lowest index recorded was in 1993. In 2002 and 2003 chum salmon runs showed a large increase in abundance as compared with runs from 1999-2001. Since the test fishery has been established, 2002 and 2003 have been the third and fourth worst years for CPUE in the test fishery (Menard 2003).

Market conditions have impacted the chum fishery in Kotzebue in recent years. A major buyer has not existed for several years and the commercial fishery is limited to a small fleet. Commercial harvests have been low due to weak chum sizes (Menard 2003).

6.2.4 Yukon River Chum

As with Chinook salmon management along the Yukon (see Section 5.2.4), chum salmon management of the Yukon fishery is difficult and complex because of the often inability to determine stock specific abundance and timing, overlapping multi-species salmon runs, increasing efficiency of the fishing fleet, the gauntlet nature of Yukon fisheries, allocation issues between lower river and upper river Alaskan fishermen, allocation and conservation issues between Alaska and Canada, and the immense size of the drainage (Clark et al 2006). Salmon fisheries within the Yukon River may harvest stocks that are up to several weeks and over a thousand miles from their spawning grounds. Since the Yukon River fisheries are largely mixed stock fisheries, some tributary populations may be under or over exploited in relation to abundance, it is not possible to manage for individual stocks in most areas where commercial and subsistence fisheries occurs (Clark et al 2006). In Alaska, subsistence fisheries have priority over other types of use. Agreements between the U.S. and Canada are in effect that commit the ADF&G to manage Alaskan fisheries in a manner that provides a Yukon River Panel agreed to passage of salmon into Canada to both support Canadian fisheries and to achieve desired spawning levels.

6.2.4.1 Stock assessment and historical run estimates

Yukon River chum salmon consists of an earlier and typically more abundant summer run and a later fall salmon run. Yukon chum salmon are harvested in commercial, subsistence and personal use fisheries.

The following information on assessment and stock status of Yukon River summer and fall chum stocks is excerpted from the Joint Technical Committee of the Yukon River US/Canada Panel Report (JTC 2008).

Yukon Summer Chum:

The strength of the summer chum salmon runs in 2008 will be dependent on production from the 2004 (age-4 fish) and 2003 (age-5-fish) escapements as these age classes generally dominate the run. The total run during 2002 and 2003 was approximately 1.2 million summer chum salmon in each year, though tributary escapements were highly variable. It appears that production has shifted from major spawning tributaries in the lower portion of the drainage, such as the Andreafsky and Anvik rivers over the last 5 years, to higher production in spawning tributaries upstream.

In 2007, the return from the 2003 brood year produced a higher than average percentage of age-4 fish. Since summer chum salmon exhibit a strong sibling relationship from age-4 fish to age-5 fish, an above average percentage of age-5 fish is expected in 2008. The 2008 run is estimated using the Anvik River brood table, sibling relationships between age-4 and age-5 fish, and the 5-year average ratio between the Anvik River and Pilot Station Sonar. It is expected that approximately 600,000 summer chum salmon will return to the Anvik River in 2008 and the total run in the Yukon River could be approximately 2.0–2.5 million summer chum salmon which constitutes an average run.

The 2008 run is anticipated to be near average and provide for escapements and support a normal subsistence and commercial harvest. Summer chum salmon runs have exhibited steady improvements since 2001 with a harvestable surplus in each of the last 5 years (2003–2007). If inseason indicators of run strength suggest sufficient abundance exists to allow for a commercial fishery, the commercial harvest surplus in Alaska could range from 500,000 to 900,000 summer chum salmon. The actual commercial harvest of summer chum salmon in 2008 will likely be dependent on market conditions and may be affected by a potentially poor Chinook salmon run, as Chinook salmon are incidentally harvested in chum salmon-directed fisheries.

Yukon Fall chum

Yukon River drainage-wide estimated escapements of fall chum salmon for the period 1974 through 2002 have ranged from approximately 180,000 (1982) to 1,500,000 (1975), based on expansion of escapement assessments for selected stocks to approximate overall abundance (Eggers 2001). Escapements in these years resulted in subsequent returns that ranged in size from approximately 311,000 (1996 production) to 3,000,000 (2001 production) fish, using the same approach to approximating overall escapement. Corresponding return per spawner rates ranged from 0.3 to 9.0, averaging 2.1 for all years combined (1974–2001).

A considerable amount of uncertainty has been associated with these run projections particularly recently because of unexpected run failures (1997 to 2002) followed by a strong improvement in productivity from 2003 through 2006. Weakness in salmon runs prior to 2003 has generally been attributed to reduced productivity in the marine environment and not as a result of low levels of parental escapement. Similarly, the recent improvements in productivity may be attributed to the marine environment. Projections have been presented as ranges since 1999 to allow for adjustments based on more recent trends in production. Historical ranges included the normal point projection as the upper end and the lower end was determined by reducing the projection by the average ratio of observed to predicted returns from 1998 to each consecutive current year through 2004. In 2005, the average ratio of the years 2001 to 2004 was used, in attempts to capture some of the observed improvement in the run.

Table 6-5 Preseason Upper Yukon River Chum salmon outlooks and observed run sizes for the 2000–2007 period

Year	Expected Run Size (Preseason)	Observed Run Size (Post season)	Proportion of Expected Run
2000	127,800	52,800	0.41
2001	126,600	86,700	0.68
2002	114,700	81,500	0.72
2003	116,900	150,000	1.28
2004	123,500	119,700	0.97
2005	121,700	124,200	1.02
2006	115,900	119,800	1.03
2007	118,500	82,900	0.70
	Average (1998 to 2007)		0.85

Yukon River fall chum salmon return primarily as age-4 and age-5 fish, although age-3 and age-6 fish also contribute to the run (JTC 2008). The 2008 run will be comprised of parent years 2002 to 2005 (Table 6-5). Estimates of returns per spawner based on brood year return were used to estimate production for 2002 and 2003. An auto-regressive Ricker spawner-recruit model was used to predict returns from 2004 and 2005. The point estimate in 2006 and 2007, utilized 1974 to 1983 even/odd maturity schedules to represent years of higher production. The 2008 estimated point projection uses years 1984–2001 of the even/odd maturity schedule, because current production is reduced from the pre-1984 level, and resulted in an estimate of 1.0 million fall chum salmon with the approximate age composition provided in JTC (2008).

Table 6-6 Preseason drainage-wide fall chum salmon outlooks and observed run sizes for the Yukon River, 1998–2007

Year	Expected Run Size (Preseason)	Estimated Run Size (Postseason)	Proportion of Expected Run
1998	880,000	334,000	0.38
1999	1,197,000	420,000	0.35
2000	1,137,000	239,000	0.21
2001	962,000	383,000	0.40
2002	646,000	425,000	0.66
2003	647,000	775,000	1.20
2004	672,000	614,000	0.92
2005	776,000	2,325,000	3.00
2006	1,211,000	1,144,000	0.94
2007	1,106,000	1,098,000	0.99
Average (1998 to 2007)			0.90

The forecast range is based on the upper and lower values of the 80% confidence bounds for the point projection. Confidence bounds were calculated using deviation of point estimates and observed returns from 1987 through 2007. Therefore, the 2008 run size projection is expressed as a range from 890,000 to 1.2 million fall chum salmon. However, this projection appears to be high based on other information, such as the lack of immature chum salmon encountered in the high seas BASIS research as well as notable declines in chum salmon bycatch levels, and the low probability of another record even-numbered-year run.

Escapements for the 2002 and 2004 parent years, that will contribute age-6 and age-4 fish in the 2008 run, were below the upper end of the drainage-wide escapement goal of 300,000 to 600,000 fall chum salmon. The 2003 and 2005 escapements, that will contribute age-5 and age-3 fish in the 2008 return, were above the upper end of the drainage-wide escapement goal range. The major contributor to the 2008 fall chum salmon run is anticipated to be age-4 fish returning from the 2004 parent year. The average age-3 component is 1.8%, however, the contribution is expected to be low (0.52) based on poor returns per spawner for the 2005 brood year.

Table 6-7 Projected return of fall chum salmon based on parent year escapement for each brood year and predicted return per spawner (R/S) rates, Yukon River, 2002–2005

Brood Year	Escapement	Estimated production (R/S)	Estimated Production	Contribution based on age	Current Return
2002	397,977	1.71	533,289	1.0%	10,083
2003	695,363	1.83	1,140,395	32.9%	346,163
2004	537,873	2.01	925,142	64.3%	675,059
2005	2,035,183	0.52	1,058,295	1.8%	19,345
				Total expected run (unadjusted)	1,050,649
Total expressed as a range based on the forecasted vs. observed returns from 1987 to 2007 (80% CI):					890,000 to 1.2 million

The 2001 brood year produced exceptionally well with a return of approximately 3.0 million fish including record contributions in nearly all age classes. Return of age-4 fish from even-numbered brood years during the time period 1974 to 2001 typically average 385,000 chum salmon, and ranges from a low of 175,000 for brood year 1988 to a high of 2.2 million for brood year 2001. Based on the high production years from 1974 to 1983, the return of even-numbered brood years averages 436,000 chum salmon. Return of age-5 fish from even-numbered brood years during the time period 1974 to 2001 typically averages 187,000 chum salmon, and ranges from a low of 57,000 for brood year 1998 to a high of 675,000 for brood year 2001. The estimated 2002 brood year return appears to be above average for an even-numbered year and the 2003 brood year is on track to contribute an average return for an odd-numbered year.

If the 2008 run size is near the projected range of 890,000 to 1,200,000 million, it will be well above the upper end of the BEG range of 600,000 fall chum salmon. A run of this projected size should support normal subsistence fishing activities and provide opportunity for commercial ventures where markets exist. The strength of the run will be monitored inseason to determine appropriate management actions and levels of harvest based on stipulations in the Alaska *Yukon River Drainage Fall Chum Salmon Management Plan*.

Canadian-Origin Upper Yukon River Fall Chum Salmon

The outlook for the 2008 Upper Yukon River fall chum salmon run is an above average run of 229,000 fish. The average Upper Yukon River fall chum salmon run size for the 1998–2007 period was estimated to be 181,000 fish.

The 2008 Upper Yukon River fall chum salmon outlook was developed using the potential production from the 2002–2005 brood years which will produce the 3 to 6 year old fish returning in 2008. For even-year returns, on average, 51% of Upper Yukon River adult fall chum salmon return as age-4 and 47% return as age-5. The major portion of the 2008 fall chum salmon run will originate from the 2003 and 2004 brood years. The estimated escapements for these years were 142,683 and 154,080 fish, respectively, based on the Fisheries and Oceans Canada (DFO) mark–recapture program[21]; both years exceeded the escapement goal for rebuilt Upper Yukon River fall chum salmon of >80,000 fish. The weighted average (by age) brood escapement (2002–2005 BY's) contributing to the 2008 Upper Yukon River fall chum salmon run is approximately 152,700 fish.

Based on the Upper Yukon River spawner-recruitment model, poor production should be expected from escapements of this magnitude. However, the return from the escapements exceeding 100,000 fall chum salmon used in the stock recruitment model occurred during a period of low marine survival. Spawner-recruitment relationships have not been determined for the 2003–2007 runs when the estimated spawning escapements ranged from 143,000 to 438,000 fish. The 2008 outlook was therefore developed using a conservative R/S value of 1.5 for the 2002–2005 brood years. The expected 2008 production was then estimated by assuming that each brood year would produce the average age composition for even-year returns within the 1988 to 2006 period, i.e., 1.6% age-3, 50.6% age-4, 46.7% age-5, and 1.1% age-6. The estimated contribution from each brood year was then summed to estimate an above average run size of 229,000 Upper Yukon River fall chum salmon in 2008.

Prior to 2002, preseason outlooks for Upper Yukon River fall chum salmon were based on an assumed productivity of 2.5 returning adults per spawner (i.e., R/S). This was the same productivity used in the joint Canada/U.S. Upper Yukon River fall chum salmon rebuilding model. There was very low survival for the 1994 to 1997 brood years with R/S values equal to or below the replacement value (i.e., R/S=1.0). The average estimated production for the 1998-2002 brood years was 2.5, excluding 2001 with an unprecedented high R/S value of 20.3.

Since 2002, preseason outlooks have been based on stock/recruitment models, which incorporate escapement and subsequent associated adult return by age data. Annual runs were reconstructed using mark–recapture data and assumed contributions to U.S. catches. Although insufficient stock identification

[21] Unlike Chinook salmon, the mark-recapture estimates for fall chum salmon generally agree with the Eagle sonar estimates.

data was available to accurately estimate the annual U.S. catch of Upper Yukon River fall chum salmon, estimates have usually been made based on the following assumptions:

i. 30% [22] of the total U.S. catch of fall chum salmon is composed of Canadian-origin fish;

ii. The U.S. catch of Canadian-origin Upper Yukon River and Canadian-origin Porcupine River fall chum salmon is proportional to the ratio of their respective border escapements; and

iii. The Porcupine River border escapement consists of the Old Crow aboriginal fishery catch plus the Fishing Branch River weir count.

All of these assumptions require additional evaluation as some recent Porcupine River mark-recapture data are available and advances in genetic stock identification (i.e., mixed stock analyses) should permit more accurate estimates of the proportion of Canadian fall chum salmon run harvested in U.S. fisheries. A summary of preseason outlooks, postseason run size estimates and the proportion of the expected run size observed for the 1998 to 2007 period is presented in Table 6-8.

Table 6-8 Preseason Upper Yukon River fall chum salmon outlooks and observed run sizes for the 1998–2007 period

Year	Expected Run Size (Preseason)	Estimated Run Size (Postseason)	Proportion of Expected Run
1998	198,000	61,400	0.31
1999	336,000	98,400	0.29
2000	334,000	62,900	0.19
2001	245,000	45,100	0.18
2002	144,000	109,900	0.76
2003	145,000	179,800	1.18
2004	146,500	181,300	1.24
2005	126,000	515,200	4.09
2006	126,000	284,200	2.26
2007	147,000	278,500	1.89
	Average	(1998 to 2007)	1.24

Conservation concerns for the Fishing Branch River fall chum salmon run arose in the late 1990s and were heightened in year 2000 when the count through the Fishing Branch River weir was only 5,053 fish, the lowest on record. However, run sizes improved somewhat within the 2001–2007 period when observed counts ranged from a low of 13,563 in 2002 to a high of 121,413 in 2005.

The 2008 fall chum salmon run to Canadian portions of the Porcupine River drainage should originate primarily from the 2003 and 2004 escapements. The Fishing Branch River weir counts for these years were 29,519 and 20,274 fall chum salmon, respectively. These counts were 99.8% and 68.5% of the 1997–2006 average of 29,577 fish. The 2003 and 2004 counts both fell below the lower end of the Fishing Branch River escapement goal range of 50,000 to 120,000 fall chum salmon established under the Yukon River Salmon Agreement. The weighted average (by age) base year escapement for the 2008 Fishing Branch River fall chum run is approximately 24,800 fish.

Assuming a return/spawner value of 2.5[23], and using the long-term average (1986–2006) even-year age at maturity for Fishing Branch River fall chum salmon of 49.8.% age-4 and 47.1% age-5 fish, an above average return of 62,000 fall chum salmon is expected in 2008 (Table 6-9).

[22] Recent tagging information has been incorporated into the Porcupine River run reconstruction and there has been some minor deviation from the assumption that 30% of the total U.S. catch of fall chum salmon is composed of Canadian-origin fish.

Table 6-9 Preseason outlook for the 2008 Fishing Branch River fall chum salmon run developed using brood year escapement data, a return per spawner value of 2.5 and an average age composition

Brood Year	Escapement	Estimated Production @ 2.5 (R/S)	Contribution based on age	Expected 2007 Run
2003	29,519	73,798	47.1%	34,738
2004	20,274	50,685	49.8%	25,250
		Sub-total		59,988
	Total expected run (expanded for other age classes and rounded)			62,000

The 2008 outlook is the estimated number of fish entering the mouth of the Yukon River and this number will be decreased by U.S. and Canadian fisheries prior to the fish being counted at the Fishing Branch River weir. It has been difficult to accurately estimate the U.S. harvest rate (and catch) of Porcupine stocks, although DNA analyses may improve this situation in the near future. Nevertheless, the 2008 Fishing Branch River fall chum salmon run may be sufficiently strong to exceed the 1997–2006 average weir escapement of 29,577 fall chum salmon.

As was observed with the Upper Yukon River fall chum salmon stocks, the postseason estimates of the estimated Porcupine River fall chum salmon run sizes were consistently below preseason outlooks throughout the period 1998 to 2002 (Table 6-8). Postseason estimates consistently exceeded preseason outlooks from 2003 to 2005, and the 2006 postseason estimate was 10% lower than the preseason estimate. The 2007 postseason run size estimate was 34% lower than the preseason outlook; however, unusually late run timing may have adversely affected the principal assessment program, the Fishing Branch River weir, as there was no reliable timing information from 2007 assessment programs that could be used to expand the weir count which ended before the run had completely passed upstream. The Porcupine River outlook includes the Fishing Branch River as well as other spawning areas. While it is believed that most fall chum salmon return to the Fishing Branch River, there is little information available on other spawning locations.

Table 6-10 Preseason Porcupine River fall chum salmon outlooks and observed run sizes for the 1998–2007 period

Year	Expected Run Size (Preseason)	Estimated Run Size (Postseason)	Proportion of Expected Run
1998	112,000	24,700	0.22
1999	124,000	23,600	0.19
2000	150,000	12,600	0.08
2001	101,000	32,800	0.32
2002	41,000	19,300	0.47
2003	29,000	46,100	1.59
2004	22,000	31,700	1.44
2005	48,000	189,700	3.95
2006	53,500	48,200	0.90
2007	79,500	52,700	0.66
	Average (1998 to 2007)		0.98

[23] The R/S value (2.5) used for the 2008 Fishing Branch River fall chum salmon outlook is higher than the R/S value (1.5) used for the 2008 Upper Yukon River fall chum salmon outlook. The principal reason for this measure is that Upper Yukon River returns from escapements exceeding 100,000 chum salmon occurred during a period of low marine survival. A more conservative (i.e., lower) Upper Yukon River R/S value captures the uncertainty associated with returns from higher escapements.

6.2.5 Kuskokwim River

The Kuskokwim management area includes the Kuskokwim River drainage, all waters of Alaska that flow into the Bering Sea between Cape Newenham and the Naskonat Peninsula, as well as Nelson, Nunivak, and St Matthew Islands. The management area is divided into 5 districts. District 1, the lower Kuskokwim District, is located in the lower 125 miles of the Kuskokwim River from Eek Island upstream to Bogus Creek. District 2 is about 50 miles in length and is located in the middle Kuskokwim River from above District 1 to the Kolmokov River near Aniak. An upper Kuskokwim River fishing district, District 3, was defined at Statehood, but has been closed to commercial fishing since 1966. Salmon returning to spawn in the Kuskokwim River are targeted by commercial fishermen in District 1 and 2. District 4, the Quinhagak fishing district, is a marine fishing area that encompasses about 5 miles of shoreline adjacent to the village of Quinhagak. The Kanektok and Arolik Rivers are the primary salmon spawning streams that enter District 4. District 5, the Goodnews Bay fishing district, a second marine fishing area, was established in 1968. District 5 encompasses the marine water within Goodnews Bay and the Goodnews River is the major salmon spawning stream that enters District 5 (Clark et al. 2006). Mainland streams north of the Kuskokwim River and streams of Nelson, Nunivak, and St Matthew Islands are not typically surveyed for salmon.

Management of Kuskokwim area salmon fisheries is complex. Annual run sizes and timing is often uncertain when decisions must be made, mixed stocks are often harvested several weeks and hundreds of miles from their spawning grounds, allocative issues divide downriver and upriver users as well as subsistence, commercial, and sport users, and the Kuskokwim area itself is immense. In 1988, the BOF formed the Kuskokwim River Salmon Management Working Group in response to users seeking a more active role in management of fisheries. Working group members represent the various interests and geographic locations throughout the Kuskokwim River who are concerned with salmon management. The Working Group has become increasingly active in the preseason, inseason, and postseason management of Kuskokwim River salmon fisheries. Over the last 10 to 20 years, the fishery management program in the Kuskokwim area has become both more precautionary and more complex with the addition of several BOF management plans, improved inseason and postseason stock status information, and more intensive inseason user group reviewing management of the salmon fisheries (Clark et al 2006). The salmon stocks of the Kuskokwim area have been sustained at a high level, and the large subsistence fishery has been sustained, while the commercial salmon fisheries of the Kuskokwim are have been greatly reduced as a result of the precautionary management approach that has been implemented over the last 15 years.

6.2.5.1 Methodology and historical run estimates

Inseason management of the various Kuskokwim area salmon fisheries is based on salmon run abundance and timing factors, including data obtained through the Bethel test fishery, subsistence harvest reports, tributary escapement monitoring projects, and when available, commercial catch per unit effort data. Inseason run timing models are used to predict subsequent escapement levels using historic run information (Clark et al 2006).

Kuskokwim River chum salmon are an important subsistence species as well as the primary commercially targeted salmon species on the Kuskokwim River in June and July. Kuskowim River chum salmon were designated a stock of concern under yield concern in September 2000 and this designation was continued in September 2003. Since 2000 however chum salmon runs on the Kuskokwim have been improving and in January 2007, the BOF discontinued this designation. Escapement is evaluated through enumeration at weirs on six tributary streams, sonar on the Aniak River and in recent years by a mainstream mark and recapture project near the Upper Kalskag River. Escapement information review indicates that chum salmon escapement was below average from 1999-2000. However since 2001 escapement has been average or better (Bergstrom and Whitmore 2004). Declining salmon markets for chum have increased the difficulty of evaluating the abundance of chum salmon in the Kuskokwim (Bergstrom and Whitmore 2004). While a harvestable surplus was identified in 2002 and 2003, no market existed for the fishery.

Historic run reconstruction for 1976-2000 was evaluated by Shotwell and Adkison (2004). More recent run reconstruction work is currently underway for the Kuskokwim. Preliminary results are shown in Fig. 6-3 (Bue, in prep). These indicate that while the stock was increasing since 2003 and in general since a low in 2000, recent years appear to be declining (Fig. 6-3).

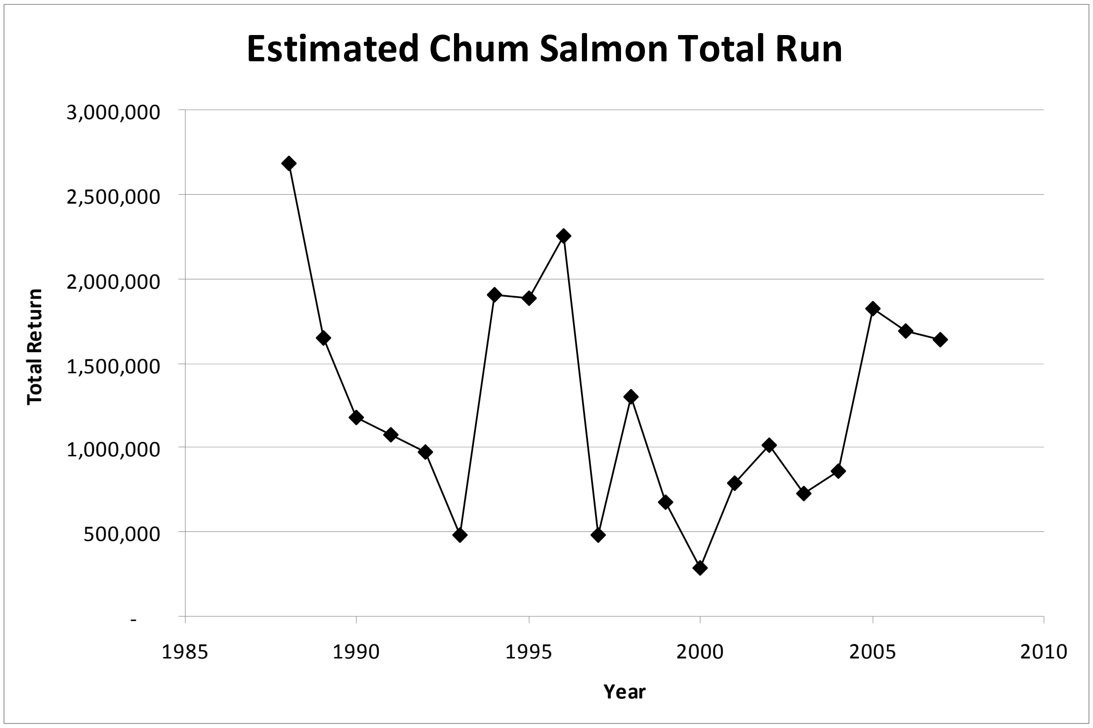

Fig. 6-3 Preliminary run reconstruction for Kuskokwim chum salmon (B. Bue preliminary data, in prep)

6.2.5.2 Forecasts and precision of estimates

ADF&G does not produce formal run forecasts for most salmon runs in the Kuskokwim region, due to lack of information with which to develop rigorous forecasts. Commercial harvest outlooks are typically based upon available parent year spawning escapement indicators, age composition information, recent year trends, and the likely level of commercial harvest that can be expected to be available from such indicators, given the fishery management plans in place. Fisheries are managed based upon inseason run assessment.

6.2.6 Bristol Bay Chum: Nushagak River

There are five discrete commercial fishing districts in Bristol Bay: the Ugashik, the Egegik, the Naknek-Kvichak, the Nushagak, and the Togiak (Fig. 5-22). Salmon management in Bristol Bay is primarily directed at the commercially harvested sockeye salmon which are found throughout the Bay.

6.2.6.1 Methodology and historical run estimates

In the Bristol Bay District chum salmon stocks are fished commercially on the Nushagak and Togiak Rivers Management of the commercial fishery in Bristol Bay is focused on discrete stocks with harvests directed at terminal areas around the mouths of major river systems. Each stock is managed to achieve a spawning escapement goal based on sustained yield. Escapement goals are achieved by regulating fishing time and area by emergency order (EO) and/or adjusting weekly fishing schedules.

Escapement data together with catch and total run estimates are shown for the Nushagak and Togiak Districts from 1987-2007 (Sands et al 2008) in Table 6-11. Escapement and catch in the Nushagak has been increasing in recent years with 2006 well above the 20-year average (Table 6-11).

Table 6-11 Inshore commercial catch and escapement of chum salmon in the Nushagak and Togiak Districts, in numbers of fish, 1987–2007 (Sands et al. 2008)

	Nushagak District			Togiak District		
Year	**Catch**	**Escapement** [a]	**Total Run**	**Catch**	**Escapement** [b]	**Total Run**
1987	416,476	147,433	563,909	419,425	361,000	780,425
1988	371,196	186,418	557,614	470,132	412,000	882,132
1989	523,903	377,512	901,415	203,178	143,890	347,068
1990	378,223	329,793	708,016	102,861	67,460	170,321
1991	463,780	287,280	751,060	246,589	149,210	395,799
1992	398,691	302,678	701,369	176,123	120,000	296,123
1993	505,799	217,230	723,029	144,869	98,470	243,339
1994	328,267	378,928	707,195	232,559	229,470	462,029
1995	390,158	212,612	602,770	221,126	163,040	384,166
1996	331,414	225,331	556,745	206,226	117,240	323,466
1997	185,620	61,456	247,076	47,459	106,580	154,039
1998	208,551	299,443	507,994	67,408	102,455	169,863
1999	170,795	242,312	413,107	111,677	116,183	227,860
2000	114,454	141,323	255,777	140,175	80,860 [c]	221,035
2001	526,602	564,373	1,090,975	211,701	252,610	464,311
2002	276,845	419,969	696,814	112,987	154,360	267,347
2003	740,311	295,413	1,035,724	68,406	39,090 [d]	107,496
2004	470,248	283,805	754,053	94,025	103,810	197,835
2005	874,090	448,059	1,322,149	124,694	108,346	233,040
2006	1,240,235	661,003	1,901,238	223,364	26,900 [c,d]	250,264
20-Year Ave.	445,783	304,119	749,901	181,249	147,649	328,898
1987-96 Ave.	410,791	266,522	677,312	242,309	186,178	428,487
1997-06 Ave.	480,775	341,716	822,491	120,190	109,119	229,309
2007			0	220,633	[c,d]	220,633

Note: Blank cells represent no data.
[a] Escapement based on sonar estimates from the Portage Creek site
[b] Escapement estimates based on aerial surveys
Estimates for 1987-88 rounded to the nearest thousand fish.
[c] No escapement counts were made for the Togiak River.
[d] Partial count

6.2.7 Gulf of Alaska

Primary chum salmon stocks in the GOA are located primary in Cook Inlet, Prince William Sound, Kodiak-Chignik, and Southeast-Yakutat regions. Approximately 75% of chum production is known to occur from salmon enhancement programs (Nelson et al. 2008) The 2007 chum salmon returns were considerably lower than forecasts of 15.7 million for the region as a whole with hatchery returns much lower than expected (Nelson et al. 2008). Reasons for low marine survivals were not well known (Nelson et al. 2008). Wild salmon escapements were lower than average. The weighted rank index of peak survey estimates of 82 streams in Southeast Alaska was 70 % of the 10-year average (Nelson et al. 2008).

In Prince William Sound, threshold escapement goals have been established for chum salmon in 5 districts (Clark et al. 2006). For Cook Inlet, 12 sustainable escapement goals for chum salmon exist for rivers in Lower Cook Inlet and one sustainable escapement goal exists in Upper Cook Inlet. The largest stock of chum salmon in lower Cook Inlet spawns in the McNeil River with an SEG of 13,750-25,750 (Clark et al. 2006) In the time period 1984-2004, this goals was met in 15 of the 21 years (Clark et al. 2006). Nine of the 11 other Lower Cook Inlet chum salmon stocks have exceeded escapement goals 87% of the 10-year time period (1995-2004) (Clark et al. 2006).

In Upper Cook Inlet (UCI) assessments of annual chum salmon runs are made difficult because of the lack of data other than commercial harvest figures. Indications from the OTF project, the commercial fishery, and the few escapement programs where chum salmon are encountered would in general support the characterization that the 2000–2004 runs were much improved from those realized during the 1990s (Shields 2007). Aerial census counts of chum salmon in Chinitna Bay revealed an escapement estimate of nearly 23,000 fish in 2000, which is the largest aerial census estimate ever recorded for this area (Shields 2007). The 2002 escapement counts of chum salmon at the Little Susitna River, Willow Creek, and Wasilla Creek weirs were the highest counts ever observed for these systems, while the 2001 chum salmon escapement in the Little Susitna River was the second largest ever observed (Shields 2007). Assessing the 2005–2007 runs of chum salmon in UCI, however, was difficult (Shields 2007). For example, although the commercial harvest of chum salmon during these 3 years was the lowest observed during the past 40 years, the 2005 OTF cumulative chum salmon CPUE of 300 was only about 35% less than the 1988–2004 average cumulative CPUE of 464, while the 2006 OTF cumulative chum salmon CPUE of 632 was the 6th highest in the past 19 years (Shields 2007). In addition, the 2006–2007 peak aerial census estimates of chum salmon escapement in streams draining into Chinitna Bay showed 11,000 and 12,100 fish, respectively, which led to Chinitna Bay being opened to drift gillnetting for regular Monday and Thursday fishing periods during both years to harvest excess chum salmon (Shields 2007). Chum salmon are no longer enumerated at any weir sites in UCI, but they are encountered and enumerated at the Yentna River sockeye salmon sonar project. However, it must be pointed out that this is a sockeye salmon project and therefore chum salmon enumeration estimates must be viewed only as rough trends (Shields 2007). Although information is limited, the past 3 years of chum salmon returns may have been less than average, but there are no obvious concerns for UCI chum salmon stocks at this time (Shields 2007).

In Lower Cook Inlet (LCI), after a seven-year string of relatively strong returns, chum salmon were a disappointment in the 2007 LCI commercial salmon season (Hammarstrom and Ford 2008). The chum salmon harvest of less than 1,800 fish was the lowest catch on record for the species in LCI. For the first time in many seasons, several areas of Kamishak Bay District on the west side of LCI were closed to commercial fishing in order to protect chum salmon for escapement purposes (Hammarstrom and Ford 2008).. Escapements into most Kamishak Bay chum systems were sufficient to achieve goals, with the exception of McNeil River, where the escapement fell short of its established goal range for the thirteenth time in the last 18 years (but only by 200 fish). Elsewhere in the management area, Outer District chum salmon returns were considered weak, and no directed openings were allowed (Hammarstrom and Ford 2008).

In the Southeast-Yakutat area, the stock assessment program for chum salmon is less developed than regional programs for other salmon species (Clark et al. 2006). Escapements are assessed through aerial and foot surveys but are limited in their utility due to the fact that most counts are obtained opportunistically during surveys to monitor pink salmon escapement complicating the ability to enumerate chum amidst the numbers of pink salmon, as well as the act that there is currently no means to adjust survey counts for boas among observers (Clark et al. 2006). The region's total harvest of wild chum salmon is estimated but detailed stock-specific information is not available for many stocks (Clark et al. 2006). Trends in overall escapement and harvest of wild chum stocks however appear to be increasing in the Southeast Alaska region (Clark et al. 2006).

6.3 Impact analysis methods

As with the pollock and Chinook analysis, chum bycatch levels were tabulated on a fleetwide basis given estimated closure dates for the years 2003–2007. These dates are replicated here in Table 6-14 for Alternative 2. The corresponding levels of chum that were observed during the remaining period was computed and provides a coarse means to evaluate the level of potential reduction in chum bycatch that might have occurred had hard caps been in place. Given that Chinook bycatch rates are often highest later in the B-season, we provide some analysis showing the possible impact of chum salmon bycatch if the historical (2003-2007) fishery had concentrated fishing on the earlier part of the season. This was accomplished by computing the chum salmon bycatch rate (chum per 1,000 t of pollock) for the period of concentration. For this hypothetical scenario, we presume that the effort is concentrated such that all the pollock were taken at shorter season lengths (60%, 70%, 80% and 90%). To arrive at hypothetical chum salmon bycatch levels for these cases, the mean rates were computed at these season lengths and multiplied by the pollock that was caught after these dates. This effectively concentrates the pollock into the shorter season-length (and assumes that it is feasible to do so). This is for evaluation purposes and is unlikely to be strictly applicable in any year. This method provides flexibility to gain appreciation of the impact potential Chinook salmon bycatch regulations may have on the bycatch of chum salmon.

As the original set of alternative Chinook salmon bycatch measures were refined into preliminary preferred alternatives (PPAs), the hypothetical fleet-specific B-season closure dates change (Table **6-16**). For the purposes of evaluating the PPAs, the impact anticipated reduced season lengths was used to evaluate possible impacts on chum salmon bycatch as with the other alternatives.

For triggered closures (Alternative 3), spatial bycatch rates of chum/ t of pollock were estimated outside of closure area to examine the extent that bycatch rates may increase under proposed Chinook salmon trigger closure areas. As with the Chinook analyses, we assume that the pollock *could* be taken outside the area. For a more detailed presentation on the pollock catch rates outside of the area, please refer to Chapter 4. The analysis of chum bycatch within and outside of the Chinook trigger closure area serves as a reasonable proxy for how the industry may redistribute effort to avoid reaching hard caps.

The chum bycatch rates were computed two different ways:

1) as a mean rate from a given date forward to the end of the year. This is the sum the year's chum numbers from that day forward to the end of the year divided by the sum of the pollock caught from that day forward.
2) as a 10-day moving average rate centered on particular dates. This is simply the 10-day sum of chum numbers divided by the analogous 10-day sum of pollock

The rate from 1) provides a way to compare how chum bycatch might change under triggered closures whereas the values from 2) provide a clearer picture of how within-season bycatch rates change. This latter value may provide insight on tendencies for the pollock fleet to fish earlier in the season in order to avoid Chinook bycatch.

6.4 Non-Chinook Salmon Bycatch in the Bering Sea Pollock Fishery under Alternative 1

6.4.1 Bycatch Management

The Chum Salmon Savings Area closures are triggered by separate non-CDQ and CDQ chum caps. This area is closed to directed fishing for pollock from August 1 through August 31. Additionally, if 42,000[24] "other" salmon are caught in the Catcher Vessel Operational Area (CVOA) during the period August 15-October 14, the Chum Salmon Savings Area remains closed to directed fishing for pollock for the remainder of the period September 1 through October 14. As catcher processors are prohibited from fishing in the CVOA during the "B" season, unless they are participating in a CDQ fishery, only catcher vessels and CDQ fisheries are affected by the chum salmon PSC limit. Under Amendment 84, pollock vessels that participate in the VRHS ICA are exempted from the area closures.

6.4.2 Overview of non-Chinook bycatch

For catch accounting and PSC limits 4 species of salmon (Sockeye, Coho, Pink and Chum) are aggregated into an 'other salmon' or non-Chinook salmon species category. Chum salmon comprises over 99.6% of the total catch in this category (Table 6-12).

The majority of non-Chinook bycatch occurs in the pollock trawl fishery. Historically, the contribution of non-Chinook bycatch from the pollock trawl fishery has ranged from a low of 88% of all bycatch to a high of >99.5% in 1993. Since 2002 bycatch of non-Chinook salmon in the pollock fishery has comprised over 95% of the total. Historical bycatch of non-Chinook salmon in the pollock fishery from 1991-2007 is shown in Fig. 6-4 and Table 6-13.

Total catch of non-Chinook salmon in the pollock fishery reached an historic high in 2005 at 705,963 fish (Table 6-13; Fig. 6-4). Bycatch of non-Chinook salmon in this fishery occurs almost exclusively in the B season. Bycatch since 2005 has declined substantially, with the 2007 total of 94,072.

Bycatch rates for chum salmon (chum salmon/ t of pollock) from 1991-2007 are shown in Fig. 6-5. There is substantial interannual variability in the distribution of chum bycatch prompting a range of historical management actions for time and area closures (NPFMC 1995, NPFMC 2006). Currently the Chum Salmon Savings Area as shown in Fig. 6-5 is invoked in the month of August annually and when triggered, closes again in September and October, however the fleet is exempt from these closures under regulations for Amendment 84.

Table 6-12 Composition of bycatch by species in the non-Chinook salmon category from 2001-2007

Year	sockeye	coho	pink	chum	Total	% chum
2001	12	173	9	51,001	51,195	99.6%
2002	2	80	43	66,244	66,369	99.8%
2003	29	24	72	138,772	138,897	99.9%
2004	13	139	107	352,780	353,039	99.9%
2005	11	28	134	505,801	505,974	100.0%
2006	11	34	235	221,965	222,245	99.9%
2007	3	139	39	75,249	75,430	99.8%

*source NMFS catch accounting, extrapolated from sampled hauls only

[24] This number includes the allocation of 4,494 non-Chinook salmon to the CDQ Program. The remaining 37,506 non-Chinook salmon are allocated as a prohibited species catch limit to the non-CDQ pollock fisheries.

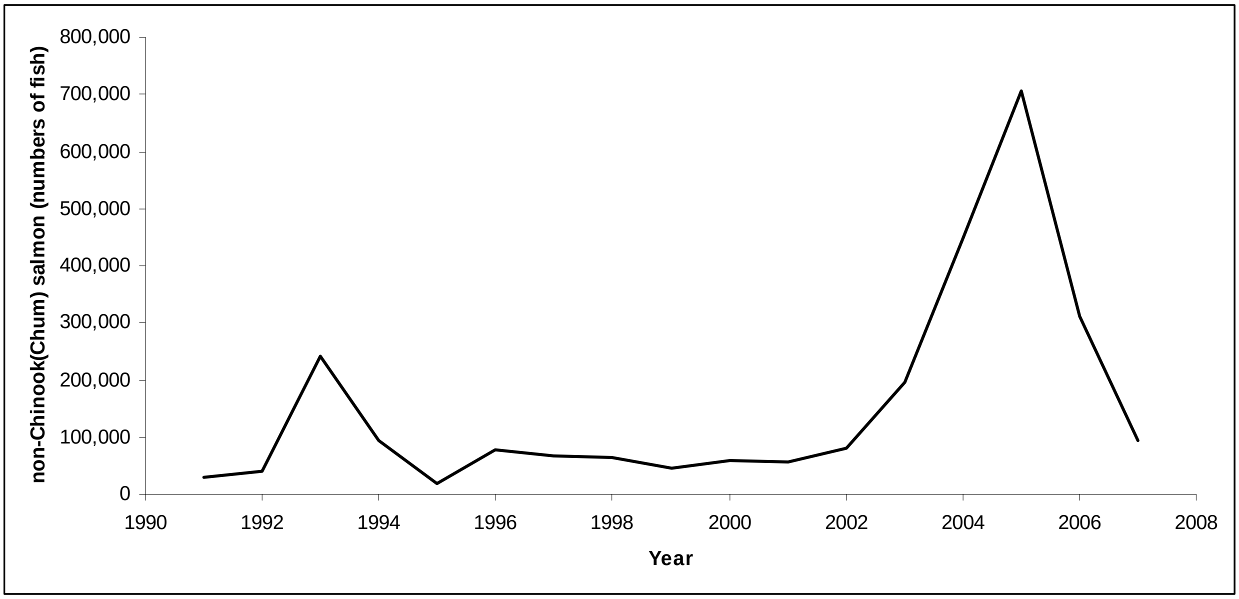

Fig. 6-4 Non-Chinook salmon bycatch in the EBS pollock trawl fishery 1991-2007. Note 1991-1993 values do not include CDQ

Table 6-13 Non-Chinook salmon catch (numbers of fish) in the BSAI pollock trawl fishery (all sectors) 1991-2008, CDQ is indicated separately and by season where available. Data retrieval from 4/30/2008. ‘na’ indicates that data were not available in that year

Year	Annual with CDQ	Annual without CDQ	Annual CDQ only	A season	B season	A season	B season	A season	B season
				With CDQ		Without CDQ		CDQ only	
1991	Na	28,951	na	na	na	2,850	26,101	na	na
1992	na	40,274	na	na	na	1,951	38,324	na	na
1993	na	242,191	na	na	na	1,594	240,597	na	na
1994	92,672	81,508	11,165	3,991	88,681	3,682	77,825	309	10,856
1995	19,264	18,678	585	1,708	17,556	1,578	17,100	130	456
1996	77,236	74,977	2,259	222	77,014	177	74,800	45	2,214
1997	65,988	61,759	4,229	2,083	63,904	1,991	59,767	92	4,137
1998	64,042	63,127	915	4,002	60,040	3,914	59,213	88	827
1999	45,172	44,610	562	362	44,810	349	44,261	13	549
2000	58,571	56,867	1,704	213	58,358	148	56,719	65	1,639
2001	57,007	53,904	3,103	2,386	54,621	2,213	51,691	173	2,930
2002	80,652	77,178	3,474	1,377	79,274	1,356	75,821	21	3,453
2003	195,135	186,779	8,356	3,946	191,189	3,709	183,070	237	8,119
2004	447,626	437,429	10,197	438	447,187	409	437,019	29	10,168
2005	705,963	698,270	7,693	599	705,364	567	697,703	32	7,661
2006	310,545	309,343	1,202	2,525	308,020	2,460	306,883	65	1,137
2007	94,072	87,592	6,480	8,546	85,526	7,390	80,202	1,156	5,324
2008	253	253	0	0	na	253	na	0	na

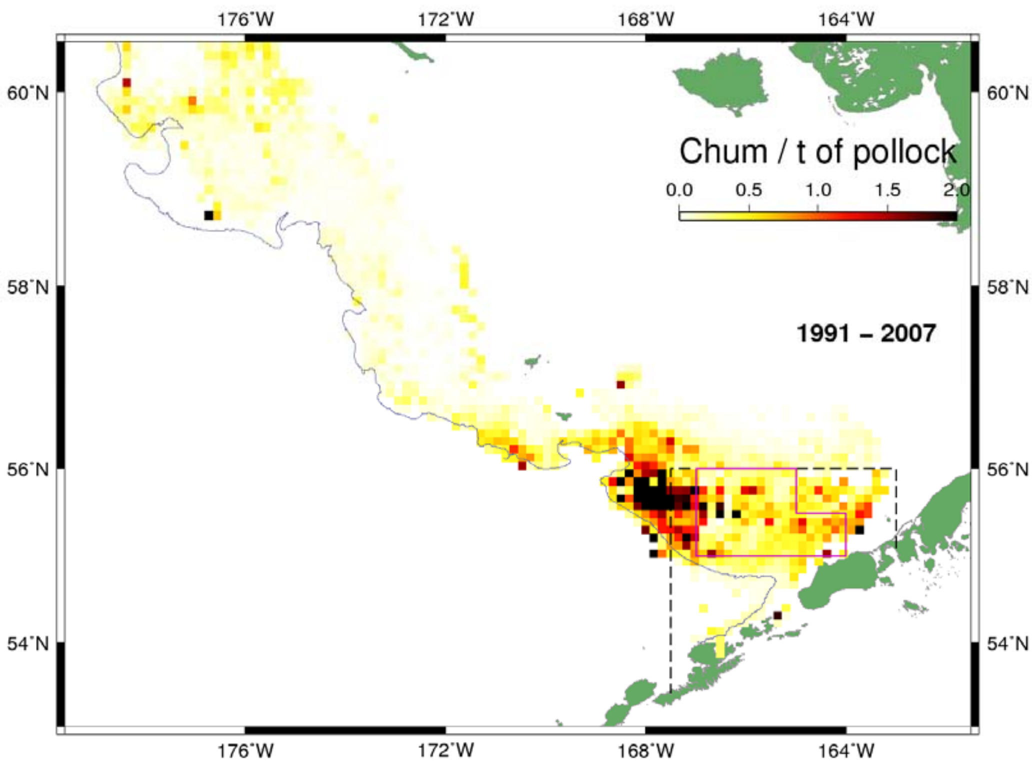

Fig. 6-5 Historical chum B-season bycatch rates 1991-2007. Note the Chum Salmon Savings Area closure (solid line) and the Catcher Vessel Operational Area (dotted line)

6.4.3 Bycatch stock of origin overview

A study conducted by NMFS evaluated bycatch samples of chum salmon from the 1994-1995 pollock trawl fishery in the Eastern Bering Sea and employed genetic stock identification methodology to evaluate the stock composition of these bycaught fish (Wilmot et al. 1998). Results from this study indicated that in 1994 between 39% and 55% of samples were of Asian origin, 20%–35% were western Alaskan stocks, and 21%–29% were from the combined Southeasten Alaska, British Columbia and Washington stocks. (Wilmot et al. 1998). The 1995 samples indicated a range of 13%–51% Asian, 33%–53% western Alaska, and 9%–46% Southeastern Alaska, British Columbia or Washington stocks (Wilmot et al. 1998). Estimates for immature versus maturing fish differed with both years indicating that maturing fish indicating a higher contribution from BC than the contribution from the immature fish (Wilmot et al. 1998). Differences in relative stock composition also varied temporally throughout the B season and by region (Wilmot et al. 1998). Additional work is currently underway at the NMFS Auke Bay Laboratory to evaluate more recent chum bycatch samples from the pollock fishery for stock composition estimates.

Additional studies of research trawl caught fish in the Bering Sea have looked at the origin and distribution of chum salmon (Urawa et al. 2004; Moongeun et al. 2004). Genetic stock identification with allozyme variation was used to determine the stock origin of chum salmon caught by a trawl research vessel operating in the central Bering Sea from late August to mid September 2002 (Urawa et al. 2004). Results indicated that the estimated stock composition for maturing chum salmon was 70% Japanese, 10% Russian and 20% North American stocks, while immature fish were estimated as 54% Japanese, 33% Russian, and 13% North American (Urawa et al. 2004). Stock composition of North American fish was identified for Northwest Alaska, Yukon, Alaskan Peninsula/Kodiak, Susitna River, Prince William Sound, Southeast Alaska/Northern British Columbia and Southern British

Columbia/Washington State. Of these the majority of mature chum salmon for North America stocks came from Southern BC/Washington State and Alaska Peninsula/Kodiak (Urawa et al. 2004). For immature chum salmon, the largest contribution for North American stocks came from Southeast Alaska/Northern BC, followed by Alaska Peninsula/Kodiak and Southern BC/Washington State.

6.5 Impacts of Alternatives 2, 3, and 4

Results using hypothetical past closure dates reduced the chum salmon bycatch by small fractions or not at all (Table 6-15). This result suggests that, had the fleet stopped fishing on those dates, then relative savings to chum salmon would be minimal. This is due to the fact that during these years, most of the chum bycatch occurred earlier in the season (Table 6-7). Under the most constraining Chinook management measure, the savings to chum salmon total ranged from a 5% to 34% reduction in chum bycatch, depending on the year (Table 6-15). For the PPA (scenario 1 and 2, assuming 70:30 A-B season Chinook allocation and 80% rollover with sector transferability), the sector date closures are generally later than those for many of the original alternatives (Table 6-16). Consequently, the chum salmon bycatch reductions will be lower. For this phase of analysis then, assuming re-allocations in space and time will not occur, then the impact of Chinook management measures on chum salmon bycatch generally are anticipated to be lower. However, scenarios where these spatial and temporal assumptions are removed were also examined.

For the spatial component, the original “triggered closure area” evaluation provides a means to understand the potential impact of Chinook salmon bycatch measures. For example, the pattern of chum bycatch within and outside of the Chinook triggered closure area shows that on average, the bycatch rate is about 4-fold higher inside the closure area than outside (Table 6-8). Therefore, any regulation or industry-activity that displaces fishing inside of the closure area is likely to reduce chum salmon bycatch levels.

For temporal patterns, one can imagine that fishermen are likely to confront Chinook hard cap scenarios with a variety of strategies to minimize their interference with pollock fishing. One option at their disposal is to try to fish earlier in the B-season when Chinook bycatch rates tend to be lower. This possible action was evaluated by concentrating pollock that was caught after a specified date into the earlier period and compute the chum salmon bycatch increase given the rates for that period. There are peak periods near the beginning of the B-season where chum bycatch rates peak, particularly within the trigger closure area (Table 6-9). For the entire region, if “planned season length” dates had concentrated to the earlier period, then in some years the chum bycatch increased slightly (Table 6-17). However, based on these speculative actions—that fishermen would concentrate effort earlier in the season—the average impact due to that factor is minimal. On the whole, it appears that the Chinook management measures for the original set of alternatives and for the PPAs are likely to slightly reduce chum salmon bycatch in the EBS pollock fishery.

Stock specific impacts of Chinook caps and triggered closures are uncertain. Since it appears under these scenarios, the level of chum bycatch decreases, then the benefits to source river systems and hatcheries would be improved returns. In Section 6.4.3, estimates of the proportions of bycatch indicate that the largest source of chum bycatch originates in Asian and that up to 35% originated from western Alaska stocks.

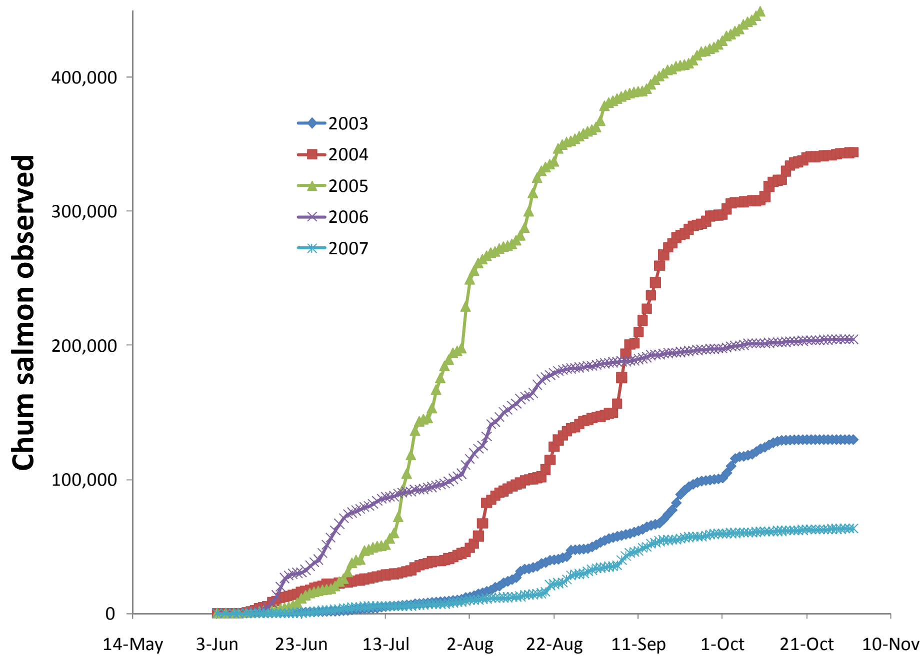

Fig. 6-6 Observed cumulative bycatch of chum salmon during the B-season, 2003-2007

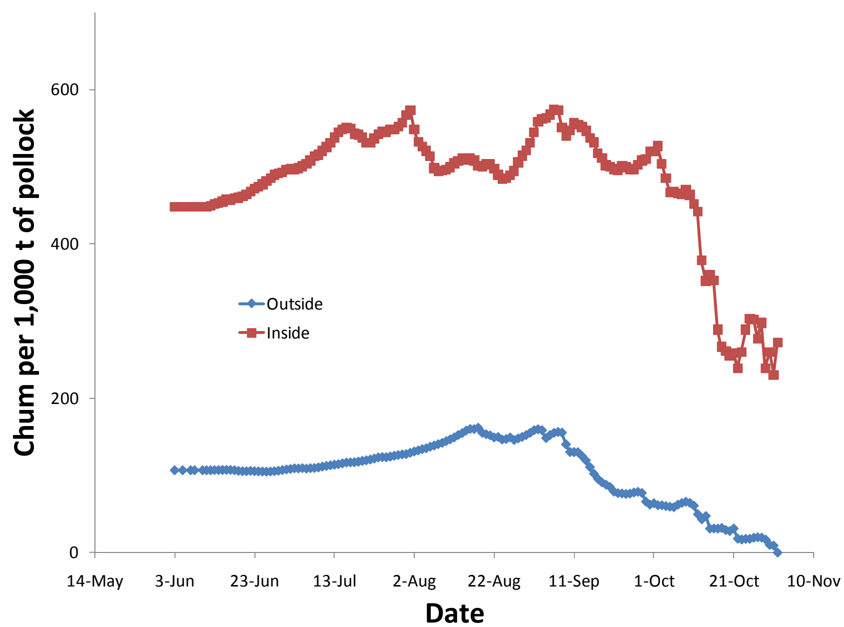

Fig. 6-7 Mean 2003-2007 chum bycatch rate (chum salmon per 1,000 t of pollock) inside and outside of Chinook salmon trigger closure area by date. Note that the numerator (chum numbers) were based solely on observer data whereas the pollock in the denominator was from the entire fleet. The chum rate on a given date represents the mean rate from that date till the end of the year.

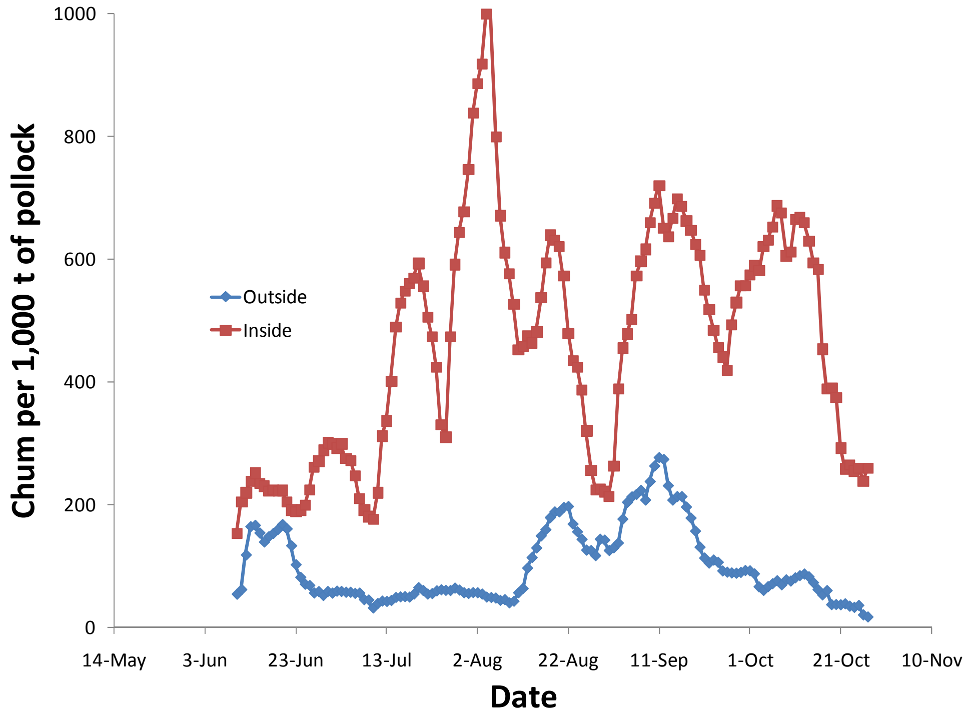

Fig. 6-8 Mean 2003-2007 chum bycatch rate (chum salmon per 1,000 t of pollock) inside and outside of Chinook salmon trigger closure area by date. Note that the numerator (chum numbers) were based solely on observer data whereas the pollock in the denominator was from the entire fleet. The chum rate on a given date represents the 10-day moving average.

Table 6-14 Hypothetical B-season closure dates under the scenarios by year, indicating when the cap level would have been exceeded in each year.

Cap scenario		CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250		25-Oct	13-Oct		13-Oct
	1-2: 58/42	36,750			30-Oct		26-Oct
	1-3: 55/45	39,375					28-Oct
	1-4: 50/50	43,750					31-Oct
68,100	1-1: 70/30	20,430		12-Oct	7-Oct	22-Oct	9-Oct
	1-2: 58/42	28,602		30-Oct	19-Oct		16-Oct
	1-3: 55/45	30,645			25-Oct		18-Oct
	1-4: 50/50	34,050			28-Oct		23-Oct
48,700	1-1: 70/30	14,610		2-Oct	1-Oct	12-Oct	30-Sep
	1-2: 58/42	20,454		12-Oct	7-Oct	22-Oct	9-Oct
	1-3: 55/45	21,915		14-Oct	9-Oct	26-Oct	10-Oct
	1-4: 50/50	24,350		20-Oct	11-Oct		11-Oct
29,300	1-1: 70/30	8,790	8-Oct	14-Sep	10-Sep	21-Sep	16-Sep
	1-2: 58/42	12,306	14-Oct	27-Sep	24-Sep	3-Oct	23-Sep
	1-3: 55/45	13,185		1-Oct	26-Sep	5-Oct	27-Sep
	1-4: 50/50	14,650		2-Oct	1-Oct	12-Oct	30-Sep

Table 6-15 Expected chum catch remaining by **all vessels** if B-season trigger-closure was invoked.

Chum bycatch remaining Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		1%	4%		3%
	1-2: 58/42	36,750			0%		1%
	1-3: 55/45	39,375					1%
	1-4: 50/50	43,750					0%
68,100	1-1: 70/30	20,430		10%	7%	0%	4%
	1-2: 58/42	28,602		0%	2%		3%
	1-3: 55/45	30,645			2%		2%
	1-4: 50/50	34,050			1%		1%
48,700	1-1: 70/30	14,610		14%	11%	1%	6%
	1-2: 58/42	20,454		10%	7%	0%	4%
	1-3: 55/45	21,915		6%	7%	0%	4%
	1-4: 50/50	24,350		2%	5%		4%
29,300	1-1: 70/30	8,790	9%	34%	18%	5%	16%
	1-2: 58/42	12,306	2%	16%	13%	3%	11%
	1-3: 55/45	13,185		14%	12%	2%	9%
	1-4: 50/50	14,650		14%	11%	1%	6%

Table 6-16 Sector-specific closure date scenarios for B-seasons by year reflecting when the cap level would have been exceeded in each year under the two PPA scenarios with A-B split equal to 70:30, 80% rollover from A to B season, and between sector transferability, 2003-2007**.**

PPA	Year	Sector:	B-Season CDQ	M	P	S
1	2003		--	--	--	--
	2004		--	--	--	--
	2005		--	--	--	29-Oct
	2006		--	--	--	22-Oct
	2007		15-Oct	25-Oct	10-Oct	7-Oct
2	2003		--	16-Oct	--	--
	2004		--	--	--	11-Oct
	2005		--	--	25-Sep	5-Oct
	2006		--	--	--	10-Oct
	2007		7-Oct	17-Oct	29-Sep	26-Sep

Table 6-17 Expected chum catch from **all vessels** if the B-season fishery had shortened their season and pooled effort into the period prior to the date in first column (set to roughly 60%, 70%, 80%, and 90% of the original season length).

Planned season completion date	2003	2004	2005	2006	2007
2-Sep	69,776	195,775	453,466	259,783	40,868
17-Sep	79,683	300,133	450,281	242,697	62,657
2-Oct	109,808	313,399	449,780	221,067	65,894
17-Oct	130,144	337,304	469,481	210,763	65,016
Actual Completion date Nov 1	129,788	343,981	474,636	204,705	63,308

6.6 Consideration of future actions

CEQ regulations require that the analysis of environmental consequences include a discussion of the action's impacts in the context of all other activities (human and natural) that are occurring in the affected environment and impacting the resources being affected by the proposed action and alternatives. This cumulative impact discussion should include incremental impacts of the action when added to past, present, and reasonably foreseeable future actions. Past and present actions affecting the chum salmon resource have been incorporated into the impacts discussion above. Section 3.4 provides a detailed discussion of reasonably foreseeable future actions that may affect the Bering Sea pollock fishery, the salmon caught as bycatch in that fishery, and the impacts of salmon bycatch on other resource components analyzed in the EIS.

The reasonable foreseeable future actions that will most impact chum salmon stocks are the continuation of the management of the directed commercial, subsistence, and sport fisheries for chum salmon and changes to the management of the Bering Sea pollock fishery.

ADF&G is responsible for managing commercial, subsistence, sport, and personal use salmon fisheries. The first priority for management is to meet spawning escapement goals to sustain salmon resources for future generations. Highest priority use is for subsistence under both State and Federal law. Surplus fish beyond escapement needs and subsistence use are made available for other uses. The BOF adopts regulations through a public process to conserve fisheries resources and to allocate fisheries resources to the various users. Subsistence fisheries management includes coordination with U.S. Federal government agencies where federal rules apply under ANILCA. Subsistence salmon fisheries are an important culturally and greatly contribute to local economies. Commercial fisheries are also an important contributor to many local communities as well as supporting the subsistence lifestyle. While specific aspects of salmon fishery management continue to be modified, it is reasonably foreseeable that the current State management of the salmon fisheries will continue into the future.

The Council is considering action on management measure to minimize chum salmon bycatch in the Bering Sea pollock fishery. A suite of alternative management measures was proposed in April 2008, and a discussion paper was presented to the Council in October 2008. In December 2008, the Council developed a range of alternatives for analysis. Because any revised chum salmon bycatch measures will also regulate the pollock fishery, there will be a synergistic interaction between the alternatives proposed in this EIS and those considered under the chum salmon action. Analysis has not yet begun on the chum salmon action, but will be underway before this EIS is finalized, and a further discussion of the impact interactions will be included at that time. As with new chum salmon measures, analysis of any new management measures for the pollock fleet would consider the impacts of adding those new measures to the existing suite of management measure for the pollock fleet and analyzing those impacts on non-target species, such as chum salmon.

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7.0 OTHER GROUNDFISH, OTHER PROHIBITED SPECIES & FORAGE FISH

The Bering Sea pollock fishery, and potential changes to the prosecution of the pollock fishery to reduce salmon bycatch under the alternatives, impacts other groundfish species, other species classified as prohibited species, and forage fish. This chapter analyses the impacts to these other fishery resources.

7.1 Other groundfish

Alaska groundfish fisheries are managed based on species quotas using the best scientific data available to determine the status of the stocks. Each year, the Council recommends, and the Secretary of Commerce publishes, harvest specifications for the Bering Sea and Aleutian Islands (BSAI) groundfish fisheries. Harvest specifications establish specific limits on the commercial harvest of groundfish and are used to manage the fisheries. Harvest specifications include the establishment of an individual overfishing level (OFL), acceptable biological catch (ABC), total allowable catch (TAC) for each species or species group, and prohibited species catch (PSC) limits. The ABC is a description of the acceptable harvest for a given stock or stock complex. Its derivation focuses on the status and dynamics of the stock, environmental conditions, other ecological factors, and prevailing harvest characteristics of the fishery. Conservative fishing mortality rates are used to calculate ABC. The OFL is defined as any amount of fishing in excess of a prescribed maximum allowable rate. Fishing at or above the OFL is considered to damage the capacity of the stock to replenish. This maximum allowable rate is prescribed through a set of six tiers. The tiers correspond to information availability. Generally, the least preferable tier utilizes the least amount of information and results in the most restrictive harvest level. Stock management centers on the ABC and OFL. The ABC is lower in amount than the OFL. By convention the individual TACs can equal but do not exceed the individual ABCs.

The objective for NMFS inseason managers is to limit catch to the TAC and or ABC. NMFS prohibits retention if the total TAC is caught before the end of the year. Retention prohibition removes any incentive to increase incidental catch as a portion of other fisheries. If the ABC is taken and the trajectory of catch indicates the OFL may be approached, NMFS imposes additional closures. To prevent overfishing, NMFS closes specific fisheries, identified by gear and area, that incur the greatest incidental catch. NMFS expands the closures to other fisheries if the rate of take is not sufficiently slowed. Over fishing closures are rare because NMFS takes these preventative measures.

Table 7-1 identifies groundfish catch in the Bering Sea pollock fishery for 2003 through 2007. The pollock fishery includes all catch by pelagic trawl gear that is greater than 95% pollock (P target) or is a majority of pollock but less than the 95% mark (B target). The table combines catch from all three sectors of the fishery (catcher/processors, motherships, and inshore catcher vessels). The table shows catch is about 99% pollock. Because of the high volume of pollock, the incidental catch rate of other groundfish species is relatively low. Pacific cod is caught at the highest rate relative to the remaining groundfish species at roughly a half a percent of the total catch. The remaining flatfish species are taken in declining amounts along with more minor components in volume.

Incidental catch of some species may be significant relative to their ABCs and OFLs while small relative to the pollock catch. For example, the 2003 catch of 927 mt of Pacific ocean perch is 38% of that year's Bering Sea subarea ABC of 2,410 mt but on the average is a minimal rate (0.047%) relative to the total groundfish catch in the target. The 2006 catch of 1,396 mt of squid is 66% of an ABC of 1,970 mt. Should catch of these species in other fisheries combine to approach the OFL, management actions would be taken that may impact the pollock fishery. Historically, closures to prevent overfishing are relatively rare but they have occurred and have impacted management of the pollock fishery and incidental catch of groundfish and prohibited species.

Table 7-1 Groundfish catch estimates (in metric tons) by species, in the Bering Sea pollock fishery, including CDQ, for years 2003-7 with a five-year average.

Species/ Species Group	2003	2004	2005	2006	2007	Five-year average	Average percentage by species
Pollock	1,305,228	1,435,936	1,446,199	1,454,514	1,321,788	1,392,733	
Pacific cod	5,526	6,409	7,366	7,270	5,566	6,427	0.46
Flathead sole	1,498	2,104	2,325	2,858	4,213	2,599	0.18
'Other species'	821	1,181	1,022	1,973	1,686	1,337	0.09
Rock sole	1,269	2,549	1,089	1,302	449	1,332	0.09
Squid	1,226	976	1,148	1,396	1,168	1,183	0.08
Arrowtooth	416	555	617	1,078	2,723	1,078	0.08
Atka mackerel	751	1,051	677	786	315	716	0.05
Pacific ocean perch	927	393	652	733	624	666	0.05
'Other flatfish'	137	345	363	463	523	366	0.03
Yellowfin sole	185	821	15	247	85	271	0.02
Shortraker rockfish		54	67	16	73	53	0.00
Northern rockfish	35	50	42	97	24	50	0.00
Greenland turbot	24	18	31	65	108	49	0.00
'Other rockfish'	21	16	15	39	91	36	0.00
Sablefish	42	17	11	8	12	18	0.00

7.2 Impacts on other groundfish

7.2.1 Alternative 1 Status Quo

Pollock catch has remained fairly consistent from year to year in the selected data. A review of Table 7-1 shows under the status quo (for the last five years) some what stable incidental catches of most species in relationship to the pollock target catch. Pacific cod has consistently numbered in the thousands of metric tons. Pacific Ocean perch in the hundreds and species at the declining end of the incidental catch distribution have remained at amounts generally less than 100 mt. Some species show fairly dramatic variation from year to year. Yellowfin sole catch has ranged from 821 mt in 2004 to 15 mt in the following year. Some species have shown an increasing trend. Arrowtooth flounder has increased from more than 400 mt in 2003 to over 2,700 mt in 2007. ‘Other flatfish’ has likewise shown yearly increases.

During the time period covered in Table 7-1, the pollock fleet has sought to minimize salmon bycatch with increasing focus culminating in the ICA in the late summer of 2006 and into 2007. The ICA allowed vessels to fish in areas that would otherwise been closed due to salmon bycatch. Some groundfish incidental catch has increased over the last several years. Explicitly attributing arrowtooth flounder or ‘other flatfish’ catch increases to only a change in behavior of the pollock fleet in response to salmon avoidance would entail an involved analysis though they are likely linked.

The incidental catch estimation process includes extrapolations based on partial observer coverage within the inshore catcher vessel fleet. Conditions affecting estimates of incidental groundfish catch include fleet distribution, vessel behavior, habitat and relative abundance, and the estimation process. Depending on how the observer estimates are incorporated into the estimation algorithm, catch estimates for species that are generally caught at relatively low rates can be based on relatively low number of observations. If an observed vessel among several unobserved vessels incurs high incidental catch that rate is extrapolated to the unobserved vessels. Such an extrapolation can be based on very few observer estimates and result in relatively high estimates of catch

Under the status quo, incidental catch of groundfish could be expected to continue roughly at the amounts identified in Table 7-1. Bycatch of other groundfish species in the pollock fishery will not significantly impact those stocks because incidental catch in the pollock fishery accrues towards each species or species group OFL, and NMFS closes all fisheries in which a species is caught before its OFL is reached. Therefore, the pollock fishery would be closed prior to contributing to significant impacts to other groundfish stocks.

7.2.2 Alternative 2

Alternative 2 would apply a hard cap of Chinook salmon which would close the Bering Sea pollock fishery when reached. The alternative does not include an exemption from that cap as with the ICA under status quo. Sub options include sector splits of the hard cap.

The hard cap would not be expected to drastically change the footprint of the fishery from the status quo. Groundfish fishery management that maintains harvests at the TAC and prevents overfishing would remain the same under Alternative 2. The rate and type of incidentally caught groundfish are expected to vary largely in the same manner as they do under the status quo. While the status quo does have an area closure, the ICA exemption allows the fishery to continue to some extent in that area. To the extent that Alternative 2 would not allow additional fishing after a cap was reached, the incidental catch of groundfish could diminish in relative amounts and perhaps in numbers of species. Under Alternative 2 the fleet would not be expected to fish for extended periods in areas marginal for pollock and incur radically different incidental catch. Further, the seasonal distribution of the Chinook hard cap can affect the rate of groundfish incidental catch.

Table 7-2 shows the seasonal difference between incidental groundfish catch in the pollock fishery. To the extent the distribution of the Chinook salmon bycatch caps constrict pollock fishing in one season and shift effort to the other season, the table may provide an index of the shift in incidental groundfish catch. For species such as Pacific cod, flathead sole, and rock sole seasonal shifts in catch are not likely to incur management implications. For species where catch is typically a relatively high percentage of their ABC and that have relatively small tolerance between the ABC/OFL, an additional catch of small tonnage could exceed the ABC and generate management actions to prevent attaining the OFL. Conversely, a relative distribution of Chinook salmon that limited pollock catch in a season where a vulnerable species incidental rate was relatively higher could decrease the potential for actions to prevent overfishing.

Table 7-2 Groundfish catch estimates (in metric tons) by species, in the Bering Sea pollock fishery average for years 2003-2007, by A season and B season, including CDQ catch.

Species/Species Group	A Season		B Season	
	2003-2007 catch average	Percentage relative to pollock	2003-2007 catch average	Percentage relative to pollock
Alaska plaice	4	0.00	1	0.00
Arrowtooth	332	0.06	745	0.09
Atka mackerel	68	0.01	648	0.08
Flathead sole	1,475	0.26	1,124	0.13
Greenland turbot	9	0.00	40	0.00
Northern rockfish	1	0.00	48	0.01
'Other flatfish'	112	0.02	254	0.03
'Other rockfish'	24	0.00	12	0.00
'Other species'	546	0.10	790	0.09
Pacific cod	4,128	0.74	2,299	0.28
Pacific ocean perch	154	0.03	512	0.06
Pollock	558,908		833,827	
Rock sole	1,297	0.23	40	0.00
Rougheye rockfish	1	0.00	0	0.00
Sablefish	3	0.00	8	0.00
Shortraker rockfish	52	0.01	1	0.00
Squid	403	0.07	779	0.09
Yellowfin sole	262	0.05	8	0.00

If a hard cap closes the pollock fishery especially early in the fishery year, the fleet may increase focus on alternate fisheries to attempt to make up for lost catch. Under the structure of Amendments 80 and 85, AFA vessels are able to target primarily Pacific cod and yellowfin sole as an alternate to pollock. If the pollock fleets' participation in alternate fisheries, especially yellowfin sole, increases more than their current substantial involvement, groundfish incidental catch in the yellowfin fishery especially will likely increase as a result of Alternative 2. However the amount of yellowfin sole and Pacific cod apportioned to the pollock fleet is limited by regulation. The amount of that apportionment they can harvest can be limited by crab and halibut PSC limits.

The size of the Chinook salmon hard cap relative to the pollock TAC can drive incidental catch as well. Within the last several years the Bering Sea pollock ABC has varied from 990,000 mt in 1999 to 2,560,000 mt in 2004. A Chinook cap may not restrict or change the relative incidental catch of groundfish if the pollock TAC is low enough relative to recent years. The incidental catch of groundfish would be expected to generally increase with increasing pollock TAC until (if) the Chinook hard cap became a restriction.

Under Alternative 2, four options are under considerations for seasonal distribution of caps. Option 1-2 is most consistent (2000-2007 average distribution of Chinook bycatch) with the years averaged in Table 7-1. Option 1-1 envisions a 70/30 relative split of the cap. If the fishery utilized 70% of the cap in the A season and consequently limited pollock catch in the B season, incidental catch of groundfish could be expected to decline at the B season rates. Catch of species that are assigned relatively small ABCs and are caught at relatively low levels but at higher rates in the A season could generate management concerns. For example shortraker rockfish are caught at slightly higher rates in the A season. In 2007 shortraker catch was within about 100 mt of the ABC. With the variable nature of the incidental catch of rockfish in all fisheries, changes in the 'normal' patterns can generate higher catches and therefore management concerns. Option 1-3 is only a few percentage points different from and is consistent with option 1-2.

Option 1-4 could decrease the amount of pollock taken in the A season since its apportionment results in an eight point decrease in the A season allocation from the average use identified in option 1-2. The remaining A season allocation of pollock would be available in the B season fishery and increase the incidental catch of groundfish. Of concern for example could be 'other rockfish', rougheye rockfish, and shortraker rockfish which generally have low ABC/OFL limits and are currently caught at levels that are less than 100 or 50 mt of their ABCs.

Under Alternative 2, two options are under consideration for sector allocations of the hard cap, with one option having four sub options. Sector allocations are not expected to affect the major incidental groundfish species. To the extent an allocation of Chinook salmon bycatch drives the ability of a sector to catch its apportionment of the pollock allocation, the incidental catch would vary somewhat in the proportions identified in Table 7-3. Table 7-3 shows the five-year average catch of groundfish in the pollock targets by sector in the Bering Sea. The estimates of incidental catch rates of Pacific cod and flathead sole are somewhat different between the processing components but not largely so. Catcher vessels in the mothership and inshore catcher vessel components have slightly higher rates for Pacific cod relative to catcher processors and the CDQ component. Fishing by CDQ vessels generally follows the seasonal patterns of catcher/processor fleet. A close study of the more minor components of groundfish catch indicates small differences in the hierarchy of incidental groundfish species. If Chinook salmon bycatch is allocated on the basis of the pollock allocations rather than historic bycatch rates and transfers are allowed between the sectors, the incidental catch rates of groundfish are expected to be consistent with the historic patterns. If the flexibility of transfers are not allowed the incidental groundfish catch may shift slightly in favor of the processing sector most favored by the limitation.

Table 7-3 likewise addresses the question of a shift in incidental catch due to transfers of Chinook salmon incidental catch apportionment between sectors of the pollock fishery. Shifts of allocations may drive relatively small fluctuations of incidental catch but not to a large divergence from the general rates identified in Table 7-3.

Table 7-3 Average groundfish catch estimates (in metric tons) by sector and species or species group, in the Bering Sea pollock fishery for years 2003-2007.

	Catcher/processors		Motherships		Inshore CV		CDQ	
	2003-2007 catch average (mt)	Percentage relative to pollock	2003-2007 catch average (mt)	Percentage relative to pollock	2003-2007 catch average (mt)	Percentage relative to pollock	2003-2007 catch average (mt)	Percentage relative to pollock
Alaska plaice	3	<0.01	9	<0.01	1	<0.01	1	<0.01
Arrowtooth	353	0.07	177	0.03	637	0.10	137	0.09
Atka mackerel	35	0.01	36	<0.01	677	0.11	148	0.10
Flathead sole	1,085	0.21	543	0.17	1,126	0.18	212	0.14
Greenland turbot	31	0.01	25	<0.01	8	<0.01	1	<0.01
Northern rockfish	12	<0.01	17	<0.01	36	0.01	4	<0.01
Other flatfish	73	0.01	138	0.01	261	0.04	7	<0.01
Other rockfish	18	<0.01	1.7	<0.01	15	<0.01	1	<0.01
Other species	545	0.11	272	0.10	559	0.09	66	0.05
Pacific cod	2,306	0.45	1,153	0.50	3,031	0.48	553	0.38
Pacific ocean perch	277	0.05	101	0.02	368	0.06	12	0.01
Pollock	515,073	**	515,073	**	631,288	**	147,124	**
Rock sole	707	0.14	353	0.10	373	0.06	18	0.01
Rougheye rockfish	1	<0.01	0.6	<0.01	0.4	<0.01	0.1	<0.01
Sablefish	2	<0.01	6.2	<0.01	15	<0.01	1	<0.01
Shortraker rockfish	50	0.01	1.0	<0.01	1	<0.01	0.3	<0.01
Squid	301	0.06	16	<0.01	706	0.11	106	0.07
Yellowfin sole	202	0.04	151	0.02	34	0.01	2	<0.01

7.2.3 Alternative 3

Alternative 3 proposes fixed closure areas once threshold incidental catch amounts are reached. In contrast to Alternatives 1, 2, and 4, Alternative 3 has a higher potential for changes to the incidental groundfish catch. Many of the options under Alternative 3 regarding transfers would have similar result as the options discussed in this section under Alternative 2.

Assuming that closures are driven by an association of a high concentration of pollock and Chinook salmon, displacing the fleet from that area and allowing the fishery to continue elsewhere may shift incidental groundfish catch from the patterns identified in the tables in this section. The degree to which incidental groundfish catch will vary in relation to status quo depends on the selected closed areas and the duration of the closures. Groundfish do have preferred habitat that may not be associated with the center of abundance for pollock. Habitat characteristics influencing incidental catch may be geographic, depth driven, or include features such as seasonal effects, temperature, currents, salinity and prey species availability. To the extent that Alternative 3 displaces the pollock fleet away from the center of pollock concentration and into the other groundfish preferred habitat, change would occur in incidental groundfish species catch.

During the 2008 A season, under the status quo fishery, an area that has been closed under the ICA as a ‘salmon conservation area’ is the same area closure proposed under Alternative 3. Salmon bycatch has been significantly reduced in both the Chinook and non-Chinook categories from about 43,000 Chinook in 2007 A season to about 16,500 in 2008 A season. Whether the closure is directly responsible for the dramatic decrease in Chinook bycatch is difficult to determine given the myriad influences on incidental catch. However incidental catch of rocksole, yellowfin sole, and skates (a component of the ‘other species’ category) increased in the 2008 A season on the order of several hundred tons per category. The amount of increase is not significant in the case of the ABC and OFL for rocksole and yellowfin sole but has a higher proportional impact on the ‘other species’ category.

The Council is currently considering splitting the ‘other species’ category into its constituent species groups (sharks, skates, octopus, sculpins). Management concerns exist over approaching an OFL level especially for sharks and octopus, which are evaluated at a tier 6 stock assessment level. The combined impacts of the increase in bycatch under Alternative 3 trigger closures and OFLs defined for smaller species groups may result in an increase likelihood of pollock fishery closures to prevent reaching the OFL for those species groups.

7.2.4 Alternative 4

Alternative 4, the Chinook salmon bycatch preliminary preferred alternative (PPA), contains two different annual scenarios that would establish caps to limit the amount of Chinook salmon that could be caught in the Bering Sea directed pollock fishery each year. The annual Chinook salmon cap differs under each scenario. PPA1 includes a high annual hard cap, but is conditional upon an ICA to reduce salmon bycatch being developed by the pollock industry. Vessels that do not participate in the ICA would be subject to a backstop cap. PPA2 includes a low annual cap that would be effective either as the only cap or in the absence of a NMFS-approved ICA. These caps may influence the mortality of other groundfish species through (1) an increased incentive to harvest non-pollock in directed fisheries, (2) changes in the pollock fleet to avoid salmon bycatch, and (3) changes in incidental groundfish catch caused by reducing the amount of pollock harvested and subsequent duration of the pollock fishery.

7.2.4.1 Chinook Salmon Cap

The environmental issues associated with Alternative 4 are very similar to those described under Alternative 2. As discussed in Alternative 2, if a hard cap constrains pollock harvest, the fleet may increase its focus on alternate fisheries in an attempt to make up for lost pollock catch. Under the structure of Amendments 80 and 85, AFA vessels are able to target primarily Pacific cod and yellowfin sole as an alternate to pollock. The yellowfin sole and Pacific cod fisheries are both valuable directed fisheries that may be an attractive source of revenue to offset losses due to decreased pollock harvest and early closure of the pollock fishery.

The harvest of Pacific cod and yellowfin sole is limited by Federal regulations that are specific to the AFA sectors and species. The Alternative 2 discussion provides a detailed description of these fisheries and the sector-specific limits. In summary, the harvest of Pacific cod by the AFA inshore CV sector is limited by regulations while AFA CPs are limited to an annual allocation. The harvest of yellowfin sole is limited by regulations when the aggregate ITAC of yellowfin sole assigned to the Amendment 80 sector and BSAI trawl limited access sector is less than 125,000 metric tons. In 2008 and 2009, the CP and CV sectors are exempted from yellowfin sole limits due to the ITAC being greater than 125,000 mt and are limited by the BSAI trawl limited access allocation. The CDQ sector is limited to species-specific allocations made to CDQ groups. In addition to groundfish harvest limits specific in regulation, the harvest of yellowfin sole and Pacific cod species may be limited by crab and halibut PSC limits.

One important difference between Alterative 4 and Alternative 2 is that incidental catches of Chinook for both non-ICA and ICA vessels would accrue to the non-ICA backstop Chinook cap, while catch from ICA vessels only accrues to the higher ICA Chinook cap. The dual accounting results in non-ICA vessels reaching the Chinook backstop cap before ICA vessels reach the high cap, which may result in forgone pollock and early closure of the fishery for those non-ICA vessels. To offset lost revenue due to early closure and forgone pollock, vessels constrained by the non-ICA cap may increase the harvest of non-pollock groundfish. This incentive would likely be driven by a number of factors, including groundfish prices, abundance, and the amount of forgone pollock.

In addition to directed fishing for non-pollock groundfish, the size of the Chinook salmon hard cap relative to the size of the pollock TAC could change incidental catch in the pollock fishery. In general, the amount of non-pollock groundfish incidentally caught under Alternative 4 would likely correspond with constraints on pollock harvest resulting from the Chinook salmon cap. The amount of incidental groundfish catch would not be allowed to exceed sustainable mortality levels specified in Federal regulation. However, incidental groundfish catches could change as vessels attempt to maximize pollock harvest under a constraining Chinook cap.

The nature of the PPA1 hard cap and dual accounting between non-ICA and ICA vessels may create a "race for fish" situation as vessels race to harvest pollock prior to the Chinook cap being exceeded. During years when the Chinook caps constrain pollock harvest, the incentive to race for pollock could be particularly strong for non-ICA vessels as they attempt to maximize pollock harvest prior to the lower cap being met. Further, the "race for fish" for non-ICA participants may be amplified because the backstop cap would not be sector allocated, thus leaving non-ICA participants in an open competition for Chinook salmon. The ICA participants would have a lower incentive to race for fish given the caps would be sector allocated and monitored/controlled by the ICA. PP2, on the other hand, would function as a hard cap.

A race to fish may result in fishing behavior changing in a manner that increases incidental catch rates of non-pollock groundfish species. Historically the pollock industry has low levels of incidental groundfish catch per mt of pollock. However, as vessels attempt to maximize pollock by fishing "faster", they may fish in a manner that would increase incidental groundfish catch. A higher level of incidental groundfish catch may result in groundfish species with relatively low catch limits requiring management action before reaching overfishing levels (e.g., squid, rockfish, and shark). In the past, closure of the pollock fishery has been avoided because the fleet voluntarily ceased operations in areas with high incidental catch rates (e.g., squid). A race to fish may change the willingness of vessels to leave areas with high incidental catch rates. However, given the potential changes in the incentive structure from status quo, predicting whether the incidental catch of groundfish species would increase under Alternative 4 due to a race for fish is speculation. Further, some of the increase would likely be offset by reduced levels of pollock harvest, which may reduce overall fishing effort and subsequent incidental catch.

Regardless of whether incidental catch increases, the amount of groundfish incidentally caught is constrained by regulations that set catch limits. Federal regulations authorize NMFS management action to close all groundfish fisheries that harvest a specific species or species group prior to that species reaching an overfishing condition. These catch limits protect the sustainability of non-pollock species. Alternative 4 does not change the regulations governing catch limits for non- pollock species and is thus not expected to have a significant adverse impact on the sustainability of these species.

7.2.4.2 Seasonal Split and Transferability

Alternative 4 would create a 70/30 relative split of the Chinook salmon caps between the A and B seasons. If the fishery utilized 70 percent of the cap in the A season and consequently limited pollock catch in the B season, the incidental catch of groundfish could be expected to decline at the B season rates. Catch of non-pollock species with relatively small TACs are generally caught at low levels; however, higher incidental catch rates in the A season could generate management concerns. For example, compared with the B season, shortraker rockfish are caught at higher rates in the A season. In 2007 shortraker catch was within about 100 mt of the ABC. With the variable nature of the incidental catch of rockfish in all fisheries, changes in historical fishing patterns can generate higher catches and therefore management concerns. Management concerns could result in the closure of the pollock fishery to avoid overfishing of species with small TACs.

For the PPA1 high cap and the PPA2 low cap, NMFS would roll-over up to 80 percent of the unused salmon bycatch transferrable allocation or sector level cap from the A season to the B season. Thus, additional Chinook salmon could be made available for the B season. In years with constraining Chinook salmon caps, the rollover would allow more pollock to be harvested in the B season. An increase of pollock in the B season fishery could increase the incidental catch of groundfish. Of concern, for example, could be other rockfish, rougheye rockfish, and shortraker rockfish. These species generally all have low allowable catch limits, with current catch levels less than 100 mt to 50 mt of their ABCs. Roll-overs would not be allowed under the backstop cap.

7.2.4.3 Sector Allocations

Sector allocations are not expected to affect the major incidental groundfish species due to catch limits. The PPA would allocate the Chinook salmon high and low caps to the mothership, inshore CV, CDQ, and at-sea sectors based on historical Chinook salmon catch (Section 2.4). The amount of incidental groundfish catch depends on the level at which Chinook limits constrain pollock harvest. Further, the mothership sector has not historically taken directed deliveries of non-pollock groundfish. The backstop cap would not be allocated by sector.

In years with high salmon bycatch levels (e.g., levels similar to 2006 and 2007), the A and B pollock season would likely be shortened by several weeks for the at-sea sectors and more than a month for the inshore CV sector (Table 5-31). The shortened season results in forgone pollock as well as increased down time between fisheries, with the inshore CV sector potentially experiencing the greatest amount of forgone pollock and fishing down-time.

In an effort to compensate for lost pollock revenue, the offshore and inshore CV AFA sectors would likely have different levels of involvement in the Pacific cod and yellowfin sole fishery. The incentives to fish Pacific cod and yellowfin sole would likely be greatest for the inshore CV fleet due to the predicted early closure of the pollock fishery. Approximately 12 at-sea pollock vessels would likely have limited involvement in non-pollock groundfish fisheries in Alaska due to their involvement with the Pacific hake (aka whiting) fishery off the coast of Washington and Oregon. However, regulations are currently being discussed that would govern the Pacific hake fishery as a limited access privilege program (LAPP). The timing of the hake fishery may change if a LAPP is promulgated.

Even with increased effort for non-pollock species, the directed harvest of non-pollock groundfish species would be governed by catch limits specified in Federal regulation.

Component 3 of the PPA describes transferability between sector entities. Transferability generally reduces that amount of forgone pollock by allowing the redistribution of Chinook caps among sectors (assuming enough sector entities formed). The economic incentives associated with pricing and bycatch availability as well as the relationships between entities will influence the redistribution of Chinook salmon among sectors. Details about these factors are discussed in the RIR in Chapter 10. In general, the increased pollock utilization is expected to have no effect to a marginally small increase of incidental groundfish catch over options that do not allow transferability.

7.2.4.4 Summary

In summary, the caps proposed in the PPA are not expected to significantly change the footprint of the pollock fishery in the Bering Sea. To the extent that Alternative 4 would not allow additional fishing after a cap was reached, the incidental catch of groundfish could diminish in relative amounts and perhaps in numbers of species. A potential for a race for fish under PPA1 could increase the incidental catch of groundfish in the pollock fishery. In years with both high pollock abundance and Chinook salmon abundance, the fleet would likely have larger amounts of forgone pollock. The pollock fleet may attempt to offset lost revenue due to forgone pollock by targeting non-pollock species. However, because the amount of directed harvest and incidental catch of non-pollock groundfish is limited through regulation, Alternative 4 is not expected to significantly impact the sustainability of non-pollock groundfish stocks.

7.3 Other prohibited species

Prohibited species are defined in the groundfish FMPs as species and species groups the catch of which must be avoided while fishing for pollock as well as other groundfish, and which must be returned to sea with a minimum of injury except when their retention is authorized by other applicable law. Prohibited species include all Pacific salmon species and stocks (Chinook, coho, sockeye, chum, and pink), steelhead trout, Pacific halibut, Pacific herring, and red king crab, Tanner crab, and snow crab. The impacts of salmon bycatch management on Chinook salmon are discussed in Chapter 5 and non-Chinook salmon are discussed on Chapter 6. This section analyses the impacts on the other prohibited species besides Chinook and non-Chinook salmon.

The most recent information on the life history, stock assessment, and management of the directed fisheries targeting these species in Alaska may be found at the following websites:

- Alaska Department of Fish and Game: http://www.adfg.state.ak.us
- International Pacific Halibut Commission: http://www.iphc.washington.edu
- 2007 SAFE report for BSAI king and Tanner crabs (NPFMC 2007): http://www.fakr.noaa.gov/npfmc/SAFE/SAFE.htm.

The effects of the Bering Sea pollock fishery on prohibited species are primarily managed by conservation measures developed and recommended by the Council over the history of the groundfish FMPs, and implemented by federal regulation. These measures can be found at 50 CFR 679.21 and include prohibited species catch (PSC) limitations on a year round and seasonal basis, year round and seasonal area closures, and gear restrictions.

7.3.1 Steelhead trout

Steelhead bycatch in the pelagic trawl pollock fishery is extremely rare. In 2003, one steelhead trout was observed taken in the Central Gulf of Alaska pollock fishery using pelagic trawl gear. In looking at observer data since 2002, no steelhead have been taken in the Bering Sea pollock trawl fishery. No specific management measures to prevent bycatch of steelhead trout exist beyond the prohibited retention that applies to all prohibited species under 679.21(b)(4). Because of the extreme rarity of occurrence, any potential effect of the pollock fishery, or changes to the pollock fishery to reduce salmon bycatch, on steelhead trout is very insignificant and will not be further analyzed in this EIS.

7.3.2 Halibut

7.3.2.1 Halibut Population Assessment

On an annual basis, the International Pacific Halibut Commission (IPHC) assesses the abundance of Pacific halibut and sets annual harvest limits for the fixed gear fishery (IFQ Program). The stock assessment is based on data collected during scientific survey cruises, information from commercial fisheries, and an area-specific harvest rate that is applied to an estimate amount of exploitable biomass. This information is used to determine a biological limit for the total area removals from specific regulatory areas. The biological target is known as the “Constant Exploitation Yield” (CEY) for a specific area and year. Removals from sources other than the IFQ Program are subtracted from the CEY to obtain the “Fishery CEY”. These removals include legal sized bycatch (discard), legal-sized halibut (>32 inches in length) killed by lost and abandoned gear, sublegal-sized halibut discarded in the groundfish fisheries, halibut harvested for personal use, and sport catch (Table 7-4). Sublegal halibut bycatch is accounted for in the setting of the harvest rate, which is applied to the total exploitable biomass calculated by the IPHC on an annual basis. Finally, the amount of halibut allocated to the IFQ Program may be different from the Fishery CEY level due to IPHC recommendations.

Table 7-4 Total Area 4 halibut removals (thousand of pounds, net weight) by IPHC category: 1995–2007

Year	Commercial	Sport	Subsistence	Legal-size Bycatch	Legal-size Wastage	Total	Sublegal-size Bycatch	Sublegal-size wastage	IPHC Research
1995	4,735	55	94	3,210	24	8,118	5,516	36	0
1996	5,272	77	94	3,580	74	9,097	4,927	42	0
1997	8,466	69	94	3,800	79	12,508	4,080	74	280
1998	8,761	96	166	3,630	54	12,707	4,095	83	310
1999	11,589	94	170	3,460	93	15,406	3,712	115	268
2000	13,471	73	175	3,270	69	17,058	4,276	146	393
2001	13,229	29	192	3,380	88	16,918	3,445	158	222
2002	11,390	48	180	3,960	51	15,629	3,263	164	199
2003	11,976	31	120	3,241	49	15,417	3,560	171	168
2004	9,045	53	95	2,725	40	11,958	3,764	146	159
2005	8,711	50	128	2,950	31	11,870	3,897	152	149
2006	8,019	46	137	4,321	18	12,541	2,555	161	128
2007	7,984	46	137	2,880	21	11,068	4,200	224	91

Source: G. Williams, IPHC (March 2008)
Data compiled from IPHC Annual Reports and IPHC Report of Assessment and Research Activities (RARA)
Note: 2007 data are preliminary

The IPHC holds an annual meeting where IPHC commissioners review IPHC staff recommendations for harvest limits and stock status (e.g., CEY). The IPHC stock assessment model uses information about the age and sex structure of the Pacific halibut population, which ranges from northern California to the Bering Sea. The most recent halibut stock assessment was developed by IPHC staff in December 2007 for the 2008 commercial fishery. The stock assessment apportioned halibut biomass among IPHC regulatory areas (Fig. 7-1) using scientific survey estimates of relative abundance and migration information. The final assessment for 2008 resulted in a coast wide exploitable biomass of 361 million pounds, down from 414 million pounds estimated in 2007. Clark and Hare (2007) indicate that approximately half of the biomass decrease is from a change in parameterization of survey catchability and the other half is attributed to lower commercial and survey catch rates in 2007. The female spawning biomass remains far above the minimum which occurred in the 1970s.

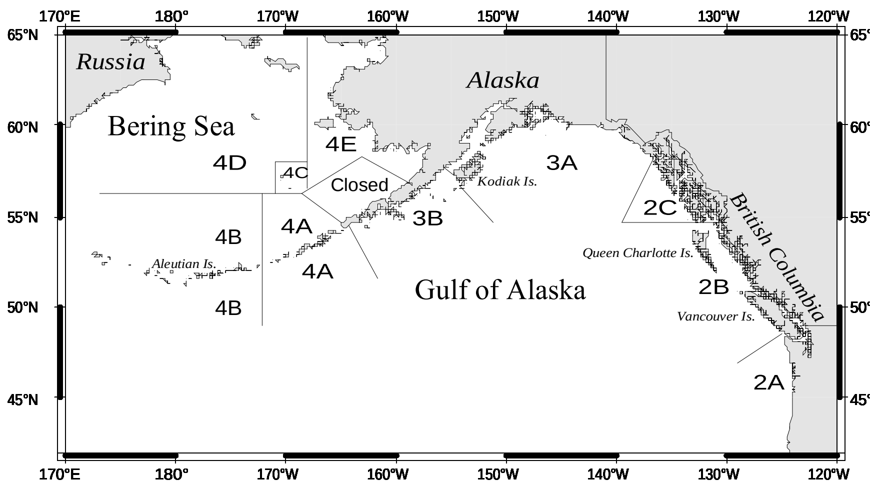

Fig. 7-1 IPHC regulatory areas in the northern Pacific Ocean and Bering Sea

The halibut resource is fully utilized. Recent average catches (1994-2006) in IFQ Program fisheries in waters off Alaska averaged 33,970 mt round weight. This catch level is 26% higher than the long-term potential yield for the entire halibut stock, reflecting the good condition of the Pacific halibut resource. In December 2007, the IPHC staff recommended commercial catch limits totaling 30,349 mt round weight for 2008, a 4% decrease from 31,667 mt in 2007. Through December 31, 2007, commercial hook-and-line harvests of halibut off Alaska totaled 29,844 mt round weight. This harvest occurred in the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI).

The Bering Sea includes IPHC regulatory areas 4D, 4E, 4C, and part of 4A and 4B. Commercial catch limits are established by the IPHC for areas 4A, 4B, and a combined catch limit for 4C, 4D, and 4E. These areas, except area 4A, are located at the periphery of the halibut distribution. Because these areas are not inside the "core" halibut productivity region (areas 2 and 3A), limited stock information exists. Due to these limitations, the IPHC has taken a precautionary approach for managing halibut mortality. For example, a decline in biomass in area 4B prompted the commission to adopt a conservative harvest rate of 0.15 for area 4B. Further, because recruitment in area 4C, 4D, and 4E is poorly understood, a conservative harvest rate of 0.15 was adopted by the IPHC for those areas. This harvest rate represents the amount of biomass that may be exploited by all fisheries within a regulatory area.

7.3.2.2 Halibut PSC and Discard Mortality

Halibut discards are composed of sublegal halibut discarded in the IFQ fishery, halibut discarded as bycatch in groundfish fisheries, wastage of halibut caught in abandoned gear, and mortality resulting from discard. Halibut bycatch in the commercial groundfish fisheries is managed as a prohibited species as discussed in the BSAI groundfish FMP and Federal regulations at 50 CFR 679.21. These management measures are discussed further in the following documents:

- Sections 3.6.1 and 3.6.2 of the BSAI FMPs cover management of the bycatch of halibut in the groundfish fisheries. The FMPs are available at http://www.fakr.noaa.gov/npfmc/
- Section 3.5 of the PSEIS reviews the effects of the groundfish fishery on halibut. The PSEIS is available at http://www.fakr.noaa.gov/index/analyses/analyses.asp.
- Charter 7 of the Alaska Groundfish Harvest Specification EIS provides an overview of prohibition species catch management, including halibut bycatch, available at: http://www.fakr.noaa.gov/analyses/specs/eis/default.htm.

The 2008 halibut PSC limit for the entire BSAI is allocated between the trawl fishery and the non-trawl fisheries. The trawl fishery has a halibut PSC limit that may not exceed 3,675 mt (679.21(e)(1)(iv)), of which 275 mt is allocated to the CDQ sector. The non-trawl fishery has a halibut PSC limit that may not exceed 900 mt, of which 87 mt is allocated to the CDQ fishery.

The Bering Sea pollock fishery is currently exempted from fishery closures due to reaching a halibut PSC limit. Regulations at 50 CFR 679.21(e)(7)(i) exempt vessels using pelagic trawl gear and targeting pollock from being closed due to reaching their bycatch allowance or seasonal apportionment. This exemption allows the pollock fishery to continue fishing even if their allowance of halibut PSC has been reached. As a result, NMFS balances the halibut PSC limit in the pollock trawl fishery against halibut PSC limits in the non-pollock trawl fishery categories. This process ensures the overall BSAI trawl PSC limit is not exceeded.

7.3.2.3 Catch Accounting

Harvest in the IFQ Program is electronically monitored by NMFS. This system allows instantaneous tracking for halibut quota and the transfer of quota between participants in the IFQ Program. This high level of monitoring allows a count of all halibut harvest in the commercial halibut fishery and allows annual quota limits to be enforced. Thus, since the implementation of the IFQ Program in 1995, the annual harvest of halibut has been maintained at levels recommended by the IPHC.

Chapter 3 provides a detailed overview of the methods used to estimate bycatch in the GOA and BSAI groundfish fisheries. In general, halibut bycatch data collected by the North Pacific Groundfish Observer Program (NPGOP) is used by the NMFS to estimate halibut bycatch for the groundfish fisheries. NMFS's estimate of halibut bycatch includes information about the amount of halibut that will not survive after being released (discard mortality). Discard mortalities for certain targets and gear types are obtained from NPGOP estimates and published in the Stock Assessment and Fisheries Evaluation report and annual harvest specifications (Table 9 in the 2008 harvest specifications, www.alaskafisheries.noaa.gov). In 2008, the halibut discard mortality rate for the trawl non-pelagic pollock target is 74% and for the trawl pelagic pollock target is 88%. Thus, 74 or 88% of the halibut incidentally caught and discarded while targeting pollock in the BSAI is assumed to be dead.

Other removal categories include sport, subsistence, wastage, research, and bycatch. Sport and subsistence removal categories are assessed using State of Alaska subsistence and sport fishing household surveys (Table 7-4). Wastage and bycatch is assessed using information from the NPGOP and IPHC scientific surveys.

7.3.3 Impacts on Halibut

The impacts of the PSC limits and the total halibut bycatch in the groundfish fisheries were analyzed in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007). The EIS examines the impacts of the fisheries on bycatch mortality, genetic structure, reproductive success, prey availability, and habitat. The EIS concludes that the impacts of the groundfish fisheries on prohibited species are reduced by existing management measures that mitigate adverse impacts to prohibited species. The IPHC takes account of the halibut bycatch in the groundfish fisheries when setting the fishery CEY. Groundfish fishery categories are closed to directed fishing when halibut PSC limits are taken. Bycatch of halibut in the groundfish fisheries is not expected to interfere with sustainable management of halibut stocks.

Between 2003 and 2007, the amount of halibut and Chinook bycatch in the pollock fishery has increased (Table 7-5). Chinook bycatch increased during this time period, while non-Chinook bycatch has been variable, but is showing an overall decline. Except for 2007, the yearly increase for halibut bycatch has ranged between 7 and 20%. The largest increase occurred in 2007 when halibut bycatch increased by 135% from 2006 levels. Despite the increase in halibut bycatch, amounts are low relative to the size of the annual pollock catch and the trawl halibut PSC limit, at less than 1% of halibut per mt of pollock. On average, the catch comprises approximately 4% of the annual trawl limit.

Table 7-5 Total bycatch of Chinook, non-Chinook, and halibut, and total catch of pollock by trawl vessels in the BSAI

Year	Pollock (mt)	Chinook (#)	Non-Chinook (#)	Halibut
2003	1,305,228	46,993	195,135	91
2004	1,435,936	54,028	447,626	99
2005	1,446,199	67,890	705,963	121
2006	1,454,514	83,257	310,545	130
2007	1,321,788	121,964	94,071	306

Vessels fishing under Alternative 1 are exempted from the salmon savings area closures if they are members of an VRHS ICA, as described in Chapter 2. The VRHS encourages vessels to move from an area of high salmon bycatch to areas of lower salmon bycatch. The VRHS has been used by industry since 2001, with several modifications to the program after its inception. Since the program's inception, halibut bycatch has increased (Table 7-5). However, the relationship between the VRHS and an increase of halibut bycatch is unknown. The amount of halibut bycatch in the pollock fishery is likely influenced by a number of factors including halibut abundance, environmental factors, and changes in fishing behavior that may be associated with avoiding salmon bycatch or responding to changes in target species abundance.

If the current PSC trend continues, halibut PSC amounts would increase for AFA pollock vessels under Alternative 1. Prior to the large increase of halibut PSC observed in 2007, halibut catch increased between 7 and 20% per year. The increasing trend could change in response to the factors discussed in the previous paragraph. These factors create a high level of uncertainty with predicting future halibut PSC amounts in the pollock fishery. As a result, it is not known for certain if halibut PSC would continue to increase. Even with an increasing trend in PSC, the annual trawl limit would constrain halibut PSC and halibut stocks would be managed under the IPHC assessment process description in section 7.3.2.

Alternatives 2 and 3 could change halibut PSC for pollock vessels in the Bering Sea. A change in halibut PSC would be driven by vessel operators avoiding areas with high salmon bycatch, racing to harvest pollock before a fishery closure, or harvesting more non-pollock groundfish species. These behavior changes are associated with the relationship between the forgone benefit from not harvesting pollock and the costs associated with avoiding salmon or switching harvest effort to another species. Halibut bycatch may increase if vessel operators relocate fishing effort to areas or time periods that have greater halibut bycatch than what is typically caught under Alternative 1. Another possibility is that fishing methods change the gear selectivity for halibut. A regulatory prohibition on the use of non-pelagic trawl gear in the AFA pollock fishery currently exists. Thus, a major change in the type of gear used is not likely, but changes in the methods used to fish pelagic trawl gear could occur.

If a salmon hard cap (Alternatives 2 and 4) constrains pollock harvest or a large area of the Bering Sea is closed (Alternative 3) to directed fishing for pollock, the pollock fleet may focus on alternate fisheries in an attempt to make up for lost revenue. Under the structure of Amendments 80 and 85, vessels fishing under the AFA qualifications are able to harvest primarily Pacific cod and yellowfin sole in addition to pollock. The harvest of yellowfin sole and Pacific cod would likely only offset some lost revenue, but would not mitigate substantial losses in the pollock fisheries. Targeting these species would change fishing methods typically used by vessels to target pollock and may result in an increase in halibut bycatch. Typically vessels targeting flatfish have higher rates of halibut bycatch than those targeting pollock.

Alternative 3 would result in area closures that were triggered when a certain limit was reached. The closure period would move fishing effort that would occur in the closed area under Component 5, to non-closed areas. The closure of these areas may result in lower catch rates for pollock. As a result, greater fishing effort may occur during periods when closures are not in effect, which may influence the amount of halibut bycatch. If the intensity of fishing substantially increased in the open area, then the associated increase in fishing effort may result in more halibut PSC within a shorter time period. However, the annual amount of halibut bycatch may not change due to decreased fishing activity during closed periods. Conversely, pollock vessels may increase the amount of yellowfin sole and Pacific cod. These targets typically have higher halibut bycatch rates.

Alternative 4 would have similar impacts on incidental catch of halibut as Alternative 2. The primary differences between Alternative 4 and Alternative 2 are the requirements for the ICA to provide incentives to avoid salmon bycatch and the provisions to encourage fishery participants to join the ICA.

In summary, the extent to which the alternatives would change halibut bycatch is not known for certain. If current trends continue, halibut PSC amounts would increase for AFA pollock vessels under Alternative 1. However, this trend could change in response to a number of factors, including changes in groundfish and halibut abundance, changes in fishing methods or fishing location, pollock abundance, and environmental factors. Thus, it is not known for certain if halibut PSC would continue to increase under Alternative 1. An increase in the halibut bycatch could occur if Alternatives 2-4 encourage pollock vessels to target non-pollock species or change fishing behavior.

However, the process used by the IPHC to specify annual quota for the IFQ Program considers removals of halibut in the trawl fishery. Because the annual amount of halibut PSC in the trawl fishery is limited by federal regulation, halibut mortality cannot be above biologically sustainable levels determined by the IPHC. Further, the IPHC adjusts catch in the IFQ program in accordance with other sources of halibut mortality such as trawl fishing (Section 7.3.2). Thus, the alternatives considered in this analysis are not expected to change the pollock fishery in a manner that would increase bycatch of Pacific halibut to the extent that they would impact the abundance of this specie.

7.3.4 Pacific Herring

Pacific herring are managed by the State of Alaska on a sustained yield principal. Pacific herring are surveyed each year and the GHLs are based on an exploitation rate of 20% of the projected spawning biomass. These GHLs may be adjusted in-season based on additional survey information to insure long-term sustainable yields. The ADF&G has established minimum spawning biomass thresholds for herring stocks that must be met before a commercial fishery may occur.

The most recent herring stock assessment for the EBS stock was conducted by ADF&G in December 2005. For 2008 and 2009, the herring biomass in the EBS is estimated to be 172,644 mt. Additional information on the life history of herring and management measures in the groundfish fisheries to conserve herring stocks can be found in Section 3.5 of the PSEIS (NMFS 2004).

In the BSAI, the herring PSC limit for the groundfish trawl fisheries is set at one percent of the estimated herring biomass. The annual herring PSC limit is published in the *Federal Register* with the proposed and final groundfish harvest specifications. The annual herring PSC limit is apportioned into herring PSC allowances, by trawl fishery categories. If NMFS determines that U.S. fishing vessels participating in any of the trawl fishery categories listed in the BSAI have caught the herring PSC allowance specified for that fishery category then NMFS will publish in the *Federal Register* the closure of the Herring Savings Area as defined in 50 CFR 679, Fig. 4 to directed fishing for each species and/or species group in that fishery category (Fig. 7-2).

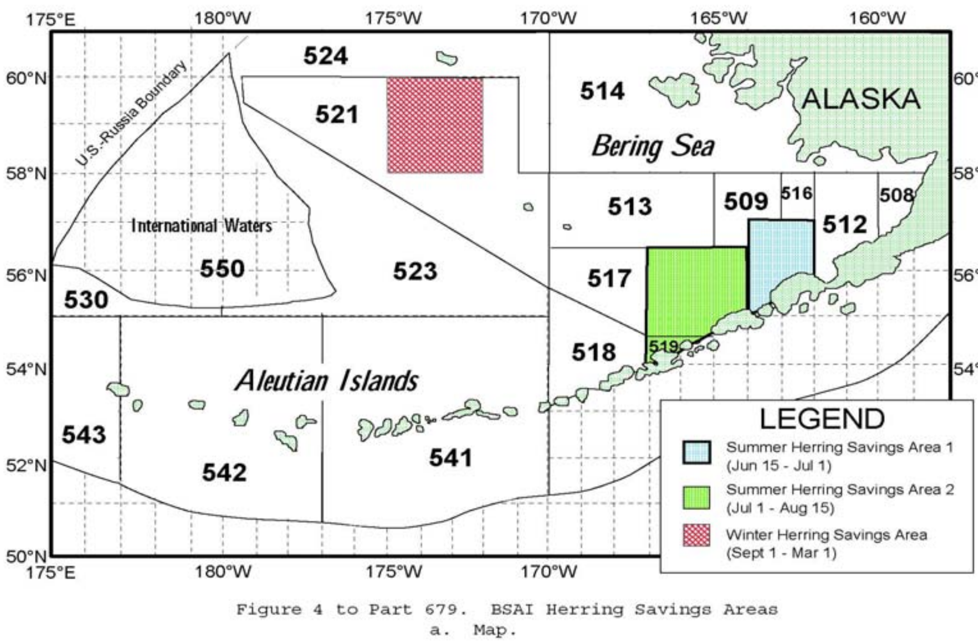

Fig. 7-2 Herring Savings Areas in the BSAI

7.3.5 Impacts on Pacific Herring

The impacts of the PSC limits and the total pacific herring bycatch in the groundfish fisheries were analyzed in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007). The EIS examines the impacts of the fisheries on prohibited species mortality, genetic structure, reproductive success, prey availability, and habitat. The EIS concludes that the impacts of the groundfish fisheries on prohibited species are reduced by existing management measures that mitigate adverse impacts to prohibited species. The amount of herring bycatch in the groundfish fisheries is so low that it would have minor impacts on the stocks of these species. The PSC limits for herring are never reached. When area PSC limits are reached, limits reduce adverse impacts to stocks by closing directed fishing in those areas.

Under Alternative 1, status quo, the pollock fishery's impacts will be less than those of all of the groundfish fisheries combined. In 2007, an estimated 341 mt of the 1,787 mt herring PSC limit was taken by the Bering Sea pollock fishery. Therefore, it is reasonable to assume that the amount of herring taken by the Bering Sea pollock fishery will remain very low and the impacts will remain minor. Changes in the pollock fishery resulting from Alternatives 2 through 4 are not expected to change typical levels of herring bycatch. Thus, the alternatives would likely not change the pollock fishery in a manner that would increase bycatch of herring to the extent that bycatch would impact abundance of these species.

7.3.6 Crab

Red king crab, Tanner crab, and snow crab caught as bycatch are treated as prohibited species in the Bering Sea pollock fishery. Regulations for prohibited species are defined in 50 CFR 672.21b. Crab bycatch in groundfish fisheries are enumerated by on-board observers and then returned to the sea. PSC limits are established for BSAI groundfish fisheries and specified by fishery categories. Once these PSC limits are reached as described below, the specified area closures are triggered for the fishery category.

7.3.6.1 Snow crab PSC limits

Pursuant to 679.21(e)(1)(iv), the PSC limit for snow crab is based on total abundance as indicated by the NMFS annual bottom trawl survey. Snow crab PSC limits are allocated among fishery categories in anticipation of their bycatch needs for the year. A PSC limit is established for snow crab in a defined area that fluctuates with abundance except at high and low stock sizes. The PSC limit is established at 0.1133% of the total Bering Sea snow crab abundance, with a minimum PSC of 4.350 million snow crabs and a maximum PSC of 12.850 million snow crabs. Snow crab taken within the "*C. opilio* Bycatch Limitation Zone" (COBLZ) accrue towards the PSC limits established for individual trawl fishery categories (Fig. 7-2). Upon attainment of a snow crab PSC limit allocated to a particular trawl fishery category, that fishery is closed to directed fishing within the COBLZ for the year, unless further apportioned by season. Based on the 2007 survey estimate of 3.33 billion animals, the calculated snow crab PSC limit is 4,350,000 animals. Of this PSC limit, 20,000 crabs are allocated to the pollock/atka mackerel/other species trawl fishery category.

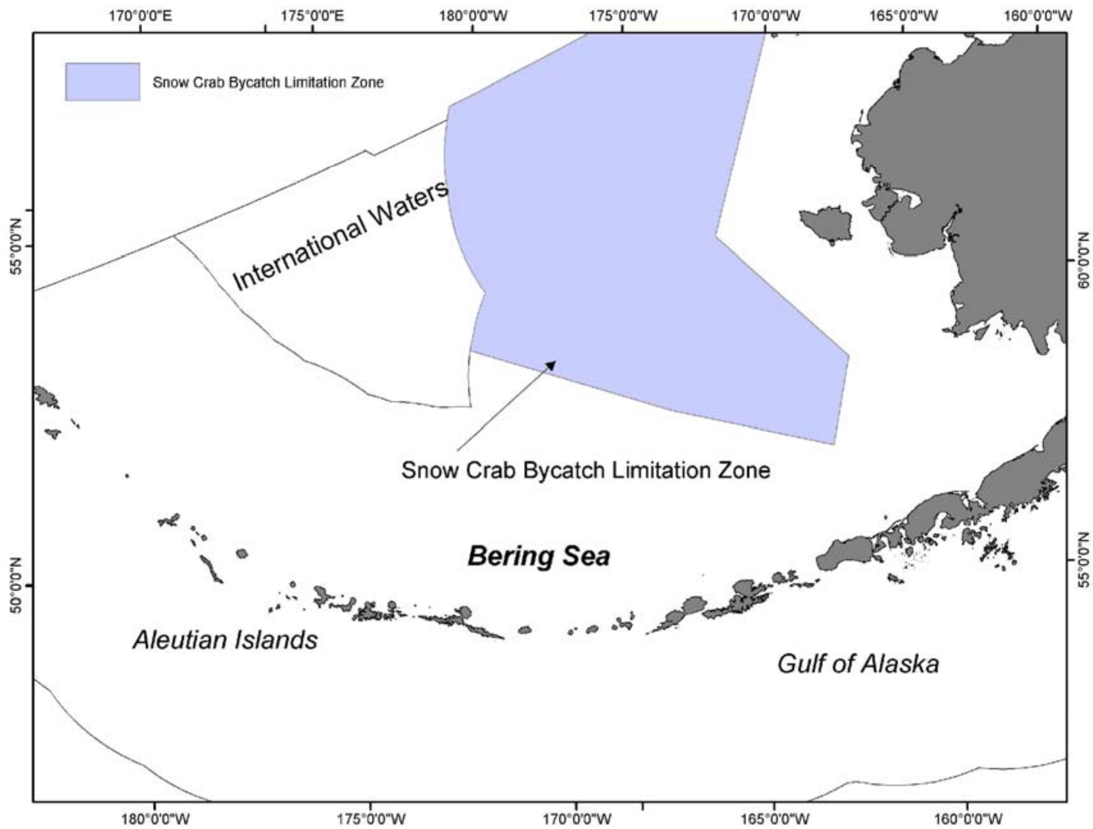

Fig. 7-3 *C. opilio* Bycatch Limitation Zone (COBLZ)

7.3.6.2 Red King Crab PSC limits

PSC limits for Zone 1 red king crab:

Abundance	PSC Limit
Below threshold or 14.5 million lbs of effective spawning biomass (ESB)	32,000 crabs
Above threshold, but below 55 million lbs of ESB	97,000 crabs
Above 55 million lbs of ESB	197,000 crabs

PSC limits are based on the abundance of Bristol Bay red king crab as shown in the adjacent box. In years when the abundance of red king crab in Bristol Bay is below the threshold of 8.4 million mature crabs, a PSC limit of 32,000 red king crabs is established in Zone 1 (Fig. 7-3). In years when the stock is above the threshold but below 55 million pounds of effective spawning biomass, a PSC limit of 97,000 red king crabs is established. A 197,000 PSC limit is established in years when the Bristol Bay red king crab stock is rebuilt (above threshold and above 55 million pounds of effective spawning biomass). Based on the 2007 estimate of effective spawning biomass (73 million pounds), the PSC limit for 2008 was 197,000 red king crabs. The red king crab PSC limit has generally been allocated among the pollock/mackerel/other species, Pacific cod, rock sole, and yellowfin sole fisheries. Of this PSC limit, 400 red king crabs are allocated to the pollock/atka mackerel/other species trawl fishery category. Once a fishery exceeds its red king crab PSC limit, Zone 1 is closed to that fishery for the remainder of the year, unless further allocated by season.

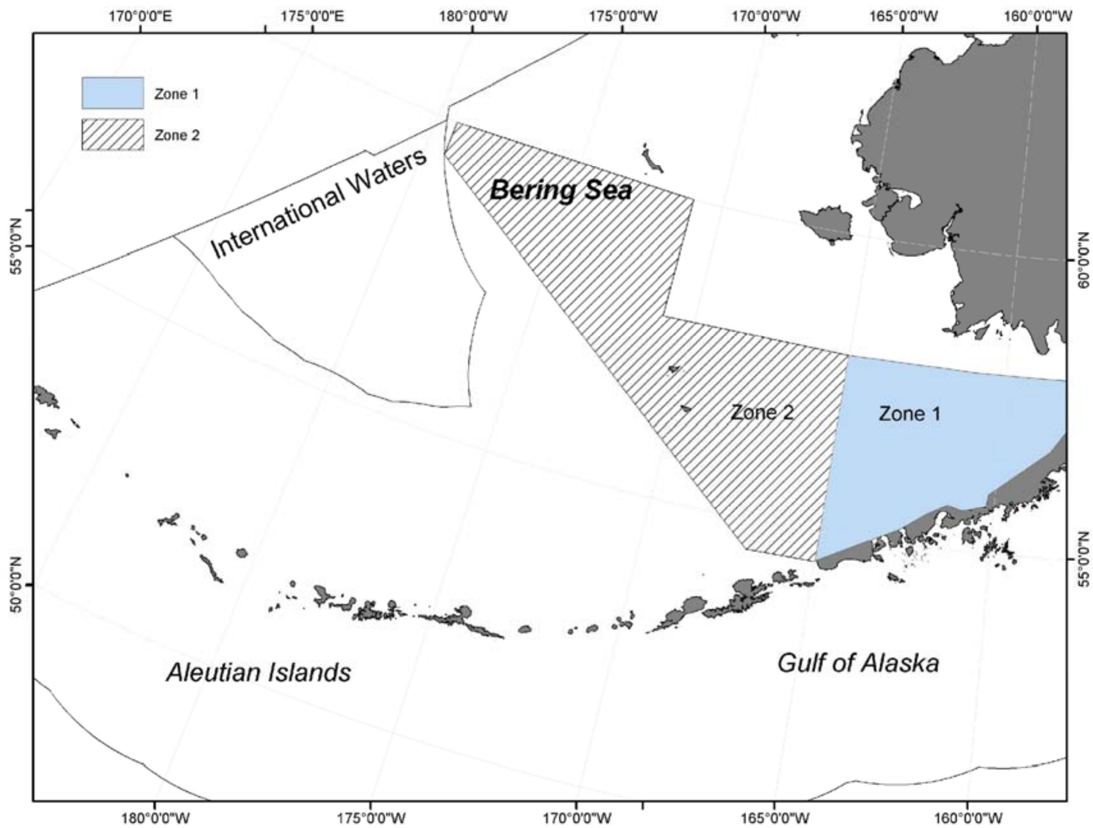

Fig. 7-4 Zones 1 and 2 for red king crab and Tanner crab

7.3.6.3 Tanner crab PSC limits

PSC limits for Tanner crab.

Zone	Abundance	PSC Limit
Zone 1	0-150 million crabs	0.5% of abundance
	150-270 million crabs	750,000
	270-400 million crabs	850,000
	over 400 million crabs	980,000
Zone 2	0-175 million crabs	1.2% of abundance
	175-290 million crabs	2,070,000
	290-400 million crabs	2,520,000
	over 400 million crabs	2,970,000

PSC limits for Tanner crab are established in Zones 1 and 2 (Fig. 7-4) based on total abundance (shown in adjacent box) of Tanner crab as indicated by the NMFS trawl survey. Based on 2007 survey data, Tanner crab abundance is estimated at 767 million animals. Given the criteria set out at 679.21(e)(1)(iii), the 2008 and 2009 Tanner crab PSC limit for trawl gear is 980,000 animals in Zone 1 and 2,970,000 animals in Zone 2. These limits derive from the Tanner crab abundance estimate of more than 400 million animals. The Tanner crab PSC limits have generally been allocated among the pollock/mackerel/other species, Pacific cod, rock sole, rockfish, and yellowfin sole fishery categories. Of this PSC limit, 5,000 crabs are allocated to the pollock/atka mackerel/other species trawl fishery category for each zone. Once a fishery reaches its Tanner crab PSC limit, Zone 1 or Zone 2 is closed to directed fishing for that fishery for the remainder of the year, unless further allocated by season.

7.3.7 Impacts on Crab

The impacts of the PSC limits and the total crab bycatch in the groundfish fisheries on these crab species were analyzed in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007). The EIS examines the impacts of the fisheries on prohibited species mortality, genetic structure, reproductive success, prey availability, and habitat. The EIS concludes that the impacts of the groundfish fisheries on crab prohibited species are reduced by existing management measures that mitigate adverse impacts to prohibited species. The crab bycatch in the groundfish fisheries is so low that it would have minor impacts on the stocks of these species. When area PSC limits are reached, limits help reduce adverse impacts to stocks by closing directed fishing in those areas.

The pollock fleet catches a very small portion of the total bycatch for red king crab, Tanner crab, and snow crab and a very small portion of the PSC cap allocated to the pollock/atka mackerel/other species trawl fishery category. Table 7-6 shows the total number of crab PSC caught in the Bering Sea pollock fishery. Under Alternative 1, this bycatch would remain low and the impact would remain negligible.

Table 7-6 Bering Sea pollock fishery total crab bycatch, by species, in numbers of crab

Year	Blue king crab	Tanner crab	Golden king crab	Snow crab	Red king crab
2003	9	1,119		865	54
2004	4	1,103	2	646	15
2005		607	1	1,950	
2006		1,129	3	2,640	28
2007		894	3	2,836	8
2008		434		400	25

Alternatives 2 through 4 are not expected to change the pollock fishery in a manner that would increase bycatch of crab species. If crab bycatch did increase in the pollock trawl fishery, bycatch would be constrained by the existing PSC limits. Therefore, Alternatives 2, 3, and 4 are expected to have negligible impacts to crab stocks similar to Alternative 1.

7.4 Forage Fish

The BSAI FMP defines forage fish species as:

> *those species…which are a critical food source for many marine mammal, seabird, and fish species. The forage fish species category is established to allow for the management of these species in a manner that prevents the development of a commercial directed fishery for forage fish. Management measures for this species category will be specified in regulations and may include such measures as prohibitions on directed fishing, limitations on allowable bycatch retention amounts, or limitations on the sale, barter, trade, or any other commercial exchange, as well as the processing of forage fish in a commercial processing facility (NPFMC 2005a).*

Some species, identified as target and prohibited species in the FMPs, such as juvenile pollock and herring, are also important forage for many marine mammal, seabird, and fish species. However, this analysis focuses on the species identified as forage fish in the BSAI FMP. Forage fish species in the FMPs include, but are not limited to, eulachon, capelin, other smelts, lanternfishes, deepsea smelts, Pacific sand lance, Pacific sandfish, gunnels, pricklebacks, bristlemouths, and krill.[25]

More information on the forage fish in Alaska's EEZ may be found in several NMFS and Council documents:

[25] Under the FMPs, the forage fish category includes fish in the families Osmeridae, Myctophidae, Bathylagidae, Ammodytidae, Trichodontidae, Pholidae, Stichaeidae, Gonostomatidae, and the order Euphausiacea.

- The Council's Fishery Management Plan for the BSAI includes a discussion of forage species. As noted above, the FMP defines the species groups. Section 4.2.2 in each document describe essential forage fish habitat. Appendix D in each document provides some information on forage fish life history (NPFMC 2005a, 2005b). The FMPs are on the internet at: http://www.fakr.noaa.gov/npfmc/default.htm .
- Sections 3.5.4 and 4.9.4 of the Programmatic Supplemental Groundfish EIS discuss forage fish and the impacts of the preferred programmatic FMP alternatives (NMFS 2004). The groundfish PSEIS is on the internet at: http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm .
- The Essential Fish Habitat/Habitat Areas of Particular Concern EIS and EA describe the forage fish species in the BSAI in Section 3.2.4.2. Appendix Section B.3.4 describes the impacts of fishing on essential fish habitat for forage species (NMFS 2005). The EFH EIS is on the internet at: http://www.fakr.noaa.gov/habitat/seis/efheis.htm .
- The SAFE Ecosystem Considerations Chapter for 2008 report has a section on forage fish and is available on the AFSC website at: http://access.afsc.noaa.gov/reem/ecoweb/Index.cfm.

Regulations at 50 CFR 679.20(i) prohibit directed fishing for forage fish species. The sale of forage fish species is limited to fish retained under the maximum retainable amount (MRA), which may be made into fishmeal. An aggregate MRA for forage fish species has been set at 2% of the retained catch in fisheries open to directed fishing (Tables 10 and 11 to 50 CFR 679).

Aggregate catches of forage fish species can be estimated from observer data. Fig. 7-5 summarizes the catch of forage fishes in the BSAI pollock fisheries, which ranged from 10 mt to 146 mt during the years 2003-2007. Most of this catch was eulachon (*Thaleichthys pacificus*). In the BSAI, where forage fish catch is much smaller than in the Gulf of Alaska, pollock trawlers accounted for about two-thirds of the incidental catch, and non-pelagic flatfish trawling accounted for about one-third.

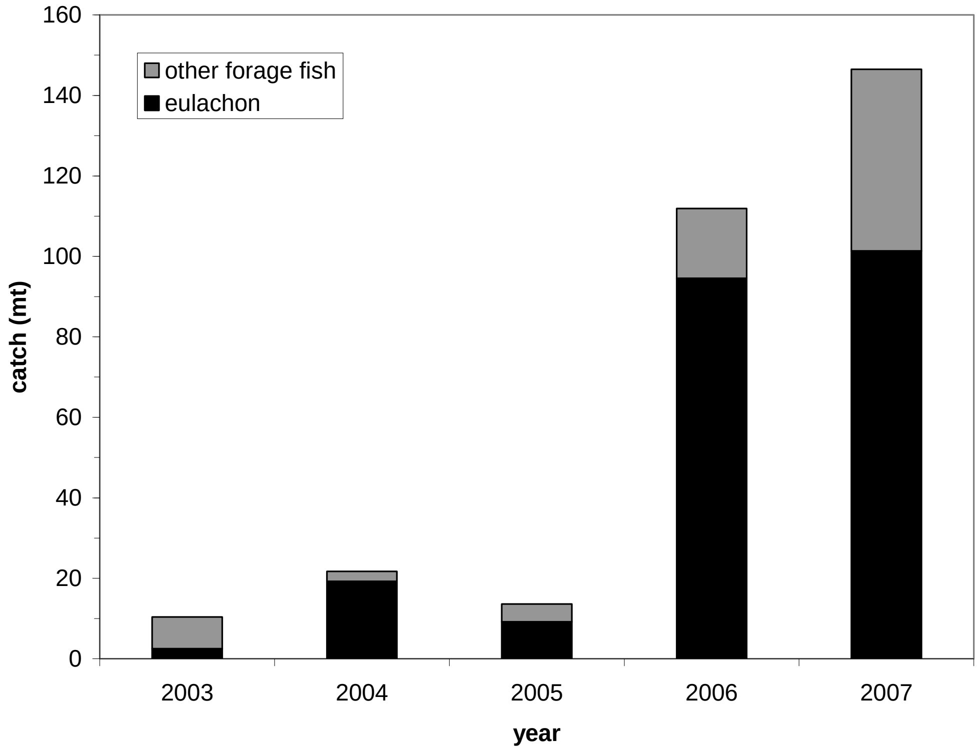

Fig. 7-5 Incidental catches of eulachon and other forage fishes in the commercial pollock fisheries of the BSAI. Data are from the Catch Accounting System database maintained by the Alaska Regional Office, National Marine Fisheries Service, Juneau, Alaska. Data were retrieved on August 25, 2008.

Exploitation rates (catch/biomass) are a useful measure for considering catch data relative to the size of the stock. For forage fishes in the BSAI, however, biomass estimates are sufficiently unreliable that no exploitation rates are included here. Biomass estimates from the eastern Bering Sea (EBS) shelf bottom-trawl survey conducted by the AFSC are available for several forage fish species and species groups (Table 7-7). These estimates are considered unreliable for at least two reasons: (1) forage fishes are small and are likely to easily escape through net meshes and (2) most forage fishes are pelagic and unlikely to be well sampled by bottom gear. Therefore, shelf survey estimates may be viewed as minimum biomass estimates. The extent to which they may underestimate biomass is demonstrated by comparison to biomass estimates from ecosystem modeling (Table 7-7). Model estimates are based on the survey biomass of forage fish predators as well as diet composition data and assumptions regarding consumption rates, and the estimates shown here used information from the early 1990s. There is considerable uncertainty in these estimates, but they do endeavor to show the amount of forage-fish biomass that must be present in the ecosystem to support the estimated level of predation. In all cases they are several orders of magnitude higher than the survey figures, and the discrepancy is particularly large for sandlance.

The available information on biomass indicates that fishing rates on eulachon and capelin, which account for most forage fish catch, are low. Based on biomass estimates prepared from bottom trawl surveys, it appears that in a typical year, exploitation rates are less that one percent of estimated biomass. Because smelts are pelagic, biomass estimates based on trawl data are believed to be low, so that true exploitation rates may be even lower. The catch of forage fishes may also be considered in light of the pollock-fishery catch of all nontarget fish species including cephalopods (octopus and squids; Table 7-7). These catches are one to two orders of magnitude higher than the forage-fish catches.

Table 7-7 Biomass estimates and catches of nontarget fishes in the BSAI. Survey biomass estimates are from the Resource Assessment and Conservation Engineering division of the Alaska Fisheries Science Center (B. Lauth, AFSC, pers. comm.). Ecosystem model estimates are from Aydin et al. 2007, NOAA Technical Memorandum NMFS-AFSC-178. Catch data are from the CAS database maintained by the NMFS Alaska Region, Juneau, Alaska. CAS data were retrieved on August 25, 2008. No Myctophidae or Bathylagidae were observed in survey trawls.

	EBS survey biomass estimates (mt)					Ecosystem model biomass estimates (mt)
	2003	2004	2005	2006	2007	
eulachon	2,535	3,141	1,738	2,044	4,136	273,583
capelin & other smelts	2,565	6,095	469	2,445	367	860,853
sandlance	3	7	8	11	7	1,229,948
other forage fishes	6,799	1,790	2,641	314	175	521,895
Myctophidae	N/A	N/A	N/A	N/A	N/A	394,664
Bathylagidae	N/A	N/A	N/A	N/A	N/A	80,047
total forage fishes	11,902	11,033	4,857	4,815	4,685	3,360,990

total forage fish catch in pollock fishery (mt)	10	22	14	112	146
catch of all nontarget fishes and cephalapods in pollock fishery (mt)	2,149	2,170	2,301	3,663	3,390

Ecopath food web models suggest that arrowtooth flounder, pollock, and squid are the three top predators of both capelin and eulachon (Conners and Guttormsen 2005). Juvenile pollock compete with capelin for food, and adult pollock are important predators of capelin. Because of this, indirect effects of pollock harvest on forage fish may occur, but their exact nature is impossible to predict.

7.5 Impacts on Forage Fish

The impacts of the salmon bycatch management measures alternatives on forage fish are evaluated using the following factors: (1) mortality, (2) genetic structure of the population, (3) reproductive success, (4) prey availability, and (5) habitat.

Almost all forage fish bycatch mortality is capelin and eulachon (smelt species), taken as bycatch in pollock fisheries. Bycatches in recent years have been between 10 mt and 146 mt in the BSAI. Status quo fishing rates in the Bering Sea are believed to be very low, on the order of 1% or less of smelt biomass. Bering Sea pollock TACs decline in 2008, potentially further reducing forage fish mortality and mortality rates. Therefore, under Alternative 1, the pollock fisheries have a very minor direct impact on forage fish mortality. As noted above, pollock compete with smelts for food, and are important smelt predators. Therefore, the pollock harvests may have an unpredictable indirect impact on smelt mortality.

No information is available on the genetic structure of forage fish stocks. Regulations disperse the pollock fishery in space and time. This, combined with the low forage fish mortality rate believed to be associated with status quo levels of harvest, suggest that pollock fishing is having a small impact on the genetic structure of forage fish populations.

Many forage fish species spawn in shallow, intertidal, or river waters; others are broadcast spawners and their eggs are pelagic. Regardless of their spawning method, pollock fishing is expected to have little impact on the spawning, nursery, or settlement habitat of forage fish species. The EFH EIS describes the impact of fishing activity on forage fish spawning habitat as having minimal, temporary, or no effect (NMFS 2005). This, combined with low harvest rates, may mean that pollock fishing under the status quo has little impact on reproductive success.

Most forage fish feed on copepods and euphausiids which are unlikely to be directly affected by pollock fishing, or they feed in shallow water where there is relatively little fishing activity. In general, there is likely to be little direct impact of fishing activity of forage fish prey availability. While direct impacts of this alternative generally appear to be small, there may be some more complicated indirect impacts. Capelin are believed to directly compete for prey with juvenile pollock. Fishing induced declines in numbers of small pollock may increase available capelin prey. However, the size of the pollock fishing impact on capelin prey, and even its direction, are not known. The pollock fishery harvests adult pollock, which themselves prey on juvenile pollock. Thus, pollock harvests may increase prey for capelin by reducing pollock stock sizes, or may reduce prey by reducing the stock of predators of juvenile pollock.

Forage fish are primarily pelagic, using shallow waters, intertidal zones, and rivers for spawning habitat. In general, the EFH EIS (NMFS 2005) finds that habitat impacts from fishing activity have minimal, temporary, or no effect on forage fish.

The Alternative 2 hard caps, to the extent that they prevent the pollock fleet from harvesting the pollock TAC and therefore reduce pollock fishing effort, would reduce the pollock fisheries impacts on forage fish from Alternative 1. Chapter 10 provides a discussion of the ability of the pollock fleet to harvest the TAC under the hard cap options. It is not possible to predict how much less fishing effort would occur under Alternative 2 because the fleet will have strong incentives to reduce bycatch through other means, such as gear modifications, to avoid reaching the hard cap and closing the fishery. And, depending on the extent vessels move to avoid salmon bycatch or as pollock catch rates decrease, pollock trawling effort may increase even if the fishery is eventually closed due to a hard cap. The impacts of Alternative 4 on forage fish would be similar because Alternative 4 is a more complex form of a hard cap that encourages avoiding salmon bycatch at all levels of salmon and pollock abundance.

The Alternative 3 trigger closures would close identified areas when a specific cap level is reached. The area closure would reduce the pollock fisheries impacts to forage fish in the closed area, but it would increase the fishing effort and therefore the impacts in the adjoining areas. Since the total amount of pollock harvested and the total effort would not change under Alternative 3, it is reasonable to conclude that the overall impacts on forage fish would be similar to Alternative 1. As with Alternative 2, fishing effort may increase as vessels move to avoid salmon bycatch or as pollock catch rates decrease.

7.6 Consideration of future actions

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the direct and indirect effects of the salmon bycatch management alternatives on other groundfish, other prohibited species, and forage fish.

7.6.1 Ecosystem-sensitive management

Ecosystem research and increasing attention to ecosystem issues, should lead to increased attention to the impact of fishing activity on non-target resource components, including prohibited species and forage fish. This is likely to result in reduced adverse impacts. AFSC scientists are developing procedures for more accurate GOA capelin biomass estimates based on acoustic surveys. It may be possible to make these estimates within one to two years. Research is also continuing on using acoustic survey information to make biomass estimates of eulachon, but this work is not as advanced (E. Conners, pers. comm., June 13, 2006).

7.6.2 Traditional management tools

The number of TAC categories with low values of ABC/OFL are increasing which tends to increase the likelihood that closures of directed fisheries to prevent overfishing will occur. In recent years management of species groups has tended to separate the constituent species into individual ABCs and OFLs. For example, in 1991 the category 'other red rockfish' consisted of four species of rockfish. By 2007, one of those species (sharpchin rockfish) had been moved to the 'other rockfish' category and northern, shortraker, and rougheye are now managed as separate species. While managing the species with separate ABCs and OFLs reduces the potential for overfishing the individual species, the effect of creating more species categories can increase the potential for incurring management measures to prevent overfishing, such as fishery closures. Managers closely watch species with fairly close amounts between the OFL and ABCs during the fishing year and the fleet will adjust behavior to prevent incurring management actions. Currently the NPFMC is considering separating components of the 'other species' category (sharks, skates, octopus, sculpin). Should that occur, incidental catch of sharks for example could impact management of the pollock fishery. As part of the 2006 'other species' incidental catch of 1,973 mt in the pollock fishery, 504 mt were shark. The tier 6 ABC for shark as part of the 'other species' category in 2006 was 463 mt and OFL 617 mt. If sharks were managed as a separate species group under their current tier, the pollock fishery would likely have been constrained in 2006.

Future harvest specifications will affect fishing mortality other groundfish, other prohibited species, and forage species. Thus, future pollock TACs in some years may be larger and may have a greater impact on these non-pollock resources than the historic catch analyzed for this action.

7.6.3 Private actions

Ongoing pollock fishing activity will continue to take other groundfish, prohibited species, and forage fish species as bycatch. Likewise, most of these species support directed fisheries that will continue. Ongoing economic development of coastal Alaska, and increasing levels of marine transportation activity may interact adversely with these species. Development that may impact coastal and riverine spawning habitat may have the greatest potential for affecting forage fish. However, development in Alaska remains small compared to development in other coastal states. Subsistence harvests of eulachon ("hooligan") occur in Alaskan waters.

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8.0 OTHER MARINE RESOURCES

The Bering Sea pollock fishery, and potential changes to the prosecution of the pollock fishery to reduce salmon bycatch under the alternatives, impacts marine mammals, seabirds, essential fish habitat, and ecosystem relationships. This chapter analyses the impacts to these other marine resources.

8.1 Marine Mammals

8.1.1 Status of Marine Mammals

The Bering Sea supports one of the richest assemblages of marine mammals in the world. Twenty-five species are present from the orders Pinnipedia (seals, sea lion, and walrus), other Carnivora (sea otter and polar bear), and Cetacea (whales, dolphins, and porpoises). Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, the continental shelf (Lowry et al. 1982), sea ice, shores and rocks, and nearshore waters. The PSEIS (NMFS 2004) describes the range, habitat, diet, abundance, and population status for marine mammals.

The most recent marine mammal stock assessment reports (SARs) for strategic BSAI marine mammals stocks (Steller sea lions, northern fur seals, harbor porpoise, North Pacific right whales, humpback whales, sperm whales, fin whales and bowhead whales) were completed in 2008 based on a review of data available through 2006 (Angliss and Outlaw 2008). Northern elephant seals, and marine mammals under U. S. Fish and Wildlife Service (USFWS) jurisdiction (polar bear, walrus, and sea otters), were assessed in 2002 (Angliss and Outlaw 2008). The information from NMFS 2004 and Angliss and Outlaw 2006, 2007, and 2008 is incorporated by reference to this EIS. The SARs provide population estimates, population trends, and estimates of the potential biological removal (PBR) levels for each stock. The SARs also identify potential causes of mortality and whether the stock is considered a strategic stock under the MMPA. The SARs are available on the Protected Resources Division web site at http://www.nmfs.noaa.gov/pr/sars/region.htm.

The Alaska Groundfish Harvest Specifications EIS provides information on the effects of the groundfish fisheries on marine mammals (NMFS 2007a). Direct and indirect interactions between marine mammals and groundfish fishing vessels may occur due to overlap in the size and species of groundfish harvested in the fisheries that are also important marine mammal prey, and due to temporal and spatial overlap in marine mammal occurrence and commercial fishing activities. This discussion focuses on those marine mammals that may interact or be affected by the pollock pelagic trawl fishery in the Bering Sea. These species are listed in Table 8-1 and Table 8-2. Marine mammals species listed in Table 8-3 and bearded and ringed seals are taken incidentally in the BSAI pollock trawl fishery based on the List of Fisheries (LOF) for 2008 (72 FR 66048, November 27, 2007) and based on information from the National Marine Mammal Laboratory. No changes in species taken by Alaska fisheries are proposed in the LOF for 2009 (73 FR 33760, June 13, 2008).

Table 8-1 Status of Pinniped stocks potentially affected by the Bering Sea pollock fishery

Pinnipedia species and stock	***Status under the ESA***	***Status under the MMPA***	***Population Trends***	***Distribution in action area***
Steller sea lion - Western and Eastern Distinct Population Segment (DPS)	Endangered (W) Threatened (E)	Depleted & a strategic stock	For the western DPS, regional increases in counts in trend sites of some areas have been offset by decreased counts in other areas so that the overall population of the western DPS appears to have stabilized (Fritz et al. 2008). The eastern DPS is steadily increasing and has been recommended to delisting consideration (NMFS 2008).	Western DPS inhabits Alaska waters from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters. Eastern DPS inhabit waters east of Prince Williams Sound to Dixon Entrance. Occur throughout AK waters, terrestrial haulouts and rookeries on Pribilof Is., Aleutian Is., St. Lawrence Is. And off mainland. Use marine areas for foraging. Critical habitat designated around major rookeries and haulouts and foraging areas.
Northern fur seal – Eastern Pacific	None	Depleted & a strategic stock	Recent pup counts show a continuing decline in the number of pups surviving in the Pribilof Islands. NMFS researchers found an approximately 9% decrease in the number of pups born between 2004 and 2006. The pup estimate decreased most sharply on Saint Paul Island.	Fur seals occur throughout Alaska waters, but their main rookeries are located in the Bering Sea on Bogoslof Island and the Pribilof Islands. Approximately 55% of the worldwide abundance of fur seals is found on the Pribilof Islands (NMFS 2007b). Forages in the pelagic area of the Bering Sea during summer breeding season, but most leave the Bering Sea in the fall to spend winter an spring in the N. Pacific.
Harbor seal – Gulf of Alaska Bering Sea	None	None	Moderate to large population declines have occurred in the Bering Sea and Gulf of Alaska stocks.	GOA stock found primarily in the coastal waters and may cross over into the Bering Sea coastal waters between islands. Bering Sea stock found primarily around the inner continental shelf between Nunivak Island and Bristol Bay and near the Pribilof Islands.
Ringed seal – Alaska	Status under review	None	Reliable data on population trends are unavailable.	Found in the northern Bering Sea from Bristol Bay to north of St. George Island and occupy ice (Fig. 8-3).
Bearded seal – Alaska	Status under review	None	Reliable data on population trends are unavailable.	Found in the northern Bering Sea from Bristol Bay to north of St. George Island and inhabit areas of water less than 200 m that are seasonally ice covered (Fig. 8-3)..
Ribbon seal – Alaska	Status under review	None	Reliable data on population trends are unavailable.	Found throughout the offshore Bering Sea waters (Fig. 8-3).

Pinnipedia species and stock	*Status under the ESA*	*Status under the MMPA*	*Population Trends*	*Distribution in action area*
Spotted seal - Alaska	Status under review	None	Reliable data on population trends are unavailable.	Found throughout the Bering Sea waters (Fig. 8-3)..
Pacific Walrus	Petitioned for listing	None	Reliable data on population trends and size are unavailable.	Occur primarily is shelf waters of the Bering Sea. Primarily males stay in the Bering Sea in the summer. Major haulout sites are in Round Island in Bristol Bay and on Cape Seniavan on the north side of the Alaska Peninsula.
Source: Angliss and Outlaw 2008 and List of Fisheries for 2008 (72 FR 66048). Northern fur seal pup data available from http://www.fakr.noaa.gov/newsreleases/2007/fursealpups020207.htm.				

Table 8-2 Status of Cetacea stocks potentially affected by the Bering Sea pollock fishery.

Cetacea species and stock	*Status under the ESA*	*Status under the MMPA*	*Population Trends*	*Distribution in action area*
Killer whale – AT1 Transient; Eastern North Pacific GOA, AI, and BS transient; West Coast transient; and Eastern North Pacific Alaska Resident	None	AT1 Transient – Depleted & a strategic stock	AT1 group has been reduced to at least 50% of its 1984 level of 22 animals, and has likely been reduced to 32% of its 1998 level of 7 animals. Unknown abundance for the eastern North Pacific Alaska resident; West Coast transient; and Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea transient stocks. The minimum abundance estimates for the Eastern North Pacific Alaska Resident and West coast transient stocks are likely underestimated because researchers continue to encounter new whales in the Alaskan waters.	Transient-type killer whales from the Aleutian Islands and Bering Sea are considered to be part of a single population that includes Gulf of Alaska transients. Killer whales are seen in the northern Bering Sea and Beaufort Sea, but little is known about these whales.
Dall's porpoise – Alaska	None	None	Reliable data on population trends are unavailable.	Found in the offshore waters from coastal western Alaska to Bering Sea.
Humpback whale- Western North Pacific Central North Pacific	Endangered	Depleted & a strategic stock	Reliable data on population trends are unavailable for the western North Pacific stock. Central North Pacific stock thought to be increasing. The status of the stocks in relation to optimal sustainable population (OSP) is unknown.	W. Pacific and C. North Pacific stocks occur in Alaskan waters and may mingle in the North Pacific feeding area shown in Fig. 8-2. Humpback whales in the Bering Sea (Moore et al. 2002) cannot be conclusively identified as belonging to the western or Central North Pacific stocks, or to a separate, unnamed stock.
North Pacific right whale Eastern North Pacific	Endangered	Depleted strategic stock	Abundance not known, but this stock is considered to represent only a small fraction of its precommercial whaling abundance and is arguably the most endangered stock of large whales in the world.	See Fig. 8-4 for distribution and designated critical habitat.
Fin whale – Northeast Pacific	Endangered	Depleted & a strategic stock	Abundance may be increasing but surveys only provide abundance information for portions of the stock in the central-eastern and southeastern Bering and coastal waters of the Aleutian Islands and the Alaska Peninsula, and much of the North Pacific range has not been surveyed.	Found in the Bering Sea and coastal waters of the Aleutian Islands and Alaska Peninsula. Most sightings in the central-eastern Bering Sea occur in a high productivity zone on the shelf break (Fig. 8-1).
Minke whale - Alaska	None	None	Considered common but abundance not known and uncertainty exists regarding the stock structure.	Common in the Bering and Chukchi Seas and in the inshore waters of the GOA.

Cetacea species and stock	*Status under the ESA*	*Status under the MMPA*	*Population Trends*	*Distribution in action area*
Sperm Whale – North Pacific	Endangered	Depleted & a strategic stock	Abundance and population trends in Alaska waters are unknown.	Inhabit waters 600 m or more depth, south of 62°N lat. Males inhabit Bering Sea in summer.
Gray Whale – Easter North Pacific	None	None	Minimum population estimate is 17,752 animals. Increasing populations in the 1990's but below carrying capacity.	Most spend summers in the shallow waters of the northern Bering Sea and Arctic Ocean. Winters spent along the Pacific coast near Baja California.
Beluga Whale – Bristol Bay, Eastern Bering Sea, and eastern Chukchi Sea	None	None	Abundance estimate is 3,710 animals and population trend is not declining for the eastern Chuckchi Sea stock. Minimum population estimate for the eastern Bering Sea stock is 14,898 animals and population trend is unknown. The minimum population estimate for the Bristol Bay stock is 1,619 animals and the population trend is stable and may be increasing.	Summer in the Arctic Ocean and Bering Sea coastal waters, and winter in the Bering Sea in offshore waters associated with pack ice.
Source: Angliss and Outlaw 2008 and List of Fisheries for 2008 (72 FR 66048). North Pacific right whale included based on NMFS 2006 and Salveson 2008 http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/spermwhale.htm				

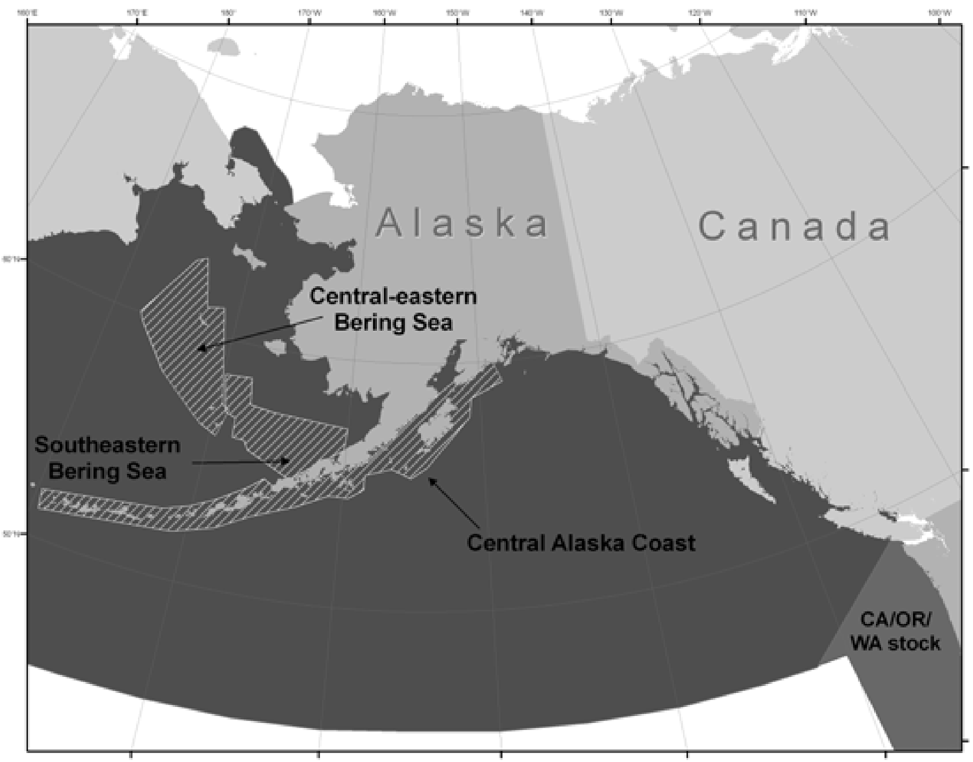

Fig. 8-1 Fin whale distribution and survey areas in lined locations (Angliss and Outlaw 2008)

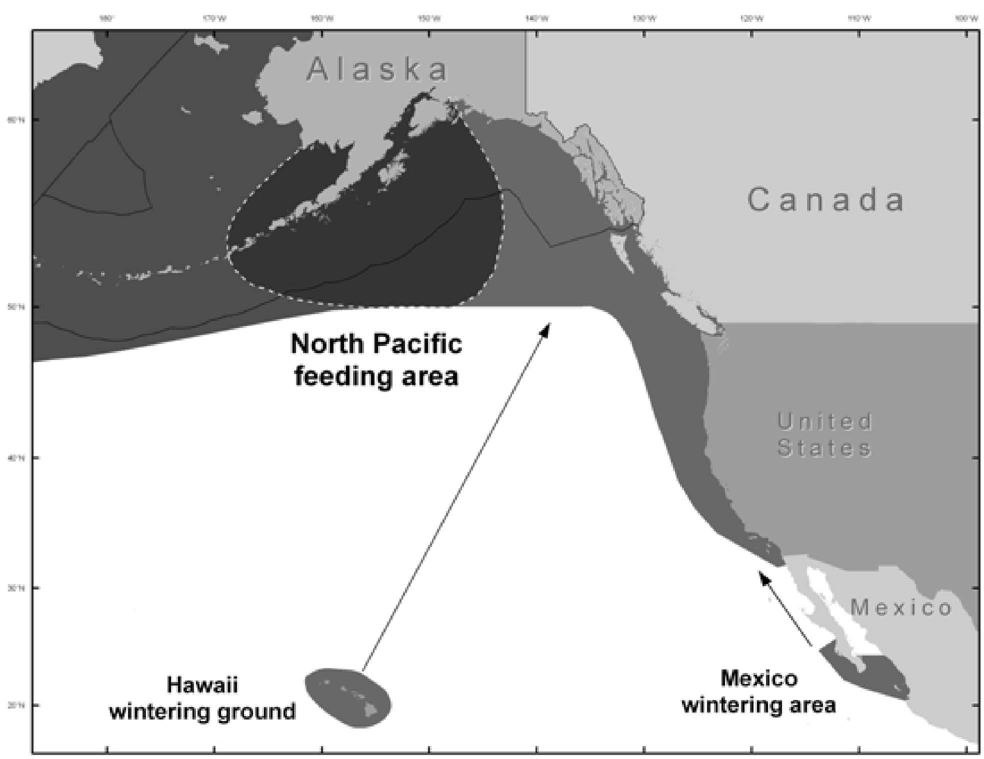

Fig. 8-2 Feeding area of humpback whales (Angliss and Outlaw 2008). Shaded area shows overlap of Central and western North Pacific humpback whale stocks.

8.1.2 ESA Consultations for Marine Mammals

The Alaska Groundfish Harvest Specifications EIS provides a detailed description of the status of ESA Section 7 consultations through December 2006 (Section 8.2 of NMFS 2007a). This section provides recent Section 7 consultation information since that document was published.

For Bering Sea marine mammals, ESA Section 7 consultation has been completed for all ESA-listed marine mammals (NMFS 2000 and NMFS 2001). NMFS is currently consulting on the effects of the groundfish fisheries on sperm whales, humpback whales, and Steller sea lions and their designated critical habitat (NMFS 2006). A draft biological opinion on the status quo groundfish fishery in the BSAI and GOA is expected to be available in late 2009.

8.1.2.1 Ice Seals

In December 2007, by the Center for Biological Diversity (CBD) petitioned NMFS to list ribbon seals as endangered or threatened under the ESA (CBD 2007). This petition is based on the dependence of this species on sea ice and the loss of sea ice due to global climate change. The petition presents information on (1) global warming which is resulting in the rapid melt of the seals' sea-ice habitat; (2) high harvest levels allowed by the Russian Federation; (3) current oil and gas development; (4) rising contaminant levels in the Arctic; and (5) bycatch mortality and competition for prey resources from commercial fisheries. NMFS determined that the petition presents substantial information that a listing may be warranted and has started a status review of the species to determine whether listing is warranted (73 FR 16617, March 28, 2008). A decision on whether listing is warranted is due in December 2008. In addition, NMFS also announced in the March 28 Federal Register notice that it will review the status of the other ice seals in the Bering Sea (spotted, ringed, and bearded seals) with the first priority given to the ribbon seal because of the statutory deadline for the listing decision. Detailed information on the biology, distribution and potential threats on ribbon seals is contained in CBD 2007.

On May 28, 2008, the Center for Biological Diversity petitioned NMFS to list ringed, bearded, and spotted seals under the ESA (CBD 2008) due to threats to the species from global warming. NMFS began the status review on ringed, bearded, and spotted seals and accepted public comments from September 4, 2008 to November 3, 2008 (73 FR 51615). NMFS is required by statute to make a decision on listing these species by May 28, 2009. Detailed information on the biology, distribution and potential threats on ringed, bearded, and spotted seals is contained in CBD 2008.

The National Marine Mammal Laboratory surveyed ice seals during April through June 2007 from the USGC vessel Healy in the Bering Sea. Fig. 8-3 shows the abundance and distribution of bearded, ribbon, and spotted seals over the survey area. Satellite tagged ribbon and spotted seals from late spring through July showed that the animals mostly stayed in the Bering Sea south and west of St. Matthews Island with a few animals traveling north through the Bering Strait (Boveng, et. al. 2008).

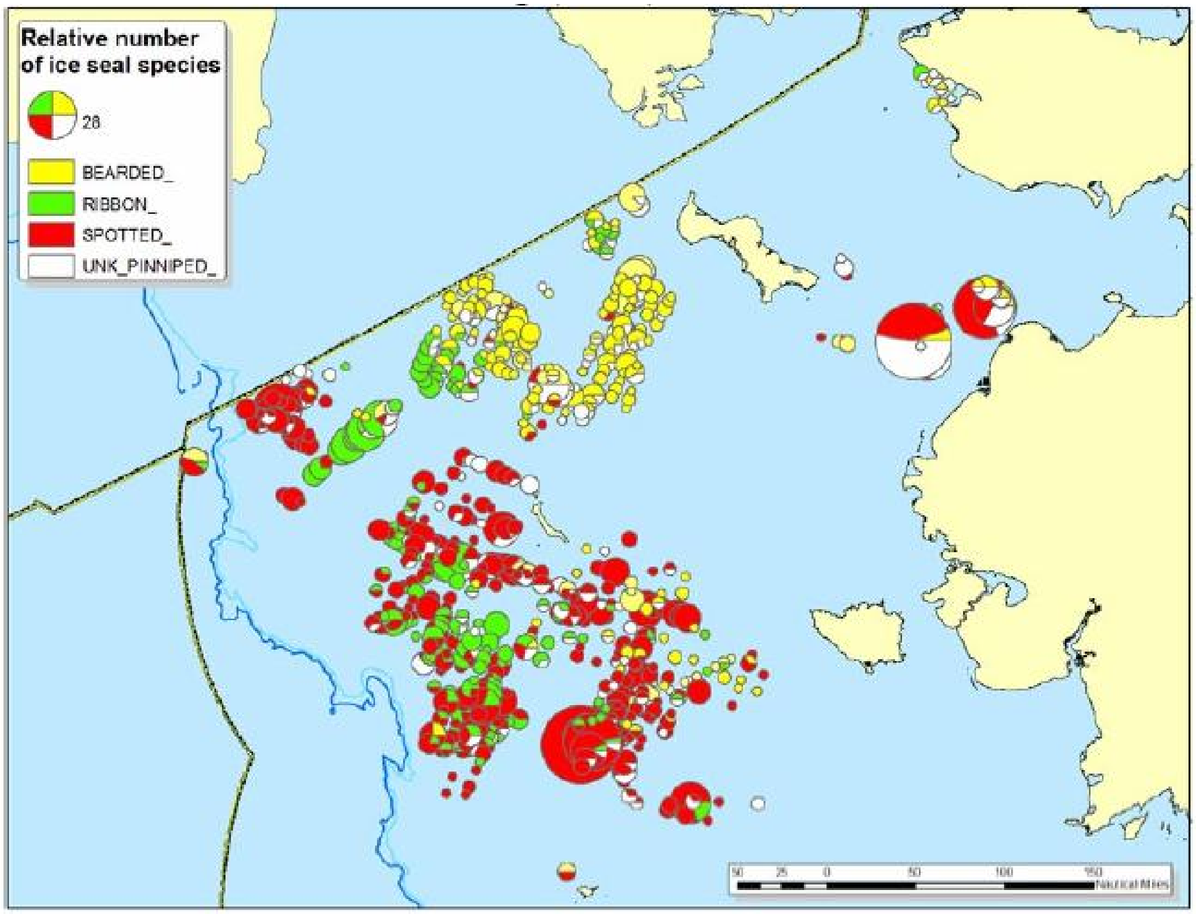

Fig. 8-3 Ice seal survey during Healy cruises in summer in Bering Sea 2007 (Cameron and Boveng 2007)

8.1.2.2 North Pacific Right Whale

Due to the recent revision of the species designation for the northern right whale (73 FR 12024, March 6, 2008) and designation of critical habitat (73 FR 19000, April 8, 2008), the NMFS Alaska Region Sustainable Fisheries Division reinitiated ESA section 7 consultation on the effects of the Alaska groundfish fisheries on the North Pacific right whale (*Eubalaena japonica)*, and its designated critical habitat, as required by 50 CFR 402.16 (Salveson 2008). The new species designation is effective April 7, 2008, and the new critical habitat designation is effective May 8, 2008. Groundfish fisheries are conducted in the North Pacific right whale designated critical habitat areas in the Bering Sea and Gulf of Alaska (Fig. 8-4). Details of the potential impact analysis for the North Pacific right whale are in the biological assessment (NMFS 2006). The recent species and critical habitat designations are necessary to address the recognition of two northern hemisphere right whale species, the North Atlantic and the North Pacific. These new designations do not change the expected impacts of fisheries on the right whales occurring in the Pacific. The previous finding that Alaska fisheries are not likely to adversely affect the species or designated critical habitat (Brix 2006) is not likely to change for the status quo fishery. The consultation concluded that the Alaska groundfish fisheries were not likely to adversely affect north Pacific right whales or their designated critical habitat.

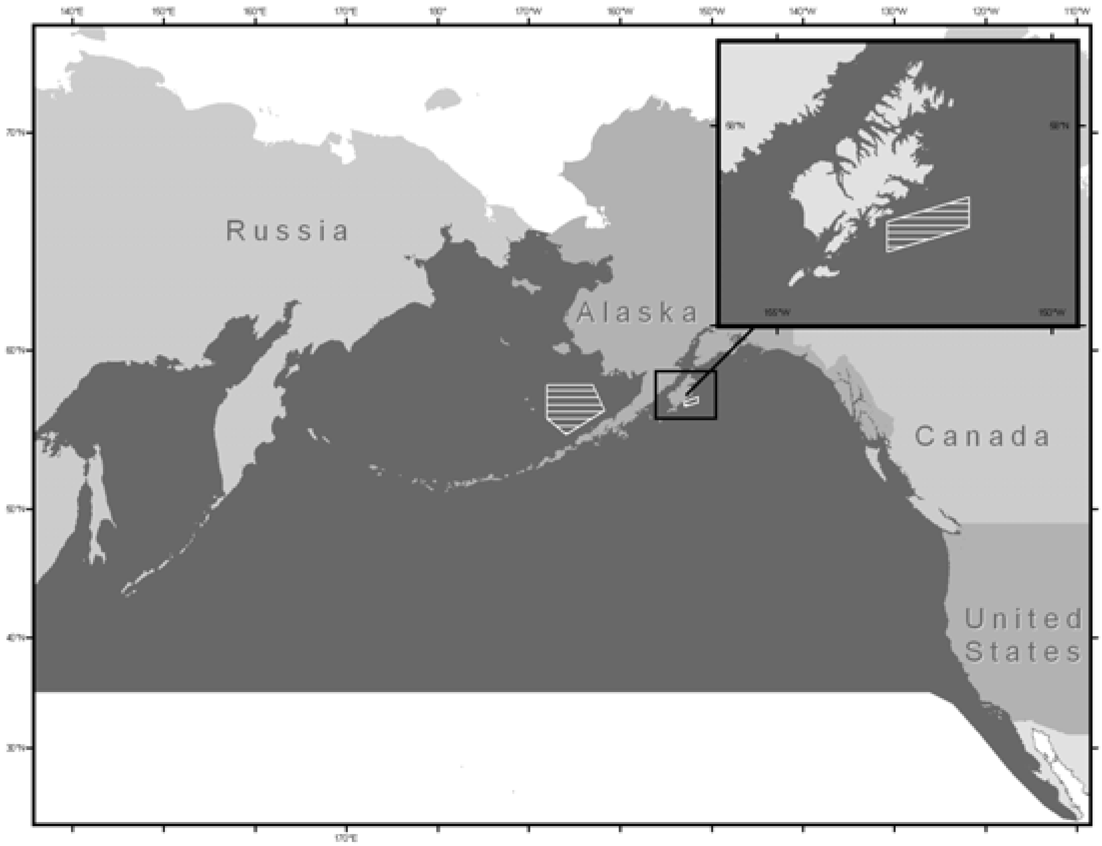

Fig. 8-4 North Pacific right whale distribution and critical habitat shown in lined boxes. (Angliss and Outlaw 2008)

8.1.3 Existing Management Measures to Mitigate Fishing Impacts on Marine Mammals

Throughout the 1990s, particularly after Steller Sea lion critical habitat was designated, various closures of areas around rookeries and haulouts and some offshore foraging areas affected commercial harvest of pollock, an important component of the western DPS of Steller sea lions' diet. The Bering Sea subarea has several pollock fishery closures in place for Steller sea lion protection including no transit zones, closures around rookeries and haulouts, the Bogoslof foraging area closure, and the Steller Sea Lion Conservation Area (Fig. 8-5). The proposed action would not change the closures associated with the five Bering Sea Steller sea lion sites located at Sea lion Rock, Bogoslof Island/Fire Island, Adugak Island, Pribilof Islands, and Walrus Islands and with the Bogoslof Foraging Area. The harvest of pollock in the Bering Sea subarea is temporally dispersed (§§ 679.20 and 679.23) and spatially dispersed through area closures (§ 679.22). Based on the most recent completed biological opinion, these harvest restrictions on the pollock fishery decrease the likelihood of disturbance, incidental take, and competition for prey to ensure the groundfish fisheries do not jeopardize the continued existence or adversely modify the designated critical habitat of Steller sea lions (NMFS 2000 and NMFS 2001). A detailed analysis of the effects of these protection measures is provided in the Steller Sea Lion Protection Measures Supplemental EIS (NMFS 2001).

Fig. 8-5 also shows the other areas closed to pollock fishing. The Nearshore Bristol Bay Trawl Closure prohibits pollock vessels from fishing in Bristol Bay. The Pribilof Island Area Habitat Conservation Zone prevents pollock trawling at all times in the area around the Pribilof Islands. The walrus protection areas around Round Island and The Twins, are closed from April 1 through September 30 to pollock vessels.

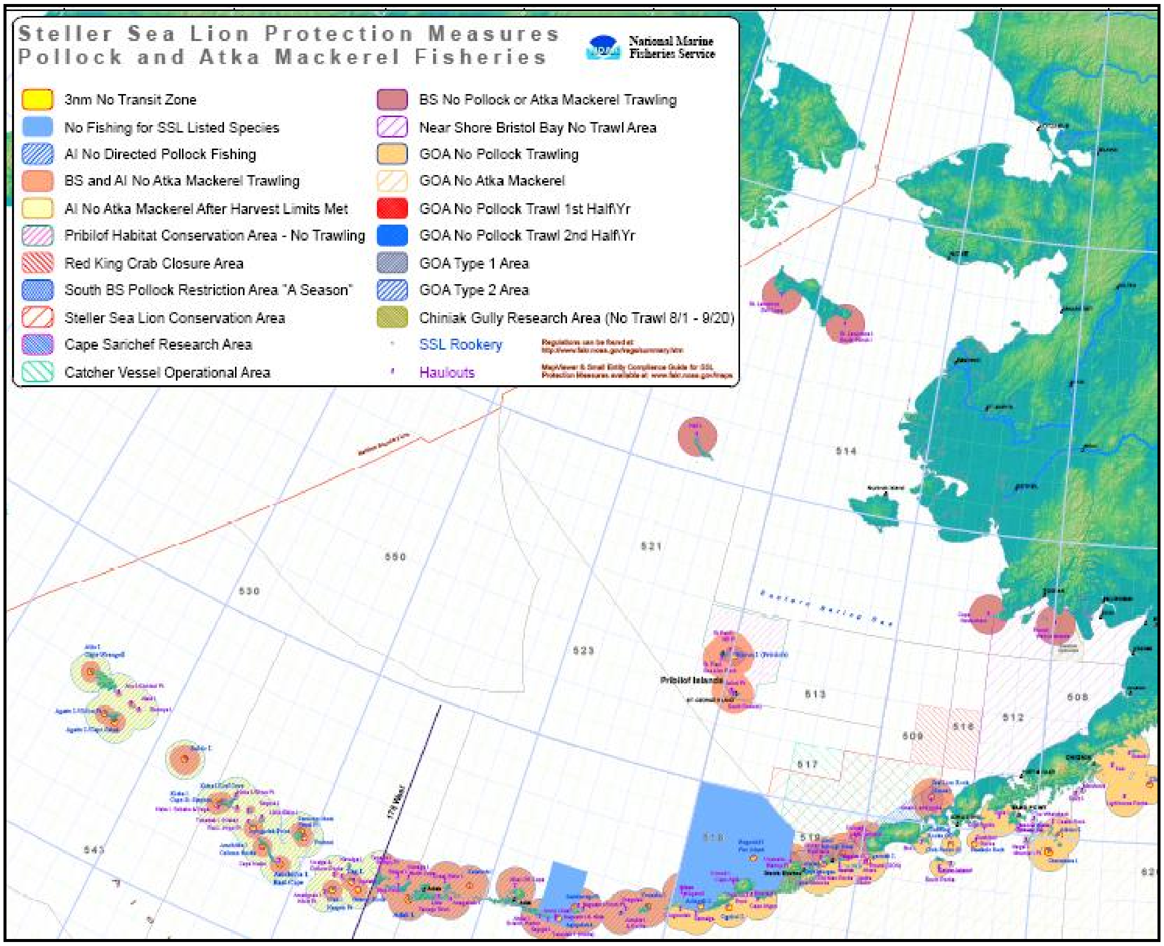

Fig. 8-5 Pollock Fishery Restrictions Including Steller Sea Lion Protection Areas of the Bering Sea Subarea. (Details of these closures are available through the NMFS Alaska Region website at http://alaskafisheries.noaa.gov/protectedresources/stellers/maps/Pollock_Atka0105.pdf).

8.1.4 Incidental Take Effects

The Alaska Groundfish Harvest Specifications EIS contains a detailed description of the effects of the groundfish fisheries on marine mammals (Chapter 8 of NMFS 2007a) and is incorporated by reference. Potential take in the groundfish fisheries is well below the potential biological removal (PBR) for all marine mammals which have a PBR determined, except killer whales and humpback whales. This means that predicted take would be below the maximum number of animals that may be removed from these marine mammal stocks while allowing the stocks to reach or maintain their OSP. Table 8-3 lists the species of marine mammals taken in the BSAI pollock fishery as published in the List of Fisheries for 2008. Table 8-3 provides more detail on the levels of take based on the most recent SARs (Angliss and Outlaw 2008, 2007, and 2006). The BSAI pollock fishery is a Category II fishery because it has annual mortality and serious injury of a marine mammal stock greater than 1% and less than 50% of the PBR level (72 FR 66048, November 27, 2007 and 73 FR 33760, June 13, 2008). Overall, very few marine mammals are reported taken in the Bering Sea pollock fishery.

Table 8-3 Category II BSAI Pollock Fishery with documented marine mammal takes from the List of Fisheries for 2008 (72 FR 66048, November 27, 2007)

Fishery	Marine Mammal Stocks Taken
Category II	
BSAI pollock trawl	Dall's porpoise, AK Harbor seal, Bering Sea Killer whale, Eastern North Pacific, GOA, Aleutian Islands, and Bering Sea transient Steller sea lions, western U. S Humpback whale, Central and western N. Pacific Minke whale, AK Ribbon seal, AK Spotted seal, AK

Based on the most recent information, the potential incidental take of marine mammals is limited to the species taken by the BSAI pollock trawl fishery listed in Table 8-3, plus bearded and ringed seals. Bearded seals have experienced recent incidental take (NMML, James Thomason, pers. comm., April 28, 2008). Northern fur seals, spotted seals, harbor seals, resident killer whales, humpback whales, and fin whales have not been reported taken in the BSAI pollock trawl fishery between 2000 and 2004; and therefore, these species have zero mortality as show in Table 8-4. Perez unpublished report documents bearded seal and a fin whale take in 2006. Perez (2006) reports takes of bearded seal in 1999. Table 8-3 is based on the List of Fisheries for 2008, which is based on all previously reported injury or mortality. Table 8-4 is based on the 2007 stock assessment reports (SARs), which use the previous 5 years of reported serious injury or mortality. Due to an error, ringed seals should be listed in the List of Fisheries for 2008 and will be added in the next version (Robyn Angliss, National Marine Mammal Laboratory, personal communication 4/28/08). Because the List of Fisheries includes all reported listings of injury, several species appear on the 2008 List of Fisheries as taken in the pollock fishery even though the recent SARs show these species are not reported taken in the pollock fishery. These species include humpback whales, harbor seals, Eastern North Pacific Alaska resident killer whales, and spotted seal. Bearded seals and a fin whale were taken in the pollock fishery in 2006, and this information has not yet been added to the List of Fisheries or the SAR report for this species (Table 8-5).

Table 8-4 Estimated mean annual mortality of marine mammals from observed BSAI pollock fishery compared to the total mean annual human-caused mortality and potential biological removal. Mean annual mortality is expressed in number of animals and includes both incidental takes and entanglements. The averages are from the most recent 5 years of data since the last SAR update, which may vary by stock. Groundfish fisheries mortality calculated based on Angliss and Outlaw (2008).

Marine Mammal Species and Stock	5 years of data used to calculate total mean annual human-caused mortality	Mean annual mortality, from BSAI pollock fishery	Total mean annual human-caused mortality*	Potential Biological Removal (PBR)
**Steller sea lions (western)	2001-2005	2.58	215.6	234
Northern fur seal	2001-2005	0.21	704	15,262
Harbor seal (BS)	2000-2004	0	176.2	603
Harbor seal (AI)	2000-2004	0	820	1334
Spotted seal	2000-2004	0	5,265	Undetermined
Ringed seal	2000-2004	0.71	9,568	Undetermined
Ribbon seal	2000-2004	0.2	194	Undetermined
Killer whale Eastern North Pacific AK resident	2000-2004	0	1.5	11.2
Killer whale, Eastern North Pacific Northern resident	2000-2004	0	0	2.16
Killer whale, GOA, BSAI transient	2000-2004	0.41	0.4	3.1
Dall's porpoise	2000-2004	1.89	30	Undetermined
**Humpback whale, Western North Pacific	2001-2005	0	0.2	1.3
**Humpback whale, Central North Pacific	2001-2005	0	5.0	12.9
Minke whale, Alaska	2000-2004	0.3	0.3	Undetermined
**Fin whale, Northeast Pacific	2001-2005	0	0	11.4

* Does not include research mortality. Other human-caused mortality is predominantly subsistence harvests for seals and sea lions.
** ESA-listed stock

Table 8-5 shows the months and locations when incidental takes of marine mammals occurred in 2003, 2004, 2005, and 2006. It is not possible to determine any seasonality to the incidental takes of killer whales, fur seals, or fin whales since only one occurrence for each is reported during this time period. It appears that Dall's porpoise may be more likely taken in July and bearded seals may be more likely taken in September and October. Steller sea lions appear to be taken in the A and B pollock fishing seasons, mostly in January through March and in September. Based on the very limited data in Table 8-5, bearded seals were primarily taken in the northern portion of the eastern Bering Sea. Killer whale, Dall's porpoise, and fin whale appear to be taken in the area along the shelf break. Steller sea lions appear to be taken primarily in the southern portion of the eastern Bering Sea and northwest of the Pribilof Islands.

Table 8-5 Marine Mammals taken in the pollock fishery in 2003, 2004, 2005, and 2006. Locations correspond to the areas depicted in Fig. 8-5 (Sources: National Marine Mammal Laboratory 4-28-08 and the North Pacific Groundfish Observer Program 10-31-08)

SPECIES	DATE	LOCATION
Killer whale	20-Mar-03	Area 521
Dall's porpoise	20-Jul-04	Area 521
Steller sea lion	15-Jul-04	Area 513
Steller sea lion	3-Feb-05	Area 509
Steller sea lion	3-Mar-05	Area 521
Steller sea lion	5-Mar-05	Area 521
Steller sea lion	5-Sep-05	Area 521
Northern fur seal	29-Jun-05	Area 521
Steller sea lion	27-Jan-06	Area 509
Steller sea lion	30-Jan-06	Area 509
Steller sea lion	5-Feb-06	Area 509
Steller sea lion	6-Mar-06	Area 509
Steller sea lion	15-Sep-06	Area 521
Steller sea lion	18-Sep-06	Area 509
Bearded seal	6-Sep-06	Area 524
Bearded seal	18-Oct-06	Area 524
Fin whale	16-Aug-06	Area 521
Dall's porpoise	26-Jul-06	Area 517

8.1.4.1 Alternative 1: Status Quo

The effects of the status quo fisheries on the incidental takes of marine mammals are detailed in the 2007 harvest specifications EIS (NMFS 2007a). Except for minke whales, the potential take of marine mammals in the pollock fishery is well below the PBRs or a very small portion of the overall human caused mortality for those species without a PBR determination (Table 8-4). A PBR for bearded seals is not available, but human caused mortality through hunting is estimated at 6,788 animals per year (Angliss and Outlaw 2007). The take of minke whales appears to be a very rare event considering no takes are reported for the pollock fishery in Table 8-5. Because of the broad distribution and common occurrence of minke whales in the Bering Sea, it is not likely that the potential incidental take by pollock fishery would have a large impact on this stock.

8.1.4.2 Alternative 2: Hard Cap

The range of hard caps under Alternative 2 may result in different potentials for incidental takes of marine mammals. The lower hard caps may result in stopping the pollock fishery in the Bering Sea earlier which would reduce the potential for incidental takes in fishing areas where marine mammals may interact with pollock fishing vessels. The higher hard caps would allow for more pollock fishing and more potential for interaction and incidental takes of marine mammals than the smaller caps.

The options to seasonally distribute the hard cap would seasonally limit the amount of fishing which would likely lead to less overall potential for incidental takes. Whether the overall annual takes of marine mammals would be affected would depend on whether there is a seasonal trend for certain species in incidental takes in the pollock fishery. If incidental takes are concentrated in a season and that season's fishing is limited by the seasonal hard cap, there would likely be less overall incidental take for that species. Having a low B season cap as in option 1-1 to Component 1, or reaching the B season cap early in the B season may result in closing the pollock fishery before the end of the B season. This may be beneficial to bearded seals, which appear to be incidentally taken in the later part of the B season (Table 8-5).

The options for sector allocations and transfers, and cooperative provisions affect the management and distribution of the cap across the sectors. These options are not likely to have any effect on pollock fishing in a manner that would change the potential for incidental takes of marine mammals since the overall quantity of pollock fishing and potential for interaction with marine mammals is not changed by the allocations, transfers, and cooperative provisions.

8.1.4.3 Alternative 3: Triggered Closures

A closure of an area where marine mammals are likely to interact with pollock fishing vessels would likely reduce the potential for incidental takes. The potential reduction would depend on the location and marine mammal species. A number of marine mammal species have been taken in northern waters of the Bering Sea (Table 8-5). Fishing under any of the alternatives and options would require vessels to comply with Steller sea lion protection measures and the Pribilof Island Area Habitat Conservation Zone, reducing the potential for interaction with Steller sea lions and northern fur seals in these areas. A large portion of the closures in the A and B season are located in the southern part of the Bering Sea where Steller sea lions are more likely to be encountered. These closures for salmon also may reduce the potential for incidental takes of Steller sea lions in the closure locations.

Any northward shift of the pollock fishery could potentially increase the risk of incidental takes of ringed, ribbon, spotted, and bearded seals, killer whales, Dall’s porpoise, and fin whales based on incidental takes shown in Table 8-5, history of incidental takes in the pollock fishery, and Fig. 8-3. Closure of the salmon area during the A and B season is likely to shift the pollock fishery northward. In the B season, the two northern portions of the salmon closure areas would provide some locations where incidental takes of these marine mammals would be prevented, but the overall effect on the incidental takes is unknown without more specific information on marine mammal locations and pollock fishery locations. Because Steller sea lions are taken in the both the northern and southern portions of the Bering Sea, a northward shift of the pollock fishery due to the salmon area closures is not likely to change the potential for incidental takes of Steller sea lions. Due to the small number of incidental takes (Table 8-5) and the lack of data on the specific location where the takes occurred, it is not possible to quantify how the moving of the pollock fishery with the trigger closures may impact the potential for incidental takes of specific species of marine mammals.

8.1.4.4 Alternative 4: Preliminary Preferred Alternative

This alternative provides for two different annual scenarios with different caps for each scenario. The distinction between the scenarios lies in the presence or absence of an approved inter-cooperative agreement (ICA) which provides explicit incentive to avoid salmon in all years. Under the scenario with the approved ICA (PPA1), the overall cap (to be divided seasonally and by sector) would be 68,392. In the absence of an ICA agreement which provides explicit incentive for salmon avoidance (PPA2), a hard cap (47,591) is provided. The prescribed seasonal splits and sector splits (and provisions to divide to the inshore CV cooperative level) are identical and occur under both PPA1 and PPA2.

Because Alternative 4 is a variation on the hard caps and seasonal and sector splits under Alternative 2, the effects of Alternative 4 on incidental takes would be the same as under Alternative 2. The lower threshold cap under Alternative 4 may result in less pollock fishing which may result in less potential interaction between fishing vessels and marine mammal and less incidental takes than the higher cap under the ICA scenario. Seasonal apportionments that result in less fishing in the B season may result in less interaction with bearded seals or other ice seals and less potential for incidental takes.

8.1.5 Prey Species Effects

Table 8-6 shows the Bering Sea marine mammals that may be impacted by the pollock fishery and their prey species. Pollock and salmon prey are in **bold**.

Table 8-6 Bering Sea Marine Mammal Prey

Species	**Prey**
Fin whale	Zooplankton, squid, fish (herring, cod, capelin, and **pollock**), and cephalopods
Humpback whale	Zooplankton, schooling fish (**pollock**, herring, capelin, saffron cod, sand lance, Arctic cod, and **salmon** species)
Gray whale	Benthic invertebrates
Sperm whale	Mostly squid, some fish, shrimp, sharks, skates, and crab (up to 1,000 m depth)
Minke whale	Pelagic schooling fish (herring and **pollock**)
Beluga whale	Wide variety invertebrates and fish including **salmon and pollock**
Killer whale	(transient) Marine mammals and (resident) fish (including herring, halibut, **salmon,** and cod)
Dall's porpoise	hake, squid, lanternfish, anchovy, sardines, and small schooling fish.
Pacific walrus	Benthic invertebrates (primarily mollusks), occasionally seals and birds
Bearded seal	Primarily crab, shrimp, and mollusks; some fish (Arctic cod, saffron cod, sculpin, and **pollock**)
Spotted seal	Primarily pelagic and nearshore fish (**pollock and salmon**), occasionally cephalopods and crustaceans
Ringed seal	Primarily Arctic cod, saffron cod, herring and smelt in fall in winter and fish and fish and crustaceans in summer and spring
Ribbon seal	Arctic and saffron cods, **pollock**, capelin, eelpouts, sculpin and flatfish, crustaceans and celphalopods
Northern fur seal	**Pollock**, squid, and bathylagid fish (northern smoothtongue), herring, **salmon,** and capelin. (Females at Bogoslof eat primarily squid and bathylagid fish and less pollock than in the Pribilofs, and salmon irregularly.)
Harbor seal	crustaceans, squid, fish, and mollusks
Steller sea lion	**pollock**, Atka mackerel, Pacific herring, Capelin, Pacific sand lance, Pacific cod, and **salmon**

Sources: NOAA 1988; NMFS 2004; NMFS 2007b; Nemoto 1959; Tomilin 1957; Lowry et al. 1980; Kawamura 1980; http://www.afsc.noaa.gov/nmml/education/cetaceans/sperm.php; Rolf Ream, NMML personal communication, September 26, 2008; and http://www.adfg.state.ak.us/pubs/notebook/marine/orca.php

Nine of the 16 species listed in Table 8-6 are documented to eat pollock, and six of the marine mammals listed eat salmon. Salmon is primarily a summer prey species for Steller sea lions (NMFS 2001), resident killer whales (NMFS 2004), spotted seals (CBD 2008a), and northern fur seals (NMFS 2007b). Steller sea lions, ribbon seals, and northern fur seals depend on pollock as a principal prey species (NMFS 2007a, 2007b and http://www.adfg.state.ak.us/pubs/notebook/marine/rib-seal.php). Spotted seals eat pollock mainly in the winter and spring, and eat salmon in the summer (CBD 2008).

Several marine mammals do not primarily depend on pollock or salmon but may be impacted indirectly by any effects that the pelagic trawl gear may have on the benthic habitat where marine mammals are dependent on benthic prey. These species include gray, beluga, and sperm whales; bearded, spotted, ringed, ribbon, and harbor seals; and walrus. Whether the benthic prey dependent species are indirectly affected by pollock fishing will depend on the effects of the pollock fishing on the benthos and whether the marine mammal forages on benthic species in the impacted area and their dependence on the benthic prey. The EFH EIS provides a description of the effects of pollock fishing on bottom habitat in the Appendix (NMFS 2005a), including the effects of the pollock fishery on the Bering Sea slope and shelf. Pollock trawl gear is known to contact the bottom and may impact benthic habitat. The fisheries effects analysis in the EFH EIS determined that the long term effects indices for pollock fishing on sand/mud and slope biostructure in the Bering Sea were much larger than the effects from other fisheries conducted in the Bering Sea, especially on the slope (Table 8.2-10 in NMFS 2005a)

Table 8-9 shows the marine mammals that may depend on benthic prey and the known depths of diving and Bering Sea locations. Most pollock fishing is conducted in waters greater than 50 m and less than 200 m (Fig.8-8). Diving activity may be associated with foraging.

Table 8-7 Listing of Benthic Dependent Marine Mammals and Location and Diving Depths in the Bering Sea

Species	Depth of Diving and location
Bearded seal	Occur in waters < 200 m, at least 20 nm from shore during spring and summer (Fig. 8-4)
Ringed seal	Usually shallow but can dive up to 500 m. Throughout pack ice.
Ribbon seal	Mostly dive < 150 m on shelf, deeper off shore. Shelf and slope areas
Spotted seal	Up to 300 m. Coastal habitats in summer and fall and ice edge in winter
Harbor seal	Up to 183 m. Generally coastal
Pacific walrus	Usually in waters < 100 m. Shelf area, concentrated SW of St. Lawrence Island and in Nunivak Island/Bristol Bay area
Gray whale	< 60 m waters, coastal and shelf area.
Beluga whale	6-30 m, shelf area and nearshore estuaries and river mouths
Sperm whale	Up to 1,000 m, but generally in waters > 600 m

Sources: http://www.adfg.state.ak.us/pubs/notebook/marine/harseal.php, http://www.afsc.noaa.gov/nmml/species/species_ribbon.php, http://www.adfg.state.ak.us/pubs/notebook/marine/rib-seal.php, Bengston et al 2006, Burns et al. 1981, Angliss and Outlaw 2008, Angliss and Outlaw 2007, http://www.adfg.state.ak.us/pubs/notebook/marine/gray.php, http://alaska.fws.gov/fisheries/mmm/walrus/nhistory.htm, and http://www.adfg.state.ak.us/pubs/notebook/marine/beluga.php

Fig.8-8 shows the location of 2006-2008 observed pollock harvest in relation to the bathymetry of the Bering Sea.

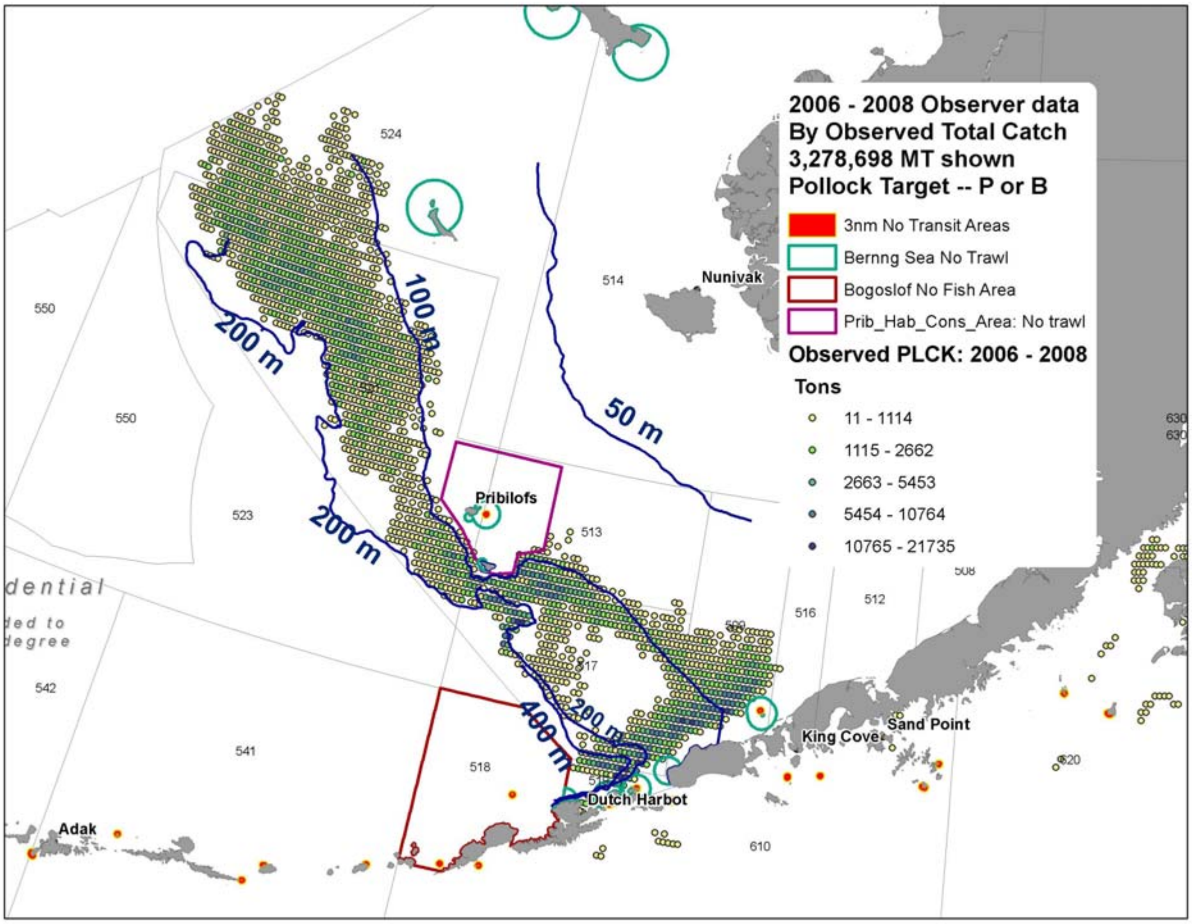

Fig. 8-6 2006-2008 Observed pollock harvest and bathymetry of the Bering Sea (Steve Lewis, NMFS Analytical Team, October 5, 2008)

Sperm whales are not likely to be affected by any potential impacts on the benthic habitat from pollock fishing because they generally occur in deeper waters than where the pollock fishery is conducted (Table 8-8 and Fig. 8-6). Harbor seals also are less likely to have any benthic habitat affected by the pollock fishery because they occur primarily along the coast where pollock fishing is not conducted. Pacific walrus are unlikely to have benthic habitat affected by the pollock fishery because they occur in shelf waters to the west of slope and out of the area where pollock fishing occurs. Beluga whales are not likely to have benthic habitat supporting prey species affected by the pollock fishery because they generally dive shallower than the locations where pollock fishing occurs. The pollock fishery in the SE Bering Sea occurs in an area between 100 m and 50 m deep which may overlap with a portion of gray whale feeding area. Gray whales feed primarily in the northern and western area of the Bering and Chukchi Seas in the summer toward St. Lawrence Island after traveling along the coast past Nunivak Island (http://www.adfg.state.ak.us/pubs/notebook/marine/gray.php). Pollock fishing is not likely to have much of an impact on gray whales considering the extensive area of the Bering Sea under 60 m depth that is not fished for pollock and the areas of pollock fishing compared to the areas of gray whale migration and feeding.

Ice seals are most likely of the marine mammals listed in Table 8-7 to potentially have benthic prey affected by the pollock fishery because of their overlap with the pollock fishery location and depth for diving. Ice seals use ice in areas of the Bering Sea where fishing is conducted during ice free conditions. It is not know what the affects of the pollock fishing may be on the benthic habitat supporting prey and the recovery time for the prey species. Bearded seals have been incidentally taken in area 524 by the pollock fishery (Table 8-5) and may use benthic habitat for feeding in locations where pollock fishing have occurred. Ribbon and spotted seals are probably less likely to be affected by any benthic prey disturbance compared to the other ice seals due to pollock being their primary prey.

8.1.5.1 Alternative 1: Status Quo

The Alaska Groundfish Harvest Specifications EIS determined that competition for key prey species under the status quo fishery is not likely to constrain foraging success of marine mammal species or cause population declines (NMFS 2007a). The exceptions to this are northern fur seals and Steller sea lions which potentially compete for principal prey with the groundfish fisheries (NMFS 2001, 2007b). The introduction to this section reviewed the marine mammal species prey and the potential impacts of the pollock fishery on benthic habitat that support marine mammal prey. Ice seals were the only species that may depend on benthic habitat for prey that could be potentially impacted by the pollock fishery. The following provides additional information regarding Steller sea lions and northern fur seals potential competitions with the pollock fishery.

Northern Fur Seals

The Northern Fur Seal Conservation Plan recommends gathering information on the effects of the fisheries on fur sea prey, including measuring and modeling effects of fishing on prey (both commercial and noncommercial) composition, distribution, abundance, and schooling behavior, and evaluate existing fisheries closures and protected areas (NMFS 2007b). The Alaska Groundfish Harvest Specifications EIS analyzed the effects of the groundfish fisheries on fur seal prey (Section 8.3.2 of NMFS 2007a). The EIS for the annual subsistence harvest of fur seals determined that the groundfish fisheries in combination with the subsistence harvest may have a conditional cumulative effect on prey availability if the fisheries were to become further concentrated spatially or temporally in fur seal habitat, especially during June through August (NMFS 2005b).

Migration of fur seals is described in detail in the Conservation Plan for the Eastern Pacific stock of Northern Fur Seal (NMFS 2007b). Northern fur seals begin to return to the breeding islands from their pelagic winter foraging in the spring of each year. Adult males arrive first and establish territories on the breeding rookeries. On the Pribilof Islands they arrive in descending order by age, beginning in early May. The youngest males may not return to the breeding areas until mid-August or later. Some yearlings arrive as late as September or October; however, most remain at sea. The older pregnant females arrive about mid-June; the peak of pupping occurs in early July. Pups leave the islands in early November after the older animals have left. Fur seals migrate during early winter through the Eastern Aleutian Islands into the North Pacific Ocean then into the waters off the coasts of British Columbia, Washington, Oregon, and California.

Based on scat sampling of female fur seals in July through September, the hydrographic domains for salmon prey include inner, middle, and outer shelves; and the oceanic domain (Zeppelin and Ream 2006 and Fig. 8-7). Female fur seal foraging locations are dependent on the rookery location for animals using St. George and St. Paul Island rookeries (Zeppelin and Ream 2006). Fur seals from St. George appear to be more dependent on salmon than fur seals from St. Paul. Frequency of occurrence of salmon in scat samples from St. George is 10 to 19% of the samples, while salmon occurs in 3% to 12% of the samples from St. Paul, with only 2 of the 11 rookeries sampled having more than 10% frequency of occurrence (Zeppelin and Ream 2006). Because of this site specific salmon foraging behavior, any harvest of salmon by the pollock fishery that may compete with female fur seals is likely to have more of an impact on fur seals using St. George Island rookeries compared to fur seals using St. Paul Island. Competition with the pollock fishery is less likely for females using the Bogoslof Island rookery as these animals eat primarily squid and northern smooth tongue and are less likely to take foraging trips outside of the Bogoslof Foraging Area closure for the pollock fishery (Rolf Ream, NMML, pers. comm., September 26, 2008).

For northern fur seals, pollock is particularly important around the Pribilof Islands and other inshore areas from July to September and is their principal prey species based on scat and spew analyses (NMFS 2007b; Gundmundson et al. 2006; Zeppelin and Ream 2006). Adult pollock were most frequently found in the stomachs of fur seals collected over the outer domain of the continental shelf, while juvenile pollock were found in seals collected both over the midshelf and outer domain (NMFS 2005b) (Fig. 8-7). Based on female fur seal scat samples from St. George and St. Paul Islands, pollock prey for fur seals from July through September come from the hydrographic domains of the middle and outer shelf regions (Zeppelin and Ream 2006). Pollock occurred in 64% to 84% of the fur seal scat samples from St. Paul Island, and in 43% to 70% of the samples from St. George Island (Zeppelin and Ream 2006). In the summer of 1999 and 2000, spew samples from St. George showed a frequency of occurrence for pollock in 36.8% of the samples compared to 60% occurrence in the scat samples (Gudmundson et al. 2006). No difference was seen for the frequencies of occurrence for pollock in scat and spew samples from St. Paul Island which were both around 70%.

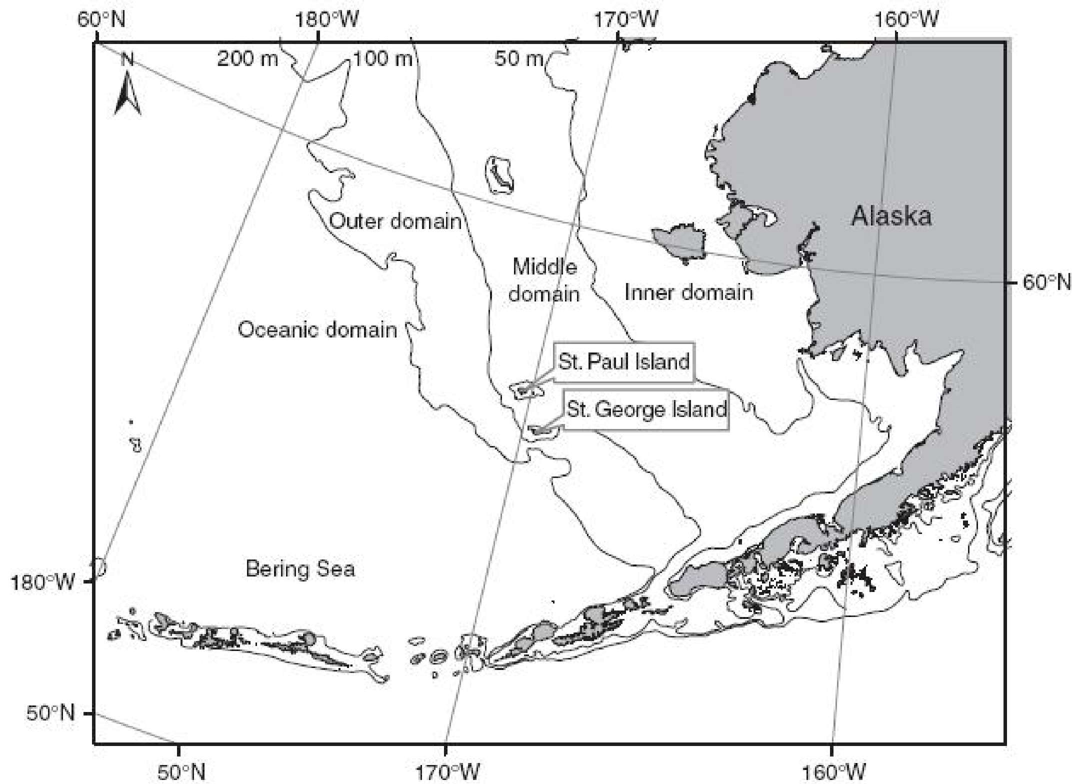

Fig. 8-7 Bering Sea Hydrographic Domains. Represents the Bering Sea areas where fur seal prey may occur (Zeppelin and Ream 2006)

Lactating female fur seals from St. Paul Island dispersed in all directions except southeast where females from St. George Island foraged (Robson 2001). Harvesting pollock near these locations when nursing females are not able to forage at locations where pollock has not been removed by commercial fishing may have an effect on the reproductive capability and possibly the population.

Fur seal use of pelagic habitat across years or seasons is not clearly understood, but is beginning to be investigated (NMFS 2007b). The subpolar continental shelf and shelf break from the Bering Sea to California are known feeding grounds for fur seals while at sea. It has been suggested that the highest fur seal densities in the open ocean occur in association with major oceanographic frontal features such as sea mounts, valleys, canyons, and along the continental shelf break (Lander and Kajimura 1982; Kajimura 1984; Loughlin et al. 1999). This area overlaps with the location of the pollock fishery (Fig. 8-7).

Steller sea lions

Analysis of diet data for Steller sea lions in the Bering Sea includes scats collected at haulouts and rookeries along the eastern portion of the Aleutian Island chain and Bogoslof/Fire Island. Pollock appear to be a major component of the Steller sea lion diet for animals using Bogoslof/Fire Island and the Akutan sites, present in 54% of the samples collected in the summer and 59% winter samples (Sinclair and Zeppelin 2002). Based on diet analysis, Steller sea lions at Akutan sites appear to depend on pollock more in the winter than the summer (Fig. 3 in Trites et al. 2007). No Steller sea lion diet analysis is available from haulouts in the northern Bering Sea. Pollock occurred in more than 36% of the stomach samples taken from Steller sea lion on the Pribilof Islands in the 1980s (NMFS 2008). Pollock occurred in 100% of the samples from Steller sea lions taken at sea in the winter of 1981 in an area between the Pribilof and St. Matthew Islands (Caulkins 1998).

Sea lions eat salmon primarily in May where salmon congregate for migration (Lowell Fritz, National Marine Mammals Laboratory, pers. comm. February 14, 2008). Diet analysis from the Akutan area indicated that Steller sea lions may be more dependent on salmon in the summer than in the winter (Fig. 3 in Trites et al. 2007). Scat and spew samples of fur seals collected between July and September on St. George and St. Paul Islands show salmon as part of the diet (Gudmundson et al. 2006; and Zeppelin and Ream 2006). Spew samples show a greater frequency of occurrence of salmon than scat samples for both islands (Gudmundson et al. 2006) so the use of scat samples for salmon occurrence in fur seals may underestimate the importance of salmon for prey.

Other direct impacts on marine mammal prey

Killer whales eat salmon that are migrating to spawning streams in nearshore waters (NMFS 2004). The impact of the pollock fishery on prey for resident killer whales would be only in the interception of salmon that would have been eaten by killer whales. Data to determine this is not available.

Spotted seals forage on pelagic fish and nearshore species, including pollock and salmon. Sampling of spotted seals in the Bering Sea coastal area in September through October showed salmon in the diet (Lowry et al. 2000). Juvenile pollock are important prey species for ribbon seals. Pollock occurred in approximately 80% of the scat samples collected from ribbon seals in 2006 and 2007 (Ziel et al. 2008). Juvenile pollock are also important prey species for spotted seals. Pollock occurred in approximately 40% of the scat samples collected from spotted seals in 2006 and 2007 (Ziel et al. 2008).

Of the ice seals, ribbon seals appear to be more dependent on pollock and may be directly impacted by pollock harvests in locations where ribbon seals may forage during summer months. Bearded seals feed primarily on benthic invertebrates (Lowry et al. 1980a) and schooling fish and invertebrates in the vicinity of St. Matthew Island (Antonelis et al. 1994). Ringed seals eat primarily Arctic and saffron cod and epibenthic and pelagic crustaceans (Lowry et al. 1980b).

Beluga whales are not likely to compete with the pollock fishery for pollock because their occurrence does not overlap with pollock fishery locations (Fig. 8-7 and Table 8-7). Any competition with the pollock fishery for salmon would depend on the stream where beluga may feed and the interception of salmon that would have returned to that stream. Data are not available to evaluate this.

Minke, fin, and humpback whales potentially compete with the pollock fishery for pollock because of the overlap of their occurrence with the location of the pollock fishery in the Bering Sea. Fin and humpback whales have a more diverse diet than minke whales and therefore may have less potential to be affected by any competition (Table 8-6). An area of overlap for feeding humpback whale stocks occurs in the southeastern Bering Sea where the pollock fishery occurs (Fig. 8-3). This overlap in stocks and pollock fishing increases the potential for prey competition between humpback whale stocks and the pollock fishery. The area of distribution and surveys for fin whales is in the same slope area as the pollock fishery, which may lead to more potential for competition for pollock (Fig. 8-2).

8.1.5.2 Alternative 2: Hard Caps

A hard cap on the amount of salmon taken in the pollock fishery could benefit Steller sea lions, resident killer whales, spotted seals, ribbon seals, and northern fur seals if the cap prevents harvest of salmon and pollock that these species prey upon. If the hard cap results in additional fishing effort in less productive pollock areas with less salmon bycatch, the shifting of the fleet may allow for additional pollock being available as prey in those areas where salmon is concentrated, if these areas are also used by Steller sea lions, spotted seals, ribbon seals, and northern fur seals for foraging. The higher hard cap would be less constraining on the fishery and would likely result in effects on prey availability similar to the status quo. Lower hard caps would be more constraining on the fishery, making more salmon available for prey for Steller sea lions, northern fur seals, spotted seals, and resident killer whales, and may allow for more pollock prey if the fishery is closed before reaching its pollock TAC.

The more restrictive caps may result in smaller pollock being taken by the pollock fishery, as described in Chapter 4. It is not clear how much smaller the pollock would be. Since 2003, the pollock fishery tends to harvest pollock that are less than 60 cm and greater than 30 cm in the Bering Sea (NPFMC 2007). Steller sea lions and northern fur seals tend to prey on whatever size of pollock is most abundant at the time of foraging (Fritz et al. 1995). In years with one or more large recently spawned year classes, Steller sea lions and fur seals consume primarily juvenile pollock (Pitcher 1981, Calkins 1998, Zeppelin et al. 2004, and Sinclair et al. 1994). As large year classes of pollock age and grow, they will continue to be targeted by sea lions and fur seals particularly if the size of subsequent year classes is small. As a consequence, overlap between fisheries (that generally take large pollock) and pinnipeds in the size of pollock consumed will change depending on the age structure of pollock. Juvenile Steller sea lions are more likely to successfully forage on smaller rather than larger pollock. Taking smaller pollock may increase the potential for the fishery to compete with juvenile Steller sea lions for pollock, and may increase the estimated overlap between the fishery and juvenile Steller sea lions for pollock prey size. Whether competition would occur depends on the abundance of the size of prey targeted by the sea lions. Steller sea lions tend to prey more on juvenile pollock in the summer on haulouts than in the winter or in the summer on rookeries (Zeppelin et al. 2004). For the year of data analyzed, the overlap between the size of pollock taken in the fishery and those used as prey by Steller sea lions in the winter and summer is 56% and 61%, respectively (Zeppelin et al. 2004). Harvesting smaller pollock in the early B season may have more of a potential for competition for juvenile Steller sea lions using haulouts in the summer compared to animals at rookeries and in the winter.

All pollock recovered from the scat sampling for spotted and ribbon seals in 2006 and 2007 were well below 20 cm in length (range 5-22.7 cm) (Ziel et al. 2008). It is not clear if this size of pollock was eaten because it was the size that could easily be captured or it was the most abundant size available for foraging. It is not likely the shifting of the pollock fishery to smaller fish would result in fish less than 20 cm in length being taken and therefore, competition with ribbon and spotted seals is not likely if they are targeting these smaller fish, regardless of abundance.

The options for sector allocations, sector transfers, and cooperative provisions affect the management and distribution of the cap across the sectors and are not likely to have any overall effect on pollock fishing that would change the potential competition for prey species between the pollock fishery and marine mammals. Options that allocate more Chinook salmon bycatch to the CV sector compared to the offshore sector would result in more harvest of pollock in the southern part of the Bering Sea where more Steller sea lions are located compared to the northern Bering Sea where northern fur seals and spotted seals may be foraging. This may result in more potential for competition for salmon and pollock prey for Steller sea lions than for northern fur seals or spotted seals. The Steller sea lion protection measures were designed to mitigate competition between the fisheries and Steller sea lions. This may reduce any potential for increased competition for prey if allocating higher portions of the salmon caps to the CV sector would result in more fishing in the southern Bering Sea.

8.1.5.3 Alternative 3: Triggered Closures

A pollock fishery closure of an area where Steller sea lions, humpback whales, spotted seals, or northern fur seals are likely to compete with pollock fishing vessels would likely reduce the potential for competition for prey resources (pollock and salmon). Occurrences of fin and minke whales are more widespread in the Bering Sea and therefore, they are less likely to be affected by the triggered closures. The potential reduction in competition would depend on the foraging locations and prey species for Steller sea lions, humpback whales, spotted seals, and northern fur seals and on the timing of the foraging activity and fishing. The closures proposed for the A season would likely shift the fleet north into areas that may contain spotted and northern fur seal prey (pollock and salmon for northern fur sea and pollock for spotted seals). The closures in the B season in the northern portion of the Bering Sea may provide some protection of salmon prey resources for fur seals from St. George Island which are more likely to forage for salmon in these northern areas compared to fur seals from St. Paul. St Paul fur seals forage more on the continental shelf than fur seals from St. George and appear to have less dependence on salmon (Zeppelin and Ream 2006). Limited sampling from spotted seals indicates that the salmon prey used is located primarily along the coast in September and October. Pollock is used by spotted seals in the Central and southern Bering Sea (CBD 2008a) and the humpback whale feeding area is located in the southeastern Bering Sea so both A season and B season closures would potentially protect pollock prey for spotted seals and humpback whales.

Based on stomach samples collected in the 1980s, Steller sea lions may not depend on salmon as prey in the areas of the Pribilof Islands and northern Bering Sea (NMFS 2008). No salmon was detected in stomach samples from these areas. Steller sea lions appear to use salmon resources in the southern portion of the Bering Sea based on scat sampling near Akutan and Bogoslof Island (Fig. 3 in Trites et al. 2007). The triggered closure in the southern portion of the Bering Sea is more likely to benefit Steller sea lions in the summer by protecting both pollock and salmon resources in this area. Salmon area closures in the northern portion of the Bering Sea during the B season is not likely to have any effect on salmon prey resources for Steller sea lions and spotted seals, because there is no evidence of the sea lions or spotted seals eating salmon in the northern portion of the Bering Sea.

For fur seals, spotted seals, and Steller sea lions, closing the salmon areas in the northern portion of the Bering Sea in the B season may only provide a localized benefit for reducing competition for pollock in the closure area. The overall availability of pollock as prey is not likely to change given the existing closure areas and the pollock fleet's likely ability to still harvest its TAC. As previously mentioned from NMFS (2005b), shifting of the pollock fishery northward with the closure of the southern area of the

Bering Sea may be more of a concern in the B season as more harvest is likely to take place in the area where fur seals are likely to forage.

8.1.5.4 Alternative 4: Preferred Alternative

Alternative 4 would have similar effects on the harvest of prey species as Alternative 2. Overall less prey may be harvested if PPA2, the lower cap without the ICA, is implemented, resulting in less competition for prey with marine mammals. Under the higher PPA1 cap, the CV sector would likely fish more in the southern portion of the Bering Sea, reducing the potential for competition with spotted seals and northern fur seals. Competition between the CV sector in the southern portion of the Bering Sea with Steller sea lions may be mitigated by the Steller sea lion protection measures and for any humpback whales that may feed in the closure area. Under the PPA2 cap would increase the potential for competition for pollock among the offshore CP fleet and northern fur seals and spotted seals and for salmon between the fleet and northern fur seals primarily from St. George Island and to a lesser extant from St. Paul Island compared to the PPA2 cap or the backstop cap.

8.1.6 Disturbance Effects

8.1.6.1 Alternative 1: Status Quo

The Alaska Groundfish Harvest Specifications EIS analyzed the potential disturbance of marine mammals by the groundfish fisheries (Section 8.3.3 of NMFS 2007a). The EIS concluded that the status quo fishery does not cause disturbance to marine mammals that may cause population level effects, and fishery closures exist to limit the potential interaction between the fishing vessels and marine mammals.

8.1.6.2 Alternative 2: Hard Cap

The effects on the disturbance of marine mammals by the proposed hard caps would be similar to the effects of these hard caps on the potential for incidental takes. If the pollock fishery reduces fishing activity because of reaching a hard cap, then less potential exists for disturbance of marine mammals. If the pollock fishery increases the duration of fishing in areas with lower concentrations of pollock to avoid areas of high salmon bycatch, there may be more potential for disturbance if this increased fishing activity overlaps with areas used by marine mammals. Fishing under the higher hard cap is likely similar to status quo because it is less constraining than fishing under the lower caps and less likely to cause a change in fishing activities.

Seasonal distribution of the hard cap may impact the potential for disturbance of marine mammals depending on the seasonal distribution of the marine mammals and the overlap with fishing activities. The lower caps may reduce the potential for seasonal disturbance if less fishing occurs when the cap is reached and the fishery closes. If the fleet is moving to less productive pollock areas to avoid salmon bycatch, more fishing may occur where marine mammals are located; and therefore, the seasonal cap may not reduce the potential for disturbance during that season.

8.1.6.3 Alternative 3: Triggered Closures

The potential effects of the trigger closures depend on the presence of marine mammals in the closure area and the timing of the closure. The Bering Sea harbor seal stock is not likely to occur in most of the areas proposed for closure; and therefore, is not likely to be disturbed by the pollock fishery restrictions in these areas. The Gulf of Alaska stock of harbor seals may cross over into the Bering Sea within the southern waters and may experience less potential for disturbance if the salmon area closures occur in either the A or B season.

The A and B season closures would include portions of waters south of St. George Island, which are currently open to pollock fishing, exclusive of the Steller sea lion protection areas and the Pribilof Island Area Habitat Conservation Zone. Closure of these waters would reduce the potential for disturbance of Steller sea lions and fur seals located at St. George Island that may use waters south of St. George. The northern areas of the B season closures may reduce the potential for disturbance by pollock fishing vessels of northern fur seals in these closure areas.

The salmon closure for the A season and the southern portion of the salmon closures for the B season overlap with a portion of North Pacific right whale designated critical habitat (73 FR 19000, April 8, 2008 and Fig. 8-4). Any spring or summer closures of these areas that overlap with the right whale critical habitat may reduce the potential for disturbance from pollock fishing vessels to foraging whales.

Salmon area closures in the southern portion of the Bering Sea during the A and B seasons also may be beneficial to humpback whales and fin whales. If the southern portion of the salmon closure is triggered, pollock fishing vessels would not be present in the portion of this salmon closure area that overlaps with the humpback whale feeding area, therefore reducing the potential for disturbance of foraging humpback whales. The benefit is likely only during the summer when whales are likely to be foraging in the southern portion of the Bering Sea (Fig. 8-2). The A season closure and closure of the southern portion of the B season salmon closure areas appear to overlap with the central eastern Bering sea area where higher concentrations of fin whale were seen. These closures are likely to overlap with locations where larger numbers of fin whales have been seen on the shelf break; and therefore, may reduce the potential for pollock fishing vessel to disturb fin whales if the closures occur at the same time that fin whales are likely to be in these closure areas.

All the ice seals occur in the northern portion of the Bering Sea where the B season salmon closures would occur and may experience less potential for disturbance if the pollock fishery is closed out of these salmon closure areas at the same time ice seals may be present. Ribbon and spotted seals are more widely distributed in the Bering Sea and may experience less potential for disturbance by pollock fishing vessels if they occur in any of the salmon closure area when the pollock fishery is prohibited. Ribbon seals likely migrate into the Chukchi Sea in summer (Angliss and Outlaw 2008). Bearded and ringed seals are located in the northern portion of the Bering Sea (Angliss and Outlaw 2007), outside of the A season closure area and the B season southern closure area. Ringed seals remain in contact with the ice most of the year (Angliss and Outlaw 2007). Because of their distribution, the salmon area closures in the southern portion of the Bering Sea are not as likely to have an effect on bearded, ringed, and ribbon seals. These stocks may benefit from the northern closures in the B season by potentially less disturbance from pollock vessels where the closures occur and these seals may be present. Bearded, ribbon, and ringed seals are not likely to occur in the A season closure area or the southern portion of the B season closure area and are therefore not likely to be affected by these portions of salmon closures under Alternative 3.

During spring, spotted seals tend to prefer small ice floes (i.e., < 20 m in diameter), and inhabit mainly the southern margin of the ice, with movement to coastal habitats after the retreat of the sea ice (Fay 1974, Shaughnessy and Fay 1977, Simpkins et al. 2003). In summer and fall, spotted seals use coastal haulouts regularly, and may be found as far north as 69-72 degrees N latitude in the Chukchi and Beaufort Seas (Porsild 1945, Shaughnessy and Fay 1977). To the south, along the west coast of Alaska, spotted seals are known to occur around the Pribilof Islands, Bristol Bay, and the eastern Aleutian Islands (Angliss and Outlaw 2007). Spotted seals may occur in all of the areas considered for closing under Alternative 3 and may have less potential for disturbance by pollock fishing vessels if they occur in these areas when the pollock fishery is prohibited.

Dall's porpoise have been encountered by the pollock fishery mostly in the northern shelf break area of the Bering Sea (Table 8-5) and therefore are more likely to be affected by closures in the northern portion of the Bering Sea during the B season. If Dall's porpoise occur in these closure areas, then prohibiting the pollock fishery in the salmon closure areas under Alternative 3 may reduce the potential for disturbance.

Minke and killer whales occurring in the closure areas would have less potential for disturbance when the pollock fishery is prohibited in these areas. No information exists to understand any potential spatial or temporal nature of disturbance impacts on individual stocks for these species.

Humpback whales that use the feeding area in the southern portion of the Bering Sea may have less potential for disturbance by pollock vessels during the A season and B season closures. The A season and the southern portion of the B season closure areas under Alternative 3 overlap with the North Pacific feeding area identified in Fig. 8-2.

Fin whales appear to gather in the northern portion of the Bering Sea, overlapping with the B season salmon area closures (Fig. 8-1). Fin whales occurring in this northern area may encounter less disturbance by pollock fishing vessels if the whales are present in the closure areas when the pollock fishery is prohibited. The potential benefit to the stock of less disturbance is likely greater for whales in this northern area compared to whales in the southern portion of the Bering Sea, where they are less numerous (Angliss and Outlaw 2008).

Options that result in lower triggers for salmon area closures are more likely to result in less potential for disturbance of marine mammals in the closure areas than options with higher triggers.

8.1.6.4 Alternative 4: Preferred Alternative

The impacts of Alternative 4 on the disturbance of marine mammals is similar to the impacts of Alternative 2. The PPA1 high cap with the ICA option would allow for more pollock fishing than the PPA2 cap and may result in more potential for disturbance if marine mammals are present in the locations where pollock fishing is occurring. The PPA2 cap without the ICA would likely result in less pollock fishing and less potential for disturbance of marine mammals.

8.1.7 Consideration of Future Actions

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the effects of the alternatives on marine mammals. Some of these actions are broadly based on the potential changes to the groundfish fisheries that may result in impacts on marine mammals. These actions are described in Chapter 3.

8.1.7.1 Ecosystem-sensitive management

Increased attention to ecosystem-sensitive management is likely to lead to more consideration for the impact of the pollock fishery on marine mammals and more efforts to ensure the ecosystem structure that marine mammals depend on is maintained, including prey availability. Increasing the potential for observers collecting information on marine mammals and groundfish fisheries interaction, and any take reduction plans, may lead to less incidental take and interaction with the groundfish fisheries, thus reducing the adverse effects of the groundfish fisheries on marine mammals.

Changes in the status of species listed under the ESA, the addition of new listed species or critical habitat, and results of future Section 7 consultations may require modifications to groundfish fishing practices to reduce the impacts of these fisheries on listed species and critical habitat. Listing any of the ice seals and designating critical habitat would require Section 7 consultation for the groundfish fisheries to determine if they are likely to adversely affect the listed species or designated critical habitat. Change to the fisheries may be required if it is determined that the fishery may pose jeopardy or adverse modification or destruction of critical habitat. Fishery measures would be needed to reduce that potential harm.

Modifications to Steller sea lion protection measures will result in Section 7 consultations. These changes may be a result of recommendations by the Council based on a review of the current protection measures, potential State actions, or recommendations from the draft FMP-level biological opinion which is scheduled for release in late 2009. Any change in protection measures likely would have insignificant effects because any changes would be unlikely to result in the PBR being exceeded and would not be likely to result in jeopardy of extinction or adverse modification or destruction of designated critical habitat.

Improved management of fur seals may result from the Council's formation of the Fur Seal Committee, and the continued development of information regarding groundfish fishery interactions and fur seals. The timing and nature of potential future protection measures for fur seals are unknown, but any action is likely to reduce the adverse effects of the groundfish fisheries on fur seals.

The ongoing research efforts described in the Consideration of Future Actions section of Chapter 3 is likely to improve our understanding of the interactions between the harvest of pollock and salmon and the impacts on marine mammals in the Bering Sea. NMFS is conducting or participating in several research projects summarized in Chapter 3 which include understanding the ecosystems, fisheries interactions, and gear modifications to reduce salmon bycatch. These projects will allow NMFS to better understand the potential impacts of commercial fisheries, the potential for reducing salmon bycatch, and the Bering Sea ecosystem. The results of the research will be useful in managing the fisheries with ecosystem considerations and is likely to result in reducing potential effects on marine mammals.

The implementation of an Arctic fishery management plan may provide protection to those marine mammals that use Arctic and Bering Sea waters, such as ice seals. The plan is likely to result in no fishing in either the Chukchi or Beaufort Seas which would prevent the potential for incidental takes, disturbance or competition for prey species between fishing vessels and marine mammals.

8.1.7.2 Traditional management tools

The cumulative impact of the annual harvest specifications in combination with future harvest specifications may have lasting effects on marine mammals. However, as long as future incidental takes remain at or below the PBR, the stocks will still be able to reach or maintain their optimal sustainable population. Additionally, since future TACs will be set with existing or enhanced protection measures, it is reasonable to assume that the effects of the fishery on the harvest of prey species and disturbance will likely decrease in future years. Improved monitoring and enforcement through the use of technology would improve the effectiveness of existing and future marine mammal protection measures by ensuring the fleet complies with the protection measures, and thus, reducing the adverse impacts of the alternatives.

8.1.7.3 Actions by other Federal, State, and International Agencies

Expansion of State pollock or Pacific cod fisheries may increase the potential for effects on marine mammals. However, due to ESA requirements, any expansion of State groundfish fisheries may result in reductions in Federal groundfish fisheries to ensure that the total removals of these species do not jeopardize any ESA-listed species or adversely modify designated critical habitat, including Steller sea lion critical habitat.

State management of the salmon fisheries of Alaska will continue into the future. The State's first priority for management is to meet spawning escapement goals to sustain salmon resources for future generations. Subsistence use is the highest priority use under both State and Federal law. Surplus fish beyond escapement needs and subsistence use are made available for other uses, such as commercial and sport harvests. The State carefully monitors the status of salmon stocks returning to Alaska streams and controls fishing pressure on these stocks. Even though prey availability is not accounted for in the setting of salmon harvest levels, the management of salmon stocks effectively maintains healthy populations of salmon where possible and may provide sufficient prey availability to marine mammals.

Incidental takes of Steller sea lions and other marine mammals occur in the State managed set and drift gillnet, troll, and purse seine salmon fisheries (72 FR 66048, November 27, 2007). Marine mammal species taken in the State-managed fisheries and also the pollock fishery are in Table 8-8.

Table 8-8 Marine Mammals Taken in State-Managed and Federal Pollock Fisheries

Marine Mammal Stocks Taken in State Managed and Federal Pollock Fishery#	State Fisheries mean annual mortality*
Dall's porpoise	28
Harbor seal, Bering Sea	0
Steller sea lions, western	14.5
Humpback whale western and central stocks	2.0
Spotted seal	0

*Angliss and Outlaw 2008
#LOF 72 FR 66048, November 27, 2007

The mortalities listed in Table 8-8 are included in the total mean annual human caused mortalities in Table 8-4. The combination of the incidental takes in the pollock fishery with takes in the State-managed fisheries for these species is either well below the PBR or a small portion of the total mean annual human caused mortality for species which PBR is not determined. It is not likely that any of the alternatives or options would change the pollock fishery in a manner that would greatly increase the overall incidental takes of these marine mammals to where either the PBR would be exceeded or the proportion of fishery mortality in the total mean annual human caused mortality would greatly change.

8.1.7.4 Private actions

Subsistence harvest is the primary source of direct mortality for many species of marine mammals. Current levels of subsistence harvests, reflected in column 3 of Table 8-4, are controlled only for fur seals. Subsistence harvest information is collected for other marine mammals and considered in the stock assessment reports. It is unknown how rates of subsistence harvests of marine mammals may change in the future.

Other factors that may impact marine mammals include continued commercial fishing; non-fishing commercial, recreational, and military vessel traffic in Alaskan waters; oil and gas exploration; seismic surveying; and tourism and population growth that may impact the coastal zone. Little is known about the impacts of these activities on marine mammals in the BSAI. However, Alaska's coasts are currently relatively lightly developed, compared to coastal regions elsewhere. Despite the likelihood of localized impacts, the overall impact of these activities on marine mammal populations is expected to be modest.

8.1.7.5 Conclusions

The continuing fishing activity and continued subsistence harvest are potentially the most important sources of additional annual adverse impacts on marine mammals. Both of these activities are monitored and are not expected to increase beyond the PBRs for most marine mammals. The extent of the fishery impacts would depend on the size of the fisheries, the protection measures in place, and the level of interactions between the fisheries and marine mammals. However, a number of factors will tend to reduce the impacts of fishing activity on marine mammals in the future, most importantly ecosystem management. Ecosystem-sensitive management and institutionalization of ecosystem considerations into fisheries governance are likely to increase our understanding of marine mammal populations and interactions with fisheries. The effects of actions of other Federal, State, and international agencies are likely to be less important when compared to the direct interaction of the commercial fisheries, subsistence harvests, and marine mammals.

8.2 Seabirds

8.2.1 Seabird Resources in the Bering Sea

Thirty-eight species of seabirds breed in Alaska. There are approximately 1,800 seabird colonies in Alaska, ranging in size from a few pairs to 3.5 million birds. The U.S. Fish and Wildlife Service (USFWS) is the lead federal agency for managing and conserving seabirds and is responsible for monitoring the distribution and abundance of populations. Twelve sites along the coastline of Alaska are scheduled for annual monitoring, and additional sites are monitored every three years. Breeding populations are estimated to contain 36 million individual birds in the Bering Sea, and total population size (including subadults and nonbreeders) is estimated to be approximately 30% higher. Five additional species that breed elsewhere but occur in Alaskan waters during the summer months contribute another 30 million birds. The USFWS Beringian Seabird Colony Catalog (2004) represents the location, population size, and species composition for each colony based on the most recent information available (Fig. 8-5). These population estimates are based on opportunistic surveys of colonies, and may rely on historical information at some locations (Stephensen, pers. com.). Colonies in the Bering Sea include large numbers of cormorants, murres, puffins, auklets, black-legged kittiwakes, and gulls.

Table 8-9 Seabird species in the BSAI (NMFS 2004)

Albatrosses - Black-footed, Short-tailed, Laysan
Northern fulmar
Shearwaters - Short-tailed, Sooty
Storm petrels - Leach’s, Fork-tailed
Cormorants - Pelagic, Red-faced, Double-crested
Gulls - Glaucous-winged, Glaucous, Herring. Mew, Bonaparte’s Sabine, Ivory
Murres - Common, Thick-billed
Jaegers - Long-tailed, Parasitic, Pomarine
Guillemots - Black, Pigeon
Eiders - Common, King, Spectacled, Steller’s
Murrelets - Marbled, Kittlitz’s, Ancient
Kittiwakes - Black-legged, Red-legged
Auklets - Cassin’s, Parakeet, Least, Whiskered, Crested
Terns - Arctic, Aleutian
Puffins - Rhinoceros, Horned, Tufted

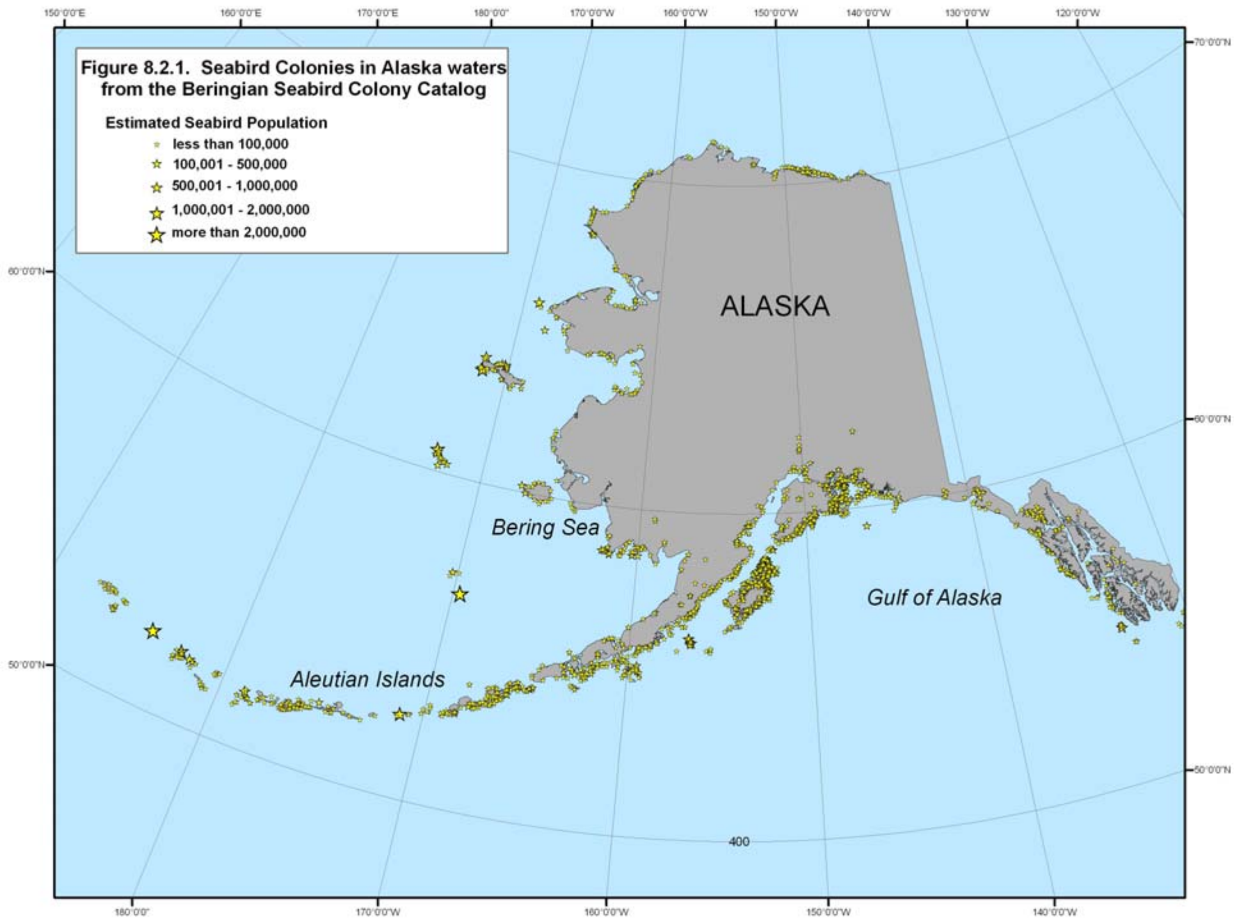

Fig.8-8 Seabird colonies in the Bering Sea.

As noted in the PSEIS, seabird life history includes low reproductive rates, low adult mortality rates, long life span, and delayed sexual maturity. These traits make seabird populations extremely sensitive to changes in adult survival and less sensitive to fluctuations in reproductive effort. The problem with attributing population changes to specific impacts is that, because seabirds are long-lived animals, it may take years or decades before relatively small changes in survival rates result in observable impacts on the breeding population. Moloney et al (1994) estimated a 5- to 10-year lag time in detecting a breeding population decline from modeled hook-and-line incidental take of juvenile wandering albatross, and a 30- to 50-year population stabilization period after conservation measures were put in place.

More information on seabirds in Alaska's EEZ may be found in several NMFS, Council, and FWS documents:

- The URL for the FWS Migratory Bird Management program is at: http://alaska.fws.gov/mbsp/mbm/index.htm
- Section 3.7 of the PSEIS (NMFS 2004a) provides background on seabirds in the action area and their interactions with the fisheries. This may be accessed at http://www.fakr.noaa.gov/sustainablefisheries/seis/final062004/Chaps/chpt_3/chpt_3_7.pdf
- The annual Ecosystems Considerations chapter of the SAFE reports has a chapter on seabirds. Back issues of the Ecosystem SAFE reports may be accessed at

http://www.afsc.noaa.gov/REFM/REEM/Assess/Default.htm.

- The Seabird Fishery Interaction Research webpage of the Alaska Fisheries Science Center: http://www.afsc.noaa.gov/refm/reem/Seabirds/Default.htm
- The NMFS Alaska Region's Seabird Incidental Take Reduction webpage: http://www.fakr.noaa.gov/protectedresources/seabirds.html
- The BSAI and GOA Groundfish FMPs each contain an "Appendix I" dealing with marine mammal and seabird populations that interact with the fisheries. The FMPs may be accessed from the Council's home page at http://www.fakr.noaa.gov/npfmc/default.htm
- Washington Sea Grant has several publications on seabird takes, and technologies and practices for reducing them: http://www.wsg.washington.edu/publications/online/index.html
- The seabird component of the environment affected by the groundfish FMPs is described in detail in Section 3.7 of the PSEIS (NMFS 2004a).
- Seabirds and fishery impacts are also described in Chapter 9 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007a).

8.2.2 ESA-Listed Seabirds in the Bering Sea

Three species of seabirds that range into the Bering Sea are listed under the ESA: the endangered short-tailed albatross (STAL) (*Phoebastria albatrus*), the threatened spectacled eider (*Somateria fischeri*) and the threatened Steller's eider (*Polysticta stelleri*). Two additional species, Kittitz's murrelet and black-footed albatrosses, are currently candidates species for listing.

STAL populations were decimated by hunters and volcanic activity at nesting sites in the early 1900s, and the species was reported to be extinct in 1949. By 1954 there were 25 total birds seen on Torishima Island. Prohibition of hunting and habitat enhancement work has allowed the population to recover at a 7%–8% rate based on egg counts from 1990-1998. The current world total population is estimated at around 2000 individuals (USFWS 2006). 80%–85% of nesting occurs at a colony subject to erosion and mudslides on Torishima Island, an active volcano in Japan, and smaller numbers nest in the Senkaku Islands where political uncertainty and the potential for oil development exist (USFWS 2005). Recently, STAL chicks were relocated to a new breeding colony without the volcanic threat. No critical habitat has been designated for the short-tailed albatross in the US, since the population growth rate doesn't appear to be limited by marine habitat loss (NMFS 2004a).

STAL feeding grounds are continental shelf breaks and areas of upwelling and high productivity. Although recent reliable diet information is not available, short-tailed albatross likely feed on squid and forage fish. Although surface foragers, their diet could include mid-water species that are positively buoyant after mortality (e.g. post-spawning for some squid species) or fragments of larger prey floating to the surface after being caught by subsurface predators (R. Suryan, pers.com.).

Most designated critical habitat for Spectacled and Steller's eiders is well outside the normal distribution of the pollock trawl fleet (Fig. 8-9 and Fig. 8-10). There is no recorded take of these species in Alaska trawl fisheries, and no take estimates produced by the AFSC (2006). Spectacled eider observations are reported in the NPPSD in Bristol Bay and Norton Sound, still outside the normal distribution of the pollock trawl fleet. Therefore, potential impacts to these species are not analyzed further in this document.

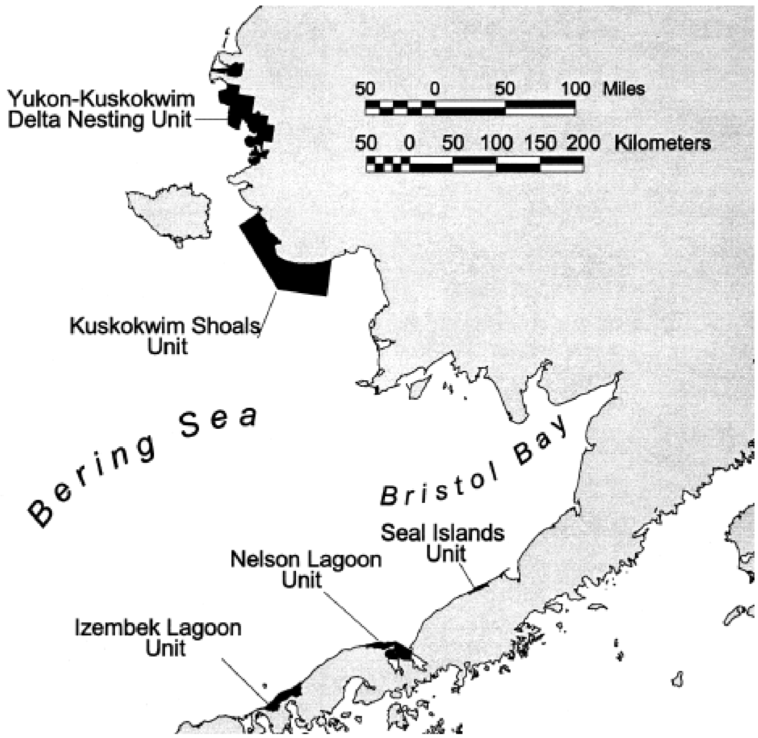

Fig. 8-9 Steller's Eider Critical Habitat (USFWS 2001b)

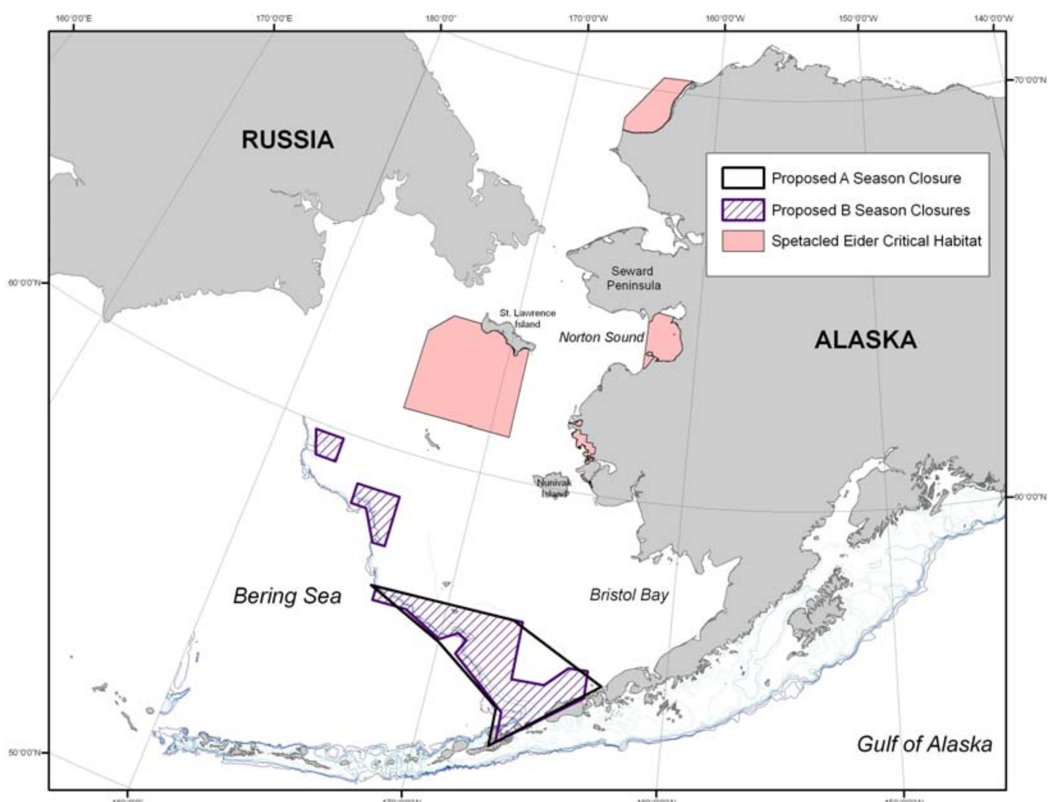

Fig. 8-10 Spectacled Eider Critical Habitat (USFWS 2001a) with the Alternative 3 proposed closures.

8.2.3 Status of Endangered Species Act Consultations on Groundfish and Halibut Fisheries

The USFWS listed the short-tailed albatross as an endangered species under the ESA throughout its United States range (65 FR 46643, July 31, 2000). The current population status, life history, population biology, and foraging ecology of these species, as well as a history of ESA section 7 consultations and NMFS actions carried out as a result of those consultations are described in detail in section 3.7 of the PSEIS (NMFS 2004a). Although critical habitat has not been established for the short-tailed albatross, the FWS did designate critical habitat for the spectacled eider (66 FR 9146; February 6, 2001) and the Steller's eider (66 FR 8850; February 2, 2001).

In 1997, NMFS initiated a section 7 consultation with USFWS on the effects of the Pacific halibut fishery off Alaska on the short-tailed albatross. FWS issued a Biological Opinion in 1998 that concluded that the Pacific halibut fishery off Alaska was not likely to jeopardize the continued existence of the short-tailed albatross (USFWS 1998b). FWS issued an Incidental Take Statement of two short-tailed albatross in a two year period (1998/1999, 2000/2001, 2002/2003, etc), reflecting what the agency anticipated the incidental take could be from the fishery action. Under the authority of ESA, USFWS identified non-discretionary reasonable and prudent measures that NMFS must implement to minimize the impacts of any incidental take.

Two updated USFWS Biological Opinions (BO) were published in 2003:

- Section 7 Consultation - Biological Opinion on the Effects of the Total Allowable Catch (TAC)-Setting Process for the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries to the Endangered Short-tailed Albatross (*Phoebastria albatrus*) and Threatened Steller's Eider (*Polysticta stelleri*), September 2003 (USFWS 2003b).
- Section 7 Consultation - Programmatic Biological Opinion on the effects of the Fishery Management Plans for the Gulf of Alaska and Bering Sea/Aleutian Islands groundfish fisheries on the endangered short-tailed albatross (*Phoebastria albatrus*) and threatened Steller's eider (*Polysticta stelleri*), September 2003 (USFWS 2003a).

Although USFWS has determined that the short-tailed albatross is adversely affected by hook-and-line Pacific halibut and groundfish fisheries off Alaska, both USFWS opinions concluded that the GOA and BSAI fishery actions are not likely to jeopardize the continued existence of the short-tailed albatross or Steller's eider or result in adverse modification of Steller's eider critical habitat. The USFWS also concluded that these fisheries are not likely to adversely affect the threatened spectacled eider. The Biological Opinion on the TAC-setting process updated incidental take limits of:

- four short-tailed albatross taken every two years in the hook-and-line groundfish fishery off Alaska, and
- two short-tailed albatross taken in the groundfish trawl fishery off Alaska while the BO is in effect (approximately 5 years).

These incidental take limits are in addition to previous take limit set in 1998 for the Pacific halibut hook-and-line fishery off Alaska of two STAL in a two year period.

The 2003 Biological Opinion on the TAC-setting process also included mandatory terms and conditions that NOAA must follow in order to be in compliance with the ESA. One is the implementation of seabird deterrent measures (NMFS 2002). Additionally, NOAA Fisheries must continue outreach and training of fishing crews as to proper deterrence techniques, continued training of observers in seabird identification, retention of all seabird carcasses until observers can identify and record takes, continued analysis and publication of estimated incidental take in the fisheries, collection of information regarding the efficacy of seabird protection measures, cooperation in reporting sightings of short-tailed albatross, and continued research and reporting on the incidental take of short-tailed albatross in trawl gear.

The USFWS released a short-tailed albatross draft recovery plan for public review (70 FR 61988, October 27, 2005). This recovery plan meets the ESA requirements of describing site-specific actions necessary to achieve conservation and survival of the species, downlisting and delisting criteria, and estimates of time and cost required to implement the recovery plan. Because the primary threat to the species recovery is the possibility of an eruption of Torishima Island, the most important recovery actions include monitoring the population and managing habitat on Torishima Island, establishing two or more breeding colonies on non-volcanic islands, monitoring the Senkaku population, and conducting telemetry and other research and outreach. Recovery criteria are currently under review. USFWS estimates that the STAL may be delisted in the year 2030, if new colony establishment is successful.

8.2.4 Other Seabird Species of Conservation Concern in the Bering Sea

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the USFWS to “identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973.” Birds of Conservation Concern (BCC) 2002 (USFWS 2002) identifies the migratory and non-migratory bird species (beyond those already designated as Federally threatened or endangered) with their highest conservation priorities and draws attention to species in need of conservation action." NMFS Evaluating Bycatch report (NMFS 2004b) says the purpose of the BCC list is to highlight potential conservation issues and concerns before species get listed. The Birds of Conservation Concern report, USFWS (2002) lists 28 species of birds in Region 7 (Alaska Region). Many of these species do not interact with Alaska fisheries, and thus are not addressed in this analysis.

8.2.4.1 Black-footed albatross

Black-footed albatrosses occur in Alaska waters mainly in the northern Gulf of Alaska, but a few have been reported near Nunivak Island in the Bering Sea (USFWS 2006). A few BFAL are reported in the NPPSD in Bristol Bay (Fig.8-14).

Although not an ESA-listed species, the black-footed albatross (BFAL, *Phoebastria nigripes*) is of concern because some of the major colony population counts may be decreasing or of unknown status. World population estimates range from 275,000 to 327,753 individuals (Brooke 2004), with a total breeding population of 58,000 pairs (USFWS 2006). Most of the population (95%) breeds in the Hawaiian Islands. Conservation concerns in the last century have included albatross mortalities by feather hunters, the degradation of nesting habitat due to introduced species such as rabbits, and population reduction programs operated by the military. Tuna and swordfish pelagic longline fisheries in the North Pacific, including the Hawaiian longline fishery, and to a lesser extent the Alaska groundfish demersal longline fishery take black-footed albatrosses incidentally.

On October 1, 2004, the USFWS received a petition to list the BFAL as a threatened or endangered species, and to designate critical habitat at the time of listing. The Service's response to the 90-day finding was deferred until October 9, 2007, due to insufficient resources. At that time, the Service found that the petition warranted further review. Following the publication of the black-footed albatross population status review, the Service began developing its 12-month finding indicating whether it believes a proposal to list this species as threatened or endangered is warranted. That 12-month finding is not yet available.

Melvin et al (2006) cites the fact that the World Conservation Union (IUCN) changed its conservation status of the species under the international classification criteria from vulnerable to endangered in 2003. Additionally, the USFWS has been working with Dr. Paul Sievert and Dr. Javier Arata of the U.S. Geological Survey (USGS) to develop a status assessment of Laysan and Black-footed Albatrosses. This assessment is in response to growing concerns regarding the current status and population trends of these two north Pacific albatrosses, particularly the black-footed. The USFWS issued a conservation plan for black-footed and Laysan Albatrosses in October 2007.

8.2.4.2 Red-legged kittiwake

The red-legged kittiwake is a small gull that breeds at only a few locations in the world, all of which are in the Bering Sea (USFWS 2006). Eighty percent of its worldwide population nests at St. George Island, with the remainder nesting at St. Paul, the Otter Islands, Bogoslof and Buldir Islands. The total population is estimated at around 209,000 birds (USFWS 2006). They are listed as a FWS bird of conservation concern because recent severe population declines remain unexplained (NMFS 2004b), but could be due to irregular food supplies in the Pribilof Islands. Red-legged kittiwakes are present in the eastern Bering Sea, but do not interact regularly with the Bering Sea fisheries.

8.2.4.3 Kittlitz's murrelet

Kittlitz's murrelet (*Brachyramphus brevirostris*) is a small diving seabird that forages in shallow waters for capelin, Pacific sandlance, zooplankton and other invertebrates. It feeds near glaciers, icebergs, and outflows of glacial streams, sometimes nesting up to 45 miles inland on rugged mountains near glaciers. They nest on the ground, and not in colonies, thus less is known about their breeding behaviors. The entire North American population, and most of the world's population, inhabits Alaskan coastal waters discontinuously from Point Lay south to northern portions of Southeast Alaska. Kittlitz's murrelet is a relatively rare seabird. Most recent population estimates indicate that it has the smallest population of any seabird considered a regular breeder in Alaska (9,000 to 25,000 birds). This species appears to have undergone significant population declines in several of its core population centers—Prince William Sound (up to 84%), Malaspina Forelands (up to 75%), Kenai Fjords (up to 83%) and in Glacier Bay. Causes for the declines are not well known, but likely include: habitat loss or degradation, increased adult and juvenile mortality, and low recruitment. FWS believes that glacial retreat and oceanic regime shifts are the factors that are most likely causing population-level declines in this species. On May 4, 2004, the FWS (2004) gave the Kittlitz's murrelet a low ESA listing priority because it has no imminent, high magnitude threats (50 CFR Part 17 Volume 69, Number 86). The listing priority elevated from 5 to 2 in 2007 in recognition that climate change will have a more immediate effect on this species than previously believed and because of more evidence of declining population trends.

The USFWS has conducted surveys for Kittlitz's murrelet in the Alaska Maritime National Wildlife Refuge over the past few years (USFWS 2006). These surveys have revealed populations at Attu, Atka, Unalaska, and Adak. Intensive surveys in 2006 found an additional 10 nests in the mountains of Agattu. Bird biologists will now be able to study the species' breeding biology for the first time.

No Kittlitz's murrelets were specifically reported taken in the observed groundfish fisheries between 1993 and 2001 (NMFS 2004a), and no estimates are presented by AFSC (2006). While Kittlitz's murrelets have been observed in the Bering Sea (Fig.8-16), their foraging techniques, diet composition, and the fact that they do not follow fishing vessels or congregate around them reduces the likelihood of incidental take in groundfish fisheries (K. Rivera, NMFS, pers. comm.) (FWS 2006).

8.2.5 Seabird Distribution in the Bering Sea

A number of data sources are available that describe the spatial distributions of seabirds species in the Bering Sea. The data sources used in this analysis are described below and represented in figures to follow. NMFS is highly appreciative of USFWS, Washington Seagrant, Oregon State University, International Pacific Halibut Commission, and the Alaska Fishery Science Center in their efforts to supply data and guidance in putting together this and other seabird-related analyses.

8.2.5.1 Washington Sea Grant Point Count Study

Melvin et al (2006) provide data on seabird distribution patterns in Alaska's EEZ, based on an inter-agency collaborative program that collected seabird distribution data during stock assessment surveys on hook-and-line vessels in the summers of 2002, 2003, and 2004. These surveys primarily report on species that are attracted to fishing vessels. Seabird data were collected from four summer hook-and-line stock assessment surveys: IPHC halibut surveys, NMFS sablefish surveys, ADF&G Southeast Inside sablefish surveys, and ADF&G Prince William Sound sablefish surveys. See Melvin et al (2006) for survey protocol and description.

Researchers observed a total of 230,452 birds over three years at an average of 1,456 stations surveyed each year. 85% of all birds sighted were procellariformes, and of these, most were northern fulmars (71% of all birds sighted) or albatrosses (13% of all birds sighted). Albatrosses occurred throughout the fishing grounds in outside waters. Sightings of the endangered short-tailed albatrosses (Fig.8-17) were extremely rare (0.03% of all sightings) and had a similar distribution to Laysan albatrosses: rare or absent east and south of the western GOA and most abundant in the Aleutian Islands. Black-footed albatrosses were observed in all outside waters.

Note that this effort gives information about STAL use of Bering Sea habitat that corroborates other studies which reference STAL preference for continental shelf break and slope areas (Suryan et al. 2006, Piatt et al. 2006).

8.2.5.2 North Pacific Pelagic Seabird Database and Observers

The North Pacific Pelagic Seabird Database (NPPSD) represents a consolidation of pelagic seabird data collected from the Central and North Pacific Ocean, the Bering Sea, the Chukchi Sea, and the Beaufort Sea. The NPPSD was created to synthesize numerous disparate datasets including at-sea boat based surveys, stations, land based observations, fixed-wing and helicopter aerial surveys, collected since 1972 (Drew and Piatt 2004). Bird observations are shown in Fig.8-16. Species of conservation concern and those more likely to interact with fishing vessels are highlighted in the figure, but other species observed in this area include murres, loons, auklets, puffins, terns, black-legged kittiwakes, short-tailed and sooty shearwaters and other species in smaller numbers.

Seabird observers have conducted surveys onboard ships of opportunity from 2006-2008 in the Bering, Chukchi, and Beaufort seas. While surveyors did observe short-tailed, black-footed, and Laysan albatrosses in the Bering Sea, the bird distributions were mostly limited to the Bering Sea shelf break.

8.2.5.3 Seabird observations from IPHC surveys

The IPHC stock assessment surveys document interactions with seabirds at all survey stations, primarily reporting on observation of seabird species that are attracted to fishing vessels. Table 8-10 lists the numbers of seabirds observed in each IPHC management area during the 2006 survey. Fig. 7-1, in Chapter 7, shows the locations of the different areas. Many seabirds were observed in the Bering Sea in areas frequently fished by the pollock trawl fleet.

Table 8-10 Numbers of Seabirds Observed in IPHC 2006 Survey in Alaska

IPHC Area	Numbers of Observed Seabirds	Numbers of Counts
2C	**1,140**	**122**
3A	**13,468**	**372**
3B	**20,946**	**229**
4A	**8,596**	**117**
4B	**7,038**	**89**
4C	**1,799**	**25**
4D	**9,253**	**92**
4E	**227**	**22**
Closed Area	**631**	**17**

Data from IPHC.

8.2.5.4 Short-tailed albatross hotspots

Piatt et al (2006) discuss oceanic areas of seabird concentrations; they explain that STAL hotspots are characterized by vertical mixing and upwelling caused by currents and bathymetric relief and which persist over time (Fig. 22). The continual upwelling brings food to the surface and, thus, draws predators back for repeated foraging, especially Albatross species which forage at the surface due to their limited diving ability (Hyrenbach et al. 2002). Sightings data were compiled from the following sources: from 1988-2004 records from seabird observers on the USFWS's research vessel M/V Tiglax; from incidental sightings by biologists, fishermen, seamen, fisheries observers and birdwatchers provided to the USFWS; from the IPHC; from the Alaska Natural Heritage Program; historical sightings documented in published literature; and from the North Pacific Pelagic Seabird Database. Researchers analyzed over 1400 sightings, the majority of which were located on the continental shelf edge of Alaska, abundance being greatly diminished along the east Gulf of Alaska coast and south to Southeast Alaska. Researchers concluded that the short-tailed albatross is most recently consistently associated with upwelling in Aleutian passes and along continental shelf margins in Alaska. The opportunistic sightings data suggest that the albatrosses appear persistently and predictably in some marine "hotspots." They were closely associated with shelf-edge habitats throughout the northern Gulf of Alaska and Bering Sea. In addition to Ingenstrem Rocks and Seguam Pass, important hotspots for short-tailed albatross in the Aleutians included Near Strait, Samalga Pass and the shelf-edge south of Umnak/Unalaska islands. In the Bering Sea, hotspots were located along margins of Zhemchug, St. Matthews and Pervenets Canyons (Piatt et al 2006). Similar findings in Byrd et al (2005) confirm the frequent presence of surface-feeding piscivores near the medium and large passes that create the bathymetric conditions for vertical mixing and upwelling. Researchers surmise that prior to decimation of the short-tailed albatross population by feather hunters around the turn of the century, the albatrosses may have been reasonably common nearshore (thus the term "coastal" albatross) but only where upwelling "hotspots" occurred near the coast. As short-tailed albatross numbers increase, it is likely that their distribution will shift into areas less utilized currently, including the coastal areas.

In the context of this analysis, the pertinent STAL hotspots in the Bering Sea are located along the Zhemchug, St Matthew, Pervenets, and Pribilof canyons along the continental shelf (Fig.8-18). Piatt et al report large groups (10-136 birds) of STAL concentrated along the Bering Sea canyons and call attention to a 2004 STAL flock sighting where approximately 10% of the world's population gathered at one hotspot near Pervenets canyon (green asterisk in Fig.8-18).

8.2.5.5 STAL takes in Alaska fisheries

Table 8-11 details the short-tailed albatrosses reported taken in Alaska fisheries since 1983. Except for the 2nd take in 1998, leg bands were recovered from all of the albatrosses allowing scientists to verify identification and age. Since 1977, Dr. Hiroshi Hasegawa has banded all short-tailed albatross chicks at their breeding colony on Torishima Island, Japan. See Fig.8-17 for a map of the take locations and note that no takes are reported from groundfish trawl fisheries (Table 8-11).

Table 8-11 Reported takes of STAL in Alaska fisheries (USFWS 2003)

Date of Take	**Location**	**Fishery**	**Age when taken**
July 1983	BS	brown crab	juvenile (4 mos)
1 Oct 87	GOA	halibut	juvenile (6 mos)
28 Aug 95	EAI	hook-and-line	sub-adult (16 mos)
8 Oct 95	BS	hook-and-line	sub-adult
27 Sept 96	BS	hook-and-line	sub-adult (5yrs)
21 Sept 98	BS	Pacific cod hook-and-line	adult (8yrs)
28 Sept 98	BS	Pacific cod hook-and-line	sub-adult

8.2.5.6 Opportunistic sightings of STAL in the Bering Sea

Balogh et al (2006) report opportunistic sightings of short-tailed albatrosses. Similar to other sources, more opportunistic sightings occurred over shelf-break areas than on the shelf. Although this pattern partially reflects where fishing effort occurred to observe STAL, and does not equally represent sightings in areas where fishing effort is less common. Large numbers of STAL were observed near the Pervenets, St. Matthew and Zhemchug canyons (Fig.8-18).

8.2.5.7 Satellite tracking of STAL (Suryan 2006a and 2006b)

The USFWS and Oregon State University have placed 52 satellite tags on Laysan, black-footed, and short-tailed albatrosses in the central Aleutian Islands over the past 4 years (USFWS 2006) to study movement patterns of the birds in relation to commercial fishing activity and other environmental variables. Details are summarized in NMFS (2008). Within Alaska, albatrosses spent varying amounts of time among NMFS reporting zones, with six of the zones (521, 524, 541, 542, 543, 610) being the most frequently used (Suryan et al 2006a). Albatrosses arriving from Japan spent the greatest amount of time in the western and central Aleutian Islands (541-543), whereas albatrosses tagged in Alaska were more widely distributed among fishing zones in the Aleutian Islands, Bering Sea, and the Alaska Peninsula. In the Aleutian Islands, area-restricted search patterns occurred within straits, particularly along the central and western part of the archipelago (Suryan et al 2006b). In the Bering Sea, area-restricted search patterns occurred along the northern continental shelf break, the Kamchatka Current region, and east of the Commander Islands. Non-breeding short-tailed albatross concentrate foraging in oceanic areas characterized by gradients in topography and water column productivity. The primary hot spots for short-tailed albatrosses in the Northwest Pacific Ocean and Bering Sea occur where a variety of underlying physical processes enhance biological productivity or prey aggregations.

8.2.6 Seabird Interactions with Alaska Groundfish Trawl Fisheries

Alaska groundfish fisheries' impacts on seabirds were analyzed in the Alaska Harvest Specifications EIS (NMFS 2007). That document evaluates the impacts of the alternative harvest strategies on seabird takes, prey availability, and seabird ability to exploit benthic habitat. The focus of this analysis is similar, as any changes to the pollock fishery in the Bering Sea could change the potential for direct take of seabirds. Potential changes in prey availability (seabird prey species caught in the pollock trawl fishery) and disruption of bottom habitat via the intermittent contact with non-pelagic trawl gear under different levels of harvest are discussed in NMFS (2007). These changes would be closely associated with changes in take levels because of the nature of the alternatives using caps and spatial restrictions. Therefore, all impacts are addressed by focusing on potential changes in seabird takes.

USFWS has determined that trawl gear may pose a threat to seabirds, primarily albatrosses and fulmars that strike cables extending from the vessel to the trawl net. Large winged birds such as albatrosses are most susceptible to mortalities from trawl-cable strikes (CCAMLR 2006a). Third wire cables have been prohibited in some southern hemisphere fisheries since the early 1990's due to substantial albatross mortality from cable strikes. No short-tailed albatrosses have been observed taken on trawl gear in Alaska fisheries, but mortalities to Laysan albatrosses have been observed. Much of the description of impacts in this section comes from Dietrich and Melvin (2007).

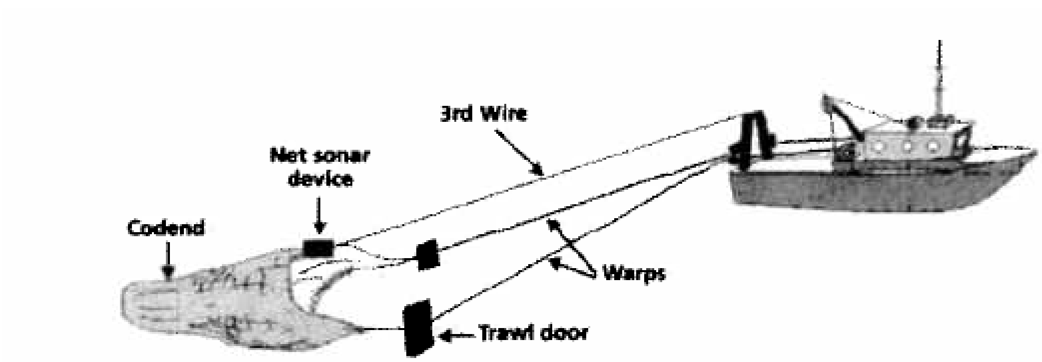

Fig.8-11 Trawl vessel diagram. (Reproduced from Dietrich and Melvin 2007, courtesy of K Williams)

Birds can collide or become entangled with either warp cables that connect the trawl net to the vessel, or by third wire, netsonde, or paravane cables that connect to net monitoring devices (Fig.8-11). In some trawl fisheries, equipment is mounted on the trawl net that sends signals to the vessel so net performance can be monitored. This is most important in midwater fisheries such as pollock trawl, but is employed in some bottom-trawl fishing applications as well. Seabirds attracted to offal and discards from the ship may either strike the hard-to-see cable while in flight, or get caught and tangled in the cable while they sit on the water due to the forward motion of the vessel. Onboard observations of birds (including Laysan albatross) colliding with either of these cables have been made by both researchers and observers. Some birds that strike vessels or fishing gear fly away without injury, while others are injured or killed. When the cable or third wire encounters a bird sitting on the water, the bird can be forced underwater and drown. The main distinction between the two systems is the different location of the transducer cables and third wires. The transducer wires are deployed from the side of the ship and can be very close to where offal is discharged. There, they are not so likely to be hit by flying birds, but very likely to encounter swimming birds. Alternatively, transducer cables can be suspended from relatively long outriggers. This gets them out of the offal discharge area, but puts them more into the birds' flying zone. In contrast, trawl sonar cables (third wires) are deployed from the center of the stern, above the main deck, and can be above the water for longer distances. Thus, they are more likely to intersect the birds' flying zone than the concentration of swimming birds feeding on offal. These differences in location are likely to affect the probability and mechanism of bird strikes.

Up to the present, information on seabird interactions with transducer or third wire cables in Alaska has not been collected systematically. NMFS (2002a) reports that the 3000+ observation records by NMFS-certified observers from 1993 to 2001 include 25 definitive reports of birds specifically striking or being drowned by the 'third wire' on trawl gear, and one report of birds striking the main trawl cables. Many of the observer notes were not about the third wires, and all observations may not have been recorded, so encounter rates cannot be calculated from this information. The third wire incidents that were noted involved 92 birds, including about 30 northern fulmars and 19 Laysan albatross (NMFS 2002a; USFWS Observer Notes Database). Researchers have made similar reports.

There are presently no standardized observer data on seabird mortality from trawler third wire collisions in Alaskan waters. Direct collection of seabird-third wire interaction data is problematic, for several reasons. Any birds killed by third wire collisions would most likely not be recorded in the observers' sampling of the trawl haul, as it is unlikely that such birds would make their way into the trawl net. Some trawlers are configured such that an observer's safety might be compromised were he or she to monitor the third wire during the tow, because direct observations would place the observer immediately below the net cables or expose them to heavy seas. Also, observer effort on trawlers is already fully allocated, and to monitor trawl third wire cables while gear is being towed may require abandoning some existing observer duties, or adding an additional observer to the trawl vessel. To date, striking of trawl vessels or gear by the short-tailed albatross has not been reported by observers. The probability of short-tailed albatross collisions with third wires or other trawl vessel gear in Alaskan waters cannot be assessed; however, given the available observer information and the observed at-sea locations of short-tailed albatrosses relative to trawling effort, the possibility of such collisions cannot be completely discounted. USFWS’ biological opinion included an ITS of two short-tailed albatross for the trawl groundfish fisheries off Alaska (USFWS 2003).

Although the vast majority of warp and third wire effort during 2003-2005 occurred in three fisheries—pollock, cod and flatfish—overlap with albatross sighted during the NMFS surveys was minimal (June through August), except at the BS shelf break in 2004, when it was moderate to high. (Dietrich and Melvin 2007). Dietrich and Melvin suggest further studies to determine overlap of albatross distribution and the use of trawl gear focus on rockfish fisheries in the GOA, Atka mackerel fisheries in the BSAI from May to October, and Pacific cod fisheries in the AI in winter.

The impacts analysis primarily focuses on birds of conservation concern and those more likely to interact with fishing vessels. Impacts to other seabird species may occur at very low levels in relation to population size and are not expected to have significant long-term effects to those populations.

8.2.6.1 Alternative 1 Status Quo

The effects of the status quo fisheries on the incidental takes of seabirds are detailed in the 2007 harvest specifications EIS (NMFS 2007). Fig.8-12 shows the seabird species taken as bycatch in the Bering Sea trawl fisheries and reported by fisheries observers from 2002-2006. This includes trawl fisheries for pollock, Pacific cod, Atka mackerel, rockfish, and flatfish. The high number of unidentified seabirds was influenced by one haul in the Pacific cod fishery in 2006 that occurred in NMFS Area 517. AFSC 2006 estimates of seabird bycatch in the pollock fishery are listed in Table 8-12. In 2006, the pollock fishery accounted for only 12.8% of the total trawl seabird bycatch. It accounted for 61.7% in 2005. These take estimates are small in comparison to seabird population estimates, and under the status quo alternative, it is reasonable to conclude that the impacts would continue to be similar. However, observers are not able to monitor all seabird mortality associated with trawl vessels. Several research project are currently underway to provide more information on these interactions.

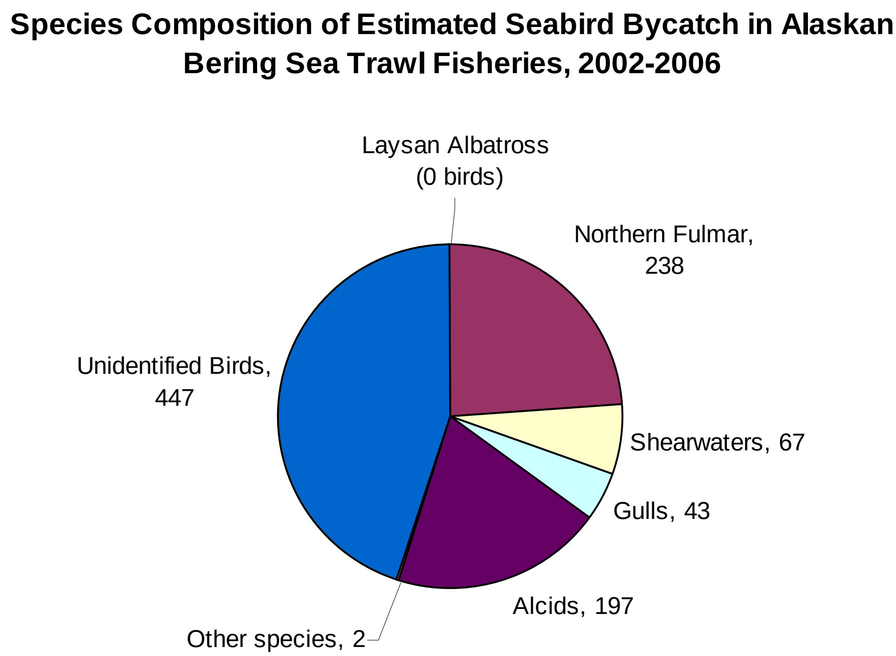

Fig.8-12 Bycatch composition of seabirds in the Bering Sea trawl fisheries, 2002-2006 (Fig. from AFSC)

Table 8-12 Estimates of seabird bycatch in the pollock fishery, 2006

Species	Point Estimate	95% Confidence Interval
Laysan Albatross	2	1-34
Northern Fulmar	335	286-393
Shearwater species	20	12-35
Unidentified Procellarids	2	1-5
Alcid species	3	1-12
Unidentified species	6	2-16

Data from AFSC. All other species are estimated at zero takes.

Dietrich and Melvin (2007) report observed warp hours from June - August pollock trawl fisheries in 2004 (Fig. 8-13 and Fig.8-14) with summer albatross sightings. A warp hour is a measure of effort used to indicate potential for bird interaction. The warp line is part of the trawl gear that interacts with seabirds (see Fig.8-11). While the vessel is trawling and has its warp lines out, each hour that passes would be one warp hour. In 2004, overlap was high along the shelf break for Laysan albatross and northwest of Zhemchug Canyon for short-tailed albatross. In 2005 overlap was minimal with only two black-footed and one short-tailed albatross. The authors are careful to point out that overlap does not necessarily imply interaction, only the potential for interaction.

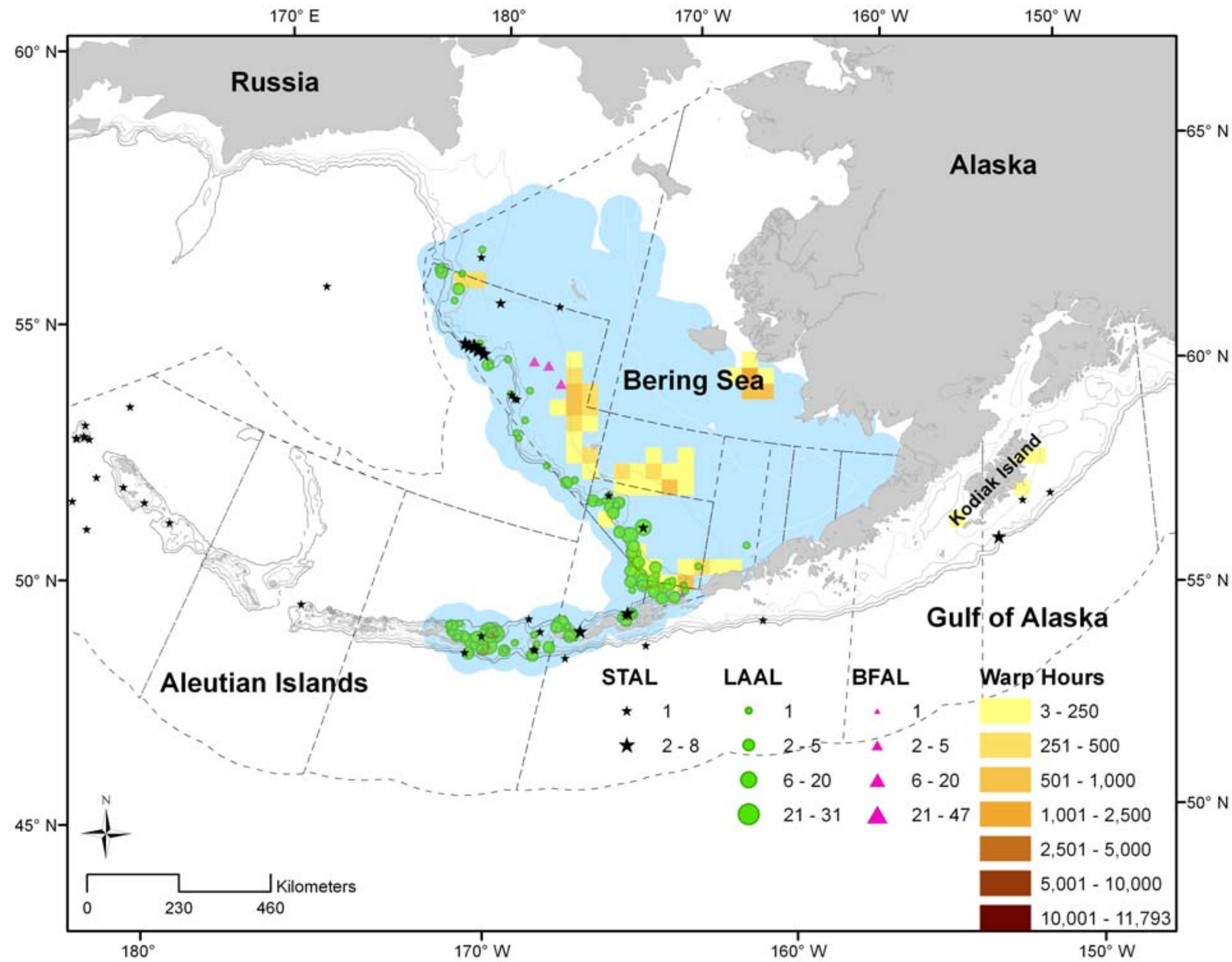

Fig. 8-13 Spatial distribution of warp hours in the pollock trawl fishery and albatross sightings, 2004. Fig. used with permission (Dietrich and Melvin 2007)

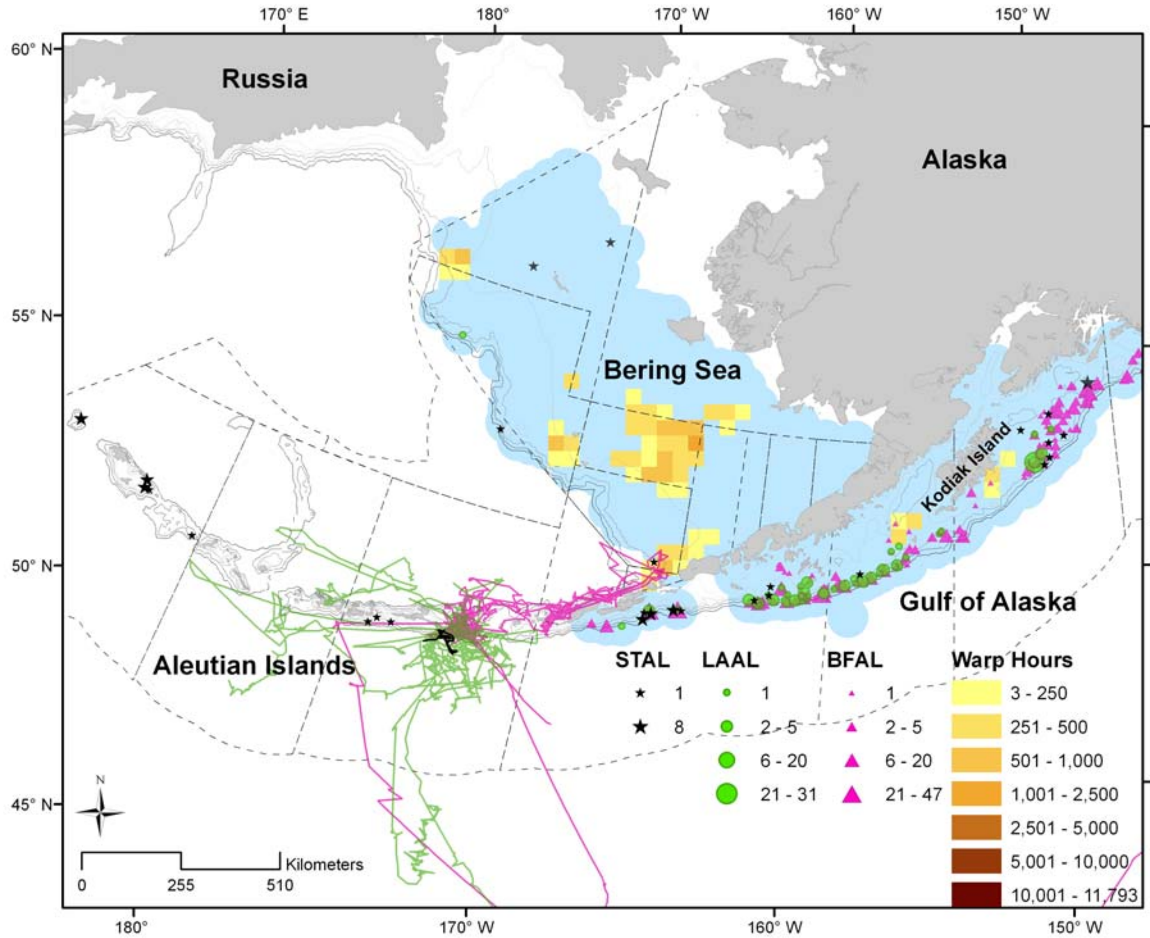

Fig.8-14 Spatial distribution of warp hours in the pollock trawl fishery and albatross sightings, 2005. Fig. used with permission (Dietrich and Melvin 2007)

Fig. 8-5 shows the current spatial restrictions on the pollock trawl fishery in the Bering Sea and Aleutian Islands. Steller sea lion haulouts near the Pribiliof, St. Lawrence, St. Matthew, Walrus, and Round Islands are protected out to various distances by closing those waters to pollock fishing (and other fisheries). Additionally, Bristol Bay, Bogoslof, and the CVOA further spatially restrict the pollock fishery. These closures decrease the potential for interaction with birds in these areas. Fig.8-8 shows that there are seabird colonies at most of these islands and nearshore in the Bogoslof area. Fig.8-16 shows the distribution of seabird species in these areas, and Fig. 8-10 shows the wintering critical habitat area for spectacled eider near St. Lawrence Island. These restrictions are not anticipated to change, so this protection would continue to be provided under any of the alternatives in this analysis.

8.2.6.2 Alternative 2 Hard Cap

The range of hard caps under Alternative 2 offers a range of potential for incidental take of seabirds. The lower hard caps may preclude pollock fishing in the Bering Sea at some point in the fishing season, which would reduce the potential for incidental takes in fishing areas that overlap with seabird distributions after the cap is reached. The higher hard caps would allow for more pollock fishing and more potential interaction and incidental takes of seabird species than the smaller caps.

The options to seasonally distribute the hard cap would seasonally limit the amount of fishing. Seasonal information on estimated takes of seabirds should be examined to better understand the potential impacts of seasonal hard caps. We only have distribution information for tagged STAL in the summer and fall months (Fig.8-15). Fig.8-17 shows the spatial distribution of these tagged birds in Alaska waters. We do not have definitive information about STAL use of the Bering Sea in winter and spring months, so it's harder to anticipate the impacts of seasonal hard caps on STAL.

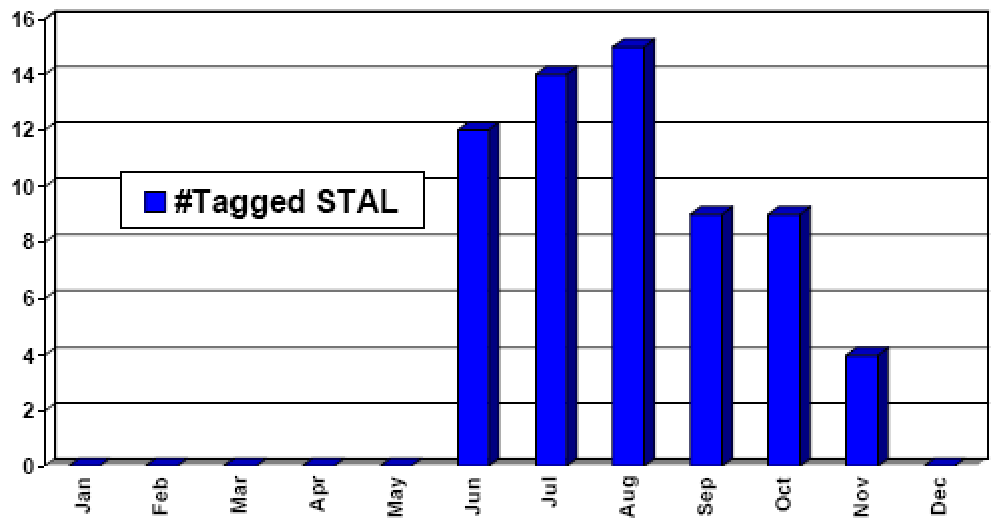

Fig.8-15 Numbers of STAL tagged in 2002-2006 by month

The options for indexed caps, sector allocations and transfers, and cooperative provisions affect the management and distribution of the cap across the sectors and consider certain salmon stocks. These options are not likely to have an effect on pollock fishing in a manner that would change the potential for incidental take of seabirds.

8.2.6.3 Alternative 3 Triggered Closures

Closing an area where interactions between pollock trawl vessels and seabirds are more likely to occur would reduce the potential for incidental takes. Fig.8-16 shows a large overlap between the distributions of red-legged kittiwakes, northern fulmars, short-tailed shearwaters, and laysan albatross with the proposed A season closure. Prohibiting pollock fishing in this area could decrease the potential for interaction with these species in this area, but could also shift pollock trawl effort immediately north where there are similar large concentrations of seabirds. The lower of the three polygons comprising the B season proposed closures is similar in size and shape to the proposed A season closure, so the effects of closing that area are similar.

The northern two polygons of the proposed B season closure warrant additional discussion. The northern-most polygon is just to the east of Pervenets Canyon, where the single largest accumulation of STAL has ever been documented (NMFS 2008), shown in Fig.8-17. If the closure of this polygon shifted pollock trawl effort west or north, potential interactions with STAL and other seabird species could increase in those areas. Fig.8-17 shows several different STAL data sources depicting STAL distribution in this area. Opportunistic sightings, surveys, and satellite tag locations all show heavy STAL use of this area and Piatt et al. (2006) discusses STAL use of Bering Sea canyons and areas of upwelling as STAL hot spots.

The polygon just east of Zhemchug Canyon also includes areas where STAL have been observed and reported taken in hook-and-line fisheries (Fig.8-17). Shifting effort just outside the closure may cause additional interactions outside the closure, while protecting birds inside the closure.

Due to the small number of incidental takes and changing seabird distributions, it is not possible to quantify how spatially shifting the pollock fishery with the trigger closures may impact the potential for incidental takes of seabirds in the Bering Sea.

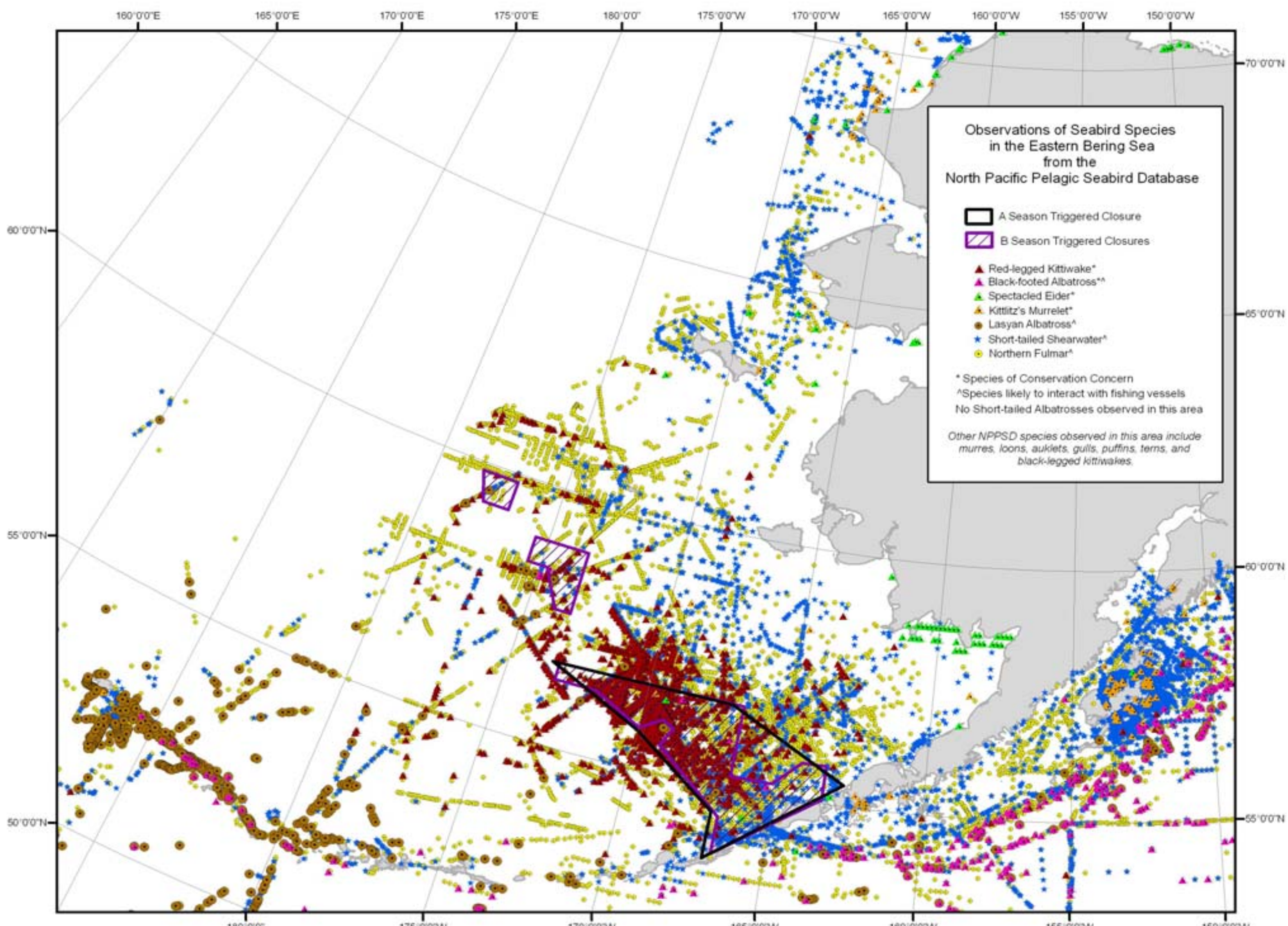

Fig.8-16 Observations of seabird species in the Bering Sea with boundaries of triggered closure areas

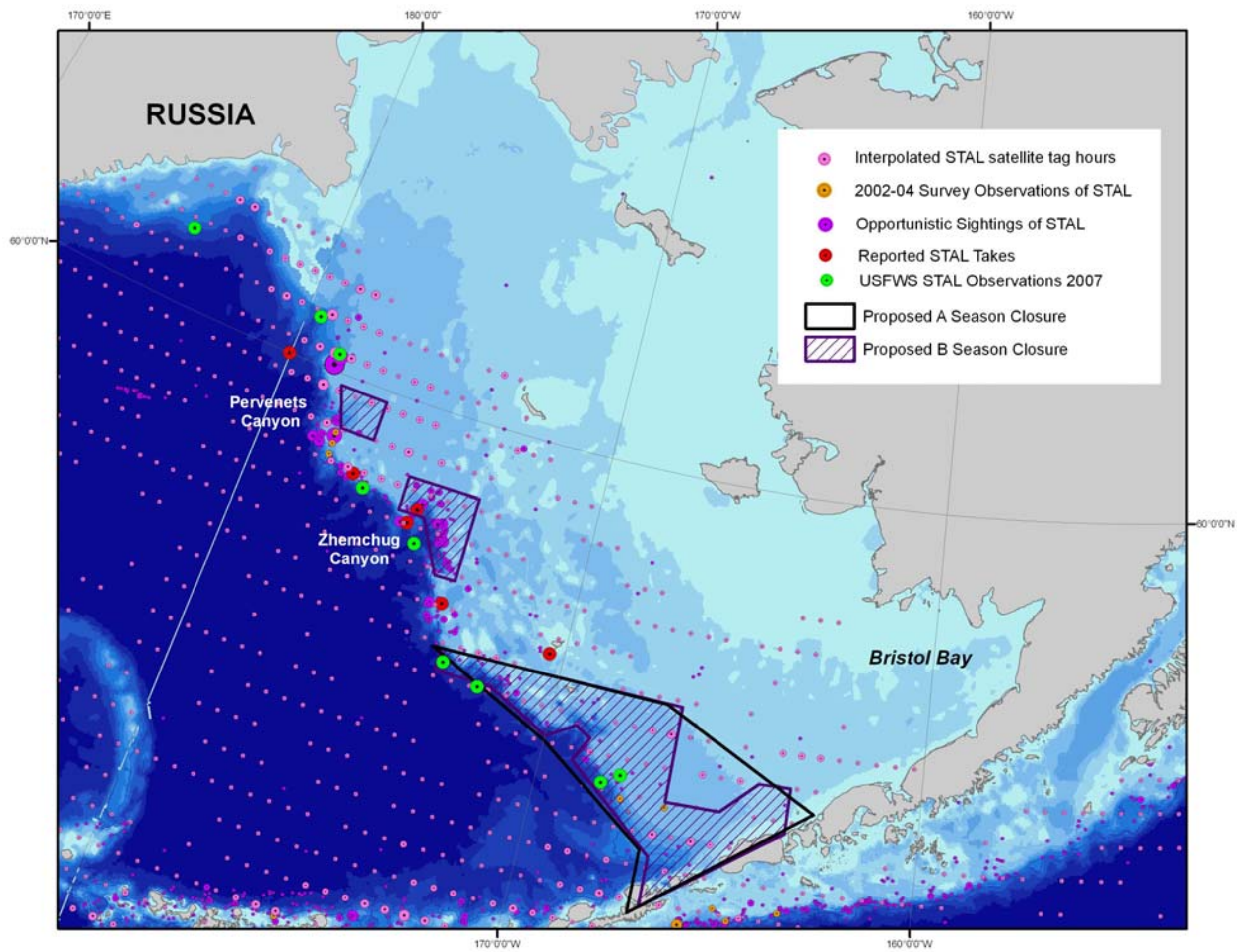

Fig.8-17 Short-tailed albatross takes (NPPSD 2004), satellite tag observations (Suryan 2006a,b), survey data (Melvin et al 2006) and (Kuletz and Labunski unpublished) and Opportunistic Sightings of Short-tailed Albatrosses (Balogh et al 2006) in relation to area closure boundaries. Bigger dots in the same color indicate greater numbers of STAL observed. Comparisons are not valid between colors. Each take (red dot) is reported as a single observation. STAL satellite tags (pink dots) were interpolated and summed over half-degree grid (NMFS 2008).

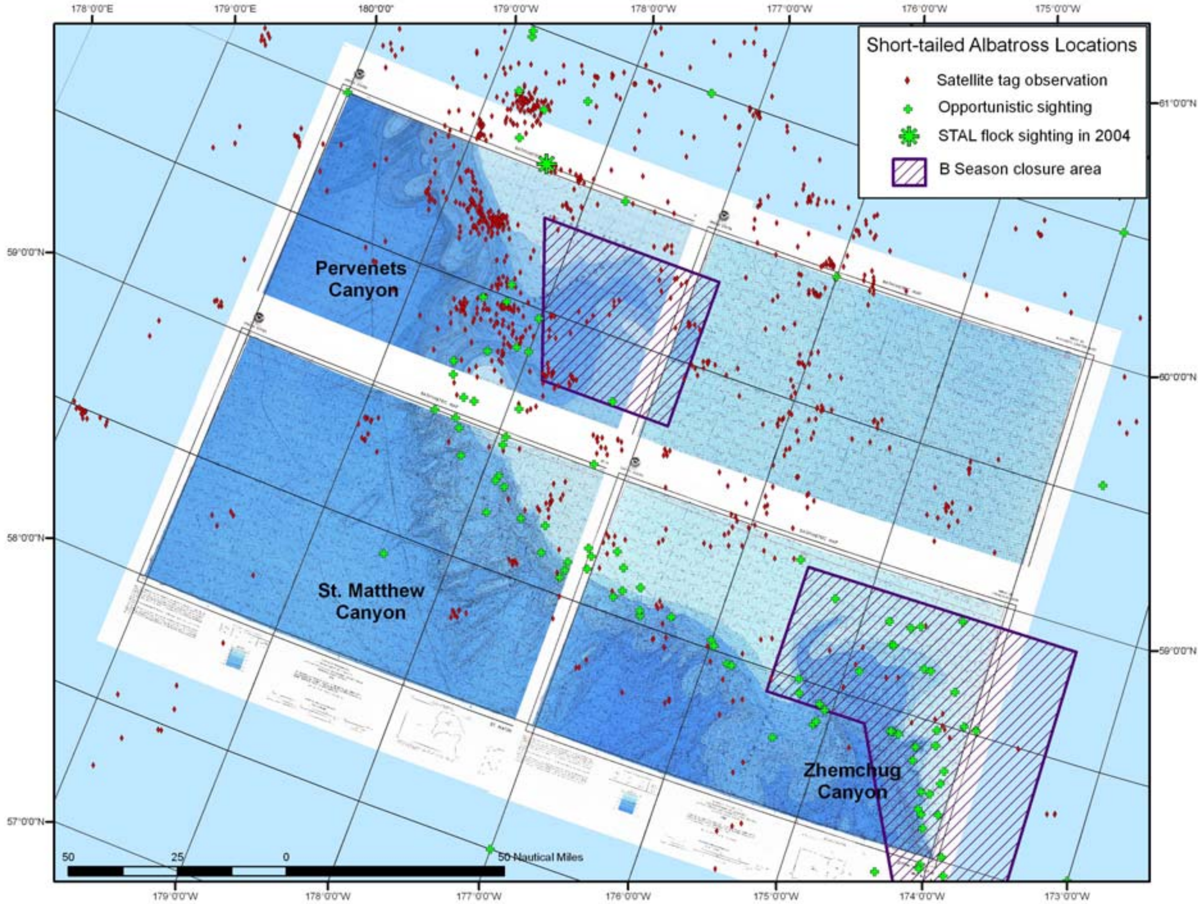

Fig.8-18 STAL locations near Bering Sea Canyons and proposed B season closure areas.

8.2.6.4 Alternative 4: Preliminary Preferred Alternative

This alternative provides for two different annual scenarios with different caps for each scenario. The distinction between the scenarios lies in the presence or absence of a NMFS-approved ICA which provides explicit incentive to avoid salmon in all years. Under the scenario with the approved ICA (PPA1), the overall cap (to be divided seasonally and by sector) would be 68,392. In the absence of an ICA agreement which provides explicit incentive for salmon avoidance (PPA2), a lower cap (47,591) is provided. The prescribed seasonal splits and sector splits (and provisions to divide to the inshore CV cooperative level) are identical and occur under both annual scenarios.

The effects of Alternative 4 on the incidental take of seabirds is very similar to those of Alternative 2 because it is just a variation on the hard caps and seasonal and sector splits. The PPA2 cap may result in less pollock fishing which may result in less potential interaction between fishing vessels and seabirds and fewer incidental takes than the PPA1 with the higher cap and the ICA. However, because seabirds make substantial use of fish resources discarded from fishing vessels in the form of offal, the net effects of less fishing is unclear.

As noted in Table 8-13, pollock and salmon are not major diet components of seabirds species in the Bering Sea. However, seabird species that do not depend on pollock or salmon may be impacted indirectly by effects that the pelagic trawl gear has on the benthic habitat where they are dependent on benthic prey, such as clams, bottom fish, and crab. The EFH EIS provides a description of the effects of pollock fishing on bottom habitat in the Appendix (NMFS 2005), including the effects of the pollock fishery on the Bering Sea slope and shelf. Pollock trawl gear is known to contact the bottom and may impact benthic habitat. The fisheries effects analysis in the EFH EIS determined that the long term effects indices for pollock fishing on sand/mud and slope biostructure in the Bering Sea were much larger than the effects from other fisheries conducted in the Bering Sea, especially on the slope (Table 8.2-10 in NMFS 2005)

Table 8-13 Bering Sea Seabird Prey (USFWS 2006 and Dragoo 2006)

Species	Foraging Habitats	Prey
Red-legged Kittiwake	Surface fish feeder	Myctophids, squid, amphipods, euphausids, minor amounts of pollock and sand lance
Black-footed albatross	Surface fish	Fish eggs, fish, squid, crustaceans
Spectacled Eider	Diving	Mollusks and crustaceans
Kittlitz's Murrelet	Surface dives	Fish, invertebrates, macroplankton
Short-tailed shearwater	Surface dives	Crustaceans, fish, squid
Northern Fulmar	Surface fish feeder	Fish, squid, crustraceans
Murres (thick-billed and common)	Diving fish-feeders offshore	Fish, crustaceans, invertebrates
Cormorants (pelagic and red-faced)	Diving fish-feeders nearshore	Bottom fish, crab, shrimp
Glaucos winged gull	Surface fish feeder	Fish, marine invertebrates, birds

Fig. 8-19 shows the location of 2006-2008 observed targeted pollock harvest in relation to the bathymetry of the Bering Sea. Note that most targeted Pollock trawls occur between 100 and 200 meters depth in the Bering Sea. It is not known how much seabird species use benthic habitat directly in this area, although research funded by the NPRB has been conducted on foraging behavior of seabirds in the Bering Sea in recent years. Thick-billed murres easily dive to 100 meters, and have been documented diving to 200 meters, while Common murres dive to 100m+ also. Since cephalopods and benthic fish comprise some of their diet, it's not unreasonable to think they could be foraging on or near the bottom (pers. com. Kuletz, October 2008).

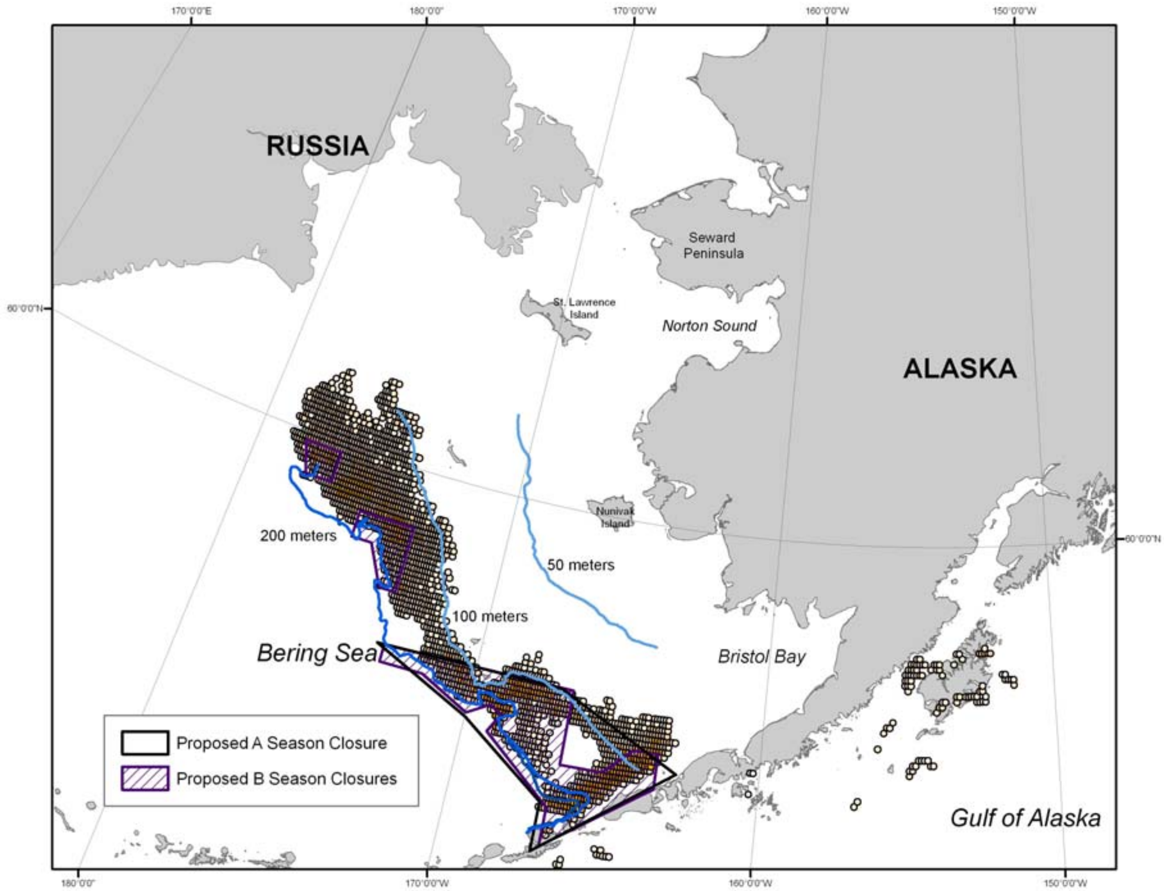

Fig. 8-19 2006-2008 Observed Pollock targeted harvest and Bathymetry of the Bering Sea (data from Steve Lewis, NMFS Alaska Region).

8.2.7 Consideration of Future Actions

8.2.7.1 Other threats to seabird species in Alaska waters

Current and future threats to seabirds other than those analyzed in this document include collisions with aircrafts, plastics ingestion, oil spills and ship bilge dumping, high seas driftnets and gillnet fisheries, and increased flightseeing near glaciers and tour boat traffic (specifically for Kittlitz's murrelets). Table 8-14 lists stressors on seabirds species of concern in Alaska waters.

Table 8-14 Stressors on seabird species of concern in Alaska

Human Activity Stressor	Species affected
Gillnet fisheries	Kittlitz's murrelet, Steller's eider
Oil spills and leaks	Kittlitz's murrelet, red-legged kittiwake, short-tailed albatross
Other hook and line fisheries outside Alaska	black-footed albatross
Tourism/vessel traffic	Kittlitz's murrelet
Feather Hunting	short-tailed albatross, black-footed albatross
Ingestion of Plastics	short-tailed albatross, black-footed albatross, laysan albatross
Collisions with fishing vessels	short-tailed albatross, Steller's eider, spectacled eider
Introduced species	black-footed albatross, red-legged kittiwake
Military eradication programs	black-footed albatross, laysan albatross

8.2.7.2 Recovery of the Short-tailed Albatross

Because the short-tailed albatross population is rapidly increasing at approximately 7% annually (Zador et al. *in review*), the potential for interaction with North Pacific fisheries is also increasing. However, recent modeling of the impact of trawl mortality on the endangered STAL population suggests that even if the current estimated take (two birds in a 5 year period) was increased ten-fold, it would have little impact on the time course of achieving the species' proposed recovery goals, barring significant changes in non-trawl bycatch and a large volcanic eruption at the breeding colony (Zadar et al 2008).

8.2.7.3 Continuation of seabird protection measures in Alaska fisheries

As research continues on seabird and fisheries interactions in Alaska waters, gear modification solutions may arise that mitigate potential interactions between trawl cables and seabirds, particularly with short-tailed albatrosses, if the research suggests further mitigation is necessary. In the hook-and-line groundfish and halibut fisheries in Alaska, fishing vessels are required to use seabird avoidance gear in areas where interactions with seabirds are likely to occur. The use of this avoidance gear has likely contributed to a drastic decline in seabird bycatch in hook-and-line fisheries since 2001 (NMFS 2007). These protection measures help to minimize the total effect of Alaska fisheries on seabird populations in Alaska waters. Also, Dietrich et al. 2008 discuss the benefits of using integrated weight lines in further reducing seabird interactions.

8.2.7.4 Actions by other Federal, State, and International Agencies

Currently ADF&G mirrors federal regulations for the use of seabird avoidance measures in state waters. This affords seabird populations in these waters increased protection from interaction with hook-and-line and trawl vessels under state management.

8.2.8 Conclusions

Many seabird species utilize the marine habitat of the Bering Sea. Several species of conservation concern and many other species could potentially interact with trawl cables. The AFSC estimates of takes are small relative to seabird population total estimates, however, those estimates do not include cable-related trawl mortalities. Recent modeling suggests that even if there were to be a large increase in trawl cable incidental takes of short-tailed albatross (the only seabird listed as endangered under the ESA), it would have negligible effects on the recovery of the species. The impacts to seabirds from each of the action alternatives are summarized below in Table 8-15.

Table 8-15 Summary of impacts to seabirds from alternatives in this analysis

Alternative	Component	Impact on Seabird populations in Alaska waters
Alternative 1	Status quo	Seabird takes are at low levels and are mitigated (to some degree) by current spatial restrictions on the pollock trawl fishery in the Bering Sea.
Alternative 2	Hard Cap	Lower caps could decrease potential seabird/fisheries interactions. Higher caps could increase potential seabird/fisheries interactions.
	Seasonal distribution of hard caps	Not enough is known about seasonal seabird distributions and their spatial overlap with seasonal pollock trawl effort to make evaluate statements about seasonal hard caps. More research is needed.
	Other options and components	Other components of this alternative should not affect the amount of impacts to seabird populations.
Alternative 3	Triggered closures	Closing the proposed A and B season closures in the Bering Sea could provide additional protection to seabirds in some locations but could also push pollock trawl effort into areas of higher potential interactions for some species.
Alternative 4	Variable caps with the ICA	Caps would decrease potential for interactions from Alternative 1. Other components of this alternative should not alter the impacts to seabird populations.

8.3 Essential Fish Habitat

This section addresses the mandatory requirements for an essential fish habitat (EFH) assessment enumerated in the final rule (67 FR 2343, January 17, 2002) implementing the EFH provisions of the Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). Importantly, an EFH assessment is required for any federal action that may adversely affect EFH. The mandatory requirements for an EFH assessment are:

- a description of the action;
- an analysis of the potential adverse effects of the action on EFH and the managed species;
- the Federal agency's conclusions regarding the effects of the action on EFH; and
- proposed mitigation, if applicable.

An EFH assessment may incorporate by reference other relevant environmental assessment documents, such as a Biological Assessment, a NEPA document, or another EFH assessment prepared for a similar action.

The Magnuson-Stevens Act defines EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." For the purpose of interpreting the definition of EFH, the EFH regulations at 50 CFR 600.10 specify that "waters" include aquatic areas that are used by fish and their associated physical, chemical, and biological properties, and may include areas historically used by fish where appropriate; "substrate" includes sediments, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' entire life cycle.

The criterion for analyzing effects on habitat is derived from the requirement at 50 CFR 600.815(a)(2)(ii) that NMFS must determine whether fishing adversely affects EFH in a manner that is "more than minimal and not temporary in nature." This standard determines whether actions are required to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable.

The final rule for EFH (67 FR 2343; January 17, 2002) does not define minimal and temporary, although the preamble to the rule states, "Temporary impacts are those that are limited in duration and that allow the particular environment to recover without measurable impact. Minimal impacts are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions" (67 FR 2354).

In 2005, NMFS and the Council completed the EIS for EFH Identification and Conservation in Alaska (EFH EIS; NMFS 2005). The EFH EIS provided a thorough analysis of alternatives and environmental consequences for amending the Council's FMPs to include EFH information pursuant to Section 303(a)(7) of the Magnuson-Stevens Act and 50 CFR 600.815(a). Specifically, the EFH EIS examined three actions: (1) describing and identifying EFH for Council managed fisheries, (2) adopting an approach to identify HAPC within EFH, and (3) minimizing to the extent practicable the adverse effects of Council-managed fishing on EFH. The EFH EIS evaluates the long term effects of fishing on benthic habitat features, as well as the likely consequences of those habitat changes for each managed stock based on the best available scientific information.

In this analysis, the effects of fishing on EFH are analyzed for alternative salmon bycatch reduction measures, using the best available scientific information. Analysis included the review of the EFH Descriptions (EFH EIS Appendix D.3), the effects of fishing analysis (EFH EIS Appendix B.2), and associated Habitat Assessment Reports (EFH EIS Appendix F) to conclude whether or not an adverse effect on EFH will occur. A complete evaluation of effects would require detailed information on the distribution and abundance of habitat types, the life history of living habitat, habitat recovery rates, and natural disturbance regimes. Although more habitat data become available from various research projects each fishing year, much is still unknown about EFH in the EEZ off Alaska.

Chapter 4 discusses the effects of this action on pollock through a range of alternatives, including the preferred alternative. Chapter 5 discusses the effects of the action on Chinook salmon through a range of alternatives, including the preferred alternative. Chapter 6 discusses the effects of the alternatives on chum salmon. The following text, including references to Chapters 4, 5, and 6, discusses the potential effects to EFH and incorporates existing, recent, and precautionary measures that lessen the effects to EFH. Specific effects on EFH for alternatives, and the magnitude of the differences between them, are hard to predict with existing data.

8.3.1 Description of the Action

The actions considered in this EFH assessment are the EIS alternatives described in detail in Chapter 2. The important components of these alternatives for the EFH assessment are the gear used, the fishing effort, and the location of the fishery. This information for the pollock fishery is presented in the EFH EIS, and is incorporated here by reference. Appendix B of the EFH EIS contains an evaluation of the potential adverse effects of fishing activities on EFH, including the effects of pelagic trawl gear. Summaries and assessments of habitat information for all federally managed species in the BSAI are provided in Appendix F of the EFH EIS. The EFH EIS describes an overall fishery impact for each fishery based on the relative impacts of the gear used (which is related to physical and ecological effects), the type of habitat fished (which is related to recovery time), and the proportion of that bottom type utilized by the fishery. Under the alternative salmon bycatch reduction measures, pollock fishing effort may change and the location of the fisheries may change to avoid salmon bycatch or because specified areas may be closed to pollock fishing. However, the fishing seasons and the gear used in the fisheries are not likely to change under the alternatives. Changes to the prosecution of the pollock fishery are described in Chapter 4.

8.3.2 Impacts on EFH

Fishing operations change the abundance or availability of certain habitat features (e.g., prey availability or the presence of living or non-living habitat structure) used by managed fish species to spawn, breed, feed, and grow to maturity. These changes can reduce or alter the abundance, distribution, or productivity of that species, which in turn can affect the species' ability to support a sustainable fishery and the managed species' contribution to a healthy ecosystem (50 CFR 600.10). The outcome of this chain of effects depends on characteristics of the fishing activities, the habitat, fish use of the habitat, and fish population dynamics. The duration and degree of fishing's effects on habitat features depend on the intensity of fishing, the distribution of fishing with different gears across habitats, and the sensitivity and recovery rates of habitat features.

The Bering Sea pollock fishery harvests pollock with pelagic trawl gear in pelagic habitat. Pelagic habitat is identified as EFH for marine juvenile and maturing salmon. Amendments 7 and 8 defined salmon EFH in the FMP for the Salmon Fisheries in the EEZ off the Coast of Alaska. The EFH EIS, in Section 3.2.1.5 and Appendix F, provides habitat descriptions for the five salmon species managed under the FMP. Briefly, marine salmon stocks school in pelagic waters and utilize ocean conditions to grow and mature before returning to nearshore and freshwater adult spawning areas. Salmon are known to associate with ocean ledges and features, such as ridges and seamounts. Salmon utilize these features because the features attract and concentrate prey.

Appendix B to the EFH EIS describes how pelagic trawl gear impacts pelagic habitat (NMFS 2005). The EFH EIS concluded that pelagic effects from fisheries are minimal because no information was found indicating significant effects of fishing on features of pelagic waters serving a habitat function for managed species. The Bering Sea pollock fishery only interacts with salmon habitat in the ocean, and the concerns about these interactions center on effects on bycatch of prey and prey availability. Salmon prey (copepods, squid, herring, and other forage fish) are subject to only a few targeted fisheries outside of the EEZ, such as the State of Alaska herring fisheries and international squid fishery. However, the pollock fishery does catch salmon prey species, including squid, capelin, eulachon, and herring. Currently, the catch of these prey species is very small relative to overall population size of these species, thus fishing activities are considered to have minimal and temporary effects on prey availability for salmon. Chapter 7 provides more information on the impacts of the Bering Sea pollock fishery on these prey species.

Appendix B to the EFH EIS also describes how pelagic trawl gear impacts benthic species and habitat (NMFS 2005). The EFH EIS notes that "pelagic trawls may be fished in contact with the seafloor, and there are times and places where there may be strong incentives to do so, for example, the EBS shelf during the summer" (NMFS 2005). Trawl performance standards for the directed pollock fishery at 50 CFR 679.7(a)(14) reduce the likelihood of pelagic trawl gear use on the bottom. However, concern exists about the contact of pelagic trawl gear on the bottom and the current standards used to limit bottom contact (from June 2006 minutes of the SSC and AP, available at: http://www.fakr.noaa.gov/npfmc/minutes/minutes.htm). Flatfish and crab bycatch in the pollock fishery also shows that pelagic gear contacts the bottom. The description of impacts by pelagic trawl gear on habitat in this document is based on the best available science, but may be considered controversial with some believing the impact may be more than described.

The results of the EFH EIS analysis of the effects of fishing on benthic habitat features determined the long-term effect index (LEI) to represent the proportion of feature abundances (relative to an unfished state) that would be lost if recent fishing patterns were continued indefinitely. The LEI was 10.9% for the biological structure of sand/mud and slope habitats of the eastern Bering Sea where fishing effort is concentrated, and recovery rates are moderately low. The analysis also calculated the proportion of each LEI attributable to each fishery. The pollock pelagic trawl fishery was the largest single component (4.6%) of the total effects on living structure in the eastern Bering Sea sand/mud habitat. The combined effects of the bottom trawl fisheries made up all of the remaining 6.3%. Nearly all (7.2%) of the LEI for living structure on the eastern Bering Sea slope was due to the pollock pelagic fishery. Based on this analysis, the EFH EIS determined that the fishing effects are not limited in duration and therefore not temporary. However, the EFH EIS considered LEIs of less than 11% as small.

The EFH EIS also evaluated the effects on managed species to determine whether stock condition indicates that the fisheries affect EFH in a way that is more than minimal. To conduct this evaluation, the analysts first reviewed the LEI from the fishing effects model to assess overlap with the distribution of each stock. The analysts then focused on habitat impacts relative to the three life-history processes of spawning/breeding, feeding, and growth to maturity. Finally, the analysts assessed whether available information on the stock status and trends indicated any potential influence of habitat disturbance due to fishing. Based on the available information, the EFH EIS analysis found no indication that continued fishing at the current rate and intensity would affect the capacity of EFH to support life history processes of any species. In other words, the effects of fishing of EFH would not be more than minimal.

Due to the nature of this action, the Bering Sea pollock fishery as modified by the proposed action is not predicted to have additional impacts beyond those identified in the EFH EIS. Based on the analysis presented in the EFH EIS and summarized above, NMFS concludes that Alternative 1 would impact EFH for managed species, but that the available information does not identify effects of fishing that are more than minimal. In other words, effects may occur but they would not exceed the minimal and temporary limits established by 50 CFR 600.815(a)(2).

The Alternative 2 and Alternative 4 PPA1 and PPA2 caps would, to the extent that they prevent the pollock fleet from harvesting the pollock TAC and therefore reduce pollock fishing effort, reduce the pollock fisheries impacts on EFH from status quo. Chapter 10 provides a discussion of the ability of the pollock fleet to harvest the TAC under Alternative 2 and 4. It is not possible to predict how much less fishing effort would occur in years when a given cap level was constraining because the fleet will have strong incentives to reduce bycatch through other means, such as gear modifications and avoiding areas with high salmon catch rates, to avoid reaching the hard cap and closing the fishery. Additionally, under PPA1, a portion of the fleet would operate under an ICA with incentives to avoid bycatch. And, depending on the extent vessels move to avoid salmon bycatch or as pollock catch rates decrease, pollock trawling effort may increase even if the fishery is eventually closed due to a hard cap.

The Alternative 3 trigger closures would close identified areas when a specific cap level is reached. The area closure would reduce the pollock fisheries impacts to EFH in the closed area, but it would increase the fishing effort and therefore the impacts in the adjoining areas. However, many areas identified as having vulnerable or sensitive habitat features, such as canyons, hard corals, and skate nursery areas would be contained in the closure area. Since the total amount of pollock harvested and the total effort would not change under Alternative 3, it is reasonable to conclude that the overall impacts on EFH would be similar to Alternative 1. As with Alternative 2, fishing effort may increase as vessels move to avoid salmon bycatch or as pollock catch rates decrease.

8.3.3 Mitigation

Currently, pelagic trawl gear is subject to a number of area closures to protect habitat and marine species: the Steller Sea lion closure areas, the Nearshore Bristol Bay closure, the Pribilof Islands Habitat Conservation Zone. If new information emerges to indicate that the Bering Sea pollock trawl fishery is having more than a minimal impact on EFH, the Council may consider additional habitat conservation measures.

8.3.4 Consideration of Future Actions

The following reasonably foreseeable future actions may have a continuing, additive and meaningful relationship to the effects of the alternatives on EFH. These actions are described in Chapter 3.

8.3.4.1 Ecosystem-sensitive management

Habitat is one component of the ecosystem in which the pollock fishery is prosecuted. If the implementation of an ecosystem approach to management results in reduced or modified fishing, the impacts of the proposed action will likely be reduced. Future fisheries management measures will be developed that consider the entire ecosystem, including habitat. Ongoing habitat research will increase our understanding of the spatial distribution of different habitats, the importance of different habitats to different life stages of fish species, the impact of different types of fishing gear on different types of living and nonliving habitat, and the recovery rates for different types of habitat. Ongoing research is summarized in the Ecosystems Considerations chapter of the SAFE report (Boldt 2007).

8.3.4.2 Traditional management tools

Since portions of habitat are impacted each year by fishing activities and since some of those habitats may require exceptionally long periods to recover from fishing impacts (i.e., slow growing, long lived corals; NMFS 2005, NMFS 2008), the current pollock fishery, in combination with future pollock fisheries, may have lasting effects on habitat. As the slow-growing, long-lived components of the habitat are impacted by cumulative years of fishing, there is likely to be cumulative mortality and damage to living habitat and changes to the benthic community structure. Species that are able to recover faster from fishing impacts may displace the longer-lived, slower-growing species, changing the structure and diversity of the benthic community. Improved monitoring and enforcement would improve the effectiveness of existing and future EFH conservation measures by ensuring the fleet complies with the protection measures, and thus, reduces the impacts of the future harvest specifications.

The EFH EIS noted that "…habitat loss due to fishing off Alaska is relatively small overall, with most of the available habitats unaffected by fishing…[b]ased on the best available scientific information, the EIS analysis concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because the analysis finds no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term" (NMFS 2005). Since past fishing activity has not resulted in impacts that are more than minimal, and future fishing activity is expected to be constrained by reasonably foreseeable future actions, the future effects of a continued fishery on EFH are predicted to continue to be minimal.

8.3.4.3 Other Federal, State, and international agency actions

The Minerals Management Service (MMS) consults with NMFS regarding leasing, exploration, and development activities and any effects on EFH. MMS prepares environmental assessments for upcoming sales in their Outer Continental Shelf Leasing Program. MMS assessed the cumulative effects of such activities on fisheries and finds only small incremental increases in effects of development are unlikely to significantly impact fisheries and EFH (Minerals Management Service 2003). Most recently, MMS has re-opened discussion to lease within the North Aleutian Basin (NAB, also known as Bristol Bay), as the moratorium to lease in this area was removed. Federally managed fisheries, including pollock, Pacific cod, crab, and scallop, are within this lease area. In fact, the overlap of the lease area is directly atop several of the nation's richest and robust commercial fisheries. Further, EFH has been described for over

40 species of federally managed fish with the NAB lease area. (NAB Energy-Fisheries Workshop at http://seagrant.uaf.edu/conferences/2008/energy-fisheries/info.html; MMS OCS 2007-066 Literature and Information Related to the Natural Resources of the NAB of Alaska.)

8.3.4.4 Private actions

Other factors that may impact marine benthic habitat include ongoing non-fishing commercial, recreational, and military vessel traffic in Alaskan waters and population growth. Appendix G of the EFH EIS identifies 24 categories of upland, riverine, estuarine, and coastal/marine activities that may have adverse effects on EFH (NMFS 2005). Little is known about the impacts of the listed activities on EFH in the Bering Sea. However, Alaska's coasts are currently relatively undeveloped, as compared to coastal regions elsewhere. Despite the likelihood of localized impacts, the overall impact of these activities on EFH during the period under consideration is expected to be insignificant.

8.3.5 Conclusions

All alternatives would have impacts on EFH similar to those found in the EFH EIS. NMFS concludes that all of the alternatives would affect EFH for managed species. However, best available information does not identify any effects of fishing as significantly adverse. In other words, effects may occur from fishing, however these effects do not exceed the minimal and temporary limits established by 50 CFR 600.815(a)(2). Alternative 2 and Alternative 4, to the extent that the cap level would close the pollock fishery before the TAC is harvested, could have less of an impact on EFH. Alternative 3 may have less of an impact because it would close, if a trigger cap was reached, areas that include important habitat. If information indicates that the Bering Sea pollock trawl fishery is having an increased impact on EFH as a result of salmon bycatch reduction measures, then the Council could consider habitat conservation measures for pelagic trawl gear.

The continuing fishing activity in the years 2008 to 2015 is potentially the most important source of additional annual adverse impacts on marine benthic habitat in the action area. The size of these impacts would depend on the size of the fisheries, the protection measures in place, and the recovery rates of the benthic habitat. However, a number of factors will tend to reduce the impacts of fishing activity on benthic habitat in the future. These include the trend towards ecosystems management. Ecosystem-sensitive management will increase understanding of habitat and the impacts of fisheries on them, protection of EFH and HAPC, and institutionalization of ecosystems considerations into fisheries governance. With diligent oversight, the effects of actions of other federal, state, and international agencies and private parties are likely to be less important when compared to the direct interaction of commercial fishing gear with the benthic habitat.

8.4 Ecosystem Relationships

The action area for Bering Sea salmon bycatch management is subject to periodic climatic and ecological "regime shifts." These shifts change the values of key parameters of ecosystem relationships, and can lead to changes in the relative success of different species.

Regime shifts are natural phenomena that have important implications for future human actions in the Bering Sea. The following discussion of these phenomena has been summarized from the Ecosystem Considerations chapters of the 2005 SAFE report and the 2007 SAFE report (NPFMC 2005 and 2007).

Predicting regime shifts will be difficult until the mechanisms that cause the shifts are better understood. It will require better understanding of the probability of certain climate states in the near-term and longer term, and the effects of this variability on individual species' production, distribution, and food webs. Future ecosystem assessments may integrate various climate scenarios into the multispecies and ecosystem forecasting models by using assumptions about the effects of climate on average recruitment of target species.

8.4.1 North Pacific

In the past three decades the North Pacific climate system experienced one major and two minor regime shifts. A major transformation, or regime shift, occurred in atmospheric and oceanic conditions around 1977, part of the Pacific Decadal Oscillation, which represents the leading mode of North Pacific sea surface temperature variability and is related to the strength of the Aleutian low. During the period 1989-1997, atmospheric pressure tended to be above normal in the high latitudes and below normal in the mid-latitudes, which translated to a relative cooling in the Bering Sea. Since 1998, the sea surface temperature in the eastern Bering Sea became anomalously warm, whereas colder-than-normal conditions were established along the U.S. West Coast. During the winter of 2003, temperatures were above the 1971-2000 average in the Bering Sea and near the average in the Gulf of Alaska and the U.S. West Coast. El Niños were present in both the winters of 2003-2004 and 2004-2005. The increase in sea surface temperature along the coast of South America which is associated with El Niños, was brief, and conditions returned to neutral in July.

It has been shown that the North Pacific atmosphere-ocean system included anomalies during the winter of 2004-05 that were unlike those associated with the primary modes of past variability. This result suggests a combination of two factors: (1) that the nature of North Pacific is actually richer in variability than appreciated previously, and (2) that there is the potential for significant evolution in the patterns of variability due to both random, stochastic effects and systematic trends such as global warming.

The Pacific Decadal Oscillation transitioned from moderately positive in early 2006 to moderately negative in the summer/early fall of 2006 and has slowly increased to weakly positive values during the summer of 2007. When the Pacific Decadal Oscillation is positive sea surface temperature anomalies tend to be positive along the North American coast, extending to the south-eastern Bering Sea. There were weak-moderate El Nino conditions near the end of 2006. Neutral conditions returned by early spring 2007. A cooling trend resumed in summer 2007 and it now appears a weak La Nina formed in the fall/winter of 2007-08.

8.4.2 Bering Sea

The major shift in the Bering Sea occurred after 1977, when conditions changed from a predominantly cold Arctic climate to a warmer subarctic maritime climate. The very warm winters of the late 1970s and 1980s were followed by cooler winters in the 1990s. Since 1998, the Bering Sea region has had milder winters. The anomalously warm winter of 2005 followed similarly warm winters of 2003 and 2004. This warming is comparable to major warm episodes in the late 1930s and late 1970s – early 1980s. The spring transition is occurring earlier, and the number of days with ice cover after March 15 has a significant downward trend. In 2005, the ice cover index reached the record low value. The lack of ice cover over the southeastern shelf during recent winters resulted in significantly higher heat content in the water column. Sea surface temperature in May 2005 was above its long-term average value, which means that the summer bottom temperatures also will likely be above average.

In 2007, the Bering Sea experienced a relatively cold winter and spring with pronounced warming in late spring resulting in above normal upper ocean temperatures by mid-summer. This and the presence of a substantial cold pool resulted in strong thermal stratification on the Bering Sea shelf. The amount of ice and the extent of the cold pool can affect production and distribution of marine organisms. Unlike the northern Bering Sea and Arctic Ocean hot spots, the rate of warming in the southern Bering Sea is slowing down, suggesting a large natural variability component to recent extremes in addition to a background anthropogenic contribution toward warmer temperatures.

8.4.3 Bering Sea warming and loss of sea ice

Since 1921, there have been three multidecadal regimes in surface air temperatures in the North Pacific: 1921-1939 (warm), 1940-1976 (cold), and 1977-2005 (warm; Rodionov et al. 2005). Depth-integrated temperatures in the southeast Bering Sea indicate that there was a shift to even warmer conditions in the Bering Sea that began in the spring of 2000 (Rodionov et al. 2005). It is worth noting that the two previous regimes had a similar pattern, when surface air temperature anomalies were strongest at the end of the regime, right before the system switched to a new one. In the current warm regime, the magnitude of surface air temperature fluctuations has been steadily increasing since the mid-1980s, and the Bering Sea may become even warmer before it will switch to a new cold regime. If the regime concept is true, this switch may happen soon, especially given the uncertain state of the North Pacific climate, suggesting that it may be in a transition phase. During the last three decades there has been a marked decrease in ice extent, duration and concentration over the southeastern Bering Sea (Stabeno et al. 2006).

Stabeno et al. (2006) state that the decrease in sea ice directly impacts water column temperature and salinity. The average temperature in the southeast Bering Sea has increased by ~3°C over the last decade, with warmer temperatures in both winter and summer. Ocean temperatures have profound influences on the distribution of many species in the eastern Bering Sea, as well as the timing of the spring transition, which is occurring earlier (Rodionov et al. 2005). Stabeno et al. (2006) also state that the sea ice over the shelf also determines the timing and nature of the spring phytoplankton bloom. Recent observations also indicate a disappearance in the southeast Bering Sea of cold water invertebrate species which were previously common (e.g. *Calanus marshallae*; *Themisto libulella*, *Chionoecetes opilio*). Populations of smaller copepods, such as Pseudocalanus spp., are much more numerous and may be much more productive in the warmer years. The direction of climate change affects different components of the ecosystem in different ways and will affect the transfer of energy through the food web.

The distributions of adult and juvenile fish respond to water temperatures. For example, the distribution of species such as Arctic cod that prefer cold temperatures may be retreating to the northern portion of the Bering Sea. On the other hand, Walleye pollock (*Theragra chalcogramma*) tend to avoid water below 2°C (e.g. Wyllie-Echeverria 1995, Overland and Stabeno 2004), and the disappearance of the summer cold pool over the shelf may result in the distribution of pollock extending further north. Spencer (2005) has shown rock sole and flathead sole are distributed further north or northwest in warm years relative to cold years.

The Bering Sea Interagency Working Group (2006) states "Changes in the finfish and shellfish communities have occurred since the 1980s, but these have included both increases and decreases in overall abundance and changes in species composition. Walleye pollock and Pacific cod abundances have fluctuated but remain at high levels. Flatfish, as an assemblage, are at high levels, but individual species have changed their relative importance (e.g., Greenland turbot has decreased in importance and arrowtooth flounder has increased). Recruitment of sockeye salmon stocks has been strong with the exception of the Kvichak run; some runs of Chinook and chum salmon have shown reduced recruitment in the Yukon and Kuskokwim Rivers (Kruse 1998). …Snow crab, the dominant species, has been decreasing, and there is evidence that populations may be retreating to the north with the cold bottom water (Orensanz et al. 2004)."

"…there is much concern about ice-dependent seals (i.e., ring, spotted, bearded, and ribbon) that require ice for different parts of their life history (molting and pupping). There is also concern that the retreating ice is transporting some benthic-feeding, ice-dependent seals and walrus away from suitable feeding grounds (e.g., shallow, productive benthic habitats)."

In spring 2007, Bering Sea sea ice lasted for almost two months just to the north of the Pribilof Islands, contrasting with previous years since 2000. The presence of sea ice together with below normal ocean temperatures likely resulted in the first ice edge primary production bloom since 1999. Additionally, there was a record low total area of sea ice in the Arctic in the summer of 2007. The implications of this trend for the North Pacific are likely to include a tendency for a shorter season during which intense cold-air outbreaks of Arctic origin can occur.

8.4.4 Ocean Acidification

The increase in carbon and a decrease in pH in the surface waters of a large section of the northeast Pacific Ocean is direct evidence of ocean acidification (Kleypas et al. 2006). This increase in acidification is attributed to anthropogenic sources (i.e., burning of fossil fuels). Increased acidification affects the calcification process utilized by calcium-secreting organisms, such as corals and zooplankton (Kleypas et al. 2006). Skeletal growth rates of these types of organisms are reduced by the increase in acidification, increased dissolution of carbonate and decreased $CaCO_3$ saturation state; however, the combined effect of acidification, lights, nutrients, and temperature are unknown (Kleypas et al. 2006).

Acidification could have implications, as yet unknown, for the food web of the northeast Pacific Ocean. Kleypas et al. (2006) outline one hypothesized ecosystem response to increased acidification: as the CO_2/carbonate chemistry of seawater changes, then calcifying species may undergo shifts in their latitudinal distributions and vertical depth ranges. Kleypas et al. (2006) points out that the potential impacts of increased CO_2 on planktonic ecosystem structure and functions are unknown because we do not known (1) whether planktonic calcifiers require calcification to survive, (2) the capacity for planktonic organisms to adapt to lower saturation states (or reduced calcification rates), and (3) the long-term impacts of elevated CO_2 on reproduction, growth, and survivorship of planktonic calcifying organisms. However, marine plankton is a vital food source for many marine species and their decline could have serious consequences for the marine food web.

However, a more acidic ocean might not be harmful to all organisms that produce calcium carbonate. Recent research indicates that increased carbon dioxide in the Earth's atmosphere is causing microscopic ocean plants to produce greater amounts of calcium carbonate (chalk) and that calcification by phytoplankton could double by the end of this century (Iglesias-Rodriguez et al. 2008). This is important because the majority of ocean calcification is carried out by coccolithophores. The Bering Sea experienced coccolithophore blooms in 1997 and 1998. Coccolithophore blooms occur when light intensity is high and nutrient levels are low and are evidence that the normal nutrient pump is not working. Coccolitophore blooms are not thought to directly harm salmon, however, they may be indicators that the conditions that support healthy Chinook salmon runs are not present. More information on the relationship between coccolitophores and salmon is presented in Kruse 1998.

Research is ongoing to better understand ocean acidification and the potential effects on fisheries from the changing chemical properties of the ocean. NOAA laboratories contribute to several international; and national research program that study ocean acidification. More information about ocean acidification is available on NOAA's Ocean Acidification website at http://www.pmel.noaa.gov/co2/OA/. Additionally, Section 701 of the MSRA requires that the Secretary of Commerce request the National Research Council study of the acidification of the oceans and how this process affects the United States, but no funding is available at this time to support this research (Regina Spallone, NMFS Headquarters, pers. comm. 3/14/08).

8.4.5 Recent ecosystem trends

The following is a summary of recent trends from the 2007 SAFE report Ecosystem Considerations chapter that are relevant to the Bering Sea and this proposed action.

8.4.5.1 Fishing Effects on Ecosystems

- No significant adverse impacts of fishing on the ecosystem relating to predator/prey interactions, energy flow/removal, or diversity were noted, either in observed trends or ecosystem-level modeling results
- No BSAI groundfish stock or stock complex is overfished and no BSAI groundfish stock or stock complex is being subjected to overfishing. Two crab stocks are overfished.
- Chinook salmon bycatch increased in recent years and for all of Alaska was essentially unchanged in 2006 compared to 2005, but it increased by about 18% in the BSAI where, in 2006 for the first time ever, the Chinook SSA was closed to fishing during the pollock ‘A’ season. The closure resulted in a large economic impact on the pollock fishery during the winter roe season.
- The “other salmon” bycatch (primarily chum) has also increased dramatically in 2003-2005 and decreased by about 54% in 2006. The increases in 2003 and 2005 and the decrease in 2006 are in line with changes in salmon abundance.
- Non-target catch of Habitat Areas of Particular Concern biota and non-specified biota has decreased and non-target forage fish catch has increased in the BSAI.
- Analysis of the trends in the size of eastern Bering Sea fishes indicates there has not been a systematic decline in the amount of large fish from 1982 to 2006.

8.4.5.2 Ecosystem Trends

- Demersal groundfish species in the BSAI had above-average recruitments from the mid- or late 1970s to the late 1980s, followed by below-average recruitments during most of the 1990s. There is an indication for above-average recruitment from 1994-2000 (with the exception of 1996). In the Gulf of Alaska, recruitment has been below average across stocks since 2001.
- Annual groundfish surplus production in the eastern Bering Sea decreased between 1978 and 2005. Declines in production may be a density-dependent response to observed increases in biomass and aging populations of groundfish.
- There was a larger than expected return of age-4 and age-5 Togiak herring in the 2006 fishery, suggesting a strong recruitment event in the future.
- Jellyfish catch-per-unit-effort in the Bering Sea survey continues to be low.
- Eulachon catch per unit effort sampled in the NMFS bottom trawl survey was the highest of the last 4 years in the eastern Bering Sea.
- The overall trend for the western stock of Steller sea lions in Alaska through 2007 is either stable or declining slightly.
- Pribilof Islands northern fur seal pup production continued to decrease in 2006; whereas, Bogoslof Island pup production increased (1995-2007). Neither trend is due solely to migration between islands.
- Trends in harbor seal populations are mixed, but overall populations are lower than they were in the 1970s and 1980s. Harbor seal populations in the Bering Sea and Aleutian Islands have decreased from the late 1970s to the 1990s.

- Reliable estimates for the current minimum population size, abundance, and trend of the Alaska stocks of bearded, ribbon, ringed or spotted seals are unavailable.

8.4.6 Impacts on Ecosystem Relationships

The impacts of the groundfish fisheries on ecosystem relationships were analyzed in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007). That EIS examines the impacts of the fisheries, as currently managed, on predator-prey relationships, energy flow and removal, and diversity. Predator-prey relationships were evaluated with respect to four indicators: (1) pelagic forage availability, (2) spatial and temporal concentration of fishery impact on forage, (3) removal of top level predators, and (4) introduction of non-native species (see Section 8.4.7). The EIS concluded that, overall, there appears to be little indication of fishing down the trophic level. The primary impact to pelagic forage availability is the predicted decline of pollock in the near-term which reduces their availability as forage sources. Biomass is likely to increase subsequently. There appear to be few other issues with forage species. The impacts on the movement of energy through the ecosystem were evaluated with respect to two indicators: (1) removal of energy from the system through fishing operations, and (2) the redirection of energy flow into new pathways by fishing operations. The EIS concluded that biomass removals are believed to be small with respect to total system biomass. Diversity was evaluated with respect to (1) species diversity, (2) functional diversity (or the diversity of components playing different roles in the ecosystem) and (3) genetic diversity. The EIS concluded that measures of species richness and diversity do not suggest a concern and that functional diversity is not considered a concern. However, impacts on genetic diversity are unknown to a considerable extent in the absence of a baseline genetic survey.

Due to the nature of this action, the Bering Sea pollock fishery as modified by the proposed action is not predicted to have additional impacts beyond those identified in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007a). Based on the analysis presented in the Harvest Specifications EIS and summarized above, NMFS concludes that the pollock fisheries, as prosecuted under Alternative 1, would have similar ecosystem impacts. The impacts of Alternative 2, 3, and 4, on each component of the ecosystem is detailed in the chapter addressing that component. Based on the analysis in those chapters, none of the alternatives would have a significant impact on any individual component, to the extent the impacts are known. The Alternative 2 hard caps, to the extent that they prevent the pollock fleet from harvesting the pollock TAC and therefore reduce pollock fishing effort, would reduce the pollock fisheries impacts on ecosystem relationships from status quo. The Alternative 4 hard caps and ICA structure would have similar impacts as Alternative 2. Chapter 10 provides a discussion of the ability of the pollock fleet to harvest the TAC under the hard cap options. It is not possible to predict how much less fishing effort would occur under Alternative 2 because the fleet will have strong incentives to reduce bycatch through other means, such as gear modifications and avoiding areas with high salmon catch rates, to avoid reaching the hard cap and closing the fishery. And, depending on the extent vessels move to avoid salmon bycatch or as pollock catch rates decrease, pollock trawling effort may increase even if the fishery is eventually closed due to a hard cap. The Alternative 3 trigger closures would close identified areas when a specific cap level is reached. Since the total amount of pollock harvested and the total effort would not change under Alternative 3, it is reasonable to conclude that the overall impacts on ecosystem relationships would be similar to Alternative 1. As with Alternative 2, fishing effort may increase as vessels move to avoid salmon bycatch or as pollock catch rates decrease.

8.4.7 Introduction of non-indigenous species

The Alaska Groundfish Harvest Specifications EIS (NMFS 2007) identifies the introduction of invasive species by fishing vessels as a concern. The introduction of non-native species through ballast water exchange and hull-fouling organism release from fishing vessels could potentially disrupt the Alaskan marine food web structure. Additionally, the potential for an introduction of Norway rats by fishing vessels onto islands with colonies of seabirds that may be vulnerable to rat predation is an important invasive species concern. Visits by fishing vessels to islands with ports, moorage near shore in protected waters, or shipwrecks, could lead to the introduction of rats. Burrowing or cliff dwelling seabirds may be particularly vulnerable to rat predation. Populations in vulnerable colonies could be reduced, or possibly destroyed. The harvest specifications EIS uses total groundfish catch levels as an indicator of potential changes in the risk of invasive species introductions by groundfish fishery vessels. Larger catch levels are associated with increased vessel activity, more exchanges of ballast water, and more visits to islands with vulnerable bird colonies. None of the alternatives under consideration are expected to increase catch levels of pollock. And, Alternatives 2 and 4 may result in a decrease in pollock catch. Therefore the impacts of the alternatives on the introduction of non-indigenous species would be similar, or slightly less than those analyzed in the harvest specifications EIS.

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9.0 ENVIRONMENTAL JUSTICE

9.1 What is an environmental justice analysis[26]

This chapter is an analysis required under Executive Order (E.O.) 12899, Environmental Justice (59 FR 7629). Under this E.O., demographic information is used to determine whether minority populations or low-income populations are present in the area affected by the proposed action. If so, a determination must be made as to whether the proposed action may cause disproportionately high and adverse human health or environmental impacts on those populations. The disproportionality of the adverse impact to identified minority or low-income populations is the key factor under environmental justice analysis. Adverse impacts that affect the wider population as a whole are not considered potential environmental justice impacts.

"Environmental" effects under E.O. 12898 are construed to include social and economic effects, and these are discussed in some detail in this section. Human health effects, as mentioned in E.O. 12898, appear to be less relevant to impacts potentially associated with the various management alternatives being considered in this document.[27]

There is no standardized methodology for identification or analysis of environmental justice issues. In determining what constitutes a minority "population," CEQ guidance states, "the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis." While no available federal guidance addresses the identification of low-income populations, a similar approach has generally been adopted when preparing NEPA documents (King 2001). The U.S. Environmental Protection Agency (EPA) has stated that addressing environmental justice concerns is entirely consistent with NEPA and that disproportionately high and adverse human health or environmental effects on minority or low-income populations should be analyzed with the same tools currently used in the NEPA process. NOAA environmental review procedures[28] state that, unlike NEPA, the trigger for analysis under E.O. 12898 is not limited to actions that are major or significant, and hence federal agencies are mandated to identify and address, as appropriate, "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

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[26] This section is based on the discussion in the Alaska Groundfish Harvest Specifications Final EIS (NMFS, 2007). The analysis was originally prepared by Michael Downs and Marty Watson of the consulting firm EDAW.

[27] E.O. 12898 does include language regarding the need to identify differential patterns of subsistence consumption of fish and wildlife, but it goes on to link this data collection with potential human health risks associated with the consumption of pollutant-bearing fish and wildlife. While subsistence in Alaska is associated more strongly with minority (Alaska Native) populations and low-income populations (those in rural areas with fewer commercial economic opportunities) than other populations, there is no indication that any of the alternatives being considered would result in a degradation of resources in a manner such that their consumption would result in a health risk elevated above existing conditions.

[28] NOAA *Environmental Review Procedures for Implementing the National Environmental Policy Act* (Issued 06/03/99).

While a “population” can mean a geographically localized set of people (for example, residents of a village, town, or other spatially bounded community), a “population” could also refer to a widely distributed set of people with a uniting or common set of circumstances, livelihoods, or lifeways that may be affected by the management alternatives. Populations could be very localized (e.g., “population pockets” of workers living in group quarters at a series of processing plants in communities directly participating in the relevant fisheries) or they could be spread over very wide areas in a distribution pattern more closely resembling the total set of communities in a given region (e.g., residents of communities hundreds of miles removed from direct fisheries activities but that may nevertheless be affected by changes in access to subsistence resources that are themselves affected by the management action). Defining populations for analysis of Chinook salmon bycatch in the Bering Sea pollock trawl fishery is challenging as the fishery literally spans an area offshore of thousands of miles of coastline that encompasses dozens of communities in Alaska, including many communities with high Alaska Native (i.e., minority) population percentages, as well as encompassing large numbers of participants from the Pacific Northwest.

9.2 What is the action area?

The action area is waters of the Bering Sea, is described in detail in Section 1.3. Note that it does not include the waters of the Aleutian Islands. This circumscribes the scope of the analysis somewhat since it is not necessary to consider the allocation of pollock to the Aleut Enterprise Corporation.

The definition of the action area notes that impacts of the action may occur outside the action area in the freshwater habitat and migration routes of the salmon caught as bycatch. Chinook salmon caught as bycatch in the Bering Sea pollock fishery may originate from Asia, Alaska, Canada, and the western United States. Impacts may extend beyond those river systems, as subsistence harvesters distribute Chinook salmon through traditional gift and exchange networks. Thus persons in major cities not on the impacted river system, such as Anchorage, may be affected. Moreover, impacts may occur on shore in communities that process and arrange for the further distribution of pollock deliveries from catcher vessels.

9.2.1 Western and Interior Alaska Communities

Environmental justice issues are particularly important for Alaskan communities around the perimeter of the Bering Sea, island communities in the Bering Sea, interior Alaska communities on or dependent on the great river systems, such as the Kuskokwim and Yukon, and communities in the southern Chukchi Sea. The harvests are important for coastal regions with Aleut, Alutiiq, Yup’ik and Inupiat populations, but also for Athabaskan Indian populations in interior Alaska.

As described Chapter 5, genetic analysis suggests that significant proportions of the Chinook salmon harvested by the pollock fishery in the Bering Sea originate in the rivers and streams of western Alaska. Chinook salmon harvests are important components of subsistence and commercial fishery harvests in western Alaska, and play an important role in the subsistence/market economies of these regions. Many public comments received during the scoping process for this EIS discussed how salmon serves an important cultural and economic role in the communities of Alakanuk, Eek, Nanakiak, Nunapitchuk, Emmonak, Kwethluk, Bethel, St. Mary’s, Ruby, Nulato, Koyukuk, Kotlik, Galena, Kaltag, Fairbanks, Kongiganak, Quinhagak, Nenana, Minto, Marshall, and Hooper Bay, and throughout western and Interior Alaska (NMFS 2008)[29].

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[29] Section 10.3 provides detailed descriptions of regional subsistence, commercial, and recreational salmon fisheries throughout western Alaska.

The pollock fishery also plays an important role in this region. Sixty-five western Alaska communities have an interest in the productivity of the pollock resource and the costs of harvesting pollock through their participation in the Community Development Quota program. Other communities, such as Dutch Harbor/Unalaska, play an important role in the fishery through the processing of pollock landed by pollock catcher-vessels.

The Yukon River extends beyond Alaska's border with Canada into the Yukon Territory. There are subsistence (aboriginal or First Nations), commercial, personal use, and sport fisheries for Chinook salmon in the Canadian Yukon. The pollock fleet in the Bering Sea may be taking Chinook as bycatch that would otherwise return to the Yukon Territory and spawn, or be taken in one of these fisheries. All of these Yukon fisheries may provide disproportionate benefits to low income or minority populations. For example, the First Nation fishery is only open to the Yukon's Natives to provide for subsistence, ceremonial, and other cultural purposes. Yukon River harvests from the subsistence, commercial, personal use, and sport fisheries combined, averaged 10,051 Chinook over the period 1997-2006. (U.S. and Canada Yukon River Joint Technical Committee 2008) Environmental Justice analysis is carried out with respect to residents of the U.S. Therefore, this fishery will not be discussed further in this chapter. However, the importance of this fishery to Yukon minorities and low income persons is undoubtedly very similar to the importance of similar fisheries on the Yukon in Alaska and many of the issues discussed below will be applicable to Yukon residents.

9.2.2 South Central, Southeast Alaska, Pacific Northwest

Southcentral and Southeast Alaska have minority Alaska Native populations that use Chinook salmon for subsistence purposes. However, the impact of these actions on their Chinook use is likely to be much less of an issue in the southcentral and southeast Alaska region communities than in western Alaska because relatively few fish in the bycatch appear to come from these areas, and Chinook are less important as a subsistence resource in these areas:

- As indicated in Chapter 5 (Table 3-9), the limited genetic evidence doesn't indicate that large proportions of the Chinook bycatch originate in these regions. Cook Inlet origin fish appear to account for less than a half percent of the "A" season Chinook bycatch, and Southeast Alaska fish appear to account for 0.1% to 1.1%. Cook Inlet origin fish may account for 5.3% to 7.5% of "B" season fish from the southeast Bering Sea, and 2.2% to 3.0% of the fish from the northwest Bering Sea. Southeast origin fish may account for 3.3% to 4.3% of the "A" season fish from the southeast Bering Sea, and 0.5% to 3.5% of the "B" season fish from the northwest Bering Sea.
- Subsistence overall appears to be less important in these regions than in does in western Alaska. Subsistence harvest summaries from the Alaska Department of Commerce, Community, and Economic Development (ADCCED) indicate that per capita consumption tends to be smaller in Southcentral and Southeast Alaska boroughs and census districts than in those in western Alaska.
- Moreover, available data from 2002 to 2005 show that subsistence catches of Chinook salmon in Southeast Alaska and Southcentral Alaska fisheries (measured in pounds) are only 1.3% and 4.6% of the Chinook salmon subsistence catch in western Alaska fisheries. (Hartman, pers. comm.).[30]

As noted in Chapter 5, genetic evidence suggests that some Chinook salmon present in the Bering Sea and taken as bycatch originate in Pacific Northwest river systems. These Chinook may have originated in one or more of over 200 stocks British Columbia to Washington. The evidence does not connect the Chinook to specific river systems. Native American tribes in northwest Washington and along the

[30] Jeff Hartman, National Marine Fisheries Service, Alaska Region. Sustainable Fisheries Division. P.O. Box 21668 Juneau, AK. 99801. Personal communication, August 29, 2008.

Columbia River have treaty rights to the harvest of returning Chinook salmon stocks and do so for commercial, ceremonial, and subsistence reasons. Thus there is a potential environmental justice issue raised with respect to these fisheries.

The greater Seattle area is the center for much of the economic activity related to the North Pacific pollock fishery. However, the geographic footprint of those activities is difficult to define, and it cannot be attributed to specific communities or neighborhoods in the same manner as Alaska communities may be linked to the fishery, as discussed in the PSEIS (NMFS 2004). Given the nature of engagement with the fishery, the Washington Inland Waters region does not have the same type of resident workforce focused in individual communities in a manner comparable to that seen in Alaska communities. Also, unlike the Alaska groundfish communities, the white portion of the population comprises a large majority of the overall population (i.e., racial or ethnic groups classified as minorities are mathematical minorities within the local overall population, unlike the relevant Alaska communities).

Data collected for the PSEIS (NMFS 2004) suggests that large proportions of the workers at groundfish processing plants in Unalaska/Dutch Harbor, Sand Point, King Cove, and Akutan and workers on catcher-processor ships and motherships, are members of minority groups. These data are collected from group quarters in these communities suggesting that these workers are transients in these communities. The data do not provide information on place of residence. However, these minorities may raise environmental justice issues as well.

9.3 Are minority or low income populations present?

9.3.1 Are minority populations present?

A significant part of the population in the impacted area is made up of Alaskan Natives. Table 9-1 shows the Alaska Native population within each of the U.S. census districts in the action area and compares these with the proportions of the U.S. and Alaskan populations that are made up of American Indian and Alaska Natives. Less than one percent of the U.S. population, and about 16% of Alaska's population is made up of Native Americans; however none of the census districts in the action area is less than 44% Alaskan Native.

Table 9-1 Minority and Low Income Populations by western Alaska Census District, 2000 Census

Area	Population	American Indian or Native Alaskan	Two or more races	Min native percentage of population	Max native percentage of population
United States	281,421,906	2,447,989	n.a.	~ 1	n.a.
Alaska	626,932	98,043	34,146	16	21
Lake and Peninsula	1,832	1,340	127	74	80
Bristol Bay	1,258	550	30	44	46
Dillingham	4,922	3,452	329	70	77
Bethel	16,006	13,114	617	82	86
Wade Hampton	7,028	6,503	177	93	95
Yukon-Koyukuk	6,551	4,644	256	71	75
Nome	9,196	6,915	387	75	79
Northwest Arctic	7,208	5,944	267	82	86
Aleutians west	5,465	1,145	189	21	24
Aleutians east	2,697	1,005	79	37	40

Source: U.S. Bureau of the Census. Minimum percentage assumes only persons characterized as “American Indian or Alaskan Native” are Alaska Natives. Maximum assumes that all of the persons of two or more races are at least half Alaska Native. “Two or more races” category has not been used for the United States as the number is unlikely to be comparable in interpretation to the Alaskan estimates.

There are a large number of indigenous peoples, with a diversity of life-styles and cultures, living within the action area. Cultural differences with implications for resource use may exist even between groups identified within one of the broad cultural-linguistic groupings commonly used.[31] The following brief list of minority ethnic groups within the region depends primarily on Langdon and Krauss (Langdon 2002; Krauss 1982). From North to South:

- Seward Peninsula, and the eastern shore of Norton Sound as far south as Unalakleet are occupied by the Inupiat Eskimo. Langdon distinguishes between the Norton Sound and Bering Straits Inupiat. The later includes the community of Wales at the end of the Seward Peninsula, and the King Island community. No one lives on King Island, but the people who used to, and their descendents, maintain themselves as a distinct community on the mainland. Langdon notes that the Bering Straits Inupiat traditionally tended to harvest larger sea mammals, while the Norton Sound Inupiat tended to harvest small sea mammals, land mammals, fish, and migratory waterfowl.

- The Athabaskan Indians are inland rather than maritime peoples. They inhabit the central core of Alaska. Athabaskan groups living along the Yukon and Kuskokwim River systems may be especially affected by this action. These include the:

    - Deghitan on the lower Yukon and Kuskokwim Rivers
    - Holikachuk on the lower middle Yukon and Innoko Rivers
    - Koyukon in the middle Yukon and Koyukuk Rivers
    - Tanana on the Lower Tanana River

[31] Fienup-Riordan found that attitudes towards non-Native hunters could contrast “sharply” between Yup’ik on Nelson and Nunivak Islands. Nelson Islanders sought to treat a relatively new musk ox resource in a more traditional manner, while Nunivak Islanders were more willing to support guided hunting as a way of earning income as well as acquiring meat (Fienup-Riordan, 2002). The point is that there can be significant cultural divergences even among fairly closely related ethnic groupings.

  - Tanacross on the middle Tanana River
  - Gwich'in on the upper Yukon and Porcupine Rivers
  - Han on the upper Yukon River
  - Upper Tanana on the upper Tanana River
  - Upper Kuskokwim on the upper Kuskokwim River

- The Yup'ik Eskimo occupy the great bulge formed by the Yukon and Kuskokwim River deltas and Nelson and Nunivak Islands. Langdon distinguishes between the Yukon, Kuskokwim, Bristol Bay and Delta Yup'ik and the Cup'ik of Nunavak Island. Membership in the different groups implies access to different resources and consequently somewhat different cultural practices. For example, he notes that Yup'ik communities along the resource rich Yukon and Kuskokwim Rivers tended to be larger than the communities of the Delta Yup'ik, who were further removed from these resources.

- The Unangan/Aleut occupy the Aleutian Islands. Langdon distinguishes between Eastern, Central, and western Unangan.

- The Sugpiaq/Alutiiq are the Pacific Eskimos, occupying the Alaska Peninsula, Kodiak, the Gulf waters of the Seward Peninsula, and Prince William Sound. Langdon identifies the Koniag Alutiiq in the west, the Chugach Alutiiq in the east, and the Eyak in the area of the Copper River delta. Communities to the south side of the Alaska Peninsula are generally considered to be minimally impacted by this action. However part of the homeland of the Koniag Alutiiq lies on the north side of the peninsula to the west of Bristol Bay.

The key point is that there is a complex group of indigenous minority populations that occupy the impacted area. There are many cultural similarities, but cultural differences may affect the way these populations interact with Chinook salmon and other subsistence resources. Cultural differences may exist between broadly defined groups such as the Yup'ik and the Athabaskans, but also between smaller groups within these larger groupings.

Members of Indian tribes in the Pacific Northwest are members of a racially and culturally distinctive minority in that region. Tribes of particular interest are those whose members harvest Chinook salmon, or could harvest Chinook salmon in the ocean fisheries off of the west coast, in Puget Sound, and on the Columbia River, for commercial, ceremonial, or subsistence reasons, pursuant to treaties between their tribes and the United States Government.

Other minority populations work on pollock catcher-processors, catcher-vessels, and shoreside processing plants.[32] These minorities enter the region for harvesting and processing pollock, and perhaps other species, but do not live there. However, these minority populations may also be impacted by the actions under consideration.

The PSEIS (NMFS 2004) took two approaches to estimate the size of the potential minority population in the shoreside processing sector. Shoreside processors were surveyed to determine the size of minority populations employed, and 1990 and 2000 Census data on group housing was examined to determine the size of minority populations that may be resident in processor housing. The group housing data provided the most detailed and disaggregated information. Information was available separately for Unalaska/Dutch Harbor, Akutan, King Cove, and Sand Point:

[32] The following discussion of minority composition of the Pollock industry workforce is based on the discussion in Section 3.9 of the Supplemental Programmatic Groundfish EIS (NMFS, 2004).

- Unalaska: In both years a significant proportion of the residents of group housing were minorities, and the minority proportion grew from 1990 to 2000. Although demographic categories changed somewhat between the 1990 and 2000 census, some relatively large changes are readily apparent. For example, in 1990, the "Asian or Pacific Islander" category accounted for 27 percent of group quarters population, but 42 percent by 2000.
- Akutan: The racial and ethnic categories used in the two censuses differ somewhat making comparisons a little difficult. However, Asian and Pacific Islanders dominate the mix in both years (49% in 1990, and 43% in 2000). The Alaska Native/Native American population grew from 1% to 7%. The white population dropped considerably between the two censuses, from 42% in 1990 to 24% in 2000).
- King Cove: Minorities dominated the group housing in King Cove as well. Again, Asian and Pacific Islanders were the most common minority, rising from 58% of the population in 1990 to 64% in 2000. A mixture of other minorities were also important. The white population fell from 25% in 1990 to 12% in 2000.
- Sand Point: Asians and Pacific Islanders grew in importance here as well, rising from 42% of the population in 1990 to 61% in 2000. In 2000, whites accounted for most of the remaining population.

Confidentiality prevented a detailed description of the data on shoreside workforces collected from industry in 2000. Returns were received from four of the six large shoreside plants, and one of the two floating processors. Out of a combined workforce for these units of 2,364 persons, 22.5% were classified as white or non-minority, and 77.5% as minority. Not all plants provided details about the specific minorities in their plants. Of those that did, 5% or less were Black or African-American and 5% or less were Alaska Native/Native American. Asian/Pacific Islanders were the largest minority group in two-thirds of the plants in any region reporting detailed data, and the group classified as Hispanic was the largest minority group in the remaining one-third.

The labor force on the catcher-processors and motherships was not covered by the 1990 and 2000 Censuses. The analysis in the EIS was based solely on the industry survey. Different firms provided different levels of detail in the breakout of the internal composition of the minority component of their workforce, but the detailed information provided encompassed 1,906 out of the 2,126 persons reported, or 90 percent of the total reported workforce. In some instances firms simply reported minority and non-minority proportions of the workforce, in others they provided more detailed information. The portion of the workforce within the detailed reporting set was 36.9 percent white or non-minority and 63.1 percent minority. Adding the more highly aggregated data does not significantly change the overall minority/non-minority ratio. Within the total set of responding entities, individual entity workforces ranged from a 36 percent minority workforce to an 85 percent minority workforce. Among entities reporting detailed data, Hispanic was the largest minority component in every entity's minority workforce segment, with one exception (in which case the largest minority segment was Asian/Pacific Islander, and Hispanic was second). Apart from the entity where Asian/Pacific Islander workers were the largest minority worker segment, Asian/Pacific Islanders were the second largest minority group represented for all but one of reporting entities (in which case the second largest group was Alaska Native/Native American).

Catcher vessel ownership and crews are assumed to reflect the overall demographic make up of the male working age population in their home communities. Although systematic demographic data were not collected for the groundfish catcher vessel crews in the Washington inland waters region, interviews with local sector association personnel suggest that minority population representation within this sector does not exceed the proportion of minority representation in the general population; therefore, environmental justice is not an issue with respect to potential impacts to this sector.

9.3.2 Are low income populations present?

Many of the people in the action area have traditionally obtained significant amounts of food and materials by harvesting local resources. Paid jobs have been relatively scarce and often seasonal, and livings were earned in both the subsistence as well as the wage economy. These communities have been characterized by relatively low levels of labor force participation, high levels of unemployment, low per capita incomes, and high measured poverty rates. In part this reflects the inability of work and income statistics to measure activity outside of the formal marketplace. Significant numbers of transactions also appear to take place in barter or informal trades and exchanges in informal markets which constitute an "underground economy."

Because we are not in a position to systematically measure the contribution of subsistence or personal use harvest activity, and this informal production and trading activity, to income and consumption, the low income evaluation in this analysis is based on information from the formal, "above-ground" economy only.

Table 9-2 provides some income indicators, including the percentage of adults that are in the labor force, the percentage of adults that are unemployed, the percentage of persons in poverty, and per capita income. Labor force, unemployment, and income variables are difficult to interpret in these areas with their mixed subsistence/cash economies. A person's formal labor force participation may be relatively small compared to what it might be in more heavily monetized economy, nevertheless the person may be working very hard to earn a livelihood. Similarly, poverty and income statistics should really be adjusted to reflect the monetary value of subsistence production to provide a relatively comparable measure of income. On the other hand, a comparison of the income or poverty gap between the people in one of these areas and the rest of the state provides an indicator of the gap to be filled by subsistence activity.

Table 9-2 1999-2000 Employment, income, and poverty information for census districts and boroughs in the action area from the 2000 Census

Status	Total adults	In labor force	Out of labor force	Employed	Unemployed	Unemployment rate	% not working	% pop in poverty	Per capita income
Alaska	458,054	326,596	131,458	281,532	27,953	9%	29%	9%	22,600
Aleutians East Borough	2,337	1,854	483	1,086	768	41%	21%	22%	18,400
Aleutians West Census Area	4,637	3,788	849	3,252	473	12%	18%	12%	24,000
Bethel Census Area	10,269	6,446	3,823	5,481	936	15%	37%	21%	12,600
Bristol Bay Borough	908	649	259	581	68	10%	29%	9%	22,200
Dillingham Census Area	3,216	2,007	1,209	1,765	230	11%	38%	21%	16,000
Lake and Peninsula Borough	1,224	678	546	581	97	14%	45%	19%	15,400
Nome Census Area	6,176	3,745	2,431	3,107	608	16%	39%	17%	15,500
Northwest Arctic Borough	4,535	2,877	1,658	2,427	447	16%	37%	17%	15,300
Wade Hampton Census Area	4,094	2,399	1,695	1,825	574	24%	41%	26%	8,700
Yukon-Koyukuk Census Area	4,531	2,847	1,684	2,276	566	20%	37%	24%	13,700

Notes: Alaska Department of Labor and Workforce Development. Accessed at http://almis.labor.state.ak.us/?PAGEID=67&SUBID=114 on April 1, 2008.

9.4 How do minority or low income communities interact with impacted resources?

This section is organized to address five broad categories of resources considered earlier in this EIS: (1) Chinook salmon, (2) chum salmon, (3) pollock, (4) marine mammals and seabirds, and (5) other groundfish species, forage species, and other prohibited species. Much of the subsistence harvest background for the section on chum salmon is covered in the section on Chinook salmon and is not repeated in the chum salmon section to minimize duplication. The first section discusses the management of both Chinook and chum salmon.

9.4.1 Management of Chinook salmon fishing

ADF&G, under the direction of the Alaska BOF, manages sport, commercial, personal use, and State subsistence harvest on lands and waters throughout Alaska. However, on Federal lands and waters, the Federal Subsistence Board implements a subsistence priority for rural residents as provided by Title VIII of ANILCA. In providing this priority, the Board may, when necessary, preempt State harvest regulations for fish or wildlife on Federal lands and waters.

9.4.1.1 State management[33]

The State manages subsistence, personal use, and commercial harvests on waters flowing in state lands. The Federal government manages subsistence harvests on Federal lands.

The State defines subsistence uses of wild resources as noncommercial, customary, and traditional uses for a variety of purposes. These include:

> Direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption (AS 16.05.940[32]).

Under Alaska's subsistence statute, the BOF must identify fish stocks that support subsistence fisheries and, if there is a harvestable surplus of these stocks, adopt regulations that provide reasonable opportunities for these subsistence uses to take place. Whenever it is necessary to restrict harvests, subsistence fisheries have a preference over other uses of the stock (AS 16.05.258).

Alaska Statue defines personal use fishing as the taking, fishing for, or possession of finfish, shellfish, or other fishery resources, by Alaska residents for personal use and not for sale or barter, with gill or dip net, seine, fish wheel, long line, or other means defined by the BOF (AS 16.05.940[24]). Personal use fisheries are different from subsistence fisheries because they do not meet the criteria established by the Joint Board for identifying customary and traditional fisheries (5 AAC 99.010), or because they occur within nonsubsistence areas.

Personal use fishing is primarily managed by ADF&G, Sport Fish Division, but some regional or area fisheries for various species of fish are managed by the Division of Commercial Fisheries. For example, permitting for Southeast Alaska king crab personal use fisheries are handled out of the Southeast Regional office, Division of Commercial Fisheries, in Douglas, Alaska (Juneau). Generally fish may be taken for personal use purposes only under authority of a permit issued by ADF&G.

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[33] The following discussion is based on the ADF&G web site http://www.adfg.state.ak.us/special/special_fisheries/personal_use.php accessed on April 7, 2008.

Also, Alaska Statute requires the Joint BOF and Game to identify nonsubsistence areas where dependence upon subsistence is not a principle characteristic of the economy, culture, and way of life of the area or community (AS 16.05.258(c)). The BOF may not authorize subsistence fisheries in nonsubsistence areas. Personal use fisheries provide opportunities for harvesting fish with gear other than rod and reel in nonsubsistence areas. The Joint Board has identified five nonsubsistence areas (5 AAC 99.015): Ketchikan Nonsubsistence Area, Juneau Nonsubsistence Area, Anchorage-Matsu-Kenai Nonsubsistence Area, Fairbanks Nonsubsistence Area, and Valdez Nonsubsistence Area.

Alaska subsistence fishery regulations do not in general permit the sale of resources taken in a subsistence fishery. However, State law does recognize “customary trade” as a potential subsistence use. Customary trade is limited to customary, traditional, and noncommercial exchanges (AS 16.05.940(33)). Alaska Statute defines customary trade as the limited noncommercial exchange, for minimal amounts of cash, as restricted by the appropriate board, of fish or game resources (AS 6.05.940(8)). At this time, the herring roe on kelp in Southeast Alaska may be used for customary trade (Magdanz 2007).

Finally, the State manages a large number of commercial salmon fisheries in waters from Southeast Alaska to the Bering Strait. Management of these fisheries is undertaken by the ADF&G Commercial Fisheries Division, under the direction of the BOF. Alaska’s salmon fisheries are limited entry fisheries. Participants need to hold a limited entry permit for a fishery in order to fish in it. The numbers of these permits for each fishery are limited. The State originally issued permits to persons with histories of participation in the various salmon fisheries. Permits can be bought and sold, and persons have entered since the original limitation by buying permits on the open market. Chapter 10 provides more detailed information on State management of the commercial salmon fisheries.

9.4.1.2 Federal subsistence management

The Alaska National Interest Lands Conservation Act (ANILCA), passed by Congress in 1980, mandates that rural residents of Alaska be given a priority for subsistence uses of fish and wildlife. In 1989, the Alaska Supreme Court ruled that ANILCA’s rural priority violated the Alaska Constitution. As a result, the Federal government manages subsistence uses on Federal public lands and waters in Alaska—about 230 million acres or 60% of the land within the state. To help carry out the responsibility for subsistence management, the Secretaries of the Interior and Agriculture established the Federal Subsistence Management Program (FSMP).

On July 1, 1990, the U.S. Departments of the Interior and of Agriculture assumed responsibility for implementation of Title VIII of ANILCA on public lands. The Departments administer Title VIII through by regulations in the Code of Federal Regulations. The Departments have established a Federal Subsistence Board and 10 Regional Advisory Councils to administer the Federal Subsistence Management Program. The Board's composition includes a Chair appointed by the Secretary of the Interior with concurrence of the Secretary of Agriculture; the Alaska Regional Director, U.S. Fish and Wildlife Service; the Alaska Regional Director, National Park Service; the Alaska State Director, Bureau of Land Management; the Alaska Regional Director, Bureau of Indian Affairs; and the Alaska Regional Forester, USDA Forest Service.

Through the Board, these agencies participate in the development of regulations which establish the program structure, determine which Alaska residents are eligible to take specific species for subsistence uses, establish seasons, harvest limits, and methods and means for subsistence take of species in specific areas. The Regional Advisory Councils provide recommendations and information to the Board; review proposed regulations, policies and management plans; and provide a public forum for subsistence issues.

Each Council consists of residents representing subsistence, sport, and commercial fishing and hunting interests.

9.4.1.3 Pacific Northwest Tribal fisheries

Indian tribes in the Pacific Northwest have treaty rights to a share of the Chinook salmon in the offshore troll fishery, Puget Sound, and along the Columbia River system. Not all tribes avail themselves of their rights under these 19th Century treaties, but many do. Members of the tribes that harvest Chinook salmon for subsistence, commercial, and ceremonial purposes, may be impacted by the actions under consideration. Tribes invest in fisheries management by hiring fisheries experts, carrying out fisheries research, managing tribal fishermen, representing tribal interests with state and federal managers, and investing in hatcheries and habitat enhancement. Tribes have created two tribal fishery commissions, the Columbia River Inter-Tribal Fish Commission and the Northwest Indian Fisheries Commission, to provide a tool for coordinated planning and joint management efforts. Not all tribes with salmon management responsibilities are members of the commissions.

9.4.2 Subsistence harvests of Chinook salmon

Alaskan residents harvest Chinook salmon for subsistence purposes. Chinook salmon consumption can be an important part of regional diets, and Chinook salmon and Chinook salmon products are distributed as gifts or through barter and small cash exchanges to persons who do not directly participate in the subsistence fishery.

Public comments received during the scoping process explained that salmon are important to the cultural, spiritual, and nutritional needs of Alaska Native people and that analysis of the impacts on subsistence users and subsistence resources must reflect the values obtained from a broad range of uses, not simply the commercial value or monetary replacement costs of these fish. Comments state that strong returns of healthy salmon are critical to the future human and wildlife uses of those fish and to the continuation of the subsistence lifestyle.

Food costs and living expenses are high in rural Alaska. Materials have to be transported long distances with limited transportation and distribution infrastructures, consequently these services are expensive. Small populations may not be able to support returns to scale in transportation, distribution, or storage, or support the large numbers of firms that would provide for competitive markets.

The Cooperative Extension Service of the University of Alaska Fairbanks routinely surveys communities to gather information on living costs. In December 2007, it found that it cost 189% more to purchase a week of food in Bethel than in Anchorage. Food costs in other communities in the action area were also higher than in Anchorage. In Kotzebue costs were 208% those in Anchorage, 218% in Naknek/King Salmon, and 171% in Nome (UAF Cooperative Extension Service).

Subsistence foods in general are important components of regional diets. For example, Magdanz et al (2007) reviewed several studies of subsistence consumption for the Norton Sound and Port Clarence areas. Average per capita consumption of subsistence foods was on the order of 600 pounds per year. Salmon accounted for a significant part of this with weights ranging from about 100 pounds to about 160 pounds per capita, depending on the study. One analysis of dietary sources of meat and fished showed that 75% was derived from subsistence sources and 25% from store bought meats. A third of the meat and fish was salmon, and the reminder was from land or marine mammal or other fish. In this region Chinook salmon accounted for 3% of meat and fish consumption, while chum salmon accounted for about 6% (Magdanz *et al.* 2007).

Chinook salmon varies in importance in regional diets, and can be significant. In 2002 the Alaska Native Health Board sponsored a survey of rural Alaskan eating habits as a first step in a program to determine potential contamination and to prioritize species for further investigation. The survey depended on participants self-reporting of consumption over the previous 12 months. Samples were not randomly selected or chosen on the basis of a systematic sampling plan. Not too much confidence can be placed on the precision of the estimates. Moreover, the survey represented consumption behavior at a single point in time: the period 2001-2002, and would reflect the availability of subsistence foods at that time. However, the survey results for Chinook salmon seem at least broadly consistent with regional Chinook salmon subsistence harvest information described below and provide a sense of the regional variation in consumption.

The survey results relevant to this action were summarized for four regional health corporations (Ballew *et al.* 2004).

- In the area of the Norton Sound Health Corporation, 151 surveyed persons reported consuming a total of 1,384 pounds of Chinook salmon products, or an average of nine pounds a piece. About half of this was consumed as a dried/smoked/salted product and the remainder as cooked, raw, or frozen. Chinook salmon was the 42nd most important food by weight in this region.

- Consumption was significantly higher in the area of the Yukon-Kuskokwim Health Corporation, where 224 respondents reported consuming 15,722 pounds of Chinook salmon, or an average of 70 pounds a person. About three-quarters was consumed dried, smoked, or salted, and most of the remainder as cooked. Chinook salmon was the fifth most important food by weight in this region.

- In the Bristol Bay Health Corporation Region, 132 surveyed persons consumed a total of 5,076 pounds of Chinook salmon, or an average of 38 pounds each. About two-thirds was consumed dried, smoked, or salted, and most of the remainder as cooked. Chinook salmon was the 12th most important food by weight in this region.

- In the Tanana Chiefs Conference Region, 33 surveyed persons consumed a total of 583 pounds of Chinook salmon, or an average of 18 pounds a person. Almost two-thirds was consumed dried, smoked, or salted, and most of the remainder as cooked. Chinook salmon was listed as the 16th most important food source, by weight in this region.

Subsistence Chinook salmon may be consumed directly by the person or family that harvests it. It may also be distributed to other persons in the community. Salmon may be given or shared with other persons without the expectation that something specific will be given in exchange. Fish may be shared with family members or friends, in the region or outside of it. On the Tanana, "…salmon is given to individual elders, elders' residences and people who do not have access or ability to fish. Almost all the fishermen interviewed stated that the first salmon caught were given away to share the taste of the first fish and bring luck to the fishermen (Moncrieff 2007)."

Chinook salmon may also be exchanged for concrete considerations. At Holy Cross, Yukon River Chinook "is traded for a variety of items. Some people bring salmon or moose when they travel and give it as a gift to the family they stay with. One participant traded fish for pizza from another village: one pizza for one Chinook salmon, each valued at about $12. Others traded their salmon for Kuskokwim River fish, berries from the stores in Anchorage, berries from the other areas, or crafts or services. Trade relationships, active in the precontact era, continue to exist today (Moncrieff 2007)."

Some subsistence harvests of Chinook are sold under the term “customary trade.” This is not legal under State law, but is for fish harvested from waters on Federal lands. Residents of Alakanuk report selling subsistence fish “if it was unplanned; they happened to have extra and someone needed it… According to respondents in this study, reasons given for selling fish today included helping others in need, avoiding waste, and having a source of cash to be used on subsistence supplies and household expenses” (Moncrieff 2007). Moncrieff (2007) suggests the sale of fish may be more common in Holy Cross, where the respondents who answered her questions about the income from sale of subsistence fish “earned an average of $1,360 annually.” In many cases it is likely that cash exchanges represent compensation by one person for a share of the costs of subsistence fishing.

Fig.9-1 below summarizes information from the most recent Alaska Subsistence Salmon Fisheries Annual Report. This is the report for 2005, published in December 2007 (ADF&G 2007). The figure summarizes the report’s estimates of subsistence takes of Chinook, chum, and other salmon, by subsistence harvest area. The report has certain limitations. As the report notes:

At the outset, it is important to recognize the limitations associated with the effort to present a comprehensive annual report on Alaska’s subsistence fisheries. These limitations include:

- Annual harvest assessment programs do not take place for all subsistence fisheries. Programs are in place for most salmon fisheries, but few other finfish fisheries or shellfish fisheries have annual harvest monitoring programs.
- Annual harvest data are mostly, but not entirely, limited to fisheries classified as subsistence by regulation, which for salmon generally means fish taken with nets, seines, or fish wheels. In some parts of Alaska, substantial numbers of fish for home use are taken with rod and reel (in most areas considered sport gear by regulation) or are retained from commercial harvests. With the exceptions noted in the chapters on each area, these harvests are not included in the subsistence harvest estimates in this report because they are not covered in annual harvest assessments. Therefore, the harvest data in this report are a conservative estimate of the number of salmon being taken for subsistence use in Alaska. Underestimates of subsistence salmon harvests are a particular issue in the Southeast Region.
- Between management areas, and sometimes between districts within management areas, there is inconsistency in how subsistence harvest data are collected, analyzed, and reported.
- In some areas there are no routine mechanisms for evaluating the quality of the subsistence harvest data. For example, in some areas it is not known if all subsistence fishermen are obtaining permits and providing accurate harvest reports. This can result in a large underestimate of harvest (ADF&G 2007).

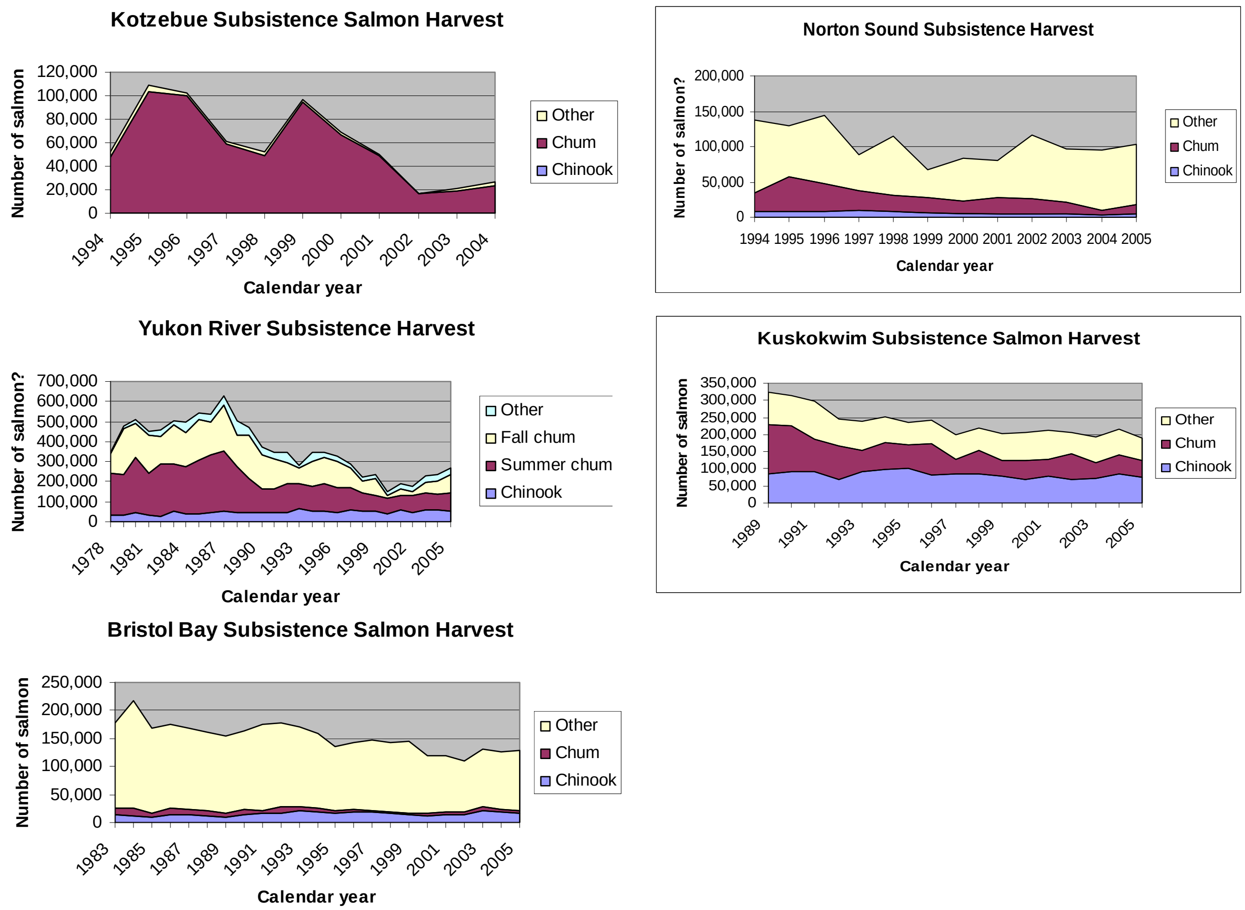

Fig.9-1 Estimated Subsistence Harvests of Chinook, Chum, and Other Salmon, by key management regions (source: ADF&G 2007)

As Fig.9-1 illustrates, the importance of subsistence Chinook harvests varies among the regions that may be affected by this action.

- Chinook salmon appears to be of relatively limited importance in subsistence harvests north of Cape Prince of Wales in Kotzebue Sound and on Alaska's North Slope. Chinook salmon also appears to be of relatively limited importance along the Alaska Peninsula and Aleutians. Chinook did not appear to be more than 1% of subsistence harvests in Kotzebue between 1994 and 2004, no more than 3% on the Alaska Peninsula between 1985 and 2005, and to be almost 0% in the Aleutians in the same period. For simplicity, these areas are not included in Fig.9-1.
- The Norton Sound region includes the Port Clarence and Norton Sound Districts. In this region, subsistence salmon harvests were dominated by chum salmon. For the district as a whole, Chinook accounted for between 4% and 10% of the subsistence salmon harvested between 1994 and 2005. Chinook were more important in the Region's more southerly Norton Sound District, where they accounted for between 4% and 11% of the salmon caught; in the more northerly Port Clarence District they accounted for between 0% and 2% of the salmon caught.
- Chinook salmon are clearly a key species on the Yukon River. Summer and Fall chum are still more important in numbers of fish, but Chinook currently account for 20% to 25% of the number of fish harvested. Prior to the large declines in the chum harvests in the early 1990s, Chinook accounted for a significantly smaller proportion of the harvest: from 6% to 23%. As noted above,

however, the count of each type of salmon doesn't account for other important considerations, including the relative size, flavor, and social significance.

- Chinook salmon are also, clearly, an important subsistence species on the Kuskokwim River Region. Between 1989 and 2005, Chinook account for between 26% and 43% of the annual subsistence salmon harvest.
- Chinook salmon are still somewhat important in the Bristol Bay Region, but distinctly less so than in the Yukon and Kuskokwim Regions. Since 1993, Chinook harvests have ranged between 9% and 16% of subsistence harvests; before that, from 1983 to 1993, they ranged between 5% and 9%.

The Native communities in the action area evolved primarily as hunter/gatherer subsistence societies. Trade of subsistence goods between communities has a long history in regional Native cultures. As Russians came into increasing contact with Natives on the Asian side of the Bering Straits from the 17th Century on, there was increasing trade in western manufactured goods and products, and increasing use of monetary sales as goods were exchanged. These processes have continued through today.

It is possible for hunter/gatherer societies to evolve and successfully adapt during contact with a monetary market economy "in the sense that the society is maintaining its essential organization around subsistence fishing, hunting, trapping, and gathering activities and traditional exchange, while at the same time, incorporating new forms of market production, wage employment, and imported technologies into the subsistence-based socio-economic system" (Wolfe 1984, Wolfe and Walker 1987). However, successful adaptation requires continued access to the resource base on which the subsistence activities depend.

Subsistence activities provide the material basis that allows these emerging mixed "subsistence-market" economies[34] to continue. They also provide a context within which the traditional subsistence hunting and gathering elements of these cultures can persist. As noted above, cultural practices in regional communities will vary between broad ethnic groupings and between smaller groups within these larger groupings. However, each of these hunter-gatherer subsistence communities was once organized completely around resource exploitation and these communities require access to these resources to support the personal relationships, and ways of thought, that emerged in those earlier times. The broader national community clearly places a value on the distinctive cultures of the communities in this region. It has taken numerous steps, for example in Federal and State subsistence regulations, the implementation of the Community Development Quota program, in whale co-management, and in other ways, to protect key elements of the traditional cultures and to allow them to evolve somewhat independently of the broader culture.

9.4.3 Commercial harvests of Chinook salmon

Many persons in the action area harvest Chinook and other species of salmon commercially. In a region in which there are relatively limited job opportunities, income from salmon fishing may be very important. Income from the Chinook fishery can be used for consumption purposes, making it possible to buy goods that cannot be produced locally, including foods from outside the region such as sugar, household consumables such as fuel, or household investments such as appliances. This income is also important because it can be used to support subsistence hunting and fishing activity. It could be used to purchase fuel, vehicles, other subsistence-related gear, or otherwise offset expenses required to engage in a range of subsistence pursuits. Thirdly, commercial fishing activity is important because commercial fishermen have the opportunity to set aside some of their harvest to use for subsistence.

[34] The term is from Wolfe and Walker, 1987.

The importance of Chinook salmon varies by the region in which commercial salmon fishermen live and by the fisheries in which they participate. Table 9-3 and Table 9-4 summarize information on the importance of Chinook salmon revenues for western Alaskan permit holders. Table 9-3 provides information on relative importance, and Table 9-4 provides information on absolute importance. Table 9-3 shows the percentage of the gross revenues earned by State of Alaska limited entry permit holders who live in a particular western or interior Alaska census district from salmon limited entry fisheries in western Alaska. Table 9-4 shows the average revenues per person fishing received by these permit holders.

Table 9-3 Percent of commercial salmon revenue from western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts that is attributable to Chinook harvests (source: AKFIN)

	Aleutians east	Aleutians west	Bethel	Bristol Bay	Dillingham	Lake and Peninsula	Nome	Northwest	Wade Hampton	Yukon-Koyukuk
1991	1%	4%	11%	0%	1%	1%	41%	0%	81%	41%
1992	1%	4%	11%	0%	2%	1%	31%	3%	91%	51%
1993	1%	1%	7%	0%	2%	2%	25%	8%	93%	53%
1994	1%	1%	5%	0%	3%	1%	13%	3%	98%	17%
1995	1%	3%	10%	0%	2%	1%	9%	0%	89%	4%
1996	1%	2%	4%	0%	2%	0%	6%	0%	91%	2%
1997	1%	3%	18%	1%	3%	1%	51%	2%	96%	28%
1998	0%	0%	10%	0%	7%	1%	28%	4%	98%	40%
1999	0%	1%	9%	0%	0%	1%	32%	0%	99%	85%
2000	0%	0%	5%	0%	0%	0%	5%	0%	98%	5%
2001	0%	0%	5%	0%	1%	0%	2%	0%	0%	0%
2002	1%	0%	17%	0%	3%	1%	88%	4%	100%	28%
2003	0%	0%	8%	0%	1%	0%	14%	1%	97%	38%
2004	0%	0%	7%	0%	3%	0%	17%	1%	100%	15%
2005	0%	0%	11%	0%	3%	0%	2%	0%	79%	5%
2006	1%	0%	11%	0%	4%	1%	3%	0%	90%	5%
2007	1%	0%	7%	0%	1%	0%	3%	0%	80%	10%

Table 9-4 Average commercial salmon revenue from western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts that is attributable to Chinook harvests; nominal dollars per year (Source: AKFIN)

	Aleutians east	Aleutians west	Bethel	Bristol Bay	Dillingham	Lake and Peninsula	Nome	Northwest	Wade Hampton	Yukon-Koyukuk
1991	1,601	2,856	2,622	32	629	361	2,631	11	18,500	1,780
1992	2,314	1,894	3,790	124	2,285	966	2,725	125	24,841	2,137
1993	2,230	889	1,888	170	2,578	1,105	1,722	175	13,485	1,378
1994	1,493	806	1,666	134	3,187	964	1,651	98	12,068	1,999
1995	2,493	3,058	3,262	123	2,689	445	2,128	9	15,149	1,060
1996	582	722	976	54	1,975	275	1,271	5	10,379	677
1997	701	265	2,089	76	1,374	354	3,021	63	15,778	1,635
1998	607	320	1,288	63	3,715	220	1,295	68	5,599	1,270
1999	505	697	1,542	14	424	293	1,435	11	13,972	4,225
2000	512	21	704	13	339	29	278	6	2,050	1,097
2001	209	13	383	8	317	37	80	3	0	51
2002	573	6	897	16	716	130	1,335	221	6,399	1,162
2003	293	156	875	19	802	107	533	68	6,203	1,611
2004	792	99	1,207	17	2,052	74	1,299	34	9,510	1,862
2005	543	283	1,642	61	2,508	159	354	26	6,279	1,484
2006	849	297	1,767	108	3,277	474	528	28	11,135	1,368
2007	1,160	646	1,126	13	1,236	30	266	9	7,161	1,146

These tables are meant to be indicative. Chapter 10 contains considerable additional information about the scope of the commercial fishing and processing industries in this region. These tables suggest that commercial king salmon harvest income is most important for persons living in the following census districts:

- Bethel: Chinook salmon revenues accounted for between 4% and 18% of the revenues earned by permit holders in the Bethel census district over the period 1991-2005. Average revenues were as low as $383, but as high as $3,790. Over this period, about 44% of the Chinook revenues were earned by persons fishing in the Kuskokwim-Goodnews Bay set net fishery, and another 45% by persons in the Lower-Yukon-Cape Romanzof Fishery.

- Nome: Chinook salmon revenues accounted for between 2% and 88% of the revenues earned by persons operating in the Nome census district. Average revenues ranged from $80 to $3,021. Over this period, about 65% of the Chinook salmon revenues earned by these persons came from the Lower-Yukon Cape Romanzof set net fishery, and another 34% from the Norton Sound set net fishery.

- Wade-Hampton: In a normal year, Chinook salmon revenues accounted for between 79% and 100% of the commercial fishing revenues earned by residents of this census district. Average revenues from Chinook salmon in a normal year range between $2,050 and $24,841. Average revenues in a year averaged about $14,500 from 1991 to 1998 but only $6,092 from 2000 to 2007. In one year, 2001, Chinook did not account for any revenues for these fishermen. All the revenues earned by fishermen resident in this census area are earned in the Lower-Yukon Cape-Romanzov set net fishery.

- Yukon-Koyukuk: Chinook salmon revenues accounted for between almost 0% and 85% of gross revenues earned by persons living in the Yukon-Koyukuk census district. Average revenues ranged from $51 to $4,225. About 46% of the revenues earned by persons in this census district came from the Lower Yukon Cape Romanzov set net fishery, another 41% came from the Upper Yukon fish wheel fishery, and a further 12% came from the Upper Yukon set net fishery.

As noted earlier, regional communities depend on processed western foods as well as on subsistence foods. Access to these foods requires cash, and, in a region with limited job opportunities, the jobs associated with fishing, with working as a skipper or crew, or as an employee in a regional processing or shipping business, can be an important source of this cash for a part of the community.

In modern times, successful subsistence hunting requires access to expensive capital and operating equipment. Moncrieff (2007) gathered information on typical subsistence fishing costs for several Yukon River communities. At Holy Cross,

> … Unavoidable costs described in the interviews included gas, motor oil, equipment repairs, and nets. Other costs may include gloves, rain pants, boots, insect repellent, burlap, twine, salt, and freezer bags. A fishing net, which costs $1,500 plus freight, may last four or five years with annual repairs or it may be lost in river debris the first year it is purchased. Outboard motors have to be maintained and sometimes replaced. Gas in this Yukon River village was $3.20 a gallon in June 2004. Most participants felt that gas was the largest annual expense related to subsistence fishing…. (Moncrieff 2007)

At Tanana,

> All the participants were asked about costs of subsistence fishing. Without fail, everyone said gas was the highest cost, ranging from $245 to $1,500 for the fishing season. During the summer of 2005, gas at the pump in Tanana cost $3.60 a gallon. Other costs that were mentioned included supplies for keeping the fish wheel running (netting $400, replacement parts $750 to $1,000, roll of wire $600 and labor), groceries (as much as

> $1,500 a month), electric bill for the freezers ($50-$60 a month), replacement set gillnets (150 feet for $750), knives ($80-200), knife sharpeners, chainsaws, guns and ammunition, sleeping bags, tents, mosquito repellant, boat maintenance ($1,000 annually), rock sale, jars, rope, and tarps. (Moncrieff 2007)

Modern subsistence lifestyles therefore require access to significant amounts of cash to purchase equipment that cannot be made locally. While some subsistence harvests are sold, either legally or illegally, legal prohibitions on sale limit the volumes. Commercial fishing provides cash incomes that can be used to buy necessary equipment.

Commercial fishermen may also use some of their catches for subsistence purposes, while selling the rest. Thus commercially reported harvests undoubtedly include a subsistence component.

The commercial salmon fisheries provide jobs for the permit holders, and for the crew members they may employ. Processing distribution, and support activities within the region also provide additional job opportunities. Chapter 10, provides more information about these additional sources of jobs.

9.4.4 Sport harvests of Chinook salmon

Regional residents may harvest Chinook salmon for sport, using a State sport fishing license, and then use these salmon for essentially subsistence purposes. Regional sport fisheries, including Chinook salmon fisheries may also attract anglers from other places.

Anglers who come to the action area from elsewhere to sport fish may generate economic opportunities for local residents. However, they may also compete with local residents for the available Chinook salmon resources. Visits by outside anglers to some remote rural communities, perhaps to take advantage of a local business combining a bed and breakfast with guided fishing opportunities, might be controversial in some places. The Alaska Department of Community and Economic Development notes that:

> Tourism development is a relatively controversial issue in many parts of Alaska. While some locals oppose visitors to their villages, others wish to open bed and breakfasts. New economic opportunities may be desirable, but some Census Area residents fear being overwhelmed with unfamiliar faces or are wary of being put “on display” for visitors interested in Native Alaska culture. Some residents have the perception that tourism affects many people in the community but benefits only a few. These legitimate concerns should be addressed in preliminary tourism planning for the area and in each community.
>
> Tourism planning and development should also consider the region’s subsistence activities and concerns about competition among resource user groups. Western Alaska has the highest subsistence activity in the state; subsistence hunting and fishing drive the economy in most villages. Cash income is used largely to support a traditional lifestyle. Locals place a high priority on protecting fishing, camping, and berry-picking sites. Poor fish returns and state disaster declarations in recent years have placed additional pressure on regulatory agencies to allocate scarce resource fairly. Also, some residents resent sport fishing and catch and release practices. They consider sport fishing to be “playing with food” and an activity that “shows no respect to the creator.” Even catch and release practices are considered by the Yup’ik culture to be disrespectful to the fish.[35]

[35] On the significance of respect towards salmon resources in Yup’ik culture, see Fienup-Riordan. See especially, Chapter 8, “Original Ecologists?: The Relationship between Yup’ik Eskimos and Animals.” Based on

Sport fishing practices such as "catch and release" that might mitigate resource conflicts, may conflict with local ways of thinking in some areas. Fienup-Riordan (2002) points out that among coastal Yup'ik fishermen, releasing a fish once it has been caught can be a disrespectful act and may have implications for future catches:

> From their earliest years, Yup'ik men and women are taught that the bodies of fish must be treated with respect. Once they have taken a fish from the water, they must use every part of its body to ensure its return the following year. According to Sam Carter of Quinhagak, "It is a warning never to place a fish back in the water once it is caught because that will cause the river to be depleted of fish."

9.4.5 Pacific Northwest Tribal Chinook Harvests

Tribal harvests offshore of the Pacific Northwest, in Puget Sound, in the Columbia River and its tributaries, and in other inland waters, from 1998 to 2007, ranged between about 120,000 Chinook in 1998, and 340,000 Chinook in 2004. (PFMC 2008). Tribal harvests are used for many of the same purposes as Native Alaskan harvests in Alaska: for subsistence, for cultural (ceremonial) purposes, and to earn cash incomes.

More details about tribal involvement in Chinook salmon harvests may be found in the "Affected Environment" sections of the Final Programmatic Environmental Impact Statement for Pacific Salmon Fisheries Management off the Coasts of Southeast Alaska, Washington, Oregon, and California and in the Columbia River Basin (NMFS 2003) and the Puget Sound Chinook Harvest Resource Management Plan Final Environmental Impact Statement (NMFS 2004).

9.4.6 Prohibited Species Donation Program

Salmon that would otherwise have to be discarded by pollock fishermen, may be retained for distribution to low income persons (via hunger relief agencies, food bank networks, or food bank distributors) through the NMFS Prohibited Species Donation Program (PSD program, 50 CFR 679.26). Please see Section 10.2.5 for a detailed discussion of this program.

These programs provide an additional source of food for low income persons. They do not necessarily address the special needs of minority populations, or support minority cultures as they would if harvested in Alaska subsistence fisheries. The volumes supplied are small compared to overall food needs of low income persons in the U.S. The program was not designed to create a market or destination for salmon bycatch, but to reduce the waste of bycatch inevitably taken. Industry participation in the program is not complete and not all salmon taken as bycatch enters this distribution channel. NMFS is unable to determine the volume of Chinook salmon entering this channel. For these reasons, this analysis does not address impacts to this program any further.

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her anthropological fieldwork, Fienup-Riordan argues that Nelson Island Yup'ik have traditional culture viewed animals as an infinitely renewable resource and did not identify a relationship between the numbers of animals harvested and the sustainability of the resource. However respectful behavior towards animals could affect their availability. Thus, a shortage of animals reflected an absence of respectful behavior in the past, rather than overharvest or other biological factors.

9.4.7 Chum salmon

Chum salmon are also used for subsistence and commercial purposes, but play less of a role in sport harvests. The comments made about subsistence harvests apply to chum salmon. They are important for personal consumption and different kinds of exchange. Chum salmon harvests in the commercial fishery provide income for consumption purposes, income that can be used for investment and operating costs in subsistence operations, and some commercial harvests may be diverted to subsistence purposes. Chum salmon have traditionally played a larger role than Chinook salmon as food for dog teams in western Alaska and the interior. This role has fluctuated as the importance of dog teams for regional transportation purposes has fluctuated.

9.4.8 Community Development Quota (CDQ) Program

A portion of the Federal pollock TAC in the BSAI is allocated for harvest by participants in the CDQ Program[36]. The CDQ Program was designed to improve the social and economic conditions in western Alaska communities by facilitating their economic participation in the BSAI fisheries. The large-scale commercial fisheries of the BSAI developed in the eastern Bering Sea without significant participation from rural western Alaska communities. These fisheries are capital-intensive and require large investments in vessels, infrastructure, processing capacity, and specialized gear. The CDQ Program was developed to redistribute some of the BSAI fisheries' economic benefits to adjacent communities by allocating a portion of commercially important BSAI species including groundfish, halibut, and crab, to such communities. The percentage of each annual BSAI catch limit allocated to the CDQ Program varies by both species and management area. These allocations, in turn, provide an opportunity for residents of these communities to participate in and benefit from the BSAI fisheries.

A total of 65 communities are authorized under Section 305(i)(1) of the Magnuson-Stevens Act to participate in the program through six CDQ groups.[37] These CDQ groups are non-profit corporations that manage and administer the CDQ allocations, investments, and economic development projects. Annual CDQ allocations provide a revenue stream for CDQ groups through various channels, including the direct catch and sale of some species, leasing quota to various harvesting partners, and income from a variety of investments. Geographically dispersed, they extend westward to Atka, on the Aleutian Island chain, and northward along the Bering coast to the village of Wales, near the Arctic Circle. The 2000 population of these communities was just over 27,000 persons of whom approximately 87% were Alaska Native. In general economic terms, CDQ communities are remote, isolated settlements with few commercially valuable natural assets with which to develop and sustain a viable, diversified economic base. As a result, economic opportunities have been few, unemployment rates have been chronically high, and communities (and the region) have been economically depressed.

The CDQ Program ameliorates some of these circumstances by extending an opportunity to qualifying communities to directly benefit from the productive harvest and use of these publicly owned resources. The CDQ Program was permanently institutionalized through the Magnuson-Stevens Act authorized by the U.S. Congress in 1996. Originally involving only the pollock fishery, in 1998, the program expanded to become multi-species. Currently, the CDQ program is allocated portions of the groundfish fishery that range from 10.7% for Amendment 80 species, 10% for pollock, and 7.5% for most other species.

[36] Section 11.3 provides an in-depth description of the pollock trawl fishery in which the CDQ groups participate.

[37] The CDQ groups include the Aleutian Pribilof Island Community Development Association (APICDA), the Bristol Bay Economic Development Corporation (BBEDC), the Central Bering Sea Fishermen's Association (CBSFA), the Coastal Villages Region Fund (CVRF), the Norton Sound Economic Development Corporation (NSEDC), and the Yukon Delta Fisheries Development Association (YDFDA).

CDQ groups also have invested in peripheral projects that directly or indirectly support commercial fishing for halibut, salmon, and other nearshore species. This includes seafood branding and marketing, quality control training, safety and survival training, construction and staffing of maintenance and repair facilities that are used by both fishermen and other community residents, and assistance with bulk fuel procurement and distribution. Several CDQ groups are actively involved in salmon assessment or enhancement projects, either independently or in collaboration with ADF&G. Salmon fishing is a key component of western Alaska fishing activities, both commercially and at a subsistence level. The CDQ Program provides a means to support and sustain both such activities.

CDQ groups have invested in inshore processing plants that process halibut, salmon, Pacific cod, crab, and other species. For example, the Coastal Villages Region Fund owns Coastal Villages Seafoods, which processes salmon and halibut. CDQ groups have invested in other local fisheries development activities as well. For example,

> A number of CDQ groups have also promoted investment in local, small-scale operations targeting salmon, herring, halibut or other species. Activities include funding permit brokerage services to assist with retention of limited entry salmon permits in CDQ communities, capitalizing revolving loan programs to provide financing to resident fishermen for the purchase of boats and gear and supporting market development for locally-harvested seafood products (Northern Economics 2002).

CDQ groups have also worked to develop regional fisheries infrastructure. The Norton Sound Economic Development Corporation has provided funding for a Nome seafood center; the Yukon Delta Fisheries Development Association has provided funding for the Emmonak Tribal Council's fish plant, and the Coastal Villages Region Fund made loans to two aluminum welding businesses for boar repair and building at Eek and Hooper Bay. CDQ groups provide educational opportunities for local residents, including college scholarships, and money for vocational and technical training (Northern Economics 2002)

One of the most tangible direct benefits of the CDQ Program has been employment opportunities for western Alaska village residents. CDQ groups have had some successes in securing career track employment for many residents of qualifying communities, and have opened opportunities for non-CDQ Alaskan residents, as well. Jobs generated by the CDQ Program included work aboard a wide range of fishing vessels, internships with the business partners or government agencies, employment at processing plants, and administrative positions. Many of the jobs by the program are associated with shoreside fisheries development projects in CDQ communities. This includes a wide range of projects, including those directly related to commercial fishing. Examples of such projects include building or improving seafood processing facilities, purchasing ice machines, purchasing and building fishing vessel, gear improvements, and construction of docks or other fish handling infrastructure.

CDQ groups provided about 2,000 full and part time jobs in 2005. CDQ wages vary as a percent of total adjusted gross income within the region. A Northern Economics study from 2002 found that, in 1999, CDQ wages were about 2% of total adjusted gross income within the Norton Sound Economic Development Association communities, about 10% within the Yukon Delta Fisheries Development Association communities, about 5% within the Coastal Villages Region Fund communities, about 2% within the Bristol Bay Economic Development Corporation communities, about 10% with in the Aleutian Pribilof Islands Community Development Association communities, and about 9% within the Central Bering Sea Fisherman's Association (Northern Economics 2002, ADCCED).

The six CDQ groups had total revenues in 2005 of approximately $134 million. Pollock is the most important source of CDQ group revenues. In 2005, pollock royalties accounted for 80% of total royalties. Pollock royalties that year were almost $50 million (ADCCED).

While CDQ pollock allocations benefit member communities, they do not provide significant benefits to non-member communities. There are many non-member communities that may be affected by this action. Communities on the mid to upper Yukon, and tributary rivers of the Yukon and communities above the lower fifty miles or so of the Kuskokwim are not members of CDQ groups. Most communities in Kotzebue Sound would not be included; however, communities in this area are dependent on chum and may not be greatly affected by an action to protect Chinook salmon. Residents of some of these communities may be affected indirectly to the extent that they can utilize CDQ group investments in infrastructure or market building. Table 9-5 summarizes key information on regional importance of CDQ groups.

Table 9-5 CDQ groups and their regional importance

Region	CDQ group	Percent of population in CDQ group	Volumes of pollock allocated to CDQ group(s) in 2008	Vessel ownership
Kotzebue	None	0	0	none
Norton Sound	Norton Sound Economic Development Corporation	Fifteen FDQ communities with 8,488 persons account for about 98% of the population in this area (Nome census area, excluding Shishmaref).	22,456 mt	Half interests in three large CPs through their half-ownership of Glacier Fish Company.
Yukon River and delta	Yukon Delta Fisheries Development Association	Six communities with about 3,123 persons account for about 23% of the population in the area (the Wade Hampton and Yukon-Koyukuk census areas minus Takotna, McGrath and Nikolai).	14,266 mt	Significant ownership interests in two large CVs and a pollock mothership
Kuskokwim River and delta	Coastal Villages Region Fund	Twenty communities with about 7,855 persons account for 47% of the regional population (Bethel census area plus Takotna, McGrath, and Nikolai)	24,456 metric tons	46% ownership of American Seafoods and thus has significant interests in eight pollock CPs, and one CV
Bristol Bay, Alaska Peninsula, Aleutians, Pribilofs	Central Bering Sea Fishermen's Association; Aleutian-Pribilof Island Community Development Association; Bristol Bay Economic Development Corporation	Twenty-three communities with 7,605 persons account for about 57% of the regional population (Aleutians East and West, Lake and Peninsula, and Dillingham census districts, minus certain communities around Lake Iliamna.	40,760 metric tons	CBSFA has significant ownership interests in three large CVs; APICDA has significant interests in a large CV and a large CP; BBEDC has significant interests in six CVs and a CP
Elsewhere	None	0	0	None
Notes: Pollock allocations are from 2008 groundfish specifications. Gross revenues associated with vessel interests are confidential and have not been reported. Population information is from the 2000 census. Vessel ownership information is estimated from a variety of sources for 2008.				

9.4.9 Pollock deliveries to shoreside processors[38]

Previous studies have indicated that the Alaska communities with the strongest engagement in the North Pacific groundfish fishery are Unalaska, Akutan, Sand Point, and King Cove.[39] These four communities and their specific ties to the groundfish fishery were detailed in the PSEIS (NMFS 2004). The pollock TAC allocated to catcher vessels delivering to inshore AFA processors is divided among fishing cooperatives that have strong community orientations. Some 55% of the 2008 catcher vessel quota is allocated to three cooperatives associated with Dutch Harbor/Unalaska processors (the Unalaska Cooperative, the UniSea Fleet Cooperative, and the Westward Fleet Cooperative), and another 31% is allocated to a cooperative associated with an Akutan processor (the Akutan Catcher Vessel Association). This suggests that Dutch Harbor, followed by Akutan, will receive the largest proportions of the landed pollock. In this section, existing community level information is summarized.[40]

These communities vary widely in their population structure. For example, Unalaska is the largest community but has the lowest Alaska Native population percentage, and King Cove and Sand Point have a much higher Alaska Native population component than either of the other two communities. While Akutan has a relatively low Alaska Native population percentage, the Alaska Native population is highly concentrated in one area and generally insulated from commercial groundfish-related activity and its associated non-Native population. Thus, the Alaska Native portion of the community at least in some ways bears the most resemblance to “village life” from an earlier era among the four communities.

As shown in Table 9-6 below, Unalaska has a far higher white or non-minority population percentage than the other three communities. Asian residents represent the largest population segment in Akutan, and the second largest in Unalaska (behind whites) and in King Cove (behind Alaska Natives), and the third largest in Sand Point (behind Alaska Natives and whites). These communities have quite different histories with respect to the growth of the different population segments present in the community in 2000.

[38] This section is based on the discussion in the Alaska Groundfish Harvest Specifications Final Environmental Impact Statement (NMFS, 2007). The analysis was originally prepared by Michael Downs and Marty Watson of the consulting firm EDAW.

[39] As noted in Alaska Groundfish Fisheries PSEIS (NMFS 2004) there are also ties between the fishery to Adak, Chignik, False Pass, and St. Paul. However, these ties are far less pervasive and do not have the historical depth of the ties seen in Unalaska, Akutan, Sand Point, and King Cove. Due to these differences in existing conditions, the communities of Adak, Chignik, False Pass, and St. Paul are not detailed in this section, but each may experience impacts resulting from management actions under the various alternatives, if not to the degree seen in Unalaska, Akutan, Sand Point, and King Cove.

[40] As noted above, this region also encompasses the Pribilof Island communities (St. George and St. Paul). While not having the same degree of direct engagement with the groundfish fisheries as the other communities specifically noted in this section, the Pribilof communities may experience impacts associated with groundfish management actions in a number of ways, as discussed in subsequent sections on impacts to CDQ communities and marine mammal-based subsistence. Existing conditions relevant to environmental justice analysis for these communities are discussed in more detail in those sections below.

Table 9-6 Racial and Ethnic Composition of Population, Selected Alaska Peninsula/Aleutian Islands Region Communities, 2000

Race/Ethnicity	Unalaska		Akutan		King Cove		Sand Point	
	N	%	N	%	N	%	N	%
White	1,893	44.2	168	23.6	119	15.0	264	27.7
Black or African American	157	3.7	15	2.2	13	1.6	14	1.5
Native American/Alaska Native	330	7.7	112	15.7	370	46.7	403	42.3
Nat. Hawaiian/Other Pacific Islander	24	0.6	2	0.3	1	0.1	3	0.3
Asian	1,312	30.6	275	38.6	212	26.8	221	23.2
Some Other Race	399	9.3	130	18.2	47	5.9	21	2.2
Two Or More Races	168	3.9	11	1.5	30	3.8	26	2.7
Total	4,283	100	713	100	792	100	952	100
Hispanic*	551	12.9	148	20.8	59	7.4	129	13.6

* "Hispanic" is an ethnic category and may include individuals of any race (and therefore is not included in the total as this would result in double counting).
Source: U.S. Bureau of Census.

Table 9-7 Employment, Income, and Poverty Information, Selected Alaska Peninsula/Aleutian Islands Region Communities, 2000

Community	Total Persons Employed	Unemployed	Percent Unemployment	Percent Adults Not Working	Not Seeking Employment	Percent Poverty	Median Family Income
Akutan	97	505	78.9	84.84	38	45.5	$43,125
King Cove	450	31	4.7	31.50	176	11.9	$47,188
Sand Point	427	190	22.8	48.67	215	16.0	$58,000
Unalaska	2,675	414	11.1	27.93	625	12.5	$80,829

Source: U.S. Bureau of the Census 2000.

One important constant across all of these communities is that each is a minority community in the sense that minorities make up a majority of the population in each community. Unalaska may be described as a plural or complex community in terms of the ethnic composition of its population. Although Unalaska was traditionally an Aleut community, the ethnic composition has changed with people moving into the community on both a short-term and long-term basis.

Akutan is a unique community in terms of its relationship to the Bering Sea groundfish fishery. It is the site of one of the largest shore plants in the region, but it is also the site of a village that is geographically and socially distinct from the shore plant. This duality of structure has had marked consequences for the relationship of Akutan to the fishery[41] and in turn highlights the fundamentally different nature of Akutan and Unalaska. Akutan, while deriving economic benefits from the presence of a large shore plant near the community proper, has not articulated large-scale commercial fishing activity with the daily life of the

[41] One example of this may be found in Akutan's status as a CDQ community. Initially (in 1992), Akutan was (along with Unalaska) deemed not eligible for participation in the CDQ program because the community was home to "previously developed harvesting or processing capability sufficient to support substantial groundfish participation in the BSAI …," though they met all other qualifying criteria. The Akutan Traditional Council initiated action to show that the community of Akutan, per se, was separate and distinct from the seafood processing plant some distance away from the residential community site, that interactions between the community and the plant were of a limited nature, and that the plant was not incorporated in the fabric of the community such that little opportunity existed for Akutan residents to participate meaningfully in the Bering Sea pollock fishery. That is, it was argued that the plant was essentially an industrial enclave or worksite separate and distinct from the traditional community of Akutan and that few, if any, Akutan residents worked at the plant). With the support of the APICDA and others, Akutan was successful in a subsequent attempt to become a CDQ community and obtained CDQ status in 1996.

community as has Unalaska, nor has it developed the type of support economy that is a central part of the socioeconomic structure of Unalaska.

While U.S. Census estimates show Akutan had a population of 589 in 1990 and 713 in 2000, the Traditional Council considers the local resident population of the community to be around 80 persons, with the balance being considered non-resident employees of the seafood plant. This definition obviously differs from census, state, and electoral definitions of residency but is reflective of the social reality of Akutan. The residents of the village of Akutan, proper, are almost all Aleut.

Sand Point and King Cove share a more or less common development history, but one quite different from either Unalaska or Akutan.[42] Historically, both of these communities saw a large influx of non-resident fish tenders, seafood processing workers, fishermen, and crew members each summer. For the last several decades, both communities were primarily involved in the commercial salmon fisheries of the area, but with the decline of the salmon fishery, plants in both communities have diversified into other species. In more recent years, the processing plants in both communities have become heavily involved in the groundfish fishery.[43]

Table 9-7 displays data on employment, income, and poverty[44] information for the relevant communities for 2000. The income range is large for the communities shown, with the median family income in Akutan being roughly half of that in Unalaska.

Additionally, Table 9-7 illustrates a potentially problematic aspect of the 2000 data. As shown in the PSEIS, in 1990 there was virtually no unemployment in these communities, no doubt due in large to the presence of fishery-related employment opportunities (NMFS 2004). A working knowledge of the fishing industry would seem to indicate the 2000 data are anomalous. For example, in 2000 the U.S. Census lists a total of 505 unemployed persons in Akutan. Given that the traditional village of Akutan consists of less than 100 persons (including all age groups, not just adults in the labor pool who could qualify as employed or unemployed), the overwhelming majority of persons enumerated as unemployed must have been idled seafood processing workers. While this unemployment may have been real in the sense that processing workers were present and not actively working when the census was taken, it is most likely an artifact of the timing of the census. Processing workers are not typically present in the community when the plant is idle for any extended period of time. Under normal conditions, there are no unemployed seafood processing workers present in the community (by design). The same type of data problem may be occurring in Sand Point and Unalaska, but this is not as clear as is the case for Akutan.

The contrast between these and the other communities is reflective of both lack of economic development in these communities and the nature of the workforce population in communities with shore plants, where

[42] Sand Point was founded in 1898 by a San Francisco fishing company as a trading post and cod fishing station. Aleuts from surrounding villages and Scandinavian fishermen were the first residents of the community. King Cove was founded in 1911 when Pacific American Fisheries built a salmon cannery. Early settlers were mostly Scandinavian, European, and Aleut fishermen and their families.

[43] Their structural relationships to the fishery have diverged since the passage of the AFA. Processing facilities in both communities qualified as AFA entities; however, King Cove qualified for a locally based catcher vessel co-op while Sand Point did not.

[44] Poverty figures in this section are based on U.S. Census information which, in turn, is based on the Federal government's official poverty definition. Families and persons are classified as below poverty if their total family income or unrelated individual income was less than the poverty threshold specified for the applicable family size, age of householder, and number of related children under age 18 present. The poverty thresholds are the same for all parts of the country and are not adjusted for regional, state, or local variations in the cost of living. The poverty thresholds are updated every year to reflect changes in the Consumer Price Index.

large numbers of processing workers are present, tend not to have non-working adult family members present with them, and tend to be in the community exclusively for employment purposes.

Beyond the overall population, income, and employment estimates for the individual communities, it is important for the purposes of environmental justice analysis to examine information on the residential groundfish fishery workforces. It is likely that employment and income losses or gains associated with at least some of the proposed alternatives would be felt among the local seafood processing workers, and these workers do not comprise a representative cross section of the community demography.

One method to examine the relative demographic composition of the local processing workforces is to use group quarters housing data from the U.S. Census (keeping with the established practice of using U.S. Census data for environmental justice analysis). The group ethnicity-by-housing type data drawn from the 1990 census and the 2000 census (as well as subsequent sections augmenting this information with industry-provided estimates for 2000) was discussed in detail in the PSEIS and is summarized here.

Group housing in Unalaska is largely associated with the processing workforce. A majority of the population lived in group housing as of 1990 and the total minority population proportion was substantially higher in group quarters than in non-group quarters. The 2000 estimates showed a similar overall split between group quarters and non-group quarters populations, but the minority population distribution between and within housing types changed substantially in the 1990 to 2000 period. Although demographic categories changed somewhat between the 1990 and 2000 census, some relatively large changes are readily apparent. For example, in 1990, the “Asian or Pacific Islander” category accounted for 27% of group quarters population, and 42% by 2000.

In general, in 2000 Unalaska had a substantially greater minority population in absolute and relative terms than it did in 1990, and this is readily apparent within the group quarters population that is largely associated with seafood processing workers. In other words, environmental justice is potentially a large concern if there is the potential for processing worker displacement, and one that has grown through time.

Group housing in Akutan is almost exclusively associated with the processing workforce. As of 2000, a total 89% of the population lived in group housing, which represents the extreme of the four communities considered in this region. In 2000, the racial and ethnic composition of the group and non-group housing segments were markedly different, with the non-group housing population being predominately Alaska Native (87%), and the group housing population having little Alaska Native/Native American representation (7%). Like Unalaska, overall minority population representation was higher in absolute and relative terms in the community as a whole and in both group and non-group quarters in 2000 than in 1990.

As with the other communities, group housing in King Cove is largely associated with the processing workforce (38% of the population in 2000). The distribution of ethnicity between housing types is striking. In 2000, Alaska Natives/Native Americans comprised 75% of the non-group quarters population in the community; there was only one Alaska Native/Native American individual living in group quarters in the community. The “Asian” group comprised over 64% of the group quarters population in 2000, having risen substantially from 1990.

The white component of the population of King Cove was smaller in absolute and relative terms in 2000 than in 1990 for the community as a whole and in group quarters. Among non-group quarters residents, the number of white residents was larger in 2000 than in 1990 but still represented a smaller proportion of the non-group quarters population in 2000 than in 1990. In other words, environmental justice is clearly an issue of potential concern for the community as a whole and for the seafood processing-associated group quarters population in particular, and census counts suggest that minority representation has substantially increased over the period 1990 to 2000.

In Sand Point as of 2000, 36% of the population lived in group housing, which was only slightly less than the King Cove estimate for that same year. In 2000, no Alaska Natives/Native Americans lived in group quarters in the community, but they comprised 66% of the population living outside of group quarters. As shown, the ethnic and racial diversity among group quarters residents was, in general, substantially less in 2000 than in 1990. Asians comprised over 60% of all persons living in group quarters in 2000 with persons of Hispanic origin accounting for about two-thirds of the remaining 40% of group quarters residents.

Information on 2000 workforce demographics was obtained for four of the six major groundfish shore plants in the Alaska Peninsula/Aleutian Islands region, as well as one of the two floating processors that are classified as inshore plants. At least some of the entities voluntarily providing these data consider them confidential or proprietary business information, but they agreed to provide the information if it was aggregated with data supplied by others such that details about individual operations were not disclosed. As a result of these concerns, communities cannot be discussed individually.

It can be stated that the total combined reported processing (and administrative) workforce of 2,364 persons was classified as 22.5% white or non-minority, and 77.5% minority. Reporting shore plants ranged from having a three-quarters minority workforce to an over 90% minority workforce. It is worth noting that different firms provided different levels of detail in the breakout of the internal composition of the minority component of their workforce. For some plants, the total minority estimate was not disaggregated, and too few plants within this region provided detailed data to allow region-specific discussion.

In general, however, all of the shore plants in this region that provided detailed data have workforces that are 5% or less Black or African American and 5% or less Alaska Native/Native American (a pattern also seen in the detailed data from Kodiak plants). More variability was seen among other minority population components. The group classified as Asian/Pacific Islander was the largest minority group in two-thirds of the plants in any region reporting detailed data, and the group classified as Hispanic was the largest minority group in the remaining one-third. Two entities provided time series data. One provided data spanning a 10-year period, while the other provided information covering a 4-year span. For the former, the minority workforce component increased over time; for the latter, no unidirectional trend existed.

9.4.10 Marine Mammals/Seabirds

9.4.10.1 Marine mammals[45]

The subsistence take of marine mammals is restricted to the Alaska Native portion of the population under the terms of the Marine Mammal Protection Act of 1972 (as reauthorized in 1994 and amended through 1997; the specific exemption for Alaska Natives is found in Section 101 [16 USC 1371]). The Alaska Native exemption within the MMPA allows for Alaska Natives who dwell on the coast of the North Pacific Ocean or Arctic Ocean to take marine mammals for the purposes of subsistence (or for the purposes of creating and selling authentic native handicrafts and articles of clothing). Chapter 8 analyses the impacts of the alternatives on marine mammals.

[45] This section reproduces, with minor changes, the marine mammals discussion from the Environmental Justice section of the Groundfish Harvest Specifications EIS. That section was originally prepared by Dr. Mike Downs and Marty Watson of the consulting firm EDAW (NMFS, 2007).

Humans harvest a wide range of marine mammals in the action area, including seals, whales, Steller sea lions, and walrus. The mammals provide food and materials for a wide range of equipment and utensils. For example, walrus hides stretched over a wooden frame provided the materials for construction on the traditional umiak. The Marine Mammal Protection Act and the Endangered Species Acts permit the sale of handicrafts made from marine mammal parts. Thus handicrafts made from marine mammal parts may be sold to generate cash incomes (NMFS, "Buying or Possessing…").

As discussed in Chapter 8, pollock fishing activities and changes in those activities could impact marine mammal populations though competition for marine mammal prey, by disturbing the animals, or by accidentally killing or injuring animals ("takes") during the course of normal operations.

The focus in this discussion is on Steller sea lions, harbor seals, and northern fur seals. Harvests in comparison with the potential biological removals (the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population) for marine mammals have been used to identify marine mammals with potentially serious adverse impacts of the groundfish fishery for detailed analysis here. In situations where human induced mortality of species is close the animal's potential biological removal level, stock declines may lead to downward adjustments in removal levels, which would result in the removal level being exceeded under the current levels of mortality. Adjustments to mortality would then be considered, with reduction in subsistence harvests one possibility. Human induced mortality is close to the removal level for two species: Steller sea lions and harbor seals. Groundfish fishery competition for marine mammal prey may be an important factor that could lead to reductions in removal levels. Prey competition is considered for Steller sea lions and northern fur seals.

Steller sea lions are taken by a number of methods throughout the year. Unlike other subsistence activities that are more broadly participatory, hunting for sea lions is a relatively specialized activity, and a relatively small core of highly productive hunters from a limited number of households account for most of the harvest. There has been some change in harvesting techniques in recent years, and there is also variation by region. Seasonality of sea lion harvest is quite variable and appears to be dependent on sea lion abundance and distribution.

Looking across regions, in 2003 approximately 51% of the total subsistence take of Steller sea lions occurred in the Aleutian Islands region, about 17% in the Kodiak Island region, about 15% in the Pribilof Island region, and about 12% in the North Pacific Rim region. The Southeast Alaska and South Alaska Peninsula regions accounted for about 3 and 2%, respectively, of the total subsistence take in 2003. In 2003 a total of 17 of the 62 surveyed communities reported harvesting sea lions, with 9 communities reporting takes of five or more sea lions. The seven top ranking communities were Atka (82 sea lions), Old Harbor (32 sea lions), St. Paul (18 sea lions), Unalaska (16 sea lions), St. George (14 sea lions), Tatitlek (14 sea lions), and Akutan (9 sea lions). These seven communities accounted for 185 sea lions, or 87% of the total Alaska subsistence take (Wolfe et al. 2004).

The number of individuals reporting hunting sea lions has declined substantially since the early 1990s. The estimated numbers of households that reported at least one member hunting sea lions declined from 199 in 1992 to 97 in 2003. In general, declines in the numbers of sea lion hunters occurred at a time when sea lions became increasingly harder to find in local hunting areas and consequently more difficult and expensive to hunt. Rate of success, however, has not tracked in parallel with numbers of hunters or reported increases in time and effort necessary to hunt successfully. The proportion of unsuccessful hunting households for sea lions has ranged from 40% in 1994 to 21% in 2001. (Wolfe et al. 2004).

While the available information suggests some support for a direct relationship between the overall Steller sea lion population and the level of subsistence harvest, such support is not definitive and other factors cannot be excluded. Given the relatively small numbers involved, the concentrated efforts of a single hunter or just a few hunters can make relatively large percentage changes in community harvest totals. The weighting of factors is also not possible from the evidence available. It does appear that present Steller sea lion harvest methods are likely to be more successful, and certainly more efficient, when resource populations (and density) are higher. A number of factors may be at work, however, such that a recovery in Steller sea lion abundance may not necessarily result in a marked increase in subsistence take, but too little is known regarding the determinants of subsistence demand for Steller sea lions to reach any definitive conclusions.

On a community level, it is important to note that of all the communities identified in the text of the PSEIS (NMFS 2004) as having a documented Steller sea lion harvest, only Akutan and Unalaska are identified as "regionally important groundfish communities" with substantial direct participation in the fishery. In other words, where use of Steller sea lions is identified as important to the community subsistence base, the commercial groundfish fishery is generally not, and vice versa.

The PSEIS notes that fifty years ago, the harbor seal was so abundant in Alaska (and perceived to be in conflict with commercial salmon fisheries) that the state issued a bounty for the animal. State-sponsored bounties and predator control programs, as well as commercial harvest of harbor seals, occurred on a regular basis throughout the animal's range until the passage of the MMPA. Both adult seals and pups were harvested for pelts. An estimated 3,000 seals, mostly pups, were harvested annually for their pelts along the Alaska Peninsula between 1963 and 1972, accounting for 50% of the pup production. (NMFS 2004)

The PSEIS goes on to note that harvest of harbor seals for subsistence purposes is likely the highest cause of anthropogenic mortality for this species since the cessation of commercial harvests in the early 1970s. Between 1992 and 1998, the statewide harvest of harbor seals from all stocks ranged between 2,546 and 2,854 animals, the majority of which were taken in southeast Alaska. Aside from their value as a food source, harbor seals play an important role in the culture of many Native Alaskan communities. (NMFS 2004)

The PSEIS provides the following regional information about the relationship between human induced mortality and the maximum number of animals that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (the potential biological removals or PBR). The Bering Sea stock of harbor seals is approximately 13,000 animals, and the calculated PBR is 379 animals. The annual subsistence harvest from this stock from 1994 to 1996 was approximately 161 animals, 42% of PBR for this species. In 1998, 178 harbor seals from this stock were taken in the subsistence harvest. For the GOA stock, the calculated PBR is 868 animals. The average annual subsistence harvest from the GOA between 1992 and 1996 was 791 animals, representing 91% of the PBR for this stock. The latest available harvest data from 1998 (792) is comparable to the average subsistence harvest of harbor seals from previous years. For the southeast stock, the calculated PBR is 2,114 animals. The average annual subsistence harvest from southeast between 1992 and 1996 was 1,749 animals, representing 83% of the PBR for this stock (NMFS 2004).

The context of subsistence harvest of northern fur seals is much different from that of Steller sea lions, and subsistence effort is highly concentrated in the communities of St. Paul and St. George in the Pribilof Islands. The commercial harvesting of northern fur seals on the Pribilof Islands began shortly after the first known discovery of the islands in 1786. The commercial harvest was continued by the United States when the Pribilof Islands came under U.S. jurisdiction with the purchase of Alaska from Russia in 1867 and lasted until 1984. The method of subsistence harvest of northern fur seals on the Pribilof Islands is a direct outgrowth of the commercial harvest that took place on the islands and, due to this historical and legislative context, the organization of the subsistence harvest of northern fur seals is very different from the organization of the harvest of Steller sea lions elsewhere. The subsistence harvest of northern fur seals in the Pribilof Islands is conducted as an organized, land-based, group activity.

NMFS entered into co-management agreements with the Tribal Governments of St. Paul and St. George under Section 119 of the MMPA in 2000 and 2001, respectively. These agreements are specific to the conservation and management of northern fur seals and Steller sea lions in the Pribilof Islands, with particular attention to the subsistence take and use of these animals. To minimize negative effects on the population, the fur seal subsistence harvest has been limited to a 47-day harvest season (June 23-August 8) during which only sub-adult male seals may be taken. In addition, the Fur Seal Act authorizes subsistence harvest of fur seals by Native Americans dwelling on North Pacific Ocean coasts (but not for seal skins, which must be disposed of), but that harvest can only be from canoes paddled by less than five people each and without the use of firearms.

On St. Paul Island, annual subsistence take of northern fur seals ranged between 754 and 522 animals over the period 2000-2003. On St. George, the annual harvest ranged between 203 and 121 animals over this same period. St. Paul and St. George are predominately Alaska Native communities. In 2000, the total population of St. Paul was 532, 86% of whom were Alaska Native/Native American. St. George had a population of 152 in 2000, of whom 92% were Alaska Native/Native American. These communities are relatively isolated, even by rural Alaska standards, from other population centers and private sector economic opportunities are relatively limited in both communities as well.

While northern fur seal harvest is an essential component of subsistence in the Pribilof Islands, only three non-Pribilof communities, the Aleutian communities of Akutan, Nikolski, and Unalaska, show any level of harvest for northern fur seals for any year in which ADF&G harvest surveys were conducted. For Akutan, during the single year that shows up in the data, fur seal harvests accounted for about 2% of the total subsistence harvest in the community. This is based on pounds per person of total subsistence harvests for the community. For Nikolski and Unalaska, fur seal harvests accounted for about two-tenths of 1% and less than one-tenth of 1% of total community subsistence harvest, respectively.

As noted in the fur seal subsistence harvest EIS (NMFS 2005), the cumulative effect of the harvest of fur seal prey species (pollock) may result in a conditionally significant adverse impact on fur seals. Such an impact could potentially result in impacts on subsistence hunting opportunities, if the impacts result in a drop in fur seal population leading to a drop in subsistence harvest levels. However, the potential competition between fur seals and the pollock fishery is not well understood (Chapter 8).

9.4.10.2 Seabirds

Alaskan's have been harvesting about 225,000 birds a year for subsistence purposes. Most of these are geese and ducks, but about 23,000 a year have been seabirds. Significant portions of the seabird harvest have taken place in the action area. St. Lawrence Island accounts for about 13,000 seabirds, while most of the rest are taken in the Yukon-Kuskokwim Deltas and the Bering Strait areas. Alaskans have also been harvesting about 113,000 bird eggs a year for subsistence purposes. The vast majority of these, about 95,000 a year, have been seabird eggs, and most of these have been taken in the action area. Particularly important components of the harvest come from the Northwest Arctic, the Bering Strait area, the Bristol Bay area, and St. Lawrence Island. Harvests are also taken, however, in the Yukon-Kuskokwim, Alaska Peninsula, and Aleutian Island areas (AMBCC).[46]

[46] Average annual harvests appear to be rough estimates prepared by the Alaska Migratory Bird Co-Management Council on the basis of a number of different survey instruments, and appear to apply to the period 1995-2002.

Pollock fishing activities and changes in those activities could impact seabird populations though competition for seabird prey, by accidentally killing or injuring birds ("takes") during the course of normal operations, or by impacting benthic habitat used by the birds. Chapter 8 analyses the impacts of the alternatives on seabirds.

9.4.11 Groundfish/Forage Fish/Prohibited Species

9.4.11.1 Groundfish

Groundfish species are those species that support either a single species or mixed species target fishery, are commercially important, and for which a sufficient data base exists that allows each to be managed on its own biological merits. Accordingly, a specific TAC is established annually for each target species. Catch of each species must be recorded and reported. This category includes pollock, Pacific cod, sablefish, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, flathead sole, Alaska plaice, "other flatfish", Pacific ocean perch, northern rockfish, shortraker rockfish, rougheye rockfish, "other rockfish", Atka mackerel, and squid (Council, BSAI FMP, page 10). Chapter 7 provides an analysis on the impacts of the alternatives on non-pollock groundfish.

Subsistence use of groundfish resources in Alaska is described in the PSEIS (NMFS 2004). The PSEIS provides relatively little detail about groundfish subsistence in western Alaska however. Data is provided for Unalaska and Akutan. This data (based on two surveys from the early 1990s) indicates that groundfish comprised 7% to 9% by weight of subsistence consumption; the major groundfish species consumed were cod and rockfish. Elsewhere in the state subsistence groundfish use levels also appear to be low compared to use levels of subsistence resources overall, and in relation to other fish resources in particular. Commercial fisheries may target stocks, such as rockfish, that are also targeted by subsistence fishermen, but there is no indication that this dual use of stocks has resulted in detrimental impacts to groundfish subsistence utilization under existing conditions. (NMFS 2007) Thus the PSEIS indicates that pollock are not an important subsistence resource.

9.4.11.2 Forage fish

Forage fish species are those species which are a critical food source for many marine mammal, seabird and fish species. Forage fish may be important to low income and minority populations in the region, if, like eulachon and capelin, they are harvested for subsistence or commercial purposes. They are also important because other species depend on them for forage, and these other species, such as salmon, seals or sea birds, may be harvested for subsistence or commercial use.

Forage fish species in the Bering Sea and Aleutian Islands region include Osmeridae family (eulachon, capelin, and other smelts), Myctophidae family (lanternfishes), Bathylagidae family (deep-sea smelts), Ammodytidae family (Pacific sand lance), Trichodontidae family (Pacific sand fish), Pholidae family (gunnels) Stichaeidae family (pricklebacks, warbonnets, eelblennys, cockscombs, and shannys), Gonostomatidae family (bristlemouths, lightfishes, and anglemouths), and Order Euphausiacea (krill) (Council, BSAI FMP, page 11). Chapter 7 provides an analysis on the impacts of the alternatives on forage fish.

Most forage fish harvests in the Bering Sea and Aleutian Islands consist of smelts (although significant volumes of sandfish were taken in 2001). From 2002 to 2005, BSAI forage fish harvests ranged between 10 and 35 metric tons. Pollock trawling accounted for almost all of the smelt harvest, however, the available information indicates that the trawlers are harvesting a small proportion of biomass. (NMFS 2007).

9.4.11.3 Prohibited species

Prohibited species are those species and species groups the catch of which must be avoided while fishing for groundfish, and which must be returned to sea with a minimum of injury except when their retention is authorized by other applicable law. Prohibited species in the Bering Sea include Pacific halibut, Pacific herring, Pacific salmon, Steelhead, King crab, and Tanner crab (Council, BSAI FMP, page 10-11).

Pacific salmon (Chinook and chum) have been dealt with in earlier sections. Several of the other species are the objects of fisheries carried out by commercial or subsistence fishermen from western Alaska (halibut, herring, steelhead) or of CDQ groups (crab species). Impacts on these species thus could have impacts on low income or minority communities in western Alaska.

Chapter 7 provides detailed background on the management of the bycatch of these species by the pollock fishery and discusses the potential impacts of the alternatives on these bycatches.

9.5 How will the alternatives affect minority or low income communities?

The potential actions may affect minority and low income populations within the region in several ways. These include: (1) changes in Chinook salmon returns to escapement, subsistence harvest, or commercial harvest, in western and Interior Alaska and changes in salmon deliveries to food banks; (2) changes in pollock revenues earned through participation in the CDQ Program, and changes in western Alaska pollock landings by catcher vessels (3) changes in the impacts of other resources that are exploited commercially or for subsistence by residents of western Alaska, including chum salmon, marine mammals, seabirds, other groundfish, forage species, and prohibited species.

Based on the review of potentially impacted minority and low income populations, the following populations have been identified for detailed analysis:

- Chinook salmon users
- CDQ group beneficiaries
- Pollock fishing and processing workers
- Other marine resource users

The analysis looks at these four user groups as they occur in six regions:

- Kotzebue Sound
- Norton Sound
- Yukon River and Yukon delta
- Kuskokwim River and Kuskokwim delta
- Bristol Bay, Alaska Peninsula, Pribilof Islands, Aleutian Islands
- Persons living outside western and Interior Alaska

Resident populations in western and Interior Alaska have been broken into five regional populations to take account of potential regional variations in impacts (for example, Chinook salmon subsistence is much less important in the Kotzebue Sound region than along the Yukon River). There may be considerable overlap between CDQ group beneficiaries and regional residents in most of these regions. However, the impact of actions would be so different for the two groups that they have been evaluated independently. Yukon River impacts may also impact residents of Canada, however, these impacts have not been addressed independently in this analysis since the focus is on impacts on residents of the United States.

The analysis is presented below in Table 9-8 through Table 9-13 below. These summarize the impacts on low income or minority populations associated with one of these three classes of impacts. Each table has the same structure with a row for each of the major elements of each alternative and a cell in the right hand column that discusses the potential impacts on these communities. This discussion is based on the evaluation of impacts in the Regulatory Impact Review (Chapter 10) and the species specific chapters in the EIS.

Table 9-8 Kotzebue Sound: impacts on low income or minority populations

Alternative	Options/ suboptions, components	Chinook users	CDQ group beneficiaries	Minorities in pollock harvesting and processing	Users of other marine resources
Alternative 1: Status quo	Status quo	Subsistence salmon harvests are important to residents of communities around Kotzebue Sound, however, most of the salmon harvest is chum salmon. There is little Chinook salmon taken here. These alternatives probably have few, if any, Chinook-related impacts in this region.	No communities north of the Bering Strait are members of CDQ groups. They would not be impacted by any of these alternatives through this mechanism.	NMFS does not have information on the numbers of persons from the Kotzebue region seasonally employed on catcher-processors, motherships, or shoreside processing plants in Dutch Harbor, Akutan, King Cove, or Sand Point. However, NMFS believes the numbers are small, and that this is not a source of disproportionate impacts in this area.	Chum salmon are an important subsistence resource for people in the Kotzebue region. However this action is expected to have a minor impact on chum salmon escapement, and much of that impact will be outside of western Alaska. This is unlikely to be a source of disproportionate impacts on minority or low income populations here. Analysis of Alt 2 impacts on chum salmon show that Chinook management measures are likely to slightly reduce chum salmon bycatch, but stock specific impacts are uncertain. Marine mammals, including seals, walrus, and whales are harvested for subsistence purposes in this region. The impacts of the alternatives on marine mammals exploited regionally are not entirely clear. To the extent that tighter caps reduce salmon bycatch and pollock directed catch, they may reduce competition between the pollock industry and certain marine mammals such as Steller sea lions and northern fur seals for prey. Existing takes by the pollock industry are small so reduction in takes is unlikely to have an impact. Disturbance impacts may decrease or increase, depending on the ways the alternatives affect pollock fleet deployment. Seabirds and seabird eggs are harvested in the region for subsistence purposes. Lower caps under Alternative 2 may reduce potential pollock industry seabird impacts; triggered closures may lead to fleet redeployments with uncertain impacts on seabirds.
Alternative 2: Hard cap	Hard Cap level				
	Seasonal distribution of hard caps				
	Sector Allocation				
	Sector Transfer and rollover				
	Cooperative Provisions				
Alternative 3: Triggered closures	Trigger cap formulation				
	Management				
	Sector allocation				
	Sector transfer				
Alternative 4 Preliminary Preferred Alternative	Hard cap with ICA: 68,392				
	Hard cap without ICA 47,591				
	Seasonal distribution of hard caps				
	Sector transfer and rollover				

					Other groundfish species, forage fish, and PSC fish species, support subsistence consumption in the region. Alternative 2 options with tighter caps may reduce groundfish bycatch in the pollock fishery; seasonal allocation options can shift the pollock fleet between the A and B seasons. These seasons have different bycatch profiles and this may lead to changes in the composition of bycatch. Pollock fishery closures may lead to redeployment of pollock vessels to alternative fisheries; however, catches in those fisheries are limited by TACs and by bycatch limits. Impacts on other groundfish are less predictable under Alternative 3. Nevertheless, aggregate species harvests would continue to be constrained by TAC and bycatch requirements. The alternatives are not expected to increase the harvests of other PSC species to an extent that would affect the abundance of these species. Forage fish impacts may be reduced under Alternative 2, but Alternative 3 impacts are likely to be similar to those under the status quo.

Table 9-9 Norton Sound: impacts on low income or minority populations

Alternative	Key elements of the alternative	Chinook users	CDQ group beneficiaries	Minorities in pollock harvesting and processing	Users of other marine resources
Alternative 1: Status quo	Status quo	Chinook salmon are of relatively small importance in the subsistence and fisheries in Norton Sound and of more importance in commercial fisheries. The average annual Chinook harvest from 1997 to 2006 was 8,332 fish. The numbers of AEQ returns to Norton Sound have not been estimated for this region.	The Norton Sound Economic Development Corporation (NSEDC) represents the CDQ interests of 15 communities and 8,488 persons in this region. This is an estimated 98% of the persons in this area. For the most part these persons benefit indirectly from the CDQ group royalty payments and income from fishing vessels through economic development projects in their communities (although some benefit by direct involvement in CDQ activities). In 2008, the NSEDC received 22,456 mt of pollock CDQ	NMFS does not have information on the numbers of persons from the Norton Sound region seasonally employed on catcher-processors, motherships, or shoreside processing plants in Dutch Harbor, Akutan, King Cove, or Sand Point. 2000 Census data and later survey information suggests that Alaska Natives were active in shoreside workforces and on catcher-processors. Except in the shoreside processors at King Cove and Sand Point, Alaska Natives do not seem to have been the largest minority group employed in these operations.	Chum salmon are of modest importance in subsistence fisheries in this region. Analysis of impacts on chum salmon show that Chinook management measures are likely to slightly reduce chum salmon bycatch, but stock specific impacts are uncertain. Marine mammals are harvested for subsistence purposes in this region. The impacts of the alternatives on marine mammals exploited regionally are not entirely clear. To the extent that tighter caps reduce salmon bycatch and pollock directed catch, they may reduce competition between the pollock industry and certain marine mammals such as Steller sea lions and northern fur seals for prey. Existing takes by the pollock industry are small so reduction in takes is unlikely to have an impact. Disturbance impacts may decrease or increase, depending on the ways the alternatives affect pollock fleet deployment. Seabirds and seabird eggs are harvested for subsistence in this region. Lower caps under Alternative 2 may reduce potential pollock industry seabird impacts; triggered closures may lead to fleet redeployments with uncertain impacts on seabirds. Groundfish, forage fish, and PSC fish support subsistence activities. Alternative2 options with tighter caps may reduce groundfish bycatch in the pollock fishery; seasonal allocation options can shift the pollock fleet between the A and B seasons. These seasons have different bycatch
Alternative 2: Hard cap	Hard Cap level	Hard caps would mean that unknown additional numbers of Chinook salmon may return to the fisheries in this area. Any benefit may be proportionately greater for local commercial fishermen than for local subsistence fishermen. Any benefit may be larger with tighter caps.	This can have adverse impacts for the CDQ communities, but not for other communities in the region. Revenue declines are larger the smaller the cap and vary considerably from year to year.	Alternatives that reduce the volumes of pollock harvested by CPs and processed by motherships or in on-shore processing plants, may reduce the demand for processing labor and adversely impact minorities in the workforce.	
	Seasonal distribution of hard caps	With tighter caps and higher bycatch years (2006, 2007) there is a tendency for the number of AEQ Chinook released to natal rivers to increase as the A season allocation is reduced. Under other conditions, the impact is not as clear.	The more the harvest is reduced in the A season, and shifted to the B season, the greater the adverse impact on the six CDQ community royalties and revenues tends to be.	Seasonal distribution of caps may affect the seasonal demand for labor and the seasonal job opportunities for minorities acting in this workforce.	
	Sector Allocation	Opt 1 appears to do better for the year with the highest bycatch or the options with the tightest cap. Opt 2a appears to do better with the higher caps in the lower bycatch years. In other years the record is mixed.	CDQ communities do better if the sector allocations are in proportion to the pollock allocations under the AFA, and worse if the allocation is based on historical average of bycatch use by sector.	Sectoral distribution of pollock may affect the sectoral demand for minority labor.	
	Sector Transfer and rollover	Provisions that allow the transfer or seasonal rollover of salmon caps between sectors allow for more complete utilization of salmon bycatch caps by pollock fishermen. This may increase salmon bycatch in some circumstances.	The ability to transfer CDQ among sectors may reduce the likelihood CDQ groups will be forced to stop fishing because they reach their allocation and provide an opportunity to benefit from clean fishing. Benefits CDQ communities, and does not hurt other communities.	Sector transfers and rollover may make it possible for Pollock operations to harvest more fish, potentially benefiting employees.	

	Cooperative Provisions	Allocation to inshore cooperatives is not expected to have an impact on this category of resource users.	No effects on CDQs were identified.	No issues identified	profiles and this may lead to changes in the composition of bycatch. Pollock fishery closures may lead to redeployment of pollock vessels to alternative fisheries; however, catches in those fisheries are limited by TACs and by bycatch limits. Impacts on other groundfish are less predictable under Alternative 3. Nevertheless, aggregate species harvests would continue to be constrained by TAC and bycatch requirements. The alternatives are not expected to increase the harvests of other PSC species to an extent that would affect the abundance of these species. Forage fish impacts may be reduced under Alternative 2, but Alternative 3 impacts are likely to be similar to those under the status quo.
Alternative 3: Triggered closures	Trigger cap formulation	The impact of this alternative in this area is likely to be relatively modest compared to more southerly areas due to the limited amount of Chinook harvested as discussed in the text of this chapter. Regional AEQ impact changes have not been estimated. The analysis does examine impacts on the change in actual Chinook bycatch. These numbers are not comparable to AEQs. At higher bycatch levels, tighter caps reduce bycatch and presumably reduce AEQ. At lower bycatch levels, weaker caps can produce little effect, or lead to bycatch increases, although the 48,700 and 29,300 cap levels are still associated with bycatch decreases. The bycatch numbers are not reported here as they are not comparable to AEQ numbers used elsewhere in this analysis.	The RIR does not break out estimates of the revenue at risk separately for CDQ groups. However, inferring the impact from the impacts on the other sectors, revenues placed at risk would fluctuate by the year and depend on the bycatch. Revenues placed at risk increase with the restrictiveness of the trigger or with the level of annual bycatch. In low bycatch years and large caps, no revenues may be placed at risk. However, in higher bycatch years and with tighter caps (48,700 and 29,300) significant revenues may be placed at risk. Particularly in the A season. In 2007, the least restrictive cap, 87,500 places 20% to 45% of A season revenues at risk depending on the seasonal allocation. The industry may well be able to make up some or all of revenues at risk.	Alternatives that reduce the volumes of pollock harvested by CPs and processed by motherships or in on-shore processing plants, may reduce the demand for processing labor and adversely impact minorities in the workforce.	
	Seasonal allocation	Regional AEQs not estimated for this alternative. The seasonal allocation options can affect the numbers of Chinook that escape the bycatch however there seems to be little pattern of impact among the different allocations. In some cases specific year-cap-allocation patterns can generate increases in net bycatch.	In higher salmon bycatch years, and when caps are tighter, seasonal allocations that reduce A season harvests more place more revenues at risk. For lower bycatch years and more relaxed caps the opposite effect can occur (although revenues at risk are much smaller).	Seasonal distribution of caps may affect the seasonal demand for labor and the seasonal job opportunities for minorities acting in this workforce.	
	Management	There are no estimates of regional AEQ impacts associated with these components of the alternative.	Management of trigger mechanisms does not appear to have significant implications for environmental justice.	Environmental justice issues have not been identified for these elements of the alternative.	
	Sector allocation		CDQ communities do better if the sector allocations are in proportion to the pollock allocations under the AFA, and worse if the allocations based on historical average of bycatch use by sector.	Sectoral distribution of pollock may affect the sectoral demand for minority labor.	

	Sector transfer and rollover		The ability to transfer CDQ among sectors may reduce the likelihood CDQ groups will be forced to stop fishing because they reach their allocation and provide an opportunity to benefit from clean fishing. Benefits CDQ communities, and does not hurt other communities.	If transfers and rollovers make it possible to harvest a larger proportion of the Pollock, these measures could benefit minorities in harvesting and processing.	
Alternative 4 Preliminary Preferred Alternative	Hard cap with ICA: 68,392	As noted in Chapter 2, it is possible that the pollock fishery will exceed this hard cap under certain circumstances. AEQ estimates are not available for this region.	CDQ losses of about 4,415 metric tons of pollock in the B season in the highest bycatch year; no A season losses, or losses in other years. This is equivalent to about 4% of the total 2008 CDQ allocation of 101,900 mt. The impact for individual CDQ groups has not been determined.	Hypothetical annual pollock forgone for non-CDQ fleet ranges from 0 to 295,776 mt depending on the year. (Assumes transferability and 80% AB rollover). This may have adverse impacts on minority populations in pollock industry workforce. Especially among workers in shoreside plants.	
	Hard cap without ICA 47,591	AEQ estimates are not available for this region.	In high bycatch year there are 10,281 mt lost in the A season, and 6,057 mt lost in the B season. This is about 16% of the total 2008 CDQ allocation of 101,900 mt. Moreover, almost two-thirds of the lost tonnage is high valued A season tonnage. The impact for individual CDQ groups has not been determined.	Hypothetical annual pollock forgone for non-CDQ fleet ranges from 25,124 to 418,958 mt depending on the year. (Assumes transferability and 80% AB rollover). This may have adverse impacts on minority populations in the pollock industry workforce. Especially among workers in shoreside plants.	
	Sector transfer and rollover	Implications same as for Alternative 2			

Table 9-10 Yukon River and delta: impacts on low income or minority populations

Alternative	**Key elements of the alternative**	**Chinook users**	**CDQ group beneficiaries**	**Minorities in pollock harvesting and processing**	**Users of other marine resources**
Alternative 1: Status quo	Status quo	Chinook salmon are important to the subsistence and commercial fishermen on the Yukon River. Reductions in harvest because of bycatch by the pollock fishery have a relatively large impact in this region. Estimated AEQ reductions in the period from 2003 to 2007 ranged between 8,484 and 18,306 fish, depending on the year. Yukon River Chinook harvests averaged 95,754 fish from 1997-2006.	The Yukon Delta Fisheries Development Association (YDFDA) represents the CDQ interests of six communities and 3,123 persons in this region. This is an estimated 23% of the persons who live in the two census districts (and three additional communities) through which the Yukon flows. For the most part these persons benefit indirectly from the CDQ group royalty payments and income from fishing vessels through economic development projects in their communities (although some benefit by direct involvement in CDQ activities). In 2008, the YDFDA received 14,266 mt of pollock CDQ.	NMFS does not have information on the numbers of persons from the Yukon River region seasonally employed on catcher-processors, motherships, or shoreside processing plants in Dutch Harbor, Akutan, King Cove, or Sand Point. 2000 Census data and later survey information suggests that Alaska Natives were active in shoreside workforces and on catcher-processors. Except in the shoreside processors at King Cove and Sand Point, Alaska Natives do not seem to have been the largest minority group employed in these operations.	Chum salmon are of importance in subsistence fisheries in this region. Analysis of impacts on chum salmon show that Chinook management measures are likely to slightly reduce chum salmon bycatch, but stock specific impacts are uncertain. Marine mammals are harvested for subsistence purposes in this region. The impacts of the alternatives on marine mammals exploited regionally are not entirely clear. To the extent that tighter caps reduce salmon bycatch and pollock directed catch, they may reduce competition between the pollock industry and certain marine mammals such as Steller sea lions and northern fur seals for prey. Existing takes by the pollock industry are small so reduction in takes is unlikely to have an impact. Disturbance impacts may decrease or increase, depending on the ways the alternatives affect pollock fleet deployment. Seabirds and seabird eggs are harvested for subsistence in this region. Lower caps under Alternative 2 may reduce potential pollock industry seabird impacts; triggered closures may lead to fleet redeployments with uncertain impacts on seabirds. Groundfish, forage fish, and PSC fish support subsistence activities. Alternative2 options with tighter caps may reduce groundfish bycatch in the pollock fishery; seasonal allocation
Alternative 2: Hard cap	Hard Cap level	Benefits vary depending on size of cap, other elements of the alternative such as seasonal and sectoral allocations, and potential bycatch in a year. The range of potential outcomes had a low of a 29 AEQ increase in bycatch to a high of a 15,332 AEQ reduction in bycatch. These results suggest that the action could provide a significant increase in regional harvests.	This can have adverse impacts for the CDQ communities, but not for other communities in the region. Revenue declines are larger the smaller the cap and vary considerably from year to year.	Alternatives that reduce the volumes of pollock harvested by CPs and processed by motherships or in on-shore processing plants, may reduce the demand for processing labor and adversely impact minorities in the workforce.	
	Seasonal distribution of hard caps	With tighter caps and higher bycatch years (2006, 2007) there is a tendency for the number of AEQ Chinook released to natal rivers to increase as the A season allocation is reduced. Under other conditions, the impact is not as clear.	The more the harvest is reduced in the A season, and shifted to the B season, the greater the adverse impact on the six CDQ community royalties and revenues tend to be.	Seasonal distribution of caps may affect the seasonal demand for labor and the seasonal job opportunities for minorities acting in this workforce.	
	Sector Allocation	Opt 1 appears to do better for the year with the highest bycatch or the options with the tightest cap. Opt 2a appears to do better with the higher caps in the lower bycatch years. In other years the record is mixed.	CDQ communities do better if the sector allocations are in proportion to the pollock allocations under the AFA, and worse if the allocations based on historical average of bycatch use by sector.	Sectoral distribution of pollock may affect the sectoral demand for minority labor.	

	Sector Transfer or rollover	Provisions that allow the transfer or seasonal rollover of salmon caps between sectors allow for more complete utilization of salmon bycatch caps by pollock fishermen. This may increase salmon bycatch in some circumstances.	The ability to transfer CDQ among sectors may reduce the likelihood CDQ groups will be forced to stop fishing because they reach their allocation and provide an opportunity to benefit from clean fishing.	Sector transfers and rollover may make it possible for Pollock operations to harvest more fish, potentially benefiting employees.	options can shift the pollock fleet between the A and B seasons. These seasons have different bycatch profiles and this may lead to changes in the composition of bycatch. Pollock fishery closures may lead to redeployment of pollock vessels to alternative fisheries; however, catches in those fisheries are limited by TACs and by bycatch limits. Impacts on other groundfish are less predictable under Alternative 3. Nevertheless, aggregate species harvests would continue to be constrained by TAC and bycatch requirements. The alternatives are not expected to increase the harvests of other PSC species to an extent that would affect the abundance of these species. Forage fish impacts may be reduced under Alternative 2, but Alternative 3 impacts are likely to be similar to those under the status quo.
	Cooperative Provisions	Allocation to inshore cooperatives is not expected to have an impact on this category of resource users.	No effects on CDQs were identified.	No issues identified	
Alternative 3: Triggered closures	Trigger cap formulation	Regional AEQ impact changes have not been estimated. The analysis does examine impacts on the change in actual Chinook bycatch. These numbers are not comparable to AEQs. At higher bycatch levels, tighter caps reduce bycatch and presumably reduce AEQ. At lower bycatch levels, weaker caps can produce little effect, or lead to bycatch increases, although the 48,700 and 29,300 cap levels are still associated with bycatch decreases. The bycatch numbers are not reported here as they are not comparable to AEQ numbers used elsewhere in this analysis.	The RIR does not break out estimates of the revenue at risk separately for CDQ groups. However, inferring the impact from the impacts on the other sectors, revenues placed at risk would fluctuate by the year and depend on the bycatch. Revenues placed at risk increase with the restrictiveness of the trigger or with the level of annual bycatch. In low bycatch years and large caps, no revenues may be placed at risk. However, in higher bycatch years and with tighter caps (48,700 and 29,300) significant revenues may be placed at risk. Particularly in the A season. In 2007, the least restrictive cap, 87,500 places 20% to 45% of A season revenues at risk depending on the seasonal allocation. The industry may well be able to make up some or all of revenues at risk.	Alternatives that reduce the volumes of pollock harvested by CPs and processed by motherships or in on-shore processing plants, may reduce the demand for processing labor and adversely impact minorities in the workforce.	
	Seasonal allocation	Regional AEQs not estimated for this alternative. The seasonal allocation options can affect the numbers of Chinook that escape the bycatch, however there seems to be little pattern of impact among the different allocations. In some cases specific year-cap-allocation patterns can generate increases in net bycatch.	In higher salmon bycatch years, and when caps are tighter, seasonal allocations that reduce A season harvests more place more revenues at risk. For lower bycatch years and more relaxed caps the opposite effect can occur (although revenues at risk are much smaller).	Seasonal distribution of caps may affect the seasonal demand for labor and the seasonal job opportunities for minorities acting in this workforce.	
	Management	There are no estimates of regional AEQ impacts associated with these components of the alternative.	Management of trigger mechanisms does not appear to have significant implications for environmental justice.	Environmental justice issues have not been identified for these elements of the alternative.	

	Sector allocation		CDQ communities do better if the sector allocations are in proportion to the pollock allocations under the AFA, and worse if the allocations based on historical average of bycatch use by sector.	Sectoral distribution of pollock may affect the sectoral demand for minority labor.	
	Sector transfer		The ability to transfer CDQ among sectors may reduce the likelihood CDQ groups will be forced to stop fishing because they reach their allocation and provide an opportunity to benefit from clean fishing. Benefits CDQ communities, and does not hurt other communities.	If transfers and rollovers make it possible to harvest a larger proportion of the Pollock, these measures could benefit minorities in harvesting and processing.	
Alternative 4 Preliminary Preferred Alternative	Hard cap with ICA: 68,392	As noted in Chapter 2, it is possible that the pollock fishery will exceed this hard cap under certain circumstances. However, if fishing stops when total Chinook bycatch is 68,392, the change in Yukon bycatch may range from an increase of 329 AEQ Chinook to a decrease of 5,228 AEQ Chinook, depending on the year.	CDQ losses of about 4,415 metric tons of pollock in the B season in the highest bycatch year; no A season losses, or losses in other years. This is equivalent to about 4% of the total 2008 CDQ allocation of 101,900 mt. The impact for individual CDQ groups has not been determined.	Hypothetical annual pollock forgone for non-CDQ fleet ranges from 0 to 295,776 mt depending on the year. (Assumes transferability and 80% AB rollover). This may have adverse impacts on minority populations in pollock industry workforce. Especially among workers in shoreside plants.	
	Hard cap without ICA 47,591	Under this scenario, the change in Yukon AEQ Chinook bycatch may range from an increase of 61 fish to a decrease of 8,840 fish, depending on the year.	In high bycatch year there are 10,281 mt lost in the A season, and 6,057 mt lost in the B season. This is about 16% of the total 2008 CDQ allocation of 101,900 mt. Moreover, almost two-thirds of the lost tonnage is high valued A season tonnage. The impact for individual CDQ groups has not been determined.	Hypothetical annual pollock forgone for non-CDQ fleet ranges from 25,124 to 418,958 mt depending on the year. (Assumes transferability and 80% AB rollover). This may have adverse impacts on minority populations in the pollock industry workforce. Especially among workers in shoreside plants.	
	Sector transfers and rollovers	Implications the same as for Alternative 2			

Table 9-11 Kuskokwim River and delta: impacts on low income or minority populations

<table>
<tr><th>Alternative</th><th>Options/ suboptions, components</th><th>Chinook users</th><th>CDQ group beneficiaries</th><th>Minorities in pollock harvesting and processing</th><th>Users of other marine resources</th></tr>
<tr><td>Alternative 1: Status quo</td><td>Status quo</td><td>Chinook salmon are important to the subsistence and commercial fishermen on the Kuskokwim River. Reductions in harvest because of bycatch by the pollock fishery have a relatively large impact in this region. Estimated AEQ reductions in the period from 2003 to 2007 ranged between 5,514 and 11,899 fish, depending on the year. Kuskokwim River Chinook harvests averaged 77,557 fish from 1997-2006.</td><td>The Coastal Villages Region Fund (CVRF) represents the CDQ interests of 20 communities and 7,855 persons in this region. This is an estimated 47% of the persons who live in the Bethel census area (and three additional communities). For the most part these persons benefit indirectly from the CDQ group royalty payments and income from fishing vessels through economic development projects in their communities (although some benefit by direct involvement in CDQ activities). In 2008, the CVRF received 24,456 mt of pollock CDQ.</td><td>NMFS does not have information on the numbers of persons from the Kuskokwim River region seasonally employed on catcher-processors, motherships, or shoreside processing plants in Dutch Harbor, Akutan, King Cove, or Sand Point. 2000 Census data and later survey information suggests that Alaska Natives were active in shoreside workforces and on catcher-processors. Except in the shoreside processors at King Cove and Sand Point, Alaska Natives do not seem to have been the largest minority group employed in these operations.</td><td rowspan="4">Chum salmon are of importance in subsistence fisheries in this region. Analysis of impacts on chum salmon show that Chinook management measures are likely to slightly reduce chum salmon bycatch, but stock specific impacts are uncertain.

Marine mammals are harvested for subsistence purposes in this region. The impacts of the alternatives on marine mammals exploited regionally are not entirely clear. To the extent that tighter caps reduce salmon bycatch and pollock directed catch, they may reduce competition between the pollock industry and certain marine mammals such as Steller sea lions and northern fur seals for prey. Existing takes by the pollock industry are small so reduction in takes is unlikely to have an impact. Disturbance impacts may decrease or increase, depending on the ways the alternatives affect pollock fleet deployment.

Seabirds and seabird eggs are harvested for subsistence in this region. Lower caps under Alternative 2 may reduce potential pollock industry seabird impacts; triggered closures may lead to fleet redeployments with uncertain impacts on seabirds.

Groundfish, forage fish, and PSC fish support subsistence activities. Alternative2 options with tighter caps may reduce groundfish bycatch in the</td></tr>
<tr><td rowspan="3">Alternative 2: Hard cap</td><td>Hard Cap level</td><td>Benefits vary depending on size of cap, other elements of the alternative such as seasonal and sectoral allocations, and potential bycatch in a year. The range of potential outcomes had a low of a 19 AEQ increase in bycatch to a high of a 9,966 AEQ reduction in bycatch. These results suggest that the action could provide a significant increase in regional harvests.</td><td>This can have adverse impacts for the CDQ communities, but not for other communities in the region. Revenue declines are larger the smaller the cap and vary considerably from year to year.</td><td>Alternatives that reduce the volumes of pollock harvested by CPs and processed by motherships or in on-shore processing plants, may reduce the demand for processing labor and adversely impact minorities in the workforce.</td></tr>
<tr><td>Seasonal distribution of hard caps</td><td>With tighter caps and higher bycatch years (2006, 2007) there is a tendency for the number of AEQ Chinook released to natal rivers to increase as the A season allocation is reduced. Under other conditions, the impact is not as clear.</td><td>The more the harvest is reduced in the A season, and shifted to the B season, the greater the adverse impact on the six CDQ community royalties and revenues tend to be.</td><td>Seasonal distribution of caps may affect the seasonal demand for labor and the seasonal job opportunities for minorities acting in this workforce.</td></tr>
<tr><td>Sector Allocation</td><td>Opt 1 appears to do better for the year with the highest bycatch or the options with the tightest cap. Opt 2a appears to do better with the higher caps in the lower bycatch years. In other years the record is mixed.</td><td>CDQ communities do better if the sector allocations are in proportion to the pollock allocations under the AFA, and worse if the allocations based on historical average of bycatch use by sector.</td><td>Sectoral distribution of pollock may affect the sectoral demand for minority labor.</td></tr>
</table>

	Sector Transfer or rollover	Provisions that allow the transfer or seasonal rollover of salmon caps between sectors allow for more complete utilization of salmon bycatch caps by pollock fishermen. This may increase salmon bycatch in some circumstances.	The ability to transfer CDQ among sectors may reduce the likelihood CDQ groups will be forced to stop fishing because they reach their allocation and provide an opportunity to benefit from clean fishing.	Sector transfers and rollover may make it possible for Pollock operations to harvest more fish, potentially benefiting employees.	pollock fishery; seasonal allocation options can shift the pollock fleet between the A and B seasons. These seasons have different bycatch profiles and this may lead to changes in the composition of bycatch. Pollock fishery closures may lead to redeployment of pollock vessels to alternative fisheries; however, catches in those fisheries are limited by TACs and by bycatch limits. Impacts on other groundfish are less predictable under Alternative 3. Nevertheless, aggregate species harvests would continue to be constrained by TAC and bycatch requirements. The alternatives are not expected to increase the harvests of other PSC species to an extent that would affect the abundance of these species. Forage fish impacts may be reduced under Alternative 2, but Alternative 3 impacts are likely to be similar to those under the status quo.
	Cooperative Provisions	Allocation to inshore cooperatives is not expected to have an impact on this category of resource users.	No effects on CDQs were identified.	No issues identified	
Alternative 3: Triggered closures	Trigger cap formulation	Regional AEQ impact changes have not been estimated. The analysis does examine impacts on the change in actual Chinook bycatch. These numbers are not comparable to AEQs. At higher bycatch levels, tighter caps reduce bycatch and presumably reduce AEQ. At lower bycatch levels, weaker caps can produce little effect, or lead to bycatch increases, although the 48,700 and 29,300 cap levels is still associated with bycatch decreases. The bycatch numbers are not reported here as they are not comparable to AEQ numbers used elsewhere in this analysis.	The RIR does not break out estimates of the revenue at risk separately for CDQ groups. However, inferring the impact from the impacts on the other sectors, revenues placed at risk would fluctuate by the year and depend on the bycatch. Revenues placed at risk increase with the restrictiveness of the trigger or with the level of annual bycatch. In low bycatch years and large caps, no revenues may be placed at risk. However, in higher bycatch years and with tighter caps (48,700 and 29,300) significant revenues may be placed at risk. Particularly in the A season. In 2007, the least restrictive cap, 87,500 places 20% to 45% of A season revenues at risk depending on the seasonal allocation. The industry may well be able to make up some or all of revenues at risk.	Alternatives that reduce the volumes of pollock harvested by CPs and processed by motherships or in on-shore processing plants, may reduce the demand for processing labor and adversely impact minorities in the workforce.	
	Seasonal allocation	Regional AEQs not estimated for this alternative. The seasonal allocation options can affect the numbers of Chinook that escape the bycatch, however there seems to be little pattern of impact among the different allocations. In some cases specific year-cap-allocation patterns can generate increases in net bycatch.	In higher salmon bycatch years, and when caps are tighter, seasonal allocations that reduce A season harvests more place more revenues at risk. For lower bycatch years and more relaxed caps the opposite effect can occur (although revenues at risk are much smaller).	Seasonal distribution of caps may affect the seasonal demand for labor and the seasonal job opportunities for minorities acting in this workforce.	
	Management	There are no estimates of regional AEQ impacts associated with these components of the alternative.	Management of trigger mechanisms does not appear to have significant implications for environmental justice.	Environmental justice issues have not been identified for these elements of the alternative.	

	Sector allocation		CDQ communities do better if the sector allocations are in proportion to the pollock allocations under the AFA, and worse if the allocations based on historical average of bycatch use by sector.	Sectoral distribution of pollock may affect the sectoral demand for minority labor.	
	Sector transfer		The ability to transfer CDQ among sectors may reduce the likelihood CDQ groups will be forced to stop fishing because they reach their allocation and provide an opportunity to benefit from clean fishing. Benefits CDQ communities, and does not hurt other communities.	If transfers and rollovers make it possible to harvest a larger proportion of the Pollock, these measures could benefit minorities in harvesting and processing.	
Alternative 4 Preliminary Preferred Alternative	Hard cap with ICA: 68,392	As noted in Chapter 2, it is possible that the pollock fishery will exceed this hard cap under certain circumstances. However, if fishing stops when total Chinook bycatch is 68,392, the change in Kuskokwim bycatch may range from an increase of 214 AEQ Chinook to a decrease of 3,398 AEQ Chinook, depending on the year.	CDQ losses of about 4,415 metric tons of pollock in the B season in the highest bycatch year; no A season losses, or losses in other years. This is equivalent to about 4% of the total 2008 CDQ allocation of 101,900 mt. The impact for individual CDQ groups has not been determined.	Hypothetical annual pollock forgone for non-CDQ fleet ranges from 0 to 295,776 mt depending on the year. (Assumes transferability and 80% AB rollover). This may have adverse impacts on minority populations in pollock industry workforce. Especially among workers in shoreside plants.	
	Hard cap without ICA 47,591	Under this scenario, the change in Yukon AEQ Chinook bycatch may range from an increase of 40 fish to a decrease of 5,746 fish, depending on the year.	In high bycatch year there are 10,281 mt lost in the A season, and 6,057 mt lost in the B season. This is about 16% of the total 2008 CDQ allocation of 101,900 mt. Moreover, almost two-thirds of the lost tonnage is high valued A season tonnage. The impact for individual CDQ groups has not been determined.	Hypothetical annual pollock forgone for non-CDQ fleet ranges from 25,124 to 418,958 mt depending on the year. (Assumes transferability and 80% AB rollover). This may have adverse impacts on minority populations in the pollock industry workforce. Especially among workers in shoreside plants.	
	Sector transfers and rollovers	Implications the same as for Alternative 2			

Table 9-12 Bristol Bay, Alaska Peninsula, Pribilofs and Aleutians: impacts on low income or minority populations

Alternative	**Options/ suboptions, components**	**Chinook users**	**CDQ group beneficiaries**	**Minorities in pollock harvesting and processing**	**Users of other marine resources**
Alternative 1: Status quo	Status quo	Chinook salmon are important to the subsistence and commercial fishermen on this area. Reductions in harvest because of bycatch by the pollock fishery may have a relatively large impact in this region. Estimated AEQ reductions in the period for the Bristol Bay area alone from 2003 to 2007 ranged between 7,211 and 15,560 fish, depending on the year. Chinook harvests from Bristol Bay alone averaged about 88,000 fish from 1997-2006.	The Central Bering Sea Fishermen's Association, Aleutian-Pribilof Island Community Development Association, and the Bristol Bay Economic Development Corporation represent the CDQ interests of 23 communities and 7,605 persons in this region. This is an estimated 57% of the persons who live in this area. For the most part these persons benefit indirectly from the CDQ group royalty payments and income from fishing vessels through economic development projects in their communities (although some benefit by direct involvement in CDQ activities). In 2008, these associations and corporation received 40,760 mt of pollock CDQ.	NMFS does not have information on numbers of minorities and low income persons from these regions participating in shoreside processing, catcher-processor, or mothership workforces. 2000 Census data suggests that Alaska Natives were active in shoreside workforces and on catcher-processors. However, the shoreside processing takes place in this region in towns on the Alaska Peninsula and in the Aleutian Islands. Plants employ Alaska Natives. If costs of travel to and from the plants are an issue, Natives from this region may be employed in shoreside plants to a greater extent than Natives from other regions.	Chum salmon are of modest importance in subsistence fisheries in this region. Analysis of impacts on chum salmon show that Chinook management measures are likely to slightly reduce chum salmon bycatch, but stock specific impacts are uncertain. Marine mammals are harvested for subsistence purposes in this region. The impacts of the alternatives on marine mammals exploited regionally are not entirely clear. To the extent that tighter caps reduce salmon bycatch and pollock directed catch, they may reduce competition between the pollock industry and certain marine mammals such as Steller sea lions and northern fur seals for prey. Existing takes by the pollock industry are small so reduction in takes is unlikely to have an impact. Disturbance impacts may decrease or increase, depending on the ways the alternatives affect pollock fleet deployment. Seabirds and seabird eggs are harvested for subsistence in this region. Lower caps under Alternative 2 may reduce potential pollock industry seabird impacts; triggered closures may lead to fleet redeployments with uncertain impacts on seabirds. Groundfish, forage fish, and PSC fish support subsistence activities. Alternative2 options with tighter caps may reduce groundfish bycatch in the pollock fishery; seasonal allocation options can shift the pollock fleet between the A and B seasons. These seasons have different bycatch profiles and this may lead to changes
Alternative 2: Hard cap	Hard Cap level	Benefits vary depending on size of cap, other elements of the alternative such as seasonal and sectoral allocations, and potential bycatch in a year. The range of potential outcomes for Bristol Bay alone had a low of a 24 AEQ increase in bycatch to a high of a 13,032 AEQ reduction in bycatch. These results suggest that the action could provide a significant increase in regional harvests.	This can have adverse impacts for the CDQ communities, but not for other communities in the region. Revenue declines are larger the smaller the cap and vary considerably from year to year.	Alternatives that reduce the volumes of pollock harvested by CPs and processed by motherships or in on-shore processing plants, may reduce the demand for processing labor and adversely impact minorities in the workforce.	
	Seasonal distribution of hard caps	With tighter caps and higher bycatch years (2006, 2007) there is a tendency for the number of AEQ Chinook released to natal rivers to increase as the A season allocation is reduced. Under other conditions, the impact is not as clear.	The more the harvest is reduced in the A season, and shifted to the B season, the greater the adverse impact on the six CDQ community royalties and revenues tend to be.	Seasonal distribution of caps may affect the seasonal demand for labor and the seasonal job opportunities for minorities acting in this workforce.	
	Sector Allocation	Opt 1 appears to do better for the year with the highest bycatch or the options with the tightest cap. Opt 2a appears to do better with the higher caps in the lower bycatch years. In other years the record is mixed.	CDQ communities do better if the sector allocations are in proportion to the pollock allocations under the AFA, and worse if the allocation is based on historical average of bycatch use by sector.	Sectoral distribution of pollock may affect the sectoral demand for minority labor.	
	Sector Transfer or rollover	Provisions that allow the transfer or seasonal rollover of salmon caps between sectors allow for more	The ability to transfer CDQ among sectors may reduce the likelihood CDQ groups will be forced to stop	Sector transfers and rollover may make it possible for Pollock operations to harvest more fish,	

		complete utilization of salmon bycatch caps by pollock fishermen. This may increase salmon bycatch in some circumstances.	fishing because they reach their allocation and provide an opportunity to benefit from clean fishing.	potentially benefiting employees.	in the composition of bycatch. Pollock fishery closures may lead to redeployment of pollock vessels to alternative fisheries; however, catches in those fisheries are limited by TACs and by bycatch limits. Impacts on other groundfish are less predictable under Alternative 3. Nevertheless, aggregate species harvests would continue to be constrained by TAC and bycatch requirements. The alternatives are not expected to increase the harvests of other PSC species to an extent that would affect the abundance of these species. Forage fish impacts may be reduced under Alternative 2, but Alternative 3 impacts are likely to be similar to those under the status quo.
	Cooperative Provisions	Allocation to inshore cooperatives is not expected to have an impact on this category of resource users.	No effects on CDQs were identified.	No issues identified	
Alternative 3: Triggered closures	Trigger cap formulation	Regional AEQ impact changes have not been estimated. The analysis does examine impacts on the change in actual Chinook bycatch. These numbers are not comparable to AEQs. At higher bycatch levels, tighter caps reduce bycatch and presumably reduce AEQ. At lower bycatch levels, weaker caps can produce little effect, or lead to bycatch increases, although the 48,700 and 29,300 cap levels are still associated with bycatch decreases. The bycatch numbers are not reported here as they are not comparable to AEQ numbers used elsewhere in this analysis.	The RIR does not break out estimates of the revenue at risk separately for CDQ groups. However, inferring the impact from the impacts on the other sectors, revenues placed at risk would fluctuate by the year and depend on the bycatch. Revenues placed at risk increase with the restrictiveness of the trigger or with the level of annual bycatch. In low bycatch years and large caps, no revenues may be placed at risk. However, in higher bycatch years and with tighter caps (48,700 and 29,300) significant revenues may be placed at risk. Particularly in the A season. In 2007, the least restrictive cap, 87,500 places 20% to 45% of A season revenues at risk depending on the seasonal allocation. The industry may well be able to make up some or all of revenues at risk.	Alternatives that reduce the volumes of pollock harvested by CPs and processed by motherships or in on-shore processing plants, may reduce the demand for processing labor and adversely impact minorities in the workforce.	
	Seasonal allocation	Regional AEQs not estimated for this alternative. The seasonal allocation options can affect the numbers of Chinook that escape the bycatch, however there seems to be little pattern of impact among the different allocations. In some cases specific year-cap-allocation patterns can generate increases in net bycatch.	In higher salmon bycatch years, and when caps are tighter, seasonal allocations that reduce A season harvests more place more revenues at risk. For lower bycatch years and more relaxed caps the opposite effect can occur (although revenues at risk are much smaller).	Seasonal distribution of caps may affect the seasonal demand for labor and the seasonal job opportunities for minorities acting in this workforce.	
	Management	There are no estimates of regional AEQ impacts associated with these components of the alternative.	Management of trigger mechanisms does not appear to have significant implications for environmental justice.	Environmental justice issues have not been identified for these elements of the alternative.	
	Sector allocation		CDQ communities do better if the sector allocations are in proportion to the pollock allocations under the AFA, and worse if the allocations based on historical average of bycatch use by sector.	Sectoral distribution of pollock may affect the sectoral demand for minority labor.	

	Sector transfer		The ability to transfer CDQ among sectors may reduce the likelihood CDQ groups will be forced to stop fishing because they reach their allocation and provide an opportunity to benefit from clean fishing. Benefits CDQ communities, and does not hurt other communities.	If transfers and rollovers make it possible to harvest a larger proportion of the Pollock, these measures could benefit minorities in harvesting and processing.	
Alternative 4 Preliminary Preferred Alternative	Hard cap with ICA: 68,392	As noted in Chapter 2, it is possible that the pollock fishery will exceed this hard cap under certain circumstances. However, if fishing stops when total Chinook bycatch is 68,392, the change in Bristol Bay bycatch may range from an increase of 280 AEQ Chinook to a decrease of 4,444 AEQ Chinook, depending on the year.	CDQ losses of about 4,415 metric tons of pollock in the B season in the highest bycatch year; no A season losses, or losses in other years. This is equivalent to about 4% of the total 2008 CDQ allocation of 101,900 mt. The impact for individual CDQ groups has not been determined.	Hypothetical annual pollock forgone for non-CDQ fleet ranges from 0 to 295,776 mt depending on the year. (Assumes transferability and 80% AB rollover). This may have adverse impacts on minority populations in pollock industry workforce. Especially among workers in shoreside plants.	
	Hard cap without ICA 47,591	Under this scenario, the change in the Bristol Bay AEQ Chinook bycatch may range from an increase of 52 fish to a decrease of 7,514 fish, depending on the year.	In high bycatch year there are 10,281 mt lost in the A season, and 6,057 mt lost in the B season. This is about 16% of the total 2008 CDQ allocation of 101,900 mt. Moreover, almost two-thirds of the lost tonnage is high valued A season tonnage. The impact for individual CDQ groups has not been determined.	Hypothetical annual pollock forgone for non-CDQ fleet ranges from 25,124 to 418,958 mt depending on the year. (Assumes transferability and 80% AB rollover). This may have adverse impacts on minority populations in the pollock industry workforce. Especially among workers in shoreside plants.	
	Sector transfers and rollovers	Implications the same as for Alternative 2			

Table 9-13 Persons who live outside of western and Interior Alaska: impacts on low income or minority populations

Alternative	Options/ suboptions, components	Chinook users	CDQ group beneficiaries	Minorities in pollock harvesting and processing	Users of other marine resources
Alternative 1: Status quo	Status quo	Chinook salmon are important to tribal fishermen in the Pacific Northwest. Reductions in West Coast AEQ harvest because of bycatch by the pollock ranged from 5,828 and 18,185, depending on the year. It is not, however, possible to assign these estimated AEQ reductions to specific river systems or states. Some low income persons have received Chinook salmon through salmon donation programs run by pollock fishing operations. As noted in the text of the chapter, this is not expected to be a significant source of impact on minorities or low income persons.	No communities in these regions are beneficiaries of CDQ groups. Therefore there are no disproportionate impacts on minority or low income populations associated with these actions.	Data from 2000 and 2004 indicates that significant portions of the shoreside processor, catcher-processor, and mothership pollock sector workforces are made up of minority populations. Minorities, including Asians and Native Americans/Alaska Natives, made up over 50% of the workforces in Unalaska, Akutan, King Cove, and Sand Point in 2000. Less detailed information on catcher-processors and motherships also suggests that over 50% of these workforces are minority as well.	Persons in these areas are not believed to be affected by impacts on the resources discussed under this category.
Alternative 2: Hard cap	Hard Cap level	Benefits vary depending on size of cap, other elements of the alternative such as seasonal and sectoral allocations, and potential bycatch in a year. The range of potential outcomes had a low of a 1,126 AEQ increase in bycatch to a high of a 14,766 AEQ reduction in bycatch. These results suggest that the hard cap could produce a significant reduction in bycatch of salmon destined for the west coast.		Alternatives that reduce the volumes of pollock harvested by CPs and processed by motherships or in on-shore processing plants, may reduce the demand for processing labor and adversely impact minorities in the workforce.	
	Seasonal distribution of hard caps	With tighter caps and higher bycatch years (2006, 2007) there is a tendency for the number of AEQ Chinook released to natal rivers to increase as the A season allocation is reduced. Under other conditions, the impact is not as clear.		Seasonal distribution of caps may affect the seasonal demand for labor and the seasonal job opportunities for minorities acting in this workforce.	
	Sector Allocation	Opt 1 appears to do better for the year with the highest bycatch or the options with the tightest cap. Opt 2a appears to do better with the higher caps in the lower bycatch years. In other years the record is mixed.		Sectoral distribution of pollock may affect the sectoral demand for minority labor.	

	Sector Transfer or rollover	Provisions that allow the transfer or seasonal rollover of salmon caps between sectors allow for more complete utilization of salmon bycatch caps by pollock fishermen. This may increase salmon bycatch in some circumstances.		Environmental justice issues have not been identified for these elements of the alternative.	
	Cooperative Provisions	Allocation to inshore cooperatives is not expected to have an impact on this category of resource users.			
Alternative 3: Triggered closures	Trigger cap formulation	Regional AEQ impact changes have not been estimated. The analysis does examine impacts on the change in actual Chinook bycatch. These numbers are not comparable to AEQs. At higher bycatch levels, tighter caps reduce bycatch and presumably reduce AEQ. At lower bycatch levels, weaker caps can produce little effect, or lead to bycatch increases, although the 48,700 and 29,300 cap levels are still associated with bycatch decreases. The bycatch numbers are not reported here as they are not comparable to AEQ numbers used elsewhere in this analysis.		Alternatives that reduce the volumes of pollock harvested by CPs and processed by motherships or in on-shore processing plants, may reduce the demand for processing labor and adversely impact minorities in the workforce.	
	Seasonal allocation	Regional AEQs not estimated for this alternative. The seasonal allocation options can affect the numbers of Chinook that escape the bycatch, however there seems to be little pattern of impact among the different allocations. In some cases specific year-cap-allocation patterns can generate increases in net bycatch.		Seasonal distribution of caps may affect the seasonal demand for labor and the seasonal job opportunities for minorities acting in this workforce.	
	Management	There are no estimates of regional AEQ impacts associated with these components of the alternative.		Environmental justice issues have not been identified for these elements of the alternative.	
	Sector allocation			Sectoral distribution of pollock may affect the sectoral demand for minority labor.	
	Sector transfer			If transfers and rollovers make it possible to harvest a larger proportion of the Pollock, these measures could benefit minorities in harvesting and processing.	
Alternative 4 Preliminary Preferred	Hard cap with ICA: 68,392	As noted in Chapter 2, it is possible that the pollock fishery will exceed this hard cap under certain		Hypothetical annual pollock forgone for non-CDQ fleet ranges from 0 to 295,776 mt depending on the year.	

Alternative		circumstances. However, if fishing stops when total Chinook bycatch is 68,392, the change in Pacific Northwest bycatch may range from a decrease of 599 AEQ Chinook to a decrease of 8,489 AEQ Chinook, depending on the year.		(Assumes transferability and 80% AB rollover). This may have adverse impacts on minority populations in pollock industry workforce.	
	Hard cap without ICA 47,591	Under this scenario, the change in Yukon AEQ Chinook bycatch may range from a decrease of 758 AEQ Chinook to a decrease of 11,135 AEQ Chinook, depending on the year.		Hypothetical annual pollock forgone for non-CDQ fleet ranges from 25,124 to 418,958 mt depending on the year. (Assumes transferability and 80% AB rollover). This may have adverse impacts on minority populations in the pollock industry workforce.	
	Sector transfers and rollovers	Implications the same as for Alternative 2			

10.0 REGULATORY IMPACT REVIEW

This Regulatory Impact Review (RIR) examines the costs and benefits of a proposed regulatory amendment to change Chinook salmon bycatch reduction measures in the Bering Sea pollock trawl fishery. The preparation of an RIR is required under Presidential Executive Order (E.O.) 12866 (58 *FR* 51735: October 4, 1993). The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following Statement from the E.O.:

> In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and Benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nonetheless essential to consider. Further, in choosing among alternative regulatory approaches agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

Under the Magnuson-Stevens Act, the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The management of these marine resources is vested in the Secretary of Commerce and in the Regional Fishery Management Councils. The pollock fishery in the Bering Sea EEZ is managed under the BSAI FMP.

This RIR examines the costs and benefits of proposed alternatives which include eliminating the Chinook Salmon Savings Areas and, thereby, eliminating an exemption to the savings area for participants in the VRHS ICA, imposing a hard cap number of Chinook salmon that may be taken in the Bering Sea pollock trawl fishery, and/or implementing a new triggered closure area that would be managed by the NMFS. The alternative set also contains components that allow for sector level allocations of hard caps, transfers and/or rollover provisions, and cooperative management provisions. The complete alternative set is described in detail in Chapter 2.

10.1 What is a Regulatory Impact Review?

The preparation of an RIR is required under Presidential Executive Order (E.O.) 12866 (58 *FR* 51735: October 4, 1993). The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following Statement from the E.O.:

> In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and Benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nonetheless essential to consider. Further, in choosing among alternative regulatory approaches agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and

> other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

E.O. 12866 requires that the Office of Management and Budget (OMB) review proposed regulatory programs that are considered to be "significant." A "significant regulatory action" is one that is likely to:

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, local or tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

10.1.1 Statutory Authority

Under the Magnuson-Stevens Act, the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The management of these marine resources is vested in the Secretary of Commerce and in the Regional Fishery Management Councils. The groundfish fisheries in the EEZ off Alaska are managed under the BSAI FMP.

Statutory authority for measures designed to reduce bycatch is specifically addressed in Sec. 600.350 of the Magnuson-Stevens Act. That section establishes the ten National Standards.

10.1.2 Purpose and Need for Action

The purpose of Chinook salmon bycatch management in the Bering Sea pollock fishery is to minimize Chinook salmon bycatch to the extent practicable while achieving optimum yield from the pollock fishery. Minimizing Chinook salmon bycatch while achieving optimum yield is necessary to maintain a healthy marine ecosystem, ensure long-term conservation and abundance of Chinook salmon, provide maximum benefit to fishermen and communities that depend on Chinook salmon and pollock resources, as well as U.S. consumers, and comply with the Magnuson-Stevens Act and other applicable federal law. National Standard 9 of the Magnuson-Stevens Act requires that conservation and management measures shall, to the extent practicable, minimize bycatch. National Standard 1 of the Magnuson-Stevens Act requires that conservation and management measures prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry. Chapter 1 contains the detailed purpose and need statement.

10.1.3 Market failure rationale

The OMB guidelines for analysis under E.O. 12866 state that…

> "in order to establish the need for the proposed action, the analysis should discuss whether the problem constitutes a significant market failure. If the problem does not constitute a market failure, the analysis should provide an alternative demonstration of compelling public need, such as improving governmental processes or addressing

> distributional concerns. If the proposed action is a result of a statutory or judicial directive (sic) that should be so stated."[47]

Groundfish, and more specifically in the present action walleye pollock, that are the target of the BS trawl fisheries, and the salmon bycatch these fisheries take, are both common property resources. However, both are subject to systems of stock and allocation management. These management systems include forms of ownership of access and/or harvest allocation privileges. Trawl vessels operations in the BS groundfish fisheries do not, by virtue of their groundfish access privileges, have ownership or access privileges to salmon. Similarly, salmon harvesters operating in the waters of and off Alaska do not have, by virtue of their salmon access privileges, ownership or access privileges to groundfish.

Bycatch of salmon in the Bering Sea pollock fishery reduces the common property pool of the salmon resource. Bycatch removals may reduce the targeted subsistence, commercial, personal use, and sport catch of Chinook salmon, and thereby the welfare (e.g. revenue, utility) of salmon harvesters who have recognized salmon access privileges (e.g. Alaska Limited Entry permits) and/or established priority harvesting rights and historical dependence (e.g. subsistence). Chinook salmon removals may, over time, reduce the value of Chinook salmon access privileges as well as reducing the economic, social, and cultural benefits for subsistence and other non-commercial users of this resource. Under the prevailing fishery management structure, the market has no efficient mechanism by which groundfish harvesters may compensate salmon harvesters for the externalities they impose through bycatch. Further, the market cannot readily measure many aspects of the value engendered in Chinook salmon (e.g. cultural significance of Chinook salmon to the subsistence user). Thus, Chinook salmon bycatch reduction measures are imposed through regulation to reduce, to the extent practicable, this market failure. The goal of the action considered in this RIR is to improve Chinook salmon avoidance in the Bering Sea pollock fishery and, thereby, further mitigate the market failure attributable to an ownership externality.

10.2 Description of the Bering Sea Pollock Fishery

Pollock is widely distributed in the North Pacific, from Central California into the eastern Bering Sea, along the Aleutian arc, around Kamchatka, in the Okhotsk Sea, and into the southern Sea of Japan. In U.S. waters of the Bering Sea and Aleutian Islands, pollock is managed as three separate stocks: the Eastern Bering Sea (EBS) stock, found on the EBS shelf from Unimak Pass to the U.S.-Russia Convention line; the Aleutian Islands region stock, found on the Aleutian Islands shelf region from 170°W to the U.S.-Russia Convention line; and the Aleutian Basin or Bogoslof stock, which is a mixture of pollock that migrate from the U.S. and Russian shelves to the Aleutian Basin.

The largest of these is the EBS stock, which in recent years has been at historically high biomass levels. The Aleutian Islands region pollock stock was closed to directed fishing between 1999 and 2003; in 2004, however, the TAC was reestablished for Aleutian Islands pollock to provide for economic development in Adak, Alaska. The Aleutian Basin pollock stock has been closed to directed fishing since 1991, due to low biomass levels.

Pollock continues to represent over 40% of the global whitefish production with the market disposition split fairly evenly between fillets, whole (head and gutted), and surimi. An important component of the commercial production is the sale of roe from pre-spawning pollock.

[47] Memorandum from Jacob Lew, OMB director, March 22, 2000. "Guidelines to Standardize Measures of Costs and Benefits and the Format of Accounting Statements" Section 1.

From 1954 to 1963, pollock were harvested at low levels in the Eastern Bering Sea and directed foreign fisheries began in 1964. Catches increased rapidly during the late 1960s and reached a peak in 1970-75 when they ranged from 1.3 to 1.9 million t annually. Following a peak catch of 1.9 million t in 1972, catches were reduced through bilateral agreements with Japan and the USSR.

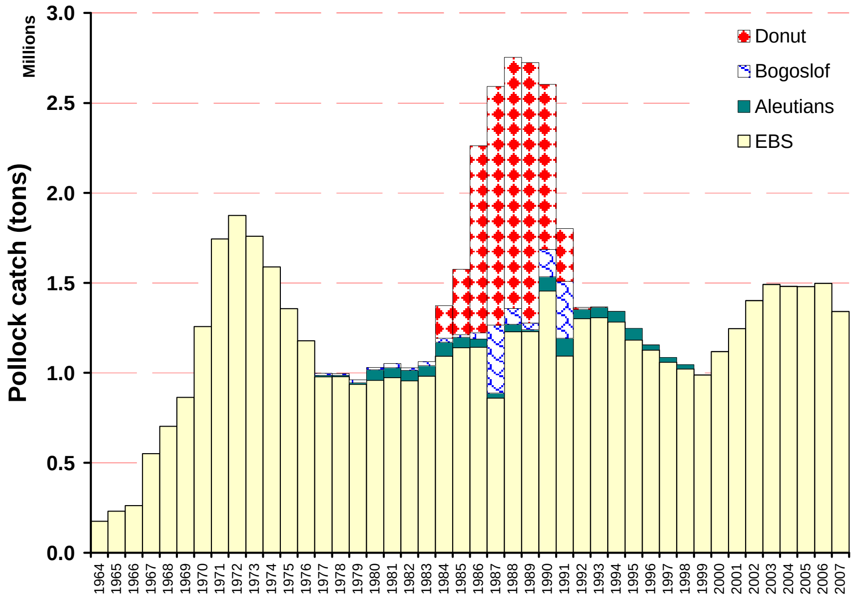


Fig. 10-1 Alaska pollock catch estimates from the Eastern Bering Sea, Aleutian Islands, Bogoslof Island, and Donut Hole regions, 1964-2007

Since the advent of the U.S. EEZ in 1977 the annual average Eastern Bering Sea pollock catch has been 1.2 million t and has ranged from 0.9 million t in 1987 to nearly 1.5 million t in recent years. Stock biomass has apparently ranged from a low of 4-5 million t to highs of 10-12 million t (Fig. 10-1). United States vessels began fishing for pollock in 1980 and by 1987 they were able to take 99% of the quota. Since 1988, only U.S. vessels have been operating in this fishery. By 1991, the current NMFS observer program for north Pacific groundfish-fisheries was in place.

Foreign vessels began fishing in the mid-1980s in the international zone of the Bering Sea (commonly referred to as the "Donut Hole"). The Donut Hole is entirely contained in the deep water of the Aleutian Basin and is distinct from the customary areas of pollock fisheries, namely the continental shelves and slopes. Japanese scientists began reporting the presence of large quantities of pollock in the Aleutian Basin in the mid-to-late 1970's, but large scale fisheries did not occur until the mid-1980s. In 1984, the Donut Hole catch was only 181 thousand t. The catch grew rapidly and by 1987 the high seas catch exceeded the pollock catch within the U.S. Bering Sea EEZ. The extra-EEZ catch peaked in 1989 at 1.45 million t and has declined sharply since then. By 1991 the Donut Hole catch was 80% less than the peak catch, and data for 1992 and 1993 indicate very low catches. A fishing moratorium was enacted in 1993 and only trace amounts of pollock have been harvested from the Aleutian Basin by resource assessment fisheries.

10.2.1 The American Fisheries Act and Participation in the Pollock Fishery

Prior to passage of the Magnuson Fishery Conservation and Management Act of 1976 (now the Magnuson Stevens Act), foreign fisheries dominated the pollock fishery off Alaska. Pollock had been harvested at low levels in the Eastern Bering Sea until the 1950s. With the advent of perfected onboard freezing technology in the 1960s, the foreign fisheries conducted mainly by Japanese, Russian, and Korean trawlers expanded. Harvests by these foreign fleets increased rapidly during the late 1960s and, in 1972, reached a reported peak catch of 2.2 million mt of pollock, flatfish, rockfish, cod, and other groundfish (Fig. 10-1).

<u>The Magnuson-Stevens Act</u>

The Magnuson Stevens Act established federal authority over the 200-mile Exclusive Economic Zone (EEZ) and, thus, effectively provided for the development of domestic fisheries. United States vessels began fishing for pollock in 1980 through, joint-ventures with foreign processing ships. By 1987, U.S. vessels were taking 99% of the quota. Since 1988, only U.S. vessels have been operating in this fishery, and pollock harvests now dominate the commercial groundfish fisheries in waters off Alaska. In 2006, pollock harvests in the BSAI and in the GOA comprised 71% (1.57 million tons) of the region’s total groundfish catch of 2.2 million tons. Approximately 95% of these pollock harvests occur in the BSAI.

<u>The American Fisheries Act (AFA)</u>

Until 1998, the Bering Sea directed pollock fishery had been a managed open access fishery, commonly characterized as a “race for fish.” In 1998, however, Congress enacted the AFA ostensibly to rationalize the fishery by limiting participation and allocating specific percentages of the BS directed pollock fishery TAC among the competing sectors of the fishery. After first deducting an incidental catch allowance and 10% of the TAC for the CDQ, the AFA allocates 50% of the remaining TAC to the inshore catcher vessels sector; 40% to the catcher processor sector; and 10% to the motherships sector.

The AFA also allowed for the development of pollock industry cooperatives. Ten such cooperatives were developed as a result of the AFA: seven inshore co-ops, two offshore co-ops, and one mothership co-op. The first cooperative was formed in 1999 by a private-sector initiative, Pollock Conservation Cooperative (PCC), and is made up of nine catcher/processor companies that divide the sector’s overall quota allowance among the companies.

In rationalizing the Bering Sea pollock fishery, the AFA also gave the industry the ability to respond more deliberately and efficiently to market demands than the “race for fish” previously allowed. The AFA also gave the fishery the means to compensate for Steller sea lion conservation measures that, beginning in 1992, created fishery exclusion zones around seal lion rookeries and haulout sites and implemented gradual reductions in seasonal proportions of the TAC taken in Steller sea lion critical habitat.

As of January 1, 2000, all vessels and processors wishing to participate in the non-CDQ BS pollock fishery are required to have valid AFA permits on board the vessel or at the processing plant. AFA permits are required even for vessels and processors specifically named in the AFA, and are required in addition to any other Federal or State permits. AFA permits also may limit the take of non-pollock groundfish, crab, and prohibited species, as governed by AFA “sideboard” provisions. With the exceptions of applications for inshore vessel cooperatives and for replacement vessels, the AFA permit program had a one-time application deadline of December 1, 2000, for AFA vessel and processor permits. Applications for AFA vessel or processor permits were not accepted after this date, and any vessels or processors for which an application had not been received by this date became permanently ineligible to receive AFA permits.

<u>Salmon bycatch management</u>

The existing management measures to control Chinook salmon bycatch in the Bering Sea pollock fishery are described in detail for Alternative 1 in Chapter 2. The Chinook Salmon Savings Areas are closed upon attainment of Chinook salmon PSC limits. These area closures, which close two different Chinook salmon savings areas, are designed to reduce the total amount of Chinook incidentally caught by closing areas with historically high levels of salmon bycatch. Vessels are exempt from savings area closures if they participate in an VRHS ICA. This industry-initiated agreement requires vessels to stop fishing in areas of high salmon bycatch and move to other areas. An analysis of the VRHS ICA is provided in section 10.2.4.

Annual Pollock Fishing Seasons

The annual BS pollock fishery is divided into two seasons: the "A" season, which opens in January and typically ends in April, and the "B" season, which typically runs from July through the end of October. The "A" season fishery has historically focused on roe-bearing females, and is concentrated north and west of Unimak Island and along the 100-meter contour between Unimak and the Pribilof Islands. "A" season pollock also provide other primary products such as surimi and fillet blocks, but yields on these products are slightly lower than in the "B" season, when pollock carry a lower roe content and are thus primarily processed for surimi and fillet blocks. The "B" season fishery takes place west of 170°W.

Description of the BS Trawl Pollock Fleet

Number of Vessels

In the 2006 Bering Sea pollock trawl fishery, 90 catcher vessels participated in harvesting pollock, a slight decline from 2002, when 98 vessels participated in the fishery. Catcher processor participation also declined over the same period, from 31 operating the BS in 2002 to 19 by 2006. Note that although the BS comprises a far larger proportion of the pollock catch than the Gulf of Alaska (GOA), the number of catcher vessels operating in each area is nearly equivalent. This result is due to the difference in size of vessels and the length of the season. For example, between the years 2002 and 2006 only two trawl vessels greater than 234 ft in length were fishing in the GOA compared to approximately 15 trawl vessels of this size fishing in the BS. (See Tables 41-44 of the 2007 Economic SAFE for additional information.)

Further comparison of the demographic characteristics of the participants in the BS and GOA fisheries provides additional information about the pollock fleet. In the GOA, where only a small portion of the total Alaska pollock is harvested, approximately 40% of the catch is harvested by vessels owned by residents of Alaska. In contrast, less than 1% of the BS catch is harvested by vessels owned by Alaska residents. These percentages have remained stable since 2002 for both the BS and GOA.

Gear

In 1990, in response to concerns about bycatch and the impact of bottom trawls on seafloor habitat, the Council reduced non-pelagic or bottom trawling, by dividing the BSAI TAC between pelagic (88%) and non-pelagic trawling (12%). Although most vessels were voluntarily using pelagic trawls by the mid-1990s, non-pelagic trawls were still responsible for amounts of bycatch that were much larger than desirable, and in 1999, the Council banned the use of non-pelagic trawls entirely in the Bering Sea pollock fishery.

Ports of Delivery

The vast majority of inshore pollock landings takes place in the ports of Dutch Harbor/Akutan, which reported 699.8 million pounds in groundfish landings for 2000, "the highest landings by pound of any port in the United States" (Sepez et al. 2005, p. 49, as cited in NMFS 2007).

Many of the west coast US-flag catcher/processors that mainly target Bering Sea pollock also target Pacific whiting (a.k.a. hake) off Washington or Oregon, as noted by the At-sea Processors Association (APA; http://www.atsea.org/).

Table 10-1 below shows the ports of delivery for the BS pollock fishery in 2006, the number of vessels delivering to those ports, and the tonnage of pollock deliveries.

Table 10-1 Bering Sea Pollock Fishery Ports of Delivery in 2006. (Ports with fewer than four processors are grouped into the "Other" category to preserve confidentiality.)

Port	Processors	Tons	Vessels
Dutch Harbor/Akutan	**7**	**615,768**	**139**
Catcher/Processors	**8**	**173,682**	**96**
Other (includes floating processors)	**80**	**678,174**	**80**

Table 10-2 provides estimated seafood processing employment, percent of non-resident workers, and percent of non-resident earnings in the Alaska Department of Labor and Workforce Development (ADOLWD) define Aleutian and Pribilof Islands Region, which includes the major landing ports used by the shorebased pollock fleet. The total worker count in the seafood processing sector has ranged from a low of 6,592 in 2005 to a high of 7,331 in 2003 and was 7,243 in 2005. It should be noted that these counts include processing workers for all fisheries in the region, not just groundfish. Furthermore, the methodology used by ADOLWD to count employees was developed for other purposes and likely does not accurately reflect employment numbers in the application to which it is used here. Nonetheless, it represents the best estimates currently available. Non-resident workers have made up a large proportion, more than 80%, of this labor force in recent years. Seafood processing wages in the region are estimated to have been approximately $115 million in 2005, with non-resident wages accounting for an estimated 74.5% of that total.

Table 10-2 Aleutian and Pribilof Islands Region1 Seafood Processing Workforce and Earnings, 2000–2005

Seafood Processing				
Year	**Total Worker Count**	**Percent Nonresident Workers**	**Wages**	**Percent Nonresident Wages**
2000	6,592	75.6	$74,218,617	62.3
2001	7,067	76.6	$81,734,163	65.0
2002	6,969	77.9	$90,271,050	68.4
2003	7,331	79.4	$108,397,216	72.5
2004	7,041	80.7	$108,021,030	73.5
2005	7,243	81.7	$114,786,581	74.4

Sources: Commercial Fisheries Entry Commission and ADOLWD, Research and Analysis Section, reprinted with permission (Windish-Cole 2008)

Fig. 10-2 depicts the locations of the canneries and land based seafood processors in the region, and identifies the organizations that operate in each location. This information is reprinted with permission of the ADOLWD (Windish-Cole 2008).

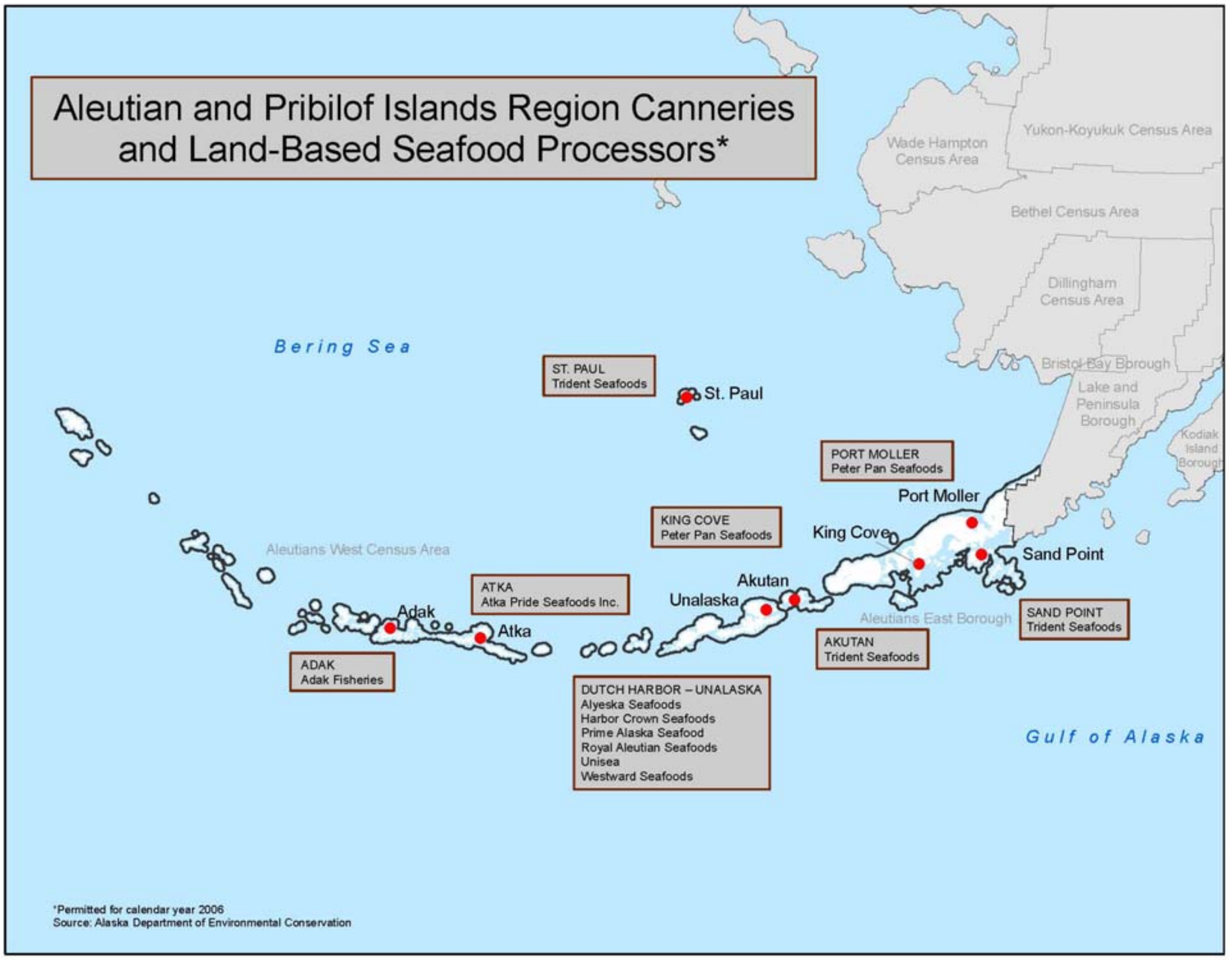


Fig. 10-2 Aleutian and Pribilof Islands Region Canneries and Land-Based Seafood Processors

10.2.2 Total Allowable Catch, Sector Allocations, Harvest, and Value.

2007-2008 BS Pollock Allocations

The Bering Sea pollock TAC is apportioned between inshore, offshore, and mothership sectors after allocations are subtracted for the CDQ program and incidental catch allowances. The pollock fishery is further divided into two seasons—the winter “A” roe season and the summer “B” season, which is largely non-roe.

The 2007-2008 allocation of the TAC in the BS is as follows:

- 10% of TAC is reserved for the CDQ program.
- 2.8% of TAC is reserved for the incidental catch allowance
- The remaining TAC is divided between catcher vessels delivering inshore (50%); catcher processors processing offshore (40%); and deliveries to motherships (10%).

The following table (Table 10-3) exhibits the allocations and harvests (in metric tons) in the Bering Sea trawl fisheries from 2003 to 2007.

Table 10-3 Bering Sea Pollock Sector Allocations, Catch, and number of participating vessels; 2003–2007

Year/ TAC	Sector (# of vessels)	Allocation (metric tons)	Pollock Catch (metric tons)
2003	CV (86)	653,047	652,254
1,491,760	CP (16)	522,437	522,428
	M (10)	130,564	130,609
	CDQ	149,176	149,121
2004	CV (86)	649,580	637,971
1,492,000	CP (17)	519,664	519,570
	M (10)	129,916	129,222
	CDQ	149,200	149,173
2005	CV (84)	653,787	648,117
1,478,000	CP (16)	523,029	517,699
	M (9)	130,757	130,669
	CDQ	149,750	149,715
2006	CV (81)	660,318	645,606
1,487,756	CP (16)	528,254	527,134
	M (9)	132,063	131,404
	CDQ	150,400	150,374
2007	CV (82)	610,736	572,507
1,394,000	CP (16)	488,588	488,543
	M (11)	122,147	121,514
	CDQ	139,400	139,336

Pollock Fishery Tax Revenue

The pollock fishery in waters off Alaska generates tax revenue collected by the State of Alaska in the form of a Fisheries business tax (shoreside processors) and a Fisheries Resource Landings Tax (CPs). Most of the tax revenue is collected from operations in the Aleutian and Pribilof Island areas and is derived from the Bering Sea pollock fishery. Unfortunately, confidentiality restrictions do not allow tax data to be shown for specific ports or communities. Table 10-4 provides pollock fishery tax revenue collection data, provided by the Alaska Department of Revenue. Also shown is the percent of the statewide pollock fishery total that the Aleutian Pribilof area tax collections represent.

Table 10-4 Pollock Fishery Tax Revenues, 2000-2007

Fisheries Business Tax

Year	Aleutians/Pribilof Pounds	Value	Tax Liability
2000	1,132,905,560	$ 134,707,191	$ 4,395,129
2001	1,293,325,964	$ 143,045,862	$ 4,468,644
2002	1,335,417,000	$ 157,355,961	$ 4,889,743
2003	1,348,116,609	$ 145,173,409	$ 4,521,874
2004	1,340,620,622	$ 142,482,037	$ 4,435,921
2005	1,378,682,085	$ 170,218,664	$ 5,207,027
2006	1,355,936,834	$ 174,203,650	$ 5,293,490
2007	1,182,552,028	$ 159,601,604	$ 4,788,432

Fisheries Business Tax

Year	Aleutians Pribilof Percent of Statewide Total Pounds	Value	Tax Liability
2000	91%	89%	90%
2001	87%	86%	82%
2002	96%	96%	96%
2003	87%	88%	84%
2004	87%	87%	83%
2005	86%	85%	81%
2006	83%	83%	79%
2007	86%	85%	81%

Fisheries Resource Landing Tax

Year	Aleutians/Pribilof Pounds	Value	Tax Liability
2000	1,158,516,598	$ 127,436,689	$ 3,823,101
2001	1,431,627,204	$ 157,483,994	$ 4,724,520
2002	1,513,929,561	$ 181,667,682	$ 5,450,030
2003	1,560,823,799	$ 156,621,765	$ 4,698,653
2004	1,545,543,121	$ 170,004,347	$ 5,100,130
2005	1,563,018,143	$ 187,562,181	$ 5,626,865
2006	1,534,011,227	$ 199,421,458	$ 5,982,644
2007	1,360,483,103	$ 190,467,633	$ 5,714,029

Fisheries Resource Landing Tax

Year	Aleutians Pribilof Percent of Statewide Total Pounds	Value	Tax Liability
2000	79%	79%	79%
2001	85%	86%	86%
2002	84%	85%	85%
2003	86%	86%	86%
2004	86%	86%	86%
2005	86%	86%	86%
2006	84%	84%	84%
2007	80%	80%	80%

Total (Business + Landing Tax)

Year	Aleutians/Pribilof Pounds	Value	Tax Liability
2000	2,291,422,157	$ 262,143,881	$ 8,218,230
2001	2,724,953,168	$ 300,529,856	$ 9,193,164
2002	2,849,346,561	$ 339,023,643	$ 10,339,773
2003	2,908,940,407	$ 301,795,174	$ 9,220,527
2004	2,886,163,743	$ 312,486,384	$ 9,536,052
2005	2,941,700,228	$ 357,780,845	$ 10,833,893
2006	2,889,948,061	$ 373,625,108	$ 11,276,133
2007	2,543,035,131	$ 350,069,237	$ 10,502,461

Total (Business + Landing Tax)

Year	Aleutians Pribilof Percent of Statewide Total Pounds	Value	Tax Liability
2000	85%	84%	85%
2001	86%	86%	84%
2002	89%	90%	90%
2003	87%	87%	85%
2004	87%	87%	85%
2005	86%	86%	84%
2006	84%	84%	82%
2007	83%	83%	81%

10.2.3 Market Disposition of Alaska Pollock

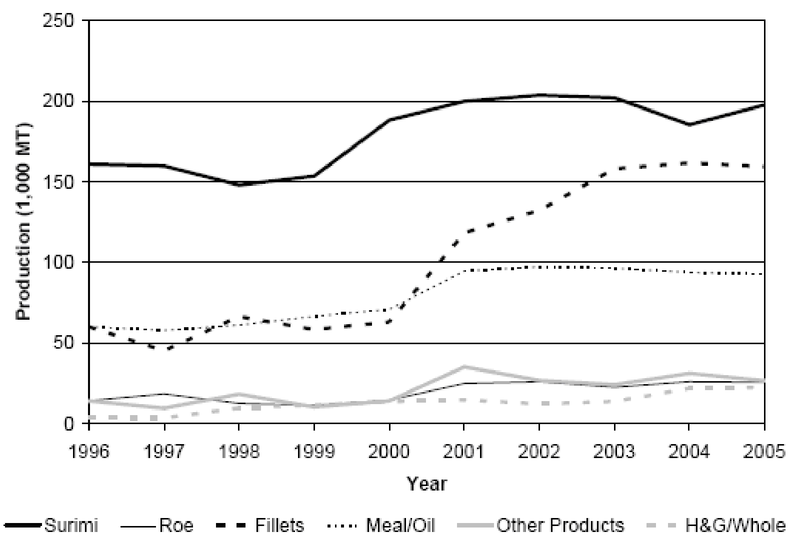
Production

The pollock fishery in waters off Alaska is the largest U.S. fishery by volume, and the economic character of that fishery centers on a varied range of products produced from pollock. In the U.S., Alaska pollock catches are processed mainly for roe, surimi, and several varieties of fillet products. Fillet production has increased particularly rapidly due to more efficient rates of harvests, increased recovery rates, and the shift by processors from surimi to fillet production, all made possible, at least in part, by the AFA. The information in this section summarizes the more extensive information presented in the 2007 Economic SAFE Report, which incorporated by reference and to which readers are referred to for a more detailed discussion.

Prior to the implementation of the AFA, U.S. pollock catches were processed mainly into surimi. The Bering Sea pollock fishery was then managed as an "open-access" fishery in which vessels sought to harvest as large a share of the TAC as possible before the TAC or established bycatch limits were reached and the fishery closed. Because surimi production allows more raw material to be processed in a shorter period of time than fillet and fillet block production, committing catches for surimi production was to a vessel's operational advantage. With the operational and economic efficiencies gained through rationalization of the fishery under the AFA, the industry was able to abandon practices compelled by the economics of open access and began developing more deliberate production strategies according to market demands.

This shift in production practices led, as noted, primarily to a particularly rapid increase in fillet production during the early 2000s, to meet greater world demand for whitefish products created by several factors, including declining harvests in the Russian pollock fishery and a sharp decrease in the supply of fillets from Atlantic cod. The result has been increased fillet production and growth in wholesale gross revenues from U.S. pollock fillet production.

Fig. 10-3 shows the Alaskan production of pollock by product from 1996 to 2005. Fig. 10-4 shows the estimated wholesale value of these products over the same period. These figures show the dramatic increase in production and wholesale value of fillets from 2000 to present.



Note: Product types may include several more specific products.
Source: NMFS Weekly Product Reports and ADF&G Commercial Operator Annual Reports 1996-2005.

Fig. 10-3 Alaska Primary Production of Pollock by Product Type, 1996-2005

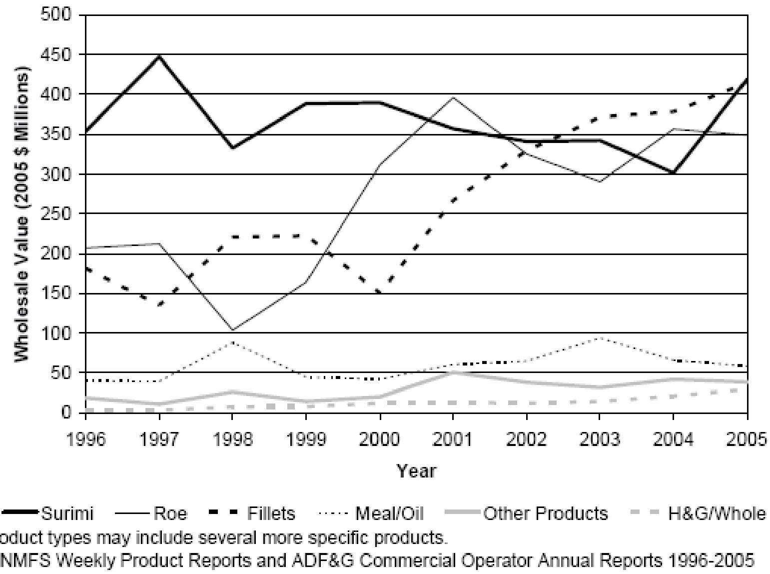


Fig. 10-4 Wholesale Value of Alaska Pollock by Product Type, 1996-2005

Fillet Production

Pollock is a fragile fish that deteriorates relatively quickly after harvest, so little is sold fresh. Pollock fillets are typically frozen, as fillets and fillet blocks (frozen, compressed slabs of fillets used as raw material for value-added products, such as breaded items, including nuggets, fish sticks, and fish burgers). The price of pollock fillets also varies according to the freezing process: single-frozen and frozen-at-sea fillets fetch the highest prices, followed by single-frozen fillets processed by Alaska shoreside plants.

The following figures (Fig. 10-5 through Fig. 10-7) show the primary production, wholesale price, and wholesale gross value of pollock fillets by fillet type from 1996 through 2005.

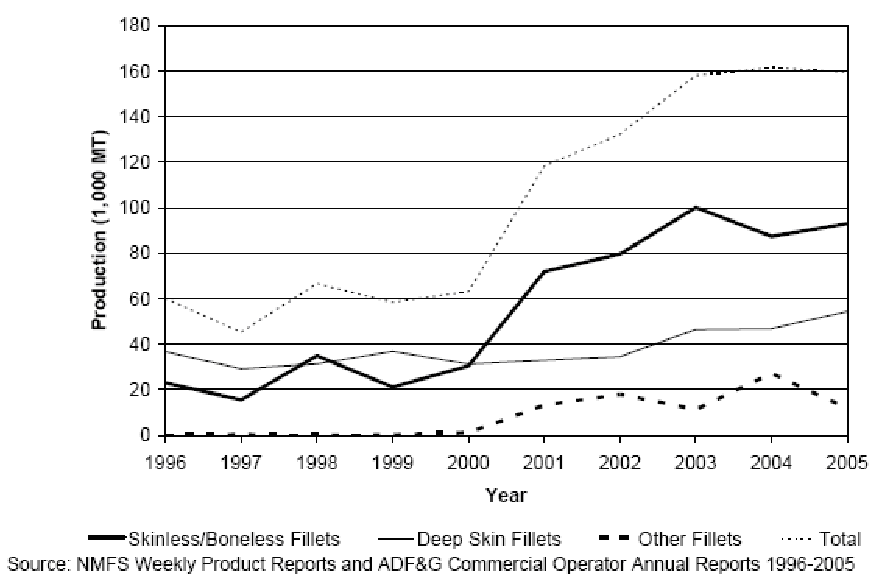


Fig. 10-5 Alaska Production of Pollock Fillets by Fillet Type, 1995-2005.

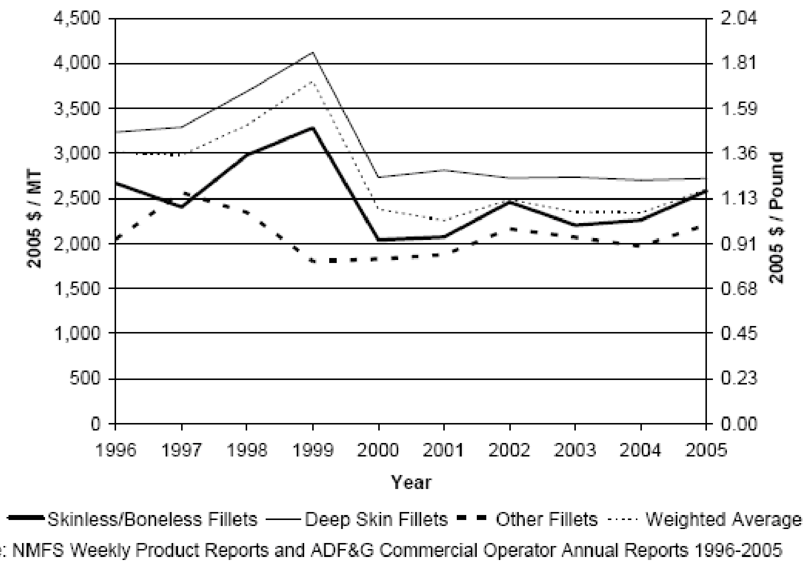


Fig. 10-6 Wholesale Prices for Alaska Production of Pollock Fillets by Fillet Type, 1996-2005

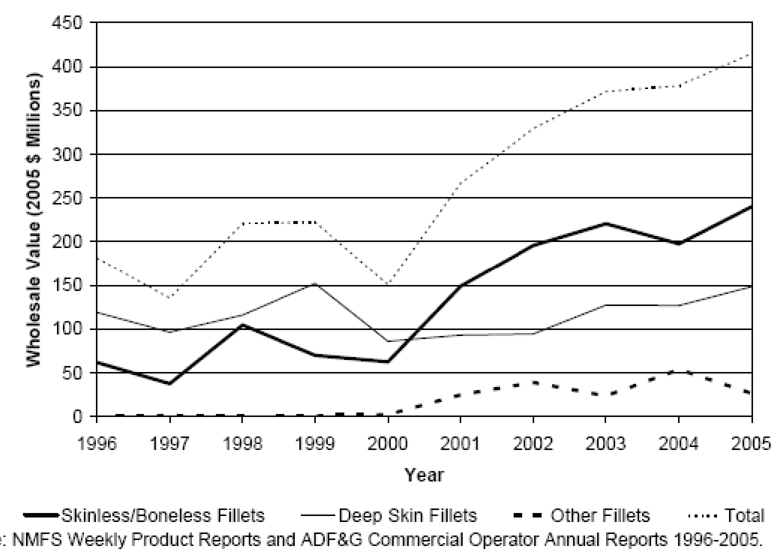
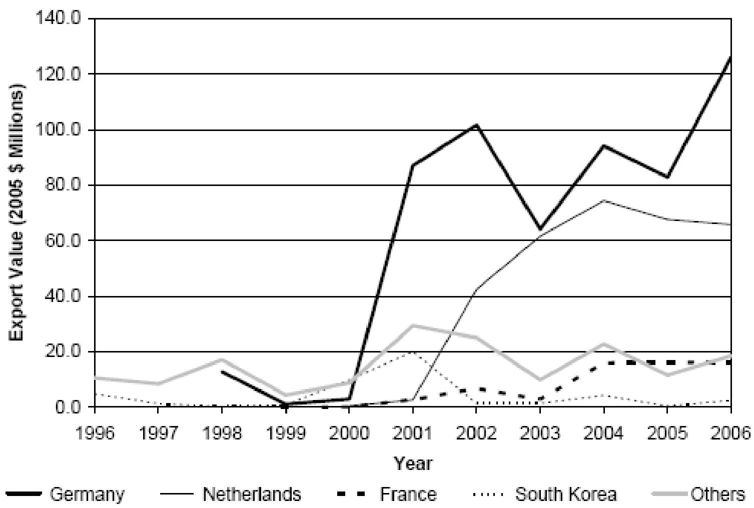


Fig. 10-7 Wholesale Value of Alaska Production of Pollock Fillets by Fillet Type, 1995-2005.

Twice-frozen (also referred to as double-frozen or refrozen) pollock fillets, most of which are processed in China, have traditionally been considered the lowest grade of fillets and sell at a discount to single-frozen fillets frozen at sea. Twice-frozen fillets are reportedly greyer in color, and often have a fishy aroma, and can be stored for a maximum of six months, whereas single-frozen can be stored for nine to 12 months (Eurofish 2003, as cited in NMFS 2007). However, industry representatives note that the acceptability of twice-frozen fillets is increasing in many markets, and the quality of this product is now considered, by some, to be similar to that of shoreside-frozen fillets, while still trailing at-sea product.

Historically, the primary market for pollock fillets has been the domestic market. Fillets made into deep-skin blocks were destined primarily for the U.S. foodservice industry, including fast food restaurants. Competition in this domestic market comes from imported twice-frozen pollock fillets and fillet blocks produced from pollock caught in Russia and reprocessed in China. However, with Russian-caught pollock in short supply due to declining harvests, twice-frozen fillets from China have become more expensive, and imports into the U.S. markets have subsequently declined.

Fig. 10-8 shows the leading countries importing U.S.-produced Alaska pollock from 1996 to 2006, along with the estimated gross export value to the U.S. economy. A number of factors may affect the industry in coming years: species substitution, a decline in the Bering Sea pollock TAC, increasing standards in the Russian fisheries, and safety concerns about Chinese food products. At present, it is unclear how these factors will affect prices for the U.S. pollock industry.



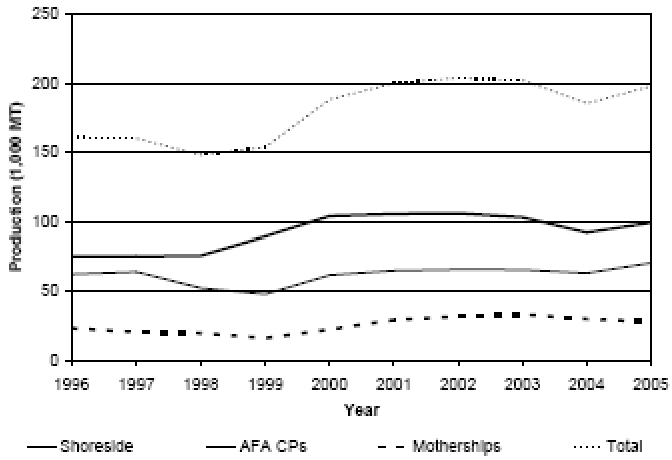
Note: Data include all exports of Alaska pollock from all U.S. Customs Districts
Source: NMFS Foreign Trade Data available at www.st.nmfs.gov/st1/trade/

Fig. 10-8 **U**.S. Exports of Alaska Pollock Fillets to Leading Importing Countries, 1996–2006.

Surimi Production

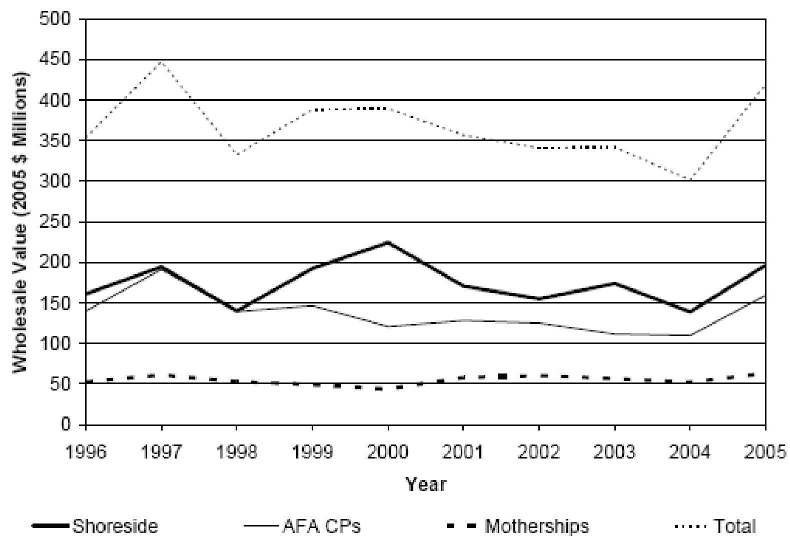
World surimi production has almost doubled in the last ten years. The chief market for surimi is Asia, particularly Japan, and the U.S. is the leading exporter of Alaska pollock surimi to the Japanese market. Chile, India, and China are increasing surimi production from other whitefishes, which now represent 25% of the total volume of surimi production. Nevertheless, approximately half of the surimi produced continues to come from Alaska pollock.

U.S. production of Alaska pollock surimi rose slightly in the late 1990s. As noted, the AFA's ending of open access occasioned the development of more efficient processing methods, which significantly increased product yields and allowed the volume and value of surimi from Alaska-caught pollock to remain fairly stable, while at the same time increasing pollock fillet production. Alaska pollock surimi wholesale prices spiked in 1999, possibly because the BSAI pollock TAC decreased, but have been relatively stable since 2001. Fig. 10-9 through Fig. 10-11show the production, wholesale value, and wholesale price of U.S.-produced Alaska pollock surimi by sector for 1996 to 2006.



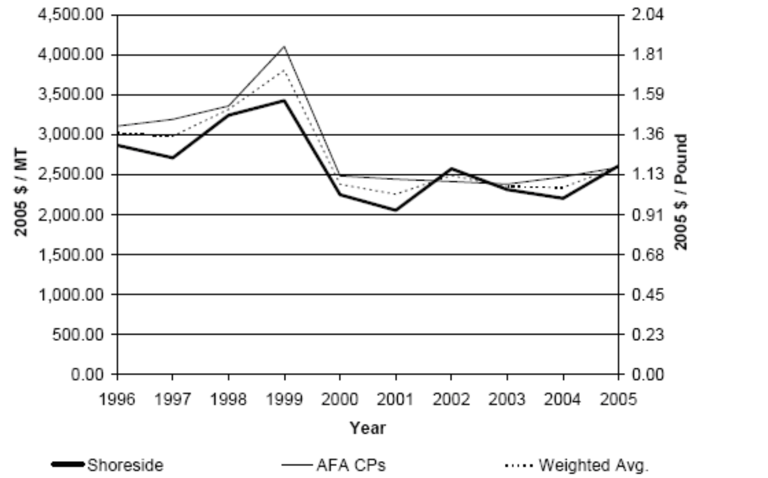
Note: Reported surimi production and value do not specify the grade of products.
Source: NMFS Weekly Product Reports and ADF&G Commercial Operator Annual Reports 1996-2005

Fig. 10-9 Alaska Production of Pollock Surimi by Sector, 1995-2006.



Note: Reported surimi production and value do not specify the grade of products.
Source: NMFS Weekly Product Reports and ADF&G Commercial Operator Annual Reports 1996-2005

Fig. 10-10 Wholesale Value of Alaska Production of Pollock Surimi by Sector, 1995-2005.



Note: Reported surimi production and value do not specify the grade of products. AFA-eligible catcher/processors and motherships are treated as a single sector for the purpose of price calculations.
Source: NMFS Weekly Product Reports and ADF&G Commercial Operator Annual Reports 1996-2005

Fig. 10-11 Wholesale Prices for Alaska Production of Pollock Surimi by Sector, 1996-2005.

The quality of pollock surimi is graded by the National Surimi Association in Japan, which established a quality-ranking system that has been adopted by many suppliers. The highest quality surimi is designated as SA grade, and the grade second highest in quality designated as FA. The third quality grade is designated with A or AA, and the labels KA or K and RA or B are used to denote lower and lowest quality grades.

In Japan, SA grade surimi yields a price approximately 10% higher than FA grade surimi. Researchers note that the Japanese generally believe that ship-processed surimi is of higher quality than surimi processed at shoreside (Sproul and Queirolo 1994, as cited in NMFS 2007), and even SA grade surimi commands a lower price if produced by shoreside processors. In addition to grade, other factors such as inventory levels and seasonal production influence the price of U.S. Alaska pollock surimi.

Roe Production

Roe is extracted from the fish after heading, separated from other viscera, and frozen. After being stripped of roe, the remaining fish can be further processed into surimi or fillets. One of the most important products of Alaska pollock, roe actually accounts for a small share of the volume of pollock products. But its high price accounts for a large share of the total value, and for some producers their highest-margin business comes from pollock roe. U.S. pollock roe production has been significantly higher since 2001 as a result of increased harvests and roe yields following the implementation of the AFA. The value of this increased production, however, has been offset by a decline in Russian harvests of pollock and a subsequent reduction in Japanese imports of pollock roe. Fig. 10-12 and Fig. 10-13 exhibit the harvests, primary production, and wholesale value of roe from Alaska-caught pollock.

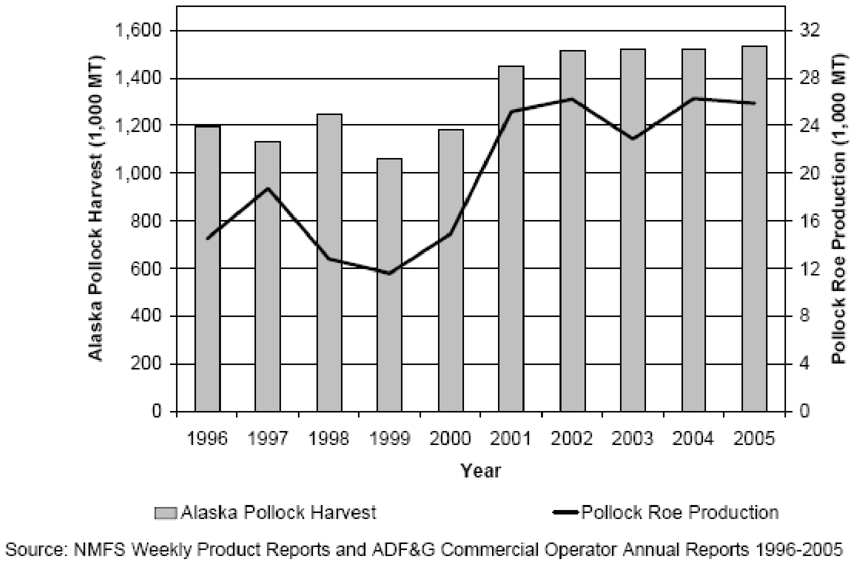


Fig. 10-12 Alaska Pollock Harvests and Production of Pollock roe, 1996–2005.

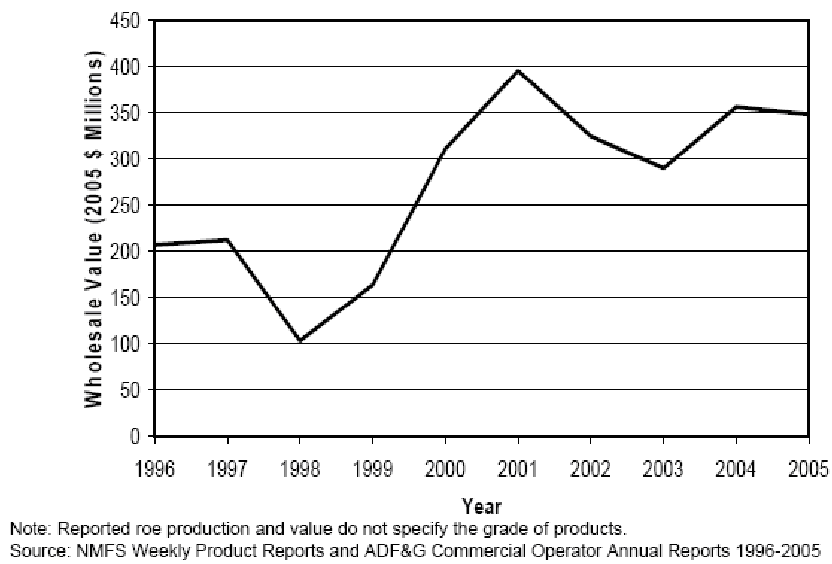


Fig. 10-13 Wholesale Value of Alaska Production of Pollock roe, 1996–2005.

Catcher processors are more likely to produce higher quality roe because they process the fish within hours of harvest, rather than within days as is typical for fish delivered to shoreside processors. Prices for roe processed at sea are generally $1.50-$2.00/lb higher than roe processed at shoreside processors. Most U.S. pollock roe is sold at auction in Seattle and Busan, South Korea. Once purchased and exported to its destination, principally Japan and Korea, the roe is processed into salted roe or, for lower-grade roe, seasoned or spicy roe.

U.S. pollock roe commands premium prices in Japan because of its consistent quality, and the volume of U.S. exports to Japan is expected to remain high. As noted above, the decline in Russian production of Alaska pollock has reduced competition for U.S. roe producers and helped strengthen the markets. The factors that may affect the roe industry in the future are difficult to predict. Certainly, any change in the tastes and demands of Asian consumers or in Russian production will have an effect on the U.S. pollock, especially the roe industry. So, too may the relative value of the U.S. dollar, as compared to other currencies.

International Trade

As the preceding discussions suggest, export of Alaska pollock products constitutes a major aspect of the U.S. pollock industry. Almost all U.S. pollock roe is exported, primarily to Japan and Korea, along with a substantial part of U.S. surimi; and American producers of fillets also have increased exports, especially to Europe where a stronger market for U.S. pollock has emerged from the declining catch of other whitefishes in European waters and the depreciation of the dollar against the Euro.

The single most important export market for pollock fillets has been Germany since 2001. The Netherlands, also, is an important European destination for Alaska-caught pollock because it has two of Europe's leading ports (Rotterdam and Amsterdam) and is in close proximity to other countries in Western Europe; most pollock product imported by the Netherlands is further processed and re-exported to other EU countries.

An increasing amount of headed and gutted pollock is being exported to China, which has been rapidly expanding imports of raw material fish becoming the world's "seafood processing plant" since the latter half of the 1990s. Transport costs to China can be offset by significant presentational and yield improvements achieved by use of a highly skilled labor force (EU Fish Processors' Association 2006, as cited in NMFS 2007). This is in contrast to the need for mainly mechanical filleting and preparation by U.S. processors, with consequent yield loss and forgone value added opportunities.

U.S. seafood companies are increasingly taking advantage of the higher recovery rates and lower labor costs associated with outsourcing some fish processing operations. For example, Premier Pacific Seafoods built a new facility on its 680-ft. mothership M/V *Ocean Phoenix* to prepare Alaska pollock for sale to re-processors in China. The fish are headed and gutted, then frozen and sent to China for further processing (Choy 2005, as cited in NMFS 2007). The vast majority of this value added pollock product then returns to U.S. consumer markets.

10.2.4 Voluntary Rolling Hotspot System

Under Alternative 1, NMFS and the Council have implemented a number of FMP amendments to reduce overall salmon bycatch in the BSAI trawl fisheries. Despite these efforts, salmon bycatch numbers have continued to increase. In 2003, 44,425 Chinook salmon and 173,963 chum and other salmon were taken incidentally in the trawl fisheries. In 2004, bycatch further increased to 51,248 Chinook and 427,653 chum and other species of salmon. Bycatch amounts remained high in 2005, totaling 68,178 Chinook and 638,531 chum and other salmon. High bycatch amounts continued in 2006 with 81,661 Chinook and 277,989 chum and other salmon taken incidentally. And in 2007, bycatch of Chinook increased to 122,000 fish, while bycatch of chum and other salmon species, although down considerably from previous years, remained high at 90,679 fish taken incidentally.

Since establishment of the Chum Salmon Savings Area in 1995, the bycatch of chum and other non-Chinook salmon triggered closures in each of the five years from 2002 through 2006. Table 10-5 exhibits pollock catch and salmon bycatch for full years from 2000 through 2007, compiled from plant landing information for catcher vessels delivering to shoreside processors and from observer data for mothership catcher vessels and catcher-processors. The "Other salmon" category includes all non-Chinook salmon, and observer data for both offshore and shoreside deliveries show only small numbers of salmon other than chum in this category (for example, in the 2006 B Season EFP, only 152 unidentified salmon, 31 pink salmon, and 5 silver salmon).

Table 10-5 Pollock catch and Chinook and non-Chinook salmon bycatch in the pollock fishery by season and for full years, 2000–2007.

Year	A Season pollock	A Season Other salmon	A Season Chinook	B Season pollock	B Season other salmon	B Season Chinook	Full year pollock	Full year other salmon	Full year Chinook
2000	418,285	235	3,418	631,755	57,228	1,793	1,050,039	57,463	5,210
2001	538,107	1,867	16,464	813,022	50,948	13,663	1,351,130	52,815	30,126
2002	570,464	387	21,989	866,034	83,033	13,309	1,436,498	83,420	35,298
2003	576,868	3,274	30,981	876,784	170,688	13,444	1,453,651	173,963	44,425
2004	579,816	419	22,011	858,799	427,234	29,238	1,438,615	427,653	51,248
2005	573,887	574	26,678	878,618	637,957	41,499	1,452,505	638,531	68,178
2006	579,112	1,210	57,637	874,435	276,779	24,024	1,453,547	277,989	81,661
2007	544,273	8,038	70,845	775,261	82,641	49,020	1,319,534	90,679	119,866

Estimates of salmon bycatch for 2000-2007 (compiled by SeaState, Inc.) are for the pollock fishery only and were made using observer data when available and from numbers of salmon counted at shore plants and reported on fish tickets for unobserved inshore CV vessels.

Source: Adapted from SeaState, Report to the North Pacific Fishery Management Council for the BSAI Groundfish Fishery Exempted Fishing Permit #07-02.

Amendment 84 to the BSAI FMP provides for the pollock cooperatives to enter into voluntary, contractual agreements for reducing salmon bycatch by the pollock fleet. These ICAs exempt participating non-CDQ and CDQ pollock vessels from closures of the Chinook and Chum Salmon Savings Areas in the Bering Sea and allow those vessels to use real-time salmon bycatch information to avoid high incidental catch rates of chum and Chinook salmon.

All parties to the ICA agree to abide by all tenets of the ICA, which provides for retaining the services of a private contractor to gather and analyze data, monitor the fleet, and report necessary bycatch information to the parties of the ICA. The ICA requires that the bycatch rate of a participating cooperative be compared to a pre-determined bycatch rate (the base rate). All ICA provisions for fleet bycatch avoidance behavior, closures, and enforcement are based on the ratio of the cooperative's actual salmon bycatch rate to the base rate.

Each cooperative participating in the ICA is assigned to one of three tiers, based on its salmon bycatch rate relative to the base rate. Higher tiers correspond to higher salmon bycatch rates. Tier assignments determine access privileges to specific areas. A cooperative assigned to a high tier is restricted from fishing in a relatively larger geographic area, to avoid unacceptably high salmon bycatch areas. A cooperative assigned to a low tier (based on relatively low salmon bycatch rates) is granted access to a wider range of fishing areas. The private contractor tracks salmon bycatch rates for each cooperative. A participating cooperative is assigned to a tier each week based on its salmon bycatch rate for the previous week. Thus, vessels have economic and operational incentives to avoid fishing behavior that results in high salmon bycatch rates.

Parties to the ICA include the following AFA cooperatives: Pollock Conservation Cooperative, the High Seas Catchers Cooperative, the Mothership Fleet Cooperative, the Inshore Cooperatives (Akutan Catcher Vessel Association, Arctic Enterprise Association, Northern Victor Fleet Cooperative, Peter Pan Fleet Cooperative, Unalaska Fleet Cooperative, UniSea Fleet Cooperative, and Westward Fleet Cooperative) and all six CDQ groups. Additionally, two western Alaskan groups that have an interest in the sustainability of salmon resources would be parties in the ICA. All these groups have participated in meetings to develop the ICA and have a compliance responsibility in the agreement.

10.2.4.1 Exempted Fishing Permit for the VRHS ICA

To address the immediate need to implement a program to reduce salmon bycatch during directed fishing for pollock, and to explore the efficacy of the VHRS ICA, the AFA Catcher Vessel Intercooperative and the Pollock Conservation Cooperative applied for and were granted an exempted fishing permit (EFP) for the time period August 2, 2006, through November 1, 2006. The 2006 EFP exempted CDQ and non-CDQ pollock vessels operating under a salmon bycatch ICA from closures of the salmon savings areas. The EFP allowed the participants to conduct operations under the salmon bycatch reduction EFP during the ‘‘B’’ season.

Preliminary results indicated that salmon bycatch was reduced under the EFP, although it could not be determined whether those reductions were due to decreases or movements in overall salmon biomass.

On October 16, 2006, the applicants submitted a request for a second EFP that would continue the work of the 2006 EFP. Because chum salmon is the predominant bycatch problem during the ‘‘B’’ season (the season investigated under the initial EFP) and Chinook salmon bycatch is the predominant bycatch problem during the ‘‘A’’ season, the applicants expected the new EFP to allow them to evaluate the impact of the ICA program on Chinook salmon bycatch in the 2007 A season.

SeaState, Inc., the private contractor tracking the results of the EFP, submitted their draft report to the Council in 2008. The following summarizes the information in that report, to which readers are referred for additional information. During the course of the fishery, the pollock Intercooperative group closed 13 areas to fishing in the 2007 A season and 52 areas during the 2007 B season, based on high bycatch rates for Chinook or chum salmon by vessels fishing in the areas.

Evaluation of Salmon Savings under the VHRS ICA

The EFP ran for both the entire pollock A and B seasons in 2007. Maps of the closures are shown in the Figures below. SeaState evaluated the number of salmon saved under the EFP by tracking vessels that fished in a closed area before it closed and then comparing the subsequent bycatch of those vessels to see if the bycatch was lower than expected had the area not closed. In conducting this before-and-after comparison of the bycatch observed and expected from the vessels that triggered the closure, SeaState used the following procedure:

1. SeaState first extracted all observer data for haul locations falling inside a closure area, for a five-day period preceding the closure. Shoreside hauls that had the same “start fishing date” were aggregated, so that hauls with the same bycatch rate are not artificially repeated. For example, if two hauls from the same catcher vessel trip show up in the closed area, they would have the same bycatch rate because observers pro-rate bycatch evenly across all hauls. The two hauls would be considered as a single observation with a value equal to the sum of the two hauls’ pollock and salmon.

2. Next, SeaState considered all of independent offshore sector (C/P and mothership) hauls and combined “trip-level” hauls to be estimates of the bycatch ratio.[48] SeaState extracted the same haul or “grouped” haul information, for the same vessels, for the next five days. Their associated bycatch was available from either observer or plant delivery information. SeaState computed the

[48] The bycatch ratio is $Ri = \sum yi / \sum xi$, where y are counts of chinook or chum salmon, and x is the pollock catch from individual hauls (offshore sector) or grouped, same-trip hauls (shoreside), and *i* indicates a separate closure.

expected bycatch had the vessels been able to stay and fish inside the now-closed area, by summing the pollock catch of all vessels in this category and multiplying this summed pollock catch by the matching bycatch ratio.

3. Finally, SeaState computed the standard error of this estimated overall salmon bycatch if vessels had stayed in the area and fished with the bycatch rate (R) treating R as a ratio estimator.

The three maps below illustrate this procedure for the Chinook closure of 9/22/06. Fig. 10-14 shows the Chinook closure that began on 9/22/06, and includes the locations of observed hauls taken in that area during the five-day period preceding the closure. After the closure, vessels that had been in that closure area (i.e. those whose hauls are shown in Fig. 10-14) either moved a small distance to the southwest, or made large moves to the northwest (Fig. 10-15 and Fig. 10-16). Lower Chinook rates were found in all of the new fishing areas.

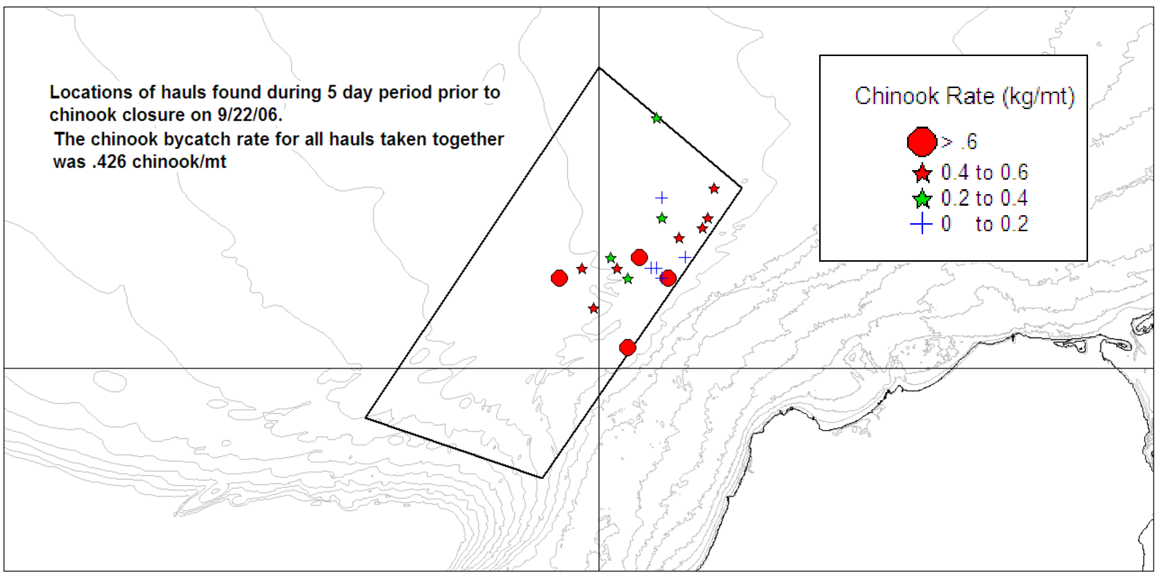


Fig. 10-14 Hauls selected for analysis of Chinook closure on 9/22

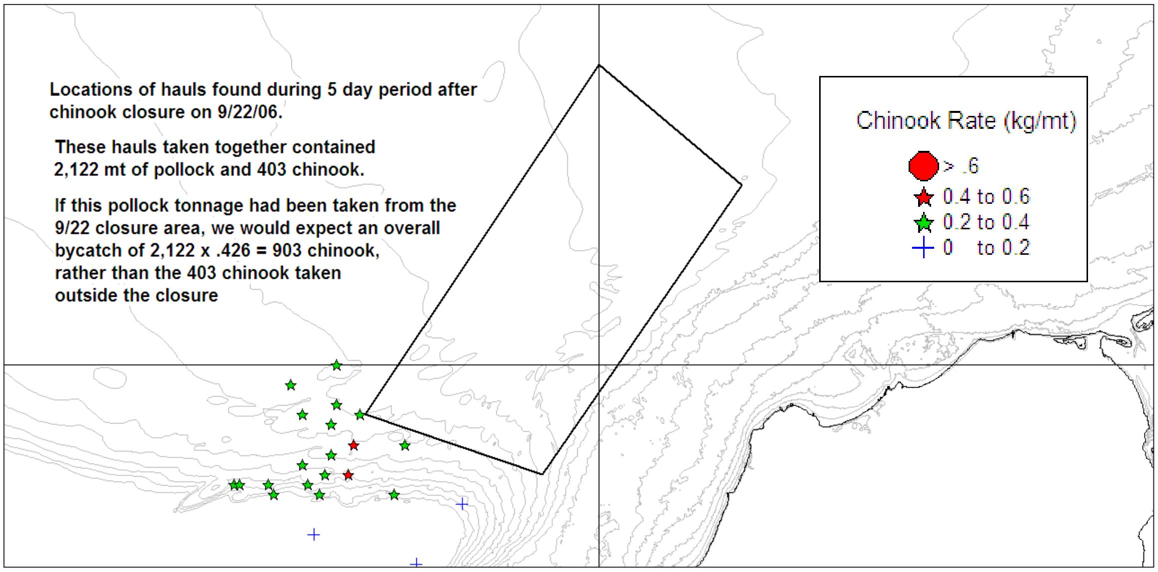


Fig. 10-15 View at the same scale as above of five day fishing activity for vessels in the first map (Fig. 10-14) showing positions that led to a reduction from an expected Chinook take of 903 to 403 actual (i.e. counted by observers from the haul positions shown).

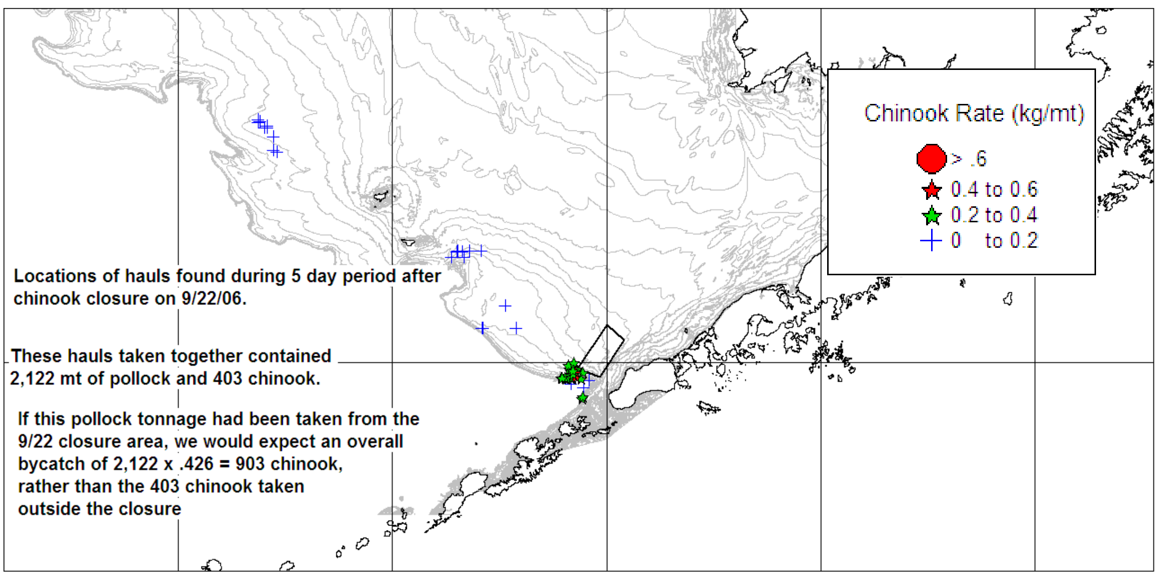


Fig. 10-16 Full view of all hauls from boats in map 1-A for the 5 day period after the start of the 9/22 closure

10.2.4.2 Salmon avoidance results from the 2007 EFP Report

This section reprints results that are documented in the Report to the Council for the BSAI groundfish fishery EFP #07-02, which authorized the VRHS system in 2007, prior to implementation of regulations under Amendment 84. This section is included as an informational item to document the efforts to reduce salmon bycatch by the participants in the VRHS. The information presented here has not been amended from its original form.

The results from these calculations for the 2007 A and B seasons are shown in Table 10-6 and Table 10-7 below. During the A season there were 12 closures. Of these there were 10 closures for which observer data could be found from vessels fishing inside the areas before they closed. (Note that closures may be based on deliveries from catcher vessels that did not carry observers, and thus there could be closures for which there is no observer information prior to the closure). Of these 10 closures, all had post-closure observer information for vessels that fished inside prior to the closure (that is, SeaState had observer information for boats both before and after the closure). Note that before-and-after comparisons were not possible for inshore CV that had observers aboard before the closure, but then delivered and came back to the grounds without an observer.

Table 10-6 summarizes the results for A-season Chinook savings resulting from these closures. For the approximately 103,000 mt of observed groundfish harvested from vessels that fished inside areas before they were closed and that also carried observers after the closures, the results indicate that 35,500 Chinook were avoided. This represents a reduction of 70% from the bycatch of Chinook that would have been expected had the vessels continued to fish in those closure areas for another five days.

Table 10-7 shows results obtained for the B season. Fifty-five closures were put in place during the B season. Of these, 40 closures had both pre- and post-closure observer data that allowed for analysis of bycatch reductions. As with the A season, some closures were based on inshore CV delivery information and VMS track inspection alone, leaving no pre-closure information for analysis. Post-closure information was not available for two periods after the 10/23/07 closure because that closure was continued forward for another week (two closure periods). Rates in that area were judged too high to allow more fishing, and the ICA agreement allows an area to be kept closed in the absence of data. However, with no pre-closure information (since the area was already closed, no one could be fishing in it), SeaState could not determine the effectiveness of continuing that closure.

Table 10-6 Summary of 2007 A-season Chinook closure effectiveness

	Chinook closures
Pollock catch (after closure)	102,592
Actual Chinook bycatch (in moved tows)	15,600
Expected Chinook bycatch	51,150
Chinook savings	35,550
% reduction	70%

Table 10-7 Summary of 2007 B-season Chinook and chum closure effectiveness

	Chinook closures	Chum closures	All closures
Pollock catch (after closure)	74,465	107,646	182,111
Actual Chinook bycatch (in moved tows)	10,879	1,593	12,472
Expected Chinook bycatch	23,448	3,600	27,048
Chinook savings	12,569	2,007	14,576
% reduction	54%	56%	54%
Actual chum bycatch	20,317	16,926	37,243
Expected chum bycatch	30,757	92,896	123,653
Chum savings	10,440	75,970	86,410
% reduction	34%	82%	70%

Table 10-8 summarizes these documented savings (i.e., based on a direct before-and-after comparison of the performance of vessels that triggered the closures) for both the 2006 and 2007 EFP. However, the portion of the entire pollock harvest affected by closures whose savings could not be documented should not be underestimated. This analysis does not include vessels without observers or vessels that avoided the closure areas entirely and fished the B seasons to the northwest, where salmon are rarely encountered. For inshore CV in particular, the uncertainty over whether or not the grounds they are fishing will be closed is significant. These catcher vessels often have only two days to fill their vessels; if their grounds are closed in the middle of a trip, they may eventually be forced to return to shore with only a partial load. SeaState could not quantify the weight of this factor in a captain's decision to fish away from the closure areas, but notes in its report that this is another factor by which salmon closures may reduce bycatch; however, that factor cannot be analyzed with the methods at hand.

Table 10-8 Documented savings summary for 2006 and 2007 EFP

	2006B	2007A	2007 B
Pollock harvest moved from closures	41,691	102,592	182,111
% of pollock harvest affected	8%	19%	23%
Chinook savings	1,537	35,550	14,576
% reduction	20%	70%	54%
Chum savings	15,419		86,410
% reduction	67%		70%

Conclusions and Projected Changes to the ICA Closure System for 2008

Finally, Fig. 10-17 and Fig. 10-18 show Chinook bycatch rates for various pollock fishing areas and contrast the 2006 and 2007 seasons (both A and B season). In Fig. 10-18, data are limited to October, when most Chinook were encountered. Comparing years shows elevated Chinook rates in 2007 relative to 2006 in areas near the horseshoe. Rates around the Pribilof Islands did not change markedly between 2006 and 2007, while rates north of the Pribilof, while still low, increased by an order of magnitude in the B season (from .013 to .12 salmon/mt). The net result is the increase in the Chinook bycatch rate shown in Table 10-9. Inshore CV and offshore sectors are shown separately only because offshore records go back further. Both sectors have shown a similar increase in Chinook bycatch rates, especially in the A season.

Table 10-9 Inshore CV and offshore Chinook rates based on data compiled by Sea State.

Year	Inshore CV A	Offshore A	Inshore CV B	Offshore B
1996		0.057		0.021
1997		0.014		0.027
1998		0.042		0.032
1999		0.015		0.010
2000	0.006	0.011	0.010	0.003
2001	0.037	0.034	0.010	0.024
2002	0.039	0.036	0.026	0.007
2003	0.035	0.054	0.023	0.012
2004	0.047	0.036	0.064	0.013
2005	0.062	0.043	0.102	0.011
2006	0.147	0.071	0.063	0.004
2007	0.153	0.113	0.147	0.024

Note: Sea State inshore CV recording began in 2000.

The pollock fishery encountered record levels of Chinook bycatch during the 2007 seasons. CPUEs on Chinook salmon, measured simply as the number of salmon caught per hour of fishing, summed across all vessels, rose dramatically in 2006 and continued to stay at high levels throughout 2007 (Fig. 10-19 and

Fig. 10-20). Slight declines in salmon CPUE were seen in the inshore CV data, but offshore sectors saw increased salmon CPUEs. Also, any lowering in the inshore CV CPUEs were cancelled by a greater decrease in pollock CPUE, leading to bycatch rates higher than any seen since the mid-1990s. The situation with chum salmon was much different, with obviously lower levels of chum on the grounds and total bycatch for the season falling to the lowest level in five years.

Chinook bycatch in the A season contained unusually high numbers of small salmon (see Fig. 10-21 below). Chinook bycatch in the B season appeared to have fewer small salmon, although the separate modes that appeared in the 2007A length frequencies are not as pronounced in the 2007 B bycatch. These high levels of bycatch of small fish mean that we will not understand the correlation between bycatch of Chinook in the Bering Sea and the return of Chinook to western Alaskan drainages for several years. It may be that high bycatch levels presage very high returns, or it may alternatively mean that the distribution of Chinook throughout the North Pacific and Bering Sea has somehow changed so that more of the run is vulnerable to being taken as bycatch. Regardless, the Intercooperative group concluded that the current system of closures was insufficient to meet these high and unanticipated levels of salmon abundance on the pollock grounds. The Intercooperative group thus took the following steps to make the program more effective in 2008:

- **The base rate for Chinook in the A season will float after February 14.** It is currently adjusted on February 14, but if bycatch levels are declining the result will be that no areas are found above the threshold for closure. Although the ICA group did in fact issue salmon advisories that all vessels observed, CDQ groups and western Alaskans asked that the base rate be allowed to float so that the program would not depend on voluntary observance of salmon advisories, should this situation occur in the future.
- **The area available for closure in the A season increases to 1,500 sq mi.** The previous total area that could be closed for A season Chinook bycatch was 1,000 sq mi.
- **The area available for closure in the B season increases to 1,500 sq mi.** The previous total area that could be closed for B season Chinook bycatch was 1,000 sq mi.
- **A predefined A season closure shown below (Fig. 10-22) will be observed for the entire A season.** The area to be closed is defined by a heavy black line in the chart below. It was determined by trying to bound the areas that show the consistently highest A season bycatch rates, but still leave fishing grounds deeper than 180 fm open. This preseason closure area appears to match the highest bycatch rate areas found by Council analysts as well.

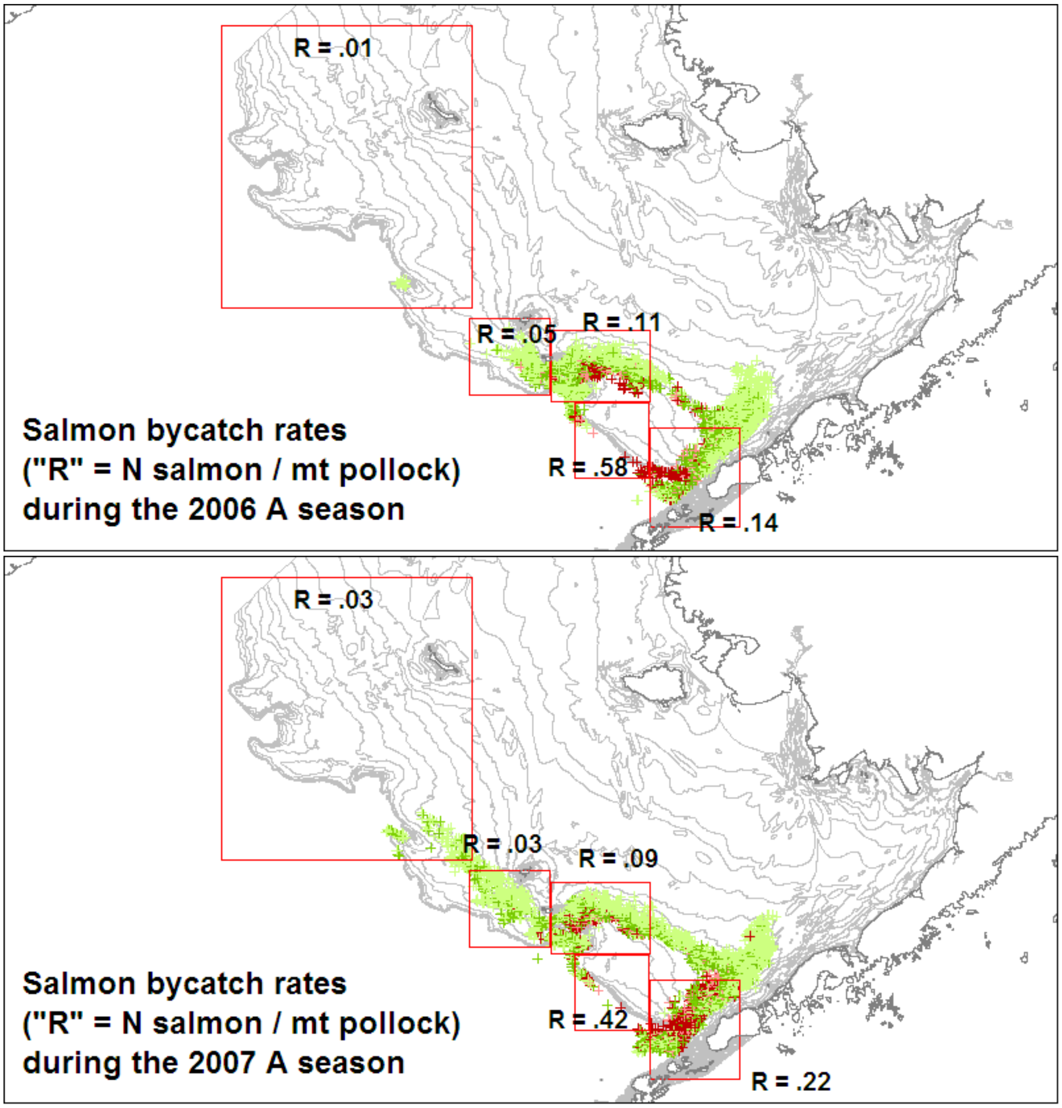


Fig. 10-17 Comparison of Salmon Bycatch Rates in the 2006 and 2007 Pollock A Seasons. Shading indicates level of Chinook bycatch, ranging from light green (lowest) to red (highest). Shading scale is the same for both years

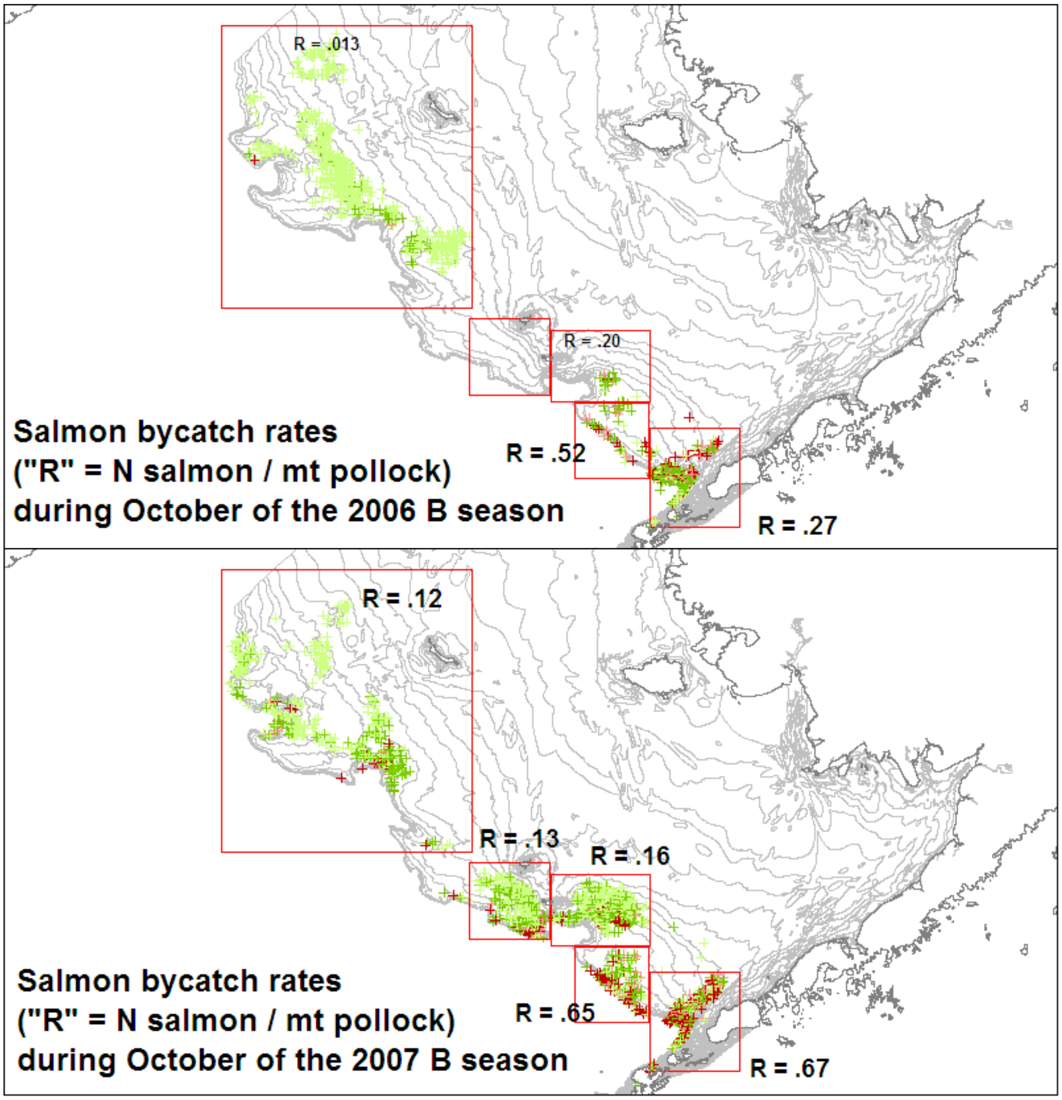


Fig. 10-18 Comparison of bycatch rates between areas fished during the 2006 and 2007 pollock B seasons. Shading indicates level of Chinook bycatch, ranging from light green (lowest) to red (highest). Shading scale is the same for both years

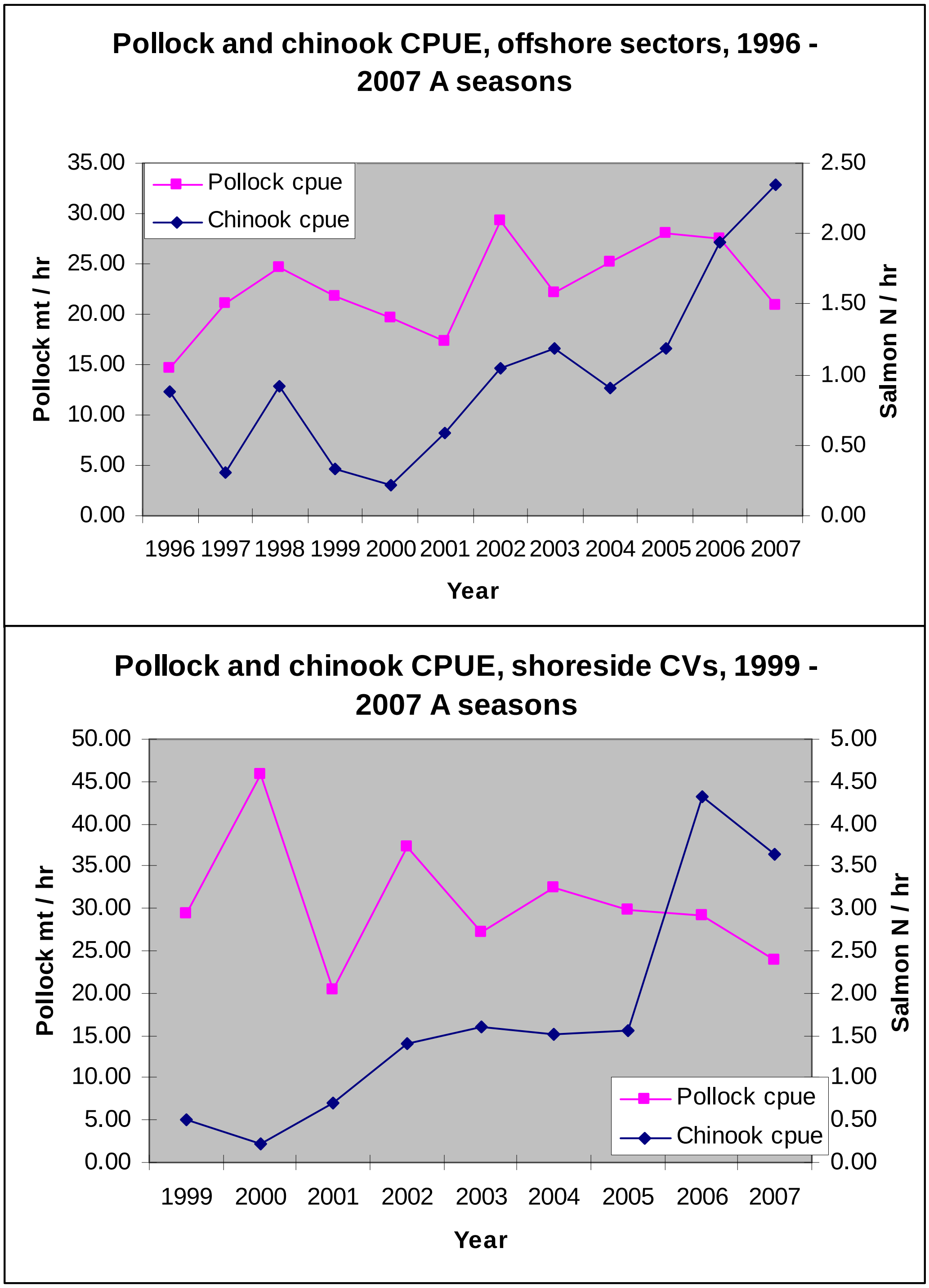
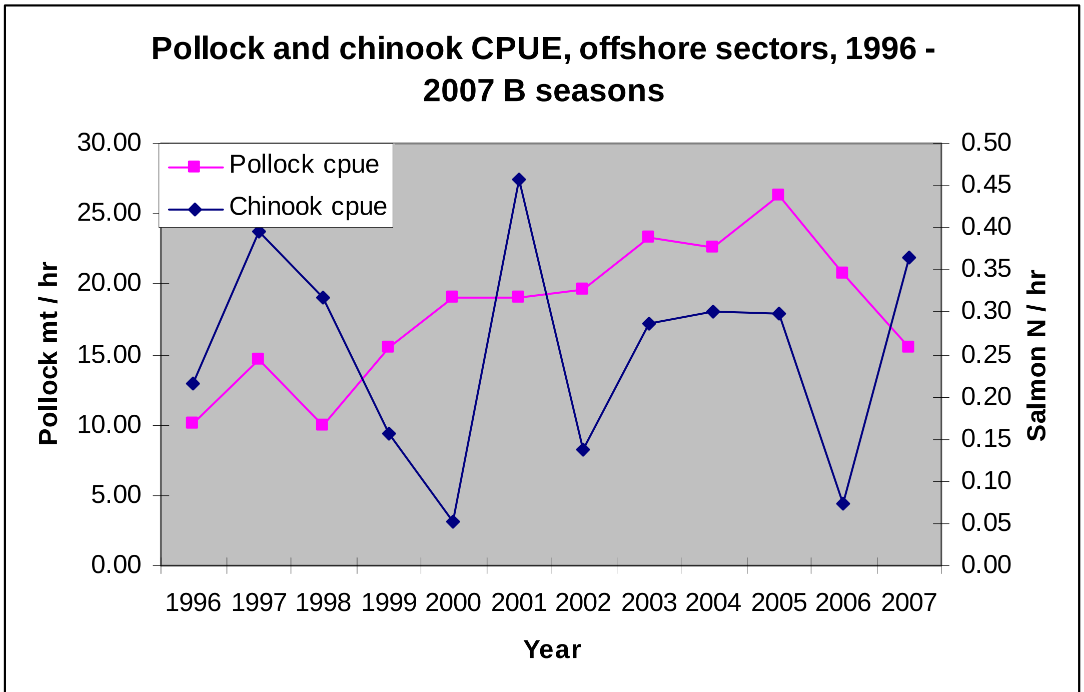


Fig. 10-19 A Season Pollock and Chinook CPUE, 1996–2007, Offshore and CV Sectors



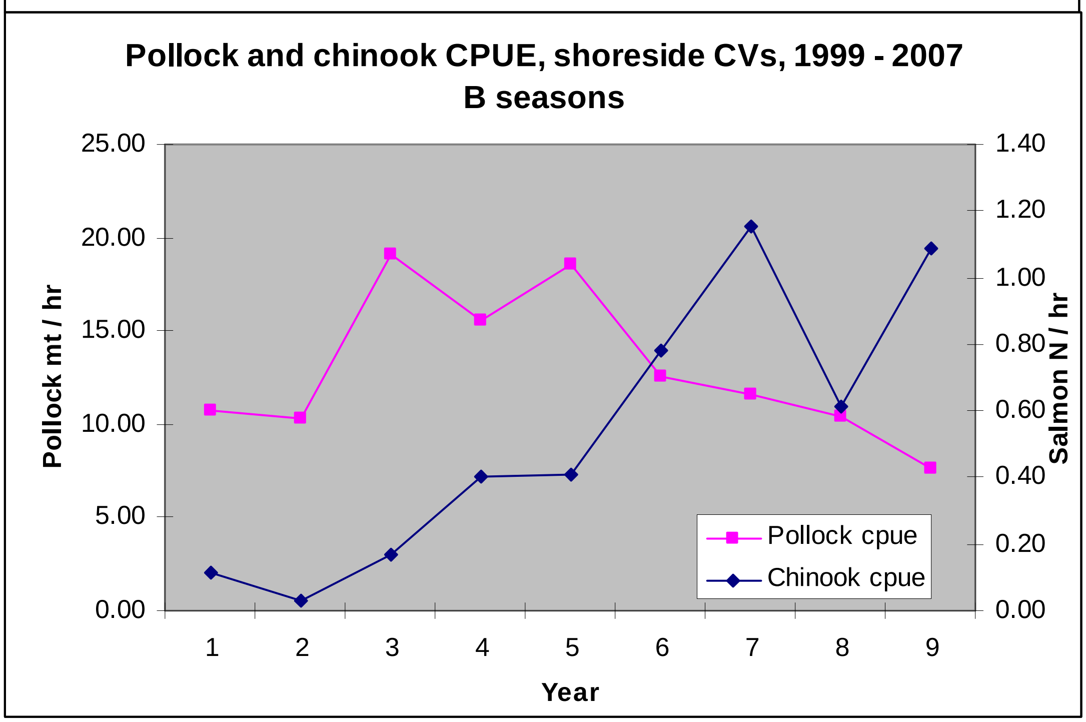


Fig. 10-20 B Season Pollock and Chinook CPUE, 1996–2007, Offshore and CV Sectors

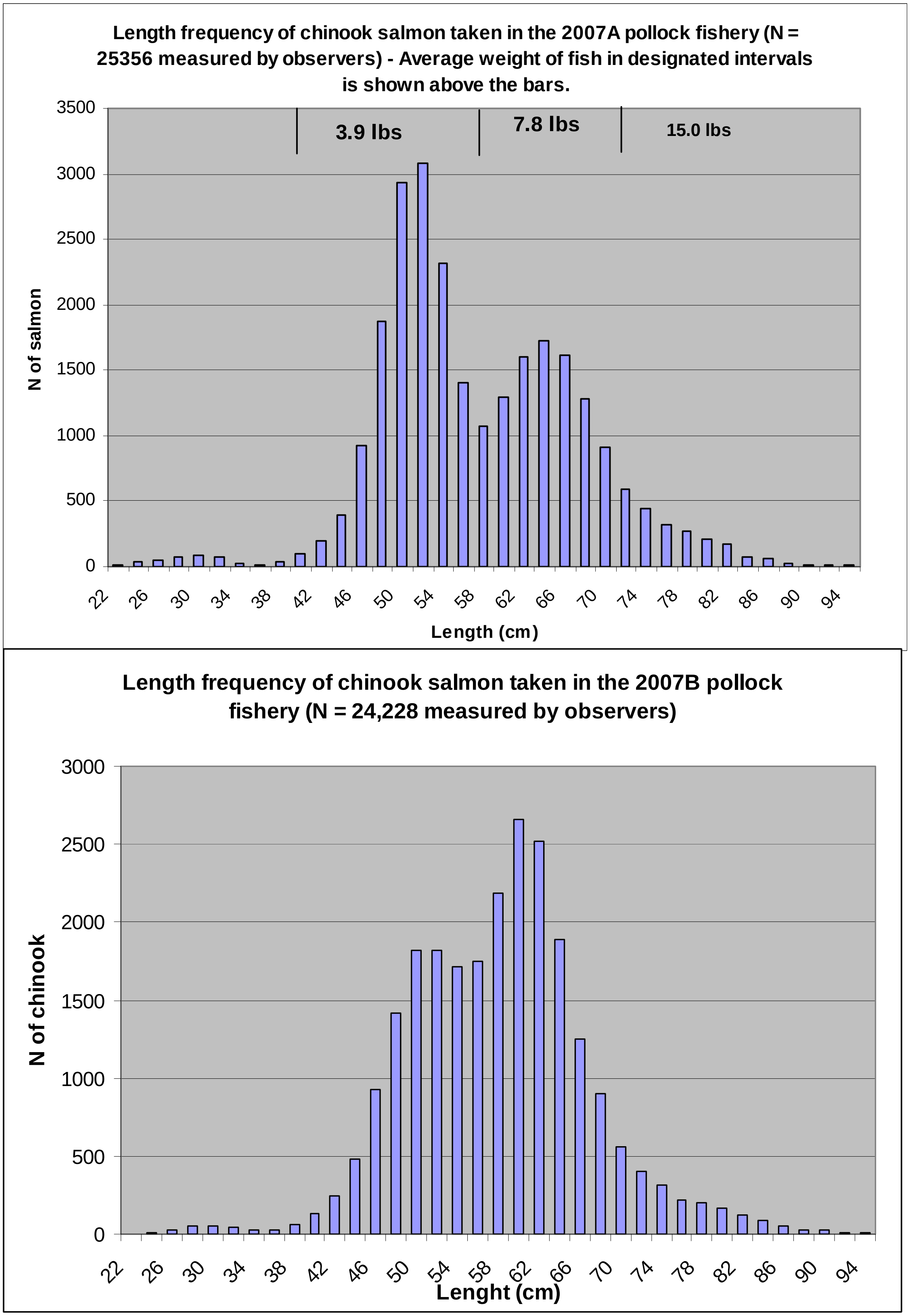


Fig. 10-21 Length frequencies of Chinook, 2007A and 2007B seasons.

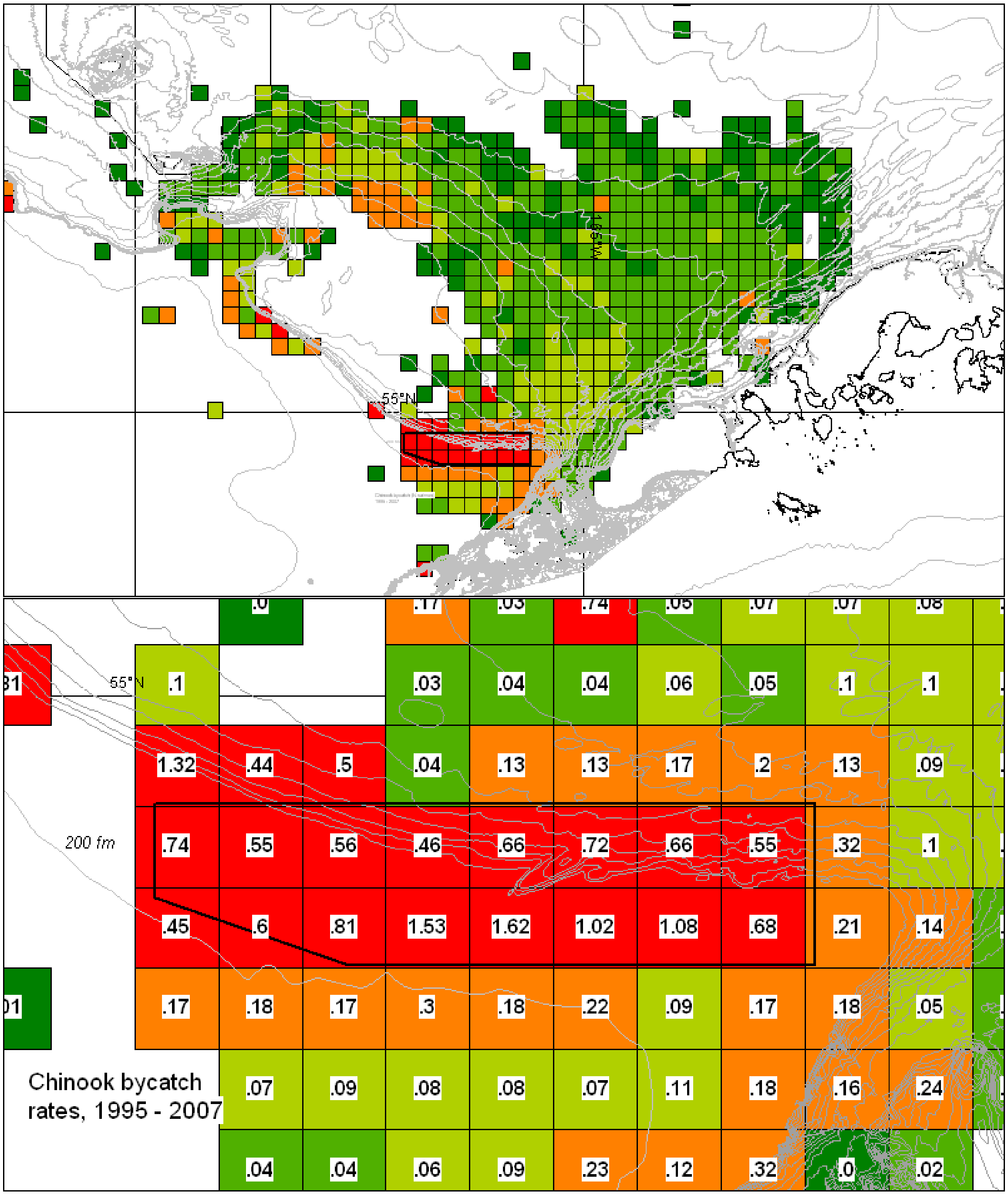


Fig. 10-22 2008 Pollock A Season Pre-season Closure

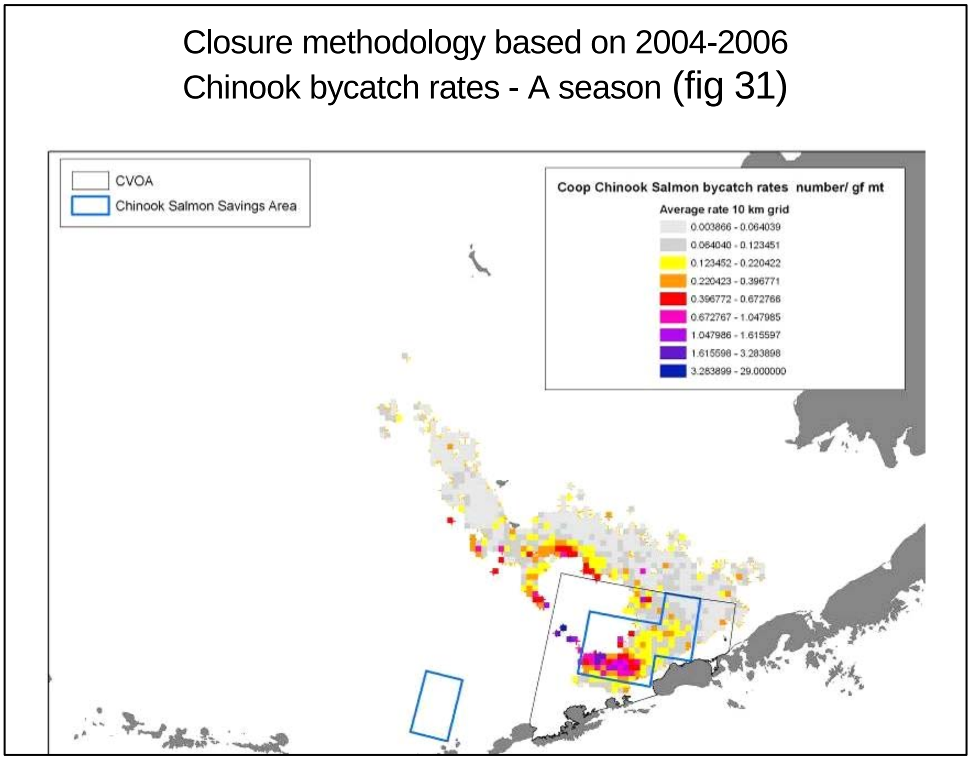


Fig. 10-23 Correspondence between high bycatch areas noted by Council analysts and pre-season closure (above).

Table 10-10 Chinook and chum salmon closure effectiveness, 2007 A season, by Chinook closure

Closure type	Date of closure	"After" closure pollock catch	"After" closure chinook	Estimated closed-area chinook catch	Chinook reduction (estimate - actual)	Std Err chinook	"After" closure chums	Estimated closed area chum	Chum reduction (estimate - actual)	Std Err chum	Number of samples prior to closure	Number of samples after closure
Chinook	01/31/06	13,166	1,582	12,923	11,341	799	100	23	-78	9	35	42
Chinook	01/31/06	6,143	852	1,849	997	399	61	0	-61	0	4	37
Chinook	02/02/06	5,012	742	5,161	4,419	562	196	3	-193	1	14	19
Chinook	02/02/06	7,340	2,773	569	-2,204	97	262	0	-262	0	3	43
Chinook	02/09/06	22,917	4,003	18,666	14,663	3,161	1,616	691	-926	123	30	135
Chinook	02/13/06	3,795	561	1,141	580	378	20	54	35	18	12	25
Chinook	02/16/06	28,936	3,087	8,164	5,077	382	435	1,372	937	69	128	191
Chinook	02/16/06	5,700	1,178	405	-773	150	44	0	-44	0	3	40
Chinook	02/23/06	456	22	180	158	34	0	0	0	0	4	4
Chinook	02/23/06	9,126	800	2,091	1,291	273	152	83	-68	20	22	54
Totals		102,592	15,600	51,150	35,550		2,887	2,226	-661			

Table 10-11 Chinook and chum salmon closure effectiveness, 2007 B season, by Chinook closure

Closure type	Date of closure	"After" closure pollock catch	"After" closure chinook	Estimated closed-area chinook catch	Chinook reduction (estimate - actual)	Std Err chinook	"After" closure chums	Estimated closed area chum	Chum reduction (estimate - actual)	Std Err chum	Number of samples prior to closure	Number of samples after closure
Chinook	08/24/06	4,679	61	392	331	32	3,621	16,327	12,706	2,688	12	23
Chinook	08/24/06	6,788	72	199	127	17	3,875	5,466	1,591	1,132	27	35
Chinook	09/04/06	18,875	729	2,258	1,529	188	7,026	1,600	-5,426	206	43	124
Chinook	09/07/06	4,033	670	321	-350	45	2,080	666	-1,414	141	12	28
Chinook	09/11/06	3,777	508	296	-212	18	295	127	-168	12	12	20
Chinook	09/18/06	1,165	439	893	454	38	328	1,419	1,091	75	9	10
Chinook	09/18/06	2,546	331	466	135	85	413	235	-178	52	18	25
Chinook	09/21/06	1,430	80	148	68	29	168	72	-96	29	5	18
Chinook	09/21/06	3,298	880	1,045	165	182	767	1,465	698	194	29	27
Chinook	09/25/06	821	259	368	109	129	182	334	152	76	10	10
Chinook	09/28/06	816	332	256	-77	20	90	73	-18	8	8	7
Chinook	09/28/06	3,125	373	539	166	97	279	739	461	117	13	29
Chinook	10/02/06	448	145	33	-112	6	20	58	38	17	5	6
Chinook	10/05/06	834	466	353	-113	45	35	82	47	15	3	6
Chinook	10/05/06	7,113	278	2,329	2,051	370	303	1,456	1,152	255	12	61
Chinook	10/09/06	2,343	1,245	1,334	89	42	111	257	146	15	10	15
Chinook	10/12/06	5,405	1,907	5,489	3,582	417	300	227	-73	15	34	35
Chinook	10/12/06	698	359	221	-137	15	109	59	-50	3	15	4
Chinook	10/16/06	1,285	511	1,364	853	122	65	39	-25	3	13	9
Chinook	10/19/06	4,543	955	4,331	3,377	370	229	49	-179	8	16	26
Chinook	10/23/06	443	278	813	536		20	7	-13		1	2
Totals		**74,465**	**10,879**	**23,448**	**12,569**		**20,317**	**30,757**	**10,441**			

Table 10-12 Chinook and chum salmon closure effectiveness, 2007 B season, by chum closure

Closure type	Date of closure	"After" closure pollock catch	"After" closure chinook	Estimated closed-area chinook catch	Chinook reduction (estimate - actual)	Std Err chinook	"After" closure chums	Estimated closed area chum	Chum reduction (estimate - actual)	Std Err chum	Number of samples prior to closure	Number of samples after closure
Chum	07/06/06	8,983	8	87	79	20	60	2,717	2,657	394	19	50
Chum	07/17/06	223	7	2	-5	1	13	34	21	8	5	4
Chum	07/24/06	150	0	0	0		9	5	-4		1	1
Chum	07/24/06	13,089	0	0	0	0	89	3,590	3,501	1,173	20	82
Chum	07/31/06	13,267	0	0	0	0	125	5,428	5,303	546	31	70
Chum	08/03/06	5,584	0	0	0	0	75	1,593	1,518	338	4	28
Chum	08/03/06	507	4	6	2	1	309	329	21	133	5	5
Chum	08/07/06	1,313	1	13	12	2	50	1,072	1,022	41	6	7
Chum	08/10/06	4,965	36	18	-18	3	375	1,407	1,032	162	19	29
Chum	08/14/06	304	1	2	1	1	5	84	79	19	4	3
Chum	08/17/06	19,890	308	741	433	119	7,394	3,612	-3,782	560	62	120
Chum	08/17/06	626	4	0	-4	0	122	83	-39	43	11	8
Chum	08/21/06	268	0	0	0		70	0	-70		1	1
Chum	08/21/06	12,820	153	1,224	1,072	307	3,029	2,429	-600	437	17	96
Chum	08/21/06	5,554	34	315	281	23	1,267	29,156	27,890	4,022	7	25
Chum	08/28/06	2,013	56	67	11	9	746	1,639	893	146	9	14
Chum	08/31/06	1,769	32	64	32	3	467	1,196	729	65	9	10
Chum	08/31/06	5,972	459	103	-356	28	426	12,841	12,415	2,572	11	52
Chum	09/04/06	10,350	491	958	468	259	2,296	25,680	23,384	5,526	6	74
Totals		**107,646**	**1,593**	**3,600**	**2,007**		**16,926**	**92,896**	**75,970**			

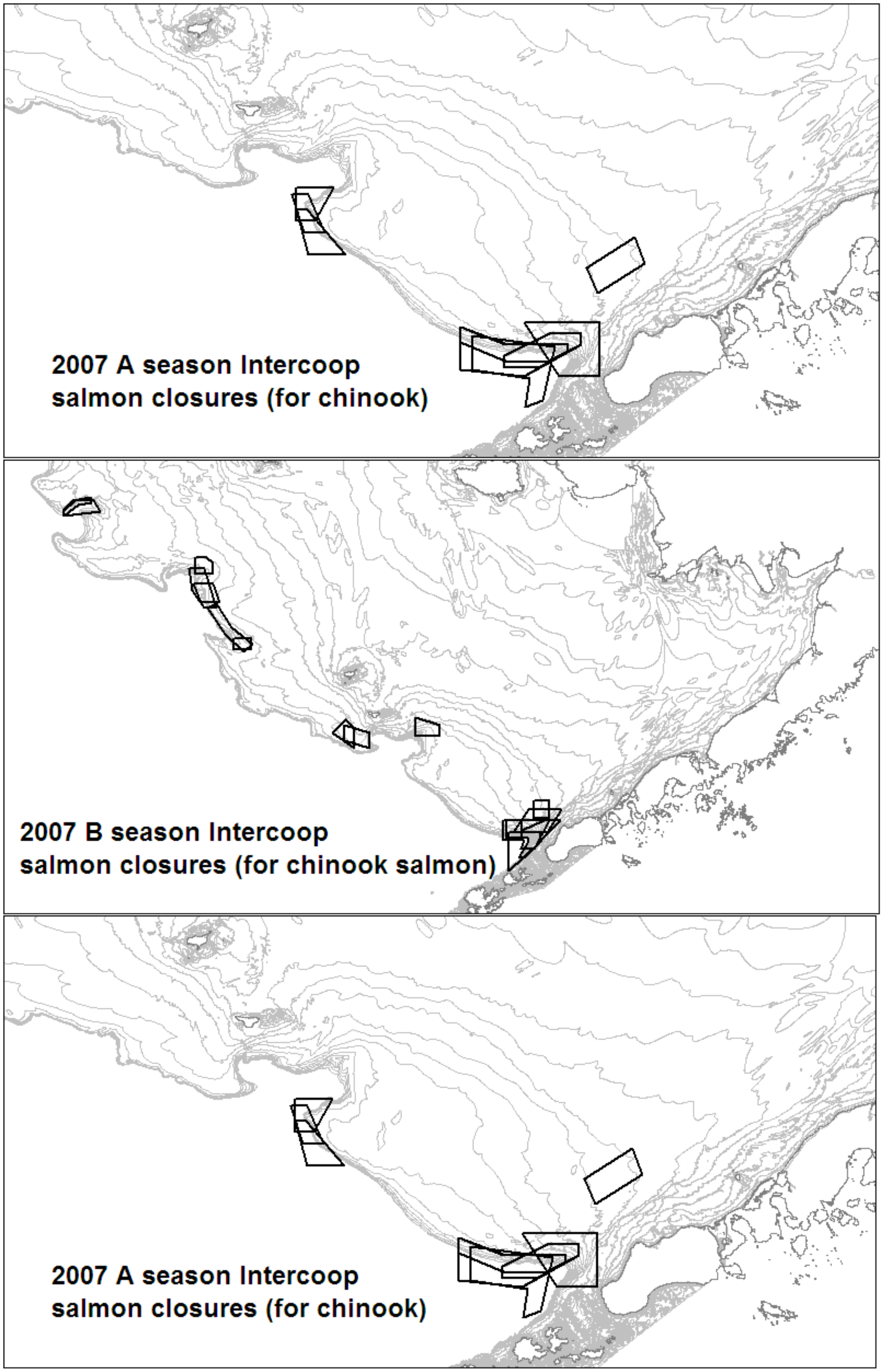


Fig. 10-24 Charts showing closures

10.2.5 Donation of Bycaught Salmon: Prohibited Species Donation Program

The Prohibited Species Donation program (PSD program) was initiated to reduce the amount of edible protein discarded under PSC regulatory requirements for salmon and halibut. Some groundfish fishing vessels cannot sort their catch at sea, but deliver their entire catch to an onshore processor or a processor vessel. In these cases, sorting and discarding of prohibited species occurs at delivery, after the fish have died. One reason for requiring the discard of prohibited species is that some of the fish may live if they are returned to the sea with a minimum of injury and delay (e.g., halibut and crab). However, all incidentally caught salmon die in the Alaska groundfish trawl fisheries (NMFS 1996). Therefore, to reduce the waste of edible protein, the PSD program was begun. NMFS implemented the PSD program for salmon in 1996, and expanded the program in 1998 to include Pacific halibut delivered to shoreside processors by CVs using trawl gear. The first donations were received under the PSD program in 1996.

The PSD program allows enrolled seafood processors in the Bering Sea and Gulf of Alaska trawl groundfish fisheries to retain salmon and halibut bycatch for distribution to economically disadvantaged individuals through tax-exempt hunger relief organizations. Regulations prohibit authorized distributors and persons conducting activities supervised by authorized distributers from consuming or retaining prohibited species for personal use. They may not sell, trade, or barter any prohibited species that are retained under the PSD program. However, processors may convert offal from salmon or halibut that has been prepared for the PSD program, into fish meal, fish oil, or bone meal, and retain the proceeds from the sale of these products. Fish meal production is not necessarily a profitable venture. The costs for processing and packaging the salmon are donated by the processors participating in the PSD program.

The NMFS Regional Administrator, Alaska Region, may select one or more tax-exempt organizations to be an authorized distributor of the donated prohibited species. The number of authorized distributors selected by the Regional Administrator is based on the following criteria: (1) the number and qualifications of applicants for PSD permits; (2) the number of harvesters and the quantity of fish that applicants can effectively administer; (3) the anticipated level of bycatch of salmon and halibut; and (4) the potential number of vessels and processors participating in the groundfish trawl fisheries. After a selection notice is published in the *Federal Register*, a PSD permit is valid for three years, unless suspended or revoked. Regulations at 50 CFR 679.26 describe numerous requirements for authorized distributors; reporting and recordkeeping requirements for vessels or processors retaining prohibited species under the PSD program; and processing, handling, and distribution requirements for PSD program processors and distributors.

Several inshore pollock processors participate in the PSD program. This program donates salmon, after being seen by an observer, to authorized distributors. Regulations require that donated salmon be headed, gutted, and frozen in a manner fit for human consumption. Generally, per regulatory design, the fishing industry may not gain economic benefit from the catch or disposition of prohibited species. However, the NMFS OLE has a policy that allows the heads and guts of these salmon to be processed into fish meal even though these may mean that prohibited species heads and guts could be sold in the form of fish meal. This policy allows processors to accrue a small economic benefit from the offal of prohibited species. Any salmon found at the plant that are not fit for human consumption are returned to the vessel and discarded whole during the vessel's next trip.

Since the program began, in 1996, SeaShare (formerly Northwest Food Strategies) of Bainbridge Island, Washington, has been the sole applicant for a PSD permit for salmon from NMFS, and, therefore, the only recipient of a PSD permit for salmon. NOAA presented SeaShare with a Marine Stewardship Award in 2006, evidence that the PSD program and its distributor SeaShare are effective. SeaShare is a 501(c)(3) tax-exempt organization that distributes seafood products through America's Second Harvest and its national network of food banks. The most recent selection notice for SeaShare was published in the *Federal Register* on July 15, 2005 (70 FR 40987). SeaShare applied for a permit renewal on March 20, 2008.

Many trawl vessels and all three major shoreside processors operating from Dutch Harbor have participated in the PSD program since its inception as a pilot program in 1994. The shoreside processors Alyeska Seafoods, Inc., and Unisea, Inc., have participated every year; Westward Seafoods, Inc., has participated less frequently. Thirty-six trawl catcher vessels are qualified to participate in the PSD program and deliver to these shoreside processors. Additionally, there are 17 trawl catcher/processors that currently participate in the salmon PSD program; however, catcher/processors may not participate in the halibut PSD program. With existing staff, SeaShare has stated that it could administer up to 40 processors and associated catcher vessels, about twice as many processors as it currently administers (SeaShare 2008).

There is limited information available on the volumes of Chinook salmon entering this distribution network. Program statistics do not discriminate between Chinook and chum salmon, although very little salmon of other species is believed to enter the system. The total processed or finished weight of Chinook and chum salmon distributed has ranged from about 38,700 pounds in 1999 up to about 483,400 pounds in 2005. In 2007, 87,300 pounds were distributed (SeaShare, personal communication 2008).[49]

Table 10-13 lists the annual net amount of steaked and finished pounds of PSD salmon received by SeaShare and donated to the food bank system from 1996 through 2007 (SeaShare, personal communication 2008). NMFS does not have the information to accurately convert the net weight of salmon to numbers of salmon. Note that salmon may be consolidated in temporary cold storage in Dutch Harbor awaiting later shipment, so salmon donated in November or December may appear in the results for the following year.

Table 10-13 Net Weight of Steaked and Finished PSD Salmon Received by SeaShare 1996-2007

Year	Salmon (lbs.)	
1996	89,181	
1997	99,938	
1998	70,390	
1999	38,731	
2000	62,002	
2001	32,741	*
2002	102,551	
2003	248,333	
2004	463,138	
2005	483,359	
2006	171,628	
2007	87,330	

*For a time in 2001, processors stopped retaining salmon under the PSD program because regulations prohibited them from processing and selling waste parts of salmon not distributed under the PSD program. The regulations were revised through a final rule published August 27, 2004, to allow processors to use this material for commercial products (69 FR 52609).

The packaged PSD salmon is distributed through SeaShare to food banks located primarily in the Puget Sound area of the Pacific Northwest. Less than full truckload quantities of fish are distributed to Seattle-

[49] Jim Harmon, Program Manager for SeaShare. Personal communication, April 25, 2008.

area food banks that use their freezer trucks to pick up the frozen salmon directly from the freight carriers. Sometimes full truckloads are made available to any qualified food bank within the America's Second Harvest network that is willing to pick it up with a freezer truck and pay for shipping expenses. Due to transportation costs, donated salmon usually stays in the western U.S. Individual food banks distribute the salmon to soup kitchens, shelters, food pantries, and hospices (SeaShare 2008). Over the 12 years that the salmon PSD program has been in place, nearly 2 million pounds of steaked and finished salmon have been donated through the program. Using an estimated four meals per pound of salmon, nearly 650,000 meals have been donated on average, per year. The donated salmon provides a highly nutritious source of protein in the diets of people who have access to only meagre, and often inadequate food (NMFS 1996).

Expenses for processing the salmon and delivery to the food banks are covered by donations. Fishermen participating in the PSD program must sort, retain, and deliver to an approved storage facility, all salmon destined for the PSD program. Their costs include space on the vessel to store the fish, and maintenance of the fish in suitable condition. Processors must accept delivery, fill out the appropriate paper work and process, refrigerate, package, and store the donated fish, incurring costs in time, labor, and equipment that must be borne by the processor. The PSD salmon must then be delivered from the processor to SeaShare, which then coordinates the temporary storage of the fish, its transportation, and routing to eligible food banks. The transportation costs to Seattle are usually donated by various freight carriers. Participation in the PSD program is entirely voluntary, so an entity that found the program requirements onerous could stop participating without financial cost to itself (NMFS 2003).

The PSD program reduces waste in fisheries attributable salmon PSC bycatch. Without this program, these fish would be discarded at sea, and would not be directly used by anyone (although discards would be available to scavengers, potentially benefitting future fish productivity). The PSD program encourages human consumption of these fish, without creating an economic incentive for fishing operations to target them. Under the PSD program, salmon that are unavoidably killed as PSC bycatch are directly utilized as high quality human food, improving social welfare and reducing fishery waste.

10.3 Potentially Affected Salmon Fisheries

Analysis of the stock composition of Chinook salmon incidentally caught in the Bering Sea pollock fishery has shown that the stock structure is dominated by western Alaska stocks. A study completed in 2003, estimated age and stock composition of Chinook salmon in the 1997 through 1999 BSAI groundfish fishery bycatch samples from the NMFS observer program database (Myers et al. 2004). Results indicated that bycatch samples were dominated by younger (age 1.2) fish in summer, and older (age 1.3 and 1.4) fish in winter (Myers et al. 2004). The stock structure was dominated by western Alaskan stocks, with the estimated stock composition of 56% western Alaska, 31% Central Alaska, 8% Southeast Alaska/British Columbia/Pacific Northwest, and 5% Russia.

This section provides extensive background information on the commercial, subsistence, and sport Chinook salmon fisheries in western Alaska river systems likely most affected by Chinook salmon bycatch. The data cited in the sections treating salmon fisheries by region are from published ADF&G reports as well as from data provided by ADF&G specifically for development of this document. ADF&G is a participating agency in the preparation of this document. Thus, data tables and text from management reports are often adopted herein as originally written by ADF&G area management staff. Some tabular data and text has been reformatted for greater focus on the issues needing treatment in this RIR; however, considerable effort has been made to include all table footnotes and to include a long range historical perspective.

Cook Inlet

After experiencing a significant downturn in the early to mid-1990s, Cook Inlet Northern District Chinook salmon stocks continue to trend sharply upward and most escapement goals are being met or exceeded (see section 5.2.7). Chinook salmon is not normally a commercially important species in the Lower Cook Inlet. Thus, formal treatment of Cook Inlet Chinook salmon fisheries is not included here.

Southeast Alaska Stocks

Chinook salmon harvest in Southeast Alaska occurs under the Pacific Salmon Treaty (described further in Chapter 1). Eleven watersheds have been designated to track spawning escapement, and counts of these 11 stocks are used as indicators of relative salmon abundance as part of a coast-wide Chinook model. The Taku, Stikine, and Chilkat rivers together make up over 75% of the summed escapement goals in the region. Escapement on the Taku River remains low relative to the 1990-1999 average, but escapement to the Stikine River has increased greatly since 1999 (Pahlke 2007).

The Chinook salmon quota for Southeast Alaska, all gears, in 2006 was 329,400. In addition, a harvest sharing agreement with Canada under the treaty allows harvest in the Stikine River; the US allocation in 2006 was 13,350 fish. There was no directed fishery for Chinook salmon on the Taku River in 2006 due to low forecast returns (Nelson et al 2008).

Southeast Alaska stocks are not individually resolved in the genetics used as the baseline for this impact analysis. Trends in stocks can be evaluated for an aggregate estimate of the impacts of the alternatives to Southeast Alaska stocks (see Chapter 5) but given the number of river systems combined to form these categories results should be interpreted with caution. It is not possible at this time to estimate the individual impact to specific Southeast Alaska river systems of the alternatives. Thus, it is not possible to evaluate potential impact on specific Southeast Alaska Chinook fisheries. For that reason, detailed background information on Southeast Alaska Chinook fisheries is not included here.

Pacific Northwest Stocks

A single grouping represents the aggregate Pacific Northwest stocks including over 200 stocks from British Columbia, Oregon and Washington State. The specific stocks included are listed in Table 3-7 in Chapter 3. Given the breath of this grouping, it is not possible to identify specific Chinook salmon harvest fisheries, be they commercial, sport, subsistence and/or tribal, that may be affected by Chinook salmon bycatch in the Bering Sea. Further, the 2007 biological opinion concluded that of the 26 ESA-listed salmon stocks, the BSAI groundfish fisheries are not likely to jeopardize the continued existence or adversely modify critical habitat for the Upper Willamette River (UWR) and Lower Columbia River (LCR) ESA-listed Chinook salmon stocks (NMFS 2007a, see section 5.2.8). Available information indicates that the remaining 24 ESA-listed salmon stocks are not taken in the BSAI groundfish fisheries. Thus, background information on Pacific Northwest Chinook salmon harvest fisheries is not included here, as it is not informative for impact assessment.

Importance of Subsistence Harvest

Many rural western Alaska communities have mixed subsistence-market based economies, where subsistence harvests are a prominent part of the local economy and the mainstay of social welfare of the people (Wolfe and Walker 1987). The subsistence salmon harvests in the Arctic-Yukon-Kuskokwim region, for example, have cultural and practical significance to many of the approximately 4,500 households residing in 38 communities in the region, and have been relied upon for food by indigenous peoples since their original immigration into the region (Buklis 1999). In western Alaska, entire families migrate seasonally to summer fishcamps. These annual migrations, and fishcamp life itself, are important elements of rural and cultural life. Subsistence studies have estimated that fish make up as much as 85% (by weight) of subsistence fish and wildlife harvested in the AYK region, with salmon contributing as much as 53% of this total and as much as 650 pounds per capita (Buklis 1999).

It is important to understand that subsistence harvesting activity is not without cost. Subsistence salmon harvesters generally use the same or similar types of set and/or drift gillnets, boats, and other equipment as commercial harvesters. Some subsistence harvesters also participate in commercial salmon fisheries, and they depend on income earned in the commercial fisheries to help offset the costs, both of acquiring equipment and of operating it, associated with subsistence salmon fishing. While it appears that sufficient opportunities for subsistence harvests have occurred in most areas in recent years, the dependency on commercial catch to offset costs incurred in the subsistence fishery may result in financial difficulties, when commercial harvests are depressed.

The relative commercial value of Chinook versus chum salmon, or other salmon, is also a consideration. A single commercially harvested Chinook salmon weighs, and is worth, considerably more than a chum salmon. It is likely more difficult to offset subsistence costs with chum salmon or other salmon commercial catch if commercial Chinook harvests are depressed. This problem has been occurring over the past decade in several fisheries as the value of chum salmon has fallen dramatically and some areas have not had commercial Chinook harvest opportunities, due to conservation concerns and subsistence harvest priority. Buklis described this problem with the example that in 1976, the sale of 6 summer chum salmon roughly equaled the value of 1 Chinook salmon. In 1988, the relationship was 14 to 1 and, by 1996, it was 65 to 1(Buklis 1999). These relationships highlight the importance of Chinook harvests but also the amounts of chum and other salmon harvests that would be needed to offset declines in commercial Chinook harvest value.

Another factor in gauging the adequacy of subsistence harvests is whether subsistence harvest opportunity is adversely affected by subsistence schedules and/or subsistence catch limits on specific river systems. If the timing of subsistence openings is heavily restricted, it is more likely that pulses of fish moving upriver may be missed and catches that do occur may be smaller in number than would occur if subsistence nets were in the water for longer periods of time. Thus, it may take longer, both in hours fished and fishing periods, for subsistence harvesters to catch enough fish to meet food supply needs when subsistence schedules are restricted. Greater time needed to harvest subsistence fish can mean that less time is available to work in summertime cash employment in, for example, seafood processing and support industries, for local government, and/or in seasonal firefighting.

Shorter subsistence openings may also affect the quality of the processed fish. If openings happen to coincide with wet weather, traditional methods of fish drying are made more difficult and spoilage may result. If subsistence fishing is not restricted, harvesters can determine whether to fish when weather limits their ability to process the fish. However, when restrictions are in place, subsistence harvesters may feel pressured to fish, and to process fish, when they would rather not do so for fear of spoilage.

Because subsistence enjoys a “priority use” privilege, only superseded by escapement needs, Chinook salmon bycatch savings from better control and avoidance of Chinook salmon interceptions in the trawl fisheries would accrue most immediately to improvements for subsistence users. Precisely how these benefits would be distributed across drainages and management areas is an important question, but one that exceeds the available data. Needless to say, given the Chinook salmon composition in the BS pollock fisheries, identified in the source-of-origin analyses reported above, any substantial reduction in losses of salmon, but particularly Chinook salmon, would make a very significant contribution to the economic, social, cultural, and quality of life of (in particular, but not exclusively) western Alaska’s salmon subsistence users, families, villages, and social communities.

Valuing subsistence, Personal Use, and Sport Fisheries

In several areas of Alaska, the value of salmon harvested in 'personal use', sport, and subsistence fisheries has been estimated via the economic travel cost modeling method. Such studies, carried out on the Copper and Gulkana river dipnet fisheries (Henderson, et al., 1999; Layman et al., 1996) Henderson, et al., found that rural areas with high unemployment and high percentages of subsistence users had higher visitation rates to the Copper River, than did users from more urban areas, although the differences were not statistically significant. They also found that estimated consumer surplus', per Copper River trip, in 1996, ranged from $50.93 to $56.88, depending on assumed opportunity cost of time. Another important finding was that these estimates were within the lower bound range of the replacement costs of the catches. However, they were estimated to be lower than the upper bound estimate of foregone gross ex-vessel (i.e., commercial) average per trip revenue of $98.09. This seemingly suggests that personal use and subsistence values are potentially less than commercial value of the catch. This conclusion assumes that the true "value" of the personal use or subsistence catch is fully reflected in the "gross ex-vessel equivalent price" of the fish. This conclusion may be suspect, because attributes unique to subsistence and/or personal use harvest activities are not readily captured in a "commercial market" equivalent price. Henderson et al., point out that the opportunity cost of personal use and subsistence harvest to commercial fishermen would be the difference between the estimated ex-vessel value and the incremental cost of catching a fish. This assertion, too, depends upon any number of imbedded assumptions (e.g., availability of a "buyer"; fully coincidental, partially overlapping, or isolated sequential openings).

Layman et al. estimated that Gulkana River sport trip consumer surpluses ranged from $26.05 to $32.35, using opportunity cost of time of 30% and 60% of wage rate, respectively, in 1992. Henderson et al. updated these numbers for inflation to 1996 values of $28.55 and $35.46 per trip. Thus, sport trips on the Gulkana appear to generate smaller consumer surplus values than do subsistence trips on the Copper River. However, the quantity of fish that may be retained in the Copper River subsistence fishery is much larger than in the Gulkana sport fishery.

Unfortunately, the range of consumer surplus benefits found in the above mentioned studies could not be directly applied (e.g., via benefits transfer) to subsistence activity in western Alaska. This is largely because it is difficult to define a similar "trip" in western Alaska, due to differing transport modes (e.g., riverboat vs. car) and duration (e.g., a week or an opening vs. a day or a weekend). The results of these studies do, however, suggest the importance of subsistence salmon harvests to rural residents is higher than non-rural residents, and that subsistence harvest has a "market-based" economic equivalent value potentially as high as replacement cost.[50] It is likely, however, that this "market-based" equivalent value estimate does not full capture the benefits subsistence users derive from the harvesting of salmon, especially in western Alaska. More comprehensive and accurate evaluation of these values must await future empirical research.

10.3.1 Kotzebue

The Kotzebue District includes all waters from Cape Prince of Wales to Point Hope. The Kotzebue District is divided into three subdistricts. Subdistrict 1 has six statistical areas open to commercial salmon fishing (Fig. 6-2). Within the Kotzebue District chum salmon are the most abundant anadromous fish. Other salmon species (Chinook, pink, coho, and sockeye) occur in lesser numbers, as do Arctic char and sheefish. (This section is developed from ADF&G 2007a, Menard 2007a, and data supplied by ADF&G).

[50] Ample evidence exists in the relevant literature to indicate that food "replacement cost" estimates constitute, at best, a rough "lower bound" measure of the true value of subsistence food stuffs, *in situ*.

Status of Runs and Conservation Concerns

The Kotzebue fishery is primarily a chum salmon fishery, with some Chinook, sockeye, and Dolly Varden taken incidentally. The overall chum salmon run to Kotzebue Sound in 2007 was estimated to be above average, based on the commercial harvest rates, subsistence participants reporting average to above average catches, and the Kobuk test fish index being above average. No stocks in the Kotzebue area are presently identified as being of management or yield concern and the commercial fishery is allowed to remain open continuously with harvest activity regulated by buyer interest.

Subsistence Fishery Situation and Outlook

Subsistence fishing has long been an important food gathering activity for people of the Kotzebue Sound drainages. The most recent subsistence survey of salmon harvests in 2004 estimated a total of 20,604 chum salmon were harvested from the Kobuk River and 3,997 chum salmon were harvested from the Noatak River. Over 90% of the subsistence salmon harvests are chum salmon. Subsistence salmon surveys were not done in 2006. Previous surveys in the 2000s indicate that Kotzebue residents harvest approximately the same amount of salmon as all the other villages combined.

As in other areas, the subsistence fishery takes precedence over the commercial fishery. There appear to be no indications, in published management reports and summaries, that subsistence chum salmon harvest opportunities are lacking in the region. The 2007 season summary (ADF&G 2007a) indicates that no subsistence salmon surveys are scheduled. No other information on subsistence harvest is available, other than comments that chum salmon fishing on the Kobuk River and Noatak River was very good in August.

Commercial Fishery Situation and Outlook

During most of the 2000s, the Kotzebue commercial fishery has been limited by buyer capacity. In 2002 and 2003, there was no onsite buyer. In 2004 and 2005, one onsite buyer was present and fish were processed locally. Beginning in 2006, the new buyer shipped the catch in the round to Anchorage for processing.

As in recent years, ADF&G opened the commercial fishery continuously and allowed the buyer to set the fishing time for their fleet. There were 46 permit holders who sold fish to the buyer, including one catcher-seller who sold fish to the buyer and also sold some of his catch from his boat to Kotzebue area residents. The number of permit holders that fished has been in the low 40s in the past three years, and is less than half the permit holders that fished in the 1990s, and well below the nearly 200 permit holders that fished in the early 1980s (Table 10-14).

In the Kotzebue fishery gear is limited to set nets with an aggregate of no more than 150 fathoms per participant. Nets are generally set with one end on, or near, shore and with all three shackles connected. Nets are also set in deeper channels on the mud flats further out from shore. Most gear used in the district is 5-7/8 in (14.9 cm) or 6 in (15.2 cm) stretch mesh gillnet.

The overall chum salmon run to Kotzebue Sound in 2007 was estimated to be above average based on the commercial harvest rates, subsistence participants reporting average to above average catches, and the Kobuk test fish index being above average. The commercial harvest consisted of 147,085 chum salmon.

Sport Fishery Situation and Outlook

The Kotzebue/Chukchi Sea sub-area includes all waters and drainages of the Selawik, Kobuk, Noatak, Wulik, Kivalina and Kukpuk rivers. The Noatak and Kobuk rivers each drain approximately 12,000 sq mi (31,000 km^2) of the western Brooks Range. The Kobuk River is 360 mi (576 km) in length while the Noatak is 400 mi (640 km). The area's third largest drainage is that of the Selawik River, with an approximate drainage area of 4,600 sq mi (11,700 km2). The Noatak River is a National Wild and Scenic River and most of the drainage is included in the Noatak National Park Preserve. The extreme upper headwaters of both the Noatak and Kobuk rivers are included in the Gates of the Arctic National Park. A portion of the lower Kobuk Valley between Kiana and Ambler is included in the Kobuk Valley National Park, and the Salmon River tributary, as well as the upper main stem of the Kobuk River are National Wild and Scenic Rivers as is the Selawik River. Much of the Selawik River valley is part of the Selawik National Preserve.

These three large river systems contain abundant fisheries resources. The Noatak River produces a large run of chum salmon that maintains a Kotzebue-based commercial fishery. Many thousands of anadromous Dolly Varden overwinter in the lower 300 km of the river and spawn in some of the river's tributary streams. This system is known for the large size of its Dolly Varden, and the current state record 8.9 kg (19.75 lbs.) was taken in 1991 from the Noatak River. Whitefish, Arctic grayling, burbot, and northern pike are resident in the Noatak River. Sheefish use the lower reaches of the river for feeding during the spring of the year, but are not known to spawn there. Both the Selawik and Kobuk rivers support spawning populations of sheefish in their upper reaches. Hotham Inlet, Selawik Lake, and the delta systems at the river mouths serve as winter feeding areas for juvenile and adult sheefish. Sheefish in these populations are slower growing, but attain a larger size than those in other areas of Alaska. The Alaska state record sheefish, 24 kg (53 lbs), was taken in 1986 from the upper Kobuk River. Abundant whitefish utilize the rivers, including Selawik Lake and Hotham Inlet and provide a food base for sheefish, northern pike and burbot. Dolly Varden, northern pike, Arctic grayling, burbot, lake trout, and Arctic char inhabit various parts of the Kobuk watershed.

The Wulik and Kivalina rivers, which empty into the Chukchi Sea near the village of Kivalina, support populations of Arctic grayling and anadromous Dolly Varden. Sport fishing effort in northwest Alaska is relatively light compared to most other areas in the state. Heaviest use occurs on the Noatak, Kobuk, and Wulik rivers. Many visitors to Gates of the Arctic National Park, Kobuk Valley National Park, and the Noatak National Park Preserve participate in float trips on the Kobuk River or Noatak rivers. Guided and unguided anglers and river floaters use these rivers for raft, canoe, and kayak trips. Lake trout and Arctic grayling occur in Matcharak, Feniak, and Desperation lakes and in other lakes in the middle and upper Noatak drainage. Some lakes also contain Arctic char. Most lakes in the area are accessible during summer months only by floatplane. The lower floodplains of the Kobuk and Selawik rivers, especially in the vicinity of the Kobuk River delta, and the lower Noatak River contain hundreds of shallow thaw lakes of various sizes. Fisheries resources in this area have been poorly inventoried, but populations of whitefish, and northern pike are known to be seasonally present. Dolly Varden spawn in several Kobuk River tributary streams. The mountains in the upper Kobuk River drainage contain several relatively large lakes. Lake trout, Arctic grayling, Arctic char, northern pike, and several species of whitefish inhabit Walker, Selby, and Nutuvukti lakes.

(http://www.sf.adfg.state.ak.us/Management/Areas.cfm/FA/northwestOverview.overview)

Table 10-14 Kotzebue District Chum Salmon Catch and Dollar Value 1963-2007.

Year	Total Catch	Number of Permits [a]	Season Catch per Permit Holder	Gross Value of Catch to Permit Holders [b]
1963	54,445	61	893	$9,140
1964	76,449	52	1,470	$34,660
1965	40,025	45	889	$18,000
1966	30,764	44	699	$25,000
1967	29,400	30	980	$28,700
1968	30,212	59	512	$46,000
1969	59,335	52	1,141	$71,000
1970	159,664	82	1,947	$186,000
1971	154,956	91	1,703	$200,000
1972	169,664	104	1,631	$260,000
1973	375,432	148	2,537	$925,000
1974	627,912	185	3,394	$1,822,784
1975	563,345	267	2,110	$1,365,648
1976	159,796	220	726	$580,375
1977	195,895	224	875	$1,033,950
1978	111,494	208	536	$575,260
1979	141,623	181	782	$990,263
1980	367,284	176	2,087	$1,446,633
1981	677,239	187	3,622	$3,246,793
1982	417,790	199	2,099	$1,961,518
1983	175,762	189	930	$420,736
1984	320,206	181	1,769	$1,148,884
1985	521,406	189	2,759	$2,137,368
1986	261,436	187	1,398	$931,241
1987	109,467	160	684	$515,000
1988	352,915	193	1,829	$2,581,333
1989	254,617	165	1,543	$613,823
1990	163,263	153	1,067	$438,044
1991	239,923	142	1,690	$437,948
1992	289,184	149	1,941	$533,731
1993 [c]	73,071	114	641	$235,061
1994 [d]	153,452	109	1,408	$233,512
1995	290,730	92	3,160	$316,031
1996 [e]	82,110	55	1,493	$56,310
1997	142,720	68	2,099	$187,978
1998	55,907	45	1,242	$70,587
1999	138,605	60	2,310	$179,781
2000	159,802	64	2,497	$246,786
2001 [f]	211,672	66	3,207	$322,650
2002	8,390	3	2,797	$7,572
2003	25,763	4	6,441	$26,377
2004	51,077	43	1,188	$64,420
2005	75,971	41	1,853	$124,820 [h]
2006	138,660	42	3,301	$216,654
Average	197,084	116	1,809	$597,286
2007	147,087	46	3,198	$243,149

[a] During 1962-1966 and 1968-1971 figures represent the number of vessels licensed to fish in the Kotzebue District, not the number of fishermen.

[b] Some estimates between 1962 and 1981include only chum value which in figures represent over 99% of the total value. Figures after 1981 represent the chum value as well as incidental species such as Dolly Varden, whitefish and other salmon.

[c] Includes 2,000 chum salmon and $3,648 from the Sikusuilaq springs Hatchery terminal fishery.

[d] Includes 4,000 chum salmon commercially caught but not sold.

[e] Includes 2,200 chum salmon commercially caught but not sold.

[f] Includes 10 chum salmon commercially caught but not sold.

[g] Includes 340 chum salmon commercially caught, but not sold.

[h] Value for chum sales was $124,423; value of other species sales was $397.

10.3.2 Norton Sound

Norton Sound is comprised of two fishing districts, the Norton Sound District and the Port Clarence District. The Norton Sound District extends from Cape Douglas south to Point Romanof and includes over 500 miles of coastline. The area open to commercial salmon fishing is divided into six Subdistricts. Each Subdistrict contains at least one major spawning stream with commercial fishing effort located in the ocean near stream mouths. The Port Clarence District encompasses all waters from Cape Douglas north to Cape Prince of Wales. The area open to commercial salmon fishing is adjacent to the communities of Brevig Mission and Teller. (This section is developed from ADF&G 2007d, Menard 2007b, and ADF&G supplied data).

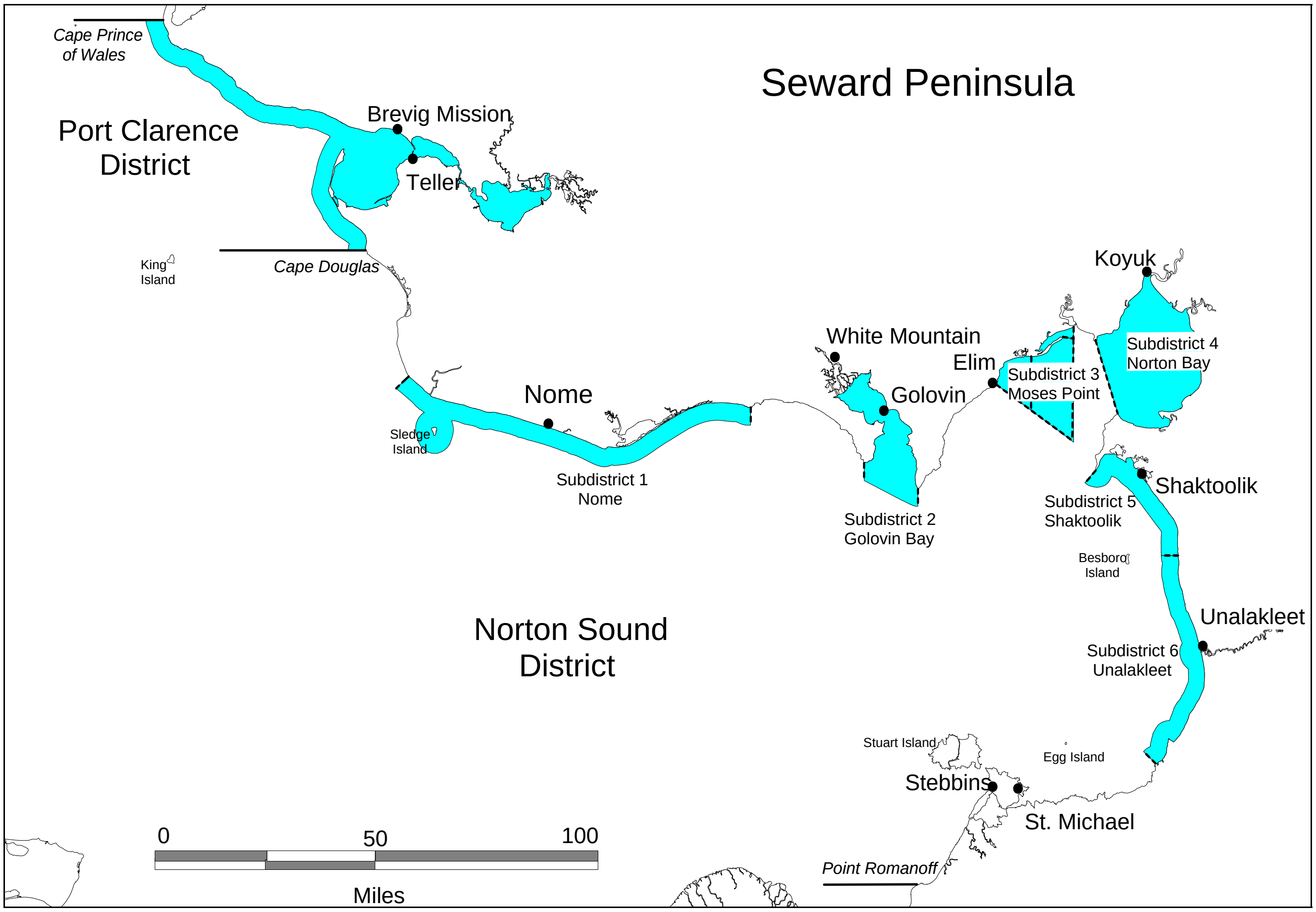


Fig. 10-25 Norton Sound Fishing District Map

Status of Runs and Conservation Concerns

The BOF made several changes to regulations at meetings in February and March 2007, for the management of Norton Sound salmon. The BOF changed the stock of concern classification for Subdistrict 1 (Nome) chum salmon from a management concern to a yield concern. Subdistricts 2 and 3 (Golovin and Moses Point) chum salmon stocks and Subdistricts 5 and 6 (Shaktoolik and Unalakleet) Chinook salmon stocks were continued as stocks of yield concern.

A commercial fishery for sockeye salmon is authorized in the Port Clarence District from July 1 through July 31, with openings established by emergency order. A guideline harvest level (GHL) was established allowing a harvest range from 0 to 10,000 sockeye salmon, dependent on a 30,000 sockeye salmon in-river goal for Pilgrim River. Also, the BOF closed the southwestern half of Salmon Lake to all subsistence salmon fishing to protect the majority of the sockeye salmon spawning grounds and the northeastern half of Salmon Lake may now only be opened by emergency order.

Subsistence Fishery Situation and Outlook

The Norton Sound subsistence fishery is managed under a permit system with annual harvest limits specific to each managed body of water in the region. There are also gear restrictions that limit use of gillnets to reduce take of Chinook and coho. Table 10-15 provides subsistence restriction information by river system in the Norton Sound Area.

A Chinook salmon management plan for Subdistricts 5 and 6 (Shaktoolik and Unalakleet) was established to address the poor Chinook salmon runs in the 2000s. Beginning June 16, subsistence fishing in the marine waters of Subdistricts 5 and 6 will be restricted to two 48-hour fishing periods a week, from 6:00 p.m. Monday until 6:00 p.m. Wednesday, and from 6:00 p.m. Thursday until 6:00 p.m. Saturday. Also, beginning June 16, subsistence fishing in the Unalakleet River will be restricted from 8:00 a.m. Monday until 8:00 p.m. Tuesday, and from 8:00 a.m. Friday until 8:00 p.m. Saturday.

Overall subsistence salmon harvest in the Norton Sound region peaked in 1996 (Table 10-16), with 129,046 fish caught. A downward trend in overall harvest occurred in the late 1990s, but the 2002 harvest of 103,488 fish was above historic averages. Since then, overall harvest has trended downward and the 2007 harvest of 48,694 fish was well below the 84,950 fish five year average. Within these overall trends are downward trends in subsistence catch of Chinook salmon since the late 1990s. Norton Sound area subsistence Chinook harvests peaked in 1997, at 8,989 fish. Since then, subsistence Chinook harvests have declined in nearly every year and the 2007 harvest of 2,646 fish was the lowest level recorded since 1994. Note, however, that prior to 1994, and between 2004 and 2006, subsistence surveys were not completed in all subdistricts.

Table 10-15 Norton Sound Areas Subsistence Restrictions

Nome Subdistrict

Sinuk River 500 salmon/family (no more than 40 chum, 40 coho, and 100 sockeye)
Cripple River 300 pink salmon/family (no chum and 5 coho)
Penny River 300 pink salmon/family (no chum and 5 coho)
Nome River 500 salmon/family (no more than 40 chum, and 40 coho)
Snake River 200 salmon/family (no more than 40 chum, and 40 coho)
Eldorado River 400 salmon/family (no more than 100 chum, and 40 coho)
Flambeau River 400 salmon/family (no more than 100 chum, and 40 coho)
Bonanza River 400 salmon/family (no more than 40 chum, and 40 coho)
Solomon River 300 salmon/family (no more than 20 chum, and 20 coho)
Safety Sound/Bonanza Channel 400 salmon/family (no more than 100 chum, and 40 coho)
Marine Waters 500 salmon/family (no more than 100 chum, and 40 coho)

Norton Sound District from Cape Douglas to Rocky Point (outside the Nome Subdistrict)

Marine Waters No catch limits
Fresh Waters 100 salmon /family (no more than 20 chum and 10 coho)

Golovin and Moses Point Subdistricts

Marine Waters & Fresh Waters - No catch limits

Port Clarence District

Marine Waters No catch limits
Pilgrim River 250 salmon/family (no more than 2 king, 200 red & 5 coho)
Salmon Lake Opened by emergency order only/50 salmon
Kuzitrin River 100 salmon/family (above the confluence of the Pilgrim River) – no more than 2 king.

Note: The waters of the Nome Subdistrict are subject to weekly closures from June 15 to September 30. The Port Clarence District is outside the Nome Subdistrict boundary and, therefore, subsistence fishing can occur 7 days a week unless closed by Emergency Order.

Table 10-16 Subsistence salmon catch by species for all subdistricts in Norton Sound District, 1963–2007

Year	Notes	Chinook	Sockeye	Coho	Pink	Chum	Total
1963		5	-	118	16607	17635	34365
1964		565	-	2567	9225	12486	24843
1965		574	-	4812	19131	30772	55289
1966		269	-	2210	14335	21873	38687
1967		817	-	1222	17516	22724	42279
1968		237	-	2391	36912	11661	51201
1969		436	-	2191	18562	15615	36804
1970		561	-	4675	26127	22763	54126
1971		1,026	197	4097	10863	21618	37801
1972		804	93	2319	14158	13873	31247
1973		392	-	520	14770	7185	22867
1974		420	-	1064	16426	3958	21868
1975		186	11	192	15803	8113	24305
1976		203	-	1004	18048	7718	26973
1977		846	-	2,530	14,296	26,607	44,279
1978		1,211	-	2,981	35,281	12,257	51,730
1979		747	-	8,487	25,247	11,975	46,456
1980		1,397	-	8,625	63,778	19,622	93,422
1981		2,021	38	13,416	28,741	32,866	77,082
1982		1,011	8	14,612	54,249	18,580	88,460
1983	b	1,942	86	8,799	21,894	11,492	44,213
1984	b	1,733	17	8,470	34,600	8,231	53,051
1985	b	1,830	119	6,496	5,312	18,457	32,214
1986	b	150	107	688	8,720	8,085	17,750
1987	b	200	107	1,100	1,251	8,394	11,052
1988	b	63	133	1,076	2,159	5,952	9,383
1989	b	24	131	5,150	18,424	4,787	4,947
1990	b	58	234	510	2,233	4,246	7,281
1991	b	395	166	3,432	3,749	6,375	14,117
1992	b	252	163	2,762	13,503	2,944	19,624
1993	b	420	80	3,287	2,599	3,401	9,787
1994		7,375	1,162	22,124	71,065	25,020	126,746
1995		7,274	3,532	21,088	37,984	39,709	109,587
1996		7,245	1,013	25,816	62,432	32,540	129,046
1997		8,989	1,843	16,267	27,088	24,503	78,690
1998		8,295	1,214	19,007	51,933	20,032	100,480
1999		6,144	1,177	14,343	19,917	19,397	60,978
2000		4,148	681	17,064	38,308	17,283	77,484
2001		5,576	767	14,543	30,253	20,208	71,347
2002		5,469	763	15,086	64,353	17,817	103,488
2003		4,728	522	11,446	46,336	9,498	72,530
2004	b	4,420	458	10,904	71,015	3,598	90,395
2005	b	3,305	794	11,846	54,174	4,961	75,080
2006	b	2,876	572	17,242	56,579	5,992	83,261
2007		2,646	938	12,023	21,039	12,048	48,694
5 year avg.	c	4,159.6	621.8	13,304.8	58,491.4	8,373.2	84,950.8
10 year avg.	d	5,395.0	879.1	14,774.8	45,995.6	14,328.9	81,373.3

[a] Subsistence totals include data from Savoonga and Gamble.
[b] Not all subdistricts were surveyed.
[c] 2002-2006.
[d] 1997-2006.

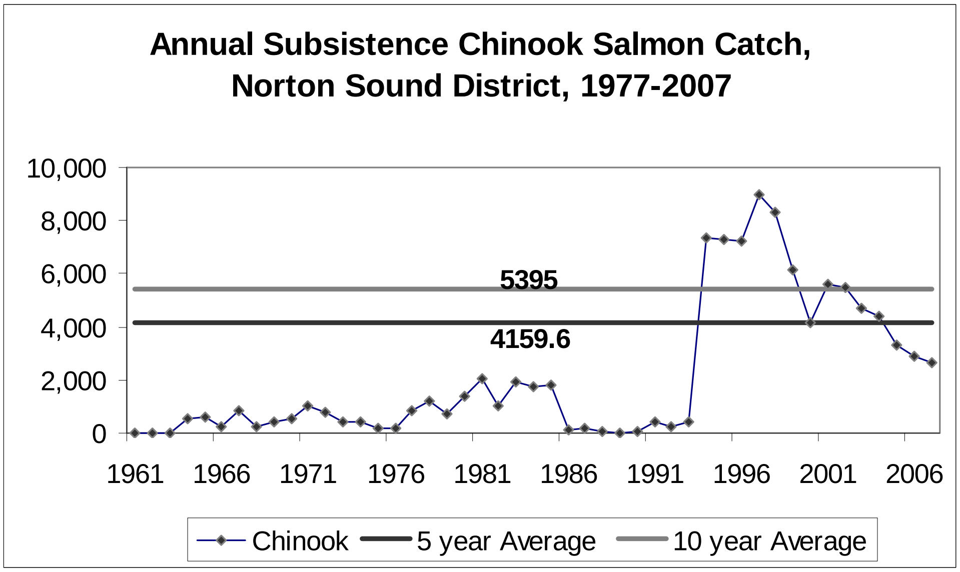


Fig. 10-26 Annual Subsistence Chinook Salmon Catch, Norton Sound District, 1977-2007

The decline in Norton Sound areas subsistence Chinook catch in recent years is shown in Fig. 10-26. It is important to note that subsistence surveys were not collected in all subdistricts until 1994. In 1994, recorded subsistence catch increased dramatically, likely as a result of complete surveys. In the years since the 1997 peak subsistence Chinook catch has trended downward and is now well below both the 5 year and 10 year averages.

Within the Norton Sound area, the subdistricts that have been most affected by declining Chinook salmon runs have been the Shaktoolik and Unalakleet subdistricts. Table 10-17 provides historic Chinook salmon subsistence catch for these subdistricts. Fig. 10-27 and Fig. 10-28 provide graphical representations of the recent catch levels. In the Shaktoolik district, the peak subsistence Chinook Catch of 1,275 fish occurred in 1995. Since then, catch declined through the late 1990s before rising to 1,230 fish in 2002. Since 2002, Shaktoolik subsistence Chinook catches have trended downward to a low of 382 fish in 2006. The 2007 harvest of 515 fish was well below the 5 year and 10 year averages.

In the Unalakleet district, the peak subsistence Chinook catch of 6,325 fish occurred in 1997. Since then, the catch has trended downward through the 2000s. The 2007 harvest of 1,665 fish was the lowest level recorded since complete surveys began in 1994. Fig. 10-28 depicts this drop and the fact that this level is well below the 5 year and 10 year averages.

Table 10-17 Subsistence Chinook Salmon Catch, for the Shaktoolik and Unalakleet Subdistricts, 1964–2007

Year	Shaktoolik	Unalakleet
1964	77	488
1965	31	521
1966	142	90
1967	262	490
1968	10	186
1969	40	324
1970	43	495
1971	87	911
1972	64	643
1973	51	323
1974	93	313
1975	18	163
1976	24	142
1977	49	723
1978	81	1,044
1979	62	640
1980	57	1,046
1981	8	869
1982	68	913
1983	a	1,868
1984	a	1,650
1985	298	1,397
1986	a	a
1987	a	a
1988	a	a
1989	a	a
1990	a	2,476
1991	a	a
1992	a	a
1993	a	a
1994	1,175	5,294
1995	1,275	5,049
1996	1,114	5,324
1997	1,146	6,325
1998	982	5,915
1999	818	4,504
2000	440	2,887
2001	936	3,662
2002	1,230	3,044
2003	881	2,585
2004	943	2,801
2005	807	2,115
2006	382	2,155
2007	515	1,665
5 year avg.	**849**	**2,540**
10 year avg.	**857**	**3,599**

[a] Subsistence surveys were not conducted.

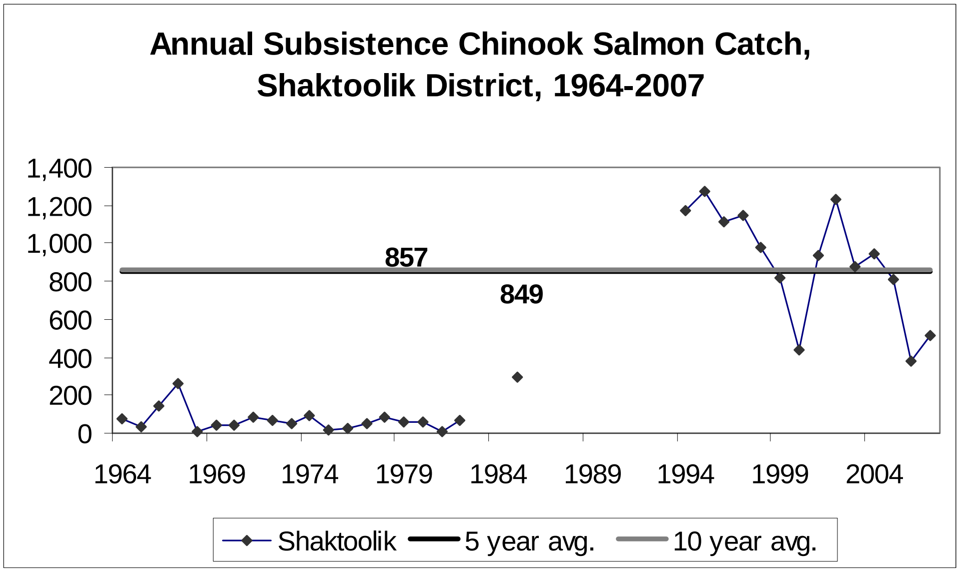


Fig. 10-27 Shaktoolik Subsistence Chinook Salmon Catch, 1964-2007

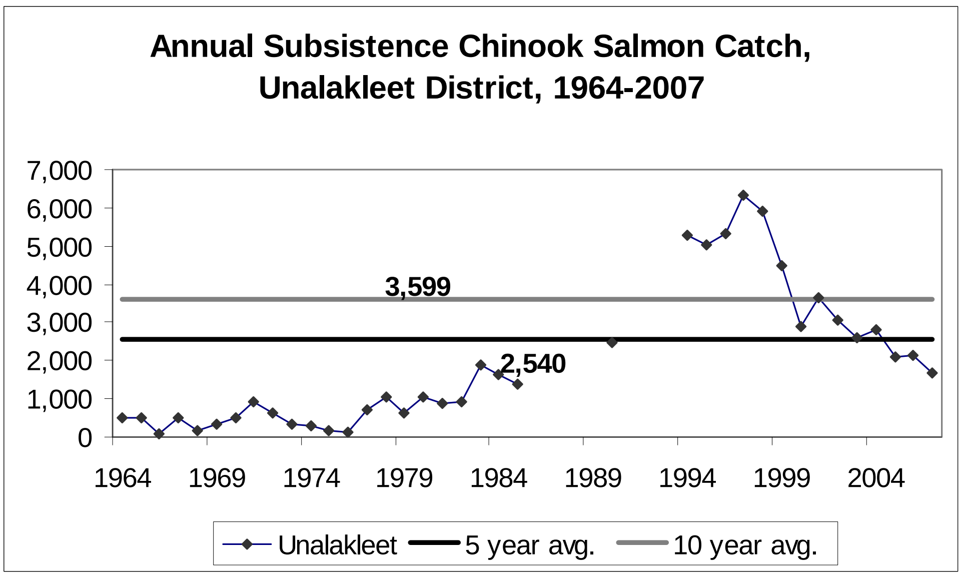


Fig. 10-28 Unalakleet Subsistence Chinook Salmon Catch, 1964-2007.

Commercial Fishery Situation and Outlook

Table 10-18 provides historic Chinook salmon catches in the Norton Sound District from 1961 through 2007. Commercial Chinook catches trended downward in the late 1990s and early 2000s. As recently at 1997, more than 12,000 Chinook were commercially harvested in the region; however, by 2000 the harvest had declined to 752 fish. By 2004, no commercial Chinook harvest was allowed. This trend in Norton Sound commercial Chinook harvests is depicted graphically in Fig. 10-29.

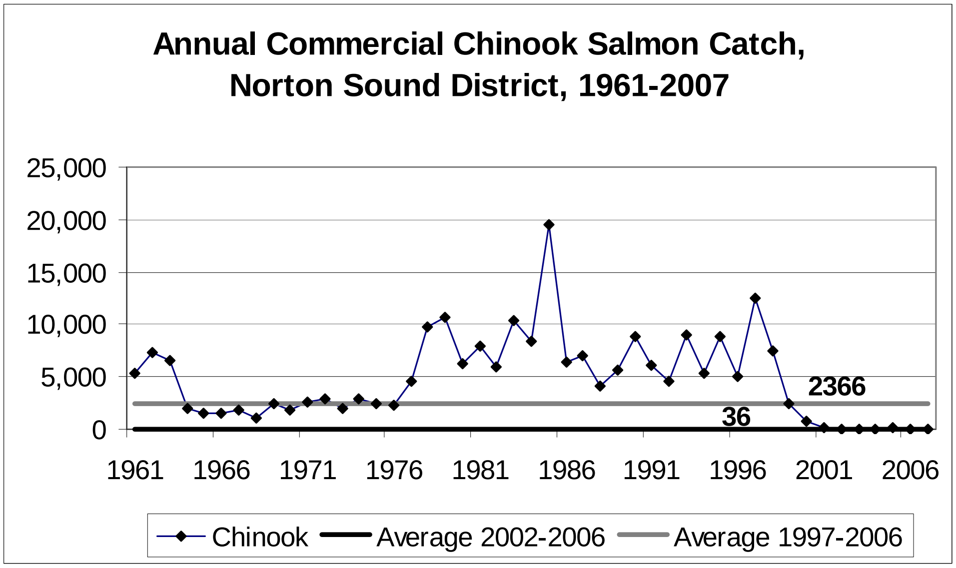


Fig. 10-29 Norton Sound Commercial Chinook Salmon Catch, 1961-2007

The catch data also document a longer term decline in commercial harvest of chum salmon. From peak numbers of more than 300,000 in the 1980's, commercial harvest of chum salmon declined to a period low of just 600 fish in 2002. The 2004 commercial chum harvest was 6,296; however, in the past two years, the commercial chum harvest has improved, as has the coho harvest and these two species are making up larger proportions of total fishery value than in the past.

Salmon outlooks and harvest projections for the 2008 salmon season are based on qualitative assessments of parent year escapements, subjective determinations of freshwater overwintering and ocean survival, and in the case of the commercial fishery, the projections of local market conditions. The Chinook salmon run is expected to be below average and no commercial fishing targeting Chinook salmon is expected.

Chum salmon runs are expected to be average in 2008, but limited commercial fishing targeting chum salmon is expected. There is some buyer interest in chum salmon this year and the harvest could be 40,000 to 50,000 fish, if there is a buyer. Although there may be limited buyer interest this year, there have been no commercial pink salmon sales since 2000, except for 2007. If there is a buyer the harvest could be 500,000 pink salmon in 2008. The coho salmon run in 2008 is expected to be above average based on good ocean survival conditions in recent years and the near record and record runs in recent years in southern Norton Sound. The commercial harvest is expected to be 80,000 to 100,000 fish and no subsistence fishing restrictions are expected, except for catch limits in the Nome Subdistrict. Based on excellent runs of sockeye salmon in recent years ADF&G expects 10,000 sockeye salmon to be harvested if there is sufficient fishing effort in the Port Clarence District.

Table 10-18 Commercial salmon catch by species, Norton Sound District, 1961-2007.

Year	Chinook	Sockeye	Coho	Pink	Chum	Total
1961	5,300	35	13,807	34,327	48,332	101,801
1962	7,286	18	9,156	33,187	182,784	232,431
1963	6,613	71	16,765	55,625	154,789	233,863
1964	2,018	126	98	13,567	148,862	164,671
1965	1,449	30	2,030	220	36,795	40,524
1966	1,553	14	5,755	12,778	80,245	100,345
1967	1,804	-	2,379	28,879	41,756	74,818
1968	1,045	-	6,885	71,179	45,300	124,409
1969	2,392	-	6,836	86,949	82,795	178,972
1970	1,853	-	4,423	64,908	107,034	178,218
1971	2,593	-	3,127	4,895	131,362	141,977
1972	2,938	-	454	45,182	100,920	149,494
1973	1,918	-	9,282	46,499	119,098	176,797
1974	2,951	-	2,092	148,519	162,267	315,829
1975	2,393	2	4,593	32,388	212,485	251,861
1976	2,243	11	6,934	87,916	95,956	193,060
1977	4,500	5	3,690	48,675	200,455	257,325
1978	9,819	12	7,335	325,503	189,279	531,948
1979	10,706	57	31,438	167,411	140,789	350,401
1980	6,311	40	29,842	227,352	180,792	444,337
1981	7,929	56	31,562	232,479	169,708	441,734
1982	5,892	10	91,690	230,281	183,335	511,208
1983	10,308	27	49,735	76,913	319,437	456,420
1984	8,455	6	67,875	119,381	146,442	342,159
1985	19,491	166	21,968	3,647	134,928	180,200
1986	6,395	233	35,600	41,260	146,912	230,400
1987	7,080	207	24,279	2,260	102,457	136,283
1988	4,096	1,252	37,214	74,604	107,966	225,132
1989	5,707	265	44,091	123	42,625	92,811
1990	8,895	434	56,712	501	65,123	131,665
1991	6,068	203	63,647	0	86,871	156,789
1992	4,541	296	105,418	6,284	83,394	199,933
1993	8,972	279	43,283	157,574	53,562	263,670
1994	5,285	80	102,140	982,389	18,290	1,108,184
1995	8,860	128	47,862	81,644	42,898	181,392
1996	4,984	1	68,206	487,441	10,609	571,241
1997	12,573	161	32,284	20	34,103	79,141
1998	7,429	7	29,623	588,013	16,324	641,396
1999	2,508	0	12,662	0	7,881	23,051
2000	752	14	44,409	166,548	6,150	217,873
2001	213	44	19,492	0	11,100	30,849
2002	5	1	1,759	0	600	2,365
2003	12	16	17,058	0	3,560	20,646
2004	0	40	42,016	0	6,296	48,352
2005	151	280	85,255	0	3,983	89,669
2006	12	3	130,808	0	10,042	140,865
2007	19	2	126,115	3,769	22,431	152,336
Average 2002-2006	**36**	**68**	**55,379**	**0**	**4,896**	**60,379**
Average 1997-2006	**2,366**	**57**	**41,537**	**75,458**	**10,004**	**129,421**

Source: Norton Sound Annual Management Report, and Jim Menard, ADF&G.

Table 10-19 provides the real, inflation adjusted to 2007 prices, value of commercial Chinook salmon harvest compared to total real value of Norton Sound commercial salmon harvest from 1967 through 2007. The decline in catch, combined with declining salmon prices since the late 1970s, have depressed overall fishery value, from a peaks of over $2 million in the late 1970s to a period low of just $3,378 in 2002. Over this time, Chinook real value peaked in 1979 at just under a half a million dollars. Chinook real value has fluctuated since the 1980s, and rose to $282,356 in 1997 when it was nearly 62% of the overall value. During the 2000s, Chinook value declined as the run has declined and has been restricted to incidental catch value since 2004. In 2007, no value was earned from Chinook target fisheries, and just $113 was earned from incidental Chinook catch in other salmon fisheries.

Table 10-19 Real Historical Value of Commercial Chinook Catch, Norton Sound, 1967-2007 (inflation adjusted to 2007 value using the GDP deflator)

Year	Chinook Value	Reported Total Value	Chinook Value % of Total
1967	$41,924	$220,557	19.01%
1968	$27,564	$305,969	9.01%
1969	$51,789	$436,102	11.88%
1970	$41,399	$430,341	9.62%
1971	$44,611	$418,044	10.67%
1972	$61,773	$405,511	15.23%
1973	$58,515	$1,160,007	5.04%
1974	$75,031	$1,506,360	4.98%
1975	$32,703	$1,301,293	2.51%
1976	$50,751	$849,291	5.98%
1977	$186,196	$1,528,297	12.18%
1978	$379,030	$2,372,855	15.97%
1979	$493,044	$2,122,382	23.23%
1980	$222,261	$1,266,820	17.54%
1981	$415,405	$1,541,688	26.94%
1982	$231,920	$2,040,738	11.36%
1983	$372,575	$1,736,469	21.46%
1984	$358,921	$1,305,442	27.49%
1985	$777,375	$1,404,935	55.33%
1986	$196,806	$917,763	21.44%
1987	$256,766	$846,676	30.33%
1988	$133,754	$1,202,491	11.12%
1989	$116,570	$486,676	23.95%
1990	$249,965	$695,286	35.95%
1991	$132,583	$585,933	22.63%
1992	$52,635	$621,135	8.47%
1993	$147,693	$436,132	33.86%
1994	$133,191	$1,144,232	11.64%
1995	$149,861	$462,728	32.39%
1996	$65,956	$433,952	15.20%
1997	$282,356	$456,397	61.87%
1998	$117,336	$445,282	26.35%
1999	$48,548	$93,977	51.66%
2000	$17,485	$179,385	9.75%
2001	$4,444	$66,518	6.68%
2002	$22	$3,378	0.66%
2003	$98	$72,508	0.14%
2004	$0	$133,923	0.00%
2005	$3,244	$313,619	1.03%
2006	$255	$400,061	0.06%
2007	$113	$572,195	0.02%

Real historic Chinook salmon value, real total value, and the percentage of real Chinook value in real total value is displayed in Fig. 10-30. Both Chinook value and total value are displayed with respect to the left vertical axis and Chinook percent of total value is displayed on the right vertical axis. From this figure it is easy to see the divergence of Chinook and total value during the 2000s as commercial Chinook harvests in Norton Sound have been halted.

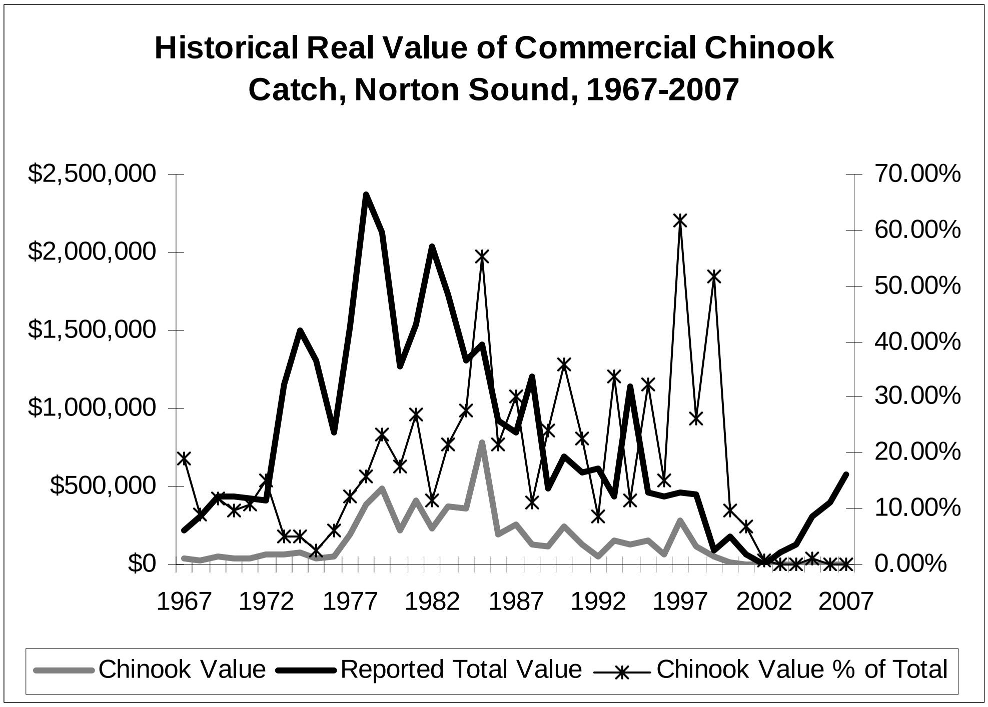


Fig. 10-30 Norton Sound Commercial Real Chinook Value, Total Value, and Percent Chinook Value in Total Value, 1967-2007 (values are inflation adjusted to 2007 values using the GDP deflator)

Table 10-20 shows that commercial fishery participation declined to 12 permit holders in 2002. Since 2002, the overall value of the fishery has improved due to strong coho returns, improving chum returns, and market improvements. As a result, participation increased to 71 permit holders by 2007. However, the commercial Chinook fishery remains closed.

Table 10-20 Number of commercial salmon permits fished, Norton Sound, 1970–2007

Year	SUBDISTRICT 1	2	3	4	5	6	Total [a]
1970	6	33	21	0	12	45	[b]
1971	7	22	45	6	19	72	[b]
1972	20	20	48	32	20	71	[b]
1973	21	34	57	30	27	94	[b]
1974	25	25	60	8	23	53	[b]
1975	24	42	67	42	39	61	[b]
1976	21	22	54	27	37	60	[b]
1977	14	25	52	24	30	45	164
1978	16	24	44	26	26	51	176
1979	15	21	41	22	29	63	175
1980	14	17	26	13	26	66	159
1981	15	19	33	10	26	73	167
1982	18	17	28	10	32	68	164
1983	19	21	39	15	34	72	170
1984	8	22	25	8	24	74	141
1985	9	21	34	12	21	64	155
1986	13	24	34	9	30	73	163
1987	10	21	34	12	39	65	164
1988	5	21	36	13	21	69	152
1989	2	0	13	0	26	73	110
1990	0	15	23	0	28	73	128
1991	0	16	24	0	25	75	126
1992	2	1	21	9	25	71	110
1993	1	8	26	15	37	66	153
1994	1	5	21	0	39	71	119
1995	2	7	12	0	26	58	105
1996	1	4	12	0	20	54	86
1997	0	11	21	9	19	57	102
1998	0	16	23	0	28	52	82
1999	0	0	0	0	15	45	60
2000	0	12	13	0	26	49	79
2001	0	5	5	0	13	29	51
2002	0	0	0	0	7	5	12
2003	0	0	0	0	10	20	30
2004	0	0	0	0	11	25	36
2005	0	0	0	0	12	28	40
2006	0	0	0	0	22	40	61
2007	0	0	11	0	15	47	71
Average 2002-2006	**0**	**0**	**0**	**0**	**12**	**24**	**36**
Average 1997-2006	**0**	**4**	**6**	**1**	**16**	**35**	**55**

[a] District total is the number of fishermen that actually fished in Norton Sound; some fishermen may have fished more than one subdistrict.

[b] Data not available.

Similar to subsistence Chinook catch, the impact of declines in commercial Chinook catch have been felt most in the Shaktoolik and Unalakleet districts. Table 10-21 provides Commercial Chinook Salmon Catch, by year for the Shaktoolik and Unalakleet subdistricts. Historically, these two subdistricts have produced nearly all of the commercial Chinook harvest in the Norton Sound District. Thus, the declines in overall commercial Chinook catch, discussed previously, are the result of declines in the Unalakleet and Shaktoolik subdistricts. These trends are shown graphically in Fig. 10-31 and Fig. 10-32.

Table 10-21 Commercial Chinook Salmon Catch, by year for the Shaktoolik and Unalakleet Subdistricts, 1961-2007

Year	Shaktoolik	Unalakleet
1961	140	5,160
1962	1,738	5,089
1963	480	5,941
1964	631	1,273
1965	127	1,321
1966	310	1,208
1967	43	1,751
1968	61	960
1969	33	2,276
1970	197	1,604
1971	284	2,166
1972	419	2,235
1973	289	1,397
1974	583	2,100
1975	651	1,638
1976	892	1,211
1977	1,521	2,691
1978	1,339	7,525
1979	2,377	6,354
1980	1,086	4,339
1981	1,484	6,157
1982	1,677	3,768
1983	2,742	7,022
1984	1,613	6,804
1985	5,312	12,621
1986	1,075	4,494
1987	2,214	3,246
1988	671	2,218
1989	1,241	4,402
1990	2,644	5,998
1991	1,324	4,534
1992	1,098	3,409
1993	2,756	5,944
1994	885	4,400
1995	1,239	7,617
1996	1,340	3,644
1997	2,449	9,067
1998	910	6,413
1999	581	1,927
2000	160	582
2001	90	116
2002	1	4
2003	2	10
2004	0	0
2005	50	101
2006	0	11
2007	5	13
2002-2006 avg.	11	25
1997-2006 avg.	424	1,823

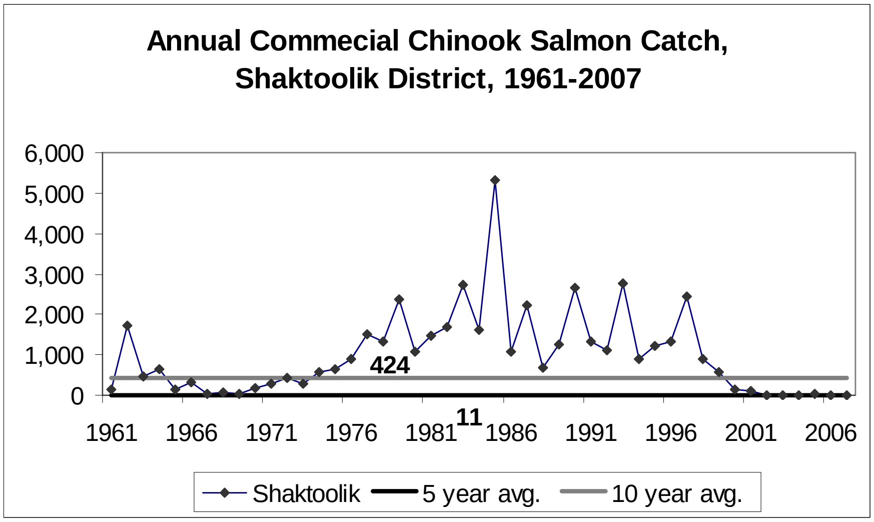


Fig. 10-31 Shaktoolik Commercial Chinook Salmon Catch, 1961-2007.

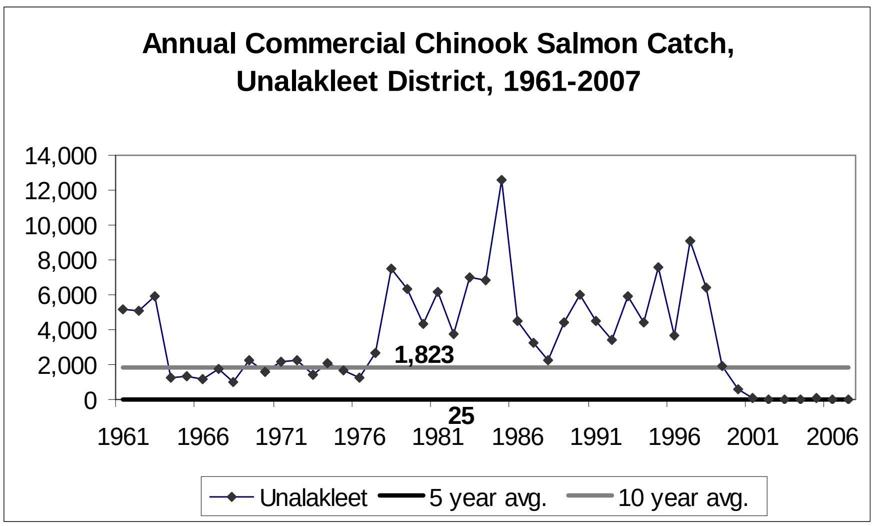


Fig. 10-32 Unalakleet Commercial Chinook Salmon Catch, 1961-2007

Sport Fishery Situation and Outlook

The Seward Peninsula Norton Sound sub area extends from the Seward Peninsula southward to the Yukon River. Streams in eastern Norton Sound include the Golsovia, Unalakleet, Egavik, Shaktoolik, Inglutalik, Ungalik and Koyuk rivers. All but the Koyuk drain the Nulato Hills which separate Norton Sound from the Yukon and Koyukuk River valleys. The Unalakleet River is the largest and most heavily utilized of these. The village of Unalakleet is located at the mouth of this river. The upper reaches of the Unalakleet River have been designated a National Wild and Scenic River and are under the management of the Bureau of Land Management. The river supports anadromous populations of Dolly Varden, Chinook, coho, chum and pink salmon and resident populations of Dolly Varden, Arctic grayling, and whitefish. Other area streams provide the opportunity for high quality fisheries for the same species, but are not as intensively fished because of the difficult access.

Many streams located along the southern half of the Seward Peninsula between Koyuk and Teller (including the Fish, Niukluk, Bonanza, Eldorado, Nome, Snake, Sinuk, Feather, Tisuk, Pilgrim, and Kuzitrin rivers) are accessible via the Nome road system and offer sportfishing opportunity for Arctic grayling, Dolly Varden, salmon and northern pike (Fish, Pilgrim and Kuzitrin). However, many of these streams are closed to chum salmon fishing because of weak runs,

Small sockeye salmon runs occur in the Pilgrim and Sinuk rivers, and a few remnant late run sockeye are present in most other locations while Chinook salmon are present in the Pilgrim and Fish Rivers. Large size Arctic grayling, some over 1.4 kg (3 lbs), are present in many Seward Peninsula rivers and many of Alaska's largest Arctic grayling have been taken there. Other remote streams are accessible by aircraft or boat from nearby villages and receive little sport fishing effort.

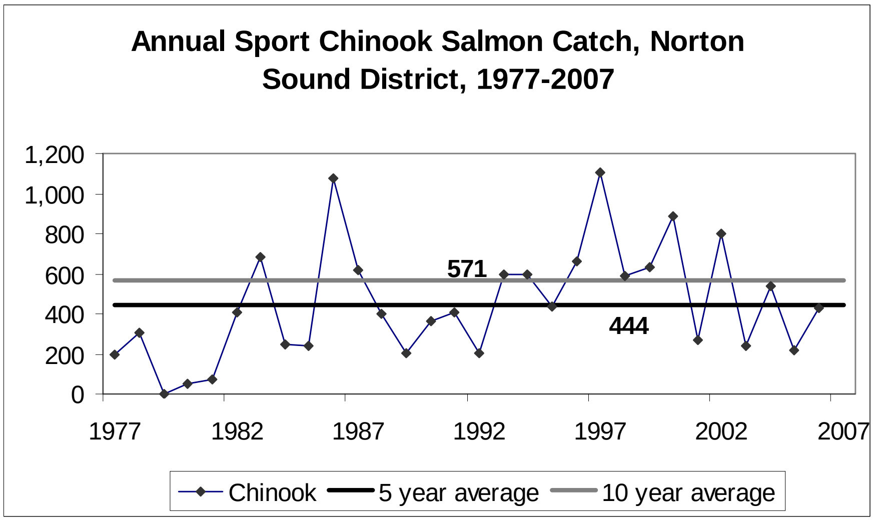


Fig. 10-33 Norton Sound Region Sport Chinook Salmon Catch, 1977-2007.

Norton Sound region sport salmon catch, by species, from 1977 through 2006 are shown in Table 10-22. Data prior to 1977 is not available and 2007 data is not available as processing of sport fishing surveys is not yet complete. Sport Chinook catches in the region have mimicked the declines in the subsistence and commercial Chinook catches. The peak sport catch of Chinook in the Norton Sound region was in 1997, when 1,106 fish were caught. Sport Chinook catch in the region has trended downward since then and the 2006 catch 427 fish was slightly below the 5 and 10 year averages (Fig. 10-33). Overall; however, sport catch in 2006 was the second highest number on record largely due to a record coho catch.

Table 10-22 Sport salmon catch by species, by year for all subdistricts in Norton Sound District, 1977-2007.

Year	Chinook	Sockeye	Coho	Pink	Chum	Total
1977	197	0	449	2,402	670	3,718
1978	303	0	742	7,399	546	8,990
1979	-	-	-	-	-	-
1980	52	0	1,455	7,732	1,601	10,840
1981	70	0	1,504	3,101	1,889	6,564
1982	409	0	2,986	13,742	2,620	19,757
1983	687	0	3,823	4,583	2,042	11,135
1984	247	351	7,582	8,322	1,481	17,983
1985	239	20	1,177	1,138	1,036	3,610
1986	1,077	19	3,926	3,172	1,719	9,913
1987	615	924	2,319	1,304	814	5,976
1988	400	782	5,038	2,912	1,583	10,715
1989	203	165	4,158	3,564	1,497	9,587
1990	364	198	3,305	7,647	925	12,439
1991	404	237	5,800	1,738	1,415	9,594
1992	204	131	4,671	6,403	523	11,932
1993	595	10	3,783	2,250	691	7,329
1994	600	18	5,547	7,051	536	13,752
1995	438	104	3,705	928	394	5,569
1996	662	100	7,289	5,972	662	14,685
1997	1,106	30	4,393	1,458	278	7,265
1998	590	16	4,441	6,939	682	12,668
1999	630	0	5,582	3,039	211	9,462
2000	889	45	7,441	2,886	1,097	12,358
2001	271	39	4,802	360	1,709	7,181
2002	802	0	4,211	4,303	818	10,134
2003	239	572	3,039	2,222	292	6,364
2004	535	404	5,806	8,309	498	15,552
2005	216	0	3,959	473	36	4,684
2006	427	22	11,427	5,317	344	17,110
2007						
5 year avg.	**444**	**200**	**5,688**	**4,125**	**398**	**10,769**
10 year avg.	**571**	**113**	**5,510**	**3,531**	**597**	**10,278**

Norton Sound Chinook Salmon Run Synopsis, 2008[51]

The 2008 Norton Sound Chinook salmon run is arguably the poorest return on record. At the onset of the season, a directed Chinook salmon commercial fishery was not expected, and early closures to the subsistence and sport fisheries were anticipated for Subdistricts 5 and 6 in early July. There was some optimism about meeting escapement needs while also avoiding an early closure, which was based on a combination of factors. These included: (1) sufficient escapements observed during the predominant brood years (2002 and 2003) for the 2008 return, (2) a restrictive subsistence fishing schedule that provides escapement windows throughout the run, and (3) mesh-size restrictions that were planned for the Unalakleet River on June 30, which were aimed at conserving age 5 and 6 Chinook salmon during their peak migration period.

The Unalakleet and Shaktoolik Rivers are the largest producers of Chinook salmon in Norton Sound. Management of Subdistricts 5 (Shaktoolik) and 6 (Unalakleet) Chinook salmon is based largely on subsistence catch indices collected inseason and passage estimates at a counting tower located on the North River, an important Chinook salmon spawning tributary of the Unalakleet River. Except for aerial surveys, escapements are not monitored in Shaktoolik, but Shaktoolik and Unalakleet Chinook are managed as one unit as previous tagging studies have shown an intermingling of salmon stocks in these subdistricts. Chinook salmon aerial surveys were not flown this season due to overcast conditions during peak spawning periods.

[51] Excerpted from Memo, dated September 10, 2007, to John Hilsinger of ADF&G from Western Alaska area managers regarding Western Alaska Chinook stock status in 2008.

By July 2, it was clear that the Unalakleet River Chinook salmon run had later than average run timing and was a very weak run. It seemed that if there was any chance of meeting escapement needs, an early closure was necessary, and the sport and subsistence fisheries were closed effective 8 p.m. Saturday, July 5. The decision to close the Chinook fishery was based largely on the June 30-July 2 reported Unalakleet Subdistrict marine subsistence catch of 145 Chinook salmon, a three-fold decrease from the previous 48-hour period's catch of 460 Chinook salmon. As of July 2, only 36 Chinook were counted by the North River tower, and July 2 is the historical quarter point of the run. Despite proactive restrictions and the eventual closure, the Chinook salmon escapement fell short of the North River tower-based SEG range of 1,200-2,600 for the fourth time since 2004. In addition, the North River tower Chinook salmon escapement of 924 was the second lowest on record. The 2008 Unalakleet River total run size estimate of 3,908 Chinook was 21 percent below the previous record low of 4,961 Chinook in 2005.

ADF&G anticipates that it will continue to be difficult to reach escapement goals in the Unalakleet watershed for the foreseeable future, even with restrictions and early closures to subsistence and sport fisheries. Prior to 2008, the 2004-2006 escapements at the North River tower were the three lowest on record and well below the lower end of the SEG range.

Chinook salmon runs also occur in the Kwiniuk and Tubutulik Rivers of the Moses Point Subdistrict (Subdistrict 3), and in the Inglutalik and Ungalik Rivers of the Norton Bay Subdistrict (Subdistrict 4). Except for aerial surveys, Chinook salmon escapements are not monitored in the Norton Bay Subdistrict. However, in the Moses Point Subdistrict, the Kwiniuk River tower is used to monitor Chinook escapements and has an SEG range of 300-550 Chinook. The Kwiniuk River Chinook salmon estimated escapement of 246 was the 4th lowest on record and represented the third consecutive year in which the tower count fell short of the SEG. Poor escapements since 2005 suggest that the 2009 return will be below average, but age-class data are lacking for this stock.

10.3.3 Northern Region Community Dependence on Salmon Fisheries.

Table 10-23 is adapted from an ADOLWD (Windish-Cole 2008) analysis of local resident crew members, by census areas, with the region defined by ADOLWD as the Northern Region. The Northern Region includes the communities, Boroughs, and Census areas associated with the fisheries of the Kotzebue, Norton Sound, and part of the upper Yukon area. Overall, in the Northern Region, 310 crew licenses were purchased in 2005 with about half of these coming from the Nome Census area. ADOLWD estimates that 168 of those licenses were used in local fisheries.

Table 10-23 Local Resident Crew Members, Northern Region, 2001–2006

Borough/Census Area	Local Residents Who Bought Commercial Crew Licenses					
	2000	2001	2002	2003	2004	2005
Fairbanks North Star Borough	88	N/A	63	63	62	67
Nome Census Area	168	N/A	83	106	78	151
North Slope Borough	7	N/A	2	4	6	5
Northwest Arctic Borough	90	N/A	3	3	60	58
Southeast Fairbanks Census Area	8	N/A	10	14	11	14
Yukon-Koyukuk Census Area	30	N/A	9	20	15	15
Local Resident Total	391	N/A	170	210	232	310
Region's Harvest Total	250	211	62	87	70	168

N/A: Crew member licensing data from 2001 was not released by CFEC because of data problems
Notes: 2005 data are preliminary. "Region's Harvest Total" represents total estimated number of crew workers working in the region's fisheries. Crew members do not necessarily work in their local fisheries.

Source: Commercial Fisheries Entry Commission, and ADOLWD.

The crew counts shown above are in addition to limited entry commercial salmon permits, shown in Table 10-24, that are actively used in the area's fisheries. Overall, in the Northern Region, 263 permit holders were active in 2005 with 109 of these coming from the Nome Census area. ADOLWD estimates that 202 of those permits were used in local fisheries in 2006.

Table 10-24 Fishermen by Residency, Northern Region, 2001 - 2006

Borough/Census Area	**Residents Who Fished Their Permits**					
	2001	**2002**	**2003**	**2004**	**2005**	**2006**
Fairbanks North Star Borough	41	39	38	41	51	54
Nome Census Area	99	72	80	63	99	109
North Slope Borough	4	1	2	3	4	3
Northwest Arctic Borough	69	6	7	44	45	43
Southeast Fairbanks Census Area	2	7	6	12	16	15
Yukon-Koyukuk Census Area	4	17	43	24	24	39
Local Resident Total	219	142	176	187	239	263
Region's Harvest Total	213	123	128	133	177	202

Source: Commercial Fisheries Entry Commission, and ADOLWD
Notes: "Region's Harvest Total" represents total fishermen who fished in the region's fisheries. Permit holders do not necessarily work in their local fisheries.

ADOLWD has also tabulated data on fish harvesting employment and earning by gear type in the Northern Region, which is reprinted with permission (Windish-Cole 2008) in Table 10-25. The largest proportions of the total estimated workforce have historically come from the salmon fisheries (gillnet and set-net combined). Salmon harvesting gross revenue declined substantially during the early 2000s; however, set-net revenue improved considerably in 2005. Norton Sound pot fishing for crab is the other major source of harvesting gross earnings in the region and accounts for more than half of the total value.

Table 10-25 Fish Harvesting Employment and Gross Earnings by Gear Type, 2000-2005, Northern Region.

Year	Gear Type	Vessels[1]	Total Estimated Workforce[2]	Total Gross Earning of Permit Holders[3]	Percent of Gross Earnings Earned by Nonresident Permit Holders
2000	Gillnet	87	218	$696,579	32
2001	Gillnet	65	163	$323,491	27.5
2002	Gillnet	32	80	$128,430	ND
2003	Gillnet	26	65	$148,152	ND
2000	Pot Gear	15	45	$960,425	38.8
2001	Pot Gear	29	87	$1,059,025	16.6
2002	Pot Gear	26	78	$1,520,502	15.8
2003	Pot Gear	24	72	$1,040,259	6.5
2004	Pot Gear	25	75	$1,020,500	ND
2005	Pot Gear	28	84	$1,199,263	ND
2000	Set-net	-	234	$387,436	ND
2001	Set-net	-	174	$373,789	0
2002	Set-net	-	22	$11,649	0
2003	Set-net	-	58	$86,588	0
2004	Set-net	-	118	$199,428	0
2005	Set-net	-	128	$411,674	0
2000	Total	102	494	$2,133,833	23.1
2001	Total	94	424	$1,830,630	14.5
2002	Total	56	185	$1,743,438	14
2003	Total	50	215	$1,446,598	ND
2004	Total	25	203	$1,280,487	ND
2005	Total	73	345	$2,024,124	ND

[1]Skiffs and small vessels are usually not registered as commercial vessels and are therefore not counted in these data.
[2]'Workforce' refers to the number of fisherman fishing permits plus the requisite crew members needed for the permits(s) they fish. Regional crew member counts are estimates derived by applying a crew factor to catch data.
[3]Gross earnings, or revenue, are currently the most reliable data available, but are not directly comparable to wages as expenses have not been deducted.

Source: Commercial Fisheries Entry Commission, and ADOLWD.

Fig. 10-34 depicts Northern Region resident permit holder salmon fishery gross earnings, by community, as tabulated by ADOLWD. None of the communities in the region have gross earnings of resident permit holders that exceed $1 million from the salmon fisheries.

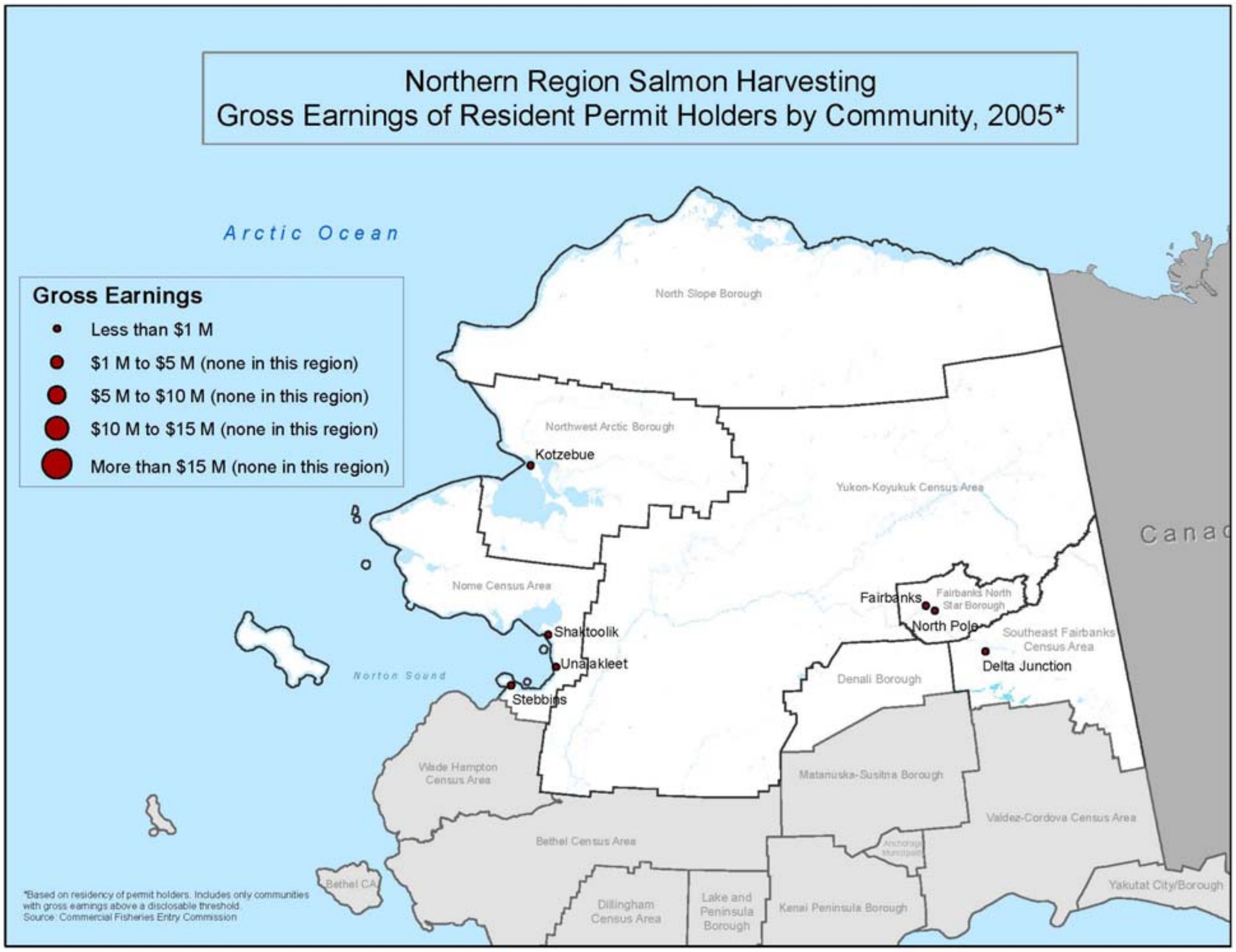


Fig. 10-34 Northern Region Salmon Harvesting, Gross Earnings of Resident Permit Holders by Community, 2005.

Northern Region fish harvesting employment, by species and month, also tabulated by ADOLWD, are shown in Table 10-26. Given the prevalence of the salmon fisheries in overall employment in the region, it is not surprising that harvesting employment tends to be dominated by the salmon industry and is greatest in the summer months of June, July and August. In 2006, for example, 324 individuals were engaged in fish harvesting activity in August as compared to the monthly average of 74. Norton Sound crab and Kuskokwim bay herring fisheries also contribute to harvesting employment as has halibut fishing in recent years.

Table 10-26 Fish Harvesting Employment by Species and Month, 2000–2006 Northern Region

All Species[1]													
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Monthly Average
2000	9	18	12	15	9	321	223	291	15	0	0	0	76
2001	3	6	6	6	6	190	294	278	3	0	0	0	66
2002	9	14	18	15	131	79	138	119	0	0	0	0	44
2003	0	18	33	36	86	31	151	160	34	4	0	0	46
2004	0	3	6	6	0	33	221	220	48	4	0	0	45
2005	5	3	13	12	3	190	242	259	71	6	0	0	67
2006[2]	0	0	0	0	3	138	283	324	124	10	0	0	74
Crab													
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Monthly Average
2000	9	18	12	15	9	0	39	39	15	0	0	0	13
2001	3	6	6	6	6	0	96	90	3	0	0	0	18
2002	9	12	18	15	18	51	75	87	0	0	0	0	24
2003	0	18	33	36	3	27	87	96	0	0	0	0	25
2004	0	3	6	6	0	30	75	78	0	0	0	0	17
2005	3	3	9	12	3	24	90	90	0	0	0	0	20
2006	0	0	0	0	3	33	72	87	0	0	0	0	16
Halibut[2]													
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Monthly Average
2000	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	0	0	0	0	0	0	3	4	0	0	0	0	1
2003	0	0	0	0	3	0	0	0	0	0	0	0	0
2004	-	-	-	-	-	-	-	-	-	-	-	-	-
2005	0	0	0	0	0	0	3	15	27	6	0	0	4
20062	0	0	0	0	0	0	3	15	24	6	0	0	4
Herring													
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Monthly Average
2000	0	0	0	0	0	238	0	0	0	0	0	0	20
2001	0	0	0	0	0	190	0	0	0	0	0	0	16
2002	0	0	0	0	113	28	0	0	0	0	0	0	12
2003	0	0	0	0	80	0	0	0	0	0	0	0	7
2004	0	0	0	0	0	3	0	0	0	0	0	0	0
2005	0	0	0	0	0	140	3	0	0	0	0	0	12
2006	0	0	0	0	0	105	0	0	0	0	0	0	9
Salmon													
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Monthly Average
2000	0	0	0	0	0	82	184	252	0	0	0	0	43
2001	0	0	0	0	0	0	198	188	0	0	0	0	32
2002	0	0	0	0	0	0	60	28	0	0	0	0	7
2003	0	0	0	0	0	4	64	64	34	4	0	0	14
2004	0	0	0	0	0	0	146	142	48	4	0	0	28
2005	0	0	0	0	0	26	146	154	44	0	0	0	31
2006	0	0	0	0	0	0	208	222	96	0	0	0	44

[1]A small number of fishermen in unknown or other fisheries are included in the totals; however, they are not listed separately in this exhibit.

[2]2006 halibut fishing employment data are not yet available. The 2005 monthly halibut figures have instead been used as a temporary proxy for 2006 and are part of the 2006 "All Species" calculation. They will be revised once they become available.

Counting Employment: Harvesting data in this table are counted differently than in other tables in this report. In this table, the permit itself is considered the employer.

In other tables where a count of workers was estimated, the employer was considered to be the vessel, or permit holders for fisheries that did not typically use vessels. This means that a permit holder who makes landings under two different permits (in the same vessel) in the same month will generate two sets of jobs whereas for tables where the vessel is the employer there would be only one set of workers.

Source: Commercial Fisheries Entry Commission; National Marine Fisheries Service and ADOLWD, Research and Analysis Section

Fig. 10-35 shows the locations of canneries and land based seafood processors in the Northern Region in 2006. As is shown in the figure, there are no processing facilities in the Kotzebue area; however, Norton Sound Economic Development Corporation has filed intent to operate processing facilities in Nome, Unalakleet and Savoonga in 2006. Note, however, that these data do not include any floating processors or buying stations that may be in operation in the area.

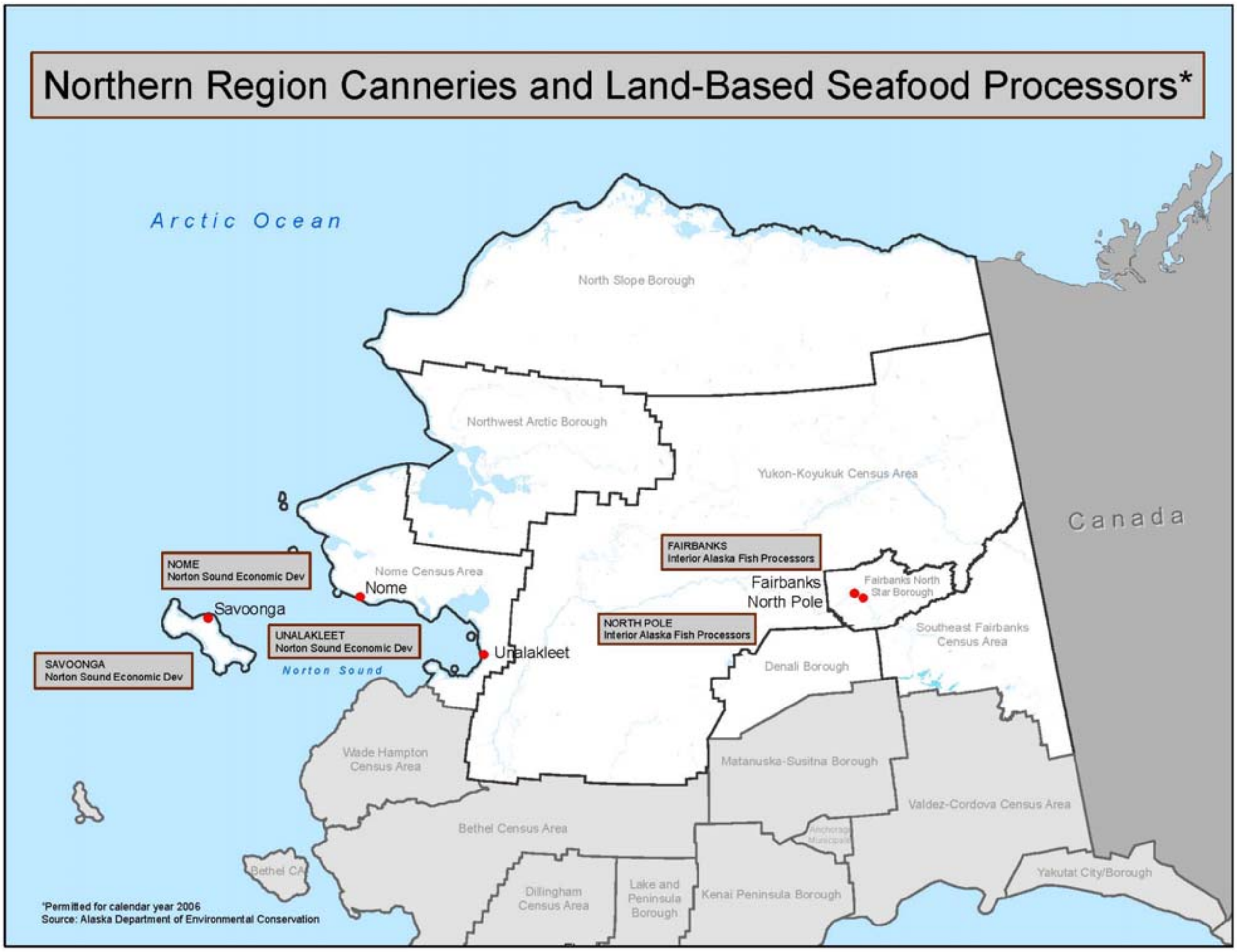


Fig. 10-35 Northern Region Canneries and Land Based Seafood Processors.

Table 10-27 provides estimated seafood processing employment and percent of non-resident workers and percent of non-resident earnings in the Northern Region. The total worker count in the Northern Region seafood processing sector declined continuously from 2000 to 2004. In 2000, the area's fisheries supported 189 seafood processors. That number declined to 20 in 2003 and 2004, before rebounding to 54 in 2005. Data for more recent years has not been compiled at present. Non-resident workers have made up a relatively small proportion, about 20% in most years. Non-resident wages cannot be disclosed; however, percent of non-resident wages is higher than percent of non-resident workers and indicates relatively higher wages (more highly skilled jobs) for non-resident workers.

Table 10-27 Northern Region Seafood Processing Employment, 2000-2005

Seafood Processing				
Year	**Total Worker Count**	**Percent Nonresident Workers**	**Wages**	**Percent Nonresident Wages**
2000	189	21.2	ND	27.4
2001	135	7.4	ND	19
2002	84	16.7	ND	26.5
2003	20	20	ND	21.6
2004	20	15	ND	26.3
2005	54	20.4	ND	37.6

Sources: ADOLWD, Research and Analysis Section and CFEC

10.3.4 Kuskokwim River, Kuskokwim Bay

The Kuskokwim Area includes the Kuskokwim River drainage, all waters of Alaska that flow into the Bering Sea between Cape Newenham and the Naskonat Peninsula, and Nunivak and St. Matthew Islands (Fig. 10-36). The 2007 Kuskokwim River salmon fisheries were managed according to the Kuskokwim River Salmon Management Plan (5 AAC 07.365). Kuskokwim Bay salmon fisheries were managed according to the District 4 Salmon Management Plan (5 AAC 07.367) and their associated regulations. (This section is developed from ADF&G 2007b,c and data supplied by ADF&G)

The Kuskokwim River Salmon Management Working Group (Working Group) was formed in 1988 by the BOF in response to requests from stakeholders in the Kuskokwim River drainage seeking a more active role in the management of salmon fishery resources. Since then, the Working Group has become increasingly active in the preseason, inseason, and postseason management of the Kuskokwim River drainage subsistence, commercial, and sport salmon fisheries. In 2001, the Working Group modified its charter in order to more effectively address the needs of the Federal Subsistence Management Program by including members of the Coordinating Fisheries Committee of the Yukon-Kuskokwim Delta and Western Interior Regional Advisory Councils. The Working Group now serves as a public forum for Federal and State fisheries managers to meet with local users of the salmon resource to review run assessment information and reach a consensus on how to proceed with management of Kuskokwim River salmon fisheries. Working Group meetings provide the forum for area fishermen, user representatives, community representatives, Regional Advisory Council representatives, Fish and Game Advisory Committee members, and State and Federal managers to come together to discuss issues relevant to sustained yield fishery management and providing for the subsistence use priority.

Improvements have been made toward strengthening the cooperative management process of the Kuskokwim River Salmon Management Working Group through funding provided by OSM in support of project Fisheries Information Services (FIS) 01-116. The funding provided by OSM allowed ADF&G staff and Working Group members to more effectively keep area fishermen informed of run abundance, fishery status, and management strategies through discussion, news releases, newspaper articles and radio talk shows. The funding allowed dedicated staff to more effectively prepare for meetings by providing complete and frequent distribution of updated fishery status information in a standardized format. The funding also allowed travel for Working Group members to participate in fishery meetings located outside the drainage. Although progress has been made toward strengthening cooperative management, it is an ongoing process that will require the continued participation by area fishermen and basic funding for material preparation, communication and travel to maintain the interaction of Working Group members with fishery managers, fishery project leaders, research planners, and policy makers.

From the beginning of the 2007 season there was a good showing of Chinook, chum, and sockeye salmon throughout the Kuskokwim Area; however, run timing for these species was approximately 5 to 7 days late compared to average. Chinook salmon abundance was characterized as average to above average while sockeye and chum salmon abundance was characterized as above average. Coho salmon abundance was characterized as average to below average with overall early run timing. Amounts necessary for subsistence use are expected to have been achieved throughout the area.

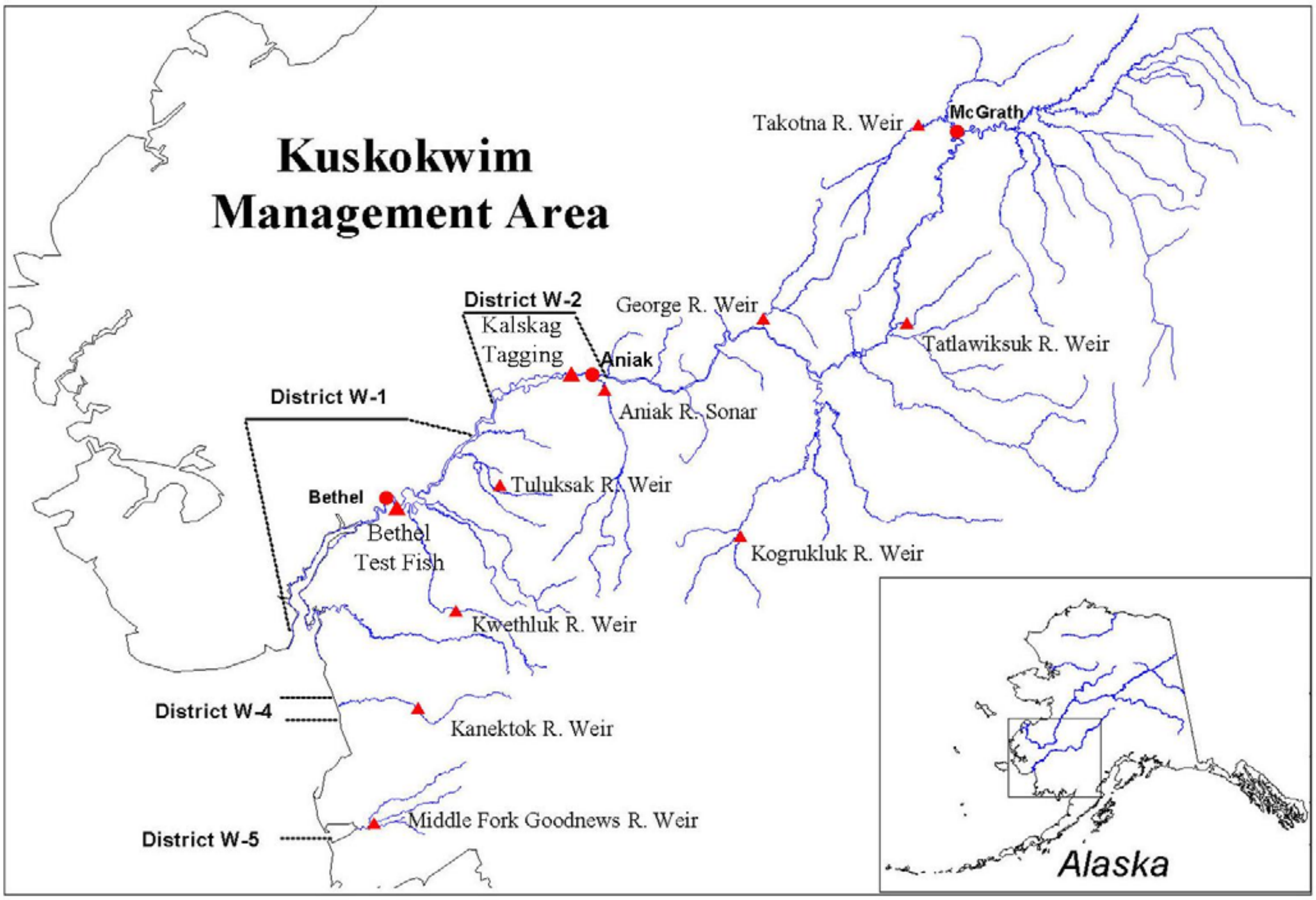


Fig. 10-36 Kuskokwim Management Area and Salmon Run Assessment Projects

Status of Runs and Conservation Concerns

The BOF met in Anchorage from January 31 to February 5, 2007, to review regulatory fisheries proposals concerning the AYK area. The BOF discontinued the stock of yield concern designations for the Kuskokwim River Chinook and chum stocks based on Chinook and chum salmon runs being at or above the historical average each year since 2002. The Kuskokwim Area has no formal forecast for salmon returns, but broad expectations are developed based on parent-year escapements and recent year trends.

Subsistence Fishery Situation and Outlook

There are 38 communities consisting of approximately 4,500 households within the Kuskokwim Area. Approximately 75% of the approximately 4,500 households in the region are situated within the drainage of the Kuskokwim River (ADF&G, Division of Subsistence 2003). Bethel is the largest community in the region, containing approximately 1,500 households. Much of the salmon fishing effort occurs within the mainstem of the Kuskokwim River; however, fishing also occurs in many of the tributaries that contain salmon. Residents of Quinhagak, Goodnews Bay, and Platinum, located along the south shore of Kuskokwim Bay, harvest salmon stocks primarily from the Kanektok, Arolik, and Goodnews River systems. Residents of Kipnuk, Kwigillingok and Kongiganak, located on the north Kuskokwim Bay harvest salmon from within the Kuskokwim River drainage and from local drainages that drain into Kuskokwim Bay. Residents of Toksook Bay, Nightmute, Tununak, Newtok, Chefornak and Mekoryuk, situated near the Bering Sea Coast, harvest salmon from coastal waters as well as local tributaries.

The ANILCA mandates that rural subsistence users have a priority over other users to take fish and wildlife on Federal public lands and waters and required the creation of Regional Advisory Councils to enable rural residents to have a meaningful role in Federal Subsistence Management (see section 1.7.12). On October 1, 1999, the Secretaries of Interior and Agriculture published regulations to expand Federal Management of subsistence fisheries to Alaskan rivers and lakes and limited marine waters within and adjacent to Federal public lands. The Secretary of Interior and the Secretary of Agriculture delegated their authority in Alaska to the Federal Subsistence Board to manage fish and wildlife resources for subsistence uses on Federal public land, including waters running through or next to these lands. Federal subsistence fishing regulations are adopted by the Federal Subsistence Board (FSB). The Regional Advisory Councils provide recommendations and information to the FSB, review policies and management plans, provide a public forum and deal with other matters relating to subsistence uses. The FSB may close fishing for other uses in these waters to a priority for Federally qualified rural subsistence users if it is determined that there are subsistence or conservation concerns.

Federal subsistence fishing schedules, openings, closings, and fishing methods are established in regulations (DOI 2005). In general, the regulations are the same as those issued for the subsistence taking of fish under Alaska Administrative Code. However, differences in regulations do exist in some cases, primarily when a Federal Special Action supersedes State regulations.

Kuskokwim River:
The subsistence-fishing schedule was not implemented in 2007 given anticipated above average runs of Chinook and chum salmon and recent action by the BOF that discontinued the stock of concern designations for Kuskokwim River Chinook and chum salmon. Subsistence fishing in the Kuskokwim River was allowed 7 days a week throughout the season with the exception of closed periods 6 hours before, during, and 3 hours after commercial fishing periods. Subsistence harvest was described as poor to normal for Chinook and sockeye salmon and normal to very good for chum salmon. The “poor” descriptions for Chinook and sockeye salmon are likely the result of late run timing for these species and the extremely low and clear water conditions that persisted through the majority of June.

Many subsistence fishermen described difficulties in harvesting fish with drift and set gillnets attributed to fish avoidance in clear water and fish running deeper in the water column because of the extreme low water conditions. Although subsistence fishing was described as difficult at times, amounts necessary for subsistence use are expected to have been achieved because of adequate run abundance and improving fishing conditions in late June and into July.

In 2007, the BOF also adopted a proposal to daily bag and possession limits in the Aniak River hook and line subsistence fishery upstream of Doestock Creek by aligning subsistence hook and line bag and possession limits with sport fishing bag and possession limits. The BOF action exempts subsistence hook and line fishermen from the sport fishing annual possession and length limits on Chinook salmon.

Subsistence fishing in the Quinhagak and Goodnews Bay areas was allowed 7 days per week throughout the season with the exception of closed periods 16 hours before, during, and 6 hours after commercial fishing periods. Subsistence harvests were characterized as adequate and amounts necessary for subsistence use is expected to have been achieved.

Kuskokwim Bay: District 4 (Quinhagak) and District 5 (Goodnews Bay)

Subsistence fishing in the Quinhagak and Goodnews Bay areas was allowed 7 days per week throughout the season with the exception of closed periods 16 hours before, during, and 6 hours after commercial fishing periods. Subsistence harvests were characterized as adequate and amounts necessary for subsistence use is expected to have been achieved.

Commercial Fishery Situation and Outlook

There are 4 commercial salmon fishing districts: 1, 2, 4, and 5 (5AAC 07.200). District 1 (District W-1), the Lower Kuskokwim River, consists of the Kuskokwim River from a line between Apokak Slough and the southernmost tip of Eek Island and Popokamiut upstream to a line between ADF&G regulatory markers located at Bogus Creek, about 9 miles above the Tuluksak River (Fig. 2; Appendix A2). The downstream boundary has been in effect since 1986, and the upstream boundary was established in 1994 (Appendix A3). District 1 was divided into 2 subdistricts in 2000. Subdistrict 1A consists of that portion of District 1 upstream from a line between regulatory markers located at the downstream end of Steamboat Slough. Subdistrict 1B consists of that portion of District 1 downstream from the Steamboat Slough regulatory markers. Subdistrict registration requirements are in effect in District 1 (5 AAC 07.370).

District 2, the Middle Kuskokwim River, consists of the Kuskokwim River from ADF&G regulatory markers located at the upstream entrance to the second slough on the west bank downstream from Kalskag to the regulatory markers at Chuathbaluk. The downstream boundary of District 2 was used for the first time in 1990.

The District 4 commercial salmon fishery was established in 1960. The boundaries of District 4 extend from the northern-most edge of the mouth of Oyak Creek to the southern-most tip of the south mouth of the Arolik River, and expand 3 mi from the coast into Kuskokwim Bay. Prior to 2001, the northern most boundary of the district was the northern most edge of Weelung Creek. The northern boundary was moved by regulation to minimize the number of Kuskokwim River bound Chinook and chum salmon harvested in the District 4 commercial fishery. The Kanektok and Arolik Rivers are the main spawning streams in the district. The village of Quinhagak is located at the mouth of the Kanektok River.

The District 5 commercial salmon fishery was established in 1968. The boundaries of District 5 extend from the southern most tip of the north spit to the northern most tip of the south spit at the entrance of Goodnews Bay, expanding east to a line between the mouth of Ukfigag Creek to the mouth of the Tunulik River. The Goodnews River drainage is the main spawning drainage in the district. The Goodnews and Middle Fork Goodnews Rivers are the primary spawning rivers within the drainage.

Table 10-28 Chinook Harvests, Kuskokwim River Area, 1960–2007

Year	Commercial[a]	Subsistence[b,c]	Test-Fish	Sport Fish	Total
1960	5,969	18,887			24,856
1961	18,918	28,934			47,852
1962	15,341	13,582			28,923
1963	12,016	34,482			46,498
1964	17,149	29,017			46,166
1965	21,989	24,697			46,686
1966	25,545	49,325	285		75,155
1967	29,986	59,913	766		90,665
1968	34,278	32,942	608		67,828
1969	43,997	40,617	833		85,447
1970	39,290	69,612	857		109,759
1971	40,274	43,242	756		84,272
1972	39,454	40,396	756		80,606
1973	32,838	39,093	577		72,508
1974	18,664	27,139	1,236		47,039
1975	22,135	48,448	704		71,287
1976	30,735	58,606	1,206		90,547
1977	35,830	56,580	1,264	33	93,707
1978	45,641	36,270	1,445	116	83,472
1979	38,966	56,283	979	74	96,302
1980	35,881	59,892	1,033	162	96,968
1981	47,663	61,329	1,218	189	110,399
1982	48,234	58,018	542	207	107,001
1983	33,174	47,412	1,139	420	82,145
1984	31,742	56,930	231	273	89,176
1985	37,889	43,874	79	85	81,927
1986	19,414	51,019	130	49	70,612
1987	36,179	67,325	384	355	104,243
1988	55,716	70,943	576	528	127,763
1989	43,217	81,175	543	1,218	126,153
1990	53,504	85,976	512	394	140,386
1991	37,778	85,556	117	401	123,852
1992	46,872	64,794	1,380	367	113,413
1993	8,735	87,513	2,483	587	99,318
1994	16,211	93,243	1,937	1,139	112,530
1995	30,846	96,435	1,421	541	129,243
1996	7,419	78,062	247	1,432	87,160
1997	10,441	81,577	332	1,227	93,577
1998[d]	17,359	81,264	210	1,434	100,267
1999	4,705	73,194	98	252	78,249
2000	444	64,893	64	105	65,506
2001	90	73,610	86	290	74,076
2002	72	66,807	288	300	67,467
2003	158	67,788	409	401	68,756
2004[e]	2,300	80,065	691	857	83,913
2005[e]	4,784	70,393	608	1092	76,877
2006	2,777	63,177	352	572	66,878
2007[f]	179	72,097	503	2,543	75,289
2002-2006 avg.	**2,018**	**69,646**	**470**	**644**	**72,778**
1997-2006 avg.	**4,313**	**72,277**	**314**	**653**	**77,557**

[a] Districts 1 and 2; also includes harvests in District 3 from 1960 to 1965.
[b] Estimated subsistence harvest expanded from villages surveyed.
[c] Discrepancies in subsistence harvest numbers by area may be attributable changes in geographic area definitions over time.
[d] Beginning in 1988, estimates are based on a new formula so data since 1988 is not comparable with previous years
[e] Preliminary estimate of subsistence in 2005 and sport in 2004 and 2005.
[f] All data not yet available.

Kuskokwim River

In 2007, a lack of processing capacity and commercial interest, and continued poor chum salmon market conditions resulted in no commercial openings in June and July during the bulk of the Chinook, sockeye, and chum salmon runs. The 2007 Kuskokwim River commercial fishing season was opened on August 1 with management directed towards coho salmon. Twelve coho salmon directed commercial fishing periods occurred from August 1 through August 24. Coho salmon harvests and catch rates were above average at the beginning of the season and transitioned to below average through the last period on

August 24. Average weight per fish of the District 1 coho salmon commercial harvest was approximately average, in contrast to the below average weights observed in 2006.

Table 10-29provides the real (inflation adjusted) value of commercial Chinook salmon harvest compared to total value of Kuskokwim Area commercial salmon harvest from 1989 through 2007. Over this time, real Chinook value peaked in 1989 at $538,052, when it represented 10% of the overall real value. The decline in catch, combined with declining salmon prices since the early 1980s, have depressed overall fishery value below $1,000 in 2001, 2002, 2003 and 2007. The low of the period was $350 in 2002. Fig. 10-37, below, provides a graphical representation of this declining trend.

Table 10-29 Chinook Salmon Harvests, Kuskokwim River Area, 1960–2007

Year	Kuskokwim Chinook Value	Total Real Value	Chinook Percent of Total Value
1989	$538,052	$5,177,130	10%
1990	$452,430	$4,894,579	9%
1991	$323,682	$3,961,266	8%
1992	$414,536	$4,636,465	9%
1993	$77,445	$4,288,365	2%
1994	$128,975	$5,140,607	3%
1995	$320,181	$4,209,582	8%
1996	$30,284	$2,885,375	1%
1997	$47,360	$2,910,754	2%
1998	$66,554	$1,636,153	4%
1999	$23,337	$551,664	4%
2000	$2,701	$1,195,865	0%
2001	$648	$751,272	0%
2002	$350	$322,677	0%
2003	$752	$893,027	0%
2004	$9,741	$1,485,277	1%
2005	$25,902	$1,155,113	2%
2006	$14,675	$1,143,806	1%
2007	$879	$1,265,035	0%
2002-2006 Average	$10,284	$1,204,661	1%
1997-2006 Average	$19,202	$3,090,869	1%

Notes: Real value, relative to 2007, is calculated using the GDP deflator.

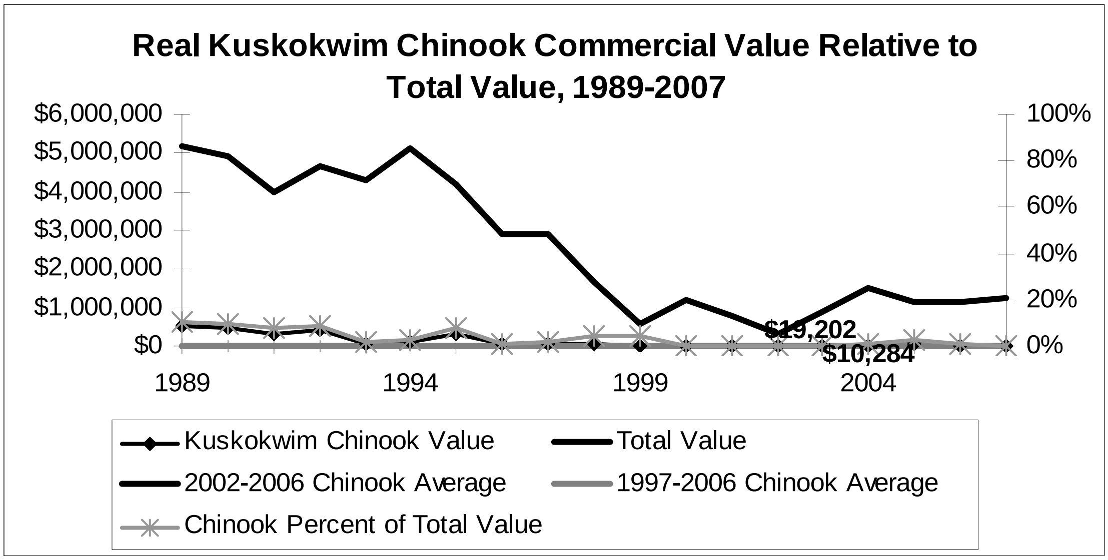


Fig. 10-37 Real Kuskokwim Chinook Commercial Value Relative to Total Value, 1989-2007.

Kuskokwim Bay

In 2007, the District 4 commercial salmon fishing season opened June 14 with management directed towards Chinook salmon harvest, and the District 5 season opened on June 19. Each district was initially placed on a 2 day per week commercial fishing schedule on Tuesdays and Thursdays. A schedule of commercial openings every other day was initiated in Districts 4 and 5 on July 2 when management transitioned to sockeye salmon directed harvest. From late June through mid- July, the single buyer imposed limits on the number of fish that could be delivered by District 4 and 5 fishermen because of limited processing capacity. Chinook salmon harvest per period was average to below average and catch rates were approximately average in 2007. Sockeye salmon harvest and catch rates per period were above average throughout the season. Chum salmon harvest and catch rates per period ranged from below average at the beginning of the season to above average towards the end of season when limits were lifted in mid-July.

Management of Kuskokwim Bay commercial fisheries was re-directed towards the harvest of coho salmon on July 31 when a commercial fishing schedule of three 12-hour periods per week was initiated in Districts 4 and 5. Coho salmon harvests and catch rates per period ranged from above average to below average in District 4 and 5 throughout the coho salmon season. Similar to District 1, average weight per fish of the District 4 and 5 coho salmon commercial harvest was approximately average in 2007, in contrast to the below average weights observed in 2006. A total of 125 individual permit holders recorded landings in District 4 during the 2007 season. This level of fishing effort was 27% below the recent 10-year average of 172 fishermen.

A total of 125 individual permit holders recorded landings in District 4 during the 2007 season. This level of fishing effort was 27% below the recent 10-year average of 172 fishermen. The 2007 District 4 commercial harvest was 19,573 Chinook, 109,343 sockeye, 34,710 coho, and 61,228 chum salmon from 33 periods. District 4 sockeye salmon harvest was at a record high for the second consecutive year and was 53% above the recent 10-year average. Chum salmon harvest was above average over all years and was 50% above the recent 10-year average. Chinook salmon harvest was below average compared to historical harvests but was similar to the recent 10-year average. Coho salmon harvest was below average compared to historical harvests and was approximately 14% below the recent 10-year average. The total ex-vessel value of the District 4 fishery was $660,865, approximately 40% above the recent 10-year average value.

A total of 28 individual permit holders recorded landings in District 5 during the 2007 season. This level of fishing effort was a slight increase compared to 2006, but was 30% below the recent 10-year average of 40 fishermen. The 2007 District 5 commercial harvest was 3,112 Chinook, 43,716 sockeye, 13,689 coho, and 7,519 chum salmon from 33 periods (Table 10-28). Chinook, sockeye, and coho salmon harvest was approximately 25%, 42% and 16% above the recent 10-year average respectively, and chum salmon harvest was approximately 4% below the recent 10-year average. The 2007 District 5 sockeye salmon harvest was the third highest on record since 1981. The total ex-vessel value of the District 5 fishery was $223,329, 42% above the recent 10-year average value.

Sport Fishery Situation and Outlook

Kuskokwim Area sport fisheries are divided between 2 management areas. The Lower Kuskokwim Management Area (LKMA) includes waters including and downstream of Aniak and all drainages in Kuskokwim Bay (Lafferty 2004). The Upper Kuskokwim Management Area (UKMA) includes all waters of the Kuskokwim River upstream of Aniak (Burr 2004).

Since the BOF discontinued the stock of concern designation for Kuskokwim River chum salmon it also lifted sport fishing restrictions on chum salmon in the Aniak River drainage. Chum salmon can now be harvested by sport fishermen in the Aniak River drainage. The bag and possession limit for king, pink, sockeye, chum and coho salmon is three fish for all salmon, of which no more than two can be Chinook salmon.

Kuskokwim Chinook Salmon Run Synopsis, 2008[52]

Kuskokwim River Chinook salmon abundance is generally on a decline following a period of exceptionally high abundance years in 2004, 2005, and 2006 that ranged from 360,000 to 425,000 fish. Abundance is estimated to have decreased in 2007 to about 250,000 fish, and may have declined a bit more in 2008 to about 225,000 fish. The 2007 and 2008 values are preliminary considering that the subsistence harvests estimates are not yet available. Annual subsistence harvest averages about 72,000 fish +/- 9,000. Kuskokwim River Chinook salmon were listed by the BOF as a Stock of Yield Concern in September 2000, but the finding was lifted in January 2007.

Chinook salmon abundance in 2008 season was expected to be about average, and comparable to 2007; inseason indicators suggested that to be the case, but actual abundance may have been lower than expected. Achievement of tributary escapement goals was mixed with 6 of 11 streams falling below goal, 3 within their respective SEG ranges, and 2 above range. Subsistence harvest needs are thought to have been met, and there is some speculation that subsistence harvest may have been above average in partial compensation for sharp increases in local fuel and food costs. A modest commercial harvest of 8,881 fish was allowed in 2008; of note, managers required use of gillnets with 6 inch or smaller mesh size, which effectively focused harvest on male Chinook salmon that accounted for about 90 percent of the commercial harvest, plus allowed for optimizing concurrent sockeye harvest. Overall Chinook salmon exploitation rate in 2008 is estimated to have been near 40%, compared to the 10-year average of 29%. Most of the harvest was likely on larger Chinook salmon, which subsistence fishermen tend to select for through the use of gillnets with 8 inch or larger mesh size.

[52] Excerpted from Memo, dated September 10, 2007, to John Hilsinger of ADF&G from Western Alaska area managers regarding Western Alaska Chinook stock status in 2008.

10.3.5 Yukon River

The Yukon River salmon fishery is among the most complex, in terms of management, in Alaska. The fishery is composed of four stocks; Chinook, summer chum, fall chum, and coho. ADF&G manages the overall Yukon salmon fishery for escapement needs and, in portions of the region, jointly manages subsistence harvest with the U.S. Fish and Wildlife Service. In addition, the U.S./Canada panel of the Pacific Salmon Treaty annually negotiates escapement objectives for the Canadian portion of the Yukon River. The fishery supports subsistence, personal use, sport, and commercial harvests of salmon. For a complete treatment of the management of this fishery please refer to 2007 Yukon Area Management Report (JTC 2008) (This section is developed from ADF&G 2008, ADF&G 2007e, Bue and Hayes 2007, and data supplied by ADF&G)

As in other areas of the State, subsistence fishing has highest priority over other uses. ADF&G utilizes a subsistence fishery schedule, as well as emergency orders, to ensure adequate subsistence fishing opportunities are made available. There is also a personal use fishery schedule. Commercial openings are made when available surpluses are determined to be available.

The Yukon River drainage is divided into fishery districts and sub-districts for management purposes (Fig. 10-38). ADF&G uses an adaptive management strategy that evaluates run strength in season to determine a harvestable surplus above escapement requirements and subsistence uses. Preseason, a management strategy was developed in cooperation with federal subsistence managers that outlined run and harvest outlooks along with the regulatory subsistence salmon fishing schedule described in an information sheet. The 2007 strategy was to implement the subsistence salmon fishing schedule as salmon began to arrive in each district or sub-district in a stepwise manner. Before implementing this schedule, subsistence fishing would be allowed 7 days a week to provide opportunity to harvest non-salmon species, such as whitefish, sheefish, pike, and suckers. Additionally, an informational sheet was used to prepare fishermen for possible reductions to the subsistence salmon fishing schedule or to allow for a small commercial fishery contingent on how the runs developed. The information sheet was mailed to Yukon River commercial permit holders and approximately 2,800 families identified from ADF&G's survey and permit databases. State and federal staff presented the management strategy to the Yukon River Drainage Fisheries Association (YRDFA), State of Alaska Advisory Committees, Federal Regional Advisory Councils, and other interested and affected Parties.

Table 10-30 and Table 10-31 provide historic Alaska Yukon and Canadian Yukon Catch statistics for all catch sectors. These data will be discussed in more detail in the discussion and graphics in the sections on subsistence, commercial and sport fisheries that appear below.

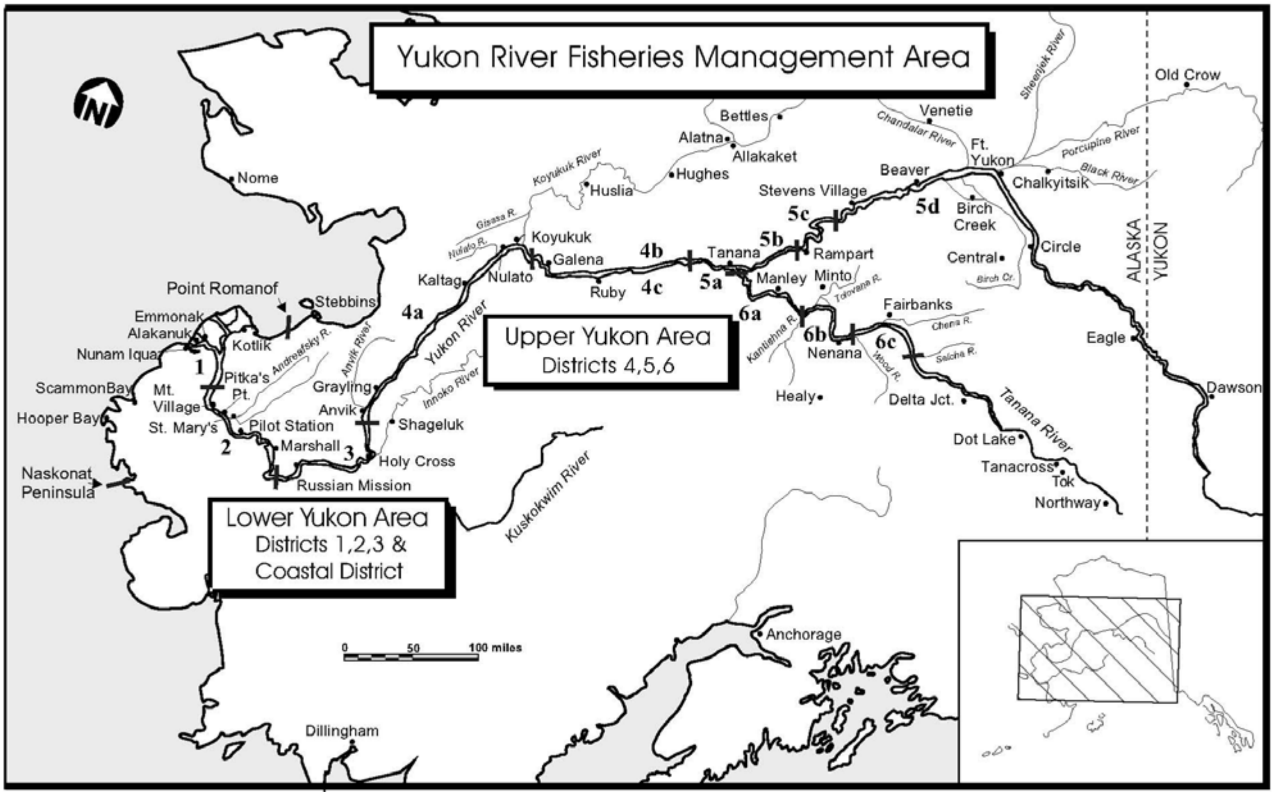


Fig. 10-38 Yukon River Fisheries Management Areas.

Table 10-30 Alaska Yukon Area Chinook Salmon Catch Totals, 1961-2007

Year	Subsistence [a]	Commercial [b,c]	Roe Sales [f]	Personal Use [d]	Test Fish	Sport [g]	Total
1961	21,488	119,664	0				141,152
1962	11,110	94,734	0				105,844
1963	24,862	117,048	0				141,910
1964	16,231	93,587	0				109,818
1965	16,608	118,098	0				134,706
1966	11,572	93,315	0				104,887
1967	16,448	129,656	0				146,104
1968	12,106	106,526	0				118,632
1969	14,000	91,027	0				105,027
1970	13,874	79,145	0				93,019
1971	25,684	110,507	0				136,191
1972	20,258	92,840	0				113,098
1973	24,317	75,353	0				99,670
1974	19,964	98,089	0				118,053
1975	13,045	63,838	0				76,883
1976	17,806	87,776	0				105,582
1977	17,581	96,757	0			156	114,494
1978	30,297	99,168	0			523	129,988
1979	31,005	127,673	0			554	159,232
1980	42,724	153,985	0			956	197,665
1981	29,690	158,018	0			769	188,477
1982	28,158	123,644	0			1,006	152,808
1983	49,478	147,910	0			1,048	198,436
1984	42,428	119,904	0			351	162,683
1985	39,771	146,188	0			1,368	187,327
1986	45,238	99,970	0			796	146,004
1987	51,418	134,760	0	1,706		502	188,386
1988	43,907	100,364	0	2,125	1,081	944	148,421
1989	48,400	104,198	0	2,616	1,293	1,063	157,616
1990	48,587	95,247	413	2,594	2,048	544	149,433
1991	46,773	104,878	1,538	0	689	773	154,651
1992	45,626	120,245	927	0	962	431	168,191
1993	62,486	93,550	560	426	1,572	1,695	160,289
1994	53,077	113,137	703	0	1,631	2,281	170,829
1995	48,535	122,728	1,324	399	2,152	2,525	177,663
1996	43,306	89,671	521	215	1,698	3,151	138,562
1997	55,978	112,841	769	313	2,811	1,913	174,625
1998	53,733	43,618	81	357	926	654	99,369
1999	52,194	69,275	288	331	1,205	1,023	124,316
2000	35,841	8,518	0	75	597	276	45,307
2001	53,059	0	0	122	0	679	53,860
2002	42,620	24,128	0	126	528	486	67,888
2003	55,109	40,438	0	204	680	2,719	99,150
2004	53,675	56,151	0	201	792	1,513	112,332
2005	52,561	32,029	0	138	296	483	85,507
2006	47,710	45,829	0	89	817	739	95,184
2007	59,242	33,634					92,876
2002-06 Avg.	50,335	39,715	0	152	623	1,188	92,012
1997-06 Avg.	50,248	43,283	114	196	865	1,049	95,754

[a] Subsistence harvest not available by district until 1978. Test Fish Sales is the number of fish sold by ADF&G test fisheries. Does not include coastal subsistence harvest in Hooper Bay and Scammon Bay. All data from the most recent year is preliminary.

[b] Includes estimates of illegal sales.

[c] Includes ADF&G test fish sales prior to 1988.

[d] After 1991 the regulation did not provide for a Personal Use fishery in Districts 1, 3 and 5.

[f] The estimated harvest of female Chinook salmon to produce roe sold.

[g] Estimated sport fish harvest for Alaskan portion of the Yukon River drainage. The majority of sport fish harvest occurs in the Tanana River drainage (District 6).

Table 10-31 Canadian Yukon Area Chinook Salmon Catch Totals, 1961-2007

Year	Mainstem Yukon						Porcupine Aboriginal	Total Canadian
	Domestic	Aboriginal	Sport [h]	Test fish[j]	Commercial	Subtotal		
1961		9,300			3,446	12,746	500	13,246
1962		9,300			4,037	13,337	600	13,937
1963		7,750			2,283	10,033	44	10,077
1964		4,124			3,208	7,332	76	7,408
1965		3,021			2,265	5,286	94	5,380
1966		2,445			1,942	4,387	65	4,452
1967		2,920			2,187	5,107	43	5,150
1968		2,800			2,212	5,012	30	5,042
1969		957			1,640	2,597	27	2,624
1970		2,044			2,611	4,655	8	4,663
1971		3,260			3,178	6,438	9	6,447
1972		3,960			1,769	5,729		5,729
1973		2,319			2,199	4,518	4	4,522
1974	406	3,342			1,808	5,556	75	5,631
1975	400	2,500			3,000	5,900	100	6,000
1976	500	1,000			3,500	5,000	25	5,025
1977	531	2,247			4,720	7,498	29	7,527
1978	421	2,485			2,975	5,881		5,881
1979	1,200	3,000			6,175	10,375		10,375
1980	3,500	7,546	300		9,500	20,846	2,000	22,846
1981	237	8,879	300		8,593	18,009	100	18,109
1982	435	7,433	300		8,640	16,808	400	17,208
1983	400	5,025	300		13,027	18,752	200	18,952
1984	260	5,850	300		9,885	16,295	500	16,795
1985	478	5,800	300		12,573	19,151	150	19,301
1986	342	8,625	300		10,797	20,064	300	20,364
1987	330	6,069	300		10,864	17,563	51	17,614
1988	282	7,178	650		13,217	21,327	100	21,427
1989	400	6,930	300		9,789	17,419	525	17,944
1990	247	7,109	300		11,324	18,980	247	19,227
1991	227	9,011	300		10,906	20,444	163	20,607
1992	277	6,349	300		10,877	17,803	100	17,903
1993	243	5,576	300		10,350	16,469	142	16,611
1994	373	8,089	300		12,028	20,790	428	21,218
1995	300	7,945	700		11,146	20,091	796	20,887
1996	141	8,451	790		10,164	19,546	66	19,612
1997	288	8,888	1,230		5,311	15,717	811	16,528
1998	24	5,424	0	737	390	6,575	99	6,674
1999	213	8,804	177		3,160	12,354	114	12,468
2000	0	4,829	0	761	0	5,590	50	5,640
2001	89	8,188	98	767	1,351	10,493	370	10,863
2002	59	7,138	128	1,036	708	9,069	188	9,257
2003	115	6,121	275	263	2,672	9,446	173	9,619
2004	88	6,483	423	167	3,785	10,946	292	11,238
2005	99	6,376	436	0	4,066	10,977	394	11,371
2006	63	5,757	606	0	2,332	8,758	314	9,072
2007	0	5,000	2	615	0	5,617	300	5,917
2002-06 Avg.	85	6,375	374	293	2,713	9,839	272	10,111
1997-06 Avg.	104	6,801	337	466	2,378	9,993	281	10,273

[h] Canadian sport fish harvest unknown prior to 1980.

[j] Canadian Chinook test fishery is conducted for management purposes, the fish harvested are retained and given to Aboriginal or Domestic users, but are not reported under those categories.

Status of Runs and Conservation Concerns

In response to the guidelines established in the Sustainable Salmon Policy, the BOF discontinued the Yukon River summer and fall chum salmon as stocks concern during the February 2007 work session. The Yukon River Chinook salmon stock was continued as a stock of yield concern based on the inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above the stock's escapement needs since 1998.

Subsistence Fishery Situation and Outlook

Subsistence fishing occurs throughout most of the Yukon River Area and has the highest priority among all uses of the resource in the State of Alaska. When salmon stocks are abundant and commercial fishing will occur, it is necessary to place some restrictions on the subsistence fishery in order to enforce commercial fishing regulations. For example, subsistence salmon fishing is closed in most areas 24 hours prior to the commercial salmon fishing season to discourage the illegal sale of subsistence caught salmon or salmon roe. However, substantially more fishing time is allowed throughout the fishing season for subsistence than for commercial activities.

Since 2001, the subsistence salmon fishery has been based on a schedule implemented chronologically by ADF&G consistent with migratory timing as the run progresses upstream. The subsistence salmon fishing schedule is based on current or past fishing schedules and provides reasonable opportunity for subsistence during years of normal to below average runs. The objectives of the schedule are to (1) reduce harvest early in the run when there is a higher level of uncertainty, (2) spread the harvest throughout the run to reduce harvest impacts on any particular component of the run and (3) provide subsistence fishing opportunity among all users during years of low salmon runs. Table 6 shows the 2007 subsistence fishing schedule based in regulation 5AAC 01.210 and 5AAC 05.360. Depending on run strength, the schedule is subject to change.

Table 10-32 Yukon Area subsistence salmon fishing schedule, 2008.

Note: this schedule is subject to change depending on run strength.

Area	Regulatory subsistence salmon fishing periods	Schedule to begin	Days of the week
Coastal District	7 days/week	by regulation	M/T/W/TH/F/SA/SU – 24 hours
District 1	Two 36-hour periods/week	May 26, 2007	Mon. 8 pm to Wed. 8 am /Thu. 8 pm to Sat. 8 am
District 2	Two 36-hour periods/week	May 28, 2007	Wed. 8 pm to Fri. 8 am / Sun. 8 pm to Tue. 8 am
District 3	Two 36-hour periods/week	May 30, 2007	Fri. 8 am to Sat. 8 pm / Tue. 8 am to Wed. 8 pm
District 4	Two 48-hour periods/week	June 8, 2007	Sun. 6 pm to Tue. 6 pm / Wed. 6 pm to Fri. 6 pm
Koyukuk River	7 days/week	By Regulation	M/T/W/TH/F/SA/SU – 24 hours
Subdistricts 5-A, B, C	Two 48-hour periods/week	June 17, 2007	Tue. 6 pm to Thu. 6 pm /Fri. 6 pm to Sun. 6 pm
Subdistrict 5-D	7 days/week	By Regulation	M/T/W/TH/F/SA/SU – 24 hours
District 6	Two 42-hour periods/week	By Regulation	Mon. 6 pm to Wed. Noon /Fri. 6 pm to Sun. Noon
Old Minto Area	5 days/week	By Regulation	Friday 6pm to Wednesday 6pm

Source: ADF&G 2008 Yukon River Salmon Fisheries Outlook Information sheet.

Once it has been determined there is a harvestable surplus of salmon in excess of subsistence uses, the subsistence fishing schedule may revert to the schedule specified in 5AAC 01.210, (c-h) FISHING SEASONS AND PERIODS.

During closed subsistence salmon fishing periods, subsistence fishing for whitefish, suckers, and other non-salmon species will be allowed throughout the drainage. Gillnets with greater than 4 inch mesh must be removed from the water and fish wheels may not be operated during closed subsistence salmon fishing periods in an effort to avoid salmon species. In addition, gillnets used to take species other than salmon during subsistence salmon closures are limited to 60 feet in length. This opportunity to target non-salmon species, while protecting salmon stocks of concern, may be discontinued if found ineffective at adequately reducing salmon harvest.

The summer and fall chum salmon management plans adopted by the BOF provide guidelines for managing subsistence salmon fisheries based on inseason run size projections. If subsistence harvest reductions are necessary, efforts will be made to spread the burden of conservation throughout the drainage. Potential harvest reduction measures include gear restrictions, reductions in fishing time, or extended periods of closed fishing. Conservation of salmon may require fish wheels to be equipped with a live box or live chute.

Subsistence fishing permits are required for Subdistricts 6-A and 6-B and upper Tanana River in the Tanana River drainage, portions of District 5 in the upper Yukon River drainage near the Haul Road Bridge, and from above the community of Fort Yukon to the U.S./Canada border. ADF&G requires fishermen to keep track of their subsistence salmon harvests on their permit in permit areas. Subsistence fishermen in permit areas are reminded that they must have their permit in possession while fishing. In non-permit areas, ADF&G conducts a postseason harvest survey and encourages fishermen to use catch calendars to keep track of their harvest. Non-permitted fishermen who did not receive a subsistence salmon calendar by mail may obtain one by contacting ADF&G in Emmonak or Fairbanks. ADF&G has prepaid postage for the calendar in an effort to encourage fishermen to use and return catch calendars. Additionally, a lottery awarding six $100 cash prizes will be conducted following the season for which all households that have returned properly filled out calendars will be entered.

Districts 1, 2, and 3

The subsistence salmon fishing schedule in Districts 1, 2, and 3 will begin with two, 36-hour periods per week. During the Chinook and summer chum salmon commercial fishing season, subsistence salmon fishing will be closed 18 hours before, during, and 12 hours following a commercial salmon fishing period. During the fall season, subsistence salmon fishing will be closed 12 hours before, during, and 12 hours following each District 1, 2, or 3 commercial salmon fishing period. If commercial fishing periods become frequent in the fall, the amount of subsistence fishing closure time may be reduced to 6 hours before, during and 6 hours after each commercial fishing period to offset lost subsistence fishing opportunity. Also during the commercial season, the two lobes of the caudal fin (both tips of the tail) are required to be removed from subsistence caught Chinook salmon.

District 4

The subsistence salmon fishing schedule in District 4 is two, 48-hour periods per week. Regulations separate subsistence fishing periods from commercial fishing periods in Subdistrict 4-A. By regulation, during the commercial salmon fishing season, subsistence salmon fishing with set nets and fish wheels will be closed 12 hours before, during, and 12 hours following each Subdistrict 4-A commercial salmon fishing period. Also by regulation, subsistence fishing for Chinook salmon with drift gillnets will be allowed for two 48-hour periods each week by emergency order during the commercial fishing season. However, if a small commercial fishery with little effort occurs in Subdistrict 4-A, subsistence fishing may be allowed 5 days per week and uninterrupted by commercial periods.

If the commercial salmon fishing season is opened in Subdistricts 4-B and 4-C, managers will attempt to coincide allowable commercial salmon fishing periods with the traditional subsistence salmon fishing schedule of two 48-hour periods per week. If subsistence salmon fishing opportunities in District 4 are not sufficient to meet needs due to the commercial fishing schedule, additional subsistence-only fishing time will be allowed. When ADF&G announces a commercial fishing closure that will last longer than 5 days in duration during the commercial salmon season in District 4, subsistence salmon fishing will be allowed 5 days per week, unless modified by emergency order.

From November 1 through June 31, waters open for subsistence fishing in the Koyukuk River drainage are expanded to include the Middle Fork of the Koyukuk River upstream of its confluence with the North Fork, and the South Fork of the Koyukuk River upstream from the mouth of the Jim River. A household subsistence fishing permit is required as a condition of this increased fishing opportunity to harvest non-salmon species. Only gillnet gear is allowed and the mesh size may not exceed 3½ inches. This was done in an effort to protect salmon species in known spawning area with road access.

District 5

The Subdistricts 5-A, 5-B, and 5-C subsistence fishing schedule is two, 48-hour fishing periods per week. Attempts will be made to coincide the subsistence salmon fishing schedule with commercial periods. Additionally, "subsistence only" salmon fishing periods may also be scheduled. When ADF&G announces a commercial fishing closure that will last longer than 5 days in duration during the commercial salmon season in Subdistricts 5-A, 5-B, and 5-C, subsistence salmon fishing will be allowed 5 days per week, unless modified by emergency order. In Subdistrict 5-D, subsistence salmon fishermen may harvest salmon 7 days per week throughout the season unless restricted by emergency order.

Subsistence fishing permits are required on the Yukon River from the western tip of Garnet Island to the Dall River including the community of Rampart and the Haul Road bridge area. Permits are also required for portions of the Yukon River near the communities of Circle and Eagle from Twenty-two Mile Slough to the U.S./Canada border. Subsistence fishermen must obtain a permit prior to subsistence fishing which can be done by contacting ADF&G's office in Fairbanks. Permits can be issued in person, by mail, and more recently by email. All permit holders are required to report harvest information on their permits and return their permits to ADF&G at the end of the fishing season.

District 6

Within the majority of Subdistricts 6-A and 6-B, the subsistence salmon fishing schedule is two, 42-hour periods per week from 6:00 p.m. Monday until 12 noon Wednesday and from 6:00 p.m. Friday until 12 noon Sunday. Exceptions are within the Old Minto Area where subsistence salmon fishing is allowed 5 days a week from 6:00 p.m. Friday until 6:00 p.m. Wednesday and within the Kantishna River, which is open 7 days per week.

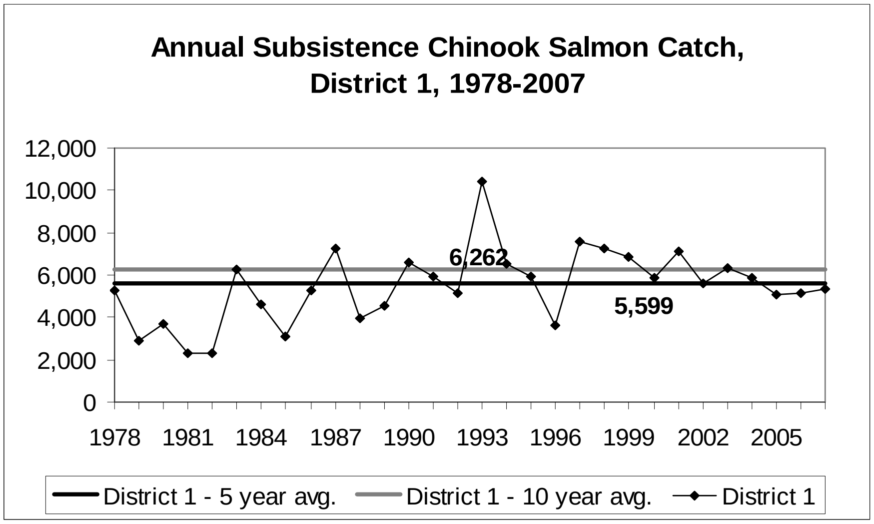
Regulations require subsistence salmon permits in District 6, the Tanana River drainage, except for Subdistrict 6-C, which is managed under personal use regulations. Subsistence salmon fishermen can obtain a permit by contacting the ADF&G office in Fairbanks. Subsistence permit holders in that portion of Subdistrict 6-B, from a point 3 miles upstream of the mouth of Totchaket Slough to the upper boundary of Subdistrict 6-B, are required to report to ADF&G the number of salmon harvested each week. Permit holders can report their weekly catch on a message recording at (907) 459-7388. All Tanana River subsistence permit holders are required to record their harvest information on their permit and return expired permits to ADF&G's office in Fairbanks at the end of the fishing season.

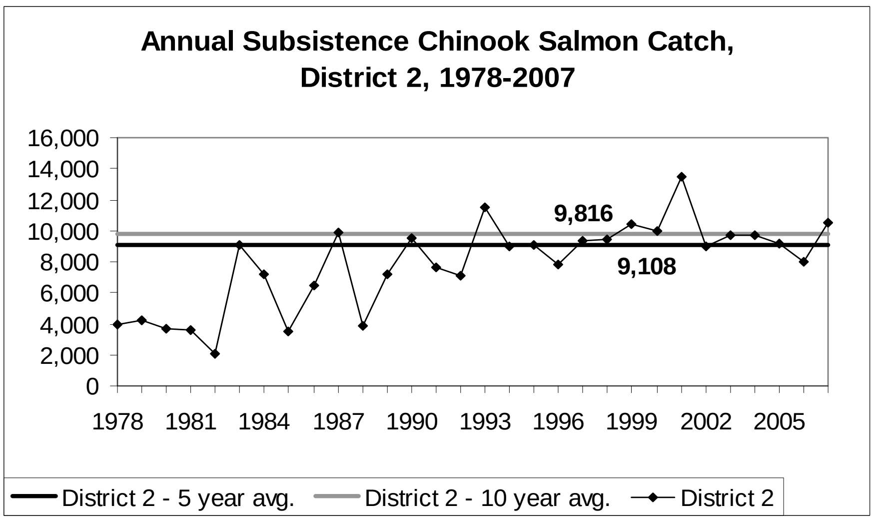
Table 10-33 provides historic subsistence Chinook catch numbers in the lower Yukon River, by district. As shown in Table 10-33 there was an increasing trend in overall Lower Yukon catch through the early 1990s. Since 1993, when lower Yukon total subsistence Chinook catch was 28,513 fish, catch has trended downwards. The 2007 lower Yukon Chinook subsistence catches of 20,514 fish was below the ten year average but above the 5 year average. In Districts 1 and 3 the 2007 catch was below both the 5 and 10 year averages; however, the 2007 district 2 subsistence Chinook catch of 10,496 was the greatest since 2001 and well above both the 5 and 10 year averages. These data are depicted graphically in Fig. 10-39.

Table 10-33 Subsistence Chinook Salmon Catch, by year, Lower Yukon Districts, 1961-2007

Year	District 1	District 2	District 3	Lower Yukon Total
1978	5,246	3,964	3,902	13,112
1979	2,879	4,268	3,325	10,472
1980	3,669	3,674	4,818	12,161
1981	2,282	3,580	4,011	9,873
1982	2,311	2,109	3,359	7,779
1983	6,263	9,065	4,910	20,238
1984	4,624	7,172	4,394	16,190
1985	3,071	3,468	3,342	9,881
1986	5,275	6,483	4,305	16,063
1987	7,278	9,866	4,708	21,852
1988	3,938	3,823	4,547	12,308
1989	4,565	7,147	4,778	16,490
1990	6,619	9,546	4,093	20,258
1991	5,925	7,617	3,187	16,729
1992	5,141	7,074	4,991	17,206
1993	10,408	11,513	6,592	28,513
1994	6,540	8,956	6,124	21,620
1995	5,960	9,037	5,419	20,416
1996	3,646	7,780	6,783	18,209
1997	7,550	9,350	6,311	23,211
1998	7,242	9,455	4,514	21,211
1999	6,848	10,439	7,715	25,002
2000	5,891	9,935	3,914	19,740
2001	7,089	13,442	6,361	26,892
2002	5,603	8,954	4,139	18,696
2003	6,332	9,668	5,002	21,002
2004	5,880	9,724	4,748	20,352
2005	5,058	9,156	5,131	19,345
2006	5,122	8,039	5,374	18,535
2007*	5,367	10,496	4,651	20,514
5 year avg.	**5,599**	**9,108**	**4,879**	**19,586**
10 year avg.	**6,262**	**9,816**	**5,321**	**21,399**

Source: ADF&G





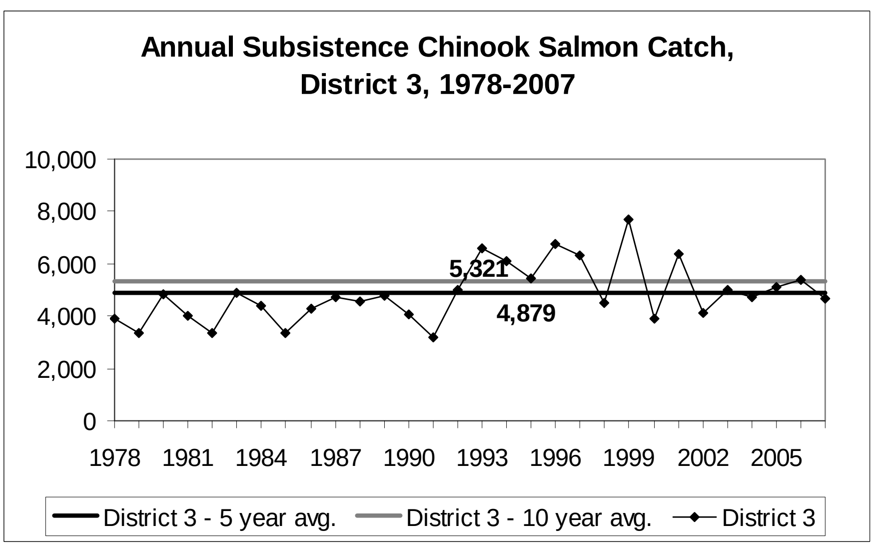


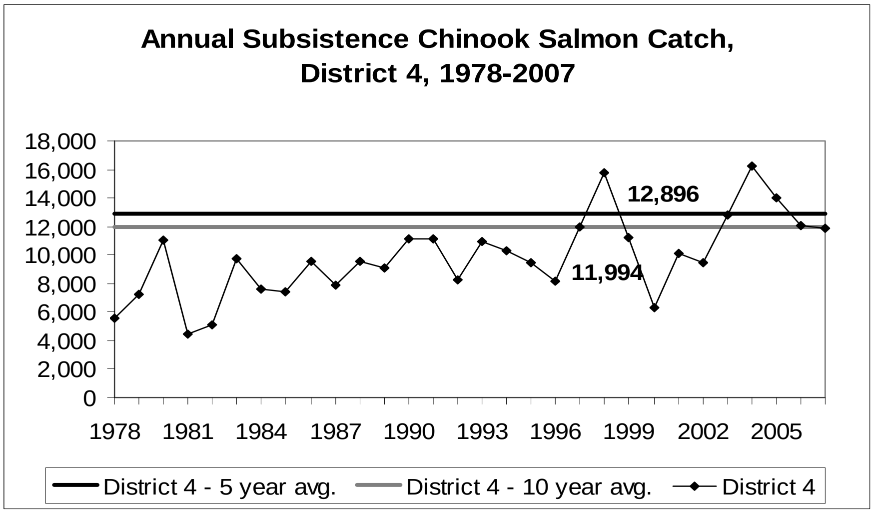
Fig. 10-39 Lower Yukon Annual Subsistence Chinook Catch by District, 1978-2007.
Source: ADF&G.

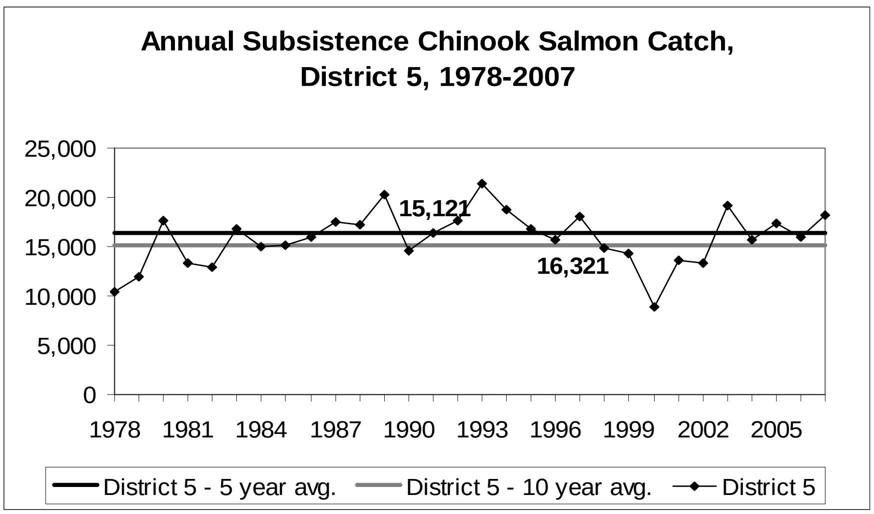
Table 10-34 provides historic subsistence Chinook catch numbers in the Upper Yukon River, by district. As shown (Fig. 10-40), total Upper Yukon subsistence Chinook catches have been at historically high levels during the early to mid 2000s, and above averages in 2007. District 4 2007 catches were below the 5 years average and close to the 10 year average, while Districts 5 and 6 had catches greater than both averages in 2007. Total subsistence catch trends for the Lower and Upper Yukon as well as the Combined total for the entire Alaska Yukon are shown in Fig. 10-41 below.

Fig. 10-42 displays annual subsistence Chinook salmon catch for the mainstem of the Yukon River in Canada from 1961-2007. The underlying data for this figure is displayed in Table 10-31 at the beginning of this section. Canadian Yukon aboriginal subsistence harvest has historically been much lower than the subsistence Chinook harvests in the U.S. portion of the Yukon River. Peak Mainstem Candian Yukon aboriginal subsistence harvests occurred in the 1980s and 1990s; however, a cyclical pattern shows wide swings in catch above and below the five and ten year averages. Similar to other areas of the Yukon, Canadian aboriginal subsistence catch declined steadily in the 2000s. The 2007 catch of 5,000 fish is well below the 5- and 10-year averages of 6,375 and 6,801, respectively. The small Porcupine aboriginal catch has exceeded the 5- and 10-year averages in each of the years since 2003.

Table 10-34 Subsistence Chinook Salmon Catch, by year, Upper Yukon Districts, 1961-2007

Year	District 4	District 5	District 6	Upper Yukon Total
1978	5,549	10,405	1,231	17,185
1979	7,203	11,997	1,333	20,533
1980	11,053	17,684	1,826	30,563
1981	4,432	13,300	2,085	19,817
1982	5,077	12,859	2,443	20,379
1983	9,754	16,780	2,706	29,240
1984	7,650	14,989	3,599	26,238
1985	7,425	15,090	7,375	29,890
1986	9,530	15,944	3,701	29,175
1987	7,914	17,556	4,096	29,566
1988	9,515	17,200	4,884	31,599
1989	9,074	20,336	2,546	31,956
1990	11,122	14,589	2,618	28,329
1991	11,100	16,429	2,515	30,044
1992	8,291	17,691	2,438	28,420
1993	10,936	21,365	1,672	33,973
1994	10,327	18,760	2,370	31,457
1995	9,474	16,866	1,779	28,119
1996	8,193	15,727	1,177	25,097
1997	12,006	18,049	2,712	32,767
1998	15,801	14,802	1,919	32,522
1999	11,238	14,330	1,624	27,192
2000	6,264	8,854	983	16,101
2001	10,152	13,566	2,449	26,167
2002	9,456	13,401	1,067	23,924
2003	12,771	19,191	2,145	34,107
2004	16,269	15,666	1,388	33,323
2005	13,964	17,424	1,828	33,216
2006	12,022	15,924	1,229	29,175
2007*	11,831	18,145	1,835	32,813
5 year avg.	12,896	16,321	1,531	30,749
10 year avg.	11,994	15,121	1,734	28,849





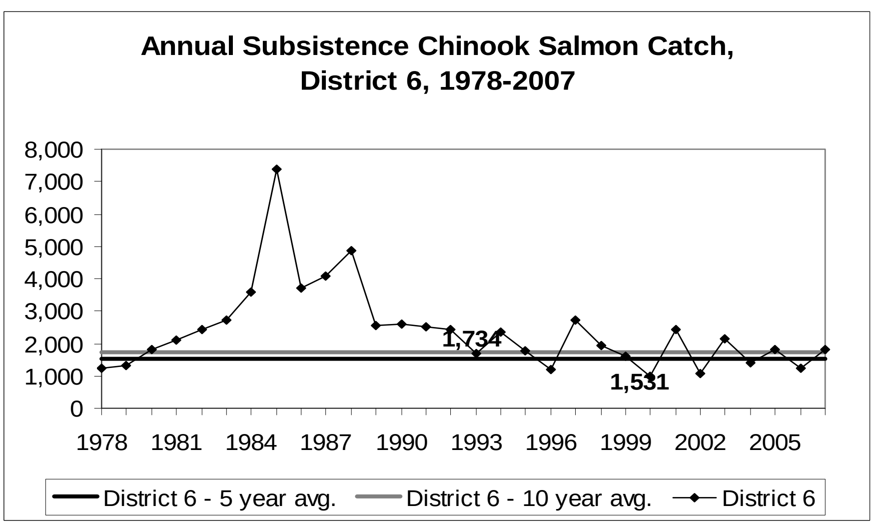


Fig. 10-40 Upper Yukon Annual Subsistence Chinook Catch by District, 1978-2007. Source: AFG&G.

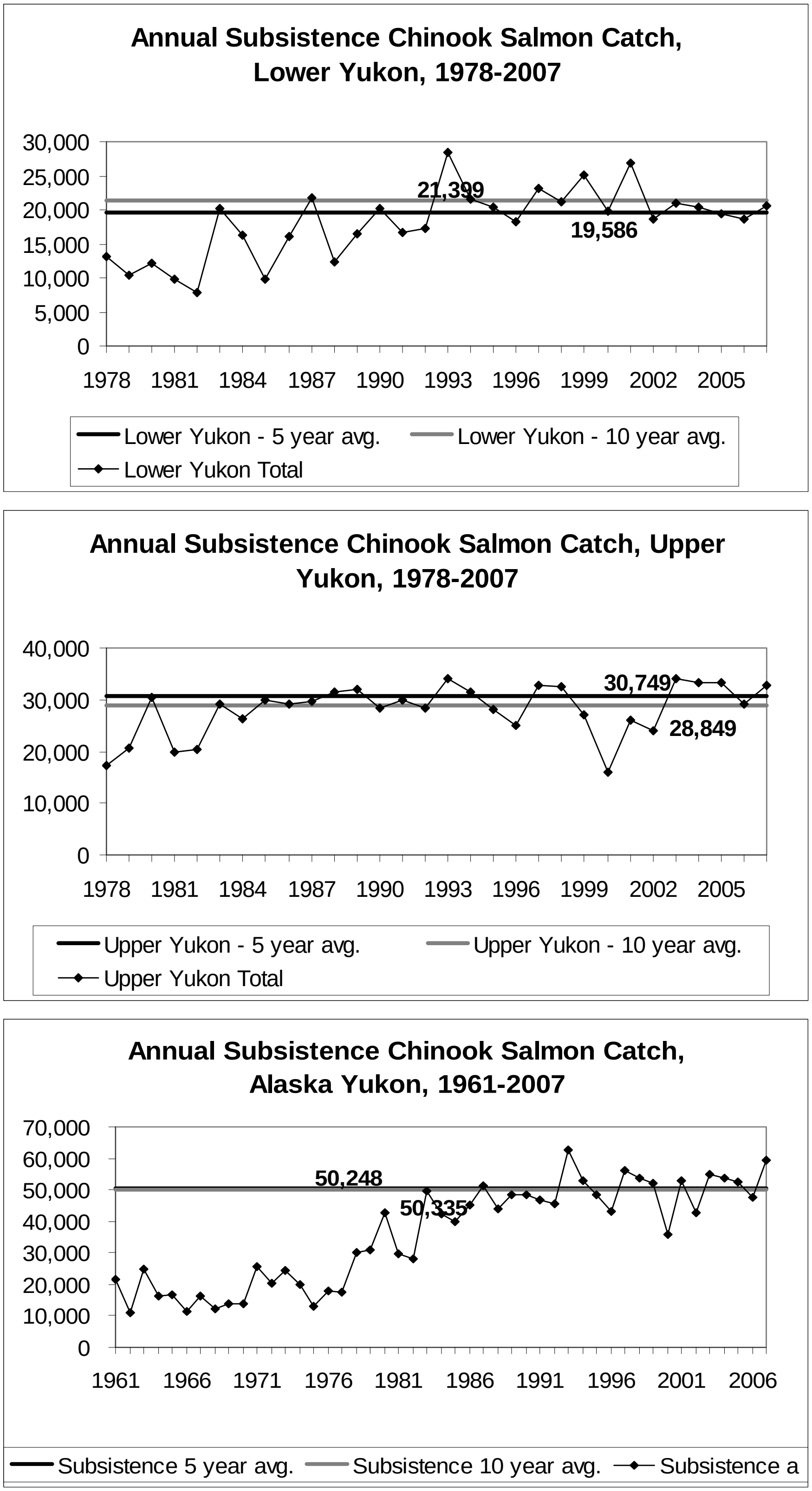
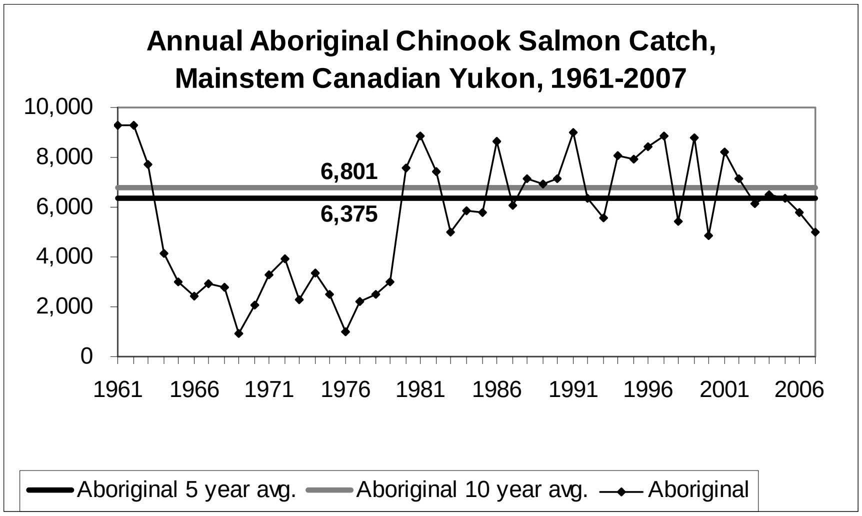


Fig. 10-41 Lower, Upper, and Alaska Yukon Total Annual Subsistence Chinook Salmon Catch, 1978-2007. Source: ADF&G.



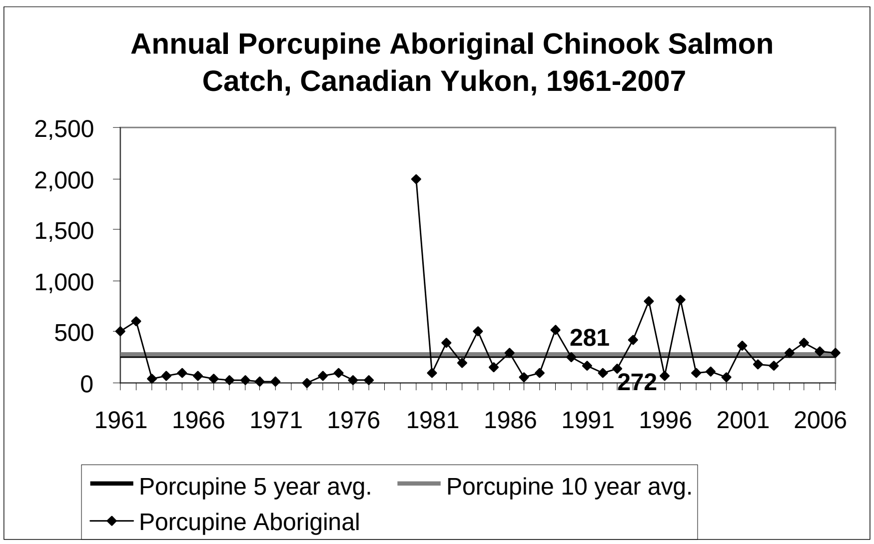


Fig. 10-42 Mainstem Canadian Yukon Aboriginal and Porcupine Aboriginal Total Annual Subsistence Chinook Salmon Catch, 1961-2007

Commercial Fishery Situation and Outlook

In 2002–2005, preseason management strategies were developed to not allow commercial fishing until near the midpoint of the Chinook salmon run. This interim strategy was designed to pass fish upstream for escapement, cross-border commitments to Canada, and subsistence uses in the event of a very poor run as occurred in 2000. However, a drawback to this approach is the harvest is not spread out over the entire run and commercial fishing is concentrated on only those stocks migrating during the latter half of the run. Furthermore, if the run is strong, delaying commercial fishing can result in forgone commercial harvest opportunities. The preferred strategy for managing commercial fisheries is to spread the harvest over the middle 50% of the run, starting near the first quarter point of the run. This strategy was in place before the decline in 1998. Additional harvest after the third quarter point can occur late in the season based on information from escapement projects. In 2007, based on the preseason projections, a short commercial fishing period was scheduled on the historic first quarter point (June 15) to target Chinook salmon, while the majority of the commercial harvest was spread over the middle 50% of the run.

Lower Yukon Test Fishery (LYTF) indices, subsistence harvest reports, and Pilot Station sonar passage estimates provide information ADF&G uses to assess the inseason salmon run. As the run progresses upriver, other projects provide additional run assessment information.

Assuming an approximately normal return of 5-year-old and 6-year-old fish, the 2007 run was expected to be average to below average and similar in abundance to the 2006 run. It was anticipated the run would provide for escapements, support a normal subsistence harvest, and a below average commercial harvest. Therefore, ADF&G developed a conservative preseason management strategy in 2007 with a potential harvest ranging from 30,000 to 60,000 Chinook salmon.

Ice breakup in the lower river occurred on May 18, 4 days earlier than the historic average of May 22 (1979–2004). River conditions in the lower river early in the season were characterized as having lower than normal water levels. The first subsistence catch of Chinook salmon was reported on June 2 near Emmonak. ADF&G's LYTF recorded the first Chinook salmon catch on June 3. The subsistence salmon fishing schedule was initiated on May 28 in District 1 and implemented upriver chronologically consistent with migratory timing as the run progressed upstream.

Early run assessment indicated the Chinook and summer chum salmon runs were of adequate strength to allow subsistence salmon fishing to continue on the regulatory fishing schedule. Further assessment indicated that a surplus of Chinook and summer chum salmon was available for other uses. Once it is projected that there is a surplus beyond escapement requirements and subsistence uses, the schedule typically reverts to the pre-2001 BOF subsistence fishing regulations and the commercial season is opened. However, despite a short commercial opening on June 15 in District 2 occurring earlier in the run, the subsistence schedule was not terminated until June 19, 4 days after the opening of the commercial season in that district and on June 18 in District 1. The schedule was relaxed in Districts 3–5 in the same manner it was instituted, chronologically upriver based on run timing, to afford similar protection to the early run fish as in the lower river.

According to the LYTF CPUE data, approximately 50% (the midpoint) of the Chinook salmon run had entered the lower river by June 21, 1 day later than the average date for the midpoint. The Pilot Station sonar preliminary passage estimate was approximately 125,553 Chinook salmon. The first quarter point, midpoint, and third quarter point were on June 19, June 24, and July 1, respectively. The cumulative LYTF CPUE in 2007 was 19.21. Compared to previous years, this CPUE was below the 1989–2006 average of 22.99, and below the 1989–1997 (before the run decline) and 2003–2004 average of 25.74. The first quarter point, midpoint, and third quarter point were on June 16, June 22, and June 28 respectively.

Similar to the management strategy utilized in 2006, ADF&G scheduled a short, early commercial fishing period based on the preseason projection. The opening was intended to foster early commercial interest. The first commercial fishing period in the lower river occurred in District 2 on Friday, June 15 for 3 hours with unrestricted mesh size gillnets; this was the second shortest commercial opening targeting Chinook salmon on record. The commercial harvest was 2,081 Chinook and 142 chum salmon.

The LYTF nets observed the first and largest pulse of Chinook salmon from June 14 through June 17. Based on this pulse, the Chinook salmon run was estimated to be slightly later than average.

ADF&G delayed opening the next commercial period targeting Chinook salmon until June 18, 2 days after the first quarter point of the Chinook salmon run at the LYTF in District 1. During the second pulse from June 20 to June 24, it appeared that Chinook salmon were entering the river at a slow, steady rate rather than the more typical pulse-like entry pattern, and the run was not as strong overall as anticipated. A strong first pulse followed by a weaker second pulse is unusual. During the poor runs of 1998 and

2000, the LYTF CPUE and Pilot Station sonar estimates were lower than average throughout the run. As the 2007 run progressed, it became clear that the Chinook salmon run was not developing as expected and was weaker than the run observed in 2006.

The border passage estimate from the Eagle sonar project was approximately 41,200 Chinook salmon. However, the escapement target into Canada, which is based on the Canadian fish wheel mark–recapture border passage estimate, and is currently being managed at the rebuilt escapement level of 33,000–43,000 Chinook salmon, was not met in 2007. The border passage estimate provided by the Canadian assessment project was approximately 17,000 fish. However, the escapement target had been achieved consistently from 2001–2005. In summary, the 2007 Chinook salmon run was weaker than the run of 2006, and below the recent 10-year average of 210,000 Chinook salmon..

Table 10-35 provides historic commercial Chinook catch numbers in the lower Yukon River. Lower Yukon Chinook harvests have trended downwards since the mid 1990s when nearly 120,000 Chinook were harvested. By 2001, there were no commercial Chinook openings in the Yukon River. Since 2001, the Chinook run has improved enough to allow for commercial openings with a peak harvest during that period of 52,548 in 2004. Since 2004, however, runs have weakened and catch has fallen steadily.

The 2007 lower Yukon Chinook catches were well below the five year and ten year averages in Districts one and 2 as well as overall. In District 3, the 2007 and 2007 Chinook catches were the first recorded since 1999. Historically, however, District 3 has had commercial Chinook harvests numbering more than 5,000. These data are depicted graphically in Fig. 10-43, which clearly shows that recent averages are well below historic harvest levels. Also shown clearly is the decline of commercial harvests in the 1990s, an improvement in the early 2000s, and the recent declines to harvest levels that are both below recent averages, but also considerably below historic commercial Chinook harvests in the lower Yukon.

The Upper Yukon River has historically accounting for a much smaller proportion of the total commercial Chinook catch (Table 10-36). District 4, has historically had commercial catches as high as 3,582 fish but there has been no commercial harvest in District 4 in recent years. Overall, upper Yukon commercial Chinook harvests have been well below historic levels during the 2000s, and the 2007 harvests were below 5 year and 10 year averages in all parts of the Upper Yukon. These trends are shown graphically in Fig. 10-44.

Table 10-35 Commercial Chinook Salmon Catch, by year, Lower Yukon Subdistricts, 1961-2007

Year	District 1	District 2	District 3	Lower Yukon Total
1961	84,466	29,026	4,368	117,860
1962	67,099	22,224	4,687	94,010
1963	85,004	24,221	7,020	116,245
1964	67,555	20,246	4,705	92,506
1965	89,268	23,763	3,204	116,235
1966	70,788	16,927	3,612	91,327
1967	104,350	20,239	3,618	128,207
1968	79,465	21,392	4,543	105,400
1969	71,688	14,756	3,595	90,039
1970	56,648	17,141	3,705	77,494
1971	86,042	19,226	3,490	108,758
1972	70,052	17,855	3,841	91,748
1973	56,981	13,859	3,204	74,044
1974	71,840	17,948	3,480	93,268
1975	44,585	11,315	4,177	60,077
1976	62,410	16,556	4,148	83,114
1977	69,915	16,722	3,965	90,602
1978	59,006	32,924	2,916	94,846
1979	75,007	41,498	5,018	121,523
1980	90,382	50,004	5,240	145,626
1981	99,506	45,781	4,023	149,310
1982	74,450	39,132	2,609	116,191
1983	95,457	43,229	4,106	142,792
1984	74,671	36,697	3,039	114,407
1985	90,011	48,365	2,588	140,964
1986	53,035	41,849	901	95,785
1987	76,643	47,458	2,039	126,140
1988	56,120	35,120	1,767	93,007
1989	61,570	33,166	1,645	96,381
1990	51,199	33,061	2,341	86,601
1991	56,332	39,260	2,344	97,936
1992	74,212	38,139	1,819	114,170
1993	49,286	37,293	1,501	88,080
1994	62,241	41,692	1,114	105,047
1995	76,106	41,458	0	117,564
1996	56,642	30,209	0	86,851
1997	66,384	39,363	0	105,747
1998	25,413	16,806	0	42,219
1999	37,161	27,133	538	64,832
2000	4,735	3,783	0	8,518
2001	0	0	0	0
2002	11,087	11,434	0	22,521
2003	22,709	14,220	0	36,929
2004	28,403	24,145	0	52,548
2005	16,694	13,413	0	30,107
2006	23,748	19,843	315	43,906
2007	18,616	13,306	190	32,112
5 year avg.	**20,528**	**16,611**	**63**	**37,202**
10 year avg.	**23,633**	**17,014**	**85**	**40,733**

Source: ADF&G

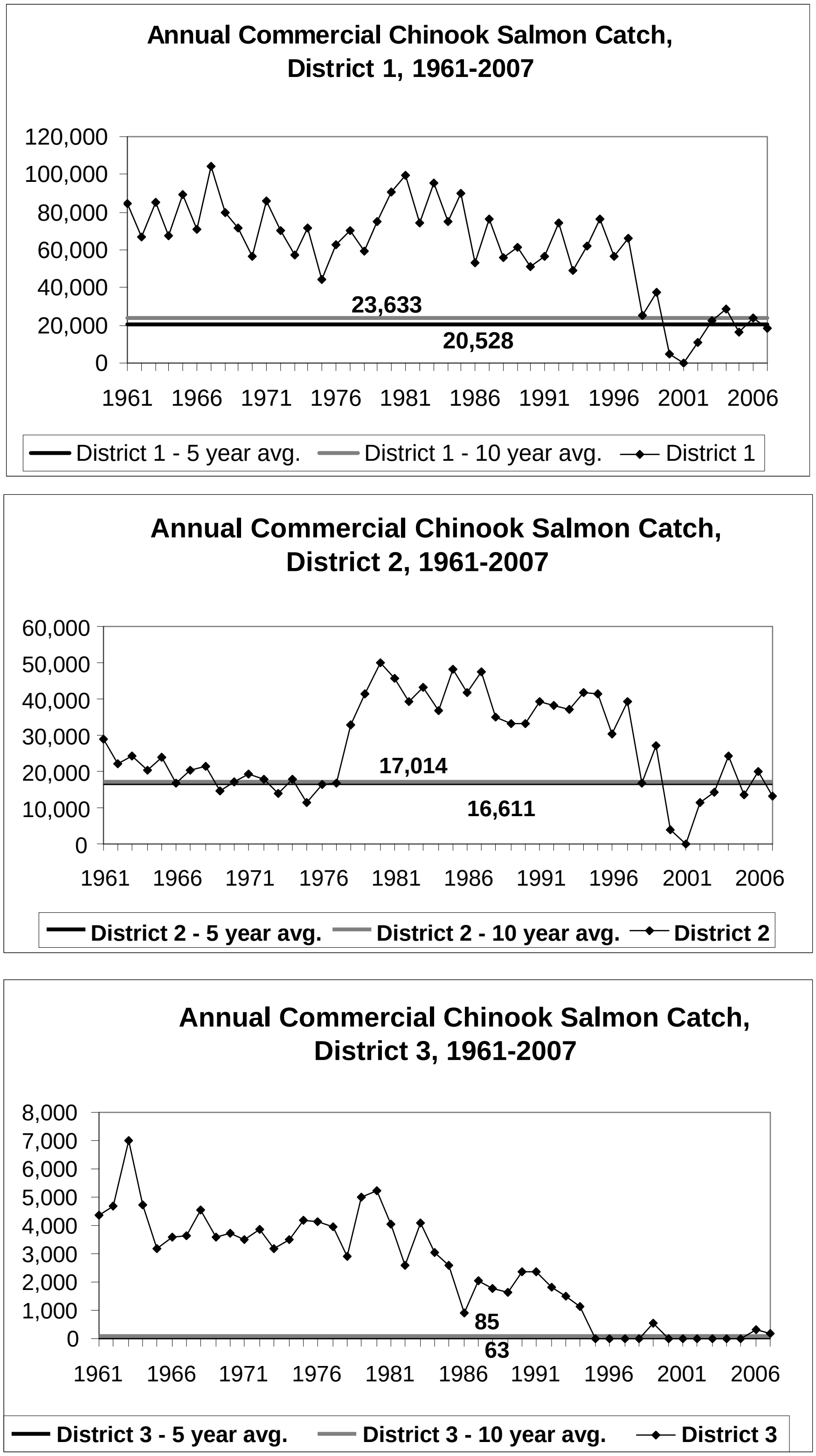
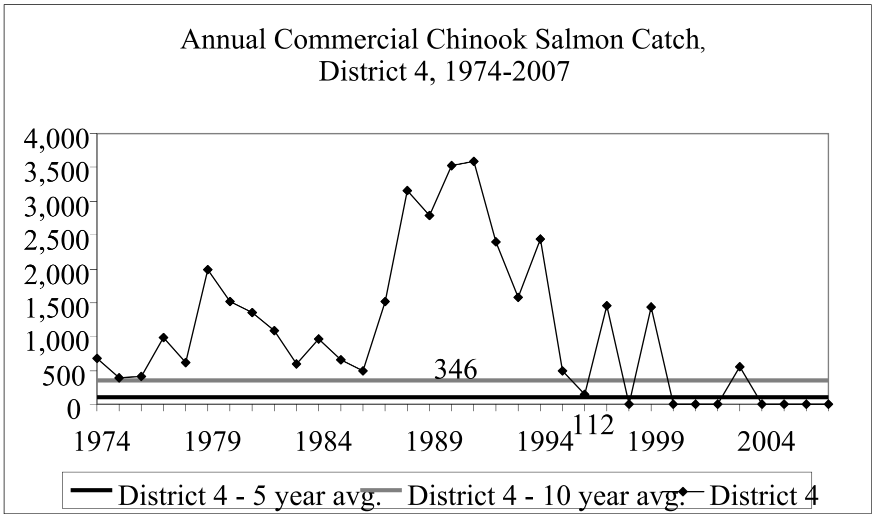


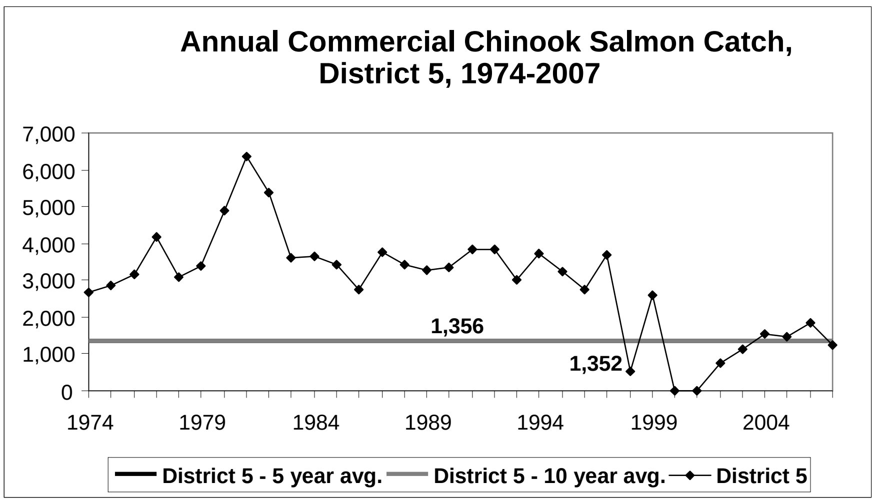
Fig. 10-43 Lower Yukon Annual Commercial Chinook Catch by District, 1961-2007
Source: ADF&G.

Table 10-36 Commercial Chinook Salmon Catch by year, Upper Yukon Subdistricts, 1974–2007

Year	District 4	District 5	District 6	Upper Yukon Total
1962	-	-	-	1,804
1963	-	-	-	724
1964	-	-	-	803
1965	-	-	-	1,081
1966	-	-	-	1,863
1967	-	-	-	1,988
1968	-	-	-	1,449
1969	-	-	-	1,126
1970	-	-	-	988
1971	-	-	-	1,651
1972	-	-	-	1,749
1973	-	-	-	1,092
1974	685	2,663	1,473	1,309
1975	389	2,872	500	4,821
1976	409	3,151	1,102	3,761
1977	985	4,162	1,008	4,662
1978	608	3,079	635	6,155
1979	1,989	3,389	772	4,322
1980	1,521	4,891	1,947	6,150
1981	1,347	6,374	987	8,359
1982	1,087	5,385	981	8,708
1983	601	3,606	911	7,453
1984	961	3,669	867	5,118
1985	664	3,418	1,142	5,497
1986	502	2,733	950	5,224
1987	1,524	3,758	3,338	4,185
1988	3,159	3,436	762	8,620
1989	2,790	3,286	1,741	7,357
1990	3,538	3,365	2,156	7,817
1991	3,582	3,826	1,072	9,059
1992	2,394	3,855	753	8,480
1993	1,577	3,008	1,445	7,002
1994	2,443	3,744	2,606	6,030
1995	499	3,242	2,747	8,793
1996	137	2,757	447	6,488
1997	1,457	3,678	2,728	3,341
1998	0	517	963	7,863
1999	1,437	2,604	690	1,480
2000	0	0	0	4,731
2001	0	0	0	0
2002	0	771	836	0
2003	562	1,134	1,813	1,607
2004	0	1,546	2,057	3,509
2005	0	1,469	453	3,603
2006	0	1,839	84	1,922
2007	0	1,241	281	1,923
5 year avg.	**112**	**1,352**	**1,049**	**2,128**
10 year avg.	**346**	**1,356**	**962**	**2,806**

Source: ADF&G





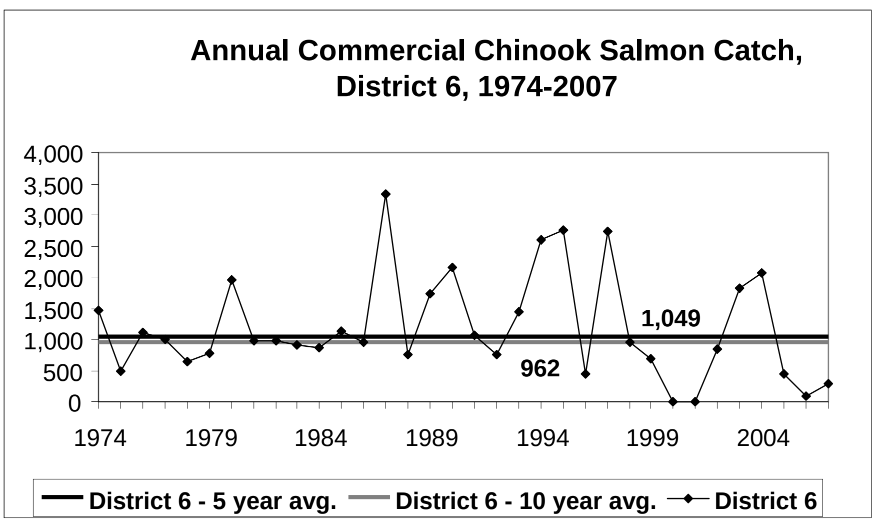
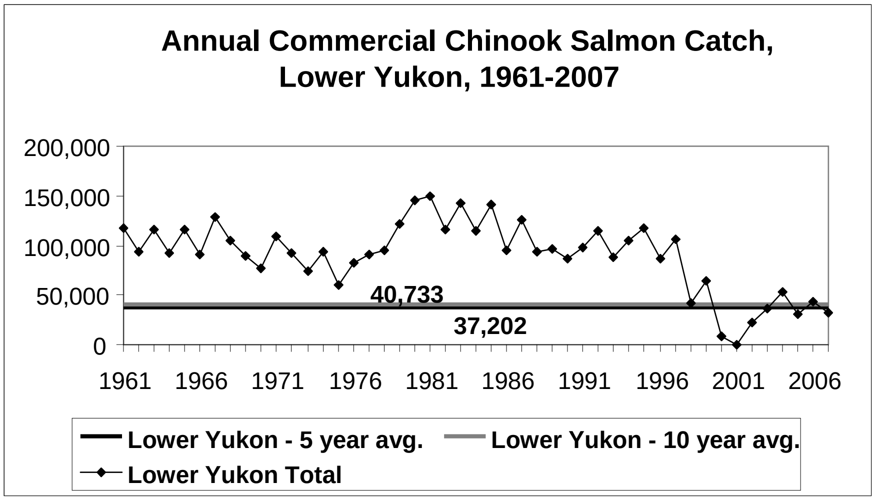
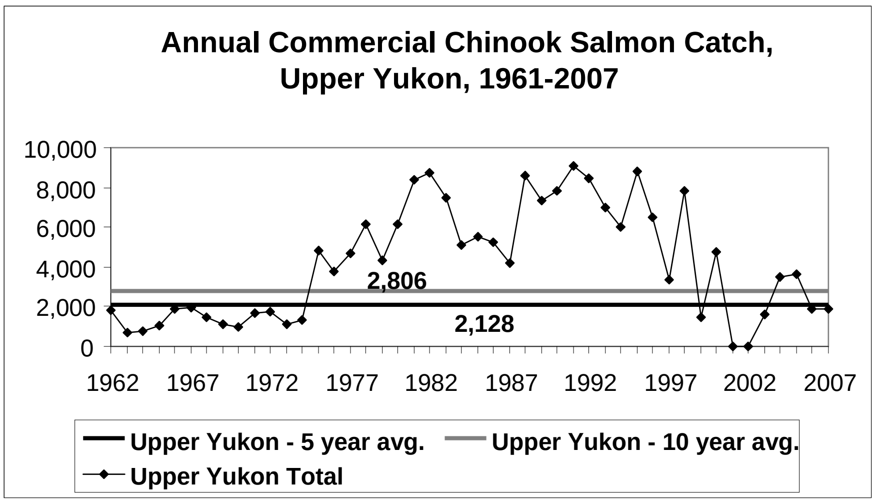


Fig. 10-44 Upper Yukon Annual Commercial Chinook Catch by District, 1961-2007
Source: ADF&G





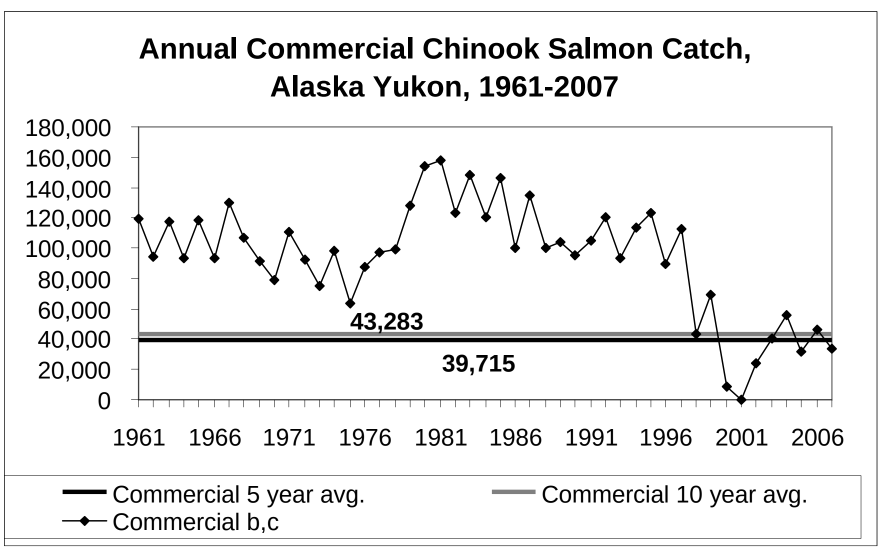


Fig. 10-45 Lower, Upper, and Alaska Yukon Total Annual Commercial Chinook Salmon Catch, 1961-2007. Source: ADF&G

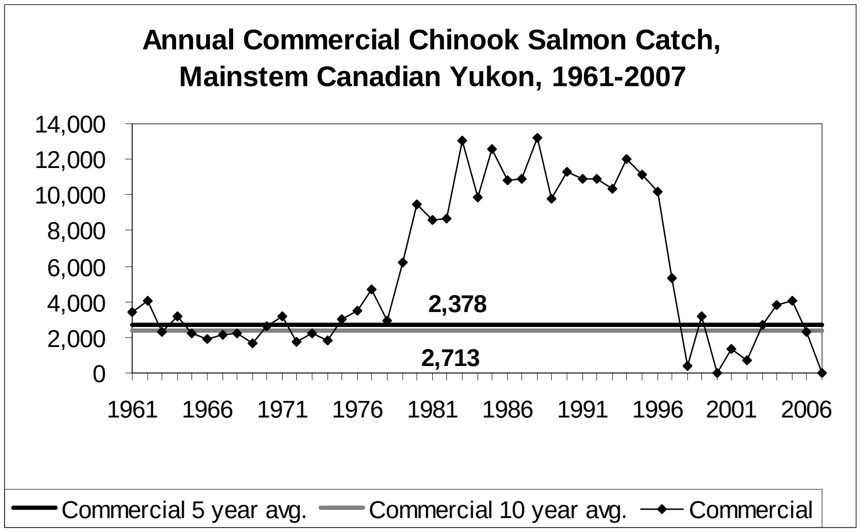


Fig. 10-46 Annual Commercial Chinook Salmon Catch, Mainstem Canadian Yukon, 1961-2007

Fig. 10-46 displays annual commercial Chinook salmon catch for the mainstem of the Yukon River in Canada from 1961-2007. The underlying data for this figure is displayed in Table 10-31 at the beginning of this section. Canadian Yukon commercial harvest has historically been much lower than the commercial Chinook harvests in the U.S. portion of the Yukon River. Similar to the Alaska Yukon, peak harvests occurred in the 1980s and into the middle 1990s before declining rapidly in the late 1990s. Some improvement occurred in the early 2000s; however, Canadian Yukon commercial harvest fell precipitously from 2005 to 2007, when no commercial Chinook harvest was allowed in Canada.

Table 10-37 (ADF&G 2007 NMFS data request) (ADF&G 2007 NMFS data request) provides historic data on Yukon Chinook and Summer chum commercial sales value, from 1977-2007. In the lower Yukon River, Chinook commercial harvest value peaked in 1992 at just under $14 million, approximately 99% of which came from the lower Yukon. As harvest trended downward in the late 1990s so did Chinook value and, by 2001, there were no commercial Chinook openings in the Yukon River, partly due to the need to conserve chum stocks. Since 2001, the Chinook and chum runs have improved enough to allow for commercial openings; however, the catch, and value, are still much lower than historic levels and the 2007 harvest was worth just under $2 million. A review of the summer chum data shows that the value of the summer chum fishery has fallen precipitously since the late 1980s, when the fishery was worth about $6.2 million. Also evident is that the Chinook fishery is often more than ten times as valuable as the chum fishery. This fact highlights the importance of the commercial Chinook fishery as a major source of cash income in the region.

Table 10-38 provides historic data on Yukon fall chum and coho commercial fisheries. The data shows that these fisheries have fallen in real commercial ex-vessel gross value from historic highs in the late 1980s and have had several periods of no commercial harvest since then. From 2000 through 2002, there were no commercial harvest of fall chum and coho in the Yukon River. Subsequently, harvests have been allowed and the value of these fisheries now exceeds five and ten year averages. Total value remains well below historic highs, as reflected in 2007 as seen in Chinook and summer chum values.

Table 10-37 Real Gross Ex-vessel Revenue from Commercial Salmon Fishing to Yukon Area Fishermen, Summer Season, 1977-2007. (Values are inflation adjusted to 2007 value using the GDP deflator)

	Yukon Chinook			Yukon Summer Chum				
Year	Lower Value	Upper Value	Subtotal	Lower Value	Upper Value	Subtotal	Total Season	Total Value
1977	$5,153,101	$416,400	$5,569,501	$2,819,404	$857,849	$3,677,252	$9,246,753	$11,944,752
1978	$5,357,705	$173,838	$5,531,543	$5,417,227	$1,714,890	$7,132,118	$12,663,661	$15,011,784
1979	$6,674,002	$300,029	$6,974,031	$5,416,045	$1,074,542	$6,490,586	$13,464,618	$17,320,016
1980	$7,548,566	$251,675	$7,800,240	$2,275,655	$1,388,878	$3,664,533	$11,464,774	$12,819,882
1981	$8,947,968	$417,738	$9,365,706	$5,548,476	$1,416,634	$6,965,109	$16,330,815	$20,282,915
1982	$7,188,514	$310,385	$7,498,899	$2,361,259	$863,889	$3,225,148	$10,724,047	$12,735,484
1983	$7,512,261	$193,761	$7,706,022	$3,182,629	$517,295	$3,699,924	$11,405,946	$12,780,338
1984	$6,209,905	$181,037	$6,390,942	$1,639,483	$677,031	$2,316,513	$8,707,455	$10,028,082
1985	$7,371,493	$141,860	$7,513,354	$1,772,654	$1,019,273	$2,791,927	$10,305,281	$12,048,912
1986	$5,315,732	$123,213	$5,438,945	$2,933,162	$1,064,952	$3,998,114	$9,437,059	$10,515,510
1987	$8,875,455	$222,659	$9,098,115	$2,147,560	$529,053	$2,676,613	$11,774,728	$11,774,728
1988	$8,637,675	$224,936	$8,862,610	$7,906,196	$1,919,188	$9,825,384	$18,687,995	$21,151,840
1989	$7,893,260	$164,787	$8,058,047	$3,378,212	$2,097,756	$5,475,969	$13,534,016	$15,506,158
1990	$7,070,514	$154,431	$7,224,945	$729,763	$743,021	$1,472,784	$8,697,729	$9,559,325
1991	$10,101,380	$137,655	$10,239,035	$1,108,583	$888,761	$1,997,343	$12,236,378	$13,537,087
1992	$13,792,842	$234,104	$14,026,947	$840,808	$727,534	$1,568,342	$15,595,288	$15,697,367
1993	$6,612,781	$153,291	$6,766,072	$307,039	$275,885	$582,924	$7,348,997	$7,348,997
1994	$5,527,554	$164,755	$5,692,310	$105,010	$525,919	$630,929	$6,323,239	$6,346,116
1995	$6,908,500	$113,107	$7,021,607	$313,884	$1,377,569	$1,691,453	$8,713,060	$9,289,797
1996	$4,451,867	$60,286	$4,512,153	$113,503	$1,232,031	$1,345,534	$5,857,687	$6,117,579
1997	$6,835,691	$138,851	$6,974,542	$70,904	$121,410	$192,313	$7,166,856	$7,386,098
1998	$2,370,866	$21,440	$2,392,306	$32,765	$1,018	$33,784	$2,426,090	$2,426,090
1999	$6,053,044	$91,061	$6,144,105	$24,071	$2,103	$26,175	$6,170,279	$6,219,353
2000	$868,289	$0	$868,289	$10,331	$0	$10,331	$878,620	$878,620
2001 [a]	$0	$0	$0	$0	$0	$0	$0	$0
2002	$1,942,319	$23,826	$1,966,145	$4,987	$7,093	$12,080	$1,978,225	$1,978,225
2003	$2,104,390	$46,061	$2,150,451	$1,783	$7,736	$9,519	$2,159,970	$2,196,693
2004	$3,349,205	$41,859	$3,391,063	$9,712	$10,544	$20,256	$3,411,319	$3,423,476
2005	$2,067,232	$25,855	$2,093,086	$11,653	$14,274	$25,927	$2,119,013	$2,614,435
2006	$3,377,787	$33,498	$3,411,285	$24,496	$44,130	$68,626	$3,479,911	$3,785,704
2007 [b]	$1,939,114	$27,190	$1,966,304	$220,715	$34,421	$255,136	$2,221,440	$2,511,840
2002-2006 Average	$2,568,186	$34,220	$2,602,406	$10,526	$16,756	$27,282	$2,629,688	$2,799,707
1997-2006 Average	$2,896,882	$42,245	$2,939,127	$19,070	$20,831	$39,901	$2,979,028	$3,090,869

a No commercial salmon fisheries occurred in the Yukon River in 2001.
b Preliminary.

Fig. 10-47, below, depicts the comparison between Yukon Chinook commercial value and total commercial value from all salmon fisheries from 1977-2007. Also shown is the percent of total value that the commercial Chinook value represents. Since the early 1990s, Chinook has accounted for 70% to nearly 100% of the total commercial value. Also clearly shown is the decline in Chinook value and total value during the 1990s, as well as the fall to zero when all the fisheries were closed in 2001. As Chinook catch has improved since 2001, so has Chinook value and total value; however, with the decline in

Chinook catch and value in 2007, it is not clear that the improvements since 2001 will be sustained as a continuing upward trend. The 2008 outlook for the commercial Chinook fishery (see below) does not alleviate this concern.

Table 10-38 Real Gross Ex-vessel Revenue from Commercial Salmon Fishing to Yukon Area fishermen, Fall Season, 1977-2007. (Values are inflation adjusted to 2007 value using the GDP Deflator)

	Yukon Fall Chum			Yukon Coho			
Year	Lower Value	Upper Value	Subtotal	Lower Value	Upper Value	Subtotal	Total Season
1977	$2,011,300	$285,977	$2,297,276	$394,422	$6,301	$400,723	$2,697,999
1978	$1,809,341	$269,604	$2,078,945	$253,212	$15,966	$269,178	$2,348,123
1979	$2,797,872	$840,010	$3,637,882	$201,580	$15,937	$217,517	$3,855,399
1980	$872,768	$438,614	$1,311,382	$38,470	$5,257	$43,727	$1,355,109
1981	$3,043,760	$722,216	$3,765,976	$176,878	$9,246	$186,124	$3,952,100
1982	$1,614,875	$101,602	$1,716,476	$259,123	$35,839	$294,961	$2,011,437
1983	$1,084,588	$236,641	$1,321,230	$32,109	$21,053	$53,162	$1,374,392
1984	$662,143	$182,918	$845,061	$452,885	$22,681	$475,566	$1,320,627
1985	$1,089,333	$305,756	$1,395,089	$302,544	$45,998	$348,542	$1,743,631
1986	$670,658	$50,904	$721,561	$355,955	$934	$356,889	$1,078,451
1987	$0	$0	$0	$0	$0	$0	$0
1988	$1,009,715	$239,189	$1,248,904	$1,161,007	$53,934	$1,214,940	$2,463,845
1989	$1,086,719	$341,212	$1,427,931	$492,481	$51,730	$544,211	$1,972,142
1990	$349,305	$256,612	$605,917	$201,374	$54,304	$255,678	$861,595
1991	$621,121	$223,659	$844,780	$425,382	$30,547	$455,929	$1,300,709
1992	$0	$75,026	$75,026	$0	$27,052	$27,052	$102,078
1993	$0	$0	$0	$0	$0	$0	$0
1994	$0	$11,292	$11,292	$0	$11,586	$11,586	$22,878
1995	$240,399	$217,708	$458,107	$103,961	$14,671	$118,631	$576,738
1996	$61,940	$57,935	$119,874	$123,416	$16,601	$140,017	$259,892
1997	$108,517	$9,095	$117,612	$100,299	$1,332	$101,630	$219,243
1998	$0	$0	$0	$0	$0	$0	$0
1999	$43,576	$1,071	$44,647	$4,426	$0	$4,426	$49,073
2000	$0	$0	$0	$0	$0	$0	$0
2001 [a]	$0	$0	$0	$0	$0	$0	$0
2002	$0	$0	$0	$0	$0	$0	$0
2003	$6,740	$3,821	$10,561	$20,432	$5,730	$26,162	$36,723
2004	$1,231	$927	$2,158	$3,033	$6,966	$9,998	$12,156
2005	$335,375	$50,999	$386,374	$88,735	$20,313	$109,048	$495,422
2006	$208,021	$34,704	$242,725	$51,635	$11,433	$63,068	$305,793
2007 [b]	$144,256	$16,907	$161,163	$127,869	$1,368	$129,237	$290,400
2002-2006 Average	$110,273	$18,090	$128,364	$32,767	$8,888	$41,655	$170,019
1997-2006 Average	$70,346	$10,062	$80,408	$26,856	$4,577	$31,433	$111,841

a No commercial salmon fisheries occurred in the Yukon River in 2001.
b Preliminary.

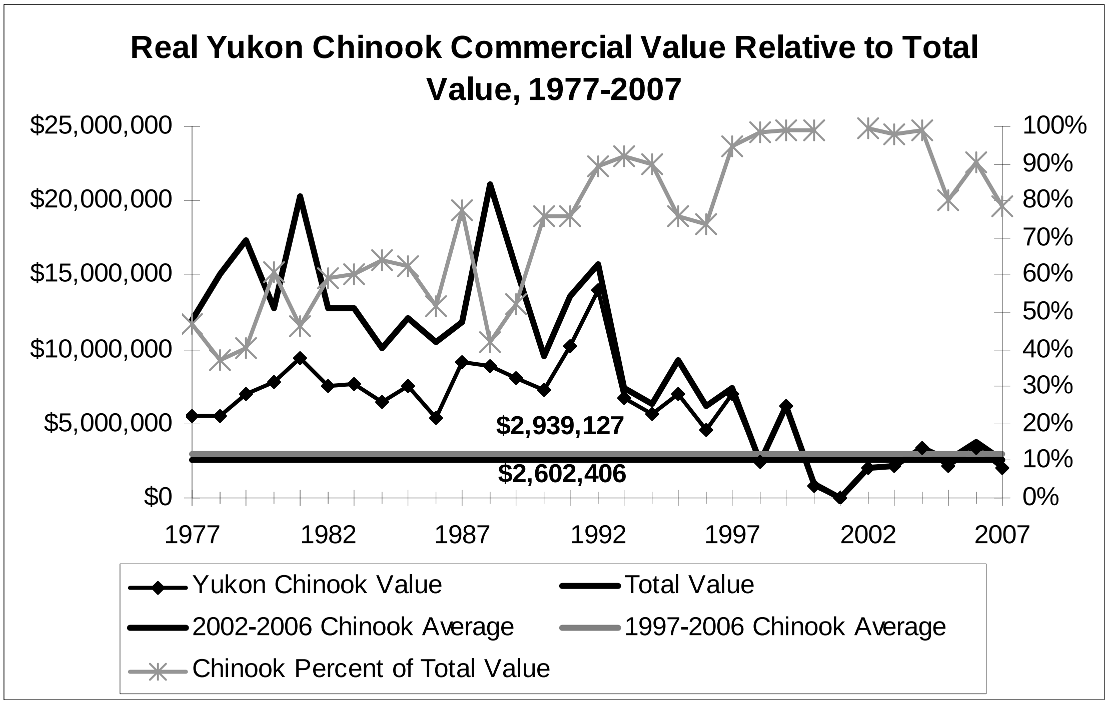


Fig. 10-47 Real Yukon Chinook Commercial Value Relative to Total Value, 1977-2007. (Values are inflation adjusted to 2007 value using the GDP deflator)

Personal Use and Sport Fishery Situation and Outlook

Subdistrict 6-C falls entirely within the Fairbanks Nonsubsistence Area and is managed under personal use regulations. Personal use salmon fishing permits are required in Subdistrict 6-C and can be obtained from ADF&G's office in Fairbanks. Personal use fishermen must possess a valid State of Alaska resident sport fishing license and report their harvests to ADF&G each week. Only one personal use salmon permit per household is allowed annually. The annual possession limit per permit holder is 10 Chinook salmon and 75 chum salmon for periods through August 15, and 75 chum and coho salmon in combination for the time period after August 15. Subdistrict 6-C fishery harvest limits are 750 Chinook, 5,000 summer chum, and 5,200 fall chum and coho salmon combined. If a harvest limit is reached inseason, the Subdistrict 6-C personal use fishery will be closed.

The personal use fishing schedule is two, 42-hour periods per week by regulation and fishing is from 6:00 p.m. Monday until 12:00 noon Wednesday and from 6:00 p.m. Friday until 12:00 noon Sunday. Whitefish and suckers may also be taken with dip nets under personal use fishing regulations and a separate personal use whitefish/sucker permit is required.

Annual personal use and sport Chinook salmon catch in the Alaska Yukon is shown in Fig. 10-48, and sport catch in the mainstem Canadian Yukon is shown in Fig. 10-49. Alaska Yukon catches had peaks in the late 1980s, again in the mid 1990s, and then declined, along with commercial catches, in the late 1990s and early 2000s. Catches rebounded considerably in 2004, but have declined since then. In the mainstem Canadian Yukon, historic data shows a flat catch rate that then peaked in the late 1990s before mimicking the declines seen in other parts of the Yukon through 2000, when no sport catch was recorded. From 2000 through 1996 catches improved continuously before the low returns in 2007 resulted in no sport Chinook catch in the mainstem Canadian Yukon.

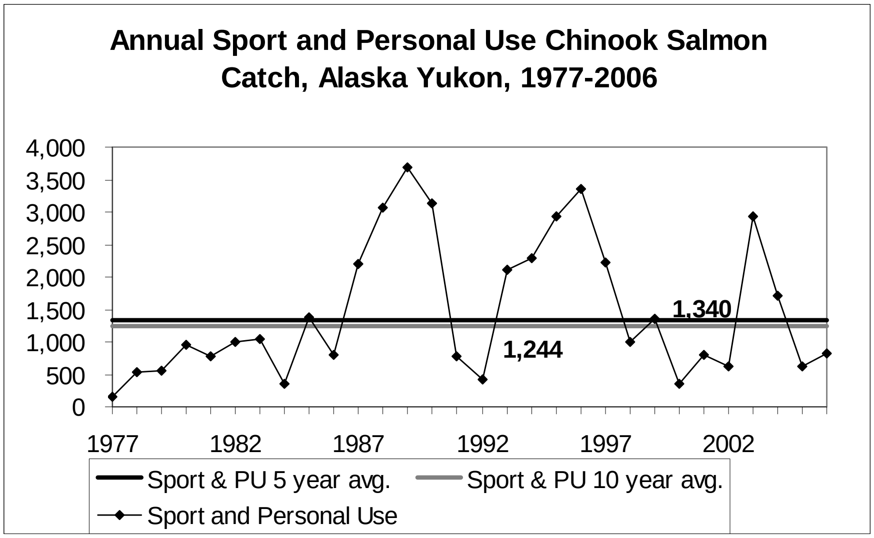


Fig. 10-48 Annual Sport and Personal Use Chinook Salmon Catch, Alaska Yukon, 1977-2006

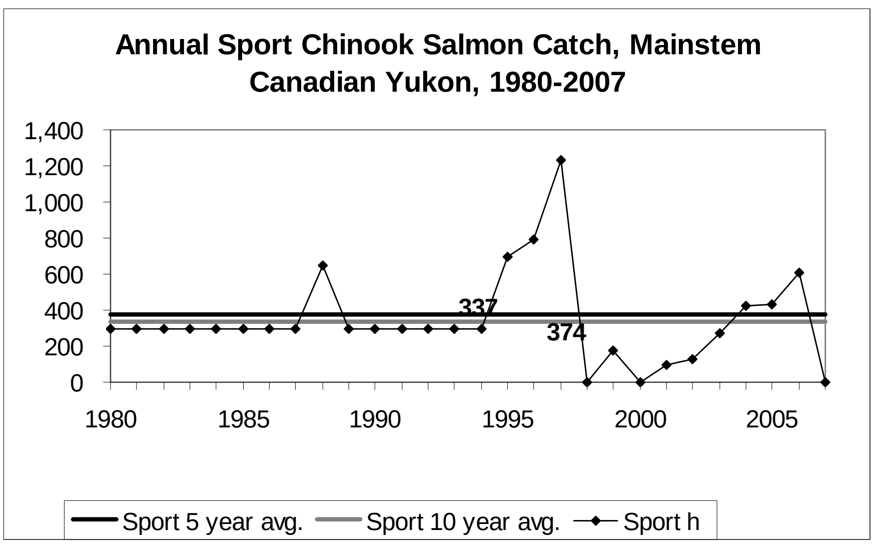


Fig. 10-49 Sport and Personal Use Chinook Salmon Catch, Alaska Yukon, 1980-2006

Yukon River Chinook Salmon Run Synopsis, 2008[53]

The 2008 total run of approximately 151,000 Chinook salmon was insufficient to fully support any directed fisheries, including subsistence. The 2008 run was approximately 36% below the recent 5-year (2003-2007) average of 235,000 Chinook salmon and 21% below the 10-year (1998-2007) average of 190,000. The 2008 run was expected to be below average and similar to the 2007 run of approximately 178,000. However, the run was anticipated to provide for escapements, support a normal subsistence harvest, and a small commercial harvest. By June 20, the historical midpoint of the run, all indicators pointed to a weak Chinook salmon run which was disappointing because of large spawning escapement in

[53] Excerpted from Memo, dated September 10, 2007, to John Hilsinger of ADF&G from Western Alaska area managers regarding Western Alaska Chinook stock status in 2008.

the parent years that produced this season's run. At that time, it was clear that there was no surplus available for a directed Chinook salmon commercial fishery and that sport and subsistence fisheries on the mainstem Yukon river would need to be reduced to provide adequate numbers of Chinook salmon on the spawning grounds.

Sport fishing bag and possession limits were reduced from 3 to 1 Chinook salmon on the mainstem Yukon River, however, the sport fish harvest only occurs in a few tributaries and is very small (<3000). Additionally, commercial fishing targeting an abundant summer chum salmon run with gillnets restricted to 6 inch maximum mesh size was delayed until July 2 in order to allow most of the Chinook run to pass through. This resulted in reducing what could have been a harvest of greater than 300,000 chum salmon to 126,000. Approximately 4,300 Chinook salmon were taken incidentally.

In an effort to conserve Chinook salmon, it was also necessary to reduce the subsistence fishery (typically around 50,000 fish) throughout the mainstem of the Yukon River. Subsistence fishing time was reduced by half for approximately two weeks implemented chronologically with the Chinook migration and mesh size restrictions (<6-inch mesh) were implemented in the lower river districts. Fishermen were affected from the mouth of the river to across the border into Canada. Fishermen reported harvesting as little as 40% of their needs in some locations in Alaska and the Aboriginal Fishery in Canada harvested half of their average take. Historically, Chinook salmon subsistence fishing restrictions have only been implemented once before, in July of 2000 after the run was nearly over.

High water hampered efforts to accurately assess escapement in 2008 from tower counts and aerial surveys; thus, most escapement goals could not be assessed. Based on the available data, it appears that the lower end of the BEGs in the Chena and Salcha rivers, the largest producing tributaries of Chinook salmon in the Alaska portion of the drainage, were met. Typically, about 50% of the Chinook salmon production occurs in Canada; hence, the US/Canada Yukon River Panel agreed to one year Canadian Interim Management Escapement Goal (IMEG) of >45,000 Chinook salmon based on the Eagle sonar program is a top priority. The preliminary estimated escapement into Canada is approximately 32,500 or 28% below the goal.

10.3.6 Yukon Delta Region Community Importance of the Salmon Fisheries

Table 10-39 reprints an ADOLWD analysis of local resident crew members by census areas with the region defined by ADOLWD as the Yukon Delta Region. The Yukon Delta Region includes the communities, Boroughs, and Census areas associated with the fisheries of the lower Yukon River area. Overall, in the Yukon Delta region 1,297 crew licenses were purchased in 2005; nearly equal numbers of licenses were purchased in each of the Bethel and Wade Hampton Census Areas.

Table 10-39 Local Resident Crew Members, Yukon Region, 2001–2006

Borough/Census Area	Local Residents Who Bought Commercial Crew Licenses					
	2000	2001	2002	2003	2004	2005
Bethel Census Area	1,074	N/A	500	523	583	654
Wade Hampton Census Area	744	N/A	547	639	526	643
Local Resident Total	1,818	N/A	1,047	1,162	1,109	1,297

N/A: Crew member licensing data from 2001 was not released by CFEC because of data problems

Note: 2005 data are preliminary.

Source: Commercial Fisheries Entry Commission

The crew counts shown above are in addition to limited entry commercial salmon permits that are actively used in the area's fisheries, which are shown in Table 10-40. Overall, in the Northern Region 1,203 permit holders were active in 2006 with 1,048 of these having fished in the region. These numbers represent a slight decline over 2005, which was the peak of the period 2001–2006.

Table 10-40 Fishermen by Residency, Yukon Region, 2001–2006

Borough/Census Area	Residents Who Fished Their Permits					
	2001	**2002**	**2003**	**2004**	**2005**	**2006**
Bethel Census Area	803	635	667	676	693	658
Wade Hampton Census Area	44	535	549	520	547	545
Local Resident Total	847	1,170	1,216	1,196	1,240	1,203
Region's Harvest Total	595	1,007	1,045	1,055	1,092	1,048

Notes: "Region's Harvest Total" represents total fishermen who fished in the region's fisheries. Permit holders do not necessarily work in their local fisheries.

Source: Commercial Fisheries Entry Commission

Fig. 10-50 depicts Yukon Delta Region resident permit holder salmon fishery gross earnings by community, as tabulated by ADOLWD. None of the communities in the region have gross earnings of resident permit holders that exceed $1 million from the salmon fisheries. However, earnings from salmon fishing are spread throughout many communities in both the Wade Hampton and Bethel Census Areas.

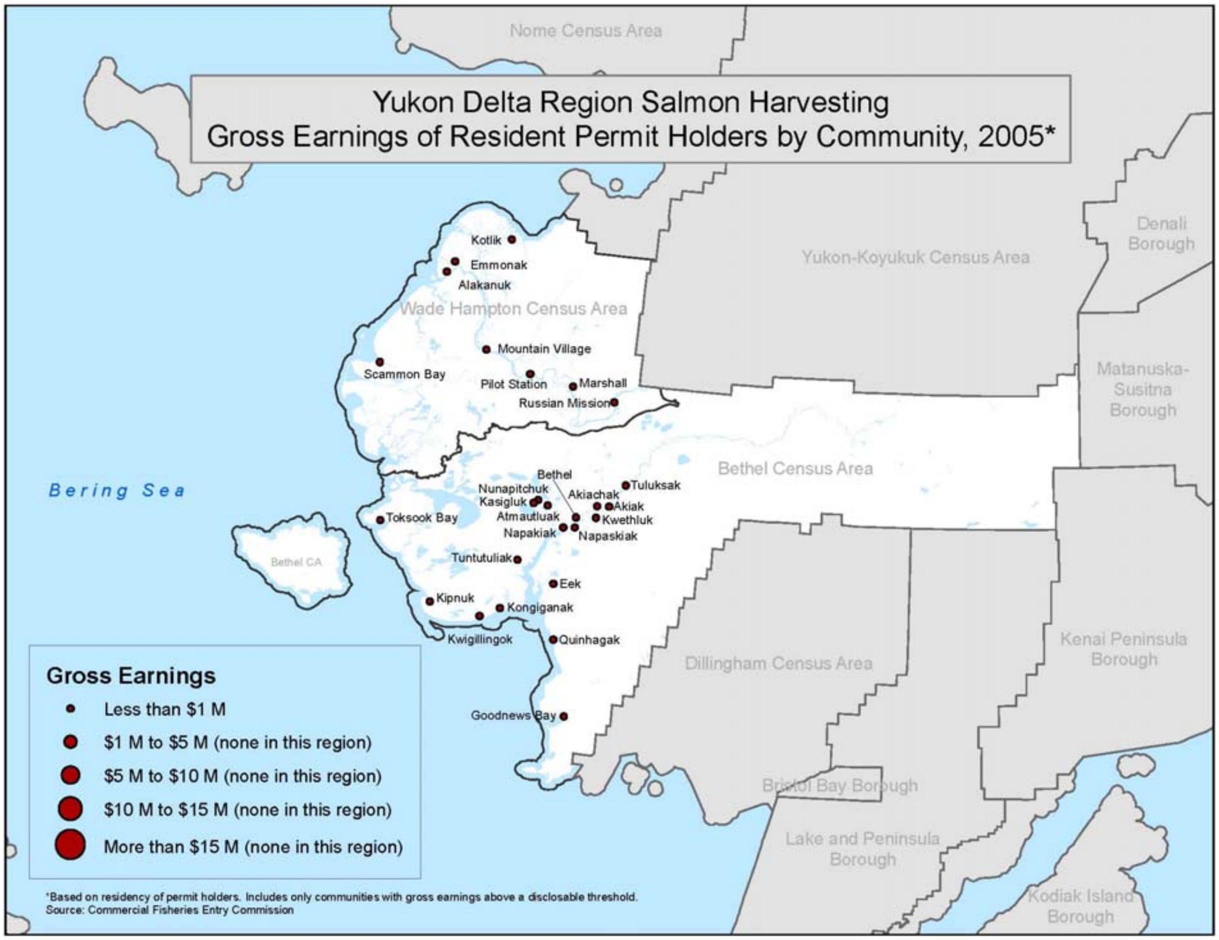


Fig. 10-50 Yukon Delta Region Salmon Harvesting Gross Earnings of Resident Permit Holders by Community, 2005

ADOLWD has also tabulated data on fish harvesting employment and earning by gear type in the Yukon Delta Region, which is reprinted with permission (Windish-Cole 2008) in Table 10-41. Salmon fisheries of the Yukon Delta region have had an increasing total harvesting workforce (permit holders and crew) over the past several years. In 2005, workforce in the set-net salmon fishery peaked at 1,596 total workers. The total workforce for the region is slightly larger than the set-net number and it is not clear from the ADOLWD data what fishery contributes the additional workforce. Total gross earning of permit holders shows the decline in value, due to poor harvests, that occurred in the early 2000s, and also shows how that gross earnings improved in the mid 2000s. However, ADOLWD has not compiled this data for 2006 or 2007.

Table 10-41 Fish Harvesting Employment and Gross Earnings by Gear Type, 2000-2005, Yukon Region.

Year	Gear Type	Vessels[1]	Total Estimated Workforce[2]	Total Gross Earning of Permit Holders[3]	Percent of Gross Earnings Earned by Nonresident Permit Holders
2000	Set-net	-	952	$1,190,875	ND
2001	Set-net	-	698	$721,157	ND
2002	Set-net	-	540	$599,446	ND
2003	Set-net	-	1,142	$1,890,795	ND
2004	Set-net	-	1,474	$3,240,140	ND
2005	Set-net	-	1,596	$2,908,123	ND
2000	Total	63	1,369	$2,107,980	ND
2001	Total	21	751	$841,656	ND
2002	Total	31	1,007	$2,255,956	ND
2003	Total	26	1,208	$2,939,374	ND
2004	Total	15	1,678	$4,517,680	ND
2005	Total	20	1,646	$3,576,085	ND

[1]Skiffs and small vessels are usually not registered as commercial vessels and are therefore not counted in these data.
[2]'Workforce' refers to the number of fisherman fishing permits plus the requisite crew members needed for the permit(s) they fish. Regional crew member counts are estimates derived by applying a crew factor to catch data.
[3]Gross earnings, or revenue, are currently the most reliable data available, but are not directly comparable to wages as expenses have not been deducted.

Source: Commercial Fisheries Entry Commission.

Fig. 10-51 shows the locations of canneries and land based seafood processors in the Yukon Delta Region in 2006. As is shown in the figure, there are as many as 10 processing facilities in the region. Note, however, that these data do not include any floating processors or buying stations that may be in operation in the area.

Yukon Delta Region Fish harvesting employment by species and month, also tabulated by ADOLWD, are shown in
Table 10-42. Salmon fisheries dominate overall employment in the region, with the greatest employment in the summer months of June, July and August. In 2006, for example, 1,900 individuals were engaged in fish harvesting activity in June as compared to the monthly average of 467. Groundfish, halibut and herring fisheries also provide harvesting employment in the region. Of note is that there is little or no fish harvesting employment in the region from October through April. Thus, all fish harvesting related income occurs from May through September.

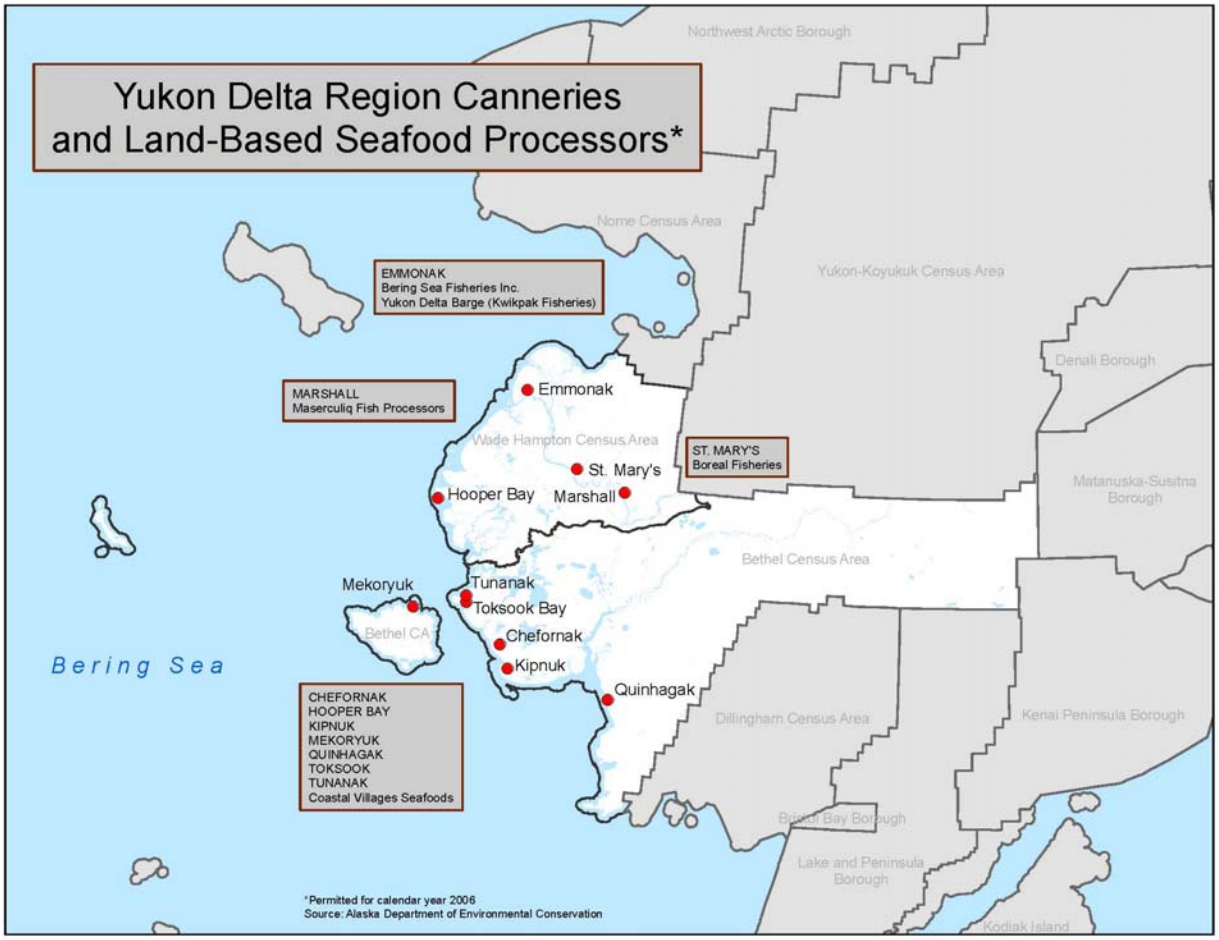


Fig. 10-51 Yukon Delta Region Canneries and Land Based Seafood Processors.

Table 10-42 Fish Harvesting Employment by Species and Month, 2000 - 2006 Yukon Region

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Monthly Average
All Species[1]													
2000	0	0	0	0	310	1,808	714	1,198	0	0	0	0	336
2001	0	0	0	0	58	463	302	958	0	0	0	0	148
2002	0	0	0	0	155	1,332	216	768	0	0	0	0	206
2003	0	0	0	0	118	1,302	1,100	992	216	0	0	0	311
2004	0	0	0	0	108	1,396	1,264	914	438	0	0	0	343
2005	0	8	0	0	90	2,034	1,783	1,329	338	26	0	0	467
2006[2]	0	0	0	0	120	1,900	1,603	1,503	118	0	2	0	437
Groundfish													
2005	0	8	0	0	15	0	40	0	0	0	0	0	5
2006	0	0	0	0	107	5	0	0	0	0	0	0	9
Halibut[2]													
2005	0	0	0	0	0	245	261	87	0	0	0	0	49
2006[2]	0	0	0	0	0	245	261	87	0	0	0	0	49
Herring													
2000	0	0	0	0	310	328	0	0	0	0	0	0	53
2001	0	0	0	0	58	173	0	0	0	0	0	0	19
2002	0	0	0	0	155	60	0	0	0	0	0	0	18
2003	0	0	0	0	118	0	0	0	0	0	0	0	10
2004	0	0	0	0	108	0	0	0	0	0	0	0	9
2005	0	0	0	0	75	13	0	0	0	0	0	0	7
2006	0	0	0	0	13	20	0	0	0	0	0	0	3
Salmon													
2000	0	0	0	0	0	1,480	714	1,198	0	0	0	0	283
2001	0	0	0	0	0	290	302	958	0	0	0	0	129
2002	0	0	0	0	0	1,272	216	768	0	0	0	0	188
2003	0	0	0	0	0	1,302	1,100	992	216	0	0	0	301
2004	0	0	0	0	0	1,396	1,264	914	438	0	0	0	334
2005	0	0	0	0	0	1,776	1,482	1,242	338	0	0	0	403
2006	0	0	0	0	0	1,630	1,342	1,416	108	0	0	0	375

[1]A small number of fishermen in unknown or other fisheries are included in the totals; however, they are not listed separately in this exhibit.
[2]2006 halibut fishing employment data are not yet available. 2005's monthly halibut figures have instead been used as a temporary proxy for 2006 and are part of the 2006 "All Species" calculation. They will be revised once they become available. Counting Employment: Harvesting data in this table are counted differently than in other tables in this report. In this table, the permit itself is considered the employer.
In other tables where a count of workers was estimated, the employer was considered to be the vessel, or permit holders for fisheries that did not typically use vessels. This means that a permit holder who makes landings under two different permits (in the same vessel) in the same month will generate two sets of jobs whereas for tables where the vessel is the employer there would be only one set of workers.
Source: Commercial Fisheries Entry Commission; National Marine Fisheries Service and ADOLWD, Research and Analysis Section

Table 10-43 provides estimated seafood processing employment, percent of non-resident workers, and percent of non-resident earnings in the Yukon Delta Region. The total worker count in the Yukon Delta

Region seafood processing sector declined during the early 2000s, as commercial harvests declined. In 2000, the area's fisheries supported 436 seafood processors. That number declined to 281 in 2002 and, before rebounding steadily to 557 by 2005. 2006 data show a decline in processing workers to 486, which is consistent with the 2006 decline in Lower Yukon commercial catches. Non-resident workers have made up a relatively small proportion of about 5% in recent years. Seafood processing wages are estimated to have been approximately $1.8 million in 2005 and $1.1 million in 2006, with non-resident wages accounting for 18.5% and 16.5% of the total in each year, respectively. As in the Northern region, percent of non-resident wages is higher than percent of non-resident workers and indicates relatively higher wages for non-resident workers.

Table 10-43 Yukon Region Seafood Processing Employment, 2000-2005

Seafood Processing				
Year	**Total Worker Count**	**Percent Nonresident Workers**	**Wages**	**Percent Nonresident Wages**
2000	436	32.8	$1,306,791	49.6
2001	397	6.8	$1,103,900	18.9
2002	281	6.4	ND	15.1
2003	459	5.4	ND	15.7
2004	468	4.9	ND	11.5
2005	557	5.0	$1,762,231	18.5
2006	486	5.3	$1,051,618	16.5

Source: ADOLWD, Research and Analysis Section and CFEC.

10.3.7 Bristol Bay

The Bristol Bay management area includes all coastal and inland waters east of a line from Cape Newenham to Cape Menshikof (Fig. 5-40). The area includes nine major river systems: Naknek, Kvichak, Alagnak, Egegik, Ugashik, Wood, Nushagak, Igushik, and Togiak. Collectively, these rivers are home to the largest commercial sockeye salmon fishery in the world. Sockeye salmon *Oncorhynchus nerka* are by far the most abundant salmon species that return to Bristol Bay each year, but Chinook *O. tshawytscha*, chum *O. keta*, coho *O. kisutch*, and (in even-years) pink salmon *O. gorbuscha* returns are important to the fisheries as well. The Bristol Bay area is divided into five management districts (Naknek-Kvichak, Egegik, Ugashik, Nushagak, and Togiak) that correspond to the major river drainages. The management objective for each river is to achieve desired escapement goals for the major salmon species while harvesting all fish in excess of the established requirement through orderly fisheries. In addition, regulatory management plans have been adopted for individual species in certain districts. (This section is developed from Dye and Schwanke 2006, Fall and Krieg 2006, Sands et.al 2008, and data supplied by ADF&G).

Overview of Bristol Bay Salmon Fisheries

The five species of pacific salmon found in Bristol Bay are the focus of major commercial, subsistence, and sport fisheries. Annual commercial catches for the most recent 20-year span (1987–2006) average over 24 million sockeye salmon, 67,000 Chinook, 937,000 chum, 98,000 coho, and 231,000 (even-years only) pink salmon (Appendices A3–A7). Since 1987, the value of the commercial salmon harvest in Bristol Bay has averaged $126 million, with sockeye salmon being the most valuable, worth an average $123 million (Appendix A25). Subsistence catches are comprised primarily of sockeye salmon and average approximately 145,000 salmon (Appendix A27). Sport fisheries harvest all species of salmon, with most effort directed toward Chinook and coho stocks. Approximately 40,000 salmon are harvested annually by sport fishermen in Bristol Bay.

Management of the commercial fishery in Bristol Bay is focused on discrete stocks with harvests directed at terminal areas around the mouths of major river systems. Each stock is managed to achieve a spawning escapement goal based on sustained yield. Escapement goals are achieved by regulating fishing time and area by emergency order (EO) and/or adjusting weekly fishing schedules. Legal gear for the commercial salmon fishery includes both drift (150 fathoms) and set (50 fathoms) gillnets. However, the BOF passed a regulation in 2003 allowing for two drift permit holders to concurrently fish from the same vessel and jointly operate up to 200 fathoms of drift gillnet gear. This regulation does not apply in special harvest areas. Drift gillnet permits were the most numerous at 1,862 in Bristol Bay (Area T), of those 1,621 fished in 2007. There were a total of 983 set gillnet permits in Bristol Bay, of those 836 made deliveries in 2007

Status of Runs and Conservation Concerns

Chinook salmon escapement into the Nushagak River was 60,000, 80% of the 75,000 inriver goal. Harvest was 51,000 Chinook in the Nushagak District. Peak Chinook salmon production in the early 1980's resulted in record commercial harvests and growth of the sport fishery. Declining run sizes and the question of how to share the burden of conservation among users precipitated the development of a management plan for Nushagak Chinook salmon. Since the plan was adopted in 1992, the Nushagak-Mulchatna Chinook Salmon Management Plan (NMCSMP) has governed management of the Nushagak Chinook salmon fisheries (5 AAC 06.361). The plan was amended in 1995, 1997, and 2003.

The purpose of this management plan is to ensure an adequate spawning escapement of Chinook salmon into the Nushagak River system. The plan directs ADF&G to manage the commercial fishery for an inriver goal of 75,000 Chinook salmon past the sonar site at Portage Creek. The inriver goal provides: (1) a biological escapement goal of 65,000 spawners, (2) a reasonable opportunity for inriver subsistence harvest and (3) a guideline sport harvest of 5,000 fish. The plan addresses poor run scenarios by specifying management actions to be taken in commercial, sport, and subsistence fisheries, depending on the severity of the conservation concern. Management decisions are heavily dependent upon the estimates of inriver Chinook salmon escapement provided by the sonar project located near Portage Creek on the lower Nushagak River.

Trends in age composition of Chinook spawning escapements in 1995 and 1996 raised concerns about the quality of Chinook escapements in the Nushagak River. The proportion of large (age-5 through age-7) fish was less than desired, and the age composition of the escapement during the first half of the run differed substantially from that of the escapement during the second half of the run. In the early portion of the run, male Chinook salmon of the younger age classes comprised the majority of the run, while the older age classes became prevalent in the latter portion of the run. Differences in age composition between escapement and total run, and between early and late-season escapement can result from size-selective harvests. To address this concern, ADF&G adopted a strategy of allowing unfished pulses of Chinook into the Nushagak River before opening a commercial period. Allowing untargeted fish into the river was intended to lessen the effects of selectivity in the commercial fishery while allowing fish with a natural age distribution to enter the river. In November 1997, additional language directing ADF&G to allow pulses of Chinook salmon into the Nushagak River that were not exposed to commercial fishing gear, was added to the NMCSMP.

ADF&G adjusts commercial fishing time and area to harvest Chinook salmon surplus to the inriver goal. Management decisions are based on the preseason forecast and inseason indicators of run strength, including commercial harvest performance, subsistence harvest rates and inriver passage rates estimated by the sonar project. During the last 4 years, managers have used directed Chinook openings early in June to harvest fish when a surplus appears to be available. Because these openings usually occur during the first third of the run, harvest can be directed toward more segments of the run at a low level. However, this strategy also has the potential for complicating management if the second half of the run is significantly weaker than the first half. When a surplus is forecasted, early commercial openings provide for more time between openings allowing unfished pulses of fish to move through the district, better quality of fish in the harvest, and harvest spread over a larger portion of the run.

The 2007 Nushagak District Chinook salmon forecast was 215,000 fish. With an inriver goal of 75,000 fish, and average sport and subsistence harvest of 6,000 fish below the counting station, 134,000 Chinook would potentially be available for commercial harvest. In 2003, a new strategy was adopted to address concerns about incidental Nushagak sockeye catch in directed Chinook openings. This strategy focused on having directed Chinook openings as early and as often as escapement and the management plan would allow. In 2007, managers worked with the Nushagak Advisory Committee and other stakeholders to decide on the fishing schedule prior to the season. The preset schedule allowed stakeholders to plan ahead and provided more certainty for marketing purposes. The schedule could be suspended if escapement was less than expected. The preseason schedule allowed for five openings based on the preseason forecast and subsequent openings based on escapement.

A formal forecast is not issued for Chinook salmon in the Togiak District. Recently, Chinook run strengths district-wide have declined from a high of almost 52,000 in 1985, to a low of less than 18,000 in 2002 (Appendix A20). Chinook escapements in the Togiak River drainage fell short of the escapement goal (10,000) from 1986 through 1992. The Chinook escapement goal was reached from 1993 to 1995 with extensive commercial fishing closures and mesh size restrictions. In 1996, with only minor reductions in the weekly fishing schedule, Chinook escapement again fell short of the goal. The Chinook escapement goal in the Togiak River has been achieved consistently since that time. Reducing the weekly schedule to 48 hours per week in late June seems to provide a good balance between commercial fishing time and closures that allow Chinook escapement to be achieved.

Subsistence Fishery Situation and Outlook

Subsistence harvests in the Bristol Bay area are among the largest in the state, and very diverse. Based on the results of systematic household surveys conducted by the Division of Subsistence, the estimated annual area-wide harvest of wild foods in the 1980s and 1990s was 422 pounds usable weight per capita and 1,439 pounds per household. Salmon made up 51% of this harvest, land mammals (mostly moose and caribou) were 31%, fish other than salmon comprised 10%, and other resources, such as marine mammals, birds and eggs, marine invertebrates, and wild plants provided the remaining 8%.

Wild resource harvests are generally higher in the smaller communities of the Bristol Bay Area than in the 2 regional centers. The area-wide estimate for these smaller communities for the 1980s/1990s period was 587 pounds per person per year, with a household average of 2,284 pounds. For this period, the composition of subsistence harvests in the smaller communities was very similar to that of the area overall: 49% salmon, 31% land mammals, 11% other fish, and 9% other.

The importance of subsistence harvests to the economy of the Bristol Bay region is evident when considering the potential cost of purchasing replacements for the foods produced by local hunting, fishing, and gathering. At a replacement cost of $5/pound, the annual value of the average household subsistence harvest in the region is $7,195; for village households it is $11,420. Using the $5/pound figure, it would cost the average Bristol Bay household 16% of its cash income to purchase replacements for lost subsistence harvests; the average village household would spend 36% of its cash income to buy replacement food. Of course, this exercise ignores the cultural, social, and nutritional costs of replacing subsistence foods with imported substitutes. Indeed, it is unlikely that adequate substitutes can be purchased for most of the subsistence foods that are produced in the region (ADF&G 2006X).

Permits are required to harvest salmon for subsistence purposes in Bristol Bay. Since 1990, under state regulations, all Alaska State residents have been eligible to participate in subsistence salmon fishing in all Bristol Bay drainages, except the Lake Clark area. Prior to 2007, with a few exceptions, only gillnets were recognized as legal subsistence gear. In the Togiak District, spear fishing was also allowed. In portions of Naknek Lake in the Naknek District, spears and dipnets, in addition to gillnets, could be used during designated periods, primarily to harvest spawning sockeye salmon ("redfish"). In the Bristol Bay area, gillnet lengths were limited to 10 fathoms in the Naknek, Egegik, and Ugashik rivers, Dillingham beaches, and within the Nushagak commercial fishing district during openings regulated by EO. Up to 25 fathoms could be used in the remaining areas, except that nets were limited to 5 fathoms in the special "redfish" harvest areas in the Naknek District.

At its regulatory meeting in Dillingham in December 2006, the BOF made three changes to the subsistence salmon fishing regulations that affected portions of the Bristol Bay area. The first change allowed salmon to be taken with a drift gillnet no more than 10 fathoms in length in the Togiak River between the mouth of the river and upstream approximately 2 miles. The second change allowed spears to be used to take salmon in Lake Clark. The third change allowed beach seines and gillnets to be used to take salmon in Iliamna Lake, Six Mile Lake, and Lake Clark.

In Nushagak, Togiak, Naknek, Egegik, and Ugashik Districts, subsistence fishing is permitted in all commercial districts during commercial openings. In addition, all commercial districts were open for subsistence fishing in May and October, from Monday to Friday. In the late 1990s and early 2000s, declining Chinook and coho stocks resulted in longer commercial closures and some residents had difficulty obtaining fish for home use. Recent years, beginning in 2004 have seen improvements in abundance of all species. The Nushagak commercial district, starting in 1988, has been opened for subsistence fishing by EO during extended commercial closures.

ADF&G issues Bristol Bay subsistence salmon permits to any Alaska resident who requests one. In 2001, the superintendent of Lake Clark National Park and Preserve, announced that the National Park Service (NPS) was prohibiting subsistence fishing with nets in the park and preserve, including all of Lake Clark, except by federally qualified residents. This prohibition was a new enforcement action of a NPS regulation and applied to anyone who was not a permanent resident of Iliamna, Lime Village, Newhalen, Nondalton, Pedro Bay, or Port Alsworth, or who did not have a Section 13.44 subsistence use permit issued by the park superintendent. ADF&G informs Bristol Bay subsistence salmon permit applicants that they need to take this NPS closure into account if they intend to subsistence fish in waters of the park and preserve.

A permit system was gradually introduced throughout the Bristol Bay region in the late 1960s to document the harvest of salmon for subsistence. Much of the increase in the number of permits issued during these years reflects: (1) a greater compliance with the permitting and reporting requirements, (2) an increased level of effort expended by ADF&G in making permits available (including a local system of vendors), contacting individuals, and reminding them to return the harvest forms, and (3) a growing regional population. Most fishermen are obtaining permits and reporting their catches, and overall permit returns have averaged between 85% and 90% annually. However, fish removed for home use from commercial catches are not included in most reported subsistence harvest totals. Also, fish caught later in the season, such as coho and spawning salmon are probably not documented as consistently as Chinook and sockeye.

Table 10-44 (ADF&G 2007 data request) provides historic data on subsistence salmon participation and harvests, by species, by district, and area wide. Participation was greatest among residents of the Naknek-Kvichak and Nushagak districts. Total permits issued in 2007, number 1,100, which is slightly below the 20-year average of 1,126. Harvest numbers show that sockeye salmon dominates the subsistence catch in all districts, but that subsistence sockeye harvests have been declining in recent years. Chinook harvests hit a 20 year high of 21,231 in 2003 but have fallen significantly with 12,617 and 16,002 fish harvested bay wide in 2006 and 2007 respectively. The 20-year average is presently 15,438. While it appears that subsistence Chinook harvests in the Bristol Bay area have improved over historic levels, there were declines in subsistence Chinook harvests in the Naknek-Kvichak District during the late 1990s and early 2000's. The Nushagak District had a similar decline, rebounded to a record catch in 2003, but then declined for the next four years before recovering to 13, 615 fish, just above the 10 year average, in 2007. Historic trends of subsistence Chinook catch for each district and overall are shown in Fig. 10-52 and Fig. 10-53.

Table 10-44 Subsistence salmon harvest, by district and species, Bristol Bay, 1987–2007.

Year [a]	Permits Issued	Sockeye	Chinook	Chum	Pink	Coho	Total
NAKNEK KVICHAK DISTRICT							
1987	407	86,706	1,289	756	490	1,106	90,347
1988	391	88,145	1,057	588	917	813	91,520
1989	411	87,103	970	693	277	1,927	90,970
1990	466	92,326	985	861	1,032	726	95,930
1991	518	97,101	1,152	1,105	191	1,056	100,605
1992	571	94,304	1,444	2,721	1,601	1,152	101,222
1993	560	101,555	2,080	2,476	762	2,025	108,898
1994	555	87,662	1,843	503	460	1,807	92,275
1995	533	75,644	1,431	1,159	383	1,791	80,407
1996	540	81,305	1,574	816	794	1,482	85,971
1997	533	85,248	2,764	478	422	1,457	90,368
1998	567	83,095	2,433	784	1,063	1,592	88,967
1999	528	85,315	1,567	725	210	856	88,674
2000	562	61,817	894	560	845	937	65,053
2001	506	57,250	869	667	383	740	59,909
2002	471	52,805	837	909	1,137	943	56,632
2003	489	61,443	1,221	259	198	812	63,934
2004	481	71,110	1,075	469	1,080	566	74,300
2005	462	69,211	1,047	546	275	1,224	72,302
2006	468	69,097	881	341	757	720	71,796
20 Year Ave.	501	79,412	1,371	871	969 [b]	1,187	83,504
1987-1996 Ave.	495	89,185	1,383	1,168	961 [b]	1,389	93,815
1997-2006 Ave.	507	69,639	1,359	574	976 [b]	985	73,193
2007 [c]	474	64,733	1,012	505	689	853	67,793
EGEGIK DISTRICT							
1987	49	3,350	87	139	2	284	3,862
1988	52	1,405	97	87	54	333	1,976
1989	50	1,636	50	33	1	414	2,134
1990	61	1,105	53	85	39	331	1,613
1991	70	4,549	82	141	32	430	5,234
1992	80	3,322	124	270	51	729	4,496
1993	69	3,633	128	148	15	905	4,829
1994	59	3,208	166	84	153	857	4,468
1995	60	2,818	86	192	100	690	3,886
1996	44	2,321	99	89	85	579	3,173
1997	34	2,438	101	21	5	740	3,304
1998	36	1,795	44	33	52	389	2,314
1999	42	2,434	106	35	2	806	3,384
2000	31	842	16	11	0	262	1,131
2001	57	2,493	111	105	16	928	3,653
2002	53	1,892	65	34	12	356	2,359
2003	62	3,240	84	32	10	297	3,663
2004	46	2,618	169	410	91	1,423	4,711
2005	45	2,267	81	231	2	526	3,106
2006	41	1,641	94	34	7	641	2,418
20 Year Ave.	52	2,450	92	111	54 [b]	596	3,286
1987-1996 Ave.	59	2,735	97	127	76 [b]	555	3,567
1997-2006 Ave.	45	2,166	87	95	32 [b]	637	3,004
2007 [c]	49	2,332	99	148	24	649	3,251

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Table 10-44, Page 2 of 3.

Year	Permits Issued	Sockeye	Chinook	Chum	Pink	Coho	Total
UGASHIK DISTRICT							
1987	22	892	104	51	29	272	1,348
1988	23	1,400	84	55	35	330	1,904
1989	22	1,309	32	35	2	214	1,592
1990	37	1,578	51	143	120	280	2,172
1991	38	1,403	121	168	42	614	2,348
1992	37	2,348	106	79	8	397	2,938
1993	39	1,766	86	107	24	495	2,478
1994	31	1,587	126	42	38	579	2,372
1995	20	1,513	56	18	6	290	1,883
1996	26	1,247	50	21	7	298	1,623
1997	28	2,785	169	39	23	311	3,327
1998	27	1,241	59	75	82	485	1,942
1999	25	1,365	35	5	0	271	1,675
2000	31	1,927	51	34	1	467	2,481
2001	24	1,197	61	8	2	357	1,624
2002	23	1,294	51	14	2	460	1,821
2003	23	1,113	31	30	0	392	1,567
2004	21	804	64	9	4	234	1,116
2005	22	818	27	18	2	249	1,114
2006	25	962	41	6	16	339	1,364
20 Year Ave.	27	1,427	70	48	31 [b]	367	1,934
1987-1996 Ave.	30	1,504	82	72	42 [b]	377	2,066
1997-2006 Ave.	25	1,351	59	24	21 [b]	356	1,803
2007 [c]	23	998	43	15	5	335	1,396
NUSHAGAK DISTRICT							
1987	474	40,900	12,200	6,000	200	6,200	65,500
1988	441	31,086	10,079	8,234	6,316	5,223	60,938
1989	432	34,535	8,122	5,704	407	8,679	57,447
1990	441	33,003	12,407	7,808	3,183	5,919	62,320
1991	528	33,161	13,627	4,688	292	10,784	62,552
1992	476	30,640	13,588	7,076	3,519	7,103	61,926
1993	500	27,114	17,709	3,257	240	5,038	53,358
1994	523	26,501	15,490	5,055	2,042	5,338	54,426
1995	484	22,793	13,701	2,786	188	3,905	43,373
1996	481	22,935	15,941	4,704	1,573	5,217	50,370
1997	538	25,080	15,318	2,056	218	3,433	46,106
1998	562	25,217	12,258	2,487	1,076	5,316	46,355
1999	548	29,387	10,057	2,409	124	3,993	45,969
2000	541	24,451	9,470	3,463	1,662	5,983	45,029
2001	554	26,939	11,760	3,011	378	5,993	48,080
2002	520	22,777	11,281	5,096	1,179	4,565	44,897
2003	527	25,491	18,686	5,064	403	5,432	55,076
2004	511	17,491	15,610	3,869	1,944	4,240	43,154
2005	502	23,916	12,529	5,006	793	5,596	47,841
2006	461	20,773	9,971	4,448	1,591	3,590	40,373
20 Year Ave.	502	27,209	12,990	4,611	2,409 [b]	5,577	51,754
1987-1996 Ave.	478	30,267	13,286	5,531	3,327 [b]	6,341	57,221
1997-2006 Ave.	526	24,152	12,694	3,691	1,490 [b]	4,814	46,288
2007 [c]	504	22,090	13,615	4,696	1,182	4,685	46,268

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Table 10-44, page 3 of 3.

Year	Permits Issued	Sockeye	Chinook	Chum	Pink	Coho	Total
TOGIAK DISTRICT							
1987	46	3,600	700	1,000	0	1,600	6,900
1988	29	2,413	429	716	45	792	4,395
1989	40	2,825	551	891	112	976	5,355
1990	37	3,689	480	786	60	1,111	6,126
1991	43	3,517	470	553	27	1,238	5,805
1992	40	3,716	1,361	626	135	1,231	7,069
1993	38	2,139	784	571	8	743	4,245
1994	25	1,777	904	398	77	910	4,066
1995	22	1,318	448	425	0	703	2,894
1996	19	662	471	285	59	199	1,676
1997	31	1,440	667	380	0	260	2,747
1998	42	2,211	782	412	76	310	3,791
1999	76	3,780	1,244	479	84	217	5,804
2000	54	3,013	1,116	569	90	342	5,130
2001	92	4,162	1,612	367	61	388	6,590
2002	36	2,319	703	605	10	241	3,878
2003	92	4,403	1,208	483	451	883	7,428
2004	46	1,795	1,094	383	108	204	3,584
2005	45	2,299	1,528	301	26	295	4,448
2006	61	2,728	1,630	492	355	408	5,613
20 Year Ave.	46	2,690	909	536	102 [b]	653	4,877
1987-1996 Ave.	34	2,566	660	625	75 [b]	950	4,853
1997-2006 Ave.	58	2,815	1,158	447	128 [b]	355	4,901
2007 [c]	56	2,709	1,233	453	190	406	4,990
TOTAL BRISTOL BAY AREA							
1987	998	135,493	14,356	7,895	689	9,453	167,886
1988	936	124,449	11,746	9,680	7,367	7,491	160,733
1989	955	127,408	9,725	7,356	799	12,210	157,498
1990	1,042	131,701	13,976	9,683	4,434	8,367	168,161
1991	1,197	139,731	15,452	6,655	584	14,122	176,544
1992	1,204	134,330	16,623	10,772	5,314	10,612	177,651
1993	1,206	136,207	20,787	6,559	1,049	9,206	173,808
1994	1,193	120,735	18,529	6,082	2,770	9,491	157,607
1995	1,119	104,086	15,722	4,580	677	7,378	132,443
1996	1,110	108,470	18,136	5,915	2,518	7,775	142,813
1997	1,166	116,991	19,159	2,974	668	6,201	145,992
1998	1,234	113,560	15,576	3,792	2,349	8,093	143,368
1999	1,219	122,281	13,009	3,653	420	6,143	145,506
2000	1,219	92,050	11,547	4,637	2,599	7,991	118,824
2001	1,226	92,041	14,412	4,158	839	8,406	119,856
2002	1,093	81,088	12,936	6,658	2,341	6,565	109,587
2003	1,182	95,690	21,231	5,868	1,062	7,816	131,667
2004	1,100	93,819	18,012	5,141	3,225	6,667	126,865
2005	1,076	98,511	15,212	6,102	1,098	7,889	128,811
2006	1,050	95,201	12,617	5,321	2,726	5,697	121,564
20 Year Ave.	1,126	113,192	15,438	6,174	3,564 [b]	8,379	145,359
1987-1996 Ave.	1,096	126,261	15,505	7,518	4,481 [b]	9,611	161,514
1997-2006 Ave.	1,157	100,123	15,371	4,830	2,648 [b]	7,147	129,204
2007 [c]	1,100	92,862	16,002	5,818	2,090	6,927	123,699

[a] Permit and harvest estimates prior to 1989 are based on the community where the permit was issued; estimates from 1989 to the present are based on the area fished, as first recorded on the permit.

[b] Includes even years only.

[c] A 5 year average was used as data was not available at the time of publication.

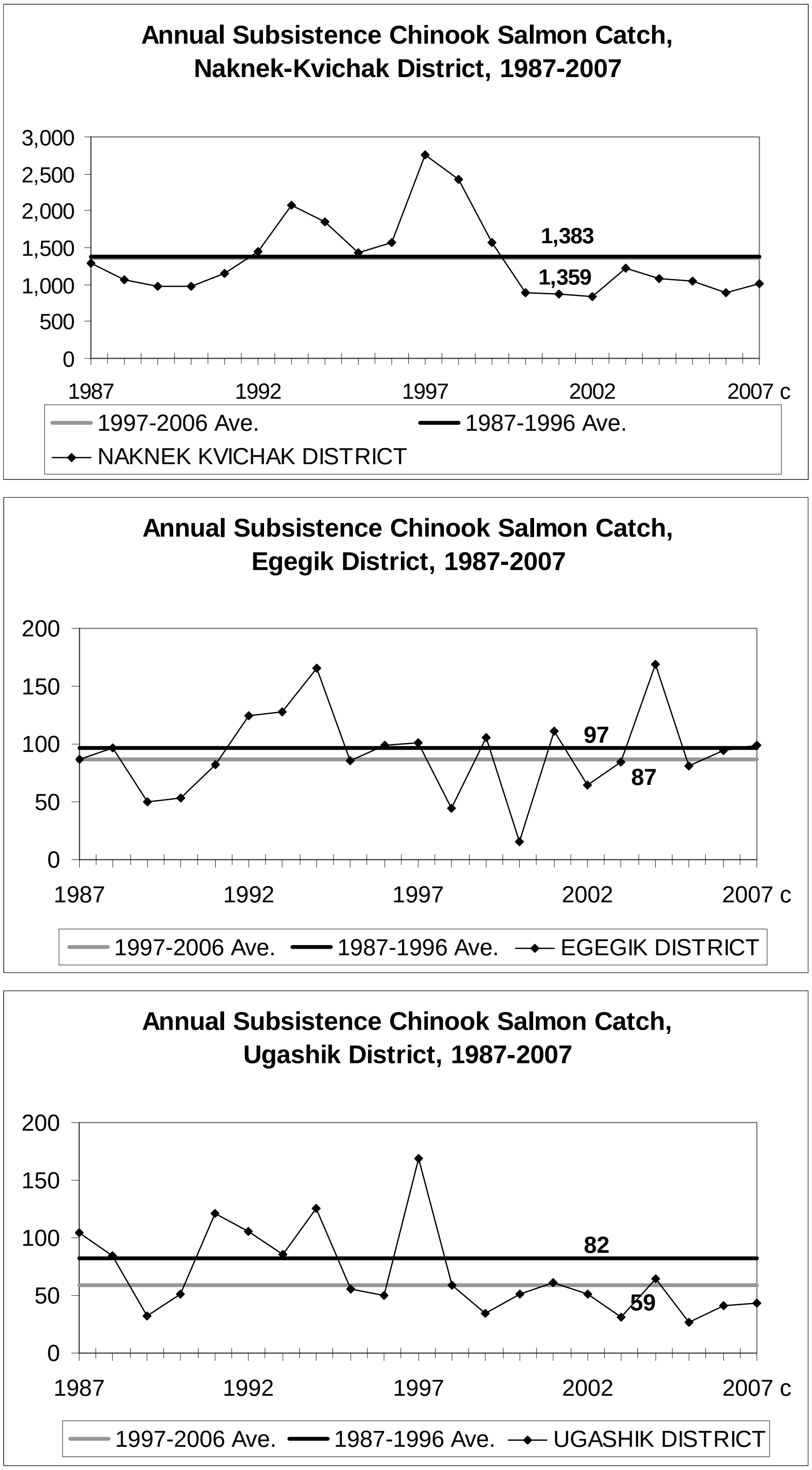


Fig. 10-52 Bristol Bay Annual Subsistence Chinook Catch by District, 1987-2007

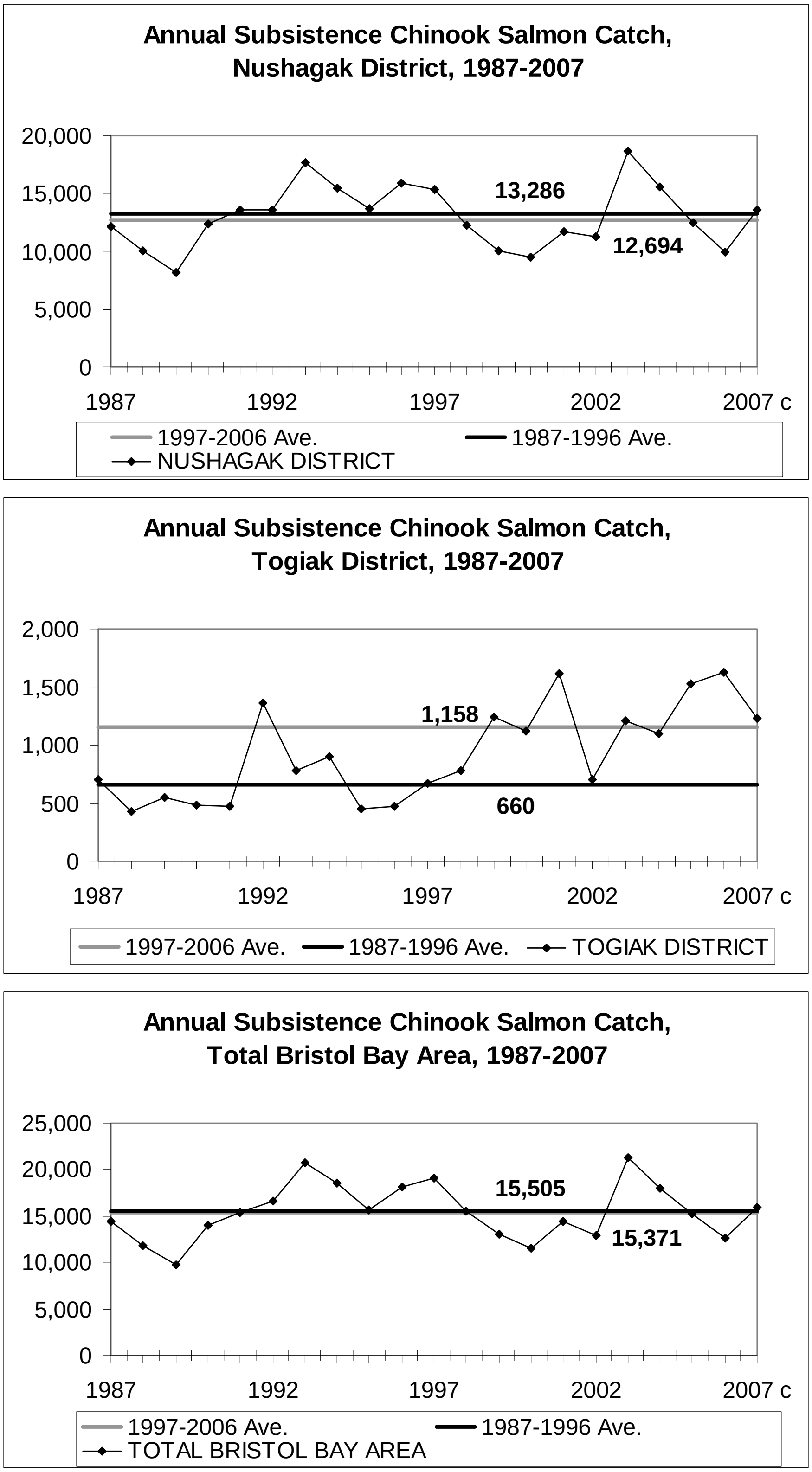


Fig. 10-53 Bristol Bay Annual Subsistence Chinook Catch, Total All Districts, 1987-2007

Commercial Fishery Situation and Outlook

The runs of Chinook salmon to Bristol Bay are many, however the Nushagak River is the only system large enough to justify producing a forecast. ADF&G does not forecast Chinook salmon for systems in the Naknek/Kvichak District, where the commercial harvest of Chinook salmon has remained relatively insignificant due to the current mesh size restrictions that have been implemented since the early 1990s and how the NRSHA is managed. Mesh restrictions are set by "Emergency Order" (E.O.) that prohibit gillnets with mesh size larger than 5.5 inches until July 21. In addition to mesh restrictions when commercial fishing in the NRSHA, the fishery is also regulated by scheduling commercial periods through part of the flood and into the ebb tide. This results in a portion of each tide with no fishing so all species of fish have an opportunity to pass through the fishery unmolested. Please see the Bristol Bay Annual Management Report for 2007 (ADF&G 2007X) For a complete treatment of the commercial fishery in the Bristol Bay region.

The reported 2007 Chinook salmon harvest in the Egegik District was 541 fish, 66% below the 20-year average of 1,195(Table 10-45). The Ugashik District harvest of 1,445 Chinook salmon was 16% below the recent 20-year average of 1,705. Total Chinook harvest for the Togiak 7,755 fish, which was 92% of the 10-year average. Overall, Chinook salmon harvests in 2007 were below the recent 20-year averages in all districts. The 2007 bay-wide commercial harvest of 62,670 Chinook was below the 20-year average of 66,607. The main factor here was the unexpected shortfall in the Nushagak District where the harvest was only 51,350. This was well below the expected harvest of 140,000.

Table 10-45 Chinook Salmon Commercial Catch By District, In Numbers of Fish, Bristol Bay, 1987-2007

Year	Naknek-Kvichak	Egegik	Ugashik	Nushagak	Togiak	Total
1987	5,175	2,959	4,065	45,983	17,217	75,399
1988	6,538	3,103	3,444	16,648	15,614	45,347
1989	6,611	2,034	2,112	17,637	11,366	39,760
1990	5,068	1,144	1,839	14,812	11,130	33,993
1991	3,584	510	589	19,718	6,039	30,440
1992	5,724	694	2,146	47,563	12,640	68,767
1993	7,468	1,464	2,811	62,971	10,851	85,565
1994	6,015	1,243	3,685	119,478	10,484	140,905
1995	5,084	760	1,551	79,942	11,981	99,318
1996	4,195	980	588	72,011	8,602	86,376
1997	3,128	2,143	1,096	64,160	6,066	76,593
1998	2,449	760	346	117,065	14,131	134,751
1999	1,295	712	1,638	10,893	11,919	26,457
2000	1,027	1,061	893	12,055	7,858	22,894
2001	904	950	989	11,568	9,937	24,348
2002	969	268	612	39,473	2,801	44,123
2003	567	131	409	42,615	3,231	46,953
2004	1,360	1,589	863	96,534	9,310	114,280[a]
2005	1,377	485	1,815	62,308	10,605	76,590
2006	2,333	915	2,608	84,881	16,225	106,962
20-Year Ave.	3,544	1,195	1,705	51,916	10,400	66,607
1987-96 Ave.	5,546	1,489	2,283	49,676	11,592	70,587
1997-06 Ave.	1,541	901	1,127	54,155	9,208	62,186
2007	1,579	541	1,445	51,350	7,755	62,670

a Total includes General District catch of 4,624.
* from 2007 season

Chinook harvests generally trended downwards from the late 1990's to mid-2000's, with total harvest well below 20-year and 10-year averages. However, Chinook harvests improved considerably in 2004 and 2006, only to fall well short of expected catch in 2007. Fig. 10-54 shows the historic trend in Bristol Bay commercial Chinook catches from 1987 through 2007, and Fig. 10-55 provides a District level view.

Table 10-46 provides the historic estimated real ex-vessel value of Bristol Bay commercial salmon catch, by species, in thousands of dollars. It is evident that the Sockeye fishery dwarfs the Chinook fishery in terms of total value. Also evident is a significant decline in Chinook value since the mid-1990s. Chinook value fell from a peak of $2.1 million in 1994 to $154,000 in 2001. Since 2001, Chinook value has improved and the 2006 value of $1.365 million was greater than the 5, and 20 year averages.

Fig. 10-56 depicts the historical trends in commercial Chinook value as well as the percent of total value (right vertical axis) that Chinook value represents. Historically, Chinook value has never exceeded 2% of the total commercial value in Bristol Bay, and in 2007 it represented only about a half a percent.

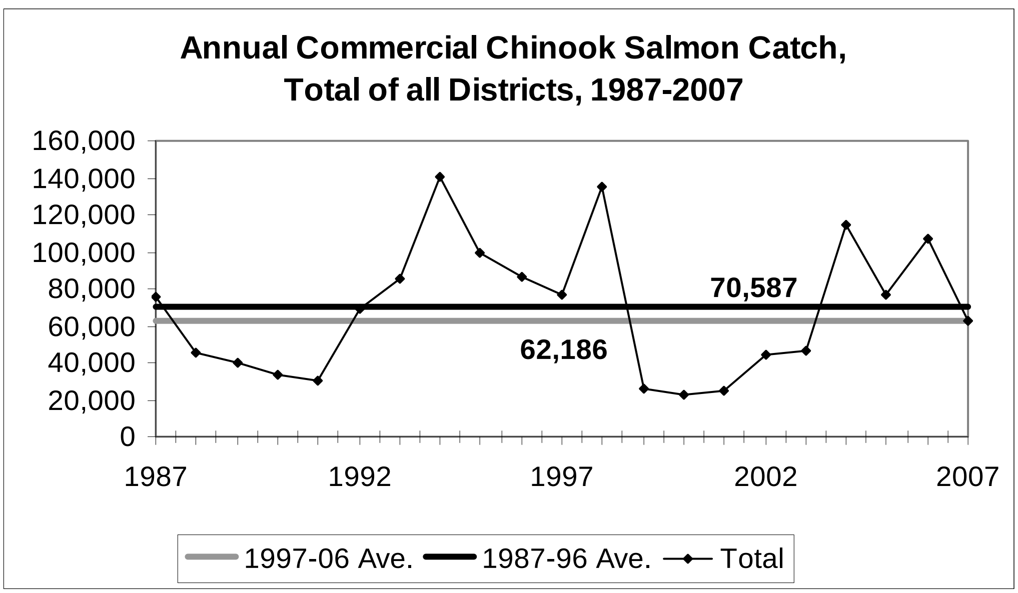


Fig. 10-54 Bristol Bay Annual Commercial Chinook Catch, Total All Districts, 1987-2007

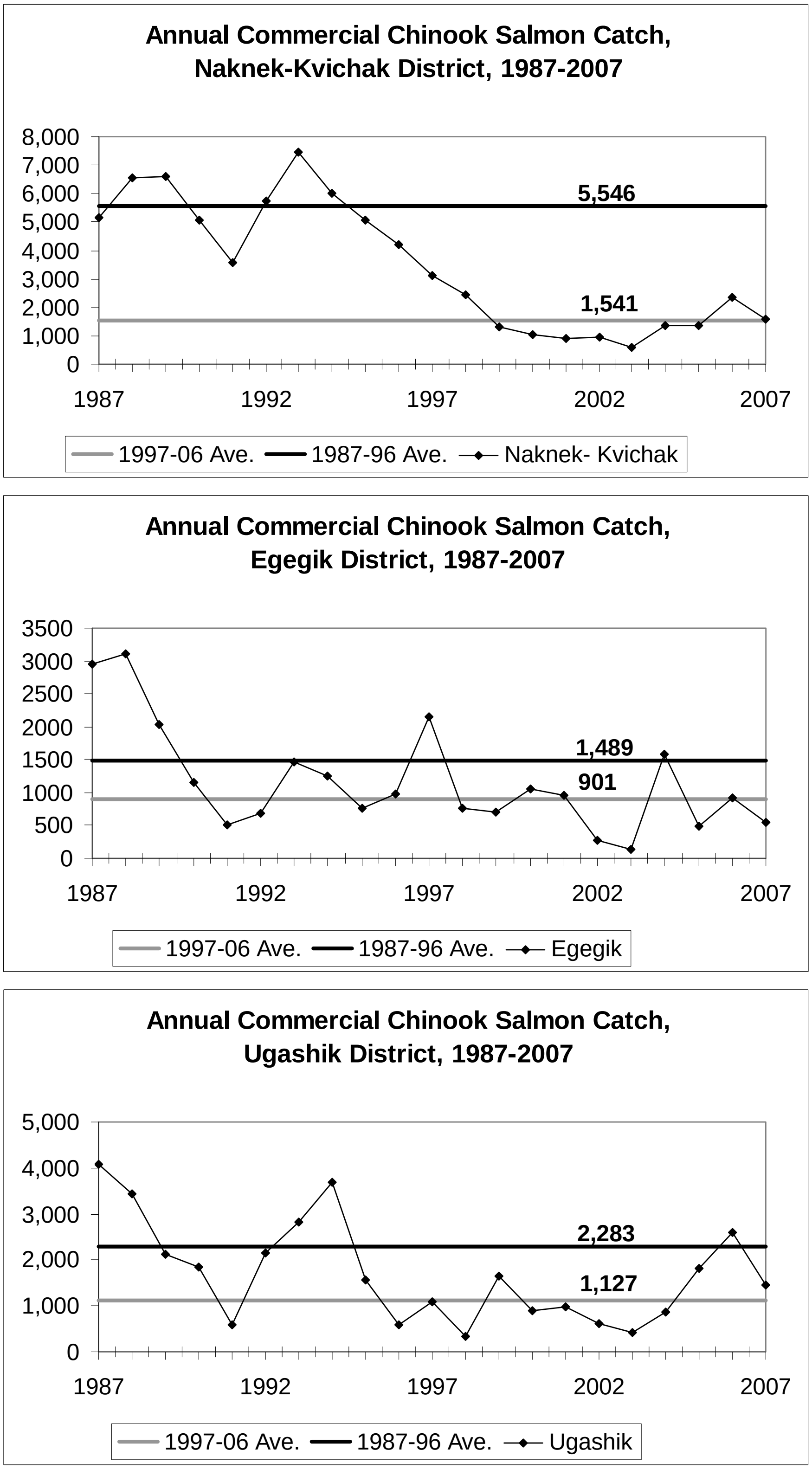
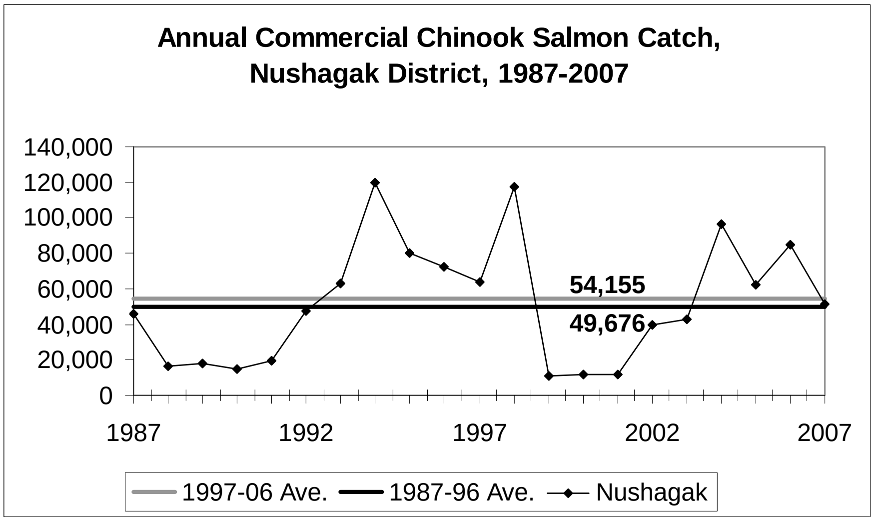


Fig. 10-55 Bristol Bay Annual Commercial Chinook Catch by District, 1987-2007



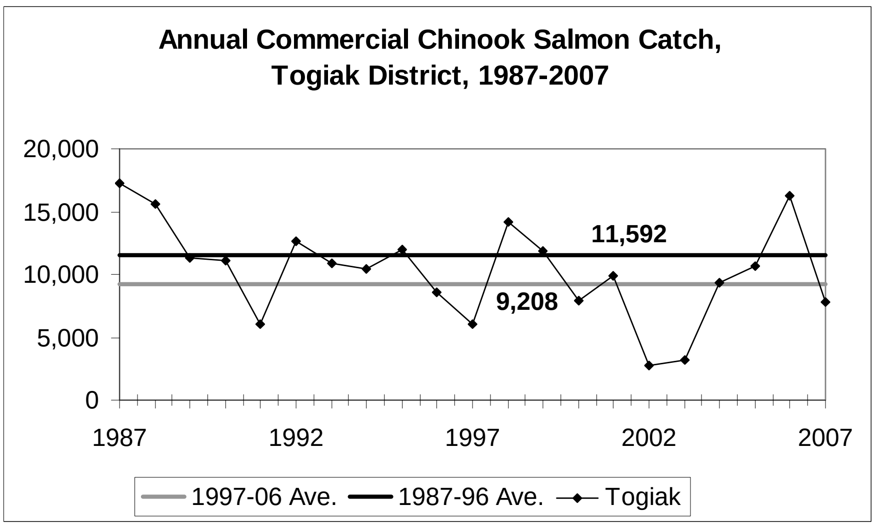


Fig. 10-55. (continued) Bristol Bay Annual Commercial Chinook Catch by District, 1987-2007

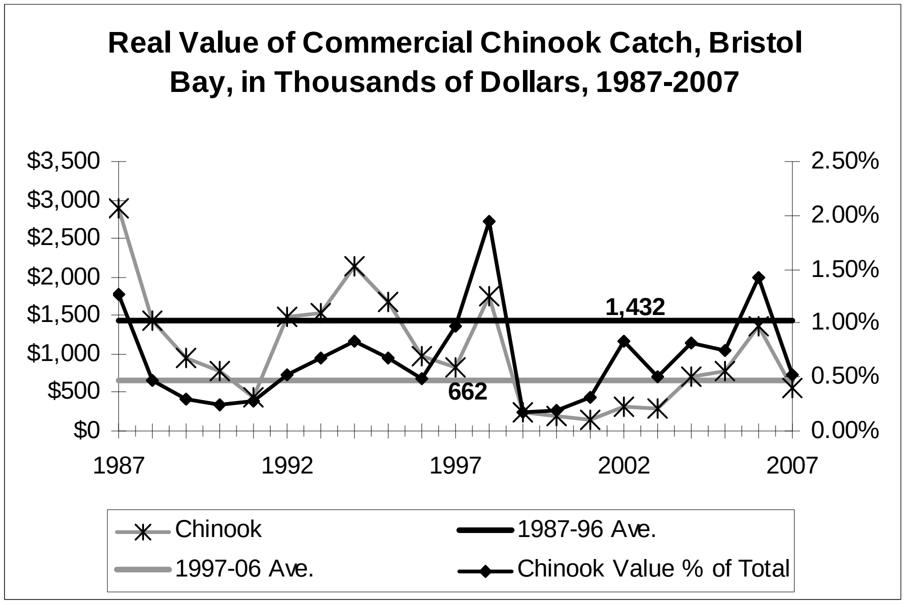


Fig. 10-56 Historical Real Value of Commercial Chinook Catch, Bristol Bay, 1987-2007

Table 10-46 Estimated Real Ex-Vessel Revenue of the Commercial Salmon Catch by Species, in thousands of dollars, Bristol Bay, 1987-2007 (Inflation adjusted to 2007 value using the GDP deflator)

Year	Sockeye	Chinook	Chum	Pink[a]	Coho	Total
1987	$219,362	$2,900	$4,885		$533	$227,680
1988	$292,707	$1,437	$7,612	$1,905	$3,333	$306,993
1989	$313,272	$955	$3,089		$1,924	$319,242
1990	$308,080	$769	$2,552	$811	$827	$313,040
1991	$158,875	$448	$2,491		$697	$162,511
1992	$283,426	$1,486	$2,114	$348	$1,097	$288,469
1993	$220,815	$1,534	$1,617		$356	$224,322
1994	$250,465	$2,142	$1,592	$54	$1,351	$255,606
1995	$244,071	$1,682	$1,640		$184	$247,578
1996	$192,489	$961	$773	$9	$428	$194,660
1997	$82,452	$818	$248		$230	$83,749
1998	$87,484	$1,754	$290	$9	$624	$90,162
1999	$140,005	$253	$498		$119	$140,874
2000	$100,446	$197	$278	$19	$482	$101,422
2001	$47,206	$154	$793		$47	$48,200
2002	$36,638	$312	$333		$22	$37,304
2003	$53,974	$280	$542		$87	$54,883
2004	$85,157	$707	$435	$21	$173	$86,493
2005	$102,350	$782	$1,019		$163	$104,312
2006	$92,630	$1,365	$1,386	$20	$183	$95,584
2007	$103,192	$549	$1,288	$0	$127	$105,156
20 Year Ave.	$165,595	$1,047	$1,709	$355	$643	$169,154
1987-96 Ave.	$248,356	$1,432	$2,836	$625	$1,073	$254,010
1997-06 Ave.	$82,834	$662	$582	$17	$213	$84,298

Note: Gross revenue paid to fishermen, derived from price per pound times commercial catch. Blank cells represent no data.

a: Included even-years only.

Sport Fishery Situation and Outlook

This section has been excerpted from ADF&G special publication No. 06-29; Report to the BOF for the Recreational Fisheries of Bristol Bay, 2004, 2005, and 2006 (ADF&G 2006x). This report is the most current report available on the Bristol Bay sport fisheries.

Bristol Bay is home to several world-class Chinook salmon sport fisheries. The peak of the sport Chinook salmon fishery occurs from mid-June to mid-July in the lower reaches of the Alagnak, Nushagak, Naknek, and Togiak rivers, as well as several smaller rivers. Chinook salmon stocks throughout the management area significantly increased in abundance from the late 1970s through the early 1980s. From about 1984 through the 1990s, Chinook salmon abundance in Bristol Bay returned to previous levels.

The Chinook salmon sport fisheries of the area, like the sport fisheries for most species, are fished primarily by guided anglers. With few exceptions, the guided to unguided angler ratio is about 3 to 1. Anglers usually keep less than 50% of the fish they catch, especially since the adoption of area-wide annual bag limits.

Sport fishing harvests of Chinook salmon have loosely followed the trends in abundance, reaching peaks of 17,404 fish in 1987 and 17,544 fish in 1994 (Table 10-47). Chinook salmon typically account for approximately 20-30% of the sport salmon harvest in Bristol Bay. The 2000 through 2004 sport harvest estimate averaged slightly more than 10,000 Chinook salmon. The 2005 sport harvest for the whole Bristol Bay area was 13,076 fish. The 2005 commercial harvest was 75,569 fish and the subsistence harvest was 15,628 fish (Westing et al. 2005). The 2005 sport harvest was about 11% of the total Bristol Bay Chinook salmon harvest, which is similar to the 1995 through 2004 average.

Since 1960, bag limits for Chinook salmon in Bristol Bay, and across Alaska, have become increasingly conservative and complex. The most conservative and sweeping regulatory changes to the area's Chinook salmon fisheries were adopted during the November and December 1997 BOF meetings. A Bristol Bay-wide annual limit of five Chinook salmon was adopted, and in the Nushagak River drainage, anglers were further restricted to an annual limit of four Chinook salmon. The daily bag limits in several other major fisheries were reduced slightly. Season closures of July 25 or 31 were adopted for all Bristol Bay waters to protect spawning Chinook salmon.

In 2001, a statewide regulation (5 AAC 67.010 (b)) created a daily bag and possession limit for Chinook salmon under 20 inches of 10 per day in all fresh waters open to Chinook salmon sport fishing, except for the Nushagak River drainage. The limit is in addition to the daily limits for Chinook salmon 20 inches or longer. Chinook under 20 inches do not count toward the annual limit of four and are in addition to the daily bag limit for Chinook salmon 20 inches or longer. The sole exception is the Nushagak River which has a daily bag and possession limit of five Chinook salmon under 20 inches per day.

In the drainages of the Alagnak, Egegik, Kvichak, Igushik, Naknek, Snake, and Ugashik rivers, the daily bag and possession limits for Chinook salmon are uniform at three per day, one of which may exceed 28 inches in length (5 AAC 67.020. (1)). Additionally, recent changes were made to Chinook salmon fisheries regulations including the Nushagak-Mulchatna Chinook Salmon Management Plan, harvest limits in the Wood River drainage, and waters open to fishing in Big Creek in the Naknek River drainage.

Anglers are prohibited from removing a Chinook salmon from the water before releasing the fish in all fresh waters of Bristol Bay. Any Chinook salmon removed from the water must be kept and becomes part of an angler's daily bag limit. The goal of this regulation is to improve the potential survival of released Chinook salmon and to encourage anglers to be more careful with the fish they release.

Table 10-47 Sport harvest of Chinook salmon, by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.

Drainage	1977-1993 Average	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2000-2004 Average	2005
Eastern														
Naknek R.	3,462	3,692	4,153	2,984	4,231	3,443	2,697	2,105	2,656	2,170	2,412	3,004	2,469	2,140
Brooks R.	10	0	19	0	12	0	0	0	0	0	0	0	0	0
Kvichak R.	146	90	175	107	47	239	0	167	61	18	183	27	91	217
Copper R.	19	0	9	43	0	17	22	20	0	0	0	27	9	0
Alagnak R.	665	1,048	891	931	982	1,531	592	501	508	305	334	1,146	559	1,008
Newhalen R.	3	30	9	0	0	0	0	0	0	0	0	13	3	0
Lake Clark	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	241	739	461	459	1,110	813	423	379	109	140	144	557	266	267
Subtotal[a]	4,423	5,599	5,717	4,524	6,382	6,043	3,734	3,172	3,334	2,633	3,073	4,774	3,397	3,632
Central														
Nushagak	1,761	8,871	4,476	4,691	3,343	5,350	3,894	5,785	5,623	3,693	5,590	6,773	5,493	7,399
Mulchatna	863	1,675	402	644	154	265	262	200	221	191	317	40	194	134
Agulowak					0	0	30	0	0	0	0	0	0	0
Agulukpak					0	30	25	0	0	0	0	0	0	0
Wood River L.[b]	70	435	93	85	23	57	58	0	208	104	186	87	117	15
Tikchik/Nuyakuk	33	60	73	11	0	170	12	0	25	58	48	93	45	61
Other	175	201	193	332	186	120	372	268	12	68	21	40	82	101
Subtotal[a]	2,862	11,242	5,237	5,763	3,706	5,992	4,653	6,253	6,089	4,114	6,162	7,033	5,930	7,710
Western														
Togiak drainage	175	663	581	790	1,165	763	644	478	1,004	76	706	1,388	730	1,734
Other	4	40	9	0	0	130	0	0	0	0	0	0	0	0
Subtotal[a]	177	703	590	790	1,165	893	644	478	1,004	76	706	1,388	730	1,734
Total		17,544	11,544	11,077	11,253	12,928	9,031	9,903	10,427	6,823	9,941	13,195	10,058	13,076

Source: Statewide Harvest Survey database, and Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b. 1996-1998 estimates were revised in 2001, so may not match previously published estimates.

[a] Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

[b] Wood River Lakes includes Lake Nunavaugaluk. Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

Bristol Bay Chinook Salmon Run Synopsis, 2008[54]

The 2008 total run of Chinook salmon to the Nushagak River was 130,783. The total run was 29,817 (18%) less than the forecast of 160,000 Chinook salmon, 15% less than the recent 20-year (1988-2007) average of 153,358 and 19% less than the recent 10-year (1998-2007) average of 162,179.

The spawning escapement in the Nushagak River was 88,452 Chinook salmon which exceeded the sustainable escapement goal (SEG) range of 40,000-80,000. A total of 42,331 Chinook salmon were harvested in the commercial (18,618), subsistence (16,642) and sport (7,071) fisheries in the Nushagak District and River. The commercial harvest of 18,618 Chinook salmon was 67% far below the anticipated harvest of 56,000 Chinook salmon. The anticipated harvest was estimated based on an average exploitation rate of 35% in the Nushagak District commercial salmon fishery from 2003-2007. When management of the commercial fishery shifted from being based on the preseason forecast to inseason escapement data, no further directed openings occurred because of the late run timing and indications that the run was less than forecasted. The actual exploitation rate in 2008 was 14%. The commercial harvest in 2008 was one of smallest harvests of Chinook salmon in the

[54] Excerpted from Memo, dated September 10, 2007, to John Hilsinger of ADF&G from Western Alaska area managers regarding Western Alaska Chinook stock status in 2008.

Nushagak District since 1966; only Chinook salmon harvests in 1999 (10,893), 2000 (12,055) and 2001 (11,568) have been smaller.

10.3.8 Community Importance of the Bristol Bay Salmon Fisheries

Table 10-48, and the other tables and figures in this section, are reprinted from an ADOLWD analysis of local resident crew members, by census areas, with the region defined by ADOLWD as the Bristol Bay Region. Overall, in the Bristol Bay Region 979 crew licenses were purchased in 2005; the majority of licenses, 643, were purchased by Dillingham residents. Given the large scale of the Bristol Bay commercial Sockeye salmon fishery it is not surprising that the regions harvest employment total, which is an estimate of the total number of crew members participating in the fishery, is much larger (4,368 in 2005) then the local resident crew counts. This indicates that non-resident crew participation in the Bristol Bay fishery is about three times more than resident crew participation.

Table 10-48 Local Resident Crew Members, Bristol Bay Region, 2001 - 2005

Borough/Census Area	Local Residents Who Bought Commercial Crew Licenses					
	2000	2001	2002	2003	2004	2005
Bristol Bay Borough	241	N/A	187	183	175	172
Dillingham Census Area	858	N/A	524	596	608	643
Lake and Peninsula Borough	225	N/A	115	157	137	164
Local Resident Total	1,324	N/A	862	936	920	979
Region's Harvest Total	5,710	N/A	3,745	4,416	4,313	4,368

N/A: Crew member licensing data from 2001 was not released by CFEC because of problems with the crew data.
Notes: 2005 data are preliminary. "Region's Harvest Total" represents total estimated number of crew workers working in the region's fisheries. Crew members do not necessarily work in their local fisheries.

Source: Commercial Fisheries Entry Commission

The crew counts shown above are in addition to limited entry commercial salmon permits that are actively used in the area's fisheries, which are shown in Table 10-49. Overall, in the Bristol Bay Region, 669 resident permit holders and a total of 2,405 permit holder were active in 2006.

Table 10-49 Fishermen by Residency, Bristol Bay Region, 2001 - 2006

Borough/Census Area	Residents Who Fished Their Permits					
	2001	2002	2003	2004	2005	2006
Bristol Bay Borough	162	160	172	166	167	173
Dillingham Census Area	489	396	434	392	401	403
Lake and Peninsula Borough	52	51	56	53	49	93
Local Resident Total	703	607	662	611	617	669
Region's Harvest Total	2,713	2,121	2,451	2,406	2,476	2,405

Source: Commercial Fisheries Entry Commission
Notes: "Region's Harvest Total" represents total fishermen who fished in the region's fisheries. Permit holders do not necessarily work in their local fisheries.

Fig. 10-57 depicts Bristol Bay Region resident permit holder salmon fishery gross earnings by community, as tabulated by ADOLWD. Dillingham recorded total earnings of between $5 million and $10 million in 2006, while Togak, Naknek, and King Salmon all recorded values of between $1 million and $5 million. Several other communities reported values less than $1 million.

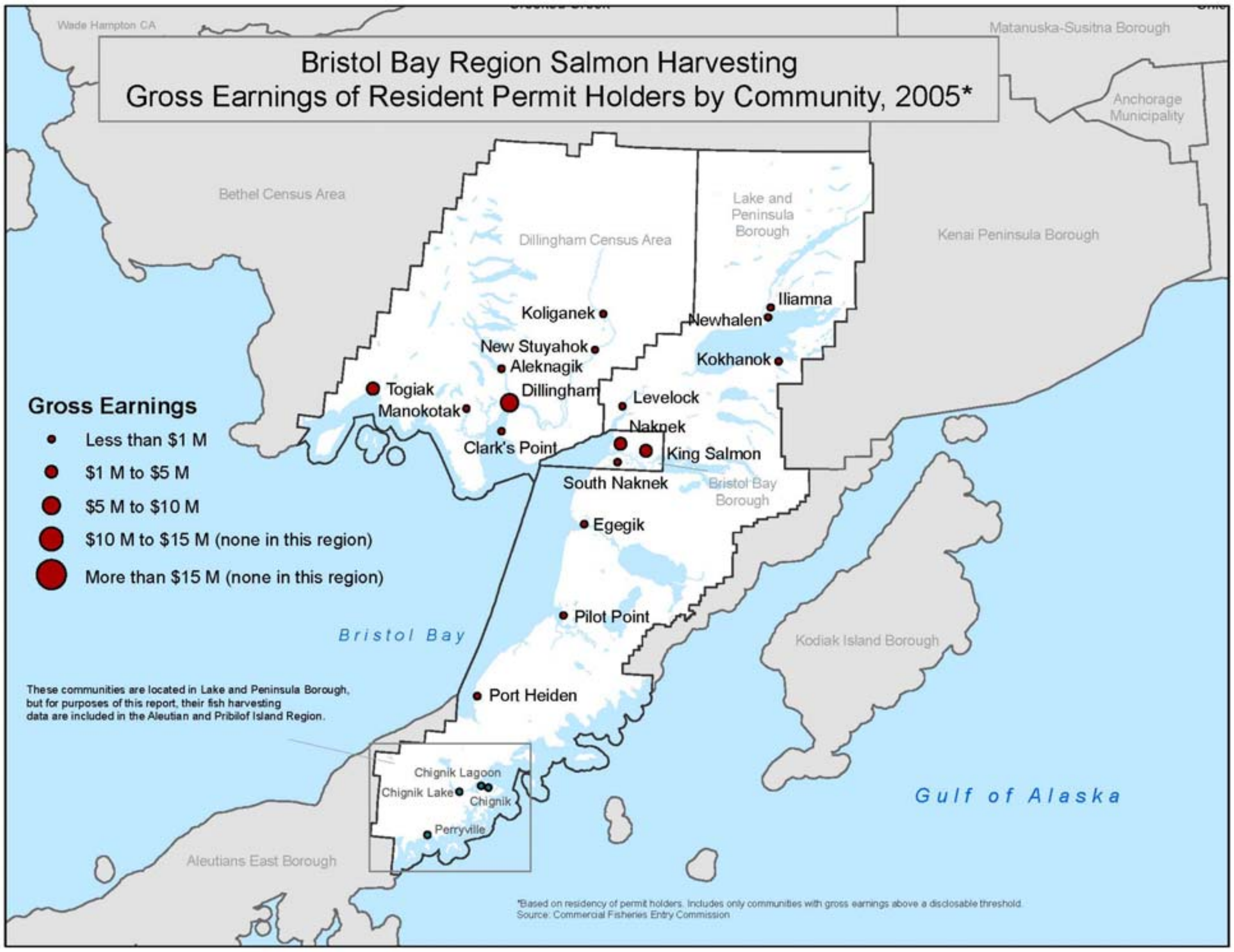


Fig. 10-57 Bristol Bay Region Salmon Harvesting Gross Earnings of Resident Permit Holders by Community, 2005.

ADOLWD has also tabulated data on fish harvesting employment and earning by gear type in the Bristol Bay Region, which is shown in Table 10-50. Salmon fishery workforce and earnings in the Bristol Bay Region have declined since 2000 when the total workforce is estimated to have been 8,091 and total gross earnings are estimated to have been about $84 million. In 2002, total workforce is estimated to have been 5,334 and gross revenues were about $32 million. In 2005, total workforce had rebounded to 6,444 and total gross earnings of about $95 million, with is the period high for the 2000s. ADOLWD has not compiled this data for 2006 or 2007.

Table 10-50 Fish Harvesting Employment and Gross Earnings by Gear Type, 2000-2005, Bristol Bay Region

Year	Gear Type	Vessels[1]	Total Estimated Workforce[2]	Total Gross Earning of Permit Holders[3]	Percent of Gross Earnings Earned by Nonresident Permit Holders
2000	Gillnet	1,825	5,475	$68,363,343	56.5
2001	Gillnet	1,547	4,641	$32,371,000	59.1
2002	Gillnet	1,160	3,480	$25,158,287	62.5
2003	Gillnet	1,397	4,191	$37,615,449	57.2
2004	Gillnet	1,354	4,062	$65,242,638	60.2
2005	Gillnet	1,376	4,128	$76,609,611	61.1
2000	Set-net	-	2,685	$15,925,879	30.1
2001	Set-net	-	2,385	$8,432,444	26
2002	Set-net	-	1,893	$6,548,040	35.4
2003	Set-net	-	2,193	$10,386,571	29.4
2004	Set-net	-	2,277	$11,629,112	38.3
2005	Set-net	-	2,358	$17,252,681	34.3
2000	Total	1,825	8,091	$84,392,479	51.2
2001	Total	1,547	6,969	$40,905,918	51.5
2002	Total	1,160	5,334	$32,029,016	56.5
2003	Total	1,397	6,324	$48,415,926	50.8
2004	Total	1,354	6,294	$77,333,163	56.3
2005	Total	1,376	6,444	$94,571,755	55.5

[1]Skiffs and small vessels are usually not registered as commercial vessels and are therefore not counted in these data.
[2]'Workforce' refers to the number of fisherman fishing permits plus the requisite crew members needed for the permit(s) they fish. Regional crew member counts are estimates derived by applying a crew factor to catch data.

[3]Gross earnings, or revenue, are currently the most reliable data available, but are not directly comparable to wages as expenses have not been deducted.

Source: Commercial Fisheries Entry Commission.

Bristol Bay Region Fish harvesting employment by species and month, also tabulated by ADOLWD, are shown in Table 10-51. Salmon fisheries dominate overall employment in the region, with the greatest employment in the summer months of June and July. In 2006, for example, 6,936 individuals were engaged in fish harvesting activity in July as compared to the monthly average of 1,185. Halibut and herring fisheries provide most of the remaining harvesting employment in the region. Of note is that there is little or no fish harvesting employment in the region from October through March. Thus, all fish harvesting related income occurs from April through September.

Table 10-51 Fish Harvesting Employment by Species and Month, 2000 - 2006, Bristol Bay Region

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mo. Avg.
All Species[1]													
2000	0	0	0	0	1,447	8,039	8,588	761	12	0	0	0	1,571
2001	0	0	0	0	939	7,246	7,476	493	18	21	12	0	1,350
2002	0	3	0	13	699	5,270	5,846	516	28	22	9	4	1,034
2003	4	0	8	380	643	6,474	6,782	389	32	22	0	0	1,228
2004	0	0	0	268	526	6,441	6,721	466	108	9	0	0	1,211
2005	0	0	3	285	411	6,135	6,755	279	15	5	5	0	1,158
2006[2]	0	0	0	0	349	6,367	6,936	549	6	3	8	0	1,185
Halibut													
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mo. Avg.
2000	0	0	0	0	42	368	335	143	0	0	0	0	74
2001	0	0	0	0	69	350	365	199	6	0	0	0	82
2002	0	0	0	0	84	422	313	191	24	18	0	0	88
2003	0	0	0	0	96	426	294	123	27	22	0	0	82
2004	0	0	0	0	116	340	199	88	24	6	0	0	64
2005	-	-	-	-	-	-	-	-	-	-	-	-	-
2006[2]	0	0	0	0	63	93	0	0	0	0	0	0	13
Herring													
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mo. Avg.
2000	0	0	0	0	1,391	0	3	0	0	0	0	0	116
2001	0	0	0	0	855	120	0	0	0	0	0	0	81
2002	0	0	0	0	600	0	0	0	0	0	0	0	50
2003	0	0	0	365	537	0	0	0	0	0	0	0	75
2004	0	0	0	263	405	0	0	0	0	0	0	0	56
2005	0	0	0	280	408	0	0	0	0	0	0	0	57
2006	0	0	0	0	274	63	0	0	0	0	0	0	28
Sablefish													
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mo. Avg.
2000	0	0	0	0	15	3	0	3	5	0	0	0	2
2001	0	0	0	0	15	5	5	14	8	21	8	0	6
2002	0	3	0	13	15	18	19	16	0	0	5	0	7
2003	0	0	8	15	10	3	15	13	5	0	0	0	6
2004	0	0	0	5	5	8	5	3	0	3	0	0	2
2005	0	0	3	5	3	0	5	0	0	5	5	0	2
2006	0	0	0	0	10	11	0	9	3	3	8	0	4
Salmon													
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mo. Avg.
2000	0	0	0	0	0	7,668	8,250	603	3	0	0	0	1,377
2001	0	0	0	0	0	6,771	7,098	276	0	0	0	0	1,179
2002	0	0	0	0	0	4,830	5,514	309	0	0	0	0	888
2003	0	0	0	0	0	6,045	6,465	249	0	0	0	0	1,063
2004	0	0	0	0	0	6,093	6,513	375	84	0	0	0	1,089
2005	0	0	0	0	0	6,135	6,750	279	15	0	0	0	1,098
2006	0	0	0	0	3	6,201	6,936	540	3	0	0	0	1,140

[1]A small number of fishermen in unknown or other fisheries are included in the totals; however, they are not listed separately in this exhibit.
[2]2006 halibut fishing employment data are not yet available. 2005's monthly halibut figures have instead been used as a temporary proxy for 2006 and are part of the 2006 "All Species" calculation. They will be revised once they become available. Counting Employment: Harvesting data in this table are counted differently than in other tables in this report. In this table, the permit itself is considered the employer.
In other tables where a count of workers was estimated, the employer was considered to be the vessel, or permit holders for fisheries that did not typically use vessels. This means that a permit holder who makes landings under two different permits (in the same vessel) in the same month will generate two sets of jobs whereas for tables where the vessel is the employer there would be only one set of workers.
Source: Commercial Fisheries Entry Commission; National Marine Fisheries Service and ADOLWD, Research and Analysis Section

Fig. 10-58 shows the locations of canneries and land based seafood processors in the Bristol Bay Region in 2006. As is shown in the figure, there are many processing facilities in the region. Note, however, that these data do not include any floating processors or buying stations that may be in operation in the area.

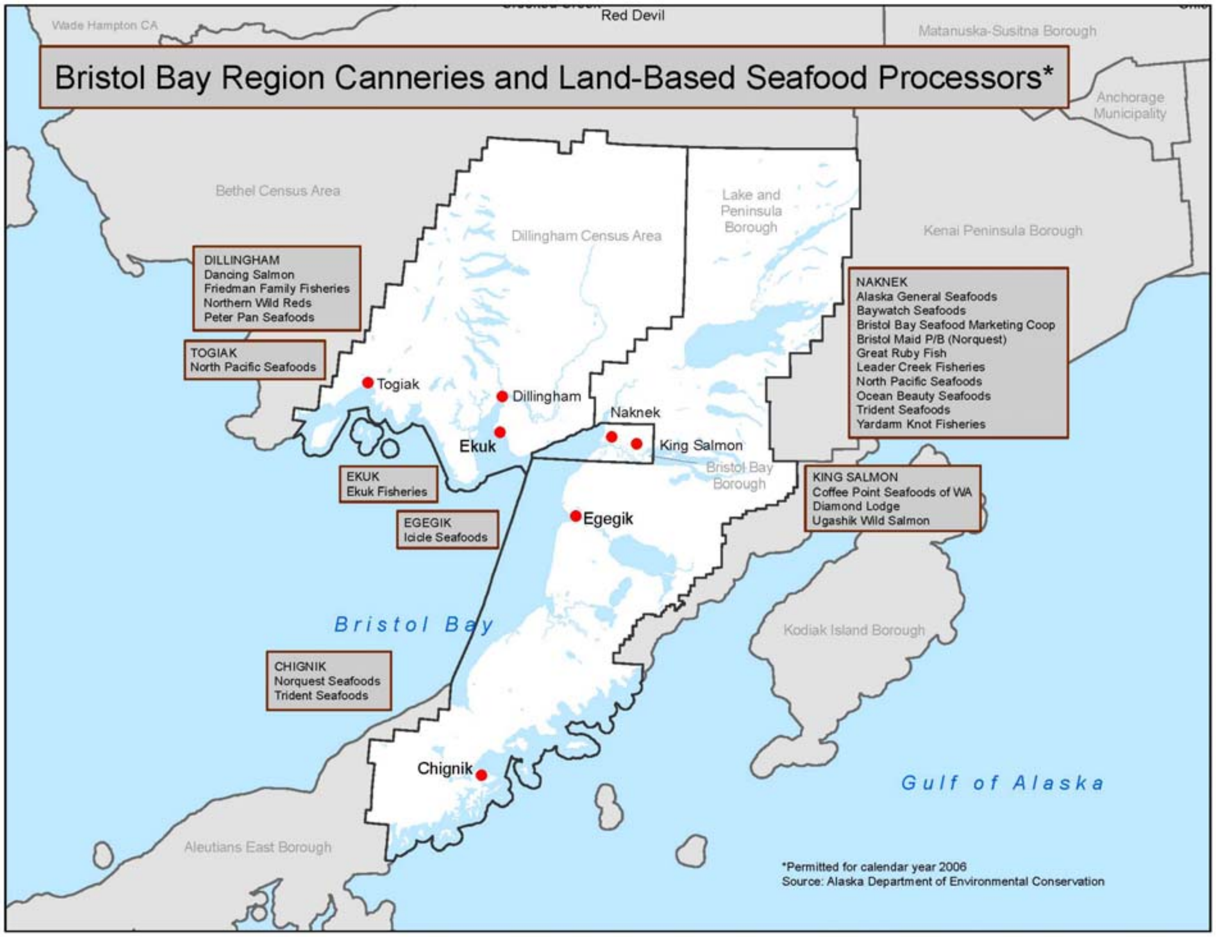


Fig. 10-58 Bristol Bay Region Canneries and Land-Based Seafood Processors

Table 10-52 provides estimated seafood processing employment, percent of non-resident workers, and percent of non-resident earnings in the Bristol Bay Region. The total worker count in the Bristol Bay Region seafood processing sector declined during the early 2000s. In 2000, the area's fisheries supported 4,091 seafood processing workers. That number declined to 2,273 in 2002, increased to 3,474 by 2004 but had fallen to 2,940 by 2006. In contrast, overall wages have increased steadily since 2002, with a prior high of $24 million in total wages estimated for 2006.

Non-resident workers have made up a substantial proportion of the Bristol Bay Region workforce and accounted for nearly 85% in 2006. Bristol Bay Non-resident wage percentages have historically been close the overall percentages of non-resident workers. Thus, wages of non-resident workers do not appear to be much higher than wages of resident workers.

Table 10-52 Bristol Bay Region Seafood Industry, 2000-2005

Seafood Processing				
Year	**Total Worker Count**	**Percent Nonresident Workers**	**Wages**	**Percent Nonresident Wages**
2000	4,091	82.7	$22,636,368	83.4
2001	2,862	75.7	$18,520,996	78.2
2002	2,273	77.6	$12,515,578	77.3
2003	2,484	75	$14,830,448	79.6
2004	3,474	83	$21,416,637	84.6
2005	3,272	81.4	$22,216,128	84.4
2006	2,940	84.6	$24,009,778	85.1

Sources: Commercial Fisheries Entry Commission and ADOLWD, Research and Analysis Section

10.4 Description of the Alternatives

In addition to the no action alternative (i.e. Alternative 1), the analysis of alternatives considers three action alternatives as well as multiple components and options under each alternative. Alternatives, components, and options may be selected in a wide array of combinations, making the "effective" suite of alternatives under consideration much more numerous than the "formal" number of alternatives might suggest. Alternative 2 would establish a hard cap on Chinook salmon bycatch, while Alternative 3 would invoke a large area closure when a triggering amount of Chinook salmon are bycaught in the pollock trawl fishery. Finally, Alternative 4, the Preliminary Preferred Alternative (PPA) contains two cap scenarios with seasonal and sector allocations and provisions for transfers, rollovers, and an ICA. These alternatives contain multiple components and options that would provide for sector level allocations, a range of seasonal split options, a range of bycatch allocations options, the potential for transferability or rollovers of unused bycatch allocations, cooperative level allocations and transfers, as well as the possibility of a system similar to the present VRHS system.

10.4.1 Alternative 1: Status Quo

Alternative 1 is the no-action alternative (status quo). This alternative is the baseline alternative against which the costs and benefits of each action alternative are compared. This alternative would leave the existing Chinook salmon bycatch reduction measures in place in the Bering Sea pollock trawl fishery. These measures include the Chinook salmon savings areas as well as the provisions of FMP Amendment 84, which exempts vessels from the Chinook salmon savings areas closures provided that they participate in the VRHS ICA described in section 10.2 above. Chapter 2 provides a complete description of Alternative 1.

10.4.2 Alternative 2: Hard Cap

Alternative 2 would establish a Chinook salmon bycatch cap on the pollock fishery which, when reached, would require all directed Bering Sea pollock fishing to cease. Only those Chinook salmon caught by vessels participating in the directed pollock fishery would accrue towards the cap, and fishery closures upon achievement of the cap would apply only to directed fishing for pollock. Table 10-53 shows the different components, options, and suboptions for determining the scale of management for the hard cap: at the fishery level (separate hard caps for the CDQ Program and the remaining three AFA sectors combined); at the sector level (each of the 4 sectors, including the CDQ sector, receive a sector-specific cap); and at the cooperative level (the sector-level cap for the inshore sector is further subdivided and managed at the individual cooperative level). Hard caps would be apportioned by season, according to the options in Component 1 (options 1-1 through 1-4). If the hard cap is to be subdivided by sector (under component 2), two options are provided for the allocation. Options for sector transfer are included in Component 3. Further subdivision of an inshore sector cap to individual inshore cooperatives is discussed under Component 4 (cooperative provisions). Chapter 2 provides a complete description of Alternative 2.

Table 10-53 Alternative 2 components, options, and suboptions.

Setting the hard cap (Component 1)	Option 1: Select from a range of numbers	ix) 87,500 x) 68,392 xi) 57,333 xii) 47,591 xiii) 43,328 xiv) 38,891 xv) 32,482 xvi) 29,323			
		Suboption adjust periodically based on updated bycatch information			
	Divide cap between A and B season	Option 1-1: 70/30 (A season/B season) Option 1-2: 58/42 (A season/B season) Option 1-3: 55/45 (A season/B season) Option 1-4: 50/50 (A season/B season)			
		Suboption rollover unused salmon from the A season to the B season, with in a sector and calendar year.			
Allocating the hard cap to sectors (Component 2)		CDQ	Inshore CV	Mothership	Offshore CP
	No allocation	7.5%	92.5%; managed at the combined fishery-level for all three sectors		
	Option 1 (AFA)	10%	45%	9%	36%
	Option 2a (hist. avg. 04-06)	3%	70%	6%	21%
	Option 2b (hist. avg. 02-06)	4%	65%	7%	25%
	Option 2c (hist. avg. 97-06)	4%	62%	9%	25%
	Option 2d (midpoint)	6.5%	57.5%	7.5%	28.5%
Sector transfers (Component 3)	No transfers				
	Option 1	Caps are transferable among sectors within a fishing season			
		Suboption: Maximum amount of transfer limited to:		a	50%
				b	70%
				c	90%
	Option 2	NMFS rolls over unused salmon bycatch to sectors still fishing in a season, based on proportion of pollock remaining to be harvested.			
Allocating the hard cap to cooperatives (Component 4)	No allocation	Allocation managed at the inshore CV sector level.			
	Allocation	Allocate cap to each cooperative based on that cooperative's proportion of pollock allocation.			
	Cooperative Transfers	Option 1	Lease pollock among cooperatives in a season or a year		
		Option 2	Transfer salmon bycatch		
		Suboption Maximum amount of transfer limited to the following percentage of salmon remaining:		a	50%
				b	70%
				c	90%

10.4.3 Alternative 3: Triggered Closures

Triggered closures are regulatory time and area closures that are invoked when specified cap levels are reached. Cap levels for triggered closures would be formulated in the same way as specified under Alternative 2. Closures may involve a single area (A season) or multiple areas (B season). Once specified areas are closed, pollock fishing could continue outside of the closure areas until either the pollock allocation is reached or the pollock fishery reaches a seasonal (June 10) or annual (November 1) closure date. Chapter 2 provides a complete description of Alternative 3.

If the trigger cap is not further allocated among the non-CDQ sectors under Component 3, sector allocation, the CDQ Program would receive an allocation of 7.5% of the BS Chinook salmon trigger cap. This CDQ allocation would be further allocated among the six CDQ groups based on percentage allocations approved by NMFS on August 8, 2005. Each CDQ group would be prohibited from directed fishing for pollock inside the closure area(s) when that group's trigger cap is reached.

Table 10-54 provides the five components and their options included under Alternative 3. The components and options that are the same as Alternative 2 are contained in Table 10-53. These components describe how the cap is formulated (component 1), who manages the closures (component 2), how the cap is subdivided (component 3), whether and how salmon can be transferred among sectors (component 4), and the specific area closure options (component 5). The areas themselves, as described in component 5, are the same areas regardless of who manages the closure (Component 2).

Table 10-54 Alternative 3 Components and options.

Setting the cap (Component 1)	Same as Alternative 2, Component 1			
Managing the cap (Component 2)	NMFS closes areas to pollock fishing when cap is reached	No allocation	7.5% to CDQ	92.5%; managed at the combined fishery-level for all three sectors
	Option 1: ICA manage vessels to avoid the cap and close areas when cap is reached			
Allocating the hard cap to sectors (Component 3)	Same as Alternative 2, Component 2			
Sector transfers (Component 4)	Same as Alternative 2, Component 3			
Area Closures (Component 5)	A season closure area (Fig. 2-2)	Once triggered, area would close for the rest of the A season		
	B season closure areas (Fig. 2-3)	If the trigger was reached before August 15, all three areas would close on August 15^{th} for the rest of the B season. If the trigger was reached after August 15^{th}, all three areas would close immediately for the rest of the B season.		

10.4.4 Alternative 4: Preliminary Preferred Alternative

The Council identified the following alternative as its preliminary preferred alternative at the June 2008 Council meeting. Alternative 4 would establish a Chinook salmon bycatch cap for each pollock fishery season which, when reached, would require all directed pollock fishing to cease for that season. Alternative 4 is described in detail in Chapter 2.

This alternative provides for two different annual scenarios with different caps for each scenario (Table 10-55). PPA1 contains a dual cap system with a high cap of 68,392 salmon and a backstop cap of 32,482 salmon. PPA2 contains a cap of 47,591. The distinction between the scenarios lies in the presence or absence of a NMFS-approved salmon bycatch ICA which provides explicit incentive to avoid salmon. At final action, the Council may choose either PPA1, PPA2, or both PPA1 and PPA2. The prescribed sector splits (and provisions to divide the sector splits to the inshore catcher vessel cooperative level and among CDQ groups) are identical for both the PPA1 high cap and PPA2 cap. All caps would be partitioned seasonally 70 percent to the A season (January 20 - June 10) and 30 percent to the B season (June 10-November 1).

Table 10-55 Alternative 4 components

<table>
<tr><td rowspan="6">Setting the hard cap (Component 1)</td><td rowspan="2">PPA1</td><td colspan="4">High cap 68,392 Chinook salmon for vessels in a NMFS-approved ICA</td></tr>
<tr><td colspan="4">Backstop cap 32,482 Chinook salmon for vessels not in a NMFS approved ICA.</td></tr>
<tr><td>PPA 2</td><td colspan="4">A Cap of 47,591, with no ICA.</td></tr>
<tr><td>PPA1 + PPA2</td><td colspan="4">A fleet-wide cap of 47,591, unless industry submits and NMFS approves an ICA agreement which provides explicit incentive for salmon avoidance, then the cap increases to 68,392 Chinook salmon. Vessels not in the ICA would be subject to the backstop cap of 32,482.</td></tr>
<tr><td>A season/B season division</td><td colspan="4">PPA1 high cap and PP2 cap would be divided 70/30 between the A and B season</td></tr>
<tr><td>Seasonal rollovers</td><td colspan="4">NMFS would rollover up to 80 percent of a sector’s or cooperative’s unused salmon bycatch from its A season account to that sector’s or cooperative’s B season account. No rollover would occur from the B season to the A season.</td></tr>
<tr><td rowspan="3">Allocating the hard cap to sectors (Component 2)</td><td></td><td>CDQ</td><td>Inshore CV</td><td>Mothership</td><td>Offshore CP</td></tr>
<tr><td>A season</td><td>9.3%</td><td>49.8%</td><td>8.0%</td><td>32.9%</td></tr>
<tr><td>B season</td><td>5.5%</td><td>69.3%</td><td>7.3%</td><td>17.9%</td></tr>
<tr><td>Sector transfers (Component 3)</td><td colspan="5">If sector level caps are issued as transferable allocations, then these entities could request NMFS to move a specific amount of the transferable allocation from one entity’s account to another entity’s account during a fishing season.</td></tr>
<tr><td rowspan="3">Allocating the hard cap to cooperatives (Component 4)</td><td colspan="5">Each inshore cooperative and the inshore limited fishery would receive a transferable allocation of the inshore CV sector level cap and must stop fishing once the allocation is reached.</td></tr>
<tr><td colspan="5">Inshore cooperative allocations would be based on that cooperative’s AFA pollock allocation percentage. Inshore limited allocation would be based on the pollock history of those vessels participating in the limited fishery.</td></tr>
<tr><td>Cooperative Transfers</td><td colspan="4">Cooperatives could request NMFS to move a specific amount of the transferable allocation from one cooperative’s account to another cooperative’s account during a fishing season.</td></tr>
</table>

10.5 Analysis of the Alternatives

This analysis addresses the potential costs and benefit of each of the proposed alternatives on the Bering Sea pollock fishery, as well as on potentially affected subsistence, commercial, personal use, and sport salmon fisheries, and on communities dependent on each of those respective fisheries. Sections 10.2 and 10.3 of this RIR provide a brief summary of relevant characteristics of these fisheries and dependent communities.

Given the extensive number of combinations of possible scenarios, the analysis has focused on a subset of those scenarios, in order to attempt to define direct adverse effects in terms of potentially forgone gross revenue, revenue at risk, and potential benefits in terms of the number of salmon potentially not bycaught, or "saved."

The various provisions for transferability, rollovers, and cooperative management provisions are treated qualitatively and in a generally comprehensive way. Such options provide flexibility with regard to allowing more pollock to be harvested by improving utilization of limited bycatch allowances across the several harvesting sectors. As such, these provisions would likely improve the aggregate economic yield of the pollock fishery, by mitigating otherwise foreclosed fishing opportunities and, thus, adverse impacts on revenue. Recognizing, however, the competing goals under Magnuson-Stevens Act of attaining optimal yield from the pollock resource, while achieving greater Chinook salmon conservation through bycatch avoidance, constraining or prohibiting transferability would tend to save more Chinook salmon, but at the possible cost of some pollock catch, while providing transferability clearly increases the probability of higher Chinook PSC losses by extending exposure to trawl bycatch, but increases pollock utilization. The PPA contains several levels of transferability limits within the available alternative set.

An Analytical Clarification

A benefit/cost framework is the appropriate way to evaluate the relative economic and socioeconomic merits of the alternatives under consideration in this RIR. When performing a benefit/cost analysis, the principal objective is to derive informed conclusions about probable net effects of each alternative under consideration (e.g., net revenue impacts). However, in the present case, necessary empirical data (e.g., operating costs, capital investment, debt service, opportunity costs) are not available to the analysts, making a quantitative net benefit analysis impossible. Furthermore, empirical studies bearing on other important aspects of these alternative actions (e.g., subsistence-use values, domestic and international seafood demand) are also unavailable, and time and resource constraints prevent their preparation for use in this analysis.

The following regulatory impact review, initial regulatory flexibility analysis, and supporting text use the best available information and quantitative data, combined with accepted economic theory and practice, to provide the fullest possible assessment (both quantitative and qualitative) of the potential economic benefits and presumptive costs attributable to each alternative action.

For clarity of presentation, a simple analytical convention is adopted for the forgone gross revenue and gross revenue-at-risk assessment (presented below), in which the 2003 through 2007 fisheries are reexamined, in succession, as if each of the proposed Chinook salmon bycatch minimization alternatives had been in place in that year. This convention is adopted, in large part, to reduce the inherent risk of introducing parameter bias, associated with the analysts speculating on, for example, future catch distributions, species catch composition, ex-vessel and first wholesale prices, and costs, etc. By using this technique, the analysis can be performed using official, empirically observed and recorded, catch and value data sets. The 2003 through 2007 records are used because they represent the most recent complete data sets for the fisheries in question and cover the timeframe during which Chinook salmon bycatch has been increasing to record levels.

Approach in this Analysis

The first section of the analysis of each alternative presents potential benefits attributable to, or deriving from, the alternative salmon bycatch minimization measures under consideration by NMFS and the Council. The second section of the analysis of each alternative presents the costs associated with the salmon bycatch minimization measures under consideration. These analyses are conducted from the point of view of all citizens of the United States; that is, they seek to address the question: "What is likely to be the net benefit to the Nation?"

The alternatives discussed in this analysis address concerns that ongoing bycatch of Chinook salmon may be adversely affecting stocks of western Alaska origin and the associated subsistence, commercial, personal use, and sport fisheries that are dependent on those Chinook salmon stocks. In economic parlance, one might say that ongoing salmon bycatch is ‘consuming’ fish that would otherwise be expected to be utilized upon return their natal rivers. Thus, a key benefit of the proposed alternative is the extent to which they release salmon to return to their natal rivers and be utilized by those who have allocative rights to Chinook salmon, including future generations of users dependent upon sustained productivity from these salmon runs, as reflected by providing for adequate escapement.

This analysis presents an overall discussion of the potential range of effects on costs and benefits of the proposed Chinook salmon bycatch minimization measures. Given the breadth of the alternative set, the analysis of direct effects has been reduced to a set of scenarios that still provide a large amount of tabular information on direct effects. As will be seen in that direct effects analysis, the impacts range from zero to virtual shutdown of the pollock fishery, and include a nearly continuous range of effects within those bounds. As such, it is difficult to present a discussion of the various impacts on costs and benefits that is directly associated with such a wide range of possible impacts. Thus, what is presented here applies, in general, to the impacts of the alternatives proportional to the severity of the constraint imposed by the alternative.

The benefits associated with the Chinook salmon savings under the alternatives are addressed under three major headings, as follows:

- Passive-use (or non-use) benefits.
- Use benefits, including consumptive use benefits, non-market benefits, and market benefits, and productivity benefits.
- Benefits of salmon savings under Alternatives 2, 3, and 4.

The costs associated with the alternative are addressed under six major headings:

1. Potentially Forgone Revenue and/or Revenue at risk
2. Fleet Operational effects
3. Safty Impacts
4. Product quality, Markets, and Consumers
5. Potentially Forgone State and Local Tax Revenues
6. Management and Enforcement Costs

10.5.1 Economic Benefits of Chinook Salmon Savings

This analysis draws heavily on the analysis in Chapters 4 and 5 that estimates the likely dates of pollock fisheries closures and thereby retrospectively projects likely forgone pollock harvest, as well as the number of Chinook salmon that may be saved under each of the alternatives due to projected fishery closures. In this way, estimates of direct costs, in terms of potentially forgone gross revenue due to unharvested pollock, may be compared to the estimated benefits, in terms of the numbers of Chinook salmon that would not be taken as bycatch. Potentially forgone pollock fishery gross revenue is estimated by tabulating the amount of pollock historically caught after a closure date and applying established sector and seasonal prices, as discussed in section 10.5.2. However, it is not a simple matter to estimate changes in gross revenues due to the changes in Chinook salmon bycatch predicted under the alternatives.

Results presented in Chapter 5 include both overall changes in Chinook salmon mortality due to alternative management measures (Alternatives 2 and 4), as well as resulting estimates of AEQ Chinook salmon that would return to natal rivers as adult fish. Additional information is provided on the relative Chinook salmon and pollock catch inside and outside proposed closures in Alternative 3, however discussion of salmon saved (overall and AEQ) is limited to the cap levels as analyzed in Alternatives 2 and 4. Additional AEQ estimates as a result of continued fishing outside of the triggered closures of Alternative 3 are not evaluated due to the difficulty in modeling the potential effect of displaced effort and the resulting bycatch of specific stocks.

The AEQ estimates represent the potential benefit in numbers of adult Chinook salmon that would have returned to individual river systems and aggregate river systems as applicable over the years from 2003 to 2007. These benefits would accrue within natal river systems of stock origin as returning adult fish that may return to spawn or be caught in commercial, subsistence, or sport fisheries. Exactly how those fish would be used is the fundamental, and exceedingly difficult, question to answer in order to provide a balanced treatment of costs and benefits.

Measuring the potential economic benefit of Chinook salmon saved, in terms of effects on specific subsistence, commercial, sport, and personal use fisheries is problematic. The proportion of AEQ estimated Chinook salmon that might be taken in each of the various fisheries is a function of many variables including overall run strength, subsistence management strategies, commercial management strategies, availability of commercial markets, the effect of weather on catch (e.g. high water), and potentially, on management of other salmon runs as well. Lacking estimates of the proportion of AEQ Chinook salmon that would be caught by each user group, it is not possible to estimate economic benefits in terms of gross revenues or other monetary values for those user groups due to changes in AEQ Chinook salmon under each alternative.

Without an estimate of changes in commercial catches, it is not possible to accurately estimate changes in gross revenue for the commercial Chinook salmon fishermen from changes in AEQ Chinook salmon under the alternatives. Estimating changes in commercial Chinook salmon gross revenues would require two unrealistic assumptions. First, the analysts would have to assume the portion of the AEQ Chinook salmon that would be caught by the commercial fisheries, such as the simple assumption that the commercial fishery would catch all of the returning AEQ Chinook salmon. This assumption would not be realistic because the subsistence use of Chinook salmon has priority over commercial use. Thus, in some river systems, increases in Chinook salmon returns might be caught wholly by subsistence fishermen.

Second, to estimate changes in gross revenues, one must also make an assumption of average weight per fish and determine an appropriate average price per pound by river system. In some rivers systems, directed commercial Chinook salmon fisheries have not occurred in recent years. Thus, average weight and average price proxy values from other areas would have to be used, which creates additional uncertainty in the estimates of potential commercial value.

Further, the total social and cultural value of subsistence Chinook salmon catch cannot be evaluated in a way that is directly comparable to the monetary value of potential increases in commercial Chinook salmon catch or forgone gross revenues from the pollock fleet. Estimates of changes to the gross revenues to the commercial Chinook salmon fishery may mask the true subsistence value; tempting the reader to focus on the monetary estimates of commercial value when the non-monetary value of subsistence harvests is very important and not reflected in terms of gross revenues.

For the reasons outlined above, this analysis of potential economic benefits does not provided estimates of a monetary value of the salmon saved. First, this analysis discussed the passive-use benefits of Chinook salmon The analysis instead relies on AEQ estimates of Chinook salmon saved as the measure of economic benefits of the alternatives and options. The first section provides an overview of the Chinook salmon saved under the alternatives. Subsequent sections provide a detailed assessment of the Chinook salmon saved under each alternative.

10.5.1.1 Passive-use Benefits

It can be demonstrated that society places economic value on relatively unique environmental assets, whether or not those assets are ever directly exploited. For example, society places real and potentially measurable economic value on simply knowing that a rare or endangered species of animal or plant is protected in the natural environment. The term 'value' is used, in the present context, as it would be in a cost-benefit analysis (i.e., what would people be willing to give up to preserve and/or enhance the asset being assessed?). Because no market, in the traditional economic sense, exists within which protections or enhancement of environmental assets is bought, sold, or traded, there is no institutional mechanism wherein a market clearing price may be observed. Such a market clearing price would typically be used to estimate a consumer's willingness-to-pay to obtain the goods or services being traded. Nonetheless, the continued and sustained existence of wild salmon, and especially Chinook salmon, does have economic value, as demonstrated by the current public debate over its preservation and enhancement in parts of the country where salmon stocks are identified as threatened or endangered under the ESA.

Among those holding these values, there is no expectation of directly 'using' this asset, in the normal sense of that term. Whether referred to as passive-use, non-use, or existence value, the underlying premise is that individuals derive real and measurable utility (i.e., benefit) from the knowledge that relatively unique natural assets, even if utilized sustainably, will continue to exist in perpetuity.

The concept of passive-use value is well established in economic theory, supported by a growing body of empirical literature, increasingly employed in both public and private valuation analyses, and accepted by most as a legitimate, appropriate, and necessary aspect of natural resource policy and management decision-making. At present, the only widely accepted means of estimating passive-use values is by surveying people to find out what they would be willing to pay (or willing to accept, depending upon with whom the implicit property right resides) for any given action that affects a resource for which non-market values are hypothesized to exist. This approach is termed the 'contingent value' method (CVM). A substantial body of empirical literature has developed, over perhaps the last 25 years, describing the application of this technique to the valuation of natural resource assets. The use of CVM has also been carefully reviewed and accepted (when employed appropriately) by the federal courts (*Ohio v. United States Department of the Interior*, 880 F.2 432 [D.C.Cir. 1989]), as well as by NOAA (58 Federal Register 4601, 4602-14 [1993]).

Empirical research on passive-use value, within the broad context of natural resources, suggests that these economic values may be substantial when they exist. When the public is consciously aware of risks posed to a unique asset (e.g., the Amazon rain forest), they often reveal significant willingness-to-pay values for its protection. In that particular example, there is empirical evidence to support the existence of significant passive-use values (e.g., cash donations to various *Save the Amazon Rain Forest* groups or efforts, celebrity-sponsored fund raisers and large monetary donations to the cause, outright purchase of at-risk land, or acquisition of use-rights to at-risk land, etc.). Closer to home, a USDA Forest Service (Forest Service) study that used contingent valuation to measure the value the public places on the existence of critical habitat for the northern spotted owl indicated that Oregon residents were willing to pay between $49.6 million and $99 million (or $28 per acre) (Loomis et al. 1996).

In the current context, Chinook salmon are clearly valuable because they contribute not only to the existence and productivity of many living assets for which both market and non-market values exist (e.g., commercial salmon fisheries, Steller sea lions, sea birds, and toothed whales of various species), but also the social fabric, identity, and culture of Native and non-native peoples throughout Alaska, the Pacific Northwest, and British Columbia. While this may seem intuitively obvious, isolating a passive-use value unique to Chinook salmon taken in the Bering Sea nonetheless presents conceptual problems. While society's desire to sustain wild salmon stocks may be regarded as a derived demand, because it provides an ecological service that supplies an input to the production of goods and services from which society derives direct consumptive benefit, passive-use values are in addition to the value obtained from derived goods and services. It seems probable that a portion of the willingness to pay for goods and services obtained from all the living marine resources of the Bering Sea, whether or not it is revealed in a market, has embedded in it the value of those same resources. Few holders of these values would likely be able to either explicitly recognize or express them.

That does not imply, however, that these values do not exist, or that with sufficient time and expertise, they could not be measured. It simply means that, to the best of the analysts' knowledge, there has been no study published to date concerning the passive-use value of changes in Chinook salmon run sizes for stocks intercepted in the Bering Sea pollock fishery. Therefore, at present, it is not possible to provide a specific monetary estimate of the passive-use value that is hypothesized to be associated with one or another of the proposed salmon bycatch minimization alternatives or, therefore, to differentiate passive use benefits by alternative. Thus, while this analysis recognizes their existence, passive use benefits cannot be further analyzed.

10.5.1.2 Use and Productivity Benefits

As noted above, passive-use value (e.g., existence, bequest value) is often regarded as a non-use value, because it does not depend on actual or even potential interaction between the person holding the value and the resource being valued. This section addresses values associated with direct use of the resource. Among these use-benefits are several categories: market and non-market, as well as consumptive and non-consumptive uses. Each is addressed below, within the context of its potential relationship to the alternative measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery.

Non-market/non-consumptive uses are, in general, associated with private recreation or leisure activities. A typical example of such a use is unguided catch-and-release sport fishing. Unless a guide is hired, the user does not enter into a market transaction to acquire access of the resource, nor does his or her use 'consume' the resource, except perhaps for some hooking mortality. In the current context, non-market/non-consumptive values are imbedded within the discussion of sport fishing value and represents an aspect of the aggregate benefit attributable to measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery.

Non-market/consumptive uses may include, within the current context, authorized subsistence use, personal use, and consumptive sport use of Chinook salmon. Alaska Native populations, and some rural residents, have retained the right to exploit the Chinook salmon resources for customary and traditional cultural activities, as well as for personal use. Many western Alaska residents lead a subsistence lifestyle that is highly dependent on salmon. Others obtain salmon for winter food through personal use and consumptive sport fishing. These extra-market consumptive uses represent a benefit that would be enhanced by minimizing Chinook salmon bycatch. They are, therefore, appropriately listed among the gains society may expect from adoption of one or more of the alternatives to the status quo.

Market/non-consumptive uses comprise activities that involve a market transaction to acquire access to the resource, but do not involve consumption of the resource. Examples may include ecotourism, wherein clients pay outfitters to guide them to locations where migrating or spawning salmon may be observed in their natural state. Consider the willingness to pay exhibited by those who incur the cost to travel to remote areas of Alaska, guided and outfitted by commercial tourism companies, simply to watch the interaction of migrating salmon and bears, eagles, and other apex predators. In the present context, guided sport fishing, when utilizing catch and release practices, would also qualify as a market/non-consumptive use. While some of this activity occurs in western Alaska, mostly in the Nushagak and Togiak areas of Bristol Bay, some consumption of fish is allowed and does occur. Thus, it is not clear what proportion of guided fishing might qualify under this criterion and what might be termed market/consumptive use. In any event, economic values of these forms will necessarily be imbedded in the overall benefit assessment of prevention of Chinook salmon bycatch.

An additional class of market/consumptive-use values may be identified in connection with Chinook salmon bycatch minimization measures in the Bering Sea. Improved in-river "Production and Yield" of Chinook salmon in the ocean environment may enhance commercial fishery opportunities (consumptive-use value) as well as improve escapements and sustainability of future Chinook salmon runs. The implication of these improvements could be quite important, given the numerous "source" water-sheds that contribute Chinook salmon lost to PSC interception in the BS pollock fisheries. As discussed in section 5.2.8, a very small amount of these Chinook salmon losses accrue to stocks of fish that are either under a "threatened" status, or already listed as "endangered" under the ESA.

10.5.1.3 Comparison of Chinook Salmon Savings under Alternatives 2 and 4 with Chinook salmon bycatch under Alternative 1.

This section evaluates the number of Chinook salmon saved and the estimated AEQ Chinook salmon saved by year, for the Alternative 2 and 4 cap levels, and season and sector options, compared to the actual Chinook salmon bycatch and AEQ Chinook salmon under Alternative 1, status quo. Table 10-56 compares the number of Chinook salmon that would have been saved in 2007, if PPA1, PPA 2, or the highest and lowest caps of comparable seasonal and sector combinations of Alternative 2 had been in place.

Table 10-56 Total projected reduction of Chinook salmon bycatch and adult equivalent salmon bycatch from the actual 2007 bycatch estimate of 121,638 Chinook salmon. Compares PPA1, PPA2, and the highest and lowest caps with comparable seasonal and sector combinations of Alternative 2.

	PPA1	PPA2	Alt2 cap 87,500 Opt2d 70/30	Alt2 cap 29,300 Opt2d 70/30
Number of Chinook salmon saved	55,307	75,306	46,766	112,647
Adult equivalent Chinook salmon saved	26,420	40,851	22,417	65,476

Table 10-57 provides this summary comparison by indicating the percentage change in aggregate AEQ estimates of benefits under the alternatives analyzed compared to the estimated historical AEQ by year (2003-2007). This comparison shows that the AEQ benefits of the PPA scenarios range from a less than 1% change in AEQ Chinook salmon estimated for 2003, to a high of 52% additional AEQ salmon estimated for PPA2 in 2007.

Four cap options for Alternative 2 with the same 70/30 seasonal splits and sector divisions (Option 2d) are compared against PPA1 and PPA2. The Alternative 2 cap level considered closest to PPA1 is 68,100 Chinook salmon. Alternative 2 at this cap level would have a similar minor benefit in 2003 but in higher bycatch years, like 2007, it would have an estimated 64% increase in benefit compared with a 34% increase for PPA1. For comparison, the highest cap of 87,500 shows the lowest increase in benefits at 28%. As with the PPA scenarios, one can see the range of values that fall in between as bycatch levels generally increased from 2003 through 2007. The highest percentage change from status quo occurs with the lowest cap considered (29,300) in the highest bycatch year (2007) which results in an estimated 83% increase in the AEQ Chinook salmon savings in that year.

Table 10-57 Percentage change in adult equivalent Chinook salmon savings from Alternative 1, status quo, between Alternative 4 (PPA) caps and closely comparable management options in Alternative 2, for the years 2003 to 2007.

	2003	2004	2005	2006	2007
Alt. 1 AEQ Chinook salmon	**33,215**	**41,047**	**47,268**	**61,737**	**78,814**
PPA1	<1%	7%	16%	22%	34%
PPA2	2%	11%	24%	40%	52%
87,500 70/30 opt2d	1%	7%	19%	21%	28%
68,100 70/30 opt2d	<1%	18%	29%	51%	64%
48,700 70/30 opt2d	12%	18%	29%	51%	64%
29,300 70/30 opt2d	42%	45%	51%	67%	83%

These results are for the total AEQ Chinook salmon saved by year to give an overall impression of the relative magnitude of effects for all river systems to compare against the constraints on the pollock fishery. Individual benefits of AEQ Chinook salmon returning to specific river systems is evaluated next, with a particular focus on river systems in western Alaska given our ability to resolve these river systems singularly. Our ability to provide results relating salmon saved to specific rivers of origin is limited by the aggregate genetic data employed in this analysis. Further discussion of this is included in Chapter 3.

Table 10-58 Projected reduction of adult equivalent Chinook salmon bycatch, in number of salmon, by region of origin (based on genetic aggregations), using 2007 results. Compares PPA1, PPA2, and the Alternative 2 highest and lowest caps with comparable seasonal and sector combinations. Higher numbers indicate a greater salmon "savings", compared to Alternative 1, status quo ("No hard cap").

Stocks of Origin[55]	PPA1	PPA2	Alt2 cap 87,500 Opt2d 70/30	Alt2 cap 29,300 Opt2d 70/30
Yukon	5,228	8,840	3,299	14,938
Kuskokwim	3,398	5,746	2,144	9,710
Bristol Bay	4,443	7,514	2,804	12,697
Pacific Northwest aggregate stocks (PNW)	8,489	11,135	9,581	15,507
Cook Inlet stocks	1,042	1,202	1,010	1,284
Transboundary aggregate stocks (TBR)	699	821	670	909
North Alaska Peninsula stocks (N.AK)	2,318	4,389	2,264	8,594
Aggregate 'other' stocks	803	1,203	646	1,837

Table 10-58 provides an overview of the stocks of origin and the relative reduction of AEQ Chinook salmon bycatch by region of origin for a snapshot of one year (2007) for PPA1 and PPA2 compared to two caps options under Alternative 2. Results for aggregate groupings for the Pacific Northwest stocks, the North Alaska Peninsula stocks, Cook Inlet stocks, and Transboundary stocks are shown in the analysis for comparison of their relative trends by alternative. Absolute impacts of aggregate AEQ savings as noted to these rivers systems is not estimable at this time due to the genetic limitations. However results are shown for inference of trends to various regions and areas.

[55] For specific information on stocks included in each stock of origin grouping, see Table 3-7 in Chapter 3.

As described in Chapter 5, proportional break-outs were only possible for western Alaskan-origin Chinook. Thus results are shown individually for these river systems with comparison made as possible with relative catch by commercial, subsistence, and sport users over the analytical time period considered.

Just as with estimating the total changes in catches in the commercial Chinook salmon fisheries from AEQ salmon saved discussed above, it is not possible, with presently available information, to determine the proportions of river specific AEQ estimates of returning adult Chinook salmon that would be caught in commercial, subsistence, and sport fisheries in the various river systems of western Alaska. The personal use fishery in western Alaska is a very small component of the subsistence fishery information presented here.

While it is very difficult to retrospectively assess the specific impacts or management implications of additional AEQ Chinook salmon to a given river system, it is reasonable to assume that any additional fish would benefit escapement and harvest according to the priorities outlined above. However, management decisions in the lower Yukon and Kuskokwim Rivers must be made long before adequate information on escapements is available and if additional AEQs of unknown stock origin were spread throughout the run, how management actions might specifically provide for greater stock-specific escapements is uncertain. Regardless, any additional fish in the run would presumably help to achieve escapement goals, and there is demonstrable benefit even from missing the escapement goal by a smaller amount of fish. Similarly, it is difficult to predict the impacts of additional fish to particular subsistence fishermen or even to the subsistence harvest as a whole. If escapement goals are projected to be met, it is logical that subsistence fishermen would directly benefit from increased run sizes of any magnitude.

Table 10-59 summarizes some management indices for the Yukon River, Kuskokwim River, and Bristol Bay, in conjunction with the restrictions that were imposed over the time period considered, and discusses what, if any, management changes could have been made given the projected changes in AEQ Chinook salmon returns indicated in this analysis. No subsistence fishery restriction occurred in the Kuskokwim, Yukon, or Bristol Bay from 2003 to 2007; however some fishermen reported that it took them longer to catch their needed number of Chinook salmon. There are direct cost increases associated with the need for increased time, effort, and resources (fuel, equipment wear and tear) necessary to approach individual subsistence needs. Where increases in run size contribute to achieving escapement goals and satisfying subsistence needs, one would expect some benefit to the commercial fishery as well. In the Yukon-Kuskokwim Delta, commercial fishing represents an important economic impact to local communities and in many respects, facilitates the pursuit of subsistence living with needed cash for supplies and equipment. The predicted benefits of additional AEQs to commercial fishermen may depend greatly on when the fish recruit to the fishery in relation to managers' assessments of escapement and subsistence harvest.

Table 10-59 Summary of Chinook salmon escapement goals obtained, restrictions imposed, and potential management changes with additional AEQ Chinook salmon returns to rivers over the time period from 2003 to 2007.

River	Escapement goals met from 2003-2007	Additional restrictions imposed from 2003-2007			Likely management changes if additional AEQ Chinook salmon had been available 2003-2007
		Subsistence	Commercial	Sport	
Yukon	2006-2007 some key goals not met	No	No	No	2006-2007 additional fish would accrue towards escapement; in all years increased potential for higher subsistence and commercial harvest
Kuskokwim	Most	No	No	No	Potential for increased commercial harvests within market constraints
Bristol Bay	2007 goals not met	No	No	2007	If additional Chinook salmon were sufficient to meet escapement then 2007 sport fish restriction would not have been imposed; In all years additional fish towards escapement, increased potential for higher subsistence and commercial harvest

Kuskokwim River

In the Kuskokwim River, most escapement goals were met during the period from 2003 to 2007 and there were no restrictions to subsistence or sport fisheries beyond those provided for in state regulation. If additional fish had returned in these years, the commercial harvest may have been higher in some years, though poor chum salmon markets and lack of buyer capacity may have precluded more commercial fishing. Processor capacity is expected to increase with completion of a large facility in the area in 2009, so future additional AEQ Chinook salmon returns could directly benefit commercial fishermen.

Table 10-60 provides Kuskokwim area specific catch, by harvesting sector and by year, compared to AEQ Chinook salmon estimates for PPA1, PPA2, and for high and low caps under Alternative 2. The Kuskokwim AEQ estimates for the PPA scenarios range from -214[56] Chinook salmon under PPA1, in 2003, to 5,746 Chinook salmon under PPA2 in 2007. This simply indicates that the greatest benefit, in terms of numbers of returning adult Chinook salmon, would occur for the lower bycatch cap in years with the highest Chinook salmon bycatch. This also holds for the cap examples shown for Alternative 2, with the lowest benefit of 365 more Chinook salmon returning occurring under the highest cap of 87,500 in 2003. The greatest benefit, in the

[56] In years when the actual bycatch was below a given cap level, this could have resulted in negative AEQ salmon savings (i.e., more, not fewer, salmon were prevented from spawning than actually occurred). This can happen when the combined cumulative effect from prior years bycatch levels are low in some seasons and sectors and high in others.

Kuskokwim areas, under Alternative 2 would be 9,710 more Chinook salmon returning, which occurs under the lowest cap of 29,300 and in the high bycatch years of 2006 and 2007.

Comparing these numbers to subsistence catches, which have priority over all other uses once escapements have been met, reveals that historic Kuskokwim area subsistence catches are much larger than the estimated increases in AEQ Chinook salmon returns under Alternatives 2 and 4. However, commercial and sport catches are smaller than many of the AEQ estimates, indicating potential benefits to commercial and sport fishermen in the area.

Table 10-60 Kuskokwim Area Annual Chinook Salmon Catch, by Sector, Compared to AEQ Chinook Salmon Estimates for Alternatives 2 and 4 (2003-2007).

Kuskokwim Area					
Catch and AEQ Estimates	Year				
	2003	2004	2005	2006	2007
Commercial Catch	158	2,300	4,784	2777	179
Subsistence Catch	67,788	80,065	70,393	63,177	72,097*
Sport Catch	401	857	1,092	572	2,543*
Total Catch	68,347	83,222	76,269	66,526	74,819
PPA1	-214	384	1,269	2217	3,398
PPA2	-40	301	1,264	3,849	5,746
Alt. 2, 87,500, opt2d, 70/30	365	824	1,369	2,144	2,144
Alt. 2, 29,300, opt2d, 70/30	2,399	3,243	6,361	9,710	9,710

* Some 2007 data are preliminary

Yukon River

In the Yukon River, for the period 2003-2005, most escapement goals were met and there were no restrictions to subsistence or sport fisheries. Due to generally low run sizes, commercial fisheries were managed conservatively. Any additional fish would have likely increased escapements and contributed to subsistence and commercial harvests. Sport fish harvest is fairly stable and the harvest may be impacted more by water conditions than abundance, unless restricted to meet escapement goals. In 2006 and 2007, some key escapement goals were not met, but there were no restrictions to subsistence or sport fisheries. Additional fish in these years would most likely have accrued to escapement and some additional subsistence harvest. Yukon River Chinook salmon command a high price in commercial markets, but their value to escapement and subsistence fishermen is inestimable.

Table 10-61 provides Alaska Yukon River specific catch, by harvesting sector and by year, compared to AEQ Chinook salmon estimates for PPA1, PPA2, and the Alternative 2 high and low caps. The Yukon AEQ estimates for the PPA scenarios range from -329 Chinook salmon under PPA1, in 2003, to 8,840 Chinook salmon under PPA2 in 2007. This indicates that the greatest benefit, in terms of numbers of returning adult Chinook salmon, would occur under the lower bycatch cap in years with the highest Chinook salmon bycatch. This also holds for the cap examples shown for Alternative 2, with the low being -2 Chinook salmon in 2004, and under the highest cap of 87,500. The greatest benefit, in the Yukon area, under Alternative 2 would be 14,938 fish, which occurs under the lowest cap of 29,300 and in the high bycatch year of 2007.

Comparing Yukon AEQ numbers to subsistence catches, which have priority over all other uses once escapements have been met, reveals that historic Yukon area subsistence catches are much larger than the projected estimates of AEQ Chinook salmon returns under Alternatives 2 and 4. The same is true of historic Yukon commercial catches. However, both PPA scenarios would result in AEQ Chinook salmon estimates that are more than 10% of the commercial catch in 2007, and considerably larger than sport catch in that year. In 2006, a similar result is seen, although with a slightly smaller percentage. Thus, it is difficult to interpret just how much benefit the projected changes to AEQ Chinook salmon would imply.

Table 10-61 Alaska Yukon River Area Annual Chinook Salmon Catch, by Sector, Compared to AEQ Chinook Salmon Estimates for Alternatives 2 and 4 (2003-2007)

Yukon River (Alaska)					
Catch and AEQ Estimates	**Year**				
	2003	**2004**	**2005**	**2006**	**2007**
Commercial Catch	40,438	56,151	32,029	45829	33,634
Subsistence Catch	55,109	53,675	52,561	47710	59,242
Sport Catch	2,719	1,513	483	739	960
Total Catch	98,266	111,339	85,073	94278	92,876
PPA1	-329	591	1,952	3409	5,228
PPA2	-61	463	1,944	5,921	8,840
Alt. 2, 87,500, opt2d, 70/30	561	-2	1,267	2,107	3,299
Alt. 2, 29,300, opt2d, 70/30	3,690	3,469	4,989	9,786	14,938

Bristol Bay

During the period 2003-2006, escapement goals were achieved and no restrictions were placed on any subsistence, sport, or commercial fisheries in Bristol Bay. Though additional AEQ Chinook salmon returns would not have changed any management decisions made in those years, additional fish would have benefited all uses while providing additional escapement. In 2007, the sport fish bag limit was reduced to a single fish after July 7 for the Nushagak River. The in-river escapement goal was not achieved despite this restriction. Increased AEQ Chinook salmon returns to Bristol Bay would have mainly accrued towards achieving the in-river escapement goal, and probably would have made the Nushagak sport fish restriction unnecessary. These restrictions have immediate and lasting economic impacts due to continued perception of poor fishing and possible future restrictions. Additional fish might have provided benefits to commercial fishermen, though specific impacts are highly dependent upon the run timing of these fish.

Table 10-62 provides Bristol Bay area catch, by harvesting sector and by year, compared to AEQ Chinook salmon estimates for PPA1, PPA2, and Alternative 2 high and low caps. The Bristol Bay AEQ estimates for the PPA scenarios range from -280 Chinook salmon under PPA1, in 2003, to 7,514 Chinook salmon under PPA2 in 2007. This indicates that the greatest benefit, in terms of numbers of returning adult Chinook salmon, would occur under the lower bycatch cap in years with the highest Chinook salmon bycatch. This also holds for the cap levels shown for Alternative 2, with the low being -1 Chinook salmon in 2004, and under the highest cap of 87,500. The greatest benefit, in the Bristol Bay area, under Alternative 2 would be 12, 697 Chinook salmon, which occurs under the lowest cap of 29,300 and in the high bycatch year of 2007.

In the Bristol Bay area, in contrast to the Yukon and Kuskokwim areas, commercial fishing takes the largest proportion of harvestable surplus of Chinook salmon, possibly due to the presence of a large sockeye fishery. Comparing Bristol Bay AEQ numbers to catches reveals that historic Bristol Bay area subsistence and sport catches are larger than the Bristol Bay AEQ estimates across under Alternatives 2 and 4, but not by as great a margin as evident in the Kuskokwim and Yukon areas. In addition, historic Bristol Bay area commercial catches are considerably larger than the estimates of AEQ Chinook salmon returns to Bristol Bay. As was the case for the Yukon; however, both PPA scenarios would result in AEQ Chinook salmon estimates that approach (PPA1) or exceed (PPA2) 10% of the commercial catch in 2007, and that are considerably larger than sport catch in that year. Thus, it is difficult to interpret just how much benefit the estimated changes in AEQ Chinook salmon returns to Bristol Bay would imply and it is variable by year and option.

Table 10-62 Bristol Bay Area Annual Chinook Salmon Catch, by Sector, Compared to AEQ Chinook Salmon Estimates for Alternatives 2 and 4 (2003-2007).

Bristol Bay Area					
Catch and AEQ Estimates	Year				
	2003	2004	2005	2006	2007
Commercial Catch	46,953	114,280	76,590	106962	62,670
Subsistence Catch	21,231	18,012	15,212	12617	16,002
Sport Catch	9,941	13,195	13,036	10749	15,200
Total Catch	78,125	145,487	104,838	119579	78,672
PPA1	-280	503	1,659	2898	4,443
PPA2	-52	394	1,653	5,033	7,514
Alt. 2, 87,500, opt2d, 70/30	477	-1	1,077	1,791	2,804
Alt. 2, 29,300, opt2d, 70/30	3,137	2,948	4,241	8,318	12,697

Western Alaska combined

Table 10-63 combines the AEQ and catch estimates discussed above for each of the three major western Alaska river systems for which AEQ estimates are available in order to compare the aggregate effect of the alternatives on western Alaska Chinook salmon runs. Note; however, that genetic data necessary to provide separate AEQ estimates for the Norton Sound area rivers are not presently available. Thus, these estimates do not include Norton Sound.

The western Alaska total (excluding Norton Sound) AEQ estimates for the PPA scenarios range from -823 Chinook salmon under PPA1, in 2003, to 22,100 Chinook salmon under PPA2 in 2007. Under the Alternative 2 cap of 87,500, the smallest increase in returns would have been 821 Chinook salmon in 2004. The greatest benefit, in the western Alaska area, under Alternative 2, would be an estimated increase in returns of 37,345 Chinook salmon under the lowest cap of 29,300 and in the high bycatch year of 2007.

Comparing the combined total of Chinook salmon catches for western Alaska with combined total AEQ estimates reveals that total catches, which are dominated by subsistence catches, are more than ten times larger than the largest estimate of AEQ Chinook salmon returns under Alternatives 2 and 4, in all years except 2007. However, these AEQ estimates, when compared to sector level commercial harvests, can range between 10% and 40% of the total commercial catch in the highest bycatch year of 2007. Similarly, the AEQ estimates are, in some cases, comparable to sport catches. Thus, while these AEQ estimates appear small relative to the total catch, they may, nonetheless, represent measurable benefit to harvesters. The extent of that benefit is, of course dependent on which option is chosen and what level of bycatch occurred, as well as on the in-season management of the western Alaska salmon fisheries. Further, the aggregate AEQ estimates of all river systems combined produce numbers of AEQ Chinook salmon returns that are much larger than the western Alaska estimates, which represent a subset of the aggregate estimates presented in Table 10-56.

Table 10-63 Total western Alaska (excluding Norton Sound) Annual Chinook Salmon Catch, by Sector, Compared to AEQ Chinook Salmon Estimates for Alternatives 2 and 4 (2003-2007).

Total Kuskokwim, Alaska Yukon, and Bristol Bay					
Catch and AEQ Estimates	Year				
	2003	2004	2005	2006	2007
Commercial Catch	87,549	172,731	113,403	155,568	96,483
Subsistence Catch	144,128	151,752	138,166	123,504	147,341
Sport Catch	13,061	15,565	14,6	12,060	18,703
Total Catch	244,738	340,048	266,180	280,383	262,527
PPA1	-823	1,478	4,880	8,524	13,069
PPA2	-153	1,158	4,861	14,803	22,100
A2, 87,500, opt2d, 70/30	1,403	821	3,713	6,042	8,247
A2, 29,300, opt2d, 70/30	9,226	9,660	15,591	27,814	37,345

10.5.1.4 Chinook salmon bycatch and fisheries under Alternative 1

In October 2005, to reduce the pollock fisheries' bycatch of Pacific salmon, the Council adopted Amendment 84 to the BSAI FMP. Regulatory management measures implemented prior to Amendment 84 to reduce salmon bycatch had not been sufficiently effective at controlling Chinook salmon bycatch. The Council developed Amendment 84 to attempt to resolve the bycatch problem through the AFA pollock cooperatives. Amendment 84 exempts pollock vessels from Chinook and Chum Salmon Savings Area closures, if the vessel participates in the VRHS ICA to reduce salmon bycatch. Despite these efforts, salmon bycatch numbers have continued to increase substantially.

While the inter-cooperative reports on Chinook salmon bycatch indicate that the VRHS has reduced Chinook salmon bycatch rates compared with what they would have been without the measures, concerns remain because of escalating amounts of Chinook salmon bycatch through 2007. From 1990 through 2001, the Bering Sea Chinook salmon bycatch average was 37,819 salmon annually. Since 2002, Chinook salmon bycatch numbers have increased substantially. The averages from 2002 to 2007 were 82,311 Chinook salmon, with a bycatch peak of approximately 122,000 Chinook salmon in 2007. Currently, the best scientific data identifying the "source of origin" of the Chinook salmon intercepted in the BS pollock trawl fisheries, while not exhaustive, do permit assignment of Chinook salmon losses to specific regional stocks (e.g., AYK, PNW, Asia) with an acceptable level of confidence. Estimates vary by year and fishing season, but more that half of the Chinook salmon caught in the Bering Sea pollock fishery were destined for western Alaska river systems.

The description of potentially affected salmon fisheries section (section 10.3) provides an extensive treatment of Chinook salmon fisheries in western Alaska. The major Chinook fisheries occur in the Norton Sound Region, Kuskokwim area, the Yukon River, and in the Nushagak and Togiak Districts of the Bristol Bay Region. A summary of findings is presented here to characterize the present situation in those fisheries.

Norton Sound

The BOF made several changes to regulations at meetings in February and March 2007 for the management of Norton Sound salmon. The BOF changed the stock of concern classification for Subdistrict 1 (Nome) chum salmon from a management concern to a yield concern. Subdistricts 2 and 3 (Golovin and Moses Point) chum salmon stocks and Subdistricts 5 and 6 (Shaktoolik and Unalakleet) Chinook salmon stocks were continued as stocks of yield concern.

A Chinook salmon management plan for Subdistricts 5 and 6 (Shaktoolik and Unalakleet) was established to address the poor Chinook salmon runs in the 2000s. This plan placed a series of restrictions on subsistence harvest of Chinook salmon. Overall subsistence salmon harvest in the Norton Sound region peaked in 1996), with 129,046 fish caught. A downward trend in overall harvest occurred in the late 1990s, but the 2002 harvest of 103,488 fish was above historic averages. Since then, overall harvest has trended downward and the 2007 harvest of 48,694 fish was well below the 84,950 fish five year average. Within these overall trends are downward trends in subsistence catch of Chinook salmon since the late 1990s. Norton Sound area subsistence Chinook harvests peaked in 1997 at 8,989 fish. Since then, subsistence Chinook harvests have declined in nearly every year and the 2007 harvest of 2,646 fish was the lowest level recorded since 1994. Note; however, that prior to 1994, and between 2004-2006, subsistence surveys were not completed in all subdistricts.

Within the Norton Sound area, the subdistricts that have been most affected by declining Chinook salmon runs have been the Shaktoolik and Unalakleet subdistricts In the Shaktoolik subdistrict, the peak subsistence Chinook Catch of 1,275 fish occurred in 1995. Since then, catch declined through the late 1990s before rising to 1,230 fish in 2002. Since 2002, Shaktoolik subsistence Chinook catches have trended downward to a low of 382 fish in 2006. The 2007 harvest of 515 fish was well below the 5 and 10 year averages.

In the Unalakleet district, the peak subsistence Chinook catch of 6,325 fish occurred in 1997. Since then, the catch has trended downward through the 2000s. The 2007 harvest of 1,665 fish was the lowest level recorded since complete surveys began in 1994.

Norton Sound commercial Chinook catches trended downward in the late 1990s and early 2000s. As recently at 1997, more than 12,000 Chinook were commercially harvested in the region; however, by 2000 the harvest had declined to 752 fish. By 2004, no commercial Chinook harvest was allowed.

Norton Sound Region Chinook value peaked in 1985 at $452,877, when it represented more then 55% of the overall value. Chinook value has fluctuated since the 1980s and rose to $225,136 in 1997 when it was nearly 62% of the overall value. During the 2000s, Chinook value has declined as the run has declined and has been restricted to incidental catch value since 2004. In 2007, no value was earned from Chinook target fisheries and just $113 was earned from incidental catch in other salmon fisheries. Similar to subsistence Chinook catch, the impact of declines in commercial Chinook catch have been felt most in the Shaktoolik and Unalakleet districts.

Kuskokwim Area

From the beginning of the 2007 season there was a good showing of Chinook, chum, and sockeye salmon throughout the Kuskokwim Area; however, run timing for these species was approximately 5 to 7 days late compared to average. Chinook salmon abundance was characterized as average to above average while sockeye and chum salmon abundance was characterized as above average. Coho salmon abundance was characterized as average to below average with overall early run timing. Amounts necessary for subsistence use are expected to have been achieved throughout the area.

The BOF met in Anchorage from January 31 to February 5, 2007, to review regulatory fisheries proposals concerning the Arctic-Yukon-Kuskokwim (AYK) areas. The BOF discontinued the stock of yield concern designations for the Kuskokwim River Chinook and Chum stocks based on Chinook and chum salmon runs being at or above the historical average each year since 2002.

Yukon River

In response to the guidelines established in the Sustainable Salmon Policy, the BOF discontinued the Yukon River summer and fall chum salmon as stocks of concern during the February 2007 work session. The Yukon River Chinook salmon stock was continued as a stock of yield concern based on the inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above the stock's escapement needs since 1998.

There was an increasing trend in overall Lower Yukon subsistence catch through the early 1990s. Since 1993, when lower Yukon total subsistence Chinook catch was 28,513 fish, catch has trended downwards. The 2007 lower Yukon Chinook subsistence catch of 20,514 fish was below the ten year average but above the 5-year average. In Districts 1 and 3 the 2007 catch was below both the 5 and 10 year averages; however, the 2007 district 2 subsistence Chinook catch of 10,496 was the greatest since 2001 and well above both the 5- and 10-year averages.

Subsistence Chinook catch numbers in the Upper Yukon River, by district, have been at historically high levels during the early to mid 2000s, and above averages in 2007. District 4 2007 catches were below the 5-year average and close to the 10 year average, while Districts 5 and 6 had catches greater than both averages in 2007. Canadian aboriginal subsistence catch declined steadily in the 2000s. The 2007 catch of 5,000 fish is well below the 5- and 10-year averages of 6,375 and 6,801, respectively. The small Porcupine aboriginal catch has exceeded the 5- and 10-year averages in each of the years since 2003.

Lower Yukon Chinook commercial harvests have trended downward since the mid 1990s when nearly 120,000 Chinook were harvested. By 2001, there were no commercial Chinook openings in the Yukon River. Since 2001, the Chinook run has improved enough to allow for commercial openings with a peak harvest during that period of 52,548 in 2004. Since 2004, however, runs have weakened and catch has fallen steadily.

The 2007 lower Yukon Chinook catches were well below the 5-year and 10-year averages in Districts 1 and 2 as well as overall. In district 3, the 2007 commercial Chinook catches were the first recorded since 1999. Historically, however, District 3 has had commercial Chinook harvests numbering more than 5,000 fish. Overall, upper Yukon commercial Chinook harvests have been well below historic levels during the 2000s, and the 2007 harvests were below 5 year and 10 year averages in all parts of the Upper Yukon.

Alaska Yukon Chinook commercial harvest value peaked in 1992 at just over $10 million, approximately 99% of which came from the lower Yukon. As harvest trended downward in the late 1990s so did Chinook value and by 2001, there were no commercial Chinook openings in the Yukon River, partly due to the need to conserve chum stocks. Since 2001, the Chinook and chum runs have improved enough to allow for commercial openings; however, the catch, and value, are still much lower than historic levels and the 2007 harvest was worth just under $2 million.

The 2008 run is expected to be below average and similar to the 2007 run, although, it is anticipated that the 2008 run will provide for escapements, support a normal subsistence harvest, and a below average commercial harvest. If inseason indicators of run strength suggest sufficient abundance exists to have a commercial Chinook salmon fishery, the U.S. commercial harvest could range from 5,000 to 30,000 Chinook salmon including the incidental harvest taken during anticipated summer chum salmon directed periods. The run of Canadian-origin Upper Yukon River Chinook salmon in 2008 is expected to be below average. The preseason outlook is for approximately 111,000 Canadian-origin Chinook salmon. However, due to the relationship between the expected and observed run size in 2007, expected 2008 run size could be as low as 80,000 fish.

Bristol Bay Region

In 2007, Chinook salmon escapement into the Nushagak River was 60,000, 80% of the 75,000 inriver goal. Harvest was 51,000 Chinook in the Nushagak District. Peak Chinook salmon production in the early 1980's resulted in record commercial harvests and growth of the sport fishery. Declining run sizes and the question of how to share the burden of conservation among users precipitated the development of a management plan for Nushagak Chinook salmon. Since the plan was adopted in 1992, the Nushagak-Mulchatna Chinook Salmon Management Plan (NMCSMP) has governed management of the Nushagak Chinook salmon fisheries (5 AAC 06.361). The plan was amended in 1995, 1997, and 2003.

Bristol Bay Subsistence Chinook harvests hit a 20 year high of 21,231 in 2003 but have fallen significantly with 12,617 and 16,002 fish harvested bay wide in 2006 and 2007 respectively. The 20 year average is presently 15,438. While it appears that subsistence Chinook harvests in the Bristol Bay area have improved over historic levels, there were declines in subsistence Chinook harvests in the Naknek-Kvichak District during the late 1990s and early 2000's. The Nushagak District had a similar decline, rebounded to a record catch in 2003, but then declined for the next four years before recovering to 13,615 fish, or just above the 10 year average, in 2007.

Overall, Bristol Bay commercial Chinook salmon harvests in 2007 were below the recent 20-year averages in all districts. The 2007 bay-wide commercial harvest of 62,670 Chinook was below the 20-year average of 66,607. The main factor here was the unexpected shortfall in the Nushagak District where the harvest was only 51,350. This was well below the expected harvest of 140,000.

10.5.1.5 Effects of Alternative 2 on Chinook Salmon Savings

This analysis draws heavily on an analysis of hypothetical reductions in coastal-west Alaska specific AEQ Chinook salmon bycatch areas, in Chapter 5. The values are based on median AEQ values and mean region proportional assignments within strata (A-season, and NW Bering Sea and SE Bering Sea in the B seasons) genetics data collected from 2005 through 2007, as described in Chapter 3. This analysis reproduces output from the AEQ analysis for western Alaska river system, specifically the Yukon, Bristol Bay, and Kuskokwim areas.

The benefits, in numbers of AEQ Chinook salmon that would potentially have accrued under Alternative 2 are dependent on the level of bycatch, and on the level of the hard cap. The greatest benefits, under Alternative 2, in numbers of adult Chinook salmon estimated to return, would occur in the highest bycatch years (2006 and 2007) and under the most restrictive hard cap of 29,300 fish. Total AEQ estimates for those years and under the 29,300 cap range from around 40,100 to more than 65,000 fish, depending on year and management option. In low bycatch years, the 29,300 cap, with its various management options, would have resulted in adult Chinook salmon savings ranging from about 12,000 to just over 20,000 fish. The 2005 year falls in between with AEQ estimates ranging from 23,000 to 27,500 fish.

A similar pattern of the relative value of AEQ Chinook salmon benefits is apparent at each cap level. At the 48,700 cap level, AEQ Chinook salmon benefits numbers range from just over 3,000 fish in 2003 to about 52,000 fish in 2007. When the cap increases to 68,100, that range is 267 fish to 43,135, and at the 87,500 cap level the range is -153 to 35,215. A negative number, which can occur in years when the actual bycatch was below a given cap level, means that more, not fewer, Chinook salmon would have been prevented from spawning than actually occurred. This can happen when the combined cumulative effect from prior years bycatch levels are low in some season and sectors and high in others.

The maximum benefit to the western Alaska region would be approximately 37,492 Chinook salmon may accrue in a high bycatch year like 2007, and for the most restrictive cap and option as discussed previously. In a low bycatch year such as 2004, that maximum benefit is estimated at 10,713 Chinook salmon. The minimum benefit in the 2007 year would have been 8,375 Chinook salmon, but in 2004, the minimum is estimated to be negative. These data demonstrate that the scenarios analyzed here have a broad range of potential benefits that depend on the level of cap and the severity of the bycatch year as well as on how restrictive the season splits and/or sector apportionments options are. Further, not all scenarios provide salmon savings benefit.

Table 10-64 provides estimates of the number of adult equivalent Chinook salmon that would have been saved (e.g. reduction in mortality) under each management option of Alternative 2, by year. These estimates combine all stock based estimates to give an overall estimate of salmon saving benefits in numbers of adult equivalent Chinook salmon and are calculated from the AEQ estimates provided in Chapter 5. Specific impact on specific western Alaska river systems, which comprise the greatest proportion of the AEQ estimates, are discussed further below. The estimates presented here are intended to provide a broad overview of potential benefits in terms of the total number of adult fish that would return to their natal streams, wherever they may be located.

The potential benefit of Chinook salmon bycatch reduction, in terms of Yukon River salmon adult equivalency, increases as the cap decreases and bycatch increases the greatest adult equivalence benefits would have occurred in years when bycatch was highest (i.e. 2007). For the Yukon River, maximum estimated adult equivalent salmon benefits, in numbers of fish, are 15,332 fish under the most constraining hard cap of 29,300 Chinook may accrue in a bycatch year like 2007. As the hard cap is increased, the benefits in terms of AEQ estimates necessarily decrease as more Chinook are allowed to be bycaught. With a hard cap of 48,700 Chinook the maximum benefit of 12,058 Chinook salmon may accrue in a bycatch year like 2007. The low end AEQ estimate of 768 Chinook salmon may accrue in a bycatch year like 2004. As the cap is further increased, the AEQ estimates decrease and with the highest cap of 87,500 Chinook maximum benefit of 7,531 Chinook salmon may accrue in a bycatch year like 2007. The smallest estimated benefit under this cap is actually negative. A thorough review of the tabular data shows a nearly continuous range of potential benefits, in numbers of adult Chinook, from less than zero to 15,332.

For the Bristol Bay Region, the maximum estimated AEQ salmon benefits, in numbers of fish, are 13,032 fish under the most constraining hard cap of 29,300 Chinook in 2007, all else being equal. With a hard cap of 48,700 Chinook the maximum benefit of 10,250 Chinook salmon may accrue in a bycatch year like 2007. The low end AEQ estimate, under a 48,700 cap, of 653 Chinook salmon may accrue in a bycatch year like 2004. As the cap is further increased, the AEQ estimates decrease and with the highest cap of 87,500 Chinook maximum benefit of 6,401 Chinook salmon may accrue in a bycatch year like 2007. The least benefit under this cap is actually negative. A thorough review of the tabular data shows a nearly continuous range of potential AEQ Chinook salmon benefits, in numbers of adult Chinook, from less than zero to 13,032 Chinook salmon, depending on the cap amount, season split, sector appropriation, and year.

For the Kuskokwim Region, the maximum estimated adult equivalent salmon benefit in numbers is 9,966 Chinook salmon under the most constraining hard cap of 29,300 Chinook salmon in the 2007 year. With a hard cap of 48,700 Chinook salmon, the maximum benefit of 7,838 Chinook salmon may accrue in a bycatch year like 2007. The low end AEQ estimate, under a 48,700 cap, 671 Chinook salmon may accrue in a bycatch year like 2004. As the cap is further increased, the AEQ estimates decrease and with the highest cap of 87,500 Chinook salmon, a maximum benefit of 4,895 Chinook salmon may accrue in a bycatch year like 2007. The least benefit under this cap is negative. A thorough review of the tabular data shows a nearly continuous range of potential benefits, in numbers of adult Chinook, from less than zero to 9,966 depending on the cap amount, season split, sector appropriation, and year.

Table 10-64 Hypothetical adult equivalent Chinook salmon saved under each cap and management option in Alternative 2, 2003-2007. Numbers are based on the median AEQ values with the original estimates shown in the second row.

	2003	2004	2005	2006	2007
No Cap	**33,215**	**41,047**	**47,268**	**61,737**	**78,814**
87,500 70/30 opt2d	312	2,792	8,789	12,679	22,417
87,500 70/30 opt2a	134	2,562	8,515	11,751	24,650
87,500 70/30 opt1	351	3,465	10,633	18,356	27,708
87,500 58/42 opt2d	-153	1,191	5,071	14,602	26,833
87,500 58/42 opt2a	1,072	1,160	2,866	6,777	19,695
87,500 58/42 opt1	107	2,884	9,115	17,399	27,802
87,500 50/50 opt2d	205	104	4,340	12,509	26,843
87,500 50/50 opt2a	2,468	2,080	4,128	13,760	25,602
87,500 50/50 opt1	64	1,300	5,356	18,598	35,215
68,100 70/30 opt2d	53	4,181	10,954	21,154	33,702
68,100 70/30 opt2a	3,234	6,352	10,414	17,447	31,171
68,100 70/30 opt1	267	4,256	11,761	21,846	36,148
68,100 58/42 opt2d	851	3,630	9,564	20,789	35,620
68,100 58/42 opt2a	3,192	4,389	8,163	18,203	33,675
68,100 58/42 opt1	107	3,570	9,866	25,842	40,677
68,100 50/50 opt2d	2,446	3,440	6,019	22,785	40,751
68,100 50/50 opt2a	3,131	3,823	8,086	18,537	33,670
68,100 50/50 opt1	873	3,388	9,065	25,403	43,135
48,700 70/30 opt2d	3,966	7,382	13,860	31,660	50,537
48,700 70/30 opt2a	4,417	9,616	16,247	27,972	44,517
48,700 70/30 opt1	3,060	7,500	13,894	30,002	49,438
48,700 58/42 opt2d	3,228	7,355	13,147	31,040	48,694
48,700 58/42 opt2a	5,493	9,872	15,261	33,712	51,749
48,700 58/42 opt1	4,866	7,846	13,480	31,194	53,360
48,700 50/50 opt2d	4,418	7,274	13,668	30,861	49,167
48,700 50/50 opt2a	6,266	10,188	16,129	33,087	51,599
48,700 50/50 opt1	6,361	9,100	15,990	32,207	52,098
29,300 70/30 opt2d	14,015	18,368	24,173	41,224	65,476
29,300 70/30 opt2a	12,100	17,234	23,443	41,125	61,594
29,300 70/30 opt1	13,963	18,523	25,382	42,636	63,594
29,300 58/42 opt2d	14,252	17,401	24,875	41,261	63,773
29,300 58/42 opt2a	13,839	18,004	25,136	40,910	63,775
29,300 58/42 opt1	14,956	19,780	25,982	43,406	63,890
29,300 50/50 opt2d	14,093	18,917	25,886	43,072	64,766
29,300 50/50 opt2a	14,092	19,120	25,755	40,812	62,810
29,300 50/50 opt1	16,111	20,375	27,592	44,195	65,653

10.5.1.6 Effects of Alternative 4 on Chinook Salmon Savings

The benefits, in numbers of total adult Chinook salmon that would potentially have accrued under Alternative 4 are dependent on the level of bycatch, and on the level of the hard cap. Alternative 4 provides for transferable allocations and rollovers of up to 80% of a sector's or cooperative's allocation from the A season to the B season. This alternative was analyzed with and without these provisions to provide an understanding of the impacts of these provisions on forgone pollock gross revenue and on Chinook salmon savings under PPA1 and PPA2. Table 10-65 provides a hypothetical retrospective analysis of the AEQ Chinook salmon savings (i.e. reductions in bycatch numbers) that would have occurred under the Alternative 4 hard cap scenarios, with and without transferability and with and without rollovers.

In the A season under PPA1, with no transferability, the high cap would have only been constraining in 2006 and 2007, which are the highest bycatch years, and only to the non-CDQ sectors of the fishery. The effect of the high cap would have been to save 14,796 Chinook salmon in 2006 and 23,341 Chinook in 2007, with the greatest savings coming from the inshore CV sector. Under PPA2 with no transferability, the hard cap would have been constraining in 2003, but not in either 2004 or 2005. The total A season Chinook savings would have been 2,059, 26,883, and 37,296 Chinook salmon in 2003, 2006, and 2007, respectively.

The B season Chinook savings of each retrospective scenario is also shown in Table 10-65. As was the case in the A season, the effect of the hard cap constraint on the inshore CV sector generates the greatest salmon savings and the greatest savings would have occurred in 2007. In contrast with the A season, however, the 2006 year under PPA1 would have had relatively modest B season savings of 4,109 fish, all from the inshore CV sector. In total, the B season salmon savings under PPA1 range from zero in 2003, to 32,346 in 2007. Under PPA2, these numbers increase to 142, in 2003, to 38,050 in 2007.

Table 10-65 also provides the estimated annual total Chinook salmon saved, which is simply the A season and B season totals combined for each scenario. Under PPA1 without transfers or rollovers, the annual total ranges from 0 in 2003, to 55,704 in 2007. Under PPA2, these numbers necessarily increase due to the lower hard cap and range from 2,200, in 2003, to 75,246, in 2007.

The greatest benefits, in numbers of adult Chinook salmon, would occur in 2007, the highest bycatch years, and under PPA2. Total AEQ estimate for PPA2 in 2007 is 40,842. The potential benefits decrease in lower bycatch years with 24,474, 11,282, 4,709, and 608 AEQ Chinook salmon estimated in 2006, 2005, 2004, and 2003, respectively. PPA1 results in lower AEQ benefits numbers ranging from 26,928 in 2007 to a negative value in 2003. A negative number, which can occur in years when the actual bycatch was below a given cap level, means that more, not fewer, Chinook salmon would have been prevented from spawning than actually occurred. This can happen when the combined cumulative effect from prior years bycatch levels are low in some season and sectors and high in others.

Without transfer and rollover provisions; PPA1 is projected to save 14,796 Chinook salmon in the 2006 A season, and 23,341 Chinook salmon in the 2007 A season, with the greatest savings coming from the inshore CV sector. Under PPA2, the hard cap would have been constraining in 2003, but not in either 2004 or 2005. The total A season Chinook savings would have been 2,059, 26,883, and 37,296 Chinook salmon in 2003, 2006, and 2007, respectively.

In the B season, the hard cap constraint on the inshore CV sector generates the greatest salmon savings. In total, the B season salmon savings under PPA1 range from zero in 2003, to 32,346 in 2007. Under PPA2, these numbers of Chinook salmon saved increase to 142 in 2003 and to 38,050 in 2007.

Under PPA1 without transfers or rollovers, the annual total Chinook salmon saved ranges from 0 in 2003, to 55,704 in 2007. Under PPA2, these numbers necessarily increase due to the lower hard cap and range from 2,200, in 2003, to 75,246, in 2007.

The general effect of A season transfers is to allow more pollock catch by necessarily utilizing more of the available salmon bycatch hard cap. As a result, transfers necessarily reduce salmon savings; however, the reduction may be relatively small. Under PPA1, transfers have the most effect in a bycatch year like 2006, when 3,113 fewer Chinook would be saved, mostly in the inshore CV sector and with none in the CDQ sector.

It is important to note that 2006 was not the highest bycatch year on record. The 2007 year had much higher Chinook bycatch; however, transfers in 2007 would have reduced salmon savings by 59 fish. Thus, it appears in this retrospective analysis, that the binding constraint of the hard cap is only mitigated by transfers when the constraint affects sectors at differing times, allowing for transfers among sectors in a season. If the hard cap is non-binding, transfers are not necessary and if the hard cap is severely binding, as in the highest bycatch year, all sectors are shut down relatively quickly and transfers would not affect the outcome very much.

Under PPA2, where the hard cap is smaller, transfers reduce salmon savings by 1,629 and 1,139 fish in 2003 and 2006 respectively. In contrast with PPA1, the effect is shown in both the CP and inshore CV sector where it was split evenly in 2006, and the 2003 impact accrued to only the CPs. These differences are directly the result of the dates of fishery closure, as discussed in Chapter 5.

Under PPA1, an 80% rollover reduces Chinook salmon savings in several different sectors, but mostly in the inshore CV sector, and by as much as 15,845 fish in a bycatch year such as 2005. Under PPA2, the lower cap means that there are fewer Chinook to rollover from A to B season. Thus, the reduction in Chinook savings is necessarily less and would have been greatest in 2004 when 6,817 fewer Chinook would have been saved, mostly in the inshore CV sector. A season transfers, in this retrospective analysis, had almost no effect on the timing of B season closures with or without rollovers. This counterintuitive result is due to the timing of B season closures, which is discussed in Chapter 5.

As expected, the potential benefit of Chinook salmon bycatch reduction, in terms of western Alaska AEQ Chinook, increases as the cap decreases and the greatest AEQ Chinook salmon benefits would have occurred in years when bycatch was highest (2007). This is simply due to the cap being a more binding constraint in high bycatch years and/or when the cap is lower (e.g. PPA2). The western Alaska AEQ totals range from -823 to a high of 13,069 Chinook salmon under PPA1, and from -153 to 22,100 under PPA2. The greatest component of the total, under both scenarios, is from the Yukon, followed by Bristol Bay and the Kuskokwim. In terms of impacts on Chinook salmon fisheries, as discussed above, it is not possible to make a direct connection between these AEQ Chinook salmon savings estimates and commercial, subsistence, and sport fisheries that exist in the various regions of western Alaska. Thus, the relative benefit of this alternative, in terms of salmon saved and AEQ estimates must be made on the basis of these overall impact estimates and not on specific impacts to specific fisheries.

Table 10-65 Hypothetical Chinook salmon savings under Alternative 4 PPA1 and PPA2, with and without transfers and rollovers. (Note: A tabular explanations of the layout of this table format is contained in Chapter 5)

PPA	A-season Transfer-Ability	Year	A-Season CDQ	A-Season M	A-Season P	A-Season S	A total	A-B Roll over	B-Season CDQ	B-Season M	B-Season P	B-Season S	B Total	Annual Total
1	No	2003	0	0	0	0	**0**	0%	0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		675	547	0	9,085	**10,307**	**10,307**
		2005	0	0	0	0	**0**		0	0	0	18,076	**18,076**	**18,076**
		2006	0	829	1,145	12,822	**14,796**		0	0	0	4,109	**4,109**	**18,906**
		2007	0	824	10,617	11,901	**23,341**		1,401	457	2,562	27,942	**32,362**	**55,704**
	Yes	2003	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		675	547	0	9,085	**10,307**	**10,307**
		2005	0	0	0	0	**0**		0	0	0	18,076	**18,076**	**18,076**
		2006	0	646	0	11,038	**11,683**		0	0	0	4,109	**4,109**	**15,793**
		2007	0	764	10,617	11,901	**23,282**		1,401	457	2,562	27,942	**32,362**	**55,644**
2	No	2003	0	0	2,059	0	**2,059**		0	142	0	0	**142**	**2,200**
		2004	0	0	0	0	**0**		1,112	966	60	13,764	**15,902**	**15,902**
		2005	0	0	0	0	**0**		0	0	1,314	22,983	**24,297**	**24,297**
		2006	0	1,980	5,375	19,529	**26,883**		0	0	0	10,004	**10,004**	**36,887**
		2007	576	2,069	14,843	19,808	**37,296**		1,743	834	3,593	31,881	**38,050**	**75,346**
	Yes	2003	0	0	430	0	**430**		0	142	0	0	**142**	**571**
		2004	0	0	0	0	**0**		1,112	966	60	13,764	**15,902**	**15,902**
		2005	0	0	0	0	**0**		0	0	1,314	22,983	**24,297**	**24,297**
		2006	0	1,980	4,806	18,959	**25,744**		0	0	0	10,004	**10,004**	**35,749**
		2007	576	2,069	14,843	19,808	**37,296**		1,743	834	3,593	31,881	**38,050**	**75,346**
1	No	2003	0	0	0	0	**0**	80%	0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2005	0	0	0	0	**0**		0	0	0	2,231	**2,231**	**2,231**
		2006	0	829	1,145	12,822	**14,796**		0	0	0	3,482	**3,482**	**18,278**
		2007	0	824	10,617	11,901	**23,341**		1,268	457	2,358	27,942	**32,025**	**55,366**
	Yes	2003	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2004	0	0	0	0	**0**		0	0	0	0	**0**	**0**
		2005	0	0	0	0	**0**		0	0	0	2,231	**2,231**	**2,231**
		2006	0	646	0	11,038	**11,683**		0	0	0	3,482	**3,482**	**15,165**
		2007	0	764	10,617	11,901	**23,282**		1,268	457	2,358	27,942	**32,025**	**55,307**
2	No	2003	0	0	2,059	0	**2,059**		0	0	0	0	[illegible]	**2,059**
		2004	0	0	0	0	**0**		0	0	0	9,085	**9,085**	**9,085**
		2005	0	0	0	0	**0**		0	0	399	19,697	**20,096**	**20,096**
		2006	0	1,980	5,375	19,529	**26,883**		0	0	0	10,004	**10,004**	**36,887**
		2007	576	2,069	14,843	19,808	**37,296**		1,743	794	3,593	31,881	**38,010**	**75,306**
	Yes	2003	0	0	430	0	**430**		0	142	0	0	**142**	**571**
		2004	0	0	0	0	**0**		0	0	0	9,085	**9,085**	**9,085**
		2005	0	0	0	0	**0**		0	0	399	19,697	**20,096**	**20,096**
		2006	0	1,980	4,806	18,959	**25,744**		0	0	0	10,004	**10,004**	**35,749**
		2007	576	2,069	14,843	19,808	**37,296**		1,743	794	3,593	31,881	**38,010**	**75,306**

Table 10-66 shows the effect of A season transferability on Chinook salmon savings under each PPA scenario. The general effect of A season transfers is to allow more pollock catch by necessarily utilizing more of the available salmon bycatch hard cap. As a result, transfers necessarily reduce salmon savings; however, the reduction is relatively small. Under PPA1, transfers have the most effect in the 2006 years, when 3,113 fewer Chinook would be saved, mostly in the inshore CV sector and none in the CDQ sector. It is important to note that 2006 was not the highest bycatch year on record. The 2007 year had much higher Chinook bycatch ; however, transfers in 2007 would have reduced salmon savings by 59 fish. Thus, it appears in this retrospective analysis, that the binding constraint of the hard cap is only mitigated by transfers when the constraint affects sectors at differing times, allowing for transfers among sectors. If the hard cap is non-binding, transfers are not necessary and if the hard cap is severely binding, as in the highest bycatch year, all sectors are shut down relatively quickly and transfers don't affect the outcome very much.

Under PPA2, where the hard cap is smaller, transfers reduce salmon savings by 1,629 and 1,139 fish in 2003 and 2006, respectively. In contrast with PPA1, the effect is shown in both the CP and inshore CV sector where it was split evenly in 2006, and the 2003 impact accrued to only the CPs. These differences are directly the result of the dates of the fishery closure discussed in Chapter 5.

Table 10-67 provides a tabulation of the reduction in B season Chinook salmon savings that would occur due to rollovers. The table provides the reductions in numbers of fish that an 80% rollover would result in. Under PPA1, an 80% rollover reduces Chinook salmon savings in several different sectors, but mostly in the inshore CV sector, and by as much as 15,845 fish (2005). Under PPA2, the lower cap means that there are fewer Chinook to rollover from A to B season. Thus, the reduction in Chinook savings is necessarily less and would have been greatest in 2004 when 6,817 fewer Chinook would have been saved, mostly in the inshore CV sector.

Table 10-68 shows the effect of allowing A season transfers on the Chinook salmon savings under an 805 B season rollover. In other words, this table shows when A season transfers result in a reduction in salmon to rollover to the B season and what that reduction does to the 80% rollover amounts. A careful comparison of these amounts with those under no A season transferability, shown immediately above, reveals that there is almost no difference between the two. The one exception is that 142 fewer Chinook would have been saved under PPA2, in the mothership sector in 2003. Otherwise, A season transfers, in this retrospective analysis, had no effect on the timing of B season closures with or without transfers and with or without rollovers. This counterintuitive result is due to the timing of B season closures, which is discussed in Chapter 5.

Table 10-66 Reduction in Chinook Salmon Savings Due to Transferability by PPA Scenario

PPA		A-Season				**A total**
	Year	CDQ	M	P	S	
1	2003	0	0	0	0	**0**
	2004	0	0	0	0	**0**
	2005	0	0	0	0	**0**
	2006	0	183	1145	1784	**3113**
	2007	0	60	0	0	**59**
2	2003	0	0	1,629	0	**1,629**
	2004	0	0	0	0	**0**
	2005	0	0	0	0	**0**
	2006	0	0	569	570	**1,139**
	2007	0	0	0	0	**0**

Table 10-67 Reduction in B Season Chinook Salmon Savings Due to Rollovers Under PPA Scenarios with no A season Transfers

PPA	Rollover Percent	Year	CDQ	M	P	S	total
1	80%	2003	0	0	0	0	**0**
		2004	675	547	0	9,085	**10,307**
		2005	0	0	0	15,845	**15,845**
		2006	0	0	0	627	**627**
		2007	133	0	204	0	**337**
2		2003	0	142	0	0	**142**
		2004	1,112	966	60	4,679	**6,817**
		2005	0	0	915	3,286	**4,201**
		2006	0	0	0	0	**0**
		2007	0	40	0	0	**40**

Table 10-68 Reduction in B Season Chinook Salmon Saved Due to Rollovers Under PPA1 and PPA2, with A season Transfers

PPA	Rollover Percent	Year	CDQ	M	P	S	total
1	80%	2003	0	0	0	0	**0**
		2004	675	547	0	9,085	**10,307**
		2005	0	0	0	15,845	**15,845**
		2006	0	0	0	627	**627**
		2007	133	0	204	0	**337**
2		2003	0	0	0	0	**0**
		2004	1,112	966	60	4,679	**6,817**
		2005	0	0	915	3,286	**4,201**
		2006	0	0	0	0	**0**
		2007	0	40	0	0	**40**

In addition to the estimates of total reductions in salmon bycatch presented above, Table 10-69 provides estimates of the number of adult equivalent Chinook salmon that would have been saved (e.g. reduction in mortality) under Alternative 4. These estimates combine all stock based estimates to give an overall estimate of salmon saving benefits in numbers of adult equivalent Chinook salmon and are calculated from the AEQ estimates provided in Chapter 5. Specific impact on specific western Alaska river systems, which comprise the greatest proportion of the AEQ estimates, are discussed further below. The estimates presented here are intended to provide a broad overview of potential benefits in terms of the total number of adult fish that would return to their natal streams, wherever they may be located.

The benefits, in numbers of total adult Chinook salmon that would potentially have accrued under Alternative 4 are dependent on the level of bycatch, and on the level of the hard cap. The greatest benefits, in numbers of adult Chinook salmon, would occur in 2007, the highest bycatch years, and under PPA2. Total AEQ estimate for PPA2 in 2007 is 40,842. The potential benefits decrease in lower bycatch years with 24,474, 11,282, 4,709, and 608 AEQ Chinook salmon estimated in 2006, 2005, 2004, and 2003, respectively. PPA1 results in lower AEQ benefits numbers ranging from 26,928 in 2007 to a negative value in 2003.

Table 10-69 Hypothetical adult equivalent Chinook salmon saved under each cap in Alternative 4 (PPA), 2003-2007. Numbers are based on the median AEQ values with the original estimates shown in the second row.

	2003	2004	2005	2006	2007
No Cap	**33,215**	**41,047**	**47,268**	**61,737**	**78,814**
PPA1	-414	2,697	7,751	13,766	26,928
PPA 2	608	4,709	11,282	24,474	40,843

Table 10-70 provides an analysis of hypothetical reductions in western Alaska specific adult equivalent Chinook salmon bycatch under PPA scenarios 1 and 2. Values are based on median AEQ values and mean proportion regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005-2007. The proportional breakout of western Alaska Chinook is from Myers et al. 2004 analysis is presented in more detail in Chapter 5. What is reproduced here is the estimation of adult equivalence by western Alaska River.

As expected, the potential benefit of Chinook salmon bycatch reduction, in terms of WAK salmon adult equivalency, increases as the cap decreases and the greatest adult equivalence benefits would have occurred in years when bycatch was highest (2007). This is simply due to the cap being a more binding constraint in high bycatch years and/or when the cap is lowered (e.g. PPA2). The WAK AEQ totals range from -823 to a high of 13,069 Chinook salmon under PPA1 and from -153 to 22,100 Chinook salmon under PPA2. The greatest component of the total, under each scenario, is from the Yukon, followed by Bristol Bay and the Kuskokwim.

Table 10-70 Difference (reduction) in AEQ mortality (i.e., added salmon due to alternative and year relative to observed).

	Total WAK	Yukon	Kuskokwim	Bristol Bay
Scenario 1				
2003	-823	-329	-214	-280
2004	1,478	591	384	503
2005	4,879	1,952	1,269	1,659
2006	8,525	3,410	2,217	2,898
2007	13,069	5,228	3,398	4,444
Scenario 2				
2003	-153	-61	-40	-52
2004	1,158	463	301	394
2005	4,860	1,944	1,264	1,653
2006	14,804	5,922	3,849	5,033
2007	22,100	8,840	5,746	7,514

In terms of impacts on Chinook salmon fisheries, it is impossible to make a direct connection between these AEQ estimates and commercial, subsistence, and sport fisheries that exist in the various regions of western Alaska. Thus, the relative benefit of this alternative, in terms of AEQ Chinook salmon saved, must be made on the basis of these overall impact estimates and not on specific impacts to specific fisheries.

10.5.1.7 Effects of Alternative 3 on Chinook salmon savings

The triggered closures analyzed are based on the same hard caps as those under Alternative 2. In other words, the triggers may be chosen from within the set of hard caps and would be used to trigger the closure areas identified in the Alternative set (discussed in detail in Chapter 2) for the A and B seasons. The difference here is that the triggered closure does not cap salmon bycatch but rather used the cap number to trigger the closure, which moves fishing effort outside of the trigger-closure area.

To determine the effects of the triggered closure on salmon bycatch, Chapters 4 and 5 presents an analysis of both pollock catch and Chinook salmon bycatch within and outside the trigger-closure area in each of the years 2003-2007. That methodology has estimated the numbers of Chinook salmon that are potentially saved by moving effort outside of the closure areas and the following tables document those numbers as potential benefits in terms of the number of Chinook potentially saved under each trigger, option, an seasonal split. These estimates are based on changed catch rates of Chinook inside and outside the trigger-closure area. The AEQ analysis presented previously in the discussion of Alternative 2 has not been specifically re-created for the trigger-closure analysis at this time, thus it is not possible to relate these savings in Chinook salmon to specific western Alaska River systems.

Table 10-71 shows the expected Chinook salmon saved by all vessels in the A season trigger closure have been invoked. The maximum Chinook saved of 40,311 fish would come from the lowest cap in the highest bycatch year (2007) and occurs for all but the 70/30 split, which had 36,899 Chinook saved. Thus, the 70/30 split reduces estimated Chinook savings overall in all years under the 29,300 trigger. In the low bycatch year of 2004, the maximum Chinook savings under the trigger-closure with the 29,300 cap is 5,224 fish and is greatest under the 50/50 split option. In general, in the more moderate bycatch years the 50/50 split results in the greatest Chinook savings under both the 29,300 and 48,700 triggers. Note, however, that the 48,700 trigger level is not estimated to save any Chinook salmon in 2004. Further, the higher triggers are only expected to save salmon in the highest bycatch years of 2006 and 2007. Under the high trigger of 87,500, the maximum Chinook salmon saved would have come from the 50/50 split and would have been 12,098 and 15,088 in 2006 and 2007, respectively.

Table 10-72 through Table 10-74 provide a breakout of these data specific to at CPs, shore based CVs and motherships in the A season, those table show consistent patterns and that the greatest number of salmon saved generally come from the shore based CV sector, and the least from the Mothership sector.

B season Chinook savings show a different pattern than in the A season. As expected, the maximum number of Chinook saved, 36,290 comes from the lowest trigger of 29,300 fish in the highest overall bycatch year (2007), and from the 70/30 season split (Table 10-75). However, even the 87,500 trigger with the 70/30 season split is expected to save Chinook salmon with savings of 2,680, 11,300 and 20,322 expected for 2004, 2005, and 2007 respectively. There are some instances when the trigger closure is shown to produce a negative savings of Chinook salmon. That finding implies that in some years, the catch rate of Chinook outside the B season triggered closure area is actually higher than inside of it. In the 2004 A season, this would have been the case under a 48,700 trigger with either the 58/42 or 55/45 splits and with a 70/30 split under the 68,100 trigger.

Table 10-76 through Table 10-78 provide the breakdown of these results for at CPs, CVs, and Motherships, respectively. These tables show that the vast majority of B season Chinook salmon savings is expected to come from the CV sector under all trigger levels.

Table 10-71 Expected Chinook salmon *saved* by all vessels if A-season trigger-closure had been invoked.

Chinook Salmon saved			**Sector (All), A season**				
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					4,827
	1-2: 58/42	50,750				6,795	11,908
	1-3: 55/45	48,125				8,736	13,417
	1-4: 50/50	43,750				12,098	15,008
68,100	1-1: 70/30	47,670				8,853	13,417
	1-2: 58/42	39,498				14,948	21,393
	1-3: 55/45	37,455				16,738	22,964
	1-4: 50/50	34,050				21,129	24,865
48,700	1-1: 70/30	34,090				21,129	24,865
	1-2: 58/42	28,246	2,824			25,409	29,031
	1-3: 55/45	26,785	3,530		83	25,409	32,071
	1-4: 50/50	24,350	5,659		878	28,632	33,279
29,300	1-1: 70/30	20,510	7,351	1,815	3,329	32,243	36,899
	1-2: 58/42	16,994	9,568	3,043	5,556	34,389	40,311
	1-3: 55/45	16,115	10,513	3,815	6,369	34,389	40,311
	1-4: 50/50	14,650	11,545	5,224	7,591	34,389	40,311

Table 10-72 Expected Chinook salmon *saved* by CPs if A-season trigger-closure had been invoked.

Chinook Salmon saved			**Sector CP, A season**				
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					2,206
	1-2: 58/42	50,750				4,216	7,381
	1-3: 55/45	48,125				5,048	7,544
	1-4: 50/50	43,750				6,673	7,854
68,100	1-1: 70/30	47,670				5,088	7,544
	1-2: 58/42	39,498				7,112	9,676
	1-3: 55/45	37,455				7,321	10,356
	1-4: 50/50	34,050				7,731	11,028
48,700	1-1: 70/30	34,090				7,731	11,028
	1-2: 58/42	28,246	456			8,791	12,288
	1-3: 55/45	26,785	662		-36	8,791	14,389
	1-4: 50/50	24,350	1,518		268	9,976	15,641
29,300	1-1: 70/30	20,510	2,517	195	1,496	10,858	16,847
	1-2: 58/42	16,994	3,239	771	2,671	11,091	17,630
	1-3: 55/45	16,115	3,904	897	2,859	11,091	17,630
	1-4: 50/50	14,650	4,766	1,437	3,158	11,091	17,630

Table 10-73 Expected Chinook salmon *saved* by inshore catcher vessels if A-season trigger-closure had been invoked.

Chinook Salmon saved			Sector CV, A season				
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					2,546
	1-2: 58/42	50,750				2,362	3,804
	1-3: 55/45	48,125				3,389	4,972
	1-4: 50/50	43,750				4,297	6,065
68,100	1-1: 70/30	47,670				3,464	4,972
	1-2: 58/42	39,498				6,346	9,998
	1-3: 55/45	37,455				7,668	10,777
	1-4: 50/50	34,050				11,346	12,062
48,700	1-1: 70/30	34,090				11,346	12,062
	1-2: 58/42	28,246	1,620			14,252	14,670
	1-3: 55/45	26,785	1,862		156	14,252	15,599
	1-4: 50/50	24,350	2,961		616	16,233	15,621
29,300	1-1: 70/30	20,510	3,664	1,778	1,749	18,705	17,498
	1-2: 58/42	16,994	4,956	2,393	2,763	19,957	19,757
	1-3: 55/45	16,115	5,182	2,989	3,393	19,957	19,757
	1-4: 50/50	14,650	5,327	3,639	4,303	19,957	19,757

Table 10-74 Expected Chinook salmon *saved* by mothership operations if A-season trigger-closure had been invoked.

Chinook Salmon saved			Sector M, A season				
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250					195
	1-2: 58/42	50,750				209	724
	1-3: 55/45	48,125				317	909
	1-4: 50/50	43,750				1,198	1,097
68,100	1-1: 70/30	47,670				323	909
	1-2: 58/42	39,498				1,570	1,724
	1-3: 55/45	37,455				1,833	1,839
	1-4: 50/50	34,050				2,140	1,796
48,700	1-1: 70/30	34,090				2,140	1,796
	1-2: 58/42	28,246	310			2,546	2,105
	1-3: 55/45	26,785	451		-32	2,546	2,111
	1-4: 50/50	24,350	520		28	2,601	2,075
29,300	1-1: 70/30	20,510	607	-33	126	2,866	2,621
	1-2: 58/42	16,994	739	-10	173	3,497	2,894
	1-3: 55/45	16,115	779	67	178	3,497	2,894
	1-4: 50/50	14,650	736	269	193	3,497	2,894

Table 10-75 Expected Chinook salmon *saved* by all vessels if B-season trigger-closure had been invoked.

Chinook saved		Sector (All), B season					
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		2,680	11,300		20,322
	1-2: 58/42	36,750			739		13,590
	1-3: 55/45	39,375					11,852
	1-4: 50/50	43,750					7,497
68,100	1-1: 70/30	20,430		-5,462	16,127	3,363	25,504
	1-2: 58/42	28,602		858	8,643		19,180
	1-3: 55/45	30,645			7,181		17,304
	1-4: 50/50	34,050			4,119		14,998
48,700	1-1: 70/30	14,610		9,588	21,384	8,537	30,513
	1-2: 58/42	20,454		-5,462	16,127	3,363	25,504
	1-3: 55/45	21,915		-3,568	14,713	1,630	24,008
	1-4: 50/50	24,350		1,105	12,612		22,069
29,300	1-1: 70/30	8,790	2,406	16,424	25,081	13,582	36,290
	1-2: 58/42	12,306	3	13,859	23,032	10,504	33,092
	1-3: 55/45	13,185		11,721	22,437	10,050	31,236
	1-4: 50/50	14,650		9,588	21,384	8,537	30,513

Table 10-76 Expected Chinook salmon *saved* by **CPs** if B-season trigger-closure had been invoked.

Chinook saved		Sector CP, B season					
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250					1,534
	1-2: 58/42	36,750			0		457
	1-3: 55/45	39,375					45
	1-4: 50/50	43,750					
68,100	1-1: 70/30	20,430				-	1,666
	1-2: 58/42	28,602					1,402
	1-3: 55/45	30,645			0		1,082
	1-4: 50/50	34,050			0		998
48,700	1-1: 70/30	14,610		-	-	41	1,863
	1-2: 58/42	20,454		-	-	-	1,666
	1-3: 55/45	21,915		-	-	-	1,664
	1-4: 50/50	24,350		-	-		1,639
29,300	1-1: 70/30	8,790	252	194	163	158	3,020
	1-2: 58/42	12,306	-	-	114	104	2,609
	1-3: 55/45	13,185		-	63	101	2,346
	1-4: 50/50	14,650		-	-	41	1,863

Table 10-77 Expected Chinook *saved* by inshore catcher vessels if B-season trigger-closure had been invoked.

Chinook saved			Sector CV, B season				
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		-	9,970		18,508
	1-2: 58/42	36,750			739		-
	1-3: 55/45	39,375					-
	1-4: 50/50	43,750					-
68,100	1-1: 70/30	20,430		-	15,570	-	23,583
	1-2: 58/42	28,602		-	-		17,906
	1-3: 55/45	30,645			7,181		16,640
	1-4: 50/50	34,050			4,119		-
48,700	1-1: 70/30	14,610		8,192	21,244	8,570	28,102
	1-2: 58/42	20,454		-	15,570	-	23,583
	1-3: 55/45	21,915		-	14,192	-	22,142
	1-4: 50/50	24,350		1,208	11,981		19,981
29,300	1-1: 70/30	8,790	2,250	13,814	24,708	13,339	27,940
	1-2: 58/42	12,306	103	10,929	22,643	10,302	27,349
	1-3: 55/45	13,185		9,889	22,081	9,891	28,282
	1-4: 50/50	14,650		8,192	21,244	8,570	28,102

Table 10-78 Expected Chinook *saved* by mothership operations **i**f B-season trigger-closure had been invoked.

Chinook saved			Sector M, B season				
Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250		268	-		533
	1-2: 58/42	36,750			-		-
	1-3: 55/45	39,375					-
	1-4: 50/50	43,750					-
68,100	1-1: 70/30	20,430		-	-	0	654
	1-2: 58/42	28,602		-	0		339
	1-3: 55/45	30,645			-		136
	1-4: 50/50	34,050			-		161
48,700	1-1: 70/30	14,610		394	4	-	1,192
	1-2: 58/42	20,454		-	-	0	654
	1-3: 55/45	21,915		-	-	0	638
	1-4: 50/50	24,350		218	-		624
29,300	1-1: 70/30	8,790	278	860	-	-	1,546
	1-2: 58/42	12,306	24	781	1	0	1,449
	1-3: 55/45	13,185		496	5	-	1,261
	1-4: 50/50	14,650		394	4	-	1,192

10.5.2 Pollock Industry Revenue and Cost Effects

This section examines the expected potential impacts on the pollock industry's gross revenues attributable to potential reductions in pollock products being delivered to market as a result of fishery closure (forgone revenue) and/or due to relocation of effort outside of a closure area (revenue at risk)[57]. To better place these

[57] "Revenue at risk" should be regarded as an upper-bound estimate. That is, it represents a projection, based upon historical effort and landings data, of the gross value of the catch that would be forgone as a result of one or more provisions of the proposed

impacts in a comparable empirical context, an analytical approach is adopted here, in which the question evaluated is expressed as follows: "What would the effects of these alternatives have been, had each, in turn, been in place in 2003 through 2007?" By posing the analytical question in this way, it is possible to use actual empirical information and official data records on fleet participation, catch composition, production patterns, first wholesale prices, bycatch quantities, spatial and temporal distribution of effort, and geographical patterns of deliveries to primary processors or transshipping facilities. These estimates can provide at least a crude empirical measure of the potential economic impact of the alternatives on different fleet sectors. Moreover, if it is assumed that harvest foreclosed to a fleet sector could not have been made up elsewhere by that fleet sector, then the forgone and/or at-risk estimate becomes an approximation of the potential maximum forgone gross revenues directly attributable to the proposed action.

It is also possible to take a further step with regard to analysis of triggered closure areas (Alternative 3). Having estimated the maximum gross revenues that might be lost by each fleet segment, on the assumption that the fleet is unable to make up reduced harvests by fishing in other areas, it is possible to gradually relax that analytical constraint by assuming the fleet component would have been able to make up some percentage of the revenue at risk by fishing in other areas not affected by Chinook salmon bycatch minimization measures. This is done without specifying where the fleet segment might otherwise have operated (or at what cost), except to assume that the effort would have been redistributed to remaining open areas, during remaining open periods, under existing management regulations. With this information available for each fleet segment, readers may apply their own assumptions about the extent to which each fleet segment would be able to make up its catch elsewhere, under the differing temporal and geographic constraints and limitations provided across competing Chinook salmon bycatch minimization alternatives, should these measures be applied to future fishing effort. In this way, individuals may produce their own estimates of the future gross revenues that might be forgone under each alternative.

To be precise, the gross revenues at risk were estimated using information about the following: (1) projected fleet segment harvests for the 2003 through 2007 fishing years assuming the provisions of each Chinook salmon bycatch minimization alternative had been in place in that year; (2) the actual proportions of harvest of different allocations, by different sectors (e.g. CDQ, CP, CV, Motherships), based upon historical catch patterns in 2003 through 2007; (3) estimated product mix and first wholesale product values for all pollock products by sector and year from 2001 through 2007. The years 2003 through 2007 were chosen as the base years for the analysis because they represent a consistent data series (new catch accounting began in 2003) and also include the years when Chinook salmon bycatch in the Bering Sea pollock fishery began to rise to record levels. Harvest tonnages were valued using annual round weight equivalent first wholesale prices derived from the catch accounting system (Hiatt 2007). The first wholesale prices were estimated by dividing the total wholesale value of pollock production by estimated retained tons of pollock, to yield a round weight per ton of catch equivalent value. First wholesale prices are the prices <u>received</u> by the first level of inshore processors, or by catcher-processors and motherships. They reflect the value added by the initial processor of the raw catch. They are not, therefore, equivalent to ex-vessel prices. The first wholesale values by species group, fishing gear, and area for the catcher-processor fleet used in this analysis are summarized in the tables below.

action, assuming none of that displaced catch could be made up by shifting effort to another area. In many cases, this will not be the case. Therefore, the true impact on gross revenue is likely to be smaller than the estimated revenue at risk, although that is not assured.

Table 10-79 First Wholesale value of retained Pollock by sector, 2003-2006 ($ millions)

Sector	Season	2003		2004		2005		2006	
		CDQ	non-CDQ	CDQ	non-CDQ	CDQ	non-CDQ	CDQ	non-CDQ
CP	A	$61.0	$200.7	$58.2	$253.9	$57.7	$282.1	$63.0	$258.8
	B	$55.4	$172.9	$46.0	$188.2	$62.3	$244.2	$60.5	$241.1
	Total	**$116.4**	**$373.6**	**$104.2**	**$442.0**	**$120.0**	**$526.3**	**$123.5**	**$499.8**
M	A	$6.0	$36.7	$6.7	$44.1	$6.9	$28.4	$6.2	$50.7
	B	$5.4	$32.4	$5.0	$33.2	$5.5	$24.1	$5.0	$43.9
	Total	**$11.3**	**$69.1**	**$11.8**	**$77.3**	**$12.4**	**$52.5**	**$11.1**	**$94.6**
S	A	$0.0	$206.3	$0.0	$220.9	$0.0	$262.4	$0.0	$249.2
	B	$0.0	$249.3	$0.0	$225.4	$0.0	$273.6	$0.0	$268.6
	Total	**$0.0**	**$455.6**	**$0.0**	**$446.3**	**$0.0**	**$535.9**	**$0.0**	**$340.5**
All	A	$66.9	$443.7	$64.9	$518.9	$64.6	$572.9	$69.2	$558.7
	B	$60.8	$454.6	$51.1	$446.7	$67.8	$541.9	$65.4	$553.6
	Total	**$127.7**	**$898.3**	**$116.0**	**$965.6**	**$132.4**	**$1,114.8**	**$134.6**	**$1,112.3**

Table 10-80 First Wholesale Value of Retained Pollock by Sector, CDQ and Non-CDQ Combined, 2003-2006

Sector	Season	2003 Total	2004 Total	2005 Total	2006 Total
CP	A	$261.7	$312.1	$339.7	$321.8
	B	$228.3	$234.2	$306.5	$301.5
	Total	**$490.0**	**$546.2**	**$646.3**	**$623.3**
M	A	$42.6	$50.8	$35.3	$56.9
	B	$37.8	$38.2	$29.6	$48.8
	Total	**$80.4**	**$89.0**	**$64.9**	**$105.8**
S	A	$206.3	$220.9	$262.4	$249.2
	B	$249.3	$225.4	$273.6	$268.6
	Total	**$455.6**	**$446.3**	**$535.9**	**$340.5**
All	A	$510.6	$583.8	$637.4	$627.9
	B	$515.4	$497.8	$609.7	$619.0
	Total	**$1,026.0**	**$1,081.6**	**$1,247.2**	**$1,246.9**

Table 10-81 Round weight Equivalent First Wholesale value of retained pollock by sector, 2003-2006 ($/mt)

Sector	Season	2003		2004		2005		2006	
		CDQ	non-CDQ	CDQ	non-CDQ	CDQ	non-CDQ	CDQ	non-CDQ
CP	A	$1,180	$921	$1,126	$1,145	$1,089	$1,284	$1,165	$1,172
	B	$712	$533	$591	$591	$766	$768	$748	$748
	Total	**$899**	**$689**	**$804**	**$818**	**$893**	**$979**	**$915**	**$920**
M	A	$716	$706	$806	$850	$1,101	$552	$963	$982
	B	$428	$412	$403	$429	$566	$304	$514	$550
	Total	**$543**	**$529**	**$564**	**$598**	**$777**	**$402**	**$693**	**$720**
S	A	$0	$797	$0	$849	$0	$1,018	$0	$947
	B	$0	$633	$0	$596	$0	$700	$0	$700
	Total	**$0**	**$698**	**$0**	**$699**	**$0**	**$827**	**$0**	**$526**
All	A	$1,116	$839	$1,081	$972	$1,090	$1,083	$1,144	$1,043
	B	$672	$570	$565	$577	$745	$688	$723	$704
	Total	**$849**	**$677**	**$771**	**$738**	**$881**	**$847**	**$892**	**$707**

Table 10-82 Round Weight Equivalent First Wholesale Value of Retained pollock by Sector, CDQ and Non-CDQ Combined, 2003–2006

Sector	Season	2003 Total	2004 Total	2005 Total	2006 Total
CP	A	$971	$1,141	$1,246	$1,170
	B	$567	$591	$767	$748
	Total	**$729**	**$816**	**$962**	**$919**
M	A	$708	$844	$612	$980
	B	$414	$425	$333	$546
	Total	**$531**	**$593**	**$443**	**$717**
S	A	$797	$849	$1,018	$947
	B	$633	$596	$700	$700
	Total	**$698**	**$699**	**$827**	**$526**
All	A	$867	$983	$1,084	$1,053
	B	$581	$576	$694	$706
	Total	**$695**	**$742**	**$850**	**$726**

The analysis of revenue impacts of the alternatives on the pollock industry was conducted in terms of two gross revenue categories. The first is the potential forgone gross revenues that could have been generated under various Chinook salmon bycatch hard caps contained within Alternative 2 and Alternative 4. This is simply the gross revenue that would have been generated by the pollock TACs, and their allocations among sectors, that have historically been caught after the projected closure date under the hard cap scenarios. These differ between the alternatives depending upon the sector, cap amount, seasonal split options, and historic allocation options.

The second general category is gross revenues at risk under the triggered closure area options contained in Alternative 3. The affected fishing fleets may or may not have been able to make up the displaced catch and the gross revenues that would have been lost because of these restrictions, by fishing outside of the closure area. Because some sectors may potentially have been able to recover some or all of these gross revenues, the gross income from these catches cannot, strictly speaking, be described as lost. Instead, they have been described here as “at risk.”

Only if it is assumed that harvest foreclosed to a fleet sector in one area by Alternative 3 could not have been made up elsewhere by that fleet sector would at-risk gross revenues be an estimate of lost gross revenues. Accurate estimates of the abilities of fleets to make up a reduction in harvests in one area, due to closures under Alternative 3, by fishing in another require information on the following: (1) the volume of catch (and resulting production) affected by the Alternative 3 closure areas, (2) the extent to which each fleet sector would have redirected its operations into other fishing areas, and (3) the comparative productivity of the fleet sectors in the new areas. Currently, it is possible to quantitatively estimate only the first of these, (i.e., the volume of catch coming from areas that would no longer have been available to fishermen under each triggered closure scenario contained within Alternative 3.

As noted above, gross revenues at risk are forgone **only** if a fishing fleet is unable to modify its operation to accommodate the imposed limits and, thus, cannot make up displaced catches elsewhere (either in remaining open fishing areas or during alternative open fishing periods). Having estimated the maximum gross revenues that might be lost to each sector, on the assumption that the fleet is unable to make up the affected harvests, it is possible to incrementally relax this assumption and assess the effects. If one assumes that the underlying behavioral model is linear in its parameters, evaluating an alternative assumption about the total forgone catch is straightforward. For example, if one assumes that a given sector is able to make up 10% of the harvest elsewhere, the estimated at risk gross revenue impact would be multiplied by 0.90; if the assumption is that, say, 20% is made up elsewhere, the total is multiplied by a factor of 0.80, and so forth. This is done without specifying where (or when) the sector might operate, or at what cost. With total gross revenue at risk information available for each fleet segment, the reader may apply his or her own assumptions about the extent to which each fleet segment would be able to make up its catch elsewhere, thus producing his or her own estimates of the gross revenues that might be forgone.

10.5.2.1 Comparison of pollock fishery forgone gross revenues under Alternative 2 and Alternative 4

This analysis assumes that past fleet behavior appropriately approximates operational behavior under the alternatives and does not estimate changes in behavior. While it is expected that the fleet would change its behavior to mitigate potential losses in pollock gross revenue, explicitly predicting changes in fleet behavior in a reasonable way would require data and analyses that are presently unavailable.

The terminology used herein to describe these impacts is “forgone gross revenue,” and simply means the amount of revenue that the fleet, or sectors within it, would not be allowed to earn under a binding hard cap. In other words, it is the answer to the hypothetical question; how much gross revenue was earned in the pollock fishery, in each of the years 2003 through 2007, from the projected date of the given closure (provided in Chapter 2) through the end of the season? Thus, it is a retrospective assessment of actual revenue earned in those years, from the projected closure date forward. The methodology, including total value of the fishery and price data, has been treated in the discussion of the costs and benefits analysis, presented previously. What is presented here are the estimates of potentially forgone first wholesale gross revenue, which is inclusive of shoreside processing value added for the shore based CV fleet, as well as the percent of total first wholesale gross value actually earned by sector, season, and year.

Impacts by hard cap alternative (Alternatives 2 and 4) are summarized by the different components and options that define them (Table 10-83). The components and options projected to cause the greatest changes to the pollock fishery gross revenues are the overall cap level, the sector specific cap allocation, and the seasonal split. Rollovers and transfers are analyzed in conjunction with the PPA scenarios only but comparative information is provided for evaluating rollover impacts under Alternative 2.

Table 10-83 Summary of main options under Alternative 2 and 4 and their relative scale of impact on pollock fishery gross revenues

Option	Relative economic impact on pollock industry
Cap level: 29,300-87,500	• Lowest cap leads to highest constraint on pollock fishery in all years. • In high bycatch years (e.g. 2007), even the highest cap (87,500) is constraining for the pollock fishery.
Sector allocation	• See Table ES-20 and Table ES-21
Seasonal allocation	• Higher forgone pollock revenue when seasonal allocations are lower in the A season (E.g. 50/50 and 58/42). • 70/30 seasonal split least constraining due to higher value roe season.
Rollover	• 80% rollover in PPA scenarios mitigates forgone revenue impacts in B season.
Transferability	• Full transferability mitigates forgone revenue impacts in the A season

Summarizing the relative impacts of sector allocations (comparing Alternative 2 with Alternative 4) is difficult due to the complexity of the sector allocation options in Alternative 2. In order to summarize some of the differences in the Alternative 2 sector splits options and the sector split in Alternative 4, a comparison is made with the Alternative 2 option 2d (midpoint between the AFA pollock allocations and the historical averages). Table 10-84 shows the different the sector split between the two alternatives.

Table 10-84 Comparison of sector allocations under Alternative 2, option 2d and Alternative 4 (PPA)

Alternative	CDQ	Inshore CV	Mothership	Offshore CP
Alternative 2: option 2d (midpoint)	6.5%	57.5%	7.5%	28.5%
Alternative 4 PPA: A season	9.3%	49.8%	8.0%	32.9%
B season	5.5%	69.3%	7.3%	17.9%

The Alternative 2 cap levels of 68,100 Chinook salmon and 48,700 Chinook salmon, with the 70/30 seasonal split and option 2d sector split, are compared with Alternative 4 PPA1 and PPA2. Full A season transferability is assumed for Alternative 4. While transferability is an option under Alternative 2, for this comparison, it was assumed that transferability was not allowed. Impacts on forgone gross revenue (millions $) by sector are shown for 2007 (Table 10-85 and Table 10-86).

Table 10-85 2007 estimated forgone gross revenue by sector for Alternative 2, option 2d (70/30 season split, cap 68,100), compared with PPA1 (cap 68,392) (in millions of $).

Sector		**CDQ**	**Inshore CV**	**Mothership**	**Offshore CP**	**Total**
Alternative 2: option 2d						
	A season	$0	$124.7	$20.7	$108.1	$253.5
	B season	$2.2	$37.5	$1.5	$3.6	$44.7
Total Alternative 2		$2.2	$162.2	$22.2	$111.7	$298.2
Alternative 4: PPA1						
	A season	$0	$114.0	$12.0	$105.0	$231.0
	B season	$3.0	$33.0	$2.0	$18.0	$57.0
Total Alternative 4		$3.0	$147.0	$14.0	$123.0	$288.0

Total forgone gross revenue is less under PPA1; however forgone gross revenue for the pollock fleet varies by sector between the two alternatives in terms of overall gains and losses. The CDQ sector has a higher forgone gross revenue under PPA1, due to the lower B season sector allocation. The inshore CV sector has a lower annual forgone gross revenue under PPA1 and lower seasonal forgone revenue in both A and B seasons as compared with Alternative 2, option 2d. The Mothership sector also has a lower annual forgone gross revenue under PPA1, driven substantially lower A season forgone gross revenue under the PPA1. The CP sector has a higher forgone gross revenue under PPA1, driven primarily by the lower B season allocation.

Table 10-86 2007 estimated forgone revenue for Alternative 2, option 2d (70/30 season split, cap 48,700) compared with PPA2 (cap 47,591) (in millions of $).

Sector		**CDQ**	**Inshore CV**	**Mothership**	**Offshore CP**	**Total**
Alternative 2: option 2d						
	A season	$22.2	$185.6	$34.5	$142.4	$384.7
	B season	$3.9	$50.2	$3.1	$11.3	$68.4
Total Alternative 2		$26.1	$235.8	$37.6	$153.7	$453.1
Alternative 4: PPA2						
	A season	$12.0	$160.0	$29.0	$141.0	$341.0
	B season	$4.0	$42.0	$3.0	$26.0	$76.2
Total Alternative 4		$16.0	$202.0	$32.0	$167.0	$417.2

Total forgone gross revenue is less under PPA2 than Alternative 2 option 2d; however forgone gross revenue for the pollock fleet varies by sector between the two alternatives in terms of overall gains and losses. The CDQ sector has a lower forgone gross revenue under PPA2, due to the higher relative A season sector allocation. The inshore CV sector has a lower annual forgone gross revenue under PPA2 and lower seasonal forgone gross revenue in both A and B seasons as compared with Alternative 2, option 2d. The Mothership sector also has a lower annual forgone gross revenue under PPA2, driven by the lower A season forgone gross revenue under the PPA2. The CP sector has a higher forgone gross revenue under PPA2, driven primarily by the lower B season allocation under the PPA.

10.5.2.2 Potentially Forgone Gross Revenue under Alternative 2

Under the Chinook salmon bycatch hard cap scenarios included in Alternative 2, the pollock trawl fishery, and/or specific sectors that participate in it (depending on apportionments of hard caps) would be required to stop fishing once a specific hard cap is reached. In such a circumstance, any remaining TAC that is not harvested when the cap is reached would remain unharvested unless specific provisions of the hard cap alternative dealing with transfers, rollovers, and/or cooperative level management are applied. These may in mitigate potential losses in revenue due to unharvested pollock TAC. This section specifically details the impacts on gross revenue that could result from an unmitigated closure of the pollock fishery, or sectors within it, due to hard caps. This analysis provides hypothetical estimates of forgone pollock first wholesale gross revenue by year and season under Chinook bycatch option for fleet wide caps, and for the CDQ fishery and non-CDQ fishery.

Table 10-87 provides hypothetical estimates of forgone pollock first wholesale gross revenue, by year and season, under the options for fleet wide caps, and for the CDQ fishery and the non-CDQ fishery. As expected, the greatest adverse economic impact would have occurred in the highest bycatch year (2007) and under the most restrictive bycatch cap of 29,300 Chinook salmon. In the A season, the greatest adverse effect occurs under the 50/50 split because of the higher roe pollock price in the A season. The maximum estimated A season economic impact on the pollock fleet was $529.4 million in 2007 under the 50/50 season split and the 29,300 cap. That gross value is composed of $482.7 million from the non-CDQ pollock fisheries and $46.7 million from CDQ pollock fisheries. In the B season, the maximum impact is $179.9 million in 2007; with the 293,300 cap and the 70/30 season split. In percentage terms (Table 10-88), the A season maximum impact represents 84% of total gross revenue and the B season total impact is 30% of total B season gross revenue, all things being equal.

As is expected, as the hard cap amount increases, the adverse economic impacts on the pollock fisheries decrease, all else being equal. However, in the 2007 year, when bycatch was highest, even the 87,500 Chinook salmon cap would have resulted in total forgone gross revenue of $322.6 million in the pollock A season, although with no CDQ impact. The gross impact would have been $72.9 million in the B season, with CDQ impact accruing only under the 70/30 season split. These values are 51% and 12% of pollock fishery total gross revenue for the A and B seasons, respectively. Thus, in a high bycatch year, even the highest cap has significant potential adverse impacts on the revenues accruing to the pollock fishery. Also evident is that as the cap amount increases, the distribution effect of the season split is increased. For example, the $322.6 million A season impact under the 50/50 season split, would have been $134.8 million under the 70/30 season split.

Impacts estimated for 2004, which ranks among the lowest bycatch year, are considerably smaller than those estimated for 2007, but are still significant in some respects. In the 2004 A season, total gross revenue impact under the 29,300 cap is estimated at $128 million in gross receipts under the 50/50 season split, all coming from non-CDQ fishery participation. Under the 70/30 season split that amount drops to $64.3 million. With the exception of $200,000 in estimated gross revenue impacts under the 50/50 season split and a 48,700 Chinook cap, none of the other caps would have caused forgone revenue impacts in 2004. In the B season, 2004 forgone revenue estimates are greatest under the 29,300 cap and 70/30 season split, where $82.7 million is the estimated gross revenue impact.

Overall, the impacts on the pollock fleet of the hard caps are greatest in the A season, when roe value is highest and in the years when bycatch has been largest. Further, the seasonal split definitely affects the impacts on pollock gross revenue. Even in the second highest bycatch year of 2006, A season impacts under even the largest cap of 87,500 Chinook salmon are estimated at $183.6 million, which is 29% of total first wholesale gross receipts in the pollock fishery. However, in the lower bycatch years of 2003, 2004, and 2005, there was very little A season impact at the 68,100 Chinook cap level, and in percentage terms, this is also true of the B season.

The following tables break the fleet wide data, discussed above, down by sector (CDQ, CP, CV, and motherships), season, option, and year, in order to show estimated forgone gross revenue and percent of total gross revenue on a more refined scale. These tables show how the effect of the Alternative 2 cap levels vary by season, sector, and year, under the various options. Unfortunately, there does not appear to be a consistent pattern with which to rank the options, as the comparative impacts by option appear to vary both by level of the hard cap and between years. Thus, these tables are provide as “lookup tables” so that the interested reader can review what the estimated impacts would have been under a particular combination of cap, split, season, sector, and year, to see how a particular combination of the various elements of the alternative set would affect pollock fishery gross revenue.

Table 10-87 Hypothetical forgone pollock gross revenue, by year and by season, under the Alternative 2 options for fleet-wide caps. ($ Millions)

			2003			2004			2005			2006			2007		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		NonCDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$183.6	$117.3	$1.1	$322.6	$253.3	$134.8
	87,500 Total		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$183.6	$117.3	$1.1	$322.6	$253.3	$134.8
	68,100	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$9.8	$1.0	$0.0
		NonCDQ	$2.5	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$261.4	$188.6	$179.0	$393.4	$326.5	$256.0
	68,100 Total		$2.5	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$261.4	$188.6	$179.0	$403.1	$327.5	$256.0
	48,700	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$35.3	$22.6	$9.7
		NonCDQ	$154.7	$109.6	$2.5	$0.2	$0.0	$0.0	$117.3	$0.1	$0.0	$339.2	$334.5	$261.3	$401.3	$398.1	$393.4
	48,700 Total		$154.7	$109.6	$2.5	$0.2	$0.0	$0.0	$117.3	$0.1	$0.0	$339.2	$334.5	$261.3	$436.6	$420.7	$403.1
	29,300	CDQ	$24.9	$22.9	$1.0	$0.4	$0.0	$0.0	$3.7	$0.0	$0.0	$22.3	$10.9	$1.2	$46.7	$46.2	$36.2
		NonCDQ	$263.2	$208.8	$204.0	$127.6	$122.2	$64.3	$330.2	$263.7	$191.9	$424.1	$348.2	$343.9	$482.7	$480.2	$476.4
	29,300 Total		$288.1	$231.7	$205.0	$128.0	$122.2	$64.3	$333.9	$263.7	$191.9	$446.5	$359.1	$345.1	$529.4	$526.3	$512.6
B	87,500	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$2.7
		NonCDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$1.0	$0.0	$1.2	$16.9	$0.0	$0.0	$0.0	$17.5	$20.6	$72.9
	87,500 Total		$0.0	$0.0	$0.0	$0.0	$0.0	$1.0	$0.0	$1.2	$16.9	$0.0	$0.0	$0.0	$17.5	$20.6	$75.6
	68,100	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$1.9	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$2.5	$3.2
		NonCDQ	$0.0	$0.0	$0.0	$0.0	$0.7	$10.7	$9.1	$16.2	$30.1	$0.0	$0.0	$15.8	$46.7	$72.1	$96.8
	68,100 Total		$0.0	$0.0	$0.0	$0.0	$0.7	$12.6	$9.1	$16.2	$30.1	$0.0	$0.0	$15.8	$46.7	$74.6	$100.0
	48,700	CDQ	$0.0	$0.0	$0.0	$0.0	$1.9	$8.6	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$2.9	$3.2	$6.0
		NonCDQ	$0.0	$0.0	$0.0	$5.6	$10.6	$27.2	$29.0	$30.1	$69.2	$2.1	$15.8	$57.1	$73.6	$96.8	$117.3
	48,700 Total		$0.0	$0.0	$0.0	$5.6	$12.6	$35.8	$29.0	$30.1	$69.2	$2.1	$15.8	$57.1	$76.4	$100.0	$123.3
	29,300	CDQ	$0.0	$0.0	$16.1	$8.6	$16.0	$25.6	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$6.0	$6.1	$8.4
		NonCDQ	$0.0	$1.5	$11.5	$27.1	$28.0	$57.1	$69.2	$96.0	$126.0	$57.1	$59.2	$118.1	$117.3	$140.8	$171.5
	29,300 Total		$0.0	$1.5	$27.6	$35.8	$44.0	$82.7	$69.2	$96.0	$126.0	$57.1	$59.2	$118.1	$123.3	$147.0	$179.9

Table 10-88 Hypothetical forgone pollock gross revenue in percent of total gross revenue, by year and by season, under the Alternative 2 options for fleet-wide caps.

			2003			2004			2005			2006			2007		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
		NonCDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%	33%	21%	0%	58%	45%	24%
	87,500 Total		0%	0%	0%	0%	0%	0%	0%	0%	0%	29%	19%	0%	51%	40%	21%
	68,100	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	14%	1%	0%
		NonCDQ	1%	0%	0%	0%	0%	0%	0%	0%	0%	47%	34%	32%	70%	58%	46%
	68,100 Total		0%	0%	0%	0%	0%	0%	0%	0%	0%	42%	30%	29%	64%	52%	41%
	48,700	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	51%	33%	14%
		NonCDQ	35%	25%	1%	0%	0%	0%	20%	0%	0%	61%	60%	47%	72%	71%	70%
	48,700 Total		30%	21%	0%	0%	0%	0%	18%	0%	0%	54%	53%	42%	70%	67%	64%
	29,300	CDQ	37%	34%	2%	1%	0%	0%	6%	0%	0%	32%	16%	2%	67%	67%	52%
		NonCDQ	59%	47%	46%	25%	24%	12%	58%	46%	34%	76%	62%	62%	86%	86%	85%
	29,300 Total		56%	45%	40%	22%	21%	11%	52%	41%	30%	71%	57%	55%	84%	84%	82%
B	87,500	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%
		NonCDQ	0%	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%	3%	4%	13%
	87,500 Total		0%	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%	3%	3%	12%
	68,100	CDQ	0%	0%	0%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%	4%	5%
		NonCDQ	0%	0%	0%	0%	0%	2%	2%	3%	6%	0%	0%	3%	8%	13%	17%
	68,100 Total		0%	0%	0%	0%	0%	3%	1%	3%	5%	0%	0%	3%	8%	12%	16%
	48,700	CDQ	0%	0%	0%	0%	4%	17%	0%	0%	0%	0%	0%	0%	4%	5%	9%
		NonCDQ	0%	0%	0%	1%	2%	6%	5%	6%	13%	0%	3%	10%	13%	17%	21%
	48,700 Total		0%	0%	0%	1%	3%	7%	5%	5%	11%	0%	3%	9%	13%	16%	20%
	29,300	CDQ	0%	0%	26%	17%	31%	50%	0%	0%	0%	0%	0%	0%	9%	9%	13%
		NonCDQ	0%	0%	3%	6%	6%	13%	13%	18%	23%	10%	11%	21%	21%	25%	31%
	29,300 Total		0%	0%	5%	7%	9%	17%	11%	16%	21%	9%	10%	19%	20%	24%	30%

Table 10-89 Hypothetical forgone pollock gross revenue, by season and sector, under Alternative 2 for 2003.

2003			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	$0.0	$0.0	$0.0	$22.5	$8.7	$0.0	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$88.8	$71.2	$19.8	$20.4	$0.0	$0.0
		S	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	87,500 Total		$0.0	$0.0	$0.0	$111.3	$79.9	$19.8	$20.4	$0.0	$0.0
	68,100	CDQ	$0.0	$0.0	$0.0	$41.6	$23.9	$9.3	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$7.2	$1.7	$0.0	$0.0	$0.0	$0.0
		P	$20.7	$0.0	$0.0	$91.8	$90.1	$87.6	$88.0	$70.5	$0.0
		S	$1.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	68,100 Total		$21.8	$0.0	$0.0	$140.6	$115.7	$96.9	$88.0	$70.5	$0.0
	48,700	CDQ	$0.0	$0.0	$0.0	$53.6	$53.3	$41.6	$0.9	$0.0	$0.0
		M	$2.0	$0.0	$0.0	$15.7	$15.4	$7.2	$11.4	$5.4	$0.0
		P	$89.4	$87.3	$20.7	$117.1	$115.6	$91.8	$92.1	$90.5	$88.0
		S	$71.8	$30.2	$1.1	$0.0	$0.0	$0.0	$11.4	$0.7	$0.0
	48,700 Total		$163.2	$117.5	$21.8	$186.4	$184.3	$140.6	$115.8	$96.6	$88.0
	29,300	CDQ	$9.1	$0.0	$0.0	$57.9	$54.3	$54.0	$49.5	$24.8	$22.3
		M	$20.2	$15.6	$11.4	$26.3	$20.9	$20.4	$20.7	$20.3	$15.6
		P	$116.8	$115.2	$91.5	$143.4	$142.6	$118.6	$118.8	$117.6	$115.7
		S	$126.4	$100.5	$98.1	$72.8	$48.2	$11.0	$99.3	$97.4	$48.4
	29,300 Total		$272.5	$231.3	$201.0	$300.5	$265.9	$203.9	$288.3	$260.1	$201.9
B	87,500	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$1.4	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.5	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	87,500 Total		$0.0	$0.0	$0.0	$0.0	$0.0	$1.9	$0.0	$0.0	$0.0
	68,100	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$16.5	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.4	$1.4	$0.0	$0.0	$0.5
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	68,100 Total		$0.0	$0.0	$0.0	$0.0	$0.5	$17.9	$0.0	$0.0	$0.5
	48,700	CDQ	$0.0	$0.0	$0.0	$7.3	$16.5	$34.8	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$1.3	$1.2	$1.4	$1.6	$0.0	$0.5	$1.5
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.2	$0.0	$0.0	$0.0
		S	$0.0	$0.0	$1.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	48,700 Total		$0.0	$0.0	$2.4	$8.5	$17.9	$36.7	$0.0	$0.5	$1.5
	29,300	CDQ	$0.0	$0.0	$0.0	$34.8	$35.4	$36.3	$0.0	$1.3	$17.0
		M	$1.3	$1.5	$1.7	$1.6	$3.2	$3.4	$1.5	$1.6	$3.2
		P	$0.0	$0.0	$0.1	$0.2	$2.0	$12.2	$0.0	$0.0	$2.1
		S	$1.1	$9.2	$18.3	$0.0	$0.0	$1.5	$0.0	$0.6	$9.6
	29,300 Total		$2.4	$10.7	$20.1	$36.7	$40.6	$53.4	$1.5	$3.5	$31.9

Table 10-90 Hypothetical forgone pollock revenue in percent of total gross revenue, by season and sector, under Alternative 2 for 2003.

2003			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0%	0%	0%	34%	13%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	44%	35%	10%	10%	0%	0%
		S	0%	0%	0%	0%	0%	0%	0%	0%	0%
	87,500 Total		0%	0%	0%	22%	16%	4%	4%	0%	0%
	68,100	CDQ	0%	0%	0%	62%	36%	14%	0%	0%	0%
		M	0%	0%	0%	20%	5%	0%	0%	0%	0%
		P	10%	0%	0%	46%	45%	44%	44%	35%	0%
		S	1%	0%	0%	0%	0%	0%	0%	0%	0%
	68,100 Total		4%	0%	0%	28%	23%	19%	17%	14%	0%
	48,700	CDQ	0%	0%	0%	80%	80%	62%	1%	0%	0%
		M	5%	0%	0%	43%	42%	20%	31%	15%	0%
		P	45%	44%	10%	58%	58%	46%	46%	45%	44%
		S	35%	15%	1%	0%	0%	0%	6%	0%	0%
	48,700 Total		32%	23%	4%	37%	36%	28%	23%	19%	17%
	29,300	CDQ	14%	0%	0%	87%	81%	81%	74%	37%	33%
		M	55%	43%	31%	72%	57%	56%	56%	55%	43%
		P	58%	57%	46%	71%	71%	59%	59%	59%	58%
		S	61%	49%	48%	35%	23%	5%	48%	47%	23%
	29,300 Total		53%	45%	39%	59%	52%	40%	56%	51%	40%
B	87,500	CDQ	0%	0%	0%	0%	0%	2%	0%	0%	0%
		M	0%	0%	0%	0%	0%	1%	0%	0%	0%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	0%	0%	0%	0%	0%	0%	0%	0%	0%
	87,500 Total		0%	0%	0%	0%	0%	0%	0%	0%	0%
	68,100	CDQ	0%	0%	0%	0%	0%	27%	0%	0%	0%
		M	0%	0%	0%	0%	1%	4%	0%	0%	2%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	0%	0%	0%	0%	0%	0%	0%	0%	0%
	68,100 Total		0%	0%	0%	0%	0%	3%	0%	0%	0%
	48,700	CDQ	0%	0%	0%	12%	27%	57%	0%	0%	0%
		M	0%	0%	4%	4%	4%	5%	0%	2%	5%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	0%	0%	0%	0%	0%	0%	0%	0%	0%
	48,700 Total		0%	0%	0%	2%	3%	7%	0%	0%	0%
	29,300	CDQ	0%	0%	0%	57%	58%	60%	0%	2%	28%
		M	4%	5%	5%	5%	10%	10%	5%	5%	10%
		P	0%	0%	0%	0%	1%	7%	0%	0%	1%
		S	0%	4%	7%	0%	0%	1%	0%	0%	4%
	29,300 Total		0%	2%	4%	7%	8%	10%	0%	1%	6%

Table 10-91 Hypothetical forgone pollock gross revenue, by season and sector, under Alternative 2 for 2004.

2004			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	87,500 Total		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	68,100	CDQ	$0.0	$0.0	$0.0	$4.2	$0.0	$0.0	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$33.6	$5.8	$0.0	$0.0	$0.0	$0.0
		S	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	68,100 Total		$0.0	$0.0	$0.0	$37.8	$5.8	$0.0	$0.0	$0.0	$0.0
	48,700	CDQ	$0.0	$0.0	$0.0	$14.6	$5.5	$4.2	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$4.4	$1.4	$0.0	$0.3	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$65.6	$63.3	$33.6	$34.2	$6.5	$0.0
		S	$11.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	48,700 Total		$11.0	$0.0	$0.0	$84.6	$70.2	$37.8	$34.5	$6.5	$0.0
	29,300	CDQ	$0.0	$0.0	$0.0	$26.7	$26.0	$15.4	$4.7	$0.4	$0.0
		M	$9.6	$4.3	$0.0	$22.3	$15.9	$9.8	$15.6	$9.7	$4.2
		P	$65.1	$62.7	$32.9	$146.6	$144.9	$115.2	$115.6	$66.4	$63.5
		S	$85.9	$56.8	$31.3	$12.0	$0.4	$0.0	$55.1	$12.6	$0.4
	29,300 Total		$160.6	$123.8	$64.2	$207.6	$187.1	$140.4	$191.0	$89.1	$68.2
B	87,500	CDQ	$0.0	$0.0	$0.0	$2.6	$8.6	$16.6	$0.0	$0.0	$1.5
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.4	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$0.7	$8.6	$17.1	$0.0	$0.0	$4.0	$0.0	$0.5	$9.1
	87,500 Total		$0.7	$8.6	$17.1	$2.6	$8.6	$21.0	$0.0	$0.5	$10.6
	68,100	CDQ	$0.0	$0.0	$0.0	$15.6	$16.3	$25.8	$0.0	$0.0	$2.5
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$1.3	$0.0	$0.0	$0.4
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$9.0	$16.8	$22.6	$0.0	$0.7	$9.4	$0.7	$8.6	$17.1
	68,100 Total		$9.0	$16.8	$22.6	$15.6	$17.0	$36.6	$0.7	$8.6	$20.0
	48,700	CDQ	$0.0	$0.0	$2.1	$16.8	$25.8	$26.7	$1.8	$2.5	$15.9
		M	$0.0	$0.0	$0.5	$0.4	$1.3	$3.9	$0.0	$0.4	$1.6
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$17.2	$22.6	$39.7	$8.4	$9.4	$22.3	$9.5	$17.1	$22.7
	48,700 Total		$17.2	$22.6	$42.4	$25.7	$36.5	$52.9	$11.3	$20.0	$40.2
	29,300	CDQ	$2.1	$8.2	$16.2	$26.7	$34.1	$34.4	$15.9	$16.5	$26.0
		M	$0.5	$1.6	$4.0	$3.9	$4.1	$10.0	$1.6	$3.8	$7.5
		P	$0.0	$0.0	$0.0	$0.0	$1.0	$14.6	$0.0	$0.0	$2.3
		S	$39.7	$40.2	$54.8	$22.3	$22.7	$39.9	$22.7	$30.1	$54.1
	29,300 Total		$42.4	$49.9	$75.0	$52.9	$61.9	$99.0	$40.2	$50.4	$89.9

Table 10-92 Hypothetical forgone pollock revenue in percent of total gross revenue, by season and sector, under Alternative 2 for 2004.

2004			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	0%	0%	0%	0%	0%	0%	0%	0%	0%
	87,500 Total		0%	0%	0%	0%	0%	0%	0%	0%	0%
	68,100	CDQ	0%	0%	0%	7%	0%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	13%	2%	0%	0%	0%	0%
		S	0%	0%	0%	0%	0%	0%	0%	0%	0%
	68,100 Total		0%	0%	0%	6%	1%	0%	0%	0%	0%
	48,700	CDQ	0%	0%	0%	22%	8%	7%	0%	0%	0%
		M	0%	0%	0%	10%	3%	0%	1%	0%	0%
		P	0%	0%	0%	26%	25%	13%	13%	3%	0%
		S	5%	0%	0%	0%	0%	0%	0%	0%	0%
	48,700 Total		2%	0%	0%	14%	12%	6%	6%	1%	0%
	29,300	CDQ	0%	0%	0%	41%	40%	24%	7%	1%	0%
		M	22%	10%	0%	51%	36%	22%	35%	22%	10%
		P	26%	25%	13%	58%	57%	45%	46%	26%	25%
		S	39%	26%	14%	5%	0%	0%	25%	6%	0%
	29,300 Total		28%	21%	11%	36%	32%	24%	33%	15%	12%
B	87,500	CDQ	0%	0%	0%	5%	17%	32%	0%	0%	3%
		M	0%	0%	0%	0%	0%	1%	0%	0%	0%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	0%	4%	8%	0%	0%	2%	0%	0%	4%
	87,500 Total		0%	2%	3%	1%	2%	4%	0%	0%	2%
	68,100	CDQ	0%	0%	0%	31%	32%	51%	0%	0%	5%
		M	0%	0%	0%	0%	0%	4%	0%	0%	1%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	4%	7%	10%	0%	0%	4%	0%	4%	8%
	68,100 Total		2%	3%	5%	3%	3%	7%	0%	2%	4%
	48,700	CDQ	0%	0%	4%	33%	51%	52%	4%	5%	31%
		M	0%	0%	2%	1%	4%	12%	0%	1%	5%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	8%	10%	18%	4%	4%	10%	4%	8%	10%
	48,700 Total		3%	5%	9%	5%	7%	11%	2%	4%	8%
	29,300	CDQ	4%	16%	32%	52%	67%	67%	31%	32%	51%
		M	2%	5%	12%	12%	12%	30%	5%	11%	23%
		P	0%	0%	0%	0%	1%	8%	0%	0%	1%
		S	18%	18%	24%	10%	10%	18%	10%	13%	24%
	29,300 Total		9%	10%	15%	11%	12%	20%	8%	10%	18%

Table 10-93 Hypothetical forgone pollock gross revenue, by season and sector, under Alternative 2, for 2005.

2005			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$54.8	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	87,500 Total		$0.0	$0.0	$0.0	$54.8	$0.0	$0.0	$0.0	$0.0	$0.0
	68,100	CDQ	$0.0	$0.0	$0.0	$12.6	$3.1	$0.0	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$91.3	$57.6	$22.8	$23.7	$0.0	$0.0
		S	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	68,100 Total		$0.0	$0.0	$0.0	$103.9	$60.7	$22.8	$23.7	$0.0	$0.0
	48,700	CDQ	$0.0	$0.0	$0.0	$24.6	$23.3	$12.6	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$6.3	$2.4	$0.0	$0.0	$0.0	$0.0
		P	$56.1	$1.9	$0.0	$155.4	$121.8	$91.2	$119.1	$58.3	$23.7
		S	$94.5	$34.3	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	48,700 Total		$150.6	$36.2	$0.0	$186.3	$147.4	$103.9	$119.2	$58.3	$23.7
	29,300	CDQ	$0.0	$0.0	$0.0	$37.3	$27.1	$25.9	$22.1	$3.6	$0.0
		M	$10.8	$6.2	$0.0	$18.5	$14.7	$10.9	$14.6	$10.9	$2.6
		P	$154.9	$121.3	$90.7	$195.5	$193.9	$158.1	$158.5	$156.3	$122.0
		S	$162.2	$132.3	$129.9	$96.3	$61.6	$0.0	$131.2	$129.1	$61.9
	29,300 Total		$327.8	$259.8	$220.6	$347.5	$297.3	$194.9	$326.3	$299.9	$186.5
B	87,500	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$15.3	$25.7	$37.1	$1.0	$9.2	$25.2	$13.9	$14.9	$26.1
	87,500 Total		$15.3	$25.7	$37.1	$1.0	$9.2	$25.2	$13.9	$14.9	$26.1
	68,100	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.1	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$26.0	$26.7	$49.4	$14.2	$15.2	$26.3	$15.3	$25.7	$37.1
	68,100 Total		$26.0	$26.7	$49.4	$14.2	$15.2	$26.4	$15.3	$25.7	$37.1
	48,700	CDQ	$0.0	$0.0	$0.0	$0.0	$0.1	$4.1	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$21.5	$0.0	$0.0	$0.0
		S	$37.3	$49.4	$62.3	$25.6	$26.3	$37.6	$26.4	$37.1	$49.7
	48,700 Total		$37.3	$49.4	$62.3	$25.6	$26.4	$63.1	$26.4	$37.1	$49.7
	29,300	CDQ	$0.0	$0.0	$0.0	$4.1	$7.1	$10.3	$0.0	$0.0	$0.2
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$2.7	$0.0	$0.0	$0.7
		P	$0.0	$0.0	$21.1	$21.4	$37.4	$56.3	$0.0	$10.7	$37.7
		S	$62.3	$87.7	$104.0	$37.6	$49.6	$74.1	$49.7	$62.1	$87.9
	29,300 Total		$62.3	$87.7	$125.2	$63.1	$94.2	$143.4	$49.7	$72.8	$126.5

Table 10-94 Hypothetical forgone pollock revenue in percent of total gross revenue, by season and sector, under Alternative 2, for 2005.

2005			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	19%	0%	0%	0%	0%	0%
		S	0%	0%	0%	0%	0%	0%	0%	0%	0%
	87,500 Total		0%	0%	0%	9%	0%	0%	0%	0%	0%
	68,100	CDQ	0%	0%	0%	20%	5%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	32%	20%	8%	8%	0%	0%
		S	0%	0%	0%	0%	0%	0%	0%	0%	0%
	68,100 Total		0%	0%	0%	16%	10%	4%	4%	0%	0%
	48,700	CDQ	0%	0%	0%	38%	36%	20%	0%	0%	0%
		M	0%	0%	0%	22%	8%	0%	0%	0%	0%
		P	20%	1%	0%	55%	43%	32%	42%	21%	8%
		S	36%	13%	0%	0%	0%	0%	0%	0%	0%
	48,700 Total		24%	6%	0%	29%	23%	16%	19%	9%	4%
	29,300	CDQ	0%	0%	0%	58%	42%	40%	34%	6%	0%
		M	38%	22%	0%	65%	52%	39%	51%	38%	9%
		P	55%	43%	32%	69%	69%	56%	56%	55%	43%
		S	62%	50%	50%	37%	23%	0%	50%	49%	24%
	29,300 Total		51%	41%	35%	55%	47%	31%	51%	47%	29%
B	87,500	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	6%	9%	14%	0%	3%	9%	5%	5%	10%
	87,500 Total		3%	4%	6%	0%	2%	4%	2%	2%	4%
	68,100	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	10%	10%	18%	5%	6%	10%	6%	9%	14%
	68,100 Total		4%	4%	8%	2%	2%	4%	3%	4%	6%
	48,700	CDQ	0%	0%	0%	0%	0%	6%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	0%	0%	9%	0%	0%	0%
		S	14%	18%	23%	9%	10%	14%	10%	14%	18%
	48,700 Total		6%	8%	10%	4%	4%	10%	4%	6%	8%
	29,300	CDQ	0%	0%	0%	6%	11%	15%	0%	0%	0%
		M	0%	0%	0%	0%	0%	11%	0%	0%	3%
		P	0%	0%	9%	9%	15%	23%	0%	4%	15%
		S	23%	32%	38%	14%	18%	27%	18%	23%	32%
	29,300 Total		10%	14%	21%	10%	15%	24%	8%	12%	21%

Table 10-95 Hypothetical forgone pollock gross revenue, by season and sector ,under Alternative 2, for 2006.

2006			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	$0.0	$0.0	$0.0	$10.7	$1.3	$0.0	$0.0	$0.0	$0.0
		M	$7.5	$2.4	$0.0	$19.1	$9.4	$8.1	$8.9	$7.8	$2.4
		P	$0.8	$0.0	$0.0	$88.1	$59.2	$9.7	$10.1	$7.9	$0.0
		S	$155.1	$123.9	$88.4	$85.4	$0.5	$0.0	$90.7	$86.8	$11.1
	87,500 Total		$163.4	$126.3	$88.4	$203.2	$70.4	$17.8	$109.7	$102.6	$13.5
	68,100	CDQ	$0.0	$0.0	$0.0	$22.7	$11.6	$1.7	$0.0	$0.0	$0.0
		M	$9.3	$8.3	$6.8	$27.1	$26.6	$18.7	$26.3	$9.6	$8.3
		P	$10.4	$8.2	$0.0	$118.1	$89.5	$60.3	$60.8	$58.3	$8.9
		S	$159.2	$156.9	$124.9	$92.0	$88.3	$33.8	$155.2	$124.0	$88.5
	68,100 Total		$178.9	$173.4	$131.6	$259.8	$216.0	$114.5	$242.3	$191.8	$105.7
	48,700	CDQ	$0.0	$0.0	$0.0	$24.2	$23.6	$22.7	$0.0	$0.0	$0.0
		M	$26.9	$26.3	$9.3	$27.9	$27.6	$27.1	$27.4	$27.0	$26.3
		P	$88.8	$60.0	$10.4	$152.9	$151.2	$118.1	$118.4	$89.9	$60.8
		S	$163.3	$161.7	$159.2	$157.6	$155.0	$91.9	$160.4	$158.3	$155.1
	48,700 Total		$278.9	$248.0	$178.9	$362.6	$357.4	$259.8	$306.3	$275.2	$242.2
	29,300	CDQ	$1.6	$0.0	$0.0	$37.0	$36.4	$35.6	$23.1	$22.3	$10.5
		M	$37.3	$27.8	$27.4	$47.4	$37.9	$37.4	$37.7	$37.4	$27.8
		P	$152.6	$150.8	$117.7	$184.9	$156.1	$154.6	$154.8	$153.5	$151.4
		S	$202.3	$201.3	$199.7	$164.0	$162.4	$160.1	$200.5	$164.5	$162.5
	29,300 Total		$393.7	$379.9	$344.8	$433.2	$392.8	$387.7	$416.2	$377.6	$352.3
B	87,500	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$1.7	$11.8	$35.9	$0.0	$0.0	$11.0	$0.0	$1.1	$22.1
	87,500 Total		$1.7	$11.8	$35.9	$0.0	$0.0	$11.0	$0.0	$1.1	$22.1
	68,100	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$22.0	$23.2	$52.7	$0.0	$1.5	$22.5	$1.7	$11.8	$35.9
	68,100 Total		$22.0	$23.2	$52.7	$0.0	$1.5	$22.5	$1.7	$11.8	$35.9
	48,700	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$36.4	$52.7	$71.8	$11.5	$22.5	$36.8	$22.7	$35.9	$70.4
	48,700 Total		$36.4	$52.7	$71.8	$11.5	$22.5	$36.8	$22.7	$35.9	$70.4
	29,300	CDQ	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
		S	$71.8	$86.7	$96.3	$36.8	$53.1	$86.4	$70.4	$71.4	$87.0
	29,300 Total		$71.8	$86.7	$96.3	$36.8	$53.1	$86.4	$70.4	$71.4	$87.0

Table 10-96 Hypothetical forgone pollock revenue in percent of total gross revenue, by season and sector, under Alternative 2, for 2006.

2006			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0%	0%	0%	15%	2%	0%	0%	0%	0%
		M	15%	5%	0%	38%	19%	16%	18%	15%	5%
		P	0%	0%	0%	34%	23%	4%	4%	3%	0%
		S	62%	50%	35%	34%	0%	0%	36%	35%	4%
	87,500 Total		26%	20%	14%	32%	11%	3%	17%	16%	2%
	68,100	CDQ	0%	0%	0%	33%	17%	3%	0%	0%	0%
		M	18%	16%	13%	53%	52%	37%	52%	19%	16%
		P	4%	3%	0%	46%	35%	23%	23%	23%	3%
		S	64%	63%	50%	37%	35%	14%	62%	50%	36%
	68,100 Total		28%	28%	21%	41%	34%	18%	39%	31%	17%
	48,700	CDQ	0%	0%	0%	35%	34%	33%	0%	0%	0%
		M	53%	52%	18%	55%	54%	53%	54%	53%	52%
		P	34%	23%	4%	59%	58%	46%	46%	35%	23%
		S	66%	65%	64%	63%	62%	37%	64%	64%	62%
	48,700 Total		44%	40%	28%	58%	57%	41%	49%	44%	39%
	29,300	CDQ	2%	0%	0%	53%	53%	51%	33%	32%	15%
		M	73%	55%	54%	93%	75%	74%	74%	74%	55%
		P	59%	58%	45%	71%	60%	60%	60%	59%	59%
		S	81%	81%	80%	66%	65%	64%	80%	66%	65%
	29,300 Total		63%	61%	55%	69%	63%	62%	66%	60%	56%
B	87,500	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	1%	4%	13%	0%	0%	4%	0%	0%	8%
	87,500 Total		0%	2%	6%	0%	0%	2%	0%	0%	4%
	68,100	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	8%	9%	20%	0%	1%	8%	1%	4%	13%
	68,100 Total		4%	4%	9%	0%	0%	4%	0%	2%	6%
	48,700	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	14%	20%	27%	4%	8%	14%	8%	13%	26%
	48,700 Total		6%	9%	12%	2%	4%	6%	4%	6%	11%
	29,300	CDQ	0%	0%	0%	0%	0%	0%	0%	0%	0%
		M	0%	0%	0%	0%	0%	0%	0%	0%	0%
		P	0%	0%	0%	0%	0%	0%	0%	0%	0%
		S	27%	32%	36%	14%	20%	32%	26%	27%	32%
	29,300 Total		12%	14%	16%	6%	9%	14%	11%	12%	14%

Table 10-97 Hypothetical forgone pollock gross revenue, by season and sector, under Alternative 2, for 2007.

2007			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	$0.0	$0.0	$0.0	$36.9	$36.3	$35.3	$8.8	$0.0	$0.0
		M	$20.1	$6.2	$0.0	$34.4	$33.8	$20.5	$27.4	$20.3	$6.2
		P	$105.8	$82.6	$61.3	$143.1	$141.2	$138.5	$138.9	$107.2	$104.1
		S	$185.6	$156.3	$124.6	$95.0	$1.9	$0.0	$126.5	$123.4	$2.1
	87,500 Total		$311.5	$245.2	$185.9	$309.3	$213.2	$194.3	$301.6	$250.9	$112.4
	68,100	CDQ	$0.0	$0.0	$0.0	$46.9	$46.4	$36.5	$22.2	$9.7	$0.0
		M	$33.7	$20.7	$11.8	$35.3	$34.8	$34.1	$34.5	$33.9	$20.7
		P	$139.2	$107.4	$104.4	$173.4	$144.2	$142.0	$142.4	$140.5	$108.1
		S	$188.6	$186.9	$157.4	$155.5	$124.6	$20.5	$185.6	$156.4	$124.7
	68,100 Total		$361.5	$315.0	$273.6	$411.2	$350.0	$233.1	$384.8	$340.5	$253.5
	48,700	CDQ	$10.2	$8.8	$0.0	$47.8	$47.4	$46.9	$36.1	$35.3	$22.2
		M	$35.1	$34.6	$33.7	$44.2	$43.8	$35.3	$43.6	$35.2	$34.5
		P	$143.6	$141.8	$139.2	$216.2	$174.7	$173.4	$173.6	$144.5	$142.4
		S	$217.6	$216.3	$188.6	$187.4	$185.5	$155.5	$189.5	$187.9	$185.6
	48,700 Total		$406.4	$401.5	$361.5	$495.6	$451.4	$411.1	$442.8	$403.0	$384.7
	29,300	CDQ	$36.4	$35.7	$22.9	$55.6	$48.4	$48.1	$47.1	$46.7	$36.8
		M	$44.5	$44.1	$43.6	$45.2	$45.0	$44.6	$44.9	$44.6	$44.1
		P	$215.9	$174.5	$173.2	$219.7	$218.8	$217.6	$217.8	$216.6	$214.9
		S	$220.8	$220.0	$218.9	$218.1	$216.9	$189.2	$219.5	$218.5	$217.0
	29,300 Total		$517.7	$474.4	$458.5	$538.6	$529.1	$499.5	$529.2	$526.3	$512.8
B	87,500	CDQ	$0.0	$0.0	$0.0	$2.2	$3.8	$3.9	$0.0	$0.8	$1.9
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$1.4	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$3.9	$0.0	$0.0	$0.0
		S	$27.6	$28.1	$37.5	$6.6	$17.0	$27.8	$17.1	$27.3	$36.8
	87,500 Total		$27.6	$28.1	$37.5	$8.8	$20.8	$37.1	$17.1	$28.1	$38.7
	68,100	CDQ	$0.0	$0.0	$1.7	$3.8	$3.9	$5.3	$0.9	$1.8	$2.2
		M	$0.0	$0.0	$1.2	$0.0	$1.3	$3.0	$0.0	$0.0	$1.5
		P	$0.0	$0.0	$0.0	$0.0	$0.2	$11.2	$0.0	$0.0	$3.6
		S	$36.8	$37.3	$50.0	$17.5	$27.5	$37.0	$27.6	$28.2	$37.5
	68,100 Total		$36.8	$37.3	$52.9	$21.3	$32.9	$56.5	$28.5	$29.9	$44.7
	48,700	CDQ	$0.8	$1.7	$2.1	$5.3	$5.3	$7.2	$2.0	$2.2	$3.9
		M	$0.0	$1.2	$2.9	$1.5	$3.0	$5.2	$1.3	$1.5	$3.1
		P	$0.0	$0.0	$4.1	$4.3	$11.2	$22.4	$0.0	$3.6	$11.3
		S	$37.7	$50.0	$59.9	$28.0	$37.0	$42.9	$37.0	$37.5	$50.2
	48,700 Total		$38.5	$52.9	$69.1	$39.1	$56.5	$77.7	$40.3	$44.7	$68.4
	29,300	CDQ	$2.1	$3.7	$3.9	$7.2	$7.3	$9.9	$3.9	$3.9	$5.4
		M	$2.9	$3.1	$6.9	$5.2	$6.9	$12.1	$3.1	$5.2	$9.9
		P	$4.1	$11.0	$22.3	$22.4	$28.1	$44.0	$11.3	$17.1	$28.2
		S	$59.9	$60.2	$60.5	$42.8	$50.1	$60.0	$50.2	$50.4	$60.3
	29300 Total		$69.0	$78.0	$93.6	$77.7	$92.4	$126.0	$68.4	$76.7	$103.7

Table 10-98 Hypothetical forgone pollock revenue in percent of total gross revenue, by season and sector, under Alternative 2, for 2007.

2007			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0%	0%	0%	53%	52%	51%	13%	0%	0%
		M	40%	12%	0%	68%	67%	40%	54%	40%	12%
		P	41%	32%	24%	55%	55%	54%	54%	41%	40%
		S	74%	63%	50%	38%	1%	0%	51%	50%	1%
	87,500 Total		50%	39%	30%	49%	34%	31%	48%	40%	18%
	68,100	CDQ	0%	0%	0%	68%	67%	53%	32%	14%	0%
		M	66%	41%	23%	70%	69%	67%	68%	67%	41%
		P	54%	42%	40%	67%	56%	55%	55%	54%	42%
		S	76%	75%	63%	62%	50%	8%	74%	63%	50%
	68,100 Total		58%	50%	44%	65%	56%	37%	61%	54%	40%
	48,700	CDQ	15%	13%	0%	69%	69%	68%	52%	51%	32%
		M	69%	68%	66%	87%	86%	70%	86%	69%	68%
		P	55%	55%	54%	84%	67%	67%	67%	56%	55%
		S	87%	87%	76%	75%	74%	62%	76%	75%	74%
	48,700 Total		65%	64%	58%	79%	72%	65%	71%	64%	61%
	29,300	CDQ	53%	52%	33%	80%	70%	70%	68%	67%	53%
		M	88%	87%	86%	89%	89%	88%	88%	88%	87%
		P	83%	67%	67%	85%	85%	84%	84%	84%	83%
		S	89%	88%	88%	88%	87%	76%	88%	88%	87%
	29,300 Total		82%	76%	73%	86%	84%	80%	84%	84%	82%
B	87,500	CDQ	0%	0%	0%	3%	6%	6%	0%	1%	3%
		M	0%	0%	0%	0%	0%	3%	0%	0%	0%
		P	0%	0%	0%	0%	0%	2%	0%	0%	0%
		S	10%	10%	14%	2%	6%	10%	6%	10%	14%
	87,500 Total		4%	5%	6%	1%	3%	6%	3%	5%	6%
	68,100	CDQ	0%	0%	3%	6%	6%	8%	1%	3%	3%
		M	0%	0%	3%	0%	3%	7%	0%	0%	3%
		P	0%	0%	0%	0%	0%	5%	0%	0%	1%
		S	14%	14%	19%	7%	10%	14%	10%	10%	14%
	68,100 Total		6%	6%	9%	3%	5%	9%	5%	5%	7%
	48,700	CDQ	1%	3%	3%	8%	8%	11%	3%	3%	6%
		M	0%	3%	7%	3%	7%	12%	3%	3%	7%
		P	0%	0%	2%	2%	5%	9%	0%	1%	5%
		S	14%	19%	22%	10%	14%	16%	14%	14%	19%
	48,700 Total		6%	9%	11%	6%	9%	13%	7%	7%	11%
	29,300	CDQ	3%	6%	6%	11%	11%	15%	6%	6%	8%
		M	7%	7%	16%	12%	16%	28%	7%	12%	23%
		P	2%	5%	9%	9%	12%	18%	5%	7%	12%
		S	22%	22%	23%	16%	19%	22%	19%	19%	22%
	29300 Total		11%	13%	15%	13%	15%	20%	11%	12%	17%

10.5.2.3 Potentially Forgone Gross Revenue under Alternative 4

As discussed under Alterative 2, the terminology used herein to describe potential impacts on the pollock fishery is "foregone revenue," and simply means the amount of revenue that the fleet, or sectors within it, would not be allowed to earn under a binding hard cap. In other words, it is the answer to the question, how much revenue was earned, in each of the years 2003 through 2007, from the projected date of the closure (as calculated in Sections 5.3.2.2 and 5.3.3) through the end of the season? Thus, it is a retrospective assessment of actual revenue earned in those years, from the projected closure date forward. The methodology, including total value of the fishery and price data, has been treated in the discussion of the costs and benefits analysis, presented previously. What is presented here are the estimates of foregone first wholesale value, which is inclusive of shoreside processing value added for the shore based CV fleet, as well as the percent of total first wholesale value actually earned by sector, season, and year.

Table 10-99 provides hypothetical estimates of foregone pollock first wholesale gross revenue, by year and season, under the PPA scenarios and for CDQ versus non-CDQ. As expected, the greatest impact under the PPA scenarios would have occurred in the highest bycatch year (2007) and under the most restrictive bycatch cap (PPA2). This effect is driven by both the higher roe pollock price in the A season and the 70/30 split contained within the PPA.

PPA1 had no effect on any sector in the A season from 2003-2005, as the bycatch amounts were below the high cap; however, the non-CDQ fishery would have been affected by PPA1 in 2006 and 2007. In 2006, the potentially foregone A season pollock gross revenue for the three non-CDQ sectors would have totaled $138 million, $122 million of which is from the inshore sector. The greatest A season effect of PPA1 would have occurred in 2007 when total foregone pollock gross revenues would have been $234 million with $114 million, $105 million, and $15 million coming from the inshore, catcher processor, and mothership sectors respectively. PPA1 would have had no A season effect on the CDQ fishery from 2003-2007. Note also that transferability in the A season lowers these impacts slightly and will be discussed further below.

The B season effects of PPA1 would be felt mostly by the inshore sector; however, in contrast to the A season effect, the CDQ fishery would be affected in 2004 and 2007. The CDQ fishery would have had $9 million and $3 million in foregone pollock gross revenues in 2004 and 2007 respectively. The inshore sector would have been affected in all but 2003, with the least effect, $10 million, in 2004 and the greatest, $33 million, in 2007. PPA1 does not affect the mothership and catcher processor sectors in the B season in 2003-2006; however, each is affected in 2007 with $2 million and $19 million in impacts accruing to motherships and catcher processors, respectively. The PPA1 B season total foregone pollock gross revenue would have been $20 million in 2004 and 2005, $11 million in 2006, and $57 million in 2007. These values, when combined with A season impacts, result in potential foregone pollock gross revenue of $ 20 million in 2004 and 2005, $149 million in 2006, and $288 million in 2007.

As the hard cap is decreased under PPA2, revenue impacts increase. Under PPA2, the largest A season impact would have been $341 million in 2007 with all sectors affected. The CDQ fishery impact would have been $12 million in 2007, while motherships, catcher processors, and the inshore sector would have had impacts of $29 million, $141 million, and $160 million respectively. The PPA2 2006 A season impacts are larger for two sectors than the impacts of PPA1. The catcher processor sector would have had foregone pollock gross revenues of $60 million in 2006 under PPA2, as compared to $8 million under PPA1. The shoreside sector would have had $169 million in foregone pollock gross revenues in 2006 under PPA2, as compared to $122 million under PPA1. PPA2 would have had no impacts on any sector in 2004 and 2005; however, catcher processors would have had $56 million in foregone pollock gross revenues in 2003 under PPA2, as compared to no impact in 2003 under PPA1. In total, PPA2 A season impacts on potentially foregone pollock gross revenue are $56 million in 2003, $244 million in 2006, and $341 million in 2007 as compared to $0, $138 million, and $234 million under PPA1 in the corresponding years.

The increase in impacts under PPA2 in the B season affects all sectors. The CDQ sector PPA1 impacts of $9 million and $3 million, in 2004 and 2007 respectively, increase to $21 million and 4 million under PPA2. Motherships had no impact in 2003 and 2004 under PPA1; however, under PPA2 they would have had $1 million in pollock gross revenues in 2003 and 2004, as well as an increase from $2 million to $3 million in 2007. Cather processors, which had no PPA1 impact in 2004 or 2005, would have had PPA2 impacts of $1 million and $29 million in those years as well as an increase from $19 million to $26 million in impacts in 2007. Shoreside processors would have had increased impact ranging from $7 million to $16 million in each of the years from 2003-2007, with the 2006 year having the greatest increase from $11 million to $27 million. In total, PPA2 more than doubles B season effects in 2004, 2005, and 2006, and increases 2007 impacts from 457 million to $76 million. The effect of PPA2 on combined A and B season total potentially foregone pollock gross revenues is similar and increases the 2006 and 2007 PPA1 annual totals of $149 million and $291 million, respectively, to $272 million and $417 million respectively.

Table 10-99 Hypothetical forgone pollock revenue by year and season under PPA1 and PPA2. ($ Millions)

PPA	A-season Transfer-Ability	Year	A-Season CDQ	A-Season M	A-Season P	A-Season S	**A total**	A-B Roll over	B-Season CDQ	B-Season M	B-Season P	B-Season S	**B Total**	**Annual Total**
1	No	2003	$0	$0	$0	$0	**$0**	**0%**	$0	$0	$0	$0	**$0**	**$0**
		2004	$0	$0	$0	$0	**$0**		$9	$0	$0	$10	**$20**	**$20**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$0	$20	**$20**	**$20**
		2006	$0	$8	$8	$122	**$138**		$0	$0	$0	$11	**$11**	**$149**
		2007	$0	$15	$105	$114	**$234**		$3	$2	$19	$33	**$57**	**$291**
	Yes	2003	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2004	$0	$0	$0	$0	**$0**		$9	$0	$0	$10	**$20**	**$20**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$0	$20	**$20**	**$20**
		2006	$0	$4	$0	$116	**$120**		$0	$0	$0	$11	**$11**	**$131**
		2007	$0	$12	$105	$114	**$231**		$3	$2	$19	$33	**$57**	**$288**
2	No	2003	$0	$0	$56	$0	**$56**		$0	$1	$0	$0	**$1**	**$57**
		2004	$0	$0	$0	$0	**$0**		$21	$1	$1	$18	**$41**	**$41**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$29	$27	**$57**	**$57**
		2006	$0	$15	$60	$169	**$244**		$0	$0	$0	$27	**$27**	**$272**
		2007	$12	$29	$141	$160	**$341**		$4	$3	$26	$42	**$76**	**$417**
	Yes	2003	$0	$0	$22	$0	**$22**		$0	$1	$0	$0	**$1**	**$22**
		2004	$0	$0	$0	$0	**$0**		$21	$1	$1	$18	**$41**	**$41**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$29	$27	**$57**	**$57**
		2006	$0	$15	$39	$162	**$216**		$0	$0	$0	$27	**$27**	**$243**
		2007	$12	$29	$141	$160	**$341**		$4	$3	$26	$42	**$76**	**$417**
1	No	2003	$0	$0	$0	$0	**$0**	**80%**	$0	$0	$0	$0	**$0**	**$0**
		2004	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2006	$0	$8	$8	$122	**$138**		$0	$0	$0	$9	**$9**	**$147**
		2007	$0	$15	$105	$114	**$234**		$3	$2	$18	$33	**$56**	**$289**
	Yes	2003	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2004	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2006	$0	$4	$0	$116	**$120**		$0	$0	$0	$9	**$9**	**$129**
		2007	$0	$12	$105	$114	**$231**		$3	$2	$18	$33	**$56**	**$286**
2	No	2003	$0	$0	$56	$0	**$56**		$0	$0	$0	$0	**$0**	**$56**
		2004	$0	$0	$0	$0	**$0**		$0	$0	$0	$10	**$10**	**$10**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$8	$21	**$29**	**$29**
		2006	$0	$15	$60	$169	**$244**		$0	$0	$0	$27	**$27**	**$272**
		2007	$12	$29	$141	$160	**$341**		$4	$3	$26	$42	**$76**	**$417**
	Yes	2003	$0	$0	$22	$0	**$22**		$0	$1	$0	$0	**$1**	**$22**
		2004	$0	$0	$0	$0	**$0**		$0	$0	$0	$10	**$10**	**$10**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$8	$21	**$29**	**$29**
		2006	$0	$15	$39	$162	**$216**		$0	$0	$0	$27	**$27**	**$243**
		2007	$12	$29	$141	$160	**$341**		$4	$3	$26	$42	**$76**	**$417**

Table 10-100 Hypothetical forgone pollock revenue, in percent of total forgone pollock revenue, by sector and scenario (% of total wholesale revenue)

PPA	A-season Transfer-Ability	Year	A-Season CDQ	A-Season M	A-Season P	A-Season S	A total 0	A-B Roll over	B-Season CDQ	B-Season M	B-Season P	B-Season S	B Total	Annual Total
1	No	2003	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	0%	**0%**	**0%**
		2004	0%	0%	0%	0%	**0%**		18%	1%	0%	4%	**4%**	**2%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	0%	7%	**3%**	**2%**
		2006	0%	16%	3%	49%	**22%**		0%	0%	0%	4%	**2%**	**12%**
		2007	0%	30%	41%	46%	**37%**		5%	4%	8%	12%	**9%**	**23%**
	Yes	2003	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2004	0%	0%	0%	0%	**0%**		18%	1%	0%	4%	**4%**	**2%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	0%	7%	**3%**	**2%**
		2006	0%	8%	0%	47%	**19%**		0%	0%	0%	4%	**2%**	**10%**
		2007	0%	24%	41%	46%	**37%**		5%	4%	8%	12%	**9%**	**23%**
2	No	2003	0%	0%	28%	0%	**11%**		0%	2%	0%	0%	**0%**	**6%**
		2004	0%	0%	0%	0%	**0%**		41%	4%	0%	8%	**8%**	**4%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	12%	10%	**9%**	**5%**
		2006	0%	30%	23%	68%	**39%**		0%	0%	0%	10%	**4%**	**22%**
		2007	17%	57%	54%	64%	**54%**		7%	8%	11%	16%	**12%**	**33%**
	Yes	2003	0%	0%	11%	0%	**4%**		0%	2%	0%	0%	**0%**	**2%**
		2004	0%	0%	0%	0%	**0%**		41%	4%	0%	8%	**8%**	**4%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	12%	10%	**9%**	**5%**
		2006	0%	30%	15%	65%	**34%**		0%	0%	0%	10%	**4%**	**19%**
		2007	17%	57%	54%	64%	**54%**		7%	8%	11%	16%	**12%**	**33%**
1	No	2003	0%	0%	0%	0%	**0%**	80%	0%	0%	0%	0%	**0%**	**0%**
		2004	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2006	0%	16%	3%	49%	**22%**		0%	0%	0%	3%	**1%**	**12%**
		2007	0%	30%	41%	46%	**37%**		5%	4%	7%	12%	**9%**	**23%**
	Yes	2003	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2004	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2006	0%	8%	0%	47%	**19%**		0%	0%	0%	3%	**1%**	**10%**
		2007	0%	24%	41%	46%	**37%**		5%	4%	7%	12%	**9%**	**23%**
2	No	2003	0%	0%	28%	0%	**11%**		0%	0%	0%	0%	**0%**	**5%**
		2004	0%	0%	0%	0%	**0%**		0%	0%	0%	4%	**2%**	**1%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	3%	8%	**5%**	**2%**
		2006	0%	30%	23%	68%	**39%**		0%	0%	0%	10%	**4%**	**22%**
		2007	17%	57%	54%	64%	**54%**		7%	7%	11%	16%	**12%**	**33%**
	Yes	2003	0%	0%	11%	0%	**4%**		0%	2%	0%	0%	**0%**	**2%**
		2004	0%	0%	0%	0%	**0%**		0%	0%	0%	4%	**2%**	**1%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	3%	8%	**5%**	**2%**
		2006	0%	30%	15%	65%	**34%**		0%	0%	0%	10%	**4%**	**19%**
		2007	17%	57%	54%	64%	**54%**		7%	7%	11%	16%	**12%**	**33%**
		2007	17%	57%	54%	64%	**54%**		7%	7%	11%	16%	**12%**	**33%**

Table 10-101 shows the calculation of reduction in potentially forgone revenue that would have resulted if A season Chinook bycatch cap allocation transfers were allowed, and assumes full transferability would have occurred. Under PPA1, transfers would have had the greatest effect in 2006, when total A season forgone gross revenue would have been reduced by $18 million, with CPs accounting for $8 million of the benefit and the inshore CV sector and motherships accounting for $46 million and $4 million respectively. In addition, in 2007 $3 million of reduction in forgone revenue would have accrued in the mothership sector.

Under PPA2, the greatest effect would have been in 2003, when total A season forgone revenue would have been reduced by $35 million, all from the CP sector. In 2006, the reduction in forgone gross revenue would have totaled $29 million with CPs accounting for $21 million of the benefit and the inshore CV sector accounting for $8 million.

Table 10-102 shows the effect that an 80% rollover would have on potentially forgone gross revenue under PPA scenarios without A season transfers. Under PPA1, an 80% rollover has the greatest effect in 2004, and 2005 when it would have reduced forgone revenue by $20 million, mostly in the inshore CV sector. There would have been no effect in 2003 and the effect in 2006 and 2007 would have totaled $2 million. Under PPA2, the effect increases to $31 million and $28 million in 2004 and 2005, respectively; however, in contrast to PPA1, CDQ groups would have benefited most with a $21 million reduction in potentially forgone gross revenue in 2004. Catcher processors would have gained the most from the rollover in 2005. Interestingly, while there are some very small gross revenue differences when A season transfers are allowed, there is no difference in B season potentially forgone gross revenue at the million dollar rounding level.

Table 10-101 Reduction in Forgone Pollock Due to Transferability by PPA Scenario ($ millions)

PPA		A-Season				**A total**
	Year	CDQ	M	P	S	
1	2003	$0	$0	$0	$0	**$0**
	2004	$0	$0	$0	$0	**$0**
	2005	$0	$0	$0	$0	**$0**
	2006	$0	$4	$8	$6	**$18**
	2007	$0	$3	$0	$0	**$3**
2	2003	$0	$0	$35	$0	**$35**
	2004	$0	$0	$0	$0	**$0**
	2005	$0	$0	$0	$0	**$0**
	2006	$0	$0	$21	$8	**$29**
	2007	$0	$0	$0	$0	**$0**

Table 10-102 Reduction in B Season Forgone Pollock Revenue Due to Rollovers Under PPA Scenarios with no A season Transfers ($ millions)

PPA	Rollover Percent	Year	CDQ	M	P	S	total
1	80%	2003	$0	$0	$0	$0	**$0**
		2004	$9	$0	$0	$10	**$20**
		2005	$0	$0	$0	$20	**$20**
		2006	$0	$0	$0	$2	**$2**
		2007	$0	$0	$1	$0	**$2**
2		2003	$0	$1	$0	$0	**$1**
		2004	$21	$1	$1	$8	**$31**
		2005	$0	$0	$22	$6	**$28**
		2006	$0	$0	$0	$0	**$0**
		2007	$0	$0	$0	$0	**$0**

Under PPA1, vessels, sectors or cooperatives would have the ability to opt out of the ICA and fish under the backstop cap of 32,482 Chinook salmon. Salmon bycatch would accrues to the backstop cap from all sectors operating both in and out of the ICA, however, only those who opt out of the ICA are required to cease fishing when the backstop cap is reached. Table 10-103 shows the hypothetical dates that fishing would have been constrained, by season, for CDQ and non-CDQ, under the backstop cap (32,482) that applies to parties who do not participate in the ICA.

Using these closure dates, salmon bycatch levels were calculated to estimate the relative amount of bycatch, by sector, should a sector have ceased fishing on that constraint date (i.e. operated under the backstop cap only and not participated in the ICA; Table 10-104). The amount of foregone pollock, by sector, is shown in Table 10-105, which provides a relative idea of the disincentive for a sector to opt out of the ICA and fish under the backstop cap.

Table 10-103 Hypothetical closure dates, by year and season, under the PPA1 backstop cap (32,482, assuming 70/30 A-B season split).

	A season		**B season**	
Year	**CDQ**	**Non-CDQ**	**CDQ**	**Non-CDQ**
2003	11-Mar	26-Feb	20-Sep	8-Oct
2004	--	16-Mar	11-Sep	16-Sep
2005	--	29-Feb	--	12-Sep
2006	15-Mar	6-Feb	--	20-Sep
2007	17-Feb	30-Jan	1-Oct	16-Sep

Table 10-104 Hypothetical Chinook salmon bycatch levels under the PPA1 backstop cap (32,482, assuming 70/30 A-B season split).

	A-Season					**B-Season**					**Annual**
Year	CDQ	M	P	S	**A-total**	CDQ	M	P	S	**B-total**	**Total**
2003	1,676	1,664	10,134	9,024	22,499	714	1,182	3,051	4,396	9,343	31,841
2004	1,167	1,819	8,164	10,435	21,585	701	511	2,392	6,095	9,699	31,284
2005	1,294	1,528	8,032	11,142	21,995	560	416	2,864	5,711	9,550	31,545
2006	1,702	1,416	4,410	13,034	20,562	157	108	857	7,687	8,809	29,371
2007	1,459	1,958	5,695	12,761	21,873	650	529	1,898	6,511	9,588	31,460

Table 10-105 Hypothetical foregone pollock levels under the PPA1 backstop cap (32,482, assuming 70/30 A-B season split).

	A-Season					B-Season					Annual
Year	CDQ	M	P	S	**A-total**	CDQ	M	P	S	**B-total**	**Total**
2003	11,691	12,384	87,190	93,530	204,795	20,099	3,214	1,166	20,346	44,826	249,621
2004	0	1,489	16,410	21,085	38,984	39,171	20,599	5,788	58,789	124,346	163,330
2005	0	9,710	68,518	85,732	163,960	0	16,014	33,092	83,730	132,836	296,797
2006	4,094	28,305	140,901	192,424	365,723	0	12,962	47,296	92,492	152,751	518,474
2007	35,699	33,625	147,942	196,449	413,716	7,314	16,052	48,598	72,901	144,865	558,580

10.5.2.4 Revenue at Risk under Alternative 3

While the hard caps of Alternative 2 and 4 have the potential effect of fishery closure and resulting forgone pollock fishery revenue, the triggered closures don't directly create forgone revenue, but rather, they place revenue at risk of being forgone. When the closure is triggered, vessels must be relocated outside the closure areas and operators must attempt to catch their remaining allocation of pollock TAC outside the closure area. Thus, the revenue associated with remaining allocation is placed at risk of not being earned if the fishing outside the closure area is not sufficiently productive to offset any operational costs associated with relative harvesting inefficiencies outside the closure area. The previous discussion contained in the overview of costs and benefits provides a treatment of some of the implications and limitations of this "revenue at risk" analysis.

As was the case for forgone revenue, the revenue at risk estimate is the answer to the question of how much revenue did they earn, in each of the years 2003-2007, from the projected date of the triggered closure (see Chapter 2) through the end of the season. Thus, it is a retrospective assessment of actual revenue earned in those years from the projected triggered closure date forward. Presented here are the estimates of revenue at risk and the percent of total revenue that these estimates comprise.

Table 10-106 provides hypothetical revenue at risk and percent of total revenue for all vessels after A season closures under each trigger and split of that trigger. The data show that in the highest bycatch years and under the most restrictive trigger levels, revenue at risk would be about $485 million in the A season for all vessels combined. That represents 77% of the 2007 estimated total A season first wholesale revenue of the pollock fleet. As the trigger is increased, the impacts decrease; however, the least restrictive A season trigger (70/30 split) of 87,500 still results in $125.2 million in revenue at risk, or a bout 21% of the overall first wholesale revenue of all pollock vessels combined. In lower bycatch years (e.g. 2003, 2004, and 2005), the larger triggers of 87,500 and 68,100 do not cause triggers to be hit, and thus there is no revenue at risk. However, in the low bycatch year of 2004 even the lowest trigger of 29,300 would place $33.2 million (70/30) to $97.4 million (50/50) at risk. These values are 11% and 31% of total revenue respectively.

Table 10-107 through Table 10-109 provide the breakout of this data by sector. A review of these tables reveals patterns consistent with the combined totals presented above. In addition, while CPs bear the greatest amount of revenue at risk, their percentages of total revenue are slightly lower than shore based CVs.

Table 10-110 provides the hypothetical revenue at risk and percent of total revenue for all vessels after B-season closures would have been triggered. The revenue at risk in the B season is greatest under the 70/30 split and is as much as $117.38 million in the worst case (2006, 29,300, 70/30), or 17% of total B season revenue. At the 29,300 trigger, and 70/30 split, the B season revenue at risk remains above 15% in all years except 2003. Even under the 87,500 trigger with a 70/30 split, more than $50 million, or 8% of total first wholesale revenue, would have been placed at risk in 2007. Ignoring the 2007 year; however, only the 29,300 trigger generates revenue at risk in excess of 10% of total first wholesale value.

Table 10-111 through Table 10-113 break the B season revenue at risk estimates down by sector. A review of the data presented in these tables reveals that shore based CV have the majority of the revenue at risk and the greatest percentages of total B season total first wholesale revenue at risk. Another finding is that the impacts associated with the 48,700 trigger are, in percentage of total B season first wholesale revenue, much greater for shore based CVs and motherships than for CPs.

Table 10-106 Hypothetical Revenue At Risk (millions of dollars (upper) percent of total revenue (lower)) based on retained tons of pollock caught by all vessels after A-season closures would have been triggered.

Pollock Cap scenario	Option	CAP	2003	2004	2005	2006	2007
			Sector (All), A season				
87,500	1-1: 70/30	61,250	$0.0	$0.0	$0.0	$0.0	$125.2
	1-2: 58/42	50,750	$0.0	$0.0	$0.0	$77.5	$263.2
	1-3: 55/45	48,125	$0.0	$0.0	$0.0	$157.0	$269.9
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$234.9	$280.5
68,100	1-1: 70/30	47,670	$0.0	$0.0	$0.0	$168.1	$269.9
	1-2: 58/42	39,498	$0.0	$0.0	$0.0	$265.8	$314.4
	1-3: 55/45	37,455	$0.0	$0.0	$0.0	$276.1	$326.4
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$300.1	$344.6
48,700	1-1: 70/30	34,090	$0.0	$0.0	$0.0	$300.1	$344.6
	1-2: 58/42	28,246	$92.3	$0.0	$0.0	$376.9	$385.6
	1-3: 55/45	26,785	$108.3	$0.0	$40.6	$376.9	$394.7
	1-4: 50/50	24,350	$141.0	$0.0	$151.5	$399.8	$412.6
29,300	1-1: 70/30	20,510	$241.5	$65.4	$232.1	$432.8	$453.0
	1-2: 58/42	16,994	$266.0	$129.3	$320.5	$442.6	$484.7
	1-3: 55/45	16,115	$272.1	$137.9	$338.7	$442.6	$484.7
	1-4: 50/50	14,650	$285.2	$179.2	$350.5	$442.6	$484.7
Pollock Cap scenario	**Option**	**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
			Sector (All), A season				
87,500	1-1: 70/30	61,250	0%	0%	0%	0%	20%
	1-2: 58/42	50,750	0%	0%	0%	12%	42%
	1-3: 55/45	48,125	0%	0%	0%	25%	43%
	1-4: 50/50	43,750	0%	0%	0%	37%	45%
68,100	1-1: 70/30	47,670	0%	0%	0%	27%	43%
	1-2: 58/42	39,498	0%	0%	0%	42%	50%
	1-3: 55/45	37,455	0%	0%	0%	44%	52%
	1-4: 50/50	34,050	0%	0%	0%	48%	55%
48,700	1-1: 70/30	34,090	0%	0%	0%	48%	55%
	1-2: 58/42	28,246	18%	0%	0%	60%	61%
	1-3: 55/45	26,785	21%	0%	6%	60%	63%
	1-4: 50/50	24,350	28%	0%	24%	64%	66%
29,300	1-1: 70/30	20,510	47%	11%	36%	69%	72%
	1-2: 58/42	16,994	52%	22%	50%	70%	77%
	1-3: 55/45	16,115	53%	24%	53%	70%	77%
	1-4: 50/50	14,650	56%	31%	55%	70%	77%

Table 10-107 Hypothetical Revenue At Risk based on retained tons of pollock caught by catcher/processors after A-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock Cap scenario	Option	CAP	CPs, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	$0.0	$0.0	$0.0	$0.0	$67.2
	1-2: 58/42	50,750	$0.0	$0.0	$0.0	$38.0	$134.4
	1-3: 55/45	48,125	$0.0	$0.0	$0.0	$86.8	$137.9
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$119.9	$142.1
68,100	1-1: 70/30	47,670	$0.0	$0.0	$0.0	$91.5	$137.9
	1-2: 58/42	39,498	$0.0	$0.0	$0.0	$134.1	$155.8
	1-3: 55/45	37,455	$0.0	$0.0	$0.0	$139.5	$161.3
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$148.7	$170.9
48,700	1-1: 70/30	34,090	$0.0	$0.0	$0.0	$148.7	$170.9
	1-2: 58/42	28,246	$59.8	$0.0	$0.0	$187.9	$191.7
	1-3: 55/45	26,785	$67.7	$0.0	$15.2	$187.9	$199.0
	1-4: 50/50	24,350	$84.3	$0.0	$78.9	$196.7	$210.5
29,300	1-1: 70/30	20,510	$138.3	$33.2	$119.3	$213.2	$225.5
	1-2: 58/42	16,994	$149.0	$71.1	$167.3	$219.2	$240.4
	1-3: 55/45	16,115	$152.1	$74.6	$177.6	$219.2	$240.4
	1-4: 50/50	14,650	$157.7	$97.3	$183.7	$219.2	$240.4
Pollock Cap scenario	**Option**	**CAP**	**CPs, A season 2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	61,250	0%	0%	0%	0%	21%
	1-2: 58/42	50,750	0%	0%	0%	12%	42%
	1-3: 55/45	48,125	0%	0%	0%	27%	43%
	1-4: 50/50	43,750	0%	0%	0%	37%	44%
68,100	1-1: 70/30	47,670	0%	0%	0%	28%	43%
	1-2: 58/42	39,498	0%	0%	0%	42%	48%
	1-3: 55/45	37,455	0%	0%	0%	43%	50%
	1-4: 50/50	34,050	0%	0%	0%	46%	53%
48,700	1-1: 70/30	34,090	0%	0%	0%	46%	53%
	1-2: 58/42	28,246	23%	0%	0%	58%	60%
	1-3: 55/45	26,785	26%	0%	4%	58%	62%
	1-4: 50/50	24,350	32%	0%	23%	61%	65%
29,300	1-1: 70/30	20,510	53%	11%	35%	66%	70%
	1-2: 58/42	16,994	57%	23%	49%	68%	75%
	1-3: 55/45	16,115	58%	24%	52%	68%	75%
	1-4: 50/50	14,650	60%	31%	54%	68%	75%

Table 10-108 Hypothetical Revenue At Risk based on Retained tons of pollock caught by Inshore Catcher Vessels after A-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock Cap scenario	Option	CAP	Inshore catcher vessels, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	$0.0	$0.0	$0.0	$0.0	$50.1
	1-2: 58/42	50,750	$0.0	$0.0	$0.0	$34.7	$107.2
	1-3: 55/45	48,125	$0.0	$0.0	$0.0	$63.2	$109.0
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$100.0	$113.8
68,100	1-1: 70/30	47,670	$0.0	$0.0	$0.0	$68.7	$109.0
	1-2: 58/42	39,498	$0.0	$0.0	$0.0	$112.4	$128.9
	1-3: 55/45	37,455	$0.0	$0.0	$0.0	$116.0	$134.6
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$127.3	$142.2
48,700	1-1: 70/30	34,090	$0.0	$0.0	$0.0	$127.3	$142.2
	1-2: 58/42	28,246	$29.8	$0.0	$0.0	$158.7	$159.5
	1-3: 55/45	26,785	$37.4	$0.0	$24.9	$158.7	$160.9
	1-4: 50/50	24,350	$51.5	$0.0	$68.3	$169.5	$166.0
29,300	1-1: 70/30	20,510	$91.5	$28.9	$104.7	$182.2	$186.0
	1-2: 58/42	16,994	$103.5	$52.3	$139.2	$186.1	$199.4
	1-3: 55/45	16,115	$106.1	$56.4	$145.8	$186.1	$199.4
	1-4: 50/50	14,650	$113.2	$71.6	$151.0	$186.1	$199.4

Pollock Cap scenario	Option	CAP	Inshore catcher vessels, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	0%	0%	0%	0%	20%
	1-2: 58/42	50,750	0%	0%	0%	14%	43%
	1-3: 55/45	48,125	0%	0%	0%	25%	44%
	1-4: 50/50	43,750	0%	0%	0%	40%	46%
68,100	1-1: 70/30	47,670	0%	0%	0%	28%	44%
	1-2: 58/42	39,498	0%	0%	0%	45%	52%
	1-3: 55/45	37,455	0%	0%	0%	47%	54%
	1-4: 50/50	34,050	0%	0%	0%	51%	57%
48,700	1-1: 70/30	34,090	0%	0%	0%	51%	57%
	1-2: 58/42	28,246	14%	0%	0%	64%	64%
	1-3: 55/45	26,785	18%	0%	10%	64%	65%
	1-4: 50/50	24,350	25%	0%	26%	68%	67%
29,300	1-1: 70/30	20,510	44%	13%	40%	73%	75%
	1-2: 58/42	16,994	50%	24%	53%	75%	80%
	1-3: 55/45	16,115	51%	26%	56%	75%	80%
	1-4: 50/50	14,650	55%	32%	58%	75%	80%

Table 10-109 Hypothetical Revenue At Risk based on retained tons of pollock caught by Mothership Processors after A-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock Cap scenario	Option	CAP	Mothership operations, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	$0.0	$0.0	$0.0	$0.0	$8.4
	1-2: 58/42	50,750	$0.0	$0.0	$0.0	$4.3	$21.4
	1-3: 55/45	48,125	$0.0	$0.0	$0.0	$8.0	$22.8
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$14.8	$24.2
68,100	1-1: 70/30	47,670	$0.0	$0.0	$0.0	$8.7	$22.8
	1-2: 58/42	39,498	$0.0	$0.0	$0.0	$18.7	$28.6
	1-3: 55/45	37,455	$0.0	$0.0	$0.0	$20.1	$29.4
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$23.0	$30.4
48,700	1-1: 70/30	34,090	$0.0	$0.0	$0.0	$23.0	$30.4
	1-2: 58/42	28,246	$5.2	$0.0	$0.0	$29.1	$33.2
	1-3: 55/45	26,785	$5.8	$0.0	$0.5	$29.1	$34.1
	1-4: 50/50	24,350	$7.9	$0.0	$5.7	$31.9	$35.9
29,300	1-1: 70/30	20,510	$14.9	$2.9	$9.6	$35.6	$40.1
	1-2: 58/42	16,994	$16.5	$6.5	$15.1	$35.7	$43.3
	1-3: 55/45	16,115	$16.9	$7.2	$16.3	$35.7	$43.3
	1-4: 50/50	14,650	$17.2	$10.8	$16.9	$35.7	$43.3

Pollock Cap scenario	Option	CAP	Mothership operations, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	0%	0%	0%	0%	15%
	1-2: 58/42	50,750	0%	0%	0%	8%	38%
	1-3: 55/45	48,125	0%	0%	0%	14%	40%
	1-4: 50/50	43,750	0%	0%	0%	26%	43%
68,100	1-1: 70/30	47,670	0%	0%	0%	15%	40%
	1-2: 58/42	39,498	0%	0%	0%	33%	50%
	1-3: 55/45	37,455	0%	0%	0%	35%	52%
	1-4: 50/50	34,050	0%	0%	0%	40%	53%
48,700	1-1: 70/30	34,090	0%	0%	0%	40%	53%
	1-2: 58/42	28,246	12%	0%	0%	51%	58%
	1-3: 55/45	26,785	14%	0%	1%	51%	60%
	1-4: 50/50	24,350	19%	0%	16%	56%	63%
29,300	1-1: 70/30	20,510	35%	6%	27%	63%	71%
	1-2: 58/42	16,994	39%	13%	43%	63%	76%
	1-3: 55/45	16,115	40%	14%	46%	63%	76%
	1-4: 50/50	14,650	40%	21%	48%	63%	76%

Table 10-110 Hypothetical Revenue At Risk (millions of dollars (upper) percent of total revenue (lower)) based on retained tons of pollock caught by all vessels after B-season closures would have been triggered.

Pollock Cap scenario	Option	CAP	Sector (All), B season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250	$0.0	$3.1	$15.8	$0.0	$50.2
	1-2: 58/42	36,750	$0.0	$0.0	$0.4	$0.0	$15.1
	1-3: 55/45	39,375	$0.0	$0.0	$0.0	$0.0	$10.6
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$0.0	$1.9
68,100	1-1: 70/30	20,430	$0.0	$11.7	$24.2	$14.4	$59.6
	1-2: 58/42	28,602	$0.0	$1.2	$9.9	$0.0	$42.4
	1-3: 55/45	30,645	$0.0	$0.0	$6.7	$0.0	$37.6
	1-4: 50/50	34,050	$0.0	$0.0	$1.5	$0.0	$22.0
48,700	1-1: 70/30	14,610	$0.0	$22.7	$35.2	$40.6	$79.0
	1-2: 58/42	20,454	$0.0	$11.7	$24.2	$14.4	$59.6
	1-3: 55/45	21,915	$0.0	$9.1	$22.6	$7.2	$57.0
	1-4: 50/50	24,350	$0.0	$4.8	$19.2	$0.0	$54.5
29,300	1-1: 70/30	8,790	$16.1	$79.8	$104.9	$117.3	$108.0
	1-2: 58/42	12,306	$7.1	$34.5	$54.4	$68.0	$91.6
	1-3: 55/45	13,185	$0.0	$23.7	$48.2	$61.7	$83.1
	1-4: 50/50	14,650	$0.0	$22.7	$35.2	$40.6	$79.0
Pollock Cap scenario	**Option**	**CAP**	**Sector (All), B season 2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250	0%	1%	3%	0%	8%
	1-2: 58/42	36,750	0%	0%	0%	0%	2%
	1-3: 55/45	39,375	0%	0%	0%	0%	2%
	1-4: 50/50	43,750	0%	0%	0%	0%	0%
68,100	1-1: 70/30	20,430	0%	2%	4%	2%	10%
	1-2: 58/42	28,602	0%	0%	2%	0%	7%
	1-3: 55/45	30,645	0%	0%	1%	0%	6%
	1-4: 50/50	34,050	0%	0%	0%	0%	4%
48,700	1-1: 70/30	14,610	0%	5%	6%	7%	13%
	1-2: 58/42	20,454	0%	2%	4%	2%	10%
	1-3: 55/45	21,915	0%	2%	4%	1%	9%
	1-4: 50/50	24,350	0%	1%	3%	0%	9%
29,300	1-1: 70/30	8,790	3%	16%	17%	19%	17%
	1-2: 58/42	12,306	1%	7%	9%	11%	15%
	1-3: 55/45	13,185	0%	5%	8%	10%	13%
	1-4: 50/50	14,650	0%	5%	6%	7%	13%

Table 10-111 Hypothetical Revenue At Risk based on retained tons of pollock caught by catcher/processors after B-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock Cap scenario	Option	CAP	CPs, B season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250	$0.0	$0.0	$0.0	$0.0	$17.0
	1-2: 58/42	36,750	$0.0	$0.0	$0.0	$0.0	$5.1
	1-3: 55/45	39,375	$0.0	$0.0	$0.0	$0.0	$3.1
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$0.0	$0.3
68,100	1-1: 70/30	20,430	$0.0	$0.0	$0.0	$0.7	$19.8
	1-2: 58/42	28,602	$0.0	$0.0	$0.0	$0.0	$14.7
	1-3: 55/45	30,645	$0.0	$0.0	$0.0	$0.0	$13.3
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$0.0	$7.6
48,700	1-1: 70/30	14,610	$0.0	$1.6	$2.4	$9.6	$28.1
	1-2: 58/42	20,454	$0.0	$0.0	$0.0	$0.7	$19.8
	1-3: 55/45	21,915	$0.0	$0.0	$0.0	$0.0	$18.9
	1-4: 50/50	24,350	$0.0	$0.0	$0.0	$0.0	$18.2
29,300	1-1: 70/30	8,790	$1.0	$25.4	$37.5	$41.6	$40.5
	1-2: 58/42	12,306	$0.0	$6.8	$11.0	$22.4	$33.5
	1-3: 55/45	13,185	$0.0	$1.9	$9.1	$19.0	$29.8
	1-4: 50/50	14,650	$0.0	$1.6	$2.4	$9.6	$28.1
Pollock Cap scenario	**Option**	**CAP**	**CPs, B season 2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250	0%	0%	0%	0%	6%
	1-2: 58/42	36,750	0%	0%	0%	0%	2%
	1-3: 55/45	39,375	0%	0%	0%	0%	1%
	1-4: 50/50	43,750	0%	0%	0%	0%	0%
68,100	1-1: 70/30	20,430	0%	0%	0%	0%	7%
	1-2: 58/42	28,602	0%	0%	0%	0%	5%
	1-3: 55/45	30,645	0%	0%	0%	0%	4%
	1-4: 50/50	34,050	0%	0%	0%	0%	3%
48,700	1-1: 70/30	14,610	0%	1%	1%	3%	9%
	1-2: 58/42	20,454	0%	0%	0%	0%	7%
	1-3: 55/45	21,915	0%	0%	0%	0%	6%
	1-4: 50/50	24,350	0%	0%	0%	0%	6%
29,300	1-1: 70/30	8,790	0%	11%	12%	14%	13%
	1-2: 58/42	12,306	0%	3%	4%	7%	11%
	1-3: 55/45	13,185	0%	1%	3%	6%	10%
	1-4: 50/50	14,650	0%	1%	1%	3%	9%

Table 10-112 Hypothetical Revenue At Risk based on retained tons of pollock caught by Inshore Catcher Vessels after B-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock Cap scenario	Option	CAP	Inshore catcher vessels, B season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250	$0.0	$1.9	$13.5	$0.0	$26.3
	1-2: 58/42	36,750	$0.0	$0.0	$0.5	$0.0	$7.2
	1-3: 55/45	39,375	$0.0	$0.0	$0.0	$0.0	$5.3
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$0.0	$0.8
68,100	1-1: 70/30	20,430	$0.0	$10.1	$20.2	$10.6	$31.9
	1-2: 58/42	28,602	$0.0	$0.6	$9.1	$0.0	$21.3
	1-3: 55/45	30,645	$0.0	$0.0	$6.8	$0.0	$18.6
	1-4: 50/50	34,050	$0.0	$0.0	$1.5	$0.0	$11.0
48,700	1-1: 70/30	14,610	$0.0	$19.3	$29.0	$26.0	$40.4
	1-2: 58/42	20,454	$0.0	$10.1	$20.2	$10.6	$31.9
	1-3: 55/45	21,915	$0.0	$7.5	$19.1	$5.4	$30.7
	1-4: 50/50	24,350	$0.0	$3.2	$16.3	$0.0	$29.3
29,300	1-1: 70/30	8,790	$14.1	$41.5	$60.3	$64.7	$52.6
	1-2: 58/42	12,306	$6.4	$21.6	$39.3	$38.6	$44.9
	1-3: 55/45	13,185	$0.0	$19.5	$35.3	$36.0	$42.3
	1-4: 50/50	14,650	$0.0	$19.3	$29.0	$26.0	$40.4

Pollock Cap scenario	Option	CAP	2003	Inshore catcher vessels, B season 2004	2005	2006	2007
87,500	1-1: 70/30	26,250	0%	1%	5%	0%	10%
	1-2: 58/42	36,750	0%	0%	0%	0%	3%
	1-3: 55/45	39,375	0%	0%	0%	0%	2%
	1-4: 50/50	43,750	0%	0%	0%	0%	0%
68,100	1-1: 70/30	20,430	0%	4%	7%	4%	12%
	1-2: 58/42	28,602	0%	0%	3%	0%	8%
	1-3: 55/45	30,645	0%	0%	2%	0%	7%
	1-4: 50/50	34,050	0%	0%	1%	0%	4%
48,700	1-1: 70/30	14,610	0%	9%	11%	10%	15%
	1-2: 58/42	20,454	0%	4%	7%	4%	12%
	1-3: 55/45	21,915	0%	3%	7%	2%	11%
	1-4: 50/50	24,350	0%	1%	6%	0%	11%
29,300	1-1: 70/30	8,790	6%	18%	22%	24%	20%
	1-2: 58/42	12,306	3%	10%	14%	14%	17%
	1-3: 55/45	13,185	0%	9%	13%	13%	16%
	1-4: 50/50	14,650	0%	9%	11%	10%	15%

Table 10-113 Hypothetical Revenue At Risk based on Retained tons of pollock caught by Mothership Processors after A-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock			Mothership operations, B season				
Cap scenario	Option	CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250	$0.0	$1.0	$1.2	$0.0	$5.8
	1-2: 58/42	36,750	$0.0	$0.0	$0.0	$0.0	$4.3
	1-3: 55/45	39,375	$0.0	$0.0	$0.0	$0.0	$3.3
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$0.0	$1.0
68,100	1-1: 70/30	20,430	$0.0	$2.8	$3.7	$4.1	$12.1
	1-2: 58/42	28,602	$0.0	$1.0	$0.8	$0.0	$9.8
	1-3: 55/45	30,645	$0.0	$0.0	$0.0	$0.0	$8.8
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$0.0	$5.3
48,700	1-1: 70/30	14,610	$0.0	$3.7	$3.7	$7.5	$16.1
	1-2: 58/42	20,454	$0.0	$2.8	$3.7	$4.1	$12.1
	1-3: 55/45	21,915	$0.0	$2.7	$3.3	$2.3	$11.3
	1-4: 50/50	24,350	$0.0	$2.4	$2.7	$0.0	$10.9
29,300	1-1: 70/30	8,790	$2.6	$21.9	$9.9	$17.5	$23.2
	1-2: 58/42	12,306	$1.5	$10.2	$4.9	$11.1	$20.4
	1-3: 55/45	13,185	$0.0	$4.5	$4.5	$10.3	$17.1
	1-4: 50/50	14,650	$0.0	$3.7	$3.7	$7.5	$16.1
Pollock			**Mothership operations, B season**				
Cap scenario	**Option**	**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250	0%	2%	4%	0%	12%
	1-2: 58/42	36,750	0%	0%	0%	0%	9%
	1-3: 55/45	39,375	0%	0%	0%	0%	7%
	1-4: 50/50	43,750	0%	0%	0%	0%	2%
68,100	1-1: 70/30	20,430	0%	7%	12%	8%	25%
	1-2: 58/42	28,602	0%	3%	3%	0%	20%
	1-3: 55/45	30,645	0%	0%	0%	0%	18%
	1-4: 50/50	34,050	0%	0%	0%	0%	11%
48,700	1-1: 70/30	14,610	0%	10%	13%	15%	33%
	1-2: 58/42	20,454	0%	7%	12%	8%	25%
	1-3: 55/45	21,915	0%	7%	11%	5%	23%
	1-4: 50/50	24,350	0%	6%	9%	0%	22%
29,300	1-1: 70/30	8,790	7%	57%	34%	36%	47%
	1-2: 58/42	12,306	4%	27%	16%	23%	42%
	1-3: 55/45	13,185	0%	12%	15%	21%	35%
	1-4: 50/50	14,650	0%	10%	13%	15%	33%

10.5.2.5 Pollock Industry Impact Reductions Through Transfers, Rollovers, and Cooperative Provisions.

As is discussed above, the proposed alternatives have potentially serious implications for pollock fleet revenues and operating costs as well as on fleet operations. The potential direct effects of the alternatives in terms of forgone gross revenue (Alternative 2 and 4) and revenue at risk (Alternative 3) are discussed, along with tabular estimates of potential impacts for a subset of the large number of possible combinations of caps or triggers, seasonal splits, sector allocations, and allocation options.

That analysis identifies a potential worst case scenario for forgone revenue impacts under Alternative 2 of as much as 84% of A season total first wholesale gross revenue and, additionally, 30% of B season total first wholesale gross revenue. Further, the trigger closure analysis of revenue at risk identified a potential worst case impact of 77% of A season, and 19% of B season total first wholesale revenue placed at risk. At the other end of the impacts spectrum, the largest cap and/or trigger levels and their various splits only have any effects in high Chinook salmon bycatch years.

Lying between these extreme values is a nearly continuous range of impact values that vary by cap/trigger, split, season, sector, option, and even year. Some consistent patterns are observed; however, the breadth of impact values calculated for even the subset chosen for analysis make an exhaustive (meaning scenario by scenario) evaluation of transfers, rollovers, and cooperative management provisions problematic, if not intractable. This analysis presents a simplified treatment of how these provisions might reduce adverse economic effects on the pollock fleet of a hard cap or area closure, while achieving the primary objective to minimize Chinook salmon bycatch to the extent practicable. Within this clear understanding of the principle objective of this action, it nonetheless follows that the greater the potential for forgone revenue and or revenue at risk, the more important these cap optimizing[58] measures become. For the very low cap levels that would result in near immediate, or even relatively early in season, shutdown of the fishery and/or closure of areas, the fleet would have little time to exercise such measures and there may be little Chinook salmon bycatch available for transfers or rollover.

Sector Transfers

As discussed in the description of the alternatives, if the Council were to recommend sector level Chinook salmon caps under Component 2, of either Alternative 2 or Alternative 3, but does not recommend a sector transfer option, the sector level cap would not change during the year. Thus, NMFS would close directed fishing for pollock (Alternative 2) and/or a triggered closure (Alternative 3) occur once each sector reached its sector level cap. This is the case that is documented in the analysis of direct effects on forgone gross revenue (Alternative 2) and revenue at risk (Alternative 3) below. The assumption of those analyses is that directed fishing would stop and/or a triggered closure would occur and would not be mitigated by any in-season transfer of Chinook salmon bycatch among sectors. As such, those analyses present what might be called the worst case scenario absent any potential mitigation of economic impacts via transfer or rollovers of unused Chinook salmon bycatch. Note that any apparent residual Chinook PSC represents "bycatch avoided savings," which is, as previously noted, the principal principle underlying this proposed fishery management action.

Alternative 4 contains transferable allocations for sectors and cooperatives, and the benefits of these provisions for reducing forgone gross revenues are presented in the analysis when compared to the analysis of Alternative 2 without transfer provisions. If sectors form the required legal entities, they would receive transferable allocations of which they could request NMFS to move a specific amount of the transferable allocation from one entity's account to another entity's account during a fishing season. A cooperatives could request NMFS to move a specific amount of the cooperative's transferable allocation from its account to another cooperative's account during a fishing season.

As the SSC correctly observed (October 2008), there is a fundamental difference between a target or retainable incidental catch "*allocation*," on the one hand, and a PSC limit "*allowance*," on the other. They state, in relevant part, *"The former imparts a harvest 'use privilege', while the latter must be regarded as a "prohibition" against harvest (to the maximum extent practicable), with an absolute cap.*

[58] In a perfect world, pollock trawlers would catch the pollock TAC and never take Chinook salmon. Reality is Chinook salmon will unavoidably be intercepted in the prosecution of the pollock fishery. Therefore, given that society has agreed to "trade-off" a limited Chinook salmon bycatch, in order to attain the benefits deriving from pollock harvests, the goal is to "optimize" the utilization (loss or cost) of that limited number of Chinook salmon, to obtain the largest possible portion of the pollock TAC, subject to the suite of prevailing regulatory, economic, and natural constraints.

No "use privilege" is implied by a PSC …. Instead, every practicable effort is required to be made to avoid use of this PSC, and if avoidance is not possible, to minimize its occurrence." In the former case, the allocation establishes a use-privilege and provides for conversion of the non-target catch to private ownership. In the case of a PSC allowance, no use-privilege authorizing removal of a specific amount of resource is conveyed and conversion of PSC to private ownership is strictly prohibited. These are crucial differences that should not be lost sight of. Indeed, this is so critical a distinction that it has been enshrined as National Standard 9 of the Magnuson-Stevens Act, expressly requires that bycatch be avoided to the maximum extent practicable.

This view of PSC limits appears to conflict with proposals that envision transfer, trading, or rolling-over of residual Chinook bycatch amounts, between AFA pollock entities or sectors. This is so, because a "sector transfer provision" conceptually suggests that, once a PSC hard cap level is chosen, it may be acceptable for Chinook salmon bycatch to *achieve* that level of removal. If that interpretation is adopted, then it may also be acceptable to allow sectors that do not remove all of their Chinook salmon bycatch allowance to transfer it to other sectors, in order to facilitate continued exploitation of the available pollock resource. Redistributing residual Chinook salmon bycatch, would, it is asserted, mitigate some portion of the foregone pollock revenues attributable to excessive bycatch of Chinook salmon by one or another AFA element. This interpretation of what the Chinook salmon bycatch cap constitutes seemingly reverses the SSCs referenced concept of PSC apportionment. That is, the language of Alternative 2, Component 3, option 1 would, in effect, establish Chinook PSC amounts as tradable incidental catch "*allocation*," with commercially negotiable use-privileges to removal (although not conversion to private ownership) of a specific quantity of Chinook salmon. This clearly changes the relationship of Chinook salmon PSC within the pollock industry, making it just another economic input to production that can be traded, sold, bartered, or withheld in the competitive prosecution of the BS pollock fishery. Alternative 4 and Alternative 2, option 1 of Component 3, promotes this approach.

Alternatively, it may be preferable to define a hard cap amount as an upper bound on Chinook salmon bycatch with the intent to promote actions that minimize Chinook salmon bycatch under that cap. Such an action might be deemed appropriate in order to promote greater Chinook salmon conservation, than afforded under full transferability, up to the overall cap, while still affording some opportunity mitigate impact to the pollock fleet. Under Alternative 2, the suboption to Option 1 of Component 3 provides an opportunity for such measures. The suboption would limit transfers to a) 50 %, b) 70% or c) 90% of the Chinook salmon that is available to the transferring entity at the time of transfer. Clearly, more Chinook salmon would be conserved with the 50% transferability than with 70% or 90%, although far fewer than without transferable allocations, and the reverse is true of mitigation of adverse impacts on pollock fleet gross revenue. Unlike Alternative 2, Alternative 4 does not contain a provision to limit the amount an allocation that can be transferred.

Interestingly, if no transfer provision were recommended under Alternative 2, the CDQ Chinook salmon sector level cap would continue to be managed as it is under status quo, with further allocation of the CDQ cap among the six CDQ groups, transferable allocations within the CDQ Program, and a prohibition against a CDQ group exceeding its Chinook salmon bycatch allocation. In other word, the CDQ groups already have transferable Chinook salmon bycatch caps and would continue to enjoy that flexibility in the absence of inclusion of transferability options for all sectors.

While this discussion has used terminology more appropriate to hard caps, it is applicable to the triggered closures of Alternative 3, but in a slightly different way. Under the triggered closure, NMFS would not issue fishery closures once the trigger cap was reached for each sector. Rather, the trigger closures would be managed similar to current management of the trigger closures under the CDQ Program. Each sector would receive a transferable trigger cap allocation, and vessels participating in that sector would be prohibited from fishing inside the area(s) selected under Component 5 after the sector's trigger cap is reached.

Rollovers

The suboption to Component 1 and option 2 to Component 3, under Alternative 2 and 3, provides for two different types of re-apportionments of unused Chinook salmon bycatch. A "rollover" is a management action taken by NMFS to "reapportion" or move salmon bycatch from sector level cap to another. Rollovers are an alternative to allowing each sector to voluntarily transfer salmon bycatch to another sector. Under the rollover suboption under Component 1, NMFS would move unused Chinook salmon from the A season to the B season, within a sector and calendar year. Under option 2 to Component 3, NMFS would rollover unused Chinook salmon bycatch from a sector that has stopped fishing to the sectors still fishing in a season based on the proportion by sector of the total amount of pollock remaining for harvest by all sectors through the end of the season. Successive reapportionment actions would occur as each non-CDQ sector completes harvest of its pollock allocation.

The CDQ groups could receive rollovers of salmon bycatch from other sectors. However, because the CDQ groups will each receive a specific, transferable allocation of salmon bycatch (as occurs under status quo), unused salmon bycatch would not be reapportioned from an individual CDQ group to other CDQ groups or other AFA sectors.

Under Alternative 4, NMFS would rollover up to 80% of a sector's or cooperative's unused salmon bycatch from it's a season account to that sector's B season account. No rollover would occur from the B season to the A season.

An important distinction should be made between voluntary transfers and rollovers. Voluntary transfers are industry initiated and fully voluntary. Meaning, the entity that represents a sector that has unused Chinook salmon bycatch must request the transfer. If that entity does not feel compelled to make a voluntary transfer, or an entity cannot be created or cannot reach consensus among members to make the transfer, then some Chinook salmon bycatch allocation could be unused and, potentially, some pollock that could otherwise have been harvested if the transfer hade been made would remain unharvested. In contrast, a rollover managed by NMFS is a somewhat automatic reapportionment that is not voluntary, and thus, does not suffer from the risks associated with voluntary transfers.

Cooperative Provisions (Alternatives 2 and 4: Hard Caps)

Under Alternative 2, if Chinook salmon bycatch is allocated among the sectors, under Component 2, and an allocation is made to the inshore sector then Component 4 (Cooperative provisions) would allow further allocation of transferable or non-transferable salmon bycatch allocations to the inshore cooperatives. Each inshore cooperative and the inshore limited access fishery (if the inshore limited access fishery existed in a particular year) would receive a salmon allocation managed at the cooperative level. If the cooperative or limited access fishery salmon cap is reached, the cooperative or limited access fishery must stop fishing for pollock. The initial allocation of salmon by cooperative within the inshore CV fleet or to the limited access fishery would be based upon the proportion of total sector pollock catch associated with the vessels in the cooperative or limited access fishery (see Chapter 2).

Also under Alternative 2 are options to allow transfers among inshore cooperatives, provided that sector allocations are made and further allocated among the inshore cooperatives and the inshore limited access fishery (if the inshore limited access fishery existed in a particular year). These provisions would allow intercooperative leases of Chinook salmon bycatch allocations or industry initiated transfers with the suboptions of 50%, 70% and 90% as defined for sector transfers. Under these options, when a salmon cooperative cap is reached, the cooperative must stop fishing for pollock and may lease additional Chinook salmon bycatch allocation or arrange a voluntary transfer from another inshore cooperative. These provisions would provide additional opportunity for the inshore cooperatives to mitigate effects of Chinook salmon bycatch caps in essentially the same way that transfers provide that opportunity at the overall sector level.

Under Alternative 4, each inshore cooperative and the inshore limited access sector would receive a transferable allocation of the inshore CV sector level cap and would be prohibited from exceeding its Chinook salmon bycatch allocation. Inshore cooperative allocations would be based on that cooperative's AFA pollock allocation percentage. The inshore limited access allocation would be based on the pollock history of those vessels participating in the limited access fishery. A cooperative could transfer its allocation to other cooperatives during a fishing season with no limits on the amount transferred.

Cooperative provisions under a binding hard cap have the potential to mitigate some of the potential for an induced race for fish, at least among the inshore cooperatives. Allocation of bycatch to the cooperative level converts the allocation by sector into smaller allocations at the inshore cooperative level. Each inshore cooperative would then have to manage the operations of its members to stay under their specific cap, or stop fishing. As such, there are clear economic incentives to avoid bycatch. At the larger sector level, those economic incentives are somewhat diminished as higher capacity operators may see an advantage in catching their pollock allocation quickly, with little regard for Chinook salmon bycatch so long as the sector level bycatch allocation is not exceeded. In such circumstances, the smallest or least capable catcher vessels may be adversely affected by the actions of the larger, more capable, vessels (i.e., the incentives to reopen the "race-for-fish", at least at the sector level. This reality, in turn, could affect the formation and membership of the inshore cooperatives themselves, resulting in "capital stuffing" within cooperatives. It is not clear at present to what extent this might become a reality; however, allocation at the inshore cooperative level may mitigate some of the risk associated with the implications of a sector level race for fish for the CV sector.

Alternative 3, ICA Management of triggered closures

Under Alternative 3, option 1 of Component 2 (Management) of the triggered closure alternative a NMFS-approved salmon bycatch reduction ICA would manage any subdivision of the seasonal trigger caps at the sector level, inshore cooperative, or individual vessel level under its contract and would enforce the area closures to the designated group or entity when subdivided caps established by the ICA are reached. The specific provisions of this option are discussed in the Chapter 2.

In general terms, this option would allow the ICA to decide how to manage participating vessels to avoid reaching the trigger closures as long as possible during each season. The ICA would operate only under the fishery-level seasonal caps established under Component 1. Any CDQ group that participated in the ICA would bring to the ICA its portion of the trigger cap to be combined with the non-CDQ trigger cap for purposes of the area closures that would apply to all CDQ and non-CDQ vessels participating in the ICA.

The ICA provision would be similar in purpose to the current status quo VRHS system. A major benefit of such a system is its dynamic ability to impose closures and change them rapidly throughout the season, as is documented in the description of the pollock fishery section on the VRHS system (Section 10.2.4). Thus, the ICA may have the ability to define small area closures throughout the season in order to keep bycatch down to levels that prevent triggering the large area closures under Alternative 3 for their participants. In essence, this is a form of dynamic self management where the ICA determines what if must do to prevent the trigger from being reached.

It is interesting to note that the VRHS system was actually in place, as an industry initiated bycatch reduction method, before the regulations associated with Amendment 84 created the specific exemptions from the Chinook salmon savings areas for participants in the VRHS system. It is possible, therefore, that some sort of ICA may continue to be employed by industry on a voluntary basis even under a hard cap and/or triggered closure measure. However, cooperatives work because participants have incentives to cooperate in order to improve efficiencies and they are most successful under rationalized or limited access fisheries (e.g. the AFA pollock fishery; the Alaska scallop fishery).

When there are incentives to not-cooperate, such as in open access race for fish circumstances, cooperatives have a more difficult time retaining members. As has been mentioned in the discussion of potential fleet operational effects, a race for fish is not an unrealistic possibility under threat of fishery closure or large area closures, even within the AFA rationalized fleet. Thus, there may be benefit to formalizing the ICA structure within the choice of a preliminary preferred alternative if a triggered closure is part of that preference. Doing so may provide needed incentives for vessel operators to join the ICA and not engaging in a race for fish, with all its associated inefficiencies and safety issues, if a large area triggered closure is imminent. To the extent that the ICA can more dynamically manage bycatch under a rolling hotspot system and can thereby ensure that more allocated pollock is harvested, this method may further the goals of both National Standard 9 and National Standard 1. Note, however that the ICA management option is not presently a part of the Alternative 2 (Hard Caps) management option but may be employed voluntarily if the perceived benefits of doing so outweigh the considerable costs that could be imposed in high bycatch years under a binding hard cap.

10.5.3 Fleet Operational Effects

Under the alternatives to the status quo, fishermen would be expected to attempt to minimize losses associated with forgone gross revenue and/or revenue placed at risk by altering their current operations. These reactions could include the following: (1) mitigating a triggered area closure by re-deploying fishing effort, using the same fishing gear and methods, to known adjacent fishing grounds that may be equally or only somewhat less productive (similar CPUE) than the fishing grounds lost to the salmon bycatch minimization measure; (2) avoiding Chinook salmon bycatch by re-deploying fishing effort to an area of unknown productivity and operational potential, using the identical fishing gear, in an exploratory mode; (3) switching to a different target fishery (e.g. yellow fin sole); (4) mitigating the risk of a hard cap induced closure by speeding up harvesting and processing activities (race for fish). Each of these strategies may have operational cost implications as described below. While empirical data on operating cost structure at the vessel or plant level are not available, cost trends for key inputs may shed some light on the probable impacts of the fishing impact minimization alternatives on the pollock industry in the aggregate and on average.

Any regulatory action that requires an operator to alter his or her fishing pattern, whether in time or space, is likely to impose additional costs on that operator. The alternative salmon bycatch minimization actions may affect the operating costs of the pollock fleet, compared to the status quo condition, with the degree of those effects necessarily dictated by the extent to which hard cap and/or triggered closures constrain harvests. The following sections address this issue in terms of both fixed and variable costs. Fixed costs tend to arise from investment decisions and variable costs arise from short-run production decisions. As the terms imply, fixed costs are those that do not change in the short run, no matter what the level of activity. Variable costs, on the other hand, are those costs that do change directly with the level of activity, recognizing that variable inputs must be used if production exceeds zero.

10.5.3.1 Fixed Costs

As suggested earlier, many costs confronting operators in these fisheries are fixed; that is, they do not change with the level of production. Fixed costs include such expenses as debt payments, the opportunity cost of the investment in the vessel (or plant), the cost of having the vessel or plant ready to participate in the fisheries, some insurance costs, property taxes, and depreciation. Following an action that negatively affects, for example, CPUE, TAC, or catch share, these fixed costs must be distributed across a smaller volume of product output, raising the average fixed cost per unit of production. As previously noted, available information on the cost structure of operations fishing for and processing pollock is very limited. This is largely so because cost information is often considered highly proprietary by industry members and is, under the best of circumstances, expensive to collect and analyze. Only scattered anecdotal information at the operation level is available on fishing costs (fixed or variable). It is, therefore, impossible to do more than provide a qualitative discussion of the impact of the proposed alternatives on pollock industry's operating costs.

10.5.3.2 Variable Costs

Of all the categories of variable factor costs, fuel ranks at or near the top of the list of operating expenses in the fisheries under consideration. Even a qualitative evaluation of the elements of the Chinook salmon bycatch minimization actions of Alternative 3 (e.g., triggered area closures) suggest that the proposed regulatory changes may likely result in the following 1) longer average trip duration to travel to remaining open fishing grounds; 2) greater total distances traveled per trip [perhaps under more extreme operating conditions]; 3) longer periods fishing in lower CPUE areas to mitigate the potential loss of catch. In addition, the Chinook salmon bycatch minimization actions of Alternative 2 (e.g., hard caps) may induce a race for fish that could result in vessels operating a maximum speed and capacity in order to harvest as much pollock as possible prior to a hard cap induced fishery closure. Alternative 4 could have a similar impact, however, under the PPA1, the ICA with incentive to reduce Chinook salmon bycatch would control to fleet operatives and avoid the race for fish.

Fig. 10-59 provides representative diesel fuel cost information for the Bristol Bay area and for Dutch Harbor. These data have been provided by the Pacific States Marine Fisheries Commission, Economic Information System. These data clearly show that diesel fuel prices more than doubled in the region between 2005 and 2008 and approached $6 per gallon in the Bristol Bay area in 2008. These increases have likely had a severe impact on the variable costs of all fishing operations in the region, including those for Chinook salmon. While it is true that some fuel is purchased by the pollock fleet in other areas, such as Seattle, there is, at present, no comprehensive accounting of costs or expenditures in the pollock fishery that would allow analysis of actual fuel consumption and costs.

Projecting how changes in running time would affect fuel costs depends on how much fuel must be burned per unit catch. While it is not possible to place a numerical estimate on this factor, it is reasonable to conclude that, on average, total fuel consumption would potentially increase relative to the status quo under each of the proposed alternatives provided that a hard cap was reached and/or a trigger closure level of bycatch was reached. This increased fuel use would apply except in the case of vessels that cease to fish as a result the Chinook salmon bycatch minimization measures, and perhaps in the case of vessels that switch to a different fishery.

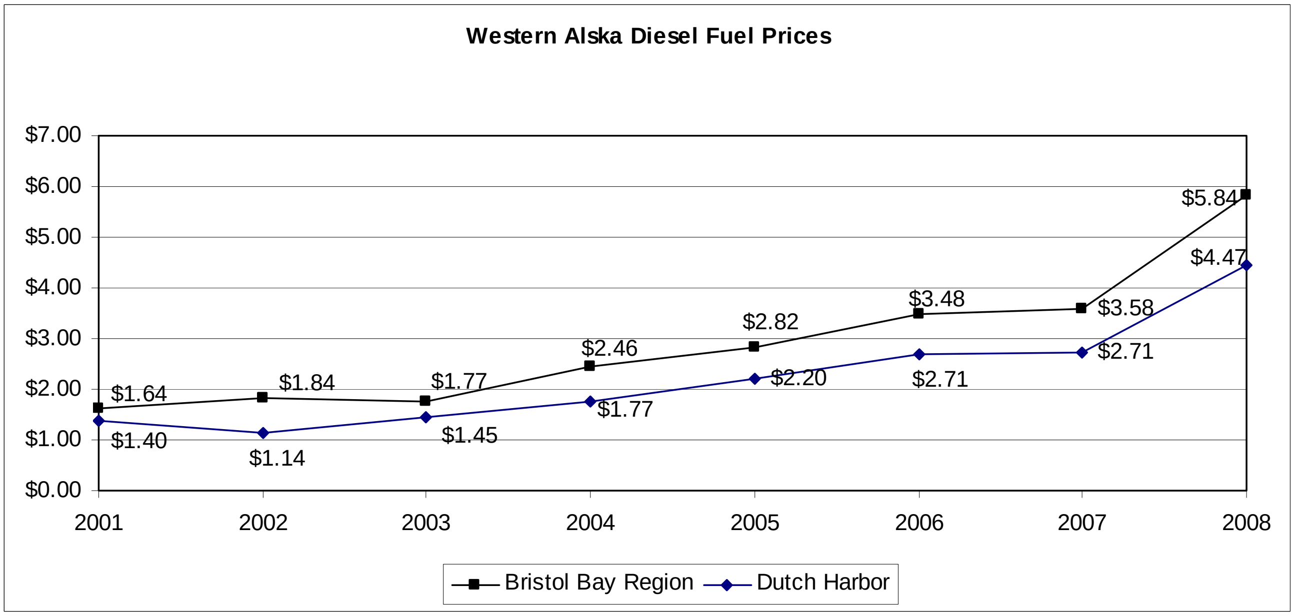


Fig. 10-59 Representative Diesel Fuel Costs from western Alaska, 2001-2007 ($/gallon)

What economists refer to as the 'opportunity cost' of labor is another variable cost that may increase by triggered closure scenarios contained within Alternative 3. Measures that increase fishing time would reduce the time available for other activities, and, in so doing would impose a cost on fishermen. Several of the contemplated measures may increase the time required for fishing in affected fisheries. As noted elsewhere, avoiding Chinook salmon bycatch may increase transit time to and from fishing grounds; they may force fishermen to fish on grounds with lower CPUE, thus increasing the time required to harvest any given amount of fish; or they may force fishermen to learn new fishing grounds, thus increasing fishing time, at least initially. Because fishing crew members are generally paid with shares of an operation's net (or modified gross) revenues, the additional time spent at sea as a result of these measures may actually decrease crew earnings, if the operating expenses of the fishing vessel increase.

This opportunity cost is also reflected in lost time, which reduces the individual's opportunities to engage in other activities and is treated as a cost in economic benefit/cost analysis. The limitations of available models for predicting how fishing operations would behave, given the constraints, and the limited amount of cost information available for fishing operations, makes it impossible to make quantitative estimates of the change in fishing hours or days associated with these alternatives, or to make monetary estimates of the changes in associated opportunity costs.

Clearly, upon attainment of a hard cap, some portion of TAC would remain unharvested, representing forgone gross revenue; however, it has been suggested by some in the industry that fishing costs may increase so much, as a result of the triggered closure provisions contained in Alternative 3, that fishermen would not be able to completely harvest the TACs available to them and may simply choose to "hang it up" for the season following the area closures. It has been suggested that this is more likely for the smallest catcher vessels in the fleet as the triggered closure area may encompass virtually all of their near shore fishing grounds. The loss of revenues in these instances has been discussed above, and is detailed in the analysis of direct effects of the alternatives, below. On the cost side, those revenue losses may be offset, to an unknown extent, by associated reductions in the variable operating costs these operations would otherwise have incurred. From the operator's perspective, for example, fewer days fishing as a result of trigged closures would mean reductions in variable costs (e.g., stores, lubricants and fuel expense), reduced wear and tear on vessels and gear, and reduced processing, packaging, and storage expenses for the product. It would also mean reduced payments to labor (although the other side of that coin reflects forgone wages to the skipper and crew, as well as the social value of other goods and services the fishermen might have produced).

On the other hand, the cost of fishing would tend to increase, per unit of the pollock that continue to be caught. Based on information provided by the industry at public meetings and through individual contacts, as well as the professional judgment of the preparers of this RIR, seven categories of costs were defined for consideration, as follows:

- Increased travel costs
- Costs of learning new grounds or using new or modified gear (e.g. excluder devices)
- Costs of bycatch avoidance measures, or (if these efforts are unsuccessful) premature closure due to excessive bycatch
- Reduced pollock CPUE due to less concentrated target stocks;
- Potential gear conflicts
- Effects on processors (floating or shoreside) built for higher throughput
- Safety impacts (addressed separately below in section 10.5.4)

Increased Travel Costs

Vessels that had formerly been able to fish areas nearer shore, and in relative proximity to their preferred port of operation, could be pushed farther offshore and/or into more remote fishing areas, as a result of specific provisions contained in Alternative 3. Running to the remaining open fishing areas, prospecting for harvestable concentrations of target species, then (depending on operating mode) running back to port with raw catch or product would, as previously noted, require increased expenditures of fuel and other consumable inputs, as well as more time on the water (i.e., trips may be longer, and all variable operating costs and wear and tear on equipment and crew would increase). These changes in fleet operating patterns would likely require a greater total number of days for a given vessel to take its share of the available TAC, other things being equal.

How many additional days may be required would vary by stock and ocean conditions, rates of success in locating fishable concentrations of the target species in remaining open areas or time periods, operational mode and capacity, the level of aggregate effort exerted by the fleet or sub-sector in the remaining open areas, etc. But clearly, if catch per unit effort declines, cost per unit of catch would increase. In the limit, smaller vessels may be so disadvantaged by the distances that must be traversed between port and open fishing grounds that they may be unable to operate economically (perhaps, even physically) under these circumstances.

The smallest, least mobile vessels could be effectively closed out of some fisheries. Even vessels that have the capacity to reach open fishing grounds may incur prohibitively high operating costs (e.g., excessive fuel consumption), increased risk (e.g., should sea or weather conditions change unexpectedly), and reduced product quality (i.e., as hold-time increases). Longer distances and more time in transit mean higher operating costs and less time fishing.

Costs of Learning New Grounds or Using New Gear

It is axiomatic that fishermen fish when and where they believe the fish are most valuable and most readily available. Under the triggered closure area provisions, triggered closures would compel operators to alter the pattern of operations they would voluntarily choose to undertake as profit maximizing entities. That is, in many instances, fishermen would be required to fish on grounds with which they may be unfamiliar. Fishermen would face a learning curve on these new grounds. They would have to become accustomed to a new physical geography underwater and perhaps more extreme and/or exposed sea surface conditions, to new fish locations, behaviors, and habits, and, importantly, to new patterns of bycatch.

While fishermen learn to operate within these new parameters, they would likely incur increased operating costs. Gear could be more frequently lost or damaged, CPUE would likely be lower, and bycatch of other species could be higher. Higher bycatch, especially of PSC species, could force early closures of fishing grounds, and with fewer optional open areas available, it would be more difficult (and, thus, more costly) for operators to voluntarily move off hot spots to reduce or avoid bycatch of both Chinook salmon and other prohibited species.

Even if the bycatch is composed of species for which there is no potential risk of regulatory closure, the additional resources (e.g., time and labor) required to land, sort, and discard unwanted catch would increase operating costs. Because, in many instances, large volumes of fish would have to be taken in places and at times when they have never been taken before, there is little available information for fishermen to use to make inferences about these issues in advance of committing the effort. Thus, they would have very little opportunity to avoid incurring the costs of prospecting new areas (at new times) even if, subsequently, the effort proved uneconomical from the standpoint of catch success.

Costs of Bycatch Avoidance Measures

While, as a general rule in pollock trawl fishery, the selectivity of the gear fished varies, pollock fishermen unavoidably take other species as incidental catch when they fish for pollock. In some instances (e.g., bycatches of halibut, salmon, herring, and some species of crabs), pollock fishermen are subject to limitations on the amounts of bycatch that they may take. When the bycatch limits (or caps) are reached, the fishery is closed. Fishermen can, to a greater or lesser degree, reduce bycatch by modifying their gear or the way they use it, and by learning the times and places when unacceptably large bycatches might take place (Queirolo et al. 1995). Both bycatches and the avoidance measures that they make necessary impose costs on the operations. Finally, with temporal and geographic dispersion provisions associated with the triggered closure alternative, there is the potential for increased interactions with protected species (e.g., short-tailed albatross, ESA-listed PNW Chinook salmon), which could require Section 7 consultation (with the potential to trigger further and more extensive fishing closures).

Reduced CPUE Due to Less Concentrated Target Stocks

The economic, operational, and socioeconomic response of individual operators may take several forms following adoption of a triggered closure. For example, anecdotal information supplied by the industry in public meetings and through individual contacts suggests that CPUE may decline, in some cases substantially, as a result of significant fishing effort being forced into unfamiliar or unfavorable areas. The effect of these declines would not likely be uniformly distributed across each management area, gear type, processing mode, or vessel size category and, thus, would carry with them very different implications for profitability, economic viability, and sustained participation in these fisheries.

Potential Gear Conflicts

Concerns have been expressed, from a variety of sources, about the adverse economic effects associated with forcing gear-specific effort out of traditional operating areas and into proximity with other gear groups and/or target fisheries. Trawl gear, pot gear, and longline gear are incompatible when fished simultaneously in a given area. Gear damage or loss is a common outcome when these competing fishing technologies come into contact with one another on the fishing grounds. Each gear group perceives itself as facing unique operating challenges with respect to such conflicts. For example, Pacific cod longline fisheries occur north of the Pribilof Islands at the same time that bottom trawl fisheries target flathead, yellowfin, and rock sole in the same area. By voluntarily isolating themselves in well defined and generally recognized areas, they insulate themselves from the high cost and frustration associated with gear conflicts (loss of longline gear and catch). If either a total pollock fishery closure and/or a triggered closure induced pollock vessels to switch, to the extent that sideboard regulations allow, to bottom trawl fishing on the flatfish fishing grounds gear conflicts could emerge. The likelihood of occurrence and magnitude of any such conflict is speculative at this time.

Effects on Processors Built for Higher Throughput

If CPUEs decline and fishing is more geographically dispersed under the triggered closure alternative, the aggregate rate of catch could slow. This implies that the rate of delivery to processors would also decline. Because existing processing plant capacity has been built, in many cases, for peak through-put (i.e., to maximize the rate at which catch is received and processed in response to the race-for-fish on the grounds), lower and slower deliveries may not supply sufficient quantities of raw fish for the largest plants to operate profitably. Many plants have been designed, configured, and operated to exploit economies-of-scale in production. They are designed to move an optimal volume of fish through the processing plant at the most efficient, most cost effective rate, given the capacity of the facility and expectations of catch and delivery rates from the catcher-vessel fleet. If operated at rates that significantly deviate from those for which the plant was designed, these economies would be lost, and a plant could become unprofitable to operate.

The nature of these interactive and compounding relationships is important to keep in mind. None of these economic, operational, or logistical elements works in isolation from one another. Further, while many of these considerations have specifically been identified as being related to relocation of effort under a triggered closure alternative, they may also affect overall fleet operations under the threat of a hard cap induced total, and/or sector level, pollock fishery closure. Given the level of cooperation that exists within the pollock industry presently, and the fact that the VRHS ICA is an industry conceived and implemented (before Amendment 84 regulations took effect) system designed for proactive bycatch avoidance it is not unreasonable to expect that the pollock industry may continue to operate the VRHS ICA, or some variant of it, in order to try to prevent attainment of a hard cap. As such, they would invoke various closures upon their membership that could have similar effects on operational costs as described above for Alternative 3. It follows, that these cost impacts are presently being felt by the members of the ICA due to VRHS closures under the status quo.

10.5.4 Safety Impacts

Commercial fishing is a dangerous occupation. Lincoln and Conway, of the National Institute of Occupational Safety and Health (NIOSH), estimate that, from 1991 to 1998, the occupational fatality rate in commercial fishing off Alaska was 116 persons per 100,000 full time equivalent jobs, or about 26 times the national average of 4.4/100,000 (Lincoln and Conway 1999). Fatality rates were highest for the Bering Sea crab fisheries. Groundfish fishing fatality rates, at about 46/100,000, were the lowest of the major fisheries identified by Lincoln and Conway. Even this relatively lower rate was about ten times the national average (Lincoln and Conway 1999).

During most of the 1990s, commercial fishing appeared to become relatively safer. While annual vessel accident rates remained comparatively stable, annual fatality per incident rates (case fatality rates) dropped. The result was an apparent decline in the annual occupational fatality rate. From 1991 to 1994, the case fatality rate averaged 17.5% per year; from 1995 to 1998 the rate averaged 7.25% per year. Lincoln and Conway report that, “The reduction of deaths related to fishing since 1991 has been associated primarily with events that involve a vessel operating in any type of fishery other than crab.” (Lincoln and Conway 1999, page 693.) Lincoln and Conway described their view of the source of the improvement in the following quotation. “The impressive progress made during the 1990s, in reducing mortality from incidents related to fishing in Alaska, has occurred largely by reducing deaths after an event has occurred, primarily by keeping fishermen who have evacuated capsized (sic.) or sinking vessels afloat and warm (using immersion suits and life rafts), and by being able to locate them readily, through electronic position indicating radio beacons" (Lincoln and Conway 1999, page 694).

There could be many explanations for this improvement. Lincoln and Conway point to improvements in gear and training, flowing from provisions of the Commercial Fishing Industry Vessel Safety Act of 1988 that were implemented in the early 1990s. Other causes may be improvements in technology and in fisheries management. Technological improvements may include advances in Emergency Position Indicating Radio Beacon (EPIRB, sometimes also called an ELT or Emergency Locator Beacon) technology. Current 406 MHz EPIRBs are more effective as a means of communicating distress than the 121.5 MHz EPIRBs in use in the early 1990s, in that they now transmit a unique identification code in addition to position information, which allows USCG personnel ashore to quickly identify the vessel, use point of contact telephone numbers, and more effectively filter out false alarms.

Fishery management changes have included the introduction of individual quotas for halibut and sablefish, actions that have dramatically slowed the historically frenetic pace of these fisheries. The introduction of co-ops in the pollock fisheries in 1999 and 2000 is not reflected in these statistics. Rationalization of the pollock fishery in the BSAI, however, may have furthered safety improvements. The Lincoln-Conway study implies that safety can be affected by management changes that affect the vulnerability of fishing boats, and thus the number of incidents, and by management changes that affect the case fatality rate. These may include changes that affect the speed of response by other vessels and the USCG. Starting in 1997, the Coast Guard's Seventeenth District instituted a practice of forward deploying a long range search helicopter to Cold Bay, Alaska, to improve agency response time during the Bristol Bay red king crab fishery. This practice was expanded in 1998 to cover the opilio crab fishery. In 1999, approximately 11 lives were saved, in a 6-day period of extreme weather, when the forward deployed helicopter responded to several vessel sinkings and other marine casualties in short order.

In this RIR, several safety-related issues have been considered with respect to the alternatives. These include the following:

1. Fishing farther offshore,
2. Reduced profitability, and
3. Changes in risk.

Fishing Farther Offshore

Changes in fishery management regulations that result in vessels, particularly smaller vessels, operating farther offshore appear likely to increase the risk of property loss, injury to crew members, and loss of life. Chinook salmon bycatch minimization measures that close nearshore areas to fishing operations, such as the triggered closures of Alternative 3, could compel vessel operators to choose between assuming these increased risks or exiting these fisheries entirely. Weather and ocean conditions in the BSAI are among the most extreme in the world. The region is remote and sparsely populated, with relatively few developed ports. The commercial fisheries are conducted over vast geographic areas. While many vessels in these fisheries are large and technologically sophisticated, some are relatively small vessels with limited operational ranges.

Several factors associated with fishing farther from shore can reduce the safety of fishing operations by increasing the likelihood of emergency incidents. Vessels would probably have to spend more time at sea in order to take a given amount of fish. It would take more time to travel between port and the remaining open fishing grounds. Operators would also be likely to be fishing in less familiar conditions and on stocks that may be less highly aggregated, thus reducing CPUE. Increases in the time spent at sea increase the length of time fishermen are potentially exposed to accidents. Furthermore, longer trips are likely to increase fatigue and thus the potential for mistakes and accidents.

Other factors may tend to increase the case fatality rate. Fishing vessels may be farther from help if an accident occurs. In many cases, the initial response to trouble comes from other fishermen. If fishing farther offshore, on more extensive fishing grounds, increases the dispersion of the fishing fleet, assistance from other fishermen may not be as readily available. In addition, regulatory actions that force fishing vessels to work farther offshore may turn what would normally have been a request for assistance search and rescue (SAR) case into an emergency or life threatening situation. Many SAR cases involving fatalities start as a casualty to the vessel that degrades its stability or survivability, but does not immediately threaten the vessel or crew. After the initial casualty, other environmental factors (e.g., heavy seas, winds, freezing spray, etc.) may quickly cause the situation to deteriorate. The ability to render assistance early is essential. Vessels fishing farther from shore and/or in more remote and exposed locations may experience additional delays before help can arrive.

In a similar respect, the ability to satisfactorily treat personnel injuries is often determined by the speed with which the injured can receive adequate medical attention. While these factors may affect all operations, they are likely to be most serious for the smaller vessels based in Alaska ports, which have tended to fish relatively close to the shore in the past.

Reduced Profitability

As discussed throughout this RIR, proposed restrictions on fishing to minimize Chinook salmon bycatch could reduce the profitability of many operations, especially including many of the smaller operations. Reduced profitability could be an indirect cause of higher accident rates. For example, fishermen facing a profit squeeze could defer needed maintenance on vessels and equipment, reduce operating costs by cutting back on safety expenditures, or scale back the size of their crew in order to reduce crew share expenses. Remaining crew would have expanded responsibilities and could risk greater fatigue, increasing the likelihood of accidents. Finally, these operators could decide to fish more aggressively, even in marginal conditions, in an effort to recoup lost revenues. These factors may affect the incident rate and the case fatality rate, as well.

Changes in Risk

Each of the factors described above increase risk. On the other hand, the potential for increased risk may be offset to some extent by changes in fleet behavior. An increase in risk effectively increases the cost of each additional day of fishing that, in turn, may contribute to reduced levels of participation (e.g., fewer fishing days) by smaller vessels. If this leads to a safety-induced reallocation of harvest from smaller to larger vessels, risk calculations may be affected. Similarly, smaller crew sizes mean that fewer people on a vessel are exposed to danger. Furthermore, skippers who have less invested in safety gear may have an incentive to behave more cautiously or conservatively in other respects in order to offset some of this perceived increased risk. Very little is known about factors that might increase risk, or that might offset risk increases, for fishermen in the North Pacific and Bering Sea. Even the best estimates of statistics as fundamental as the occupational fatality rate are not precise, and are not available at all for recent years. Rough estimates of the relative ranking of occupational fatality rates in different fisheries are known. Little more than qualitative speculation is available concerning the factors that affect the rates in the different fisheries, however. Available information does not permit quantitative modeling of changes in these rates in response to changes in fishery management regulations that could be induced by fishing impact minimization measures. These changes in fishing behavior and patterns could lead to an increased level of risk to vessels and crews, albeit an increase that cannot be empirically estimated.

10.5.5 Pollock Product Quality, Markets, & Consumers

This section analyzes the economic impacts of the alternatives on (1) product quality and revenue impacts, including changes in the time between harvest and delivery and changes in the average size of pollock, (2) costs to consumers, (3) impacts on related fisheries, and (4) impacts of fishery dependent communities.

10.5.5.1 Product Quality & Revenue Impacts

The Chinook salmon bycatch minimization alternatives considered in lieu of the status quo may impose restrictions on pollock fishing vessel operations that might lead to a decline in product quality and associated reductions in the price the industry receives for fishery products. Changes in product quality may occur for at least three reasons:

- If a triggered closure occurs, fishermen may have to fish farther away from processors, requiring them to travel greater distances to deliver their catch.
- If forced out of the most productive grounds, fishermen may be induced to target stocks of sub-optimal sized fish.
- If a hard cap threatens a fishery closure, a race for fish may occur and catcher processors and motherships may change product mix in order to speed up production, thereby possibly reducing product quality and/or finished product value.

The economic law of demand (e.g., a downward sloping demand curve) suggests that (assuming all other factors are held constant), if fewer units of a normal good or service are supplied, the individual unit price would be expected to rise. This means that, within the limits of this model, and the context of this action, if fewer fish of a given species are harvested, then fishermen should receive more for each unit of that species they continue to catch and deliver to the market, all else equal. Any increase in price that would actually occur would depend on, among other things, how responsive the price consumers are willing to pay is to changes in the quantity of catch supplied. The consumers' willingness to pay more for these products is dependent upon how unique the products are; that is, whether the consumer can substitute a lower cost alternative product. Very little empirical information is available at this time concerning the responsiveness of price to quantity supplied for the species and product forms potentially affected by the alternatives over the range of possible quantity change that might be anticipated.

Pollock is sold into a world whitefish market place, in which many close substitutes exist. As such, it is very unlikely that marginal changes in pollock catches of a size that might be envisioned under the terms of this action would have any noticeable price impact. Some specialty product form and niche markets (e.g., pollock roe marketed in Japan) may, under extraordinary circumstance, be an exception, but even there, history suggests the Japanese can be rather price-sensitive, even in the roe market. Increased revenue accruing from any per-unit price rise would, of course, represent a benefit to primary producers (i.e., fishermen), offsetting, to some indeterminate degree, the increased operational costs expected to accompany adoption of any one of the proposed Chinook salmon PSC minimization alternatives to the status quo.

To the extent that these pollock fishery products are consumed in the United States, any producer benefit accruing from a price response to diminished supply would be, to a very large extent, offset by a reduction in consumer welfare from the increase in price. That is, the benefit to the industry would simply be the result of a transfer from consumers. Thus, under these conditions, this hypothesized supply-induced price increase would create no net benefits to Americans that could be revealed in a cost-benefit analysis for domestically consumed fish. Quantity changes under some alternatives under consideration in this action (e.g., Alternative 3) may be small enough to have no perceptible impact on prices, while under other alternatives (e.g., Alternative 2 and Alternative 4) they may. It is not possible, at this time, to estimate the likelihood or magnitude of these hypothetical supply and price effects.

Alternatively, to the extent that these fish are exported and consumed outside of the United States, any supply-induced price increase would create an attributable net benefit improvement to the Nation, from a cost/benefit perspective. This is because the price increase would accrue, in the form of increased gross revenues, to United States producers, while the loss in consumer welfare would be imposed on citizens of other countries. Under OMB guidelines, costs incurred by (and, for that matter, benefits accruing to) foreign producers and consumers are excluded from the net benefit analysis performed in a Regulatory Impact Analysis. Such changes would (all else equal) have no effect on net benefits to the nation.

10.5.5.2 Longer Travel to Deliver Fish

The interval between catching and initiating processing pollock is, reportedly, negatively correlated with product quality (and, thus, value). Some reports suggest that, on a product-for-product basis, the quality of pollock harvested and processed at-sea is uniformly higher than that of product produced onshore, owing primarily to the significant difference in the interval of time between catching and processing. Inshore processors routinely place limits on the maximum holding time for pollock onboard catcher vessels, and deduct from the price or refuse delivery if the delivery time is exceeded. For those vessels that do not have the capability to process their own catch, given a fixed catch rate and hold capacity, any action that substantially increases the time between catch and delivery imposes costs, both on the harvester and the processor. Beyond some point (which varies by vessel size, configuration, condition of the target fish, and weather/sea conditions) delivery of a usable catch (i.e., one with an economic value to the fisherman and processor) is not feasible.

In this latter connection, a concern common to all operators delivering catch ashore for processing is the effective time limit that exists from ‘first catch onboard’ until offloading to deliver a salable catch. Informed sources in the industry place the maximum interval at 72 hours (at least in the case of pollock). If fishing grounds that remain open under one or another of the fishing impact minimization alternatives are more remote from sites of inshore processing facilities than the traditional fishing locations, the delivery time for the raw product by the catcher vessel may be lengthened and the value of the delivered product lowered. For smaller vessels with more limited holding capacity and slower running speeds, this limit would impose relatively greater constraints (i.e., operational burdens). The result may be an effective intra-sectoral redistribution of catch share.

Closures (or other operational restrictions) of fishing grounds adjacent to inshore processing facilities may inadvertently redistribute the catch within a sub-sector, from the smaller, least operationally mobile vessels to the larger, faster, more seaworthy elements of the fleet. In the long run, this may have the added (undesirable) effect of inducing further ‘capital stuffing’ behavior within the industry as those disadvantaged small boat owners perceive the need to invest in added capacity to continue to participate profitably in the fishery.

10.5.5.3 Change in Average Size of Fish

A corollary effect of altering the timing and/or location of catch might accrue if the average size of fish in the catch falls below the minimum requirement for specific product forms, as discussed in Chapter 4. These minimums are often dictated by the marketplace, but may also be directly linked to the technical limits of the available processing technology. These impacts could accrue to any or all segments of the fishery. For example, on average, fillet production requires a larger pollock than does, say, surimi production. If spatial displacement (e.g. via a triggered area closure) results in a significant decline in the average size of fish harvested by a given operation, there could be adverse effects on product mix, quality, grade, and value.

10.5.5.4 Costs to Consumers

Ultimately, fish are harvested, processed, and delivered to market because consumers place a value on the fish that is over and above what they have to pay to buy them. A person who buys something would often have been willing to pay more than they actually did for the good. The difference between what they would have been willing to pay and what they had to pay is treated, by economists, as an approximation of the value of the good or service to consumers (i.e., consumer's surplus) and as one component of its social value. If the price of the good rises, the size of this benefit will be reduced, all else equal. If the amount of the good available for consumption is reduced, the size of this benefit is also reduced. Provisions of the proposed Chinook salmon bycatch minimization actions could reduce the value consumers of seafood (and associated fish products) receive from the fisheries for several reasons, including 1) consumers may be supplied fewer fish products; 2) consumers may have to pay a higher price for the products they do consume; and 3) the quality of fish supplied by the fishing industry may be reduced and, thus, the value consumers place on (and receive from) them will decline.

The domestic consumer losses would fall into two parts. One part, corresponding to the loss of benefits from fish products that are no longer produced, would be a total loss to society. This is often referred to as a deadweight loss. The second part, corresponding to a reduction in consumer benefits because consumers have to pay higher prices for the fish they continue to buy, would be offset by a corresponding increase in revenues to industry (i.e., producers' surplus gains). While a loss to consumers, this is not a loss to society. It is a measure of the benefit that consumers used to enjoy, but that now accrues to industry in the form of increased prices and additional revenues.

The actual loss to society cannot be measured with current information about the fisheries. Estimation would require better empirical information about domestic consumption of the different fish species and products, and information about the responsiveness of consumers to the reduction in the supply (e.g., their willingness and ability to substitute other available sources of protein). In addition in the present case, because, under the status quo, society is already in a suboptimal state (i.e., incurring a welfare loss associated with the externalities imposed by salmon bycatch), actions taken to reduce these externalities (i.e., minimizing pollock trawl fishing impacts on salmon) will result in an aggregate welfare improvement to society, offsetting any apparent welfare reduction in the retail/wholesale domestic seafood/fish products commercial marketplace (i.e., no deadweight loss is incurred).

10.5.5.5 Impacts on Related Fisheries

Direct changes to a fishery, induced by salmon bycatch minimization measures, could have indirect and unanticipated impacts on other fisheries beyond the gear conflict issue addressed earlier. Some of these impacts could impose (perhaps substantial) costs on these other fisheries. Chapter 7 provides a detailed discussion on the impacts of the alternatives on related groundfish fisheries. The following costs have been considered in this RIR:

- Displacing capacity and effort,
- Compression/overlapping of fishing season, and
- Increased costs of gearing up and standing down.

<u>Displacing Capacity and Effort</u>: While AFA sideboard provisions and license limitation program constraints seek to manage and control transfer of effort and capacity across fisheries, they are not absolute barriers to this phenomenon. Should salmon bycatch minimization measures become too constraining to support existing levels of effort, it is possible that effectively displaced capacity would redistribute to remaining open target fisheries within the limits imposed by AFA sideboards, imposing potentially increased costs on the operations that currently prosecute them.

Compression/Overlapping of Fishing Season: Many of the larger operations in the Bering Sea pollock fishery are highly specialized (e.g., AFA surimi C/Ps). Many others, however, rely upon diversification (i.e., fishing a sequential series of different target fisheries over the course of the year) to sustain an economically viable operation. Communities have developed around, and invested in facilities and infrastructure to support, these fishery participation patterns. The classic Alaska example has come to be the 58-foot Limit Seiner. This class of commercial fishing vessel was specifically designed to meet the State of Alaska's regulatory limit (i.e., maximum 58 feet LOA) for participation in the salmon seine fishery. Over time, these, as well as many other, small boats have evolved patterns of operation that include participation in fisheries for (among others) crab, halibut, and various combinations of groundfish species.

Because these operations are economically dependent on participation in a suite of fisheries, anything that alters their ability to move sequentially from fishery opening to fishery opening places them at economic risk. For example, should the Council select an Chinook salmon bycatch minimization action that results in temporal displacement of fisheries (either directly or indirectly), placing fishery openings in conflict, it could reduce the economic viability of some fishing operations. They could find themselves in the position of choosing to participate in only one fishery, among two or more alternative openings, and foregoing participation in the others. It may not be possible, under these circumstances, for such an operation to remain economically viable in the long run. Besides losing the revenues from participation in fisheries that overlap, these operations could find themselves idled during portions of the year when weather and sea conditions would otherwise permit fishing operations. This could have unintended consequences, such as difficulty retaining a professional crew and smaller gross revenues over which to spread fixed costs. It could also mean lost wages to the community.

There could be an analogous concern about the inshore processing sector. Processing plants often are equally dependent on the predictable sequential prosecution of fisheries during their operating year. Many plants in Alaska are specifically designed and configured to take advantage of efficiencies attributable to a consistent seasonal sequence of species delivered for processing. Crews are hired, maintained, or let go, as needed, based on expected demand for processing services. Likewise, start-up, maintenance, and shut-down costs are predicated on the timing and duration of fishery openings, as are logistical and staging costs to assure production inputs are in place when needed, and outputs reach markets on time.

In the worst case scenarios considered in this RIR, owners of processing capacity could be forced to consider not opening their plants because of uncertainty about the timing and duration of fisheries. If some plants fail to open on schedule, fishermen who otherwise would have participated in a fishery may have no market for their catch. This may be particularly significant for small catcher boats operating in relatively remote areas of the state. Furthermore, these effects need not necessarily accrue only to operators in the pollock fishery. In some areas, processors are able to provide markets for, say, salmon, only because they can underwrite some of their fixed staging costs by keeping their operations employed over an extended season with deliveries of crab, halibut, groundfish, etc. The extent to which these potential adverse effects are actually realized cannot be assessed at this time. Nonetheless, they represent potentially significant sources of economic disruption for these sectors of the industry, and the coastal communities dependent upon them.

Increased Costs of Gearing Up and Standing Down: Logistical and staging costs can represent a significant expense for many operations participating in the fisheries of the BS. Should one or more of the Chinook salmon bycatch minimization measures result in temporal displacement of fisheries there would be adverse economic and operational impacts on vessels, plants, and crews that could not be readily avoided or compensated for. That is, if a salmon bycatch minimization measure results in, for example, an early fishery shutdown due to attainment of a hard cap, the immediate result would be an idling of the fleet and associated processing plant capacity. In effect, the fishery would be required to stand-down until the next scheduled seasonal opening. From the perspective of the fishing industry, mandatory idle periods between openings impose direct costs. The longer the duration of imposed idleness and the more numerous these periods, the greater the potential economic and operational burden.

Presumably, there exists some form of a step function that characterizes these potential adverse impacts. That is, it may be likely that a mandatory stand-down of 24 hours, or 48 hours, or even 72 hours, would impose costs that could be absorbed by most operators participating in the target fishery (although all would likely prefer to avoid them). Indeed, over such a relatively brief interval, an operator might keep the crew productively employed with maintenance and/or other forms of preparation for the anticipated re-opening. Nonetheless, the plant or vessel must continue to pay its variable costs (e.g., wages and salaries, food and housing expenses, fuel and other consumable input costs, etc.) during the stand-down while producing no marketable output, and therefore earning no revenues.

Under such circumstances, each operator could eventually reach a threshold, beyond which the cost of standing-by would become a significant economic burden. Precisely where this threshold lies would likely vary by operation. At present, no empirical information is available with which to predict when these thresholds might be attained by any given plant or vessel. However, if the threshold were reached, the operator would face a series of decisions with potentially significant economic costs and operational consequences.

These costs may be characterized as staging expenses. For example, transporting crews by air to and from remote Alaska locations multiple times in a fishing year (rather than once or twice, as has historically been required) would represent a significant additional operating expense. In association with analysis of the Bering Sea Pollock/Steller RPA analysis undertaken in late 1999 and early 2000, the At-sea Processors Association reported that each C/P that participates in the pollock target fishery carries a crew of 100 to 125. Motherships and inshore plants in that same fishery have at least as many transient employees. Repeated movement of crew to and from staging areas in remote Alaska ports in response to stand-down periods, on the scale suggested by these estimates, would represent a potentially significant economic and logistical burden for these fleets and plants.

Similarly, moving fishing supplies and support materials to and from the vessel's staging port or onshore plant location two or more times each season, as well as providing for secure stand-down status of the vessel or plant and its equipment between openings, could impose considerably higher operating costs, and thus smaller profit margins. Moorage slips, especially for the larger vessels in these fleets, may be in short supply, given the limited physical facilities that currently exist in ports and harbors. If entire fleets must lay-up for weeks or even longer periods between openings, existing moorage facilities could be overwhelmed. Even if adequate space could be found, it is probable that rental/leasing costs for that space would be bid up significantly. In the long run, this induced demand could result in investment in additional port and harbor facilities.

As suggested above, inshore processors may experience equivalent logistical costs, depending upon their relative level of operational diversification, geographic location, length of current operating season, etc. Presumably, there exists a balance-point between the minimum necessary volume of deliveries of catch to a plant, the duration of idleness between delivery flows, and the ability to operate a processing facility at all. While likely varying from plant to plant, operator to operator, and even species to species delivered, it is clear that if a plant cannot cover its variable operating costs, it is better off (from an economic perspective) to cease operation altogether. As staging costs (e.g., moving crews and supplies to and from the facility) increase, this operating margin shrinks. Data limitations preclude estimating which plants can or would choose to operate under these circumstances. It is apparent; however, that significant temporal changes in fishery openings and/or duration (as implicitly or explicitly provided for under several of the proposed alternatives) would increase the likelihood that some may not continue to operate.

10.5.5.6 Impacts on Fishery Dependent Communities

Many of the communities of coastal Alaska that are adjacent to the Bering Sea are engaged in, and highly dependent upon, the commercial fisheries in the adjacent EEZ. The nature of engagement varies from community to community and from fishery to fishery. Some communities have fish processing facilities, others are homeport to harvest vessels, and many have both processors and harvesters. Some of the larger communities also have relatively well-developed fishing support sectors. Other communities participate in the fisheries primarily through the CDQ program. The engagement of CDQ communities occurs in a variety of ways, including receipt of royalties, investment in commercial fishing harvest and/or processing entities, and direct participation in commercial fishing activities through owning/operating vessels. CDQ investments in community fisheries infrastructure, training, and vessels have resulted in additional employment and income for local residents. Sixty-five CDQ communities and numerous Alaska non-CDQ communities (including Unalaska/Dutch Harbor, Sand Point, King Cove, Chignik, Adak, and Kodiak) are most clearly and directly engaged in and dependent upon multiple BSAI fisheries. In addition, Seattle, Washington (and the adjacent Puget Sound area) has a substantial and direct involvement in many of these fisheries. Harvest vessels from Oregon, especially from Newport, also account for a significant portion of the total catch in a number of the larger groundfish and crab fisheries.

Alternative 1 would not provide any additional measures to minimize Chinook salmon bycatch, beyond those currently in place or planned as part of other fishery management actions. Therefore, there would be no direct short-term effect on pollock fishery dependent communities. However, to the extent that bycaught Chinook salmon could represent an important element of both subsistence and commercial use in western Alaska communities, the status quo provides no specific limit on Chinook salmon bycatch, in stead relying on the existing VRHS and/or savings areas to minimize Chinook salmon bycatch.

For the dependent Alaska communities, there are very few economic opportunities available as an alternative to commercial fishing related activities, whether it be related to groundfish or salmon. For many of these communities (and especially the CDQ communities), unemployment is chronically high, well above the national average, and the potential for economic diversification of these largely remote, isolated, local economies is very limited. Indeed, it is this absence of economic opportunity, combined with the ebb and flow of fishery activity, that has historically resulted in a high level of transient, seasonal labor, and an unstable population base in many of the communities with processing facilities. Closure of the pollock fishery under a hard cap or closure of an area under a triggered closure could further reduce employment and business opportunities, especially in communities with significant investment in onshore groundfish processing capacity and fleet services, further destabilizing these rural coastal communities. At the same time, reduction in Chinook salmon bycatch may result in improved commercial Chinook salmon fishing and processing opportunities in communities that have historically depended on commercial Chinook salmon fisheries to infuse cash into a mixed cash-subsistence economy.

From firms with direct and obvious linkages to the Bering Sea pollock fishery, such as maritime equipment purveyors, fuel pier operators, cold storage and bulk cargo transshipping firms; to local hotels, restaurants, bars, grocery stores, and commercial air carriers serving these communities, all would be affected by the structural changes in commercial fishing attributable to the Chinook salmon bycatch minimization measure actions. While not readily amenable to quantitative estimation at present, overall, many of these relatively isolated, rural, fishery-dependent communities would likely experience some level of loss in economic and social welfare, as reflected through a general decline in the quality-of-life for their residents. Beyond the private sector effects, local government jurisdictions would likely be adversely affected as well. Most of these coastal fishing communities rely heavily upon tax revenues associated with fishing activities, in all its myriad forms, for operating and capital funds (e.g., fish landings taxes, business and property taxes, sales taxes).

As populations adjust to structural changes associated with some of the alternatives, emigration would likely impose burdens on local social service agencies. For example, school districts depend for economic support upon state and federal revenues based upon per capita enrollment. Because few, if any, viable alternative sources of economic activity exist in most of these rural coastal Alaska communities, the prospects for mitigating any adverse impacts do not appear promising, at least in the foreseeable future.

Fishing is the economic base in many of these communities. Moreover, these communities are generally very fragile, in the sense that they do not have well-developed secondary economic sectors. The cost of doing business in these communities is high and few retail or other firms find it economically advantageous to locate in them. As a result, local residents often have no choice but to spend a large part of their incomes outside their communities. In addition, many who work in the fishing and/or processing sector in these communities are transient laborers who take a large part of their incomes home with them at the end of the season.

Anything that tends to diminish economic activity in such a setting (e.g., reduction in seafood landings, fishing activity, and associated imports of goods and services for the fishing sectors and exports of fishery products) can do disproportionate harm to an already limited infrastructure in these communities. Many of these communities may become vulnerable to loss of transportation service due to disruptions in key fisheries. While the relationship is likely not perfectly linear, the more significant the structural change associated with the final alternative adopted (e.g., the greater the increase in potentially forgone revenue and/or revenue at risk, especially those in proximity to these communities), the greater will likely be the adverse effects on community stability, social welfare, and quality of life.

Communities that support and depend upon these commercial fisheries may incur substantial adverse economic, socioeconomic, and cultural impacts as they adjust to changes in the total magnitude of fishery related activities, associated with newly imposed requirements of Chinook salmon bycatch management. Because much of the economic infrastructure of rural Alaska coastal communities has developed in support of commercial fishing, secondary adverse effects on businesses that supply goods and services to the fleet could also be widespread.

Sixty-five communities in the Bering Sea region, organized into six non-profit groups, depend upon CDQs of pollock. These CDQs are either harvested directly by vessels belonging to the communities or contracted out to private companies. If, as expected, the alternatives being considered result in lower CPUEs and higher costs in fishing operations, the revenue from the CDQ harvests could be diminished, the value of the CDQ allocations to the member-communities could decrease, and secondary adverse impacts on community businesses may occur. The likelihood of such dramatic impacts cannot be judged, *a priori*. The possible threat of actions leading to these results surely provides strong incentives for all aspects of the pollock industry to avoid Chinook salmon bycatch, which, after all, is the primary objective of this action.

10.5.6 Potential Forgone State and Local Tax Revenues

The State of Alaska charges both a landings tax and a fisheries business tax on the value of pollock landed and processed. Unfortunately, confidentiality restrictions prohibit reporting of the tax value by sector, by season, and/or at a community level. Thus, the Alaska Department of Revenue has provided annual tax revenue data aggregated for the entire Aleutian/Pribilof region and in statewide totals.

It is possible to make a crude estimate of the total tax revenue impacts, fisheries business tax and landings tax combined, that would have occurred under the various hard cap scenarios. This can be done by multiplying the forgone percentage of total annual pollock fishery gross revenue for each cap level by the total annual tax revenue collection. This calculation; however, ignores seasonal and sector level differences in pollock value, which would tend to increase revenue in the A season and for the offshore sectors. Still, it is an "average" tax impact estimate for the entire region and the entire pollock fishery.

10.5.6.1 Potential Forgone State and Local Tax Revenues under Alternative 2

Table 10-114 provides estimated forgone state tax revenue calculations from 2003 through 2007 for the various cap levels and split options under Alternative 2. The largest tax revenue impact is nearly $6 million and would have occurred in 2007, the highest bycatch year, under the lowest cap and with the 70/30 season slit. In low bycatch years, the largest cap would result in no loss of tax revenue. As has been demonstrated in the forgone revenue calculations and the salmon savings calculations under this alternative, there is a nearly continuous range of state tax revenue impacts from zero to nearly $6 million depending on cap level, option, and year. State of Alaska uses a formula sharing system for distributing a portion of State fishery tax revenue collections. However, State tax revenue sharing of pollock fishery tax revenue paid to local governments is highly confidential and cannot be divulged.

Table 10-114 Hypothetical forgone pollock state tax revenue under the Alternative 2 fleet-wide cap levels.

2003			
Cap	50/50	58/42	70/30
87,500	$0	$0	$0
68,100	$22,822	$0	$0
48,700	$1,390,051	$984,659	$22,551
29,300	$2,588,850	$2,095,675	$2,090,633
2004			
Cap	50/50	58/42	70/30
87,500	$0	$0	$20,037
68,100	$0	$6,072	$111,110
48,700	$51,057	$111,004	$315,645
29,300	$1,444,205	$1,465,423	$1,295,830
2005			
Cap	50/50	58/42	70/30
87,500	$0	$20,711	$299,903
68,100	$79,187	$141,158	$261,730
48,700	$1,271,194	$262,367	$601,543
29,300	$3,501,746	$3,124,620	$2,761,402
2006			
Cap	50/50	58/42	70/30
87,500	$3,395,290	$2,169,862	$20,814
68,100	$2,363,528	$1,705,486	$1,761,431
48,700	$3,086,755	$3,167,343	$2,879,551
29,300	$4,553,396	$3,782,593	$4,188,643
2007			
Cap	50/50	58/42	70/30
87,500	$5,857,614	$4,718,923	$3,624,832
68,100	$3,789,147	$3,386,489	$2,998,255
48,700	$4,321,441	$4,385,681	$4,433,711
29,300	$5,497,103	$5,670,994	$5,832,983

10.5.6.2 Potential Forgone State and Local Tax Revenues under Alternative 4

Table 10-115 provides estimated forgone state tax revenue calculations from 2003 through 2007 for the PPA scenarios, with and without transfers and rollovers. The largest tax revenue impact is nearly $3.5 million and would have occurred in 2007, the highest bycatch year, under the PPA2. In low bycatch years, the largest cap would result in no loss of tax revenue. As has been demonstrated in the forgone revenue calculations and the salmon savings calculations under this alternative, there is a nearly continuous range of state tax revenue impacts from zero to nearly $3.5 million depending on cap level, option, and year. Also evident is that the effect of transfers and rollovers is minimal when considered in percent of total revenue terms. That result may be due to rounding to the millions in the underlying pollock total revenue calculations. The State of Alaska uses a formula sharing system for distributing a portion of State fishery tax revenue collections. However, State tax revenue sharing of pollock fishery tax revenue paid to local governments is highly confidential and cannot be divulged.

Table 10-115 Hypothetical forgone pollock state tax revenue under Chinook bycatch options under PPA1 and PPA2.

PPA	A-season Transferability	Year	A-B Rollover	Annual Total	A/P Tax Impact
1	No	2003	0%	**0%**	$0
		2004		**2%**	$173,346
		2005		**2%**	$175,671
		2006		**12%**	$1,346,659
		2007		**23%**	$2,451,677
	Yes	2003		**0%**	$0
		2004		**2%**	$173,346
		2005		**2%**	$175,671
		2006		**10%**	$1,183,035
		2007		**23%**	$2,425,464
2	No	2003		**6%**	$512,115
		2004		**4%**	$362,425
		2005		**5%**	$492,139
		2006		**22%**	$2,455,520
		2007		**33%**	$3,510,300
	Yes	2003		**2%**	$201,303
		2004		**4%**	$362,425
		2005		**5%**	$492,139
		2006		**19%**	$2,196,496
		2007		**33%**	$3,510,300
1	No	2003	80%	**0%**	$0
		2004		**0%**	$0
		2005		**0%**	$3,942
		2006		**12%**	$1,330,376
		2007		**23%**	$2,437,312
	Yes	2003		**0%**	$0
		2004		**0%**	$0
		2005		**0%**	$3,942
		2006		**10%**	$1,166,752
		2007		**23%**	$2,411,098
2	No	2003		**5%**	$506,762
		2004		**1%**	$89,332
		2005		**2%**	$249,970
		2006		**22%**	$2,455,520
		2007		**33%**	$3,509,345
	Yes	2003		**2%**	$201,303
		2004		**1%**	$89,332
		2005		**2%**	$249,970
		2006		**19%**	$2,196,496
		2007		**33%**	$3,509,345

10.5.6.3 Potential Forgone State and Local Tax Revenues under Alternative 3

Table 10-116 provides estimated forgone state tax revenue calculations from 2003 through 2007 for the various triggered closure options. The largest tax revenue impact is nearly $4.8 million and would have occurred in 2007, the highest bycatch year, under the lowest cap and with the 58/42splitt. In low bycatch years, the largest cap would result in no loss of tax revenue. As has been demonstrated in the forgone revenue calculations and the salmon savings calculations under this alternative, there is a nearly continuous range of state tax revenue impacts from zero to nearly $5 million depending on cap level, option, and year. State of Alaska uses a formula sharing system for distributing a portion of State fishery tax revenue collections. However, State tax revenue sharing of pollock fishery tax revenue paid to local governments is highly confidential and cannot be divulged.

Table 10-116 Hypothetical forgone pollock state tax revenue under Chinook salmon bycatch options for triggered closures.

Pollock Cap scenario	Option	All Sectors All State Pollock Tax Impact Annual Totals 2003	2004	2005	2006	2007
87,500	1-1: 70/30	$0	$27,320	$137,593	$0	$1,476,902
0	1-2: 58/42	$0	$0	$3,904	$701,026	$2,344,255
0	1-3: 55/45	$0	$0	$0	$1,419,664	$2,362,856
0	1-4: 50/50	$0	$0	$0	$2,124,681	$2,378,252
68,100	1-1: 70/30	$0	$103,457	$210,236	$1,650,185	$2,774,847
0	1-2: 58/42	$0	$10,948	$86,109	$2,404,015	$3,005,115
0	1-3: 55/45	$0	$0	$58,400	$2,497,216	$3,066,099
0	1-4: 50/50	$0	$0	$13,050	$2,713,562	$3,087,843
48,700	1-1: 70/30	$0	$200,124	$305,527	$3,081,129	$3,567,525
0	1-2: 58/42	$829,678	$103,457	$210,236	$3,538,203	$3,749,714
0	1-3: 55/45	$973,458	$80,194	$549,656	$3,473,050	$3,805,019
0	1-4: 50/50	$1,267,004	$42,011	$1,482,947	$3,615,505	$3,934,704
29,300	1-1: 70/30	$2,314,688	$1,279,847	$2,927,657	$4,974,637	$4,725,321
0	1-2: 58/42	$2,454,887	$1,444,376	$3,257,130	$4,617,237	$4,853,514
0	1-3: 55/45	$2,444,996	$1,424,992	$3,360,936	$4,560,375	$4,782,312
0	1-4: 50/50	$2,562,989	$1,780,214	$3,350,047	$4,369,846	$4,747,461

10.5.7 Management & Enforcement Costs

This section summarizes the costs associated with managing and enforcing the alternatives. Managing costs include monitoring components for catcher vessels that would be subject to the increased observer coverage, increased monitoring at shoreside processors, and changes to the NMFS Catch Accounting System. This section also discussed electronic monitoring as a way to reduce observer costs, summarizes several existing fisheries in which electronic monitoring is being used or has been tested, makes applicable comparisons to the pollock catcher vessel fleet, and provides suggestions for future research in electronic monitoring.

10.5.7.1 Observer Costs

Ttransferable allocations of hard caps, proposed under Alternatives 2, 3, and 4, would increase the need for accurate salmon bycatch accounting, particularly for the inshore CV sector. This is because salmon bycatch for the inshore sector is based on NMFS calculated rates, as described in Chapter 3. More accurate salmon bycatch estimates would also assist NOAA in enforcing any prohibitions against exceeding salmon caps, since the calculation of overages must be based on more accurate estimates of total salmon bycatch by a particular sector. NMFS considers catch composition data collected by an observer onboard a vessel as the best source of information for prohibited species catch accounting for catcher/processors, motherships. NMFS recommends a census. Or count, of salmon as the best estimate of Chinook salmon bycatch for catcher vessels delivering to shorebased processors. However, a portion of the inshore catcher vessel fleet is not subject to 100 percent observer coverage. Therefore, NMFS recommends that increased observer coverage be required for the inshore catcher vessel fleet with transferable allocations to monitor compliance with a requirement to not discard salmon unless it is first counted by the observer. The objective of recommending increased observer coverage requirements is to have bycatch data collected by a trained, independent third party.

Participants in the pollock fishery would likely incur additional costs associated with increased monitoring requirements. Costs associated with increased observer coverage are difficult to predict. Based on NMFS's experience with the AFA catcher/processor fleet, some data are available about requiring observers on the catcher vessels potentially regulated by this action. A requirement that all catcher vessels be subject to 100 percent observer coverage would result in increased observer coverage for each of the 56 inshore catcher vessels which currently are required to carry an observer at least 30 percent of the time that they are fishing. This discussion is centered on the incremental changes in costs that would result from requiring that catcher vessels that are equal to or greater than 60 feet LOA, but less than 125 feet LOA, carry observers 100 percent of the time that they are directed fishing for pollock. NMFS notes that there also is at least one AFA-eligible inshore catcher vessel that is less than 60 ft. LOA (The Morning Star, ADF&G number 70323). This vessel has not fished for pollock in recent years. Currently, this size of vessel is not required to have any observer coverage. However, if this vessel participated in the AFA pollock fisheries in the future under a system of transferable salmon bycatch allocations, it probably would be required to carry an observer, as would all other catcher vessels.

Observation of every trip would require the deployment of one observer aboard each inshore catcher vessel while it was engaged in directed fishing for pollock in the Bering Sea. Current regulations require trawl vessels 125 feet LOA or larger to carry one NMFS-certified observer at all times while fishing for groundfish. Therefore, this action would not require an increase in observer coverage on such vessels.

NMFS estimates that a certified observer costs a vessel or processor approximately $355 per day. This is the best estimate currently available with which to project future costs associated with changing observer coverage levels, although it may not be representative of the actual costs for current observer coverage. Future NMFS actions are being considered that may require the fishing industry to provide the agency with the cost data needed to estimate a more representative average observer cost[59].

In 2007, 56 vessels between 60 feet and 124 feet LOA participated in the AFA pollock fishery. These vessels carried an observer 1,590 days out of a their total 3,364 fishing days. These vessels had observer coverage for an average of 47 percent of their pollock fishing days. NMFS estimates that observer coverage costs for this level of coverage was approximately $564,450 (1,590 days x $355). If all of the 2007 fishing days had been observed, the estimated total cost for 100 percent observer coverage would have been $1,194,220 (3,364 days x $355). Increasing observer coverage requirements to 100 percent would have cost vessel operators an additional $629,770, as depicted in the following table. This equates to slightly over $11,000 more per vessel in this observer coverage category. If these vessels continued to fish the same number of days in future years, as used in this example, the total cost for observer coverage

[59] NMFS is preparing a proposed rule to implement a suite of observer-related regulatory changes, per the Council's April 2008 recommendation. One of these changes includes requiring observer contractors to periodically submit cost data to NMFS. Access to these data would be limited to agency staff, but could provide aggregate cost information for future analytical purposes.

per vessel would be approximately $21,300 annually, using existing observer cost estimates. These costs do not include days when an observer is aboard a vessel, but the vessel was not fishing. Vessels operators have to pay for onboard observers even during non-fishing days. In 2006, the gross ex-vessel value of the 645,599 mt of pollock caught by the entire BS inshore catcher vessel fleet (90 vessels) was about $231 million.

Table 10-117 Estimated cost of increasing observer coverage levels to 100 percent for inshore CV currently subject to 30 percent observer coverage requirements (estimated cost for all vessels combined).

Inshore catcher vessels < 125 ft. LOA	(A) Estimated cost/day of observer coverage	(B) Actual number of fishing days in 2007	(C) Number of observed fishing days in 2007	(D) Estimated 2007 cost of observer coverage [A*C]	(E) Estimated cost of increasing to 100 pct observer coverage [A*B]	Cost increase for fleet [E-D]	Average cost increase per Vessel [(E-D)/56]	Total cost of increased observer coverage per vessel [E/56]
56	$355	3,364	1,590	$564,450	$1,194,220	$629,770	$11,246	$21,325

When considering potential observer cost increases, it is also important to consider that costs will vary with the amount of pollock each vessel catches, and that some participants' pollock allocations could diverge from the average. The future amount of additional coverage is difficult to predict because vessel operators may coordinate fishing efforts in order to consolidate observer coverage and reduce costs. Some cost savings may be achieved if inshore sector catcher vessel operators "stack" their pollock history on a single, or fewer, vessel(s) than have been fishing in recent years. However, these savings may be relatively small, as this fleet is already highly efficient and the main savings in stacking permits would be related to reductions in the time spent in transit to and from fishing grounds, as well as the time needed to offload catch. Vessels also may choose to reduce the number of non-fishing days during which they have an observer aboard. Additionally, vessels may choose to change the pace of their fishing operations by increasing operational efficiencies or decreasing the amount of time they operate in marginal weather. If vessel operators alter their typical fishing behavior, it is likely to change the number of days they fish and thus, their observer costs. Other costs could change as well, such as those associated with crew compensation, consumables (fuel, lube, stores), maintenance, and insurance. It has long been asserted that the presence of an observer, especially aboard a smaller vessel, can only be achieved by displacing a crewmember. If this is true, reducing the number of working crew on a commercial fishing vessel likely will reduce operational efficiency, slow harvest rates, or both.

The cost of implementing a program that allows salmon bycatch allocations and transfers is likely to exceed NMFS's current observer-related costs for the Bering Sea pollock fisheries. In addition to increased management costs, increasing the number of observer days and associated increase in the amount of data collected would increase costs for the Observer Program. Such increases can be attributed to increased staffing needs for data quality control and processing, additional training classes to accommodate the increase in observers to meet the expanded demand, additional observer sampling equipment to acquire scientifically accurate and statistically reliable catch and bycatch data, and additional travel costs associated with providing field support. The estimated costs to the Observer Program for increased staffing and costs associated with this action include 2.5 full time equivalent staff positions and approximately $325,000, annually (personal communication, J. Ferdinand, AFSC, March 2008).

However, for Alternative 2 hard caps without sector level caps or transferable allocations, NMFS would manage a single hard cap for all of the non-CDQ AFA sectors combined and the current levels of observer coverage and data available to estimate salmon bycatch by the fishery as a whole would be adequate to support NMFS issuing fishery closures that apply to all of the non-CDQ AFA sectors at the same time.

10.5.7.2 Catch Accounting System

Increasing the number of annual and seasonal salmon hard caps would require additional agency resources to implement and manage considered under the options for Alternative 2 and 3 and as part of Alternative 4. Sector level caps would increase the complexity of changes that would be required to be made to NMFS's CAS. NMFS probably would incur additional software design and development costs to accommodate allocating the non-CDQ salmon hard cap among three sectors. The additional sector allocations would require NMFS to design and test its CAS software to ensure sector-specific Chinook salmon catch is correctly counted. These costs probably would be greater than those associated with the seasonal fishery level bycatch caps.

Transferable allocations would further increase the complexity of the changes that would be required to be made to NMFS's CAS, since it involves both sector level caps and transferable allocations. Programming the business rules and establishing new accounts is a time-consuming process that often requires contracting with third party computer software developers. The costs associated with both NMFS staff time and contractors time will depend on the complexity of revised salmon bycatch management measures. This complexity includes the number of sector specific accounts and seasonal accounts.

Transfer provisions would require accounts to be established for entities that receive salmon allocations, including designing accounts that enable NMFS to track and archive transfers and changes in cooperative structure. Transfers between entities would require receipt of transfer information and readjustment of accounts for the transferor and transferee. For these reasons, this option would require significant software development resources for database construction, an internet-based interface for quota-holding entities to check their salmon accounts, and, potentially, to transfer salmon. Estimating the development costs associated with a new management program is difficult due to the complexity of the CAS and the ripple effect that new programming changes may have on existing programming and data base structures.

The Gulf of Alaska Rockfish Program provides a recent example of the development and programming costs associated with implementing a new quota-based fishery program. The implementation of this program in 2007 established transferrable rockfish and PSC quotas. This required approximately 850 hours of contracted programmer time for changes to the CAS. Contract costs were approximately $100,000[60]. This estimate does not include a substantial amount of NMFS staff time that was required to design appropriate databases, test account structures, track errors, and design reports. While establishing an increased number of salmon bycatch caps (both annual and seasonal) would require NMFS to incur additional programming costs, these costs probably would not be the same magnitude as those incurred with the development of the GOA Rockfish Program. That program implemented a more complex suite of target and prohibited species allocations to GOA rockfish fisheries participants, whereas this proposed action address the allocation of a single prohibited species.

The cost associated with changing the CAS will likely be greater than costs associated with existing pollock transfers. The greater cost is due to the programming time required to implement the more complex business rules associated with salmon bycatch caps. Some costs would be reduced if less

[60] Jennifer Mondragon, Catch Accounting and Data Quality Branch, NMFS Alaska Region, April 2008.

complicated seasonal options are selected for salmon and the same online platform is used for pollock and salmon transfers. However, because of the interaction between components, the amount of programming time and associated costs is not known. Programming time and associated costs are increased for combinations of components/options that increase the number of salmon bycatch caps and transfer options. These costs include the initial creation of account structures, long-term maintenance, and other subsequent programming changes required as accounting for other management programs evolve.

As with Alternative 2, Alternative 4 would increase the complexity of changes and development costs that would have to be made to the NMFS CAS. This includes costs associated with software design and development costs. Under PPA1, the inclusion of the backstop cap would further increase the extent of the CAS changes that would be needed to properly account for Chinook salmon bycatch. This bycatch potentially could be accruing to parallel accounts established for (1) sector, inshore cooperative, or CDQ level accounts under the high cap and (2) the non-CDQ and CDQ backstop accounts established for the aggregate Chinook catch made by all AFA sectors and CDQ groups, respectively.

Additionally, NMFS would process and approve Chinook salmon bycatch allocation transfer applications. NMFS would incur increased administrative costs associated with conducting transfers, issuing salmon allocations on an annual basis, and (for NOAA OLE) enforcing quota overages. The burden on the agency would increase proportionally with the number of inter-sector transfers that industry chose to request during a given season. Participants in the pollock fishery would face additional costs associated with preparing and submitting Chinook salmon bycatch allocation transfer applications to NMFS. Pollock cooperatives also would have an increased administrative burden associated with managing their annual salmon allocations and conducting transfers.

Rollovers among sectors in a season would require additional agency resources to monitor and carry out. These would require NMFS to assess the amount of Chinook salmon a sector may catch to complete its harvest of pollock and what salmon bycatch may be remaining to rollover to another sector. The process would require considerable effort to monitor catch rates for pollock and bycatch rates for salmon, coordinate with the pollock industry, and project pollock and salmon usage for specific periods of time. NMFS would use the best available data to maximize the amount of salmon allocation available to the different pollock sectors. However, there could be some time delay between when salmon bycatch appeared to be available to other sectors and when an in-season action to reapportion that salmon bycatch could be effective.

The burden on NMFS to monitor additional salmon caps would depend on whether sector level caps could be reapportioned between seasons or transferred between sectors. The administrative difference with the rollover option is the increased amount of time that NMFS would have to expend on monitoring and closing additional sectors on a seasonal basis, versus the additional agency resources that would be spent processing inter-sector salmon allocation transfers. Rollovers would require more NMFS resources than would transfers, particularly if transfers are done electronically, as we expect them to be in the future. Under either the rollover or the transfer options, NMFS would have to monitor an incrementally greater number of salmon bycatch caps in the pollock fishery.

10.5.7.3 Monitoring shoreside processors

Each shoreside pollock processors must annually submit a catch monitoring and control plan (CMCP) to NMFS. Regulations regarding CMCPs requirements are at 50 CFR 679.28(g). These plans are designed to ensure that processing facilities are laid out in a manner that allows for accurate catch accounting. The plans ensure that observers have adequate facilities to conduct their sampling duties efficiently, and obtain adequate estimates of the weight and species composition in each offload. Because plant layouts and operations vary widely between processors, the CMCP regulations were developed as a series of performance-based standards that each processor must meet. Each CMCP describes how a particular processor will meet each standard. Therefore, additional measures would need to be implemented in addition to existing CMCP performance standards in order to ensure that fisheries observers have the means to count all Chinook salmon in each delivery.

CMCP performance standards require that an observer sampling station and an observation area be provided in the vicinity of the first location where catch can be sorted. Salmon and other species that are sorted out by the processor are collected by the observer in this area. Depending on the depth of fish flow, the width and number of belts, and the volume of bycatch, some bycatch (including prohibited species) will pass the sorting area and arrive in the processing area of the plant. Plant personnel bring salmon found in the factory to the vessel's observer so that they can be counted. Salmon found in the shoreside factory, after a vessel has departed (with its observer) are brought to the plant observer.

Sector-level salmon bycatch caps could result in individual salmon significantly limiting pollock fishing. Since each salmon counted against a hard cap could ultimately constrain the full harvest of a sector's pollock allocation, Chinook salmon hard caps may create strong economic incentives to misreport salmon bycatch. This is particularly applicable to shoreside processors. The factory areas of processing plants are large and complex. Preventing observers from seeing Chinook salmon that enter the factory would not be difficult. In order for hard caps to be effective, NMFS needs to ensure that there is a credible salmon bycatch monitoring system in place at shoreside processing plants. This would ensure that observers have access to all salmon, prior to the fish being conveyed into the factory.

NMFS proposes that additional measures may need to be implemented to ensure that no salmon make it into the factory when the vessel observer is monitoring a CV's offload and that all salmon are seen by the observer. To ensure that an observer may completely sort and count all salmon, the following constraints on processors could be required:

- The depth of fish flowing past the observer on the belt may be no more than one fish deep;
- Belt widths may need to be narrowed to allow observers to access all fish, and;
- Multiple belts in the sorting area would be prohibited in order to ensure that all of the fish in an offload passed a single observation point.

Proposed changes to inshore monitoring requirements would likely impose processing costs associated with lower throughputs of pollock in the plant and potential decreases in product quality if fish remain unprocessed for longer periods of time. Costs would increase in concert with an increase in the time required to convey fish through a processing facility, increased vessel offload times, and the need to reconfigure conveyor belt and sorting layouts. However, the variability in the flow of fish through a given plant and the changes to sorting conditions make it difficult to predict costs to industry. Further, the magnitude of these costs would likely be plant-specific as needed to facilitate a salmon census of observed deliveries.

10.5.7.4 Electronic monitoring

In order to ensure adequate monitoring of salmon bycatch by inshore CV, NMFS recommends that all catcher vessels be required to have 100 percent observer coverage, as discussed previously. NMFS included consideration of electronic monitoring (EM) in lieu of observer coverage in a discussion paper presented to the Council in February 2008. While considerable progress has been made in the development and application of EM technologies in various fisheries programs, NMFS believes that additional research must take place before such an EM approach could be recommended for the Bering Sea pollock fishery. This section summarizes several existing fisheries in which EM is being used or has been tested, makes applicable comparisons to the pollock catcher vessel fleet, and provides suggestions for future research in EM.

Pacific whiting (hake) catcher vessels

Catcher vessels fishing in the hake fishery off the west coast of the United States have operated under an exempted fishing permit (EFP) requiring the use of EM since 2004. The EFP exempts vessels from regulatory requirements to discard prohibited species and any groundfish above applicable trip limits, but requires "nearly" full retention of all catch. An EM system consisting of two or more video cameras, global positioning systems (GPS), hydraulic and winch sensors, and on-board data storage is used by these vessels to document compliance with the EFP retention provisions. Until 2007, the EM program was funded entirely by NMFS. In 2007, vessels fishing under the EFP paid the costs of equipment installation and maintenance directly to the EM service provider. Because the hake fishery operates under an EFP, regulations have not yet been implemented to specify the technical requirements for the EM systems, the responsibilities of vessel owners for their installation and upkeep, or how the resultant electronic data must be archived or submitted. According to the draft Environmental Analysis (EA)[61] prepared for EM in the hake fishery, future regulations would include:

- an EM service provider permitting process;
- EM service provider responsibilities;
- EM service provider data confidentiality standards;
- EM coverage requirements for vessels;
- prohibitions against intentionally damaging EM equipment;
- vessel operator's responsibilities for procuring EM equipment and services;
- vessel operator's responsibilities for scheduling EM installations, equipment, maintenance and data retrieval; and,
- vessel operator's responsibilities for scheduling EM system removal.

As described in the hake fishery EA, NMFS would use base funds to administer the program and analyze the EM data unless the Magnuson-Stevens Act is amended to allow NMFS to accept funds directly from industry for administrative and analytical infrastructure costs. The draft EA does not detail the level of review that would be required for the EM data nor estimate what those costs may be.

The hake fishery does share some similarities with the AFA pollock fishery. Both are high volume, mid-water trawl fisheries with relatively small amounts of bycatch. Catch is quickly moved from the deck to refrigerated seawater tanks. Both fleets deliver their catch to a shore-based processor, where the majority of bycatch sorting occurs. The hake fishery is limited by the amount of certain rockfish species it is allowed as bycatch. If salmon hard cap management is adopted for the AFA pollock fleet, then both fleets could be limited to a catch of a species that could close the fishery without allowing the complete harvesting of the target species.

However, there are also distinct differences between the hake and pollock fisheries. First, pollock catcher vessels are often significantly larger and may have multiple decks where fish may be sorted or be designed with on deck belts for efficient at-sea sorting. This ability to sort in multiple locations and the

[61] http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-Management/NEPA-Documents/upload/Amend-10-EA.pdf

generally larger trawl decks would increase the complexity of an appropriate EM system. The current EM provider's standard system in the hake fishery allows for up to 4 cameras, but with larger vessels more cameras may be needed.

Given the large areas that cameras must cover and the low light levels in which fishing often takes place, it would be difficult or impossible to distinguish salmon discard from the discard of other species on a pollock catcher vessel using an EM system. Thus, given the current state of technology, any EM program in this fleet would have to be coupled with an absolute prohibition on discard of any species, and the degree to which it is practical to mandate a zero discard policy that would prohibit normal operations such as net cleaning is unknown. The hake EFP fishery, on the other hand, uses EM to monitor a minimal discard requirement under which the limited discard of large animals and normal operations such as net cleaning are allowed.

The AFA pollock catcher vessel fleet currently has a mix of vessels that require 30 percent and 100 percent observer coverage. The observers not only monitor for compliance with salmon retention requirements, but also collect biological information that can only be collected at sea. For hake, observer coverage was only meant to monitor and enumerate discard events. As EM program has been able to fill this role in the hake fishery under an EFP, observer coverage no longer exists. Even if an EM program was implemented, AFA pollock catcher vessels would continue to need some amount of at-sea observer coverage to collect haul-specific biological data.

Because the hake fishery has been prosecuted for the last four years under an EFP, it has been possible to modify the EM program on an annual basis. In the first years of this EFP, the data from the fishery were used to revise the retention requirements, improve the EM system performance, better define the amount and type of data that needed to be collected, and alter EFP participant behavior in relation to catch retention standards. Such an iterative process would not be possible if EM was implemented by regulation in the pollock fishery, given the difficult and time consuming nature of changing regulatory requirements.

Central Gulf of Alaska (CGOA) rockfish fishery

In 2005, NMFS conducted a pilot study aboard the vessels that fish for rockfish in the CGOA management area. This study tested the use of EM to identify discarded bycatch, with a focus on the identification of halibut, a mandatory discard. The results of this pilot study found that in order for EM to function efficiently and accurately, discards would need to be limited to a single location, and all species other than halibut would have to be retained. In 2007 an EFP was conducted on a single vessel to compare EM systems ability to estimate the quantity of halibut discard when compared with a full census of halibut made by a trained sea-sampler. A final report for this project will be presented at the June 2008 Council meeting, but the preliminary results indicate that video is able to estimate the quantity of halibut discard successfully. This work will continue in 2008 with a larger group of vessels and is designed to investigate the logistical, cost, and infrastructural issues associated with full scale regulatory implementation of such a EM program.

In many ways, this application of EM in the CGOA rockfish fishery is the most demanding one that has been investigated to date, because it seeks to use EM not only to monitor a single location discard policy, but also to accurately quantify the amount of halibut PSC actually discarded. There are many differences between the Bering Sea pollock and GOA fleets. Pollock catcher vessels are often significantly larger and may have multiple decks where fish may be sorted. Some are designed with on deck or below deck belt systems for efficient at-sea sorting. This ability to sort in multiple locations and the generally larger trawl decks would increase the complexity of an appropriate EM system. The CGOA rockfish vessels currently use three to four cameras to cover all areas where fish may be discarded. As the pollock vessels tend to be larger, with several areas where discard may occur, more cameras would most likely be needed.

Again, NMFS and the fishing industry have approached the potential use of EM in the CGOA rockfish fishery in a methodical manner that will have involved three years of study and two EFPs to test the effectiveness, enforceability, and affordability of this type of system prior to mandating its use through regulations.

EM for bin monitoring –Amendment 80 catcher/processors

NMFS OLE has documented deliberate biasing of observer samples on catcher/processors participating in head-and-gut fisheries. In most of these cases, crewmembers sorted out limiting species inside the live tanks, outside of the view of the observer. A limiting species is a species that may, if its catch limit is reached first, result in a target fishery being closed prior to its catch limit being completely caught. Presorting resulted in an under-representation of the limiting species in observers' samples. With the implementation of a quota-based fishery under Amendment 80, incentives to bias observer samples have increased. For NMFS to obtain a credible estimate of total quota harvested, it was necessary to ensure that observers had full access to unsorted catch. This required the implementation of a bin monitoring program so that observers could ensure that presorting was not occurring in the live tanks. One option under this program is to allow vessels to install cameras and a display to allow an observer a view of all the areas where crew might be sorting fish. Other options exist under this program and the majority of vessel operators selected another option, rather than installing EM inside their vessel's live tanks.

In this situation, EM is being used for a comparatively undemanding application and is primarily a "real time" tool to assist the observer in ensuring that presorting is not occurring in the live tanks. In the event that the equipment fails to operate properly, the observer is present and can inform vessel crew to remedy the situation immediately. The vessel may not allow crew inside the bin until the problem is remedied.

There are significant differences between the Bering Sea pollock catcher vessel fleet and the Amendment 80 catcher/processors. EM onboard Amendment 80 vessels is used in real-time for compliance monitoring, not for post-trip verification of compliance. If EM failed aboard AFA pollock catcher vessels, no observer would be present to inform the vessel's crew of EM failure or malfunction.

Prior to implementation of the bin monitoring regulations, Amendment 80 vessels interested in using EM for bin monitoring agreed to carry the system voluntarily. This allowed industry and the agency to work out problems prior to regulatory implementation. The pre-implementation research resulted in a multitude of adjustments to the EM systems in order to create an effective, enforceable program. Had these vessels not been able to test the EM systems, many would have not met the standards defined in the regulations and may not have been able to participate in the fishery.

NMFS recommendations for EM in the Bering Sea Pollock Fishery

All of the EM programs described above have operated under experimental conditions prior to regulatory implementation, or continue to be operated under EFPs. In order to ensure that EM would be an effective tool for monitoring compliance with a no discard requirement in the AFA pollock catch vessel fleet, NMFS would need to answer numerous questions concerning operational issues specific to this particular fleet and fishery. However, given the similarities between this potential application of EM and other, better researched, EM applications the amount of pre-implementation testing may be comparatively minimal.

An EFP would not only need to verify EM as an effective tool for monitoring compliance with a no discard requirement, it would need to answer other operational issues. These issues include the level of review necessary to ensure compliance, the costs associated with implementing and managing a comprehensive EM program, the appropriate cost distribution between NMFS and the fleet, the amount of observer coverage at the processor needed to obtain salmon numbers when a vessel observer is no longer present at the plant, and adequate enforcement procedures to ensure a functional program. Even if an EFP verified EM was an effective tool in lieu of observers for monitoring compliance with a no discard requirement, some level of observer coverage would continue to be necessary to obtain haul-specific biological samples on catcher vessels.

If NMFS were to adopt EM for inshore CV in the AFA pollock fishery, a multi-year, iterative EFP would need to be conducted to test whether vessels could comply with a no discard policy, to test whether video equipment could withstand the elements in the Bering Sea during the winter, and to ensure that NMFS had the infrastructure to enforce compliance with EM and no discard requirements. As previously discussed, NMFS already is experimenting with the use of EM in the Alaska Region. NMFS is willing to work with the fishing industry to develop EFPs to test EM as a salmon bycatch monitoring tool in the Bering Sea pollock fisheries.

An Electronic Monitoring workshop was sponsored by the AFSC's Fisheries Monitoring and Analysis Division, the NMFS Alaska Regional Office, North Pacific Research Board, and the Council. It was held in Seattle, Washington on July 29 and 30, 2008. The goal of the workshop was to assess the current state of video monitoring technology in fisheries, the applicability of EM to research and management of North Pacific fisheries, the future potential of EM, and research and development needs. Workshop materials and findings are posted at the Alaska Region website.[62]

10.5.7.5 Enforcement costs

Changing from a system of Chinook Salmon Savings Area closures, to pollock directed fishing closures, by sector would require NOAA OLE to monitor the fishing activities of trawl vessels operating in the Bering Sea to ensure that no vessels were directed fishing for pollock after a sector's fishery had been closed. This is similar to the existing practice of monitoring the Bering Sea fisheries to ensure that vessels are not pollock fishing in a closed area, but would have to occur at a larger spatial scale. NOAA OLE also would be responsible for investigating any violations associated with exceeding CDQ seasonal salmon bycatch caps. The seasonal splits would add 12 additional CDQ salmon caps, in addition to the approximately 150 groundfish and prohibited species annual CDQ allocations. There have been approximately two dozen groundfish CDQ overages since 1999. The most recent CDQ overage was in 2006.[63]

Sector allocations would incrementally increase the number of fishery closures that NOAA OLE would monitor, compared to a CDQ and non-CDQ hard cap. The same basic principles apply: fishing vessels in the Bering Sea would be monitored to ensure that vessels within a sector were not directed fishing for pollock after the sector had reached its salmon hard cap for a season or for the year. Logbooks, VMS, vessel boardings, and observer information would be used by NOAA OLE to determine if a vessel was directed fishing for pollock. In addition, NMFS would continue to monitor observer information to manage groundfish catch limits and prohibited species catch limits. Thus, NMFS could refer some potential directed fishing violations to NOAA OLE.

The enforcement implications of Alternative 4's PPA1 include all of those noted for managing transferable hard caps under Alternative 2, but are somewhat more complicated because of the existence of the backstop cap. NOAA OLE would have to monitor the fishing activities of trawl vessels operating in the Bering Sea to ensure that such vessels were not directed fishing for pollock after their affiliated Chinook allocation had been reached or, for those vessels subject to the backstop cap, that that cap had been reached.

[62] http://www.alaskafisheries.noaa.gov/scales/default.htm
[63] Patty Britza, NMFS Alaska Region, May 5, 2008.

NMFS would monitor the catch of each sector's Chinook salmon bycatch allocation. Each sector would be prohibited from exceeding its Chinook salmon bycatch allocation and would have to manage its pollock fishery to stay within its Chinook salmon bycatch allocation or be subject to enforcement action. NOAA OLE may enforce prohibitions against exceeding salmon hard caps and NOAA General Counsel Enforcement would prosecute such violations. Prosecution of a Chinook salmon bycatch allocation overage would require additional enforcement and NOAA General Counsel resources and would depend upon the observer being willing to provide testimony regarding their data and observations. This would increase the resource and personnel burden on these two agency components.

Transferable allocations would allow the salmon allocation holder to obtain more salmon within an allocation period (e.g., the A season) or to transfer salmon to another sector, cooperative or CDQ group in a season. The transfer process would require the different pollock entities to monitor their respective members' salmon bycatch to ensure the sector's collective salmon allocation was not exceeded. An entity could be subject to enforcement actions if its sector exceeded its annual salmon bycatch cap. NOAA OLE would be responsible for enforcing annual salmon allocation overages, but it is difficult to estimate the additional resources that it would take to monitor compliance with transfer provisions.

Additionally, there could be additional enforcement considerations associated with NMFS's recommendation that all inshore catcher vessels be required to have 100 percent observer coverage and that shoreside monitoring improvements be required. NOAA OLE personnel potentially would be required to oversee additional activities associated with salmon bycatch monitoring. This would involve enforcement personnel determining whether inshore catcher vessels had sufficient observer coverage, if such catcher vessels were complying with "no discard" requirements, and if shoreside processors were complying with additional monitoring and operational requirements intended to facilitate salmon bycatch monitoring. Thus, enforcement costs would be greater for transferable allocations and rollovers than those that would expected for fishery level caps, since a higher level of salmon bycatch accountability is required in order to carry out inter-sector transfers or rollovers.

Salmon allocated to a cooperative would require the NOAA OLE to monitor, detect, and investigate salmon bycatch allocation overages. The enforcement of this level of allocations would require cooperative-specific catch monitoring and accounting. Thus, without vessel and trip based specific catch salmon bycatch monitoring improvements, the agency would likely not be able to enforce salmon bycatch overages. Bycatch rates from observed vessels are not a sufficiently robust means to track salmon bycatch or prosecute alleged violations of exceeding salmon allocations on non-observed vessels. NMFS cannot estimate the potential number of salmon allocation overages that cooperatives may incur, or the associated enforcement costs that the agency would incur in investigating, settling, or prosecuting violations against a cooperative exceeding its salmon allocation.

The general enforcement issues associated with Alternative 3 include the detection and investigation of non-compliance with area closures by vessels targeting pollock. This is similar to existing practices associated with monitoring fishing activity in closed areas. Under the components considered for Alternative 3, closing areas becomes increasingly complex. NMFS's ability to detect salmon allocation overages and violations of area closures is decreased with greater area closure complexity. In general, the more the salmon allocation is divided among entities and seasons, the more difficult it becomes for NMFS to detect a violation, particularly if salmon is allowed to be transferred between sectors. This also may have a bearing on how effectively and successfully alleged violations may be investigated and prosecuted. The enforcement implications of this component are similar to those discussed under Alternative 2 and Alternative 4. NOAA OLE would need to continually determine which sector and vessels are prohibited pollock fishing in a closed area, even though this determination could change after an inter-sector salmon transfer.

11.0 INITIAL REGULATORY FLEXIBILITY ANALYSIS

11.1 The Purpose of an IRFA

The Regulatory Flexibility Act (RFA), first enacted in 1980, was designed to place the burden on the government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA recognizes that the size of a business, unit of government, or nonprofit organization frequently has a bearing on its ability to comply with a Federal regulation. Major goals of the RFA are: (1) to increase agency awareness and understanding of the impact of their regulations on small business, (2) to require that agencies communicate and explain their findings to the public, and (3) to encourage agencies to use flexibility and to provide regulatory relief to small entities. The RFA emphasizes predicting impacts on small entities as a group distinct from other entities and on the consideration of alternatives that may minimize the impacts while still achieving the stated objective of the action.

On March 29, 1996, President Clinton signed the Small Business Regulatory Enforcement Fairness Act. Among other things, the new law amended the RFA to allow judicial review of an agency's compliance with the RFA. The 1996 amendments also updated the requirements for a final regulatory flexibility analysis, including a description of the steps an agency must take to minimize the significant economic impact on small entities. Finally, the 1996 amendments expanded the authority of the Chief Counsel for Advocacy of the Small Business Administration (SBA) to file *amicus* briefs in court proceedings involving an agency's violation of the RFA.

In determining the scope, or 'universe', of the entities to be considered in an IRFA, NMFS generally includes only those entities that can reasonably be expected to be directly regulated by the proposed action. If the effects of the rule fall primarily on a distinct segment, or portion thereof, of the industry (e.g., user group, gear type, geographic area), that segment would be considered the universe for the purpose of this analysis. NMFS interprets the intent of the RFA to address negative economic impacts, not beneficial impacts, and thus such a focus exists in analyses that are designed to address RFA compliance.

Data on cost structure, affiliation, and operational procedures and strategies in the fishing sectors subject to the proposed regulatory action are insufficient, at present, to permit preparation of a "factual basis" upon which to certify that the preferred alternative does not have the potential to result in "significant adverse impacts on a substantial number of small entities" (as those terms are defined under RFA). Because, based on all available information, it is not possible to 'certify' this outcome, should the proposed action be adopted, a formal IRFA has been prepared and is included in this package for Secretarial review.

11.2 What is required in an IRFA?

Under 5 U.S.C., Section 603(b) of the RFA, each IRFA is required to contain:

- A description of the reasons why action by the agency is being considered;
- A succinct statement of the objectives of, and the legal basis for, the proposed rule;
- A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply (including a profile of the industry divided into industry segments, if appropriate);
- A description of the projected reporting, record keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;
- An identification, to the extent practicable, of all relevant Federal rules that may duplicate, overlap or conflict with the proposed rule;
- A description of any significant alternatives to the proposed rule that accomplish the stated objectives of the proposed action, consistent with applicable statutes, and that would minimize any significant economic impact of the proposed rule on small entities. Consistent with the stated objectives of applicable statutes, the analysis shall discuss significant alternatives, such as:

    1. The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;
    2. The clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;
    3. The use of performance rather than design standards;
    4. An exemption from coverage of the rule, or any part thereof, for such small entities.

11.3 What is a small entity?

The RFA recognizes and defines three kinds of small entities: (1) small businesses, (2) small non-profit organizations, and (3) small government jurisdictions.

<u>Small business</u>. Section 601(3) of the RFA defines a ‘small business’ as having the same meaning as ‘small business concern’, which is defined under Section 3 of the Small Business Act. ‘Small business’ or ‘small business concern’ includes any firm that is independently owned and operated and not dominant in its field of operation. The SBA has further defined a “small business concern” as one “organized for profit, with a place of business located in the United States, and which operates primarily within the United States or which makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor… A small business concern may be in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the firm is a joint venture there can be no more than 49 percent participation by foreign business entities in the joint venture.”

The SBA has established size criteria for all major industry sectors in the United States, including fish harvesting and fish processing businesses. A business involved in fish harvesting is a small business if it is independently owned and operated and not dominant in its field of operation (including its affiliates) and if it has combined annual receipts not in excess of $4.0 million for all its affiliated operations worldwide. A seafood processor is a small business if it is independently owned and operated, not dominant in its field of operation, and employs 500 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide. A business involved in both the harvesting and processing of seafood products is a small business if it meets the $4.0 million criterion for fish harvesting operations. Finally, a wholesale business servicing the fishing industry is a small business if it employs 100 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide.

The SBA has established "principles of affiliation" to determine whether a business concern is "independently owned and operated." In general, business concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party controls or has the power to control both. The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, are treated as one party with such interests aggregated when measuring the size of the concern in question. The SBA counts the receipts or employees of the concern whose size is at issue and those of all its domestic and foreign affiliates, regardless of whether the affiliates are organized for profit, in determining the concern's size. However, business concerns owned and controlled by Indian Tribes, Alaska Regional or Village Corporations organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601), Native Hawaiian Organizations, or Community Development Corporations authorized by 42 U.S.C. 9805 are not considered affiliates of such entities, or with other concerns owned by these entities solely because of their common ownership.

Affiliation may be based on stock ownership when, (1) a person is an affiliate of a concern if the person owns or controls, or has the power to control 50 percent or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock, or (2) if two or more persons each owns, controls or has the power to control less than 50 percent of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern.

Affiliation may be based on common management or joint venture arrangements. Affiliation arises where one or more officers, directors, or general partners, controls the board of directors and/or the management of another concern. Parties to a joint venture also may be affiliates. A contractor and subcontractor are treated as joint ventures if the ostensible subcontractor will perform primary and vital requirements of a contract or if the prime contractor is unusually reliant upon the ostensible subcontractor. All requirements of the contract are considered in reviewing such relationship, including contract management, technical responsibilities, and the percentage of subcontracted work.

<u>Small organizations.</u> The RFA defines "small organizations" as any not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

<u>Small governmental jurisdictions.</u> The RFA defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with populations of fewer than 50,000.

11.4 Reason for considering the action

The purpose of Chinook salmon bycatch management in the Bering Sea pollock fishery is to minimize Chinook salmon bycatch to the extent practicable, while achieving optimum yield from the pollock fishery. Minimizing Chinook salmon bycatch while achieving optimum yield is necessary to maintain a healthy marine ecosystem, ensure long-term conservation and abundance of Chinook salmon, provide maximum benefit to fishermen and communities that depend on Chinook salmon and pollock resources, and comply with the Magnuson-Stevens Act and other applicable federal law. National Standard 9 of the Magnuson-Stevens Act requires that conservation and management measures shall, to the extent practicable, minimize bycatch. National Standard 1 of the Magnuson-Stevens Act requires that conservation and management measures prevent overfishing, while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

Several management measures are being used to reduce Chinook salmon bycatch in the Bering Sea pollock fishery. Chinook salmon taken incidentally in groundfish fisheries are classified as prohibited species and, as such, must be either discarded or donated through the Pacific Salmon Donation Program. In the mid-1990s, NMFS implemented regulations recommended by the Council to control the bycatch of Chinook salmon taken in the Bering Sea pollock fishery. These regulations established the Chinook Salmon Savings Areas and mandated year-round accounting of Chinook salmon bycatch in the pollock fishery. Once Chinook salmon bycatch levels reached a maximum limit in a Chinook Salmon Savings Area, the area would be closed to any further pollock fishing. These areas were adopted based on historic observed salmon bycatch rates and were designed to avoid high spatial and temporal levels of salmon bycatch.

The Council started considering revisions to salmon bycatch management in 2004 when information from the fishing fleet indicated that it was experiencing increases in salmon bycatch following the regulatory closure of the Chinook Salmon Savings Area. While the non-CDQ fleet could no longer fish inside the Chinook Salmon Savings Area, vessels fishing on behalf of the CDQ groups were still able to fish inside the area because the CDQ groups had not yet reached their Chinook salmon prohibited species catch limit. Much higher salmon bycatch rates were reportedly encountered outside of the closure areas by the non-CDQ fleet than experienced by the CDQ vessels fishing inside. Further, the closure areas increased costs to the pollock fleet and processors.

To address this problem, the Council examined other means that were more flexible and adaptive to minimize salmon bycatch. Since 2006, the pollock fleet has used an ICA to establish a VRHS. The VRHS is intended to increase the ability of pollock fishery participants to minimize salmon bycatch by giving them more flexibility to move fishing operations to avoid areas where they experience high rates of salmon bycatch. The VRHS was first implemented voluntarily in 2002 and through an exempted fishing permit in 2006, and subsequently, in 2007, through Amendment 84 to the BSAI FMP.

In light of the high Chinook salmon bycatch in recent years, the Council and NMFS are considering alternative measures to more effectively reduce bycatch to the extent practicable while achieving optimum yield from the pollock fishery. While the inter-cooperative reports on Chinook salmon bycatch indicate that the VRHS has reduced Chinook salmon bycatch rates compared with what they would have been without the measures, concerns remain because of escalating Chinook salmon bycatch through 2007. From 1990 through 2001, the Bering Sea Chinook salmon bycatch average was 37,819 salmon annually. Since 2002, Chinook salmon bycatch numbers have increased substantially. The average from 2002 to 2007 was 82,311 Chinook salmon, with a bycatch peak of 122,000 Chinook salmon in 2007.

The Council and NMFS decided to limit the scope of this action to Chinook salmon, leaving in place the existing non-Chinook salmon bycatch reduction measures, because of the need for immediate action to reduce Chinook salmon bycatch. Chinook salmon is separated from non-Chinook salmon because Chinook salmon is a highly valued species and a species of concern that warrants specific protection measures. Additionally, the Council and NMFS expect the Chinook salmon bycatch reduction measures under consideration to also reduce non-Chinook salmon bycatch. The Council will address non-Chinook salmon bycatch in the Bering Sea pollock trawl fishery with a subsequent action.

11.5 Objectives of, and legal basis for, the proposed action

Under the Magnuson-Stevens Act, the United States has exclusive management authority over all living marine resources found within its EEZ. The management of marine fishery resources is vested in the

Secretary of Commerce, with advice from the Regional Fishery Management Councils. The Bering Sea pollock fishery in the EEZ off Alaska is managed under the BSAI FMP.

Statutory authority for measures designed to reduce bycatch is specifically addressed in Sec. 600.350 of the Magnuson-Stevens Act. That section establishes National Standard 9—Bycatch, which directs the Councils to minimize bycatch and to minimize mortality of bycatch when it cannot be avoided.

The dual objectives of the proposed action are to reduce Chinook salmon bycatch, to the extent practicable, in the BSAI trawl fisheries in compliance with National Standard 9 of the Magnuson-Stevens Act and, further, to comply with National Standard 1 of the Magnuson-Stevens Act which requires that conservation and management measures prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

11.6 Number and description of small entities regulated by the proposed action

The proposed action(s) being considered by the Council apply only to those entities that participate in the directed pollock trawl fishery in the BS. These entities include the American Fisheries Act (AFA) affiliated pollock fleet and the six western Alaska Community Development Quota (CDQ) organizations that presently receive CDQ allocations of BS pollock.

As described in Section 11.4, the RFA requires a consideration of affiliations between entities for the purpose of assessing if an entity is small. The AFA pollock cooperatives in the BS are an important type of affiliation. All of the entities directly affected by the proposed action are members of AFA co-ops in 2008, and therefore, are “affiliated” and are considered to be large entities for RFA purposes. The six CDQ organizations potentially directly regulated by the proposed action are considered to be small entities for RFA purposes, and, as discussed in section 11.4 above, their affiliations with other large entities does not define them as large entities. Thus, the only small entities that are directly regulated by this action are the six western Alaska CDQ organizations.

11.7 Recordkeeping and reporting requirements

Depending on the alternative chosen, the subsequent proposed regulation may impose new record keeping or reporting requirements on directly regulated small entities. This would be true for components of both Alternative 2, 3, and 4, which would eliminates existing salmon bycatch prevention measures, and replaces them with hard caps and/or triggered closure areas. The present alternative set contains a great number of options and suboptions including provisions for transfers, rollovers, and cooperative management. Alternative 4, the preferred alternative, includes a provision that would encourage, via a greater hard cap, formation of an ICA designed to provide salmon bycatch reduction incentives for participants. Alternative 4 would require annual recordkeeping to document the level of success of the ICA as well as annual reporting to the Council.

11.8 Federal rules that may duplicate, overlap, or conflict with proposed action

Section 7 consultation under the Endangered Species act could pose the risk of future additional restrictions on the Bering Sea pollock trawl fishery if genetic information identifies threatened or endangered salmon stocks in the salmon bycatch of the BS pollock trawl fishery. A consultation will occur in support of the proposed actions.

11.9 Description of significant alternatives to the proposed action

Chapter 2 describes in detail the alternative under consideration. Once a preferred alternative is chosen, this section will identify and describe any significant alternatives to the proposed action that (1) meet the action objectives and (2) imposed smaller adverse economic impacts on the identified directly regulated entities, CDQ groups.

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Diana L. Stram (NPFMC) graduated from Colgate University (B.A. Geology), and received her Ph.D. in Oceanography from the University of Rhode Island, in 2001. She has worked as Fishery Management Plan Team Coordinator for the North Pacific Fishery Management Council for the last seven years, and is the Co-Chair of the Council's Gulf of Alaska Fishery Management Plan Team, Interim Chair of the Council's Scallop Fishery Management Plan Team, and coordinator of the Council's King and Tanner Crab Fishery Management Plan Team. She has been working on salmon bycatch issues for the Council for the last four years. Dr Stram is the Council project leader for this EIS. In addition to preparing the background and Council presentation materials throughout the development of the EIS, and helping to develop the impacts methodology for analysis of Chinook, pollock, and chum impacts, Dr Stram was a primary author on Chapters 2, 3, 4, 5, 6, and the Executive Summary.

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13.0 REFERENCES

Chapter 1

ADF&G (Alaska Department of Fish and Game). 1998a. Catalog of waters important for spawning, rearing, or migration of anadromous fishes. ADF&G, Habitat Division, 6 vols. Anchorage, Alaska. Revised periodically.

ADF&G. 1998b. An atlas to the catalog of waters important for spawning, rearing, or migration of anadromous fishes. ADF&G, Habitat Division, 6 vols. Anchorage, Alaska. Revised periodically.

NMFS (National Marine Fisheries Service). 2005. Final environmental impact statement for essential fish habitat identification and conservation in Alaska (EFH EIS). NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska. April. URL: http://www.fakr.noaa.gov/habitat/seis/efheis.htm

NMFS. 2004. Programmatic supplemental environmental impact statement for the Alaska Groundfish Fisheries implemented under the authority of the fishery management plans for the groundfish fishery of the Gulf of Alaska and the groundfish fishery of the Bering Sea and Aleutian Islands Area. (PSEIS). NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska. June. URL: http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm

NMFS. 2002. Final environmental impact statement for the American Fisheries Act Amendments 61/61/13/8 (AFA EIS). NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska. June. URL: http://www.fakr.noaa.gov/sustainablefisheries/afa/eis2002.pdf

Chapter 2

NPFMC (North Pacific Fishery Management Council). 2005. Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Assessment for modifying existing measures for Chinook and chum salmon savings areas for Amendment 84 to the BSAI Groundfish FMP . North Pacific Fishery Management Council, 605 West 4th Ave., Suite 306, Anchorage, AK, 99501.

Chapter 3

CBD (Center for Biological Diversity). 2008. Petition to list three sea species under the Endangered Species Act: ringed sea (Pusa hispida), bearded seal (erignathus barbatus), and spotted seal (Phoca largha). May 28, 2008. The Center for Biological Diversity, 1095 Market St., Ste. 511, San Francisco, CA 94103.

CBC. 2007. Petition to List the Ribbon Seal (*Histriophoca fasciata*) as a Threatened or Endangered Species under the Endangered Species Act. December 20, 2007. The Center for Biological Diversity, 1095 Market Street, Suite 511, San Francisco, CA 94103.

Conners, M.E. and E. Logerwell. 2005. Fishery Interaction Team (FIT) presentations to the North Pacific Fishery Management Council (NPFMC), June Council Meeting, Girdwood, Alaska.

Ames, R. T., G. H. Williams, and S.M. Fitzgerald. 2005. Using digital video monitoring systems in fisheries: Application for monitoring compliance of seabird avoidance devices and seabird mortality in Pacific halibut longline fisheries. U.S. Dep. of Commer., NOAA Tech. Memo. NMFS-AFSC-152. Seattle, Washington. URL: http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-152.pdf

Angliss, R. P., and R. B. Outlaw. 2007. Alaska marine mammal stock assessments, 2006. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-168, 244 p.

Boldt, J. L. (editor). 2007. Ecosystem considerations for 2008: Appendix C of the BSAI\GOA stock assessment and fishery evaluation reports (SAFE documents). North Pacific Fishery Management Council, Anchorage, Alaska. URL: http://access.afsc.noaa.gov/reem/ecoweb/EcoChaptMainFrame.htm

Boldt, J. L. (editor). 2005. Ecosystem considerations for 2006: Appendix C of the BSAI\GOA stock assessment and fishery evaluation reports (SAFE documents). North Pacific Fishery Management Council, Anchorage, Alaska. URL: http://access.afsc.noaa.gov/reem/ecoweb/EcoChaptMainFrame.htm

Center for Biological Diversity. 2007. Petition to List the Ribbon Seal (*Histriophoca fasciata*) as a threatened or endangered species under the Endangered Species Act. December 20, 2007. Available from http://www.fakr.noaa.gov/protectedresources/seals/ice/ribbon/petitiontolist.pdf.

Crossett, K. M., T. J. Culliton, P. C. Wiley, and T. R. Goodspeed. 2004. Population trends along the coastal United States: 1980-2008. Coastal Trends Report Series, U.S. Dep. of Commer., NOAA, National Ocean Service, Management and Budget Office, Special Projects, Bethesda, Maryland.

Evans, D., and B. Wilson. 2005. Role of the North Pacific Fishery Management Council in the development of an ecosystem approach to management for the Alaska large marine ecosystems. NPFMC. Anchorage, Alaska.

Hartig, L. 2008. Letter to the Alaska State Legislature reporting the status of the application for primacy from the U. S. Environmental Protection Agency for the National Pollution Discharge Elimination System program. January 15, 2008. Available from http://www.dec.state.ak.us/water/npdes/pdfs/Report%20to%20Leg%202008%20Final.pdf

Healey, M.C. 1991. Life history of Chinook salmon. In: C. Groot, and L. Margolis, editors. Pacific Salmon Life Histories. UBC Press, Vancouver. p. 313-393.

Heifetz, J., R. P. Stone, P. W. Malecha, D. L. Courtney, J. T. Fujioka, and P. W. Rigby. 2003. Research at the Auke Bay Laboratory on benthic habitat. AFSC Quarterly Report. July-August-September, 2003. pp. 1-10.

McElderry, H., J. Schrader, D. McCullough, J. Illingworth, S. Fitzgerald, and S. Davis. 2004. Electronic monitoring of seabird interactions with trawl third-wire cables on trawl vessels – a pilot study. U.S. Dep. of Commer., NOAA Tech. Memo. NMFS-AFSC-147, 39 p.

Melvin, E. F., K. S. Dietrich, and T. Thomas. 2004. Pilot tests of techniques to mitigate seabird interactions with catcher processor vessels in the Bering Sea pollock trawl fishery: Final report. Washington Sea Grant Program. University of Washington. Seattle.

Miller, T. J. 2005. Estimation of catch parameters from a fishery observer program with multiple objectives. School of Aquatic Fisheries Science. Seattle, WA, University of Washington. PhD. Thesis 419 p.

MMS (Minerals Management Service). 2003. Cook Inlet planning area oil and gas lease sales 191 and 199, Final Environmental Impact Statement, MMS-2003-055, U.S. Dep. of Interior, Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

Myers, K.W., R.V. Walker, J.L. Armstrong, and N.D. Davis. 2003. Estimates of the bycatch of Yukon River Chinook salmon in U.S. groundfish fisheries in the eastern Bering Sea, 1997-1999. Final Report to the Yukon River Drainage Fisheries Association, Contr. No. 04-001. SAFS-UW-0312, School of Aquatic and Fishery Sciences, University of Washington, Seattle. 59 p.

Myers, K.W., and D.E. Rogers. 1988. Stock origins of Chinook salmon in incidental catches by groundfish fisheries in the eastern Bering Sea. North American Journal of Fisheries Management 8:162-171.

Myers, K.W., D.E. Rogers, C.K. Harris, C.M. Knudsen, R.V. Walker, and N.D. Davis. 1984. Origins of Chinook salmon in the area of the Japanese mothership and landbased driftnet salmon fisheries in 1975-1981. International North Pacific Fisheries Commission Document, Fisheries Research Institute, University of Washington, Seattle. 204 p.

NMFS. 2008a. Recovery Plan for the Steller Sea Lion. Revision. February 29, 2008. National Marine Fisheries Services Office of Protected Resources. P. O. Box, 21668, Juneau, Alaska. Available from http://alaskafisheries.noaa.gov/protectedresources/stellers/recovery/sslrpfinalrev030408.pdf.

NMFS. 2007a. Conservation plan for the Eastern Pacific stock of northern fur seal (*Callorhinus ursinus*). National Marine Fisheries Service, Juneau, Alaska. Available from http://www.fakr.noaa.gov/protectedresources/seals/fur/cplan/final1207.pdf.

NMFS. 2007b. Alaska Groundfish Harvest Specifications Environmental Impact Statement. January 2007. DOC, NOAA, National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802. Available from http://www.fakr.noaa.gov/analyses/groundfish.

NMFS. 2006. Biological assessment of the Alaska groundfish fisheries and NMFS managed Endangered Species Act listed marine mammals and sea turtles. NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska. April. URL:| http://www.fakr.noaa.gov/sustainablefisheries/sslmc/agency_documents/BA4-6-06.pdf

NMFS. 2005. Setting the annual subsistence harvest of northern fur seals on the Pribilof Islands: Final environmental impact statement. NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska, May. URL: http://www.fakr.noaa.gov/protectedresources/seals/fur/eis/final0505.pdf.

NPFMC. 2007. Aleutian Islands Fishery Ecosystem Plan. December 2007. North Pacific Fishery Management Council, Anchorage, Alaska. Available from: http://www.fakr.noaa.gov/npfmc/current_issues/ecosystem/AIFEP12_07.pdf

Nuka Research & Planning Group, LLC and Cape International, Inc. 2006. Vessel Traffic in the Aleutians Subarea. Updated Report to Alaska Department of Environmental Conservation. Seldovia. September 20.

Pew Oceans Commission. 2003. America's living oceans: charting a course for sea change. Report to the Nation, Recommendations for a New Ocean Policy. Pew Charitable Trust, May. URL: http://www.pewtrusts.org/ideas/ideas_item.cfm?content_item_id=1635&content_type_id=8&issue_name=Protecting%20ocean%20life&issue=16&page=8&name=Grantee%20Reports.

Scientific Certification Systems, Inc. (SCS). 2004. The United States Bering Sea and Aleutian Islands pollock fishery. MSC Assessment Report. Emeryville, California.

Seeb, J.E,. S. Abe, S. Sato, S. Urawa, N. Varnavskaya, N. Klovatch, E.V. Farley, C. Guthries, B. Templin, C. Habicht, J.M. Murphy, L.W. Seeb. 2008. The Use of Genetic Stock Identification to Determine the Distribution, Migration, Early Marine Survival, and Relative Stock Abundance of Sockeye, Chum, and Chinook Salmon in the Bering Sea. Poster presentation at the North Pacific Anadromous Fish Commission International Symposium on Bering-Aleutian Salmon International Surveys (BASIS): Climate Change, Production Trends, and Carrying Capacity of Pacific Salmon in the Bering Sea and Adjacent Waters. Seattle, Washington. November 23-25, 2008.

Templin, W. D., L.W. Seeb, J.M. Murphy, J. Seeb. 2008. High-Resolution Stock Identification for Migratory Studies of Chinook Salmon. Poster presentation at the North Pacific Anadromous Fish Commission International Symposium on Bering-Aleutian Salmon International Surveys (BASIS): Climate Change, Production Trends, and Carrying Capacity of Pacific Salmon in the Bering Sea and Adjacent Waters. Seattle, Washington. November 23-25, 2008.

U.S. Commission on Ocean Policy. 2004. An Ocean Blueprint for the 21st Century.

United States Department of Agriculture (USDA). 2005. China's agricultural imports boomed during 2003-04. Electronic outlook report from the Economic Research Service. WRS-05-04. URL: http://www.ers.usda.gov/Publications/WRS0504/

Williams, G. 2005. Population projections: Projections for Alaska population, 2005-2029. Alaska Economic Trends. 25(2):4-16.

Witherell, D.W., D. Ackley and C. Coon. 2002. An overview of salmon bycatch in Alaska groundfish fisheries. Alaska Fishery Research Bulletin (9)1:53-6.

Zweig, D. and B. Jianhai. 2005. China's global hunt for energy. Foreign Affairs 84(5).

Chapter 4

Aydin, K. Y., et al.2002. A comparison of the Eastern Bering and western Bering Sea shelf and slope ecosystems through the use of mass-balance food web models. U.S. Department of Commerce, Seattle, WA. (NOAA Technical Memorandum NMFS-AFSC-130) 78p.

Bailey, K.M., T.J. Quinn, P. Bentzen, and W.S. Grant. 1999. Population structure and dynamics of walleye pollock, *Theragra chalcogramma*. Advances in Mar. Biol. 37:179-255.

Boldt, J. 2007. Ecosystem considerations chapter for 2007. http://access.afsc.noaa.gov/reem/ecoweb

Ciannelli, L., B.W. Robson, R.C. Francis, K. Aydin, and R.D. Brodeur (2004). Boundaries of open marine ecosystems: an application to the Pribilof Archipelago, southeast Bering Sea. *Ecological Applications*, Volume 14, No. 3. pp. 942-953.

Dawson, P. K. 1989. Stock identification of Bering Sea walleye pollock. Pages 184-206 *in* Proceedings of the International Scientific Symposium on Bering Sea Fisheries held in Sitka, Alaska, 19-21 July 1988. NOAA Technical Memorandum, NMFS F/NWC-163.

Hart, J. L. 1973. Pacific Fishes of Canada. Fisheries Research Board of Canada, Ottawa, Canada.

Hinckley, S. 1987. The reproductive biology of walleye pollock, *Theragra chalcogramma,* in the Bering Sea, with reference to spawning stock structure. Fishery Bulletin. 85(3):481-498.

Ianelli, J.N., S. Barbeaux, S. Kotwicki, K. Aydin, T. Honkalehto, and N. Williamson. 2007. Assessment of Alaska Pollock Stock in the Eastern Bering Sea. Pages 35-138 in Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions. North Pacific Fishery Management Council, Anchorage. section 1:41-138.

Ianelli, J.N., S. Barbeaux, T. Honkalehto, S. Kotwicki, K. Aydin and N. Williamson. 2008(draft). Eastern Bering Sea walleye pollock. In: Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions. North Pacific Fishery Mgt. Council, Anchorage, AK, section 1:37-98.

Jurado-Molina J., P. A. Livingston and J. N. Ianelli. 2005. Incorporating predation interactions to a statistical catch-at-age model for a predator-prey system in the eastern Bering Sea. Canadian Journal of Fisheries and Aquatic Sciences. 62(8): 1865-1873.

Kajimura, H., and C. W. Fowler. 1984. Apex predators in the walleye pollock ecosystem in the eastern Bering Sea and the Aleutian Islands region. Pages 193-233 *in* D. H. Ito, ed. Proceedings of the Workshop on Walleye Pollock and its Ecosystem in the eastern Bering Sea. NOAA Technical Memorandum NMFS F/NWC-62, Seattle, WA.

Livingston, P. A. 1989. Interannual trends in walleye pollock, *Theragra chalcogramma*, Cannibalism in the eastern Bering Sea. Pages 275-296 i*n* Proceedings of the International Symposium on the Biology and Management of Walleye Pollock held in Anchorage, AK, 14-16 November 1988. Alaska Sea Grant Report No. 89-1.

Livingston, P. A., and Methot, R. D. (1998). "Incorporation of predation into a population assessment model of Eastern Bering Sea walleye pollock. *In* Fishery Stock Assessment Models." NOAA Technical Report 126, *NMFS F/NWC-54*, Alaska Sea Grant Program, 304 Eielson Building, University of Alaska Fairbanks, Fairbanks, AK 99775. pp. 663-678.

Mecklenburg, C. W., T.A. Mecklenburg, and L.K. Thorsteinson. 2002. Fishes of Alaska. American Fisheries Society, Bethesda, MD.

National Research Council. 1996. The Bering Sea Ecosystem. National Academy Press, Washington D.C. 307 pp.

Smith, G.B. 1981. The biology of walleye pollock. *In* Hood, D.W. and J.A. Calder, The Eastern Bering Sea Shelf: Oceanography and Resources. Vol. I. U.S. Dep. Comm., NOAA/OMP 527-551.

Sogard, S. M., and B.L. Olla. 1993. The influence of predator presence on utilization of artificial seagrass habitats by juvenile walleye pollock, *Theragra chalcogramma*. Environmental Biology of Fishes 37:57-65.

Swartzman, G.L., A.G. Winter, K.O. Coyle, R.D. Brodeur, T. Buckley, L. Ciannelli, G.L. Hunt, Jr., J. Ianelli, and S.A. Macklin. 2005. Relationship of age-0 pollock abundance and distribution around the Pribilof Islands with other shelf regions of the Eastern Bering Sea. Fisheries Research, Vol. 74, pp. 273-287.

Tsuji, S. 1989. Alaska pollock population, *Theragra chalcogramma,* of Japan and its adjacent waters, I: Japanese fisheries and population studies. Marine Behavior and Physiology 15:147-205.

Walters, C. J., and J. F. Kitchell. 2001. Cultivation/depensation effects on juvenile survival and recruitment. Can. J. Fish. Aquat. Sci. 58:39-50.

Wespestad, V. G. 1993. The status of Bering Sea pollock and the effect of the "Donut Hole" fishery. Fisheries 18(3):18-24.

Winter, A.G., G.L. Swartzman, and L. Ciannelli. 2005. Early- to late-summer population growth and prey consumption by age-0 pollock (*Theragra chalcogramma*), in two years of contrasting pollock abundance near the Pribilof Islands, Bering Sea. Fisheries Oceanography Vol. 14, No. 4, pp. 307-320.

Chapter 5

ADF&G. 2007a. 2007 Kuskokwim Area Salmon Fishery News Release Preliminary 2007 Kuskokwim Area Salmon Fishery Summary. http://www.cf.adfg.state.ak.us/region3/finfish/salmon/catchval/07ksksalsum.pdf.

ADF&G. 2007b. 2007 Bristol Bay Salmon Season Summary. http://www.cf.adfg.state.ak.us/region2/finfish/salmon/bbay/brbpos07.pdf.

ADF&G. 2004. Escapement goal review of select AYK region salmon stocks. Alaska Department of Fish and Game Division of Commercial Fisheries, Regional Information Report No. 3A04-01, Anchorage, AK.

Anonymous. 2007. Pacific salmon enhancement by Russia in 2006. NPFAC Doc. 1066. 3pp. (available at http://www.npafc.org).

Aydin, K.Y., K.W. Myers, and R.V. Walker. 2000. Variation in summer distribution of the prey of Pacific salmon (*Onchorhynchus* spp.) in the offshore Gulf of Alaska in relation to oceanographic conditions, 1994-98. N. Pac. Anadr. Fish. Comm. Bull. No. 2:43-54

Azumaya, T., and Y Ishida. 2000. Density interactions between pink salmon (*Oncorhynchus gorbuscha*) and chum salmon (*O. keta*) and their possible effects on distribution and growth in the North Pacific Ocean and Bering Sea. N. Pac. Anadr. Fish. Comm. Bull. No. 2:165-174

Balsiger J. W. 2008. Memo to R. Lohn, Administrator, Northwest Region. January 14, 2008. 7 p. w/attachments.

Bartlett, H.R. 2007. Washington, Oregon, Idaho, and California salmon hatchery releases, commercial fishery catch statistics, and sport fishery catch statistics for 2006 season. NPAFC Doc. 1052, 5 pp. Washington Dept. Fish and Wildlife, Fish Program, 600 Capital Way N., Olympia, WA 98501. (Available at http://www.npafc.org)

Bartlett, H.R. 2006. Washington, Oregon, Idaho, and California salmon hatchery releases, commercial fishery catch statistics, and sport fishery catch statistics for 2005 season. NPAFC Doc. 984, 6 pp. Washington Dept. Fish and Wildlife, Fish Program, Olympia, WA. (Available at http://www.npafc.org)

Bartlett, H.R. 2005. Washington, Oregon, Idaho, and California salmon hatchery releases, commercial fishery catch statistics, and sport fishery catch statistics for 2004 season. NPAFC Doc. 909 rev 1, 7 pp. Washington Dept. Fish and Wildlife, Fish Program, Olympia, WA. (Available at http://www.npafc.org)

Bigler, B.S., D.W. Welch, and J.H. Helle. 1996. A review of size trends among North Pacific salmon (*Onchorhynchus* spp.). Can. J. Fish. Aquat. Sci. 53:455-465.

Brazil, C., F. West, and T. Baker. 2007. 2008 Nushagak River Chinook Salmon Forecast. Alaska Department of Fish and Game.

Bue, F.J., Lingnau, T.L. 2005. 2005 Yukon Area Subsistence, Personal Use, and Commercial Salmon Fisheries Outlook and Management Strategies. Fishery Management Report NO.05-31. Alaska Department of Fish and Game. Anchorage Alaska. May, 2005

Bugaev, V.F., D.W. Welch, M.M. Selifonov, L.E. Grachev, and J.P. Eveson. 2001. Influence of the marine abundance of pink salmon (*Oncorhynchus gorbuscha*) and sockeye (*O. nerka*) on growth of Ozernaya River sockeye. Fish. Oceanogr. 10:26-32.

Clark, J.H., A. McGregor, R. Mecum, P. Krasnowski, and A. Carroll. 2006. The Commercial Salmon Fishery in Alaska. Alaska Fishery Research Bulletin. Vol. 12, No. 1, Summer 2006. http://www.adfg.state.ak.us/pubs/afrb/afrbhome.php.

Cook, R. and J.R. Irvine. 2007. Canadian enhanced salmonid production during 1978-2006 (1977-2005 brood years). NPAFC Doc. No. 1039. 10p. Fisheries and Oceans Canada

Davis, N.D., K.W. Myers, and Y. Ishida. 1998. Caloric value of high-seas salmon prey organisms and simulated salmon ocean growth and prey consumption. N. Pac. Anadr. Fish Comm. Bull. No. 1:146–162.

Davis, N.D. 2003. Feeding ecology of Pacific salmon (*Onchorhynchus* spp.) in the Central North Pacific Ocean and Central Bering Sea, 1991-2000. Ph.D. Dissertation, Hokkaido University, Hakodate 190 p.

Davis, N.D., J.L. Armstrong, and K.W. Myers. 2004. Bering Sea salmon diet overlap in fall 2002 and potential for interactions among salmon. NPAFC Doc. 779. Sch. Aquat. Fish. Sci., Univ. Washington, Seattle. 30 p.

Delaney, K. 1994. Chinook Salmon. http://www.adfg.state.ak.us/pubs/notebook/fish/chinook.php

Eiler JH, Spencer TR, Pella JJ, Masuda MM. 2006a. Stock composition, run timing, and movement patterns of Chinook salmon returning to the Yukon River basin in 2004. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-165, 107 p.

Eiler JH, Spencer TR, Pella JJ, Masuda MM. 2006b. Stock composition, run timing, and movement patterns of Chinook salmon returning to the Yukon River basin in 2003. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-163, 104 p.

Eiler JH, Spencer TR, Pella JJ, Masuda MM, Holder RR. 2004. Distribution and movement patterns of Chinook salmon returning to the Yukon River basin in 2000–2002. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-148, 99 p.

Eggers, D.M. 2006. Alaska salmon hatchery releases, commercial fishery catch statistics, and sport fishery catch statistics for 2005 season. NPAFC Doc. No. 991. 6p. Alaska Dept. of Fish and Game, Div. of Commercial Fisheries, P.O. Box 25526, Juneau, AK 99802-5526, USA

Eggers, D.M. 2005. Alaska salmon hatchery releases, commercial fishery catch statistics, and sport fishery catch statistics for 2004 season. NPAFC Doc. No. 887. 8p. Alaska Dept. of Fish and Game, Div. of Commercial Fisheries, P.O. Box 25526, Juneau, AK 99802-5526, USA

Eggers, D. 2004. “Historical Trends in Alaskan Salmon.” In J. Boldt, ed., Ecosystem Considerations for 2005. North Pacific Fishery Management Council. 605 W 4th Ave, Suite 306, Anchorage, AK 99501. November 2004. pp. 131-137.

Evenson, D.F. 2008. US Exploitation rates on Yukon River Canadian-origin Chinook salmon, Memorandum to Dan Bergstrom, Acting Regional Supervisor, Commercial Fisheries Division, ADF&G. June 11, 2008.

Farley, E. V., Jr., J. M. Murphy, M. Adkison, and L. Eisner. 2007. Juvenile sockeye salmon distribution, size, condition, and diet during years with warm and cool spring sea temperatures along the eastern Bering Sea shelf. Journal of Fish Biology 71:1145 –1158.

Farley, E.V., Jr., J. Murphy, A. Middleton, L. Eisner, J. Pohl, O. Ivanov, N. Kuznetsova, K. Cieciel, M. Courtney, and H. George. 2006. Eastern Bering Sea (BASIS) coastal research (August–October 2005) on juvenile salmon (NPAFC Doc. 992) Auke Bay Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, Juneau, AK.

Good, T.P., R.S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Dept. Commerce, NOAA Tech. Memo NMFS-NWFSC-66, 598 p.

Hayes, S. J., D. F. Evenson, and G. J. Sandone. 2006. Yukon River Chinook salmon stock status and action plan; a report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Special Publication No. 06-38, Anchorage.

Helle, J.H., and M.S. Hoffman. 1995. Size decline and older age at maturity of two chum salmon (*Oncorhynchus keta*) stocks in western North America, 1972-1992. pp. 245-260. *In* R.J. Beamish (ed.) Climate change and northern fish populations. Can. Spec. Publ. Fish Aquat. Sci. No. 121.

Ishida, Y., S. Ito, M. Kaeriyama, S. McKinnell, and K. Nagasawa. 1993. Recent changes in age and size of chum salmon (*Oncorhynchus keta*) in the North Pacific possible causes. Can. J. Fish. Aquat. Sci. 50:290-295.

Ishida, Y., S. Ito, and K. Murai. 1995. Density dependent growth of pink salmon (*oncorhynchus gorbuscha*) in the Bering Sea and western North Pacific. N. Pac. Anadr. Fish Comm. Doc. 140. Nat. Res. Inst. Far Seas Fish., Shimizu. 17 p.

JCRMS (Joint Columbia River Management Staff). 2006. Joint staff report concerning commercial seasons for spring Chinook, steelhead, sturgeon, shad, smelt, and other species and miscellaneous regulations for 2006. January 18, 2006. 70 p.

JTC (Joint Technical Committee of the Yukon River US/Canada Panel). 2008. Yukon River salmon 2007 season summary and 2008 season outlook. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A08-01, Anchorage. March 2008.

Joesephson, R.P. 2007. Alaska salmon hatchery releases, commercial fishery catch statistics, and sport fishery catch statistics for 2006 season. NPAFC Doc. No. 1062. 6p. Alaska Dept. of Fish and Game, Div. of Commercial Fisheries, P.O. Box 115526, Juneau, AK 99811-5526 (available at http://www.npafc.org).

Kaeriyama, M. 1989. Aspects of salmon ranching in Japan. Physiol. Ecol. Japan. Spec. Vol. 1:625-638

Kaeriyama, M., M. Nakamura, M. Yamaguchi, H. Ueda, G. Anma, S. Takagi, K. Aydin, R.V. Walker, and K.W. Myers. 2000. Feeding ecology of sockeye and pink salmon in the Gulf of Alaska. N. Pac. Anadr. Fish. Comm. Bull. No. 2:55-63.

Kahler, E., T. Burton, T. Hamazaki, B. M. Borba, J. R. Jasper, and L.-A. Dehn. 2007. Assessment of Ichthyophonus in Chinook salmon within the Yukon River Drainage, 2004. Alaska Department of Fish and Game, Fishery Data Series No. 07-64, Anchorage.

Kahler, E., Hamazaki, T., Borba, B.M., Jasper, J. and T. Burton. In Prep. Prevalence of Ichthyophonus in Chinook salmon in the Yukon River drainage, 2004 – 2006.

Kocan, R.M., P.K. Hershberger, and J. Winton. 2003. Effects of *Ichthyophonus* on survival and reproduction success of Yukon River Chinook salmon. Federal Subsistence Fishery Monitoring Program, Final Project Report No. FIS 01-200. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fishery Information Services Division, Anchorage, AK.

LCFRB (Lower Columbia Fish Recovery Board). 2004. Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan. December 15, 2004.

McElhany, P., M. Chilcote, J. Myers, R. Beamesderfer. 2007. Viability Status of Oregon Salmon and Steelhead Populations in the Willamette and Lower Columbia Basin. September 2007. Prepared for the Oregon Department of Fish and Wildlife and the National Marine Fisheries Service.

McElhany, P., T. Backman, C. Busach, S. Heppell, S. Kolmes, A. Maule, J. Myers, D. Rawding, D. Shively, A. Steel, C. Steward, and T. Whitesel. 2003. Interim report on viability criteria for Willamette and lower Columbia basin Pacific salmonids. Willamette/Lower Columbia Technical Recovery Team (W/LC TRT). Northwest Fisheries Science Center, Seattle, WA. March 31.

Mecum, R. D. 2006a. Memo to R. Lohn, Administrator, Northwest Region. June 2, 2006. 2 p. w/ attachment.

Mecum, R.D. 2006b. Memo to R. Lohn, Administrator, Northwest Region. November 24, 2006. 8 p. w/ attachments.

Molyneaux, D.B., and L.K. Brannian. 2006. Review of Escapement and Abundance Information for Kuskokwim Area Salmon Stocks. Alaska Depart of Fish and game, Divisions of Sport Fish and Commercial Fisheries. Fishery Management Bulletin No. 06-08. December 2006.

Myers, K.W., R.V. Walker, J.L. Armstrong, and N.D. Davis. 2003. Estimates of the bycatch of Yukon River Chinook salmon in U.S. groundfish fisheries in the eastern Bering Sea, 1997-1999. Final Report to the Yukon River Drainage Fisheries Association, Contr. No. 04-001. SAFS-UW-0312, School of Aquatic and Fishery Sciences, University of Washington, Seattle. 59 p.

Myers, K.W., and D.E. Rogers. 1988. Stock origins of Chinook salmon in incidental catches by groundfish fisheries in the Eastern Bering Sea. Contribution 744, School of Fisheries, University of Washington, Seattle. North American Journal of Fisheries Management 8:162–171.

Myers, J., C. Busack, D. Rawding, A. Marshall, D. Teel, D.M. Van Doornik, and M.T. Maher. 2006. Historical population structure of Pacific salmonids in the Willamette River and lower Columbia River basins. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-73, 311 p.

Nelson, P., M. D. Plotnick, and A. M. Carroll, eds. 2008. Run Forecasts and Harvest Projections for 2008 Alaska Salmon Fisheries and Review of the 2007 Season. Alaska Department of Fish and Game. Special Publication 08-09. February 2008.

NMFS. 2007a. Supplemental Biological Opinion Reinitiating Consultation on the November 30, 2000 Biological Opinion regarding Authorization of Bering Sea/Aleutian Islands Groundfish Fisheries. January 11, 2007. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Seattle, WA.

NMFS. 2007b. 2007 Report to Congress: Pacific Coastal Salmon Recovery Fund FY 2000-2006. NMFS, Northwest Region, Seattle, WA. http://www.nwr.noaa.gov/Salmon-Recovery-Planning/PCSRF/Index.cfm.

NMFS .2006. 2005 Report to Congress: Pacific Coastal Salmon Recovery Fund FY 2000-2005. NMFS, Northwest Region, Seattle, WA.

NMFS. 2005a. Biological Opinion on Impacts of Treaty Indian and Non-Indian Fisheries in the Columbia River Basin in Years 2005-2007, on Salmon and Steelhead Listed Under the Endangered Species Act, Conference on Lower Columbia Coho, and Magnuson-Stevens Act Essential Fish Habitat Consultation. May 9, 2005.

NMFS. 2005b. Endangered and threatened species: final listing determinations for 16 ESUs of West Coast salmon and final 4(d) protective regulations for threatened salmonid ESUs. Final Rule. Federal Register, Vol. 70, pg. 37160, June 28, 2005.

NMFS. 2005c. 2005 report to Congress: Pacific Coastal Salmon Recovery Fund – FY 2000-2004. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Seattle, WA.

NMFS. 1999. ESA Reinitiated Section 7 Consultation Biological Opinion. Take of Listed Salmon in Groundfish Fisheries Conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans. December 22, 1999. NMFS Northwest Region.

Nomura, T. M. Fukuwaka, N. Davis, and M. Kawana. 2002. Total lipid contents in the white muscle, liver, and gonad of chum salmon caught in the Bering Sea and the Gulf of Alaska in summer 2001. N. Pac. Anadr. Fish Comm. Doc. 615, 12 pp. Nat. Salmon Res. Ctr., Sapporo.

NPAFC (North Pacific Anadromous Fish Commission). 2001: Plan for NPAFC Bering-Aleutian Salmon International Survey (BASIS) 2002-2006. (NPAFC Doc. 579, Rev. 2) 27 p.

Pahlke, K.A.. 2007. Escapements of Chinook Salmon in Southeast Alaska and Transboundary Rivers in 2005. Alaska Department of Fish and Game. Fishery Data Series No. 07-62. October 2007.

Rogers, D.E. 1980. Density-dependent growth of Bristol Bay sockeye salmon. Pp. 267-283. *In* W. McNeil and D. Himsworth (eds.) Salmonid ecosystems of the North Pacific. Oregon State Univ. Press, Corvallis.

Rogers, D.E. and G.T. Ruggerone. 1993. Factors affecting marine growth of Bristol Bay sockeye salmon. Fish. Res. 18:89-103.

Ruggerone, G.T., M. Zimmermann, K.W. Myers, J.L. Nielsen, and D.E. Rogers. 2003. Competition between Asian pink salmon (*Oncorhynchus gorbuscha*) and Alaska sockeye salmon (*O. nerka*) in the North Pacific Ocean. Fish. Oceanog. 12:209-219.

Sands, T., C. Westing, P. Salomone, S. Morstad, T. Baker, F.West, and C. Brazil. In preparation. 2007 Bristol Bay Area Annual Management Report. Alaska Department of Fish and Game. Fishery Management Report No. 07-XX. Anchorage.

Tadokoro, K., Y. Ishida, N.D. Davis, S. Ueyanagi, and T. Sugimoto. 1996. Change in chum salmon (Oncorhynchus keta) stomach contents associated with fluctuations of pink salmon (O. gorbuscha) abundance in the central subarctic Pacific and Bering Sea. Fish. Oceanogr. 5:89-99.

TINRO-Centre (Pacific Scientific Research Fisheries Centre). 2006. Biostatistical information on salmon catches, escapement, outmigrants number, and enhancement production in Russia in 2005 (North Pacific Anadromous Fish Commission, Doc. 999) 15 p. TINRO-Centre, 4, Shevchenko Alley, Vladivostok, 690600, RUSSIA.

TINRO-centre. 2005. Russian Pacific salmon hatchery releases, commercial fishery catch statistics, and sport fishery harvest statistics for 2004 season. (North Pacific Anadromous Fish Commission, Doc. 918 Rev. 1) 14 p. TINRO-centre, 4, Shevchenko Alley, Vladivostok, 690950, RUSSIA.

Walker, R.V., K.W. Myers, and S. Ito. 1998. Growth studies from 1956-1995 collections of pink and chum salmon scales in the central North Pacific Ocean. N. Pac. Anadr. Fish. Comm. Bull. No. 1:54-65.

Chapter 6

Clark, J.H., A. McGregor, R. Mecum, P. Krasnowski, and A. Carroll. 2006. The Commercial Salmon Fishery in Alaska. Alaska Fishery Research Bulletin. Vol.12, No. 1, Summer 2006. http://www.adfg.state.ak.us/pubs/afrb/afrbhome.php.

Hammarstrom, L. F. and E.G. Ford. 2008. 2007 Lower Cook Inlet Annual Finfish Management Report. Alaska Department of Fish and Game, Fishery Management Report No. 08-12, Anchorage.

Menard and Kent 2007 memo on Norton sound (dls has ref)

NPAFC. 2006. Annual Report of the Bering-Aleutian Salmon International Survey (BASIS), 2005. NPAFC Doc. 1009. 94 p. BASIS Working Group, North Pacific Anadromous Fish Commission, Vancouver, B.C., Canada.

NPFMC. 1995b. Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Assessment for Proposed Alternatives to Reduce Chum Salmon Bycatch in the Bering Sea Trawl Fisheries: Amendment 35. Alaska Department of Fish and Game, National Marine Fisheries Service and the North Pacific Fishery Management Council, Juneau.

Nomura, T. M. Fukuwaka, N. Davis, annd M. Kawana. 2002. Total lipid contents in the white muscle, liver, and gonad of chum salmon caught in the Bering Sea and the Gulf of Alaska in summer 2001. N. Pac. Anadr. Fish Comm. Doc. 615, 12 pp. Nat. Salmon Res. Ctr., Sapporo.

Sands, T., C. Westing, P. Salomone, S. Morstad, T. Baker, F. West, and C. Brazil. 2008. 2007 Bristol Bay area annual management report. Alaska Department of Fish and Game, Fishery Management Report No. 08-28, Anchorage.

Shields, P. 2007. Upper Cook Inlet commercial fisheries annual management report, 2007. Alaska Department of Fish and Game, Fishery Management Report No. 07-64, Anchorage.

Shotwell, S.K. and M.D. Adkison. 2004. Estimating indices of abundance and escapement of pacific salmon for data-limited situations. Transactions of the American Fisheries Society 133:538–558.

Urawa, S., T. Azumaya, P.A. Crane, and L.W. Seeb. 2004. Origin and distribution of chum salmon in the Bering Sea during the early fall of 2002: estimates by allozyme analysis. NPAFC Doc. 794, 11 pp. National Salmon Resources Center, Toyohira-ku, Sapporo 062-0922, Japan.

Wilmot, R.L., C.M. Kondzela, C.M. Guthrie, and M.S. Masuda. 1998. Genetic stock identification of chum salmon harvested incidentally in the 1994 and 1995 Bering Sea trawl fishery. N. Pac. Anadr. Fish Comm. Bull., 1:285–299.

Chapter 7

Boldt, J. L. (editor). 2005. Ecosystem considerations for 2008: Appendix C of the BSAI\GOA stock assessment and fishery evaluation reports (SAFE documents). North Pacific Fishery Management Council, Anchorage, Alaska. URL: http://access.afsc.noaa.gov/reem/ecoweb/EcoChaptMainFrame.htm

Clark, W.G., and S.R. Hare. 2007. Assessment of the Pacific halibut stock at the end of 2007. International Pacific Halibut Commission. Seattle, Washington. URL: http://www.iphc.washington.edu/halcom/research/sa/papers/sa07.pdf

Conners, M. E., and M. A. Guttormsen. 2005. Forage fish species in the Gulf of Alaska. Appendix A In NPFMC (Ed.) Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska (2005 GOA SAFE report). Anchorage, Alaska. URL: http://www.afsc.noaa.gov/refm/stocks/assessments.htm

NMFS. 2004. Programmatic supplemental environmental impact statement for the Alaska Groundfish Fisheries implemented under the authority of the fishery management plans for the groundfish fishery of the Gulf of Alaska and the groundfish fishery of the Bering Sea and Aleutian Islands Area. (PSEIS). NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska, June. URL: http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm

NMFS. 2005. Final environmental impact statement for essential fish habitat identification and conservation in Alaska (EFH EIS). NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska, April. URL: http://www.fakr.noaa.gov/habitat/seis/efheis.htm

NMFS. 2007. Alaska Groundfish Harvest Specifications Environmental Impact Statement. January 2007. DOC, NOAA, National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802. Available from http://www.fakr.noaa.gov/analyses/groundfish.

NPFMC. 2003. Appendix B: Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska (SAFE document). GOA Plan Team. Anchorage, Alaska. URL:http://www.afsc.noaa.gov/refm/stocks/Historic_Assess.htm

NPFMC. 2005a. Fishery management plan for groundfish of the Bering Sea and Aleutian Islands management area. North Pacific Fishery Management Council. Anchorage, Alaska, January. URL: http://www.fakr.noaa.gov/npfmc/fmp/bsai/bsai.htm

Section 8.1

Angliss, R.P., and R.B. Outlaw. 2008. Alaska marine mammal stock assessments, 2007. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-180, 252 p.

Angliss, R.P., and R.B. Outlaw. 2007. Alaska marine mammal stock assessments, 2006. U.S. Dep.Commer., NOAA Tech. Memo. NMFS-AFSC-168, 244 p.

Angliss, R.P., and R.B. Outlaw. 2006. Alaska marine mammal stock assessments, 2005. U.S. Dep.Commer., NOAA Tech. Memo. NMFS-AFSC-161, 250 p.

Antonelis, G. A., S. R. Melin, and Y. A. Bukhtiyarov. 1994. Early spring feeding habits of bearded seals (Erignathus barbatus) in the central Bering Sea, 1981. Arctic 47:74-79.

Brix, K. 2006. Memorandum to Sue Salveson regarding the Effects Determination for the Alaska Groundfish Fisheries on Northern Right Whales. August 31, 2006. NMFS P. O. Box 21668, Juneau, AK 99802.

Brownell, R.L., P.J. Clapham, T. Miyashita, T. Kasuya. 2001. Conservation status of North Pacific right whales. J. Cetacean Res. Manage. (Special Issue). 2:269-86.

Calkins, D.G. 1998. Prey of Steller sea lions in the Bering Sea. Biosphere Conservation 1:33-44.

Cameron, M., and P. Boveng. 2007. Abundance and distribution surveys for ice seals aboard the USCG Healy and the Oscar Dyson, 10 April-18 June 2007. National Marine Mammal Laboratory, Alaska Fisheries Science Center Quarterly Research Report April-May-June 2007.

CBD. 2008. Petition to list three sea species under the Endangered Species Act: ringed sea (Pusa hispida), bearded seal (erignathus barbatus), and spotted seal (Phoca largha). May 28, 2008. The Center for Biological Diversity, 1095 Market St., Ste. 511, San Francisco, CA 94103.

CBD. 2007. Petition to List the Ribbon Seal (*Histriophoca fasciata*) as a Threatened or Endangered Species under the Endangered Species Act. December 20, 2007. The Center for Biological Diversity, 1095 Market Street, Suite 511, San Francisco, CA 94103.

Fay, F.H. 1974. The role of ice in the ecology of marine mammals of the Bering Sea. Pp. 383-389 In D.W. Hood and E.J. Kelley (eds.), Oceanography of the Bering Sea. Univ. Alaska, Fairbanks, Inst. Mar. Sci. Occas. Publ. 2.

Fritz, L.W., R. C Ferrero, and R. J. Berg. 1995. The Threatened Status of Steller Sea Lions, Eumetopias jubatus, under the Endangered Species Act: Effects on Alaska Groundfish Fisheries Management. Marine Fisheries Review 57(2): 15-27.

Fritz, L., M. Lynn, E. Kunisch, and K. Sweeney. 2008. Aerial, ship, and land-based surveys of Steller sea lions (Eumetopias jubatus) in Alaska, June and July 2005-2007. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-AFSC-183, 70 p.

Gudmundson, C.J., T.K. Zeppelin, and R.R. Ream. 2006. Application of two methods for determining diet of northern fur seals (*Callorhinus ursinus*). Fish Bull. 104:445-455.

International Whaling Commission. 2001. Report of the workshop on the comprehensive assessment of right whales: a worldwide comparison. J. Cetacean Res. Manage. (Special Issue 2):1-60.

Kajimura, H. 1984. Opportunistic feeding of the northern fur seal, Callorhinus ursinus, in the eastern North Pacific Ocean and eastern Bering Sea. NOAA Technical Report NMFS SSRF-779. 49 p.

Lander, R.H., and H. Kajimura. 1982. Status of northern fur seals. FAO Fisheries Series 5:319-345.

Loughlin, T.R., W.J. Ingraham, Jr., N. Baba, and B.W. Robson. 1999. Use of a surface current model and satellite telemetry to assess marine mammal movements in the Bering Sea. Pp. 615-630 In Loughlin, T.R., and K. Ohtani (eds.), Dynamics of the Bering Sea. University of Alaska Sea Grant Press, AK-SG-99-03, Fairbanks, AK.

Lowry, L. F., K. J. Frost, and J. J. Burns. 1980a. Feeding of bearded seals in the Bering and Chukchi Seas and trophic interaction with Pacific walruses. Arctic 33:330-342.

Lowry, L. F., K. J. Frost, and J. J. Burns. 1980b. Variability in the diet of ringed seals, Phoca hispida, in Alaska. Canadian Journal of Fisheries and Aquatic Science 37:2254-2261.

Lowry, L.F., K.J. Frost, D.G. Calkins, G.L. Swartzman, and S. Hills. 1982. Feeding habits, food requirements, and status of Bering Sea marine mammals. Document Nos. 19 and 19A, NPFMC, Anchorage, Alaska.

Lowry, L. F., V. N. Burkanov, K. J. Frost, M. A. Simpkins, R. Davis, D. P. DeMaster, R. Suydam, and A. Springer. 2000. Habitat use and habitat selection by spotted seals (Phoca largha) in the Bering Sea. Canadian Journal of Zoology-Revue Canadienne De Zoologie 78:1959-1971.

Mizroch, S.A. 1992. Distribution of minke whales in the North Pacific based on sightings and catch data. Unpubl. doc. submitted to the Int. Whal. Comm. (SC/43/Mi36). 37 pp.

Moore, S.E., J.M. Waite, L.L. Mazzuca, and R.C. Hobbs. 2000. Provisional estimates of mysticete whale abundance on the central Bering Sea shelf. J. Cetacean Res. Manage. 2(3):227-234.

Moore, S.E., J.M. Waite, N.A. Friday and T. Honkalehto. 2002. Distribution and comparative estimates of cetacean abundance on the central and south-eastern Bering Sea shelf with observations on bathymetric and prey associations. Progr. Oceanogr. 55(1-2):249-262

NMFS. 2008. Recovery Plan for the Steller Sea Lion. DOC, NOAA, National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802. Available from http://alaskafisheries.noaa.gov/protectedresources/stellers/recovery/sslrpfinalrev030408.pdf

NMFS. 2007a. Alaska Groundfish Harvest Specifications Environmental Impact Statement. January 2007. DOC, NOAA, National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802. Available from http://www.fakr.noaa.gov/analyses/groundfish.

NMFS. 2007b. Conservation plan for the Eastern Pacific stock of northern fur seal (Callorhinus ursinus). National Marine Fisheries Service, Juneau, Alaska. Available from http://www.fakr.noaa.gov/protectedresources/seals/fur/cplan/final1207.pdf

NMFS. 2006. Biological assessment of the Alaska groundfish fisheries and NMFS managed Endangered Species Act listed marine mammals and sea turtles. NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska, April. URL: http://www.fakr.noaa.gov/sustainablefisheries/sslmc/agency_documents/BA4-6-06.pdf

NMFS. 2005. Setting the annual subsistence harvest of northern fur seals on the Pribilof Islands: Final environmental impact statement. NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska, May. URL: http://www.fakr.noaa.gov/protectedresources/seals/fur/eis/final0505.pdf

NMFS. 2004. Programmatic Supplemental Environmental Impact Statement For Alaska Groundfish Fisheries Implemented Under the Authority of The Fishery Management Plans for the Groundfish Fishery of the Gulf of Alaska and the Groundfish of the Bering Sea and Aleutian Islands Area. January 2004. National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802. Available from http://www.fakr.noaa.gov/analyses/groundfish

NMFS. 2001. Steller sea lion protection measures supplemental environmental impact statement. November 2001. DOC, NOAA National Marine Fisheries Service, P.O. Box 21668, Juneau, Alaska 99802.

NMFS. 2000. ESA Section 7 Consultation Biological Opinion and Incidental Take Statement. Activities Considered: Authorization of Bering Sea/Aleutian Islands groundfish fisheries based on the Fishery Management Plan for the Bering Sea/Aleutian Islands Groundfish and Authorization of the Gulf of Alaska groundfish fisheries based on the Fishery Management Plan for Groundfish of the Gulf of Alaska. November 30, 2000. NMFS Alaska Region, P. O. Box 21668, Juneau, Alaska 99802. Also available at http://www.nmfs.noaa.gov/steller/fmp_sec07-NOV30_2000_FINAL.pdf

NPFMC. 2007. BSAI Groundfish Stock Assessment and Fishery Evaluation Report 2007 for Eastern Bering Sea Pollock. North Pacific Fishery Management Council, Anchorage, Alaska. Available from: http://www.afsc.noaa.gov/REFM/docs/2007/EBSpollock.pdf.

Pitcher, K. W. 1981. Prey of the Steller sea lion, Eumetopias jubatus, in the Gulf of Alaska. Fish. Bull. 79:467–472.

Porsild, A.E. 1945. Mammals of the Mackenzie Delta. Can. Field-Nat. 59:4-22.

Robson, B.W. (editor). 2002. Fur seal investigations, 2000-2001. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-134, 80 p.

Robson, B.W. 2001. The relationship between foraging areas and breeding sites of lactating northern fur seals, Callorhinus ursinus in the eastern Bering Sea. M.S. thesis, University of Washington, Seattle, WA. 67 p.

Salveson, S. 2008. Memorandum to Kaja Brix regarding reinitiation of ESA Section 7 consultation on the effects of the Alaska groundfish fisheries on north Pacific right whales and their designated critical habitat. April 30, 2008. NMFS P. O. Box 21668, Juneau, AK 99802.

Shaughnessy, P.D., and F.H. Fay. 1977. A review of the taxonomy and nomenclature of North Pacific harbour seals. J. Zool. (Lond.) 182:385-419.

Simpkins, M.A., L.M. Hiruki-Raring, G. Sheffield, J.M. Grebmeier, and J.L. Bengtson. 2003. Habitat selection by ice-associated pinnipeds near St. Lawrence Island, Alaska in March 2001. Polar Biol. 26:577-586.

Sinclair, E. H., G. A. Antonelis, B. W. Robson, R.R. Ream, and T. R. Loughlin. 1995. Northern fur seal predation on juvenile walleye pollock. –In D. Brodeur, P.A. Livingston, T.R. Loughlin and A.B. Hollowed (editors), Ecology of juvenile walleye pollock. U.S. Dep. Commer. , NOAA Tech. Rep. NMFSAFSC

Sinclair, E.H. and Zeppelin, T.K. 2002. Seasonal and Spatial Differences in Diet in the Western Stock of Steller Sea Lions (*Eumetopias jubatus*). J. of Mammalogy. 83(4):973-990.

Trites, A.W., A.J. Miller, H.D.G. Maschner, M.A. Alexander, S.J. Bograd, J.A. Calder, A. Capotondi, K.O. Coyle, E. Di Lorenzo, B.P. Finney, E.J. Gregr, C.E. Grosch, S.R. Hare, G.L. Hunt, J. Jahncke, N.B. Kachel, H.J. Kim, C. Ladd, N.J. Mantua, C. Marzban, W. Maslowski, R. Mendelssohn, D.J. Neilson, S.R. Okkonen, J.E. Overland, K.L. Reedy-Maschner, T.C. Royer, F.B. Schwing, J.X.L. Wang and A.J. Winship. 2007. Bottom-up forcing and the decline of Steller sea lions (*Eumetopias jubatus*) in Alaska: Assessing the ocean climate hypothesis. Fisheries Oceanography, 16, 46-67.

Zerbini, A.N., J.M. Waite, J.L. Laake and P.R. Wade. 2006. Abundance, trends and distribution of baleen whales off western Alaska and the central Aleutian Islands. Deep Sea Res. Part I:1772-1790.

Zeppelin, T.K., and R.R. Ream. 2006. Foraging habitats based on the diet of female northern fur seals (*Callorhinus ursinus*) on the Pribilof Islands, Alaska. J. Zool. (Lond.). ISSN 0952-8369. p. 12.

Zeppelin, T. K. , D. J. Tollit, K. A. Call, T. J. Orchard, C. J. Gudmundson. 2004. Sizes of walleye pollock and Atka mackerel consumed by the western stock of Steller sea lions in Alaska from 1998 to 2000. July 2004 Fishery Bulletin. Available from http://findarticles.com/p/articles/mi_m0FDG/is_3_102/ai_n6237283.

Ziel, H., L. M. F. Cameron, and P. L. Boveng. 2008. Spring diet of ribbon and spotted seals in the Bering Sea. National Marine Mammal Laboratory, Alaska Fisheries Science Center. Poster Presentation available from ftp://ftp.afsc.noaa.gov/posters/pZiel01_bs-seal-diet.pdf.

Section 8.2

AFSC (Alaska Fisheries Science Center). 2006. Summary of Seabird Bycatch in Alaskan Groundfish Fisheries, 1993 through 2004. Available at http://www.afsc.noaa.gov/refm/reem/doc/Seabird. Updated 13 April 2006.

Balogh, G. L. Piatt, J. Wetzel, and G. Drew. 2006. Opportunistic short-tailed albatross sightings database. U.S. Fish and Wildlife Service and U.S Geological Survey. Anchorage, AK.

Byrd, G. V., H .M. Renner, M. Renner. 2005. Distribution patterns and population trends of breeding seabirds in the Aleutian Islands. Fisheries Oceanography 14:139-159.

CCAMLR. 2006a. Report of the twenty-fifth meeting of the Scientific Committee (SC-CAMLR-XXV). Annex 5, Appendix D. Commission for the Conservation of Antarctic Marine Living Resources, Hobart, Australia.

Dietrich, K.S. and E.F. Melvin. 2007. Alaska Trawl Fisheries: Potential Interactions with North Pacific Albatrosses. WSG-TR 07-01 Washington Sea Grant, Seattle, WA.

Dietrich, K. S., E. F. Melvin, and L. Conquest. 2008. Integrated weight longlines with paired streamer lines – Best practice to prevent seabird bycatch in demersal longline fisheries. Biol. Cons. 141:1793-1805.

Drew, G.S.and John F. Piatt. 2006. The North Pacific Pelagic Seabird Database Users Manual. U.S. Geological Survey, Alaska Science Center, Anchorage, AK.

Hyrenbach K.D., R.C. Dotson. 2002. Assessing the susceptibility of female black-footed albatross (Phoebastria nigripes) to longline fisheries during their post-breeding dispersal: An integrated approach. Biological Conservation, 112 (3), pp. 391-404.

Melvin, E.F., M.D. Wainstein, K.S. Dietrich, K.L. Ames, T.O. Geernaert, and L.L. Conquest. 2006. The distribution of seabirds on the Alaskan longline fishing grounds: Implications for seabird avoidance regulations. Washington Sea Grant. Project A/FP-7.

Moloney, C.L., Cooper, J., Ryan, P.G. & Siegfried, W.R. 1994. Use of a population model to assess the impact of longline fishing on Wandering Albatross *Diomedea exulan/* populations. *Biological Conservation* 70:195-203.

Naughton, M. B, M. D. Romano, T. S. Zimmerman. 2007. A Conservation Action Plan for Black-footed Albatross (Phoebastria nigripes) and Laysan Albatross (P. immutabilis), Ver. 1.0.

NMFS. 1999a. Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis for a Regulatory Amendment to Revise Regulations for Seabird Avoidance Measures in the Hook-and-Line Fisheries Off Alaska to Reduce Bycatch of the Short-tailed Albatross and other Seabird Species. Draft for Public Review, Prepared by NMFS, Alaska Region Office, March, 98 pp.

NMFS. 2002a. Biological Opinion for Listed Species In the BSAI Groundfish Fishery Management Plan and the GOA Groundfish Fishery Management Plan.

NMFS. 2004a. Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries Implemented Under the Authority of the Fishery Management Plans for the Groundfish Fishery of the Gulf of Alaska and the Groundfish of the Bering Sea and Aleutian Islands Area. June 2004. DOC, NOAA, NMFS P.O. Box 21668, Juneau, AK 99802. Available at http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm.

NMFS 2004b. Evaluating Bycatch: A National Approach to Standardized Bycatch Monitoring Programs. NOAA Technical Memorandum NMFS-F/SPO-66. October 2004.

NMFS. 2005. Final environmental impact statement for essential fish habitat identification and conservation in Alaska (EFH EIS). NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska, April. URL: http://www.fakr.noaa.gov/habitat/seis/efheis.htm

NMFS 2006c. Environmental Assessment, Regulatory Impact Review, and Regulatory Flexibility analysis for Amendments 65/65/12/7/8 to the BSAI Groundfish FMP (#65), GOA Groundfish FMP (#65), BSAI Crab FMP (#12), Scallop FMP (#7), and Salmon FMP (#8) and Regulatory Amendments to Provide Habitat Areas of Particular Concern. April 2006.

NMFS. 2007. Final Environmental Impact Statement for the Alaska Groundfish Harvest Specifications. September 2006. National Marine Fisheries Service, Alaska Region, P.O. Box 21668, Juneau, Alaska 99802-1668. Available http://www.fakr.noaa.gov/analyses/specs/eis/default.htm.

NMFS 2008. Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis for a regulatory amendment to revise regulations for seabird avoidance measures in the hook-and-line fisheries off Alaska to reduce the incidental take of the short-tailed albatross and other seabird species.

NPPSD (North Pacific Pelagic Seabird Database). 2004. Short-tailed Albatross, Version 2004.06.15., USGS Alaska Science Center & U.S. Fish and Wildlife Service, Anchorage. www.absc.usgs.gov/research/NPPSD/

Piatt, J.F., J. Wetzel, K. Bell, A.R. DeGange, G.R. Balogh, G.S. Drew, T. Geernaert, C. Ladd, and G.V. Byrd. 2006. Predictable hotspots and foraging habitat of the endangered short-tailed albatross (Phoebastria albatrus) in the North Pacific: Implications for conservation. Deep-Sea Research II 53:387-398.

Suryan, R. M., K.S. Dietrich, E.F. Melvin, G.R. Balogh, F. Sato, and K. Ozaki. 2006a. Migratory routes of short-tailed albatrosses: Use of exclusive economic zones of North Pacific Rim countries and spatial overlap with commercial fisheries in Alaska. Biological Conservation in review.

Suryan, R. M., F. Sato, G.R. Balogh, K.D. Hyrenbach, R.P Sievert, and K. Ozaki. 2006b. Foraging destinations and marine habitat use of short-tailed albatrosses: A multi-scale approach using first-passage time analysis. Deep-Sea Research II 53: 370-386.

USFWS (United States Fish and Wildlife Service). 1998. Section 7 Consultation - Biological Opinion <http://www.fakr.noaa.gov/protectedresources/seabirds/section7/pachalibut.pdf> for Pacific Halibut Fisheries in Waters Off Alaska, March 13, 1998.

USFWS 1999. Beringian Seabird Colony Catalog manual for censusing seabird colonies. U.S. Fish and Wildlife Service Report, Migratory Bird Management. Anchorage, Alaska. 27 pp.

USFWS. 2001a. Federal Register Notice 50 CFR Part 17 US Fish and Wildlife Service. Feb 2001. RIN 1018-AF92. pp. 9146-9185. Final Determination of Critical Habitat for the Spectacled Eider.

USFWS 2001b. Federal Register Notice 50 CFR Part 17 US Fish and Wildlife Service. Feb 2001. RIN 1018-AF95. pp. 8850-8884. Final Determination of Critical Habitat for the Alaska breeding Population of Steller's Eider.

USFWS. 2002. Birds of conservation concern 2002. Division of Migratory Bird Management, Arlington, Virginia. 99 pp. Online version available at http://migratorybirds.fws.gov/reports/bcc2002.pdf

USFWS. 2003a. "Programmatic Biological Opinion on the effects of the Fishery Management Plans (FMPs) for the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI) groundfish fisheries on the endangered short-tailed albatross (Phoebastria albatrus) and threatened Steller's eider (Polysticta stelleri)". Anchorage Fish and Wildlife Field Office. Available from NMFS website: http://www.fakr.noaa.gov/protectedresources/seabirds.html.

USFWS. 2003b. Biological Opinion on the Effects of the Total Allowable Catch-Setting Process for the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries to the Endangered Short-tailed Albatross (Phoebastria albatrus) and Threatened Steller's Eider (Polysticta stelleri), September 2003. Available from http://www.fakr.noaa.gov/protectedresources/seabirds/section7/biop0903/esaseabirds.pdf. 42 pp.

USFWS. 2004. Federal Register: May 4, 2004 (Volume 69, Number 86)] [Page 24875-24904] Part III 50 CFR Part 17. Kittlitz's murrelet (Brachyramphus brevirostris) assigned a listing priority number of 5.

USFWS. 2006. Report to the North Pacific Fishery Management Council, October 2006. Agenda Item B(5).

Zador, S.G., Parrish, J.K., Punt, A.E., Burke, J.L., Fitzgerald, S.F., 2008. Determining spatial and temporal overlap of an endangered seabird with a large commercial trawl fishery. Endangered Species Research. Vol. 5 No. 2-3

Zador, SG, A.E. Punt, J.K. Parrish. 2008. Population impacts of endangered short-tailed albatross bycatch in the Alaskan trawl fishery. Biol Conserv 141: 872-882.

Section 8.3

Boldt, J. L. (editor). 2007. Ecosystem considerations for 2007: Appendix C of the BSAI\GOA stock assessment and fishery evaluation reports (SAFE documents). North Pacific Fishery Management Council, Anchorage, Alaska. URL: http://access.afsc.noaa.gov/reem/ecoweb/EcoChaptMainFrame.htm

MMS (Minerals Management Service). 2003. Cook Inlet planning area oil and gas lease sales 191 and 199, Final Environmental Impact Statement, MMS-2003-055, U.S. Dep. of Interior, Minerals Management Service, Alaska OCS Region, Anchorage, Alaska.

NMFS. 2005. Final environmental impact statement for essential fish habitat identification and conservation in Alaska (EFH EIS). NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska, April. URL: http://www.fakr.noaa.gov/habitat/seis/efheis.htm

Section 8.4

Bering Sea Interagency Working Group. 2006. Climate change and the Bering Sea ecosystem: An integrated, interagency/multi-institutional approach, Workshop held 8 April 2005, Seattle, WA. AFSC Processed Rep. 2006-01, 30 p. Alaska Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115. URL: http://www.afsc.noaa.gov/Publications/ProcRpt06.htm

Boldt, J. L. (editor). 2007. Ecosystem considerations for 2007: Appendix C of the BSAI\GOA stock assessment and fishery evaluation reports (SAFE documents). North Pacific Fishery Management Council, Anchorage, Alaska. URL: http://access.afsc.noaa.gov/reem/ecoweb/EcoChaptMainFrame.htm

Iglesias-Rodriguez, D., P. Halloran, R. Rickaby, I. Hall, E. Colmenero-Hidalgo, J. Gittins, D. Green, T. Tyrrell, S. Gibbs, P. von Dassow, E. Rehm, V. Armbrust, K. Boessenkool. 2008. Phytoplankton calcification in a high CO2 world. Science. Friday, 18 April 2008.

Kleypas, J.A., R.A. Feely, V.J. Fabry, C. Langdon, C.L. Sabine, and L.L. Robbins, 2006. Impacts of Ocean Acidification on Coral Reefs and Other Marine Calcifiers: A Guide for Future Research, report of a workshop held 18–20 April 2005, St. Petersburg, FL, sponsored by NSF, NOAA, and the U.S. Geological Survey, 88 pp. URL: http://www.ucar.edu/communications/Final_acidification.pdf

Kruse, G. 1998. Salmon run failures in 1997-1998: A link to anomalous ocean conditions. Alaska Fishery Research Bulletin, 5(1):55-63.

NMFS. 2005a. Final environmental impact statement for essential fish habitat identification and conservation in Alaska (EFH EIS). NMFS Alaska Regional Office, PO Box 21668, Juneau, Alaska. April. URL: http://www.fakr.noaa.gov/habitat/seis/efheis.htm

NMFS. 2005b. New priorities for the 21st Century: National Marine Fisheries Service strategic plan updated for FY 2005-FY 2010. U.S. Dep. of Commer., NOAA, NMFS, Silver Spring, Maryland. URL: http://www.nmfs.noaa.gov/mb/strategic/NMFSstrategicplan200510.pdf

NPFMC. 2007. Stock Assessment and Fishery Evaluation Report for the groundfish resources of the Bering Sea/Aleutian Islands region. URL: http://www.afsc.noaa.gov/REFM/Docs/2007/BSAISafe.pdf

NPFMC. 2005. Stock Assessment and Fishery Evaluation Report for the groundfish resources of the Bering Sea/Aleutian Islands region. URL: http://www.afsc.noaa.gov/refm/stocks/Historic_Assess.htm

Orensanz, J.L., B. Ernst, D. Armstrong, P. Stabeno, and P. Livingston. 2004. Contraction of the geographic range of distribution of snow crab (Chionoecetes opilio) in the eastern Bering Sea: An environmental ratchet? Calif. Coop. Fish. Invest. Rep. 45: 65-79.

Overland, J.E., and P.J. Stabeno. 2004. Is the Climate of the Bering Sea Warming and Affecting the Ecosystem? Eos Trans. Am. Geophys. Union, 85(33): 309–316.

Rodionov, S., P. Stabeno, J. Overland, N. Bond, S. Salo. 2005. Temperature and ice cover – FOCI. In J.L. Boldt (Ed.) Ecosystem Considerations for 2006. Appendix C of the BSAI\GOA Stock Assessment and Fishery Evaluation Reports. North Pacific Fishery Management Council, 605 W. 4th Ave., Suite 306, Anchorage, AK 99501

Spencer, P. 2005. Relationships between EBS flatfish spatial distributions and environmental variability from 1982-2004. In J.L. Boldt (Ed.) Ecosystem Considerations for 2006. Appendix C of the BSAI\GOA Stock Assessment and Fishery Evaluation Reports. North Pacific Fishery Management Council, 605 W. 4th Ave., Suite 306, Anchorage, AK 99501

Stabeno, P, J. Napp, T. Whitledge. 2006. Long-term observations on the Bering Sea shelf (2004-2005): Biophysical moorings at sites 2 and 4 as sentinels for ecosystem change. NPRB Project 410 Final Report. http://doc.nprb.org/web/04_prjs/f0410_final_report.pdf

Wyllie-Echeverria, T. 1995. Sea-ice conditions and the distribution of walleye pollock (Theragra chalcogramma) on the Bering and Chukchi Sea shelf. In Climate Change and Northern Fish Populations, R.J. Beamish (ed.), Can. Spec. Publ. Fish. Aquat. Sci.: 121, 131–136.

Chapter 9

Alaska, State of. Department of Commerce and Economic Development. n.d. Wade Hampton Census Area: Tourism. Web page.

Alaska Department of Commerce, Community, and Economic Development. n.d. Alaska Economic Information System. Web site accessed at http://www.dced.state.ak.us/dca/AEIS/AEIS_Home.htm on August 21, 2008.

Alaska, State of. Department of Commerce, Community, and Economic Development (ADCCED). N.D. Community Development Quota (CDQ). Webpage accessed at http://www.commerce.state.ak.us/bsc/CDQ/cdq.htm on April 22, 2008.

Alaska Migratory Bird Co-Management Council (AMBCC). n.d. Website. Accessed at http://alaska.fws.gov/ambcc/ on April 23, 2008.

Ballew, C. A. Ross, R.S. Wells, V. Hiratsuka. 2004. Final Report on the Alaska Traditional Diet Survey. Alaska Native Health Board and Alaska Native Epidemiology Center. March. Accessed at: http://www.nativescience.org/assets/Documents/PDF%20Documents/ATDP_final.pdf

Federal Subsistence Management Program (FSMP). n.d. Website. Accessed at http://alaska.fws.gov/asm/index.cfm on April 23, 2008.

Fienup-Riordan, Ann. 1990. Eskimo Essays. Rutgers University Press. New Brunswick, N.J.

Krauss, Michael E. 1982. Native Peoples and Languages of Alaska. Map. Alaska Native Language Center. University of Alaska, Fairbanks. Fairbanks, Alaska.

Langdon, Steve J. 2002. The Native People of Alaska. Traditional Living in a Northern Land. Greatland Graphics. Anchorage, Alaska.

Magdanz, James. 2007. Customary Trade of Fish in the Norton Sound-Port Clarence Area Proposal 148. Briefing Note. Alaska Department of Fish and Game Division of Subsistence. January 8, 2007.

Magdanz, James. Eric Trigg, Austin Ahmasuk, Peter Nanouk, David Koster, and Kurt Kamletz. 2005. Patterns and Trends in Subsistence Salmon Harvests, Norton Sound and Port Clarence. Alaska Department of Fish and Game Division of Subsistence Technical Paper 294. Department of Natural Resources, Kawerak, Inc and Division of Subsistence. Nome and Juneau. August 2005.

Moncrieff, Catherine F. 2007. Traditional Ecological Knowledge of Customary Trade of Subsistence Harvested Salmon on the Yukon River. Final Report to the Office of Subsistence Management, Fisheries Information Services, Study 04-265. Yukon River Drainage Fisheries Association. Anchorage. July.

NMFS. n.d. Questions and Answers about Purchasing or Possessing Marine Mammal Skins, Muktuk, Baleen, and Bones. Web page accessed at http://www.fakr.noaa.gov/protectedresources/buying.htm on April 25, 2008.

NMFS. 1996. Environmental Assessment and Regulatory Impact Review for Amendment 26 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Island Area and Amendment 29 to the Fishery Management Plan for Groundfish of the Gulf of Alaska; NMFS-Authorized Distribution of Salmon Bycatch in the Groundfish Fisheries Off Alaska to Economically Disadvantaged Individuals. NMFS, P.O. Box 21668, Juneau, AK 99801. 32 p.

NMFS. 2003. Final Programmatic Environmental Impact Statement for Pacific Salmon Fisheries Management off the Coasts of Southeast Alaska, Washington, Oregon, and California, and in the Columbia River Basin. National Marine Fisheries Service, Northwest Region, Alaska Department of Fish and Game, Cooperating Agency. Seattle, WA. November 2003.

NMFS. 2003. Regulatory Impact Review for a Proposed Rule to Allow Processors to Use Offal from Prohibited Species for Fish Meal. NOAA Fisheries, P.O. Box 21668, Juneau, AK 99801. 12 p.

NMFS. 2004. Puget Sound Chinook Harvest Resource Management Plan. Final Environmental Impact Statement. National Marine Fisheries Service Northwest Region with assistance from the Puget Sound Treaty Tribes and Washington Department of Fish and Wildlife. Seattle, WA. December 2004.

NMFS. 2004. Programmatic supplemental environmental impact statement for the Alaska Groundfish Fisheries implemented under the authority of the fishery management plans for the groundfish fishery of the Gulf of Alaska and the groundfish fishery of the Bering Sea and Aleutian Islands (PSEIS). NMFS Alaska Regional Office. Juneau, AK. Accessed at http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm on April 25, 2008.

NMFS. 2005. Setting the Annual Subsistence Harvest of Northern Fur Seals on the Pribilof Islands. Final Environmental Impact Statement. National Marine Fisheries Service Alaska Regional Office. Juneau, AK. May 2005. Accessed at http://www.fakr.noaa.gov/protectedresources/seals/fur/eis/final0505.pdf on April 25, 2008.

NMFS. 2007. Alaska Groundfish Harvest Specifications Final Environmental Impact Statement. National Marine Fisheries Service Alaska Regional Office. Juneau, AK. January 2007. Accessed at http://www.fakr.noaa.gov/analyses/specs/eis/default.htm on April 24 2008

NMFS. 2008. Bering Sea Salmon Bycatch Management Environmental Impact Statement Scoping Report. National Marine Fisheries Service Alaska Regional Office. Juneau, AK. March 2008. Accessed at http://www.fakr.noaa.gov/sustainablefisheries/bycatch/default.htm.

NPFMC. 2008. Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area. Anchorage, Alaska. April 2008. Accessed at http://www.fakr.noaa.gov/npfmc/fmp/bsai/BSAI.pdf on April22, 2008.

Northern Economics. 2002. An Assessment of the Socioeconomic Impacts of the Western Alaska Community Development Program. Report prepared for the Alaska Department of Community and Economic Development Division of Community and Business Development. Anchorage, Alaska. November 2002.

Pacific Fishery Management Council. 2008. Review of 2007 Ocean Salmon Fisheries. 7700 NE Ambassador Place, Suite 101, Portland OR. February.

SeaShare. 2008. Application for Permit renewal to operate as NMFS Authorized Distributor of Salmon. SeaShare, 600 Ericksen Avenue, Suite 310, Bainbridge Island, WA 98110. 21 p.

The United States and Canada Yukon River Joint Technical Committee. 2008. Regional Information Report No. 3A08-01. Yukon River Salmon 2007 Season Summary and 2008 Season Outlook. Alaska Department of Fish and Game, Division of Commercial Fisheries. 333 Raspberry Rd., Anchorage, AK 99518. March 2008.

University of Alaska Cooperative Extension Service. 2007. Cooperative Extension Service Food Cost Survey. University of Alaska Fairbanks. December 2007. Accessed at: http://www.uaf.edu/ces/fcs/index.html on April 18, 2008.

Wolfe, Robert J. 1984. Commercial Fishing in the Hunting-Gathering Economy of a Yukon River Yup'ik Society. Etudes/Inuit/Studies. 8 (special issue): 159-183.

Wolfe, Robert J. and Robert J. Walker. 1987. Subsistence Economies in Alaska: Productivity, Geography, and Development Impacts. Arctic Anthropology. 24(2):56-81.

Ch 10 References

ADF&G, 2008. Yukon River Salmon Fisheries Outlook, 2008. Alaska Department of Fish and Game, Division of Commercial Fisheries. Fairbanks Alaska. April, 2008.

ADF&G. 2007a. Kotzebue Sound Salmon Season Summary, 2007. Alaska Department of Fish and Game, Division of Commercial Fisheries News Release. Alaska Department of Fish and Game. Anchorage, Alaska. October 1, 2007

ADF&G, 2007b. Kuskokwim Area Regulatory Changes, Salmon Outlook, and Management Strategies, 2007. Department of Fish and Game, Division of Commercial Fisheries. Bethel, Alaska. April 2007

ADF&G, 2007c. Kuskokwim Area Salmon Fishery Summary, Preliminary 2007. Department of Fish and Game, Division of Commercial Fisheries. Bethel, Alaska. September 2007.

ADF&G, 2007d. Norton Sound Salmon Season Summary, 2007. Alaska Department of Fish and Game, Division of Commercial Fisheries. Anchorage Alaska. October 2007.

ADF&G, 2007e. Yukon River Summer Season Summary, 2007 Preliminary. Alaska Department of Fish and Game, Division of Commercial Fisheries. Anchorage Alaska. September 2007.

Buklis, L.S. 1999. A description of economic changes in commercial salmon fisheries in a region of mixed subsistence and market economies [Arctic-Yukon-Kuskokwim]. Arctic, v. 52 no. 1. March 1999 pp 40-48.

Bue, F.J., Hayes S.J. 2007. 2005 Yukon Area Subsistence, Personal Use, and Commercial Salmon Fisheries Outlook and Management Strategies. Fishery Management Report No. 3A07-04. Alaska Department of Fish and Game, Division of Commercial Fisheries. Anchorage Alaska. May, 2007

Bue, F.J., Lingnau, T.L. 2005. 2005 Yukon Area Subsistence, Personal Use, and Commercial Salmon Fisheries Outlook and Management Strategies. Fishery Management Report NO.05-31. Alaska Department of Fish and Game, Division of Commercial Fisheries. Anchorage Alaska. May, 2005

Dye J.E., Schwanke C. J., and Jaecks T.A. 2006. Report to the Alaska Board of Fisheries for the Recreational Fisheries of Bristol Bay, 2004, 2005, and 2006. Alaska Department of Fish and Game. Anchorage Alaska. November 2006.

Fall J.A., Krieg, T. 2006. An Overview of the Subsistence Fisheries of the Bristol Bay Management Area. Division of Subsistence Alaska Department of Fish and Game 333 Raspberry Road, Anchorage, AK, 99518. December, 2006.

Hyatt, T.R. et.al. 2007. Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Island Area: Economic Status of the Groundfish Fisheries off Alaska, 2006. Economic and Social Sciences Research Program Alaska Fisheries Science Center National Marine Fisheries Service National Oceanic and Atmospheric Administration 7600 Sand Point Way N.E. Seattle, Washington 98115-6349 October 2007. 354 pp.

Henderson, M.M., Criddle, K.R., and Lee, S.T. 1999. The Economic Value of Alaska's Copper River Personal Use and Subsistence Fisheries. Alaska Fisheries Research Bulletin. 6(2):63-69.

Layman, C.R., Boyce, J.R., and Criddle, K.R. 1996. Economic Valuation of the Chinook Salmon Sport Fishery of the Gulkana River, Alaska, Under Current and Alternate Management Plans. Land Economics; 72(1) 113-128, February 1996.

Menard, J. 2007a. Kotzebue Sound Salmon Fisheries Management Plan. 2007. Regional Information Report No. 3A07-06. Alaska Department of Fish and Game. Anchorage, Alaska. May 2007.

Menard, J. 2007b. 2007 Norton Sound Salmon Fisheries Management Plan. Regional Information Report No. 3A07-05. Alaska Department of Fish and Game. Anchorage, Alaska. December 2003.

Myers, K., R.V. Walker, N.D. Davis and J.L. Armstrong. 2004. High Seas Salmon Research Program, 2003. SAFS-UW-0402, School of Aquatic and Fishery Sciences, University of Washington, Seattle. 93p.

NMFS. 2003. Regulatory Impact Review for a Proposed Rule to Allow Processors to Use Offal from Prohibited Species for Fish Meal. NOAA Fisheries, P.O. Box 21668, Juneau, Alaska 99801. 12 p.

NMFS. 1996. Environmental Assessment and Regulatory Impact Review for Amendment 26 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Island Area and Amendment 29 to the Fishery Management Plan for Groundfish of the Gulf of Alaska; NMFS-Authorized Distribution of Salmon Bycatch in the Groundfish Fisheries Off Alaska to Economically Disadvantaged Individuals. NMFS, P.O. Box 21668, Juneau, Alaska 99801. 32 p.

Sands et al. 2008. 2007 Bristol Bay Area Annual Management Report. Fishery Management Report No. 08-28. Alaska Department of Fish and Game. Anchorage, Alaska. May 2008

SeaShare. 2008. Application for Permit renewal to operate as NMFS Authorized Distributor of Salmon. SeaShare, 600 Ericksen Avenue, Suite 310, Bainbridge Island, Washington, 98110. 21p.

Ward, T.C., Coffing, M., Estensen, J., Fisher, R., Molyneaux, D. 2003., Annual Management Report for the Subsistence and Commercial Fisheries of the Kuskokwim Region. Regional Information Report No. 3A03-27. Alaska Department of Fish and Game. Fairbanks, Alaska. December 2003.

Windish-Cole, B. 2008. Permission to use ADOLWD web content. Personal Communication, April 2008.

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15.0 INDEX