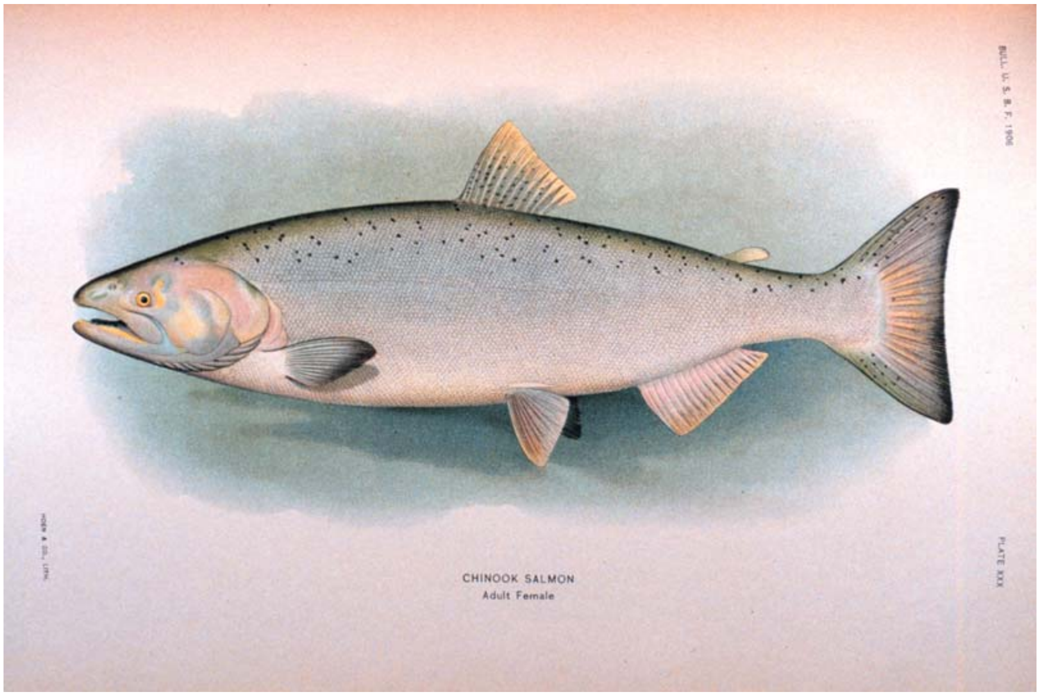
Bering Sea Chinook Salmon Bycatch Management

Volume I
Final Environmental Impact Statement



North Pacific Fishery Management Council

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

December 2009

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FINAL ENVIRONMENTAL IMPACT STATEMENT

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Abstract: The Environmental Impact Statement (EIS) provides decision-makers and the public with an evaluation of the environmental effects of alternative measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. The alternatives analyzed in this EIS 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 and other applicable federal law. The Regulatory Impact Review, in Volume II, provides decision-makers and the public with an evaluation of the social and economic effects of these alternatives to address the requirements of Executive Order 12866, Executive Order 12898, and other applicable federal law.

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EXECUTIVE SUMMARY

This executive summary summarizes the Bering Sea Chinook Salmon Bycatch Management Final Environmental Impact Statement (EIS) and Final Regulatory Impact Review (RIR). The EIS and RIR provide 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). The Draft EIS/RIR/Initial Regulatory Flexibility Analysis served as the central decision-making document for the Council to recommend Amendment 91 to the Secretary of Commerce. This Final EIS is intended to 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 Final EIS, Volume I, complies with the National Environmental Policy Act (NEPA) and other applicable federal law. The Final RIR, Volume II, complies with Executive Order 12866 and Executive Order 12898 and other applicable federal law. The final Initial Regulatory Flexibility Analysis will be published in the classifications section of the preamble to the proposed rule.

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. 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.

Amendment 91 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, Amendment 91 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, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such 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, Amendment 91 must minimize Chinook salmon bycatch in the Bering Sea pollock fishery to the extent practicable while achieving optimum yield. 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 examines five alternatives to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. The EIS evaluates the environmental consequences of each of these alternatives with respect to ten 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

The RIR evaluates the social and economic consequences of the alternatives with respect to three major issues:

- economic impacts and net benefits to the Nation
- Alaska Native, non-native minority, and low income populations
- 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 derives from the products produced from pollock: roe (eggs), surimi, and fillet products. In 2007, the total value of pollock harvested off Alaska was estimated to be $1.248 billion. In 2008, the total value of pollock increased to an estimated $1.415 billion. Table ES-1 shows the number of participating vessels in the Bering Sea pollock fishery and the pollock total allowable catch (TAC) in metric tons from 2003 to 2009.

Until 1998, the Bering Sea pollock fishery was managed as an open access fishery, commonly characterized as a "race for fish." In October 1998, Congress enacted the American Fisheries Act (AFA) to rationalize the fishery by identifying the vessels and processors eligible to participate in the Bering Sea pollock fishery and allocating specific percentages of the Bering Sea directed pollock fishery TAC among the competing sectors of the fishery. Each year, NMFS apportions the pollock TAC among the inshore catcher vessel (CV) sector, offshore catcher/processor (CP) sector, and mothership sector after allocations are made to the Community Development Quota (CDQ) Program and incidental catch allowances.

The Bering Sea pollock TAC is divided into two seasons –the A season (January 20 to June 10) and the B season (June 10 to November 1). Typically, the fleet targets roe –bearing females in the A season and harvests the A season TAC by early April. The B season fishery focuses on pollock for filet and surimi markets and the fleet harvests most of the B season TAC in September and October.

The AFA also allowed for development of pollock fishing cooperatives. 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 percent of the pollock TAC and 7.5 percent of the Bering Sea Chinook salmon prohibited species catch limit to the CDQ Program.

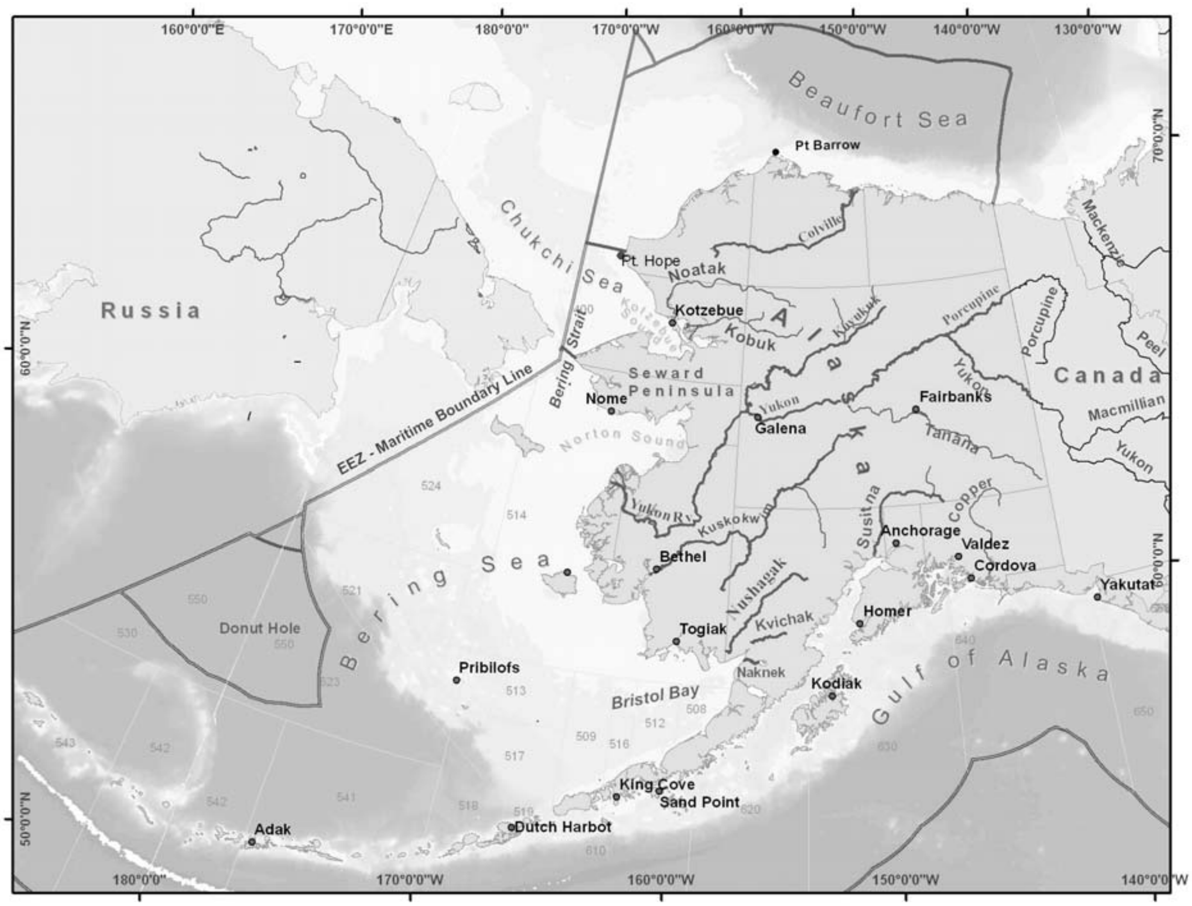

Fig.ES -1 Map of the Bering Sea and major connected salmon producing rivers in Alaska and Northwest Canada

Salmon Bycatch in the Pollock Fishery

Pacific salmon are caught incidentally in the Bering Sea pollock fishery. Pollock is harvested with fishing vessels using trawl gear, which are large nets towed through the water. Salmon in the Bering Sea occur in the same locations and depths as pollock and are, therefore, caught in the nets as fishermen target pollock. Of the five species of Pacific salmon, Chinook salmon (*Oncorhynchus tshawytscha*) and chum salmon (*O. keta*) are caught most often in the pollock fishery.

NMFS recognizes the cultural and economic significance of salmon. NMFS also recognizes that salmon are fully allocated and used in subsistence, commercial, and recreational fisheries in and off Alaska and, in the case of Chinook and chum salmon, in Canada. Therefore, NMFS manages Chinook salmon and all other species of salmon (a category called non-Chinook salmon) as prohibited species in the BSAI groundfish fisheries, including the Bering Sea pollock fishery. As a prohibited species, salmon must be avoided as bycatch, and any salmon caught must either be donated to the Prohibited Species Donation Program or be returned to the sea as soon as is practicable, with a minimum of injury, after an observer has determined the number of salmon and collected any scientific data or biological samples.

The Council and NMFS decided to give priority to Chinook salmon bycatch management and limited the scope of this action to Chinook salmon, because Chinook salmon is a highly valued species and specific protection measures are warranted. The Council and NMFS are considering how to address non-Chinook salmon (primarily chum salmon) bycatch in the Bering Sea pollock trawl fishery is a separate action. Until then, existing non-Chinook salmon bycatch control measures will remain in effect.

Several management measures are currently used to reduce salmon bycatch in the Bering Sea pollock fishery. In the mid-1990s, the Chinook Salmon Savings Areas, which are large area closures, 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.

From 1992 through 2002, the annual average Chinook salmon bycatch in the pollock fishery was 32,665 Chinook salmon. Chinook salmon bycatch numbers increased substantially from 2003 to 2007. The average bycatch from 2003 to 2007 was 74,067 Chinook salmon, with a peak of approximately 122,000 Chinook salmon taken as bycatch in 2007. Table ES-1 shows the number of Chinook salmon taken as bycatch from 2003 to 2009. In 2008 and 2009, Chinook salmon bycatch in the Bering Sea pollock fishery decreased substantially from these historic high levels. The 2008 Chinook salmon bycatch estimate was 20,559 Chinook salmon. The preliminary estimate for 2009 is 12,410 Chinook salmon.

Table ES-1 The number of participating vessels in the Bering Sea pollock fishery, the pollock total allowable catch (TAC) in metric tons (t), and the number of Chinook salmon taken as bycatch from 2003 to 2009 (data retrieved on 11/05/2009).[1]

Year	Number of pollock fishing vessels	Pollock TAC (t)	Chinook salmon bycatch (numbers of fish)
2003	107	1,491,760	45,794
2004	109	1,492,000	51,696
2005	106	1,478,000	67,396
2006	103	1,487,756	82,694
2007	105	1,394,000	121,638
2008	106	1,000,000	20,559
2009	103	815,000	12,410

Variation in the total number of Chinook salmon taken each year, and in the seasonal and sector distribution of that catch, is significant. The unpredictability of Chinook salmon encounters in the pollock fishery results from the current lack of understanding of the biological and oceanographic

[1] Chinook salmon bycatch is estimated using the NMFS Catch Accounting System (CAS). The CAS continually revises past bycatch estimates based on new information. Therefore, these numbers change slightly depending on when the analyst retrieved the data from the CAS. NMFS periodically revises the bycatch estimates and posts the most recent estimates on the NMFS Alaska Region webpage at: http://www.fakr.noaa.gov/sustainablefisheries/inseason/chinook_salmon_mortality.pdf. EIS Chapter 3 provides more detailed information on the CAS.

conditions that result in these encounters. In years of historically high Chinook salmon losses to the Bering Sea pollock fishery (2003-2007), the rate of Chinook salmon bycatch averaged 52 Chinook salmon per 1,000 tons of pollock harvested. At this catch rate, Chinook salmon encounters are difficult to predict, let alone to avoid, without vessel cooperation to share information about areas of high Chinook salmon encounters rates. The causes of the decline in Chinook salmon bycatch in 2008 and 2009 are unknown but most likely are a result of a combination of factors including changes in Chinook salmon and pollock abundance and distribution, and changes in fleet behavior to avoid bycatch.

As Chinook salmon bycatch increased in the Bering Sea pollock fishery thought 2007, many Chinook salmon runs in western Alaska declined. Although there are many factors potentially contributing to the reductions in historic run strength, measures to minimize Chinook salmon losses to the trawl fishery could allow more Chinook salmon to remain in the ocean and return to in-river systems. Salmon dependent communities rely on strong salmon runs with more Chinook salmon entering river systems to spawn than are necessary to meet the minimum escapement thresholds. Historically, Chinook salmon numbers returning to western Alaska's rivers have typically exceeded the escapement level needed to sustain the run. This amount of Chinook salmon, over and above the escapement goal, is fully allocated to subsistence, commercial, recreational, or personal-use fisheries.

The Council started considering revisions to existing Chinook salmon bycatch management measures 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 Chinook 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. Since 2006, all AFA cooperatives and all six of the CDQ groups have participated in a salmon bycatch reduction ICA and have been exempt from closures of the Chinook Salmon Savings Areas in the Bering Sea.

In light of the high amount of Chinook salmon bycatch through 2007, the Council and NMFS are considering new measures to minimize bycatch to the extent practicable while achieving optimum yield. 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, and despite the 2008 and 2009 decrease in Chinook salmon bycatch, concerns remain that, under the status quo, the potential exists for a high amount of Chinook salmon bycatch such as experienced in 2007.

Description of Alternatives

EIS Chapter 2 describes and compares five 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: Hard caps with an intercooperative agreement

Alternative 5: Preferred Alternative - Hard caps with incentive plan agreements and a performance standard

The alternatives analyzed in the EIS and RIR generally involve limits or "caps" on the number of Chinook salmon that may be caught in the Bering Sea pollock fishery and closures 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.

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 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 hard cap amount and how to divide the total cap between the A and B season, (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 CV cooperatives.

Setting the Hard Cap

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

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

Suboption	Overall fishery cap	CDQ cap	Non-CDQ cap (all sectors combined)
i)	87,500	6,562	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
87,500	6,563	80,938
68,100	5,108	62,993
48,700	3,653	45,048
29,300	2,198	27,103

Seasonal division 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).

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

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

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.

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. 2004-06)	3%	70%	6%	21%
Option 2b (hist. avg. 2002-06)	4%	65%	7%	25%
Option 2c (hist. avg. 1997-06)	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, Alternative 2 could include the ability to transfer sector and cooperative allocations and/or rollover unused salmon bycatch (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 could 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 closure areas in the Bering Sea 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 15, the B season areas would not close until August 15. If triggered anytime after August 15, the area would close immediately and remain closed for the duration of the season. Fig. ES-1 provides a map of the larger area.

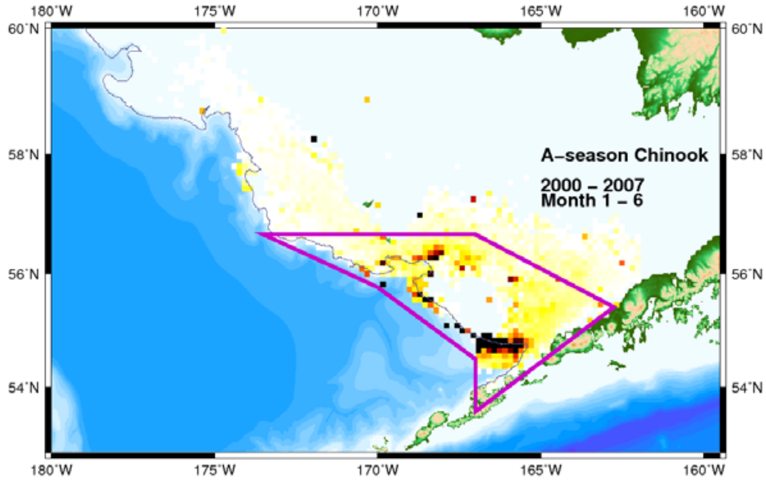

Fig. ES-2 Proposed A season area closure under Alternative 3.

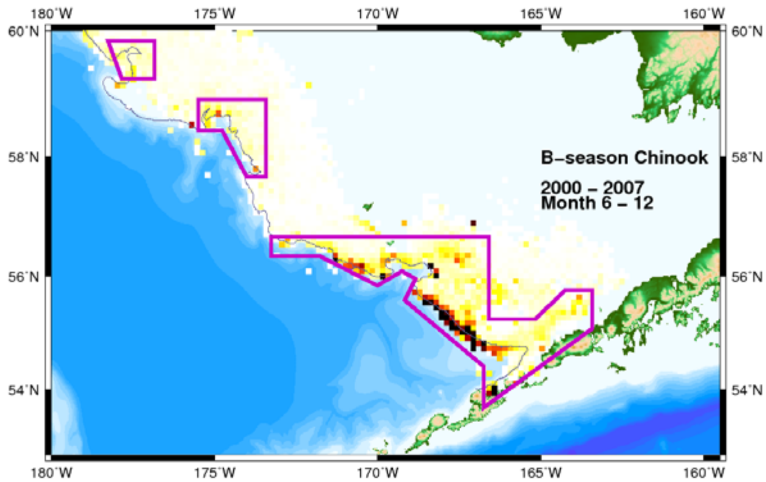

Fig. ES-3 Proposed B season area closures under Alternative 3. Note: all three areas would close simultaneously on or after August 15.

Alternative 4: Hard caps with an intercooperative agreement

Alternative 4 consists of two separate 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 pollock fishing to cease for the remainder of that season. Annual scenario 1 (AS1) 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, 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 (AS2) 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 at the inshore CV cooperative level and among CDQ groups) are identical for both the AS1 high cap and the AS2 cap. Each cap would be apportioned 70 percent to the A season and 30 percent to the B season.

Annual Scenario 1 (AS1)

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 stop fishing or be subject to an enforcement action if it exceeded its allocation.

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 its 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, showing both the sector allocation as a percentage and in numbers of Chinook salmon

	Annual scenario 1 (AS1)				Annual scenario 2 (AS2) 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.

Annual Scenario 2 (AS2)

Under AS2, 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 47,591 Chinook salmon cap would be subject to the same seasonal apportionments, sector allocations, and rollover and transfer provisions described for the 68,392 Chinook salmon high cap (Table ES-7).

Annual Scenario 1 combined with Annual Scenario 2

If AS1 and AS2 were combined, 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 the 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.

Alternative 5: Preferred Alternative - Hard caps with incentive plan agreements and a performance standard

Alternative 5 contains two different overall Chinook salmon caps (60,000 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 incentive plan agreement (IPA),[2] that establishes an incentive program to keep Chinook salmon bycatch below the 60,000 Chinook salmon cap. Alternative 5 would rely on the cap to limit Chinook salmon bycatch in all years and, if the IPA works as intended by the Council, it would provide incentives to keep bycatch below the cap. The 47,591 Chinook salmon cap would apply fleet-wide if industry does not form any IPAs. Both caps would be divided between the A and B seasons and allocated to sectors, cooperatives, and CDQ groups.

Alternative 5's combination of the high cap, transferable allocations, and one or more IPAs is intended to provide a more flexible and responsive approach to minimizing salmon bycatch than would be achieved by a cap alone. The high bycatch cap of 60,000 Chinook salmon alone would be unlikely to meet the conservation objectives of the Council and would not be expected to minimize Chinook salmon bycatch in most years. Likewise, the bycatch cap of 47,591 Chinook salmon on its own would not provide the desired flexibility to accommodate the high variability in Chinook salmon encounters and the difficulty of avoiding salmon encounters in certain years. Therefore, the Council combined the 60,000 Chinook salmon hard cap with an IPA to encourage Chinook salmon avoidance in all years with the goal that actual salmon bycatch would be below the cap.

To ensure Chinook salmon savings regardless of whether an IPA successfully minimizes bycatch at all levels of salmon encounters, Alternative 5 contains a sector level performance standard. For a sector to continue to receive Chinook salmon bycatch allocations under the 60,000 Chinook salmon cap, that sector may not exceed its performance standard in any three years within seven consecutive years. If a sector

[2] The term IPA under Alternative 5 is the same concept as the ICA under Alternative 4. The term IPA is used under Alternative 5 because participation in the IPA is not limited to AFA cooperatives as it may include individual vessel owners or CDQ groups. In addition, more than one IPA may be approved and an IPA could be created by a single cooperative (so it does not have to involve more than one cooperative or be an agreement among cooperatives).

fails this performance standard, it will permanently be allocated a portion of the 47,591 Chinook salmon cap.

Hard Cap Allocations

Under Alternative 5, each year NMFS would determine the amount of transferable Chinook salmon bycatch allocations available to sectors, cooperatives, and CDQ groups based on their participation in a NMFS-approved IPA and a sector's past bycatch relative to its performance standard. Once each sector, cooperative, or CDQ group reaches its specific allocation in a season, vessels in that sector would be prohibited from pollock fishing for the remainder of that season.

In the absence of any NMFS-approved IPAs, the 47,591 Chinook salmon would be available to the fleet. If some or all fishery participants form one or more IPAs that meet the criteria in regulations, then the high cap of 60,000 Chinook salmon would be available to the fleet. Both the 60,000 Chinook salmon cap and the 47,591 Chinook salmon cap would be allocated to sectors, cooperatives, and the CDQ Program using a method that recognizes that sectors have different fishing patterns and needs for Chinook salmon bycatch in order to harvest their AFA pollock allocation. Table ES-8 shows the percentage allocations and the corresponding Chinook salmon cap levels in each season for each sector. Under the 60,000 and the 47,591 Chinook salmon caps, the inshore and CDQ sector allocations would be further allocated among the inshore cooperatives, inshore open access fishery, and six CDQ groups based on the NMFS-approved percentage allocations of pollock that have been in effect since 2005 (71 FR 51804; August 31, 2006).

Table ES-8 Alternative 5 A and B season allocation percentages and corresponding cap levels for each sector.

Alternative 5	Allocation Percentages	60,000 Chinook salmon	47,591 Chinook salmon
A season allocation:	70.0%	42,000	33,314
CDQ	9.3%	3,906	3,098
Inshore CV	49.8%	20,916	16,591
Mothership	8.0%	3,360	2,665
Offshore CP	32.9%	13,818	10,960
B season allocation:	30.0%	18,000	14,277
CDQ	5.5%	990	785
Inshore CV	69.3%	12,474	9,894
Mothership	7.3%	1,314	1,042
Offshore CP	17.9%	3,222	2,556

Each year, any sector, cooperative, CDQ group, or individual vessel could choose not to participate in, or opt-out of, an IPA. These vessels would then fish under a backstop cap. Each year, NMFS would calculate the amount of the backstop cap as the sum of each opt-out participant's portion of 28,496 Chinook salmon. NMFS would then subtract this backstop cap amount from the 60,000 Chinook salmon hard cap before allocating the resulting cap among sectors according to the percentages in Table ES-8. NMFS would allocate the backstop cap 70 % for the A season and 30 % for the B season. NMFS would manage all vessels fishing under the backstop cap, including vessels fishing on behalf of a CDQ group, as a group under the seasonal backstop cap. NMFS would close directed fishing for pollock by vessels under the backstop cap before the seasonal backstop cap has been reached.

Incentive Plan Agreements

An IPA is a private contract among vessel owners, cooperatives, or CDQ groups that establishes incentives for participants to reduce Chinook salmon bycatch. Alternative 5 includes IPA content requirements, participation requirements, and deadlines for submission to NMFS for approval. Each IPA would be required to be submitted and approved by NMFS prior to fishing under the IPA. If NMFS approves an IPA, those participating in the IPA would fish under the 60,000 Chinook salmon hard cap.

To accomplish reductions in Chinook salmon bycatch, the IPA concept includes two components (1) the NMFS-approved IPA contract that contains the elements of the incentive program that all vessel owners and CDQ groups agree to follow, and (2) the annual report to the Council on performance under the IPA in the previous year.

Transferability and Rollovers

Alternative 5 contains two provisions to provide the fleet the flexibility to fully harvest the pollock TAC while maintaining the overall Chinook salmon bycatch at or below the cap. Transferable Chinook salmon bycatch allocations would enable eligible participants to transfer bycatch allocations among sectors, cooperatives, and CDQ groups, under either the 60,000 or 47,591 Chinook salmon hard caps. Transferability is expected to mitigate the variation in the encounter rates of salmon bycatch among sectors, CDQ groups, and cooperatives in a given season by allowing eligible participants to obtain a larger portion of the bycatch allocation in order to harvest their full pollock allocation or to transfer surplus allocation to other sectors. Additionally, NMFS would rollover any unused Chinook salmon allocation remaining at the end of the A season to the B season for all sectors, cooperatives, or CDQ groups fishing under either the 60,000 or 47,591 Chinook salmon hard caps.

Performance Standard

Alternative 5 includes a performance standard as an additional tool to ensure sectors do not fully harvest the Chinook salmon bycatch allocations under the 60,000 Chinook salmon hard cap every year. With the performance standard, for each sector to continue to receive its allocation of the 60,000 Chinook salmon cap, it could not exceed its annual portion of 47,591 Chinook salmon in any three years within a seven consecutive year period. The performance standard was designed to account for the unpredictability of high Chinook salmon encounters and the fact that a sector may not be able to avoid exceeding its portion of 47,591 Chinook salmon in certain years.

Managing and Monitoring the Alternatives

EIS 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 management and enforcement costs and the impacts of these changes on the pollock fishery are discussed in RIR Chapter 6.

Each of the four alternatives to the status quo includes a cap, or limit, on the amount of Chinook salmon bycatch that may be caught in the Bering Sea pollock fishery. Under Alternatives 2, 4, and 5, all pollock fishing must cease once this cap is reached. Reaching the bycatch cap under Alternative 3 would result in the closure of certain areas important to pollock fishing. Each of the alternatives analyzed includes options that would allocate these Chinook salmon bycatch caps among the AFA sectors and further allocate the inshore sector allocation to inshore cooperatives and the CDQ Program allocation among the six CDQ groups.

The catch of most target species is readily determined using observer and landings data because the target species must be retained, landed, and sold for the vessel owner to receive earnings from that catch. However, prohibited species catch generally is required to be discarded and its catch often limits the catch of economically valuable target species. The greater the potential to limit the target species catch, the greater the incentive created to avoid enumeration of prohibited species. If pollock catch is forgone as a result of the Chinook salmon bycatch caps, vessel owners or CDQ groups will not earn the income that could have been generated by the harvest and sale of that pollock. Each Chinook salmon properly accounted for contributes to the potential limit on the catch of pollock. Any Chinook salmon that is caught but does not get counted by an observer or reported by a vessel owner or processor does not accrue against a Chinook salmon cap and does not increase the potential limit on the catch of pollock. The addition of transferable Chinook salmon bycatch caps further increases the economic incentive to misreport Chinook salmon bycatch because an entity transferring Chinook salmon is likely receive monetary or other benefits in exchange for the transfer.

For these reasons, all of the alternatives to the status quo, but particularly Alternatives 2, 4, and 5, would significantly increase the economic incentives to under report or misreport the amount of Chinook salmon bycatch or to discard or hide Chinook salmon before they can be counted by an observer. As a result, current methods of estimating Chinook salmon bycatch in the Bering Sea pollock fishery may not be adequate to support monitoring and enforcement of the Chinook salmon caps under any of the alternatives.

To ensure effective monitoring and enforcement of transferable Chinook salmon bycatch caps, NMFS recommends a census, or a count, of all salmon bycatch by all sectors directed pollock fishing in the Bering Sea. An accurate census of Chinook salmon bycatch requires revisions to regulations for observer coverage and equipment and operational requirements for all participants in the Bering Sea pollock fishery. Currently, observer coverage is based on vessel length and 56 of the catcher vessels in this fleet are less than 125 feet length overall, so are required to carry an observer for 30 percent of their fishing trips. Under Alternatives 2, 3, 4, and 5, all catcher vessels, except those delivering unsorted catch to motherships, would be required to carry an observer all of the time that it is directed fishing for pollock in the Bering Sea. In addition, no salmon of any species could be discarded from the catcher vessel. Modifications would be required in the catch monitoring and control plans for the inshore processors to improve the observers' ability to accurately count salmon bycatch sorted from each pollock delivery.

For catcher/processors and motherships, no change in observer coverage would be required because these vessels already are required to carry two observers. Revisions would be made in equipment and operational requirements to ensure that no salmon are discarded before they are counted by an observer. The most significant additional requirement for the catcher/processors and motherships is the requirement to install a video system with a monitor in the observer sample station that provides views of all areas where salmon could be sorted from the catch and the secure location where salmon are stored. Catcher/processors would be required to report the count of salmon in each haul using an electronic logbook supplied by NMFS. No changes in reporting requirements would be needed for motherships, because they already are required to report the number of salmon in each delivery through an electronic landings report.

Alternatives 4 and 5 are more complicated to manage and enforce than the other alternatives, in part, because participants in any given year could be operating under different Chinook salmon cap levels, and under either transferable allocations or non-transferable caps. Prior to the start of each year's fishery, NMFS would be required to identify which cap each of the approximately 120 vessels participating in the pollock fishery is fishing under. During the fishing seasons, NMFS would attribute the catch from each vessel to the appropriate sector's, inshore cooperative's, or CDQ group's allocation, or the backstop cap, and monitor compliance with Chinook salmon bycatch caps for up to 36 different groups of vessels fishing under different Chinook salmon bycatch caps. Alternative 5 would require NMFS to determine whether a sector has failed to meet its performance standard. Also, each alternative includes a provision for an industry contractual agreement with incentives to reduce Chinook salmon bycatch below the high cap. NMFS would be required to review an industry contractual agreement submitted by the pollock industry and approve or disapprove this agreement prior to the start of the pollock fishery.

Consequences of the Alternatives

The specific components as prescribed in Alternative 1, Alternative 4, Alternative 5, 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. EIS 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 comparing the actual bycatch of Chinook salmon, by season and sector, for the years from 2003 to 2007 with the alternative cap levels and then determining when, if at all, the pollock fishery would have closed. When a cap level would have closed the pollock fishery earlier in a given season than actually occurred, an estimate is made of (1) the amount of pollock TAC that would have been left unharvested, “forgone pollock,” and (2) the reduction in the amount of Chinook salmon bycatch as a result of the closure, “salmon saved.” The estimates of forgone pollock and salmon saved under each alternative are then used as the basis for comparing the relative impacts of the alternatives.

Results presented in EIS Chapter 5 include both overall changes in Chinook salmon bycatch due to alternative management measures, as well as resulting estimates of the amount of Chinook salmon that would have returned 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 is limited to the cap levels as analyzed in Alternatives 2, 4, and 5. Estimates of the amount of Chinook salmon that would return to natal rivers as adult fish as a result of continued fishing outside of the triggered closures of Alternative 3 could not be evaluated due to the difficulty in modeling the potential effect of displaced effort and the resulting bycatch of specific stocks.

The RIR examines the costs and benefits of the alternatives based on the analysis in EIS Chapters 4 and 5 that estimates the likely dates of pollock fisheries closures and thereby retrospectively projects likely forgone pollock harvest and the number of Chinook salmon that may have been saved. 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 estimates of Chinook salmon saved as the measure of economic benefits of the alternatives.

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: 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-9. In general, these western Alaska Chinook salmon stocks declined sharply in 2007 and declined even further in 2008. In recent years of low Chinook salmon returns, the in-river harvest of western Alaska Chinook salmon has been severely restricted and, in some cases, river systems have not met escapement goals. Additionally, in 2007 and 2008 the United States did not meet the Yukon River Chinook salmon escapement goals established with Canada by the Yukon River Agreement to the Pacific Salmon Treaty of 2002. In 2009, the United States exceeded these escapement goals. EIS Chapter 5 provides an overview of Chinook salmon biology, distribution, and stock assessments by river system or region.

Table ES-9 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	Below	Yes	No	Yield concern (since 2004)
Yukon	Yes	Below	Yes	Most in Alaska No-Canadian treaty goal	Yield concern (since 2000)
Kuskokwim	Yes	Below	Yes	Some [3]	No Yield concern discontinued 2007
Bristol Bay	Yes	Below	Yes	Some	No

Chinook salmon support subsistence, commercial, personal use, and sport fisheries in their regions of origin. RIR Chapter 3 provides 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 manages the commercial, subsistence, sport, and personal use salmon fisheries. The Alaska Board of Fisheries adopts regulations through a public process to conserve fisheries resources and to allocate fisheries resources to the various users. The first priority for state 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. Subsistence fisheries management includes coordination with U.S. federal government agencies where federal rules apply under the Alaska National Interest Lands Conservation Act. Surplus fish beyond escapement needs and subsistence use are made available for other uses. Yukon River salmon fisheries management includes obligations under an international treaty with Canada.

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. Subsistence salmon fisheries are important culturally and greatly contribute to local economies. In addition, commercial fishing for Chinook salmon may provide a

[3] For the Kuskokwim: 3 of 4 weir goals were below while 3 of 5 aerial goals were below.

significant source of income for many people who live in remote villages and often supports the subsistence lifestyle.

Chinook salmon savings

EIS 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 that 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. The second step was to use a model to estimate and analyze the total numbers of adult Chinook salmon that were expected to return to their rivers of origin, called adult equivalents or AEQ. The third step was to analyze the amount of adult equivalent Chinook salmon that would return to specific rivers or regions of origin.

Table ES-10 shows the predicted changes in the amount of Chinook salmon bycatch under each alternative in the highest (2007) and lowest (2003) bycatch years analyzed. For each year, the table indicates the projected fleetwide bycatch, by season and annually, for the Alternative 5 caps 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 5 to the actual bycatch in that year under Alternative 1, and shows the percentage reduction under Alternatives 2 and 5 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 any alternative.

Table ES-10 Projected fleetwide salmon bycatch, by season and annually, under Alternative 5, and the lowest and highest bycatch sector and season combinations for Alternative 2, for the highest (2007) and lowest (2003) bycatch years[4].

Bycatch years[3]	Alternative	Bycatch cap	Projected salmon bycatch			Reduction from actual bycatch in that year (Alt 1)
			A season	B season	Annual Total	
2007	Alt 5	60,000	40,718	17,683	58,401	52%
	Alt 5	47,591	32,175	14,208	46,383	62%
Actual bycatch: 121,638	Alt 2, Option 2d sector split, 70/30 season split	29,300	2,801	6,557	9,358	92%
	Alt 2, Option 2a sector split, 50/50 season split	87,500	40,415	36,828	77,243	37%
2003	Alt 5	60,000	33,578	13,113	46,691	0%
	Alt 5	47,591	31,520	13,113	44,633	5%
Actual bycatch: 46,691	Alt 2, Option 1 sector split, 50/50 season split	29,300	11,550	11,084	22,634	52%
	Alt 2[5]	87,500	33,808	13,185	46,993	0

The highest bycatch year analyzed, and the year of highest historical bycatch of Chinook salmon, was 2007. For Alternative 5, in 2007, the 60,000 Chinook salmon cap would have resulted in a 52 percent reduction overall in Chinook bycatch, from the actual amount caught and the 47,591 Chinook salmon cap would have resulted in a 62 percent reduction from the actual bycatch. Under Alternative 2, a reduction of 92 percent was estimated under the most restrictive cap of 29,300 Chinook salmon (with seasonal split of 70/30 and a sector split as noted in option 2d), while the least restrictive cap of 87,500 Chinook salmon

[4] The analytical base years used were 2003-2007, and actual bycatch estimates retrieved from the CAS in 2008.

[5] 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].

(with seasonal split of 50/50 and sector split of option 2a) would have resulted in a 37 percent reduction from actual bycatch in that year.

In low bycatch years, the majority of caps under consideration would have minimal impact on annual bycatch amounts. In 2003, the lowest bycatch year analyzed, none of the Alternative 5 cap results in large reductions from the actual bycatch in that year, 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 percent reduction from the status quo. In years when the actual bycatch was well below all of the cap levels, like in 2008 and 2009, none of the cap levels analyzed would have result in salmon saved or pollock forgone.

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 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.

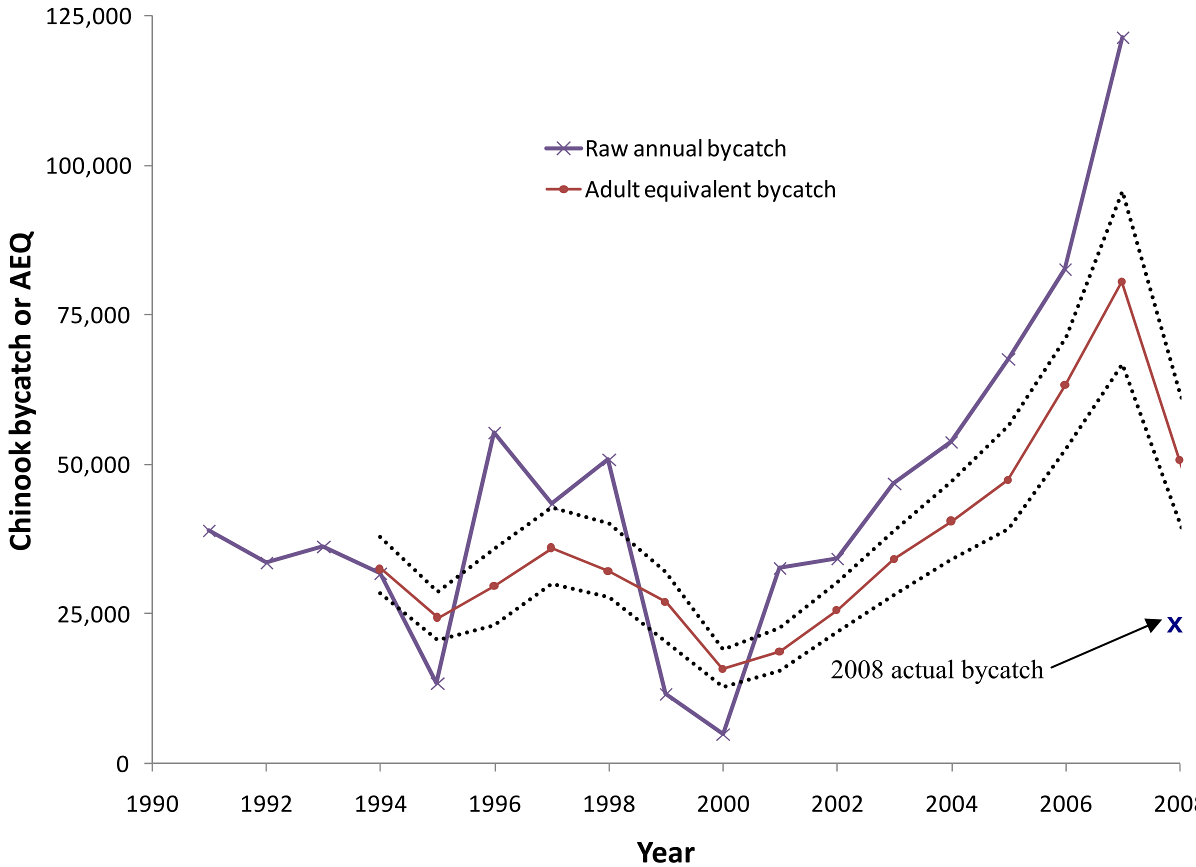

Fig. ES-4 Time series of Chinook actual and adult equivalent bycatch from the pollock fishery, 1991-2007 (2008 bycatch indicated by 'x'). The dotted lines represent the uncertainty of the AEQ estimate, due to the combined variability of ocean mortality, maturation rate, and age composition of bycatch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

For the cap levels in Alternatives 4 and 5, 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-11 compares the number of Chinook salmon that would have been saved in 2007, if Alternative 5, Alternative 4, or the highest and lowest caps of comparable seasonal and sector combinations of Alternative 2 had been in place.

Table ES-11 Comparison of the total projected reduction in Chinook salmon bycatch and adult equivalent salmon bycatch using 2007 results under Alternative 5, Alternative 4, and the highest and lowest caps of comparable seasonal and sector combinations of Alternative 2.

	Alt 5 60,000 cap	Alt 4 and 5 47,591 cap	Alt 4 68,392 cap	Alt 2 cap 87,500 Opt 2d 70/30	Alt 2 cap 29,300 Opt 2d 70/30
Number of salmon bycatch saved	63,288	75,306	55,307	46,766	112,280
Adult equivalent salmon saved	27,119	40,843	26,928	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 return 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 for 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 EIS Chapter 3 for methodology and EIS Chapter 5 for detailed impacts by river system.

Table ES-12 provides a comparison of the distribution of AEQ salmon saved to selected river systems and the relative reduction of AEQ Chinook salmon bycatch by region of origin for a snapshot of one year (2007) under the alternatives. Alternative 5 is compared to results from Alternative 4 and Alternative 2, using the Option 2d sector split for the highest and lowest cap levels (87,500 and 29,300). The 70/30 seasonal split is used for all caps. EIS Chapter 5 contains an analysis of additional scenarios for different caps, seasonal and sector splits.

This table shows the increases in AEQ Chinook salmon saved by river systems from the estimated AEQ returns under Alternative 1. 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 data limitations. However results are shown for inference of trends to various regions and areas.

Table ES-12 Comparison of the projected reduction of adult equivalent salmon bycatch, in number of salmon, by region of origin (based on genetic aggregations) under Alternative 5, Alternative 4, 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[6]	Alt 5 60,000 cap	Alt 4 and 5 47,591 cap	Alt 4 68,392 cap	Alt 2 cap 87,500 Opt 2d 70/30	Alt 2 cap 29,300 Opt 2d 70/30
Yukon	5,396	8,840	5,228	3,299	14,938
Kuskokwim	3,507	5,746	3,398	2,144	9,710
Bristol Bay	4,586	7,514	4,443	2,804	12,697
Pacific Northwest aggregate stocks (PNW)	8,444	11,135	8,489	9,581	15,507
Cook Inlet stocks	912	1,202	1,042	1,010	1,284
Transboundary aggregate stocks (TBR)	617	821	699	670	909
North Alaska Peninsula stocks (N.AK)	2,882	4,389	2,318	2,264	8,594
Aggregate "other" stocks	592	865	534	549	1,495

Relative impacts to individual river systems 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 EIS Section 5.3.5 for additional results by year and stock of origin. 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 returning to western Alaska rivers would have been over 26,000 in 2006 and over 33,000 in 2007. Alternative 5 provides neither the highest nor lowest reduction in adult equivalents to individual river systems, based on the range of caps under consideration.

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 and Upper Yukon River). Given that Chinook salmon 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 percent to over 44 percent 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 the relative effects appear to vary in different years.

Benefits of Chinook salmon savings

RIR Chapter 5 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

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

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.

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, the analysis of potential economic benefits is in terms of AEQ estimated Chinook salmon saved and does not provide estimates of a monetary value of the salmon saved. The first step is to evaluate, by year, the overall AEQ salmon saved for Alternative 2, 4, and 5, and season and sector options, as compared to Alternative 1, status quo. Table ES-13 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 Alternative 5 range from a less than 1 percent change in AEQ Chinook salmon estimated in 2003, to a high of 52 percent more AEQ Chinook salmon in 2007.

Four cap options for Alternative 2, with the same 70/30 seasonal split and sector divisions (Option 2d), are compared against Alternatives 4 and 5. The Alternative 2 68,100 Chinook salmon cap is considered closest to (though higher than) the Alternative 5 60,000 Chinook salmon cap. Alternative 2 at this cap would have a similar minor benefit in 2003 but in higher bycatch years, like 2007, it would have an estimated 43 percent increase in benefit compared with a 34 percent increase for Alternative 5. For comparison, the highest cap of 87,500 Chinook salmon shows a 28 percent increase in benefits. As with Alternative 5, 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 percent increase in the AEQ Chinook salmon savings in that year.

Table ES-13 Percentage change in adult equivalent Chinook salmon savings from Alternative 1, status quo, between Alternative 4 and 5 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**
Alt 5 60,000 cap	<1%	7%	17%	24%	34%
Alt 4 68,392 cap	<1%	7%	16%	22%	34%
Alt 4 and 5 47,591 cap	2%	11%	24%	40%	52%
Alt 2 87,500 cap, opt 2d, 70/30	1%	7%	19%	21%	28%
Alt 2 68,100 cap, opt 2d, 70/30	0%	10%	23%	34%	43%
Alt 2 48,700 cap, opt 2d, 70/30	12%	18%	29%	51%	64%
Alt 2 29,300 cap, opt 2d, 70/30	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 salmon. 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 EIS Chapter 3.

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-14 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 are available to the fishery in relation to managers' assessments of escapement and subsistence harvest.

Table ES-14 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 met from 2003-2007	Additional restrictions imposed from 2003-2007			Likely management changes if additional AEQ salmon had been available 2003-2007
		Subsistence	Commercial	Sport	
Yukon	2006 some key goals not met	More conservative management plan imposed since 2001			2006-2007 additional fish would accrue towards meeting escapement; in all years increased potential for higher subsistence and commercial harvest
	2007 Treaty goal not met	2007 Canada	Below average 2005-2007	2007 Canada	
Kuskokwim	Most	More conservative management plan imposed 2001-2006			Potential for increased commercial harvests within market constraints
	2007 Most	No	No	No	
Bristol Bay (Nushagak)	2007 goals not met	No	No	2007	If sufficient additional 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
Norton Sound subdistricts 5 and 6	2003-2006 Unalakleet goal not met	2003-2004; 2006-2007	2003-2007	2003-2004; 2006-2007	Additional fish would accrue to escapement

Note that, 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 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. Limited 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. EIS Chapter 5 and RIR Chapter 3 provide more information about the 2008 run sizes and Chinook salmon fisheries.

Table ES-15 through Table ES-18 show the AEQ Chinook salmon savings results for the Yukon River, Kuskokwim River, Bristol Bay, and total western Alaska compared with commercial, subsistence, and sport catch 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.

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 increased 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-15 provides Kuskokwim area specific catch, by harvesting sector and by year, compared to AEQ Chinook salmon estimates for Alternatives 4 and 5, and for high and low caps under Alternative 2. The Kuskokwim AEQ estimates for the Alternative 4 range from -214[7] Chinook salmon under the 68,392 Chinook salmon cap in 2003 to 5,746 Chinook salmon under the 47,591 Chinook salmon cap in 2007. The Kuskokwim AEQ estimates for the Alternative 5 60,000 Chinook salmon cap range from -36 Chinook salmon in 2003 to 3,507 Chinook salmon 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 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, 4, and 5. However, commercial and sport catches are smaller than many of the AEQ estimates, indicating potential benefits to commercial and sport fishermen in the area.

[7] 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.

Table ES-15 Kuskokwim area annual Chinook salmon catch, by fishery, compared to AEQ Chinook salmon savings estimates for Alternatives 2, 4, and 5 (2003-2007).

Kuskokwim Area					
Catch and AEQ Estimates	Year				
	2003[6]	2004	2005	2006	2007
Commercial Catch	158	2,300	4,784	2,777	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
Alt. 5 60,000 cap	-36	419	1,117	2,331	3,507
Alt. 4 68,392 cap	-214	384	1,269	2,217	3,398
Alt. 4 and 5 47,591 cap	-40	301	1,264	3,849	5,746
Alt. 2, 87,500 cap, opt 2d, 70/30	365	824	1,369	2,144	2,144
Alt. 2, 29,300, opt 2d, 70/30	2,399	3,243	6,361	9,710	9,710

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-16 provides Alaska Yukon River specific catch, by harvesting sector and by year, compared to AEQ Chinook salmon estimates for Alternatives 4 and 5, and the Alternative 2 high and low caps. The Yukon AEQ estimates for the Alternative 4 range from -329 Chinook salmon under the 68,392 Chinook salmon cap, in 2003, to 8,840 Chinook salmon under the 47,591 Chinook salmon cap in 2007. The Yukon AEQ estimates for the Alternative 5 cap of 60,000 Chinook salmon range from -54 Chinook salmon under, in 2003, to 5,396 Chinook salmon 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, 4, and 5. The same is true of historic Yukon commercial catches. However, both Alternatives 4 and 5 would result in AEQ Chinook salmon estimates that are more than 10 percent 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 ES-16 Alaska Yukon River area annual Chinook salmon catch, by fishery, compared to AEQ Chinook salmon savings estimates for Alternatives 2, 4, and 5 (2003-2007).

Yukon River (Alaska)					
Catch and AEQ Estimates	**Year**				
	2003	**2004**	**2005**	**2006**	**2007**
Commercial Catch	40,438	56,151	32,029	45,829	33,634
Subsistence Catch	55,109	53,675	52,561	47,710	59,242
Sport Catch	2,719	1,513	483	739	960
Total Catch	98,266	111,339	85,073	94278	92,876
Alt. 5 60,000 cap	-54	645	1,718	3,586	5,396
Alt. 4 68,392 cap	-329	591	1,952	3,409	5,228
Alt. 4 and 5 47,591 cap	-61	463	1,944	5,921	8,840
Alt. 2, 87,500 cap, opt 2d, 70/30	561	-2	1,267	2,107	3,299
Alt. 2, 29,300 cap, opt 2d, 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 Chinook salmon 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-17 provides Bristol Bay area catch, by fishery and by year, compared to AEQ Chinook salmon estimates for Alternatives 4 and 5 as well as those for Alternative 2 high and low caps. The Bristol Bay AEQ estimates for the Alternative 4 range from -280 Chinook salmon under the 68,392 Chinook salmon cap in 2003 to 7,514 Chinook salmon under the 47,591 Chinook salmon cap in 2007. The Bristol Bay AEQ estimates for the Alternative 5 60,000 Chinook salmon cap range from -47 Chinook salmon in 2003 to 4,586 Chinook salmon 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, 4, and 5, 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 Alternatives 4 and 5 would result in AEQ Chinook salmon estimates that approach or exceed 10 percent 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-17 Bristol Bay area annual Chinook salmon catch, by fishery, compared to AEQ Chinook salmon savings estimates for Alternatives 2, 4, and 5 (2003-2007).

Bristol Bay Area					
Catch and AEQ Estimates	**Year**				
	2003	**2004**	**2005**	**2006**	**2007**
Commercial Catch	46,953	114,280	76,590	106,962	62,670
Subsistence Catch	21,231	18,012	15,212	12,617	16,002
Sport Catch	9,941	13,195	13,036	10,749	15,200
Total Catch	78,125	145,487	104,838	119,579	78,672
Alt. 5 60,000 cap	-47	548	1,461	3,048	4,586
Alt. 4 68,392 cap	-280	503	1,659	2,898	4,443
Alt. 4 and 5 47,591 cap	-52	394	1,653	5,033	7,514
Alt. 2, 87,500 cap, opt2d, 70/30	477	-1	1,077	1,791	2,804
Alt. 2, 29,300 cap, 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-18 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 Alternative 4 range from -823 Chinook salmon under the 68,392 Chinook salmon cap in 2003 to 22,100 Chinook salmon under the 47,591 Chinook salmon cap in 2007. The western Alaska total AEQ estimates for the Alternative 5 60,000 Chinook salmon cap range from -134 Chinook salmon in 2003 to 13,085 Chinook salmon 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, 4, and 5, in all years except 2007. However, these AEQ estimates, when compared to commercial harvests, can range between 10 percent and 40 percent 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 (Table ES-11) that are much larger than the western Alaska subset estimates.

Table ES-18 Total western Alaska (excluding Norton Sound) annual Chinook salmon catch, by fishery, compared to AEQ Chinook salmon estimates for Alternatives 2, 4, and 5 (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
Alt. 5 60,000 cap	-134	1,545	3,948	8,818	13,085
Alt. 4 68,392 cap	-823	1,478	4,880	8,524	13,069
Alt. 4 and 5 47,591 cap	-153	1,158	4,861	14,803	22,100
Alt. 2, 87,500 cap, opt 2d, 70/30	1,403	821	3,713	6,042	8,247
Alt. 2, 29,300 cap, opt 2d, 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.

Comparison of Chinook salmon saved and forgone pollock harvest

Selection of the preferred alternative involved explicit consideration of trade-offs between the potential salmon saved and the forgone pollock catch and of ways to maximize the amount of salmon saved and minimize the amount of forgone pollock. Table ES-19 compares Alternative 2 cap levels (with the sector split options from Table ES-5 and season split options from Table ES-4) with Alternative 4 and Alternative 5 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 compares changes in actual Chinook salmon bycatch, not changes in AEQ bycatch.

In 2007, a 92 percent reduction in Chinook salmon bycatch would have occurred under the cap level of 29,300 Chinook salmon (with the sector and seasonal splits as noted). However, this would be achieved at a cost of 46 percent 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 percent, but with a 22 percent reduction in pollock catch. Alternative 5 falls between these high and low levels, as indicated. The 60,000 Chinook salmon cap is estimated to result in a higher percentage of salmon saved than the 87,500 cap for an only slightly higher (3 percent increase) reduction in pollock catch. However, in a lower bycatch year (such as 2003), the 60,000 Chinook salmon cap is estimated to result in a limited reduction in salmon bycatch and corresponding limited reduction in pollock catch. In low bycatch years, only the lowest cap considered (29,300) is estimated to achieve substantial bycatch reduction.

Table ES-19 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**	87,500[8]	37%	22%
	68,392 (Alt 4)	46%	23%
	60,000 (Alt 5)	52%	26%
	47,591 (Alt 5 and Alt 4)	62%	32%
	29,300[9]	92%	46%
2003 (lowest) **Actual bycatch= 46,691**	87,500[10]	0%	0%
	68,392 (Alt 4)	0%	0%
	60,000 (Alt 5)	0%	0%
	47,591 (Alt 5 and Alt 4)	5%	4%
	29,300[11]	52%	22%

As analyzed in EIS Chapters 4 and 5, the impacts of the alternatives on total bycatch numbers and forgone pollock would vary by year. 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 plots the forgone pollock and Chinook salmon saved estimates for the subset of Alternative 2 options and Alternative 4 and 5, over the years 2003 to 2007. The Alternative 2 caps are one of the four Alternative 2 hard cap suboptions in Table ES-3, with the option 2d sector split and the 70/30 season split, and assuming no transfers or rollovers. The Alternative 2 caps are not enclosed by symbols. The 68,392 Chinook salmon cap is illustrated by closed circles. The 47,591 Chinook salmon cap is illustrated by closed triangles. The 60,000 Chinook salmon cap is illustrated by stars. Each number represents the

[8] Option 2a sector split, 50/50 seasonal split
[9] Option 2d sector split, 70/30 seasonal split
[10] 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]
[11] Option 1 sector split, 50/50 seasonal split

year in which a particular cap would have resulted in that level of forgone pollock and Chinook salmon bycatch.

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 pollock 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). The figure also illustrates the inter-annual variability; the same option can have very different results in terms of forgone pollock and Chinook saved, on an annual basis.

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, the 60,000 Chinook salmon cap (stars) resulted in lower levels of forgone pollock but higher levels of bycatch than the 47,591 Chinook salmon cap (triangles). The 60,000 Chinook salmon cap would have only been taken in years of higher bycatch, 2005-2007, and would have resulted in some forgone pollock in those years, although less than under the lower caps. In 2003 and 2004, the 60,000 Chinook salmon cap would not have been reached, and no pollock would have been forgone. In 2005, the inshore CV sector would have reached its allocation in the B season, and would have had forgone pollock. The 47,591 Chinook salmon 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, 47,591 Chinook salmon cap would have resulted in little or no forgone pollock. For Alternatives 4 and 5, 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.

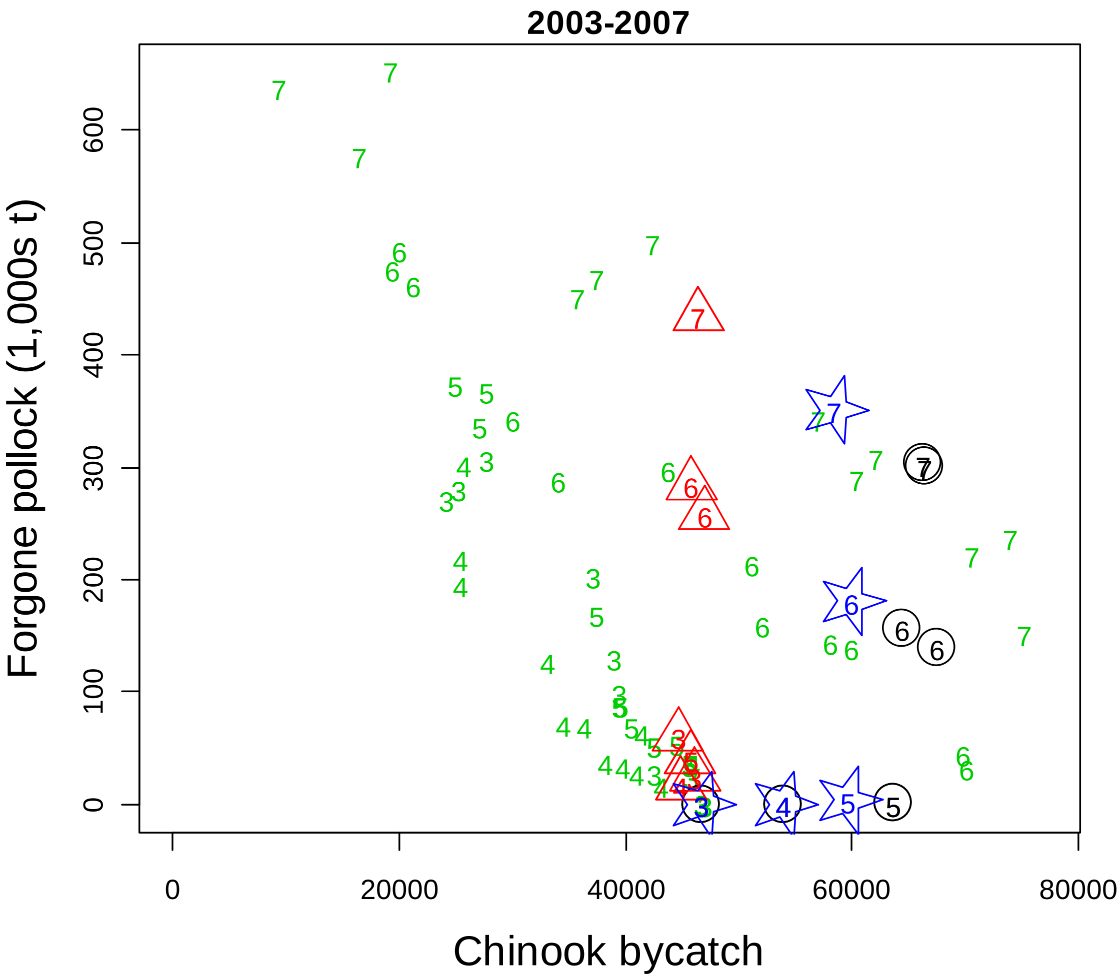

Fig. ES-5 Comparisons of hypothetical Chinook bycatch (numbers, horizontal axis) and forgone pollock (thousands of t, vertical axis). Numbers represent the year (e.g., 6=2006). The 68,392 cap is shown in circles, the 47,591 cap in triangles, and 60,000 cap in stars. The Alternative 2 caps are those not enclosed by a symbol and apply a 70/30 A-B season split and Option 2d sector split (CDQ=6.5%, inshore CV=57.5%, Motherships=7.5%, and at-sea processors= 28.5%).

Costs of forgone harvest in the pollock fishery

RIR Chapter 6 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 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, 4, and 5) are summarized by the different components and options that define them (Table ES-20). 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 Alternatives 4 and 5 only, but comparative information is provided for evaluating rollover impacts under Alternative 2.

Table ES-20 Summary of main options under Alternatives 2, 4, and 5 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	• Sector impacts highly variable by season and by year. • See 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 Alternative 4 mitigates forgone revenue impacts in B season. • 100% rollover in Alternative 5 mitigates forgone revenue impacts in B season.
Transferability	• Full transferability mitigates forgone revenue impacts in the A season.

In order to summarize some of the differences between the impacts of the caps under Alternative 2, 4, and 5, the other aspects of Alternative 2 are assumed to be constant. For this analysis, Alternative 2 includes the Option 2d sector split, a 70/30 seasonal split, and, while transferability is an option under Alternative 2, for this comparison, it was assumed that transferability was not allowed. Full A season transferability is assumed for Alternatives 4 and 5.

Summarizing the relative impacts of sector allocations is difficult due to the complexity of the sector allocation options in Alternative 2. Table ES-21 compares the sector allocation option analyzed for the Alternative 2 caps with the sector allocations for Alternatives 4 and 5.

Table ES-21 Comparison of sector allocations under Alternative 2, option 2d, and Alternatives 4 and 5

Alternative	CDQ	Inshore CV	Mothership	Offshore CP
Alternative 2: option 2d (midpoint)	6.5%	57.5%	7.5%	28.5%
Alternatives 4 and 5: A season	9.3%	49.8%	8.0%	32.9%
B season	5.5%	69.3%	7.3%	17.9%

Table ES-22, Table ES-23, and Table ES-24 show the estimated impacts on forgone gross revenue (millions $) by sector for 2007.

Table ES-22 Comparison of the 2007 estimated forgone gross revenue, by sector, for the 68,100 Chinook salmon cap, the 68,392 Chinook salmon cap, and the 68,000 Chinook salmon cap (in millions of $).

Sector		CDQ	Inshore CV	Mothership	Offshore CP	Total
68,100 cap (Alt 2)						
	A season	$0	$135	$20	$118	$273
	B season	$3	$41	$2	$4	$49
	Total	**$2.5**	**$176**	**$22**	**$123**	**$322**
68,392 cap (Alt 4)						
	A season	$0	$123	$12	$115	$249
	B season	$4	$36	$2	$22	$64
	Total	**$4**	**$159**	**$14**	**$137**	**$313**
60,000 cap (Alt 5)						
	A season	$0	$145	$20	$128	$293
	B season	$5	$39	$3	$24	$70
	Total	**$5**	**$184**	**$23**	**$152**	**$363**

Table ES-22 provides a comparison of potentially forgone gross revenue impacts for Alternative 2 cap of 68,100 Chinook salmon the caps of 68,392 Chinook salmon under Alternative 4 and 60,000 Chinook salmon under Alternative 5. In this comparison, total potentially forgone gross revenue is less under Alternative 4 ($249 million); however, potentially forgone gross revenue for the pollock fleet varies by sector between the alternatives in terms of overall gains and losses. The CDQ sector has higher potentially forgone gross revenue under Alternative 5, due to the lower B season sector allocation. The inshore CV sector has a lower annual forgone gross revenue under Alternative 4 and lower seasonal forgone revenue in both A and B seasons as compared with Alternatives 2 and 5. The mothership sector also has a slightly lower annual forgone gross revenue total under Alternative 4 than under the other alternatives. This is driven by substantially lower A season forgone gross revenue under that scenario. The CP sector has higher forgone gross revenue under Alternative 4, driven primarily by the lower B season allocation.

Table ES-23 Comparison of the 2007 estimated forgone gross revenue, by sector, for the Alternative 2 48,700 Chinook salmon cap, the Alternative 4 and 5 47,591Chinook salmon cap (in millions of $).

Sector		CDQ	Inshore CV	Mothership	Offshore CP	Total
48,700 cap (Alt 2)						
	A season	$24	$201	$34	$156	$414
	B season	$5	$55	$4	$13	$76
	Total	**$29**	**$256**	**$38**	**$169**	**$490**
47,591 cap (Alt 4 and 5)						
	A season	$13	$154	$28	$172	$367
	B season	$5	$46	$4	$30	$86
	Total	**$18**	**$200**	**$32**	**$202**	**$453**

Table ES-23 provides a comparison of potentially forgone gross revenue impacts for Alternative 2 cap of 48,700 Chinook salmon with 47,591 Chinook salmon cap under Alternatives 4 and 5. At lower cap levels, the CDQ sector has a lower forgone gross revenue under the 47,591 Chinook salmon cap, due to the higher relative A season sector allocation. The inshore CV sector has a lower annual forgone gross revenue under the 47,591 Chinook salmon cap and lower seasonal forgone gross revenue in both A and B seasons as compared with Alternative 2. The mothership sector also has a lower annual forgone gross revenue under the 47,591 Chinook salmon cap, driven by the lower A season forgone gross revenue. The CP sector has a higher forgone gross revenue under the 47,591 Chinook salmon cap, driven primarily by the lower B season allocation.

Table ES-24 Comparison of the 2007 estimated potentially forgone gross revenue, by sector, for the Alternative 5 60,000 Chinook salmon cap the Alternative 4 and 5 47,591 Chinook salmon cap (in millions of $).

Sector		CDQ	Inshore CV	Mothership	Offshore CP	Total
60,000 cap (Alt 5)						
	A season	$0	$145	$20	$128	$293
	B season	$5	$39	$3	$24	$70
	Total	**$5**	**$184**	**$23**	**$152**	**$363**
47,591 cap (Alt 4, 5)						
	A season	$13	$154	$28	$172	$367
	B season	$5	$46	$4	$30	$86
	Total	**$18**	**$200**	**$32**	**$202**	**$453**

Table ES-24 provides a comparison, based on the 2007 high bycatch year, of the impacts of the 60,000 Chinook salmon cap with the 47,591 Chinook salmon cap that would be invoked if the performance standard of Alternative 5 is not met or if no IPA were formed. If all sectors had failed to meet the performance standard, and thus fished under the 47,591 Chinook salmon cap, the total potentially forgone pollock gross revenue would have increased approximately 25 percent from $363 million to $453 million. On a sector level, the greatest impacts of not meeting the performance standard would have occurred in the CDQ sector where impacts would have increased from $5 million to $18 million, which is more than 2.5 times larger than the impact of the 60,000 Chinook salmon cap. The inshore CV sector would have had an approximately 9 percent increase in forgone gross revenue from $184 to $200 million. Motherships would have had an approximately 39 percent increase from $23 million to $32 million. Finally, the offshore CP sector would have had an approximately 33 percent increase from $152 to $202 million.

Within Alternative 5, the Council established the 60,000 Chinook salmon hard cap with an IPA to encourage Chinook salmon avoidance in all years with the goal that actual salmon bycatch would be below the cap. Alternative 5 includes a performance standard as an additional tool to ensure sectors do not fully harvest the Chinook salmon bycatch allocations under the 60,000 Chinook salmon hard cap every year. This analysis shows that the penalty for violating the performance standard would be considerable in terms of the difference in potentially forgone gross revenue between the 60,000 Chinook salmon cap and the 47,591 Chinook salmon cap. This implies that the risk of bearing these impacts is likely to create the intended incentive for industry to avoid Chinook salmon bycatch by participating in an IPA with effective incentives to keep Chinook salmon bycatch below the 60,000 Chinook salmon cap.

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

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, 4, and 5. However, for Alternative 3, there is some potential for the levels of estimated bycatch to be higher than the cap given since 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 percent or more of the bycatch by season was taken. In the A season, since 1991, the areas have comprised 72-100 percent 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 percent 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, 4, and 5 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 at 2004 bycatch levels. 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 bycatch levels, 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 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 (2007) and under the most restrictive trigger levels, gross revenue at risk for the pollock industry would be about 85 percent, or $520 million, in the A season for all vessels combined. 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 $134.4 million in gross revenue at risk, or about 22 percent 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 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 $65.4 million (70/30) to $179.2 million (50/50) at risk. These values are 11 percent and 31 percent of total revenue respectively.

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 19 percent of total B season revenue. At the 29,300 trigger, and 70/30 split, the B season revenue at risk remains above 15 percent in all years except 2003. Even under the 87,500 trigger with a 70/30 split, $57 million, or 98 percent 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 percent of total first wholesale value.

Pollock stocks

EIS Chapter 4 analyzes the impacts of the alternatives on pollock stocks. Analysis of Alternatives 2, 3, 4, and 5 indicate that these alternatives would make it more difficult to catch the full TAC for Bering Sea pollock compared to Alternative 1. 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, 4, or 5 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 area closures 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, 4, and 5, 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 farther 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

EIS 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, 4, and 5 caps resulted in some reduction in overall chum salmon catch by year. The overall estimated reduction ranged from 34 percent 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). 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 had already been caught. Results for Alternative 5 (preferred alternative) 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, AEQ levels for chum were not estimated at this time.

Other groundfish

EIS 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.

None of the hard cap alternatives considered under Alternatives 2, 4, or 5, would be expected to measurably 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 these alternatives, 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

EIS Chapter 7 also evaluates the impacts of the alternatives on other prohibited species 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 limit 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, 4, or 5 constrain the pollock fishery that would reduce fishing effort and the associated incidental catch of forage fish.

Other marine resources

EIS 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. The pollock fishery 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.

Potential impacts of the alternatives on seabirds and marine mammals are expected to be limited. The preferred alternative (Alternative 5) as well as other hard cap alternatives under consideration (Alternatives 2 and 4), would potentially lead to a decrease in disturbance and the incidental takes of marine mammals and seabirds due to relative constraints by season on the pollock fishery if seasonal caps close the pollock fishery earlier than would have occurred with no cap. Additionally, 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.

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. 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, 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.

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, 4, and 5, 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, 4, and 5 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

RIR Chapter 8 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 United States, 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 RIR Chapters 3 and 8, Chinook salmon is extremely important to subsistence and commercial fishermen. Alternatives 2, 4, and 5 (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. 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.

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. The EIS Scoping Report, and the Comment Analysis 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 the Comment Analysis Report is included in Chapter 10. Both reports are available on the NMFS Alaska Region website.[12]

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. 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. The RIR discusses the social and economic impacts of the alternatives, particularly on Alaskan communities where the majority of the bycatch losses are believed to accrue.

[12] http://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm

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ACRONYMS & ABBREVIATIONS

%	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
AS1	Annual Scenario 1
AS2	Annual Scenario 2
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
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 (EIS) provides decision-makers and the public with an evaluation of the predicted environmental effects of alternative measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. The Regulatory Impact Review (RIR), in Volume II, provides decision-makers and the public with an evaluation of the social and economic effects of these alternatives to addresses the requirements of Executive Order 12866, Executive Order 12898, and other applicable federal law. If approved, 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). The Draft EIS/RIR served as the central decision-making document for the Council to recommend Amendment 91 to the Secretary of Commerce. The EIS and RIR are intended to serve as the central decision-making documents 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 addresses the requirements of Executive Order 12866 and Executive Order 12898.

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.

The EIS and RIR examine five 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 ten 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

The RIR evaluates the social and economic consequences of the alternatives. RIR analyzes the economic impacts of the alternatives, including a net benefit analysis of the preferred alternative and an Environmental Justice analysis of the impacts of the alternatives on minority and low income populations.

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 fishery. 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. This EIS analyzes 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. The alternatives represent a range of bycatch management measures for analysis that assist the decision-makers and the public in determining the best alternative to meet the purpose and need for the action. The alternatives meet the purpose and need by presenting different ways to minimize Chinook salmon bycatch in the Bering Sea pollock fishery to the extent practicable while achieving optimum yield.

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. 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 shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry. Section 3(33) of the MSA defines optimum yield to mean "the amount of fish which . . . (A) 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; [and] (B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor . . . ." NMFS has established in regulations at 50 C.F.R. § 679.20(a)(1)(i) that the optimum yield for the Bering Sea Aleutian Island Management area is a range from 1.4 to 2.0 million metric tons (mt).

The BSAI FMP defines total allowable catch is the annual harvest limit for a stock or stock complex, derived from the acceptable biological catch by considering social and economic factors. NMFS's regulations at 50 C.F.R. § 679.20(a)(2) provide that the sum of the TACs so specified must be within the optimum yield range. The BSAI FMP provides further elaboration of the differences among optimum yield (OY), acceptable biological catch (ABC) and total allowable catch (TAC):

> In addition to definitional differences, OY differs from ABC and TAC in two practical respects. First, ABC and TAC are specified for each stock or stock complex within the "target species" and "other species" categories, whereas OY is specified for the groundfish fishery (comprising target species and other species categories) as a whole. Second, ABCs and TACs are specified annually whereas the OY range is constant. The sum of the stock-specific ABCs may fall within or outside of the OY range. If the sum of annual TACs falls outside the OY range, TACs must be adjusted or the FMP amended (BSAI FMP at 13).

Recognizing that salmon bycatch management measures precluding the pollock fishery from harvesting its entire TAC for any given year are not determinative of whether the BSAI groundfish fishery achieves optimum yield, providing the opportunity for the fleet to harvest the TAC in any given year is one aspect of achieving optimum yield in the long term.

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 2002, the annual average Chinook salmon bycatch in the pollock fishery was 32,665 Chinook salmon. Chinook salmon bycatch numbers increased substantially from 2003 to 2007. 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 and 2009. The 2008 Chinook salmon bycatch estimate was 20,599 Chinook salmon. The preliminary estimate for 2009 is 12,410 Chinook salmon.

In light of the high amount of Chinook salmon bycatch through 2007, the Council and NMFS are considering new measures to minimize bycatch to the extent practicable while achieving optimum yield. 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, and despite the 2008 and 2009 decrease in Chinook salmon bycatch, concerns remain that, under the status quo, the potential exists for a high amount of Chinook salmon bycatch such as experienced in 2007.

The Council and NMFS decided to give priority to Chinook salmon bycatch management and limited the scope of this action to Chinook salmon, because Chinook salmon is a highly valued species and specific protection measures are warranted. The Council and NMFS are addressing non-Chinook salmon (primarily chum salmon) bycatch in the Bering Sea pollock trawl fishery with a separate subsequent 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.

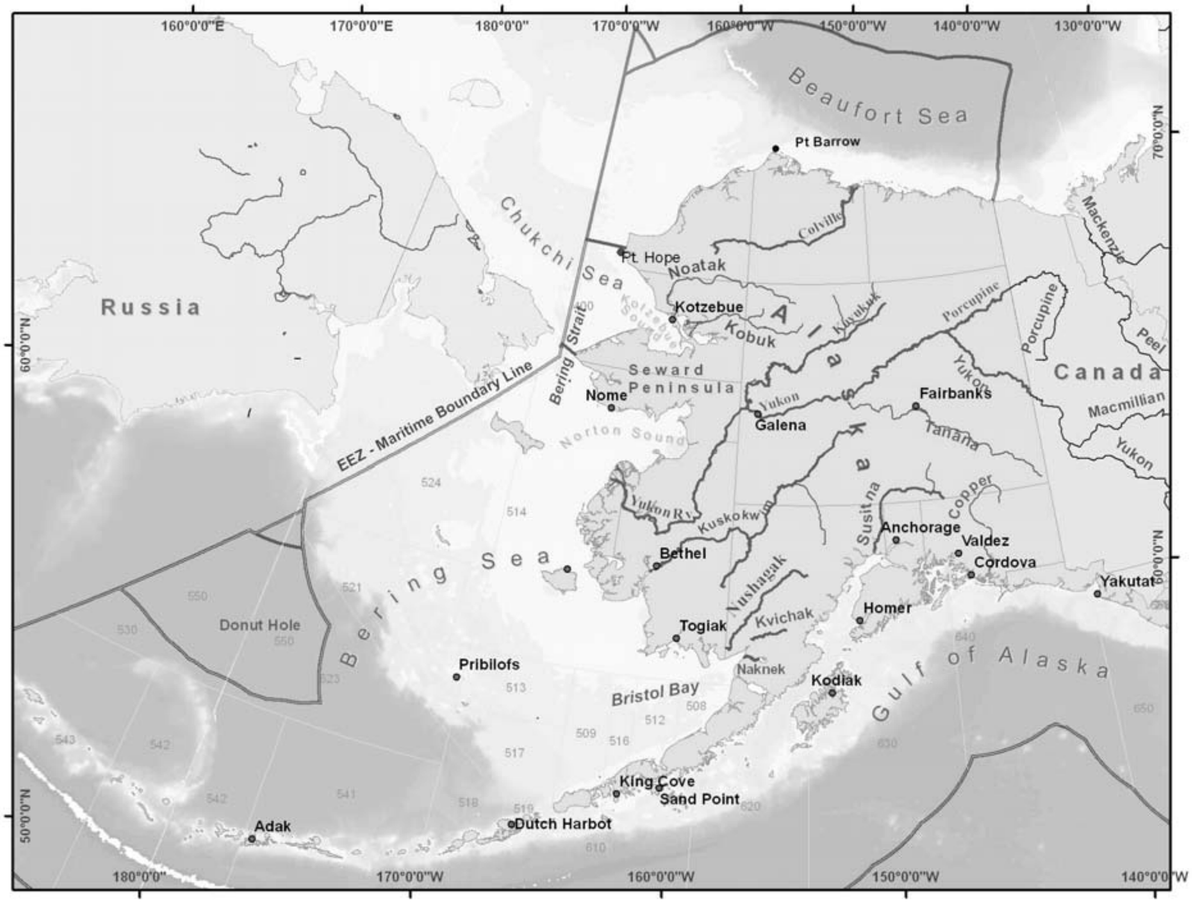

Fig. 1- 1 Map of the Bering Sea and major connected salmon producing rivers in Alaska and Northwest Canada

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.[13]

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

[13] http://alaskafisheries.noaa.gov/

species and life stages that use them. Additional information on salmon streams is available from the ADF&G website.[14]

1.4 The Bering Sea pollock fishery

Pollock is a commercially targeted species distributed in the North Pacific from Central California to the southern Sea of Japan. Currently, this species comprises a major portion of the BSAI finfish biomass and supports the largest single species fishery in the U.S. EEZ. The economic character of the fishery centers on the products produced from pollock: roe (eggs), surimi, and fillet products. In 2007, the total first wholesale gross value of retained pollock was estimated to be $1.248 billion. In 2008, the total value of pollock increased to an estimated $1.415 billion.

Within the BSAI management area, pollock is managed as three separate stocks: the Eastern Bering Sea, the Aleutian Islands region stock, and the Aleutian Basin or Bogoslof stock. The largest of these stocks, the Eastern Bering Sea stock, is the primary target of the pollock fishery. Since 1977, average annual catch of pollock in the Bering Sea has been 1.2 million tons while reaching a peak of catch of nearly 1.5 million tons in 2006.

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.

Sections 206(a) and (b) of the AFA establish the allocation of the Bering Sea pollock TAC among four AFA sectors. First, 10% of the Bering Sea pollock TAC is allocated to the CDQ Program. Then, NMFS reduces the remainder of the TAC by an amount of pollock that will be harvested as incidental catch in the non-pollock fisheries. In 2009, the incidental catch allowance for Bering Sea pollock was 29,340 mt. The remaining amount, after subtraction of the CDQ allocation and the incidental catch allowance, is called the directed fishing allowance. As required under the AFA, NMFS then allocates the directed fishing allowance among the three remaining AFA sectors (the "non-CDQ sectors"): 50% to the inshore catcher vessel (CV), 40% to the offshore catcher processor (CP), and 10% to the mothership sector (MS). Because the percentage of the TAC allocated to each of the four AFA sectors is specified in the AFA, transfer of pollock among the sectors is not allowed.

Pollock allocations to the AFA sectors are further divided into two seasons – 40% to the A season (January 20 to June 10) and the 60% to the B season (June 10 to November 1). NMFS may add any under harvest of a sector's A season pollock allowance to the subsequent B season allowance. Typically, the fleet targets roe –bearing females in the A season and harvests the A season TAC by early April. The B season fishery focuses on pollock for filet and surimi markets and the fleet harvests most the B season TAC in September and October.

In addition to the required sector level allocations of pollock, the AFA allowed for the development of pollock industry cooperatives. Ten such cooperatives were developed as a result of the AFA: seven inshore cooperatives, two offshore cooperatives, and one mothership cooperative. These cooperatives are described below in more detail. All cooperatives are required to submit preliminary and final annual written reports on fishing activity including prohibited species catch (PSC) on an area-by-area and vessel by vessel basis. NMFS and the Council are required by the AFA to release this information to the public.

[14] http://www.state.ak.us/adfg/habitat

1.4.1 Community Development Quota Program

The CDQ Program was established by the Council in 1992 to improve the social and economic conditions in western Alaska communities by facilitating their economic participation in the BSAI fisheries. 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 pollock to such communities. Their initial 7.5% allocation of pollock was expanded to 10% with the enactment of the AFA. These allocations are further allocated among the 6 CDQ groups: 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). The percentage allocations of pollock among the six CDQ groups were approved by NMFS in 2005 based on recommendations from the State of Alaska. These percentage allocations are now the required allocations of pollock among the CDQ groups under section 305(i)(1)(B) of the Magnuson-Stevens Act. CDQ groups typically sell or lease their Bering Sea pollock allocations to various harvesting partners. The vessels harvesting CDQ pollock are the same vessels conducting AFA non-CDQ pollock harvesting. More detailed information on the CDQ Program is contained in the RIR.

1.4.2 Inshore catcher vessel sector

Each year, catcher vessels eligible to deliver pollock to the seven eligible AFA inshore processors may form cooperatives associated with a particular inshore processor. These catcher vessels are not required to join a cooperative and those that do not join a cooperative are managed by NMFS under the "inshore open access fishery." In recent years, all inshore catcher vessels have joined one of seven inshore cooperatives. Annually, NMFS allocates the inshore sector's allocation of pollock among the inshore cooperatives and, if necessary, the inshore open access fishery. NMFS permits the inshore cooperatives, allocates pollock to them, and manages these allocations through a regulatory prohibition against an inshore cooperative exceeding its 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. The annual pollock allocation for the inshore CV sector is divided up by applying a formula in the regulations which allocates catch to a cooperative or the inshore open 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(a)(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 to the inshore cooperative, with the permit application listing the vessels added or subtracted.

An inshore CV open access fishery could exist if vessels choose not to join a cooperative in a given year. In this case, the inshore CV pollock allocation would be partitioned to allow for an allocation to the limited access fishery. The TAC for the inshore open access fishery is based on the portion of total sector pollock catch associated with the vessels not participating in one of the inshore CV cooperatives.

1.4.3 Offshore catcher/processor 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.

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

1.4.4 Participation in the 2007 and 2008 pollock fisheries

In 2007 and 2008, 89 unique catcher vessels participated in the pollock fishery with 17 catcher vessels making delivering to motherships. The number of CV delivering pollock to inshore processors varied between 2007, 82 vessels, and 2008, only 80 vessels. All 7 shore based processors participated in the 2008 fishery, while in 2007 the Arctic Enterprise Association did not operate and, therefore, their allocation was delivered to another AFA plant. In 2008, one catcher vessel (*Muir Milach*) delivered pollock to the CP sector comprised of 17 participating CP vessels, as compared to only 16 CP vessels participating in the fishery in 2007. Each of the mothership sector's three AFA permitted vessels participated in the 2007 and 2008 fishery. The RIR Chapter 2 provides the participation in the pollock fishery from 2003 to 2008.

Table 1-1 Participation in the 2007 and 2008 Bering Sea pollock fishery

AFA sectors, processors, and vessels	Number permitted under AFA	Number participating in 2008	Number participating in 2007
Catcher/processor	21	17	16
CV delivering to catcher/processor	7	1*	0
Motherships	3	3	3
CV delivering to motherships	19	17	17
Inshore processors	7	7	6
CV 60 ft.-125 ft.	70	56	56
CV ≥ 125 ft	29	24	26
Total CV to inshore processors	N/A	80	82
Total unique CV	99	89	89
Inshore cooperatives	N/A	7	6
CDQ groups	N/A	6	6

* In 2008, catcher vessel (*Muir Milach*) delivered 1467 mt of pollock to 2 AFA CPs and did not deliver to shoreside or motherships.

1.5 Public Participation

The EIS and RIR were developed with several opportunities for public participation and is based on and prepared from the issues and alternatives identified during the scoping process, the Council process, and the public comment process for the draft EIS/RIR. This section describes these avenues for public participation.

1.5.1 Notice of intent and scoping

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 and RIR. 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.[15]

Additionally, members of the public participated and commented 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 continued as NMFS and the Council developed and refined the alternatives under consideration until the Council took final action in April 2009 to recommend a preferred alternative to NMFS.

1.5.2 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, the EIS and RIR address 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.

[15] http://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm

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/RIR, can provide a resource to tribes to enable them to adequately participate.

1.5.3 Public comments on the Draft EIS/RIR/IRFA

NMFS released the Draft EIS/RIR/IRFA and solicited public comment on the during an 80-day public comment period from December 5, 2008, to February 23, 2009. NMFS received 61 letters of comment. The letters of comment are posted on the NMFS Alaska Region website.[16]

Chapter 9 contains the Comment Analysis Report (CAR), which provides the public comments received during the comment period, summarizes them, and presents the agency's response. NMFS provided a preliminary CAR to the Council at the April 2009 meeting and posted the preliminary CAR on the NMFS Alaska Region web page along with the public comments. The preliminary CAR contained summaries of the public comments received during the comment period and the agency's responses. The preliminary CAR also contained, as appendices, the EIS and RIR sections that authors substantively revised based on public comments. The preliminary CAR appendices have been incorporated into this final EIS. The preliminary CAR was also a tool for the authors to revise the EIS and RIR and respond to each statement of concern.

1.5.4 Changes to the Final EIS and Final RIR from the Draft EIS/RIR/IRFA

All changes from draft to final are detailed in Chapter 9. This section summarizes the major changes. The first major change from the Draft EIS/RIR/IRFA was to separate the Final EIS and Final RIR into Volume I and Volume II, respectively. This change was made primarily because the combined final document was over 1000 pages and thus too large to fit into one volume. Additionally, the final IRFA is not included these documents and will be published in the classifications section of the preamble to the proposed rule due to the nature of that analysis.

The second major change was the incorporation and analysis of Alternative 5, which the Council recommended as the preferred alternative in April 2009. A description of Alternative 5 was added to Chapter 2 and Chapters 4 through 8 and the Final RIR analyze the impacts of Alternative 5.

The third major change was to incorporate into the Final EIS and Final RIR the sections that authors substantively revised based on public comments. These sections were provided as appendices to the preliminary CAR for Council consideration when it took final action in April 2009.

Additional changes were made throughout the document to improve clarity and organization.

1.5.5 Community outreach

One of the Council's policy priorities is to improve Alaska Native and community consultation in federal fisheries management. The Council identified the need to improve the stakeholder participation process during development of the EIS and RIR. 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 and prior to final Council action. The Council developed an outreach plan 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, dovetailed with the Council's overall community and Native stakeholder participation policy.

[16] http://www.fakr.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/comments/default.htm

The outreach plan for Chinook salmon bycatch management was intended to enable 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 1.5.7, 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 summary report to document the outreach process and results of the regional and Native meetings were prepared and presented to the Council in April 2009, when the Council took final action to recommend Alternative 5. The report, entitled "Summary and Results of Outreach Plan for DEIS on Chinook Salmon Bycatch in the Bering Sea Pollock Fishery," is summarized below and available on the Council website.[17]

1.5.6 Summary of the community outreach meetings

Upon informal consultation with community and Native coordinators, Council staff determined that the most effective approach to community outreach meetings is to work with established community representatives and Native entities within the affected regions and attend annual or recurring regional meetings, in order to reach a broad group of stakeholders in the affected areas. Council staff consulted with the coordinators of the Federal Subsistence Regional Advisory Councils (RACs) 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 Council process, overall outreach efforts, and the proposed action on Chinook salmon bycatch reduction measures, at six separate regional meetings. After the presentations, the organizations and the public asked questions and provided feedback on the proposed action and process. Council staff recorded questions and comments. Two Council members attended five of the six meetings, and one to two Council staff analysts attended each meeting.

In sum, Council staff, Council members, and when possible, NMFS staff, participated in the following regional meetings:

Bristol Bay RAC October 6 – 7, 2008 Dillingham
AVCP meeting October 7 - 9, 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
Nome Outreach Meeting January 22, 2009 Nome

In addition to the above regional/community meetings, Council staff provided a lengthy presentation of the main EIS findings at the Yukon River Panel meeting on December 9, 2008. The Yukon River Panel is an international advisory body established under the Yukon River Salmon Agreement for the conservation, management, restoration, and harvest sharing of Canadian-origin salmon between the U.S. and Canada. Nine Council members attended. In addition to specific clarifications on the presentation and Council intent, there was substantial time allotted for discussion between Yukon River Panel members and Council members on the forthcoming action.

A short summary of each meeting is provided below. Note that the dates provided below refer to the date on which the Council presentation and comments occurred, recognizing that each meeting was typically two to three days. The complete outreach report also contains (1) details of the regional meetings attended, the participants, and the comments (by category), and (2) copies of resolutions or motions resulting from these meetings.

[17] http://www.fakr.noaa.gov/npfmc/current_issues/bycatch/BycatchOutreach409.pdf

Bristol Bay Subsistence Regional Advisory Council, October 7, 2008, Dillingham

The Bristol Bay RAC meeting was comprised primarily of RAC members and State and Federal agency staff, with a few public participants (estimate of 25 total participants). The Bristol Bay RAC represents 31 Bristol Bay subsistence communities and rural residents. The RAC emphasized the importance of Chinook salmon as a subsistence food and noted lower returns (and smaller Chinook) in their region. The RAC was also very concerned about the lack of genetic information on which to base potential impacts to individual river systems. The RAC adopted a resolution to (1) request the Council adopt regulations to significantly minimize the bycatch of all salmon species in the Bering Sea pollock fishery; (2) support a Chinook salmon bycatch hard cap not to exceed 38,000 fish annually; (3) support hard caps and other regulations that are conservative and designed to preserve salmon stocks; and (4) support State and Federal efforts to conduct additional data collection and analyses to refine regulations that minimize salmon bycatch in the Bering Sea trawl fisheries.

Association of Village Council Presidents 44th Annual Convention, October 8, 2008, Bethel

The AVCP is centralized in the Yukon-Kuskokwim Delta, along the Southwestern region of Alaska, and serves 56 Federally-recognized Alaska tribes. Approximately 200 participants attended, including representatives from member tribes, subsistence and commercial salmon fishermen, Federal and State agency staff, CDQ group representatives, and city and borough representatives. Translation services were provided to translate between Yupik and English. Comments were centered on the priority to protect the subsistence salmon fishery, both for cultural and traditional reasons, as well as a primary food source.

Detailed comments were provided with regard to Alternative 4 and incentive plans linked to a higher cap of 68,000 Chinook salmon. The AVCP submitted a resolution relevant to this issue at the 2008 Alaska Federation of Natives annual convention, which passed. The resolution encouraged the Council and NMFS (1) to take emergency action to regulate the 2009 pollock fishery such that measures would ensure the conservation and rebuilding of western Alaska Chinook salmon stocks; (2) to implement permanent regulations for the 2010 pollock fishery; and (3) to establish a bycatch hard cap of no more than 30,000 Chinook.

Eastern Interior Subsistence Regional Advisory Council, October 15, 2008, Nenana

The Eastern Interior RAC meeting was comprised primarily of RAC members, community members, environmental groups, and some State and Federal agency staff (estimate of 40 total participants). The Eastern Interior RAC represents thirteen villages along the Yukon or Tanana rivers and an additional seventeen villages within the region. The RAC emphasized several concerns about the preliminary preferred alternative and its ability to meet a goal of reduced Chinook salmon bycatch and to increase in-river fisheries. While appreciative of the efforts to communicate with the RAC on this issue, the RAC also commented that ongoing, open dialogue with the Council is long overdue and that additional, noncommercial representation on the Council is necessary.

The RAC adopted several motions, which were sent in the form of a letter to the Council (dated 1/30/09). The motions (1) supported a Chinook salmon hard cap of 29,323 for immediate implementation; (2) requested economic penalties on individual trawl vessels; (3) recommended that the pollock industry bear the cost of improved sampling methods and genetic studies on the Chinook salmon stocks impacted by the industry's bycatch; (4) recommended modification to the food bank program in order to distribute bycaught salmon to Western and Interior Alaska communities; and (5) related concerns with the length of time it takes to have a management action implemented.

Northwest Arctic Subsistence Regional Advisory Council, October 16, 2008, Kotzebue

The Northwest Arctic RAC meeting was attended primarily by RAC members and Federal and State agency staff. The region the RAC represents encompasses 11 villages on the coast of Kotzebue Sound and along the Noatak and Kobuk Rivers. The RAC did not have a quorum under which it could conduct business, due to airline cancellations due to weather. However, members present did receive the presentation and comment on the proposed action. The primary comments and questions addressed the rationale for the various range of hard caps. The RAC noted some tentativeness in providing a recommendation on the proposed action, as Chinook salmon is less important to their region relative to chum and char. The RAC noted significant interest in future management measures for chum salmon.

Western Interior Subsistence Regional Advisory Council, October 28, 2008, McGrath

The Western Interior RAC meeting was comprised of RAC members, State and Federal agency staff, and community members (estimate of 25 total participants). The region the RAC represents encompasses 27 villages along the Yukon and Kuskokwim rivers. The RAC related concerns that several external factors, including fuel prices and unsustainable management measures, put increasing pressure on subsistence users. They had several questions about the rationale supporting Alternative 4 and questioned the potential efficacy of the incentive plans and the transferability provisions. The RAC did not support the hard cap of 68,000 Chinook, noting that it represents an average of the three highest bycatch years on record.

The Western Interior RAC adopted several motions, which were sent in the form of a letter to the Council (1/30/09). The motion recommended a hard cap of 29,323 Chinook, which represents the long-term historic range of Chinook salmon bycatch, but that a hard cap within the 10-year average of 29,000 – 38,000 Chinook would be acceptable. While the RAC does not support the higher cap of 68,000 Chinook, if a higher cap figure is adopted, selling or trading the caps should not be allowed. The motion also recommended that all salmon bycatch should be processed and returned to Alaskan communities within the rivers of origin, but not to replace subsistence activities. Finally, the RAC requested a review of the pollock quota and consideration of season reductions to protect the pollock stock, noting concern that as the pollock stock becomes less abundant, more fishing effort follows, which results in additional salmon bycatch.

Nome Council Outreach Meeting, January 22, 2009,

Council staff organized an outreach meeting in Nome to reach the Bering Straits communities. The Alaska Sea Grant Marine Advisory Program (MAP) agent in Nome helped publicize the meeting and provided equipment, and the Nome Eskimo Community hosted the meeting at its tribal hall. This meeting was also coordinated with NMFS, in that NMFS conducted a tribal consultation with the Nome Eskimo Community subsequent to the Council's outreach meeting. The outreach meeting was also intended to provide background information to facilitate the tribal consultation. The meeting in Nome was publicized through the community's email list serve, which generally reaches the sector of Nome which attends events, meetings, and activities. The meeting was also advertised on two radio stations in Nome. A letter was also sent to 30 Bering Strait governments, IRAs, and village corporations in early January, which announced the meeting and the ability to set up remote audio/internet sites in several villages, which would allow nearby villages to listen to the meeting real-time and follow the powerpoint presentation on a host computer. In addition, the Nome MAP agent posted the Council outreach flyer at about 15 locations in Nome.

An estimated 50 people attended the meeting in Nome, with several additional people participating remotely from the communities of Stebbins, Brevig Mission, Elim, Unalakleet, and Kotzebue. A broad cross-section of individuals participated, including ADF&G staff, Board members and staff of the NSEDC, members of the pollock industry, an environmental group, staff from the local radio and newspaper, subsistence and commercial salmon fishermen, tribal representatives from the Nome Eskimo Community, Elim, Stebbins, and Brevig Mission, and staff of Kawerak, Inc., which is the regional non-profit corporation organized by the Bering Straits Native Association to provide services throughout the Bering Straits Region.

Feedback provided at this meeting was also varied, but centered heavily on the cultural significance and traditional use value of Chinook to surrounding communities, and the lack of adequate analysis in the EIS/RIR on the impacts to and characterization of the subsistence fishery. Participants also provided several comments on Alternative 4, and the concept of the industry incentive plans. Overall, those who addressed a specific cap level supported a lower cap of 30,000 Chinook salmon, noting that the starting place for such a measure should be conservative due to the lack of genetic data and uncertainty. Comments were also made noting that the local CDQ group, NSEDC, contributes heavily to the Norton Sound economy in terms of employment, community share payments, and fishery infrastructure projects, and that the majority of CDQ funding is directly related to the pollock fishery. Formal comments on the EIS/RIR have been provided from several of the tribes and organizations that attended this meeting.

1.5.7 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. The tribal consultation process is an opportunity for NMFS to learn about local subsistence use and harvest of Chinook salmon as well as the cultural value and importance of subsistence. The information NMFS learned during these consultations is reflected in the EIS and RIR analysis.

NMFS's consultation process involves the tribes early and throughout the decision-making process in accordance to Executive Order 13175. Presently, for major federal actions that require an EIS, we begin the tribal consultation process at scoping, which is the first step in the decision-making process. Scoping is intended to identify the issues associated with, and alternatives to, the proposed action. The NMFS Regional Administrator sends each tribe a letter explaining the proposed action and how an interested tribe can provide comments and contact NMFS for a consultation. Thereafter, NMFS consults with any tribe upon request. Subsequently, upon release of the DEIS, NMFS sends another letter to each tribe soliciting comments on the scope and content of the document, providing information on how to receive a copy, and again inviting interested tribes to contact NMFS for a consultation. Likewise, NMFS sends a similar letter with the release of the final EIS. Each tribal consultation letter identifies the NMFS point of contact for the proposed action. That person is typically NMFS's most knowledgeable person on the issues relevant to the proposed action. The NMFS point of contact works with each interested tribe to conduct the consultation between the tribe and the NMFS Regional Administrator or his designee.

To start the consultation process for this action, 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 proposed action and 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 outreach meetings and the Council meetings where the Council developed the alternatives.

Once the DEIS 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 DEIS. The letter included a copy of the executive summary and provided information on how to obtain a printed or electronic copy of the DEIS. Also, NMFS mailed 23 copies of the DEIS to the Alaska Native representatives that requested a copy or provided written comments to NMFS. NMFS received 14 letters providing comments on the DEIS and the alternatives from tribal government, tribal organization, and Alaska Native corporation representatives, which are summarized and responded to in this Comment Analysis Report in Chapter 9. These comments provide information about local subsistence use of salmon and the importance of Chinook salmon to individuals and communities in Alaska. The comment letters are posted on the NMFS Alaska Region website.[18]

Additionally, NMFS received letters from seven tribal government representatives requesting a consultation; the Nome Eskimo Community, Chinik Eskimo Community (Golovin), the Stebbins Community Association, the Native Village of Unalakleet, the Native Village of Kwigillingok, the Native Village of Kipnuk, and the Alakanuk Tribal Council.

NMFS held a tribal consultation in Nome on January, 22, 2009 in conjunction with a Council outreach meeting on Chinook salmon bycatch. Consulting in person with NMFS in Nome were representatives of the Nome Eskimo Community, the Chinik Eskimo Community, and the Native Village of Elim. Consulting by telephone were representatives of the Stebbins Community Association and the Native Village of Unalakleet. Council staff provided information on the DEIS, the alternatives, and the schedule for Council action. NMFS staff provided additional information and then listened to the concerns and issues raised by the tribal representatives. The issues and concerns discussed at the consultation are reflected in the letter from the Nome Eskimo Community, which is summarized and responded to in the CAR.

NMFS also held a tribal consultation teleconference on March 17, 2009, with the Native Village of Kwigillingok and the Bering Sea Elders Advisory Group. The issues and concerns discussed at the consultation are reflected in the letter from the Bering Sea Elders Advisory Group, which is summarized and responded to in the CAR and posted on the NMFS Alaska Region web page.

NMFS also held a tribal consultation teleconference on October 19, 2009, with the Alakanuk Tribal Council and the Native Village of Kipnuk. The Regional Administrator provided information the Chinook and chum salmon bycatch in the Bering Sea in 2009 and then listened to the concerns and issues raised by the tribal representatives. The tribal representatives expressed the difficulty of meeting subsistence needs of Chinook salmon in 2009. They explained a cap of 60,000 Chinook salmon was too high to conserve the species and recommended a cap of 29,000 Chinook salmon.

Once NMFS released the Final EIS and Final RIR, NMFS sent another letter to Alaska Native representatives to announce the release of the document and solicit comments. The letter included a copy of the executive summary and provided information on how to obtain a printed or electronic copy of the

[18] http://www.fakr.noaa.gov/sustainablefisheries/bycatch/default.htm

Final EIS and Final RIR. Also, NMFS mailed 28 copies of the Final EIS and Final RIR to the Alaska Native representatives that requested a copy or provided written comments to NMFS.

1.5.8 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 the EIS and RIR and provided data, staff, and review for this analysis. ADF&G has an integral role in the development of the EIS and RIR 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. NMFS mailed a copy of the DEIS/RIR/IRFA and Final EIS and RIR to all members of the Council, its Scientific and Statistical Committee and its advisory Panel.

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 Laws, Policies, and Treaties

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. The EIS and RIR contain 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)
- Information Quality Act (IQA)
- Coastal Zone Management Act (CZMA)
- Alaska National Interest Lands Conservation Act (ANILCA)
- American Fisheries Act (AFA)
- Executive Order 12866: Regulatory planning and review
- Executive Order 13175: Consultation and Coordination with Indian Tribal Governments
- Executive Order 12898: Environmental Justice
- Pacific Salmon Treaty and the Yukon River Agreement

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.

The actions under examination in the EIS and RIR 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 (ESA)

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[19] 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. NMFS Sustainable Fisheries, Alaska Region, conducted an ESA Section 7 consultation on the proposed action with NMFS Northwest Region for listed salmon. On December 2, 2009, the NMFS Northwest Region issued a Supplemental Biological Opinion that concluded that the proposed action is not likely to jeopardize Upper Willamette Chinook or Lower Columbia River Chinook, and will have no effect on designated critical habitat for these two species (NMFS 2009).

1.7.4 Marine Mammal Protection Act (MMPA)

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

[19] 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)).

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.

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 DEIS contained a draft IRFA as Chapter 11 that identified the small entities directly regulated by the proposed action. The preamble to the proposed regulations that will be published in the *Federal Register* will contain the IRFA that evaluates the adverse impacts of this action on directly regulated small entities, in compliance with the RFA.

1.7.7 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.[20] Pursuant to the IQA and the NOAA guidelines, this information product has undergone a pre-dissemination review by NMFS, completed on November 30, 2009.

1.7.8 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.

1.7.9 Alaska National Interest Lands Conservation Act (ANILCA)

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).

[20] http://www.noaanews.noaa.gov/stories/iq.htm

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. The RIR evaluates the consequences of the proposed actions on subsistence uses. 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.

1.7.10 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.[21]

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. The RIR contains a detailed discussion of the pollock fishery under the AFA and the relationship between the Chinook salmon bycatch management and the AFA.

1.7.11 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

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

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.

The RIR, in Volume II, identifies economic impacts and assesses of costs and benefits of the proposed salmon bycatch reduction measures.

1.7.12 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 and RIR, NMFS has initiated a meaningful government-to-government consultation process with affected tribal governments and Alaska Native corporations, as described in Section 1.5.7.

1.7.13 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. The RIR analyzes the effects of this federal action on minority populations in Chapter 8 on Environmental Justice.

1.7.14 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 and RIR addresses the substantive issues involving the portion of Chinook salmon taken as bycatch in the Bering Sea pollock fishery that originated from the Yukon River and the impacts of salmon bycatch in the pollock fishery on returns of Chinook salmon to the Canadian portion of the Yukon River.

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 five alternatives:

Alternative 1: Status Quo (No Action)

Alternative 2: Hard cap

Alternative 3: Triggered closures

Alternative 4: Hard caps with an intercooperative agreement

Alternative 5: Preferred Alternative - Hard caps with incentive plan agreements and a performance standard

The alternatives analyzed in this EIS and the RIR 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 a portion of the pollock total allowable catch (TAC) has not yet been harvested. Alternatives 2, 4, and 5 represent a change in management of the pollock fishery because if the Chinook salmon bycatch allocations are reached before the full harvest of the pollock quota, then pollock fishing must stop. Under Alternative 3, like Alternative 1, reaching the cap closes specific areas important to pollock fishing.

To best present the alternatives in comparative form, this chapter is organized into sections that describe in detail each alternative's components, options, and suboptions. To avoid unnecessary repetition, many aspects of the alternatives are presented in this chapter only, and cross-referenced later in the document as applicable.

For each alternative, the specific Chinook salmon bycatch caps under consideration for each component and option are listed in this chapter. Alternatives 2 and 3 contain eight different cap options, ranging from 29,323 to 87,500 Chinook salmon. For Alternatives 2 and 3, a subset of caps are used as the basis for the impact analysis in Chapters 4 through 8 and in the RIR. Alternatives 4 and 5 contain three different cap levels. Each of the alternatives to status quo include options that would allocate Chinook salmon bycatch caps among the sectors, inshore cooperatives, and CDQ groups participating in the pollock fishery. The use of transferable Chinook salmon bycatch allocations is a new aspect of managing the pollock fishery and represents the largest challenge for management and enforcement.

This chapter also describes how management of the pollock fishery 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 pollock fishery are discussed in RIR Chapter 6.

2.1 Alternative 1: Status Quo (No Action)

Alternative 1 retains the current program of Chinook Salmon Savings Area (SSA) closures in the BS 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 Voluntary Rolling Hot Spot intercooperative agreement (VRHS ICA). The VRHS ICA regulations were implemented in 2007 through Amendment 84 to the BSAI FMP. Closure of the SSAs is designed to reduce the total amount of Chinook incidentally caught by closing areas with historically high levels of salmon bycatch. The VRHS ICA operates in lieu of regulatory closures of the SSA and requires industry to identify and close areas of high salmon bycatch and move to other areas. Only vessels directed fishing for pollock are subject to the SSA closures and ICA regulations.

2.1.1 Chinook Salmon Savings Areas

Alternative 1 would keep the existing Chinook SSA closures in effect (Fig. 2-1). The Chinook salmon PSC limit in the Bering Sea is 29,000 Chinook salmon. This PSC limit is allocated among the non-CDQ pollock fisheries (92.5% or 26,825 salmon) and the CDQ Program (7.5% or 2,175 salmon). In the absence of an approved VRHS ICA described in Section 2.1.2, NMFS closes the two Chinook SSAs to directed fishing for pollock if the non-CDQ portion of the Chinook salmon PSC limit is triggered by vessels directed 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.

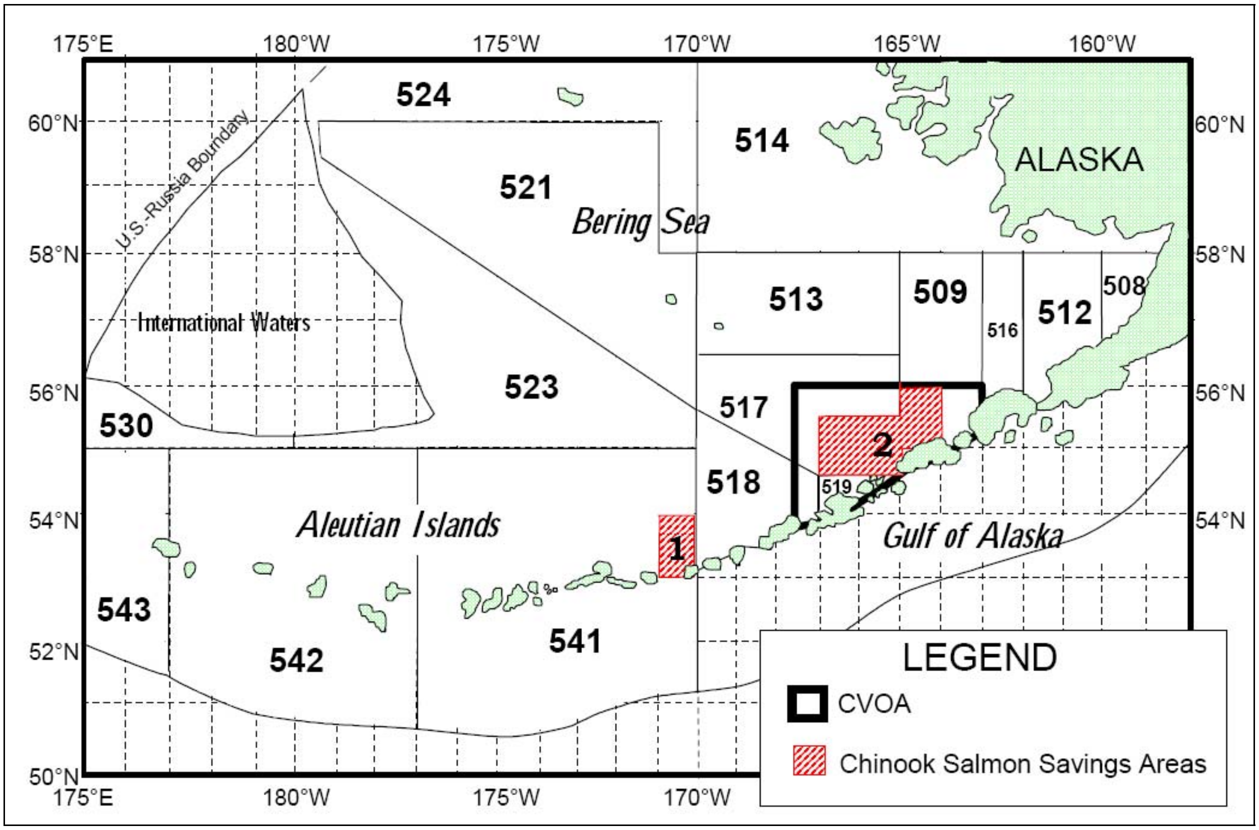

Fig. 2-1 Bering Sea and Aleutian Islands Chinook Salmon Savings Areas.

2.1.1.1 PSC limits for the CDQ Program

Under the status quo, the CDQ Program receives allocations of 7.5 % 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 PSQ reserve[22], 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 (CVRF) 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 VRHS ICA approved in 2008, so they currently are exempt from closure of the Chinook salmon savings area.

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

2.1.2 Voluntary Rolling Hotspot System Intercooperative Agreement

Regulations implemented under Amendment 84 to the BSAI FMP exempt 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 fleet voluntarily started the VRHS program in 2001 for chum salmon and in 2002 for Chinook salmon. The exemption to regulatory area closures for vessels that participated in the VRHS was implemented in 2006 and 2007 through an exempted fishing permit. 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 and CDQ groups that have participated in the BS pollock fishery since 2008, except one vessel, have participated in this ICA.

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.

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 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. Additional information about the VRHS ICA is provided in RIR Chapter 2.

2.1.3 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 the NOAA Office for Law Enforcement (OLE) for subsequent investigation. Depending on its findings for each particular case, NOAA OLE may forward cases to NOAA General Counsel (GC) for prosecution. The investigation and disposition of regulatory infractions requires considerable staff time from the Alaska Fishery Science Center's (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. Additional information about 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 vessel and its operation. 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. One AFA permitted vessel is less than 60 feet, however, currently this vessel does not actively participate in the pollock fishery.

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). Additional information about monitoring for salmon bycatch at the shoreside processing plants is in Section 3.1.

2.1.4 2007 and 2008 pollock catch and 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, vessels in the 30 percent observer coverage category are a significant component of the inshore sector. 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).

Table 2-1 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 2-1 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	101	1,182,669	100%	116,193	100%

Number of vessels does not include 7 catcher vessels that deliver only unsorted codends to motherhips and do not require an observer.

Table 2-2 shows the estimated pollock catch and salmon bycatch in the AFA pollock fisheries in the Bering Sea in 2008, by fishery sector and vessel length class. Fifty-four of the 80 vessels participating in the inshore sector in 2008 were in the 30 percent observer coverage category. These vessels caught approximately 21 percent of the pollock catch and an estimated 25 percent of the Chinook salmon bycatch.

Table 2-2 Number of vessels that participated in the 2008 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	17	346,998	40%	4,467	23%
Motherships	3	85,364	10%	1,301	7%
CV 60 ft.-125 ft.	56	177,156	21%	4,948	25%
CV ≥ 125 ft.	24	250,585	29%	8,742	45%
Total	100	860,103	100%	19,458	100%

Number of vessels does not include 9 catcher vessels that deliver only unsorted codends to motherhips and do not require an observer.

2.2 Alternative 2: Hard Cap

Alternative 2 would establish a hard cap to limit Chinook salmon bycatch in the pollock fishery. When the hard cap 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 2-3).

Under this alternative, Component 1 requires selecting the hard cap. As described below and shown in Table 2-3, 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 none of the options under the Components 2-4 are selected, 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 up to seven cooperatives, each composed of multiple fishing vessels associated with a specific inshore processor. There also is a possibility than an inshore open access sector could form, if one or more catcher vessels do 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 specific cap levels 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.

Table 2-3 Alternative 2 components, options, and suboptions.

Setting the hard cap (Component 1)	Option 1: Select from a range of numbers	i) 87,500 ii) 68,392 iii) 57,333 iv) 47,591 v) 43,328 vi) 38,891 vii) 32,482 viii) 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%; allocated and managed at the CDQ group level	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 in 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%

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 at the pollock fishery level to the CDQ and non-CDQ fisheries (not allocated by sector within the non-CDQ sectors), or may be subdivided by sector (Component 2) and the inshore sector allocation further allocated among the inshore cooperatives (Component 4). All annual hard caps would be apportioned by season.

2.2.1.1 Range of numbers for a hard cap

Table 2-4 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 2-4 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 2-4. 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.

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.[23]
- 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.

[23] 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 1.7.14.

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 2-5).

Table 2-5 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 updated salmon bycatch information would be reassessed after a certain number of years to determine whether adjustments to the hard cap are needed. 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 2-6 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 2-5). 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 2-6 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 2-7). Note that here the CDQ allocation of salmon is higher than under status quo (10% rather than 7.5%).

Table 2-7 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 2-8 lists the range of sector cap levels under Option 1 for the A season (applying the seasonal allocation options listed in Table 2-6), and Table 2-9 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 2-8 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 2-9 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 2-10).

Table 2-10 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 2-11).

Table 2-11 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 2-12).

Table 2-12 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 2-13).

Table 2-13 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 2-14 - Table 2-17 list the range of sector cap levels for the A season under Options 2a-2d (applying the seasonal allocation options listed in Table 2-6), which will be utilized to evaluate the impacts of Component 2. Shaded rows are omitted from detailed impact analysis.

Table 2-14 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 2-15 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 2-16 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 2-17 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 2-18 through Table 2-21 list the range of sector cap levels for the B season under Options 2a-2d (applying the seasonal allocation options listed in Table 2-6), which were utilized to evaluate the impacts of Component 2. Shaded rows were omitted from detailed impact analysis.

Table 2-18 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 2-19 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 2-20 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 2-21 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 hard cap is apportioned among the sectors under Component 2. Options 1 and 2 are mutually exclusive, which means that 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 could be selected.

If sector level caps under Component 2 are selected, but 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 an entity that could:

- represent all vessels eligible to participate in the particular AFA sector and receive allocations 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 entity).

More information about the entities necessary to receive transferable Chinook salmon bycatch allocations is in Section 2.2.5.4

Once sector level salmon bycatch hard caps are allocated to an 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. The Council did not recommend transfers to cover overages of Chinook salmon bycatch allocations as an option under Alternatives 2, 3 or 4. However, when the Council developed its preferred alternative (Alternative 5) in April 2009, it included a recommendation for transfers to cover overages.

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 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 sector level caps are set under Component 2. Component 4 would further subdivide the inshore CV sector level cap to the inshore cooperatives and the inshore open access fishery (if the inshore open 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 inshore open access fishery once that fishery's cap is reached.

The allocation of salmon to a cooperative within the inshore CV fleet or to the inshore open access fishery would be based upon the proportion of total sector pollock catch associated with the vessels in the cooperative or inshore open access fishery, respectively. The annual pollock quota for this sector is allocated by applying a formula which allocates catch to a cooperative, or the inshore open access fishery, according to the specific sum of the catch history for the vessels in the cooperative or the inshore open 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 inshore open 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 inshore open 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 2-7, Table 2-10 to Table 2-13). The cooperative level allocations are listed in Table 2-22 through Table 2-26. All inshore sector catcher vessels have been part of a cooperative since 2005. However, if this component is selected, regulations would accommodate allocations of an appropriate portion of the salmon bycatch cap to the inshore open 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 2-22 to Table 2-26 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 2-6). The range of inshore cooperative and inshore open 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 2-27 through Table 2-31.

Table 2-22 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% open 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 2-23 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% open 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 2-24 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)

			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**	**open 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 2-25 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)

			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**	**open 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 2-26 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**	**open 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 2-27 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% open 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 2-28 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% open 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 2-29 Seasonal inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, using Component 2, Option 2b, and seasonal distribution options

			Inshore cooperative allocation:							
Cap Suboption and seasonal allocation	Overall fishery cap level Chinook	Resulting Inshore sector 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% open 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 2-30 Seasonal inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, using Component 2, Option 2c, and seasonal distribution options

			Inshore cooperative allocation:							
Cap Suboption and seasonal allocation	Overall fishery cap level Chinook	Resulting Inshore sector 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% open access AFA vessels
Option 2c: 70/30 A	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
	48,700	21,136	3,960	242	2,004	608	2,577	5,127	3,996	0
	29,300	12,716	3,960	146	1,206	366	1,550	3,084	2,404	0
Option 2c : 70/30 B	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
	48,700	9,058	1,697	104	859	261	1,104	2,197	1,713	0
	29,300	5,450	1,697	62	517	157	664	1,322	1,030	0
Option 2c : 58/42A	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
	48,700	17,513	3,282	201	1,660	504	2,135	4,248	3,311	0
	29,300	10,536	3,282	121	999	303	1,284	2,556	1,992	0
Option 2c : 58/42B	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
	48,700	12,681	2,376	145	1,202	365	1,546	3,076	2,398	0
	29,300	7,630	2,376	87	723	219	930	1,851	1,442	0
Option 2c : 50/50 (A and B)	87,500	27,125	8,448	311	2,572	780	3,307	6,579	5,128	0
	68,100	21,111	6,575	242	2,002	607	2,574	5,121	3,991	0
	48,700	15,097	2,829	173	1,431	434	1,840	3,662	2,854	0
	29,300	9,083	2,829	104	861	261	1,107	2,203	1,717	0

Table 2-31 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	open 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 sector level caps under Component 2 and the inshore CV sector level cap is further allocated among the cooperatives and the inshore open access fishery (if the inshore open access fishery existed in a particular year) under Component 4. Option 1 or Option 2 or both could be selected.

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%

2.2.5 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, 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 further allocated among 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 inshore open access fishery for catcher vessels not participating in an 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.

2.2.5.1 Managing hard caps

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, as shown in Table 2-32.

Table 2-32 Number of Chinook salmon bycatch salmon caps under Component 1, assuming no further allocation to the non-CDQ sectors or inshore cooperatives.

Season	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

Management of hard caps would be the same for all proposed hard cap levels under Component 1. When salmon bycatch by all vessels fishing for any of the three non-CDQ sectors (the offshore CP sector, the mothership sector, and the inshore CV sector) reached the seasonal Chinook salmon bycatch cap, NMFS would close directed fishing for pollock for all three of the sectors combined. 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 seasonal rollover suboption was not selected, analysts interpret 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.

2.2.5.2 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 Component 3, option 1, is chosen. 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 2-33 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.

2.2.5.3 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 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 an 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 2.2.5.6). 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 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.

2.2.5.4 Entities necessary to receive transferable allocations

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

- receives an allocation of 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 entity).

The 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 entities by NMFS:

- Inshore cooperatives are 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 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 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 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 and the catcher vessels permitted to deliver to these motherships. 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.
- <u>Inshore CV sector</u>. While NMFS recognizes cooperatives as entities, the sector as whole does not have an 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 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 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 their respective 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.

2.2.5.5 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 under Alternative 2, the Council did not include the ability for sectors or CDQ groups to conduct post delivery transfers.

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. NMFS regulations 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.

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 has developed the internal processes that allow quota share and allocation holders in various Alaska fisheries to conduct transfers through the internet. Such a process would be extended to transferable Chinook salmon bycatch allocations. The transfer process would 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.

2.2.5.6 NMFS rollovers of sector level caps

Rollovers under Option 2 would be selected if a hard cap or a trigger cap for salmon bycatch is allocated among the AFA sectors, but either:

- salmon bycatch caps are not transferable among the sectors, or
- the non-CDQ sectors cannot form the entity necessary to allow transferability of salmon bycatch among the sectors.

Under Component 3 (sector transfers), 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) could be selected.

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 open 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 2-34 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.

2.2.5.7 Monitoring requirements for managing transferable bycatch allocations

Prohibited species catch monitoring requirements depend on whether NMFS manages PSC limits (caps) for a group of vessels or whether these PSC limits are allocated among specific entities within a fishery. There are two general types of allocations:

- Fishery or sector-level PSC limits or caps. Management of limits or caps is 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 the entity from exceeding its 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.

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 allocations at a fishery or sector level. This is particularly true when catch or bycatch data collected by observers must be used as a basis for enforcement action should an entity exceed an allocation.

The catch of most target species is readily determined using observer and landings data because the target species must be retained, landed, and sold for the vessel owner to receive earnings from that catch. However, prohibited species catch generally is required to be discarded and its catch often limits the catch of economically valuable target species. The greater the potential to limit the target species catch, the greater the incentive created to not have prohibited species bycatch identified and estimated.

Current methods for estimating Chinook salmon bycatch by catcher vessels delivering to inshore processors or motherships and by catcher/processors is described in Section 3.1. Estimates of prohibited species bycatch by catcher vessels delivering to inshore processors are based on data collected by observers. Data collected by an observer on a vessel is used to estimate the bycatch by that vessel. Bycatch rates from observed vessels are used to estimate the bycatch by unobserved vessels. There are two primary problems associated with using estimated bycatch rates when enforcing a prohibition against exceeding a PSC allocation.

- The CAS method of applying information from observed vessels to non-observed vessels to estimate PSC bycatch by catcher vessels delivering to inshore processors 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.

Transferable bycatch allocations that would be implemented under Component 2 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 would be needed to implement Alternatives 2 through 5.

Catch monitoring issues were a large component of the implementation of the Amendment 80 Program, which allows non-AFA catcher/processors to form cooperatives. Amendment 80 cooperatives receive allocations of BSAI flatfish and PSC species. Similar to the constraint that will exist as a result of a Chinook salmon bycatch cap, halibut PSC catch by the Amendment 80 cooperatives could limit their catch of target species. The analysis prepared to evaluate the monitoring requirements for the Amendment 80 Program concluded that the use of bycatch rates from observed vessels to estimate the bycatch by unobserved vessels was not appropriate due to the incentive for unobserved vessels to fish differently than observed vessels and the difficulty of enforcing penalties for overages based in part on bycatch rates from other vessels. 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.

For the reasons described above, to ensure effective monitoring and enforcement of transferable Chinook salmon bycatch allocations, NMFS recommends that the following additional monitoring requirements be implemented:

- Each catcher vessel regardless of length, except catcher vessels delivering unsorted codends, must have 100 percent observer coverage.

- All salmon of any species that is brought onboard a catcher vessel must be retained onboard the catcher vessel and delivered to the processing facility (no at-sea discards of salmon from catcher vessels).

- Shoreside processor monitoring requirements will have to be adjusted to incorporate a higher standard for Chinook salmon bycatch accounting. This could include such changes as modifying observer duties, modifying factory configurations, 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.

- Chinook salmon bycatch by catcher/processors and catcher vessels delivering to motherships will be based on a count or census of the salmon rather than using the current method described in section 3.1 of estimating Chinook salmon bycatch based on observer's species composition samples. Additional regulations will be needed to ensure that all salmon are retained and counted by an observer before they are discarded from a catcher/processor or mothership.

These additional monitoring requirements are described below and in RIR Chapter 6 in more detail. Electronic (video) monitoring in lieu of observers would only be allowed after a successful, comprehensive assessment of the effectiveness of electronic monitoring to verify that Chinook salmon are not discarded.

2.2.5.8 Changes to Inshore Catcher Vessel Monitoring Requirements

For reasons described in Section 2.2.5.7, NMFS's existing use of bycatch rates to estimate salmon bycatch by unobserved catcher vessels is not adequate to support a system of transferable salmon bycatch allocations. It would be too 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. Also, Chinook salmon are difficult to differentiate from other species of salmon unless an observer can examine each fish. Therefore, Alternative 2 would require that all salmon of any species are retained onboard the catcher vessel and delivered to a processing plant where it would be counted using the methods described below in Section 2.2.5.9. In addition, each catcher vessel, regardless of size, must have 100 percent observer coverage to ensure that salmon are not discarded at sea before they are counted at the processing plant.

2.2.5.9 Changes to Inshore Processor Monitoring Requirements

Each inshore processing plant that receives AFA pollock is required to develop and operate under a NMFS-approved CMCP. Monitoring standards for CMCP are described in regulation at 50 CFR 679.28(g). Additional information about current methods for counting salmon bycatch at the inshore processors is in section 3.1.

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. 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 need to be implemented to ensure that no salmon make it into the factory when the vessel observer is monitoring a CV's offload. Chinook salmon are difficult to differentiate from other species of salmon as they pass by the observer on the conveyor belt. The observer must examine each salmon to verify the species identification. Therefore, processors would be prohibited from allowing salmon to pass from the sorting area and into the factory and no salmon of any species 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 would be required:

- Processors would be prohibited from allowing salmon to pass from the area where catch is sorted and into the factory area of the processing plant;
- The observer work station would be required to be located within the observation area;
- A location must be designated within the observation area for the storage of salmon, and;
- All salmon of any species must be stored in the observation area and within view of the observer at all times during the offload.

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 rejected because of the number of people that would be required to thoroughly monitor all areas where salmon could appear in the factory 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.

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.

2.2.5.10 Changes to Catcher/Processor and Mothership Monitoring Requirements

Current methods for estimating salmon bycatch by catcher/processors and catcher vessels delivering to motherships are described in section 3.1. These methods rely on requirements for two observers on each AFA catcher/vessel and mothership and expanding observers' species composition data to estimate the number of salmon in each haul. NMFS recommends that an actual count of all of the salmon in each haul be used for determining Chinook salmon bycatch under Alternative 2 and all of the other alternatives that involve hard caps on Chinook salmon bycatch. A count, or census, of the Chinook salmon would remove the uncertainty associated with expanding the species composition data. Industry members also have expressed interest in using a census because of their concern with the uncertainty associated with current methods. NMFS supports the use of a census on catcher/processors and motherships, as long as conditions exist to properly monitor that all of the salmon bycatch is retained and to provide the observer the tools needed to identify, count, and report salmon bycatch by haul. Current regulations require the retention of salmon "until the number of salmon has been determined by an observer." Observers report the count of salmon for each haul in data submitted to NMFS and vessel operators separately report the count of salmon bycatch each day on their daily production reports.

To ensure accurate counts of salmon bycatch, the following requirements would be applied to the catcher/processors and motherships:

- No salmon of any species would be allowed to pass from the location catch is sorted and into the factory area of the catcher/processor or mothership;
- All salmon bycatch of any species must be retained until it is counted by an observer;
- Vessel crew must transport all salmon bycatch from each haul to an approved storage location adjacent to the observer sampling station so that the observer has free and unobstructed access to the salmon, and the salmon must remain within view of the observer from the observer sampling station at all times;
- The observer must be given the opportunity to count the salmon and take biological samples, even if this requires the vessel crew to stop sorting or processing catch until the counting and sampling is complete; and
- The vessel owner must install a video system with a monitor in the observer sample station that provides views of all areas where salmon could be sorted from the catch and the secure location where salmon are stored;
- The counts of salmon by species must be reported by the operator of a catcher/processor for each haul, using an electronic logbook that will be provided by NMFS as part of the current eLandings software.

The video requirements would be modeled similar to those designed for the bin monitoring requirements under Amendment 80 and the Rockfish Pilot Program. A vessel may provide and maintain cameras, a monitor, and a digital video recording system for all areas where sorting, storage, and discard of salmon prior to being counted by an observer could be located. The video data must be maintained and made available to NMFS upon request for no less than a 120 day period. The video systems would also be subject to approval by NMFS at the time of the observer sample station inspection.

In addition, NMFS would require vessel operators to report the salmon bycatch counts by species for each haul rather than the daily total currently required. NMFS would require that an electronic logbook be used to submit these haul-by-haul salmon bycatch counts so that the data is readily available to NMFS in an electronic format. The haul-by-haul reporting of salmon by the vessel operator would ensure that the vessel operator agreed with the salmon counts submitted by observers and that any discrepancies or disagreements about the counts could be resolved quickly.

2.2.5.11 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 among the seven inshore cooperatives, and potentially to an inshore open 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 open access fishery (this has not happened since 2005). The creation of an inshore open access fishery would result in the inshore sector allocation of salmon being divided between the cooperatives and the inshore open access fishery. The amount of salmon allocated to the inshore open 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 inshore open access sector would result in a potential maximum of 16 seasonal allocations and 32 annual salmon allocations, as depicted in the Table 2-35. 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 2-35 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	Inshore Open 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. All of the revisions to monitoring requirements for inshore catcher vessels described in Sections 2.2.5.8, including 100% observer coverage on all inshore catcher vessels regardless of vessel length, and all of the revisions to monitoring requirements for inshore processors described in Section 2.2.5.9 would be required. 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 in Section 2.2.5.9, to support an accurate count of Chinook salmon bycatch by each inshore catcher vessel.

Option 1: 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. Thus 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. These regulatory amendments could be made without requiring the Council to supercede requirements of the AFA.

Full transferability of pollock among the inshore cooperatives by superseding the 90 percent processor delivery requirements of subsections 210(b)(1) and (b)(6), could be allowed 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.

Option 2: 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 under Alternative 2, unlike its recommendations for cooperative allocations under the CDQ Program, GOA Rockfish Program, Amendment 80, and the Crab Rationalization Program. (The Council did, however, recommend allowing post delivery transfers under Alternative 5, the preferred alternative.)

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 in section 2.2.5.5 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 allocations are not exceeded. Transfers applications will be available online and transfers will be required to be made electronically. NMFS will develop the computer programs necessary to conduct electronic transfers similar to how transfers are made under Amendment 80, the Gulf of Alaska rockfish program, the CDQ Program, and the Crab Rationalization Program. As long as the electronic forms are filled out completely and correctly and the transferring entity has available Chinook salmon bycatch to transfer, the transfers will be completed in a very short period of time.

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 2-36 Alternative 3 Components and options.

Setting the cap (Component 1)	How to formulate the cap	Select a cap from a range of numbers, 29,323 – 87,500 (same range as Alternative 2)			
	How to apportion cap by season	Apportion cap A season : B season from range 70:30 to 50:50 (same range as Alternative 2)			
Managing the cap (Component 2)	NMFS closes areas to pollock fishing when cap is reached				
	Option 1: An ICA will set in place a system to allow vessels to avoid bycatch, and will close areas when cap is reached for vessels managed under the ICA				
Allocating the hard cap to sectors (Component 3)		CDQ	Inshore CV	Mothership	Offshore CP
	By sector (same range as Alternative 2)	3% - 10%	45% - 70%	6% - 9%	21% - 36%
	Default, if no sector allocation	7.5%	92.5% (all three sectors combined)		
Sector transfers (Component 4)	Voluntary transfers among sectors are allowed				
	NMFS can reapportion unused salmon to other sectors based on their proportion of remaining pollock (except not from CDQ groups)				
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 15th, 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.			

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 2-4).

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.

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

If transferable sector allocations under Component 4, Option 1, are selected, 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 none of the sector allocation of the trigger caps under Component 3 are selected, 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. With 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.

With 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 with the allocation of the salmon bycatch trigger cap among the sectors, under Component 3.

Options 1 and 2 are mutually exclusive, which means that 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 must be selected.

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 an entity that could:

- represent all vessels eligible to participate in the particular AFA sector and receive an allocation of 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 entity).

If transferable salmon bycatch trigger caps are allocated to an 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 under 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 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 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 non-CDQ trigger caps were allocated among the inshore, catcher/processor, and mothership sectors and the (1) ICA management of the trigger caps was not allowed (Component 2, Option 1), (2) transferable trigger caps among the sectors was not allowed (Component 4, Option 1), or (3) the non-CDQ AFA sectors could not form the 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 2-37 and Table 2-38. 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.

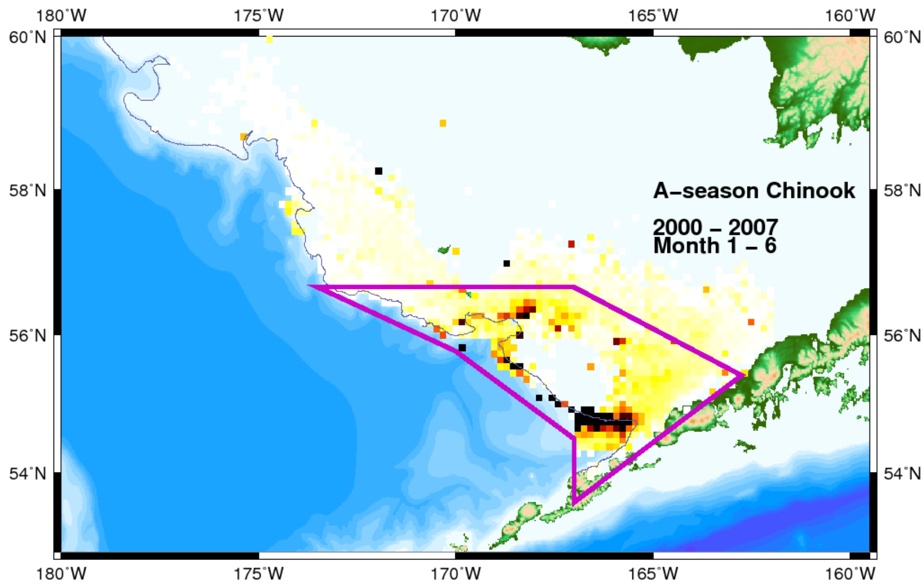

Fig. 2-2 Proposed A-season trigger closure, encompassing 90% of Chinook bycatch in 2000-2007.

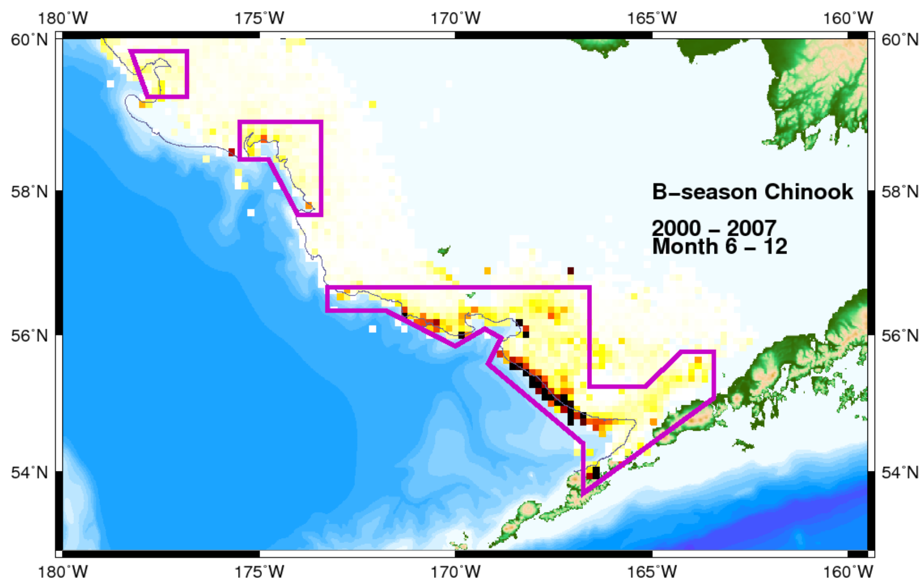

Fig. 2-3 Proposed B-season trigger closures, encompassing 90% of Chinook bycatch in 2000-2007.

Table 2-37 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 2-38 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.

Under this suboption, the updated salmon bycatch information would be reassessed after a certain number of years to determine whether adjustments to the hard cap are needed. 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.

2.3.1 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 address 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 allocations of the caps to the AFA sectors, inshore cooperatives, and CDQ groups. Thus, the management and monitoring issues described for 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.

2.3.1.1 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 in the closed areas 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. 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.

2.3.1.2 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 complicate NMFS's management of salmon savings areas that had been closed due to a sector's salmon cap being reached. Allowing salmon bycatch 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. 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 and at-sea processor monitoring requirements described in Section 2.2.5.7.

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.

2.4 Alternative 4: Hard caps with an intercoperative agreement

In June 2008, the identified Alternative 4 as the preliminary preferred alternative 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 (ICA)). 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. Alternative 4 would rely on the cap to limit Chinook salmon bycatch in all years and, if the ICA works as intended, 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 open access fishery, if the inshore open 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

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.[24]
- 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.

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

[24] 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."

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.[25]

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).

Component 4: Cooperative provisions

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

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

[25] 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.

2.4.2 Description of Alternative 4

Alternative 4 includes two different annual scenarios with different caps for each scenario. Annual scenario 1 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 contains a single cap of 47,591 Chinook salmon. The distinction between the scenarios lies in the presence or absence of a NMFS-approved ICA which provides explicit incentives to avoid salmon. Under Alternative 4, either annual scenario 1, annual scenario 2, or both annual scenario 1 and annual scenario 2 combined, may be chosen, 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 annual scenario 1 high cap and the annual scenario 2 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 2-39 provides a summary of the features of Alternative 4. Table 2-40 shows the three caps and each cap's seasonal and sector divisions.

Under either annual scenario 1 or annual scenario 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.

During the process of writing the Draft EIS and describing and analyzing Alternative 4, three issues arose that had a bearing on how, and whether, Alternative 4 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 Chinook salmon bycatch would accrue to both the high cap and the backstop cap.

The Draft EIS, in Section 2.4.3 Options for changes to Alternative 4, describes these issues and suggests possible options for resolving them. The Council, in developing Alternative 5, resolved the applicable issues, as discussed in the description of Alternative 5 in Section 2.5.

Table 2-39 Alternative 4 components

Setting the hard cap (Component 1)	Annual scenario 1 (AS 1)	High cap 68,392 Chinook salmon for vessels in a NMFS-approved ICA Backstop cap 32,482 Chinook salmon for vessels not in a NMFS approved ICA.			
	Annual scenario 2 (AS 2)	A cap of 47,591, with no ICA.			
	AS1 + AS2	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.			
	A season/ B season division	All hard caps would be divided 70/30 between the A and B season			
	Seasonal rollovers	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. No rollover would occur for the backstop cap.			
Allocating the hard cap to sectors (Component 2)		CDQ	Inshore CV	Mothership	Offshore CP
	A season	9.3%	49.8%	8.0%	32.9%
	B season	5.5%	69.3%	7.3%	17.9%
Sector transfers (Component 3)	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. Allocations under the backstop cap are non-transferable.				
Allocating the hard cap to cooperatives (Component 4)	Each inshore cooperative and the inshore open-access fishery would receive a transferable allocation of the inshore CV sector level cap and must stop fishing once the allocation is reached.				
	Inshore cooperative allocations would be based on that cooperative's AFA pollock allocation percentage. Inshore open access allocation would be based on the pollock history of those vessels participating in the inshore open access fishery.				
	Cooperative Transfers	Upon request, NMFS could transfer allocations among all recipients during a fishing season.			

2.4.3 High Cap of 68,392 Chinook salmon – Annual scenario 1

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. 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.

Table 2-40 A and B season caps for Alternative 4 under annual scenarios 1 and 2

	Annual scenario 1				**Annual scenario 2 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 the 68,392 Chinook salmon cap and 47,591 Chinook salmon cap, the inshore sector allocation and CDQ Program allocations would be further allocated among the inshore cooperatives, inshore open access fishery, and six CDQ groups.

Table 2-40 shows the percentage allocations of Chinook salmon bycatch and the resulting sector level caps. As described in the Council's motion, the percentage allocations of Chinook salmon bycatch among the AFA sectors, including the CDQ sector, 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.

Blending of the CDQ and non-CDQ bycatch history was done because the actual bycatch rates could not be accurately estimated due to past practices in how pollock hauls were assigned to CDQ and non-CDQ pollock allocations by the catcher/processors and mothership that fished on behalf of the CDQ groups. Historically, CDQ groups were constrained by multiple hard caps for other groundfish species and prohibited species when the non-CDQ pollock fisheries were not. Some CDQ groups would request that the vessel operators assign the lower bycatch hauls to the CDQ groups and higher bycatch hauls to the non-CDQ pollock fisheries. This would result in it appearing that vessels fishing on behalf of the CDQ groups were achieving lower bycatch in their CDQ pollock hauls versus their non-CDQ hauls. Because actual bycatch rates could not be estimated due to this method of assigning hauls, and because bycatch history is such an important element in the percentage allocations under Alternative 4 and Alternative 5, the Council approved using an average bycatch rate for the CDQ and non-CDQ sectors that the CDQ groups partnered with.

The adjusted historical percentage bycatch for the CDQ, offshore C/P, and mothership sectors was determined as follows. The number of Chinook salmon recorded as CDQ bycatch within each of the two CDQ partner sectors was summed with the number of Chinook salmon recorded within the respective CDQ partner sector as non-CDQ for each year. Similarly, the volume of CDQ and non-CDQ pollock harvested in each year was summed. This combined pool of CDQ and non-CDQ Chinook salmon was divided by the combined pool of harvests for each CDQ partner sector. This average bycatch rate was multiplied by the pollock associated with the CDQ harvest to calculate and 'adjusted' number of CDQ

Chinook salmon taken as bycatch in each year and season, and was multiplied by the pollock associated with the non-CDQ harvest to calculate an 'adjusted' non-CDQ number of Chinook salmon in each year and season for each of the two partner sectors. These adjusted numbers of Chinook salmon within each season and sector are used to calculate adjusted proportion of salmon bycatch by sector and season in Table 2-40. This adjustment does not affect the allocations to the inshore catcher vessel sector.

The inshore CV sector cap would be divided among the inshore cooperatives and the inshore open access fishery based on the proportion of total sector pollock catch associated with the vessels in the cooperative or inshore open access fishery. NMFS would issue transferable allocations to the inshore cooperatives because the inshore cooperatives are entities. The inshore open 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. The six CDQ groups are entities that receive transferable Chinook bycatch allocations under current regulations governing the CDQ Program.

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 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 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 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.

Alternative 4 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 Alternative 4. 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.

It is important to note that the high cap of 68,392 Chinook salmon is not a hard cap because Alternative 4 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. Alternative 4 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.

2.4.4 Backstop Cap of 32,482 Chinook salmon – Annual scenario 1

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, and by season, as shown in Table 2-40. 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.

Alternative 4 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. Under annual scenario 1 only, and if no NMFS-approved ICA existed in a given year, the entire pollock fleet would be subject to the backstop cap for that year.

2.4.5 Annual scenario 1 combined with Annual scenario 2

Under both annual scenario 1 and annual scenario 2, 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.

2.4.6 A Cap of 47,591 Chinook salmon – Annual scenario 2

Under annual scenario 2 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. Alternative 4 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 scenario 1 high cap.

2.4.7 Managing and Monitoring Alternative 4

The general management of transferable sector, cooperative, and CDQ group Chinook salmon bycatch allocations would be similar to those discussed under Alternative 2 (Section 2.2.5). The Chinook bycatch allocations would increase the complexity and cost of NMFS's salmon bycatch monitoring efforts due to the staff and budget resources associated with establishing, monitoring, and enforcing additional Chinook salmon caps. As under Alternative 2, transferable salmon bycatch allocations must be issued to an entity that represents all members of the group eligible to receive the transferable allocation (see Section 2.2.5.4). The 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.

Alternative 4 is more complicated to manage and enforce than the other alternatives because annual scenario 1 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 annual scenario 1, NMFS would be required to identify which cap each of the approximately 110 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.

2.4.7.1 Salmon Bycatch Intercooperative Agreement (ICA)

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

- the ICA contract that contains the elements of the incentive program that all vessel owners and CDQ groups agree to follow in the future, and
- the annual report 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. The ICA representative 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 Alternative 4 requires the creation of a single ICA. However, nothing in Alternative 4 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.

Alternative 4 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. Alternative 4 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 Alternative 4 would have specified the option for cooperatives to opt out rather than for “operations” to opt out.

Alternative 4 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.

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 Alternative 4, using the exact same words as Alternative 4 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 Alternative 4. 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 a party to an ICA, a vessel owner, sector, inshore 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 file an administrative appeal challenging the IAD to disapproved the proposed ICA. 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 annual scenario 1 alone or annual scenario 1 and annual scenario 2 combined were in effect.

Under annual scenario 1 only and if no ICA was submitted or approved, all vessels would fish under the backstop cap of 32,482 salmon.

Under annual scenario 1 and annual scenario 2 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 Alternative 4.

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 in effect at the time of review. The Council reviewed industry proposals for the ICA prior to its 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 or at any time in the future.

2.4.7.2 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 annual scenario 1. Under annual scenario 1, 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 (CAS).

As shown in Table 2-41, seasonal allocations of Chinook salmon caps under annual scenario 1 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 2-41 Potential number of seasonal and sector caps under annual scenario 1.

	ICA fishery under high cap				**Opt-out fishery with backstop cap**		**Total salmon caps**
	Catcher/ processor	Mothership	Inshore co-op's (and open 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.

Under annual scenario 2 only or as the initial cap in combination with annual scenario 1, 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 open 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 annual scenario 1 high cap. These low caps are portrayed in Table 2-42. There would be four less caps under this scenario than under annual scenario 1.

Table 2-42 Number of potential seasonal and sector caps under annual scenario 2.

	Number of caps by sector				**Total salmon caps**
	Catcher/ processor	Mothership	Inshore co-op's (and open 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 annual scenario 2 would be subject to the same seasonal and sector specific apportionments as those described above under the annual scenario 1 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 annual scenario 2 (47,591 hard cap) are essentially the same as described for annual scenario 1 high cap, as well as under Alternative 2. Annual scenario 2 would be simpler for NMFS to implement, as it would not have to include the dual accounting that would be required under annual scenario 1. This would put annual scenario 2 on par with the CAS development cost and complexity considered under Alternative 2. Under annual scenario 2, 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 annual scenario 1.

NMFS's involvement with Chinook salmon transfers under either annual scenario 1 or annual scenario 2 would be inshore open 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.

2.4.7.3 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 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, catcher/processors, and mothership monitoring requirements. These recommendations are described in Section 2.2.5.7 through Section 2.2.5.10

Given the complexity of the dual Chinook accounting envisioned under annual scenario 1 (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.

2.5 Alternative 5: Hard caps with incentive plan agreements and a performance standard (Preferred Alternative)

The Council developed Alternative 5 as the preferred alternative at the April 2009 Council meeting. Alternative 5 builds on Alternative 4, the preliminary preferred alternative. Alternative 5 includes two different overall Chinook salmon cap levels (60,000 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 incentive plan agreement (IPA) [26], that establishes an incentive program to keep Chinook salmon bycatch below the 60,000 Chinook salmon cap. Alternative 5 would rely on the cap to limit Chinook salmon bycatch in all years and, if the IPA works as intended by the Council, it would provide incentives to keep bycatch below the cap.

The combination of the high cap, transferable allocations, and one or more IPAs is intended to provide a more flexible and responsive approach to minimizing salmon bycatch than would be achieved by a cap alone. The high bycatch cap of 60,000 Chinook salmon alone would be unlikely to meet the conservation objectives of the Council and would not be expected to minimize Chinook salmon bycatch in most years. Likewise, the bycatch cap of 47,591 Chinook salmon on its own would not provide the desired flexibility to accommodate the high variability in Chinook salmon encounters and the difficulty of avoiding salmon encounters in certain years. Therefore, the Council combined the 60,000 Chinook salmon hard cap with an IPA to provide incentives to avoid Chinook salmon in all years with the goal that actual salmon bycatch would be below the cap.

To ensure Chinook salmon savings regardless of whether an IPA successfully minimizes bycatch at all levels of salmon encounters, the Council established a sector level performance standard in Alternative 5. For a sector to continue to receive Chinook salmon bycatch allocations under the 60,000 Chinook salmon cap, that sector may not exceed its performance standard in any three years within seven consecutive years. If a sector fails this performance standard, it will permanently be allocated a percentage allocation of the 47,591 Chinook salmon cap.

[26] The term incentive plan agreement (IPA) under Alternative 5 is the same concept as the intercooperative agreement (ICA) under Alternative 4. The term IPA is used under Alternative 5 because participation in the IPA is not limited to AFA cooperatives as it may include individual vessel owners or CDQ groups. In addition, more than one IPA may be approved and an IPA could be created by a single cooperative (so an IPA is not required to include more than one cooperative or to be an agreement among cooperatives).

Alternative 5 contains selected provisions under six components:

- **Component 1: Hard cap with options for IPAs,** addresses the Chinook salmon bycatch caps, IPA requirements under the high cap, and seasonal distribution and rollovers of the caps.
- **Component 2: Sector allocation**, 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: Sector transfers**, allows transferability of the Chinook salmon bycatch allocations among the sectors, inshore cooperative, and CDQ groups to better ensure harvest of the full pollock TAC.
- **Component 4: Cooperative provisions,** allows further allocation of the inshore sector's Chinook salmon bycatch among the inshore cooperatives and the inshore open access fishery, if the inshore open access fishery exists in any particular year.
- **Component 5: Performance standard**, annually evaluates each sector's bycatch against that sector's portion of 47,591 Chinook salmon.
- **Component 6: Observer program,** authorizes NMFS to modify regulations for shoreside processors and increase observer coverage on all catcher vessels.

Table 2-43 Alternative 5 components

Setting the hard cap (Component 1)	**47,591 Chinook salmon**	The fleet-wide cap unless industry submits and NMFS approves an IPA agreement which provides explicit incentives for salmon avoidance.			
	60,000 Chinook salmon	The fleet-wide cap if fishery participants form one or more IPAs that meet the criteria in regulations.			
	28,496 Chinook salmon	Vessels not in an IPA would fish under a portion of this "opt-out" or backstop cap.			
	A season/ B season division	The Chinook salmon caps would be divided 70% A season and 30% B season before allocations to sectors, CDQ groups, and cooperatives.			
	Seasonal rollovers	NMFS would rollover 100% percent of a sector's, cooperative's, or CDQ group's unused salmon bycatch from its A season account its B season account. No rollover would occur from the B season to the A season. No rollover would occur under the backstop cap.			
Allocating a hard cap to sectors (Component 2)		**CDQ**	**Inshore CV**	**Mothership**	**Offshore CP**
	A season	9.3%	49.8%	8.0%	32.9%
	B season	5.5%	69.3%	7.3%	17.9%
Sector transfers (Component 3) + Cooperative transfers	Upon request, NMFS could transfer allocations among all recipients of transferable allocations during a fishing season. If an entity's allocation account falls below zero in a given season, the entity would be provided the opportunity to receive transfers of Chinook salmon bycatch sufficient to bring the entity's account to zero.				
Allocating the hard cap to cooperatives (Component 4)	Each inshore cooperative and the inshore open-access fishery would receive a transferable allocation of the inshore CV sector level cap and must stop fishing once the allocation is reached.				
	Inshore cooperative allocations would be based on that cooperative's AFA pollock allocation percentage. Inshore open access allocation would be based on the pollock history of those vessels participating in the inshore open access fishery.				
Performance Standard (Component 5)	If a sector's annual bycatch exceeds its performance standard in any three years within seven consecutive years, NMFS would reduce that sector's Chinook salmon allocation to that sector's portion of 47,591 Chinook salmon for perpetuity.				
Observer Program (Component 6)	Increase observer coverage to 100% for catcher vessels not delivering unsorted cod-ends at sea and modify, if necessary, shore side processors' catch monitoring plans.				

2.5.1 Council's April 2009 motion for Alternative 5

The following is the Council's April 2009 motion to recommend its preferred alternative:

This alternative 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 incentive plan agreements (IPA)

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

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

Overall Chinook salmon cap: 60,000, allocated by season and under Components 2-4 as described below.

For those vessels or CDQ groups that opt out of such a NMFS approved incentive plan agreement, the maximum hard cap (backstop cap) will be established as follows:

An amount no greater than the overall cap: 28,496

Option 3: To ensure the overall cap can be managed as a hard cap, subtract from the overall cap a proportion representing vessels or CDQ groups opting out of the incentive plan(s), and create a backstop cap so that the sum of the caps does not exceed the high cap.

Option C: Subtract from the overall cap the proportion of the backstop cap represented by vessels or CDQ groups opting out and fishing under the backstop cap and use this same amount to create the backstop cap.

Adjustments to the overall cap and backstop cap for vessels or CDQ groups opting out will be made after sector allocations. The amount of the adjustments will be based on the opt out vessel's percentage of AFA pollock within their sector as specified on pages 67-70 of the DEIS or on the CDQ group's current percentage allocation of their sector allocation of the Chinook salmon cap.

IPA requirements (for NMFS approval):

- An IPA must describe 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 describe rewards for Chinook salmon bycatch avoidance, penalties for failure to avoid Chinook salmon bycatch at the vessel level, or both.
- The IPA 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 Chinook salmon savings in any condition of pollock and Chinook salmon abundance, such that they are expected to influence operational decisions to avoid Chinook salmon bycatch.
- The IPA must describe how the IPA ensures each vessel will manage their bycatch to keep total bycatch below the sector level regulatory performance standard.

Annual reporting:

- The IPA(s) must be made available for Council and public review. In addition, year-end annual reports are required to be submitted to the Council by April 1 the following year to provide sufficient time for independent evaluation by the Council.
- An annual report to the Council 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.

IPA eligibility:
On an annual basis, before a date certain established by NMFS through regulation, participants in the pollock fishery may file an IPA with NMFS or join or exit an existing approved IPA. An IPA will be considered valid if 1) it meets the criteria set forth above; 2) it commits each party to be bound by the rules of the IPA; and 3) the parties to the IPA represent not less than 9% of the pollock quota and at least two non-affiliated companies using the AFA definition of affiliation.

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

In the event that no IPA is approved by NMFS, then the pollock fishery shall be managed under annual scenario 2.

Annual scenario 2: Hard cap in absence of an approved IPA with explicit incentive(s) to promote Chinook salmon avoidance
Hard cap in absence of an approved IPA that provides explicit incentive(s) to all participants to avoid salmon bycatch in all years:

Overall Chinook salmon 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.

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 equal to 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%

Rationale for distribution: This distribution is based on an estimate of the 5-year (2002-2006) historical average of the annual proportion of Chinook salmon bycatch by sector within each season, adjusted by blending the reported bycatch 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 is made up of 0.75 multiplied by the adjusted 5-year historical average bycatch by sector and 0.25 multiplied by the AFA pollock allocation by sector.

Component 3: Sector transfers
Allocate Chinook salmon bycatch caps to each sector and allow the entity representing each non-CDQ sector and the CDQ groups to transfer Chinook salmon bycatch caps among the sectors and inshore cooperatives and CDQ groups.

Allow post-delivery (bycatch) transfer of Chinook salmon allocations. This provision would be administered consistent with the post-delivery provisions the Council adopted for the BSAI crab rationalization program, Amendment 80, and Rockfish Program, except that any recipient of a post delivery transfer during a season may not fish for the remainder of that season.

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

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

Cooperative transfers
When a Chinook salmon cooperative cap is reached, the cooperative must stop fishing for pollock. Cooperatives may transfer Chinook salmon bycatch with other sectors, inshore cooperatives, or CDQ groups.

Allow post-delivery (bycatch) transfer of Chinook salmon allocations. This provision would be administered consistent with the post-delivery provisions the Council adopted for the BSAI crab rationalization program, Amendment 80, and Rockfish Program, except that any recipient of a post delivery transfer during a season may not fish for the remainder of that season.

Component 5: Performance standard
Each sector will be annually evaluated against a performance standard. If the sector's annual Chinook salmon bycatch exceeds the sector's portion of the annual scenario 2 cap level in any 3 years within a consecutive 7-year period, all vessels within that sector will operate under annual scenario 2 in all subsequent years. Any vessel or CDQ group that fishes under the opt-out backstop pool will not be evaluated or included in annual calculations of a sector's performance standard.

Component 6: Observer program
The Council includes in its preferred alternative the observer coverage and monitoring requirements recommended by NMFS for the PPA and described in Section 2.5.4.3 (page 98) of the DEIS and in Sections 2.5.2.7 and 2.5.2.8 (pages 81 - 84). These recommendations increase observer coverage to 100 percent for catcher vessels regardless of vessel length. This increase in observer coverage does not apply to catcher vessels delivering unsorted codends at sea. Chinook salmon would be allowed to be discarded from catcher vessels only after being reported to and recorded by the vessel observer.

The Council also authorizes NMFS to develop modifications to regulations for the shoreside processors' catch monitoring and control plans to add performance standards to ensure accurate accounting for Chinook salmon at the plants, if NMFS determines that such modifications are needed.

Remove current regulations for Chinook salmon bycatch management
In taking final action, the Council's intent is for NMFS to remove current regulations governing Chinook salmon bycatch management in the Bering Sea and replace those regulations with the preferred alternative. Revisions to current regulations are as follows:

- Remove regulations for the current BS Chinook salmon PSC limit of 29,000 salmon that triggers closure of the Chinook salmon savings area for the BS pollock fishery.

- Remove Chinook salmon savings area definition for the BS.

- Remove exemptions to closure of the BS Chinook salmon savings areas for those cooperatives and CDQ groups participating in the current voluntary rolling hot spot (VRHS) ICA.

- Remove all elements of the current VRHS ICA regulations addressing Chinook salmon. New Chinook salmon bycatch management measures, including any incentive plan agreement requirements, would be added to the regulations. Retain regulations for the non-Chinook salmon components of the current VRHS ICA would remain.

2.5.2 Hard cap allocations under Alternative 5

Under Alternative 5, each year NMFS would determine the amount of transferable Chinook salmon bycatch allocations available to sectors, cooperatives, and CDQ groups based on their participation in a NMFS-approved IPA and a sector's past bycatch relative to its performance standard. Detailed examples for calculating the annual caps and allocations are in section 2.5.6. Once each sector, cooperative, or CDQ group reaches its specific allocation in a season, vessels in that sector would be prohibited from pollock fishing for the remainder of the season.

In the absence of any NMFS-approved IPAs, NMFS would allocate a portion of the 47,591 Chinook salmon hard cap to each sector, cooperative, and CDQ group eligible to receive pollock allocations. If some or all fishery participants form one or more IPAs that meet the criteria in regulations, then the high cap of 60,000 Chinook salmon would be available to the fleet. In this case, each year NMFS would make the following calculations to set Chinook salmon bycatch allocations:

1. Divide the 60,000 Chinook salmon cap by season.
2. Make initial allocations of the seasonal cap to the AFA sectors.
3. Make further allocations to the inshore cooperatives and CDQ groups.
4. Adjust the initial allocations if any CDQ group or vessel owner within a sector or cooperative chooses not participate in an approved IPA:
    a. reduce the amount of Chinook salmon bycatch allocated to its sector or cooperative by the calculated amount added to the backstop cap.
    b. distribute the remaining portion of the high cap among the sector or cooperative participating in an approved IPA.

  c. reduce each sector's annual threshold amount proportionally for the vessels, cooperatives, or CDQ groups fishing under the backstop cap.

5. If no members of a sector participate in an IPA, or if a sector has not met the performance standard, the difference between their sector allocation of the 60,000 cap and the new sector allocation under a 47,591 or 28,496 cap would remain unallocated.

Both the 60,000 Chinook salmon cap and the 47,591 Chinook salmon cap would be allocated to AFA sectors using a method that recognizes that sectors have different fishing patterns and needs for salmon bycatch in order to harvest their AFA pollock allocation. Table 2-44 shows the sector allocation percentages and estimated cap levels. Under the 60,000 and the 47,591 Chinook salmon caps, the inshore and CDQ sector allocations would be further allocated among the inshore cooperatives, inshore open access fishery, and six CDQ groups based on the NMFS-approved percentage allocations that have been in effect since 2005 (71 FR 51804; August 31, 2006).

Table 2-44 Alternative 5 A and B season allocation percentages and corresponding cap levels for each sector.

Alternative 5	Allocation Percentages	60,000 Chinook salmon	47,591 Chinook salmon
A season allocation:	70.0%	42,000	33,314
CDQ	9.3%	3,906	3,098
Inshore CV	49.8%	20,916	16,591
Mothership	8.0%	3,360	2,665
Offshore CP	32.9%	13,818	10,960
B season allocation:	30.0%	18,000	14,277
CDQ	5.5%	990	785
Inshore CV	69.3%	12,474	9,894
Mothership	7.3%	1,314	1,042
Offshore CP	17.9%	3,222	2,556

The sector allocation percentages are based on the 5-year (2002-2006) historical average of the annual proportion of Chinook salmon bycatch by sector within each season, adjusted by blending the reported bycatch for CDQ and non-CDQ vessels fishing on behalf of CDQ groups. Allocation estimates for the sectors for each season were calculated by (1) multiplying 0.75 by each sector's adjusted 5-year historical average bycatch and (2) multiplying 0.25 by each sector's AFA pollock allocation. Providing for a portion of the historical average mitigates the inshore CV sector's disadvantage under the 70/30 seasonal split. Placing 70 percent of the cap in the A season benefited the CP, CDQ, and mothership sectors that have historically taken a larger portion of their bycatch in the A season. However, the 0.25 AFA pollock distribution adjustment to bycatch history ensures the poorest performers in the inshore CV sector will not be fully rewarded for past behavior.

Blending CDQ and non-CDQ bycatch history was done because the actual bycatch rates could not be accurately estimated due to past practices in how pollock hauls were assigned to CDQ and non-CDQ pollock allocations by the catcher/processors and mothership that fished on behalf of the CDQ groups. Historically, CDQ groups were constrained by multiple hard caps for other groundfish species and prohibited species when the non-CDQ pollock fisheries were not. Some CDQ groups would request that the vessel operators assign the lower bycatch hauls to the CDQ groups and higher bycatch hauls to the non-CDQ pollock fisheries. This would result in it appearing that vessels fishing on behalf of the CDQ groups were achieving lower bycatch in their CDQ pollock hauls versus their non-CDQ hauls. Because actual bycatch rates could not be estimated due to this method of assigning hauls, and because bycatch history is such an important element in the percentage allocations under Alternative 4 and Alternative 5, the Council approved using an average bycatch rate for the CDQ and non-CDQ sectors that the CDQ groups partnered with.

The adjusted historical percentage bycatch for the CDQ, offshore C/P, and mothership sectors was determined as follows. The number of Chinook salmon recorded as CDQ bycatch within each of the two CDQ partner sectors was summed with the number of Chinook salmon recorded within the respective CDQ partner sector as non-CDQ for each year. Similarly, the volume of CDQ and non-CDQ pollock harvested in each year was summed. This combined pool of CDQ and non-CDQ Chinook salmon was divided by the combined pool of harvests for each CDQ partner sector. This average bycatch rate was multiplied by the pollock associated with the CDQ harvest to calculate and "adjusted" number of CDQ Chinook salmon taken as bycatch in each year and season, and was multiplied by the pollock associated with the non-CDQ harvest to calculate an "adjusted" non-CDQ number of Chinook salmon in each year and season for each of the two partner sectors. This adjustment does not affect the allocations to the inshore catcher vessel sector.

Any sector, cooperative, CDQ group, or individual vessel choosing not to participate in an IPA would fish under the backstop cap. NMFS would determine the amount of the backstop cap based on the opt-out participant's percentage share of AFA pollock. NMFS would subtract from the 60,000 Chinook salmon hard cap the proportion of the 28,496 backstop cap represented by the participant opting out of an IPA and use this same amount to create the backstop cap. Each vessel opting out of an IPA would forfeit any additional Chinook salmon that would have otherwise been allocated with participation in an IPA and allocations under the 60,000 hard cap. The Chinook salmon allocation forfeited by the opt-out participants will remain within the sector and be redistributed to IPA participants within that sector. However, if no members of a sector participate in an IPA or if a sector has not met the performance standard, the difference between their sector allocation of the 60,000 cap and the new sector allocation under a 47,591 or 28,496 cap would remain unallocated.

The resulting the backstop cap would be some number less than 28,496 Chinook salmon, depending on the number of vessels that opted out of an IPA. Only the Chinook salmon bycatch by vessels fishing under the backstop cap would accrue against 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. Unlike Alternative 4, the backstop cap would not be divided between CDQ and non-CDQ sectors. The Council determined that a separate allocation of the backstop cap to CDQ participants was unnecessary because the CDQ participants have the opportunity to realize the benefits of a direct allocation by participating in an IPA. The Council was also concerned that a CDQ allocation of a backstop cap could be so small that it may effectively prevent the CDQ group from participating in the pollock fishery. All vessels fishing under the backstop cap, including vessels fishing on behalf of a CDQ group, would be managed as a group under the seasonal allocation of Chinook salmon bycatch. NMFS would close directed fishing for pollock by vessels under the backstop cap before the seasonal backstop cap has been reached. No transfer provisions exist for non-IPA participants fishing under the backstop cap. NMFS would not rollover any remaining backstop cap from the A season to the B season.

Alternative 5 is similar to Alternative 4 in that if fishery participants do not form any IPAs for reducing Chinook bycatch, all vessels would fish under the hard cap of 47,591 Chinook salmon. Additionally, sectors that fail to meet their performance standard would fish under a portion of the 47,591 Chinook salmon hard cap.

2.5.3 Incentive plan agreements (IPAs)

A single hard cap could be perceived as a maximum number of Chinook salmon the pollock fishermen are authorized to catch each year. The concern is that fishermen would catch Chinook salmon up to this cap even if they could have taken some actions to limit their bycatch below the cap. To provide incentives for the fleet to avoid Chinook salmon bycatch, the hard cap of 60,000 Chinook salmon would be available to vessel owners or CDQ groups participating in a NMFS-approved IPA that included specific incentives to minimize bycatch in all years and fishing seasons. However, vessel owners, sectors, inshore cooperatives, or CDQ groups that chose not to participate in an IPA would be subject to the backstop cap. Also, if a sector exceeded its performance standard, its allocation would be reduced to a portion of the 47,591 Chinook salmon cap.

An IPA is a private contract among vessel owners, cooperatives, or CDQ groups that establishes incentives for participants to reduce Chinook salmon bycatch. Alternative 5 includes IPA content requirements, participation requirements, and deadlines for submission to NMFS for approval. Each IPA would be required to be submitted and approved by NMFS prior to fishing under the IPA. If NMFS approves an IPA, those participating in the IPA would receive an allocation of the 60,000 Chinook salmon hard cap.

To accomplish reductions in Chinook salmon bycatch, the IPA concept includes two components: (1) the NMFS-approved IPA contract that contains the elements of the incentive program that all vessel owners and CDQ groups agree to follow and (2) the annual report to the Council on performance under the IPA in the previous year. The IPA contract must meet the following requirements: (1) an IPA must provide incentive(s) for each vessel to avoid salmon bycatch under any condition of pollock or Chinook salmon abundance; (2) incentive measures must include rewards for salmon bycatch avoidance and/or penalties for failure to avoid Chinook bycatch at the vessel level; and (3) the IPA must specify how those incentives are expected to promote reduction in actual individual vessel bycatch rates relative to what would have occurred in absence of the incentive program. The Council intended that the IPAs contain incentive measures that promote salmon savings in any condition of pollock and salmon abundance, and that these incentive measures would influence fishing decisions at the vessel level to keep bycatch at or below the performance standard.

More than one IPA could be approved by NMFS. To be approved by NMFS, an IPA must meet minimum participation of vessel owners or CDQ groups representing at least 9 percent of the CDQ and non-CDQ pollock allocations for directed fishing under the AFA and be composed of at least two unaffiliated AFA companies or CDQ groups. The mothership sector, the smallest AFA sector, represents 9 percent of the amount of pollock allocated for directed fishing. The minimum participation requirements would allow each sector to form an IPA without needing participation from other sectors, as long as the IPA met all requirements and was submitted prior to the application deadline.

The deadline for submission of an IPA would be in the year preceding the year in which the IPA is proposed to be effective. All minor errors or omissions in the IPA would be resolved by NMFS contacting the IPA representative and requesting revisions to the IPA. All approved IPAs would be made available for Council and public review. Once approved, the IPA is in effect until the IPA representatives notify NMFS in writing that the IPA is no longer in effect or NMFS approves an amendment to the IPA. Although re-submission of an IPA is not required, the IPA representative must submit an annual participation list to NMFS that is signed by each owner or representative for each vessel and CDQ group that is a party to the IPA. Representatives of inshore cooperatives, catcher/processors, or motherships may sign a proposed IPA on behalf of all vessels that are members of the sector level entity. Once a party to an IPA, a vessel owner, sector, inshore cooperative, or CDQ group could not withdraw from the IPA mid-way through the year.

If a proposed IPA does not meet the regulatory requirements, NMFS would identify the deficiencies in the IPA in writing to the IPA representative. The IPA representative would be provided 30 days to submit a revised IPA that addresses the deficiencies or to otherwise submit written information to NMFS that addresses the deficiencies. If the deficiencies identified by NMFS are not addressed within this 30 day evidentiary period, NMFS would issue an initial administrative determination (IAD) to disapprove the proposed IPA. The IPA representative would have 60 days to file an administrative appeal. If an administrative appeal was not filed within 60 days, disapproval of the IPA would be NMFS's final agency action.

The process of disapproving a proposed IPA is lengthy and resolution of an administrative appeal likely would not be completed prior to the fishing year in which the IPA is intended to start. The proposed IPAs would be due to NMFS by October 1. It likely would take NMFS four to six weeks to complete review and determine whether the proposed IPA could be approved or disapproved (up to November 15). If NMFS identifies deficiencies of the proposed IPA, the 30 day evidentiary period would likely run from November 15 to December 15. If the IPA representative submitted a revised proposed IPA that addressed the deficiencies identified by NMFS, the decision to approve the revised IPA could easily take until mid-January. However, if the IPA representative did not address the deficiencies identified by NMFS and an IAD was issued by the end of December, the 60 day deadline for filing an administrative appeal would be close to March 1, well after the start of the pollock A season. While an appeal is pending, participants in the proposed IPA may not receive transferable Chinook salmon allocations under the 60,000 hard cap.

Participants in the pollock fishery are not required to join an IPA, and vessel participation in an IPA would be voluntary. Entire sectors, inshore cooperatives, or CDQ groups could opt to not participate in an IPA, or any number of vessels within the catcher/processor or mothership sectors or the inshore cooperatives could opt-out of the IPA as long as an IPA was approved by NMFS. 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 an IPA or opts-out. In this respect, only a CDQ group could decide whether to participate in an IPA and not the owners of vessels fishing on behalf of the CDQ group. A CDQ group could not have some vessels fishing under the 60,000 hard cap and others fishing under the backstop cap.

Any vessel or CDQ group permitted to receive pollock allocations under the AFA that wants to join an IPA must be allowed to join subject to the terms and agreements that have been agreed upon by all parties in that IPA. A participant who believed that they were involuntarily excluded from the IPA could submit a challenge to NMFS's approval of the proposed IPA that provided documentation of violation. NMFS would have to review this information and determine whether the assertion was valid. If it were, NMFS would disapprove the IPA. 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 IPA was approved.

If no challenge was submitted and if a proposed IPA contains all of the required information, met the participation requirements, and it generally described an incentive program that is designed to accomplish the Council's goals, NMFS would approve the IPA. 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 of outcomes of the proposed incentive program would be subjective and the regulations would not provide a legal basis for NMFS to disapprove the proposed IPA because it did not believe that the proposed measures would work as intended. Any number of different incentive programs could meet these objectives because the requirements for the IPA are performance based. Therefore, the annual report and evaluation would be the primary tool to determine whether an IPA is meeting the Council's goal to minimize Chinook salmon bycatch.

Each IPA representative would be required to prepare an annual report that describes the performance of the IPA. All reports would be required to be submitted to the Council and would be made available to the public. This report would include (1) a comprehensive explanation of incentive measures in effect in the previous year, (2) how incentive measures affect individual vessels, and (3) an evaluation of whether incentive measures were effective in achieving salmon savings beyond levels that would have been achieved in the absence of the measures.

2.5.4 Transferability and eligibility to receive transferable allocations

Alternative 5 contains two provisions, transferability and rollovers, to provide the fleet the flexibility to fully harvest the pollock TAC while maintaining the overall Chinook salmon bycatch at or below either the 60,000 or 47,591 Chinook salmon hard caps. Separate Chinook salmon hard cap allocations could limit the pollock harvest within a sector or cooperative. Transferable Chinook salmon bycatch allocations under this alternative would enable eligible participants to transfer bycatch allocations among sectors, cooperatives, and CDQ groups. Transferability is expected to mitigate the large variation in the amount of Chinook salmon that each sector, CDQ group, or cooperative catches in a given season by allowing eligible participants to obtain a larger portion of the bycatch allocations in order to harvest their full pollock allocation or to transfer surplus allocation to other sectors.

Transfers are a voluntary request to NMFS, initiated by the entity transferring surplus Chinook salmon allocations, to move a specific amount of a Chinook salmon bycatch allocation from one entity's account to another entity's account. NMFS would review the transferring entity's catch account to ensure sufficient salmon was available to transfer; therefore, NMFS approval would be required before a transaction could be completed. Transfers to eligible entities could occur at anytime in a season but transfers cannot be made between the B and A seasons.

Transferable salmon bycatch allocations must be issued to an entity. The entity represents all members of the group eligible to receive the transferable allocation. Some AFA participants already are recognized as entities by NMFS. NMFS recognizes inshore cooperatives as entities by through the AFA pollock permitting process. They file contracts with NMFS and are issued permits by NMFS. Under §679.7(k)(5)(ii) an inshore cooperative is prohibited from exceeding its annual allocation of pollock. CDQ groups are entities recognized by NMFS to receive groundfish, halibut, crab, and prohibited species quota allocations. Under §679.7(d)(5) a CDQ group is prohibited from exceeding its groundfish, crab, and halibut PSC allocations. Chinook salmon bycatch allocations would be added to this prohibition under this action.

Non-transferable "sector" allocations of pollock are made to the catcher/processor sector and the mothership sector. Therefore, these two sectors have not been required to be permitted by NMFS and the sector is not held accountable through a prohibition in 50 CFR part 679 from exceeding its allocation of pollock. NMFS retains in-season management authority to close directed fishing by these sectors if their catch of pollock reaches their allocation. Existing contracts forming the Pollock Conservation Cooperative, the High Seas Catchers' Cooperative, and the Mothership Fleet Cooperative could be modified to create the entities required to receive transferable bycatch allocations from NMFS or new entities (contracts) could be formed by these same vessel owners to address only NMFS's requirements to receive and transfer Chinook salmon bycatch allocations.

The entity receiving transferable Chinook salmon bycatch allocations would be 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 be 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 entity). The contract necessary to form the entity to receive salmon bycatch allocations is different from the contract establishing an IPA. If members of either the catcher/processor or mothership sector are unable to form a single entity to accept their share of the transferable salmon bycatch allocations under the 60,000 cap or the 47,591 cap, then that sector would receive its portion of the hard cap as a sector level cap that is not transferable and would be managed by NMFS with directed fishery closures that would apply to all members of the sector. Additionally, if the sector could not form an entity and some members of the sector joined an IPA and some members opted-out, then the nontransferable sector level cap would be adjusted to account for the opt-out vessels just like a transferable allocation as described under section 2.5.2.

Alternative 5 also contains a post-delivery transfer provision modeled after the provisions of Amendment 80 and the Central Gulf of Alaska Rockfish Pilot Program. The procedure for making transfers after an entity had exceeded its Chinook salmon bycatch allocation is described in Section 2.5.8.1.

Additionally, NMFS would rollover any unused Chinook salmon allocation or sector level cap remaining at the end of the A season to the B season for all sectors, cooperatives, or CDQ groups. Rollovers are management actions by NMFS to move unused Chinook salmon bycatch from an entity's A season account to its B season account. Rollovers could occur when a sector, cooperative, or CDQ group has harvested all of its pollock allocation, but has not reached its A season Chinook salmon bycatch allocation or sector level cap. Rollovers would only occur under the 60,000 and 47,591 Chinook salmon caps because these caps are allocated to sectors, cooperatives, and CDQ groups.

No rollover or transfer provisions exist for non-IPA participants fishing under the backstop cap because that cap is not apportioned to sectors, cooperatives, or CDQ groups. The Council's motion is not explicit on this point, however, the description of Alternative 4 in the DEIS was explicit that rollovers would not occur for the backstop cap and the motion language for the rollover provision is similar in the Council motion for both Alternative 4 and Alternative 5. The motion language states that unused salmon from the A season would be made available to the recipient of the salmon bycatch hard cap in the B season. No recipients would exist under the backstop cap as all vessels would be managed as a group.

2.5.5 Performance standard

The Council recognized the uncertainty and variability in salmon encounters in any given year when it selected the 60,000 Chinook salmon high cap. The Council also intended that bycatch over time be closer to the historical average through the IPAs that provide incentives to reduce bycatch below the cap. However, the Council also recognized that the IPA concept is novel and has not been demonstrated to achieve reductions in bycatch. Therefore, the Council included a performance standard as an additional tool to ensure sectors do not fully harvest the Chinook salmon bycatch allocation every year.

With the performance standard, for each sector to continue to receive its allocation of the 60,000 Chinook salmon cap, each sector's Chinook salmon bycatch could not exceed its annual portion of the 47,591 Chinook salmon in three years within a consecutive seven year period. The performance standard was designed to account for the unpredictability of high Chinook salmon encounters and the fact that occasionally a sector or cooperative may not be able to avoid exceeding its portion of 47,591 Chinook salmon in certain years.

Before each fishing year, NMFS would determine each sector's portion of 47,591 Chinook salmon. This amount would be called the annual threshold amount. A sector's annual threshold amount could vary each year depending on the number of vessels in that sector, or CDQ groups in the CDQ sector, choosing not to participate in an IPA. Any vessel or CDQ group that fishes under the backstop cap will not be included in the calculation of a sector's annual threshold amount. An example of calculating the annual threshold amount for the performance standard is in Section 2.5.7.

At the end of each fishing year, NMFS would evaluate each sector's bycatch in that year against that sector's annual threshold amount. Only the bycatch of vessels or CDQ groups participating in an IPA would accrue against a sector's annual threshold amount. If a sector's annual bycatch exceeds its annual threshold amount in any three years within seven consecutive years, NMFS would reduce that sector's Chinook salmon allocation to that sector's portion of 47,591 Chinook salmon, for all future years.

2.5.6 Calculating annual caps and allocations

Examples are provided below to illustrate how, under Alternative 5, NMFS would (1) assign an amount of Chinook salmon bycatch to sectors, cooperatives, and CDQ groups under each cap level and (2) adjust the sector level annual threshold amount if some vessels do not participate in an IPA.

Inshore CV Sector

NMFS would allocate the inshore CV sector's portion of either the 60,000 or 47,591 Chinook salmon cap to the inshore cooperatives based on the same percentages as the annual pollock allocations to the inshore cooperatives under current NMFS regulations. If the inshore CV sector was eligible for allocations under the 60,000 Chinook salmon cap, and if no vessel or cooperative opted out of an IPA, the amount of Chinook salmon allocated to the inshore CV sector would be 20,916 Chinook salmon in the A-season (49.8% of the A season allocation) and 12,474 Chinook salmon in the B-season (69.3% of the B season allocation) for a total of 33,390 Chinook salmon annually to the inshore CV sector. Assuming all permitted inshore catcher vessels were members of inshore cooperatives (no inshore open access fishery), then each of the inshore cooperatives would receive the transferable allocation of Chinook salmon shown in Table 2-45.

If one or more of the inshore cooperatives does not participate in an approved IPA, the amount of Chinook salmon allocated to the inshore CV sector would be reduced by the amount of Chinook salmon allocated to the backstop cap (Table 2-45). Members of the inshore cooperative not participating in an approved IPA would fish under a backstop cap with all vessels not participating in any IPA.

The following example shows how the allocations would be calculated if two inshore cooperatives opted out of an IPA and fished under the backstop cap. For this example, assume that the cooperatives with the highest and lowest Chinook salmon bycatch allocations opted out of an IPA; the Akutan CV Association (31.145%, highest allocation) and Arctic Enterprise Association (1.146%, lowest allocation). Also assume that vessels fishing for these two inshore cooperatives were the only vessels opting out of the IPA and fishing under the backstop cap.

Table 2-45 Each cooperative's (1) portion of the inshore sector's allocation of pollock, (2) Chinook salmon allocation in the A season and B season under the 60,000 Chinook salmon cap, (3) for the backstop cap, the amount of the 28,496 Chinook salmon that would be used to create the backstop cap if that cooperative opted out of an IPA, and (4) the amount of the 47,591 Chinook salmon cap used for the annual threshold calculation for the performance standard. Seasonal Chinook salmon bycatch allocations to the inshore cooperatives are based on each cooperative's percentage allocation of the inshore CV sector's allocation of pollock.

Inshore Cooperatives Alternative 5	**(1)**	**(2) 60,000**	**(3) 28,496**	**(4) 47,591**
Inshore sector A season allocation		20,916	9,933	16,591
Akutan CV Assoc	31.145%	6,514	3,094	5,167
Arctic Enterprise Assoc	1.146%	240	114	190
Northern Victor Fleet coop	9.481%	1,983	942	1,573
Peter Pan Fleet coop	2.876%	602	285	477
Unalaska coop	12.191%	2,550	1,211	2,023
Unisea Fleet coop	24.256%	5,073	2,409	4,024
Westward Fleet coop	18.906%	3,954	1,878	3,137
limited access AFA vessels	0.000%	0	0	0
Inshore sector B season allocation		12,474	5,925	9,894
Akutan CV Assoc	31.145%	3,885	1,845	3,081
Arctic Enterprise Assoc	1.146%	143	68	113
Northern Victor Fleet coop	9.481%	1,182	562	938
Peter Pan Fleet coop	2.876%	359	171	285
Unalaska coop	12.191%	1,521	722	1,206
Unisea Fleet coop	24.256%	3,026	1,437	2,400
Westward Fleet coop	18.906%	2,358	1,120	1,871
limited access AFA vessels	0.000%	0	0	0

If all members of the Akutan cooperative and the Arctic Enterprise cooperative did not participate in an IPA, the Chinook salmon allocated to the inshore sector would be reduced by these cooperatives' portion of 28,496 Chinook salmon. The Chinook salmon bycatch numbers specified under the 28,496 cap in Table 2-46 would be subtracted from the inshore sector's allocation of the 60,000 cap and that amount of Chinook salmon would be used to create the backstop cap. The calculation of the backstop cap associated with the two inshore cooperatives is shown below:

A season: 19,947 Chinook salmon * 49.8% (inshore A season proportion) = 9,933 Chinook salmon
9,933* [(31.145% (Akutan) + 1.146% (Arctic Enterprise)] = 3,208 Chinook salmon

B season: 8,549 Chinook salmon * 69.3% (inshore B season proportion) = 5,925 Chinook salmon
5,925* [(31.145% (Akutan) + 1.146% (Arctic Enterprise)] = 1,913 Chinook salmon

The backstop cap for these two inshore cooperatives would be 3,208 Chinook salmon in the A season and 1,913 Chinook salmon in the B season. In this example, the two inshore cooperatives were the only participants in the pollock fishery that did not participate in an approved IPA, thus this amount of Chinook salmon would represent the full amount available under the backstop cap.

This seasonal backstop cap would then be subtracted from the inshore sector's seasonal allocation of the 60,000 Chinook salmon cap; 20,916 in the A season and 12,474 in the B season. The resulting cap for the inshore CV sector that participates in the IPA would be 17,708 in the A season and 10,561 in the B season.

The amount of Chinook salmon deducted from the inshore sector's allocation of the 60,000 cap would be 5,121 Chinook salmon, which is less than the amount of Chinook salmon that would have been allocated to the Akutan Cooperative and the Arctic Enterprise Cooperative had they participated in an IPA (10,782 Chinook salmon). The difference of 5,661 Chinook salmon remains in the inshore CV sector's allocation to be distributed among the inshore cooperatives that participate in an IPA, in proportion to each cooperative's adjusted share of Chinook salmon bycatch.

The adjusted Chinook salmon bycatch allocation for each inshore cooperative in an IPA would be calculated by (1) adding the percentage allocations of the remaining inshore cooperatives (67.71%), and (2) dividing each remaining inshore cooperative's original percentage allocation by 0.6771. The resulting percentage allocations for each cooperative participating in an IPA is applied to the total amount of Chinook salmon allocated to the inshore sector after the amount allocated to the backstop cap is subtracted. The adjusted percentages add to 100%. In this example, the remaining five inshore cooperatives participating in an approved IPA now share the remaining 5,661 Chinook salmon plus the initial allocation of 22,608 for a total of 28,269 Chinook salmon allocation.

Table 2-46 Allocations of Chinook salmon under Alternative 5 (1) if all cooperatives participate in an IPA and (2) if two cooperatives opt-out of an IPA.

Inshore Cooperative	% allocation of pollock	Chinook Salmon Allocations			If two cooperatives don't participate in IPA				
		A season	B season	Total	% share of backstop cap	A season	B season	Total removed from sector allocation to create backstop cap	Total Chinook salmon forfit to sector
Akutan CV Assoc	31.145%	6,514	3,885	10,399	31.145%	3,094	1,845	4,939	5,460
Arctic Enterprise Assoc	1.146%	240	143	383	1.146%	114	68	182	201
Total	32.291%	6754	4,028	10,782	**Total**	3,208	1,913	5,121	5,661
					Adjusted % share*	Adjusted A season	Adjusted B season	Adjusted annual allocation to IPA participants	Additional IPA allocation
Northern Victor Fleet co-op	9.481%	1,983	1,182	3,165	14.002%	2,480	1,479	3,959	794
Peter Pan Fleet co-op	2.876%	602	359	961	4.248%	752	449	1,201	240
Unalaska co-op	12.191%	2,550	1,521	4,071	18.005%	3,188	1,901	5,089	1,018
Unisea Fleet co-op	24.256%	5,073	3,026	8,099	35.823%	6,344	3,783	10,127	2,028
Westward Fleet co-op	18.906%	3,954	2,358	6,312	27.922%	4,944	2,949	7,893	1,581
open access AFA vessels	0.000%	0	0	0	0.000%	0	0	0	0
Total	100%	20,916	12,474	33,390	100%	17,708	10,561	28,269	5,661

*Adjusted share of the Chinook salmon allocation

Table 2-47 Hypothetical estimates for the catcher/processor sector of (1) the percentage of each vessel's pollock allocation, (2) the amount of Chinook salmon that would be apportioned to each vessel in the A season and B season under the 60,000 Chinook salmon cap, (3) the amount of Chinook salmon removed from the sector allocation to create the backstop cap, and (4) each vessel's portion of the 47,591 Chinook salmon for the annual threshold calculation for the performance standard.

Offshore Catcher/Processor Sector Alternative 5		**60,000**		**28,496**		**47,591**
		A season	**B season**	**A season**	**B season**	**Annual**
		42,000	18,000	19,947	8,549	
Vessel	Allocation	13,818	3,222	6,563	1,530	13,516
American Dynasty	4.932%	681	159	324	76	667
American Triumph	7.246%	1001	233	475	111	979
Northern Eagle	6.070%	839	196	398	93	820
Northern Hawk	8.449%	1167	272	554	129	1,142
Northern Jaeger	7.384%	1020	238	485	113	998
Ocean Rover	6.394%	883	206	420	98	864
Highland Light	5.136%	710	165	337	79	694
Island Enterprise	5.595%	773	180	367	86	756
Seattle Enterprise	5.476%	757	176	359	84	740
Kodiak Enterprise	5.904%	816	190	387	90	798
Northern Glacier	3.121%	431	101	205	48	422
Pacific Glacier	5.062%	699	163	332	77	684
Alaska Ocean	7.295%	1008	235	479	112	985
Arctic Storm	4.579%	633	148	301	70	619
Arctic Fjord	4.458%	616	144	293	68	603
Starbound	3.943%	545	127	259	60	533
Katie Ann*	0.000%	0	0	0	0	0
U.S. Enterprise*	0.000%	0	0	0	0	0
American Enterprise*	0.000%	0	0	0	0	0
Endurance*	0.000%	0	0	0	0	0
Ocean Peace	0.500%	69	16	33	8	68
American Challenger**	0.783%	108	25	51	12	106
Forum Star**	0.607%	84	20	40	9	82
Ocean Harvester**	1.076%	149	35	71	16	145
Tracy Anne**	1.155%	160	37	76	18	157
Muir Milach**	1.129%	156	36	74	17	153
Neahkahnie**	1.661%	230	54	109	25	225
Sea Storm**	2.046%	283	66	134	31	276

*AFA permitted catcher/processors, none of which participated in the 2006 Bering Sea pollock fishery and are unlikely to return to the directed pollock fishery. The *American Enterprise* and the *U.S. Enterprise* have not participated since 1998, the *Endurance* since 2000, and the *Katie Ann* since 2004.
**AFA permitted catcher vessels eligible to deliver to catcher processors.
Source: Testimony to the Council at the 10/2008 meeting. The *Harvester Enterprise* was incorrectly listed in the draft EIS for this action but has been removed from this table because the vessel is not AFA eligible. Revisions for the final EIS: Personal communication with Plesha, J.T. of Trident Seafoods, 9/03/2009.

Offshore CP
Hard cap adjustments under the 60,000 Chinook salmon cap are not as complicated for the CP and MS sectors because NMFS would allocate the Chinook salmon only to the sector level, regardless of the number of vessels in the sector participating or not participating in an approved IPA. Estimates of the pollock catch history used in this example to assign Chinook salmon bycatch allocations to CP vessels are provided in Table 2-47.

These hypothetical percentage allocations were recommended by the PCC board and were presented to the Council during the October 2008 meeting. The suggested values in Table 2-47 are based on the percentage of Bering Sea pollock that each company received under either PCC or HSCC agreement and the 2006 vessel catch history. The 2006 Bering Sea pollock catch histories represent the best estimate of each vessel's relative harvesting capacity because this is one of the few years the *F/T American Dynasty* fished for pollock in both the A and B seasons.

AFA eligible catcher/processors that do not currently participate in the fishery are not likely to return. Therefore, the PCC board recommended that these vessels receive 0 percent of the pollock catch history within the CP sector. Three of the four inactive vessels (*Katie Ann, U.S. Enterprise,* and *American Enterprise)* could return to the directed pollock fishery. The fourth vessel, *Endurance,* is listed as an AFA eligible vessel but is permanently precluded from participation in the fishery because foreign flagged vessels cannot receive endorsements to fish in the EEZ of the U.S. In the unlikely event that a vessel currently assigned a zero proportion would return to the fishery and choose to opt-out of participation in an IPA, the portion and number of Chinook salmon associated with that vessel will be assigned, within the sector, based on revisions to the cooperative contract until regulations can be revised to reflect the new proportions assigned to each vessel.

For this example, if the CP vessels assigned the highest and lowest proportions opted out of an IPA, the calculation of Chinook salmon bycatch allocations would be similar to those for cooperatives opting out of the CV sector. The CP vessel with the highest estimated salmon proportion (8.449%) is the Northern Hawk, and the vessel with the lowest proportion (0.5%), is the Ocean Peace.

If these vessels opt-out of an IPA, an amount equal to the allocation under the backstop cap (724 Chinook salmon) would be subtracted from the overall CP sector's allocation of the 60,000 Chinook salmon cap and used to create the backstop cap. The calculation of the amount of the backstop cap associated with these inshore cooperatives is shown below:

A season: 19,947 * 32.9% (Offshore CP A season proportion) = 6,563 Chinook salmon
6,563 * [8.449% (Northern Hawk) + 0.5% (Ocean Peace)] = 587 Chinook salmon

B season: 8,549 Chinook salmon * 17.9% (Offshore CP B season proportion) = 1,530 Chinook
1,530* [8.449% (Northern Hawk) + 0.5% (Ocean Peace)] = 137 Chinook salmon

The initial CP sector's share (13,818 A season; 3,222 B season; 17,040 annual Chinook salmon) of the 60,000 Chinook salmon cap would be reduced by 587 A season and 137 B season, for a total of 724 Chinook salmon annually to create the backstop cap. The adjusted allocation of Chinook salmon, 13,231 A season and 3,085 B season for a total of 16,316 annually, would be distributed among the remaining 26 vessels in the CP sector. Adjustments made to cooperative portions in the earlier inshore CV example are not necessary for the MS or CP sector because NMFS does not allocate Chinook salmon bycatch beyond the sector level for the offshore fleet.

<u>Mothership sector</u>

For illustrative purposes, information from the 2008 Final Report of the Mothership Fleet Cooperative, as provided to the Council, was used to determine relative percentage apportionments for the vessels in this sector. From that report, the cooperative member share percentages and their associated vessels were applied to the mothership sector level cap (Table 2-48). The proportions do not total exactly in this report (99.939% rather than 100.000%), hence the resulting salmon allocations are hypothetical.

As with the examples provided for inshore CVs and CP sectors, if the vessels from the mothership sector with the highest and lowest proportions were to opt-out of an IPA (e.g., the Pacific Challenger and the Alyeska), the resulting sector level cap for the mothership sector would be an adjusted annual allocation of 4,409 Chinook salmon, adjusted downward from their initial allocation (Table 2-48) by the portion removed by vessels opting out of IPA participation. The resulting backstop cap would then be 191 Chinook salmon in the A season 75 Chinook salmon in the B season.

Here the vessel with the highest estimated salmon proportion (9.671%), the Pacific Challenger with 325 A season and 127 B season Chinook salmon, and the vessel with the lowest proportion (2.272%), the Alyeska with 76 A season and 30 B season Chinook salmon, opt-out of the IPA.

Their allocation under the backstop cap (264 Chinook salmon) would be calculated and subtracted from the overall mothership sector's allocation of the 60,000 Chinook salmon cap and moved from the offshore sector's allocation cap to create the backstop cap. The calculation of the amount of the backstop cap associated with these inshore cooperatives is shown below:

A season: 19,948 * 8.0% (Mothership A season proportion) = 1,596 Chinook salmon
1,596* [9.671% (Pacific Challenger) + 2.272% (Alyeska)] = 190 Chinook salmon

B season: 8,548 Chinook salmon * 7.3%% (Mothership B season proportion) = 624 Chinook
624* [9.671% (Pacific Challenger) + 2.272% (Alyeska)] = 74 Chinook salmon

The initial mothership sector's share (3,360 A season; 1,314B season; 4,674 annual Chinook salmon) of the 60,000 Chinook salmon cap would be reduced by 190 A season and 74 B season, for a total backstop cap of 264 Chinook salmon. The adjusted allocation of Chinook salmon, 3,170 A season and 1,240 B season for a total of 4,410 Chinook salmon would be distributed among the remaining 17 vessels permitted by the AFA in the mothership sector.

Table 2-48 Hypothetical estimates for the mothership sector of (1) the percentage of each vessel's pollock allocation, (2) the amount of Chinook salmon that would be apportioned to each vessel in the A season and B season under the 60,000 Chinook salmon cap, (3) the amount of Chinook salmon removed from the sector allocation to create the backstop cap, (4) each vessel's portion of the 47,591 Chinook salmon for the annual threshold calculation for the performance standard.

Mothership Sector		**(2) 60,000 cap**		**(3) 28,496 backstop cap**		**(4) 47,591 Annual Threshold**
		A season	**B season**	**A season**	**B season**	
		42,000	18,000	19,947	8,549	
Vessel	**(1) Allocation**	3,360	1,314	1,596	624	3,707
American Beauty	6.000%	202	79	96	37	223
Pacific Challenger	9.671%	325	127	154	60	359
Nordic Fury	6.177%	208	81	99	39	229
Pacific Fury	5.889%	198	77	94	37	218
Margaret Lyn	5.643%	190	74	90	35	209
Misty Dawn	3.569%	120	47	57	22	132
Vanguard	5.350%	180	70	85	33	199
California Horizon	3.786%	127	50	61	24	140
Oceanic	7.038%	236	92	112	44	261
Mar-Gun	6.251%	210	82	100	39	231
Mark 1	6.251%	210	82	100	39	231
Aleutian Challenger	4.925%	165	65	79	31	182
Ocean Leader	6.000%	202	79	96	37	223
Papado II	2.953%	99	39	47	18	110
Morning Star	3.601%	121	47	57	23	134
Traveler	4.272%	144	56	68	27	158
Vesteraalen	6.201%	208	82	99	39	230
Alyeska	2.272%	76	30	36	14	84
Western Dawn	4.150%	139	55	66	26	154

Source: Information from the 2008 Final Report of the Mothership Fleet Cooperative, as provided to the NPFMC, was used to determine relative proportions.

CDQ groups

Similar adjustments would be made if one or more of the CDQ groups did not participate in an approved IPA. If the CDQ groups with the highest and lowest proportions Chinook salmon allocations were to opt-out of the IPA (e.g., the CVRF, 24% and the CBSFA, 5%) the resulting sector level cap for the CDQ sector would remain an annual total of 4,896, with 4,222 Chinook salmon allocated to CDQ groups participating in an IPA and 674 used to create the backstop cap. The resulting backstop cap would then be allocated between seasons: 538 Chinook salmon in the A season and 136 Chinook salmon in the B season (Table 2-49).

Table 2-49 Seasonal allocations to the CDQ sector and each CDQ group under the 60,000 and 47,591 Chinook salmon caps and, for the backstop cap, the amount of the 28,496 Chinook salmon that would be used to create the backstop cap if a CDQ group opted out of an IPA. Seasonal Chinook salmon bycatch allocations to the CDQ groups are based on each entity's percentage allocation of the CDQ sector's allocation of pollock.

CDQ Sector Alternative 5		**60,000**	**28,496**	**47,591**
A season allocation	**70.00%**	**42,000**	**19,947**	**33,314**
CDQ seasonal allocation	**9.30%**	**3,906**	**1,855**	**3,098**
APICDA	14.00%	547	260	434
BBEDC	21.00%	820	389	651
CBSFA	5.00%	195	93	155
CVRF	24.00%	938	445	743
NSEDC	22.00%	859	408	681
YDRFA	14.00%	547	260	434
B season allocation:	**30.00%**	**18,000**	**8,549**	**14,277**
CDQ seasonal allocation	**5.50%**	**990**	**470**	**785**
APICDA	14.00%	138	66	110
BBEDC	21.00%	208	99	165
CBSFA	5.00%	49	23	39
CVRF	24.00%	238	113	188
NSEDC	22.00%	218	103	173
YDRFA	14.00%	139	66	110

<u>All sectors in aggregate</u>

Assuming that all of these examples occurred during the same fishing season with two of each sector's vessels, cooperatives, or entities opting out of an IPA, all vessels these fishing under the backstop cap would be required to stop fishing once their bycatch aggregate accrued to the cap. In this case, the participants from each sector (inshore CV, offshore CP, MS, and CDQ) would fish under the backstop cap of 4,523 Chinook salmon in the A season and 2,260 Chinook salmon in the B season (Table 2-49 and Table 2-50). Vessels fishing under the backstop cap would not have individual or separate sector caps. Therefore, the bycatch of all vessels choosing to opt out of an IPA would accrue towards the seasonal backstop cap. Directed fishing under the backstop cap would likely lead to a 'race for bycatch' and truncated pollock fishing season for vessels fishing under the backstop cap. In this example NMFS would monitor the fishery and issue a directed fishery closure to ensure that bycatch does not exceed the backstop cap.

Under this example, the various sectors and vessels participating in a NMFS-approved IPA would receive an allocation of the remaining 53,216 Chinook salmon from the initial 60,000 hard cap allocation.

Table 2-50 Hypothetical sector level caps, under Alternative 5, resulting from the examples of highest and lowest members of each sector opting out of an IPA in a given year and the recalculated backstop cap of 6,783 Chinook salmon.

Sector	Initial annual allocation of the 60,000 cap	Amount deducted due to vessels with the high and low proportions "opting out"	Adjusted total allocation to IPA participants	Total allocation to sector
Inshore CV	33,390	5,121	28,269	33,390
Offshore C/P	17,040	724	16,316	17,040
Mothership	4,674	264	4,410	4,674
CDQ	4,896	674	4,222	4,896
Total	60,000	6,783	53,217	60,000

Regardless of the number of vessels participating in the IPA or under the backstop cap, the annual hard cap allocation will be 60,000 Chinook salmon. The total Chinook salmon hard cap allocation will remain 60,000, unless (1) an IPA is not approved by NMFS, (2) one or more entire sector(s) (inshore CV, offshore CV, MS, or CDQ (all six entities) opt out of an IPA, or (3) one or more sectors do not meet the sector level performance standard and fish under the 47,591 hard cap.

If one or more entire sectors did not participate in an IPA or had exceeded their performance standards the total allocation to the pollock fishery would not total 60,000 Chinook salmon annually. Instead, the total Chinook salmon hard cap allocation would be reduced by the difference between what the sector opting out would have been allocated under the 60,000 cap and their allocation under the new cap level, either 28,496 or 47,591 Chinook salmon. For example, if the mothership sector opted out of participation in an IPA their allocation under the 28,496 cap would be 2,220 Chinook salmon annually (1,596 A season and 624 B season), fewer fish than would have been allocated had the sector participated in an IPA (4,674 annually: 3,360 A season and 1,314 B season) (Table 2-44). Instead of being reallocated, as for individual vessels within a sector or cooperatives opt-out, the difference, 2,454 Chinook salmon (4,674-2,220), between these two allocations is not reallocated. The actual maximum Chinook salmon hard cap would then be reduced to 57,546 Chinook salmon annually for the pollock fishery. However, sectors with one or more vessels joining a NMFS approved IPA have less of a reduction in Chinook salmon allocations, as described above.

Similarly if the mothership sector, or any sector, had exceeded their performance standard and had to fish under the 47,591 hard cap, the difference in Chinook salmon allocations would not be redistributed among other participants in the fishery. In this case, the mothership sector would be allocated 3,707 Chinook salmon annually (2,665 A season and 1,042 B season) under the 47,591 Chinook salmon hard cap (Table 2-44). The fleet-wide maximum Chinook salmon hard cap would then be reduced to 59,033 Chinook salmon annually.

2.5.7 Calculating the annual threshold amounts for the performance standard

NMFS will annually calculate each sector's annual threshold amount under the performance standard based on its portion of 47,591 Chinook salmon and the level of participation by its members in an IPA. NMFS would determine a sector's portion of 47,591Chinook salmon by multiplying the sector's seasonal percentages by the seasonal allocations and summing the results (Table 2-44). This amount could change from year to year if any members of a sector do not participating in an IPA. The annual threshold amount for that sector would be reduced proportionally based on the percentages shown in Table 2-45, Table 2-47, Table 2-48, and Table 2-49 for the inshore cooperative, vessel, or CDQ group that did not participate in the IPA. A sector's annual threshold amount would not change when vessels from other sectors or another sector opt-outs of an IPA or if another sector exceeds their performance standard and fishes under the 47,591 Chinook salmon cap. For example, if each inshore cooperative joined an IPA, the inshore sector's annual threshold would be 26,485 Chinook salmon, regardless of the participation of other sectors in an IPA or the performance of other sectors.

The calculation of the inshore sector's annual threshold amount is shown below:

- 16,591 Chinook salmon in the A-season (49.8% of the A season's allocation, 33,314); plus
- 9,894 Chinook salmon in the B-season (69.3% of the B season's allocation, 14,277); equals
- 26,485 Chinook salmon annually for the inshore sector.

If one or more of the inshore cooperatives or individual vessels within the inshore sector do not participate in an approved IPA, the amount of Chinook salmon in the inshore sector's annual threshold amount would be reduced by the portion of the 47,591 Chinook salmon cap represented by those operations opting out of an IPA (Table 2-45). Similar to the earlier CV example, members of the inshore sector not participating in an approved IPA would fish under a backstop cap with all other vessels not participating in an IPA. Vessels or cooperatives fishing under the backstop cap would not be a part of the calculation of the annual threshold amount for their sector. Assuming the cooperative with the highest and the cooperative with the lowest allocation of Chinook salmon PSC opt-out of an IPA, the annual threshold amount for the inshore vessels participating in an IPA would be reduced from 26,485 to 18,030 Chinook salmon.

The calculation of the amount of the inshore sector's annual threshold amount is shown below:

A season: 33,314 Chinook salmon * 49.8% (inshore A season proportion) = 16,591 Chinook
16,591* [(31.145% (Akutan) + 1.146% (Arctic Enterprise)] = 5,357 Chinook salmon

B season: 14,277 Chinook salmon * 69.3% (inshore B season proportion) = 9,894 Chinook salmon
9,894* [(31.145% (Akutan) + 1.146% (Arctic Enterprise)] = 3,194 Chinook salmon

Annual threshold amount = 26,485 Chinook salmon – (5,357 Chinook salmon + 3,194 Chinook salmon) = 17,934 Chinook salmon

2.5.8 Managing and Monitoring Alternative 5

The management and monitoring issues associated with Alternative 5 are many of the same issues discussed in Section 2.2.5 for Alternative 2 and Section 2.4.7 for Alternative 4. The preferred alternative would make transferable allocations of Chinook salmon bycatch to the following entities:

- No more than one entity representing the AFA catcher/processor sector,
- No more than one entity representing the AFA mothership sector,
- Up to seven inshore cooperatives,
- Six CDQ groups.

If all of these entities were eligible to receive transferable bycatch allocations there would be 15 different Chinook salmon bycatch accounts each season for a total of 30 bycatch accounts each year. Separate allocations would be made for the A season and the B season for a total of up to 30 transferable bycatch allocation accounts. This number of transferable bycatch account could exist under either the 60,000 Chinook salmon cap or the 47,591 Chinook salmon cap. In addition to the transferable allocations, non-transferable allocations could be issued under either cap to the inshore open access fishery for any inshore catcher vessel that did not join an inshore cooperative. Under the 60,000 cap, NMFS would manage any vessels that did not participate in an IPA as a group under the seasonal "opt-out" or "backstop" cap. Table 2-51 shows the maximum number of transferable allocations under Alternative 5 and the two possible categories of non-transferable allocations. These allocations would be managed as described for Alternative 2 (Section 2.2.5) and Alternative 4 (Section 2.4.7.2).

Table 2-51 Potential number of transferable Chinook salmon bycatch accounts under Alternative 5.

	Entities that could receive transferable allocations					Potential non-transferable allocations	
	Catcher/ processors	Motherships	Inshore co-ops	CDQ Program	Total transferable	Inshore open access	Opt-out cap
A season	1	1	7	6	15	1	1
B season	1	1	7	6	15	1	1
Annual total	2	2	14	12	30	2	2

An added complexity of managing transferable allocations of Chinook salmon bycatch under the preferred alternative is the potential for some vessels to be fishing under transferable allocations of the 60,000 cap and other vessels to be fishing under transferable allocations of the 47,591 cap. This could occur if some sectors had not exceeded their performance standards, but other sectors had exceeded their performance standard. At its most complex, the preferred alternative could require NMFS to manage some transferable allocations under the 60,000 cap, some vessels fishing under the backstop cap, some vessels fishing in the inshore open access fishery under a different portion of the 60,000 cap, and some vessels fishing under transferable allocations of the 47,591 cap (vessels in sectors that had exceeded their performance standard in past years).

Alternative 5 would require NMFS to complete a number of administrative functions each year before the pollock fishery starts on January 20. These functions include:

1. determine how each sector had performed against its annual threshold for the previous year;

2. publish a notice in the *Federal Register* if any sector had exceeded its performance standard by exceeding its annual threshold amount of Chinook salmon bycatch in three of the past seven years;

3. determine if any sectors, inshore cooperatives, CDQ groups, or vessels were not participating in an IPA;

4. determine the appropriate Chinook salmon bycatch allocations for each entity, fishery, and season;

5. make adjustments to the transferable allocations and the opt-out cap for those not participating in an IPA; and

6. calculate the annual threshold amounts for the upcoming year for each sector still fishing under the 60,000 cap.

All information listed above would be posted on NMFS's web page by January 1 of each year.

NOAA GC advised NMFS that a reduction in a sector's allocations as a result of exceeding its performance standard requires NMFS to publish a notice in the *Federal Register*. In doing so, NMFS must address as part of each notice whether a public comment period is necessary on the decision or whether waiver of notice and comment could be justified under the Administrative Procedure Act. NMFS anticipates that, because the determination of the performance standard and each sector's bycatch against its annual threshold will not involve any discretionary decisions by NMFS, that waiver of the public comment period could be justified. However, if the notice of reduction in allocations as a result of exceeding the performance standard cannot be made effective before January 20 of the next year, then it will be effective on January 20 of the following year, which would result in a one-year delay in reducing Chinook salmon bycatch allocations.

2.5.8.1 Managing transferable allocations under either the 60,000 cap or the 47,591 cap

Entities receiving transferable allocations of Chinook salmon bycatch would be prohibited from exceeding their seasonal allocations. Each group would be required to manage its pollock fishing so that neither its pollock allocation nor its salmon bycatch allocation was exceeded. The Council intended that both the A-season allocation and the annual allocation would not be exceeded. The only way to do that is to treat the A-season and B-season allocations as separate quota accounts and evaluate overages at the end of the A-season and the end of the year. NMFS would not close directed fishing for pollock by the sectors, inshore cooperatives, or CDQ groups receiving transferable salmon bycatch allocations when those salmon bycatch allocations are reached. Rather, penalties could be assessed for overages of their Chinook salmon bycatch allocation.

Chinook salmon bycatch allocations under the 60,000 cap and the 47,591 cap would be transferable among the entities receiving transferable allocations. The entity representing the catcher/processor sector, the entity representing the mothership sector, any of the inshore cooperatives, or any of the CDQ groups may transfer to and from any of the other entities, subject to the following restrictions:

- Entities receiving transferable allocations under the 60,000 cap would only be allowed to transfer to and from other entities receiving allocations under the 60,000 cap.
- Entities receiving transferable allocations under the 47,591 cap would only be allowed to transfer to and from other entities receiving allocations under the 47,591 cap.
- Chinook salmon may not be transferred from one entity's A-season account to another entity's B-season account or vice-versa.

Any Chinook salmon remaining in an entity's A-season account at the end of the A-season would be added by NMFS to the entity's B-season account.

Post-delivery transfers: If an entity's catches more Chinook salmon than it has been allocated each season, the entity's Chinook salmon bycatch allocation account balance will become negative. This is called an "overage" of the entity's Chinook salmon bycatch allocation. If an overage occurs, all vessels fishing on behalf of the entity would be allowed to complete the pollock fishing trip that they are on, but would not be allowed to start another fishing trip for the remainder of the season. Chinook salmon bycatch likely will continue to accrue against the entity's allocation as vessels complete fishing trips. The entity will be allowed to transfer in Chinook salmon bycatch from another entity to "cover" these overages and bring their Chinook salmon allocation account balance up to zero. They will not be allowed to transfer any more Chinook salmon than is needed to bring their account balance to zero. Because each entity will receive separate allocations for the A season and the B season and will be prohibited from exceeding either of those allocations, the allowance for post delivery transfers will be provided for both the A season and the B season allocations. Each entity will be allowed 15 days after the end of the A season and 30 days after the end of the B season to conduct post delivery transfers to cover overages. Any overages that exist after June 25 for the A season and after December 1 for the B season will be subject to enforcement action for violating NMFS regulations.

2.5.8.2 Managing non-transferable Chinook salmon allocations under either the 60,000 cap or the 47,591 cap

There are three scenarios under which NMFS would manage non-transferable allocations of Chinook salmon bycatch:

1. Vessels fishing under the opt-out cap

2. The inshore sector open access pollock fishery that exists if any inshore catcher vessel does not join an inshore cooperative. Vessels in the inshore open access fishery could be allowed to participate in the Chinook salmon IPA. However, they could not receive a transferable salmon bycatch allocation. The inshore open access fishery would receive non-transferable Chinook salmon bycatch allocations under either the 60,000 cap or the 47,591 cap.

3. If the catcher/processor sector or mothership sector do not form the entity necessary to receive transferable allocations, these sectors would receive non-transferable allocations of Chinook salmon bycatch under either the 60,000 cap or the 47,591 cap.

Non-transferable Chinook salmon bycatch allocations would be managed by NMFS with a directed fishing closure once this limit was reached.

Managing the Opt-Out Cap: Any vessel or CDQ group entity in a sector or cooperative receiving an allocation under the 60,000 Chinook salmon cap, but not participating in an approved IPA, would be managed under the Chinook salmon bycatch opt-out cap. Vessel owners, cooperatives, or CDQ groups not participating in an IPA do not have to notify NMFS that they are not participating in an IPA. NMFS will know the list of vessels participating in each approved IPA and will post on the internet the status of all permitted vessels as to whether they are participating or not participating in an IPA and what cap they will be managed under. Vessel owners will be expected to notify NMFS if they are incorrectly listed as a vessel fishing under the opt-out cap. All Chinook salmon bycatch by vessels directed fishing for pollock in the Bering Sea under the opt-out cap will accrue against the opt-out cap. All vessels fishing under the opt-out cap, including vessels fishing on behalf of a CDQ group, will be managed as a group under the seasonal allocations of Chinook salmon bycatch to the opt-out cap. NMFS will close directed fishing for pollock by vessels fishing under the opt-out cap when NMFS determines that the seasonal cap has been reached. However, nothing would prevent the vessels or CDQ groups fishing under the opt-out cap from cooperating to conduct their pollock fisheries so that they did not exceed the cap.

No rollover or transfer provisions exist for non-IPA participants fishing under the backstop cap. However, if the A season closure date selected by NMFS results in more Chinook salmon caught than were allocated to these fisheries in the A-season, the amount over the A-season allocation would be deducted by NMFS from the B-season allocation to the opt-out cap.

2.5.8.3 Managing Chinook salmon bycatch under the CDQ Program

Transferable allocations of the Chinook salmon cap to the CDQ Program would be further allocated among the CDQ groups based on percentage allocations approved by NMFS on August 8, 2005 (71 FR 51804; August 31, 2006). For Chinook salmon, these percentage allocations are:

- 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 (CVRF) 24%;
- Norton Sound Economic Development Corporation (NSEDC) 22%;
- Yukon Delta Fishery Development Corporation (YDFDC) 14%.

Any CDQ group not participating in an approved IPA would not receive a transferable allocation of a portion of the 60,000 cap. Any CDQ group that does not participate in an IPA will fish under the seasonal opt-out cap along with any other vessels not participating in an approved IPA. Only the CDQ group may decide whether to participate in an IPA or opt out, not owners of vessels fishing on behalf of a CDQ group. A CDQ group could not have some vessels fishing under the 60,000 cap and others fishing under the opt-out cap.

Vessels fishing on behalf of a CDQ group could not individually opt out of the IPA because they are not authorized to make decisions about whether a CDQ group participates in the IPA or opts out. They fish under whatever cap and whatever IPA 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.

The amount of Chinook salmon bycatch subtracted from the CDQ sector's allocation of the 60,000 cap would be the percentage allocation for that CDQ group opting out to the CDQ sector's allocation of 28,496 Chinook salmon. This amount would be added to the opt-out cap. The difference between the opting out CDQ group's share of the 60,000 cap and its share of the 28,496 cap would be redistributed among the CDQ groups receiving transferable allocations of the 60,000 cap based on the remaining CDQ groups' percentage allocations. The annual threshold amount for purposes of applying the annual performance standard will be based on the proportional share of 47,591 represented by the CDQ groups that are participating in an approved IPA each year.

If Chinook salmon bycatch by vessels fishing on behalf of CDQ groups under transferable allocations of the 60,000 cap exceeds the CDQ sector's annual threshold bycatch amount in any three years within a consecutive seven-year period, then all CDQ groups, including those under the under the opt-out cap, will fish under transferable allocations of the 47,591 cap in all subsequent years.

CDQ allocations of a portion of the 60,000 or 47,591 Chinook salmon cap could be transferred to other CDQ groups, inshore cooperatives, or the entity representing the catcher/processor sector or the mothership sector if these other entities also are fishing under transferable allocations of these caps. All other transfer limitations described above also apply to the CDQ sector and entities.

Any new monitoring requirements that apply in the BS pollock fisheries will apply to vessels and processors fishing or processing CDQ pollock. In addition, catcher vessels directed fishing for pollock on behalf of the CDQ groups and delivering to shoreside processing plants will be required to deliver to a plant that has an approved catch monitoring and control plan. This requirement is necessary to properly account for any Chinook salmon bycatch in that pollock CDQ delivery.

2.5.8.4 Observer coverage and monitoring requirements

As was discussed for transferable Chinook salmon bycatch allocations under Alternatives 2, 3, and 4, NMFS recommends the increased monitoring requirements under the preferred alternative. The Council included these recommendations as component 6 for Alternative 5. These recommendations are described in Section 2.2.5.7 through Section 2.2.5.10 and include:

- Each catcher vessel regardless of length, except catcher vessels delivering unsorted codends, must have 100 percent observer coverage.
- All salmon of any species that is brought onboard a catcher vessel must be retained onboard the catcher vessel and delivered to the processing facility (no at-sea discards of salmon from catcher vessels).
- Shoreside processor monitoring requirements will have to be adjusted to incorporate a higher standard for Chinook salmon bycatch accounting. This could include such changes as modifying observer duties, modifying factory configurations, 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.
- Chinook salmon bycatch by catcher/processors and catcher vessels delivering to motherships will be based on a count or census of the salmon rather than using the current method described in section 3.1 of estimating Chinook salmon bycatch based on observer's species composition samples. Additional regulations will be needed to ensure that all salmon are retained and counted by an observer before they are discarded from a catcher/processor or mothership.
- Electronic (video) monitoring in lieu of observers would only be allowed after a successful, comprehensive assessment of the effectiveness of electronic monitoring to verify that Chinook salmon are not discarded.

Given the complexity of the dual Chinook salmon accounting envisioned under Alternative 5 (including Chinook transferability by some sectors and CDQ groups), NMFS recommended 100 percent observer coverage for all inshore catcher vessels, even those fishing with non-transferable allocations under the inshore open access fishery or the opt-out cap, as described in Section 2.4.7.3.

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 5 times, in March 2007, May 2007, August 2007, November 2007 and January 2009. 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, December 2007, February 2009). 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.

The SBW meeting in January 2009 was held with the express purpose to review incentive program proposals prior to Council review of these proposals in February 2009. This SBW meeting occurred during the public comment period on the DEIS. The DEIS had identified a preliminary preferred alternative (now Alternative 4) which incorporated these programs conceptually and review and comment by the committee provided an additional opportunity for committee members as well as members of the public to understand and provide feedback on the programs during their development. As with previous SBW meetings, a report was compiled by staff of the discussions and recommendations of the committee and presented to the Council at the subsequent meeting (February 2009).

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. In April 2008, 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 chum salmon alternatives were last modified by the Council in June 2009 (see June 2009 Council motion at http://fakr.noaa.gov/npfmc/current_issues/bycatch/Chumbycatch709.pdf). The Council continued to discuss these alternatives in December 2009 and will likely move forward with an analysis of separate chum salmon management in 2010.

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 think that the index cap formulation was sufficient developed at this time to include as an alternative.

The Council also considered establishing a new cap on an annual basis; however, this would be extremely difficult, if not impossible, to implement successfully. The process first requires Council to make a recommendation and second requires NMFS to implement that recommendation through a rulemaking, which must comply with a variety of federal laws. NMFS expects that it would take more that a year for (1) for the necessary information to be collected, analyzed and presented to the Council, (2) for the Council to determine alternative cap levels that would then be analyzed according to NEPA and applicable law, (3) for the Council recommend to the Secretary of Commerce the alternative cap level that best represented the new information, and (4) for NMFS to implement the new cap level in Federal regulations. By the time the new cap level was effective, it would be based on outdated information and the current information may indicate that a different cap level is appropriate.

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 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 (RIR). 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 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 assuming that catch and bycatch rate information collected by observers is similar to catch and bycatch rates by unobserved fishing vessels. Data from observed vessels and processors is extrapolated to catch made by unobserved vessels.

The sampling intensity for salmon bycatch in the pollock fishery is very high in order to reduce the severity of potential sampling issues and to satisfy the demands of inseason management. Because sampling fractions are high for the pollock fishery, uncertainty associated with the magnitude of salmon bycatch is relatively low. 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 percent (Miller 2005[27]). This indicates that, assuming that the observed fishing

[27] Miller's dissertation represents a thorough presentation of statistically sound methodology that accurately characterizes low variation in salmon bycatch estimates. However, NMFS recognizes the differences between its estimates and

operations are unbiased relative to unobserved operations, the total salmon bycatch levels are precisely estimated for the fleet as a whole. Imprecision of the estimates of 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.

those presented in Miller 2005. Chapter 9 addresses the public comment about this issue. In brief, the main reason that Miller's estimates are considerably higher than NMFS is that partial and whole-haul samples with no Chinook salmon were inadvertently excluded in his estimation. Prior to 2008, the observer program had a data convention that if a sample was taken and no salmon were found, then a zero for the number of salmon in the sample was recorded. These specimen records were inadvertently overlooked in Miller's dissertation. A second, relatively minor issue, is that Miller's design and model-based estimators assume that the observer coverage for 60-125' vessels was exactly 30 percent for all trips within each quarter of the calendar year. In reality, these vessels often have a much higher levels of coverage based on trips (sometimes in excess of 50 percent) and therefore this assumption may lead to estimates that are biased (depending on the real level of observer coverage). One simple solution is to use the true ratio of observed and unobserved trips or fishing days for each year and quarter and this was noted in his study but at the time, the information was unavailable.

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 processing plant 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.

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 observed vessels that operate in a similar time and place as the unobserved catcher vessels.

The CAS methodology used to estimate prohibited species catch is the same for the inshore and offshore sectors; however, the methodology to obtain haul-specific estimates is different between the sectors. The offshore sector relies on robust sampling methods and the inshore sector uses a census approach.

Estimates of salmon, crab, and halibut bycatch for catcher processors and motherships in the pollock fishery 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 CAS 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 extrapolation method for prohibited species, such as halibut, salmon, and crab are 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. Prohibited species catch that is discarded at-sea is assessed by onboard observers. The total amount of prohibited species 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. The years 2003 to 2007 were chosen as the analytical base years because that was the most recent 5 year time period reflective of recent fishing patterns at the time of initial Council action, with 2007 representing the highest historical bycatch of Chinook. Catch accounting changed beginning in the 2003 pollock fishery with the CAS. Since 2003, the CAS has enabled consistent sector-specific and spatially-explicit treatment of the Chinook salmon bycatch data for comparative purposes across years. Thus, starting the analysis in 2003 utilized the most consistent and uniform data set that was available from NMFS on a sector-specific basis.

The selected years for analysis included the available data at that time (2008 data were unavailable). NMFS decided that including 2008 in the analysis would have delayed completion and since the purpose of the analysis was to estimate the Chinook salmon saved and forgone pollock catch and related impacts, extending the period would have had little effect on the conclusions. In fact, because the bycatch in 2008 was below all caps under consideration, most likely there would have been no salmon saved or pollock forgone under any of the alternatives in 2008. The data from 2003-2007 is sufficient to highlight relative differences among the alternatives and associated options and show how these alternatives and options perform given the variability in Chinook salmon bycatch between seasons and among sectors and years. Final EIS and Final RIR do include 2008 data on Chinook salmon bycatch, the pollock fishery, and Chinook salmon stock status and directed fisheries to provide an understanding of the existing conditions.

This analysis assumes that past fleet behavior approximates operational behavior under the alternatives, but stops short of estimating changes in fishing vessel operations. While it is expected that the vessel operators will change their behavior to avoid salmon bycatch and associated potential losses in pollock revenue, data were unavailable to accurately predict the nature of these changes.

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).

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 the 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 the RIR. 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.

Alternatives 4 and 5

For the scenarios under Alternative 4, the following options, as indicated in Chapter 2, were examined:

1) Sector split (by season):

	CDQ	inshore CV	Mothership	Offshore CP
A season	9.3%	49.8%	8.0%	32.9%
B season	5.5%	69.3%	7.3%	17.9%

2) Seasonal split (70/30)
3) Rollover 80% within sectors from A to B seasons
4) Unrestricted transferable quotas

For the scenarios under Alternative 5, the following options, as indicated in Chapter 2, were examined:

1) Sector split (by season):

	CDQ	inshore CV	Mothership	Offshore CP
A season	9.3%	49.8%	8.0%	32.9%
B season	5.5%	69.3%	7.3%	17.9%

2) Seasonal split (70/30)
3) Rollover 100% 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 (Alternative 4 scenarios 1 and 2, Alternative 5 scenarios 1 and 2).
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 (Alternative 4 only)
5) B-season sector caps invoked with transferability for all cases (though the ability to do calculations with non-transferability is retained).

For both scenarios under Alternatives 4 and 5, 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 Alternative 4 scenario 1, 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). For Alternative 5, the effective caps were 31,550 Chinook for the A season cap and 23,490 for the B season. 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 values as applied for 2003-2007. The intention is to capture the anticipated effect of alternative cap scenarios and account for seasonal and sector-specific bycatch patterns.

In order to estimate the relative impact of an 80% rollover from the A to B seasons under Alternative 4, 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. The method follows an expanded version of Kimura (1989) and modified by Dorn (1992). Length at age data are used to construct age-length keys for each stratum and sex. These keys are then applied to randomly sampled catch-at-length frequency data. The stratum-specific age composition estimates are then weighted by the catch within each stratum to arrive at an overall age composition for each year.

The modification from Kimura's (1989) approach was simply to apply a two-stage bootstrap scheme to obtain variance estimates. In the first stage, for a given year, sampled tows were drawn with replacement from all tows from which salmon were measured. In the second stage, given the collection of tows from the first stage, individual fish measurements were resampled with replacement. All stratum-specific information was carried with each record. For the length-age data, a separate but similar two-stage bootstrap process was done. 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). The bycatch in the A-season is dominated by age 5 fish (51%) with ages 6 and 7 Chinook representing 15% on average while ages 3 and 4 are 35%.

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). Genetic stock identification estimated the relative composition of 15 regional groups in the bycatch samples. For this analysis, estimates are provided for the 8 largest contributing groups and the remaining components were combined into the 'other' category, resulting in 9 stock groups (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 3-8Myers 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. These more recent estimates were chosen since they are most representative of the timeframe analyzed. Earlier work presented in Myers et al. (2003) had a different resolution to stock composition and was from samples covering an earlier period.

To illustrate the influence of bycatch temporal and spatial variability regarding bycatch stock composition, retrospective analyses were performed using the available genetics data collected from 2005-2007. We acknowledge that this assumption (i.e., constant stock composition within season-area strata) may be poor, especially for years beyond this period. For the main impact analysis the time period was selected to be from 2003-2007 which overlaps with the sample collection period and may reduce concerns about mis-matches between the sampling period for genetics work and the application period for impact analysis.

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).

The Seeb 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 Seeb et al. (2008) analysis were obtained opportunistically for a study to evaluate using scales and other tissues as collected by the NMFS observer program for genetic sampling. Unfortunately, during this 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). To account for these sampling issues we computed a weighted average of the samples over years within regions and seasons. The 2005 B-season stock composition results were given one third of the weight since sampling effort was low during October of that year (relative to the bycatch) while the 2006 B-season stock composition data was given two-thirds of the weight in simulating stock apportionments. For the A season, the 2007 data (collected from a limited number of tows) were given one fifth the weight while the 2006 was weighted 4 times that value.

Once these mean stock composition estimates (and associated uncertainties) were obtained, it was necessary to apply the stratum-specific stock composition levels (Table 3-11) to the stratum specific bycatch totals to arrive at an annual stock-specific bycatch level for application in the model (Fig. 3-6). An important feature of this analysis is that the bycatch amounts by location and season were used explicitly for the estimates of the relative contribution of bycatch from different salmon regions (e.g. Fig. 3-8). This is also an important distinction from previous studies (e.g. Myers et al, 2003) which assumed that the stock identification samples were proportional to the season and area specific bycatch over all years.

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, and mean apportionments of the bycatch to stock (region) of origins by area and season of the pollock fishery are shown in Table 3-11.

While stock units differ from previous studies in levels of aggregation, results for western Alaskan aggregate river systems (e.g., AYK region) 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). However, comparisons of stock composition estimates from other areas are more variable. For example the contribution from Cook Inlet stocks ranges from 4%-31% amongst studies while Russian stocks vary from 2%-14% (Table 3-12). There is particular variation amongst the two scale patterns studies (Myers and Rogers 1988 and Myers et al. 2003) for these other stocks. Due to this apparent variability the impact analysis focused mainly on the AYK stocks, in particular the Yukon, Kuskokwim and Bristol Bay river systems. Impacts are characterized in aggregate for these stocks, in aggregate for Coastal western Alaska grouping (which includes the lower Yukon, Kuskokwim and other minor stocks) as well as by individual river system. Impacts are reported in general for stocks such as Cook Inlet, aggregate Pacific Northwest, and Russia but discussions of these are limited due to the uncertainty.

For this impact analysis, it was desirable to provide some estimates of AEQ specific to the following western Alaska river systems individually: Yukon, Kuskokwim, Bristol Bay. The recent genetics study treated these stocks as a group. Thus, for purposes of discussion in this analysis, the AEQ results for the Coastal western Alaska stock grouping were combined with results for the middle and upper Yukon and the resulting aggregate broken out to individual river systems using the proportions estimated by Myers et al. (2003). Doing so provides a way to make rough comparisons of bycatch impacts (AEQ) and river system specific measures of run size, harvest, and escapement. However, impacts presented in this analysis are characterized to the extent possible within the limitations of the data. AEQ estimation was employed to provide some information on the relative impacts by genetic groupings and in conjunction with scale pattern estimates by western Alaskan river systems. As noted previously, these data are limited by their uncertainty thus extensions of these results beyond the scope of the data was carefully avoided.

Use of total run-size estimates for impact analysis by river system or in aggregate is problematic. As described in sections 5.2 assessment of total run size and escapement by river system is highly variable between systems. Some river systems in the WAK region lack total run or escapement estimates. As such, combining available estimates to determine an "aggregate total run" for WAK is inappropriate due to magnification of errors as well as masking the uncertainties and data limitations associated with individual river system estimates. Use of individual run estimates to compare with bycatch AEQ is also complicated by the caveats associated with the stock composition estimates. AEQ estimation to river of origin is used to estimate the relative changes under various cap scenarios. These estimates are also uncertain and that uncertainty increases with further extrapolations historically and to finer resolutions. Therefore, judgments with respect to detailed impacts were avoided, especially in cases where it would require interpretations beyond the extent of the data. Finally, impact rates by river system (i.e., explicit comparison of AEQ with run size for runs) would presume analyses on productivity thresholds about river systems that are beyond the scope of this analysis.

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	Coast W AK (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 = 313	(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 = 543	(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 = 309	(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 = 296	(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 = 902	(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 = 380	(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 (also includes Norton Sound)							48%		
								Lower Yukon	Kusko-kwim	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 54 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.

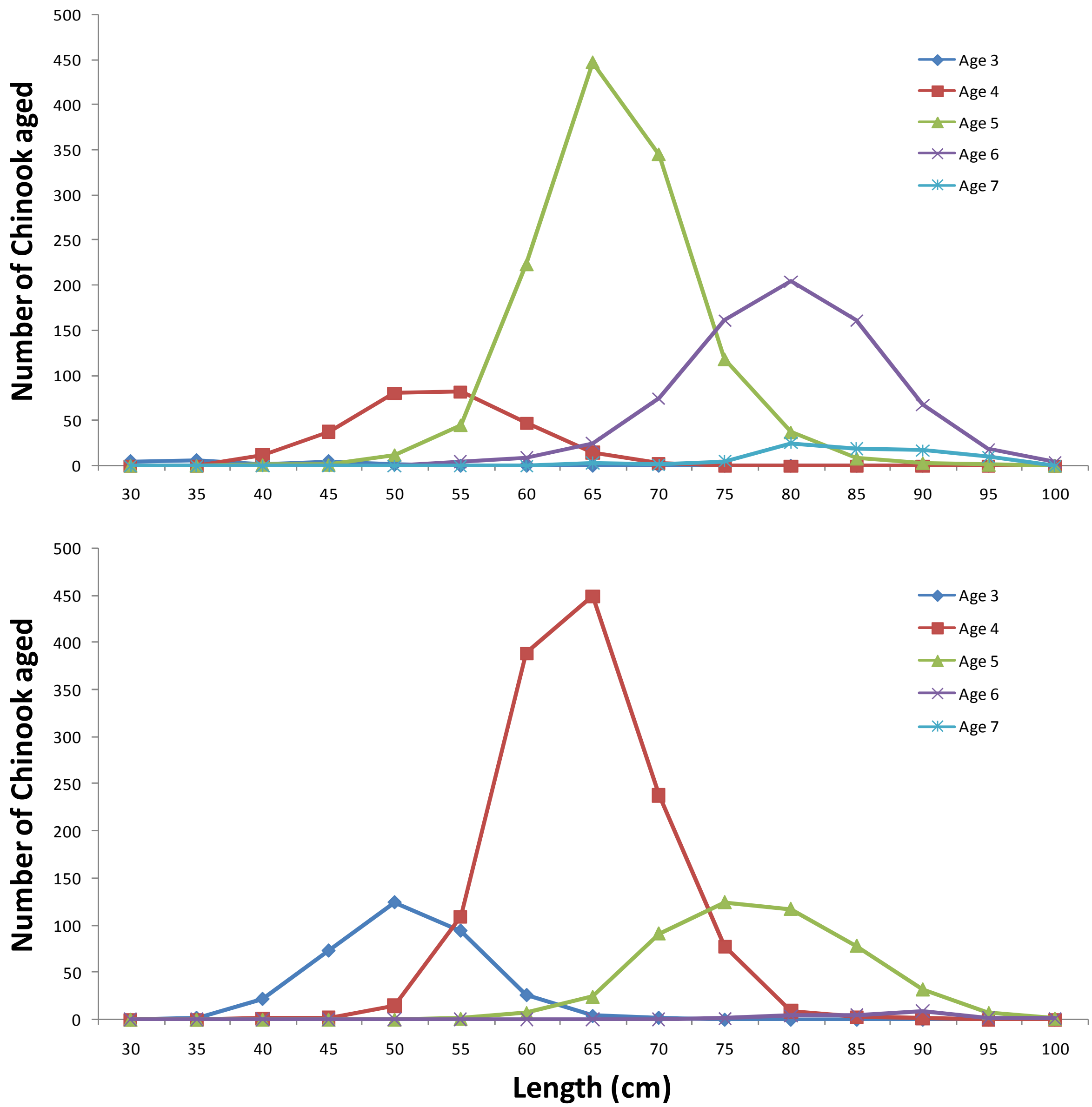

Fig. 3-1 Summary distribution of age samples by length collected by the NMFS groundfish observer program during 1997-1999 and analyzed by University of Washington scientists (Myers et al. (2003) for the A-season (top panel) and B season (bottom panel).

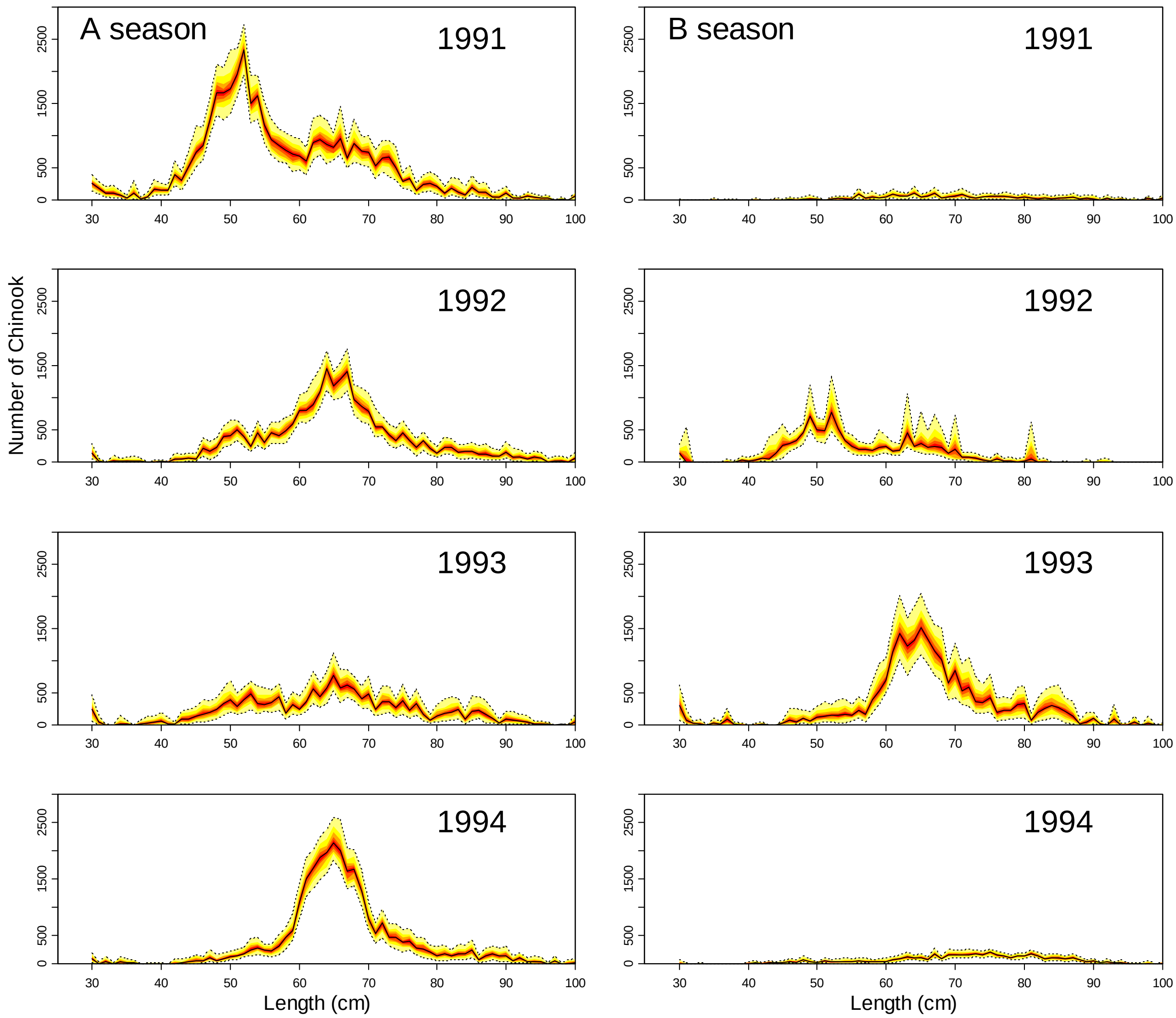

Fig. 3-2 Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

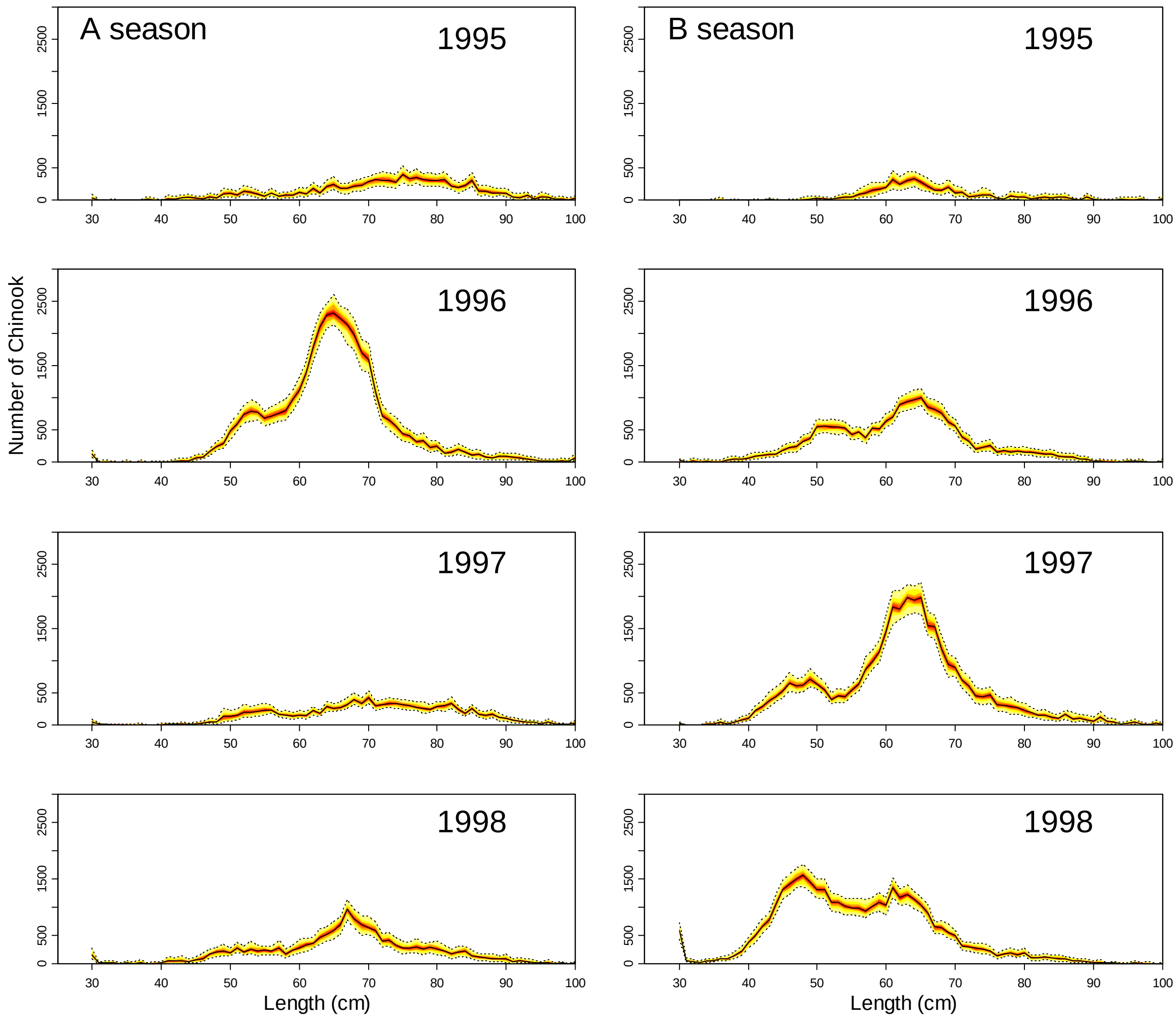

Fig. 3-2 (continued) Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

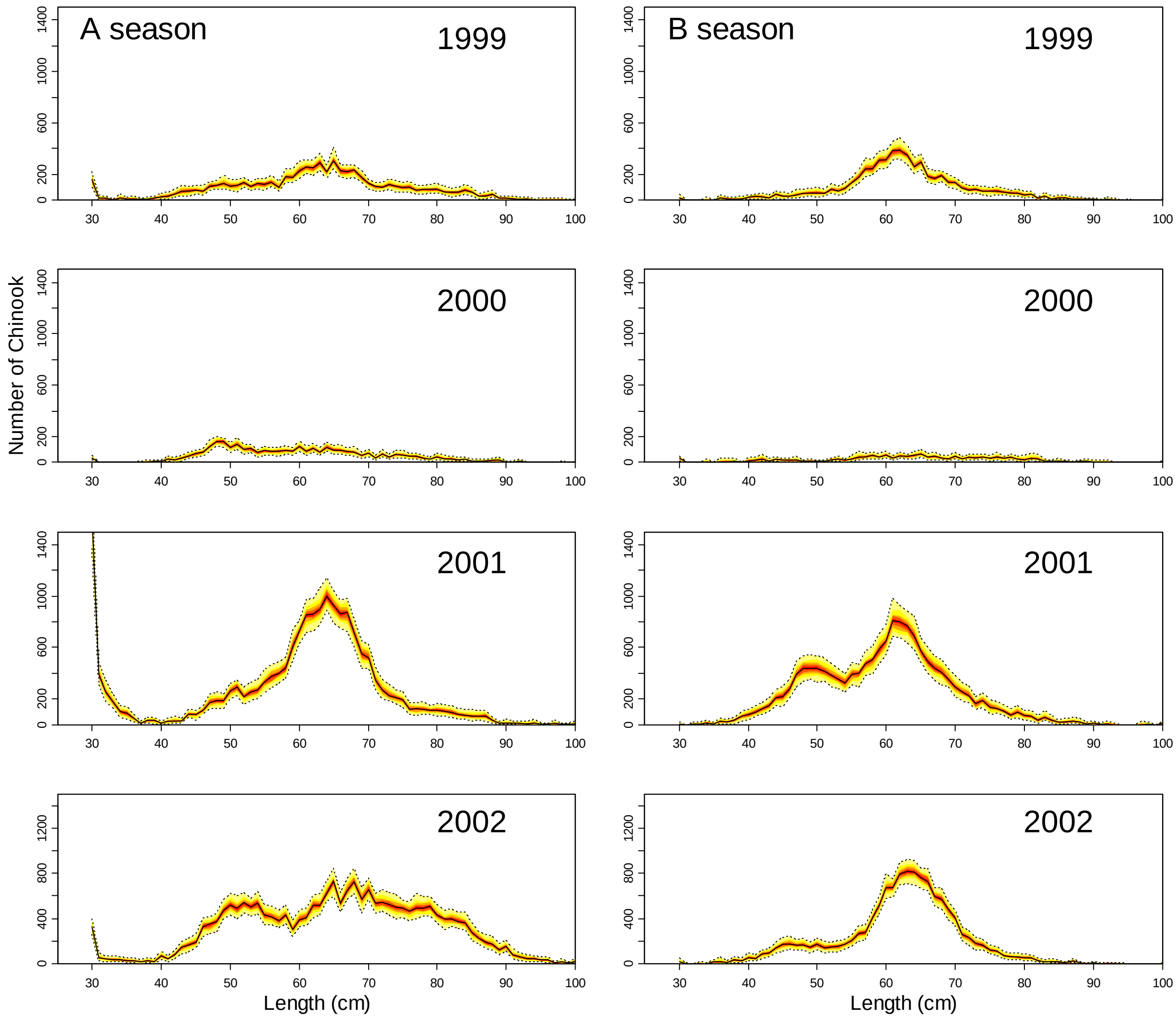

Fig. 3-2 (continued) Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

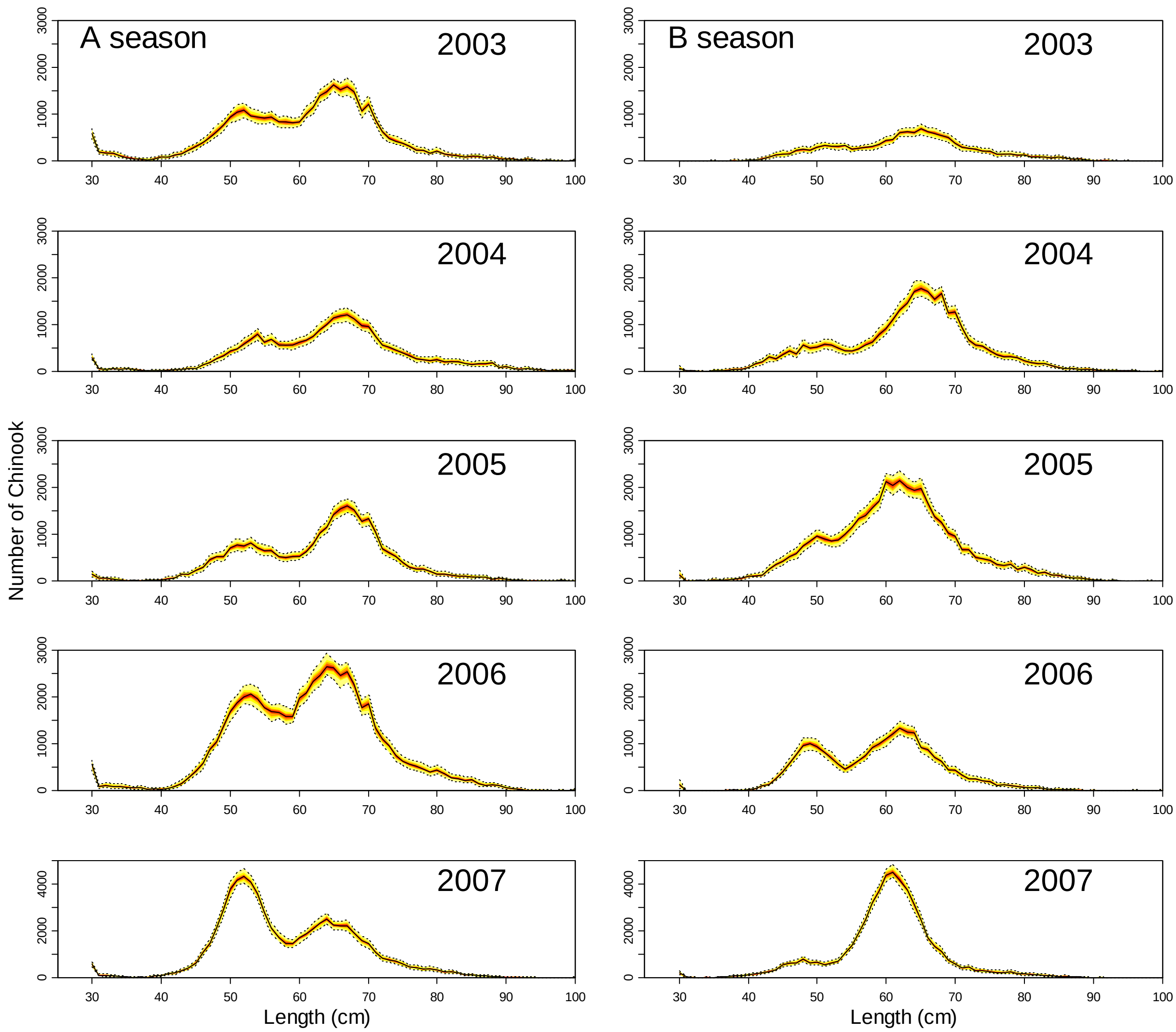

Fig. 3-2 (continued) Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

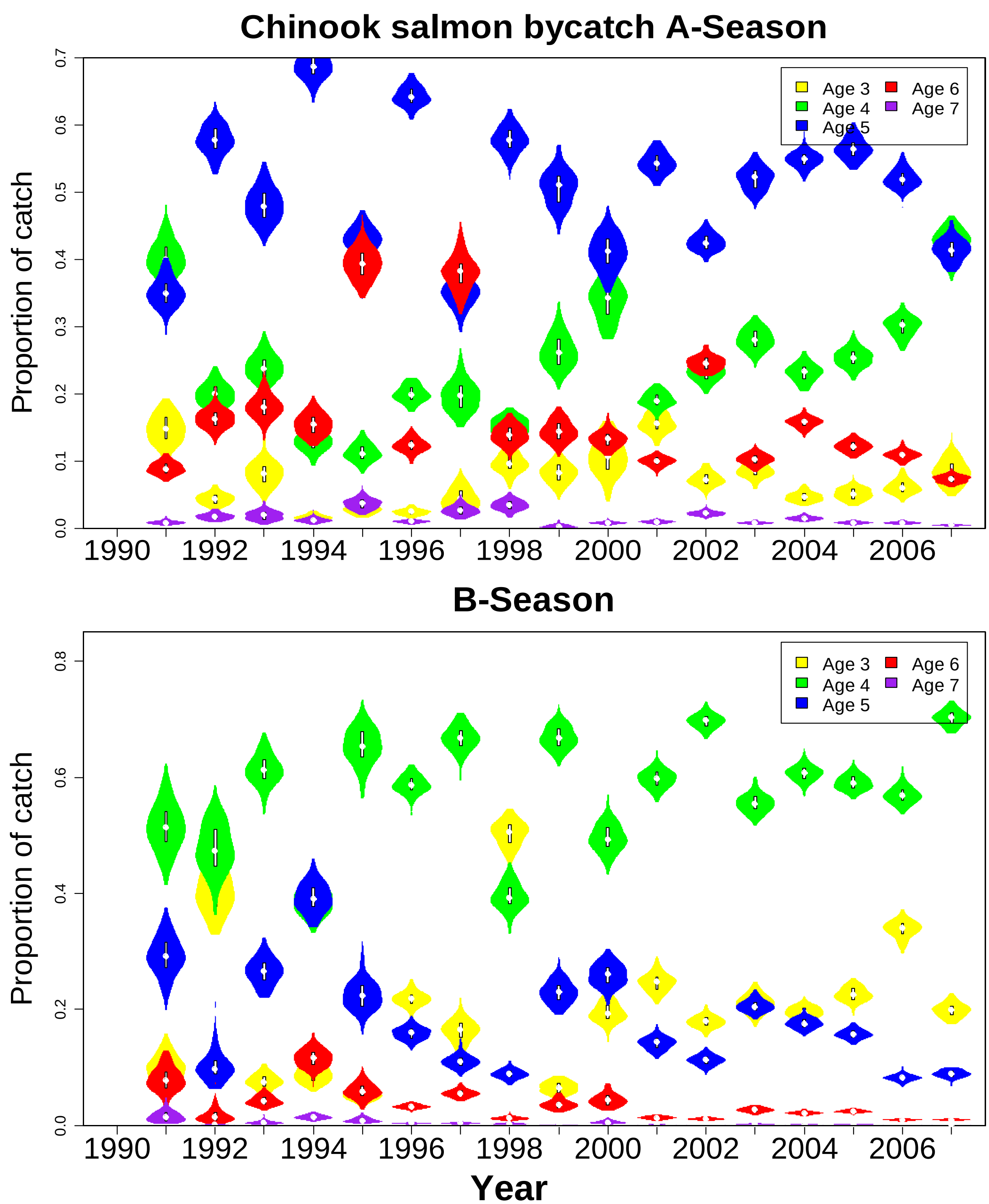

Fig. 3-3 Chinook salmon bycatch age composition by year and A-season (top) and B-season (bottom). Vertical spread of blobs represent uncertainty as estimated from the two-stage bootstrap re-sampling procedure.

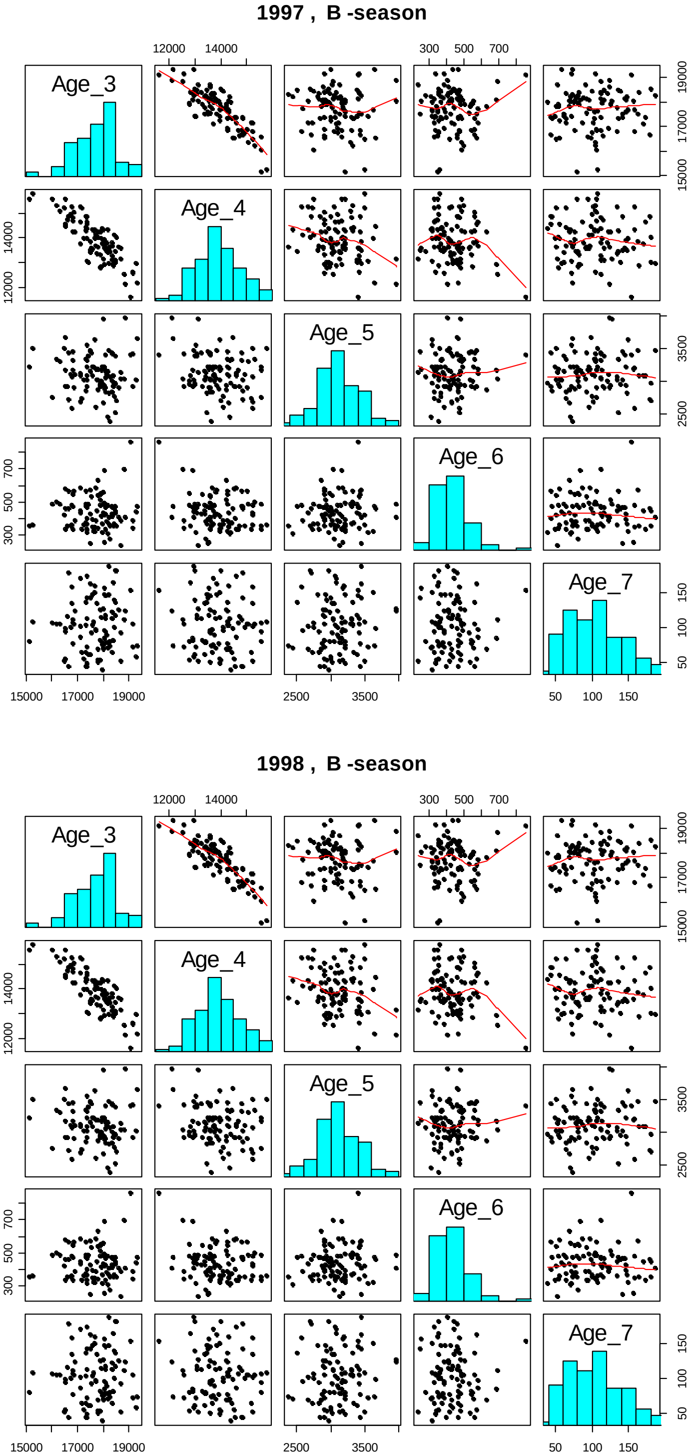

Fig. 3-4 Bootstrap estimates of Chinook salmon bycatch example showing correlation of bycatch at different ages for the B-season in 1997 (top) and 1998 (bottom).

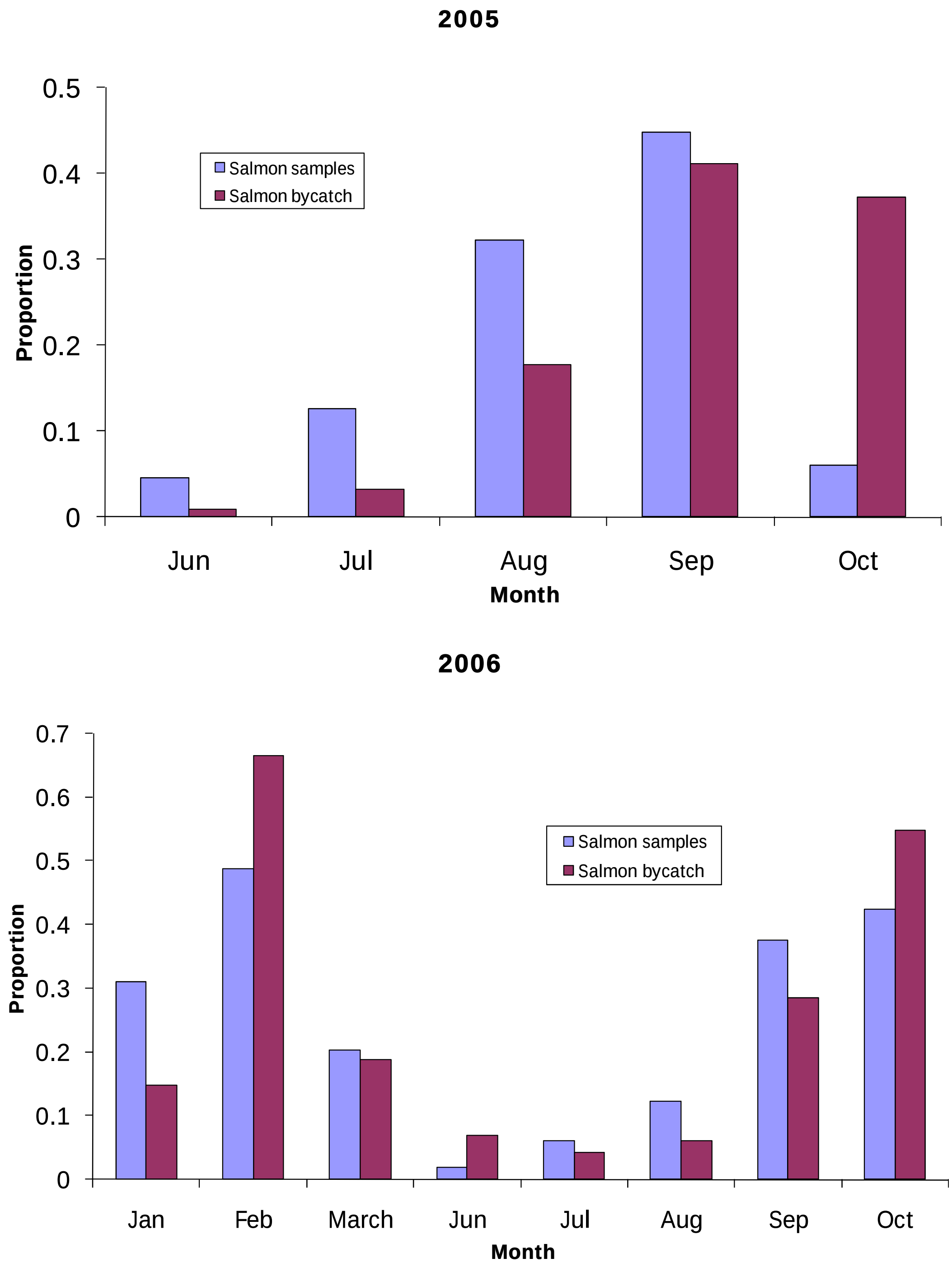

Fig. 3-5 Proportion of Chinook salmon samples collected for genetics compared to the proportion of bycatch by month for 2005 B-season only (top panel) and 2006 A and B season combined (bottom panel).

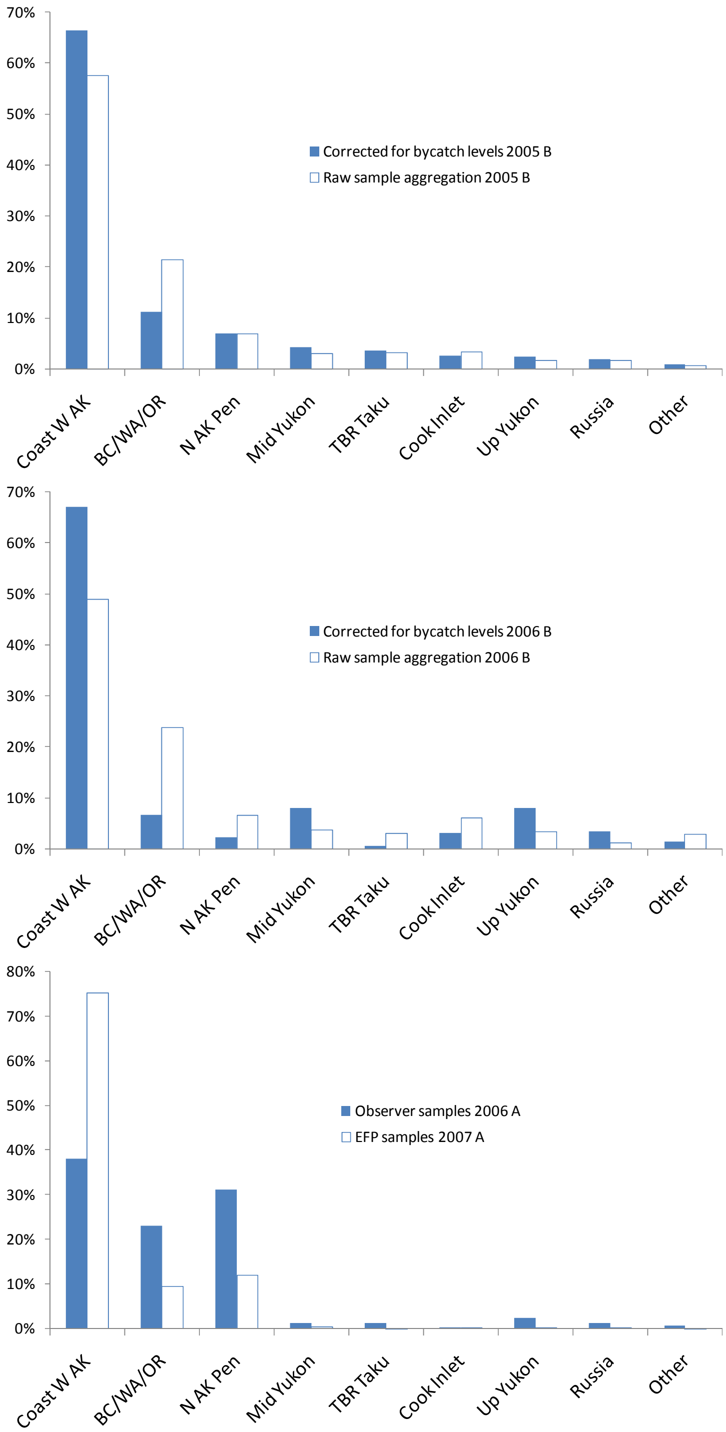

Fig. 3-6 Chinook salmon bycatch results by reporting region for 2005 B season (top), 2006 B season (middle), and the 2006 and (partial sample) of 2007 A seasons (bottom). The top two panels include uncorrected results where bycatch differences between regions (east and west of 170°W) are ignored (empty 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:

$$u_{t,k} = \frac{AEQ_{t,k}}{AEQ_{t,k} + S_{t,k}} \qquad (1)$$

where $AEQ_{t,k}$ and $S_{t,k}$ are the adult-equivalent bycatch and stock size (run return) estimates of the salmon species in question, respectively. The calculation of $AEQ_{t,k}$ 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. The impact of current year and previous years bycatch on salmon returning (as adult equivalents in year *t*) can be expressed in expanded form (without stock specificity) as:

$$\begin{aligned}
AEQ_t = & \sum_{a=3}^{7} c_{t,a}\gamma_a + \\
& \gamma_4(1-\gamma_3)s_3c_{t-1,3} + \\
& \gamma_5(1-\gamma_4)(1-\gamma_3)s_3s_4c_{t-2,3} + \\
& \gamma_6(1-\gamma_5)(1-\gamma_4)(1-\gamma_3)s_3s_4s_5c_{t-3,3} + \\
& \gamma_7(1-\gamma_6)(1-\gamma_5)(1-\gamma_4)(1-\gamma_3)s_3s_4s_5s_6c_{t-4,3} + \\
& \\
& \gamma_5(1-\gamma_4)s_4c_{t-1,4} + \\
& \gamma_6(1-\gamma_5)(1-\gamma_4)s_4s_5c_{t-2,4} + \\
& \gamma_7(1-\gamma_6)(1-\gamma_5)(1-\gamma_4)s_4s_5s_6c_{t-3,4} + \\
& \\
& \gamma_6(1-\gamma_5)s_5c_{t-1,5} + \\
& \gamma_7(1-\gamma_6)(1-\gamma_5)s_5s_6c_{t-2,5} + \\
& \\
& \gamma_7(1-\gamma_6)s_6c_{t-1,6}
\end{aligned} \qquad (2)$$

where $c_{t,a}$ is the bycatch of age *a* salmon in year *t*, s_a is the proportion of salmon surviving from age *a* to *a+1*, and γ_a is the proportion of salmon at sea that will return to spawn at age *a*. Since this model is central to the calculation of *AEQ* values, an explanatory schematic is given in Fig. 3-7. 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). Note that there is a distinction between the distribution of mature age salmon found in rivers (Table 3-13) and the expected age-specific maturation rate of oceanic salmon ($\gamma_{a,k}$) used in this model. However, given ocean survival rates the values for $\gamma_{a,k}$ can be solved which satisfy the age-specific maturation averaged over different stocks (bottom row of 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 $S_{t,k}$):

$$\dot{S}_{t,k} = \overline{S}_k e^{\varepsilon_t + \delta_t} \qquad \begin{array}{l} \varepsilon_t \sim N\left(0, \sigma_1^2\right), \\ \delta_t \sim N\left(0, \sigma_2^2\right) \end{array} \qquad (3)$$

where σ_1^2, σ_2^2 are specified levels of variability in inter-annual run sizes and run-size estimation variances, respectively. Note that for the purposes of this EIS, estimates of run sizes were unavailable for some stocks hence this method is described here for conceptual purposes only.

The stochastic survival rates were simulated as:

$$\dot{s}_a = 1 - \exp\left(-M_a + \delta\right), \qquad \delta \sim N\left(0, 0.1^2\right) \qquad (4)$$

whereas the maturity in a given year and age was drawn from beta-distributions:

$$\dot{\gamma}_a \sim B\left(\alpha_a, \beta_a\right) \qquad (5)$$

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:

$$\dot{p}_k \sim B(\alpha_k, \beta_k) \qquad (6)$$

again with α_k, β_k specified to satisfy the expected value the estimates and variances shown in Table 3-1. 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 ($c_{t,a}$) for each year from the catch-age procedure described above;
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. Store stratum-specific AEQ values for each year;
5. Repeat 1-4 200 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 (M_a) 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. 3-10). For simplicity in presenting the analysis, subsequent values are based on the intermediate age-specific natural mortality (Model 2). The corresponding age-specific probabilities that a salmon would return to spawn (given the in-river mature population proportions shown in Table 3-13) are:

Age	3	4	5	6	7
Maturation probability (γ_a)	0.059	0.273	0.488	0.908	1.000

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 that the intent here is to show that annual stock composition estimates of the bycatch is affected by the seasons and areas when and where bycatch occurs. Note 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.

The sum over ages of catch in year *t* that would have returned in that year

$$AEQ_t = \sum_{a=3}^{7} c_{t,a}\gamma_a + \text{ Fish caught in earlier years that would have survived:}$$

The catch of age 3 salmon in previous years that survived and had not returned in earlier years

$$\begin{cases} \gamma_4(1-\gamma_3)s_3c_{t-1,3} + \\ \gamma_5(1-\gamma_4)(1-\gamma_3)s_3s_4c_{t-2,3} + \\ \gamma_6(1-\gamma_5)(1-\gamma_4)(1-\gamma_3)s_3s_4s_5c_{t-3,3} + \\ \gamma_7(1-\gamma_6)(1-\gamma_5)(1-\gamma_4)(1-\gamma_3)s_3s_4s_5s_6c_{t-4,3} + \end{cases}$$

The catch of age 4 salmon in previous years that survived and had not returned in earlier years

$$\begin{cases} \gamma_5(1-\gamma_4)s_4c_{t-1,4} + \\ \gamma_6(1-\gamma_5)(1-\gamma_4)s_4s_5c_{t-2,4} + \\ \gamma_7(1-\gamma_6)(1-\gamma_5)(1-\gamma_4)s_4s_5s_6c_{t-3,4} + \end{cases}$$

The catch of age 5 salmon…

$$\begin{cases} \gamma_6(1-\gamma_5)s_5c_{t-1,5} + \\ \gamma_7(1-\gamma_6)(1-\gamma_5)s_5s_6c_{t-2,5} + \end{cases}$$

$$\gamma_7(1-\gamma_6)s_6c_{t-1,6}$$

Fig. 3-7 Explanatory schematic of main AEQ equation. Symbols are defined in text.

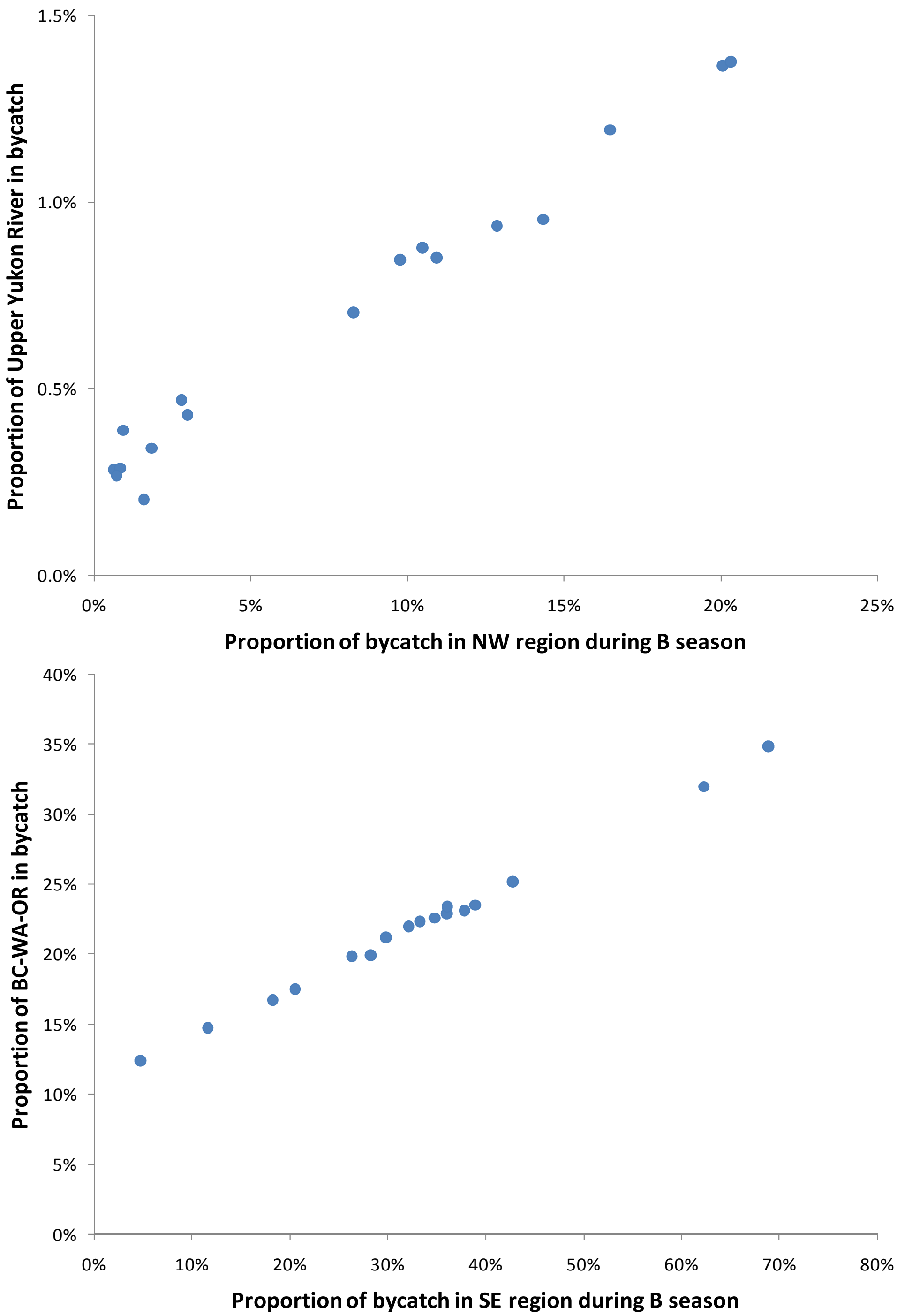

Fig. 3-8 Figure showing how the overall proportion of Upper Yukon River relates to the bycatch proportion that occurs in the NW region (west of 170°W; top panel) and how the proportion of the BC-WA-OR (PNW) relates to the SE region (east of 170°W; bottom panel) during the summer-fall pollock fishery, 1991-2007.

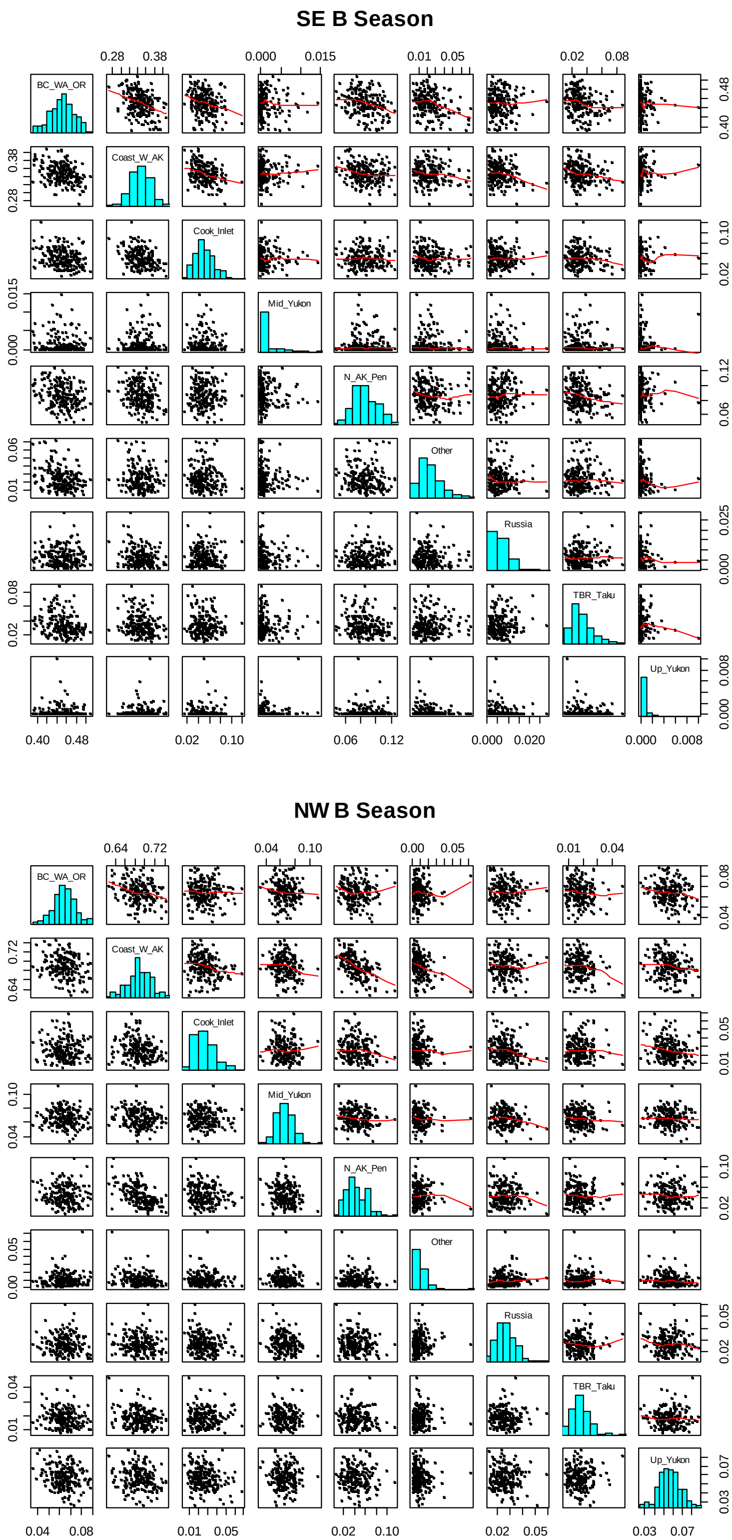

Fig. 3-9 Simulated Chinook salmon stock proportion by region for the B season based on reported standard error values from ADF&G analyses and assuming that the 2006 data has better coverage and is hence weighted 2:1 compared to the 2005 B-season data.

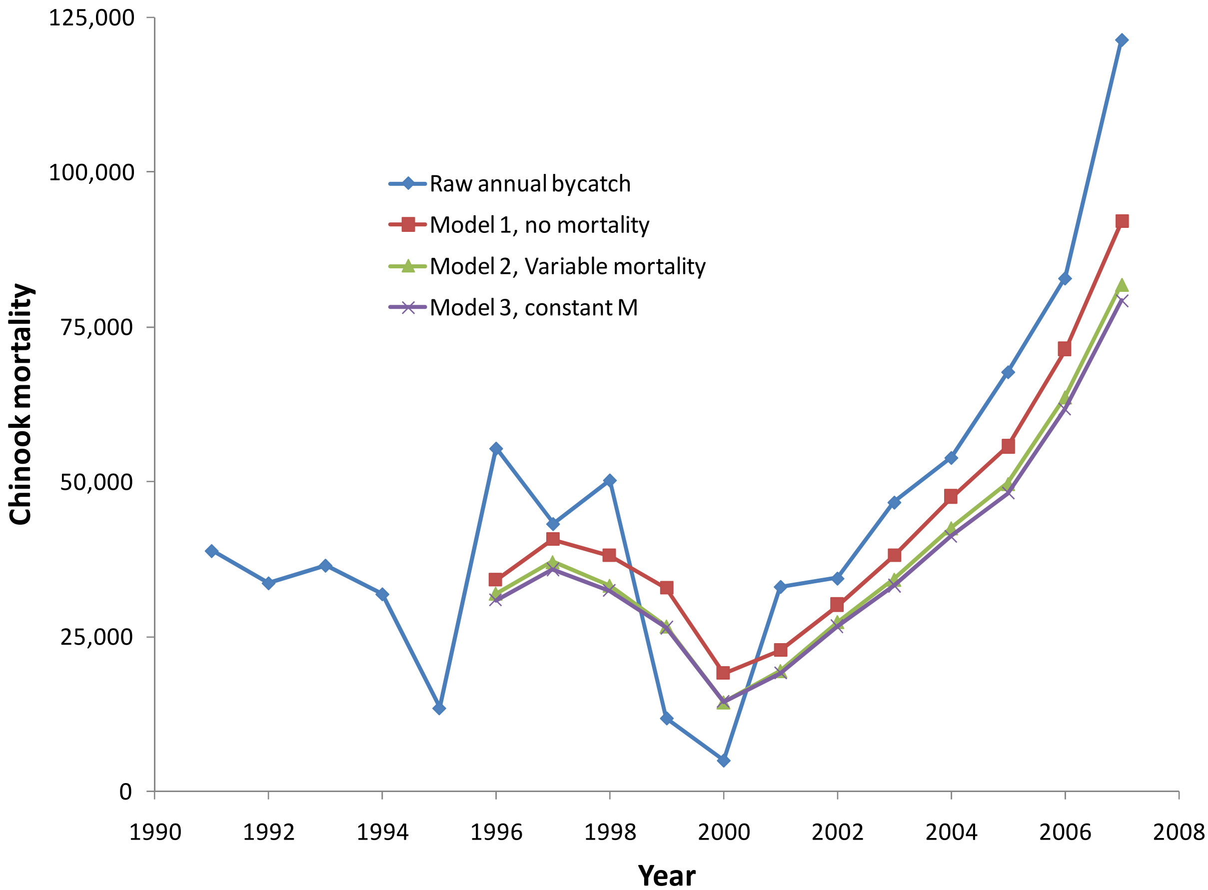

Fig. 3-10 Time series of Chinook adult equivalent bycatch from the pollock fishery, 1991-2007 compared to the annual totals under different assumptions about ocean mortality rates.

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
Alt 5 AS 1	31,550	23,490	55,040
Alt 4 AS 1 w/ transfer	46,561	20,372	66,933
Alt 4 AS 1 w/o transfer	44,974	20,372	65,346
Alt 4 AS 2 w/ transfer	33,010	13,500	46,510
Alt 4 AS 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 decision makers and the public 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[28]

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

[28] 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 (Conners 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.

In December 2007, NMFS was petitioned by the Center for Biological Diversity (CBD) 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 presented substantial information that a listing may be warranted and started a status review of the species to determine whether listing is warranted (73 FR 16617, March 28, 2008). NMFS determined that the listing is not warranted at this time due to modeling of future sea ice extent and population estimates (73 FR 79822, December 30, 2008). On March 31, 2009, the CBD and Greenpeace filed a 60 day notice of intent to sue NMFS for failing to propose listing ribbon seals under the ESA. The CBD and Greenpeace filed a complaint for declaratory and injunctive relief on September 3, 2009, asking for the 12 month finding to be remanded. The CBD and Greenpeace filed a complaint for declaratory and injunctive relief on September 3, 2009, asking for the 12 month finding to be remanded.

On May 28, 2008, the CBD petitioned NMFS to list ringed, bearded, and spotted seals under the ESA due to threats to the species from (1) global warming, (2) high harvest levels allowed by the Russian Federation, (3) oil and gas exploration and development, (4) rising contaminant levels in the Arctic, and (5) bycatch mortality and competition for prey resources from commercial fisheries (CBD 2008a). NMFS has initiated the status review for ringed, bearded, and spotted seals (73 FR 51615, September 4, 2008). Pursuant to a court settlement, NMFS completed the status review and issued a 12-month finding on October 15, 2009 for the spotted seal (74 FR 53683, October 20, 2009) and is scheduled to complete the status reviews and 12-month findings on November 1, 2010 for the ringed and bearded seals. NMFS determined that the status of the stocks of spotted seals occurring in Alaska indicated that no listing was needed. Listing of ringed or bearded seals would require ESA consultation on federal actions that may adversely affect them or any designated critical habitat.

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 established Federal fisheries management in the Arctic Management Area. The Council developed, and NMFS approved, an Arctic Fishery Management Plan that (1) closes the Arctic to commercial fishing until information improves so that fishing can be conducted sustainably and with due concern to other ecosystem components, (2) determines the fishery management authorities in the Arctic and provide the Council with a vehicle for addressing future management issues, and (3) implements an ecosystem based management policy that recognizes the unique issues in the Alaskan Arctic. 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 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.

3.4.1.4 Fishery management responses to the effects of climate change

While climate warming trends are being studied and increasingly understood at a global scale (IPCC 2007), the ability for fishery managers to forecast biological responses to changing climate continues to be difficult. The Bering Sea 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. The impacts of climate change in the Bering sea, and the related phenomenon of ocean acidification, is addressed in Section 8.4.

The Council and NMFS have taken actions that indicate a willingness to adapt fishery management to be proactive in the face of changing climate conditions. The Council currently receives an annual update on the status and trends of indicators of climate change in the Bering Sea through the presentation of the Ecosystem Assessment and Ecosystem Considerations Report (Boldt 2007). Much of the impetus for Council and NMFS actions in the northern Bering Sea, where bottom trawling is prohibited in the Northern Bering Sea Research Area, and in the Alaskan Arctic, where the Council and NMFS have prohibited all fishing until further scientific study of the impacts of fishing can be conducted, derives from the understanding that changing climate conditions may impact the spatial distribution of fish, and consequently, of fisheries. In order to be proactive, the Council has chosen to close any potential loopholes to unregulated fishing in areas that have not previously been fished.

Consequently, it is likely that as other impacts of climate change become apparent, fishery management will also adapt in response. Because of the large uncertainties as to what these impacts might be, however, and our current inability to predict such change, it is not possible to estimate what form these adaptations may 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 RIR. 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.

Support of the North Pacific Groundfish Observer Program (NPGOP) and investigations involving observers and observer data quality are the highest priority of the NOAA OLE. Since 1998, the NOAA OLE has provided dedicated staff to investigate observer reported violations and to maintain the partnership between NOAA OLE and the NPGOP. NOAA OLE currently dedicates two Special Agents to liaison with and to provide law enforcement support for the NPGOP. The dedicated agents provide inseason enforcement, observer deployment and debriefing support, subject matter expertise, and observer training to the NPGOP staff and the observers. NOAA OLE provides support to observers and industry through public outreach, partnership building, education, program development, and the enforcement of laws and regulations intended to protect observers and to provide them safe and productive work environments. NOAA OLE strives to promote voluntary compliance and law enforcement through communication with the observers themselves, the NPGOP, fishery stakeholders, and other law enforcement agencies.

In 2008, when compared to 2006 and 2007, NOAA OLE saw an increase of at least 62% in the total number of NPGOP observer statements alleging violations. This increase coincides with the increased concerns regarding prohibited species numbers and with the implementation of the Amendment 80 Program fisheries. Stronger prohibited species restrictions will continue to increase the need for the high quality observer data, while simultaneously providing greater incentive for industry to hide fish or to manipulate or bias observer data.

During 2008, NOAA OLE provided compliance monitoring training to more than 450 new and prior observers in more than 40 training sessions. NOAA OLE provides observer training on prohibited species mishandling, sample station requirements, limited access fishery requirements, reasonable assistance, accommodations, access to catch and records, recordkeeping and reporting, conflict resolution, interference, sample biasing, and hostile work environments. Under Amendment 91, NOAA OLE anticipates the need for additional law enforcement support and NOAA OLE provided training on the above subject categories and on issues related specifically to salmon number verification.

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 as 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. Studies have suggested that efforts to increase salmon populations with hatcheries may have an impact on the body size of Pacific salmon (Holt et al 2008). 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 and the RIR, 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 the RIR 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.

Also in southwestern Alaska, near the Kuskokwim River, is the Donlin Creek gold mining project, which is currently completing its feasibility study, and is in preparation for beginning the permitting process. The land is owned by the Kuskokwim Corporation, and the subsurface rights are owned by the Calista Corporation, both Native corporations formed under the Alaska Native Claims Settlement Act. Donlin Creek is one of the largest undeveloped gold deposits in the world.

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.

It is possible that hydrokinetic power will be generated on WAK rivers within the next ten years. The Federal Energy Regulatory Commission has issued 12 preliminary permits for in-river turbines on Alaskan mainstem rivers. One very small project operated for 60 days on the Yukon River at Ruby last year, and one larger project is likely to be installed at Eagle this year. NMFS statutory authorities require alternative energy permitting and licensing agencies to consult with NMFS regarding the impacts of proposed ocean energy projects on ocean and anadromous resources. FPA also grants NMFS the authority to prescribe fishways and to propose conservation measures to address any adverse effects to fish and wildlife resources at projects licensed by FERC. These consultations offer the opportunity to provide recommendations to both the permitting agencies and energy companies on how to avoid, minimize, or mitigate the impacts of their energy projects on living marine resources and essential habitat. Therefore, NMFS will be aware and review any future studies on the impacts of the hydrokinetic turbines. Additionally, NMFS is reviewing a proposal for ocean kinetic energy generation near Teller-Brevig Mission.[29] The NMFS Alaska Region web page provides more information at http://www.nmfs.noaa.gov/habitat/habitatprotection/oceanrenewableenergy/index2.html.

[29] Sue Walker, Hydropower Coordinator, NMFS Alaska Region, personal communication, August 2009.

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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. Chapter 3 provides a description of the methodology used to conduct these analyses. The description of the pollock fishery and economic impacts to the pollock fishery from the alternatives are discussed in the RIR.

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 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.

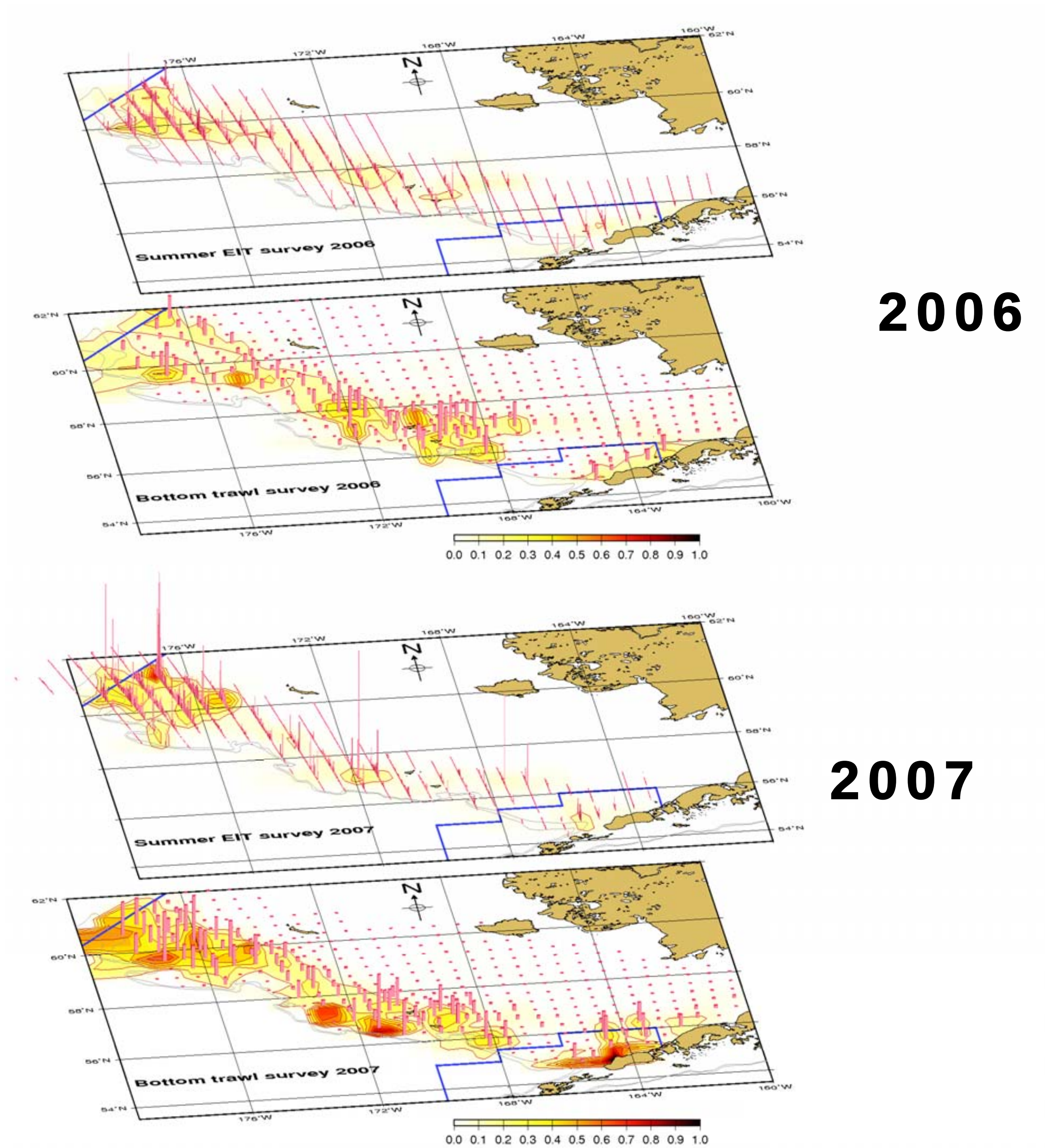


Fig. 4-1 Echo-integration trawl survey results for 2006 and 2007. The lower Fig. is the result from the BTS data in the same years. Vertical lines represent biomass of pollock as observed in the different surveys

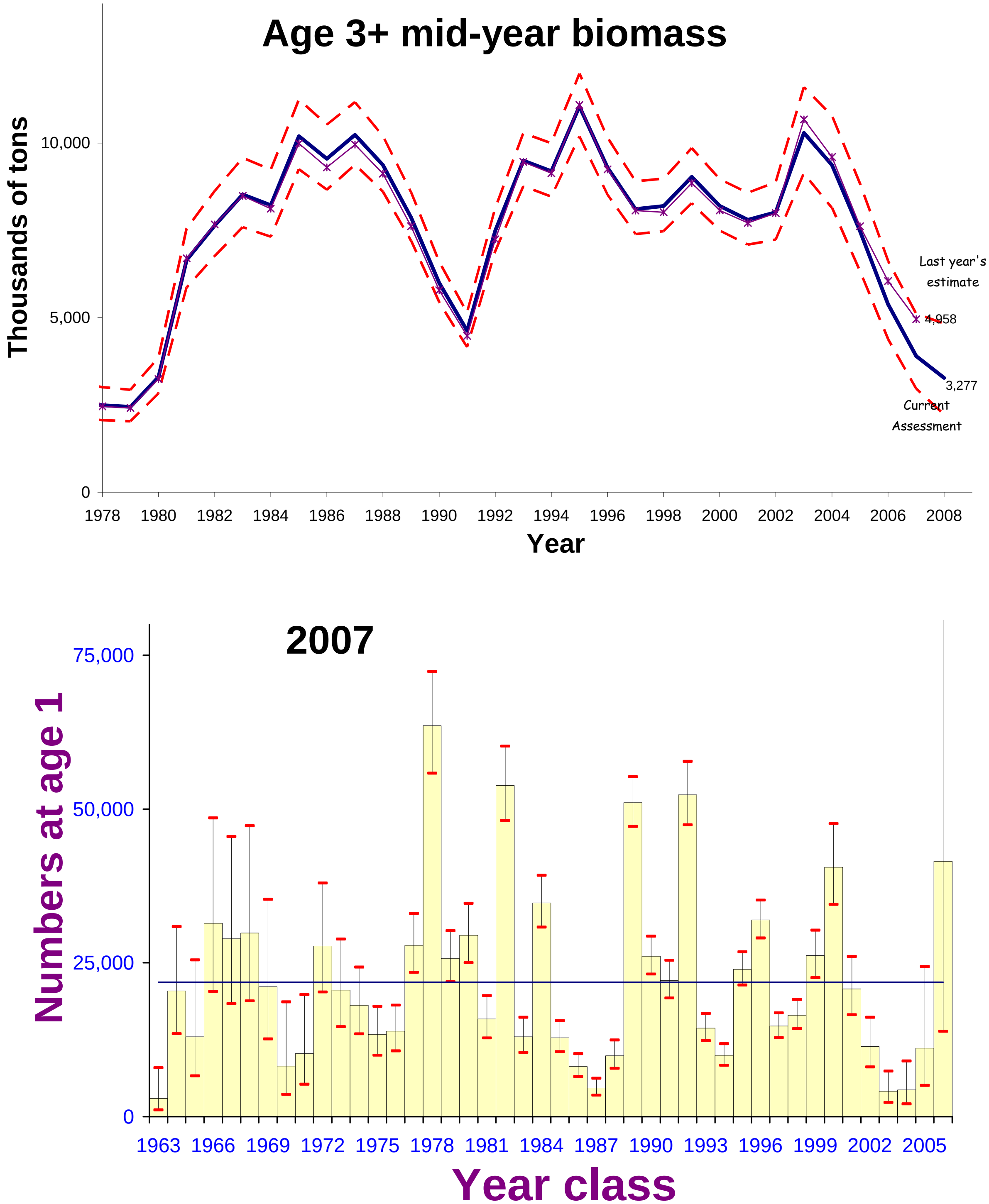


Fig. 4-2 Estimated age 3+ EBS mid-year pollock biomass, 1978-2008 (top) and age-1 year-class strengths. Approximate upper and lower 95% confidence limits are shown by dashed lines and error bars.

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.

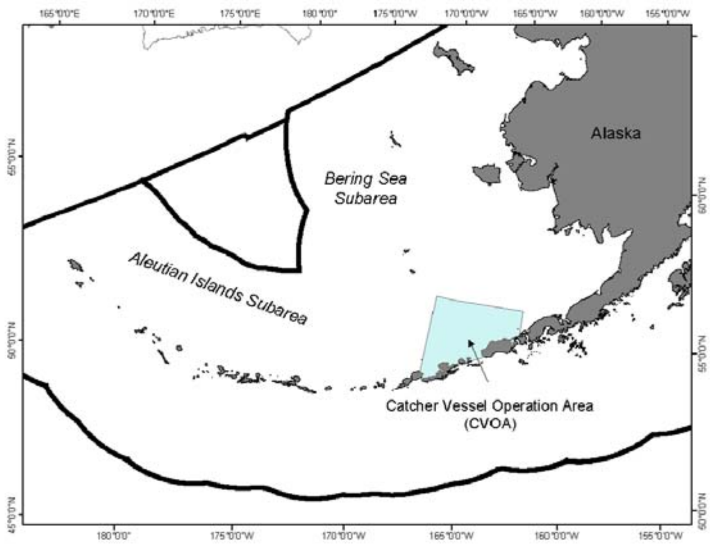


Fig. 4-3 Catcher Vessel Operational Area (CVOA)

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).

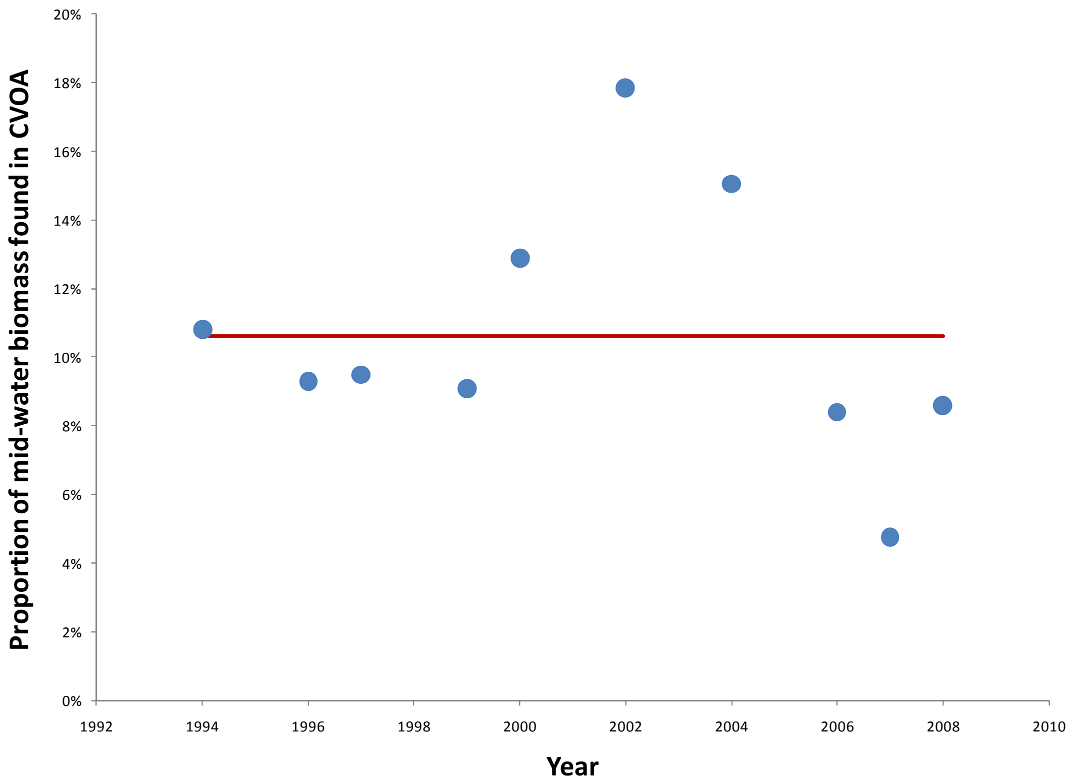


Fig. 4-4 Proportion of pollock found within the CVOA based on the echo-integration mid-water trawl survey (from Ianelli et al. 2008).

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 4-3 show hypothetical dates when the fisheries would have closed had Alternative 2 Chinook caps been in place. These dates translate into estimates of forgone pollock (Table 4-4 through Table 4-8). For Alternative 3, the impact of continued fishing outside the closed areas uses the hypothetical date projections for area closure impacts in terms of relative pollock catch rates (inside and outside of closed areas). Parallel impacts are expected to occur under each of the alternatives.

All four 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 but were provided as 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 and 5 was similar to that for caps in Alternative 2, and retrospective fishery closures were tabulated from 2003-2007. However, for Alternatives 4 and 5, transfers between sectors within each season and rollovers between seasons were assumed. Alternatives 4 and 5 have identical lower cap levels (scenario 2) but differ in the higher cap level (scenario 1) and the rollover provision (80% in Alternative 4, 100% in Alternative 5).

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 (annual scenario 1) 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 annual scenario cap level and transferability (but assuming 80% rollover allowance; Table 4-21). 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 4-22). Compared to the 80% rollover in Alternative annual scenarios 1 and 2, 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 4-24).

The Alternative 5 (annual scenario 1) analysis shows that sector specific closure dates for both the A and B seasons result in closure dates that are several days earlier than those under the similar scenario of Alternative 4 (Table 4-20). For example, under the assumption of full A season transferability, Alternative 5 scenario 1 would have closed each sector of the fishery between 3 to 9 days earlier in the 2007 A season, and 2 to 7 days earlier in the B season (Table 4-20).

The estimated amounts of forgone pollock catch under Alternative 5 annual scenario 1 are higher than under Alternative 4 annual scenario 1 in conjunction with the earlier closure dates by sector. In 2007, the highest bycatch year, Alternative 5 annual scenario 1 would have resulted in forgone pollock of approximately 50 thousand tons more than under the higher cap level in Alternative 4 annual scenario 1(Table 4-23).

Alternative 4 and 5 annual scenarios 2 are equivalent except for the different rollover provision whereby Alternative 5 includes 100% rollover while Alternative 4 includes an 80% rollover provision. 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 4-22). Compared to the 80% rollover in the Alternative 4, 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 4-24). Further discussion of the differences in these rollover provisions for the same cap level are contained in Chapter 5 section 5.3.3.

Analysis indicates that Alternatives 2, 3, 4, and 5 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 4-25.

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 through 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 pollock resource 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 Alternative 2 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 Alternative 2 Chinook salmon hard cap sector allocation Option 2a (3-year (2004-2006) average).

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 Alternative 2 Chinook salmon hard cap section allocation Option 2d (midpoints of the ranges provided by Option 1 and options 2(a-c) by sector).

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 Alternative 2 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 Alternative 2 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 Alternative 2 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 Alternative 2 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 Alternative 2 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 each Alternative 2 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 under Alternative 2 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 under Alternative 2 on the dates provided in Table 4-9.

Pollock			At-sea processors, A season				
Cap scenario		CAP	**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 under Alternative 2 on the dates provided in Table 4-9.

Pollock			Inshore CV, A season				
Cap scenario		CAP	**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 under Alternative 2 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 Alternative 2 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 under Alternative 2 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 under Alternative 2 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 under Alternative 2 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 under Alternative 2 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 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).

Alt 4	A-season Transfer-	A-Season					A-B	B-Season			
Scenario	Ability	Year	CDQ	M	P	S	Rollover	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 Alternative 5 dates of closures for the 60,000 Chinook salmon cap between A and B seasons, with and without A-season transferability.

		A-Season				B-Season			
Transferability	Year	CDQ	M	P	S	CDQ	M	P	S
No	2003	---	---	---	---	---	---	---	---
	2004	---	---	---	---	---	---	---	---
	2005	---	---	---	---	---	---	---	26-Oct
	2006	---	21-Feb	13-Mar	15-Feb	---	---	---	19-Oct
	2007	---	12-Feb	12-Feb	11-Feb	8-Oct	21-Oct	6-Oct	5-Oct
Yes	2003	---	---	---	---	---	---	---	---
	2004	---	---	---	---	---	---	---	---
	2005	---	---	---	---	---	---	---	26-Oct
	2006	---	21-Feb	14-Mar	17-Feb	---	---	---	19-Oct
	2007	---	13-Feb	12-Feb	11-Feb	8-Oct	21-Oct	6-Oct	5-Oct

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 **80%** rollover from A to B season under the two Alternative 4 annual scenarios (AS), 2003-2007 and summed over these years (last 4 rows)**.**

Alt 4 AS	A-season Transfer-ability	**A-Season**						**B-Season**					**Annual Total**
		Year	CDQ	M	P	S	**A-Total**	CDQ	M	P	S	**B-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 4-22 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 Alternative 4 annual scenarios (AS), 2003-2007.

Alt 4 AS	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 4-23 Hypothetical forgone pollock by sector for Alternative 5 given dates presented in Table 4-19 been invoked as closures by sector with A-B split equal to 70:30 and allowing rollover from A to B season and transferability.

	A-season					B-season					
	CDQ	**M**	**P**	**S**	**A-total**	**CDQ**	**M**	**P**	**S**	**B-total**	**Annual**
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	3,672	3,672	3,672
2006	0	11,101	12,652	137,026	160,779	0	0	0	19,752	19,752	180,531
2007	0	20,864	99,698	142,134	262,696	5,363	4,152	27,113	51,737	88,365	351,062
Total	**0**	**31,965**	**112,350**	**279,160**	**423,475**	**5,363**	**4,152**	**27,113**	**75,161**	**111,789**	**223,579**

Table 4-24 2003-2007 sum of additional forgone pollock relative to 80% rollover amounts presented in Table 4-21. E.g., for Alt 4 AS1 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).

AS	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 4-25 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

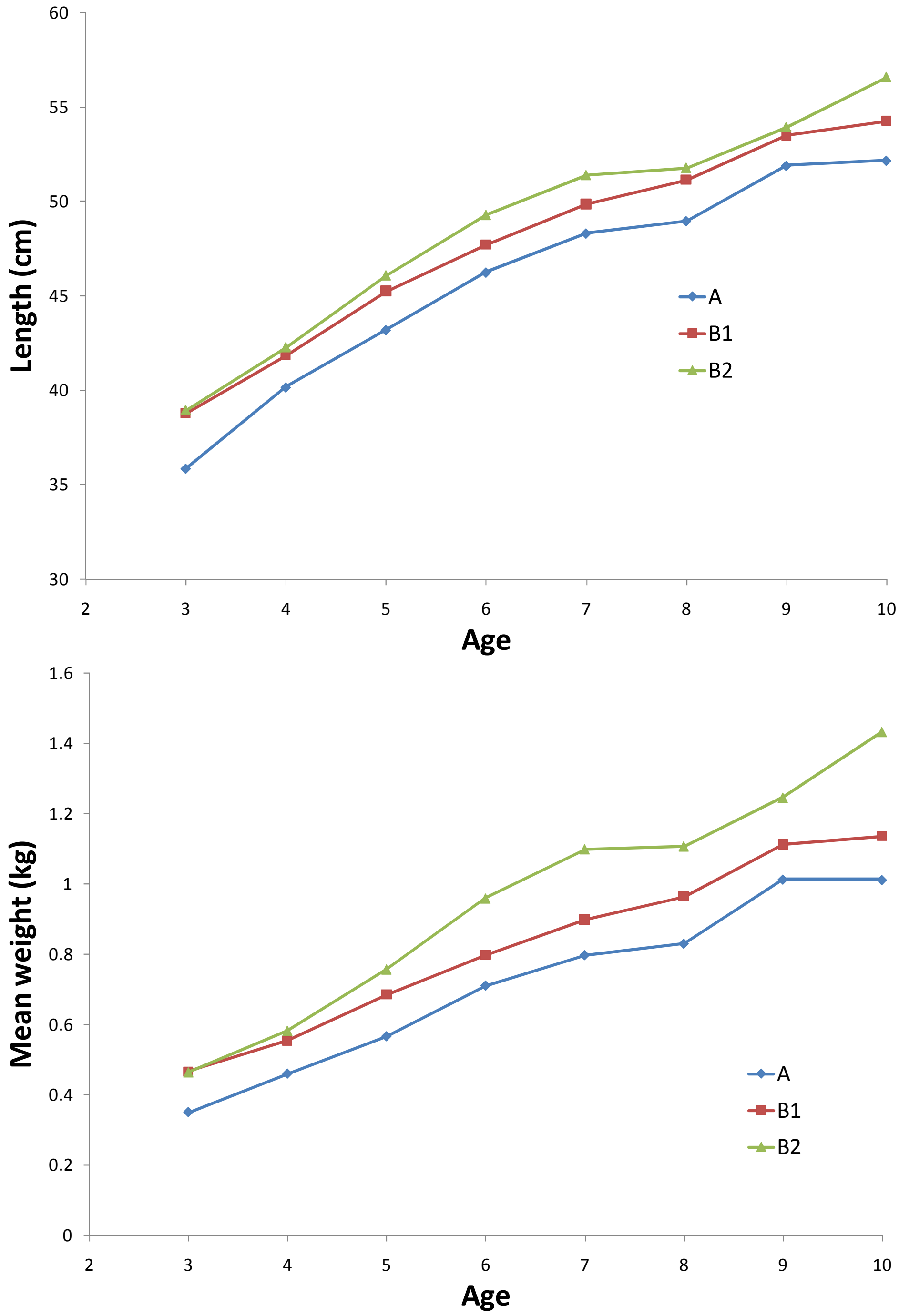


Fig. 4-5 Mean length (top panel) and mean weight (bottom) at age for EBS pollock based on fishery observer data from 2000-2007 broken out by A-season (Jan 20 – May 31) and two B-season time frames: June 1 – August 31 (B1) and September 1 – December 31

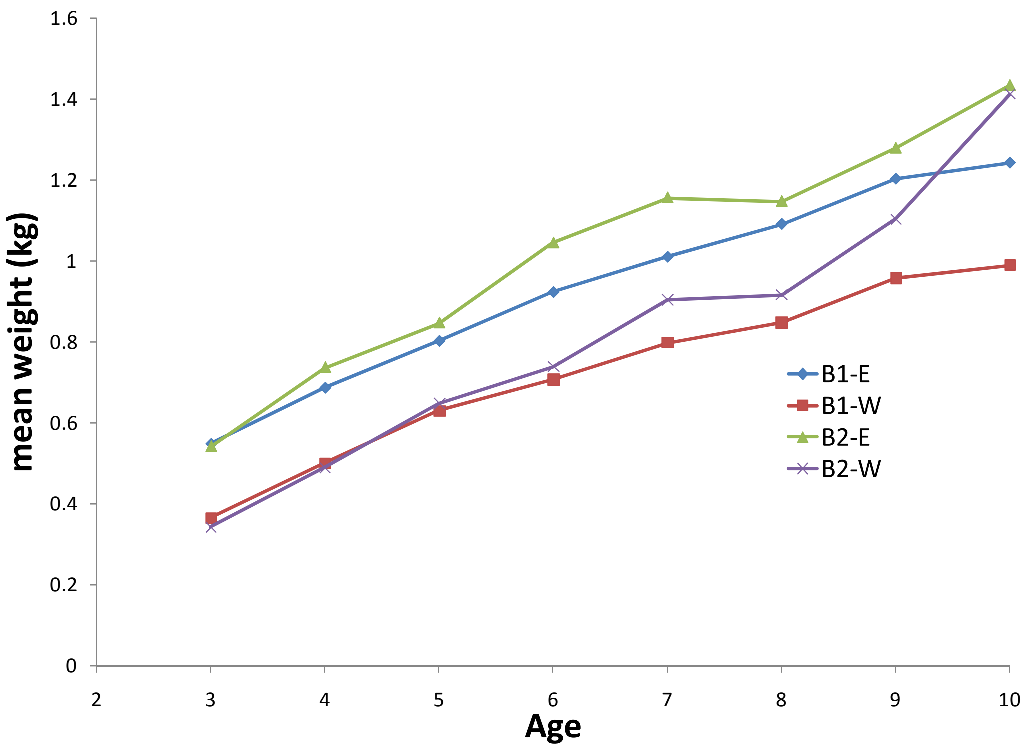


Fig. 4-6 Mean weight at age for EBS pollock based on fishery observer data from 2000-2007 broken out by two B-season time frames: June 1 – August 31 (B1) and September 1 – December 31 and geographically by east of 170°W (E) and west of 170°W (W)

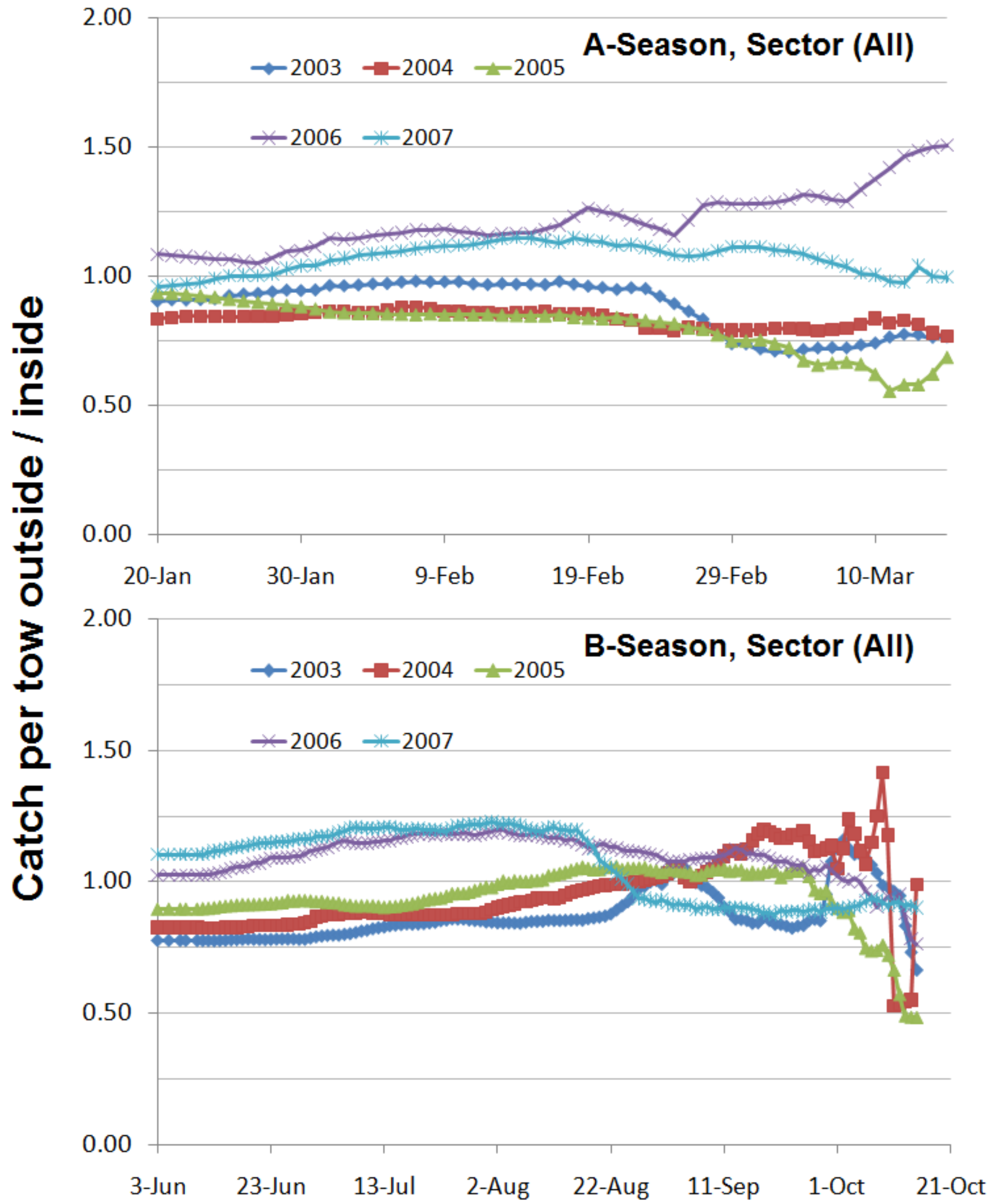


Fig. 4-7 Relative catch rates of pollock for all vessels combined by tow of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season

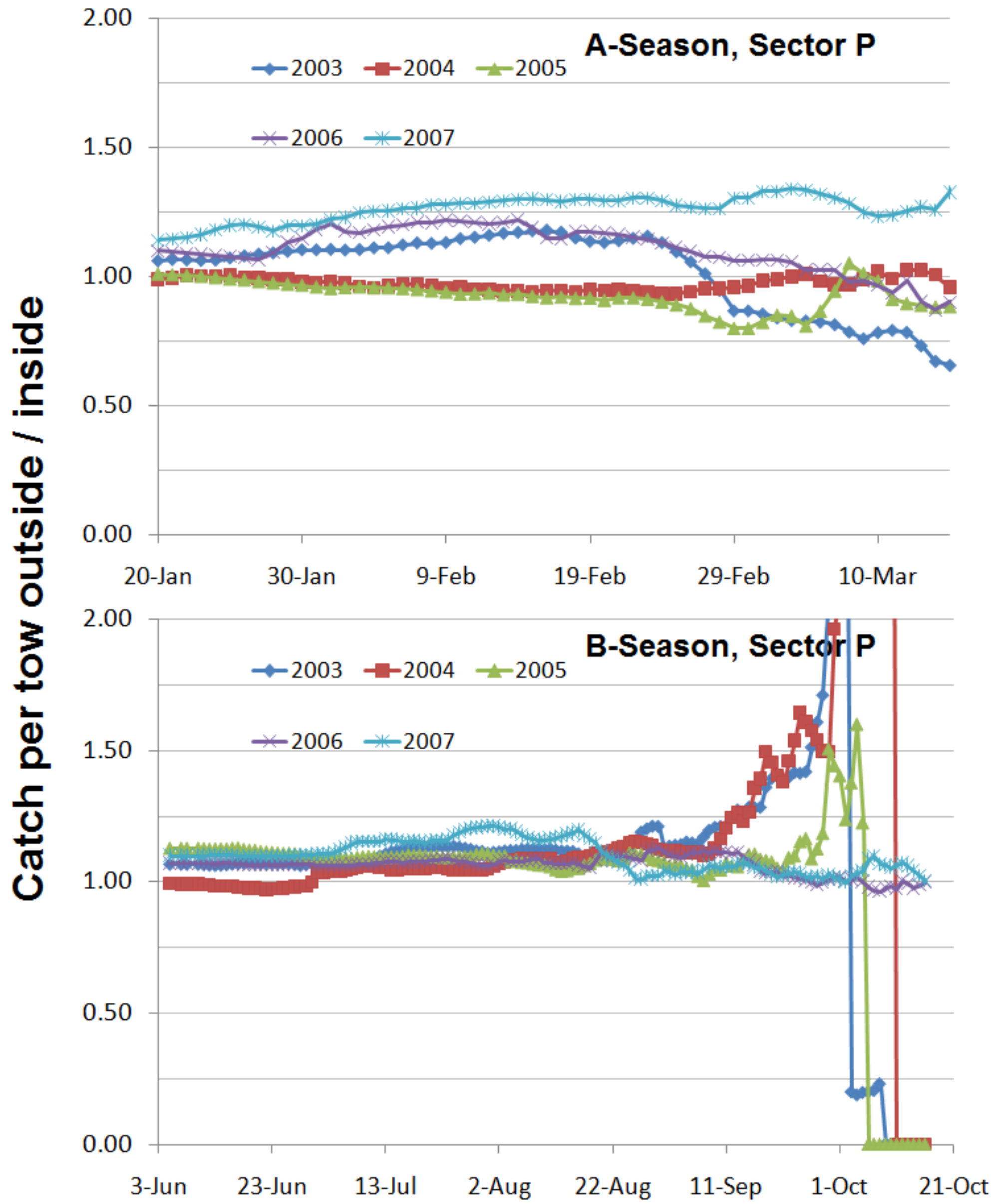


Fig. 4-8 Relative catch rates of pollock for at-sea processors by tow of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season..

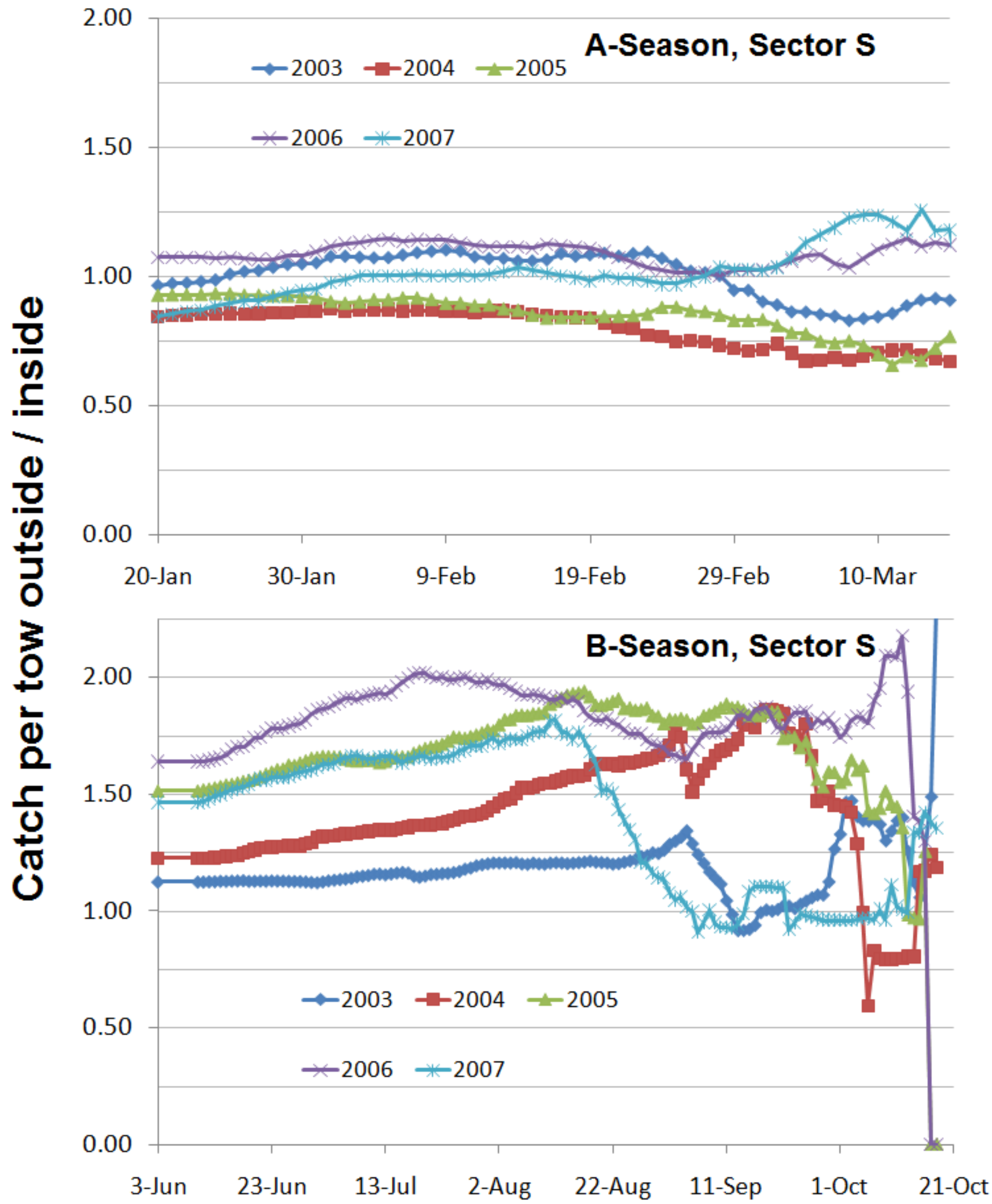


Fig. 4-9 Relative catch rates of pollock for shorebased catcher vessels by tow of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season.

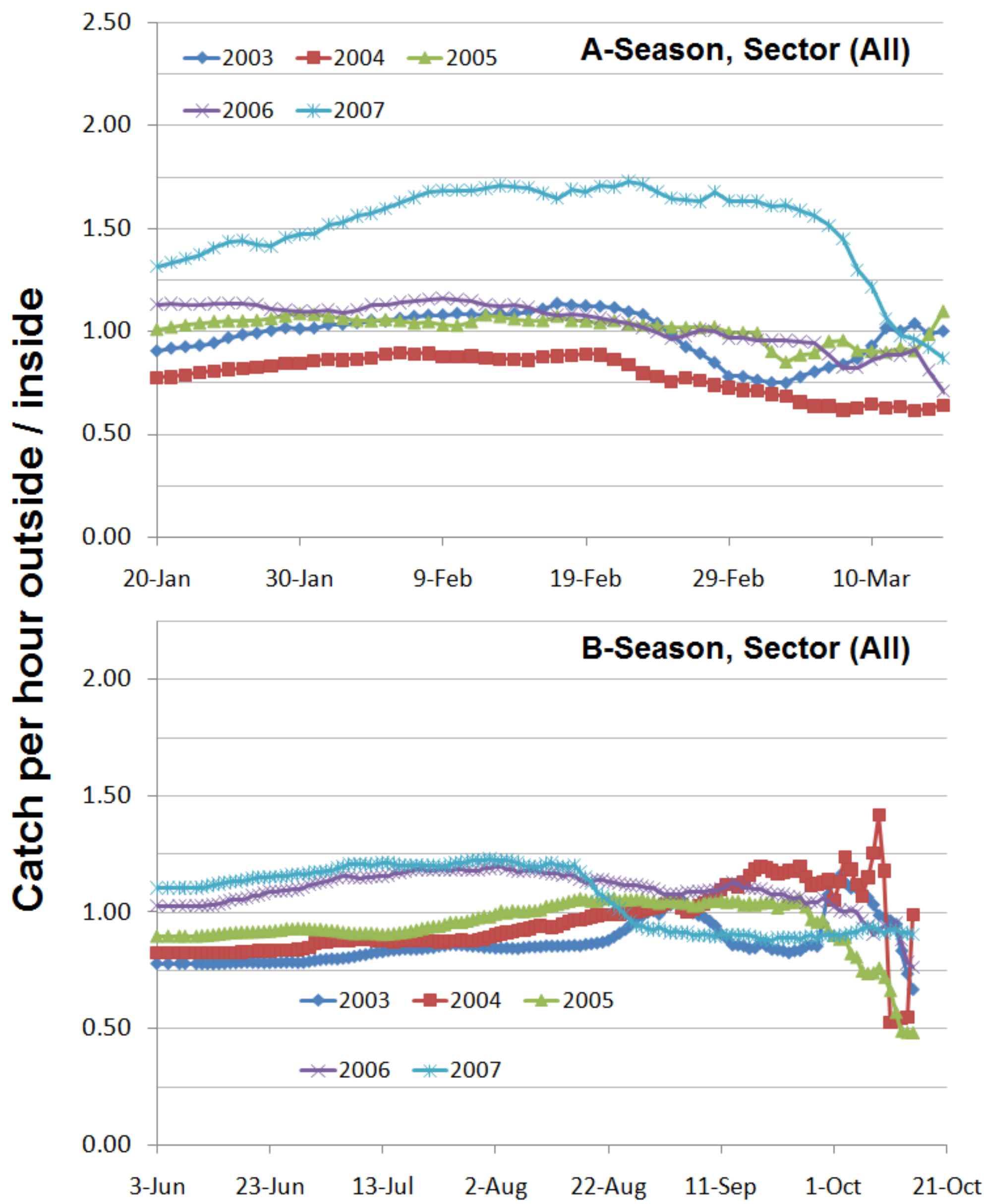


Fig. 4-10 Relative catch rates of pollock for all vessels combined by hour of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season.

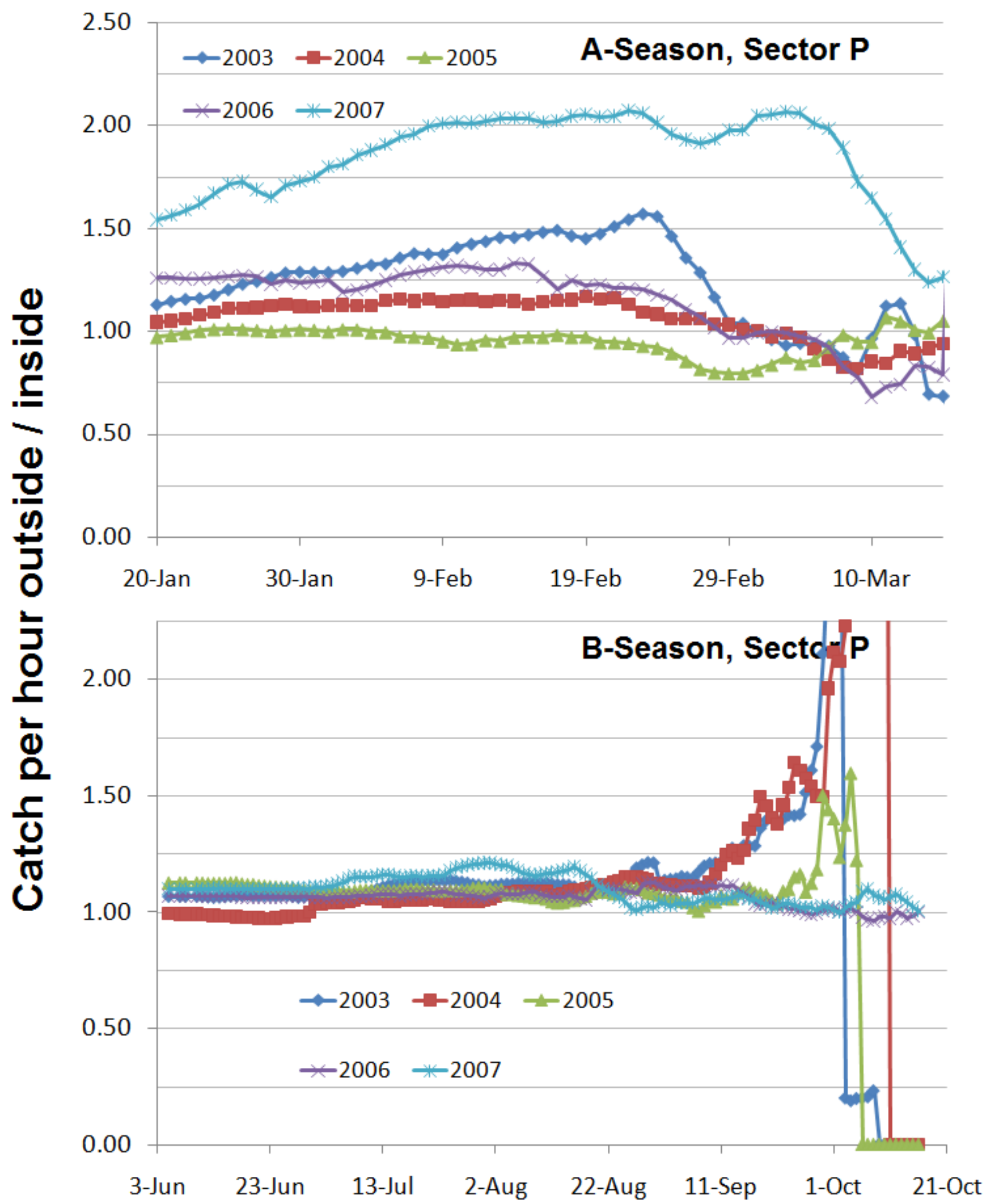


Fig. 4-11 Relative catch rates of pollock for at-sea processors by hour of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season.

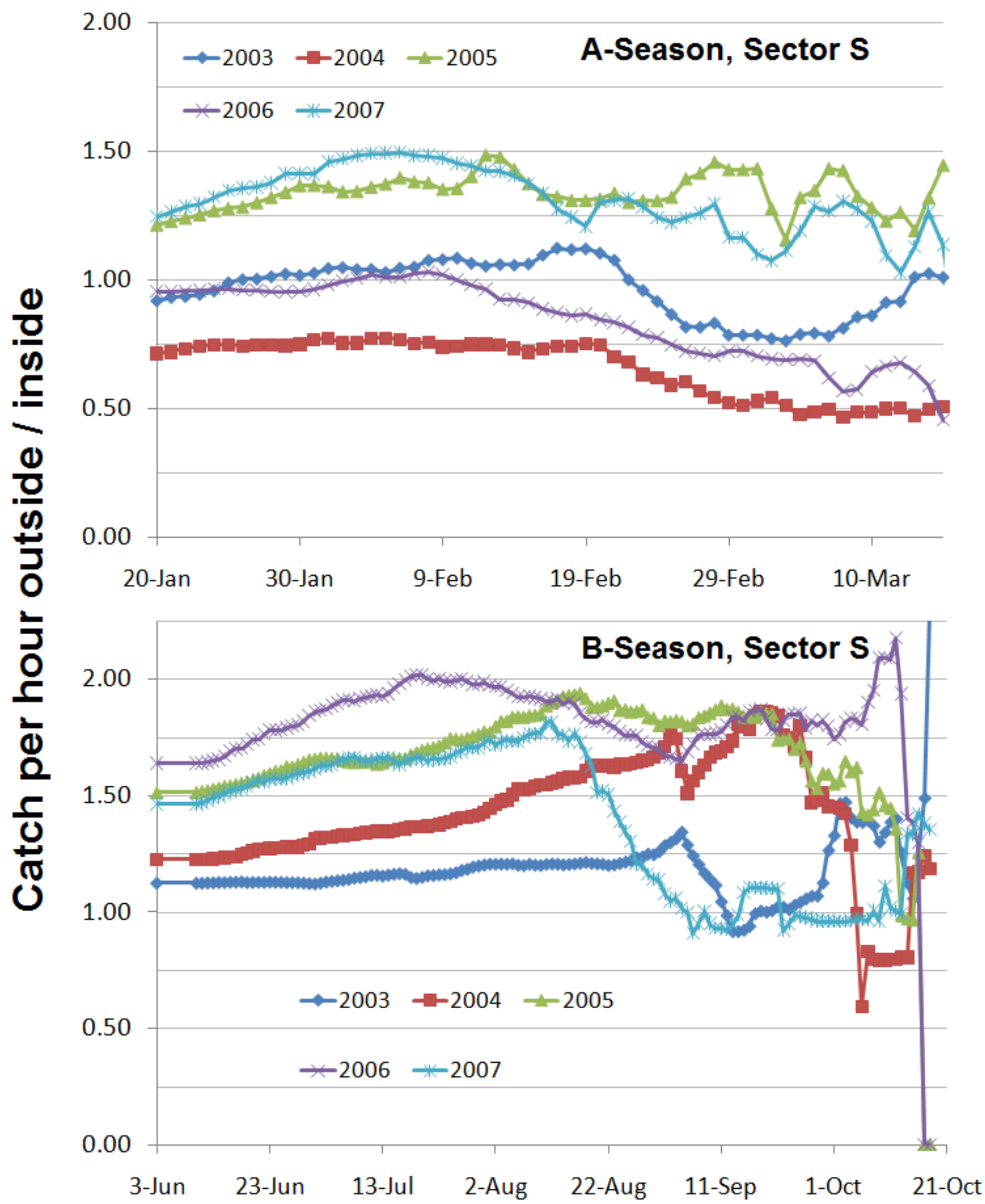


Fig. 4-12 Relative catch rates of pollock for shorebased catcher vessels by hour of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for 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.

4.4.1 Ecosystem-sensitive management

Measures to minimize chum salmon bycatch

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.

Adjusting protections for Steller sea lions

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 3.4, 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.

Changes to fishery management based on ongoing research and understanding of ecosystem interactions and the effects of climate change

Pollock stocks may also be affected by changing climate conditions. Pollock distribution has been shown to be affected by bottom temperatures, with densities occurring in areas where the bottom temperatures are greater than zero (Ianelli et al., 2008). A study is currently underway linking temperature and salmon bycatch rates, and preliminary evidence indicates a relationship (Ianelli et al. 2009). At this time, it is not possible to forecast in what way changing climate conditions are likely to affect pollock stocks.

4.4.2 Traditional management tools

Development of the salmon excluder device

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. The salmon excluder is still being tested in pollock fisheries, and is not yet in wide-scale use, however many of the early design flaws have been corrected at this stage.

Authorization of the pollock fishery in future years

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.

Increasing enforcement responsibilities

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.

Improved enforcement through VMS

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.

4.4.3 Actions by Other Federal, State, and International Agencies

Future exploration and development of offshore mineral resources

The Minerals Management Service (MMS) expects that reasonably foreseeable future activities include development of oil and gas deposits over 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. The MMS has 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. A notable proportion of the pollock fishery occurs in the North Aleutian Basin program area, and adverse environmental impacts resulting from exploration and development in the future could impact pollock stocks. The extent to which these impacts may occur is unknown.

4.4.4 Private actions

Commercial pollock fishing

The analysis assumes that the commercial fishery for pollock will continue into the future, and the direct effects analysis has been designed to study the impacts of the fishery.

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 (Akinicheva et al. 2008; Anon. 2007; TINRO-centre 2006, 2005); Canada (Cook et al. 2008); USA (Josephson 2008; 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.

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	-	-	40.9	181.2	223.7
2007	0.78	-	-	44.6	182.2	227.6

For Chinook salmon fry, the United States has the highest number of annual releases (80% of total in 2007), followed by Canada (~20%). 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 (63% in 2007), followed by California (19% in 2007), and then Oregon (7% 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	10.5	114.5	13.2	34.8	9.2	171.7	182.2

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).

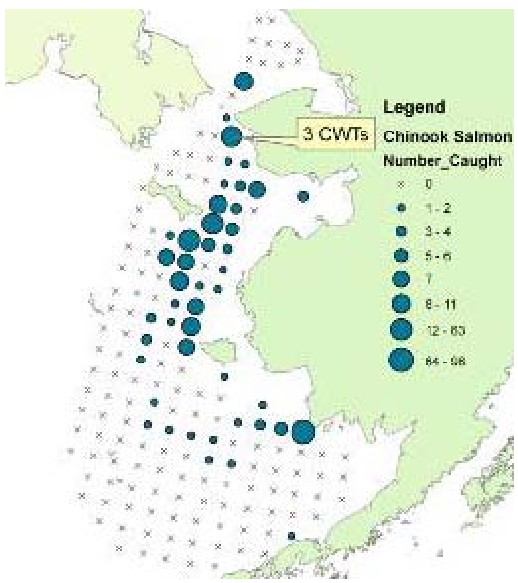


Fig. 5-1 U.S. BASIS juvenile Chinook salmon catches in 2007. The location of three coded-wire tag (CWT) recoveries for Canadian Yukon is noted in the callout box. *Source: Jim Murphy and Adrian Celewycz, NMFS AFSC.*

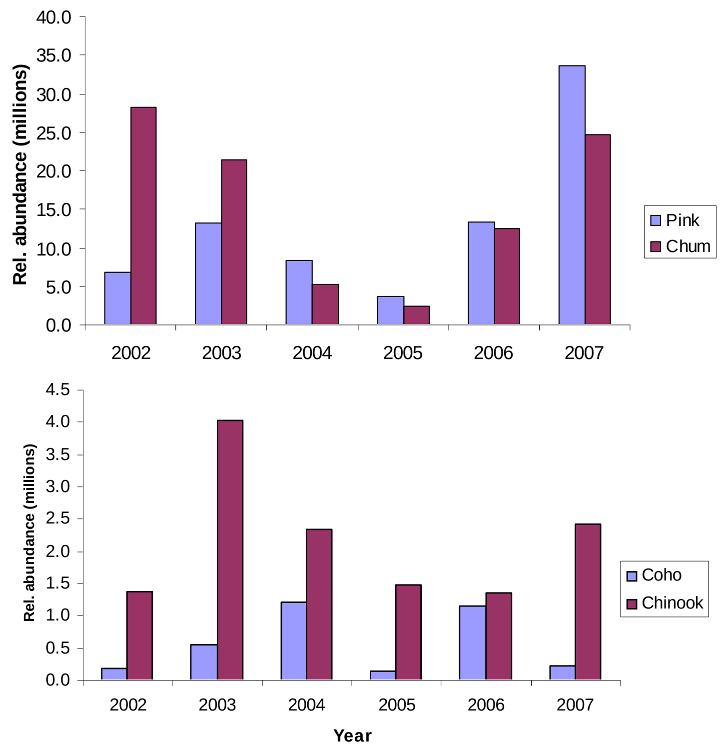


Fig. 5-2 Relative abundance of juvenile salmon in the Northern Shelf Region (60°N-64°N latitude) of the U.S. BASIS survey, 2002-2007. *Source: Chris Kondzela, NMFS AFSC.*

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).

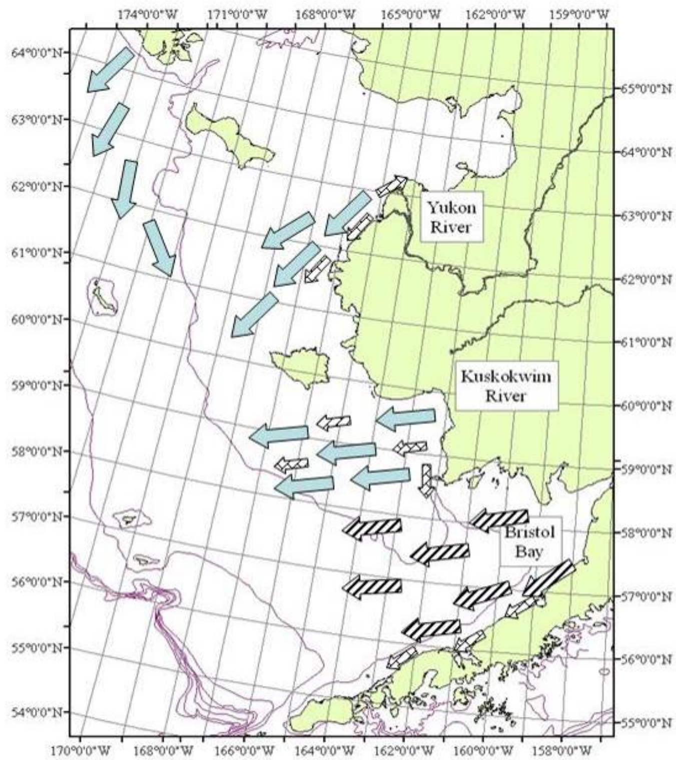
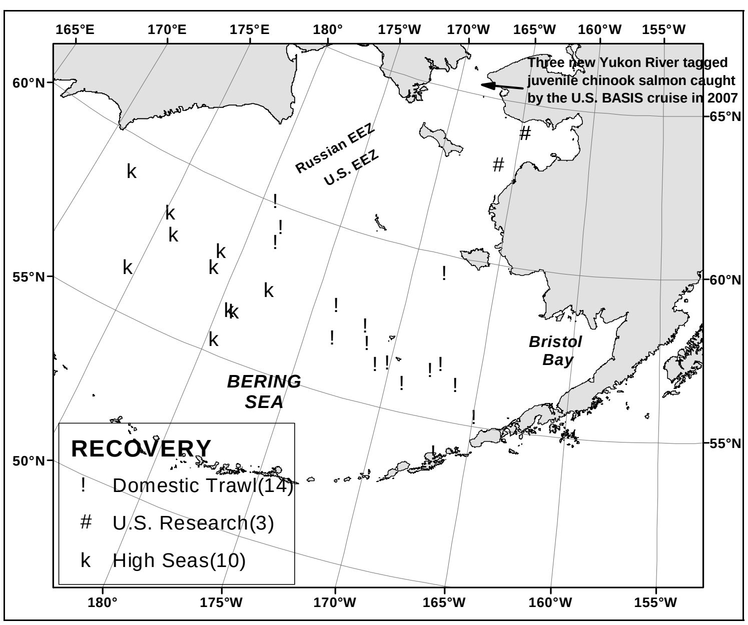


Fig. 5-3 Seaward migration pathways for juvenile chum (solid arrow), sockeye (slashed line arrow), coho, and Chinook (boxed line arrow) salmon along the eastern Bering Sea shelf, August through October. *Source: Farley et al 2007.*



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.

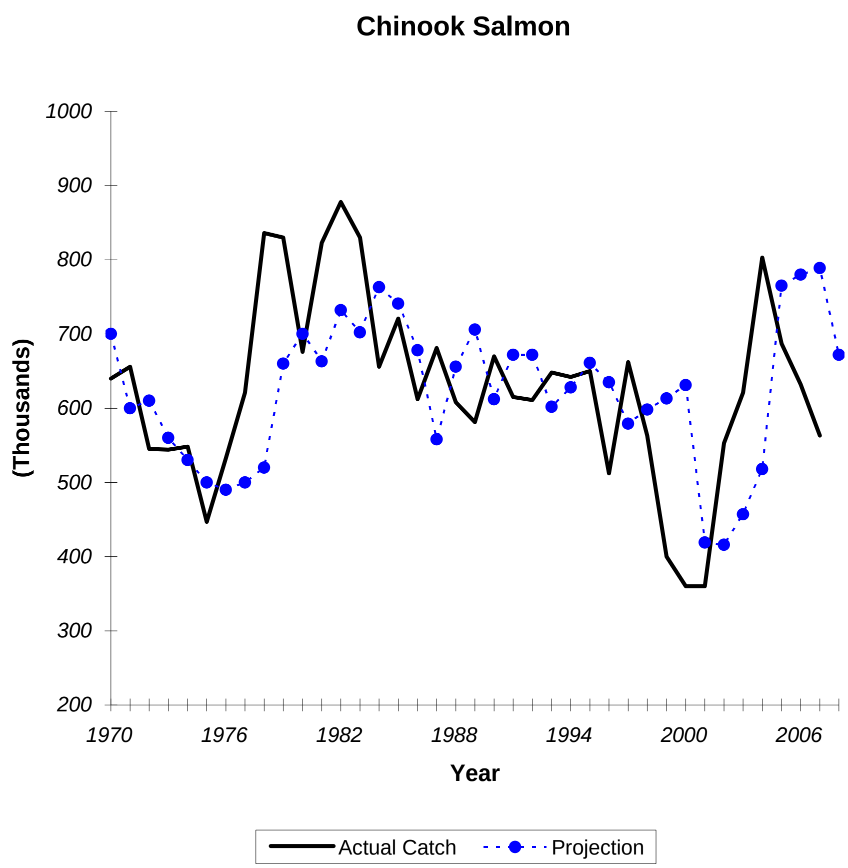


Fig. 5-5 Relationship between actual catch and projected catch in thousands, for Alaskan Chinook salmon fisheries from 1970 to 2007, with the 2008 projection (Nelson et al. 2008).

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. A general overview of 2008 stock status is contained in Table 5-3 and by stock in detail in subsequent sections. Preliminary information of escapements in 2009 is presented in the next section.

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	Below	Yes	No	Yield concern (since 2004)
Yukon	Yes	Below	Yes	Most in Alaska No-Canadian treaty goal	Yield concern (since 2000)
Kuskokwim	Yes	Below	Yes	Some [30]	No Yield concern discontinued 2007
Bristol Bay	Yes	Below	Yes	Some	No

5.2.2.1 2009 salmon run synopses for all western Alaskan stocks

Preliminary 2009 stock status information is summarized generally below for all stocks while detailed information by stock through 2008 is summarized in region-specific sections below. The 2009 season is still on-going (August 2009) thus characterizations of run strengths, escapement and trends for this season are preliminary.

Norton Sound: The 2009 Norton Sound run appears to have been similar to the historically low return of 2008 (ADF&G 2009). In Unalakleet, passage at the counting tower on the North River was weak and there are concerns that the lower end of the North River tower escapement goal range (1,200-2,600 Chinook) may not be reached (ADF&G 2009).

Yukon: Preliminary escapements at upriver projects have been variable. Management strategies concentrated on protecting the early portion of the run in order to pass fish upriver. As of August 10, 2009, approximately 68,400 Chinook had passed the Eagle Sonar station (ADF&G 2009). The interim management goal of 45,000 fish to Canadian spawning grounds was therefore met. The Chena River counts were near the upper end of the BEG (5,700 fish) and Salcha River counts were double the upper end of the BEG (6,500 fish) for that river. In contrast, preliminary data indicates that Chinook escapements for East Fork Andreafsky and Gisasa Rivers were below average.

Kuskokwim: Preliminary escapement data through August 31, 2009, indicated that many of the weir projects (Kwethluk, George, Kongrukluk, Middlefork Goodnews) reached or neared their lower end of goal range with projects remaining open until mid-September. Run timing at the Bethel test fishery appeared normal. Returns overall to the Kuskokwim region were expected to be similar in abundance to 2008 which exceeded escapement (and subsistence) needs thus allowing for harvestable surplus.

Bristol Bay: The Nushagak River Chinook escapement for 2009 was 81,480, which is above the inriver goal of 75,000 established in the Nushagak Mulchatna King Salmon Management Plan (M. Jones, pers. comm.). A total of 145,000 Chinook salmon were forecasted to return to the Nushgak in 2009, which

[30] For the Kuskokwim: 3 of 4 weir goals were below while 3 of 5 aerial goals were below.

was a 4% decrease from the recent 10-year average (M. Jones, pers. comm.). Actual harvests were below average in every district (see RIR for more details on the 2009 Chinook harvest).

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 yield. 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. 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. Escapement is assessed for major index river systems of Norton Sound. Assessments are often qualitative relative to historical escapement goals for indexed areas (Menard 2007).

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). 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.).

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). 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 2008).

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 was 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.

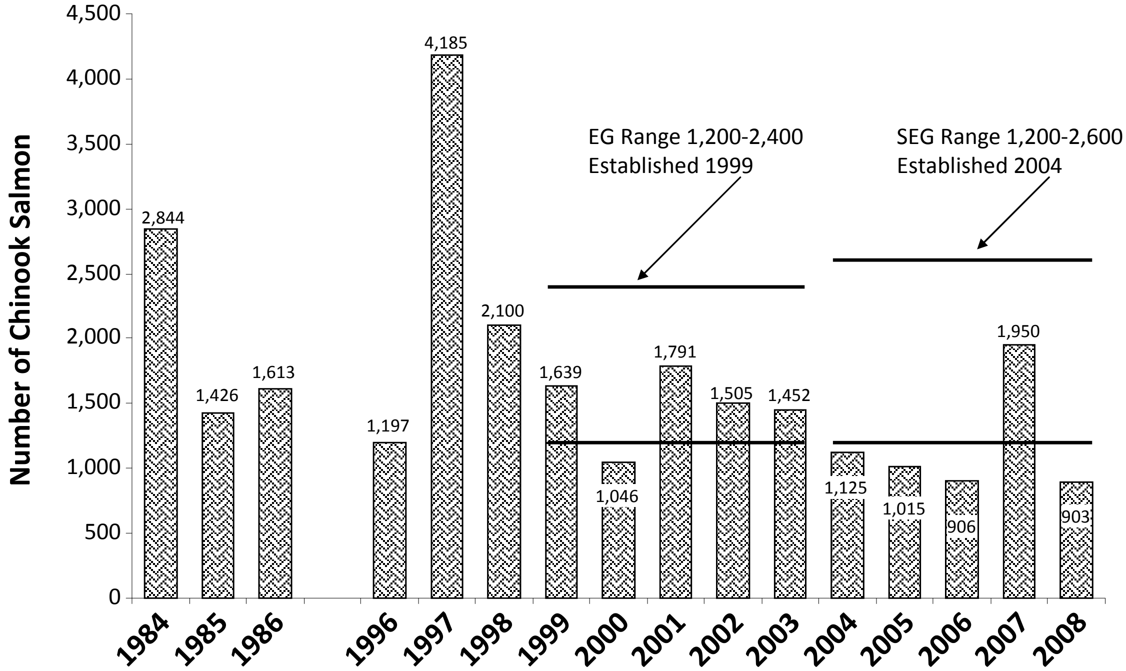


Fig. 5-6 Estimated Chinook salmon passage compared to the escapement goal range 1984-1986 and 1996-2008, North River counting tower, Unalakleet River drainage, Norton Sound.

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. 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.

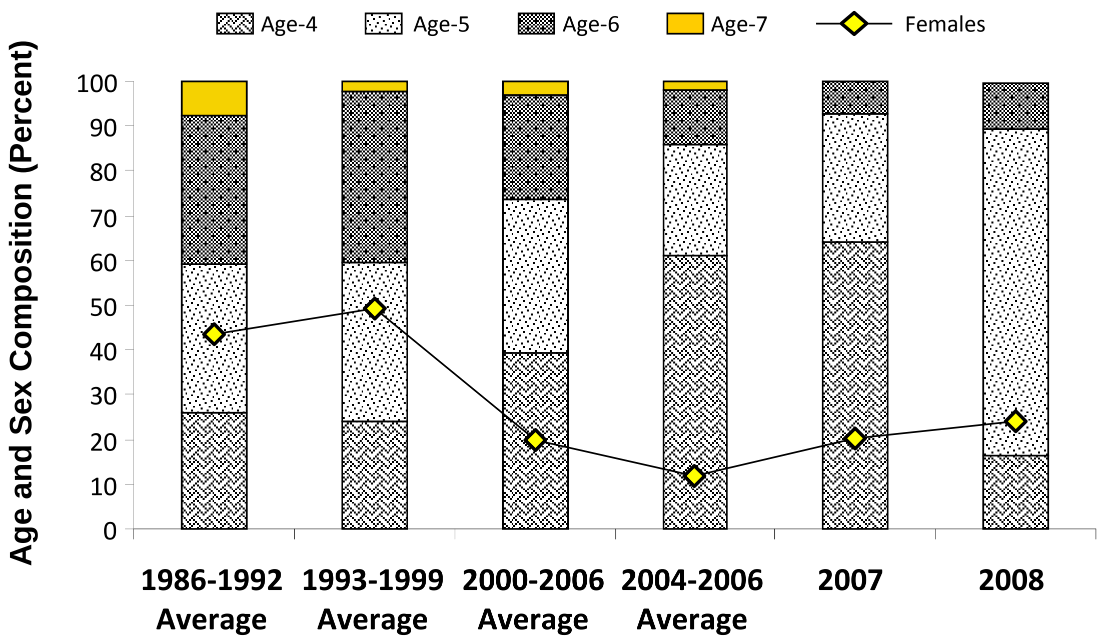


Fig. 5-7 Chinook salmon age and sex composition trends observed in the Unalakleet River test net samples (5 7/8" stretched mesh), 1986-2008, Norton Sound. *Source: S. Kent, ADF&G.*

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 was anticipated (nor occurred) 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.).

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.

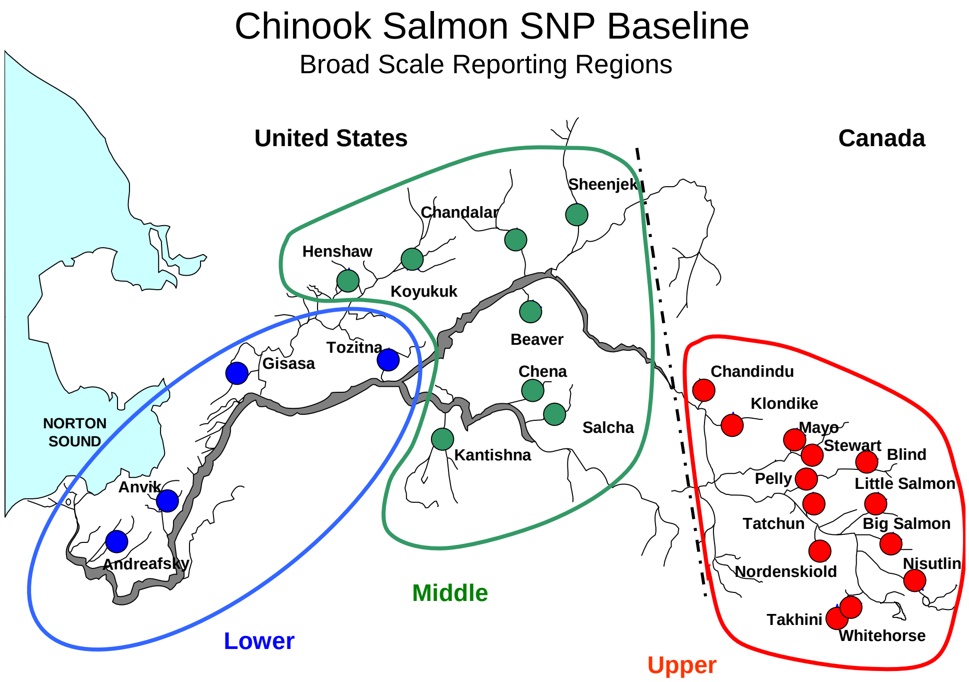


Fig. 5-8 Stock group delineations of the Yukon River: lower, middle and upper. *Source: D. Evenson, ADF&G.*

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. The classification as a yield concern was originally based on low harvest levels for the previous three-year period (1998-2000) and anticipated low harvest in 2001. An action plan was subsequently developed by ADF&G and approved by the BOF in 2001. The BOF continued the classification as a yield concerns in 2004 (Lingnau and Bergstrom 2004) and 2007. The Yukon River Chinook salmon stock continues to meet the definition of a yield concern based on low yield 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.

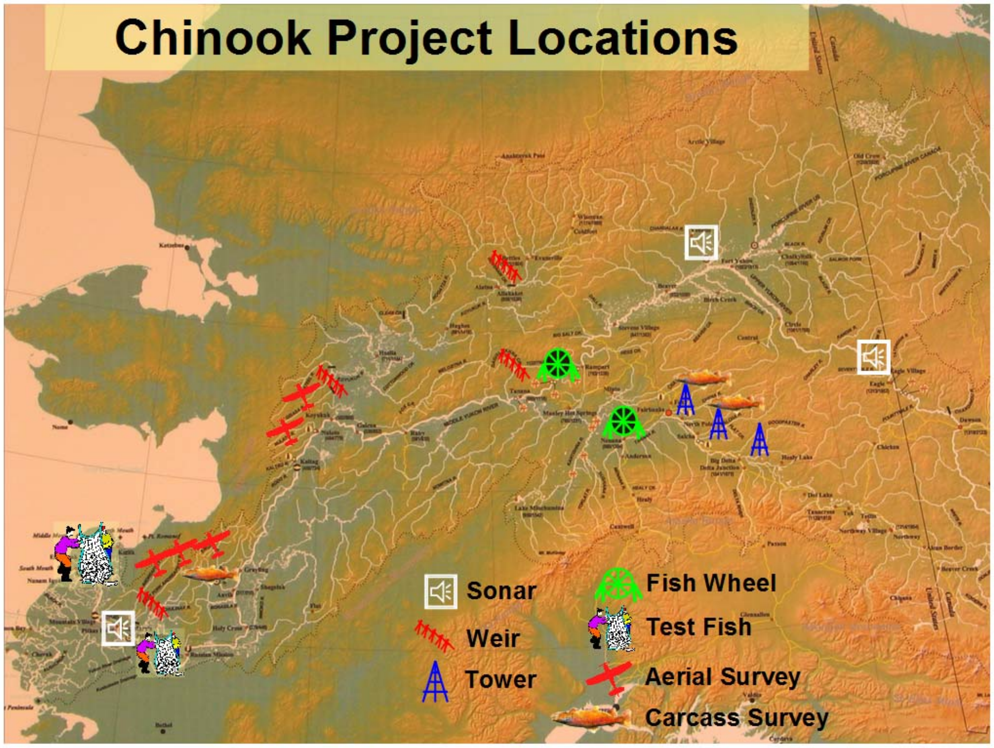


Fig. 5-9 Project location for assessing Yukon River Chinook salmon. Source: L. DuBois, ADF&G

Tributary escapements have been monitored with counting tower projects in the Chena and Salcha rivers, Goodpaster River, weir counts in the East Fork Andreafsky and Gisasa 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]	34,000[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 1986-1993 (Table 5-7, Fig. 5-10). Escapement data for the Canadian portion of the drainage are shown in Fig. 5-12and Fig. 5-13. 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. 5-14). 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. 5-12, Fig. 5-13). The IMEG was not met in 2008 and was more than 24% below the minimum goal.

Table 5-6 Chinook salmon aerial survey indices for selected spawning areas in the Alaskan portion of the Yukon River drainage, 1961–2007.

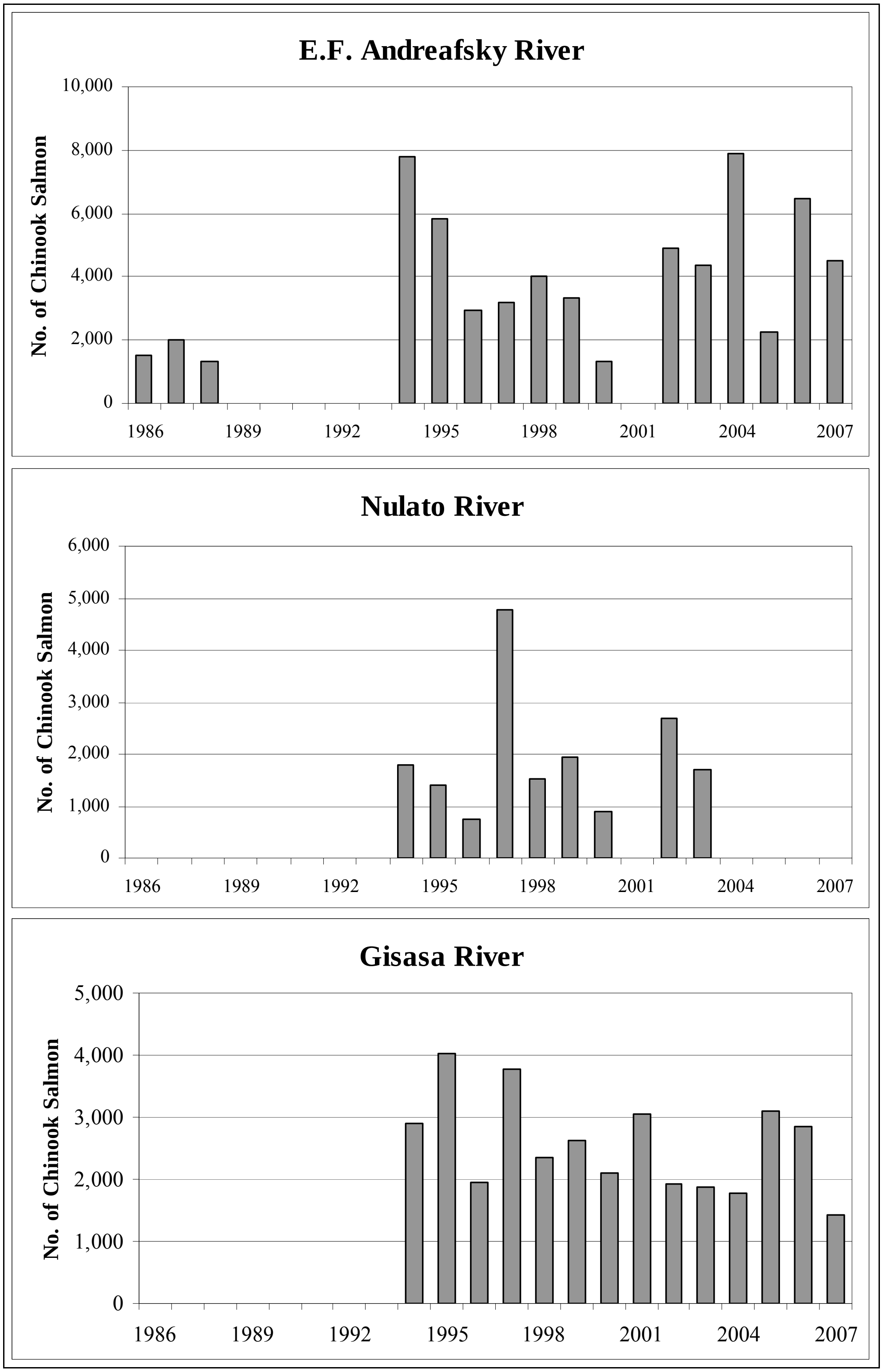
Year	Andreafsky River		Anvik River		Nulato River			Gisasa River
	East Fork	West Fork	Drainage Wide Total	Index Area	North Fork	South Fork	Both Forks	
1961	1,003		1,226		376 a	167		266 a
1962	675 a	762 a						
1963								
1964	867	705						
1965		344 a	650 [a]					
1966	361	303	638					
1967		276 a	336 [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.

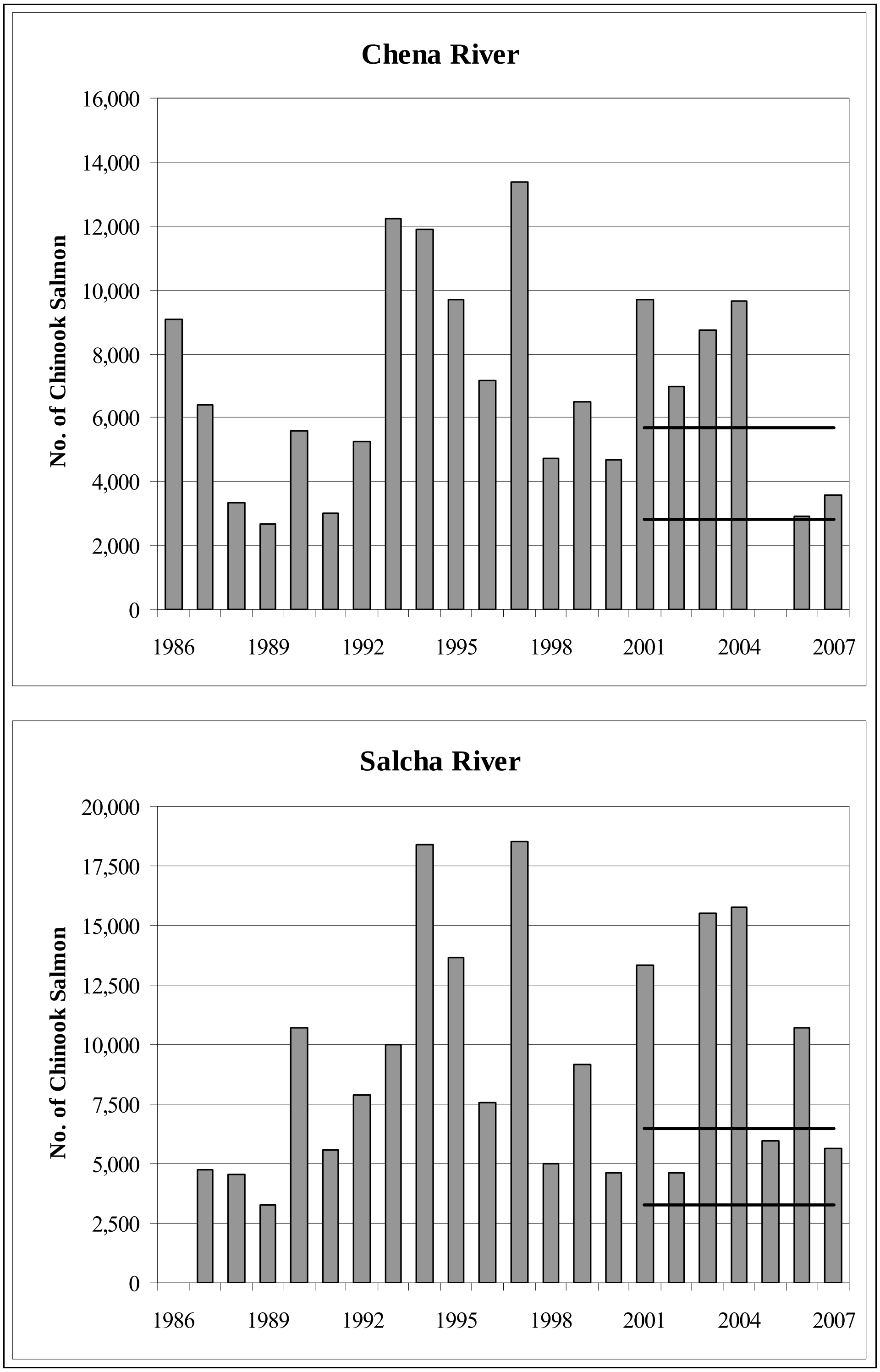
	Andreafsky River		**Nulato River Tower**	**Gisasa River Weir**		**Chena River**		**Salcha River**	
Year	No. Fish	% Fem.	No. Fish	No. Fish	% Fem.	No. Fish	% Fem.	No. Fish	% Fem.
1986	1,530	23.3[a]				9,065	20.0[d]		35.8
1987	2,011	56.1[a]				6,404	43.8[d]	4,771	47.0[d]
1988	1,339	38.7[a]				3,346	46.0[d]	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.



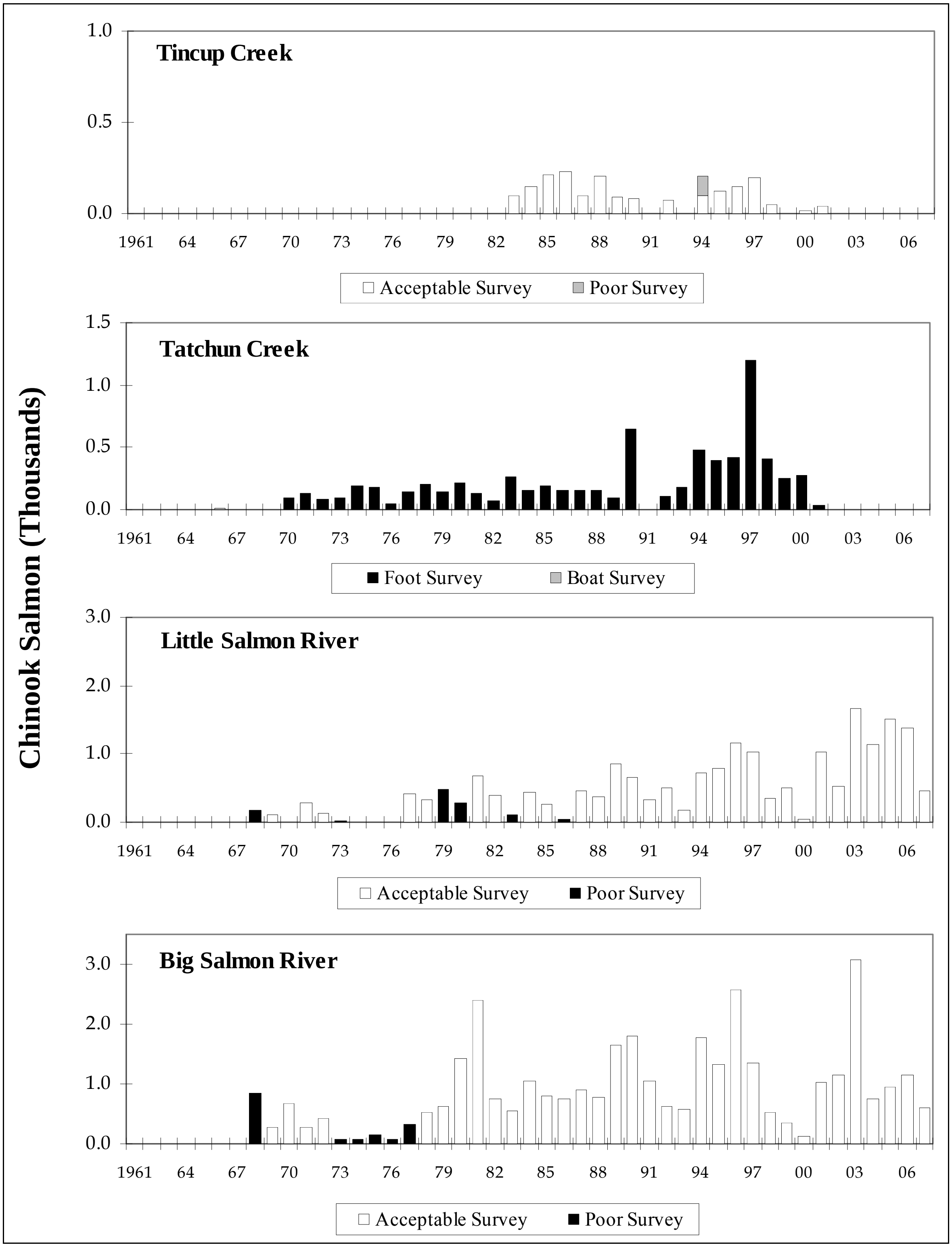
Note: The vertical scale is variable.

Fig. 5-10 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. 5-11 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. 5-12 Chinook salmon escapement data for selected spawning areas in the Canadian portion of the Yukon River drainage, 1961–2007

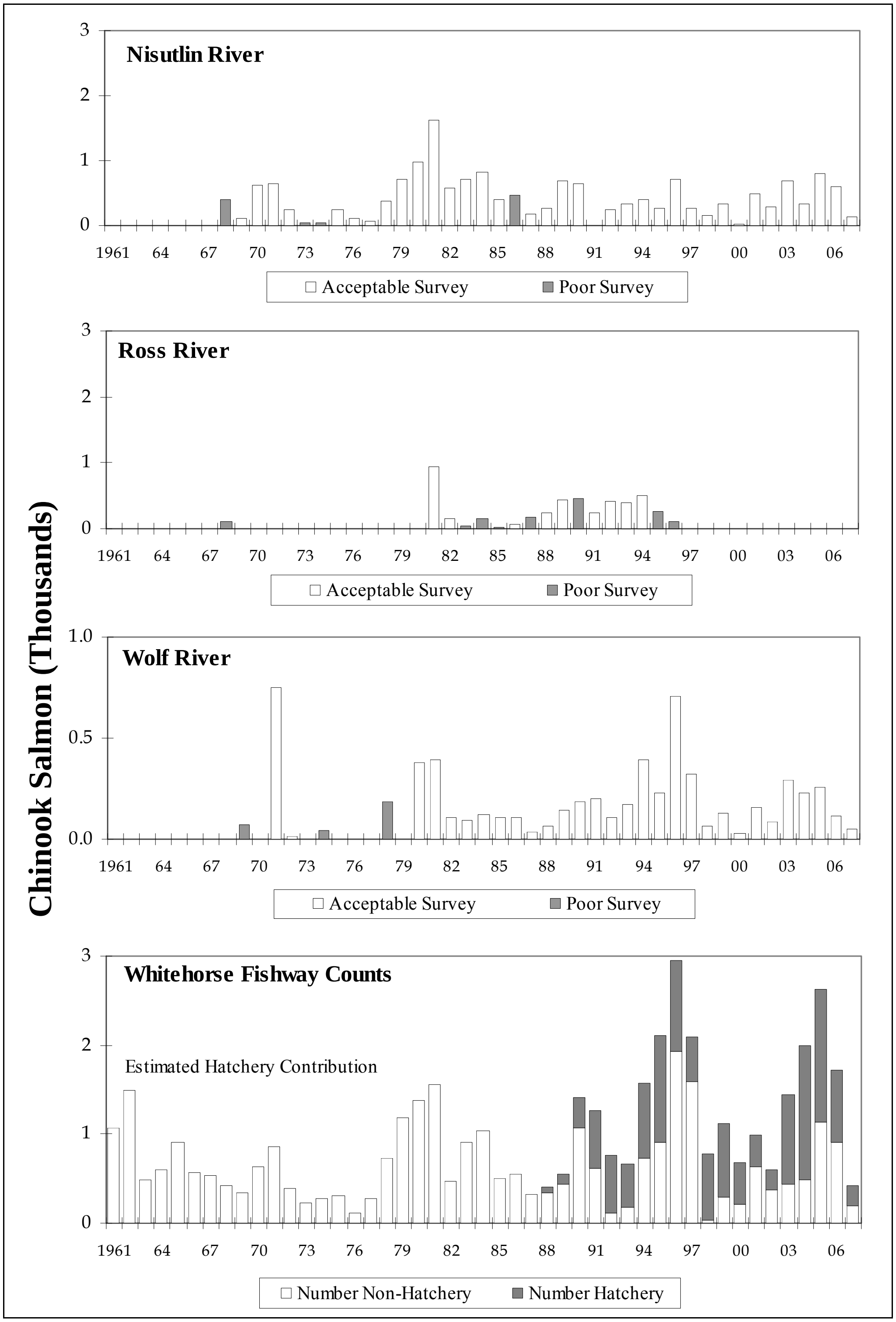


Fig. 5-13 Chinook salmon escapement data for selected spawning areas in the Canadian portion of the Yukon River drainage, 1961–2007.

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		East Fork	Pilot	
Year	Comm. fishery.	Subsist. fishery	Test Fishery	Comm. fishery	Subsist. fishery	Test Fishery	Comm. fishery	Subsist. fishery	Andreafsky River	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[31]. 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.

[31] Salmon ages given in this document represent the combined freshwater and saltwater age.

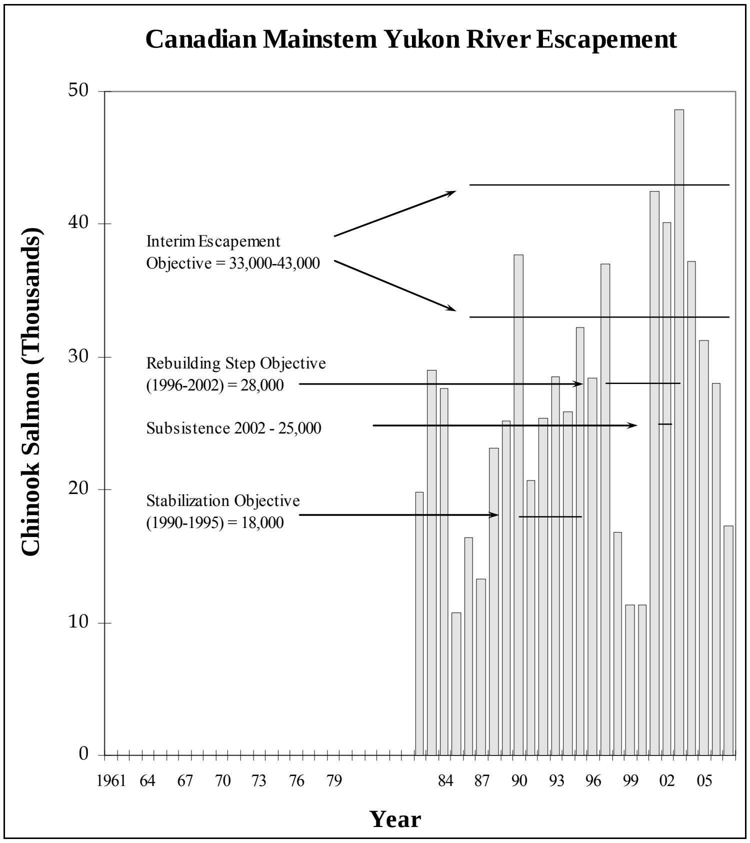


Fig. 5-14 Estimated total Chinook salmon spawning escapement in the Canadian portion of the mainstem Yukon River drainage based on Canadian mark-recapture, 1982–2007. Note: Horizontal lines represent the interim escapement objective range of 33,000–43,000 salmon, the rebuilding step objective of 28,000 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).

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). The S/R model predicted 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. The 2008 return of Canadian-origin Yukon Chinook was well below the expected amount of 80,000 fish.

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 155,000 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. 5-15). 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. However, there was no surplus available for a directed Chinook salmon commercial fishery and that sport and subsistence fisheries on the mainstem Yukon River were reduced in an attempt to provide adequate numbers of Chinook salmon on the spawning grounds. Despite these efforts, escapement was more than 24% below the minimum goal.

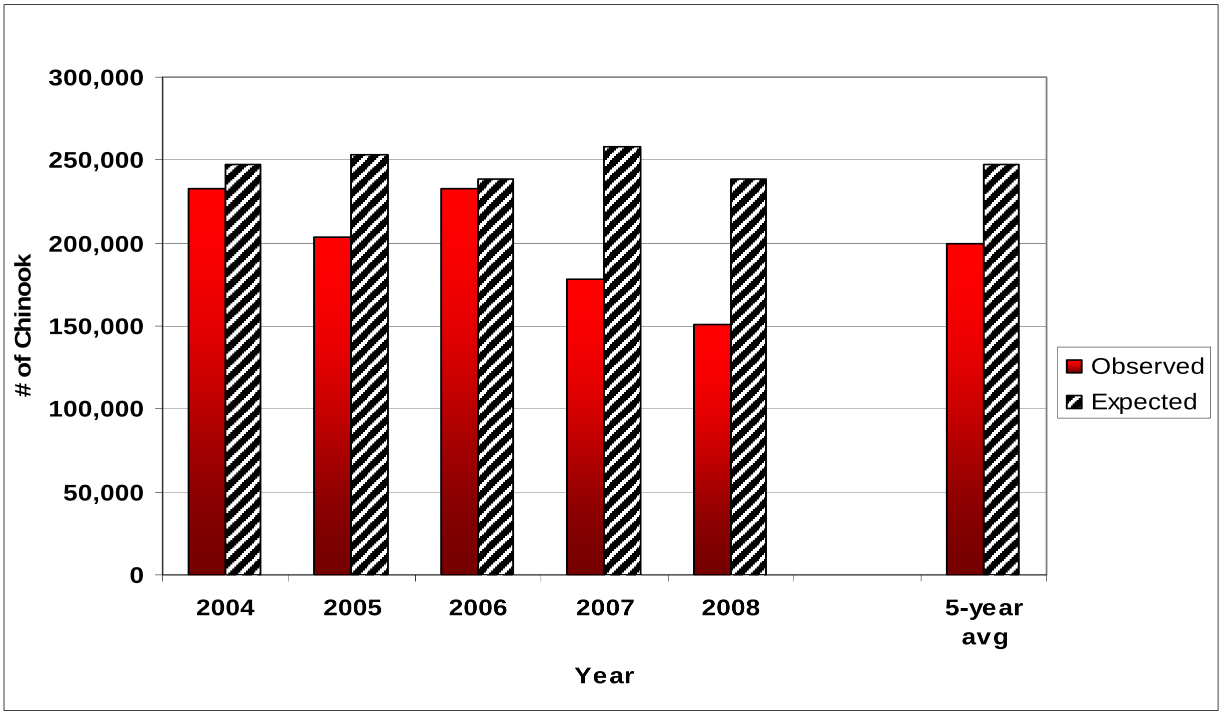


Fig. 5-15 Yukon River Chinook salmon observed versus expected total runs based on S/R and Sibling Relationships, 2004-2008, and 5-year average. 2008 data are preliminary (ADF&G 2008).

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 500,000 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 34,000 or 24% below the goal.

5.2.4.2 Exploitation rates

The following is an excerpt 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. 5-16). 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. 5-17). Associated exploitation rates exerted by Alaskan fishermen on this stock ranged from 39% in 2001 to 76% in 1987 (Fig. 5-17). Average exploitation rates during the period 2001–2005 decreased by 19% from the 1989–1998 average (Fig. 5-17). Recent exploitation rates are therefore low compared to rates during the 1970s, 1980s, and 1990s.

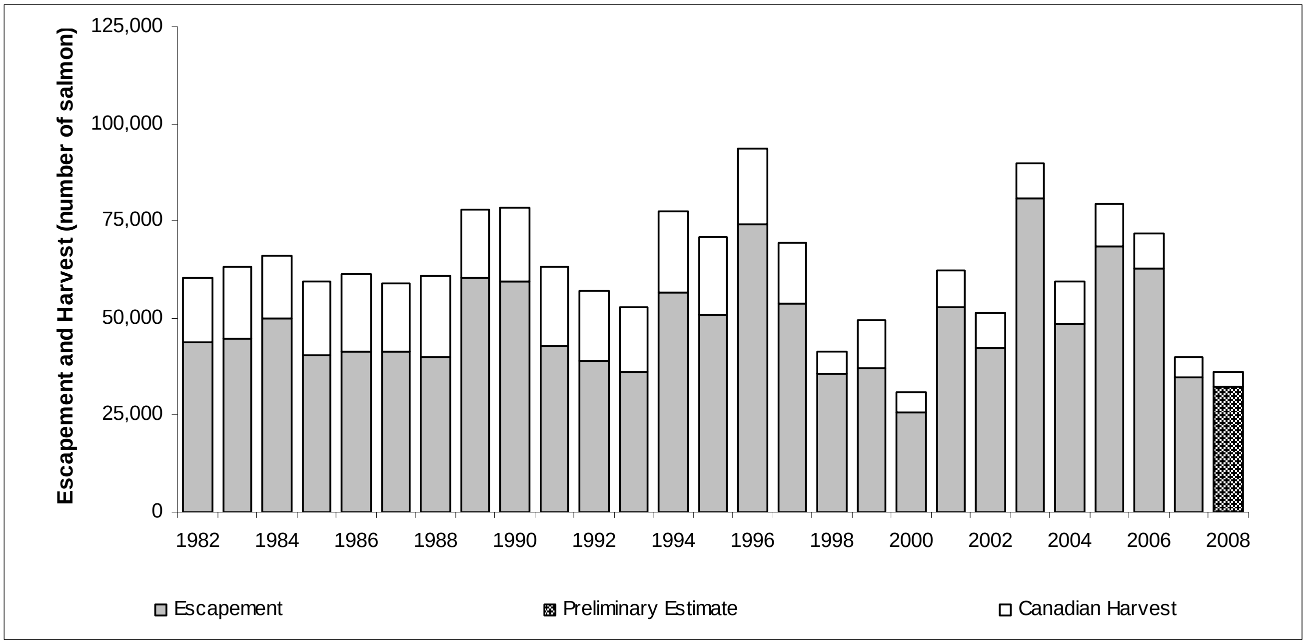


Fig. 5-16 Eagle sonar based estimates of Yukon River Chinook salmon passing from Alaska into Canada by harvest and escapement in the main-stem of the Yukon River, Canada, 1982–2006 (JTC 2009).

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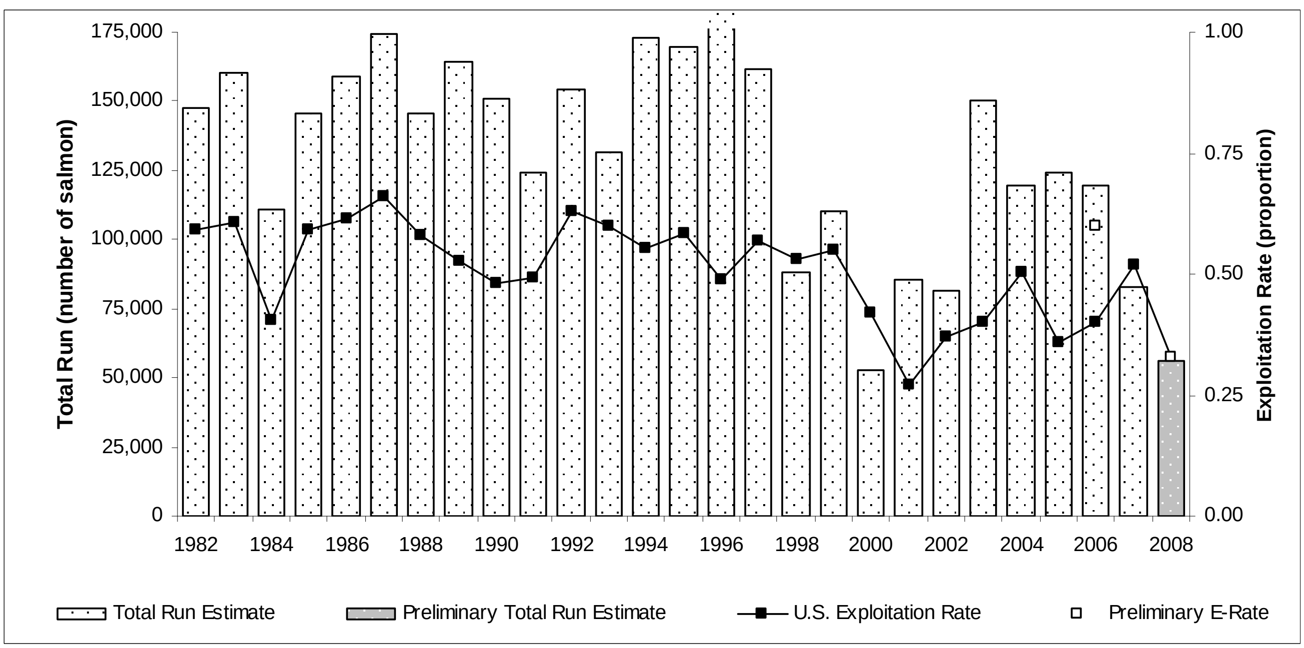


Fig. 5-17 Total run and U.S. exploitation rates of Yukon River Canadian-Origin Chinook salmon, 1982-2008. Border passage estimates are based on Eagle sonar, radio-telemetry, and a 3-area escapement index. 2008 data are preliminary.

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 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. The Goodnews River (while not included in the district itself) 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).

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 since the early to late 1990’s, 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. 5-18 illustrates the location of escapement projects in the management area.

ADF&G staff are in the final stages of developing total inriver run reconstruction from 1976 through 2007 based on 6 years of tagging studies that will be used to scale and abundance index from 1976 to 2007.

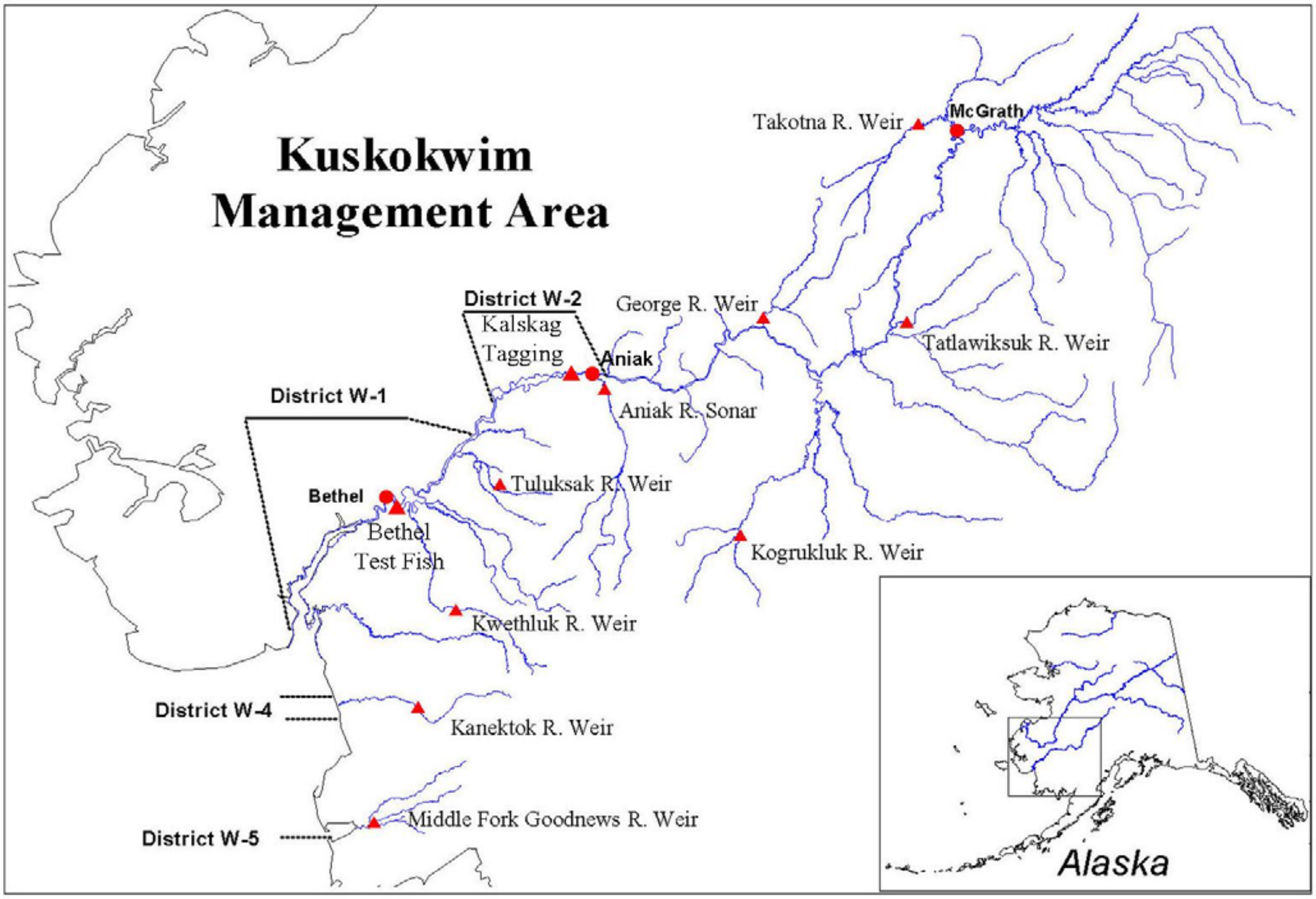


Fig. 5-18 Escapement projects in the Kuskokwim management area.

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. 5-19 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.

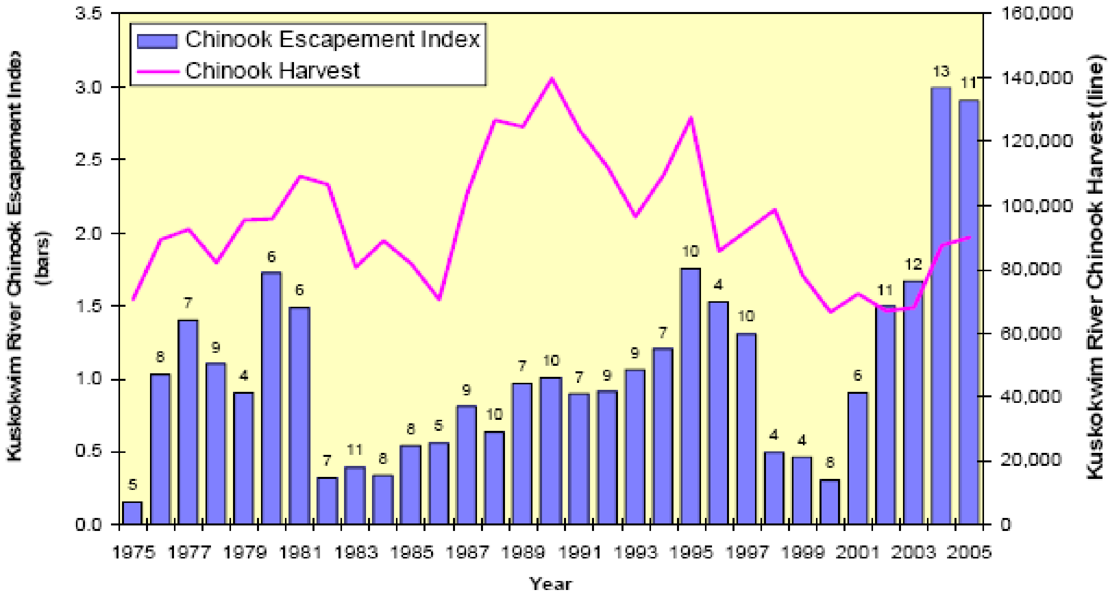
Year	Lower Kuskokwim River [a]				Middle Kuskokwim River [a]							Upper Kuskokwim River [a]		
	Eek	Kweth-luk Canyon C.	Kisara-lik	Tuluk-sak	Aniak	Kip-chuk (Aniak)	Salmon (Aniak)	Holo-kuk	Oska-walik	Holitna	Kogruk-luk Weir	Gagaray ah	Chee-neetnuk	Salmon (Pitka)
1975					202	94								
1976		997								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. 5-19 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 in-river 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. 5-20). 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 near 40%, compared to the 10-year average of 29%. Subsistence fishermen target king salmon by use of gillnets with 8 inch or larger mesh size. Additionally, Chinook salmon commercial harvest in Kuskokwim Bay districts were below average in 2008.

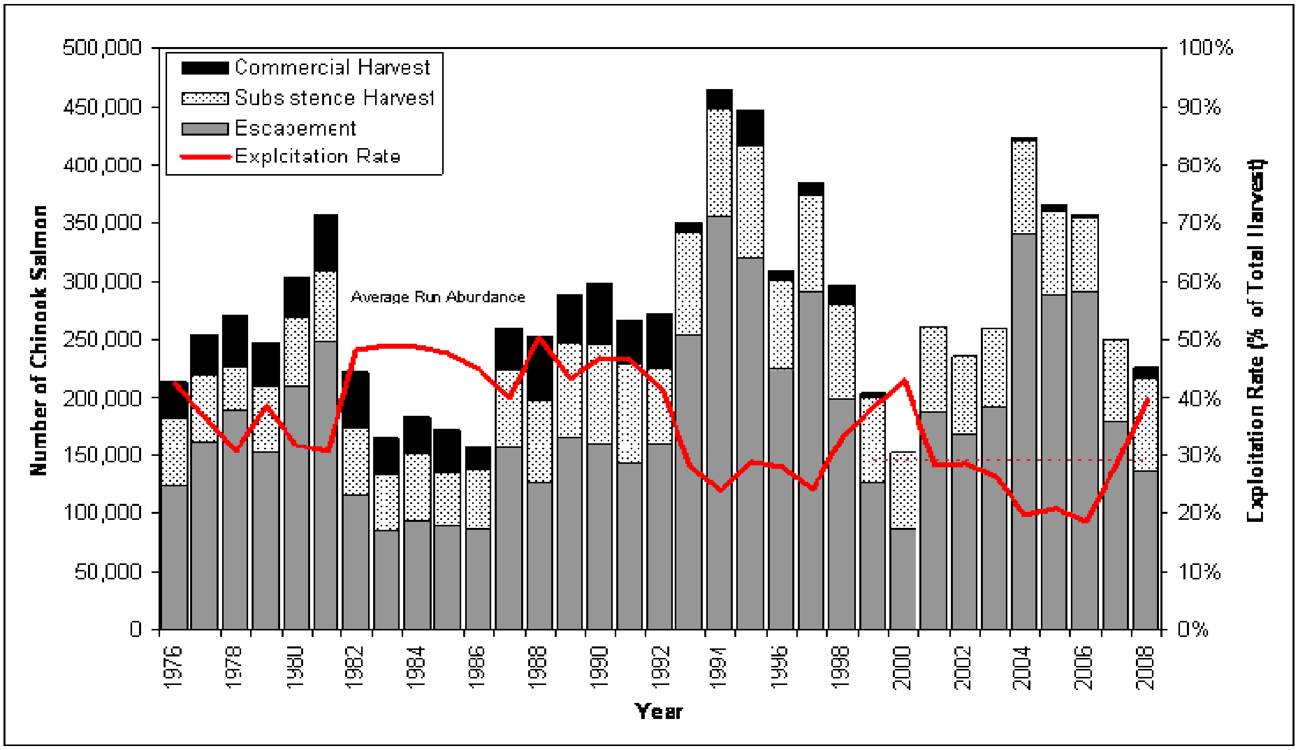


Fig. 5-20 Preliminary Kuskokwim River Chinook salmon run reconstruction and exploitation rate, 1976-2008. 2007 and 2008 data are preliminary.

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 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.

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. 5-21). 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.

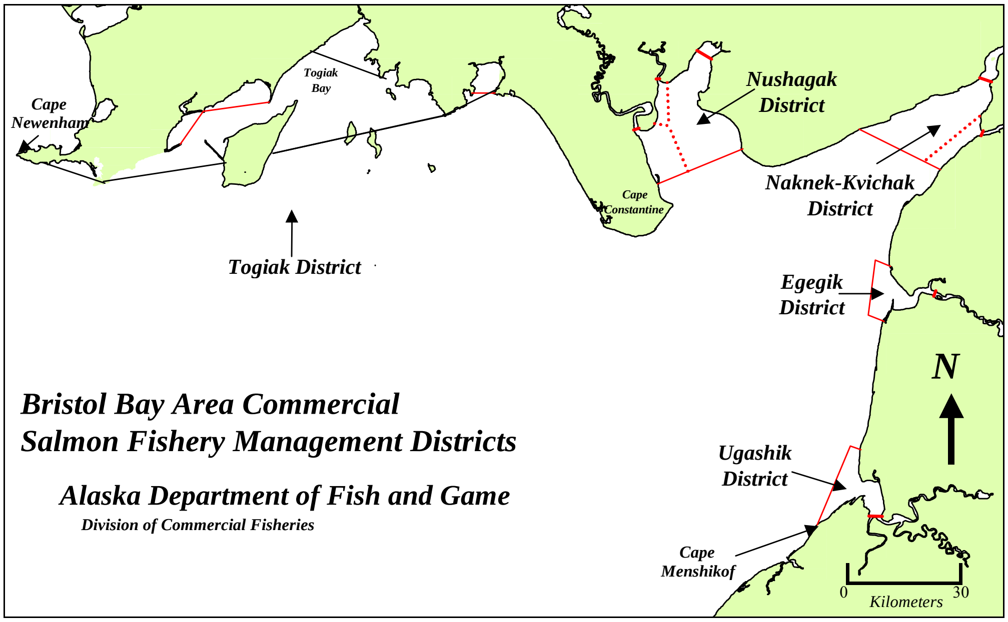


Fig. 5-21 Bristol Bay area commercial salmon fishery management districts.

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					Total %
		1.1	1.2	1.3	1.4	1.5	
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 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.

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. 5-22).

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.

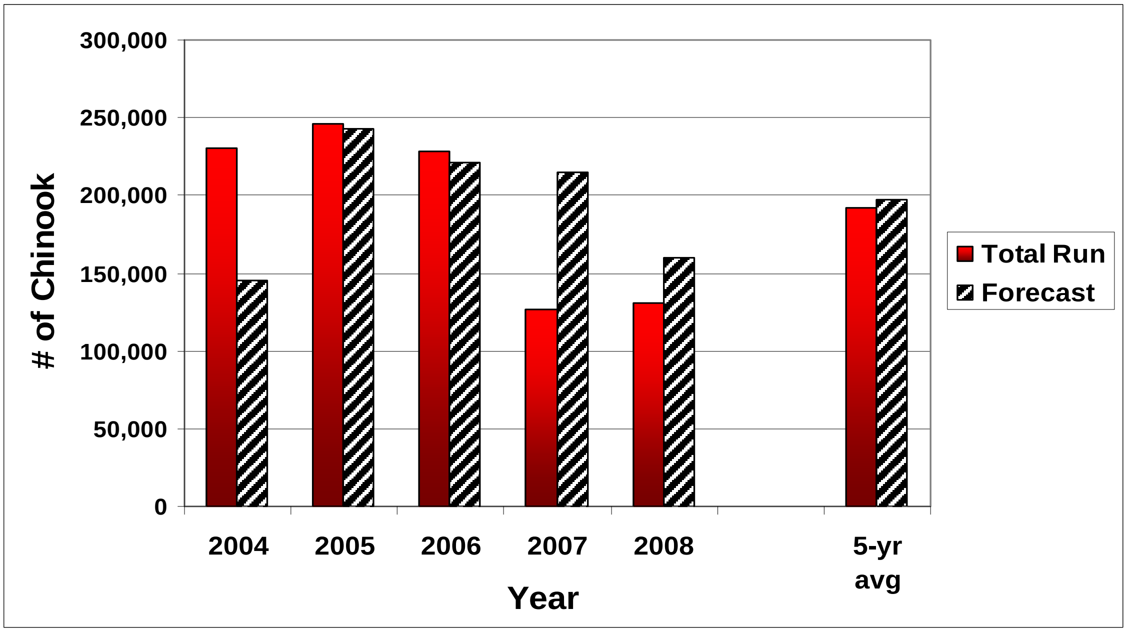


Fig. 5-22 Observed versus forecasted total Chinook salmon runs, Nushagak River, 2004-2008 and 5-year average. 2008 data are preliminary. From ADF&G 2008.

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. 5-23). 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).

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 trended sharply upward and most escapement goals were being met or exceeded through 2006. 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.

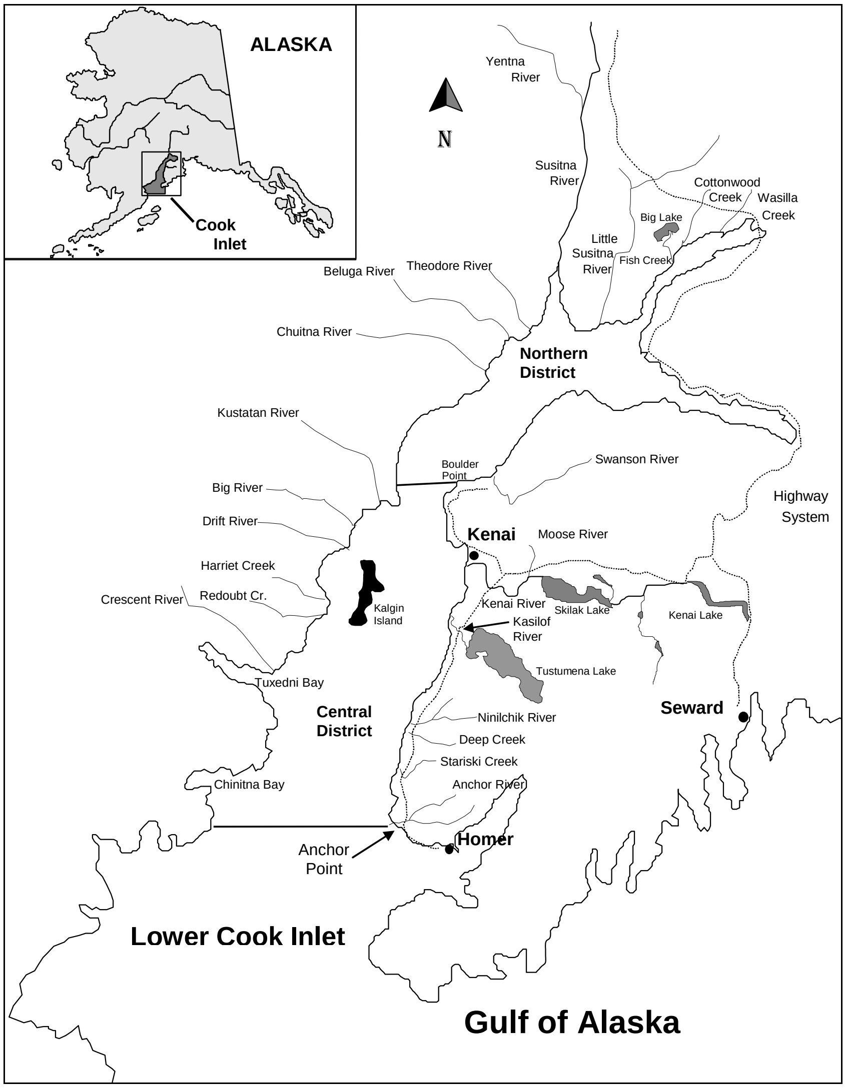


Fig. 5-23 Major Tributaries of the Cook Inlet Basin.

From 2004-2006, there were 5 occurrences when the lower end of the escapement goal was met for the 63 escapement observations (Fair et al 2007). Note this was based on 21 current escapement goals. The South Fork of Eagle River no longer has a Chinook escapement goal. 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), recent inseason management data on salmon bycatch, and the 2009 Supplemental Biological Opinion. 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 consulted 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.

NMFS Sustainable Fisheries, Alaska Region, conducted an ESA Section 7 consultation on the proposed action with NMFS Northwest Region for listed salmon. On December 2, 2009, the NMFS Northwest Region issued a Supplemental Biological Opinion that concluded that the proposed action is not likely to jeopardize Upper Willamette Chinook or Lower Columbia River Chinook, and will have no effect on designated critical habitat for these two species (NMFS 2009).

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).

		LCR Spring Chinook		UWR Chinook	
Year	Chinook Bycatch	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 the RIR.

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 the RIR. 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, 4, and 5 are discussed in section 5.3.2 through 5.3.5, and particular attention is devoted to comparing and contrasting impacts between Alternative 4, 5 and the range of options analyzed under Alternative 2. Following the comprehensive discussion of Alternatives 1, 2, 4 and 5, 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. 5-24) 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.

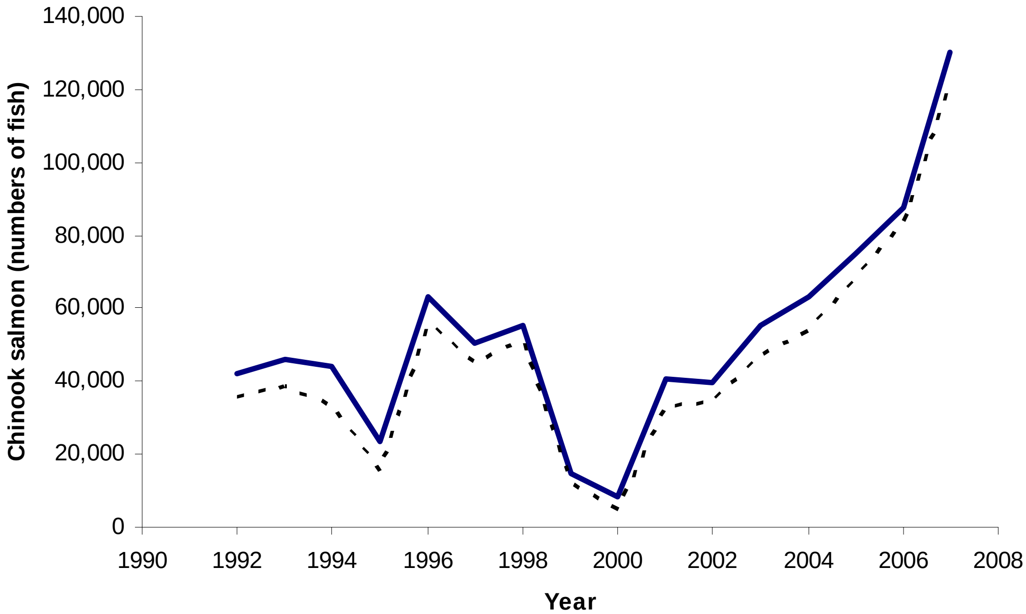


Fig. 5-24 Annual Chinook salmon catch in all BSAI groundfish fisheries (solid line) and pollock trawl fishery only (dotted line) 1992-2007.

Chinook bycatch is taken in both A and B seasons in the pollock fishery. Total catch of Chinook bycatch in the pollock fishery reached an historic high in 2007 at 121,638 fish (Fig. 5-25, Table 5-20). 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 2008 and 2009 was lower than any year since 2000 (Fig. 5-25, Table 5-21). Fig. 5-25 shows the seasonal distribution of bycatch. 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) 1991-2009, CDQ is indicated separately and by season where available. Data retrieval from 3/19/09. 'na' indicates that data were not available in that year.[32]

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	19,928	19,288	640	15,162	4,766	14,558	4,730	604	36
2009	9,527	9,213	314	9,527		9,213		314	

[32] Chinook salmon bycatch is estimated using the NMFS Catch Accounting System (CAS). The CAS continually revises past bycatch estimates based on new information. Therefore, these numbers change slightly depending on when the analyst retrieved the data from the CAS. NMFS periodically revises the bycatch estimates and posts the most recent estimates on the NMFS Alaska Region webpage at: http://www.fakr.noaa.gov/sustainablefisheries/inseason/chinook_salmon_mortality.pdf. EIS Chapter 3 provides more detailed information on the CAS.

Table 5-21 Chinook bycatch by sector for the Bering Sea pollock fleet, 1991-2007

		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

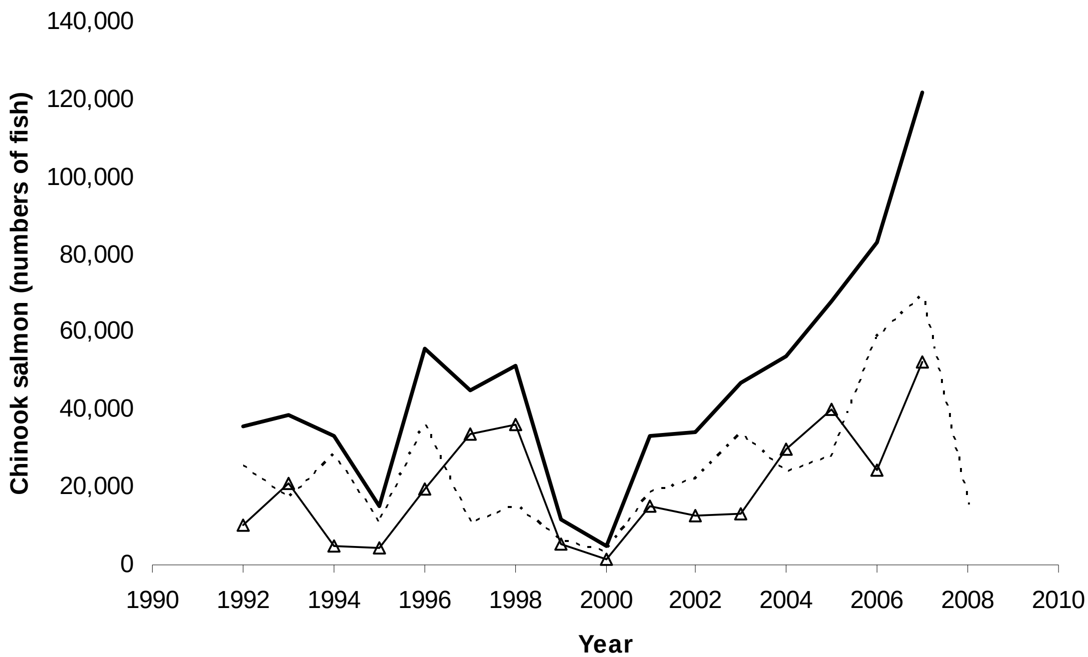


Fig. 5-25 Chinook salmon catch in pollock trawl fishery: annually 1992-2007 (solid line), A season 1992-2008 (dotted line), and B season 1992-2007 (triangles).

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. 5-26 through Fig. 5-29). The pattern for B-season Chinook bycatch rates as a whole is shown in Fig.

5-30. 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. 5-31)

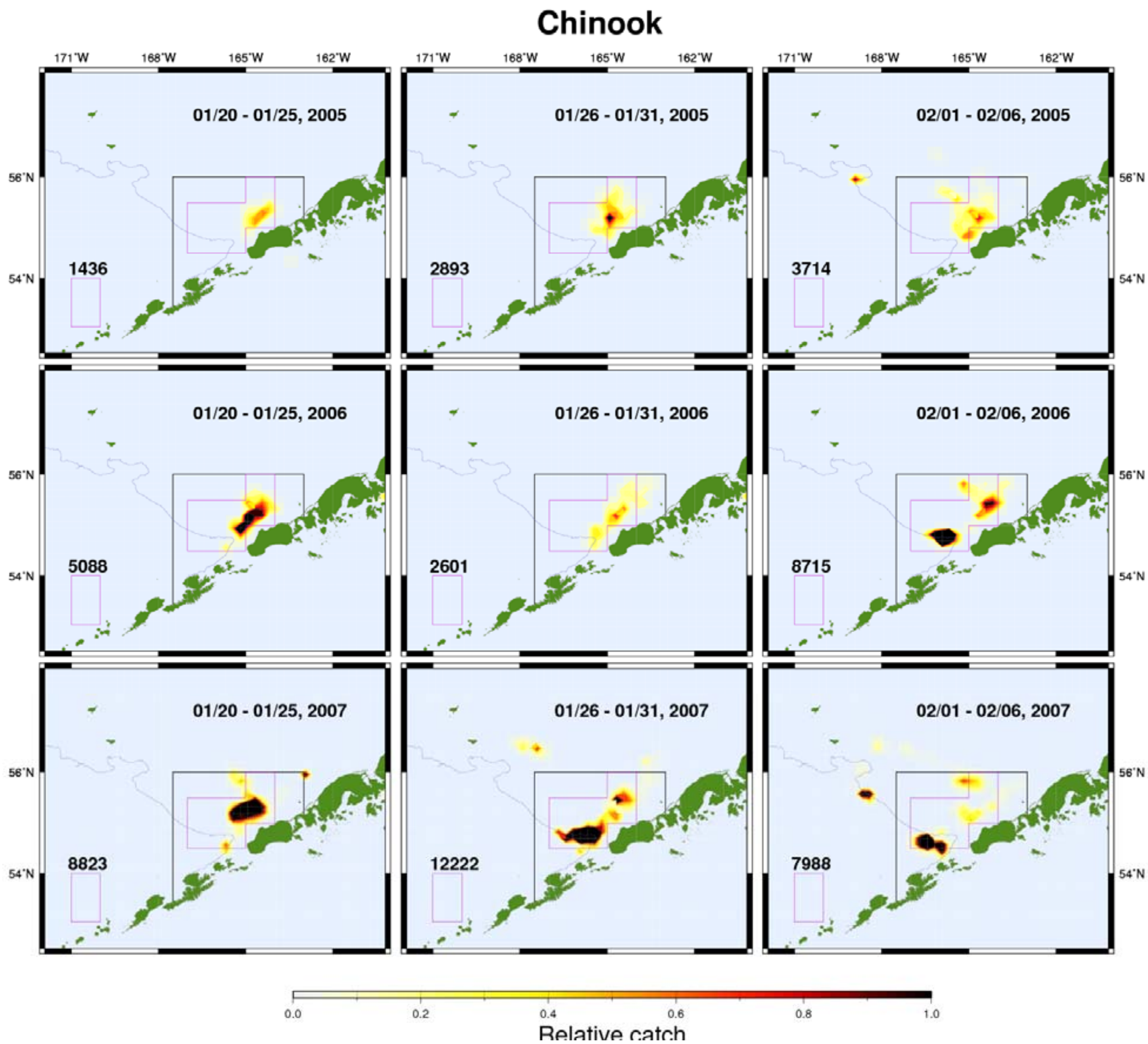


Fig. 5-26 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting Jan 20th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

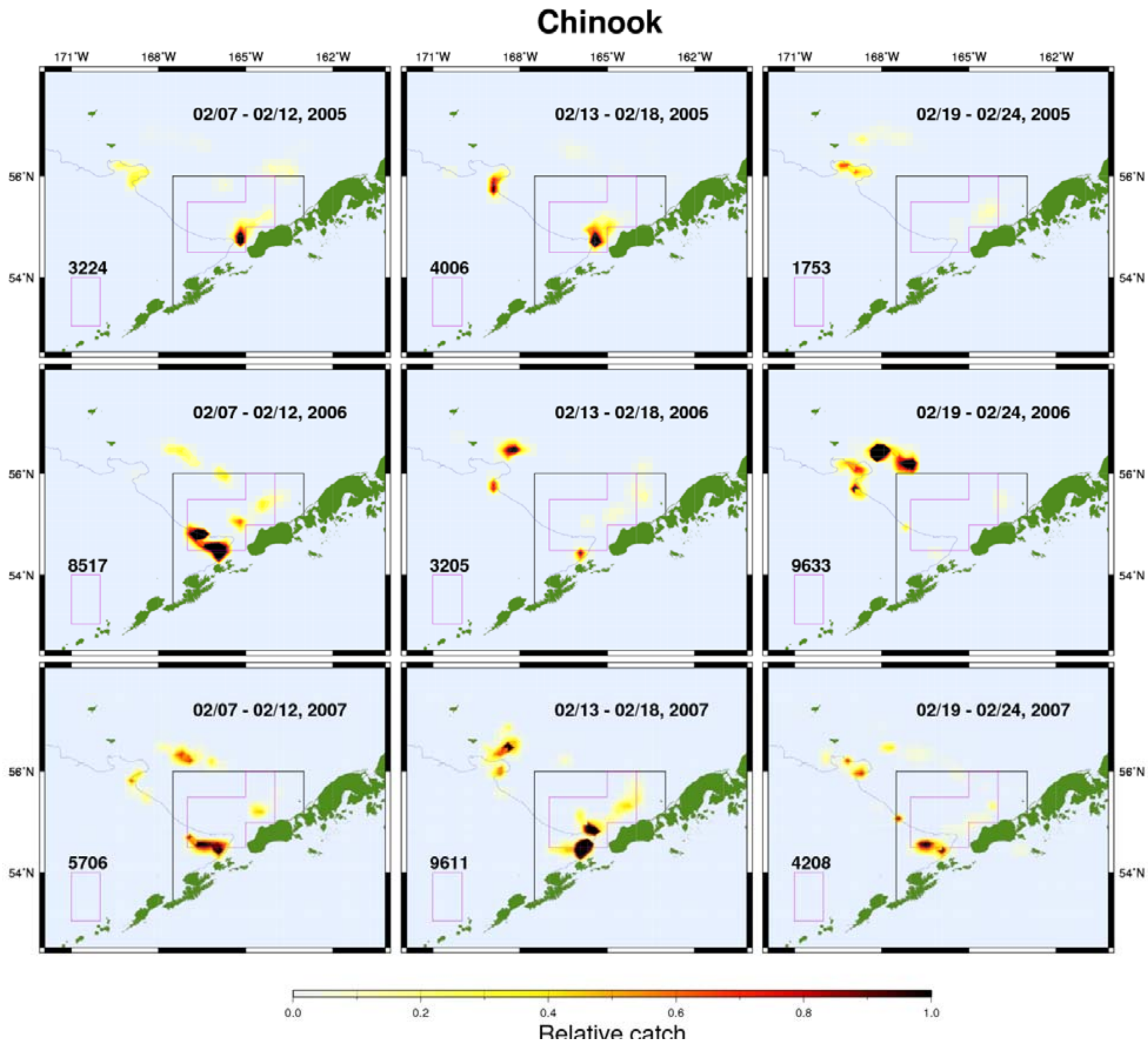


Fig. 5-27 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting Feb 7th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

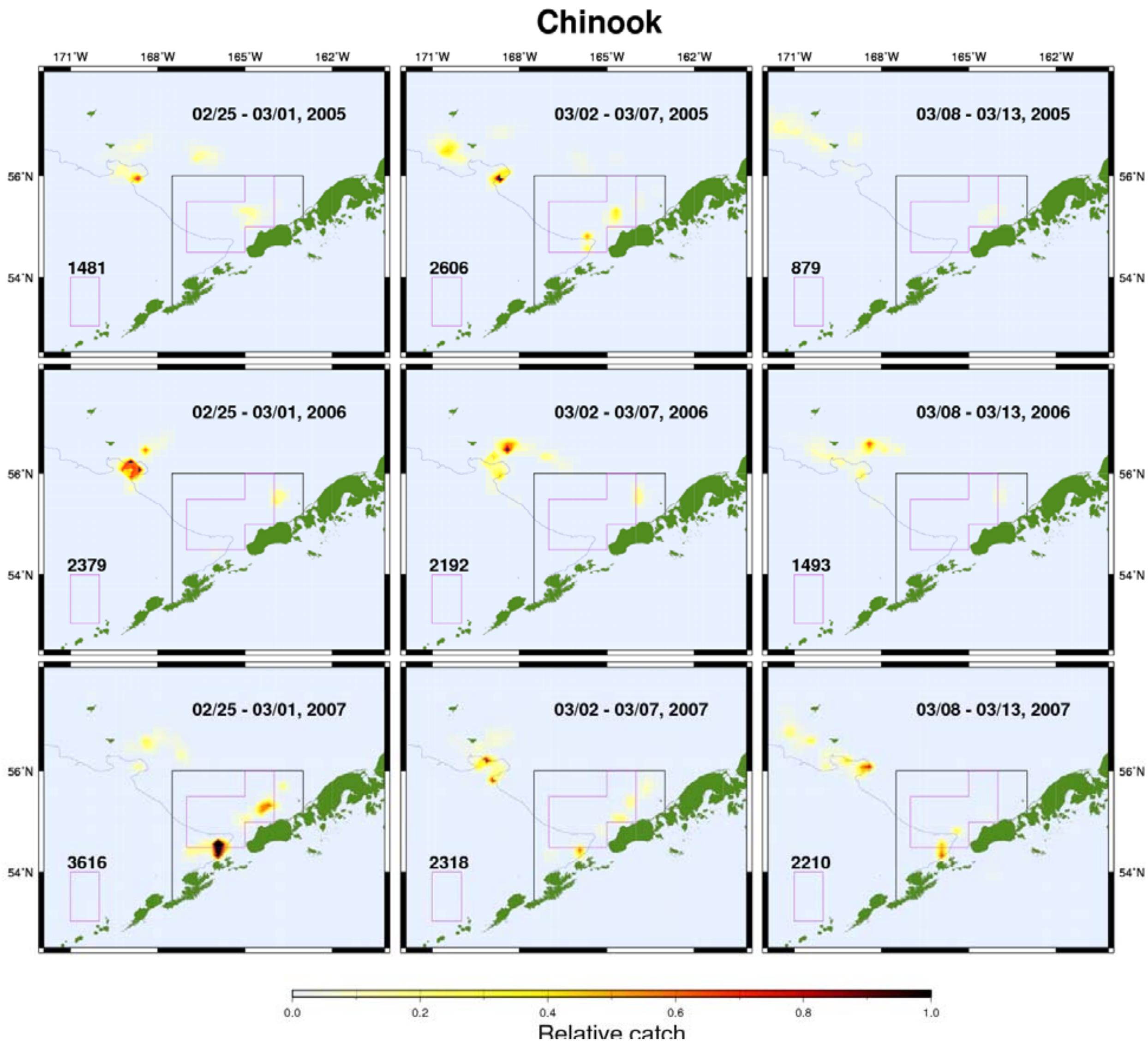


Fig. 5-28 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting Feb 25th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

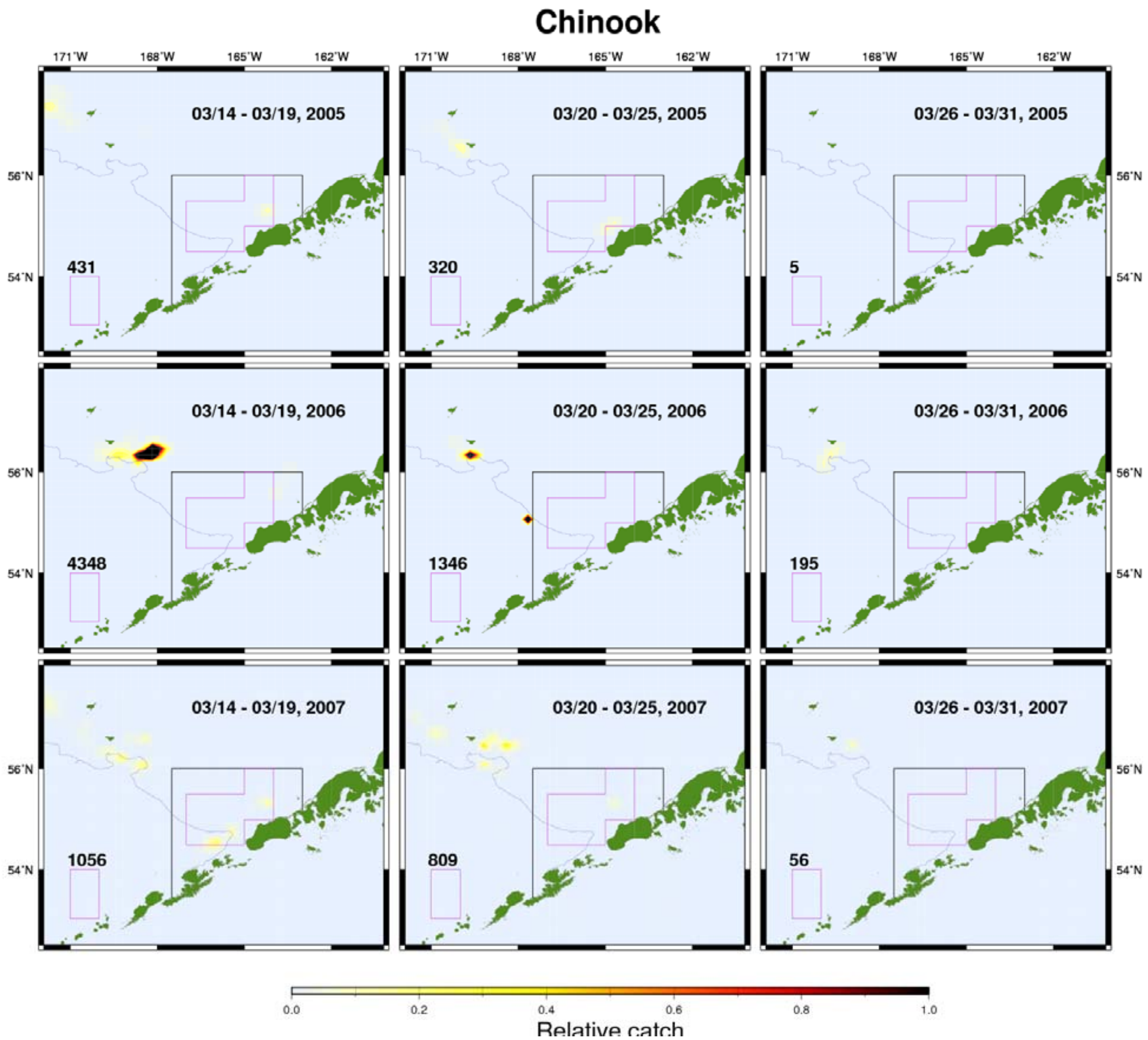


Fig. 5-29 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting March 14th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

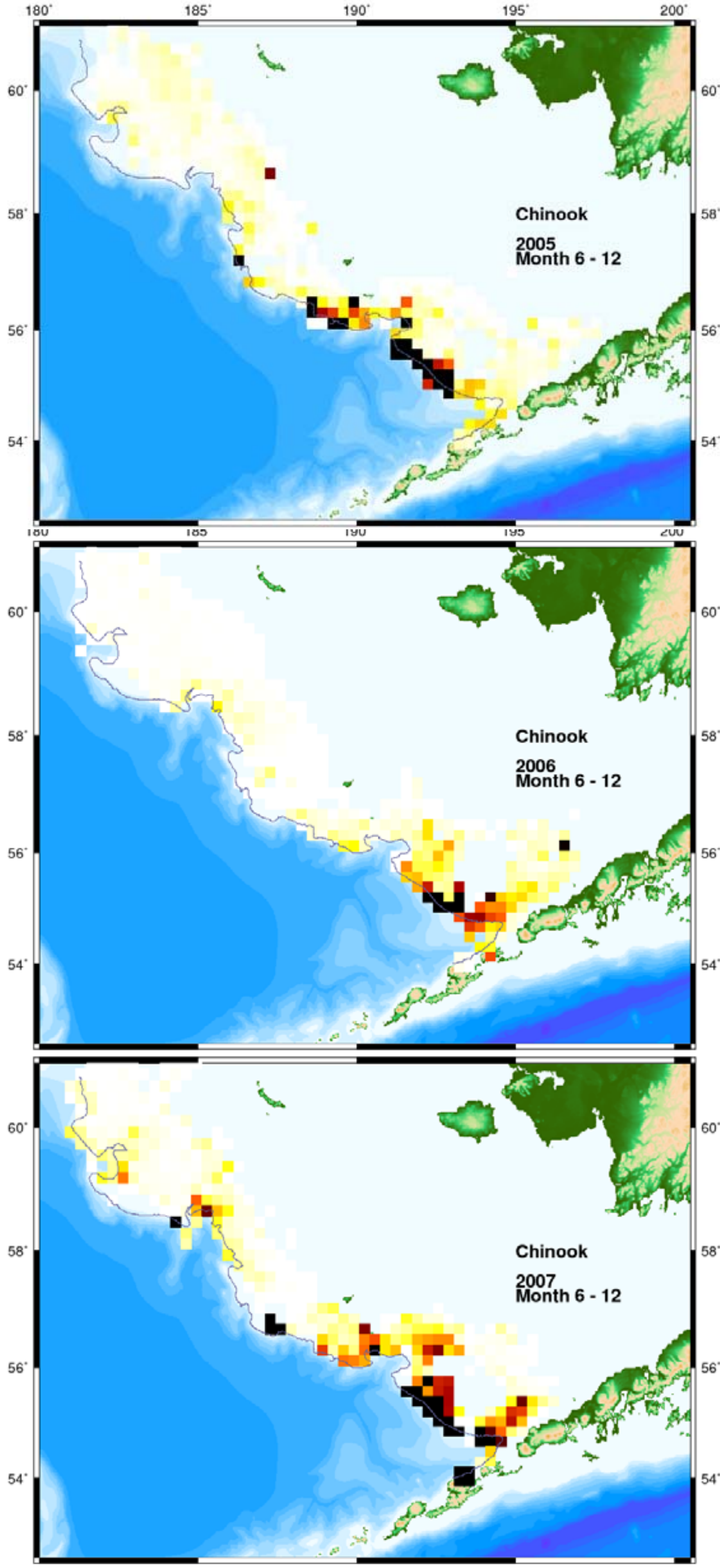


Fig. 5-30 Chinook salmon bycatch rates (darker colors mean higher numbers of Chinook / t of pollock) in the EBS pollock fishery for 2005-2007 B-season.

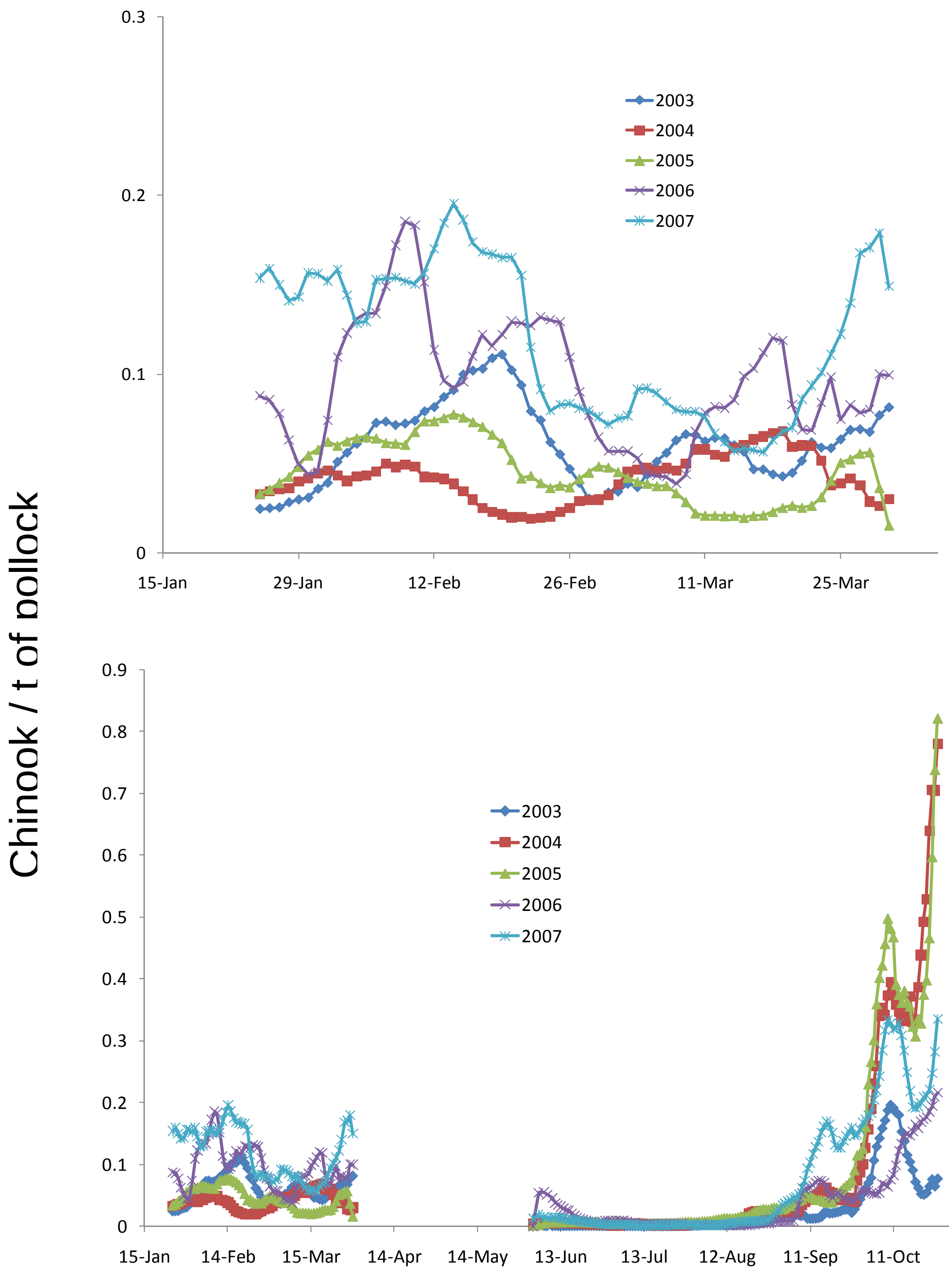


Fig. 5-31 Seasonal trends in Chinook bycatch rates (number / t) for the A-season (top) and for the entire year (bottom) 2003-2007.

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. 5-32). 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. 5-33). Over time, tow duration in October has steadily increased (Fig. 5-34).

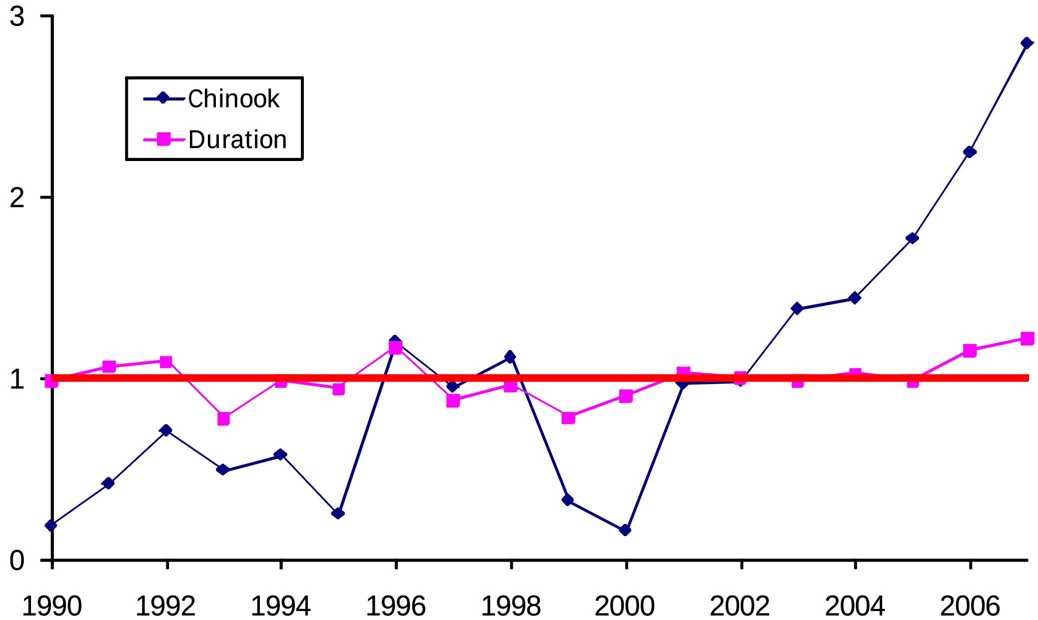


Fig. 5-32 Standardized (to have mean values of 1) relative Chinook catch and pollock fishing effort (annual total hours spent towing).

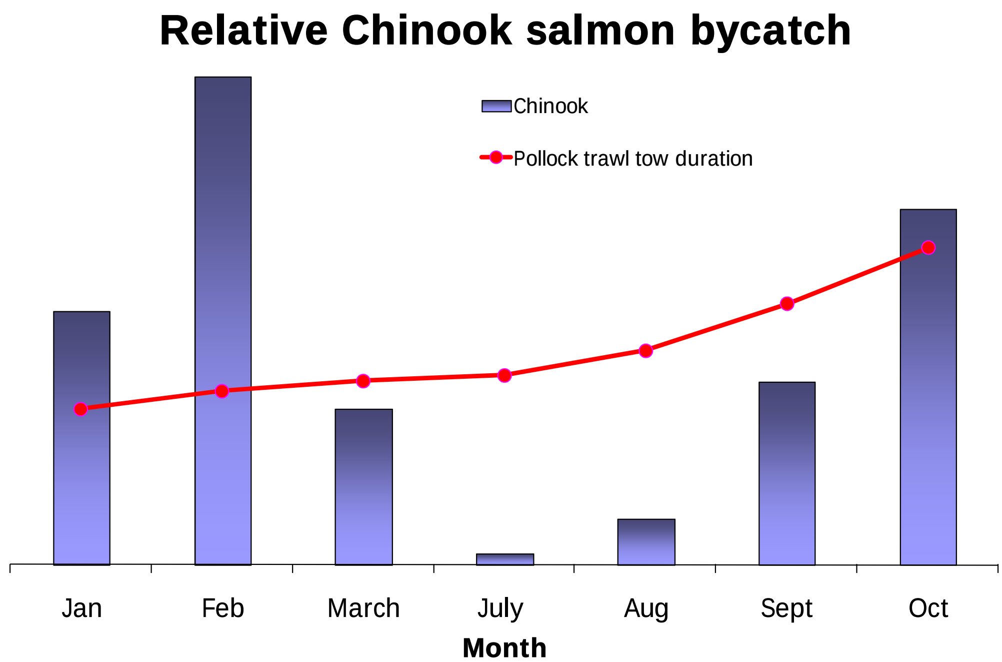


Fig. 5-33 Average relative Chinook bycatch (columns) and tow duration (marked line) by month based on NMFS observer data, 1991-2007.

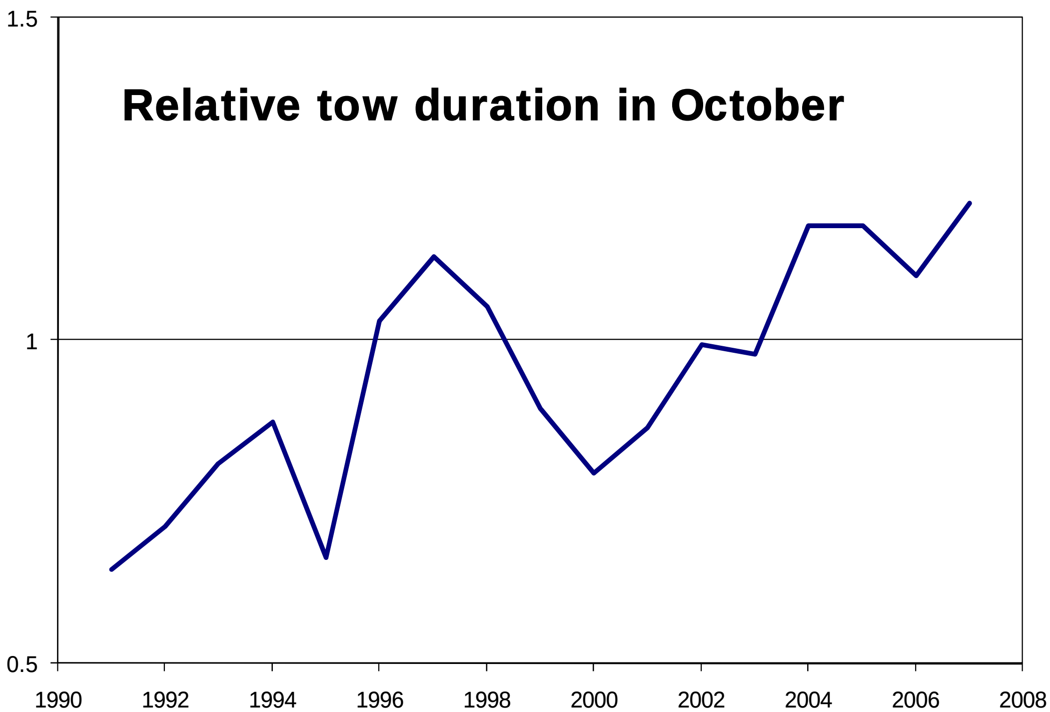


Fig. 5-34 Average relative tow duration (scaled to have mean value of 1.0) for October based on NMFS observer data, 1991-2007.

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 5-22). 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 a seasonal basis (Fig. 5-36). Catch by the mothership sector in the A season has always been lower than the other two sectors. Mean Chinook rates (number per 1,000 t of pollock) were presented for summary purposes and shows higher rates during the A-season compared to the B season except for 2005 where the average rates in both seasons were similar (though varied by sector; bottom panel of Table 5-22).

In the B season 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). To illustrate the relative difference between sectors, Table 5-23 shows the contrast of bycatch sector-specific patterns within aggregate season and annual mean levels. This shows a fair degree of inter-annual variability in the relative rates by sectors. The 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).

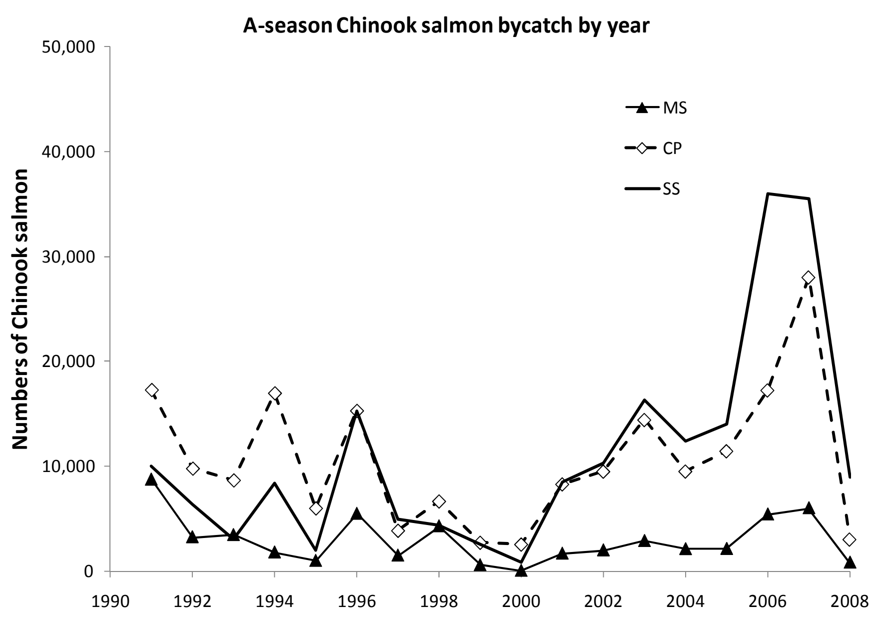


Fig. 5-36 Chinook salmon catch by sector in pollock fishery A season 1991-2008. Data are shown by inshore catcher vessel sector (solid line), offshore catcher processor (dotted line with diamonds) and mothership sector (solid line with triangles).

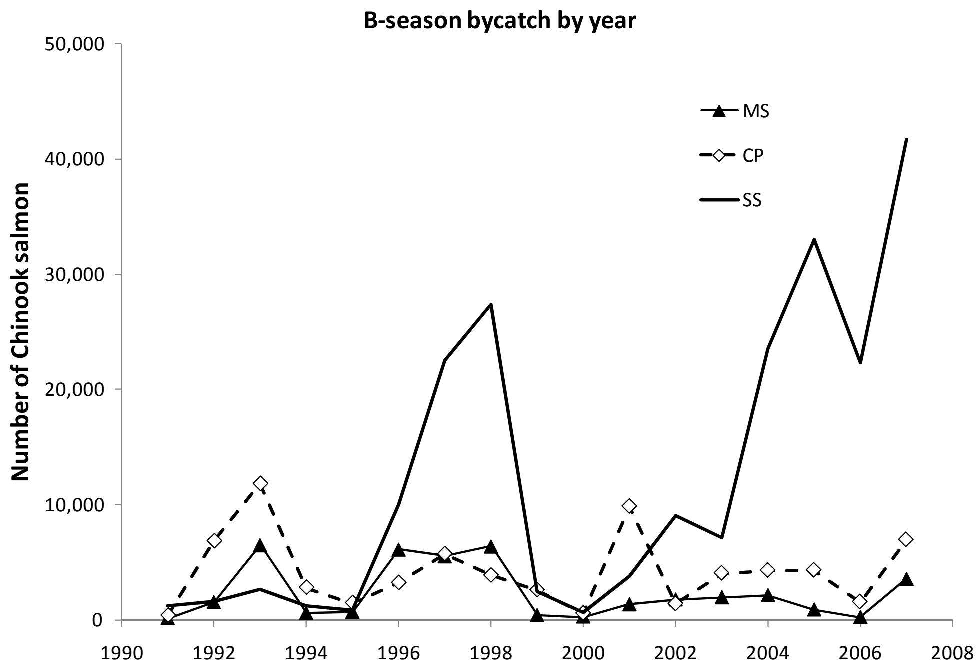


Fig. 5-37 Chinook salmon catch by sector in pollock fishery B season 1991-2007. Data are shown by inshore catcher vessel sector (solid line), offshore catcher processor (dotted line with diamonds) and mothership sector (solid line with triangles).

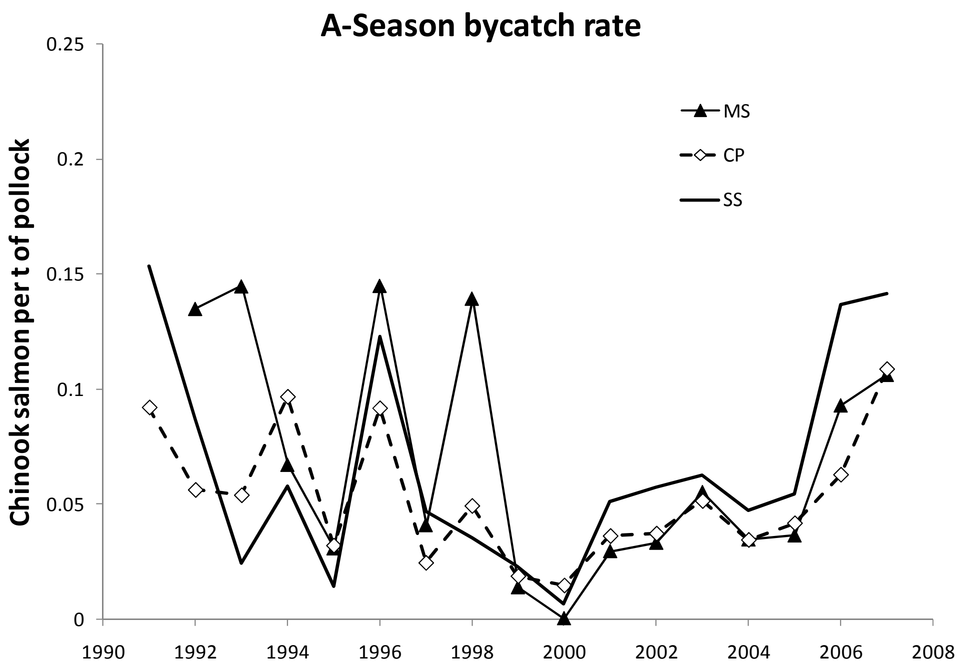


Fig. 5-38 Chinook salmon A season bycatch rates by sector (Chinook per t pollock). Inshore catcher vessel (solid line), offshore catcher processor (dashed line with diamonds) and mothership sector (solid line with filled triangles), 1991-2007.

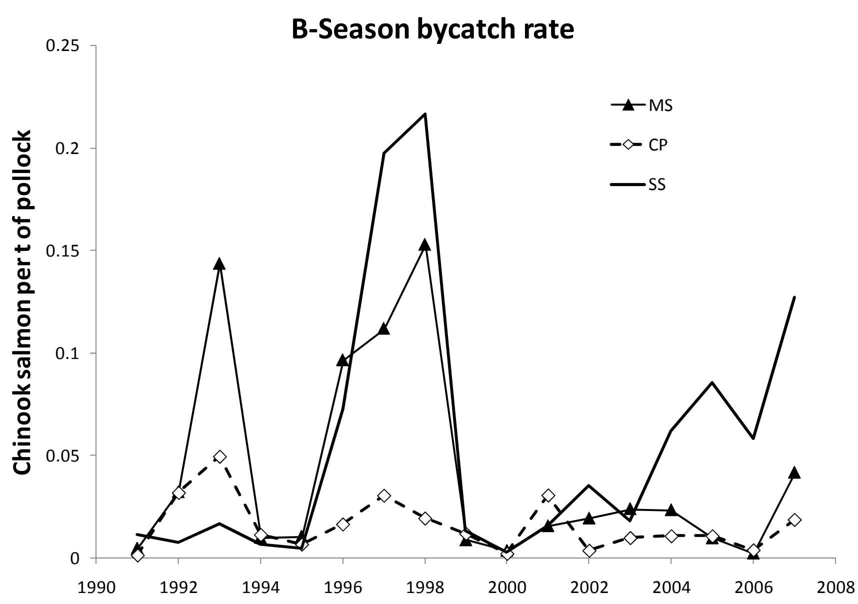


Fig. 5-39 Chinook salmon B season bycatch rates by sector (Chinook per t pollock). Inshore catcher vessel (solid line), offshore catcher processor (dashed line with diamonds) and mothership sector (solid line with filled triangles), 1991-2007.

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. Catches from CDQ are included. M=Mothership sector, P=catcher processor sector, and S=shoreside catcher-vessel sector.

Pollock (t)

Season	Sector	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

	Sector	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

	Sector	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. M=Mothership sector, P=catcher processor sector, and S=shoreside catcher-vessel sector.

Season	Sector	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 Alternative 2 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; RIR).

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 Alternative 2 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 Alternatives 4 and 5 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 these alternatives. 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 annual scenarios 1 and 2 under Alternatives 4 and 5. These 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 and 5 bycatch levels and comparison of options

Alternatives 4 and 5 prescribe specific combinations of options, as described in Section 2.4 and Section 2.5. In analyzing these alternatives, 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 Alternative 5 against alternative combinations in Alternative 2 and 4 as well as to indicate which options are driving the observed impacts under Alternatives 4 and 5.

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 5-35 through Table 5-39. All tables have a similar format and structure. The first column indicates the annual scenario; the second transferability. Scenarios with A season transferability ('Yes') indicates that fishing sectors that have met their pollock allocation can transfer remaining salmon bycatch allowances. Transferability is the default assumption for the B season. The subsequent 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 alternatives and the impact of the different rollover provisions, given these assumptions and perturbations.

Alternative (4 or 5). Annual scenario AS1 or AS2

If assume perfect transferability in A season then 'yes'. Otherwise no transferability

Amount rollover to B season from A season remainder. Default under Alt 4 is 80%. For contrast 0 and 100% are analyzed. Alt 5 is 100%.

All B season bycatch assumed perfect transferability

Alt 4 AS	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 Alternative 4 and 5 impact tables.

Table 5-31 Dates of closures under Alternative 4 AS1 and AS2, with an 80% A-B season rollover provision.

Alt 4 AS	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 Alternative 4 AS1 and AS2, with 0 and 100% A-B season rollover provisions

Alt 4 AS	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.

Table 5-33 Dates of pollock fishery closures under Alternative 5, with and without A-season transferability.

		A-Season				B-Season			
Transferability	Year	CDQ	M	P	S	CDQ	M	P	S
No	2003	---	---	---	---	---	---	---	---
	2004	---	---	---	---	---	---	---	---
	2005	---	---	---	---	---	---	---	26-Oct
	2006	---	21-Feb	13-Mar	15-Feb	---	---	---	19-Oct
	2007	---	12-Feb	12-Feb	11-Feb	8-Oct	21-Oct	6-Oct	5-Oct
Yes	2003	---	---	---	---	---	---	---	---
	2004	---	---	---	---	---	---	---	---
	2005	---	---	---	---	---	---	---	26-Oct
	2006	---	21-Feb	14-Mar	17-Feb	---	---	---	19-Oct
	2007	---	13-Feb	12-Feb	11-Feb	8-Oct	21-Oct	6-Oct	5-Oct

Cap level

Two cap levels are evaluated under each alternative (Alternatives 4 and 5) based upon the two annual scenarios, as described in Section 2.4 and Section 2.5. This analysis assumes that the entire fleet is operating under either the high cap (annual scenario 1) of 68,392 (Alternative 4), 60,000 (Alternative 5) or the lower cap of 47,591 (annual scenario 2 for both Alternatives 4 and 5). A separate section below discusses the implications of ‘opting out' of the ICA or IPA under annual scenario 1, 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 and Section 2.5).

Seasonal allocation and sector split

The annual scenarios under both Alternatives 4 and 5 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 sector split options under Alternative 2 do not include this specific seasonal sector allocations prescribed in Alternatives 4 and 5. 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 Alternative 2 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 Alternatives 4 and 5 consider 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

Alternative 4 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. Alternative 5 includes a prescribed rollover of 100% from A to B season. Given that Alternative 2 options were analyzed without such a provision, some comparative information was computed for Alternative 4 (only) to evaluate rollover impacts of 0% (no rollover from A to B) and 100% (all remaining bycatch rolls over from A to B by sector). This comparative information serves to illustrate the impact of these assumptions. For clarity and to limit the number and sizes of tables presented, the assessment of different rollover provisions was provided for the Alternative 4 scenarios. For the reasons described below, results for Alternative 4 AS2 are used throughout to characterize the impacts of Alternative 5 AS2.

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 5-34 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 5-35 and Table 5-36 detail the hypothetical Chinook bycatch levels under the Alternative 4 annual scenarios, assuming 80%, 0%, 100% rollover scenarios. Table 5-38 and Table 5-39 describe the hypothetical number of salmon that would have been saved, had the Alternative 4 annual scenario caps been in place, and assuming 80%, 0%, 100% rollover scenarios.

Table 5-34 Summary of sector-specific impacts for different rollover allowances (100% and 0%) compared to the 80% seasonal rollover levels.

Sector	100% rollover compared to 80%	No rollover compared to default 80% rollover
CDQ	No change	In 2004 closures would have occurred under Alt 4 AS1 (September 23) and Alt 4 AS2 (September 12). These earlier closures would have saved an additional 675 salmon (Alt 4 AS1) and 1,112 (Alt 4 AS2) at the expense of forgone pollock of 15,995 t (Alt 4 AS1) and 37,452 t (Alt 4 AS2).
Mothership	No change	2004? B season closure on October 16 (Alt 4 AS2). 142 salmon saved and 1,447 t of forgone pollock. In 2004, closure on October 29 (Alt 4 AS1) and October 13 (Alt 4 AS2) resulting in 547 and 966 salmon saved, respectively with corresponding forgone pollock levels of 1,152 t and 3,187 t.
Catcher Processor	There would have been a 5 day delay in closure in 2005 and a one day delay in the closure in 2007. Chinook salmon bycatch levels would have increased by 154 fish in 2005 (and allow forgone pollock to decrease by 6,840 t)	Additional closures in 2004 and 2005 (Alt 4 AS2) and earlier closure in 2007 (Alt 4 AS1). 204 fewer salmon caught (2007 Alt 4 AS1) and 60 and 1,314 fewer salmon under Alt 4 AS2. Forgone pollock increases by 1,008 t (2004) 37,999 t (2005), and 1,983 t (2007).
Inshore CV	No closure in 2005 (Alt 4 AS1) and delayed closures by 1-3 days in 2004 and 2006 (Alt 4 AS2). Chinook salmon bycatch levels would have increased by 1,949, 1,621, and 674 more salmon in 2004-2006, respectively, with corresponding decreases in forgone pollock of 4,397 t (2004), 1,498 t (2005) and 1,828 t (2006) for 100% rollover scenario, compared to 80% rollover	Additional closure in 2004 (October 11) and earlier closures in 2005 and 2006.

Table 5-35 Hypothetical Chinook salmon bycatch levels by sector for Alternative 4 AS1 and AS2, assuming **80%** allowable rollover from A to B season.

Alt 4 AS	**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	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 bycatch levels by sector for Alternative 4 AS1 and AS2, assuming 0% and 100% allowable rollover from A to B season.

Alt 4 AS	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 5-37 Hypothetical Chinook salmon bycatch levels by sector for Alternative 5 AS1. Note that estimated salmon bycatch levels under Alt 5 AS2 are considered equivalent to those under Alt 4 AS2.

	A-Season					B-Season					Annual
Year	CDQ	M	P	S	A-total	CDQ	M	P	S	B-total	Total
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	26,817	31,988	59,600
2006	1,804	3,285	14,354	21,612	41,056	157	164	1,431	17,119	18,871	59,927
2007	3,634	3,382	13,264	20,437	40,718	965	1,283	3,289	12,146	17,683	58,401

Table 5-38 Hypothetical Chinook salmon saved (relative to estimated mortalities) by sector for Alternative 4 AS1 and AS2, assuming **80% allowable** rollover from A to B seasons.

	A-season		A-Season					B-Season					Annual **Total**
Alt 4 AS	Transfer-Ability	Year	CDQ	M	P	S	A **total**	CDQ	M	P	S	B **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 5-39 Hypothetical Chinook salmon saved (relative to estimated mortalities) by sector for Alt 4 AS1 and AS2, assuming **0% and 100% allowable** rollover from A to B seasons.

Alt 4 AS	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	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**

Table 5-40 Hypothetical Chinook salmon saved (relative to estimated mortalities) by sector for Alternative 5 AS1. Note that for comparative purposes Alt 5 AS2 are considered equivalent to those under Alt 4 AS2.

	A-Season					B-Season					Annual
Year	CDQ	M	P	S	A-total	CDQ	M	P	S	B-total	Total
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	6,206	6,206	6,206
2006	0	1,352	1,840	14,368	17,559	0	0	0	5,163	5,162	22,721
2007	0	1,243	12,491	15,021	28,753	1,546	580	2,842	29,568	34,535	63,288

Transferability

Transferable bycatch quotas were included under both annual scenarios of Alternatives 4 and 5. The value of having transferable quotas within each season was evaluated by making two different fleet behavior assumptions in the A season: to operate under either perfect transferability or no transferability. This provided two contrasting sets of results for A season catch. In the B season it was assumed that the fleet would have perfect transferability.

Results show that A season transferability affects the number of Chinook salmon saved. The closure dates by sector and relative bycatch levels in 2006 and 2007 differ depending on transferability for both high and low cap levels. For example in 2006, the A-season bycatch for Alternative 4 AS1 with transferability was higher for all non-CDQ sectors compared to what would have occurred without transferability (Table 5-35; 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 fleetwide salmon cap. For the CP sector, differences are more pronounced, particularly under the lower Alternative 4 (or 5) AS2 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 5-35). 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 5-35).

5.3.4 Comparison of impacts: Alternatives 1, 2, 4 and 5

Information used to compare the impacts of Alternative 1, Alternative 4’s AS1 and AS2, Alternative 5’s AS1 and AS2, and those of Alternative 2’s components and options, is shown in Table 5-41 and Table 5-43. As noted above, the impact estimates for Alternative 5 AS2 were considered to be adequately covered based on results from Alternative 4 AS2. The difference in rollover provision (80% to 100%) between the two was demonstrated to have very minor impact on salmon saved (and only for the CV fleet).

In Table 5-41, 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 Alternative 5 AS1, Alternative 5 AS2 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 5-41 Projected fleetwide salmon bycatch, by season and annually, under Alternative 5 (annual scenarios AS 1 and AS 2), and the lowest and highest bycatch sector and season combinations for Alternative 2, for highest (2007) and lowest (2003) bycatch years[33].

Bycatch year	Alternative	Bycatch cap level	Projected salmon bycatch			Reduction from actual bycatch in that year
			A season	B season	Annual Total	
2007	Alt 5 AS1	60,000	40,718	17,683	58,401	52%
	Alt 5 AS2	47,591	32,175	14,208	46,383	62%
Actual	Lowest 2007 bycatch alternative[34]	29,300	2,801	6,557	9,358	92%
bycatch: 121,638	Highest 2007 bycatch alternative[35]	87,500	40,415	36,828	77,243	37%
2003	Alt 5 AS1	60,000	33,578	13,113	46,691	0%
	Alt 5 AS2	47,591	31,520	13,113	44,633	5%
Actual	Lowest 2003 bycatch alternative[36]	29,300	11,550	11,084	22,634	52%
bycatch: 46,691	Highest 2003 bycatch alternative[37]	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), Alternative 5 AS1 would have resulted in a 52% reduction overall in Chinook bycatch, from the actual amount caught. Alternative 5 AS2, 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 Alternative 5 AS1 or AS2 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 5-42 and Table 5-43 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). Alternative 5 AS1 and AS2 are compared against results from Alternative 4 as well as 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 5-42 summarizes total salmon savings in bycatch numbers and adult equivalents, under the scenarios. Table 5-43 indicates the distribution of adult equivalent salmon to selected river systems. Additional scenarios for different

[33] The analysis was based on bycatch data from 2003-2007, retrieved from the CAS in 2008.
[34] Option 2d sector split, 70/30 seasonal split
[35] Option 2a sector split, 50/50 seasonal split
[36] Option 1 sector split, 50/50 seasonal split
[37] 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]

cap, seasonal and sector splits, as compared against Alternatives 4 and 5 annual scenarios, are included in Sections 5.3.4.1 and 5.3.2.2.

Table 5-42 Total projected reduction of Chinook salmon bycatch levels, and adult equivalent salmon bycatch. Compares Alternative 5 annual scenarios 1 and 2, Alternative 4 annual scenarios 1 and 2, and the highest and lowest caps of comparable seasonal and sector combinations of Alternative 2, using 2007 results.

	Alt 5 AS1	Alt 5 AS2	Alt 4 AS1 (note Alt 4 AS2 results identical to Alt 5 AS2)	Alt2 cap 87,500 Opt2d 70/30	Alt2 cap 29,300 Opt2d 70/30
Number of salmon bycatch saved	63,288	75,306	55,307	46,766	112,280
Adult equivalent salmon saved	27,119	40,843	26,928	22,417	65,476

Table 5-43 Projected reduction of adult equivalent salmon bycatch, in number of salmon, by region of origin (based on genetic aggregations). Compares Alternative 5 annual scenarios 1 and 2, Alternative 4 annual scenarios 1and 2, 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[38]	Alt 5 AS1	Alt 5 AS2	Alt 4 AS1 (note Alt 4 AS2 results identical to Alt 5 AS2)	Alt2 cap 87,500 Opt2d 70/30	Alt2 cap 29,300 Opt2d 70/30
Yukon	5,396	8,840	5,228	3,299	14,938
Kuskokwim	3,507	5,746	3,398	2,144	9,710
Bristol Bay	4,586	7,514	4,443	2,804	12,697
Pacific Northwest aggregate stocks (PNW)	8,444	11,135	8,489	9,581	15,507
Cook Inlet stocks	912	1,202	1,042	1,010	1,284
Transboundary aggregate stocks (TBR)	617	821	699	670	909
North Alaska Peninsula stocks (N.AK)	2,882	4,389	2,318	2,264	8,594
Aggregate 'other' stocks	592	865	534	549	1,495

Alternative 5 AS1 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.

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

5.3.4.1 Comparison of 2007 projected bycatch levels under Alternatives 2, 4, and 5

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 5-44) compared with Alternative 4 (Table 5-45) and Alternative 5 (Table 5-46). 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.

Table 5-44 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 5-45 Annual totals of hypothetical Chinook salmon bycatch levels, in numbers of fish, under Alternative 4 AS 1 and 2 scenarios for sector and season specific caps for 2007.

Alt 4 Annual 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**

Table 5-46 Annual totals of hypothetical Chinook salmon bycatch levels, in numbers of fish, under Alternative 5 for sector and season specific caps for 2007. Note salmon bycatch results were not analyzed for the 'no' transferability assumption for Alternative 5 as explained in section 5.3.3.

Alt 5 Annual Scenario	Transferability	Sector	Annual total
1	No	CDQ	N/A
		M	N/A
		P	N/A
		S	N/A
		Total	N/A
	Yes	CDQ	5,363
		M	25,016
		P	126,811
		S	193,871
		Total	351,061
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 Impacts for 2008 and 2009

The primary analytical timeframe for impacts analysis is 2003-2007. However, given updated catch information it is possible to estimate some of the potential for fleet impacts in 2008 and 2009. Table 5-47 compares actual catch by sector and season in 2008 and 2009 with the cap levels by season and sector of the 47,591 Chinook salmon cap in Alternatives 4 and 5 and the lowest cap under consideration, the Alternative 2 cap of 29,300 Chinook salmon with the 70:30 seasonal and option 2d sector allocations. Note that under Alternative 5, 47,591 Chinook salmon is also the performance standard. While NMFS will annually calculate each sector's annual performance threshold, that threshold will be similar to that sector's annual allocation of 47,591 Chinook salmon.

Under Alternatives 4 and 5, none of the sectors would have exceeded their seasonal and sector-specific cap allocation in 2008 or 2009, or the annual cap over in either 2008 or 2009. The low cap is used as a basis for considering whether any of the sectors would have been constrained under the alternatives in the more recent years. None of the caps that would have been imposed under the most restrictive cap level would have been reached in either season by any of the sectors.

Table 5-47 Sector and seasonal caps, in numbers of Chinook salmon, for the Alternative 5 and Alternative 4 cap of 47,591 Chinook salmon and Alternative 2 cap of 29,300 Chinook salmon compared to actual bycatch by sector and season in 2008 and 2009.

	A-season				B-season				Total		
Sector	Sector/ Season allocation of 29,300 cap	Sector/ Season allocation of 47,591 cap	2008 actual bycatch	2009 actual bycatch	Sector/ Season allocation of 29,300 cap	Sector/ Season allocation of 47,591 cap	2008 acual bycatch	2009 actual bycatch	Annual Sector allocation of 47,591 cap	2008 Annual total bycatch	2009 Annual total bycatch
C/P	5,845	10,960	4,091	2,738	2,505	2,556	377	310	13,516	4,468	3,048
Mothership	1,538	2,665	1,125	547	659	1,042	175	86	3,707	1,300	633
CV	11,793	16,590	9,815	6,030	5,054	9,894	4,271	2,252	26,484	14,086	8,282
CDQ	1,333	3,098	604	358	571	785	36	89	3,883	640	447
Total	20,510	33,314	15,635	9,673	8,790	14,277	4,859	2,737	47,591	20,494	12,410

AEQ levels are not estimated for 2008 and 2009. The AEQ for each year considers both removals in that year as well as the lagged impact of age-specific removals in previous years. While bycatch levels in 2008 and 2009 are much lower than previous years, the AEQ estimate for those years would likely be higher than the actual bycatch due to the lagged impacts of the high removals in previous years, particularly the highest year in 2007. This is shown graphically in Fig. 5-43. As noted in these sections, while this impact analysis does not predict impacts past 2007, the 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.

5.3.4.3 Comparison of Alternatives 2, 4, and 5 for Chinook salmon saved and forgone pollock

Selection of the final preferred alternative involved explicit consideration of trade-offs between the potential salmon saved and the forgone pollock catch (see Section 2.5). In this section, summary information is provided to indicate the range of Alternative cap levels and their estimated salmon saved and the forgone pollock over the highest bycatch year analyzed (2007) and the lowest bycatch year analyzed (2003) (Table 5-48). Alternative 2 cap levels (with explicit seasonal and sector splits as noted) are compared with the Alternative 4 and Alternative 5 annual scenarios (AS1 and AS2). 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 preferred alternative (Alternative 5) falls between these high and low levels, as indicated. The Council's Alternative 5 AS1 would indicate a higher percentage of salmon bycatch reduction than the 87,500 cap for a slightly higher (3% increase) reduction in pollock catch. However in a lower bycatch year (such as 2003), Alternative 5 AS1 results in limited reduction in salmon bycatch and corresponding reduced pollock catch. In low bycatch years, only the lowest cap considered (29,300) is estimated to achieve substantial bycatch reduction.

Table 5-48 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[39]	37%	22%
	68,392 (Alt 4 AS1)	46%	23%
Actual bycatch= 121,638	60,000 (Alt 5 AS1) Council Pref. Alt (high)	52%	26%
	47,591 (Alt 5 AS 2) Council Pref. Alt (low)	62%	32%
	29,300[40]	92%	46%
2003 (lowest)	87,500[41]	0%	0%
	68,392 (Alt 4 AS1)	0%	0%
Actual bycatch= 46,691	60,000 (Alt 5 AS1) Council Pref. Alt (high)	0%	0%
	47,591 (Alt 5 AS2) Council Pref. Alt (low)	5%	4%
	29,300[42]	52%	22%

The combination of sector and seasonal allocations, as presented under Alternatives 2, 4, and 5 show that the impact of the alternative options on total bycatch numbers and numbers forgone pollock vary by year (Fig. 5-41). Selection of the preferred alternative (as described in Section 2.5) considered the tradeoffs between salmon saved and pollock forgone under this range of sector and seasonal allocations, understanding that impacts are variable by year. Fig. 5-41 plots the results for the subset of Alternative 2 options that are analyzed, in comparison with the Alternative 4 and 5 annual scenarios, for the period 2003-2007. The Alternative 2 options are illustrated by open circles, open squares, and open diamonds. Alternative 4 AS1 is illustrated by closed circles, Alternative 4 (and Alternative 5) AS2 by closed triangles and Alternative 5 AS1 by stars. 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.

[39] Option 2a sector split, 50/50 seasonal split
[40] Option 2d sector split, 70/30 seasonal split
[41] 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]
[42] Option 1 sector split, 50/50 seasonal split

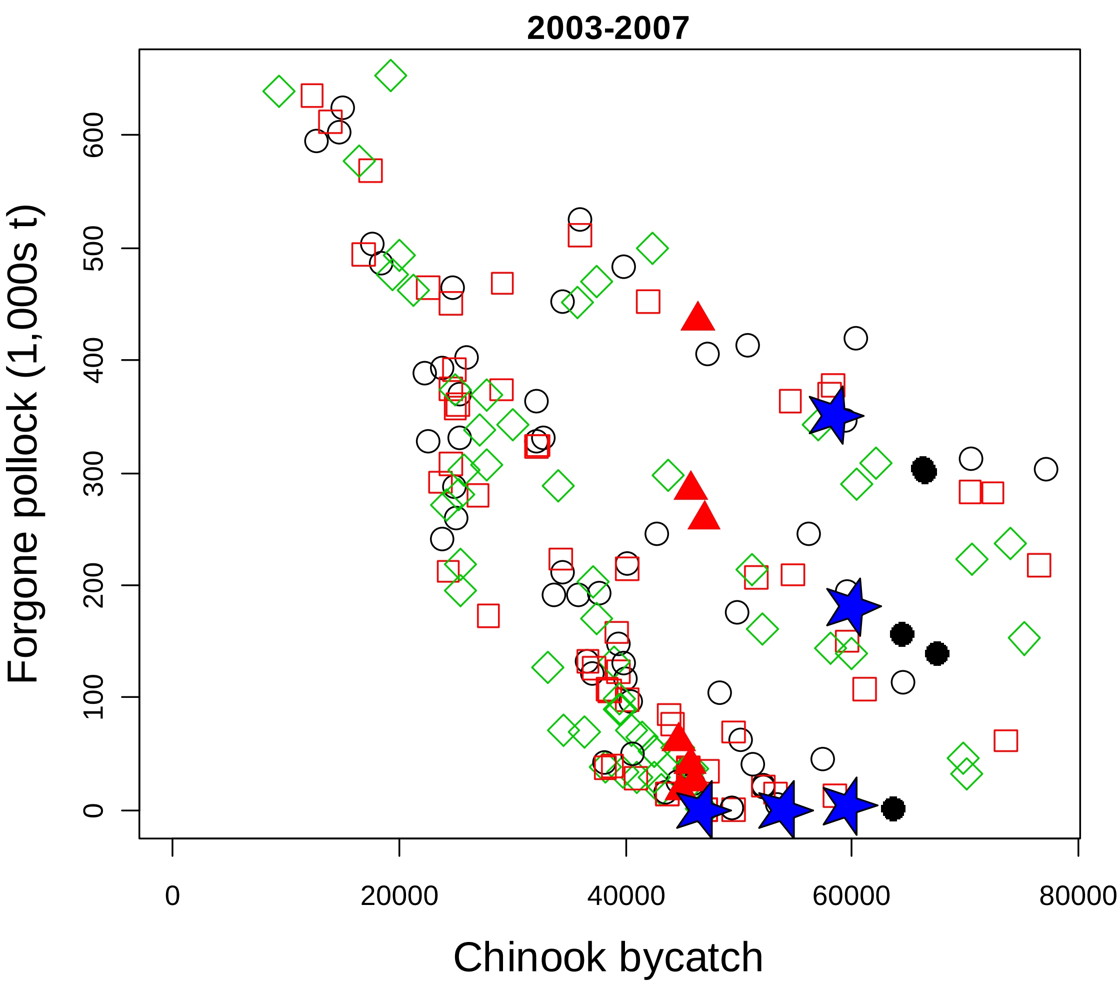


Fig. 5-41 Comparisons of hypothetical Chinook bycatch (numbers, horizontal axis) and forgone pollock (thousands of t, vertical axis) for all Alternative 2 options analyzed (open circles, open squares and open diamonds) as compared to the Alt 4 AS1 (closed circles), Alt 5 (and Alt 4) AS2 (closed triangles) and Alt 5 AS1(stars). Results are for all years analyzed (2003-2007).

Fig. 5-42 compares Alternative 4 and 5 annual scenarios, by year (open circles, triangles, or stars 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 Alternatives 4 and 5 for sector and seasonal split.

For Alternatives 4 and 5, 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 Alternative 5 AS 1 resulted in lower levels of forgone pollock but higher levels of bycatch (Fig. 5-42). Results implementing Alternative 5 AS 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.

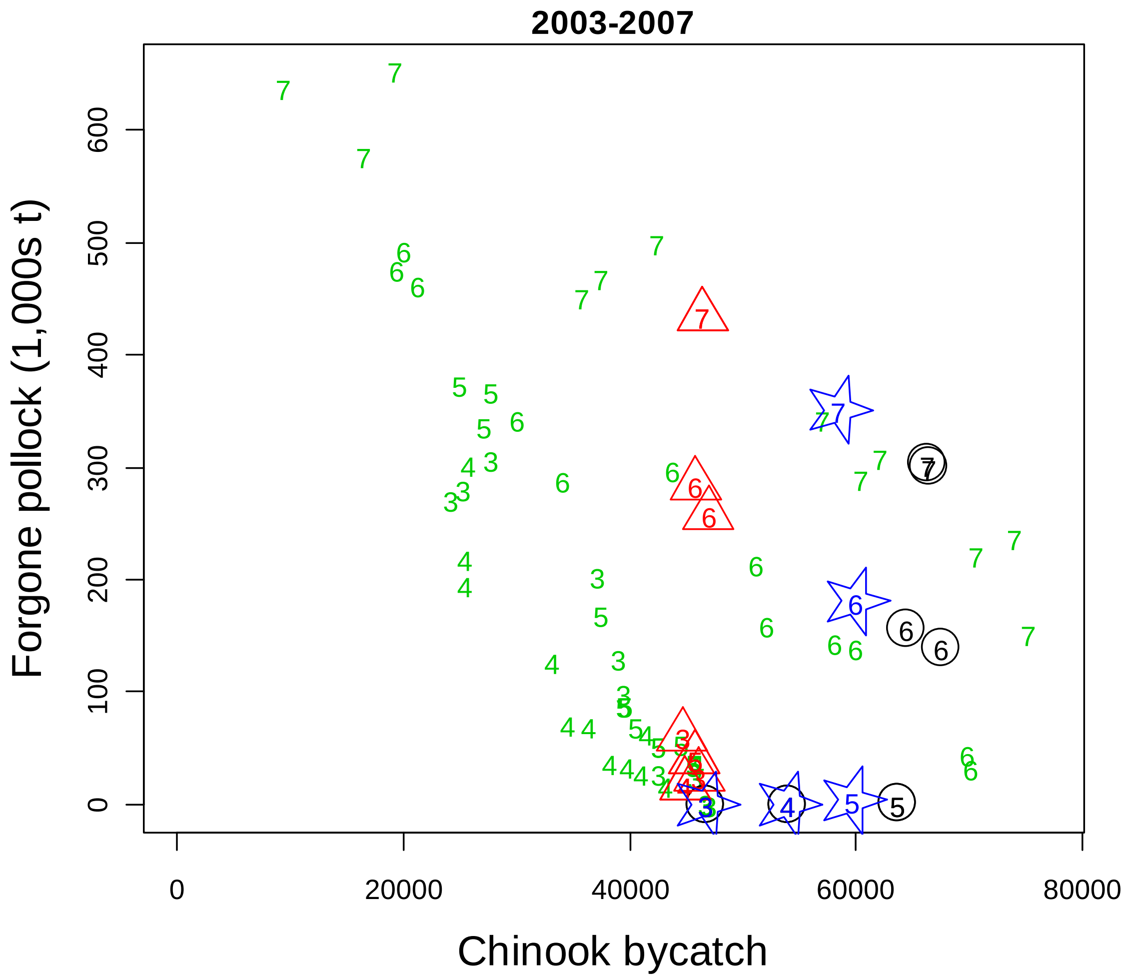


Fig. 5-42 Comparisons of hypothetical Chinook bycatch (numbers, horizontal axis) and forgone pollock (thousands of t, vertical axis) for Alt 4 AS1 (circles), Alt 5 (and Alt4) AS2 (triangles) and Alt 5 AS1(stars). Numbers represent the year (i.e., 6=2006, 7=2007 etc) and those not enclosed by symbols 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, 4 and 5

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 5-49 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 5-49 Proportions of the bycatch occurring within each stratum under the different annual scenarios in Alternatives 4 and 5 (AS1, AS2), 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 Alternatives 4 and 5).

	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%
Alt 5 AS 1	72%	44%	46%	69%	70%	10%	13%	18%	4%	8%	18%	43%	36%	28%	22%
Alt 5 AS 2	72%	53%	60%	70%	69%	10%	13%	16%	4%	8%	18%	33%	24%	26%	22%
Alt 4 AS 1	72%	44%	43%	70%	70%	10%	13%	18%	3%	8%	18%	43%	39%	27%	22%
Alt 4 AS 2	72%	53%	60%	70%	69%	10%	13%	16%	4%	8%	18%	33%	24%	26%	22%
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 5-50 and Table 5-51 displays the adult equivalent Chinook salmon bycatch mortality totals for the two annual scenarios in Alternatives 4 and 5, and Table 5-50 displays similar results for Alternatives 4 and 5 annual 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 5-50). For Alternative 5 annual scenarios, the average AEQ bycatch mortality was 80% and 69% of the average bycatch mortality with no cap in place.

Table 5-50 Hypothetical adult equivalent Chinook salmon bycatch mortality **totals** under each cap in Alternative 4 and 5(AS 1 and AS2[43]) 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**	
Alternative 5 AS1	33,454	38,140	39,431	47,165	51,695	80%
Alternative 5 AS1	32,607	36,338	35,986	37,263	37,971	69%
Alternative 4 AS1	33,629	38,350	39,517	47,971	51,886	81%
Alternative 4 AS 2	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 Alternatives 4 and 5.

[43] Annual scenarios have 70:30 A:B season split, 80% rollover from the A to B season (Alt 4), 100% rollover from the A to B season (Alt 5) 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.

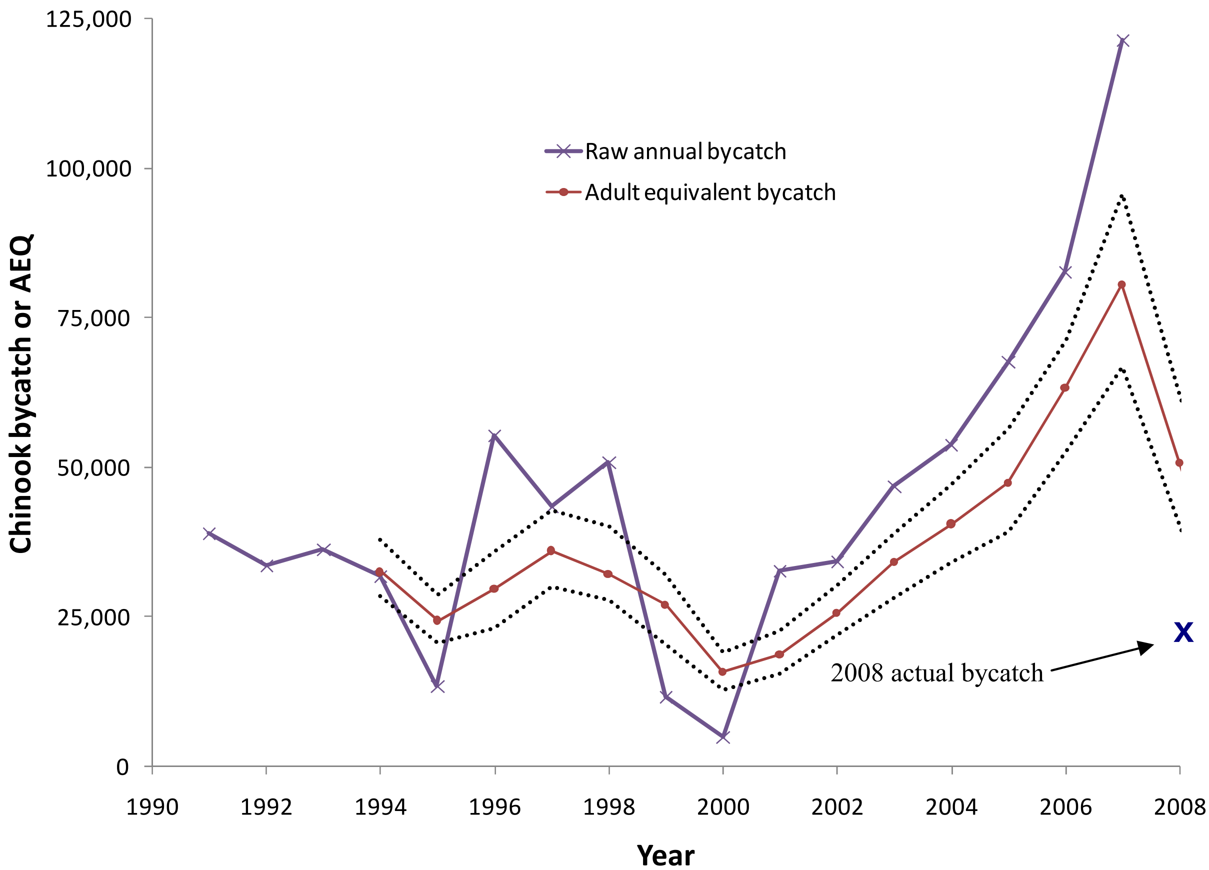


Fig. 5-43 Time series of Chinook actual and adult equivalent bycatch from the pollock fishery, 1991-2007 (2008 raw annual bycatch also indicated separately). The dotted lines represent the uncertainty of the AEQ estimate, due to the combined variability of ocean mortality, maturation rate, and age composition of bycatch estimates.

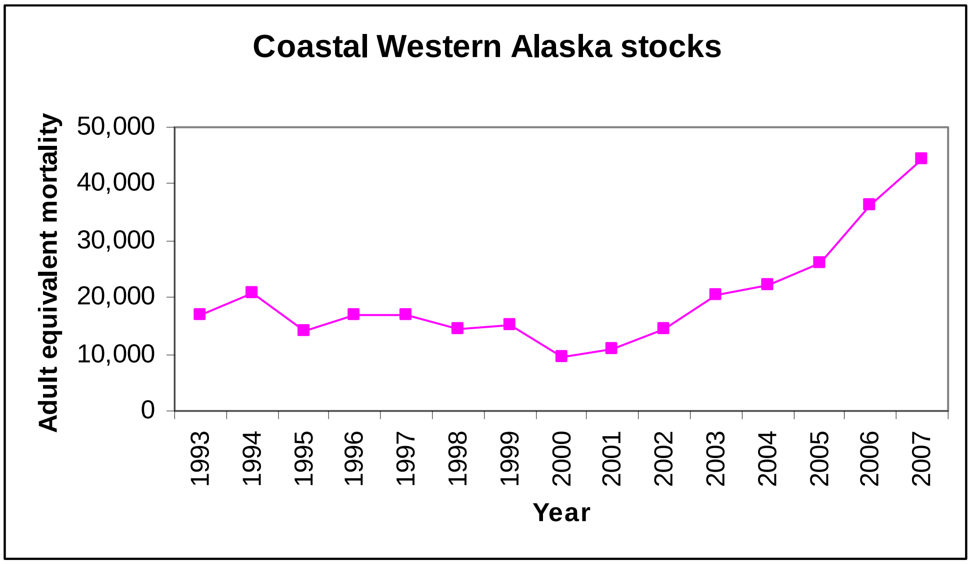


Fig. 5-44 Annual estimated pollock fishery adult equivalent removals on stocks from the Coastal western Alaska returns, 1993-2007.

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.

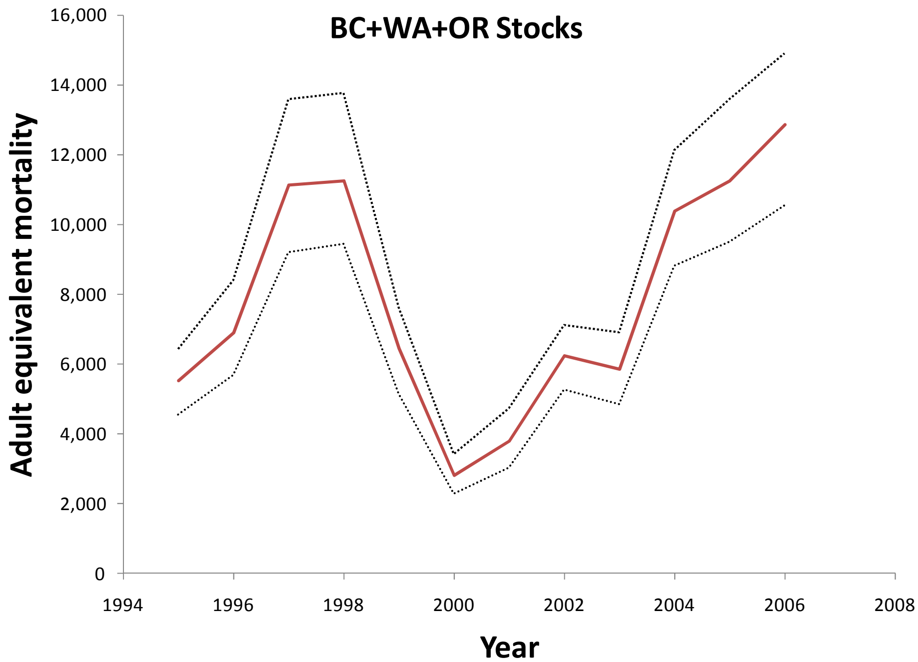


Fig. 5-45 Annual estimated pollock fishery adult equivalent removals on stocks from the Pacific Northwest aggregate stock returns, 1995-2007 with stochasticity in natural mortality (Model 2, CV=0.1), bycatch age composition (via bootstrap samples), maturation rate (CV=0.1), and stock composition.

Breaking the AEQ bycatch to Chinook stock-specific impacts for each stock-specific region, by year, is shown in Table 5-51 for Alternatives 4 and 5, which illustrates hypothetical bycatch levels to the river system regions. Table 5-52 through Table 5-56 compare annual AEQ Chinook bycatch for all Alternative 2, 5 and 5 scenarios, 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 could also be a 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 5-52).

In a high-bycatch year such as 2007 (Table 5-56), 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 5-49 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 5-53 through Table 5-56. Results primarily indicate the inter-annual variability in stock specific impacts, and should be considered accordingly.

Table 5-51 Hypothetical adult equivalent Chinook bycatch levels attributed to river system, under the two annual scenarios for Alternatives 4 and 5. For each Alternative the A-B split is equal to 70:30, Alternative 4 has an 80% rollover from A to B season, Alternative 5 has 100% rollover from A to B season and both employ between sector transferability, 2003-2007.

	PNW	Coast W AK	Cook Inlet	Middle Yukon	N AK Penin	Russia	TBR	Upper Yukon	Other	Total
Alt 5 Annual Scenario 1										
2003	5,888	20,656	422	364	4,521	221	316	326	733	33,448
2004	9,682	20,515	975	444	4,326	299	676	379	829	38,123
2005	9,043	22,095	923	584	4,450	346	645	500	830	39,416
2006	9,910	27,635	745	324	6,373	256	541	293	1,075	47,152
2007	9,741	31,306	727	512	6,932	329	535	458	1,144	51,684
Alt 5 Annual Scenario 2										
2003	5,747	20,126	412	354	4,406	215	308	317	715	32,601
2004	8,086	20,680	761	450	4,356	282	537	390	784	36,326
2005	6,822	21,628	605	519	4,462	293	436	453	761	35,978
2006	7,547	22,106	554	274	5,069	206	405	248	845	37,253
2007	7,198	22,952	540	376	5,082	242	397	336	841	37,963
Alt 4 Annual Scenario 1										
2003	5,919	20,764	424	366	4,545	222	317	327	737	33,623
2004	9,735	20,628	980	447	4,349	300	679	381	834	38,334
2005	9,407	21,794	980	585	4,372	351	681	499	832	39,502
2006	9,975	28,219	737	322	6,525	256	537	292	1,095	47,958
2007	9,775	31,421	731	518	6,949	331	539	463	1,148	51,875
Alt 4 Annual Scenario 2										
2003	5,747	20,126	412	354	4,406	215	308	317	715	32,601
2004	8,086	20,680	761	450	4,356	282	537	390	784	36,326
2005	6,822	21,628	605	519	4,462	293	436	453	761	35,978
2006	7,547	22,106	554	274	5,069	206	405	248	845	37,253
2007	7,198	22,952	540	376	5,082	242	397	336	841	37,963

Table 5-52 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 5 AS1	-60	-134	9	2	-36	-3	6	-5	-12	-233
Alt 5 AS2	81	396	19	12	79	3	14	4	6	614
Alt 4 AS1	-91	-242	7	0	-60	-4	5	-6	-16	-408
Alt 4 AS2	81	396	19	12	79	3	14	4	6	614
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 Alternatives 4 and 5.

Table 5-53 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 5 AS1	764	1,545	88	38	324	24	56	29	53	2,924
Alt 5 AS2	1,981	4,321	324	304	497	145	213	254	121	8,161
Alt 4 AS1	890	1,132	200	191	-84	86	128	155	15	2,712
Alt 4 AS2	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 Alternatives 4 and 5.

Table 5-54 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 5 AS1	2,189	3,948	300	190	629	103	196	158	139	7,852
Alt 5 AS2	2,674	8,245	235	156	1,794	93	171	124	288	13,779
Alt 4 AS1	1,981	4,321	324	304	497	145	213	254	121	8,161
Alt 4 AS2	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 Alternatives 4 and 5.

Table 5-55 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 5 AS1	2,802	8,818	198	84	2,082	66	148	65	323	14,585
Alt 5 AS2	6,471	7,398	860	332	1,229	211	571	259	341	17,672
Alt 4 AS1	2,674	8,245	235	156	1,794	93	171	124	288	13,779
Alt 4 AS2	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 Alternatives 4 and 5.

Table 5-56 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 5 AS1	8,444	13,085	912	227	2,882	194	617	176	592	27,130
Alt 5 AS2	11,135	21,182	1,202	504	4,389	338	821	414	865	40,851
Alt 4 AS1	8,489	12,325	1,042	414	2,318	269	699	330	534	26,420
Alt 4 AS2	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 Alternatives 4 and 5.

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 5-59 through Table 5-62 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 annual scenarios under Alternatives 4 and 5 in Table 5-58. 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 5-55 and Table 5-56). 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 Alternative 4 scenarios these values range from 8,200 to 14,400 in 2006 to 12,300 to 21,182 in 2007. For Alternative 5 these values range from 8,800 to 14,400 in 2006 to 13,000 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 5-57 Hypothetical Chinook adult equivalent bycatch levels to western Alaska river systems under Alternative 5, using Myers et al. (2003) estimates for Yukon, Kuskokwim and Bristol Bay.

	Total western Alaska	Yukon	Kuskokwim	Bristol Bay
Alternative 5 Annual Scenario 1				
2003	21,346	8,538	5,550	7,258
2004	21,338	8,535	5,548	7,255
2005	23,179	9,272	6,027	7,881
2006	28,252	11,301	7,346	9,606
2007	32,276	12,910	8,392	10,974
Alternative 5 Annual 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

Table 5-58 Hypothetical Chinook adult equivalent bycatch levels to western Alaska river systems under Alternative 4, using Myers et al. (2003) estimates for Yukon, Kuskokwim and Bristol Bay.

	Total western Alaska	Yukon	Kuskokwim	Bristol Bay
Alternative 4 Annual 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
Alternative 4 Annual 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 5-59, 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 compared to the estimated actual mortalities due to bycatch. For most Alternative 2 options, the 2003 levels actually had a higher impact (negative salmon saved) compared with similar cap levels in the Alternative 4 and 5 scenarios. In this year Alternative 5 AS1 and AS2 show increases in each year in reduced mortality of Cook Inlet AEQ, while many of the Alternative 2 options analyzed show a decrease. These are likely due to changes in fishing locations due to sector-specific cap constraints which could (expanded by regional apportionments of bycatch to river of origin) result in higher impacts to some systems than actually are presently estimated to have occurred. The Cook Inlet AEQ levels for 2003 are relatively low compared to all other years.

Cap levels of 68,100 (option 2d, 70/30 seasonal) and 48,700 (option 2d, 70/30 seasonal) are the closest to the sector and seasonal divisions in Alternatives 4 and 5 yet indicate much higher inter-annual differences than the annual scenarios under these alternatives. This is primarily due to the differences in seasonal sector specific allocations under these alternatives compared with the fixed sector allocation 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 5-64 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 5-65). 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 5-62) due to the spatial extent of the bycatch and regional contribution from these stocks in the southeast portion of the Bering Sea.

Table 5-59 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 5 AS1	-134	1,545	3,948	8,818	13,085
Alt 5 AS2	396	789	4,129	14,419	21,182
Alt 4 AS1	-242	1,132	4,321	8,245	12,325
Alt 4 AS2	396	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 Alternatives 4 and 5.

Table 5-60 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 5 AS1	-54	645	1,718	3,586	5,396
Alt 5 AS2	-61	463	1,944	5,921	8,840
Alt 4 AS1	-329	591	1,952	3,409	5,228
Alt 4 AS2	-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 Alternatives 4 and 5.

Table 5-61 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 5 AS1	-36	419	1,117	2,331	3,507
Alt 5 AS2	-40	301	1,264	3,849	5,746
Alt 4 AS1	-214	384	1,269	2,217	3,398
Alt 4 AS2	-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 Alternatives 4 and 5.

Table 5-62 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 5 AS1	-47	548	1,461	3,048	4,586
Alt 5 AS2	-52	394	1,653	5,033	7,514
Alt 4 AS1	-280	503	1,659	2,898	4,444
Alt 4 AS2	-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 Alternatives 4 and 5.

Table 5-63 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 5 AS1	9	88	300	198	912
Alt 5 AS2	19	302	618	389	1099
Alt 4 AS1	7	83	243	206	908
Alt 4 AS2	19	302	618	389	1099
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 Alternatives 4 and 5.

Table 5-64 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 5 AS1	6	56	196	148	617
Alt 5 AS2	14	195	405	284	755
Alt 4 AS1	5	53	160	152	613
Alt 4 AS2	14	195	405	284	755
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 Alternatives 4 and 5.

Table 5-65 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 5 AS1	-60	764	2,189	2,802	8,444
Alt 5 AS2	81	2,360	4,410	5,165	10,987
Alt 4 AS1	-91	711	1,825	2,737	8,410
Alt 4 AS2	81	2,360	4,410	5,165	10,987
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 Alternatives 4 and 5.

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 5-66). 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 5-67 and Table 5-68).

Table 5-66 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 5-67 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 5-68 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 5-69). 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 5-70 and Table 5-71).

Table 5-69 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 M	CP	CV	Outside Subtotal	Inside of B-season areas M	CP	CV	Inside Subtotal	Total	Percent 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 5-70 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 M	CP	CV	Outside Subtotal	Inside of B-season areas M	CP	CV	Inside Subtotal	Total	Percent 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 5-71 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 5-72 and Table 5-82 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 5-73 and Table 5-83 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 5-74 and Table 5-84. 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 5-75 through Table 5-80 (A season) and in Table 5-86 through Table 5-91 (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 5-72 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 5-73 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 5-74 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 5-75 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 5-76 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 5-77 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 5-78 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 5-79 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 5-80 Expected Chinook *saved* by **mothership operations** if A-season trigger-closure was 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 5-81 Remaining pollock catch estimated from **mothership operations** at the time A-season trigger-closures were invoked.

Pollock				**Mothership operations, A season**			
Cap scenario		CAP	**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 5-82 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 5-83 Expected Chinook catch by **all vessels** if B-season trigger-closure was invoked on the dates provided in Table 5-82.

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 5-84 Expected Chinook *saved* by **all vessels** if B-season trigger-closure was invoked on the dates provided in Table 5-82.

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 5-85 Remaining pollock catch estimated from **all vessels** at the time B-season trigger-closures were invoked on the dates provided in Table 5-82.

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 5-86 Expected Chinook catch by **at-sea processors** if B-season trigger-closure was invoked on the dates provided in Table 5-82.

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 5-87 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 5-88 Expected Chinook catch by **shorebased catcher vessels** if B-season trigger-closure was invoked on the dates provided in Table 5-82.

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 5-89 Expected Chinook *saved* by **shorebased catcher vessels** if B-season trigger-closure was invoked on the dates provided in Table 5-82.

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 5-90 Expected Chinook catch by **mothership operations** if B-season trigger-closure was invoked on the dates provided in Table 5-82.

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 5-91 Expected Chinook *saved* by **mothership operations** if B-season trigger-closure was invoked on the dates provided in Table 5-82.

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 Buklis (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 et al. 2008, Cook and Irvine 2007); USA (Josephson 2008, 2007; Eggers 2006, 2005; Bartlett 2008, 2007, 2006, 2005); Korea (YIFRI 2008, SRT 2006, 2007); Japan (Takahashi and Tojima 2008) 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	121.2	578.8	2,895.5
2007	*	1870.0	13.8	142.0	653.3	---

*2007 data not 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
2007	604.7					48.6	653.3

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).

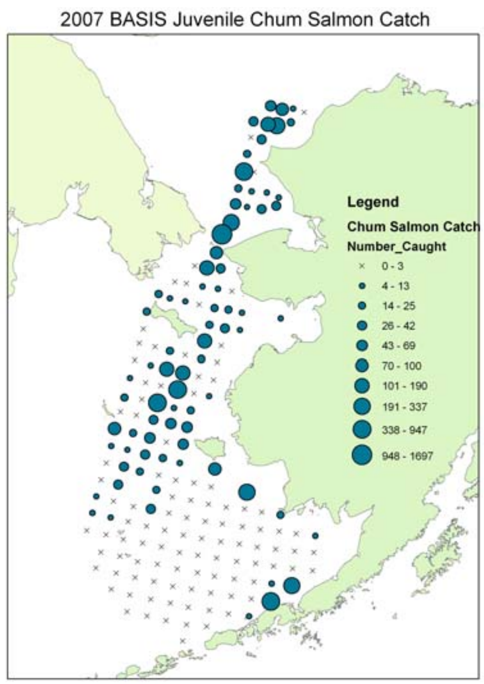

Fig. 6-1 U.S. BASIS juvenile Chum salmon catches in 2007. Source: Chris Kondzela, AFSC

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.

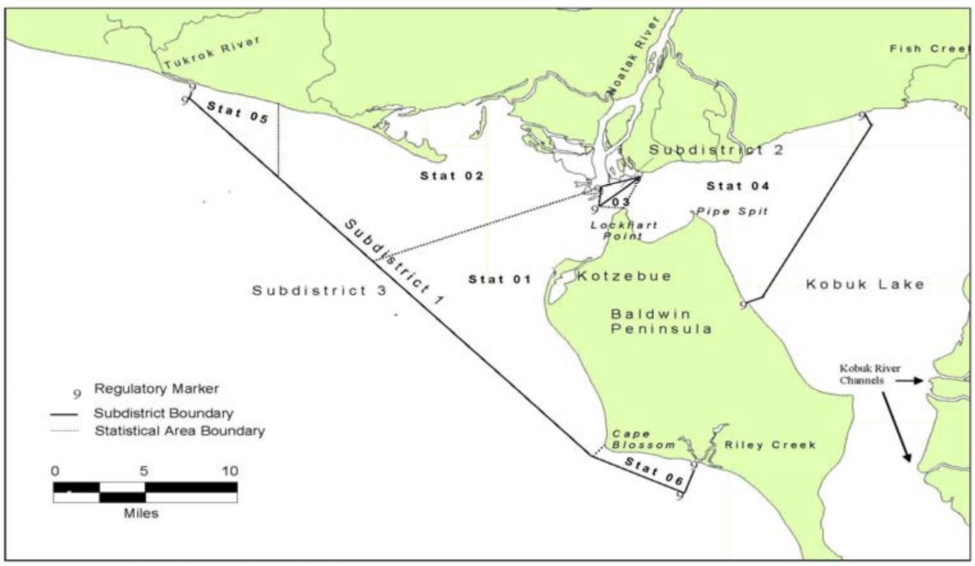

Fig. 6-2 Kotzebue Fishery Management Area

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.

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. 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 6-5 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 6-6 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	680,541	1.0%	10,083
2003	695,363	1.83	1,272,514	32.9%	346,163
2004	537,873	2.01	1,081,125	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[44]; 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 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% [45] 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 6-7.

[44] Unlike Chinook salmon, the mark-recapture estimates for fall chum salmon generally agree with the Eagle sonar estimates.

[45] 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 6-7 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[46], 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 6-8).

Table 6-8 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

[46] 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.

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 6-7). 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 6-9 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

6.2.5 Kuskokwim River Chum

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. Information presented in this section focuses upon the Kuskokwim River chum 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 Stock status 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.

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. Escapement information review indicates that chum salmon escapement was below average from 1999-2000. However since 2001 escapement has been average or better (Bue et al. 2008). Declining salmon markets for chum have increased the difficulty of evaluating the abundance of chum salmon in the Kuskokwim (Bue et al. 2008). While a harvestable surplus was identified in 2002 and 2003, no market existed for the fishery.

Historical run reconstruction for 1976-2000 was evaluated by Shotwell and Adkison (2004). More recent run reconstruction work was completed for the Kuskokwim (Bue et al. 2008). Comparative results between the studies are shown in Fig. 6-3. 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).

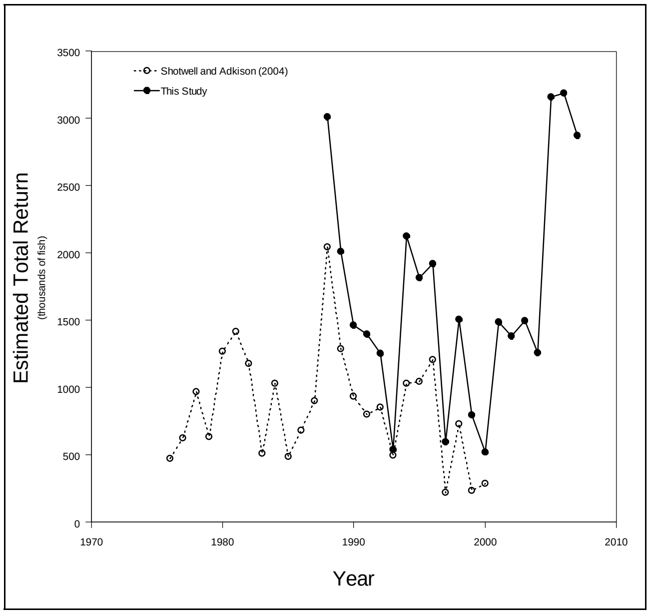

Fig. 6-3 Comparison of the time series of total run estimates for chum salmon returning to the Kuskokwim River obtained by Shotwell and Adkison (2004) and total run estimates from this study. The estimates made by this study were for the purpose of illustrating the performance of the run reconstruction model and are not actual estimates of total run. From Bue et al. 2008.

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. 5-21). 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 6-10. Escapement and catch in the Nushagak has been increasing in recent years with 2006 well above the 20-year average (Table 6-10).

Table 6-10 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 6-13 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.

Changes in fleet-specific B-season closure dates change by alternatives (Table 6-13, Table 6-15,

Table 6-16). The relative impact of each alternative is evaluated in terms of the overall anticipated reduced season lengths in order to evaluate possible impacts on chum salmon bycatch.

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[47] "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.

[47] 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.

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 6-11).

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 6-12.

Total catch of non-Chinook salmon in the pollock fishery reached an historic high in 2005 at 705,963 fish (Table 6-12; 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 6-11 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

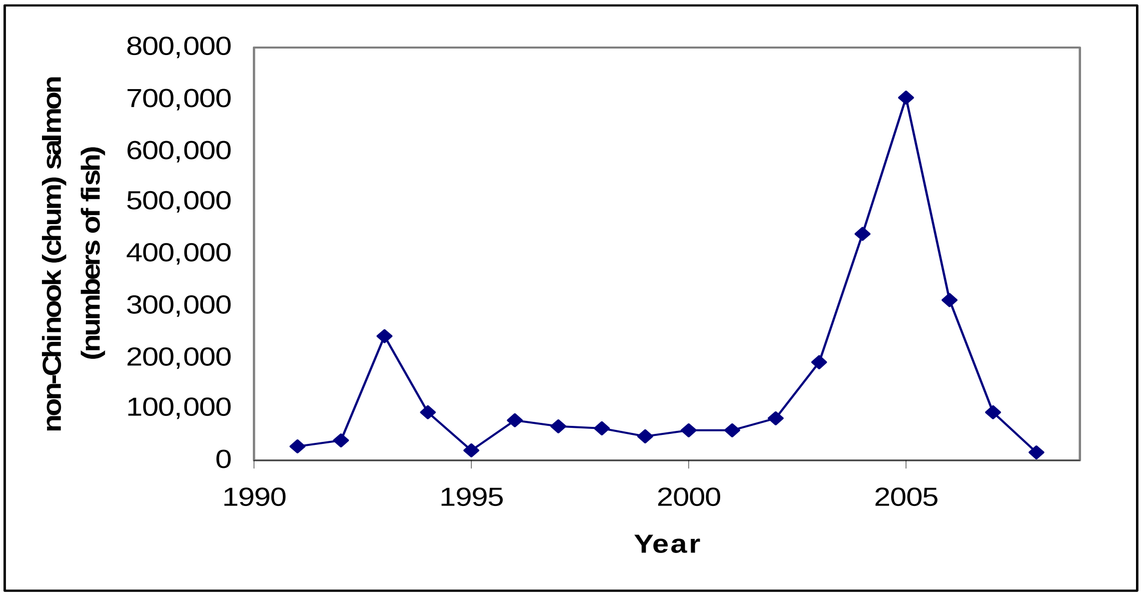

Fig. 6-4 Non-Chinook salmon bycatch in the EBS pollock trawl fishery 1991-2008. Note 1991-1993 values do not include CDQ

Table 6-12 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 3/19/09. 'na' indicates that data were not available in that year

Year	Annual with CDQ	Annual without CDQ	Annual CDQ only	A season With CDQ	B season With CDQ	A season Without CDQ	B season Without CDQ	A season CDQ only	B season 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	80,782	77,178	3,604	1,377	70,404	1,356	75,821	21	3,583
2003	189,184	180,782	8,404	3,834	185,350	3,597	177,185	237	8,165
2004	440,472	430,284	10,188	422	440,050	395	429,889	27	10,161
2005	704,590	696,880	7,710	595	703,995	563	696,317	32	7,678
2006	309,643	308,429	1,214	1,332	308,311	1,266	307,163	66	1,148
2007	93,660	87,191	6,469	8,523	85,137	7,368	79,823	1,155	5,314
2008	15,423	14,992	431	320	15,103	247	14,745	73	358

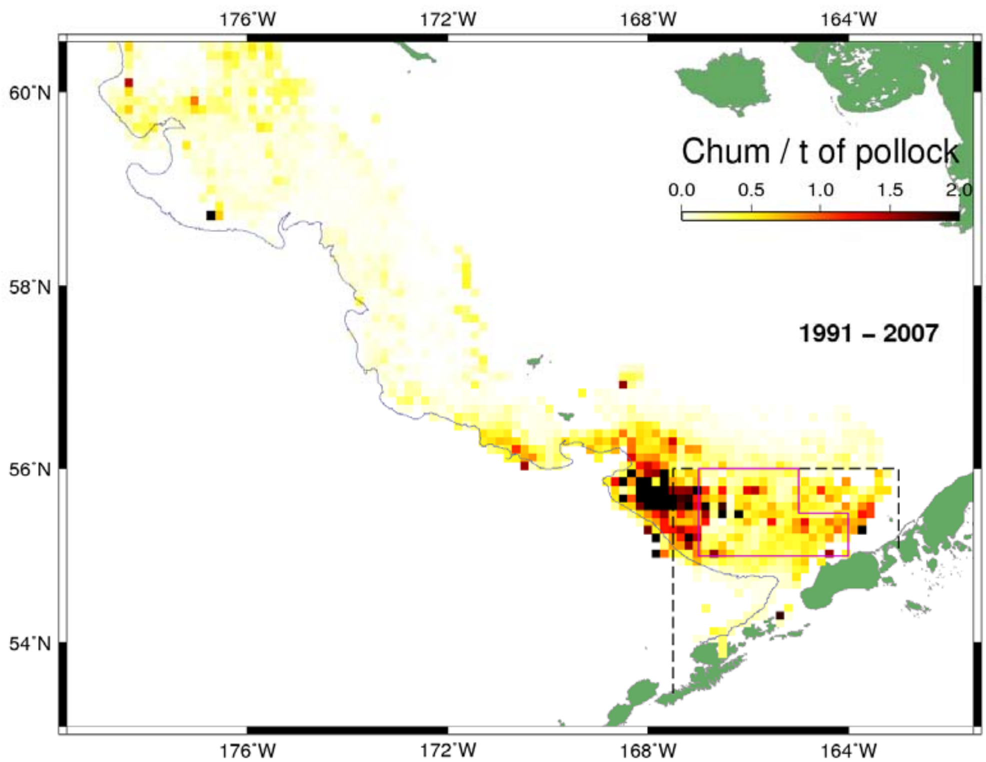

Fig. 6-5 Historical chum B-season bycatch rates 1991-2007. Note the Chum Salmon Savings Area closure (solid line) and the Catcher Vessel Operational Area (dotted line)

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 a higher contribution of maturing fish originated from BC than the relative 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, 4, and 5

Results using hypothetical past closure dates reduced the chum salmon bycatch by small fractions or not at all (Table 6-14). 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 6-6). 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 6-14). For Alternative 4 (annual scenarios 1 and 2, assuming 70:30 A-B season Chinook allocation and 80% rollover with sector transferability), and Alternative 5 (annual scenario 1) the sector date closures are generally later than those for many of the options under Alternative 2 (Table 6-15, 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 6-7). 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 6-8). 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 alternatives 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.

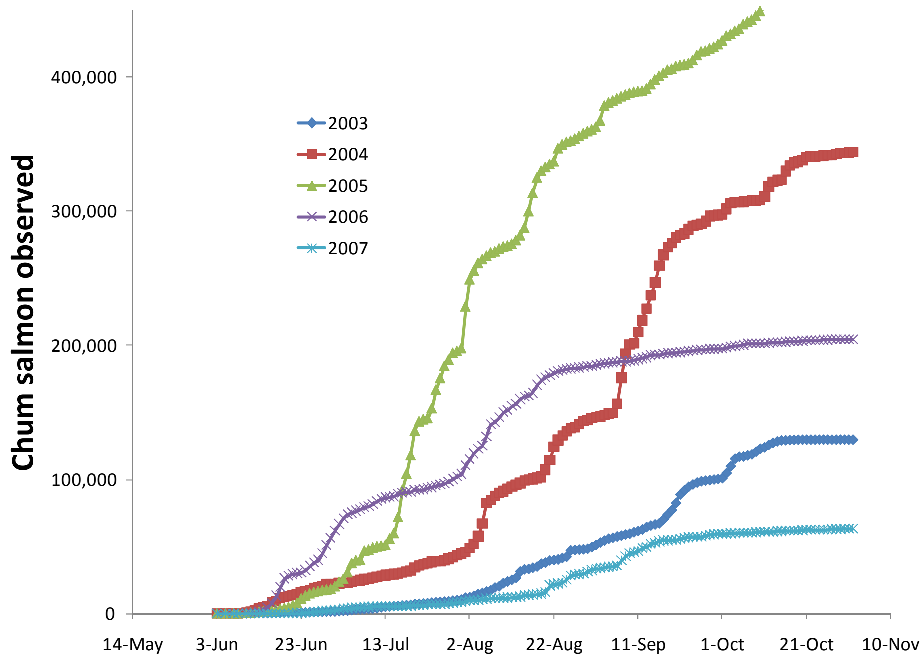

Fig. 6-6 Observed cumulative bycatch of chum salmon during the B-season, 2003-2007

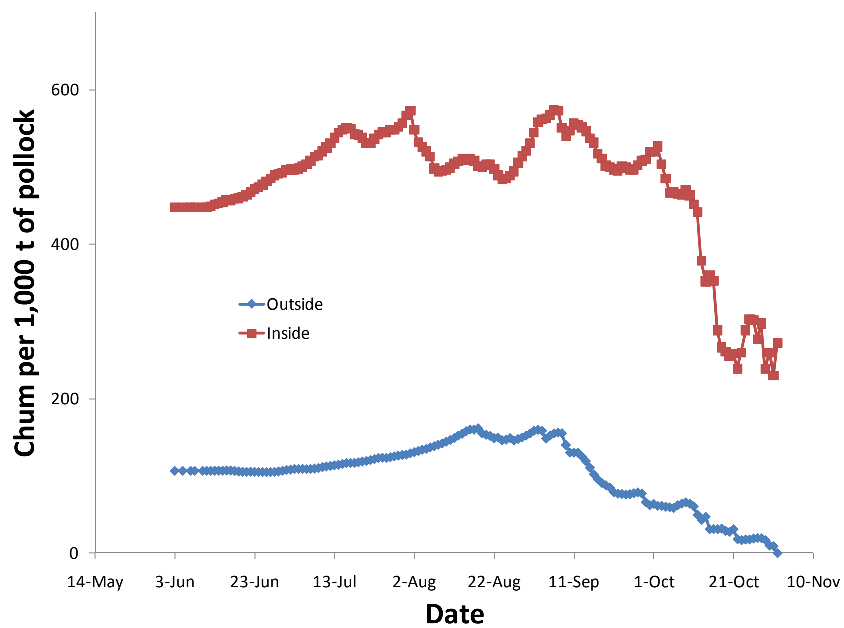

Fig. 6-7 Mean 2003-2007 chum bycatch rate (chum salmon per 1,000 t of pollock) inside and outside of Chinook salmon trigger closure area by date. Note that the numerator (chum numbers) were based solely on observer data whereas the pollock in the denominator was from the entire fleet. The chum rate on a given date represents the mean rate from that date till the end of the year.

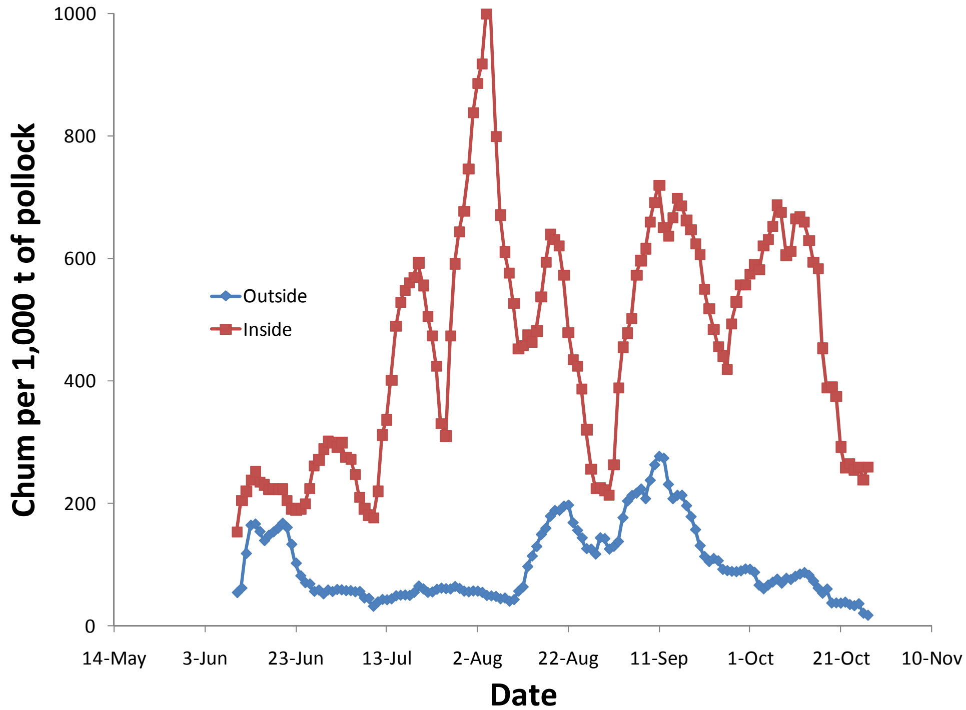

Fig. 6-8 Mean 2003-2007 chum bycatch rate (chum salmon per 1,000 t of pollock) inside and outside of Chinook salmon trigger closure area by date. Note that the numerator (chum numbers) were based solely on observer data whereas the pollock in the denominator was from the entire fleet. The chum rate on a given date represents the 10-day moving average.

Table 6-13 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 6-14 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 6-15 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 annual scenarios in alternative 4 with A-B split equal to 70:30, 80% rollover from A to B season , and between sector transferability, 2003-2007**.**

Alt 4			B-Season			
AS	Year	Sector:	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 6-16 Sector-specific closure date scenarios for B-seasons by year reflecting when the cap level would have been exceeded in each year under Alternative 5 with A-B split equal to 70:30, 100% rollover from A to B season, and between sector transferability, 2003-2007.

Alt 5			B-Season			
AS	Year	Sector:	CDQ	M	P	S
1	2003		---	---	---	---
	2004		---	---	---	---
	2005		---	---	---	26-Oct
	2006		---	---	---	19-Oct
	2007		8-Oct	21-Oct	6-Oct	5-Oct

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.

6.6.1 Ecosystem-sensitive management

Measures to minimize chum salmon bycatch

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.

Changes to fishery management based on ongoing research and understanding of ecosystem interactions and the effects of climate change

Many efforts are underway to assess the relationship between oceanographic conditions, ocean mortality of salmon and their maturation timing to their respective rivers of origin for spawning (see Section 5.1). It is unclear whether the observed changes in salmon bycatch in recent years is due to fluctuations in salmon abundance, or whether there is a greater degree of co-occurrence between salmon and pollock stocks as a result of changing oceanographic conditions. Pollock distribution has been shown to be affected by bottom temperatures, with densities occurring in areas where the bottom temperatures are greater than zero (Ianelli et al. 2008). Specific ocean temperature preferences for salmon species are poorly understood. Regime shifts and consequent changes in climate patterns in the North Pacific ocean has been shown to correspond with changes in salmon production (Mantua et al 1997). Archival tags affixed to Asian chum salmon indicate that behavior and migration in juvenile, immature, and maturing fish are linked to temperature gradients (Friedland et al. 2001) and that immature chum exhibit a tendency to remain above the thermocline along the continental shelf (Azumaya et al. 2006). Anecdotal information suggests that Chinook and chum salmon prefer different (warmer) ocean water temperatures than adult pollock. A study linking temperature and salmon bycatch rates is underway and preliminary evidence indicates a relationship, even when factoring for month and area (Ianelli et al. 2009).

Compelling evidence from studies of changes in Bering Sea and Arctic climate, ocean conditions, sea ice cover, and permafrost and vegetation indicate that the area is experiencing warming trends in ocean temperatures and major declines in seasonal sea ice (IPCC, 2007; ACIA, 2005). Some evidence exists for a contraction of ocean habitats for salmon species under global warming scenarios (Welch et al. 1998). Studies in the Pacific northwest have found that juvenile survival is reduced when in-stream temperatures increase (Marine and Cech 2004, Crozier and Zabel 2006). A correlation between sea surface temperature and juvenile salmon survival rates in their early marine life has also been proposed (Mueter et al. 2002). The variability of salmon responses to climate changes is highly variable at small spatial scales, and among individual populations (Schindler et al 2008). This diversity among salmon populations means that the uncertainty in predicting biological responses of salmon to climate change remains large, and the specific impacts of changing climate on salmon cannot be assessed.

6.6.2 Traditional management tools

Development of the salmon excluder device

The development and deployment of the salmon excluder device may reduce chum salmon bycatch. The salmon excluder is still being tested in pollock fisheries, and is not yet in wide-scale use, however many of the early design flaws have been corrected at this stage.

6.6.3 Actions by Other Federal, State, and International Agencies

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 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.

Future exploration and development of offshore mineral resources

The Minerals Management Service (MMS) expects that reasonably foreseeable future activities include development of oil and gas deposits over 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. The MMS has 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. Many of the western Alaska salmon migration corridors pass through the program area identified by MMS, and adverse environmental impacts resulting from exploration and development in the future could impact salmon stocks. The extent to which these impacts may occur is unknown.

Hatchery releases of salmon

The continued release of salmon fry into the ocean by domestic and foreign hatcheries is also expected to continue at similar levels. Hatchery production increases the numbers of salmon in the ocean beyond what is produced by the natural system, however some studies have suggested that efforts to increase salmon populations with hatcheries may have an impact on the body size of Pacific salmon (Holt et al 2008).

6.6.4 Private actions

Commercial pollock and salmon fishing (domestic and foreign), subsistence and sport fisheries for Chinook salmon

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. The analysis of direct effects assumes that these activities will continue at similar levels into the future.

Future exploration and development of onshore mineral resources

Salmon stocks may also be affected by onshore mining activities, to the extent that pollutants or contaminants from those operations may affect salmon spawning streams. Some instances of mining operations in southwestern Alaska are discussed in Section 3.4.

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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 Alternatives 4 and 5

Alternatives 4 and 5 contain 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 Alternative and scenario. Alternative 4 includes a high annual hard cap of 68, 392 Chinook salmon, but is conditional upon an ICA to reduce salmon bycatch being developed by the pollock industry. Alternative 5 includes a high annual hard cap of 60, 000 Chinook salmon, but is conditional upon an IPA to reduce salmon bycatch being developed by the pollock industry Vessels that do not participate in the ICA or IPA would be subject to a backstop cap. Both Alternatives 4 and 5 include a lower annual cap on 47,591 Chinook salmon that would be effective either as the only cap or in the absence of a NMFS-approved ICA or IPA. 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 Alternatives 4 and 5 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.

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 Alternatives 4 and 5 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.

One important difference between Alternative 4 and Alternative 2 is that incidental catches of Chinook salmon 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 could result 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. This potential impact is mitigated under Alternative 5 by the modification that only bycatch by vessels fishing under the backstop cap accrue towards that cap.

The nature of the Alternative 4 high 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.

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 or 5 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. Alternatives 4 and 5 do not change the regulations governing catch limits for non- pollock species and are thus not expected to have a significant adverse impact on the sustainability of these species.

7.2.4.2 Seasonal Split and Transferability

Alternatives 4 and 5 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.

Under Alternative 4, 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. Under Alternative 5, NMFS would roll-over 100 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. Alternatives 4 and 5 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 and Section 2.5). 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.

Alternatives 4 and 5 provide for 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 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 Alternatives 4 and 5 are not expected to significantly change the footprint of the pollock fishery in the Bering Sea. To the extent that Alternative 4 or 5 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 the Alternative 4 backstop cap 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, neither Alternative 4 or Alternative 5 is 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.

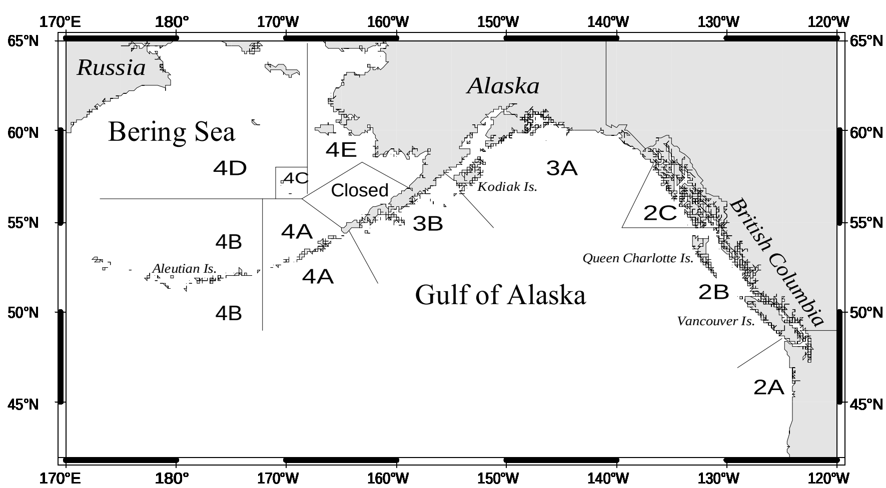

Fig. 7-1 IPHC regulatory areas in the northern Pacific Ocean and Bering Sea

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, 4, and 5) 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.

Alternatives 4 and 5 would have similar impacts on incidental catch of halibut as Alternative 2. The primary differences between Alternatives 4 and 5 and Alternative 2 are the requirements for the ICA or IPA to provide incentives to avoid salmon bycatch and the provisions to encourage fishery participants to join the ICA or IPA.

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, 3, 4, or 5 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).

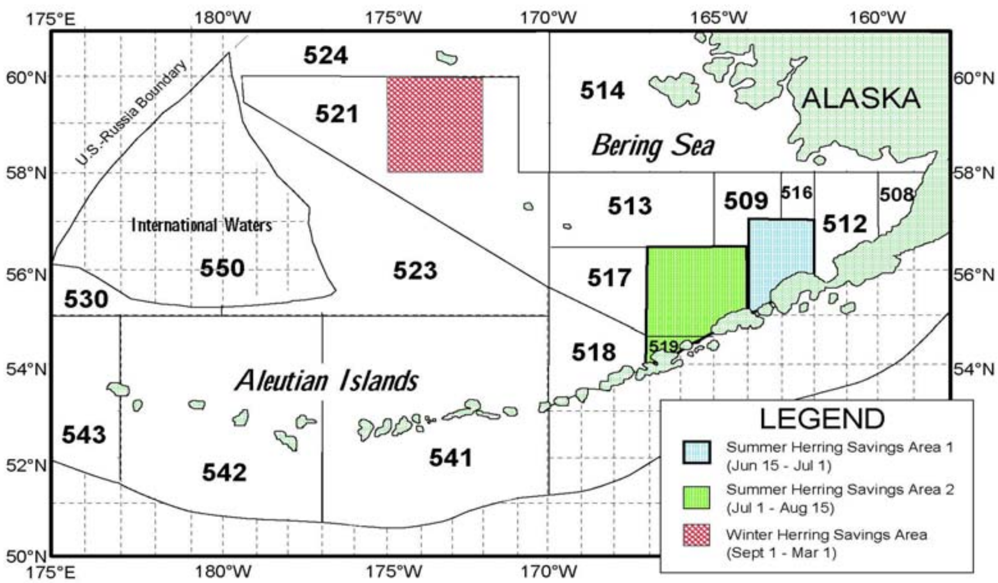

Figure 4 to Part 679. BSAI Herring Savings Areas
a. Map.

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 5 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.

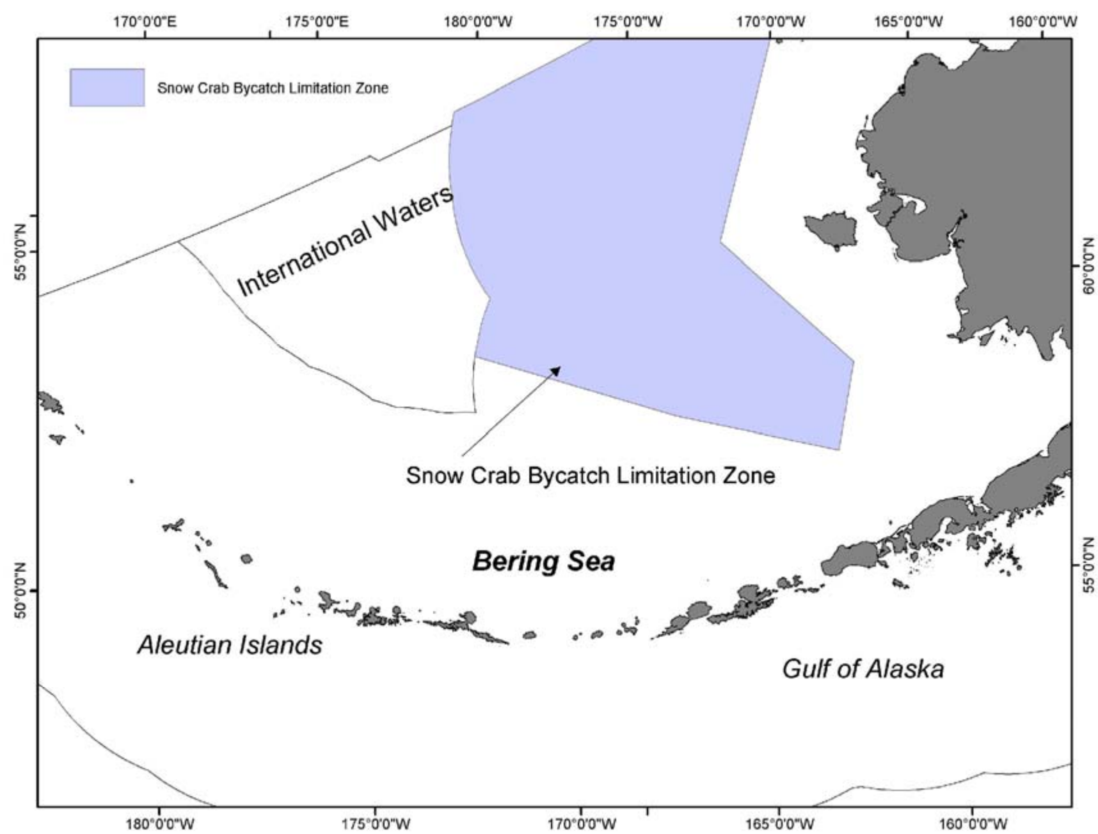

Fig. 7-3 *C. opilio* Bycatch Limitation Zone (COBLZ)

7.3.6.2 Red King Crab PSC limits

PSC limits 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

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

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.

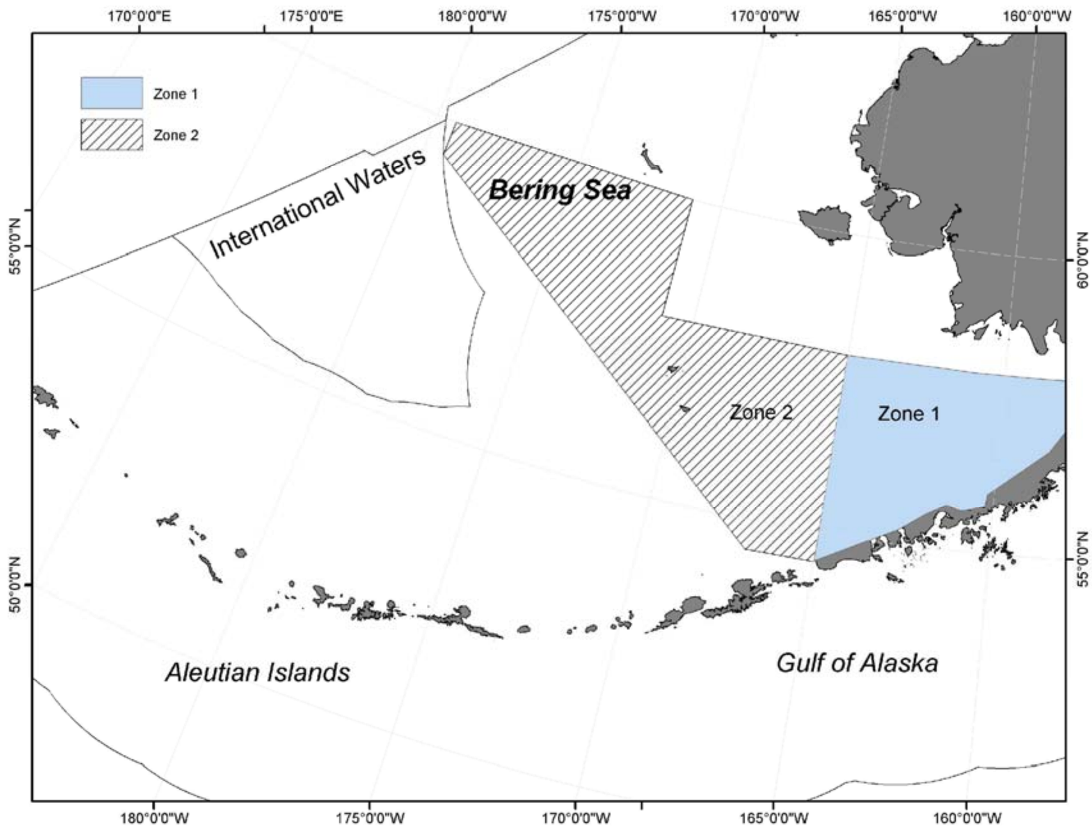

Fig. 7-4 Zones 1 and 2 for red king crab and Tanner crab

7.3.6.3 Tanner crab PSC limits

PSC limits for Tanner crab 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

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

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 5 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, 4, and 5 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.[48]

More information on the forage fish in Alaska's EEZ may be found in several NMFS and Council documents:

- 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.

[48] Under the FMPs, the forage fish category includes fish in the families Osmeridae, Myctophidae, Bathylagidae, Ammodytidae, Trichodontidae, Pholidae, Stichaeidae, Gonostomatidae, and the order Euphausiacea.

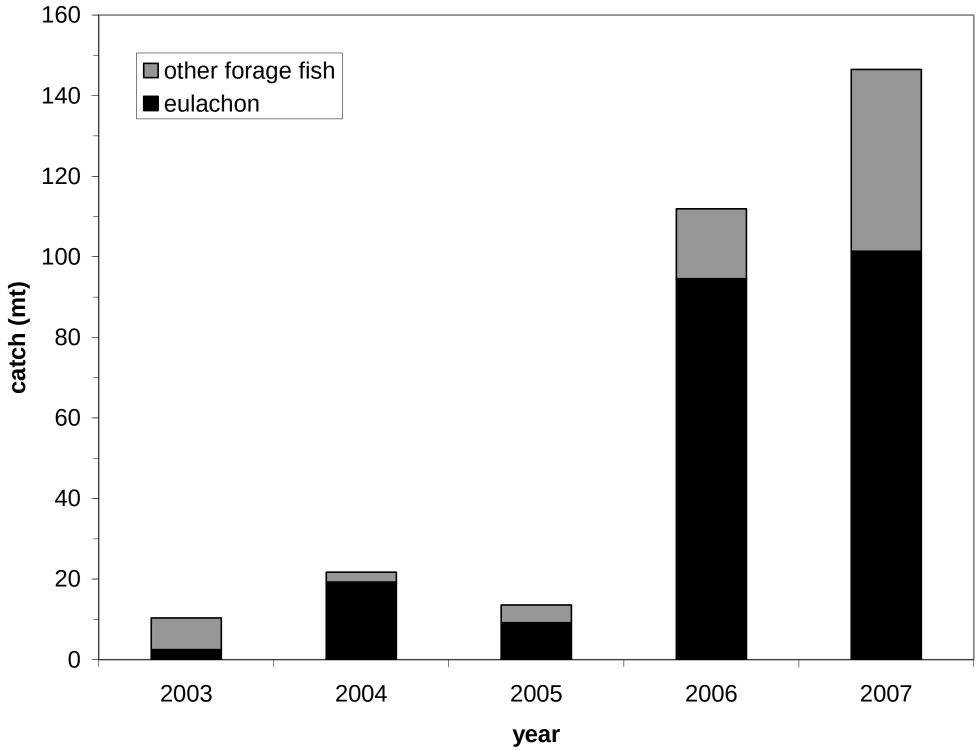

Fig. 7-5 Incidental catches of eulachon and other forage fishes in the commercial pollock fisheries of the BSAI. Data are from the Catch Accounting System database maintained by the Alaska Regional Office, National Marine Fisheries Service, Juneau, Alaska. Data were retrieved on August 25, 2008.

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. The RIR 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 Alternatives 4 and 5 on forage fish would be similar because Alternatives 4 and 5 are 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 most recent stock assessment of Pacific walrus was completed in May 2009 (URL: http://alaska.fws.gov/fisheries/mmm/stock/DraftPacificWalrusSAR.pdf). The information from NMFS 2004 and Angliss and Outlaw 2006, 2007, and 2008 and the walrus stock assessment 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	None	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	Status under review	Strategic	Population trends are unknown. Population size estimated from a 2006 ice survey is 15,164 animals, but this is considered a low estimate. Further analysis is being conducted on the 2006 survey to refine the population estimate.	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. Pacific Walrus information available from http://alaska.fws.gov/fisheries/mmm/stock/DraftPacificWalrusSAR.pdf.				

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.

Cetacea species and stock	*Status under the ESA*	*Status under the MMPA*	*Population Trends*	*Distribution in action area*
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.
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, Cook Inlet, and eastern Chukchi Sea	None for all stocks except Cook Inlet, which are endangered	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. For Cook Inlet Belugas, estimated decline of 71 percent in 30 years with 375 animals estimated in 2008.	Summer in the Arctic Ocean and Bering Sea coastal waters, and winter in the Bering Sea in offshore waters associated with pack ice. Cook Inlet belugas remain in Cook Inlet year round, but eat salmon that occur in the Bering Sea and are taken as bycatch.
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				

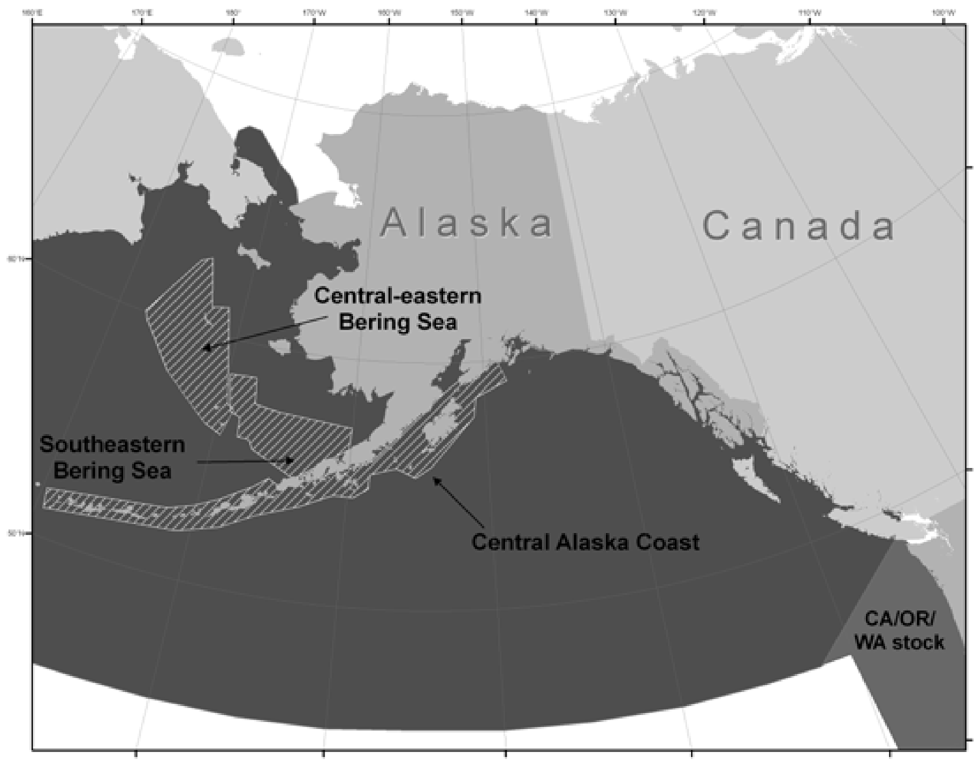

Fig. 8-1 Fin whale distribution and survey areas in lined locations (Angliss and Outlaw 2008)

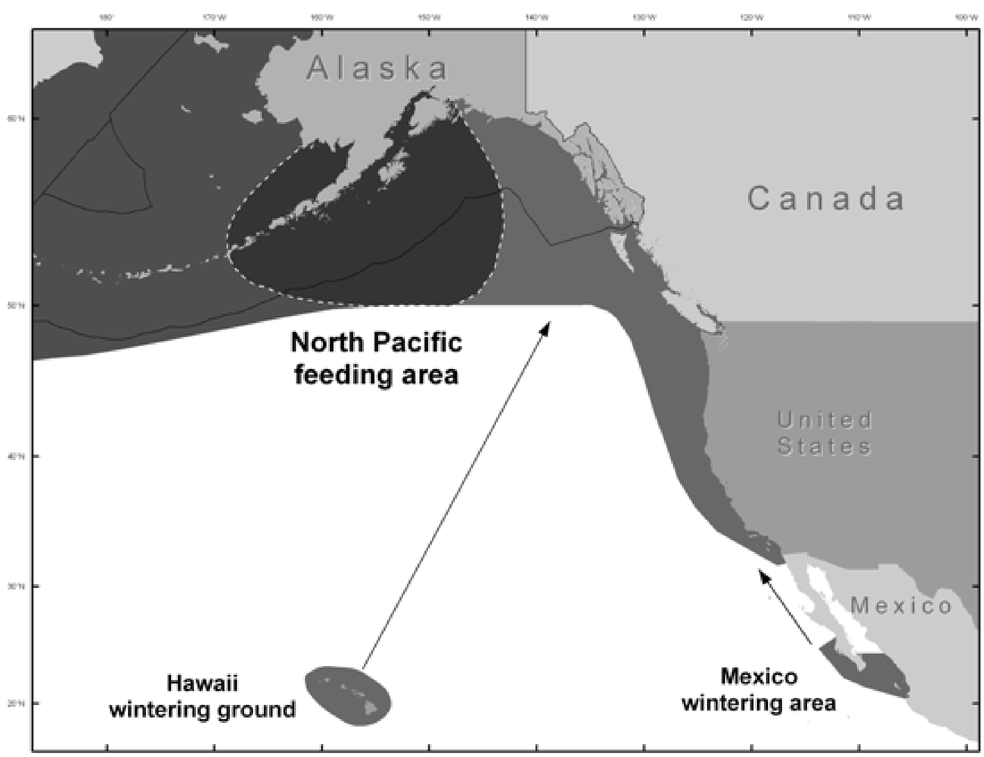

Fig. 8-2 Feeding area of humpback whales (Angliss and Outlaw 2008). Shaded area shows overlap of Central and western North Pacific humpback whale stocks.

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) and on Cook Inlet beluga whales. A draft biological opinion on the status quo groundfish fishery in the BSAI and GOA is expected to be available in spring 2010.

8.1.2.1 Ice Seals

In December 2007, NMFS was petitioned by the Center for Biological Diversity (CBD) 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 presented substantial information that a listing may be warranted and started a status review of the species to determine whether listing is warranted (73 FR 16617, March 28, 2008). Detailed information on the biology, distribution and potential threats on ribbon seals is contained in CBD 2007.

NMFS determined that the listing is not warranted at this time due to modeling of future sea ice extent and population estimates (73 FR 79822, December 30, 2008). On March 31, 2009, the CBD and Greenpeace filed a 60 day notice of intent to sue NMFS for failing to propose listing ribbon seals under the ESA. The CBD and Greenpeace filed a complaint for declaratory and injunctive relief on September 3, 2009, asking for the 12 month finding to be remanded.

On May 28, 2008, the CBD petitioned NMFS to list ringed, bearded, and spotted seals under the ESA due to threats to the species from (1) global warming, (2) high harvest levels allowed by the Russian Federation, (3) oil and gas exploration and development, (4) rising contaminant levels in the Arctic, and (5) bycatch mortality and competition for prey resources from commercial fisheries (CBD 2008a). NMFS has initiated the status review for ringed, bearded, and spotted seals (73 FR 51615, September 4, 2008). Pursuant to a court settlement, NMFS completed the status review and issued a 12-month finding on October 15, 2009 for the spotted seal (74 FR 53683, October 20, 2009) and is scheduled to complete the status reviews and 12-month findings on November 1, 2010 for the ringed and bearded seals. NMFS determined that the status of the stocks of spotted seals occurring in Alaska indicated that no listing was needed. Listing of ringed or bearded seals would require ESA consultation on federal actions that may adversely affect them or any designated critical habitat.

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).

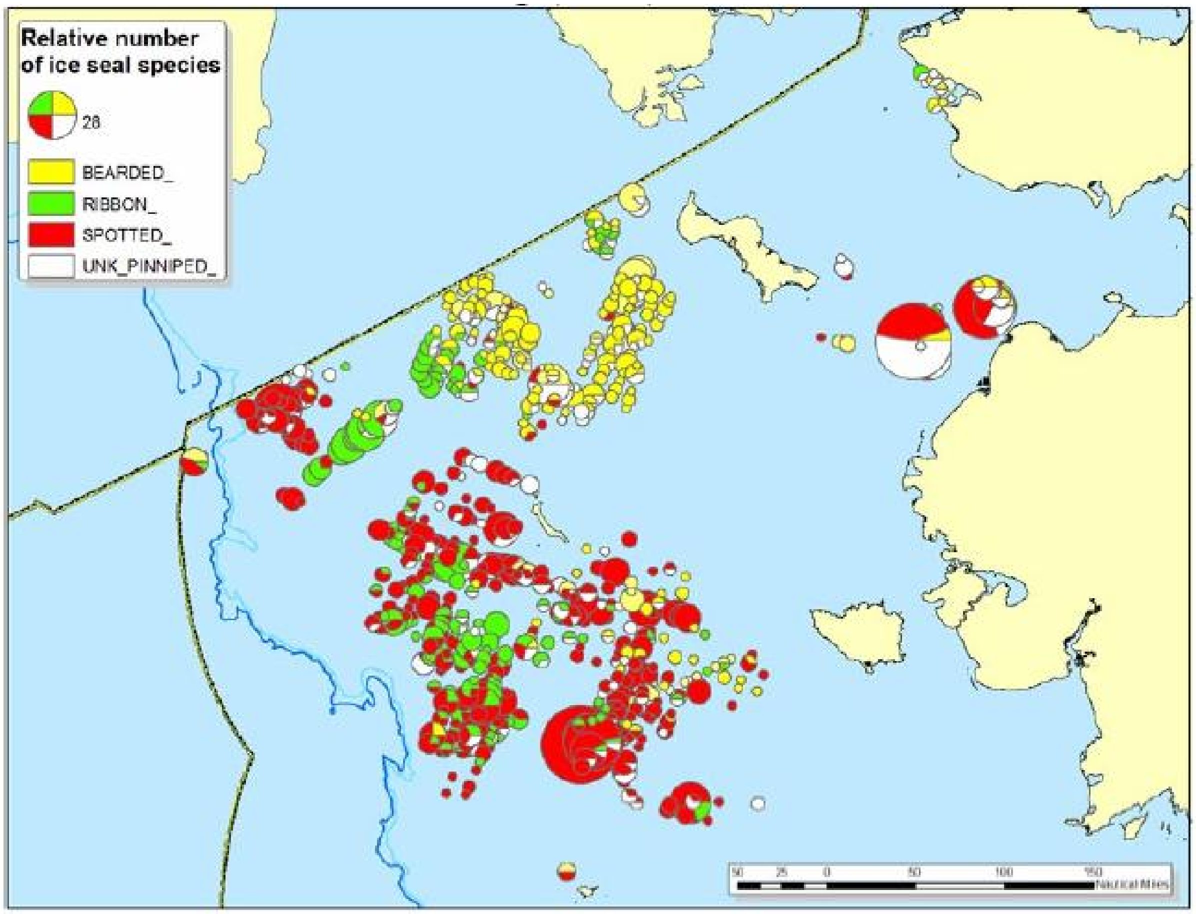

Fig. 8-3 Ice seal survey during Healy cruises in summer in Bering Sea 2007 (Cameron and Boveng 2007)

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.

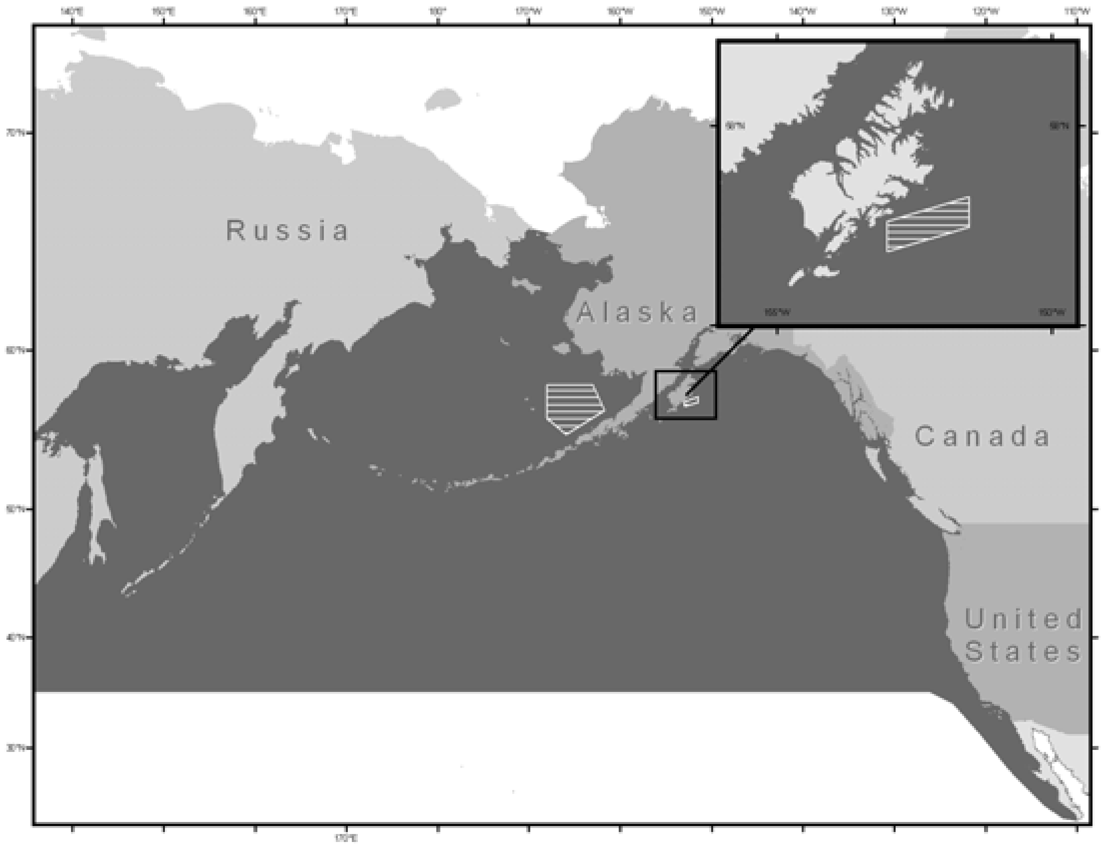

Fig. 8-4 North Pacific right whale distribution and critical habitat shown in lined boxes. (Angliss and Outlaw 2008)

8.1.2.3 Pacific Walrus

Management of the Pacific walrus is under the jurisdiction of the USFWS. They occur in the shelf waters of the Bering and Chukchi Sea and some attempts at population estimates range from 200,000 to 246,000 animals (USFWS 2002a). No reliable population estimates or trends are available. In April 2006, federal and state agencies conducted satellite tagging and aerial surveys of walrus in the Bering Sea to develop an abundance estimate (http://alaska.usgs.gov/science/biology/walrus/2006_tagging.html). The shallow productive waters of the Northern Aleutian Basin support some of the largest concentrations of Pacific walruses in the world. Large breeding aggregations form in late winter in the broken pack ice of northern Bristol Bay. Females and dependent young migrate out of the region in spring, following the retreating pack-ice to summer feeding areas in the Chukchi Sea. Thousands of primarily adult male walruses remain in the Bristol Bay region through the ice free season, foraging on rich beds of benthic invertebrates and resting at isolated coastal haulout sites. The most heavily used coastal haulouts in Bristol Bay are located at Round Island (Walrus Islands State Game Sanctuary), Cape Peirce and Cape Newenham (Togiak National Wildlife Refuge), and Cape Seniavin on the Alaska Peninsula. Less consistently used haulout sites are found at Cape Constantine, Amak Island, Big Twin Island, Crooked Island, High Island, and Hagemister Island. Walruses have also occasionally been observed at isolated beaches near Port Moller, Port Heiden, and Egegik Bay. In summer 1982, adult male walruses were observed using haulouts and foraging areas on the east end of St. Matthew Island (Irons 1983). Hauling out and foraging at St. Matthew Island by adult males has not been observed in the past 15 to 20 years (Dr. Chadwick Jay, personal communication, U.S. Geological Survey, June 10, 2009). Adult males may transit through areas near St. Matthew Island in the fall as they move north towards the females, but the concentration of migration is generally further east (Dr. Chadwick Jay, personal communication, U.S. Geological Survey, June 10, 2009). Females and juveniles may forage near St. Matthew Island in the winter depending on the extent of sea ice and open leads or polynyas.

The number of walruses attending coastal haulout sites in northern Bristol Bay (Round Island, Cape Peirce, and Cape Newenham) has declined in recent years, while the number of animals using haulouts along the Alaska Peninsula (principally at Cape Seniavin) has increased. On February 7, 2008, the Center for Biological Diversity petitioned the USFWS to list Pacific walrus under the ESA because of the impact of global warming in the sea ice habitat (CBD 2008). On December 3, 2008, the CBD filed suit against the USFWS for failing to act on the petition (http://www.biologicaldiversity.org/news/press_releases/2008/pacific-walrus-12-03-2008.html). On May 18, 2009 the USFWS agreed to complete the review of the petition by September 10, 2009, in a settlement with the CBD. On September 8, 2009, the USFWS announced that the CBD petition presents substantial scientific or commercial information indicating that adding Pacific walrus to the federal list of threatened and endangered species may be warranted. The USFWS has opened a 60 day public comment period and initiated the status review, which is scheduled for completion by September 10, 2010. (http://alaska.fws.gov/fisheries/mmm/walrus/pdf/press_release.pdf)

8.1.3 Existing Management Measures to Mitigate Fishing Impacts on Marine Mammals

The most recent action that will provide protection to some marine mammals in the Bering Sea is the approval of the Fishery Management Plan for Fish Resources of the Arctic Management Area. This plan was approved on August 17, 2009 and implementing regulations are scheduled by the end of 2009. This plan initially prohibits commercial fishing in the Arctic Management Area until information is available to support sustainable fisheries management. This action would prevent the potential adverse effects of unregulated commercial fishing activities on marine mammal species. Several of these species occur in both the Arctic Management Area and in the Bering Sea (e. g., bowhead whales, gray whales, walrus, and ice seals).

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.

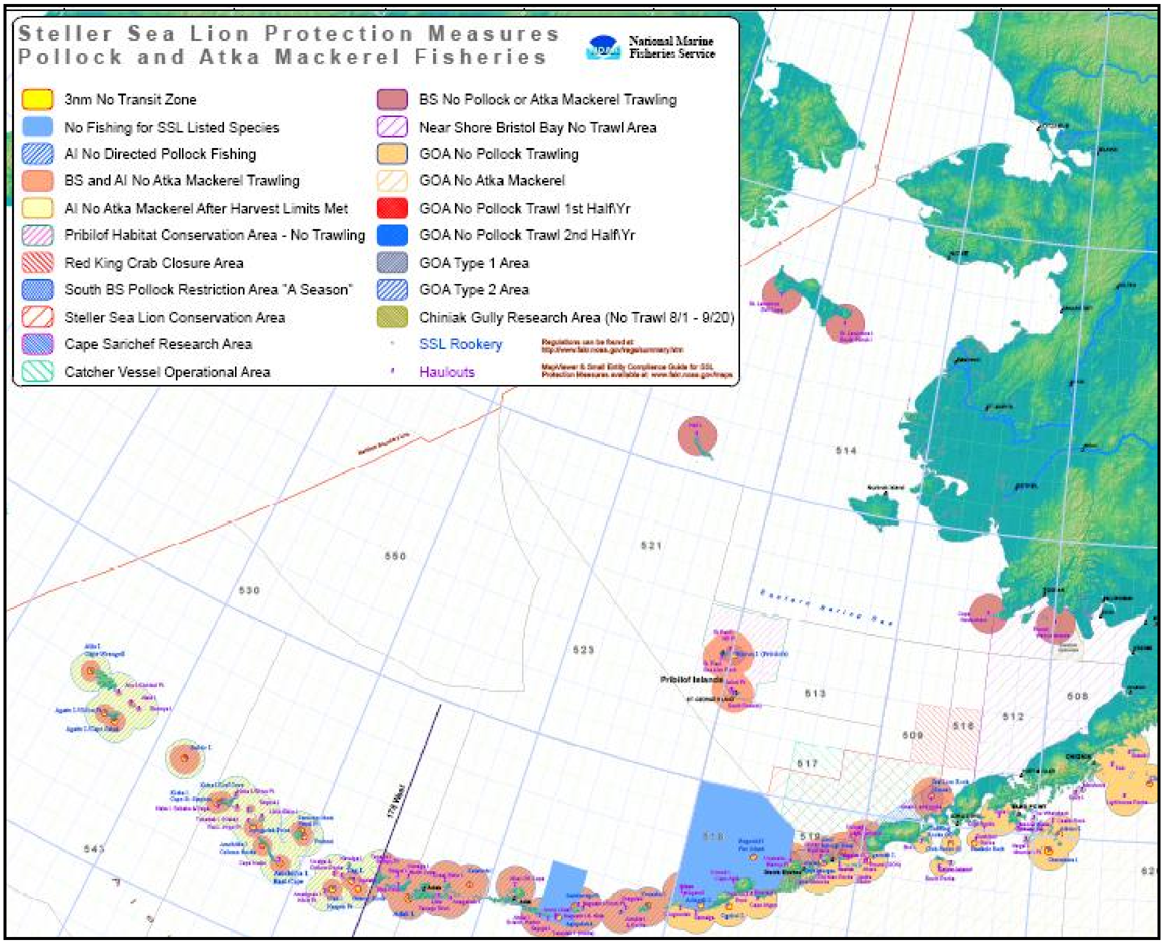

Fig. 8-5 Pollock Fishery Restrictions Including Steller Sea Lion Protection Areas of the Bering Sea Subarea. (Details of these closures are available through the NMFS Alaska Region website at http://alaskafisheries.noaa.gov/protectedresources/stellers/maps/Pollock_Atka0105.pdf).

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 (2007) 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
Pacific walrus	2002-2006	2.66	4,963-5,460	

* 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 Alternatives 4 and 5

Because Alternatives 4 and 5 are a variation on the hard caps and seasonal and sector splits under Alternative 2, the effects of Alternatives 4 and 5 on incidental takes would be the same as under Alternative 2. The 47,591 Chinook salmon cap under Alternatives 4 and 5 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 or IPA 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), beluga whales (NMFS 2008), 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, 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.

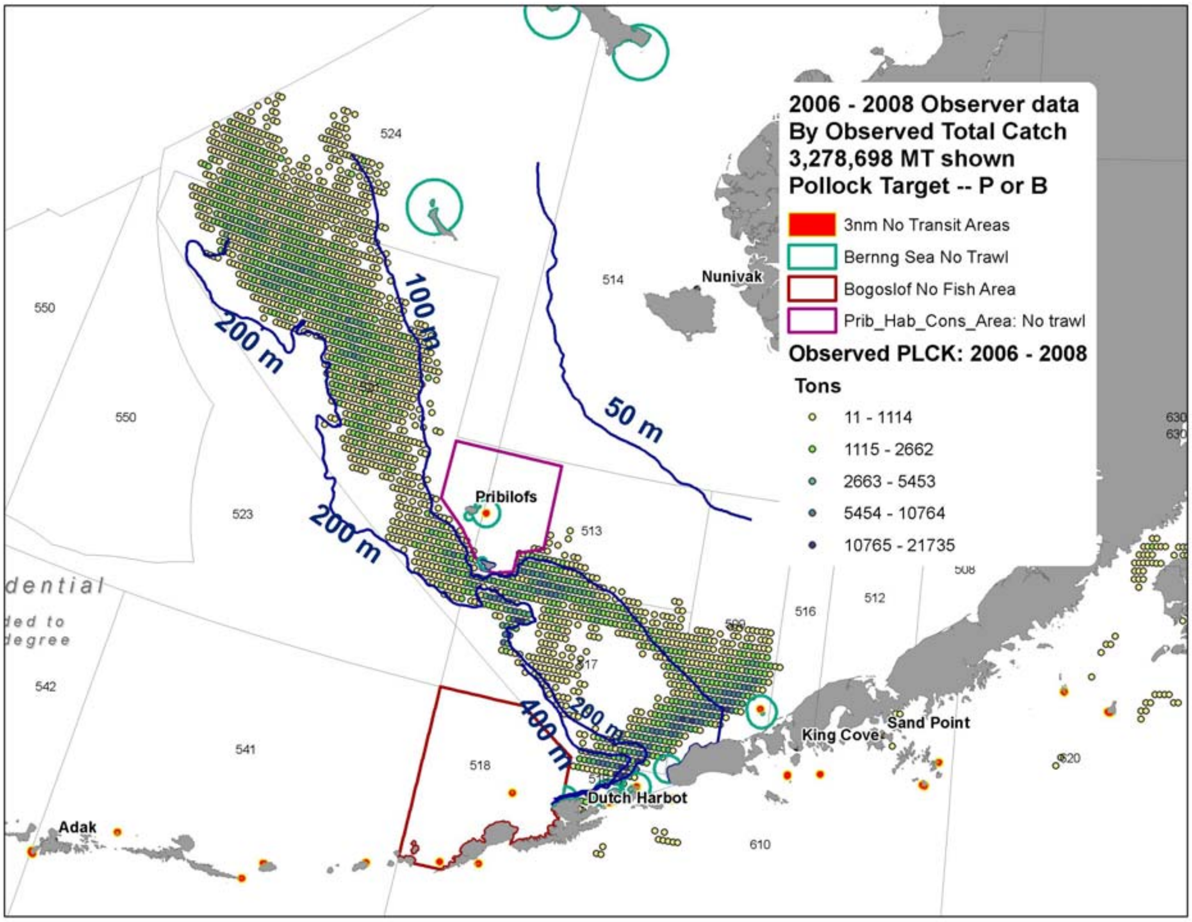

Fig. 8-6 2006-2008 Observed pollock harvest and bathymetry of the Bering Sea (Steve Lewis, NMFS Analytical Team, October 5, 2008)

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%.

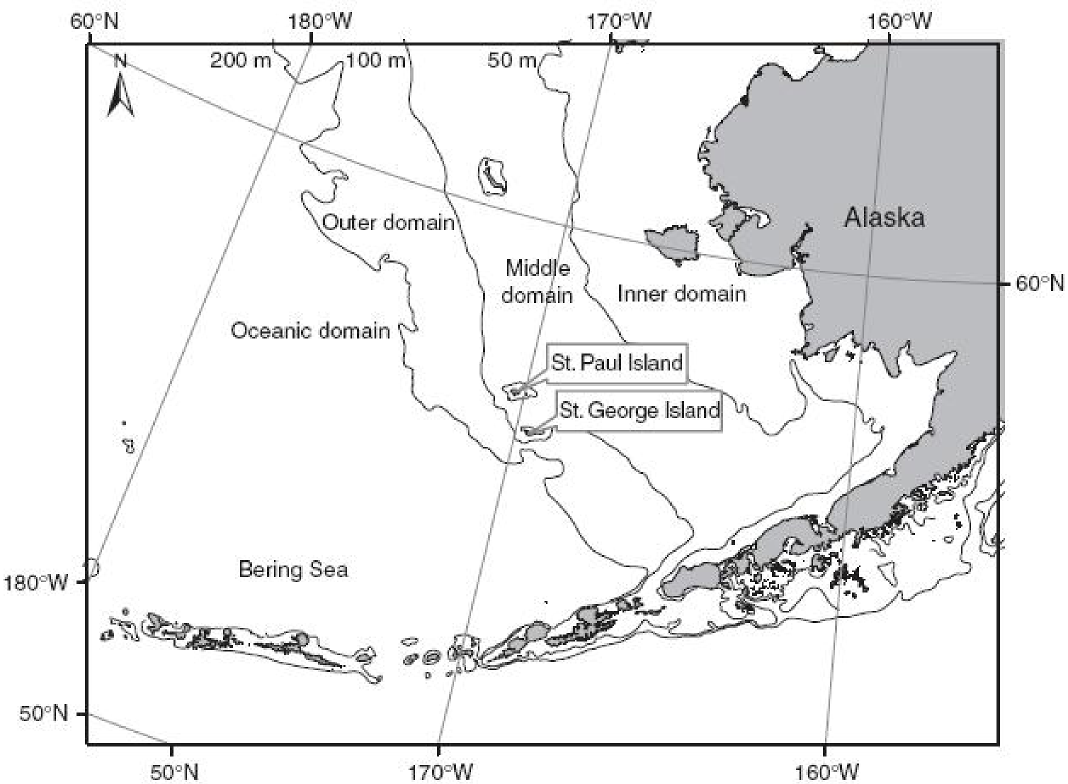

Fig. 8-7 Bering Sea Hydrographic Domains. Represents the Bering Sea areas where fur seal prey may occur (Zeppelin and Ream 2006)

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. Even though the pollock fishery takes Cook Inlet salmon as bycatch, it is not likely the number of salmon taken under the alternatives would have a measurable effect on Cook Inlet beluga whales. As shown in Table 5-48 through Table 5-52, the AEQs for Cook Inlet Chinook salmon taken in the pollock fishery range from 431 fish in 2003 to 1,639 fish in 2007, the historically highest bycatch year. The overall returns of Chinook salmon are in the thousands of fish based on the number of river systems in the inlet with Chinook salmon runs. Because the AEQs of Chinook salmon taken in the Bering Sea pollock fishery are likely a small proportion of overall Cook Inlet Chinook salmon returns, it is not likely that the Chinook salmon bycatch in the Bering Sea pollock fishery would have a measurable effect on prey availability for Cook Inlet beluga whales.

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 Alternatives 4 and 5

Alternatives 4 and 5 would have similar effects on the harvest of prey species as Alternative 2. Overall less prey may be harvested if 47,591 Chinook salmon cap is implemented, resulting in less competition for prey with marine mammals. Under the 68,392 or 60,000 Chinook salmon caps, 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. The 47,591 Chinook salmon cap may 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 47,591 Chinook salmon cap or the backstop cap under either alternative.

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 Alternatives 4 and 5

The impacts of Alternatives 4 and 5 on the disturbance of marine mammals is similar to the impacts of Alternative 2. The 68,591 or 60,000 Chinook salmon high cap would allow for more pollock fishing than the 47,591 Chinook salmon cap and may result in more potential for disturbance if marine mammals are present in the locations where pollock fishing is occurring. The 47,591 Chinook salmon cap 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 the Arctic fishery management plan will provide protection to those marine mammals that use Arctic and Bering Sea waters, such as ice seals. The plan initially prohibits commercial fishing in the Arctic Management Area until information is available to sustainably manage the fishery. Once implementing regulations are effective in 2010, no commercial fishing in either the Chukchi or Beaufort Seas 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

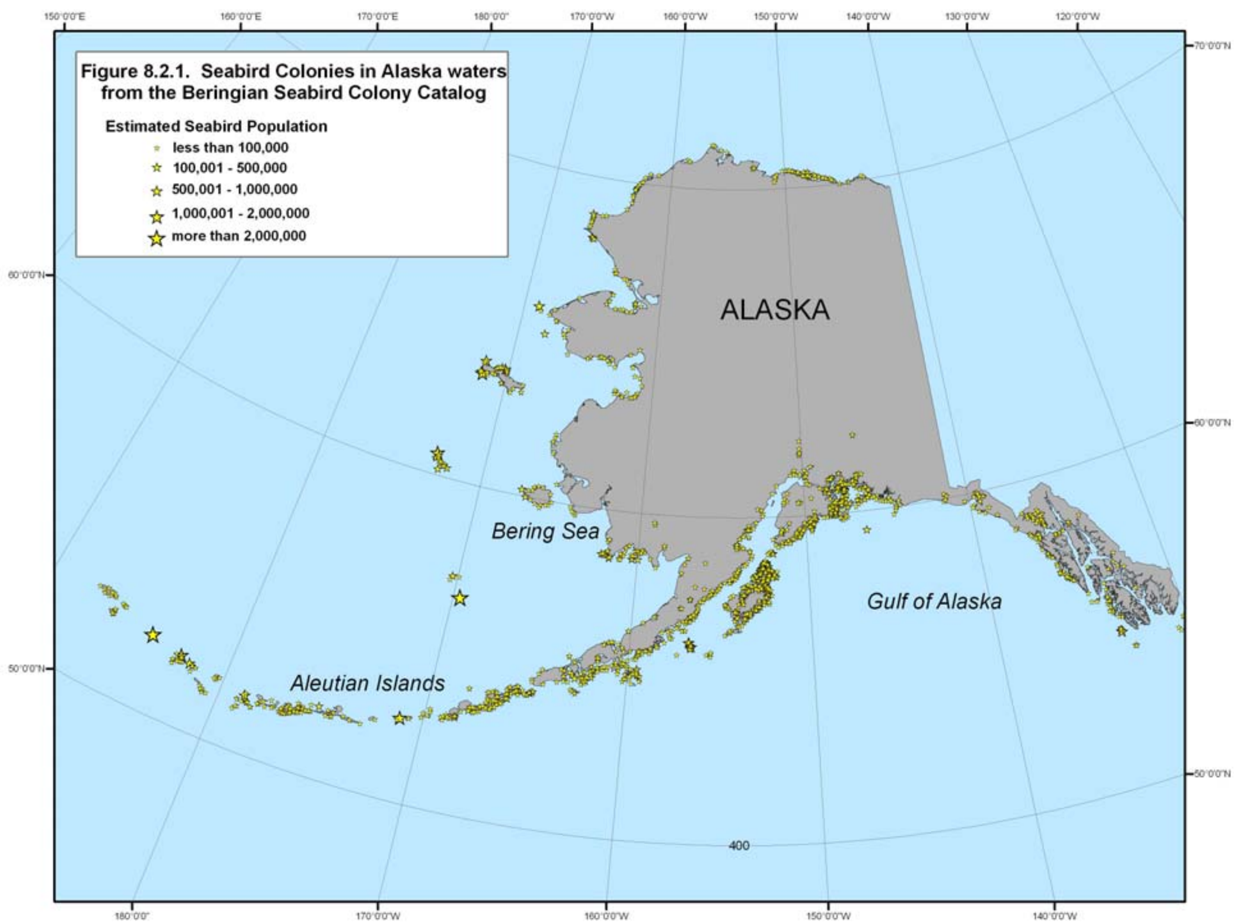

Fig.8-8 Seabird colonies in the Bering Sea.

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 USFWS documents:

- The URL for the USFWS 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.

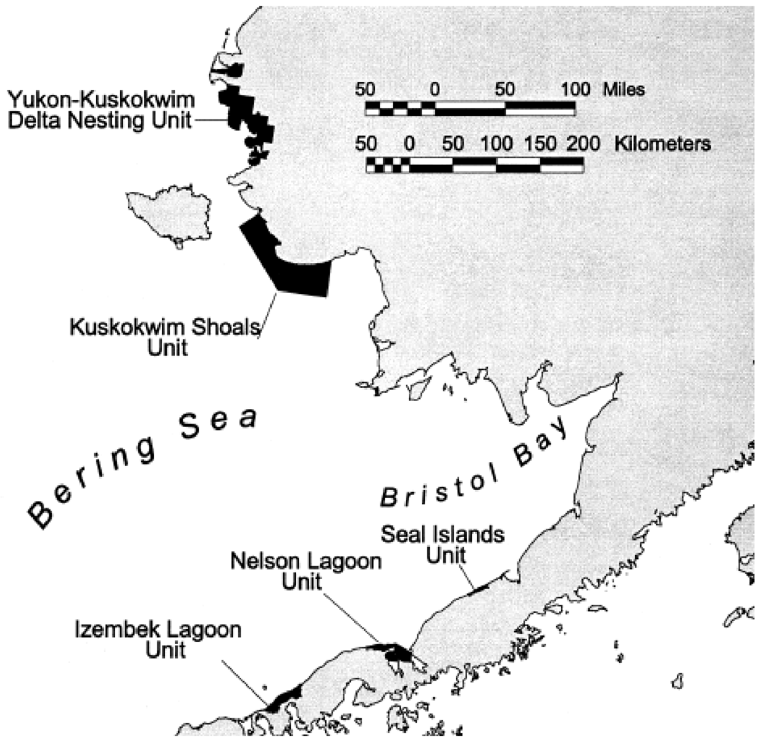

Fig. 8-9 Steller's Eider Critical Habitat (USFWS 2001b)

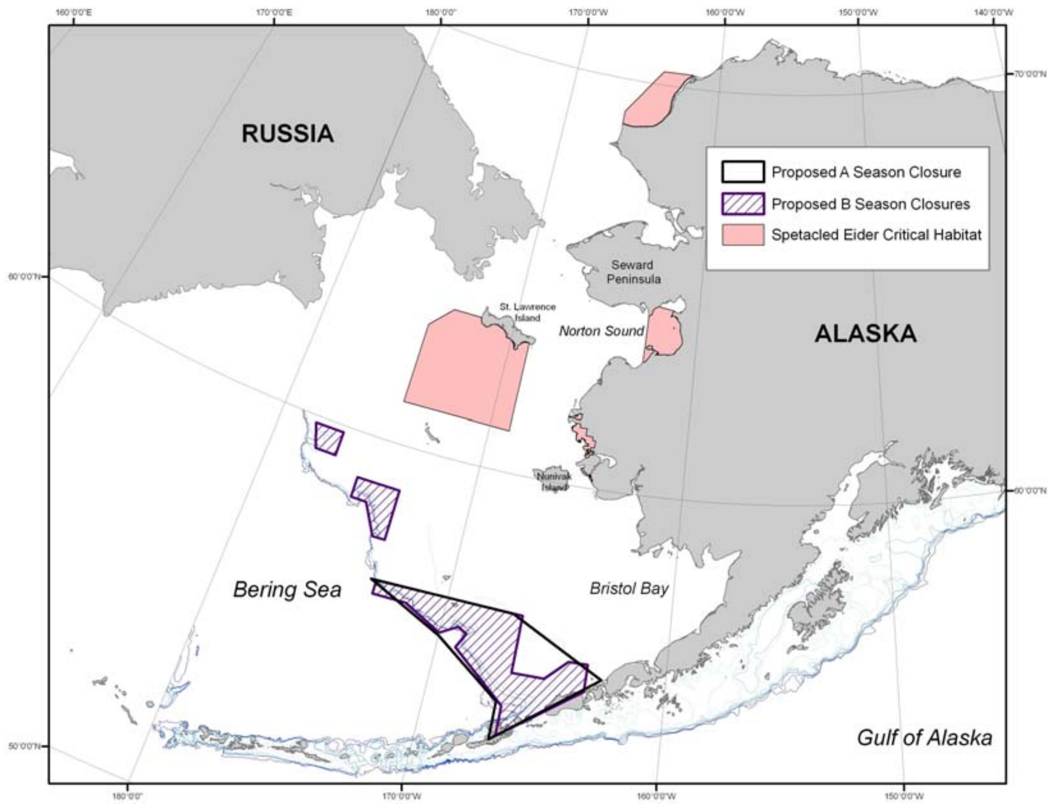

Fig. 8-10 Spectacled Eider Critical Habitat (USFWS 2001a) with the Alternative 3 proposed closures.

8.2.3 Status of ESA 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. USFWS 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). USFWS 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. The birds that interact with Alaska fisheries and are addressed in this analysis are black-footed albatrosses (BFAL, *Phoebastria nigripes*), red-legged kittiwake, and Kittlitz's murrelet (*Brachyramphus brevirostris*).

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 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 the BFAL conservation status under the international classification criteria from vulnerable to endangered in 2003. The USFWS issued a conservation plan for black-footed and Laysan Albatrosses in October 2007. Additionally, the USFWS just published a status assessment of Laysan and Black-footed Albatrosses, in response to growing concerns regarding the current status and population trends of these two north Pacific albatrosses, particularly the black-footed (Arata et al, 2009).

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 USFWS 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.

Kittlitz's murrelet 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.) (USFWS 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. Eighty-five percent 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. 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).

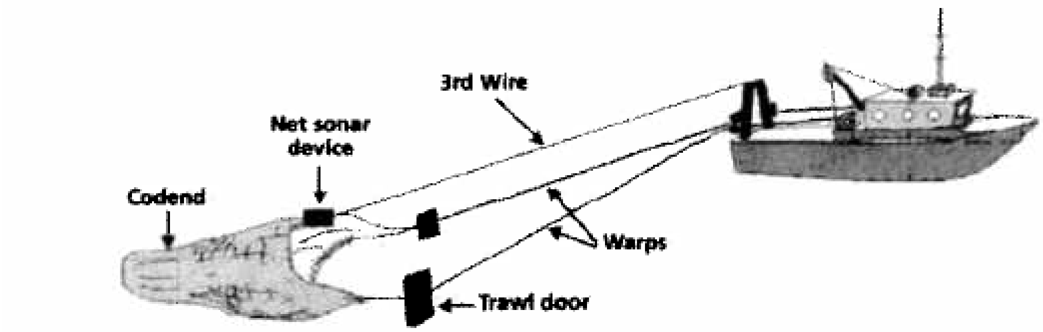

Fig.8-11 Trawl vessel diagram. (Reproduced from Dietrich and Melvin 2007, courtesy of K Williams)

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 (2002) 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 2002; 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.

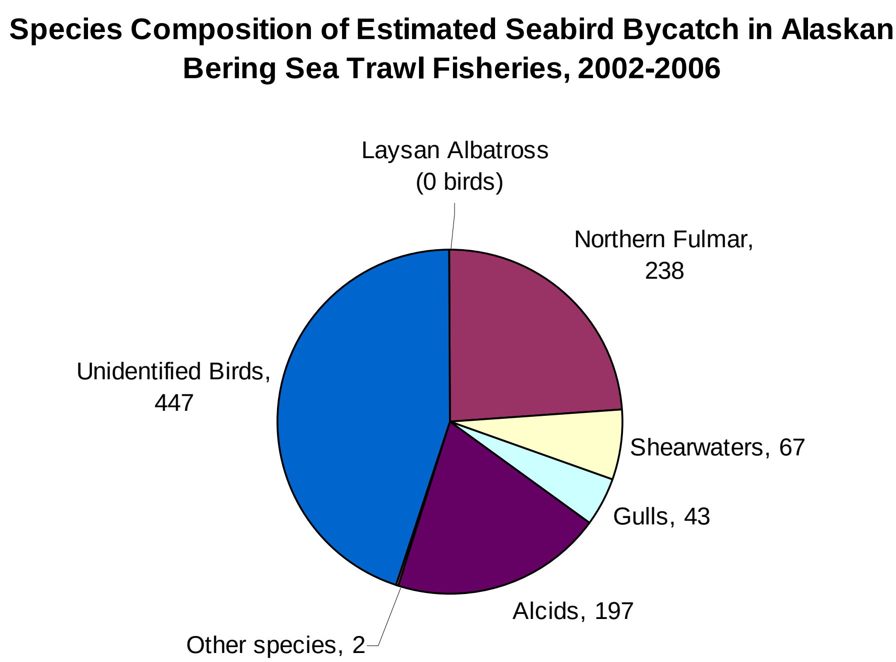

Fig.8-12 Bycatch composition of seabirds in the Bering Sea trawl fisheries, 2002-2006 (Fig. from AFSC)

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.

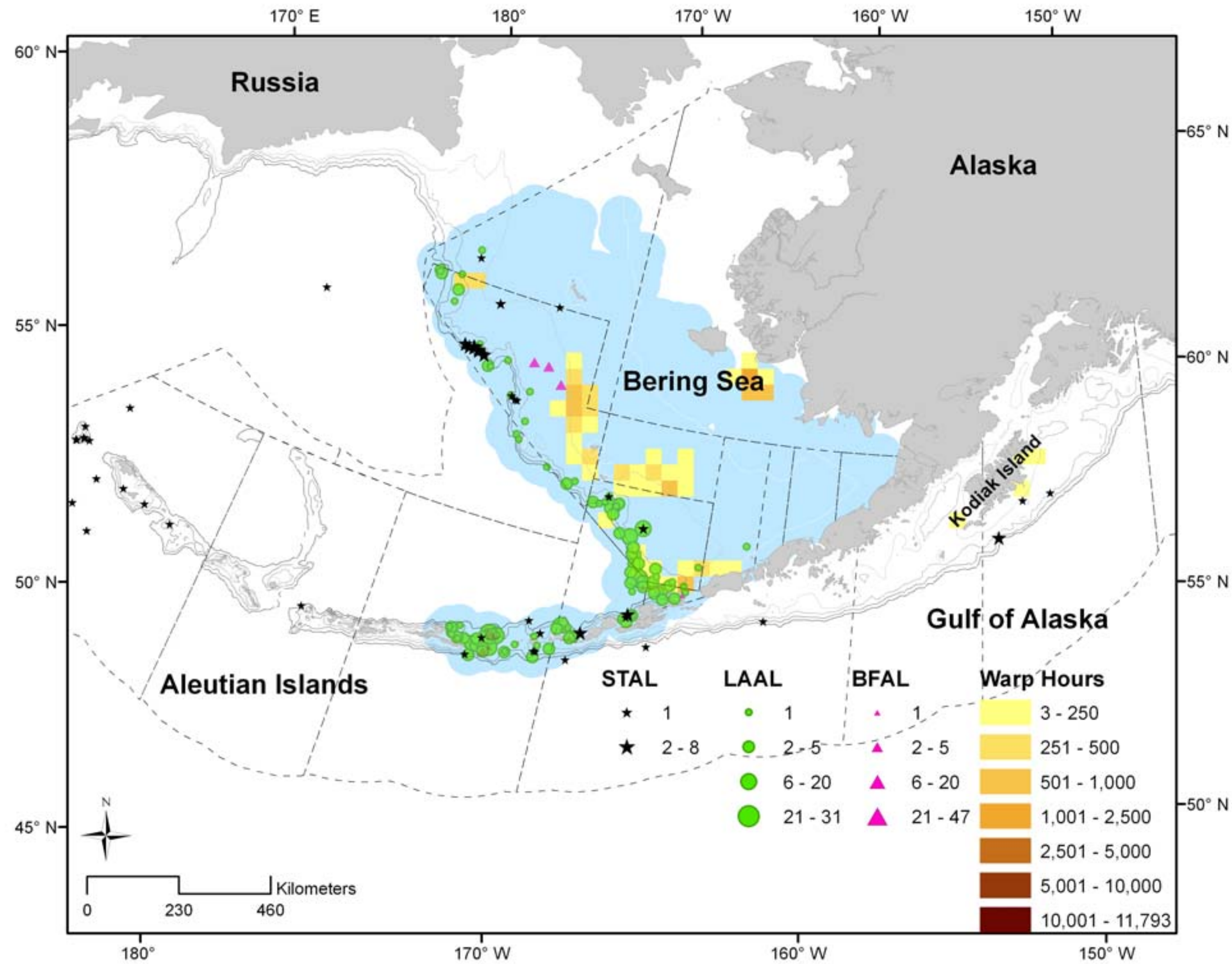

Fig. 8-13 Spatial distribution of warp hours in the pollock trawl fishery and albatross sightings, 2004. Fig. used with permission (Dietrich and Melvin 2007)

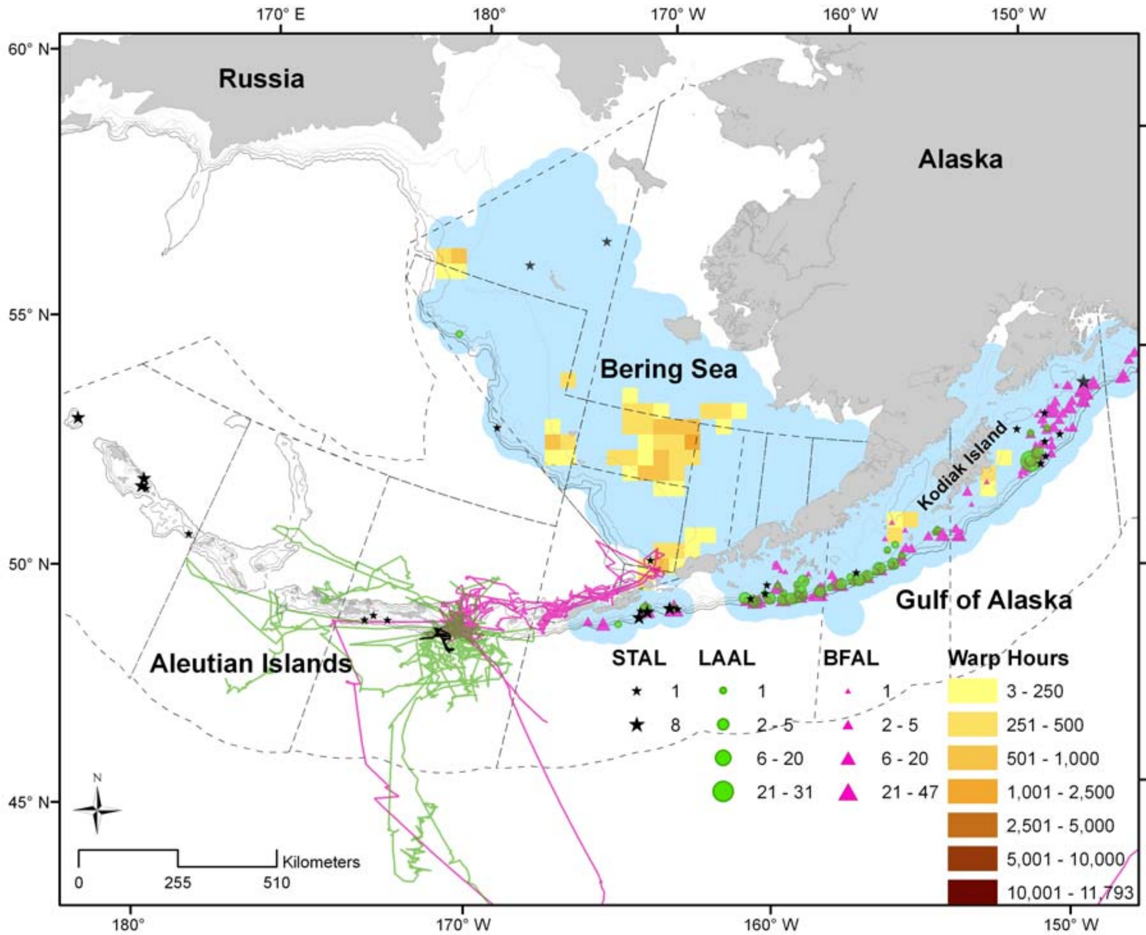

Fig.8-14 Spatial distribution of warp hours in the pollock trawl fishery and albatross sightings, 2005. Fig. used with permission (Dietrich and Melvin 2007)

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 Pribilof, 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.

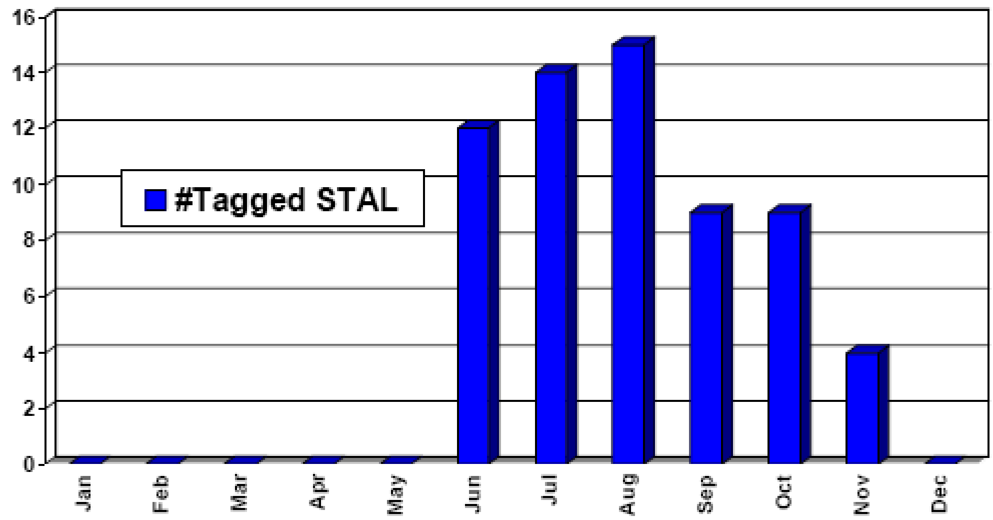

Fig.8-15 Numbers of STAL tagged in 2002-2006 by month

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.

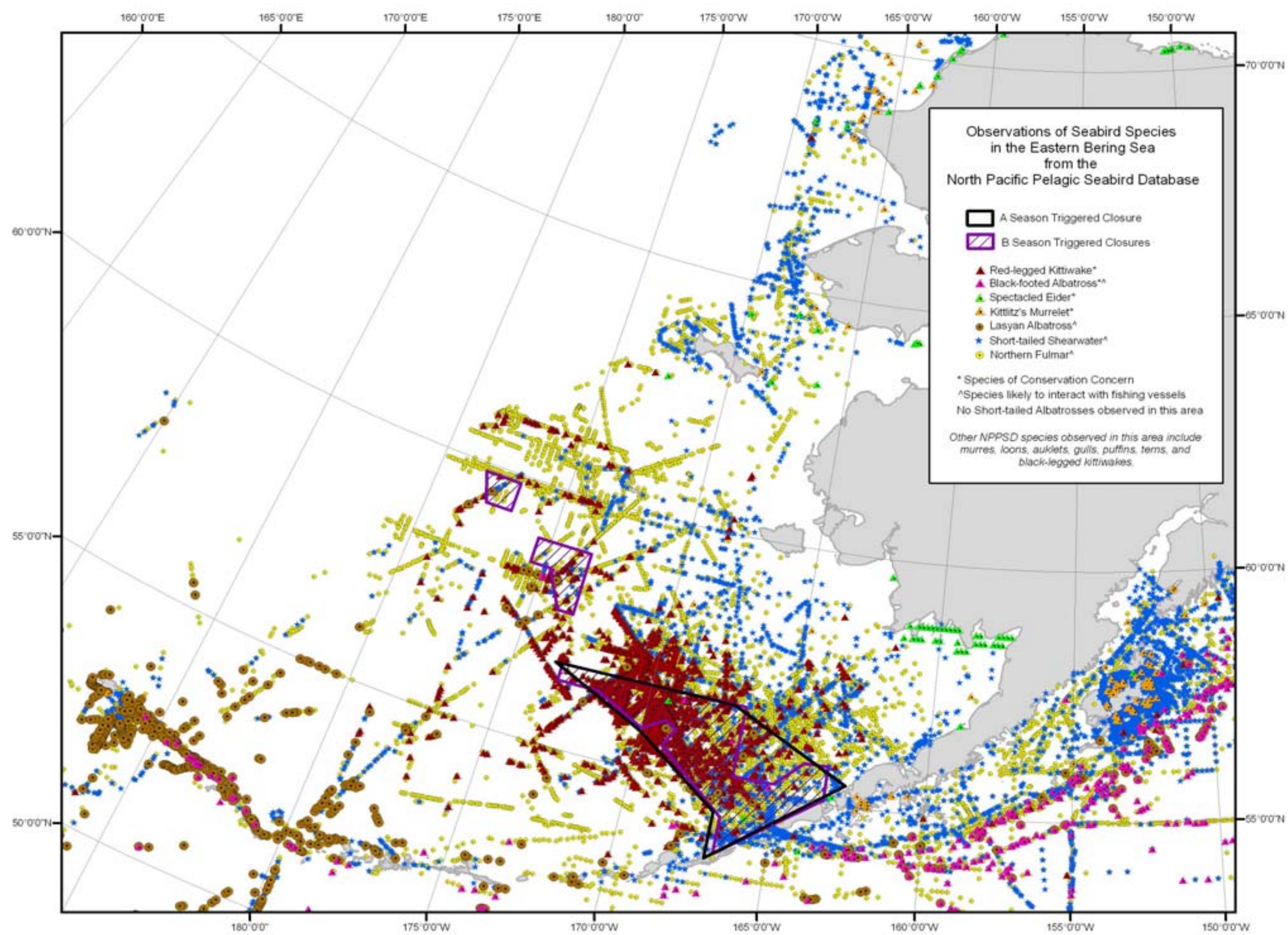

Fig.8-16 Observations of seabird species in the Bering Sea with boundaries of triggered closure areas

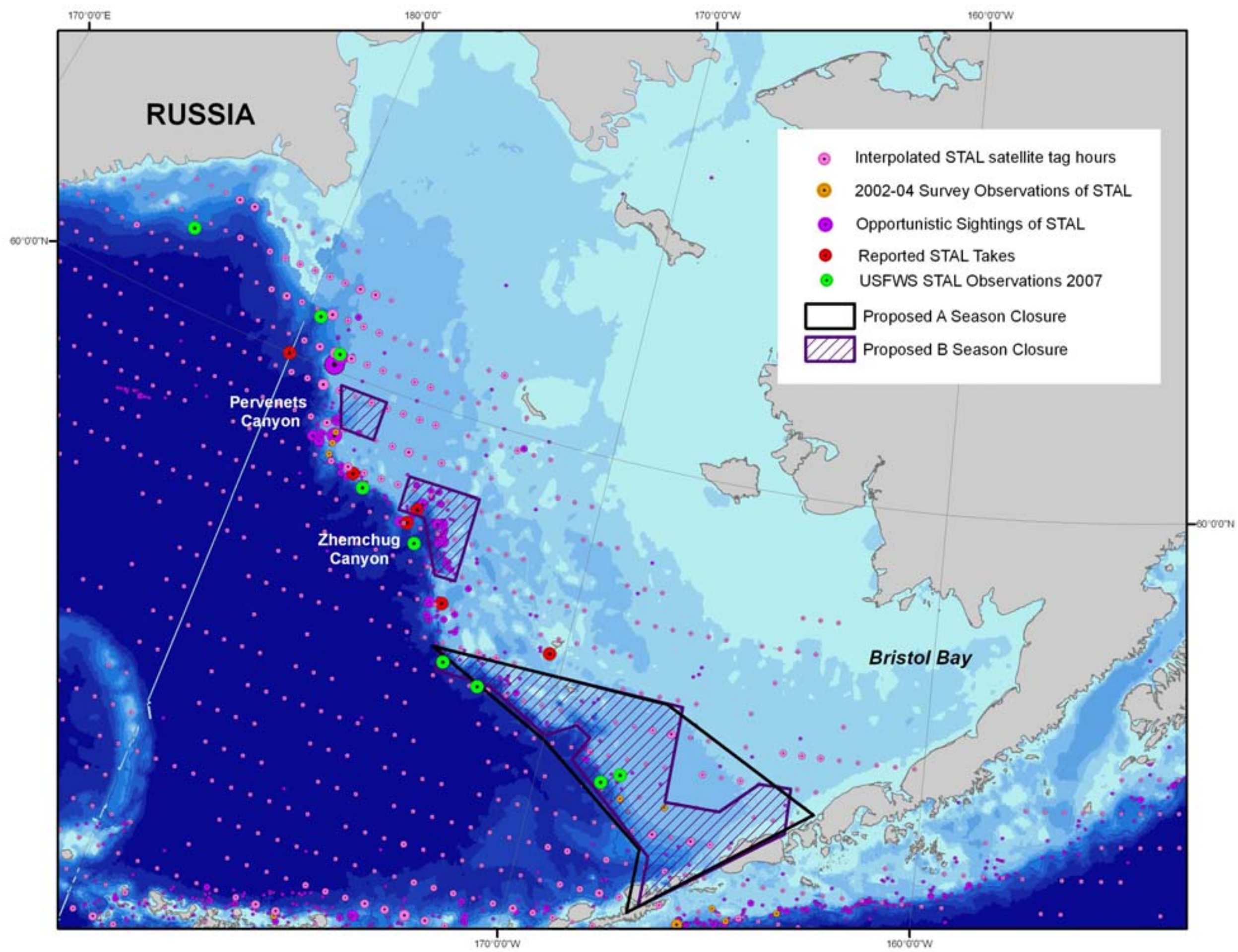

Fig.8-17 Short-tailed albatross takes (NPPSD 2004), satellite tag observations (Suryan 2006a,b), survey data (Melvin et al 2006) and (Kuletz and Labunski unpublished) and Opportunistic Sightings of Short-tailed Albatrosses (Balogh et al 2006) in relation to area closure boundaries. Bigger dots in the 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).

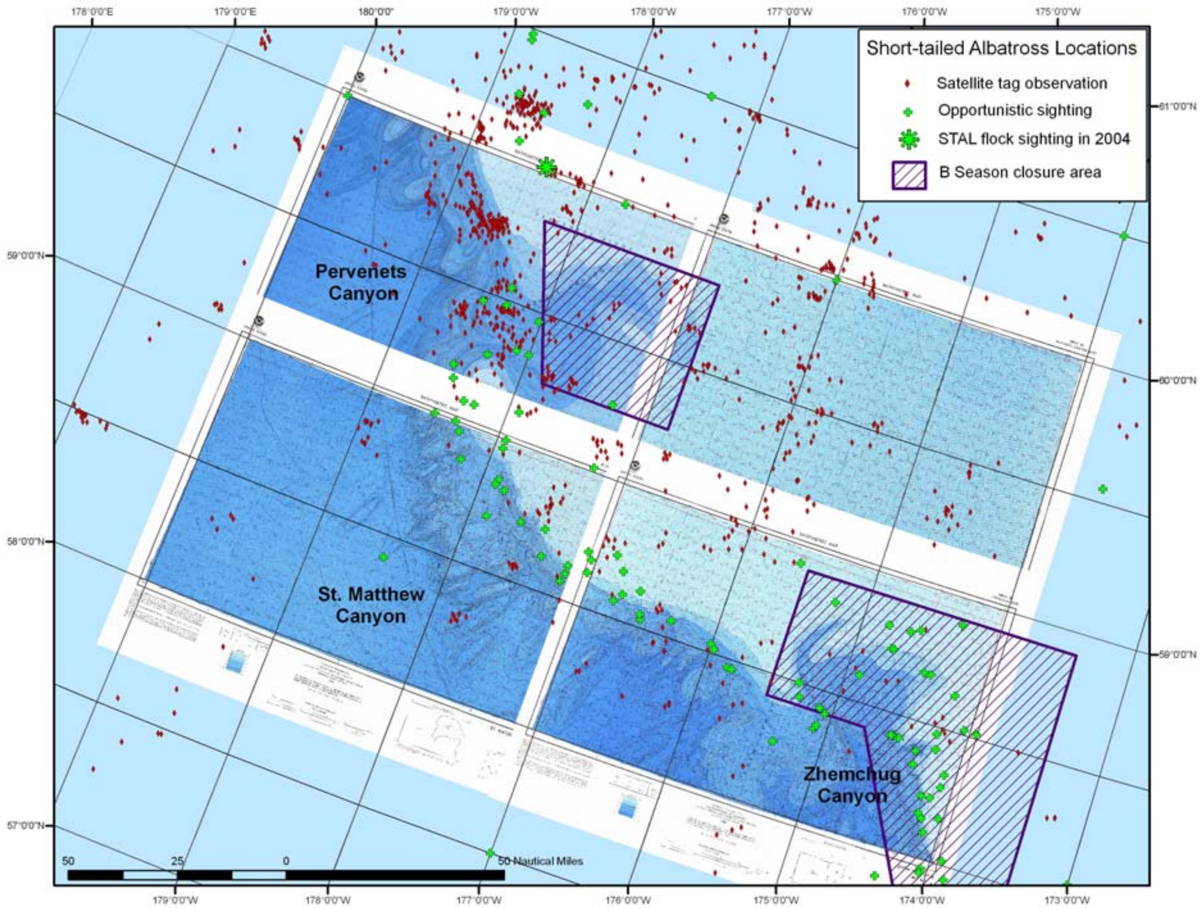

Fig.8-18 STAL locations near Bering Sea Canyons and proposed B season closure areas.

8.2.6.4 Alternatives 4 and 5

The effects of Alternatives 4 and 5 on the incidental take of seabirds are very similar to those of Alternative 2 because it is just a variation on the hard caps and seasonal and sector splits. The 47,591 Chinook salmon 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 68,392 or 60,000 Chinook salmon. 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).

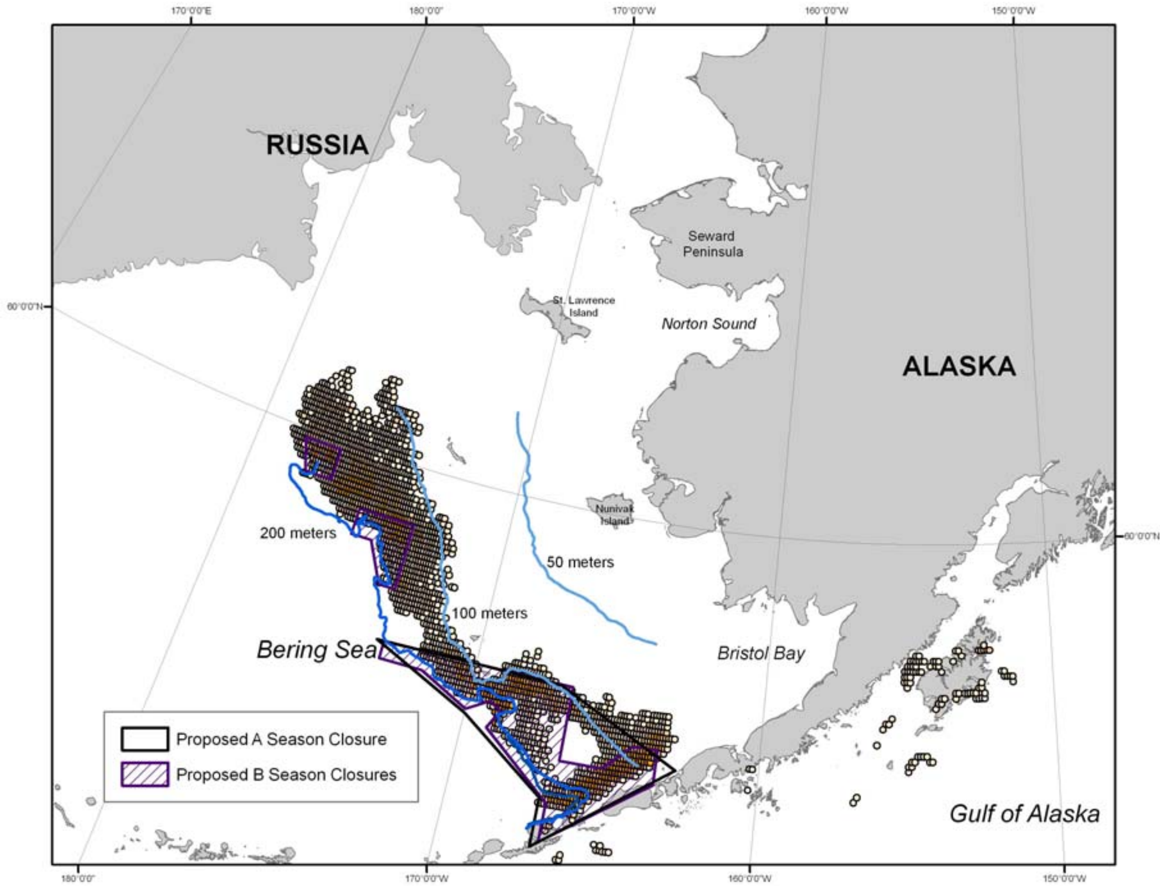

Fig. 8-19 2006-2008 Observed Pollock targeted harvest and Bathymetry of the Bering Sea (data from Steve Lewis, NMFS Alaska Region).

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 (Zador 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.
Alternative 5	Variable caps with the IPA and performance standard	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 Alternatives 2, 4, and 5 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. The RIR provides a discussion of the ability of the pollock fleet to harvest the TAC under Alternative 2, 4 and 5. 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 Alternatives 4 and 5, a portion of the fleet would have the opportunity to operate under an ICA or IPA 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). Alternatives 2, 4, and 5, 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.

In the Bering Sea, the year 2008 was the third sequential year with cold temperatures and extensive springtime sea ice cover, partially due to La Nina and a positive Arctic Oscillation. Bering Sea bottom and sea surface temperatures were cold in summer 2008. In the summers of 2006-2008, the extent of the cold pool increased from low values observed during 2000-2005. Cold pool size and location may affect the distribution and dynamics of Bering Sea fish species. The Bering Sea contrasted with much of the larger Arctic which had extreme summer minimum sea ice extents in 2007 and 2008 and positive autumn 2007 surface temperature anomalies north of Bering Strait of greater than 5°C. Despite continuing warming trends throughout the Arctic, Bering Sea climate will remain controlled by large multi-annual natural variability, relative to a small background trend due to an anthropogenic (global warming) contribution. Over the next five years the Bering Sea may shift back toward warmer temperatures and less sea ice.

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.

8.4.5 Recent ecosystem trends

The following is a summary of recent trends from the 2007 and 2008 SAFE report Ecosystem Considerations chapters 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. One crab stocks is overfished
- Recent exploitation rates on biological guilds are within one standard deviation of long-term mean levels. An exception was for the forage species of the Bering Sea (dominated by walleye pollock) which has relatively high exploitation rates 2005-2007 as the stock declined. The 2008 and 2009-recommended catch levels are again within one standard deviation of the historical mean. This is a more direct measure of catch with respect to food-web structure than are trophic level metrics.
- 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

- In the Bering Sea, the year 2008 was the third sequential year with cold temperatures and extensive springtime sea ice cover, partially due to La Nina and a positive Arctic Oscillation.

- Bering Sea bottom and sea surface temperatures were cold in summer 2008. In the summers of 2006-2008, the extent of the cold pool increased from low values observed during 2000-2005. Cold pool size and location may affect the distribution and dynamics of Bering Sea fish species.

- The Bering Sea contrasted with much of the larger Arctic which had extreme summer minimum sea ice extents in 2007 and 2008 and positive autumn 2007 surface temperature anomalies north of Bering Strait of greater than 5°C.

- Despite continuing warming trends throughout the Arctic, Bering Sea climate will remain controlled by large multi-annual natural variability, relative to a small background trend due to an anthropogenic (global warming) contribution. Over the next five years we should look for the next shift back toward warmer temperatures and less sea ice.

- 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. Declines in biomass of most species of jellyfish were observed in the BASIS survey in 2006 and 2007 compared to 2004 and 2005.
- 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.

8.4.5.3 Climate Effects on Ecosystems and Ecosystem Trends

- In a comparison between warm years (2002 to 2005) and cold years (2006 and 2007) in the Bering Sea BASIS survey, age-0 EBS pollock appear to be more broadly distributed and of higher relative abundance during warm years. They tended to be more cannibalistic in warm years and had lower energy density; whereas, in cool years they tended to switch to euphausiid-foraging and had higher energy densities. Juvenile sockeye salmon tended to consume age-0 pollock during warm years and also switched to sandlance and euphausiids in cool years. Overall there appears to be a negative relationship between relative abundance of age-0 pollock from the BASIS survey (high in recent warm years) and subsequent recruitment to age-1 pollock (low following warm years).

- Bering Sea zooplankton biomass appears to have returned towards average levels in 2006-2007 since a prolonged low period in 2001-2005.
- The relative CPUE of Arctic cod increased dramatically in the area of the cold pool in the summer Bering Sea bottom trawl survey.
- Togiak herring abundance in 2007 was below average but the stock is considered stable.
- EBS groundfish condition was low in 1999 and tended to be high in 2002-2003. Condition also tended to be higher on the outer shelf, but this may be due to the survey sampling timing.
- Spring wind-driven advection of rock sole larvae was onshore to favorable nursery areas in 2008 suggesting the potential for an above average strength 2008 year class.
- In the Bering Sea, there was an indication of a return to below average groundfish recruitment across multiple stocks in 2004.
- Overall annual surplus production in the EBS has been relatively stable. Annual surplus production of all non-pollock species in the EBS, however, decreased significantly from 1977 to 1995, increased and then has been very stable since 2000.

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 Alternatives 2, 3, 4, and 5, 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 that 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 and 5 hard cap structures would have similar impacts as Alternative 2. The RIR 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, 4, and 5 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 COMMENT ANALYSIS REPORT

In December 2008, the National Marine Fisheries Service (NMFS), in conjunction with the North Pacific Fishery Management Council (Council), issued the Bering Sea Chinook Salmon Bycatch Management Draft EIS/RIR/IRFA. In conformance with NEPA requirements, NMFS solicited public comment on the DEIS/RIR/IRFA. NMFS accepted public comments during an 80-day public comment period from December 5, 2008, to February 23, 2009. NMFS received 61 letters of comment.[49]

This Comment Analysis Report (CAR) provides summaries of the public comments received during the comment period and presents the agency's responses. Changes to the EIS and RIR from draft to final as a result of public comment are noted in this report.

A preliminary CAR was first prepared to provide information to the decision-makers and the public prior to the publication of the Final EIS and Final RIR.[50] The preliminary CAR served as an intermediate document that informed NMFS, the Council, and the public of the issues that need to be addressed in the Final EIS and Final RIR. The preliminary CAR contained summaries of the public comments and the agency's responses. The preliminary CAR also contained, as appendices, the EIS and RIR sections that authors substantively revised based on public comments. The preliminary CAR was a tool used by the EIS and RIR authors to revise the documents and respond to each statement of concern. The preliminary CAR was presented to the Council in April 2009 when it took final action to recommend Amendment 91.

9.1 The Role of Public Comment

NEPA is a procedural law intended to facilitate better government decisions concerning the management of our lands and oceans. The law has an environmental emphasis. Drafters of the law believed that by requiring a process designed to provide decision-makers with the best information available about a proposed action and its various alternatives, fewer adverse impacts would occur. NEPA does not dictate protection of the environment, but instead assumes that common sense and good judgment, based on a thorough analysis of impacts of various alternatives, will result in the development of the Nation's resources in a way that minimizes adverse impacts to our environment. This is achieved by requiring an open public process whereby the responsible government agency, combined with the stakeholders associated with a particular natural resource and development project, pull together and present relevant information for use in making decisions.

[49] NMFS posted the public comments received on the NMFS Alaska Region web page at: http://www.fakr.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/comments/default.htm

[50] NMFS posted the preliminary CAR on the NMFS Alaska Region web page at: http://www.fakr.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/eis_car0309.pdf

9.1.1 What is the Response to Public Comments?

NEPA requires government agencies to include in a Final EIS all the comments received on the Draft. The Final EIS must include responses to the comments, and must describe any changes made to the EIS as a result of those comments.

According to the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 CFR §1503.4), an agency preparing a FEIS shall assess and consider comments both individually and collectively and shall respond by one or more of the means listed below, stating its response in the final statement. Possible responses include the following:

1. Modify alternatives including the proposed action.

2. Develop and evaluate alternatives not previously given serious consideration by the agency.

3. Supplement, improve, or modify its analysis.

4. Make factual corrections.

5. Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response.

NMFS staff, Council staff, and ADF&G staff, as a cooperating agency, have undertaken a careful and deliberate approach to ensure that all substantive public comments were reviewed, considered, and responded to.

9.1.2 Analysis of Public Comments

The analysis of public comment on the DEIS/RIR/IRFA was a multi-stage process that included reviewing and summarizing the comments within each submission, preparing responses, and reviewing the responses. The process is explained in detail below.

The NMFS Alaska Region staff copied and logged all incoming letters of comment, maintaining a comprehensive list of all public comments. Staff assigned each letter or email a unique submission ID number. NMFS posted the 61 letters of comment in the order in which they were received on the NMFS Alaska Region web page.[51]

Each letter of comment was reviewed by the preparers. The preparers divided each submission by its individual comments, each of which was assigned a Comment ID number. The goal was to capture each sentence and paragraph in a comment letter containing substantive content pertinent to the DEIS/RIR/IRFA. Substantive content included assertions, suggested alternatives or actions, data, background information or clarifications relating to the DEIS/RIR/IRFA document or its preparation. The substantive comments were summarized and organized by issue area. Within the 61 letters received by NMFS, the preparers identified 304 specific substantive comments. The preparers then wrote the response for each summarized comment.

The comment summaries and responses are presented by chapter and then by subject area. During the process of identifying statements of concern, all comments were treated equally. The emphasis is on the

[51] URL: http://www.fakr.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/comments/default.htm

content of the comments. They were not weighted by organizational affiliation or other status of commenters. No effort has been made to tabulate the number of people for or against a specific aspect of the DEIS/RIR/IRFA. In the interests of producing a Final EIS and Final RIR that both meets the mission of NMFS and best serves all stakeholders, all comments have been considered equally on their merits.

9.1.3 Quality Control and Review

All comments and responses were reviewed by the preparers and NOAA General Counsel-Alaska Region. Additionally, various procedures were established in the analysis process to prevent a submission or comment from being inadvertently omitted. Communication and cross-checking between the submissions and the comments has ensured that all submissions received during the comment period are included in the report.

9.2 Chapter 1 Comments

These comments are on Chapter 1; the purpose and need, Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act or MSA) national standards, NEPA issues, and general EIS issues. Changes were made to Chapter 1 to reflect these comments and to up-date the information on the Bering Sea pollock fishery, Chinook salmon bycatch in the pollock fishery, the consultations with Alaska Native tribes, and the Council's community outreach process.

NMFS acknowledges the following general comments:

- NMFS has portrayed a very jaded management perspective and it is clear that NMFS is mainly concerned with ensuring that pollock fishing continues even if salmon are not effectively conserved.

- Not enough is being done to reduce the bycatch high rate in the pollock trawl fishery.

- The proposed actions (including "no Action") have the potential to significantly affect the human environment of the Bering Sea.

- It takes too long to implement a management action when there are clear concerns regarding conservation and sustainability of the Chinook salmon stocks.

- Take final action in April 2009 to meet the goal as stated in the DEIS of controlling and reducing salmon bycatch regardless of annual abundance. Despite the deficiencies of the DEIS, any further delay would be detrimental to the salmon resource, meeting escapement objectives, and the communities and people who depend on the salmon resource, both in the US and Canada.

- Immediate action should be taken to reduce wasteful Chinook salmon bycatch in the groundfish fisheries despite the numerous problems with the DEIS. It is taking too long to implement this management action when there are clear concerns regarding conservation and sustainability of the Chinook salmon stocks. The state of Chinook salmon, and the communities who depend on them for subsistence and income, has deteriorated rapidly since the Council first began this action.

- Flexibility in the strategy to minimize salmon bycatch is important to minimize effects of the pollock fishery, but should not preclude decisive action to protect salmon stocks and the communities, commercial fisheries, and subsistence fisheries that depend on them.

9.2.1 Comments on legal issues

Comment 1-1: How are the alternatives consistent with the Magnuson-Stevens Act requirement to reduce salmon bycatch?

Response: The alternatives represent a range of bycatch management measures for analysis that assist the decision-makers and the public in determining the best alternative to meet the purpose and need for the action. The EIS explains the purpose and need in section 1.2. The alternatives meet the purpose and need by presenting different ways to minimize Chinook salmon bycatch in the Bering Sea pollock fishery to the extent practicable while achieving optimum yield. Based on the EIS analysis and the public comments received, the agency will be able to make an informed decision on which alternative best meets the purpose and need for the action. Amendment 91 must comply with the Magnuson-Stevens Act and all other applicable federal laws. With respect to the Magnuson-Stevens Act, Amendment 91 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. The FEIS and the record of decision explain how the final preferred alternative best meets the purpose and need and complies with the Magnuson-Stevens Act.

Comment 1-2: The Chinook salmon bycatch plan was developed to meet the objectives of National Standard 9. However, what is required by National Standard 9 has been hotly debated before the courts with various parties offering different interpretations. According to the DEIS, the interpretation of National Standard 9 used to justify the proposed bycatch reduction proposal is that National Standard 9 "expressly requires that bycatch be avoided to the maximum extent practicable" and that "every" practicable effort be made to avoid bycatch, DEIS at 688-689. This interpretation of National Standard 9 has been expressly rejected by the courts as unnecessarily and unlawfully strict. Contrary to the DEIS, National Standard 9 does not "expressly" require that bycatch be avoided to the "maximum" extent practicable. Alternatives 2-4 were designed to meet a non-existent legal standard. National Standard 9 does not require that these bycatch reduction measures be adopted.

Response: This comment mischaracterizes the EIS. In no less than ten places, the EIS correctly notes that National Standard 9 requires that the adopted bycatch management measures, among other things, minimize bycatch to the extent practicable. Most prominently, the Purpose and Need section clearly states: "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."

As the comment notes, on pages 688-89 of the draft RIR (Chapter 10 of the DEIS) is a quotation from the October 2008 minutes of the Scientific and Statistical Committee (SSC) that contains the SSC's discussion of the difference between an incidental catch allowance and a prohibited species catch limit, the latter of which "must be regarded as a 'prohibition' against harvest (to the maximum extent practicable), with an absolute cap." The RIR goes on to explain that "this is so critical a distinction that it has been enshrined as National Standard 9 of the Magnuson-Stevens Act, expressly require[ing] that bycatch be avoided to the maximum extent practicable." NMFS agrees that it would have been preferable to use the exact language of National Standard 9 here. Accordingly, NMFS has corrected the non-quoted portion of the text in RIR Section 6.1.10, Implications of Sector and Cooperative Level Quota Share Allocation of Bycatch Caps. However, in light of the EIS's correct statements in the other, more relevant passages and the context of the SSC's discussion here, the EIS did not rely on the standard set forth on in the SSC minutes any material way, including with respect to the development, discussion, and analysis of Alternatives 2-5.

Comment 1-3: Alternatives 2-4 each violate National Standard 1 of the MSA by preventing the achievement of optimum yield in the pollock fishery. First, as the DEIS readily admits through its calculations of forgone catch and revenue, the bycatch reduction measures will prevent the harvest of the pollock TAC. Achieving the optimum yield for the BSAI groundfish fishery depends on fully harvesting the pollock TAC. Additionally, Alternatives 2-4 will prevent the achievement of the optimum yield the fishery is capable of producing on a continuing basis by forcing the harvest of less biologically acceptable age and size classes, all in violation of National Standard 1. Finally, preventing the full harvest of the pollock TAC because of bycatch-induced fishery closures will deprive the U.S. of substantial quantities of protein. Given that food production is a key element of achieving optimum yield, restrictions on food production caused by Alternatives 2-4 violate National Standard 1.

Response: NMFS disagrees. This comment conflates achieving optimum yield with harvesting the total allowable catch. The MSA defines optimum yield to mean "the amount of fish which . . . (A) 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; [and] (B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor . . . ." 16 U.S.C. § 1802(33). NMFS has established that the optimum yield for the Bering Sea Aleutian Island Management area is a range from 1.4 to 2.0 million metric tons (mt). 50 C.F.R. § 679.20(a)(1)(i).

By contrast, the total allowable catch "is the annual harvest limit for a stock or stock complex, derived from the [acceptable biological catch] ABC by considering social and economic factors" (Fishery Management Plan for Groundfish of the BSAI Management Area ("BSAI FMP") (Jan. 2009) at 13). NMFS's regulations provide that the "sum of the TACs so specified must be within the [optimum yield] range . . . ." 50 C.F.R. § 679.20(a)(2). The BSAI FMP provides further elaboration of the differences among optimum yield (OY), acceptable biological catch (ABC) and total allowable catch (TAC):

> In addition to definitional differences, OY differs from ABC and TAC in two practical respects. First, ABC and TAC are specified for each stock or stock complex within the "target species" and "other species" categories, whereas OY is specified for the groundfish fishery (comprising target species and other species categories) as a whole. Second, ABCs and TACs are specified annually whereas the OY range is constant. The sum of the stock-specific ABCs may fall within or outside of the OY range. If the sum of annual TACs falls outside the OY range, TACs must be adjusted or the FMP amended (BSAI FMP at 13).

Thus, whether salmon bycatch management measures preclude the pollock fishery from harvesting its entire TAC for any given year is not determinative of whether the BSAI groundfish fishery achieves optimum yield. If the total catch for the BSAI groundfish fishery is within 1.4 and 2.0 million mt over the long-term, optimum yield will have been met. NMFS clarified the use of the term optimum yield in the FEIS to reflect this response and the statute, NMFS's regulations, and the BSAI FMP, which are authoritative and explicit on this issue.

It is worth emphasizing that "optimum yield is a standard that should be achieved over the long-run, not necessarily a standard that must be achieved with precision each year." Nat'l Coalition For Marine Conservation v. Evans, 231 F.Supp.2d 119, 135 (D. D.C. 2002). See also 50 C.F.R. § 600.310(f)(1)(ii) ("'achieving, on a continuing basis, the OY from each fishery' means producing, from each fishery, a longterm series of catches such that the average catch is equal to the average OY and such that status determination criteria are met"). In this case, even if the Council and NMFS were to evaluate compliance with National Standard 1 only in terms of the amount of groundfish harvested in the BSAI Management Area, each alternative would achieve optimum yield (1.4 – 2.0 million mt), though to varying degrees. For example, if one considers the lowest hard cap option (29,300), the table below shows that, under the worst case scenarios, after subtracting the forgone pollock from the total catch within the BSAI groundfish fishery, optimum yield still would have been met for the 2003-2007 period.

Year	Alternative	Cap	Total forgone pollock (mt)	BSAI groundfish total catch	Difference
2003	2a (50/50)	29,300	392,440	1,973,541	1,581,101
2004	2a (50/50)	29,300	286,802	1,979,143	1,692,341
2005	2a (50/50)	29,300	401,470	1,981,374	1,579,904
2006	2d (50/50)	29,300	503,048	1,976,553	1,473,505
2007	2a (70/30)	29,300	653,339	1,856,717	1,203,378

See Table 4-4 through Table 4-8. Theoretically, while the total catch in 2007 would have been below 1.4 million mt, the results of that single year do not undermine the conclusion that OY would have been met even under the worst case scenario because, as noted above, OY is measured over the long-term.

With respect to the argument that the alternatives would force the harvest of less biologically acceptable age and size classes, the Section 4.3 notes this possibility if pollock fishermen go to extremes to avoid salmon bycatch. The EIS explains that this could result in lower TACs and ABCs. However, as explained above, a lower TAC for the pollock fishery does not necessarily correlate to a failure to achieve OY. Moreover, if the BSAI groundfish fishery fails in the future to achieve optimum yield on a continuing basis, the Council and NMFS will assess the reasons for that failure and either propose modifications to the FMP or reassess the determination that OY for the fishery is between 1.4 and 2.0 million mt (or both).

With respect to the argument that the alternatives violate National Standard 1 because they would deprive the United States citizens of substantial quantities of protein, the commenter misconstrues National Standard 1. Overall benefit to the Nation does not equate with protein supply. Rather, it requires consideration, in addition to food production, of recreational opportunities and protection of marine ecosystems. Further, commenter's argument is speculative. It makes several assumptions not supported by the best scientific information available, such as that no protein substitution would occur and that all of the forgone pollock would have been delivered to U.S. markets (as opposed to exported). Nonetheless, NMFS will consider any credible information to the contrary that becomes available.

Comment 1-4: When considering the requirements of National Standard 1 and the practical meaning of the term "to the extent practicable" in National Standard 9, it is important to bear in mind the complete statutory context. The ultimate goal of the MSA is to conserve and manage fisheries to achieve their optimum yield. Reducing bycatch is not the MSA's top priority. To achieve optimum yield, the goals of the different National Standards may conflict, and the goals of one will take priority over the goals of another. In this case, to strike an overall balance, not all National Standards are created equally and National Standard 1 provides a mandate that optimum yield be achieved.

Response: To the extent this commenter argues Congress intended NMFS to give National Standard 1 priority over National Standard 9, or any other standard, NMFS disagrees. All regulations enacted under the MSA must be consistent with the ten national standards. 16 U.S.C. § 1851(a). Congress did not establish any priority among the specific standards. It did, however, establish that the "purpose of the Act is clearly to give conservation of fisheries priority over short-term economic interests." Natural Res. Def. Council v. NMFS, 421 F.3d 872, 879 (9th Cir. 2005); see also, Natural Res. Def. Council v. Daley, 209 F.3d 747, 753 (D.C. Cir. 2000). The Council and NMFS will therefore ensure that the final action is consistent with the national standards in light of the MSA's over-arching purpose.

To the extent this commenter argues Congress intended NMFS to consider and balance all the national standards in the development of regulations, NMFS agrees. Congress was aware of the potential conflicts among the competing National Standards' requirements and authorized the Secretary of Commerce to exercise discretion and judgment in balancing the standards. Alliance Against IFQs v. Brown, 84 F.3d 343, 350 (9th Cir. 1996).

Comment 1-5: The DEIS neglects to specifically address National Standard 8, which requires minimizing adverse economic impacts on communities. Although the DEIS discusses communities in several sections, the DEIS fails to explicitly address the requirement in relation to the other National Standards. The DEIS does not provide enough or detailed enough analysis as to how the proposed action and its various alternatives may affect coastal Alaska Native communities. Miscalculations, omissions, and inaccuracies abound in the analysis on subsistence users and their harvest. The DEIS in no way satisfies the intent of National Standard 8 regarding the impact to fishing communities. Thus, NMFS should consider National Standard 8, as balanced with the other National Standards, especially in the context of adverse impacts on the subsistence and commercial economics in Western Alaska salmon fisheries.

Response: NMFS agrees that the Council and NMFS must consider and weigh all National Standards, including National Standard 8, when they select and approve the final action. National Standard 8 provides:

> Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data [based on the best scientific information available,] in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

16 U.S.C. § 1851(a)(8). NOAA guidance on National Standard 8 explains that this standard requires that a fishery management plan take into account the importance of fishery resources to fishing communities, and where the preferred alternative negatively affects the sustained participation of fishing communities, the FMP should discuss the rationale for selecting this over another alternative with a lesser impact on fishing communities. 50 C.F.R. § 600.345(b)(1).

The EIS itself does not attempt to balance the National Standards. The Council and NMFS will perform that analysis when they select and approve the final action. The EIS endeavors to analyze all impacts from the alternatives in order to disclose such information to the public and provide the decision-makers with the necessary information to balance the National Standards and render a final decision.

NMFS agreed that the EIS and RIR should provide a more complete description of subsistence users, their Chinook harvest, and the value of this fishery to western Alaska, even if the total value of the Chinook subsistence harvest 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 (a discussion of this issue is provided in RIR Section 5.1.1). NMFS reorganized, clarified and created a section in the RIR to better address these issues, and add a list and description of information on potentially affected communities. Final RIR Sections 3.2 and 3.3 describe subsistence harvests of Chinook salmon and provide detailed descriptions of regional subsistence salmon fisheries throughout western Alaska.

With regard to the comment that the EIS does not provide enough analysis as to how the proposed action may affect coastal Alaska Native communities, NMFS lacks the necessary information to provide community-level impact analysis because there is no information available on which NMFS could rely to directly link Chinook salmon taken as bycatch in the pollock fishery with the in-river runs of Chinook salmon near any particular community. The EIS utilizes the best scientific information available, which is provided and presented by region (EIS Chapter 5 and RIR Chapter 3). These section provides extensive background information on the subsistence (and commercial and recreational) Chinook salmon fisheries in western Alaska river systems that are likely affected by Chinook salmon bycatch. The regions are based on the ADF&G management areas (Kotzebue, Norton Sound, Kuskokwim River/Bay, Yukon, and Bristol Bay).

In addition, RIR Chapter 5 states that it is not possible with presently available information to determine the proportions of river-specific Adult Equivalency (AEQ) estimates of returning adult Chinook salmon that would be caught in subsistence fisheries (or commercial or recreational fisheries) in the various river systems of western Alaska, and further, in any particular community. This Chapter notes that, while it is difficult to assess the specific impacts of additional AEQ Chinook salmon to a given river system, it is reasonable to assume that any additional fish would benefit escapement and harvest.

Finally, shoreside processing sector revenue impacts are estimated in the RIR, embedded within the overall shoreside sector impacts. This is because the price used to estimate impacts on the shoreside sector is inclusive of all value-added processing, at shoreside plants, to the first wholesale level. It is important to note that the analysis includes shoreside processing impacts, just not at the port or community level. Confidentiality requirements prevent refining shoreside impacts down to the port or community level.

Comment 1-6: The Problem Statement adopted by the Council states salmon bycatch "must be reduced" to address concerns about subsistence fishermen in rural areas who depend on local fisheries for their sustenance and livelihood (pg 1). Recognizing the very real and important role that subsistence has in the life of many Alaskans, the sad reality is that restricting the pollock fishery will have not have the positive benefits for subsistence that the DEIS implies. In fact, the central problem with the DEIS is that it assumes these benefits will occur without doing an analysis of the impacts of the alternatives on the availability of Chinook salmon for subsistence. If the DEIS had done so, it would have found that even if 100% of the Chinook salmon bycatch was eliminated, the subsistence harvest would have increased by only one-tenth of one fish per household in the Norton Sound area, just over one fish per household in the Kuskokwim area, 1.7 fish per household in the Yukon, and less than three fish per permit holder in Bristol Bay.

Response: This comment misconstrues the role the Council's problem statement plays in the process, ignores other language in the problem statement that puts this excerpted language in its proper context, and makes an improper extrapolation from the analysis in the EIS and RIR.

The Council issues its problem statement as one of the first steps in the process for amending fishery management plans and/or promulgating regulations. It is a trigger for the NEPA process and, as a result, occurs before the EIS and RIR are drafted. The problem statement reflects the concerns of the Council, which is a body of 11 voting members who typically offer several viewpoints. It is important for NMFS, the public, and the regulated fishing community to understand the problems that form the incipient stage of the Council's action, and it guides in the development of an EIS's Statement of Purpose and Need.

Here, the Council properly expressed its concern due to the high Chinook salmon bycatch levels by the pollock fishery. The problem statement, on page 1, identifies several reasons for the Council's concern, including the high value of Chinook salmon to commercial, subsistence, and sport fisheries; the command in National Standard 9 to minimize bycatch to the extent practicable; and the low salmon runs in Western Alaskan rivers. The problem statement also states that the reasons for those low runs are uncertain, but the increases in bycatch by the pollock fishery "may be a contributing factor."

Following the Council's problem statement, NMFS and the Council developed the EIS and RIR to analyze alternative management measures, the purpose of which, as set forth in the EIS's Statement of Purpose and Need, is "minimize Chinook salmon bycatch to the extent practicable, while achieving optimum yield from the pollock fishery." NMFS agrees that subsistence plays a very important role in the culture and lives of many Alaskans, and subsistence users may benefit from the minimization of bycatch of the species on which they rely. NMFS disagrees, however, that the analysis overstates benefits from the minimization of Chinook salmon bycatch in the pollock fishery.

Rather, the EIS uses a three-step approach to explain what the potential benefits may be, which, in light of the problem statement and scoping comments, is an issue of great concern to the Council and public. The three-step approach is described in the executive summary and in Chapter 5. In the first step, the EIS analyzes reductions in bycatch numbers or salmon saved from bycatch by the pollock fishery, and the EIS is careful to point out that this number does not represent the actual numbers of salmon that will return to their rivers of origin. In the second step, the EIS employs an adult-equivalency model to estimate how the bycatch reductions from the various alternatives would translate into spawning salmon because not all salmon caught as bycatch in the pollock fishery would otherwise have survived to return to their spawning streams. Finally, based on the best scientific information available, the EIS incorporates into the adult-equivalency model genetic estimates of Chinook salmon taken as bycatch to determine where the adult-equivalent salmon would have returned.

Since there is no information available and it is impossible to predict, the EIS makes no assumptions as to the fate of those returning salmon. The EIS clearly states in a number of places that it is not possible, with presently available information, to determine the proportions of river specific AEQ estimates of returning adult Chinook salmon that would have been available for escapement or caught in commercial, subsistence, and sport fisheries in the various river systems.

Finally, it is important to recognize that the express language of National Standard 9 provides that " [c]onservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch." 16 U.S.C. § 301(a)(9). Minimize means "to reduce to the smallest possible number, degree, or extent." Webster's Third New International Dictionary of the English Language (Unabridged) (1963). NMFS has promulgated guidelines for implementing this standard, see 50 C.F.R. § 600.350. Of course, National Standard 9 does not exist in a vacuum. Rather, it is the Council and NMFS's role to ensure that the final action complies with all ten National Standards. Where there is tension among competing standards, the standards are balanced in light of the MSA's over-arching purposes.

Comment 1-7: NMFS's government-to-government consultations efforts have been less than impressive, and NMFS have been resistant to developing formal and accountable consultation processes and protocols. While the Council has made an admirable effort to reach out with tribes and communities, NMFS continues to conduct inadequate systematic consultation with the Alaska Native tribes as required by the Executive Order (EO) 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations and accompanying Presidential memorandum (1994), or EO 13175, Consultation and Coordination With Indian Tribal Governments (2000). NMFS should develop a Tribal Government-to-Government Consultation Plan to outline a framework for working effectively with tribal governments in setting the management direction for Chinook salmon bycatch management. A Tribal Government-to-Government Consultation Plan would be useful in determining the best timing for conducting the consultation meetings which will not conflict with Alaska Native subsistence seasons. This plan should be developed in collaboration with interested tribal governments.

Response: NMFS has a consultation process that involves the tribes early in and throughout the decision-making process in accordance to Executive Order 13175. Section 1.5.7 details the consultation process for the Chinook salmon bycatch issue, which is being conducted in addition to the extensive Alaska community outreach efforts by the Council. Section 1.5.5 contains a description of the Council outreach program. The Final RIR in Chapter 8 provides an environmental justice analysis pursuant to EO 12898. We are currently discussing ways to make our consultation process more clear to tribal governments, Alaska Native Claims Settlement Act corporations, and interested organizations. We welcome any suggestions interested Alaska Native representatives may have.

Comment 1-8: The FEIS should disclose the tribal consultation and coordination process by providing a chronology with the dates and locations of meetings with tribal governments, results of the meetings, and a discussion of how the tribal government's input was used to develop the EIS and the action alternatives. The tribal consultation process is an opportunity to gather traditional ecological knowledge about local subsistence use and harvest of Chinook and chum salmon in Norton Sound, Kotzebue, Yukon and Kuskokwim Rivers, Bristol Bay, and Gulf of Alaska.

Response: NMFS agrees that the tribal consultation process is an opportunity to learn about local subsistence use and harvest of salmon as well as the cultural value and importance of subsistence. Section 1.5.7 contains the complete consultation history for this action.

Comment 1-9: The DEIS, on page 18, notes that Title VIII of the Alaska National Interest Lands Conservation Act ("ANILCA") creates a priority for subsistence uses of fish and wildlife over other purposes on public lands. The DEIS cites this priority as a legal rationale for restricting the offshore harvest of pollock. The DEIS contains numerous statements regarding the need to implement this subsistence priority. However, the legal argument advanced in the DEIS for doing so is without merit. The United States Supreme Court has ruled that ANILCA does not apply to the outer continental shelf ("OCS") of the United States. Amoco Production Co. v. Village of Gambell, 480 U.S. 531, 546-47 (1987). The action area for the proposed Chinook salmon bycatch management plan is the OCS region. ANILCA is not legally applicable, a fact the DEIS admits. Nevertheless, the DEIS asserts that NMFS intends to implement ANILCA by using NEPA and the MSA.

There are two legal defects with NMFS's approach. First, if ANILCA does not apply in the OCS region, it is not another applicable law under the MSA. Thus, the MSA does not provide a legal basis to implement ANILCA. Second, NEPA does not provide the authority to enforce the substantive provisions of any statute, including ANILCA. The Supreme Court has ruled on at least four occasions that NEPA is a procedural statute only that requires issues be examined. It does not provide the authority for a particular result to be reached or enforced. Contrary to the legal position set forth in the DEIS, neither the MSA nor NEPA can be used to enforce ANILCA.

Response: This comment mischaracterizes the EIS and the proposed action. Section 1.7.9 clearly states: “ANILCA does not apply to the outer continental shelf (OCS) region.” It further explains that “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.” Id. This hardly shows that “NMFS intends to implement ANILCA by using NEPA and the MSA.” Rather, it reflects NMFS’s and the Council’s recognition of the importance of subsistence in Alaska and interest in avoiding actions that have adverse consequences on such uses.

The purpose the proposed action is to minimize Chinook salmon bycatch to the extent practicable, while achieving optimum yield. The EIS analyzes the impacts of alternatives to this proposed action, including potential benefits to subsistence users of salmon. That is part of the NEPA process and understanding the priority that federal and state law have afforded those uses is relevant to understanding the benefits, even if those laws do not dictate the outcome here.

Comment 1-10: According to the DEIS, the pollock bycatch reduction program was designed to meet the requirements of the Pacific Salmon Treaty. The DEIS states the proposed action is an element of the Council's efforts to "ensure" compliance with the Treaty, DEIS at 19. The Problem Statement adopted by the Council states that salmon bycatch "must" be reduced in order to meet the U.S. "obligation" under the Treaty and its associated Yukon River Annex, DEIS at 1. The supposition is incorrect that additional actions to address bycatch are required by the Treaty. The Treaty does not apply to the pollock fishery because it defines a "fishery" as "the activity of harvesting or seeking to harvest salmon." Even if the Treaty applied to the pollock fishery, it would be satisfied by the status quo because salmon bycatch reduction measures have been continued and additional bycatch reduction actions have been taken since 2002. Additionally, the Secretary of State has not made a determination that the US is in jeopardy of not fulfilling its international obligations under the Treaty.

Response: This comment offers interpretations of the Pacific Salmon Treaty with which NMFS disagrees. The purpose of the proposed action is to minimize bycatch to the extent practicable while maintaining optimum yield. The fact that such action also has the potential to contribute to satisfying U.S. treaty obligation is an additional compelling factor in decision-making. When the United States enters into a treaty with another country it does so in good faith to implement its provisions through relevant domestic law and regulatory action.

The Treaty's provision (Annex IV, Ch. 8, Cl. 12) that the parties must "maintain efforts to increase the in-river run of Yukon River origin salmon by reducing marine catches and by-catches of Yukon River salmon" is not limited to the salmon fishery. Similarly, there is no limitation on "maintain efforts" to only those that were in effect in 2002. Finally, while it is true that the Secretary of State, who is charged with ensuring and determining the United States' compliance with the Treaty, (e.g., 16 U.S.C. §§ 3632(h)(8)), has not issued a formal decision that United States is out of compliance with the treaty, the treaty remains in effect for the United States. This has bearing on the proposed action. In addition, the Council and Secretary of Commerce are not limited to taking action only upon a formal finding of noncompliance with the treaty since the MSA provides independent authority for this action.

Comment 1-11: The DEIS does not adequately analyze the United States' obligations under the Yukon River Salmon Agreement of the Pacific Salmon Treaty. While the treaty is mentioned and described in Section 1.7.13, nowhere does the DEIS discuss the specific obligations and the degree to which the proposed alternatives meet those obligations.

Under the terms of this Treaty the United States is bound to pass a set number of Chinook and fall chum salmon across the Canadian border to provide for Canadian harvests and escapement needs. NMFS must analyze the impacts each alternative will have on compliance with the United States' obligations under the Yukon River Salmon Agreement and identify other actions that may be necessary to ensure compliance with the agreement. Any cap numbers which exceed pre-2002 bycatch numbers may violate the United States' treaty obligations in the Yukon River Salmon Agreement. In-river commercial fisheries are eliminated and subsistence fisheries are regularly reduced to meet our treaty obligations; therefore, NMFS must restrict the take of these same salmon in the pollock fishery.

Response: The Council and NMFS are concerned about the low salmon runs returning to western Alaska which includes those returning to the Yukon River and believe that salmon bycatch should be minimized for several reasons, including, as the Council's problem statement indicates, to address 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. It is, however, beyond the scope of this EIS to analyze what level salmon bycatch by the pollock fishery is necessary, in conjunction with the varying efforts of the State of Alaska, Canada, and other federal agencies, to meet the United States' obligations under the Pacific Salmon Treaty. The specific purpose and need for this action are to minimize Chinook salmon bycatch to the extent practicable, while achieving optimum yield. Accordingly, the EIS examines alternatives that accomplish this goal. See Vt. Yankee Nuclear Power Corp. v. Natural Res. Def. Council, Inc., 435 U.S. 519, 551 (1978) (the statement of purpose and need of the project determines the range of alternatives that an agency must consider).

Comment 1-12: The parties to the United States-Canada Yukon River Salmon Agreement of 2002 are required to increase the in-river run of Yukon River origin salmon by reducing marine catches and bycatches of Yukon River salmon. They shall further identify, quantify and undertake efforts to reduce these catches and bycatches. How do the alternatives impact the U.S.'s ability to reduce bycatch below pre-2002 levels?

Response: The purposes underlying the proposed action are multi-faceted: minimize Chinook salmon bycatch to the extent practicable, while achieving optimum yield. 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. Accordingly, using the best scientific information available, the EIS discusses, among other things, the substantive issues involving the portion of salmon taken as bycatch in the Bering Sea that originated from the Yukon River. See response to comment 3-9.

The Council and NMFS remain concerned about the low salmon runs returning to western Alaska which includes those returning to the Yukon River. The Council's problem statement expressly states that 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 . . . ."

9.2.2 Comments that the DEIS is inadequate

Comment 1-13: Extend the public comment period for 45 more days to provide more time for the pollock industry to prepare analysis, data, and information for comments on the costs, benefits, and environmental impacts of the proposed action and its alternatives analyzed in the DEIS.

Response: NMFS agreed that the public should be provided more time to read and make informed comments on the document and, on January 9, 2009, a notice was published in the Federal Register to extended the 60-day comment period an additional 20 days, from February 3, 2009, to February 23, 2009 (74 FR 898).

Comment 1-14: Inadequate time was allowed for the public to comment on the 762-page DEIS. An extension of the public comment period was requested to assist in developing the analyses required by NEPA. The twenty-day extension was inadequate to prepare a proper review of the document. The overall length of the comment period remains inadequate to prepare analyses on every issue that must be thoroughly examined before the DEIS can be considered compliant with NEPA.

Response: NMFS provided an 80-day public comment period, including the 20-day extension. This was the optimum length of time to allow both meaningful public comment as well as timely Council action on this important issue.

Comment 1-15: The presentation of the information in the DEIS makes it challenging for the public to understand all the associated impacts and how each alternative differs. The result of this may limit or bias those who can meaningfully participate in agency planning. The FEIS therefore should be organized and written in a clear manner that allows for meaningful public participation, especially for those whose first language is not English.

Response: Though the subjects are complex and the issues numerous, NMFS disagrees that the presentation of the information makes it challenging for the public to understand. The document's organization follows a logical and predictable pattern. Likewise, we have tried to communicate the complex issues as simply as possible to enable the general public to understand the analysis. While the document is 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. Yet, however lengthy, detailed, and technical the analyses, we have tried our best where possible to keep the information accessible to the reader. As with every large document analyzing extremely complex issues, improvements in clarity and organization can be made. NMFS has worked to make the Final EIS and Final RIR more accessible to all readers.

Comment 1-16: DEIS fails to meet the requirements of NEPA insofar as it fails to include an adequate range of alternatives for considered action. The range of alternatives presented fails to explore, in a serious manner, reasonable alternatives to address the obligation to reduce bycatch.

Response: NMFS disagrees. CEQ regulations at 40 CFR 1502.14(a) require that all reasonable alternatives be "rigorously explored and objectively evaluated." It is well settled that the benchmark for determining whether an alternative is reasonable depends on the nature and scope of the proposed action and that the range of alternatives considered in an EIS need not extend beyond those reasonably related to the purpose of the project. The purpose and need of the proposed action is to minimize bycatch to the extent practicable while achieving optimum yield. The range of alternatives in the EIS includes the status quo or no action alternative, measures to impose hard caps on the taking as bycatch of Chinook salmon, and triggered closure areas. In connection with each of these alternatives, the EIS also analyzes suites of options, including the distribution of the bycatch cap. This range of alternatives, including the suite of options within each alternative, is reasonable and adequate.

Comment 1-17: Reject this particular DEIS in favor of a more comprehensive and adequate analysis of bycatch. The DEIS does not adequately analyze the options, which impose unrealistic or impracticable restrictions on the Bering Sea pollock fishery. The DEIS is therefore inadequate to support informed decision-making to reduce Chinook salmon bycatch while allowing for reasonable prosecution of the pollock fishery.

For the Council and NMFS to make informed decisions about how to balance all of these important interests, they must have an environmental analysis that fully and accurately examines all of the issues. As the Supreme Court has said, the National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4331, requires that there be a “hard look” at all of the issues (Citizens to Preserve Overton Park, Inc. v. Volpe, 401 U.S. 402 [1971]). This DEIS does not take a hard look at all the issues. It fails to mention basic and critical issues; it fails to include necessary facts and analyses; it analyzes only a small number of issues, and those issues are analyzed inaccurately or incompletely; and it uses old data that severely underestimates impacts.

On economic issues, the DEIS fails to rigorously evaluate the costs and benefits associated with the alternative measures under consideration; it relies on erroneous assumptions about ownership and investment patterns in the Bering Sea pollock fishery; it fails to consider the full range of impacts that some of the proposed measures would have on economically disadvantaged communities in Western Alaska; it fails to consider other critical factors affecting Chinook salmon runs in Western Alaska; and it fails to correctly depict the bycatch profile of the pollock fleet; and other reasons.

This DEIS does not provide adequate biological and economic information to make a reasonable assessment of management alternatives and therefore cannot be considered a legally sufficient document or adequate to inform decision makers of the consequences of a decision until it identifies and examines those consequences. This DEIS needs a great deal of additional work before being finalized.

Response: NMFS disagrees. The EIS and RIR take a hard look and provides the analysis necessary for informed decision-making. The EIS and RIR provide the decision-makers and the public with an evaluation of the potential impacts of the alternatives on the human environment based on the best available information. A number of public comments point out specific areas where changes should be made to the document with which NMFS agrees. As a result of this public comment process, NMFS has provided additional information to the Council and the public in the preliminary CAR provided to the Council and posted on the NMFS web page in March 2009. NMFS has incorporated this information and analysis in this FEIS. Based on the DEIS, the preliminary CAR, and the public comments, the Council had before it all of the information and analysis relevant and necessary to make an informed decision. All information and analysis in the public comment and in the preliminary CAR that was used by the Council as a basis for its final action was included in the FEIS prepared for the Secretary of Commerce to take action to approve the FMP amendment and the final rule implementing the Council's recommendation.

Comment 1-18: The deficiencies in the evaluation of the preferred alternative are highlighted by NMFS using this DEIS to provide suggestions for ways in which the Council might address them. DEIS at 63-71. The NEPA process is designed to ensure "that the agency, in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts [and] that the relevant information will be made available to the larger audience that may also play a role in both the decision-making process and the implementation of that decision." Dep't of Transp. v. Public Citizen, 541 U.S. 752, 768 (2004) (citation omitted). Providing feedback to an advisory body is not one of these enumerated purposes. NEPA and CEQ require consideration of alternatives as "the heart of the environmental impact statement."

Response: NMFS disagrees that discussing open-questions and potential flaws in alternatives in the EIS is an inappropriate use of the NEPA process. Under the MSA, the fishery management councils serve a variety of functions, including preparing fishery management plans and amendments thereto. 16 U.S.C. § 1852(h)(1). Under consideration at this time is an amendment to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area. At its June 2008 meeting, the Council developed Alternative 4 as its preliminary preferred alternative. In analyzing that alternative, NMFS staff identified three issues that needed to be resolved to avoid inherent ambiguities in implementing Alternative 4. By proposing and analyzing options to modify the Council's preliminary preferred alternative, NMFS provided the public, interested persons, and decision-makers with important information for considering and improving an alternative in the EIS. This DEIS discussion was then used by the Council as a basis for some of the features of Alternative 5, which the Council developed as its recommended alternative in April 2009. NMFS believes that openly discussing means to modify and/or improve alternatives within the EIS itself is an appropriate and important aspect of the NEPA process.

9.2.3 Comments that DEIS is adequate

Comment 1-19: The DEIS contains a considerable amount of information necessary for managers to make reasoned decisions and for the public to understand the issues and tradeoff's available. However, there are areas where the analysis could be improved to ensure that decision-makers have the most recent and relevant information available. None of these changes should be construed as reasons to delay action before the Council on the issue of salmon bycatch reduction.

Response: NMFS acknowledges the comment. A number of public comments point out specific areas where changes should be made to the document. For those changes that NMFS agrees with, we provided additional information to the Council and the public in the preliminary CAR and incorporated this information and analysis in the Final EIS and Final RIR. Public comment also suggested a number of changes that NMFS disagrees with and the reasons why these changes were not made to the Final EIS and Final RIR are provided in the response to those specific comments.

Comment 1-20: The DEIS adequately provides alternatives available to address Chinook salmon bycatch by the BSAI pollock fleet, recognizing constraints and limitations on developing a quantitative assessment of impacts. Analysis is limited by an incomplete understanding of the stock of origin and age distribution of the Chinook salmon taken as bycatch; interactions between pollock and Chinook salmon; relationship of Chinook salmon encounters in the pollock fishery with abundance; and expected changes and effect of changes in the behavior of the pollock fleet operating under bycatch management measures. The document effectively highlights these areas of incomplete understanding and relies on reasonable methods to inform decision makers and the public. We commend the authors for their comprehensive work and have offered suggestions for improving the document throughout its development. Public comments identify further needs for expansion and ADF&G will assist NMFS and the Council in responding to comments and in preparing the final draft. Working within constrains of unknowns and recognizing the NMFS Comment Analysis Report will bring additional information to the Council, the Council will have sufficient information in April to take action to reduce Chinook salmon bycatch in the BSAI pollock fishery.

Response: Comment acknowledged.

Comment 1-21: The DEIS is sufficient to take final action and does a good job of analyzing the effects of the caps and triggers closures given the best available science.

Response: Comment acknowledged.

9.3 Chapter 2 Comments

These comments are on Chapter 2, the alternatives and their monitoring and enforcement. Changes were made to Chapter 2 to add Alternative 5, the Council's recommended alternative from its April 2009 meeting. Additional editorial and organizational changes were made to Chapter 2. The DEIS Section 2.5, Managing and Monitoring the Alternatives, was separated and added to the section for each alternative in the Final EIS.

9.3.1 Comments on the alternatives in general

Comment 2-1: The DEIS does not describe options other than the alternatives analyzed that the Council may have discussed at its recent meetings or work-sessions.

Response: Section 2.6 identifies the alternatives considered but eliminated from detailed analysis and discusses the options recommended through the EIS scoping process and discussed by the Council. Many of the issues identified during the scoping process are presented in the current analysis; others were not carried forward for the reasons described in Section 2.6. This section also 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 in this section, were not analyzed in detail.

Comment 2-2: How do hundreds of options help inform the decision making process?

Response: The five alternatives analyzed in the EIS represent different policy choices for how to manage Chinook salmon bycatch. Chapter 2 describes the alternatives. The alternatives analyzed in the EIS 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. Each alternative, except the status quo alternative, contains four 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. The EIS provides both an analysis and discussion of the impacts of the four alternatives as a whole and a more detailed analysis of the various options and suboptions to inform the Council and the public of the consequences on the human environment. These decision points are necessary to understand not only the impacts but how the hard cap will function and the distributional differences among the many options.

Comment 2-3: Limit Chinook salmon bycatch restrictions to practicable measures that are reasonably calculated to reduce bycatch without resulting in a premature closure of the Bering Sea pollock fishery.

Response: NMFS acknowledges the comment.

Comment 2-4: To protect cultures and livelihoods through out the North Pacific, NMFS should implement a precautionary approach to reducing Chinook salmon bycatch in the pollock fishery that considers the potential impacts on salmon of changes in climate and marine species composition, ocean acidification, and planned offshore oil and gas development in the Arctic and the Bering Sea.

Response: NMFS acknowledges the comment.

Comment 2-5: Ensure that the hard cap does not confer to the pollock fleet ownership of, nor the right to take, salmon.

Response: NMFS agrees that a transferable allocation of a Chinook salmon bycatch hard cap to the sector or cooperative level would not convey ownership of that amount of Chinook salmon or the right to take those Chinook salmon.

Comment 2-6: With any new management scenario it is possible that the pollock industry will have additional incentives to underreport bycatch. Therefore, NMFS must enact measures to ensure proper reporting of Chinook salmon bycatch. Under any of the alternatives, the Council should require 100% observer coverage to avoid attempts to under-report salmon bycatch. Enumeration of every salmon is imperative for a program that relies upon individual vessel accountability.

Response: NMFS agrees and identified in DEIS Section 2.5 the concern that the alternatives could create an increased incentive to misreport salmon bycatch because the cost to the industry of reaching the Chinook salmon bycatch cap could be so high. Therefore, NMFS recommended an increase in observer coverage requirements for catcher vessels delivering to inshore processors so that one observer is required on all of these vessels, regardless of vessel length. In addition, in the Final EIS, NMFS recommends that an actual count, or census, of all Chinook salmon bycatch be used as a basis for determining Chinook salmon bycatch by all vessels participating in the Bering Sea pollock fishery under any of the alternatives that involved a hard cap (all of the alternatives, except Alternative 1). This method currently is used for catcher vessel delivering to inshore processors and NMFS would expand this method to catcher/processors and motherships. In Section 2.2.5, NMFS describes the additional requirements that would need to be met by catcher vessels, inshore processors, catcher/processors, and motherships so that we may obtain accurate counts of salmon bycatch.

Comment 2-7: The Final EIS should include a monitoring and enforcement implementation framework for NMFS to be able to efficiently and effectively manage, monitor, and enforce the preferred action. In order to understand how monitoring and enforcement would be carried out, it would be helpful to have specific information in the framework, such as estimates for full-time equivalents (FTEs), labor hours, and costs associated with implementation of the program. In addition, the framework should identify the types of computer models and assumptions that would be necessary to ensure that the accounting system accurately considers salmon allocations for rollovers and transfers.

Response: NMFS believes that the EIS provides the necessary explanation about how NMFS will monitor and enforce the alternatives in Chapter 2, in Section 3.1, and in RIR Chapter 6.

9.3.2 Comments suggesting new alternatives

Comment 2-8: Ban trawling in Alaskan waters for the sake of all fish species and communities that depend upon them because bycatch wastes millions of dollars and sufficient evidence links trawling to ecosystem damage. Trawling is an indiscriminate way to fish and there must be a better way to fish. The pollock trawl fishery is having enormous implications on our entire ecosystem and economy and the only way to reduce bycatch is to ban trawling. Close the Bering Sea pollock fishery until it can be proven that trawling can be accomplished without destroying the Chinook salmon that Alaska communities depend on.

Response: An alternative to ban trawling or permanently close the Bering Sea pollock fishery is outside the scope of the action because it does not meet the action's purpose and need. The proposed action in the EIS is to minimize Chinook salmon bycatch in the Bering Sea pollock fishery to the extent practicable while achieving optimum yield. Closing the pollock fishery would not achieve optimum yield.

Comment 2-9: To meaningfully address National Standard 9, a range of alternatives should be analyzed that includes options that will reduce bycatch below the historical average of 32,500 Chinook salmon to a more biological and culturally sustainable level. The hard cap should be 30,000 Chinook salmon, based on the 2009 ADF&G Yukon River Chinook salmon forecast and the obligations under the Pacific Salmon Treaty. This hard cap should decline over time, as bycatch reduction methods result in declining bycatch rates in the pollock fishery. This hard cap, while low compared to with most alternatives, is still too high given the poor state of Chinook salmon stocks in Western Alaska.

Response: A hard cap that declines below 29,323 Chinook salmon is not in the range of alternatives considered and the EIS does not analyze the impacts cap levels below 29,323 Chinook salmon. Section 2.6 on alternatives considered and eliminated from further analysis, discusses that the Council chose to limit the low end of the range of caps under consideration to 29,323 Chinook salmon which is representative of the 5 year average prior to 2001. Cap levels below 29,323 Chinook salmon were initially considered, but the Council felt that including this number was sufficiently conservative to meet the purpose of this action. The purpose of the action is to minimize bycatch to the extent practicable while, at the same time, achieving optimum yield. Based on the analysis in the EIS, a cap below 29,323 Chinook salmon would impose substantial costs on the pollock industry without providing additional substantial Chinook salmon savings. Therefore, the Council and NMFS concluded that hard caps below 29,323 do not meet the purpose of the action.

Comment 2-10: Establish a stair-stepped cap, which would further reduce the hard cap over time. This declining cap would reduce salmon bycatch initially, while allowing the pollock fishery time to adapt their operations to these expectations. Reducing bycatch over time would increase the return of Chinook salmon to the rivers and escapement while also allowing the pollock fleet time to adjust their catch methods.

Response: Comment acknowledged. Adding a stair-step provision for Alternative 2 that includes the hard cap suboptions analyzed under Alternative 2, component 1, was an available option for the Council to recommend.

Comment 2-11: The hard cap should be no higher than 32,500 Chinook salmon with the goal to further reduce salmon bycatch. An annual review should be conducted to determine a lower cap. This review should include information of escapement goals and success in meeting those goals, reports on the status of subsistence, commercial and personal use salmon harvests, updates on the stock-of-origin of the bycatch, and new insights in ocean research. The cap should decline on an annual basis to less than 10,000 Chinook salmon over a few years.

Response: A hard cap that declines from 32,500 to 10,000 Chinook salmon is not in the range of alternatives considered. As discussed in Section 2.6, the EIS does not analyze the impacts cap levels below 29,323 Chinook salmon or annual caps based on a consideration of a variety of factors. Section 2.6 contains the discussion regarding alternatives considered but eliminated from detailed analysis, and it notes that the Council considered an index cap based on consideration of run-size impacts and a number of uncertain components (e.g. river-of-origin, ocean survival, future expected run size). Due to a lack of information and uncertainty in estimating these components, the Council did not think that the index cap formation was sufficiently developed to include as an alternative. Additionally, the Council also considered establishing a new cap on an annual basis; however, this would be extremely difficult, if not impossible, to implement successfully.

This comment did not provide the specific method by which to determine a cap based on escapement goals and success in meeting those goals, reports on the status of subsistence, commercial and personal use salmon harvests, updates on the stock-of-origin of the bycatch, and new insights in ocean research.

Comment 2-12: The initial cap should be set at 45,000 Chinook salmon for 2010-2011. This hard cap should change based on ADF&G estimates of abundance. If and when the escapement of Chinook salmon all along the coast returns to the biologically acceptable level for a period, then the allowable bycatch levels could be raised in proportion. If there is a hard cap on each boat, based on its pollock quota, there should be no increased problem of a race for fish.

Response: A cap of 45,000 Chinook salmon is similar to the cap level suboptions under Alternative 2; however, the EIS does not analyze the impacts of caps set based on Chinook salmon abundance estimates. Section 2.6, Alternatives considered and eliminated from further analysis, discusses that the Council considered an index cap based on consideration of run-size impacts and a number of uncertain components (e.g. river-of-origin, ocean survival, future expected run size). Due to the uncertainty in estimating these components, the Council did not think that the index cap formation was sufficiently developed to include as an alternative.

Comment 2-13: The range of alternatives is awkward and inadequate because the status quo alternative really represents a hybrid approach which, under different scenarios, imposes entirely different and distinct bycatch management rules and regulations. It is essential for the analysis and decision-making process to treat the cap and closure provisions of Amendment 58 and the VRHS ICA provisions of Amendment 84 as two separate and distinct "stand alone" alternatives. Each of those alternatives could then be evaluated on its own merits and compared and contrasted with Alternatives 2, 3 and 4.

The hybrid nature of the status quo alternative makes analysis difficult and confusing and complicates efforts to compare it with the other competing measures. Status quo involves (1) a pre-determined closure area that is triggered whenever total Chinook bycatch in the pollock fishery reaches 29,000 fish implemented under Amendment 58 and (2) a waiver, implemented under Amendment 84, of the cap and closure as long as the industry has agreed to and is operating under what is known as the VRHS. In order to qualify for such a waiver, the VRHS must have been implemented via an ICA that closes pre-determined "hot-spot'" areas to those vessels failing to comply with bycatch limits and rules embodied in the VRHS ICA itself.

Amendment 58 was the extant Chinook bycatch management system at the time the US Canadian salmon treaty was signed in 2002 and clearly complies with both the letter and spirit of that treaty that require the US to "maintain" efforts to reduce bycatch of Yukon River salmon. Amendment 58 is a proven management measure that best balances the legal requirements of National Standard 1 and 9. Bycatch levels experienced in those years that Amendment 58 was in place were significantly lower than the bycatch levels experienced recently.

Amendment 84 involves an entirely different approach to Chinook bycatch management. Whether or not the increased bycatch levels experienced since Amendment 84 was implemented represent a failure of the VRHS or simply some other set of dynamics that have resulted in higher Chinook encounters remains to be seen. Nevertheless, some have argued that current bycatch levels have been too high and that the current system violates the spirit if not the letter of the US obligations under the US/Canadian Treaty.

Response: Alternative 1 represents the current regulations that manage Chinook salmon bycatch in the Bering Sea pollock fishery. Section 2.1 describes Alternative 1, the status quo alternative, as the current regulations implemented under three amendments to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area, Amendment 21b, Amendment 58 (which modified the previous Amendment 21b closure areas), and more recently Amendment 84.

The Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for modifying existing Chinook and chum salmon savings areas analyzed, as Alternative 1, the trigger closure of 29,000 Chinook salmon implemented under Amendment 58 and also analyzed, as Alternative 3, the program implemented under Amendment 84. This document is available on the NMFS Alaska Region website at: http://www.fakr.noaa.gov/analyses/amd84/Am84_EARIRFRFAfr.pdf. Therefore, the provisions of Amendment 58 and Amendment 84 were previously analyzed as stand alone alternatives in a NEPA document.

Based on that analysis, the Council did not find that the Amendment 58 measures best balanced the legal requirements of National Standard 1 and 9. Instead, the Council recommended, and NMFS implemented, Amendment 84 which was an exemption to the closure areas for pollock vessels participating in the VHRS ICA. As explained in that analysis, Amendment 84 was developed to address concerns that the closures were no longer effective at reducing bycatch as the fleet was experiencing increases in Chinook salmon bycatch after the regulatory closure of the Chinook Salmon Savings Area (ChSSA) with Chinook salmon bycatch rates in some cases higher outside of the savings area than inside of the savings area.

In refining alternatives for the EIS, the Council considered a wide range of time/area closures similar to the previous ChSSA but based upon updated bycatch information. Analysis brought forward in the development of candidate closure area alternatives indicated that while some areas of the previous ChSSA currently contained average areas of high bycatch (per design of previous areas), not all of the areas with high seasonal levels of bycatch in recent years were contained within the ChSSA. Therefore rather than re-considering this as a separate closure alternative, the Council chose to evaluate new closure areas under Alternative 3 that were more responsive to current spatial and temporal patterns of bycatch. These areas are specifically designed to be triggered by a seasonal cap level (as with the ChSSA).

For a discussion of the Pacific Salmon Treaty, please see Section 1.7.14.

Comment 2-14: The DEIS should have considered an alternative in which fishing vessels would be required to pay a set amount for each salmon caught. Such as system would create an incentive to fish below the cap and could generate revenue for the necessary research. The economic penalties for the BSAI fishing industry must be implemented and strictly enforced to prevent high Chinook salmon bycatch. The penalties should apply to the individual trawl vessel and not across the fleet or industry.

Response: Section 2.6 explains that the EIS does not analyze an alternative containing provisions for fees or economic penalties for Chinook salmon bycatch by Bering Sea pollock fishing vessels because such provisions do not meet the purpose and need for this action because they do not comply with the Magnuson-Stevens Act.

Comment 2-15: The pollock industry should bear the cost of both improved sampling and analysis for genetic studies on the Chinook salmon stocks impacted by the fishery's bycatch. This should be tied to the economic incentives to improve the commercial fishery.

Response: An alternative that would have the pollock industry pay for improved sampling and genetic studies is outside the scope of this action because it does not directly meet the action's purpose and need. Economic incentives are addressed in the response to comment 2-14.

Comment 2-16: Develop and fund a comprehensive research program to adaptively manage Western Alaska salmon at all life-stages. This gravel-to-gravel research plan should emphasize hiring and development of local expertise and include community-based salmon research like habitat assessments, integration of traditional knowledge, in-river and ocean sampling for genetic stock identification, and the temporal and spatial use of ocean habitat. Research should also include identification of the stock-of-origin and age of all Chinook salmon caught as bycatch. This commitment should include funding the genetic stock identification of salmon caught as bycatch in the pollock fishery, marine research such as the BASIS program, and funding in-river enumeration and management.

Response: An alternative to develop and fund a comprehensive research program is outside the scope of this action because it does not directly meet the actions purpose and need to minimize Chinook salmon bycatch to the extent practicable while achieving optimum yield.

However, NMFS agrees that continued research on salmon at all life stages is desirable. In addition, the Council's 5-year research priorities, available on the Council web page at: http://www.fakr.noaa.gov/npfmc/misc_pub/ResearchPlan1008.pdf, identifies "stock delineation for estimation of adult equivalence to appropriately account for the impact of incidental catches of salmon in pollock fisheries on salmon populations" as a research priority.

Stock identification studies

Stock identification of salmon will require adequate funding and a scientifically defensible sampling plan for determining stock composition estimates that are representative of the entire bycatch. Funding for NMFS to genetically analyze any bycatch samples is currently lacking. Limited funding ($60K for 1 year) has been obtained from the Alaska Sustainable Salmon Fund to analyze the 2008 tissue samples collected by the North Pacific Groundfish Observer Program (NPGOP) to support a feasibility study at Auke Bay Laboratories. Changes have been made to the NPGOP tissue sampling procedures for the 2009 season that will provide for increased numbers of tissue samples for analyses. However, further refinements to the sampling protocols may be required in the future before stock composition estimates representative of the entire bycatch can be completed. Given substantial financial resources and a sampling plan designed for the purpose, seasonal estimates of the stock composition of the samples would be possible.

Bering Sea salmon survey research

The following summarizes NMFS current and planned future salmon research. Standard research surveys by the Alaska Fisheries Science Center, the Bering-Aleutian Salmon International Survey (BASIS) research group in the Bering Sea have sampled the epi-pelagic fish communities within the northeastern Bering Sea (2002 to 2007) and Chukchi Sea (2007) from nearshore (> 20 m) to greater depths (100 m) offshore during late summer and early fall. These surveys provided much needed data for our understanding of how ocean conditions affect growth and marine survival of Pacific salmon, forage fish, and other commercially important fish species such as walleye pollock and Pacific cod after their first summer at sea.

For Yukon Chinook salmon populations, BASIS data provided:

- stock-specific catch data throughout the entire Bering Sea:
- relative abundance of juvenile Chinook salmon off the Yukon as well as relative abundance of co-occurring pelagic fish species;
- indicators of juvenile Chinook salmon health, including size, diet, and energy density; and
- biological (i.e., zooplankton samples) and physical (i.e., sea temperature and salinity) oceanographic parameters.

The BASIS data have been used to:

- build a new Yukon River Chinook salmon migration model;
- examine the relationship between juvenile Chinook salmon relative abundance and bycatch numbers as well as adult returns; and
- determine the consequences of climate variation and cycles on the health (survival), distribution, and migration pathways of juvenile Yukon River Chinook salmon.

The AFSC no longer funds BASIS research surveys off the Yukon River, so our 5 year data set limits our statistical power to address some of the issues related to determining the consequences of climate variation and cycles on the health (survival), distribution, and migration pathways of juvenile Yukon River Chinook salmon as well as Chinook salmon bycatch.

Comment 2-17: Secure adequate funds to ensure rebuilding and sustainable Chinook salmon escapement through comprehensive management and co-management of salmon by managing for all life-stages of salmon from in-river to estuary to ocean and return.

Response: Measures to manage Chinook salmon are outside of the scope of the action. The proposed action is to minimize Chinook salmon bycatch in the Bering Sea pollock fishery to the extent practicable while achieving optimum yield. ADF&G is responsible for Chinook salmon management and ensuring escapement. ADF&G is a cooperating agency in the analysis to provide the expertise necessary to understand the impacts of ocean bycatch on Chinook salmon escapement and abundance.

Comment 2-18: Expand the food bank program to distribute salmon bycatch to Western and Interior Alaska communities. This distribution would by no means be considered a substitution or replacement of the in-river subsistence fisheries.

Response: The Prohibited Species Donation (PSD) Program is a voluntary program needing participation from the fishing industry and the approved distributors, as described in RIR Section 2.1.5. There are no regulatory barriers to the PSD Program distributing salmon bycatch to Western and Interior Alaska communities. However, expansion of this program in this manner requires efforts from the industry, any approved distributors, and people and organizations in western Alaska. Any organization that can meet the requirements for a PSD program permit may apply to NMFS. To date, only one authorized distributor, SeaShare, is permitted to handle donated salmon. Because of the logistics of handling and shipping the fish, only Pacific Northwest residents have benefited from the donated salmon. Having an authorized distributor that could provide donated salmon to Western Alaska communities would be a good way to reduce salmon waste in the pollock fishery. More information about the PSD program is available at: http://www.fakr.noaa.gov/ram/psd.htm. NMFS agrees that a donation program for salmon cannot be considered a substitute to the nutritional and cultural importance of in-river subsistence fisheries. Fresh salmon harvested and processes in traditional ways from a river cannot be replaced by a frozen product with no traditional links.

At its February 2009 meeting, the Council expressed interest in modifying this program to mandate full participation. Any amendments to the PSD program would be analyzed in the future as a separate action.

Comment 2-19: Continue studies on bycatch reduction, such as salmon excluder devices and the effect of fishing tow speed and depth on salmon bycatch.

Response: NMFS acknowledges this comment and notes that while explicit continuation of studies is outside of the scope of this analysis, investigations such as the work on salmon excluder device and evaluations of temperature, tow speed and depth are on-going studies whose results are expected to inform management decisions in the future (section 5.4).

Comment 2-20: Close known salmon migrating areas to trawling.

Response: This alternative is not analyzed in the EIS. Based on a preliminary analysis using information in the EIS, a closure of the migration areas would not be effective at minimizing bycatch and therefore would not meet the purpose and need for this action. The known migration pathways for Chinook salmon are identified in Figure 5-3. Comparing the map of the migration pathways with the map of the location of pollock biomass in Figure 4-1, it appears that pollock does not occur in the migration pathways. Also, the migration pathway area is not included in the area closures in Alternative 3, which are based on where 90% of the Chinook salmon bycatch occurs in the pollock fishery.

9.3.3 Comments on status quo – Alternative 1

A description of Alternative 1 is provided in Chapter 2.

Comment 2-21: The VRHS system as currently implemented (including the A season fixed closure) provides adequate protection for Chinook salmon in low encounter years. The high encounter failings of the 2007 program were partially addressed in the 2008 revisions, and a hard cap to limit total take would complete the package.

Response: NMFS acknowledges the comment.

Comment 2-22: The status quo and Amendment 84 has not effectively reduced or minimized bycatch of Yukon Chinook salmon stocks. Salmon bycatch has increased despite Salmon Saving Area closure and VRHS ICA.

Response: NMFS acknowledges the comment.

9.3.4 Comments in support of a hard cap – Alternative 2

A description of Alternative 2 is provided in Chapter 2.

Public comments provided the following general comments on a hard cap:

- Immediately set a hard cap of the lowest number of salmon bycatch to protect western Alaska Chinook salmon.

- In light of the current state of the Yukon River Chinook salmon and the salmon-dependent people of western Alaska, it is essential to put a hard cap on Chinook salmon bycatch immediately. The weak Chinook run of 2008 has already created problems of crisis proportions along the Yukon River. While subsistence restrictions limited the amount of food available for the winter, the lack of a commercial Chinook fishery cut off one of the only sources of income for many Yukon River residents. These restrictions combined with high fuel costs result in a serious burden on subsistence fishermen. The promise of the same or worse Chinook salmon returns in 2009 is no comfort.

- Set the cap considering that other fisheries have Chinook salmon bycatch that won't accrue against this cap.

Public comments suggested that the following hard cap alternatives be chosen as the preferred alternative:

- **29,323 Chinook salmon:** Immediately implement a hard cap of 29,323 Chinook salmon (Alternative 2, Option 1, suboption viii, see Table 1). This is the only proposed bycatch cap that uses the average bycatch numbers for the 5 years prior to the United States-Canada Yukon River Salmon Agreement of the Pacific Salmon Treaty, 1997-2001, which requires the U.S. to increase in-river returns of Yukon River origin salmon by reducing marine catches and bycatches. This alternative would best ensure that Chinook salmon are returning to western and interior rivers to meet spawning escapement and subsistence needs.

- **30,000 Chinook salmon:** It is important for the conservation of Chinook salmon and the welfare of salmon-dependent villages that the cap is set no higher than 30,000 Chinook salmon, based on the cap level in Amendment 58. A 30,000 Chinook salmon hard cap will help ensure the health of the Chinook fisheries that sustain and provide economic opportunities for Alaskan residents. Without such a cap there is not sufficient incentive for the pollock fleet to move forward with improved fishing practices that will minimize Chinook bycatch. The British Columbia example shows that hard caps are sufficient incentives to vessel owners to fish cleaner and to reduce bycatch.

- **30,000 Chinook salmon:** The simplest management scenario and the best course of action is hard cap with a seasonal distribution, no rollover, and no provisions for ICAs. To protect and conserve Chinook salmon, implement a hard cap of 30,000 Chinook salmon, with the Alternative 2, component 1, option 1-2 seasonal distribution of 58% to the A season and 42% to the B season, and the Alternative 2, component 2, option 1 sector allocation (10% to the CDQ sector, 45% to the inshore catcher vessel sector, 9% to the mothership sector, and 36% to the offshore sector, see Table 1).

- **29,000 to 38,000 Chinook salmon**: A hard cap of 29,000 to 38,000 Chinook salmon represents the historic range of Chinook bycatch. This substantial reduction in Chinook salmon bycatch would rebuild the Yukon River salmon stocks so that, first and foremost, biological escapement needs would be met, the subsistence needs of Alaska and Canada would be met, and the Yukon and Kuskokwim rivers' commercial fisheries would return.

- **32,500 Chinook salmon:** Hard cap should not exceed 32,500 Chinook salmon in the pollock fishery coupled with a comprehensive salmon research and management program. While we recognize that there are a variety of programs including incentive programs, gear modifications, and time and area closure that may have promise for managing bycatch, these programs do not provide a rationale for allowing an annual hard cap of more than 32,500 Chinook salmon.

- **32,500 Chinook salmon:** Adopt a hard cap of no more than 32,500 salmon (Alternative 2, Suboption vii) immediately with the following options and suboptions; a.) A/B Season split: 58/42 (Seasonal Distribution Option 1-2); b.) Allocation to the co-op level with allocation based pro rata on pollock allocation (Sector Apportionment Option 1, see Table 1). The recommended A/B season split provides essential protections to maturing salmon which are bound for their natal rivers in the coming summer.

- **32,500 Chinook salmon:** The best way to prevent future excessive bycatch of salmon stocks throughout the North Pacific is through the implementation of an adequate precautionary cap, such as hard cap of no more than 32,500 Chinook salmon bycatch (Alternative 2, Suboption vii, see Table 1). Implementing this as a hard cap and not a management goal or "soft cap" would provide a level of assurance to communities affected by low Chinook salmon returns in 2008 and may have to face equal or lower returns in 2009. This hard cap is the ten year average bycatch prior to the signing of the Yukon River Salmon Agreement of 2002. Additionally, Chinook salmon bycatch reached an all-time low in 2000 of 4,961 Chinook salmon but bycatch has steadily increased every year since.

- **37,000 Chinook salmon:** Implement, by emergency regulations, a hard cap of 37,000 Chinook salmon. When historic bycatch of Chinook salmon exceeds 37,000 Chinook salmon, escapements or harvests in the Yukon River have been less than expected, restricted, or reduced.

- **38,891 Chinook salmon:** Do not combined industry incentive programs with a cap level higher than 38,891 Chinook salmon. A cap above 38,000 would increase the likelihood of Chinook salmon mortality, thereby decreasing the in-river returns and negatively impacting escapements and harvest opportunities.

- **40,000 Chinook salmon:** Based on experience with the Yukon River fishery, bycatch near 40,000 Chinook salmon appears to allow in-river escapement, subsistence harvest, and Canadian border passage goals to be achieved, while also providing for in-river commercial fishing opportunities. It appears when bycatch levels exceed 40,000 Chinook salmon, some segment of in river escapement or harvest is likely reduced. Therefore, based on review of the alternatives presented in the DEIS, a hard-cap of 38,891 Chinook salmon, beyond which the pollock fishery would close, would be most consistent with management responsibilities and the most likely to provide for the long-term conservation of Federal in-river Chinook salmon trust resources. This level would also be consistent with ANILCA.

- **40,000 to 50,000 Chinook salmon:** Implement Alternative 2 with a cap of 40,000 to 50,000 Chinook salmon. A low cap is necessary because a number of our river systems have escapement goals of less than 20,000 fish, such as the Naknek River, which has an escapement goal of 5,000 fish. With a high cap, the pollock fishery could inadvertently wipe out an entire season of Chinook fishing for all user groups in an area.

- **68,392 Chinook salmon:** A bycatch hard cap lower than 68,392 Chinook salmon would risk losing the pollock industry's ability to consistently fill contracts. Low caps would shut down the Bering Sea pollock fishery in unpredictable ways and times causing surimi buyers/users to seek alternative sources of supply that are more reliable.

9.3.5 Comments on time-area closures – Alternative 3

A description of Alternative 3, including maps of the proposed closed areas, is provided in Chapter 2.

Comment 2-23: Closing the savings area is no longer a functional mechanism to avoid Chinook salmon bycatch. Chinook salmon distribution has changed such that more and more salmon are encountered outside of the savings area. For this reason the proposed management measure to impose seasonal closures of areas where high salmon bycatch has traditionally occurred should not be considered as an adequate enforcement tool to prevent Chinook bycatch in the BSAI pollock fishery. Area closures have proven to be an ineffective tool in reduction of overall bycatch.

Response: NMFS agrees that the current regulatory approach is no longer adequate to minimize bycatch. The exemption for vessels that participate in the VRHS ICA was implemented in response to the shortcomings of the Chinook salmon savings areas and as a first step towards the more comprehensive measures analyzed in the EIS. The Alternative 3 trigger areas were specifically designed as large seasonal areas representing where 90% of the Chinook salmon bycatch occurs to meet the goal of reducing bycatch in response to SSC concerns that the Chinook Salmon Savings Area has been found to be insufficient to reduce bycatch. Section 5.3.6 provides a detailed discussion of the potential of Alternative 3, triggered area closures, to change Chinook salmon bycatch amounts. NMFS disagrees that area closures cannot be enforced. NMFS believes that the EIS provides the necessary explanation about how NMFS will monitor and enforce the alternatives, including the area closures, in Section 2.3, Section 3.1, and Section 9.6.4.

Comment 2-24: Time/area closures of areas identified as having high rates of Chinook salmon bycatch are a simple management measure that has proven effective in other Bering Sea fisheries. NMFS should modify these time/area closures as necessary, based on new bycatch data as it becomes available. Vessels should not be exempt from these time/area closures for any reason.

Response: The Alternative 3 triggered area closures are based on areas of high Chinook salmon bycatch rates, as explained in Section 2.3. The Alternative 3 trigger areas were specifically designed as large area representing where 90% of the Chinook salmon bycatch occurred. Alternative 3 does not contain a provision to exempt vessels from the area closures or to adjust these areas based on new bycatch data. Adding a provision to adjust the closure areas based on new information would require additional analysis.

Comment 2-25: Close areas where high Chinook bycatch rates occur during time periods when bycatch rates are high and a hard cap is projected to be exceeded, for example when there is increased Chinook bycatch during the month of October. Some closed areas may change seasonally, whereas others may be closed indefinitely. Regulations and programs must address existing hot spots and new hot spots during the fishing season.

Response: Alternative 3 provides triggered seasonal closure areas which are explicitly designed in areas where 90% of the Chinook bycatch has occurred between 2000-2007. These areas would be triggered by a cap level as specified in component 1 of Alternative 3. As the analysis relates, some of the trigger cap levels would close these areas in the B season prior to the month of October. This alternative does not however allow for indefinite closures, each closure is designed seasonally and would reopen the following season and remain open until a trigger cap level is reached. Fixed closures were initially considered under the development of Alternative 3 candidate closures. The SSC recommended that they not be considered in this analysis as they have not proven effective previously (section 2.6). This was validated by analysis of candidate regions during the development of alternatives which showed temporally and spatially variable bycatch patterns by season.

Comment 2-26: Do not implement locked-in targeted area closures because there is too much noticeable movement of pollock stocks to make that feasible.

Response: NMFS acknowledges the comment.

9.3.6 Comments that support Alternative 4

A description of Alternative 4 is provided in Chapter 2.

The following public comments support Alternative 4:

- Implement the hard cap of 47,591 Chinook salmon in 2011, and do not delay action. In the analysis of how the different alternatives will affect minority or low income communities (DIES Table 9-8 through Table 9-13), this cap seems to be the most effective in reducing salmon bycatch for Chinook salmon users and other marine resource users in the six regions analyzed. It also states that adopting such a hard cap may reduce bycatch for seabirds and marine mammals. This may compound benefits of salmon bycatch reduction because the reduction in bycatch for other species may directly benefit Alaska Natives and other indigenous peoples of the North Pacific who subsist off of these species. Furthermore the analysis speculates that such Chinook management measures 'are likely to slightly reduce chum salmon bycatch' and that this cap may also reduce groundfish bycatch. This approach seems most consistent with National Standard 9, which states that "Conservation and management measures shall, to the extent practicable, minimize bycatch and to the extent bycatch cannot be avoided, minimize the mortality of such bycatch," particularly in the context of achieving environmental justice. A cap of 47,591 would strike a balance between National Standard 1 and National Standard 9, both allowing the pollock fishery to continue and minimizing bycatch. A cap at this level would address the long term health of the Chinook salmon.

- The following measures show great promise in reducing Chinook salmon bycatch; reasonable limits on Chinook bycatch, the use of salmon excluder devices in pollock fishing nets, rolling hot spot closures, and intercooperative agreements that help reduce bycatch and penalizing fishermen who have high bycatch levels.

9.3.7 Comments opposing Alternative 4

The following public comments suggest that the hard cap of 68,392 Chinook salmon is too high:

- Salmon dependent communities and ecosystems in the Pacific Northwest, Alaska, and Canada are being harmed by the current management plan and will be harmed more with the 68,393 hard cap alternative that higher than average bycatch of 49,600 Chinook salmon. This estimate is reminiscent of the destruction foreign fleets caused.

- The high cap of 68,392 Chinook salmon is not justified and is too high for conservation reasons. The direct correlation between encounters and abundance is not borne out by the analysis, yet that underpins the argument for a higher cap in exchange for an incentive plan. It's fairly clear that the recent high encounter years are due to other factors, such as increased overlap in the ranges of Chinook and pollock, as the EIS notes. In years when high encounters don't correlate with high abundance, a higher cap simply translates to a higher rate of interception and larger impact to the other users of Chinook and to the resource. Low encounter years don't necessarily correspond to low abundance either, and there are other effective ways to limit bycatch at those times, such as the current VRHS system. Additionally, the industry has only hit that amount twice in 30 years so it would not stimulate avoidance of salmon bycatch in most years.

- Neither of the hard cap amounts in Alternative 4 (68,392 and 47,591) represents a reduction in Chinook salmon bycatch, but rather an allowance for higher bycatch. Therefore, Alternative 4 should not be adopted, as subsistence users would likely continue to experience difficulty meeting their Chinook salmon needs.

- As noted in Chapter 2, given that it is possible that the pollock industry may still exceed a hard cap of 68,000 Chinook salmon bycatch under the proposed alternative and that the incentives envisioned may prove elusive, Alternative 4 does not provide a reasonable alternative to reduce salmon bycatch within the National Standards.

- A cap somewhere between 47,591 and 68,392 Chinook salmon represent averages that, if continued, would only ensure that the status quo level of salmon bycatch would continue to occur and not be reduced as the MSA requires.

- In any alternative scenario, a cap of 68,392 has the effect of maximizing bycatch rather than minimizing bycatch. The pollock industry acknowledges that the hard cap of 68,392 Chinook salmon will likely still be hit. Even though a cap at this level would only have been exceeded 2 times in the last 20 years, a cap of 68,392 is not reasonable or prudent. Precautionary measures are necessary to conserve the Yukon River Chinook salmon and are required under MSA National Standard 9 and the Yukon River Salmon Agreement.

- A 68,392 Chinook cap is excessive and the incentive program conceptually does not ensure that bycatch will be held at levels significantly below 68,392 Chinook salmon. Furthermore, after listening to the pollock industry's presentation on incentive programs, we are not at all confident that the plans will successfully drive down salmon bycatch to low levels. The incentive programs contemplated are interesting creative approaches but as long as the cap is high and the direction to industry is unspecified, what motivation does the industry have to challenge themselves? The alternative only says that bycatch reduction below the cap should be "as far as practicable." The industry will define what is practicable for them based on how much they are willing to sacrifice. What is practicable for villages and their success at harvesting enough salmon for their needs will be ignored.

- If the incentive program works well then a cap lower than 68k should suffice. There is no greater incentive to reduce bycatch than a cap that reduces bycatch to the historical average (1992 to 2001) prior to 2002. The ICA cannot be analyzed historically to determine its effectiveness, nor can an analysis be done to determine its effectiveness in the future.

Public comments provided the following viewpoints on the ICAs:

- Because the ICA are still under development and may continue to be so until fall of 2010, the ICA is difficult at best to evaluate. Because the proposals continue to change as much as they do provides no comfort to the public that the ICAs proposed today will have any resemblance to what we see when they are submitted to NMFS. Under these circumstances it is difficult to evaluate the efficacy of the current proposals let alone the proposals the Council will see at either final action or implementation. Both plans fail to meet the requirements and the intent of Alternative 4, nor is there any indication that they will meet those requirements by the time of final action or at implementation when an ICA would need to be submitted for approval. And once again, there is nothing to ensure that any ICA submitted to NMFS for approval would bear any resemblance to what the Council sees at final action in April. Therefore the 68,392 Chinook salmon hard cap should be rejected and 47,591 Chinook salmon hard cap should be adopted. Nothing precludes the industry from doing any of the elements of any of the Incentive Plans that have been proposed outside the Council process - in fact, it may be in their best interest to do so.

- AS1 also introduces additional conditions that create the incentive for secrecy and gaming at an unacceptably high hard cap. AS1 provides for pushing sector and cooperative allocations down to the vessel level. While this is a laudable goal, it may have the unintended consequence of creating a disincentive to share information with other vessels, as 'I do better if you do worse' is a real consequence. One of the strengths of the current VRHS system is the active, real-time information sharing. An argument can be made that more restrictive cap allocations at the cooperative level will do more to get the fleet to work together and address bycatch as a team effort than incentive plans, especially if some companies can figure out how to game the system despite the best efforts of the rest of the industry. We are very concerned about potential gaming, especially with the Financial Incentive Plan/Undercatch Incentive Program. Some industry players have repeatedly demonstrated that they will push the envelope and actively game whatever the Council passes. This plan in particular lets large companies buy their way out of bycatch problems as just another cost of doing business. As there is no carryover effect from year to year, the cost of being below average in performance just gets dialed in as a cost. A simple cost-benefit analysis may also encourage vessels to continue to fish in areas with high bycatch rates at certain times because the penalty paid for salmon caught will still be less than the revenue generated targeting higher-value fish.

- We recommend that if AS1 moves forward, explicit criteria for the content and evaluation of any ICA and its Incentive Plans be outlined in regulation. The guidance provided in AS1 is so vague that it sets the bar very low. The AS1 guidance is inadequate and the bycatch price offered for the ICAs is way too high. The plans are quite complex, and frankly we're having a hard time trusting the industry due to some participants who appear to be operating in bad faith, despite the best efforts of the majority.

- If Alternative 4 is selected the performance of the incentive programs would not be subject to an objective evaluation. We are supportive of rewarding clean fishing and allowing industry room to apply innovative mechanisms to change behavior. However, leaving evaluation of the results up to vested parties does not serve the public interest. Furthermore the alternative does not require that the industry implement the same incentive program that has been presented. This irregular management approach presents serious problems from the standpoint of public policy and transparency.

- None of the incentive plans proposed to date provide enough additional disincentive in low encounter years to justify a higher cap and higher mortality in high encounter years. All incentive plans would also add significant and unnecessary complexity. Incentive plans alone also do not have the effect of flat out prohibiting a vessel from fishing in high bycatch areas. Trying to do this through financial disincentives is far less direct than simply closing those areas as under the hot spot system. That's why the incentive plans all include a substantial rolling hot spot system.

- Implicit in the selection of Alternative 4 is the proposition that it is within the means of the fishing industry to reduce bycatch if sufficiently motivated. Little evidence is presented to support this conclusion. Absent evidence that bycatch avoidance is at least partially determined by decision on where, when and how to fish, it is not clear that any incentive program could actually work.

- Alternative 4 and the ICA requires strong faith that the industry will do the right thing for the salmon interests even when it's not in the pollock industry's best financial interest.

- While the industry should be commended for offering to implement some of its own regulations and invest in methods to protect Chinook salmon, realistically, how would NMFS be able to execute a fishery if all participants are not on the same page? It would be dangerous and possibly unmanageable to have a portion of the fleet willing to cooperate under the ICA and fishing under one cap and the remaining portion fishing under a separate cap. It will cause dissension and unease among users. The alternative implemented should result in everyone playing from the same deck of cards.

- Alternative 4 includes measures developed, managed, and overseen by the pollock industry (the ICA) that cannot be enforced or evaluated. The uncertainty surrounding the effects of an ICA, the lack of analysis, and the fluidity of the ICA itself suggest strongly that these measures should be removed from Alternative 4.

- Reject the industry incentive program proposals. Neither proposal can guarantee that it will achieve bycatch reduction to a level sufficient to warrant a cap of 68,000, more than twice that recommended by many Western Alaska and tribal groups. It is clear that both systems depend on boats to buy bycatch credits, or conversely a desire to keep bycatch levels down so as to avoid buying credits. Since a hard cap level of 68,000 has rarely been hit, 2006 & 2007 there is little incentive to buy credits or fear of losing them as the hard cap is unlikely to be hit.

- The current ICA proposals suffer from a failure of transparency, public participation, scientific rigor, and management oversight, and offer no assurance that salmon bycatch will be reduced. They should not be part of any alternative selected by the Council or agency at this time.

- Alternative 4 is not a viable option because of the reasons the Council's SSC spelled out at the February 2009 Council meeting.

- ICAs reviewed to date do not provide adequate incentives to change bycatch behavior. The proposed incentive programs that will be before the Council and NMFS when they take final action, will not necessarily be the incentive programs the industry submits prior to implementation of Amendment 91. Due to the changing nature of these proposals the Council cannot make an adequate review. It is unacceptable to adopt a management plan which includes industry incentive plans that can change at any time in the future. In effect, no one, including the public, NMFS, and the Council has the opportunity to assess the efficacy of the final incentive programs submitted NMFS. NEPA requires that ICAs be analyzed as alternatives within the DEIS. The preferred alternative in the Final EIS cannot rely upon a voluntary program that has received no substantive review of its environmental and human health impacts on the EIS.

Public comments provided the following viewpoints on the 47,591 Chinook salmon cap:

- The cap of 47,591 is too low and could cause major harm to the industry and fishery-dependent communities. A total closure of the Bering Sea pollock fishery would threaten the viability of the City of Unalaska and other communities in the region.

- If the 47,591 Chinook salmon cap is selected, bycatch will not be minimized but that number would basically sanction average years as acceptable. Also selecting this number rolls back the effect of the 1999 action which was expected to reduce bycatch from 48,000 to 29,000 Chinook salmon. Federal fishery managers should not start over but rather continue a rigorous program that improves fishery performance to minimize salmon bycatch.

- Even when coupled with triggered closures or incentive programs, a cap of 47,591 will jeopardize meeting the salmon escapement goals of the U.S. and Canada. This would continue to place the burden of conservation solely on in-river managers and fishermen while the marine fisheries continue unchecked.

Comment 2-27: The proposed incentive plans are not analyzed in the DEIS. The Alternative 4 analysis is inadequate because it does not evaluate the effectiveness of the ICA. The only major differences between annual scenarios 1 and 2 of Alternative 4 are the incentive plans. Thus, the entire premise of Alternative 4 is that bycatch will be reduced through the voluntary participation in the ICA. Reduction via the ICA is illusory and there is no analysis within the DEIS that supports its effectiveness. Therefore, analysis of the ICAs are a key factor to the decision making process. Analyze the ICAs before taking final action. Without analysis of incentive-based program proposals, it is difficult to assess the effectiveness of any proposed program to reduce salmon bycatch.

Response: It is not necessary for such an analysis to be included in the EIS for the Council to take final action or for the Secretary to approve the Council’s recommendation because the Council did not establish any benchmark for measuring "the effectiveness" of the incentive programs. Hard caps are proven bycatch controls that are enforceable and analyzed in the EIS. The EIS discloses the environmental impacts from instituting the alternative hard cap levels. Through the development of the incentive plans in Alternatives 4 and 5, these alternatives allow the pollock fleet the flexibility to stay within this cap. However, while additional reductions in Chinook salmon bycatch may occur as a result of the incentive programs, this outcome is uncertain and not required.

Alternative 4 does not provide any guarantee or contain any requirement that the actual level of bycatch be below 68,392 Chinook salmon. It is therefore permissible, and arguably foreseeable, that this level of bycatch would occur each year.

To address this issue, the Council included a performance standard in Alternative 5. Under Alternative 5, the 60,000 high cap is available to participants in an IPA, which is an incentive program similar to the ICA under Alternative 4. The IPA should provide incentives to minimize bycatch so that sectors, cooperatives, and CDQ groups harvest less that their allocation of the 60,000 Chinook salmon cap. However, if the IPA does not result in bycatch below the cap and if a sector fully harvests its allocation in three of seven consecutive years, then that sector has failed to meet its performance standard and would then be allocated a portion of the 47,591 Chinook salmon cap.

The EIS contains an explanation of the Council's general goals for incentive programs and the Council's intent to evaluate these programs once they are in effect and operational in the pollock fishery. This evaluation would be done through the annual report that would be required of the industry. The annual report would be required to 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. Through these annual reports and its own assessment of future Chinook salmon bycatch levels, the Council would determine the effectiveness of the incentive programs. If analysis prepared after the incentive plans are in effect demonstrates that the Council's goals for salmon avoidance are not being met, the Council could reinitiate analysis of alternative salmon bycatch management measures and implement revised or new management measures in the future.

Analysis of the efficacy and impacts of the incentive programs and its salmon bycatch avoidance incentive programs are not required under NEPA because the environmental impacts of Alternatives 4 and 5 are determined by the cap levels. The impacts on the human environment are based on the assumption that this level of bycatch could be reached in any year. Under Alternative 4, no regulations would prevent the pollock industry from reaching this cap. Alternative 5 includes a performance standard that would reduce the cap for sectors that did not maintain an average bycatch below that sector’s performance standard. As long as the EIS analyzes and discloses the consequences of adopting the caps specified in the alternatives, and the Council considers the incentive programs as a feature of the alternative that may provide additional incentives to avoid Chinook salmon bycatch within these cap levels, the Council can take final action and the Secretary can approve the Council recommendation without an analysis in the EIS of the specific incentive program the pollock industry may submit.

The two principal goals of an EIS are to (1) ensure that the decision-makers carefully consider detailed information concerning significant environmental impacts and (2) make sure that the relevant information will available to the public. The EIS discloses the environmental impacts from instituting the cap levels under each alternative. Additional reductions in Chinook salmon bycatch may occur as a result of the incentive programs, but this outcome is uncertain. Therefore, the EIS assumes that no additional environmental benefits or impacts are anticipated from the implementation of the incentive programs.

Consequently, the EIS provides the decision-makers and public with the relevant information with respect to the alternatives.

Comment 2-28: NMFS has failed to comply with MSA requirement by choosing to take no effective action to curb bycatch in the pollock fishery. Choosing to adopt a management structure dependent on an unproven, unenforceable, and unanalyzed industry agreement, as proposed in Alternative 4 would not address this failure. The MSA, 16 U.S.C. §1801 et seq, is a mandate for "conservation and management" of our marine resources. 16 U.S.C.§1801(b)(1). The first enumerated purpose of the MSA is "to take immediate action to conserve and manage the fishery resources found off the coasts of the United States." This conservation mandate applies broadly to all stocks of fish and all fisheries. Against this backdrop, the MSA requires NMFS to take practicable actions to minimize bycatch. See 16 U.S.C. §§ 1853(a)(11); 1851(a)(9).

Response: NMFS is in the process of taking action to minimize bycatch to the extent practicable in the pollock fishery in compliance with the MSA and other applicable law. To ensure that the most effective and practical methods for controlling bycatch are implemented, NMFS needs to take the time to work with the Council and consider the concerns of the fishing industry, affected communities, and interested members of the public. NMFS also must meet obligations to analyze the potential effects of the action under the NEPA, ESA, RFA, Executive Order 12866 on regulatory planning and review, Executive Order 13175 on consultation and coordination with tribal governments, and Executive Order 12898 on environmental justice. As a result, it is likely NMFS will not be able to implement additional salmon bycatch management measures before 2011. The EIS assumes that no additional environmental benefits or impacts are anticipated from the implementation of the incentive program, which are one part of Alternatives 4 and 5, the primary provision of which are dual hard caps and, for Alternative 5, a performance standard. See response to comment 2-27.

Comment 2-29: Alternative 4 allows for an unacceptable and unenforceable level of bycatch that will have significant adverse impacts on the western and interior Alaska way of life as well as the regional commercial salmon fishery.

Response: NMFS acknowledges the comment but disagrees that Alternative 4 would allow for an unenforceable level of Chinook salmon bycatch. Under Alternatives 2, 4, and 5, the level of bycatch would be controlled by the hard caps. The Final EIS and Final RIR provide the necessary explanation about how NMFS will monitor and enforce the alternatives in Chapter 2, Section 3.1, and RIR Section 6.1.4.

Comment 2-30: Alternative 4 is not adequately analyzed in the DEIS. The AS1 is described as a 68,392 Chinook salmon cap. As explained in the DEIS on page 65, however, the actual high cap on salmon bycatch under this alternative could exceed 100,000 Chinook salmon (68,392 salmon plus 32,482 under opt-out cap). The DEIS does not evaluate the effects of allowing bycatch to exceed 100,000 salmon and the impacts on subsistence and commercial fisheries.

Response: The DEIS, in Section 2.4.3.2, recognized that without a change to Alternative 4, bycatch could exceed 68,392 Chinook salmon if vessels, sectors, or cooperatives opted out of the ICA. However, as explained in the DEIS, even if vessels, sectors, or cooperatives opted out of the ICA, it is unlikely that 68,392 Chinook salmon would be exceeded. In recommending Alternative 5, the Council included a provision that ensures the 60,000 Chinook salmon cap is not exceeded by the bycatch of participants fishing under the opt-out cap. A description of how the opt-out cap would function under Alternative 5 is in Section 2.5.2.

9.3.8 Comments suggesting changes to Alternative 4

Comment 2-31: NMFS has expressed concern over how to handle a situation where more than one ICA was submitted. We believe that only one ICA should be approved, and that this will ensure that industry works together to find real solutions rather than just easy solutions that fit any one user group. Should more than one ICA be submitted for a calendar year, NMFS should reject all ICAs and give the industry 30 days to work together to submit one comprehensive ICA that represents at some minimum percentage (90%?) of the pollock harvest. If the industry cannot reach a resolution, then the ICA will be rejected for the year and the lower cap will be allocated as outlined at final action.

Response: Comment acknowledged.

Comment 2-32: The DEIS identifies potential problems with Alternative 4 in the event that some entities opt out of the ICA and fish under the lower hard cap. Without additional clarification at final action, the 68,392 hard cap could be exceeded. Option B identified in the DEIS is the best resolution to this potential problem and we believe it to meet the intent of the Council motion. Option B would subtract from the 68,392 cap the portion of the 68,392 cap represented by vessels opting out and fishing under the backstop cap using the proportion of 32,482 represented by the vessels fishing under the backstop.

Response: NMFS acknowledges this comment. In recommending Alternative 5, the Council included a provision that ensures the 60,000 Chinook salmon cap is not exceeded by the bycatch of participants fishing under the opt-out cap, as described in Section 2.5.2.

Comment 2-33: Consider an adaptive management approach to determine which components and options of Alternative 4 would best support the purpose and need for this action. The selection of the preferred alternative should be based on sound scientific research, field data, and modeling information. A phased approach over a specified timeframe/schedule may be an effective way to implement the preferred alternative based on an adaptive management framework.

Response: All fishery management actions are intrinsically adaptive in the sense that the FMP is an on-going process of adaptive management. Monitoring is ongoing to collect Chinook salmon bycatch data, including river-of-origin and stock identification information. As scientific data indicates a need for a change in management course, NMFS and the Council respond by initiating an FMP amendment analyses to evaluate different management strategies. The selection of the preferred alternative is based upon the best scientific data and analysis available to support decision-making at the time of final action. This does not preclude further changes to management actions at a later time should new information become available. A phased-in approach for implementing a hard cap was discussed at the Council but was not included in the alternatives, as discussed in Section 2.6.

Comment 2-34: There is no discussion in either of the industry-initiated incentive plans for monitoring and enforcing their program. We find this to be a serious flaw in both plans. The plans put forward are complicated, outside the public process, and ripe for gaming by the industry - it's a case of the fox watching the chicken coop. Should Alternative 4 be recommended to the Secretary, strong provisions for monitoring and enforcement of the rules imposed by the ICA should be required.

Response: Under Alternatives 4 and 5, the incentive plans are industry agreements and its provisions would be monitored and enforced through the incentive plans and civil contract. NMFS would not have a role in monitoring or enforcing the express provisions of the incentive plans. NMFS, however, will monitor the bycatch from each vessel and will, in the event the NMFS closes a fishery because the cap is exceeded, enforce compliance with such closure(s) and assess penalties if an allocation is exceeded. The

Final EIS and Final RIR provide the necessary explanation about how NMFS will monitor and enforce the alternatives in Chapter 2, Section 3.1, and RIR Section 6.1.4.

Comment 2-35: Adopt a hard cap of no more than 32,500 Chinook salmon. This cap is equal to the ten year average of salmon bycatch in the BSAI pollock fisheries prior to signing the 2002 Yukon River Salmon Agreement. Thus, a hard cap of 32,500 is necessary and achievable. Given the forecasts for salmon returns in western Alaska in 2009 that project equal or lower salmon returns than the low returns of 2008, a hard cap of 32,500 salmon represents necessary insurance to the communities of the North Pacific who depend on salmon as a subsistence resource.

Response: NMFS acknowledges this comment. A hard cap of 32,500 is within the range of cap levels analyzed in the EIS.

Comment 2-36: Adopt Alternative 4 AS2, with one change and two additions. (1) With respect to the sector allocations under a hard cap, allocating Chinook salmon based on 75% salmon bycatch history and 25% AFA pollock amounts Alternative 4 allows sectors with the highest salmon bycatch a higher portion of the proposed allocation. The Alternative 4 weighted sector allocation formula should be reversed to 25% history bycatch and 75% AFA pollock. Alternative 4's use of a blend of history and pollock allocation to addresses the issue that basing sector allocations on straight history rewards a bigger share of the bycatch cap to sectors with members that fish in October or otherwise have Chinook bycatch significantly higher than that of their peers. However, the history component needs to be reduced to 25% to wring out the differences in behavior. All other aspects of the sector cap calculations, specifically including the adjustment of CDQ and CDQ harvesting sector history as described in the Council's June 2008 motion, would remain unchanged.

(2) Add to Alternative 4 the Alternative 3 B season triggered closure, applied at the cooperative or entity level such that if October 7 or any date thereafter, an entity has met or exceeded its bycatch allocation, it is subject to the closure. The cap allocation would be calculated using the methodology of Alternative 4 modified by the change above, but for a cap level of 29,300.

(3) Add to Alternative 4 the status quo VRHS and exemption from the savings area closures such that the hard cap and triggered closure are in addition to status quo.

These changes will provide adequate protection for Chinook salmon stocks in low encounter years and will be much simpler to implement than the incentive plans currently being proposed. Overlaying a hard cap on the status quo shouldn't require significant analysis. The effects of the hard cap are already fully analyzed. The effects of the rolling hot spot system are fully analyzed. Putting the two together should provide effective low encounter avoidance under Status Quo and effective high encounter avoidance under the hard cap. It should be possible for the analysts to flesh out how the agency would implement that between final action and the FEIS without delaying implementation.

Response: Comment acknowledged. The suggested modifications to the seasonal sector-specific allocations differ from those explicitly considered in the alternatives, but are nonetheless within the range of sector allocations considered in this analysis. However some provisions of the area closure suggestions have not been considered in this analysis. While layering the area closure in conjunction with a hard cap is possible under the existing suite of alternatives, there are management complexities to be considered in doing so that have been raised in previous Council discussions and were contained in the preliminary review draft (June 2008 Initial review version of the analysis).

Furthermore the commenter suggested that the B season area closure should be applied at the cooperative level. Application of area closures below the sector level (managed by NMFS) is not included in the existing suite of options due to the management difficulties raised in tracking cooperative-level caps and the challenges in enforcing cooperative level area closures for the Agency. Note that Alternative 3 component 2, option 1 provides for ICA management of a triggered area closure which could be applied under the ICA provisions at the cooperative level.

The combination of a B season area closure triggered by a lower cap in conjunction with the status quo system of VRHS program (with the exemption to status quo closures) and a hard cap divided by sector and season is possible under the existing suite of alternatives, but a more specific analytical discussion of the impacts of this alternative combination in conjunction with the existing analysis would be necessary following final action.

Comment 2-37: Any ICA that moves forward should be required to have a third-party conduct an annual analysis of the effectiveness of the ICA as it relates to the current problem statement and ICA criteria identified at final action. That analysis should be presented to the Council in an annual report for public review. The Council should also require scheduled review by NMFS of the proposed action after one, three and five years of the program to consider whether the program continues to meet Council intent and to consider new developments in the understanding of salmon biology and pollock fishing patterns. Should the program fail to prove more effective than a hard cap alone, the program would sunset.
To evaluate the efficacy of an ICA the following criteria should be required:

- Test fishing (up to 5% of the TAC) inside closed areas for the purpose of evaluating performance of the ICA against any Incentive Plan.
- Thorough explanation of the mechanisms for monitoring and enforcement of the ICA including any fee structure and the ultimate outcome for where those fees would be spent.

Response: Comment acknowledged. Alternatives 4 and 5 do contain general goals for the incentive plans and provisions for the Council to evaluate these programs once they are in effect and operational in the pollock fishery. This evaluation will be done through the annual report that will be required of the industry. Under Alternatives 4 and 5, the annual report would be required to 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. Through these annual reports and its own assessment of future Chinook salmon bycatch levels, the Council would determine the effectiveness of the incentive programs. If analysis prepared after the incentive plans are in effect demonstrates that the Council's goals for salmon avoidance are not being met, the Council could reinitiate analysis of alternative salmon bycatch management measures and implement revised or new management measures in the future.

Comment 2-38: The industry incentive program should begin working immediately and include funding, at a meaningful level, to support research relevant to salmon bycatch reduction.

Response: Section 2.6 explains that the Council considered 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.

Comment 2-39: The Council should evaluate each proposed incentive program with regard to the following: a) monitoring and enforceability; b) meaningful penalties for non-compliance, not simply a "trading" of credits or reducing or phasing out of participation in the fishery; and c) the inclusions of funding from industry for research that will help reduce salmon bycatch in the pollock fishery and meet escapement goals established by the Yukon River Salmon Agreement.

Response: NMFS acknowledges this comment. See also the response to Comments 2-34 regarding monitoring and enforcement and Comment 2-38 that explains that the Magnuson-Stevens Act does not authorize NMFS or the Council to impose a fee on industry to support research.

Comment 2-40: Oppose transferability of Chinook salmon bycatch allocations between sectors or individuals. If the higher cap amounts are adopted, selling or trading the caps should not be allowed. Such activity would result in reaching the cap instead of providing incentive for the fishing industry to reduce bycatch below the cap. It is unconscionable to allow the pollock industry to buy and sell Chinook salmon allocations when it is illegal for subsistence salmon fishermen to do the same. Transferability would result in greater use of salmon bycatch allocations and will result in less salmon returning to the region's rivers and streams. Transferability would allow a vessel with low bycatch rates to transfer their unused bycatch allocation to a vessel with high bycatch rates, and the result is that both vessels' bycatch allocations of salmon may be taken. There would be no long term commitment or incentive to reduce bycatch.

Response: Comment acknowledged.

Comment 2-41: Regulatory and non-regulatory measures are necessary to reduce salmon bycatch. Support industry incentive programs that work with meaningful performance measures. Reward pollock boats reducing bycatch. Industry could fund such a program with dockside fees similar to the vessel buy-back program.

Response: Alternatives 4 and 5 do contain regulatory and non-regulatory measures to reduce salmon bycatch. The regulatory measures are the hard caps. The incentive plan component would be largely a non-regulatory measure. As explained in section 2.4.7.1 and 2.5.8, the implementing regulations for the incentive plans would include requirements for the information that must be included in the agreement and a deadline for submission of the agreement. In addition, the regulations would describe the process NMFS would use to review and approve or disapprove the incentive plans. However, the regulations would not specify any specific requirements for the type of incentives that must be included in the plans. As non-regulatory measures, the plans could include rewards for boats to reduce bycatch or a system of fees. Note that, as discussed in the response to comment 2-38, NMFS does not have the authority to impose fees on the amount of bycatch. Fees collected on bycatch are different than cost recovery fees necessary to pay back a loan, as under a vessel buyback program.

Comment 2-42: Do not allow the rollover of bycatch from A season to B season if the cap is 47,591 or higher, because these caps do not effectively minimize bycatch. A rollover could result in higher bycatch in the following B season. However, if the hard cap is 37,000 or lower, then a rollover provision would be more acceptable, because a lower cap will result in minimizing the overall bycatch.

Response: Comment acknowledged.

Comment 2-43: The Council should allocate more pollock quota to the CDQ groups because they have harvested pollock with lower Chinook salmon bycatch rates than the other sectors. Allocating relatively more pollock to the CDQ groups would promote clean fishing and penalize dirty fishing.

Response: The AFA establishes the allocation of ten percent of the BSAI pollock total allowable catch to the CDQ Program. Because this allocation was established by Congress in a federal statute, the Council does not have the authority to increase the allocation of pollock to the CDQ Program. In addition, it would be difficult to confirm the statement that the CDQ entities have harvested pollock with lower salmon bycatch rates than the other sectors because operators of vessels harvesting both CDQ and non-CDQ pollock on the same fishing trip have the option of assigning a haul of pollock to either the CDQ entity's quota or to the vessels quota after the crew assesses the bycatch in that haul. NMFS regulations allow up to 2 hours after the fishing gear is retrieved to record the assignment of the haul in the vessel's logbook. Historically, because the CDQ entities were constrained by multiple hard caps for other groundfish species and prohibited species and the non-CDQ pollock fisheries were not, some CDQ entities would request that the vessel operators assign the lower bycatch hauls to the CDQ entity and the higher bycatch hauls to the non-CDQ pollock fisheries. This would result in it appearing that the CDQ entities were fishing with lower bycatch rates than the non-CDQ pollock fisheries.

9.4 Chapter 3 Comments

These comments are on Chapter 3, Methodology for Impact Analysis. In response to public comments, substantive changes were made to sections 3.1 Estimating Chinook salmon bycatch in the pollock fishery, 3.3 Estimating Chinook salmon adult equivalent bycatch, and 3.4 Consideration of Future Actions. The revised Sections 3.3 and 3.4 were provided to the Council and public as appendices to the preliminary CAR. The specific changes are detailed in the following comments and responses.

9.4.1 Comments on the AEQ methodology and genetics

Comment 3-1: The 68,000 cap is too high regardless of an incentive program's effectiveness and is unacceptable because it represents the average of the three highest bycatch years on record. If the all-time high year of 2007 is included as the basis for analysis, the low year of 2000 should also be included.

Response: The years used to calculate the caps which are based upon average bycatch over different time periods are different than the years chosen for the impact analysis. Section 2.2.1.1 describes all of the iterative ranges of years employed in establishing a range of cap level alternatives. None of the cap options include the highest year of 2007 in calculation of historical averages. The option chosen in the Alternative 4 represents a three-year average 2004-2006. Other options under Alternative 2 have different year-sets included (3, 5, and 10 year averages before and after 2002). Option iv is specifically the 10 year average 1997-2006 with the lowest year (2000) dropped from consideration, while option vi is the same 10 year average but with 2006 dropped.

The years selected for the impact analysis are based upon consideration of current conditions and consistent data. As explained in section 3.2, the years 2003-2007 were chosen for the impact analysis 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 NMFS catch accounting changed after 2002 and thus starting in 2003, the most consistence and uniform data set was available from NMFS on a sector-specific basis for analysis. Note that the Chinook salmon bycatch information from 2000 is included in the EIS. Section 5.3.1, in Tables 5-20 and 5-21, provides Chinook salmon bycatch data from 1991 to 2008 to show how bycatch has changed over time and the variability in bycatch between years.

Comment 3-2: This method used to assess impacts on Chinook salmon and forgone pollock is unreliable because it assumes impacts from the highest bycatch years for the historical behavior (2003-2007) and it assumes no behavioral changes by the pollock fleet in response to hard cap. The methodology assumes that the retrospective behavior of the pollock fleet will be repeated under the various hard cap alternatives. The analysis is based on past performance of the fishery, but you should not assume that past amounts of bycatch would have the same impacts in future years. This assumption is inconsistent with the primary justification for the preliminary preferred alternative, which presumes adoption of incentives to change fleet behavior. The DEIS analysis of impacts on Chinook bycatch and forgone pollock catch is very likely incorrect because the pollock industry will make considerable efforts to avoid Chinook when faced with a hard cap, and that using historic bycatch with no savings due to avoidance measures greatly overstates the impact of a hard cap. This analysis could be improved by assuming a set percentage reduction in historical bycatch levels to account for the behavioral change a hard cap will produce.

Response: Using the time series 2003-2007 was selected since this reflects the most consistent and uniform dataset available from NMFS on a sector-season specific basis for analysis. NMFS acknowledges that the analysis does not account for any changes in fleet behavior that may result in bycatch levels below historical amounts. The analysis of impacts is structured based upon the 'worst case scenario' of sections of the fleet reaching their cap retrospectively over the year analyzed in order to estimate salmon saved and forgone pollock and does not make any allowances for the fleet modifying their behavior to stay below the cap.

NMFS agrees there are issues with adequately predicting changes in fleet behavior, but disagrees that this represents a flaw in the analysis. Alternative predictive approaches (and data to support these approaches) are lacking and as such, the analysis notes that fleet behavior is likely to change, and the likely impact of changing fleet behavior is dealt with qualitatively. One approach would be to model potential changes in fleet behavior. However, such a model requires more information than is currently available. The SSC, in June 2008, noted in its review of the model methodology that "…while the calculated impacts in 2003-2007 are in one sense the worst case because they make no allowance for changes in fleet behavior, it is quite possible that in some future year the impacts on the pollock fishery could be even larger, even with changes in fleet behavior. This may occur simply because of a greater spatial overlap of Chinook salmon and pollock then seen in any of the years 2003-2007." Any set percent reduction employed to estimate behavior changes in response to a hard cap would be arbitrary and thus potentially uninformative in estimating true fleet operational behavior under a hard cap.

Comment 3-3: The Chinook salmon bycatch caps should be based on the strength of the projected Chinook salmon returns. There is no scientific data to support the use of bycatch data when compared to the use of projected returns. This method is similar to way the groundfish quota is set, based on percent of biomass. Successful fisheries have shown that the use of a projected run is more sound and then setting an allowable intercept for catch.

Response: NMFS agrees and setting the cap based on Chinook salmon abundance was considered extensively during the development of alternative management approaches. In discussions with the SSC over the years, options such as using BASIS surveys or other indices were considered. However, the data on future-year oceanic salmon abundances (preferably to river system) that would be required to manage salmon bycatch levels in this manner is lacking. Retrospectively, there is some evidence that salmon bycatch rates are positively correlated with subsequent salmon run-strengths but this relationship is variable and therefore cannot at this time be used as a basis for determining bycatch limits (e.g., 2007 Chinook salmon bycatch encounter-rates were extremely high while run-strengths for a significant group of these fish was relatively low).

Comment 3-4: Two significant deviations in the DEIS from methods employed in all previous bycatch AEQ estimates were 1) the use of ADF&G's genetic (SNP) analysis (Page 111, last paragraph), instead of the traditional scale pattern analysis for determination of stock of origin; and 2) seemingly biased bycatch sample collections for the genetics studies (page 118 2nd paragraph). The SNP methodology underestimates the stock composition of Yukon River Chinook salmon and overestimates others such as the Alaska Peninsula stock over the years presented in the DEIS. The SNP analyses of bycatch used in the DEIS are unable to allocate fish stocks to the major drainages (Yukon, Kuskokwim, Columbia, etc) even though this is the primary metric for managing Chinook. Scale pattern analysis provides this information. Biased genetic tissue sampling in the 2005 B and 2007 A seasons is apparent and acknowledged in the DEIS, 'most genetic tissue sampling was completed prior to when most the bycatch occurred' and 'all of the 2007 samples came from a single vessel fishing in a closed area using experimental salmon excluder trawl gear'.

Response: NMFS disagrees. Section 3.3 is revised in the Final EIS to clarify the methodology employed in this analysis. For further information on the use of the SNP analysis as the primary determinant of stock of origin please see response to comment 3-5 where an explanation of the rationale for the most recent data is provided as well as further details on the use of Myers et al. (2003) in this analysis. With respect to the apparent bias in sample collections, this is fully acknowledged and accounted for in this analysis (as opposed to a possible similar bias in Myers et al. study). Furthermore the 2007 A season data was downweighted considerably in its relative use compared to the other seasonal data due to these issues with sampling intensity. Additional information has been added to section 3.3 regarding the weighting of each season as this was inadvertently omitted in the DEIS.

Comment 3-5: The DEIS repeatedly relies on preliminary or cursory studies to develop arguments that are of central importance to any proper evaluation of environmental impacts, without a clear presentation of how the limitations of those studies translate into uncertainties. The genetic data used to derive the estimates of Chinook salmon adult equivalent bycatch for the AEQ model relies heavily upon two poster presentations (Seeb et al. 2008; Templin et al. 2008) that have not been made publicly available or peer reviewed. The preliminary nature of these studies and the lack of an opportunity to fully review their methodology and sampling techniques makes their inclusion in the DEIS questionable. NMFS must make clear the extent to which the DEIS relies on information that is not peer reviewed. We recommend that the published Myers (2003) methodology be the sole methodology utilized by the DEIS.

Response: NMFS disagrees. The data and the methodology by which the data have been employed in this analysis are all fully explained in the text. Section 3.3 is revised in the FEIS to clarify any additional details to the methodology that was not adequately explained in the DEIS. The only aspect to the studies that were not included in the DEIS are the methodologies by which the genetic data (single nucleotide polymorphisms SNPs) are analyzed and the specifics by which classification groupings are made as this is both outside of the scope of this analysis as well as proprietary pending publication by the geneticists involved in that study. However all details including the classification thresholds, river systems included in each group, as well as aspects of the data necessary for understanding their use in this analysis were included in the DEIS, with additional details for clarification purposes included in the FEIS.

Furthermore, the cited Myers et al. (2003) study, which was employed in this analysis for purposes of estimating impacts to the Yukon, Kuskokwim and Bristol Bay (as described in revised section 3.3) received a similar level of review and has not been published. The Myers et al. (2003) study result is presented in a final report of a multi-year project funded by the Yukon River Drainage Fisheries Association (YRDFA). This study had relatively high levels of sampling but simply assumed that sampling was proportional to bycatch in space and time. For the genetic study results used in the EIS, this was not assumed and sampling was adjusted to account for differences in proportionality.

The need to use a more recent time frame is important. Hence, the EIS focused on samples and results collected during 2005-2007 (see Section 3.3 for additional details on the time period for sampling over those years). Genetic results in aggregate for western Alaskan stock composition compared favorably with Myers et al. (2003) earlier work from 1997-1999.

Comment 3-6: The model used in the DEIS drastically underestimates the impacts to western Alaska Chinook salmon stocks and to Chinook salmon users.

Response: NMFS disagrees. For total salmon taken incidentally as bycatch, the sampling effort is very high by scientifically trained and certified who observe a majority of the catch in the pollock fishery. This indicates that the uncertainty in total removals of salmon is well known.

Relative to specific impacts to western Alaska Chinook stocks, NMFS acknowledges the uncertainty in estimating the stock composition of the bycatch. However, this study uses results from both genetics and scale pattern analysis (which gave similar results relative to WAK stocks) to arrive at estimates. These approaches, combined with appropriate weighting schemes to account for sampling disparities, should provide unbiased estimates of the loss of salmon returning to western Alaska rivers due to pollock fishery bycatch.

Comment 3-7: The 2007 A season tissue collections have an unusually high proportion (55%) of age-4 Chinook salmon bycatch compared to the historic average of 30% (table 3-5). Younger fish tend not to be AYK stocks contrary to older fish. Historically, the A season bycatch has been dominated by older fish, AYK stocks, contrary to 2007 bycatch estimates. This results in misallocation and biased estimates of regional impacts in the DEIS (Table 3-8, Myers et. al. 2003). All prior AEQ impact analysis suggested the bulk of the AYK stock bycatch occurred in the A season, contrary to the DEIS (Table 3-11). This issue is compounded by the small genetic tissue sample size (N=360). Using an estimate of 1% of the 2007 A season bycatch tissue samples being AYK stock, so only 3 or 4 fish taken as A season samples (table 3.9) were of Yukon origin, suggesting a high potential for error due just to insufficient sample size. Earlier studies by Myers and others commonly had sample sizes greater than 1,000.

Response: NMFS disagrees and notes that the 2007 A seasons genetics collection were downweighted appropriately. The 2006 A-season samples genetics received 4 times the weight of the 2007 samples and the proportion of age 4 in 2006 was 30% (close to the average). The bycatch in the A-season is dominated by age 5 fish (51%) with ages 6 and 7 Chinook representing 15% on average while ages 3 and 4 are 35%. The age compositions are based on extensive length frequency sampling. While Myers sample sizes were relatively large, no attempt to correct for area and season specific sampling was done (they assumed that sampling was proportional to the actual bycatch by region and seasons). Further clarifications of methodology are included in the revised section 3.3 in the Final EIS.

Comment 3-8: In Section 3.3.2, the salmon genetics for non-western Alaska stocks are not in close agreement with the scale analysis, and there are questions concerning North Alaska Peninsula and upper Yukon contributions to bycatch. Please refer to Table 3-12. The data for western Alaska stocks (Bristol Bay and north) from the three studies cited in the DEIS are reasonably consistent in the aggregate and are good enough to use as basis to protect those stocks. The extensive work done by the analysts to deal with the less than ideal sampling for the Seeb et al. study is to be commended.

Summing figures from western AK and Yukon segments (Seeb et al.) yields 54%, which is in reasonable agreement with the scale analysis done by Myers et al. at 56% and 60% for the core bycatch stocks. That said, there are some limitations to sampling methodology for the Seeb et al. study in particular, and the need for additional work characterizing the stock composition of the Chinook bycatch is obvious.

The North Alaska Peninsula contribution to the pollock bycatch, indicated by Seeb et al., seems highly unlikely, though if true could explain their very weak status. These stocks are quite small, and if the stock composition is true, they contributed 10,810 fish to the bycatch in 2006. This probably exceeds total run size for those rivers. The composition of the rest of the bycatch, totaling 40-46%, is quite variable. Do Cook Inlet stocks contribute 4%, 17% or 31% of the bycatch? Are Russian stocks 2%, 5% or 14%? Are Pacific Northwest stocks 0% or 23%?

Given this variability, it's also possible that the Upper Yukon stock components' migration patterns and degree of interception by the pollock fishery are not well understood. While it was 3% in the 2006 samples analyzed by Seeb et al., given these stocks' magnitude and importance, it may be prudent to assume that these stocks may not have shown up proportionally in the less than optimally collected, spatially and temporally limited samples analyzed. The Upper Yukon stocks might show up at higher levels at other times and their interception rate may vary more than the core stocks. The last caveat may also apply to the North Alaska Peninsula, Pacific Northwest, Cook Inlet and Russian stocks.

Response: NMFS agrees that while there is consistency in relative stock composition estimates for aggregate WAK river systems between scale pattern and genetic studies, we note that there is considerable variability among the other stock composition estimates between studies. Table 3-12 highlights these issues. Additional text has been added to the revised Section 3.3 in the Final EIS to clarify the intent of the comparative table. Given these similarities and differences we note the following: the consistency in aggregate WAK core groupings between all studies supports the impact estimates for the aggregate groupings. Differences in stock composition estimates between studies for other regions were noted but given less emphasis in impact analysis for these regions (e.g., Cook Inlet, North Alaska Peninsula, Russia, Pacific Northwest) due to the variability between studies. This also lead to our conclusion that further study is required to better estimate stock composition for those regions.

Comment 3-9: The genetics and AEQ model provide reliable aggregate stock trend information, but do not accurately assess stock-specific impacts. Due to the inconsistencies associated with insufficient sample size, the genetic analysis should be used only to indicate treads across broad stock groups, such as WAK and should not be used for smaller stock groupings. Myers et al. (2003) should be used to break out the Coastal Western Alaska aggregate grouping. Given the importance of these stocks for treaty obligations, we cannot assume that the stock composition from the spatially and temporally limited samples analyzed by Seeb et al. are indicative of the overall presence of these stocks in the bycatch.

Tables 5-47, 5-48, 5-49, 5-50 and 5-51 should be amended to present information on an aggregate level.

Response: The revised Section 3.3 includes further clarifications on the methodology employed and these are also reflected in the response to comment 5-6. Given the aggregate grouping of Coastal WAK from genetics, the results from Myers et al. (2003) was in fact used to break out this grouping (plus the added portions from the middle and upper Yukon) and provide gross river-specific impacts for the Yukon, Kuskokwim and Bristol Bay. No attempt is made in this analysis to discuss the middle and upper Yukon based on genetics alone for impact analysis, instead they are reaggregated as noted and only the Yukon as a whole system is estimated. Tables 5-47 through 5-51 present the 9 genetic groupings while the specific river systems are shown in Tables 5-52 through 5-56.

Comment 3-10: The DEIS lacks sound data on the abundance and origin of Chinook salmon in the Bering Sea. This combined with uncertainty about how salmon ecology is linked to ocean conditions will force the Council to take action without the best science and research available to them and in doing so invite unintended negative economic consequences to the Bering Sea pollock industry and associated dependent communities. On-going research of such concerns is underway but has not yielded results.

Response: NMFS agrees that uncertainty exists in understanding the factors affecting Chinook salmon abundance and the relationship between bycatch mortality and in-river abundance. Identifying these uncertainties was a major scientific undertaking presented in the EIS. This EIS identifies the potential impacts of the alternatives on Chinook salmon and points to areas of uncertainty about those impacts. NMFS is actively taking steps to reduce uncertainty and better understand the river-of-origin of Chinook salmon caught as bycatch and ADF&G has ongoing research to estimate and understand the factors impacting in-river abundance. See response to comment 2-16.

Comment 3-11: In section 3.3.2, page 119, the DEIS states that ongoing work to identify the stock of origin of salmon bycatch is occurring. However, the description of sampling and study design is not included.

Response: NMFS appreciates the comment. Presently the AFSC has developed a sampling strategy to improve genetic sampling done by observers. Additionally, ADF&G has contracted a review of sampling approaches for this problem. These efforts are underway and will improve future analysis of the type presented in the EIS.

Comment 3-12: NMFS must include all relevant 2009 catch data, including Chinook salmon bycatch, in the FEIS to comply with NEPA. Bycatch rates of Chinook salmon in the early stages of the 2009 pollock fishery are comparable to the 2007 when more than 120,000 Chinook were killed. By many indications, 2009 is shaping up to be another disaster for Chinook salmon bycatch.

Response: The Final EIS provides the most recent Chinook salmon bycatch data up to the finalizing of the document, as the DEIS provided the bycatch estimates for 2008 prior to printing at the end of November. Additionally, NMFS posts the weekly catch reports of Chinook salmon bycatch in the Bering Sea pollock fishery on the NMFS Alaska Region website at: http://www.fakr.noaa.gov/2009/2009.htm.

Note that the 2009 estimates of Chinook salmon bycatch have been adjusted from the reports for the first weeks of the 2009 pollock fishery which used very preliminary data. A large amount of observer data were missing for this time period. Once the observer data were incorporated into the catch accounting system the salmon rates decreased and the bycatch numbers decreased. The 2009 rates are lower than the 2007 rates. For the same time period in 2007, the bycatch was 59,451 Chinook salmon in the Bering Sea pollock fishery.

9.4.2 Comments on the cumulative effects analysis

Comment 3-13: The analysis neglects to adequately acknowledge the cumulative impacts associated with climate change. Climate change represents one of the most ominous threats to Alaska's fisheries resources and cannot be ignored as it relates to changes in abundance, distribution, and the general ecological relationship of fish populations in the Bering Sea. Climate change could completely alter the ecology of the Bering Sea, resulting in significant acute and chronic effects on individual species and considerable population level effects among various species. Moreover, climate change could have substantial impacts on subsistence, beyond the population level effect it could have on various species. Increasing arctic temperatures and associated physical effects could compound and amplify the impacts large-scale commercial fishing in the Bering Sea. Section 3.4.1(Ecosystem-sensitive management) addresses climate change only by noting that current research in the Bering Sea might inform the process in the future, but fails to acknowledge existing research that would inform decision-makers and the public.

In light of the potential threats posed by climate change and its potential negative impacts on in-river salmon harvests, salmon bycatch, and the pollock fishery, it is important that the EIS address the issue in a systematic and transparent way in the context of cumulative impacts. Thus, the DEIS should take a hard look at the issue of climate change and how it may affect both the pollock fishery and its prosecution as well as how it may affect salmon populations. The potential negative effects on both the pollock and the salmon fisheries resulting from climate change would argue for additional precaution in setting a cap for salmon bycatch. The public comment provide references the EIS also should consider in assessing the potential effects of climate change.

Response: NEPA requires a cumulative impact assessment on past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR 1508.7). Global climate change can is a natural occurrence and, under NEPA, is not characterized as an “action”; therefore it is not a reasonably foreseeable future action. However, the EIS does provide information on ocean climate change and regime shift issues in Section 8.4. This discussion relies on the Ecosystem Chapter of the annual SAFE report. The SAFE report is available to decision-makers and the public. NMFS agrees that the EIS should include additional discussion on the available information regarding the potential impacts of climate change on salmon and pollock. The Final EIS was revised to included this information in Sections 3.4, Section 4.4, Section 5.4, and Section 6.6.

Comment 3-14: Section 3.4 fails to consider several reasonably foreseeable future actions that will have impacts on Chinook salmon in the affected region. The "Other Federal, State, and international agencies" category should include future exploration and development of onshore mineral and oil and gas resources and development of hydrokinetic power resources in river. Water quality, pollution, habitat damage caused by mining, dredging and cumulative effects of same on Chinook salmon stocks are not discussed in the DEIS. Nor are management practices that may be harmful to selected stocks (e.g. those that increase bycatch of Chinook salmon in in-river fisheries). These factors need to be identified as additional sources of potential harm to Chinook salmon runs and need to be addressed in the EIS.

Section 3.4.4.3 states that Chinook salmon consumption can be an important part of regional diets. Chinook salmon are in fact the staple of many regional diets, and the most important subsistence food in many of the regions discussed. This statement should be modified to more accurately characterize the importance of Chinook salmon as a subsistence resource. Section 3.4.4.5 mentions increasing mining activities in Alaska in coming years. Donlin Creek mine, a proposed open-pit gold mine located between the Kuskokwim and Yukon River watersheds should be specifically mentioned in this section as is the proposed Pebble mine.

Response: NMFS agrees and included additional reasonably foreseeable future actions and their impacts of Chinook salmon should in the Final EIS. These additional reasonably foreseeable future actions have been added to Section 3.4 and the analysis of impacts of these on Chinook salmon have been added to Section 5.4.

Comment 3-15: The DEIS does not discuss the cumulative impacts of the proposed action. Instead of providing a review of the associated cumulative impacts, the DEIS lists a variety of impacts with no analysis of what the actual cumulative impact is. So, while the DEIS acknowledges potential impacts in Section 3.4, there is no way to gauge the impact, taking all these different actions into account, on salmon runs. Section 3.4 does not a contain conclusion that assesses the cumulative impact of all the past, present, and reasonably foreseeable actions.

Response: Section 3.4 was not designed to assess the cumulative impacts of all the past, present, and reasonably foreseeable future actions. As explained in section 3.4, 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. The reasonably foreseeable future actions identified in Section 3.4 are likely to have an impact on a resource component within the action area and timeframe.

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 the EIS. 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 decision makers and the public to make a reasoned choice among alternatives.

In the 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.

Public comment identified a number of reasonably foreseeable future actions that NMFS added to Section 3.4 for the Final EIS. See response to comments 3-13, 3-14, 5-06, 5-12, 5-13, 5-14, and 5-15. NMFS has also added to the analysis of the impacts of reasonably foreseeable future actions on pollock (Section 4.4), Chinook salmon (Section 5.4), and chum salmon (Section 6.6), as requested by public comments.

9.4.3 Comments on the observer issues and the catch accounting system

Comment 3-16: It is our understanding that NMFS observers may be underreporting bycatch and that NMFS is aware of the underreporting bias but has not adequately accounted for it in the EIS.

Response: NMFS disagrees and is unaware of a deliberate underreporting bias by observers. Observers are trained by NMFS, monitored during the fishery, and debriefed extensively by NMFS staff after each deployment. The AFSC North Pacific Observer Program (NPGOP) has long standing and sophisticated quality control practices in place and regularly evaluates the quality of observer information and sampling methodology. Data which NMFS identifies as being collected incorrectly are routinely corrected, when possible, or removed from the system, and the estimation processes are re-run to account for any corrections. NMFS final catch statistics for any given year include all of the corrections made to that year’s observer information.

Comment 3-17: The NMFS Alaska Region relies on unverified assumptions that may lead to overly optimistic estimates of precision and systematic underestimation of bycatch. These assumptions include: 1) unobserved vessels behave the same as vessels with observers onboard; 2) observed vessels behave the same while observers are off shift; 3) salmon outside of an observer's sample on catcher processors are not included in bycatch estimates but are claimed to be delivered to observer for examination; 4) observers attempt to remove all salmon from the catch as it is offloaded at shoreside plants, but inevitably miss some (called 'after-scale' salmon in DEIS); 5) observers record 'after-scale' salmon as if the observers themselves had collected them; 6) it is not clear if 'after-scale' salmon are physically sampled by observers for coded wiretags; 7) the proportion of salmon physically examined by observers for coded-wire tags is not reported; and 8) the proportion of salmon discarded at sea is not reported.

Response: NMFS agrees that there are potential issues associated with estimation of bycatch. Response to each of the comments follows:

1 and 2) NMFS agrees that catch estimates rely on the assumption that unobserved fishing operations have similar bycatch characteristics as observed fishing operations. NMFS has not evaluated this assumption; however, NMFS is not aware of evidence of biases favoring overly optimistic estimates of

precision and systematic underestimation of bycatch. This assumption associated with NMFS catch estimation is acknowledged in Chapter 3. Efforts to improve overall quality of observer data are ongoing within NMFS and through the Council to restructure the mode in which observers are contracted and deployed.

3) NMFS disagrees that salmon outside of an observer's sample on a catcher processor may cause biased estimates. Regulations require vessel personnel to retain salmon from all catches until they are counted by an observer, but NMFS does not use these unverified, industry sorted, numbers in management. Instead, NMFS estimates salmon bycatch by expanding the independent observer sampled salmon to unsampled portions of the catch using accepted statistical estimation techniques.

4 and 5) The commenter refers to "after-scale" salmon and this means salmon which were detected by plant personnel after the fish were weighed in a fish processing plant. NMFS agrees that some salmon may initially make it past the observer into the shoreside processing plant and improvements needed to reduce the occurrence of "after scale" salmon are addressed in Section 3.1.3. Currently these after scale salmon are returned to the plant observer by plant personnel and they are counted in NMFS estimates of Chinook salmon bycatch.

6 and 7) The "after-scale" salmon are brought to the observer by plant personnel and these fish are included in the observer's counts. NMFS observers are trained to collect snouts from Chinook salmon which are missing an adipose fin. Observers currently collect snouts from salmon they encounter within their samples. The coded wire tag is not visible and is extracted later by NMFS staff noting that not all fish with clipped adipose fins have tags in them. In some circumstances when there are large numbers of salmon, the observer can only look at a subset of them, and this subset can be identified using the protocols NMFS had had in place since 2008. Observers also collect snouts opportunistically from adipose clipped salmon from outside of their samples. Information is collected to identify which fish were collected outside of the samples so analysts can use the information appropriately in their work.

8) NMFS disagrees that the number of at-sea discards is unknown. Vessel operators are prohibited from discarding salmon at-sea until salmon are sampled by an observer. The final estimates produced by NMFS include at-sea discards.

Comment 3-18: The DEIS notes that Chinook 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." Capturing such information could provide a useful check on the accuracy of the observer estimates for the observed vessel hauls. Id. at 104. Also, in light of Miller (2005), it would seem that this information is ultimately used by the Alaska Region via transmission from the fishing industry to estimate bycatch, so it is not clear why the information is not recorded by observers to serve as a check on the accuracy of the industry data.

Response: NMFS agrees that this information could be useful, however NMFS prefers to rely on scientifically trained observers as opposed to crew-member census as recorded on WPR. NMFS disagrees with the premise that this information is then used by the NMFS Alaska Region to estimate bycatch.

Comment 3-19: Explain the technique used to estimate Chinook salmon bycatch in the pollock fishery.

Response: Chapter 2 and Section 3.1.4 provides a detailed explanation of the estimation procedure for Chinook salmon.

Comment 3-20: If current bycatch monitoring is effective, why does NMFS advocate increasing observer coverage for catcher vessels with transferable bycatch allocations and for shoreside processors?

Response: NMFS explains in Section 2.2.5 that increased observer coverage on catcher vessels from status quo is required for alternatives that allocate Chinook salmon bycatch to entities. Entities that receive an allocation are prohibited from exceeding the allocation. If an entity exceeds an allocation, NOAA may initiate an enforcement action against the entity. Enforcement of a quota allocation requires entity-specific catch information. Currently, some catcher vessels under 125 feet in length are required to carry an observer on 30 percent of their fishing trips. To enforce transferable allocations, NMFS would only increase catcher vessel coverage so that all trips were observed so the bycatch estimate is entity-specific. The EIS does not recommend increased observer coverage on catcher vessels for alternatives that do not have entity-specific allocations.

Comment 3-21: The DEIS states that the "the levels of salmon bycatch are precisely estimated. . . " pg. 103 (citing Miller (2005). The DEIS, however, fails to explain or consider several important factors in this regard. It does not appear that the bycatch numbers reported in the DEIS were estimated by the same methods presented in Miller (2005). A comparison of Chinook salmon bycatch estimates presented in Miller (2005) and in the DEIS suggests the biases introduced by the NMFS Alaska Region. Given the precision claimed by Miller (2005) for his estimates and the fact that he relies solely on sampling results, it is unlikely that such large differences could be dismissed as mere modeling differences. The DEIS must explain this discrepancy between the bycatch numbers on which it relies and those in Miller (2005).

Response: NMFS believes the estimates for bycatch used in the EIS are based on the best available science. NMFS disagrees that the agency is using an ad hoc method for estimating bycatch. The NMFS estimates of Chinook salmon are based on well-established sampling methodology implemented by the observer program and ratio estimators based on post stratification of catch. The sampling intensity for bycatch in the pollock fishery is very high in order to reduce the severity of potential sampling issues and to satisfy the demands of inseason management. Because sampling fractions are high for the pollock fishery, uncertainty associated with the magnitude of salmon bycatch is relatively low. Fishing activities during the time period considered in the EIS were managed under NMFS-generated catch estimates, not the estimates used by Miller (2005) in his PhD dissertation. The NMFS estimate is the official record of catch of Chinook salmon.

NMFS recognizes the differences between their estimates and those presented in Miller 2005 as part of a dissertation. To address this comment, several potential sources of error and the assumptions used by Miller in querying the database were examined. The results indicate one fundamental flaw is the way that Miller understood and used the observer data. Additionally, an assumption about the observer coverage level was made, but is no longer necessary. Neither of these issues discredit Miller's dissertation work, which represents a very comprehensive and thorough presentation of a statistically sound method. However, an unfortunate detail about how observer data records were coded for salmon specifically was overlooked. While the methodology presented in Miller is sound, the details required for proper implementation of the method include extensive sets of cross-checking about assumptions on how data are being used and how they are being interpreted. NMFS is continuing to develop a system that provides reliable scientifically defensible estimates while at the same time meeting the needs of inseason management and transparency in how estimates are computed.

The main reason that Miller's estimates are considerably higher than NMFS is due to the fact that partial and whole-haul samples with no Chinook salmon were inadvertently excluded in his estimation. Prior to 2008, the observer program had a data convention that if a sample was taken and no salmon were found, then a default species code (220) was used and a zero for the number of salmon in the sample was recorded. These specimen records were inadvertently overlooked. If salmon species other than Chinook salmon were found in the bycatch, then those species codes were recorded and the partial or whole-haul record created for that species. Those records (positive records of non-Chinook salmon) were also omitted from the algorithm. Since in both of these cases the samples represent effort that should be included as part of the Chinook sampling, the unintentional omission of those samples is clearly incorrect and results in significant overestimates. Observer data collection system revisions implemented in 2008 eliminated this potential for confusion by eliminating different sample sizes for different species within a haul.

A second, relatively minor issue is that Miller's design and model-based estimators assume that the observer coverage for 60-125' vessels was exactly 30% for all trips within each quarter of the calendar year. In reality, these vessels often have a much higher levels of coverage based on trips (sometimes in excess of 50%) and therefore this assumption may lead to estimates that are biased (depending on the real level of observer coverage). One simple solution is to use the true ratio of observed and unobserved trips or fishing days for each year and quarter and this was noted in his study but at the time, the information was unavailable.

In summary, the discrepancy in point estimates between Miller and NMFS estimates are due to some incorrect data interpretations from Miller and is not due to differences in estimation methods. Edits to clarify the differences between these methods are included in the Section 3.1 in the Final EIS.

Comment 3-22: Observers should be collecting fin clips from Chinook bycatch as part of a long term scientific genetic sampling program designed to represent, annually, the genetic contributions of the salmon bycatch. In-season stock identification techniques are available and should be used. This is especially important as listed ESA stocks are taken as bycatch (DEIS p, 244). In addition, coded-wire-tag data should be evaluated against genetic estimated to access concordance.

Response: The majority of salmon bycatch in the Bering Sea groundfish fisheries is in the pollock fishery for which a large fraction of the fishing operations (~70%) are sampled by observers. In fact, since 2003 the average sample fraction of the total pollock catch from observed vessels exceeds 50% (although this does vary by sector). This level of sampling effort is unprecedented. The current level of observer coverage provides sufficient data and confidence in the catch data to allow for sustainable management of the fishery and to give some understanding of the bycatch in the fishery.

The NPGOP has collected salmon tissue for genetic analysis at the request of AFSC Auke Bay Lab staff in support of a developing genetics program. The salmon tissues were initially collected in an ad hoc manner to support a pilot project. In 2009, AFSC staff collaborated to make changes in the tissue collections by moving from ad hoc collections to selecting the tissues from salmon encountered in the existing sample frame used by observers for catch composition sampling. The changes made in 2009 provide more tissue samples for analysis, but further refinements to the sampling protocols may be required in the future before stock composition estimates representative of the entire bycatch can be completed. NMFS may make further modifications to observer tissue sampling as we evaluate these samples and further refine our work. NMFS is committed to continuing to obtain tissues to enable a better genetic understanding of the origin of salmon taken as bycatch. Given substantial additional financial resources and a sampling plan designed for the purpose, seasonal estimates of the stock composition of the samples would be possible.

In-season (near real time) analyses are not presently feasible due to the large numbers of observers collecting samples and the non-uniform times at which they return to port to ship the samples. The analysis of samples taken may occur months to years after the samples were collected, dependent on available funding for the laboratory analysis for either CWTs or genetics. It is important to determine the origin of salmon in the pollock fishery bycatch to understand the potential effects of bycatch on ESA-listed salmon stocks. The incidental take statement of ESA-listed salmon is based on annual determinations of salmon bycatch and CWT recoveries and is not based on an inseason determination. CWT recoveries and genetic analysis of salmon bycatch are both described in the annual report on salmon bycatch to the NW Region, as required by the terms and conditions in the 2007 supplement to the 2000 biological opinion on the effects of the Alaska groundfish fisheries on ESA-listed salmon. At this time, only the CWT recoveries provide direct evidence of bycatch of ESA-listed stocks while genetic analysis provides origin of the salmon on only a regional level.

Scientific challenges surround the ability to genetically detect ESA-listed salmon stocks in the bycatch. Detection or identification of ESA-listed stocks depends in large part on sufficient numbers of samples from the bycatch and the power of the genetic markers to separate stocks. Individuals from ESA-listed stocks are expected to be rare in the bycatch of federal fisheries in the Bering Sea, based on CWT recoveries from salmon sampled by the observer program and from research cruises. If the number of individuals from the ESA-listed salmon stocks is small relative to all stocks contributing to the bycatch mixture, the probability of detecting the presence of the ESA-listed stock may be quite small, even with a relatively large sample from the salmon bycatch.

Comment 3-23: How effective is the quality control on observer data? Explain the nature and amount of corrections and the nature of any data entry problems.

Response: NMFS believes that this comment is outside the scope of the EIS since the alternatives considered in the analysis do not require changes to quality control and data entry procedures for observer data. For reference, the observer protocols for data collection are documented in observer sampling manual (http://www.afsc.noaa.gov/FMA/Manual_pages/MANUAL_pdfs/manual2009.pdf) and a description of data quality is documented in the North Pacific Groundfish Overview (http://www.afsc.noaa.gov/FMA/PDF_DOCS/NPGOP%20REPORT%20-%20Overview%202001%20-%20web.pdf).

Comment 3-24: The average bycatch (pg. 244) of 49,600 Chinook salmon does not include unreported bycatch by vessels without observers or chum salmon.

Response: NMFS provides estimates of all bycatch including chum and for vessels without observers. Section 3.1 explains how NMFS estimates Chinook salmon bycatch by expanding observer data to unobserved fishing operations.

9.5 Chapter 4 comments

These comments are on Chapter 4, Walleye Pollock. Chapter 4 was revised for the Final EIS to include an analysis of Alternative 5 and a more detailed section on the consideration of future actions as requested by public comment.

Comment 4-1: The lowering of the pollock TAC to 815,000 tons will help to alleviate bycatch but it is not enough. Scientific evidence presented at the December 2009 Council meeting that indicated that the pollock TAC should be 400,000 tons, was ignored.

Response: NMFS disagrees with this comment. While a lower pollock TAC might result in lower bycatch amounts of salmon (assuming similar salmon bycatch rates per metric ton of pollock), there was no scientific information presented in December 2009 to indicate the pollock TAC should be set to 400,000 metric tons. Scientific information presented at the December 2009 Council meeting, using the latest stock assessment information from the Alaska Fisheries Science Center, reviewed by scientists from the Groundfish Plan Teams and the Council's Scientific and Statistical Committee, indicated a conservative acceptable biological catch limit of 815,000 metric tons.

Comment 4-2: As the pollock abundance continues to decline, fishing effort will increase resulting in additional salmon bycatch. Review the pollock quota and consider season reductions to protect the pollock stocks. As the desired commercial fish stock becomes less abundant, more fishing effort follows, which results in additional salmon bycatch.

Response: NMFS disagrees. In the event abundance did continue to decline, fishing effort is likely to decrease correspondingly. While it is possible that catch per unit effort would decrease (thereby resulting in increased effort relative to a given stock abundance), it is not accurate to assume that overall effort would increase. If seasons were shortened, effort to catch the TAC (at whatever level) would simply be compressed into a shorter time frame. It is possible that season restrictions could be effective at reducing salmon bycatch, if seasons were closed during certain periods of higher bycatch rates, but overall effort would not necessarily be decreased. Shortening the pollock season, or closing it during certain periods of higher salmon bycatch rates, is discussed in Section 2.6, Alternatives considered and eliminated from further analysis. The Council and NMFS could consider such season adjustments through a separate plan amendment analysis, but not as part of the action covered under this EIS.

Comment 4-3: The FEIS should include a discussion of how climate change may have a direct, indirect, and/or cumulative impact on the Bering Sea pollock fishery and the management decisions for the Chinook salmon bycatch management. The Final EIS should discuss adaptive management measures that would be taken to address climate change conditions. Additional information exists regarding how pollock abundance and distribution may change as a result of climate change. These changes could have a profound effect on salmon bycatch in the pollock fishery. For instance, if pollock abundance continues to decrease or stocks become more erratically distributed it could increase towing times which would correlate with higher overall salmon bycatch. A number of peer-reviewed scholarly articles investigating climate change effects on pollock and other gadids with similar life histories may be found in the Proceedings of the Symposium Resiliency of Gadid Stocks to Fishing and Climate Change, 2007. G.H. Kruse, K. Drinkwater, eds. Alaska Sea Grant, Anchorage, Alaska.

Response: Additional information on climate change and impacts to salmon and pollock productivity is included in Section 4.4. Note that while a general discussion of climate change impacts can be included in the document, it is not possible to definitively estimate impacts on pollock or Chinook salmon stocks.

Comment 4-4: The DEIS overlooks the potential cumulative impacts of foreign fisheries on transboundary stocks of pollock. Russian fishery managers project increased effort and catch in all pollock fisheries from the Sea of Okhotsk to the Western Bering Sea. Two separate investigations of the Eastern Bering Sea pollock stock estimated that 10-30% of the U.S. stock spills over into Russian waters.

Response: NMFS acknowledges this comment. However, the focus of this EIS, and potential action being considered, is Chinook salmon bycatch caps on the U.S. pollock fisheries. The cumulative effects of foreign fisheries on transboundary pollock stocks is of interest in the determination of annual catch limits on U.S. pollock fisheries, and these affects are taken into consideration in the determination of those catch limits on an annual basis.

9.6 Chapter 5 Comments

These comments are on Chapter 5, Chinook salmon. Chapter 5 was revised for the Final EIS to include an analysis of Alternative 5 in Section 5.3, updated Chinook salmon status information in Section 5.2, and a more detailed section on the consideration of future actions as requested by public comment in Section 5.4. Substantive changes were made to Section 5.3.1.1 Pollock fishery bycatch of Chinook salmon in response to public comments. The revised Sections 5.3.1.1 and 5.4 were provided to the Council and public as appendices to the preliminary CAR for Council final action in April 2009. Specific changes are detailed in the following comments and responses.

9.6.1 Comments containing run information

Comment 5-1: Management and conservation of Yukon River salmon are challenging during these times of reduced salmon production when restrictions to subsistence fisheries may be necessary. 2008 was a very poor Chinook salmon fishing season on the Yukon River. The Canadian Chinook salmon escapement objective was not met for the second year in a row. Fisheries managers closed commercial fishing in the US and Canada. They reduced fishing time in the U.S. subsistence fisheries and allowed only smaller mesh gillnets in the lower Yukon River districts. Managers reduced sport fishing bag limits in the U.S. and closed sport fishing in Canada. Canadian First Nations voluntarily reduced aboriginal fishing harvests by more than 50 percent. Even with these severe reductions, spawning escapement of Canadian-origin Chinook was 27 percent below the minimum interim management escapement goal of 45,000 Chinook salmon. A poor run of Yukon River Chinook salmon is anticipated in 2009. Returns in Bristol Bay are also down.

Response: NMFS acknowledges this comment. Updated run and harvest information, to the extent the information is available, is included in this Final EIS.

Comment 5-2: In 2008, 150,000 Chinook salmon were counted entering the Yukon River while 122,000 Chinook salmon were caught as bycatch in the BSAI pollock fishery. These bycatch estimates only include the December fishing season and no bycatch was recorded for this fishery during the earlier fishing season. All of the bycatch Chinook salmon were bound for Western Alaskan Rivers but only a small portion reached the Canadian border. Escapement was also low on the Tanana River, Ankreafsky River, and other tributaries to the Yukon River due to bycatch in the BSAI pollock fishery.

Response: NMFS acknowledges this comment. Updated run information as well as estimated stock composition proportions of the pollock bycatch of Chinook salmon are included in the Final EIS. The degree to which bycatch relates to declining Yukon River salmon stocks is unknown.

9.6.2 Comments on ichthyophonus

Comment 5-3: The DEIS fails to consider the effect of ichthyophonus, an infection that can render fish unusable, on the availability of fish for subsistence harvest. Of the 762 pages in the DEIS, exactly 21 lines are devoted to ichthyophonus infection and none of this rather abbreviated text discusses the impact of the disease on subsistence. DEIS at 228. The DEIS does cite ADF&G statistics that the ichthyophonus infection rate on the Yukon River averaged 20%, 2004-2007. DEIS at 228. However, the DEIS also cites a study by Dr. Richard Kocan as providing the "baseline" analysis of the extent to which the disease is present in Yukon River Chinook salmon. Id. After admitting the Kocan study establishes the baseline, the DEIS neglects to mention that the "baseline" showed the infection rate had already reached "about 45%" in the Yukon River by 2003. Kocan, R., P. Hershberger, J. Winton; Ichthyophoniasis: An Emerging Disease of Chinook Salmon in the Yukon River; Journal of Aquatic Animal Health, 2004 ("Kocan 2004") at 58. The DEIS also cites Hayes, et al. 2006 as documenting the ichthyophonus infection rate on the Chena River, but fails to mention that this study showed a 37% infection rate. DEIS at 228. The DEIS also neglects to mention that the Kocan study reports ichthyophonus is "firmly established" in the Yukon River, "increasing to levels that impact subsistence and commercial fishing, as well as the resource itself." Kocan 2004 at 68. In that regard, the DEIS fails to mention that middle Yukon River fish processors are discarding up to 20% of purchased fish because of tissue damage caused by ichthyophonus. Id. at 58.

Response: Ichthyophonous is described in section 5.2.4.3. While additional details could be included in this section as well as noted in the subsistence section to more comprehensively describe the disease, an estimate of the impact on harvests due to ichthyophonous is beyond the scope of this analysis.

Comment 5-4: The DEIS does not discuss whether or not such fish lost to ichthyophonus are adequately accounted for in the annual salmon catch accounting system, but the disease is clearly a problem for subsistence fishermen.

Response: The EIS provides some information on ichthyophonus in section 5.2.4.3. No information on presence of the disease is recorded by NMFS observers and no additional information on the disease presence or absence in bycaught Chinook salmon in the federal fisheries is available from NMFS.

Comment 5-5: Ichthyophonus has several potential implications for the issues discussed in DElS. First, there are reproductive issues associated with disease-related mortality and/or failure of infected fish to reach the spawning grounds in a sufficiently good enough condition to successfully spawn, in other words, what the infestation does to the salmon runs themselves. Second, there is the effect that the disease has on subsistence fishermen who are compelled to inspect their catch and then throwaway infected fish. For every such fish they discard, they must return to the stream to catch another.

The ichthyophonus effect is not even mentioned in the DEIS as a factor for consideration in connection with the subsistence fishery. Instead, the DEIS focuses entirely on Chinook bycatch in the pollock fishery as the sale explanation for the extra time and expense that, according to the DEIS, Yukon fishermen have been reporting in connection with their efforts to meet subsistence needs.

The DEIS'S failure to disclose, much less discuss, the complications that the Ichthyophonus infestation is having on in-river Chinook stocks and on the fishermen who depend on those stocks for subsistence purposes is a major flaw in the analysis. The disease is clearly a complication insofar the development and maintenance of a commercial fishery for Chinook well. Again, the DEIS is silent on the issue. The Council and the public deserve to be fully informed about all such other causal factors when making their decisions about whether or not and to what extent bycatch in the pollock fishery may be contributing to the problems being faced by up-river fishermen and what to do about it. The DEIS fails to meet that test insofar as its cursory discussion of Ichthyophonus is concerned.

Response: Additional information on ichthyophonous is not necessary in order to understand the impacts of the Council's forthcoming management decision. A discussion of ichthyophonous is included in Section 5.2.4.3. The relationship of ichythyophonous to in-river returns is certainly a consideration for ADF&G managers, however treatment of and analysis of the impacts of the disease is outside the scope of this analysis.

9.6.3 Comments on impacts to Chinook salmon

Comment 5-6: The DEIS fails to provide decision makers with the necessary refinement showing, for example, the relative impact of a bycatch salmon cap of 68,000 versus 47,000. This difference of 21,000 fish would result in an AEQ of returning fish of only 17,640. However, since only 54% of the Chinook salmon taken in the pollock fishery originates in western Alaska, the total difference to all of western Alaska would be 9,526 fish. An addition of only 9,526 fish throughout western Alaska is a minuscule number when one considers the actual percentages that would be available for escapement by the river system, let alone for subsistence and other uses. The DEIS does none of this analysis.

Response: NMFS disagrees. The values cited are drawn directly from the analysis and these are valuable for decision considerations. Carrying the results further and making an assertion about relative impacts would require a number of inappropriate assumptions about in-river management and stock productivity.

Background

Impact rates had been presented in the preliminary draft for public review as part of the evaluation of using indexed (annually varying) caps as an alternative. Information was presented as an example of the process by which a threshold impact rate policy, indexed to a specific stock (or stock grouping), could be used to establish a cap level (e.g., of not more than X% impact rate on Y river system). A specific example in the preliminary draft involved comparing Coastal W AK estimates of run sizes with AEQ levels. This information was not included as a representation of the relative impact of bycatch rates or thresholds on the river systems themselves due to incomplete understanding of the impact of bycatch on stock productivity. Rather it was included as a means to provide a policy-basis for the cap in terms of freezing or decreasing relative impact rates. Because estimates were unavailable for some river systems, and because it would be difficult to select the stock from which to index the cap, the Council decided to drop consideration of a cap indexed to a specific impact rate threshold by river system, as discussed in the in Section 2.6. As the information was only presented in the context of formulating a policy-based cap, impact rate information was not included in the EIS to reduce the possibility of mis-characterizing impacts.

Use of fine-scale AEQ and run-size results

At finer scales (i.e., specific river systems), the data become increasingly uncertain for both AEQ estimation and for run sizes. For AEQ estimation, some critical assumptions include

1. that the genetics results within season and areas are constant;
2. that the sample period (2005-2007) is suitable for earlier periods;
3. that a weighted average age-specific maturation by brood year is adequate; and
4. that oceanic survival rates are reasonable and similar for different river systems.

For these reasons, a full assessment of this level of uncertainty is incomplete. The EIS carries forth AEQ estimation uncertainty to the extent possible, but given some of the critical assumptions as noted above, these uncertainty estimates are too low and consequently may be misleading. Hence, NMFS believes it is inappropriate to present fine-scale point estimates.

Use of total run-size estimates for impact analyses by river system or in aggregate are also problematic. As described in the EIS, assessment of total run size and escapement by river system is variable between systems. Some river systems in the WAK region lack total run or escapement estimates. As such, combining available estimates to determine an "aggregate total" for WAK is inappropriate due to magnification of errors. Also, combining harvest and escapement data independently to reconstruct runs (as with the NRC report “Effects of Chinook salmon bycatch in the Bering Sea pollock on salmon harvest, escapement, and abundance in Western Alaska (Ruggerone 2009), attached to the comment letter number c39 from Nossaman LLP) tends to mask the uncertainties and data limitations. Use of individual run estimates to compare with bycatch AEQ is also complicated by the caveats associated with the stock composition estimates. AEQ estimation to river of origin was used in the EIS to estimate the relative changes under various cap scenarios. These estimates are also uncertain and that uncertainty increases with further extrapolations historically and to finer resolutions. Therefore, judgments with respect to detailed impacts were avoided, especially in cases where it would require interpretations beyond the extent of the data. Finally, impact rates by river system (i.e., explicit comparison of AEQ with run size for runs) would presume analyses on productivity thresholds about river systems that are beyond the scope of this analysis.

Even if it were appropriate to include data for specific river systems, this information is insufficient for determining whether there is a conservation concern. NMFS considers the EIS adequate for making reasoned decisions and has presented data in a fair manner while attempting to minimize judgments on Chinook salmon management and productivity levels.

Summary

Estimates of impact rates as a metric for evaluating conservation issues of concern were discussed. Given the paucity of information to evaluate the relative impact of bycatch on specific river systems for explicit decision-making, and due to uncertainties related to the river-specific AEQ analysis, a comparison of AEQ values relative to run sizes was omitted.

Comment 5-7: The analysis of impacts on Chinook salmon is limited to the gross estimated number of bycatch salmon that are reported by the fishery. Other factors that must be evaluated include:

1) impacts on salmon that are contacted, but not retained, by the net or associated gear;
2) data collection issues explained above which may bias estimates of the total number of salmon downward and which may bias estimates of the number of ESA-listed salmon downward;
3) impacts to Chinook salmon stocks in other regions besides Western Alaska;
4) impacts on salmon schools or schooling behavior;
5) cumulative effects of persistent trawl mortality on salmon populations;
6) effects of non-selective mortality on Chinook salmon populations as the Chinook salmon taken by trawls may not be the same ones that would succumb to disease, predation, or other causes of natural mortality;
7) interactions and cumulative effects from other fisheries, especially the Russian pollock fishery, which almost certainly intercepts significant numbers of Chinook salmon; and
8) attractive nuisance impacts associated with the effects of offal discharge from the mothership and catcher/processor vessels that lure Chinook salmon to the vicinity of these vessels during wintertime operations when the availability of alternative food sources is low, thereby increasing the likelihood attracted Chinook will be caught by subsequent trawling.

Response: The analysis of impacts on Chinook salmon is based on the best available scientific information regarding the action and Chinook salmon. Responses are specific to the numbered comments above.

1) Without specific studies to determine the effects of contacting the salmon by trawl gear, it is not possible to determine the impacts on salmon and address this in the EIS. It is likely the contact with the salmon by fishing gear may result in injury, but the impact on the mortality of the salmon is not known and cannot be analyzed without more information.

2) The pollock fishery is well sampled for bycatch resulting in highly confident estimation of salmon bycatch. Because of extrapolation of subsamples to the whole haul at times of high catch, the likelihood of over and under estimating the bycatch is about the same. The number of ESA-listed salmon taken is based on the coded-wire tag (CWT) recoveries and the estimated contribution of the tagged population. Recoveries of the tags are based not only on the normal observer samples but also on the occasional salmon that may not have been part of the observer's sample but noticed to have a clipped fin by crew and delivered to the observer by the crew. Therefore, the ESA-listed salmon numbers are based not only on the observer sampling but also on the opportunistic collection of additional CWTs, outside the normal observer sampling process.

3) The EIS discusses not only the effects on salmon bycatch on western Alaska stocks but also on ESA-listed stocks, Pacific Northwest, Cook Inlet, and Russian stocks. This information is included in Chapter 5, Tables 5-47 through 5-51.

4) Without specific studies to determine the effects of trawling on salmon schools and schooling behavior, it is not possible to determine these kinds of impacts on salmon and address this in the EIS.

5) The effects of continued trawling on salmon is inherent in the analysis provided in the EIS. The action is expected to continue into the future and the effects on salmon are described expecting the fishery to be implemented for the long term.

6) It is not possible to tease out the salmon that may have been taken by different causes of natural mortality versus salmon affected by trawling. No information is available to determine the selectivity of the condition of salmon taken in trawling vs the condition of salmon that would die of natural mortality (e.g. are healthy salmon more likely to be taken in a trawl)

7) The EIS contains a discussion of other fisheries that may be most likely to have an impact on salmon resources in Sections 3.4.3 and 3.4.4. The Russian pollock fishery is not discussed because no information on salmon bycatch in this fishery is available to allow for an analysis of potential effect.

8) Recent information from the BASIS survey indicates that Chinook salmon may be eating offal in the winter possibly due to starvation (45 % of stomachs from winter sampling were empty), available at: http://www.npafc.org/new/events/symposium/BASIS%202008/Abstracts/Poster-19(Davis). It is not known whether Chinook salmon feeding on offal are also more likely to be taken in trawls compared to Chinook salmon that eat primarily squid, the usual winter prey. It is possible that the Chinook salmon are provided an easy source of food from the offal discharge which may be a beneficial effect, but it may also be a detrimental effect if the salmon are more likely to be taken in a trawl when feeding on offal. Without more information, it is not possible to determine the potential effect of offal discharge on Chinook salmon and if there is a nuisance effect.

Comment 5-8: Due to the presence of ESA-listed Chinook salmon stocks taken in the BSAI pollock bycatch, a comprehensive research and monitoring program, including both Alaskan and lower-48 streams, is necessary. This research and monitoring program must be based on sound science and full public participation and disclosure. To complete such an evaluation, the DEIS and NMFS should have more complete biological information about age and stock of origin. If it is technically impossible to separate ESA and transboundary stocks with genetics or other means, the Final EIS must describe the reasons.

Response: The EIS uses the best available information on the origin of salmon based on genetic research and provides the most complete description of the stocks possible based on this information. NMFS agrees that additional analysis is needed to better understand the potential effects on salmon bycatch on salmon stocks. That is why we are working with other organizations and universities to conduct genetic research on salmon bycatch from the Bering Sea pollock fishery, and we continue to be a participant in the Pacific coast wide coded wire tag (CWT) program which provides public access to all coded wire tag activities throughout the Pacific region at: http://www.rmpc.org/. The CWT recoveries provide direct evidence of the take of ESA-listed salmon. Genetic research on salmon bycatch from the pollock fishery is ongoing and is expected to provide more information on the origin of salmon taken in the pollock fishery, including information on ESA-listed salmon stocks. The CWT recoveries from salmon taken in the pollock fishery give stream origin specific information. The CWT program includes transboundary and ESA-listed salmon stocks from streams and hatcheries coastwide along the US and Canada Pacific. Based on the review of all ESA-listed salmon stocks in the 2007 supplement to the 2000 biological opinion on the effects of the Alaska Groundfish fisheries on ESA-listed salmon and on recent CWT recoveries, only the Lower Columbia River and Upper Willamette River Evolutionary Significant Units (ESUs) ESA-listed Chinook salmon stocks are caught in the BSAI pollock fishery.

NMFS agrees that ESA Section 7 consultation will be required before implementation of the Bering Sea pollock fishery salmon bycatch reduction program. The best available scientific and commercial information will be used at the time of the consultation to understand the potential impacts of the action on ESA-listed salmon. The consultation will likely result in a new biological opinion including an incidental take statement that applies to the Bering Sea pollock fishery and to the other BSAI groundfish fisheries. Under the monitoring provisions of Amendment 91, all Chinook salmon will be sampled, ensuring all fish with CWTs are sampled and all Chinook salmon are counted rather than the durrent practice of estimating the number of salmon incidentally caught. The biological opinion will likely contain reasonable and prudent measures for monitoring and reporting of Chinook salmon incidental catch and to continue genetic studies and participation in the CWT program. We continue to monitor the amount of Chinook salmon incidental catch in the Alaska fisheries and provide annual reports to the NMFS Northwest Region, as required by the 2007 supplement to the 2000 biological opinion.

Comment 5-9: The current Chinook salmon genetic analysis and the adult savings calculations were based on an insufficient number of opportunistically collected samples which inadequately represent stock contributions being harvested by the BSAI pollock fishery. The bias in these data could confound the AEQ and not accurately represent the stock composition of Chinook salmon bycatch harvested by the pollock fishery. The likely inadequacy of the existing samples to represent the entire bycatch seriously undermines the apparent conclusion that few Yukon River Chinook salmon occur in the bycatch.

This appears to be substantiated by Tables 5-47 to 5-51 on pages 297-301. These tables purport to show the adult reductions in equivalent numbers under various scenarios. Using the last row of Table 5-51, as an example, the bycatch for Chinook salmon bound for western coastal Alaska (column 3) would be reduced by 37,492. However, the bycatch reduction to the middle and upper Yukon (columns 5 and 9) would only be reduced by 449 and 389, respectively. This appears to be at odds with our general understanding of run magnitudes in Western Alaska, considering that the Yukon run tends to be the largest in western Alaska and that the middle and upper Yukon stocks typically comprise greater than 75% of the Yukon run in most years. For example, if the Yukon run was of average magnitude of 250,000 and 75% were middle or upper Yukon origin, this would mean that the western coastal abundance of Chinook salmon would be nearly 8.4 million, which seems exceptionally high. While we realize the stock composition estimates being used are the only ones available, that does not mean they are representative of the entire bycatch. Certainly, the samples were not collected for the purpose of supporting an analysis of such broad scope.

Samples were taken on an EFP only and likely do not represent fleetwide bycatch patterns.

Response: NMFS disagrees. This Final EIS includes a revised section 3.3 to further clarify the methodology employed in this analysis. For further information on the use of the SNP analysis as the primary determinant of stock of origin please see the response to Comment 3-5 where an explanation of the rationale for the most recent data is provided as well as further details on the use of Myers et al. (2003) in this analysis. With respect to the apparent bias in sample collections, this is fully acknowledged and accounted for in this analysis (as opposed to a possible similar bias in Myers et al. study). Furthermore the 2007 A season data was downweighted considerably in its relative use compared to the other seasonal data due to these issues with sampling intensity. Further information has been added to section 3.3 regarding the weighting of each season as this was inadvertently omitted in the DEIS.

With respect to the proportion of middle and upper Yukon stocks, these are resolved genetically (as opposed to scale pattern analyses which fail to break out estimated proportions of the Yukon River). As noted in the EIS, bycatch is accounted for by season and location which exerts an impact on the relative contribution of bycatch from different salmon regions, e.g., upper Yukon as presented in Figure 3-7. Nonetheless, we chose to aggregate results for upper and middle Yukon with the Coastal WAK grouping (see Section 3.3) and characterize our results for the Yukon River as a whole system. Neither scale pattern analyses Myers et al. (2003) nor Myers and Rogers (1988) provided estimates on the relative percent contribution of the upper and middle Yukon stocks in the bycatch. Thus information on the effect of sampling variability versus actual stock composition variability in the bycatch is lacking. Stock composition estimates as presented do provide some indication of relative impacts by area and river systems using available data.

Regarding the comment about how (for example) Table 5-51 appears to be at odds a general understanding of run magnitudes in Western Alaska, it is important to understand that the bycatch composition may be out of proportion to relative run strengths, particularly by season and area strata. The AEQ estimates, based on hypothetical past scenarios, result in re-allocating bycatch among these strata so that relative stock composition of the bycatch can change by scenario.

Comment 5-10: The DEIS should provide more salmon species composition information and obtain stock of origin information to better understand how Norton Sound's salmon stocks interplay in the Chinook salmon bycatch. The DEIS does not characterize any Norton Sound salmon savings component.

Response: All salmon caught in groundfish fisheries are identified by observers to species level.

The ability to indicate impacts of bycatch to region of origin is dependant upon the genetic ability to resolve individual stocks. Stock of origin information for Norton Sound is currently limited by the genetic resolution for those stocks. This is described in Section 3.3.2. The genetic stock identification (GSI) study employed a classification criteria whereby the accuracy of resolution to region-of-origin must be greater than or equal to 90%. Under this criteria, the Norton Sound stocks are reported in the aggregate Coastal west Alaska stock unit. As the resolution gets finer with each reporting of the expanding data set, further resolving of the individual components of Coastal Western Alaska group is planned. However, at this time it is not known whether or not the accuracy of resolution for those Norton Sound stocks will allow for them to be resolved separately.

Impacts to Norton Sound are thus characterized in terms of trends consistent with the aggregate Coastal western Alaska stock grouping. For further information on the limitations of our ability to estimate impacts of bycatch as it relates to the overall sustainability of individual or aggregate salmon runs please see comment 5-6.

Comment 5-11: The EIS does not contain adequate information about Norton Sound Chinook salmon and this lack of information must be provided for NMFS and the Council to make an informed decision about the appropriate way to manage Chinook salmon bycatch in the BS pollock fishery.

- NMFS and the Council must make decisions that reflect the broad range of knowledge we now have concerning salmon in Norton Sound and Nome. The EIS says (on page 205) that there is only one escapement project operating specifically for Chinook enumeration in Norton Sound. There are four fish counting projects in the Nome area that count Chinook salmon. These projects count all salmon species, so they are counting Chinook.
- The EIS must include a broader range of scientific knowledge (information) about Norton Sound Chinook.

- The EIS has a limited number of references about Norton Sound Chinook salmon and must make meaningful efforts to portray a broader array of information about Norton Sound Chinook salmon so that the Council will make an appropriate action.

Response: Where sufficient information exists, we have attempted to provide overviews of the primary data which is employed in each region in assessing stock status. The other projects listed do enumerate all salmon species but are not used for primary assessment information for Norton Sound Chinook. Information provided in the EIS attempts to summarize stock assessment and stock status by region. This provides the Council with information on run status as background information to consider in assessing the vulnerability of salmon stocks. Some of the summary information for Norton Sound stocks (as reflected in the DEIS Table ES-9 and Table 5-3) incorrectly listed information about the 2008 preliminary run forecast as NA when this should have been characterized as "below". Likewise the Norton Sound escapement goals summary in those tables should be changed from "infrequent" to "No". This Final EIS includes a revised version of this table. The ability to indicate impacts of bycatch to region of origin is dependant upon the genetic ability to resolve individual stocks (see comment response for 5-14 regarding genetic limitations for Norton Sound). Impacts to Norton Sound are thus characterized in terms of trends consistent with the aggregate Coastal western Alaska stock grouping.

Comment 5-12: The DEIS fails to clearly identify the wide array of factors likely impacting Western Alaska Chinook runs and the ranking of bycatch in the pollock fishery among those factors and impacts. Such analysis is necessary to avoid unfounded assumptions about the need for drastic measures aimed at bycatch reduction (that could have enormous negative impacts on the pollock fishery) and unrealistic expectations about potential benefits to Chinook stocks. The Chinook salmon returns to western Alaska are highly variable and unpredictable. Bycatch of Chinook and other salmon in the pollock fishery is also highly variable and unpredictable. While much is not known, Council actions, particularly those that may bring enormous negative economic impacts, must be based on the best available information of all factors that may be at play and a realistic analysis of likely costs and benefits.

Section 5.4 contains no detailed information or conclusions about what the cumulative impact is for Chinook salmon. The DEIS must analyze what those impacts, in total, mean to the salmon runs and how those action further exacerbate or contribute to the bycatch problem.

Response: The EIS does include a discussion of other factors that may impact western Alaska Chinook runs. Sections 3.4 and 5.4 of the Final EIS augment the discussion in these sections, in response to comments from the public. At the same time, it is not possible to conduct a cost and benefit analysis of the various factors impacting Chinook salmon at this time, because insufficient information is available to determine the proportionate impact each factor may have on Chinook salmon runs. Consequently, the revised sections include a broader cumulative discussion of the various factors impacts Chinook, but they do not attempt to rank these factors against Chinook bycatch in the pollock fishery.

Comment 5-13: The DEIS overlooks the potential cumulative impacts of foreign fisheries on transboundary stocks of salmon. We currently do not know the level at which salmon bycatch occurs in the Russian pollock fishery and Russian authorities are unwilling or unable to share information on salmon bycatch at this time. Despite Russian official's claims that no salmon bycatch exists in their fishery, it can reasonably be inferred from existing bycatch rates in the U.S. fishery and the absence of any kind of bycatch mitigation scheme in Russian waters that substantial bycatch in the Russian fishery goes unobserved and/or unreported. Additionally, recent news regarding Russian and Japanese driftnet fisheries in the Western North Pacific indicates that some salmon bound for U.S. waters are intercepted in those fisheries. Recently, Russian authorities began to take action to exclude Japanese fishermen from participation in the driftnet fishery that occurs in the Russian EEZ. The Japanese fishermen involved in this fishery have indicated intentions of potentially withdrawing from the North Pacific Anadromous Fish

Commission process and re-engaging in the high seas driftnet fishery. The lack of information in these two important fisheries and the high degree of potential impact argues for additional precaution in addressing salmon bycatch in U.S. waters. Therefore the DEIS should estimate potential catch and bycatch in foreign fisheries in an effort to inform our own managers and the public of the level of precaution that may be necessary in our own fisheries to ensure that U.S. salmon runs ate maintained.

Response: NMFS acknowledges that bycatch in foreign fisheries can affect salmon stocks that originate in western Alaska. At the same time, it is not possible to estimate the degree to which bycatch in foreign fisheries affects western Alaska stocks. This analysis addresses management measures within the BSAI FMP region and the EBS pollock fishery only, and an evaluation of foreign catch is outside of the scope of this analysis.

Comment 5-14: To better inform managers and the public about the issues associated with climate change impacts, the Draft E1S should include the best available scientific information regarding climate change effects on salmon. A growing volume of recent research specifically addresses the issue of climate change impacts on salmonids.

Response: NMFS agrees and included additional information on climate change and the potential impacts on salmon should in the Final EIS. Specific information has been added to Section 3.4, and to the analysis of the impacts of reasonably foreseeable future actions on Chinook salmon (Section 5.4), and chum salmon (Section 6.6), as requested by public comments. However, the impacts of climate change on salmon stocks are unpredictable, and the analysis does not attempt to draw definitive conclusions about the impacts of future climate change on salmon stocks.

Comment 5-15: Additional sources of potential harm to Chinook salmon runs need to be addressed in the DEIS. Water quality, pollution, habitat damage caused by mining, dredging, and cumulative effects of same on Chinook stocks are not discussed in the DEIS. Nor are management practices that may be harmful to selected stocks (e.g. those that increase bycatch of Chinook in in-river fisheries).

Response: Additional information on mining and dredging activities and in-river and ocean hydrokinetic power generation has been included in the revised Section 3.4. A discussion of these impacts relative to Chinook stocks is included in the revised Section 5.4. An acknowledgement of the impact of in-river management practices on Chinook salmon stocks is included in the revised Section 5.4.

9.6.4 General comments

Comment 5-16: The DEIS states, "Relative impacts to individual river systems are highly dependent upon where the fleet fished in a given year, as a river system's proportional contribution to bycatch varies spatially." (pg 155). This statement calls into question the premise of the retrospective analysis used to predict impacts. Since fishing locations may change in future years, the impact results from past history may not be indicative of future impacts.

Response: NMFS agrees but notes that the retrospective component takes into account the location and season that historical bycatch occurred. Stock composition of future Chinook salmon bycatch is also acknowledged to be impacted by when and where bycatch occurs from year to year.

Comment 5-17: More research regarding the origin of Chinook salmon taken as bycatch, in the Bering Sea pollock fishery as well rivers of origin, should be addressed, and the overall abundance figures of the salmon resource in the Bering Sea need to be better understood before restrictive hard caps or other measures are put in place.

Response: NMFS disagrees. While research is continuing to better understand the stock of origin and abundance of salmon species in the Bering Sea, management actions can be taken now which work toward minimizing salmon bycatch. As new information unfolds, the Council may choose to revise its management actions for Chinook bycatch. The Council has historically taken many measures to manage salmon bycatch and will continue to proactively work to improve upon management measures as new information becomes available.

Comment 5-18: The DEIS lacks a credible analysis of the relationship between encounter rates of salmon in the pollock fishery, behavior of the pollock fishery itself, and salmon abundance. Though several of the alternatives focus on managing encounter rates of salmon, no credible analysis has been conducted to evaluate whether these measures reduce overall Chinook salmon bycatch. Nor is there an analysis of the effects these measures may have on salmon populations.

Response: NMFS agrees that encounter rates relative to salmon abundance are poorly understood. However, abundance of oceanic salmon is largely unavailable. Extensive GIS methods have been applied to bycatch patterns leading up to the EIS and many of the results from these studies remain in the document (e.g., Fig. ES-2, Fig. ES-3, Fig. 4-1Fig. 5-27 through Fig. 5-31).

Regarding effectiveness of measures, NMFS disagrees. Bycatch of salmon is estimated through extensive observer sampling and this includes extensive sampling for length and age compositions. The approach to apply these data properly accounts for factors affecting actual returns of salmon. This is done by using information on the amount, timing, length, and age structure of the salmon bycatch.

Comment 5-19: There is no such thing as "surplus" fish that can be sacrificed for bycatch because every fish that returns to our rivers is important for meeting our subsistence needs, for supporting our small commercial salmon harvest, and for contributing to continued migrations of salmon and future generations of Alaska Native people.

Response: NMFS acknowledges this comment.

Comment 5-20: The DEIS admits that the cause of any weaker Chinook runs in western Alaska is not bycatch in the pollock fishery but food limitations for salmon in the ocean. DEIS at 196, 199. The food Chinook salmon rely on, nekton, is very sensitive to rising ocean temperatures. The DEIS contains no analysis of this issue and its effect on the availability of Chinook salmon.

Response: NMFS disagrees with this comment. The EIS acknowledges that a definitive cause for declines in Western Alaska salmon runs is lacking. The degree to which food limitation is a primary factor in comparison to bycatch in the pollock fishery is also unknown. The statements on the referenced pages are misconstrued. In the first instance, Section 5.1 states "Weak runs during this time period (referring to the previous sentence of 1998-2002) 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)." No comparisons to other causes (i.e., bycatch in the pollock fishery) are mentioned. This section provides a descriptive overview of the food habits and ecology of Chinook salmon.

The second reference is presumably related to the sentence in Section 5.1.3 (second paragraph) "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 SSTs have the opposite effect (NPAFC, 2001)". This simply references published literature on Chinook salmon growth patterns and acknowledges the complexity of ecosystem linkages. Extension and further speculation on ecosystem mechanisms is beyond the scope of this EIS. However, additional information on climate change and its relation to salmon productivity is included in a revised Section 5.4 in this Final EIS.

Comment 5-21: The dramatic rise in salmon bycatch in the pollock fishery threatens the sustainability of the Yukon River salmon stocks and the continuation of a subsistence way of life in interior Alaska.

Response: NMFS acknowledges this comment. The degree to which bycatch relates to declining Yukon River salmon stocks is unknown.

Comment 5-22: The Yukon River Chinook salmon run is clearly under stress biologically within the river system. This run does not need indiscriminate harvest by the Bering Sea pollock fishery prior to entering the river system. Huge bycatch in the pollock fishery must be curtailed at once.

Response: NMFS acknowledges this comment.

Comment 5-23: The pollock harvesters in the Bering Sea are contributing to the decline of the Chinook and chum salmon in Western Alaska. Although the pollock fishery is justified in providing food for the nation, Chinook salmon feed on the pollock and the bycatch cannot be avoided and will continue despite efforts to lower the bycatch.

Response: NMFS acknowledges this comment. The degree to which levels of bycatch are related to declining returns to salmon streams in western Alaska and elsewhere is unknown.

Comment 5-24: The continuing decline in the returning salmon stocks has to stop, and a key component with reversing this decline is the immediate reduction on the BSAI Chinook salmon bycatch.

Response: The purpose of this action (and analysis) is to make an informed decision on measures to minimize bycatch of Chinook salmon in the Bering Sea pollock fishery. The degree to which levels of bycatch are related to declining returns to salmon streams in western Alaska and elsewhere is not well known.

Comment 5-25: It is a long held belief that commercial mid-water and bottom trawling are the primary human influences affecting salmon returns to western Alaska streams. Other influences such as severely cold winters, poor ocean conditions, predation, and migration also affect the number of returning salmon. It is apparent that chronic commercial bycatch is one of the major human influences in the recovery of salmon.

We appreciate that BSAI pollock fishery bycatch is not the only impact to Western Alaska Chinook salmon stock returns, but it has been shown to contribute significantly to mortality. (Meyers et al. 2004).

Response: NMFS agrees that the EIS and studies such as Myers et al. (2003), Myers and Rogers (1988) and Witherell et al. (2002) have estimated the impacts of adult equivalent salmon returning to western Alaskan river systems as a result of bycatch in the pollock and other groundfish fisheries. However, the degree to which pollock fishery bycatch is impacting the runs on these rivers is not well known when compared with other factors as noted. This Final EIS includes a revised Section 5.4 with additional discussion of other impacts on salmon.

Comment 5-26: None of the proposed bycatch reduction plans proposes eliminating the entire bycatch, as doing so would mean the complete closure of the pollock fishery. Thus, in every instance where these comments provide a number of fish that would be added to escapement or to subsistence, commercial, or sport harvests, that number overstates the benefits of the proposed action because that number is based on what would happen if zero Chinook salmon were taken as bycatch.

Response: NMFS disagrees. Such comments are based on a misinterpretation of the results. The alternatives as presented are designed for cross-comparisons and no alternative includes zero pollock fishing (which is the only means of assuming zero Chinook catch). For comparative purposes, all alternatives are also contrasted against actual historical bycatch levels and their resulting estimated AEQs. This is to provide context for how various management alternatives under consideration in this action would save more or less salmon than the status quo (no cap) scenario.

Furthermore, the analysis specifically avoids adding AEQ values to returning salmon, escapement, or commercial, subsistence, or sport harvest. Qualitative estimates are provided in consultation with area management biologists from ADF&G to the extent that management might have differed if additional salmon returned to specific river systems. Table ES-14, and RIR Table 7-4, and the text were revised in the Final EIS to help avoid such misinterpretation of results.

Comment 5-27: There is no conservation rationale based on escapement goals for a bycatch reduction program with respect to 46% of the Chinook salmon that originate outside of western Alaska that are incidentally caught in the pollock fishery.

Response: NMFS and the Council are mandated to minimize bycatch to the extent practicable under National Standard 9 of the MSA. While the primary impact analysis focuses upon impacts to western Alaska, the goal of minimizing salmon bycatch is not limited to only those salmon originating in western Alaskan streams, and proposed measures to reduce bycatch in the pollock fishery will minimize bycatch for salmon originating in all areas. Information on the impacts to Chinook salmon outside of western Alaska is also reported in the EIS and RIR. To the extent that information is available on stock status and management for other aggregate regions (Cook Inlet, Southeast Alaska, Pacific Northwest) this information is also included in the EIS and RIR.

Comment 5-28: A careful analysis of the facts reveals no support for the argument that there is a biological need to severely curtail Chinook salmon bycatch in the pollock fishery. Proponents of imposing additional restrictions on the pollock fishery to reduce Chinook salmon bycatch can find no biological basis for such restrictions based on escapement rates. The vast majority of the Chinook salmon stocks interacting with the pollock fishery is meeting or exceeding escapement goals. Even where runs are weaker, the number of Chinook incidentally taken in the pollock fishery is so small that it cannot be responsible for changes in salmon abundance. In other words, there is no biological issue in terms of meeting escapement but there is an issue of providing more fish for harvest. The fact that the DEIS glosses over and fails to examine these issues makes the DEIS legally inadequate.

Response: NMFS disagrees with this comment, in part. NMFS and the Council are mandated to minimize bycatch to the extent practicable under National Standard 9 of the MSA, regardless of whether there is a conservation concern with respect to salmon populations. The Council's approved problem statement and a description of the purpose and need for this analysis are provided in Chapter 1. See response to comment 10-38. The analysis provides a comparison of the relative impacts of AEQ bycatch by river system (or aggregate grouping) but does not assert that bycatch is the limiting factor in salmon productivity. Further information on the data limitations in evaluating this are provided in response to comment 5-6 and in the revised section 3.3. The EIS and RIR also explicitly includes qualitative information in the revised Table ES-14, and RIR Table 7-4, regarding the possible management-related changes that would have occurred as a result of additional fish by river system over the time period (2003-2007) of the analysis. These changes include both accruing additional fish towards escapement by river system as well as increases in harvest levels by commercial, sport and subsistence users.

9.6.5 Comments with specific suggested changes

Comment 5-29: Page 241, first paragraph, it is not accurate to state that the Northern District stocks "continue to trend sharply upward and most escapement goals are being met or exceeded." Perhaps based on older information (as the Clark, 2006 reference eludes). Some Northern District stocks have declined notably in the Deshka River in 2008 and Alexander Creek. This section should perhaps be updated with more current information from ADF&G.

Response: NMFS agrees and updated this section with current information from ADF&G in the FEIS.

Comment 5-30: Figures 5-27 through 5-30 appear to be paired (27&28 and 29&30), where the second in the pair is a continuation to the right of the first. Why is the information presented in 5-31 (which portrays the B season) so different in format than the previous 4 figures, that showed the A season? Consistency across these figures would be helpful.

Response: NMFS appreciates the comment. The reason they are different is because they show different things. Full sets for both seasons had been presented in earlier drafts of the EIS but were dropped to shorten the document. NMFS feels that this is acceptable and the level of information is provided in sufficient detail.

The A-season figures are arranged to easily show the spatial variability over 5-day intervals over different years. This is suited to the A-season since it is more concentrated in time and space. Including the same figures for the B-season would have required a larger scale map, and more weeks of data (many of which were blank).

Comment 5-31: Page 319, Table 5-75: Note a comment on this specific table referring to the mothership sector, but why are there not similar tables for the shoreside and catcher/processor sectors within this cluster of tables?

Response: NMFS appreciates the comment and corrected this typographical error. This table (and the corresponding ones for other sectors) is found in Chapter 4 (specifically Table 4-13).

Comment 5-32: The past and present configuration of pollock trawl gear and its operation in the Bering Sea pollock fishery must be described. The DEIS states that, based on anecdotal information, the configuration of trawl gear has changed over time. See DEIS at 259. It then states that no information is available to analyze these changes. The DEIS must explain why this information is not available and whether efforts were made to obtain it. The configuration of trawl gear including mesh sizes, trawl sweeps or aggregating devices, net dimensions vertically and horizontally, speed and depth of towing and towing on or near the seafloor would all influence the rate and retention of salmon bycatch.

Response: NMFS agrees that this is an important issue. Unfortunately, the configuration and net mensuration data have not been collected and any anecdotal or voluntarily supplied information was unavailable for the analysis. This is a research priority that has been identified.

Comment 5-33: Page 259, first paragraph: the three tables referenced in the paragraph (5-9 through 5-11) are incorrect. Perhaps the text should have referred to tables 5-33 through 5-35?

Response: NMFS notes that the figures (not tables) referenced in this comment on pages 259-260 in the DEIS should have been numbered 5-33 through 5-35 in accordance with the figures included in this section. These figure reference corrections will be included in the Final EIS.

Comment 5-34: Section 5.3.1.1 is a short, but important section of the DEIS. It presents historical Chinook bycatch information for each of the three sectors involved in the Bering Sea pollock fishery. Unfortunately, the information as presented is confusing and potentially prejudicial. The text of the entire section should be re-written. For example:

1). Seasonal Bycatch levels by sector. Remove Figures 5-36 and 5-37 from the analysis. Figures 5-36 and 5-37 show total A season and B season Chinook bycatch by sector for each of the years 1990-2007. The resulting graphs show widely diverging salmon "catch" patterns overtime between the three sectors. The text suggests that some conclusion can be drawn from those patterns. But no where is there any explanation that the differences in "catch levels" between sectors in any given year and/or over time are, to a certain extent, simply due to the amount of pollock each sector caught during the year(s) in question. This is complicated further by the time period spanned by the charts: 1990-2008. That period covers times of the open access "race for fish" when each of the pollock sectors competed with each other for a share of the common pollock quota pool (1990 ~ 1992); the period of inshore/offshore allocation measures that created and then changed sectoral shares of the annual pollock quota periodically (1993-1999); and the years in which the fishery has operated under the allocation provisions of the AFA--2000-present. Thus, to a great extent, the changes in salmon bycatch shown in Figures 5-36 and 5-37 simply reflect different allocations of the pollock quota that were imposed in the sectors' respective shares of pollock over time. Simply put, any depiction of salmon bycatch levels without some adjustment for the amount of pollock caught by each of the sectors during the period in question paints an extremely erroneous picture-a picture that is irrelevant to any determination about how to address salmon bycatch and potentially prejudicial to the sector(s) that happened to catch the most pollock in any given year. For this reason, the charts and graphs shown should be limited to comparative rates of salmon bycatch (by sector) over time.

2) Figures 5-38 and 5-39 should indicate if CDQ catch and bycatch is included in the bycatch rate calculations. These figures show relative rates of salmon bycatch (Chinook/1000 tons of pollock). For that reason, these figures are more informative than Figures 5-36 and 5-37. The text that accompanies Figures 5-38 and 5-39, however, does not indicate whether or not CDQ catch is included in the comparative rate lines shown for the catcher/processor and mothership sectors. In our view, the preferred approach should be to include CDQ pollock catch and related salmon bycatch along with the non - CDQ catch and bycatch in the same rate calculations for those sectors and vessels engaged in the harvest of both CDQ and non-CDQ pollock. In practice, a vessel with CDQ pollock normally harvests both CDQ and its non-CDQ pollock as part of a normal fishing trip. It is the same boat, the same skipper and the same crew, fishing in the same places that harvests both COQ and non-CDQ pollock---on the same trip. Any attempt to distinguish CDQ from non CDQ tows (and the salmon bycatch attributed to such tows) made by the same boat would be arbitrary at best. At worst, it could be unfair and prejudicial.

3) Tables 5-22 and 5-23 need clarification as well. a) First, the symbols used in these tables (and elsewhere in the document) to depict the three pollock sectors are somewhat confusing. There should either be a legend indicating what "M", "P" and "S" mean; or symbols that are more familiar to the public should be used: "CP" for catcher processors; "MS" for vessels delivering to motherships; and "SS" for vessels delivering to shoreside processors. b) Second, the rate of bycatch should be shown in the metric most commonly used to depict bycatch--a "rate per ton", instead of the "rate per 1,000 mt'" as used in the tables; c) Third, the "mean" and "deviation from the mean" values used in the tables is not a familiar way of showing/comparing bycatch. Simple "rates per ton" with an average over time at the end would convey the message in a more meaningful way to the reader. d) Fourth, the text that accompanies the tables should indicate if CDQ catch and bycatch is included in the data series. As noted above, we think it should be.

Response: NMFS disagrees that the figures are confusing. They are clearly labeled and show the actual pattern of actual estimates. The allocation is irrelevant for this presentation. NMFS however recognizes the sensitivity and hence revised section 5.3.1.1 by showing a longer time series of the rates by the Final EIS.

Regarding tables 5-22 and 5-23, a legend was provided elsewhere for these abbreviations. However, to help minimize confusion, the more standard abbreviations of CP, MS, and SS have been added. Regarding the request to express the rate per ton instead of the rate per 1,000 t, NMFS feels that this is clearly labeled and presenting integer numbers adds clarity in this case. Further explanation regarding the utility of comparing bycatch rates by sector in reference to mean values has also been included in this section for increased clarity. The text has been modified to denote that CDQ has been included in the revised section 5.3.1.1.

9.7 Chapter 6 comments

These comments are on Chapter 6, chum salmon abundance, stock of origin, impacts to chum stocks. Chapter 6 was revised for the Final EIS to include an analysis of Alternative 5 in Section 6.5 and a more detailed section on the consideration of future actions as requested by public comment in Section 6.6.

Comment 6-1: Put measures in place to eliminate or at least minimize the non-Chinook bycatch in the Bering Sea. Support closure of the pollock fishery after a cap has been reached. Limit the total poundage of fish caught, including by-catch. Fishermen would then have to quit fishing when the reach that total amount, whether they caught the kind of fish they were targeting or bycatch fish. Fishermen would have to bring whatever they caught to shore and sell it and whatever escapes will return to their spawning grounds, regardless of species. This is a much better option than having fishermen throw the chum salmon back into the sea, dead. The Nenana area of the Tanana River have had a steep decline in salmon returns. The people in the Nenana area are very dependent on chum salmon as a food source for themselves and our dog teams. So, in many ways their lifestyle is dependent upon the return of the salmon.

Response: NMFS acknowledges this comment and notes that changes to bycatch management measures for non-Chinook salmon are being considered separately and are outside of the scope of this analysis. For accounting purposes all non-Chinook salmon are reported as one aggregate group, however non-Chinook salmon are comprised of greather than 99% chum salmon as described in section 6.4.2. The Council is considering separate management measures for non-Chinook salmon. Measures under consideration for non-Chinook salmon species include hard caps on the pollock fishery as well as area closures. These measures are being considered separately from this EIS which specifically addresses Chinook bycatch management. People's dependence upon chum salmon will be considered in conjunction with the forthcoming analysis on separate management measures for non-Chinook salmon species.

Comment 6-2: The Tanana-Rampart-Manley areas are also concerned about the severe detrimental effect that the pollock fishery's salmon bycatch is having on salmon runs in the Yukon and Tanana rivers. The bycatch of other species, such as chum salmon, needs to be addressed immediately. The pollock fishery is a 'dirty' or wasteful fishery that is putting one of the world's last wild salmon runs in jeopardy.

Response: NMFS acknowledges this comment. The Council is scheduled to discuss proposed alternatives to address non-Chinook (chum) salmon bycatch in the Bering Sea pollock fisheries at its June 2009 meeting.

Comment 6-3: DEIS does not mention that chum salmon in Nome (subdistrict 1) were managed under a Tier II subsistence strategy, the first and only time for a fish stock. The Tier II scoring and permit system limited effort and harvest because chum salmon numbers did not meet subsistence needs.

Response: NMFS agrees and notes that updated information on stock status and management information is included in the Final EIS in Chapter 6. We also note that separate management measures are under consideration by the Council for non-Chinook salmon bycatch management. This forthcoming analysis will include comprehensive information on chum salmon stock status and management.

Comment 6-4: NMFS must include an analysis of the environmental and economic effects that low abundance Chinook management by ADF&G has on the optimum yield of the Yukon River summer chum fishery. This information is necessary to provide to the Council and other decision makers like the public. The Council's preferred alternative must comply with MSA National Standard 1. Low Chinook runs have affected the management of the summer chum runs on the lower Yukon the Council's preferred alternative must take into account that management measures currently being considered may preclude the optimum yield of the Yukon River summer chum commercial fishery.

Response: NMFS disagrees. An overview of stock status and management of Yukon River chum salmon are provided in sections 6.2.4 and RIR Chapter 3. A discussion of the impacts of low abundance Chinook management on the management of Yukon chum is provided in these sections as well as the related sections on Yukon Chinook management (5.2.4 and RIR Chapter 3). This information is provided for context on the broader impacts that decreased Chinook returns have on other fisheries such as chum salmon management on the same river system and was updated in the Final EIS to reflect additional management restrictions through 2008. This information is sufficient in the context of the decision point for the Council with respect to Chinook salmon bycatch management measures. The Council's preferred alternative must comply with all of the National Standards.

Comment 6-5: It is important to note that in years of low Chinook salmon returns chum salmon are a vital subsistence resource, and the primary marketable fish on the Yukon River. In such times management measures limit and delay the summer chum fisheries to allow Chinook salmon to pass up river. In 2008 failed Chinook salmon runs on the Yukon River prevented the harvest of a significant number of harvestable summer chum resulting in forgone revenue of millions of dollars to the WAK region. The Yukon River commercial chum harvest was economically impacted by in-river Chinook salmon management actions limiting fishing effort. The forgone commercial harvest was close to 1 million fish. This caused a large adverse economic impact on the residents and businesses of the lower Yukon and will have potential negative environmental effects due to the over-escapement of chum. Forgone chum salmon harvest due to Chinook salmon management measures averages $18,500,000 annually or 50% of the pre capita income for the region.

Response: NMFS acknowledges this comment. An overview of stock status and management of Yukon River chum salmon are provided in Section 6.2.4. A discussion of the impacts of low abundance Chinook management on the management of Yukon chum is provided in these sections as well as the related sections in RIR Chapter 3 on Yukon Chinook management. This information is provided for context on the broader impacts that decreased Chinook returns have on other fisheries such as chum salmon management on the same river system. Updated information through 2008 on restrictions in the chum fisheries in response to management of Chinook will be included in the Final EIS.

9.8 Chapter 7 comments

These comments are on Chapter 7; other groundfish, other prohibited species, and forage fish. Chapter 7 was revised for the FEIS to include an analysis of Alternative 5 in Sections 7.2, 7.3.3, 7.3.5, 7.3.7, and 7.5.

Comment 7-1: Bycatch in the trawl fleet negatively affects other fisheries, such as halibut, and causes billions of dollars of economic waste. Halibut brings in millions of dollars to many communities and to the State of Alaska. Trawl bycatch of halibut is affecting commercial quotas as shown by the IPHC cuts across the board for 2009.

Response: NMFS believes the comment is not necessary to understand potential impacts from the alternatives considered in the EIS. The alternatives considered in the EIS do not change halibut PSC catch limits for the Bering Sea trawl fisheries, nor do they change allocation of halibut. Section 7.3.2.2 discusses management of the halibut PSC, including a detailed discussion on the overall trawl limit for PSC halibut and Section 7.3.3 discusses the potential impacts of the alternatives on halibut.

Comment 7-2: The DEIS assumes pollock fishermen will move to new pollock fishing grounds if Alternative 2, 3, or 4 is adopted. DEIS at 165. The DEIS does not consider the potential problem of increased interactions with other species, such as non-pollock groundfish, squid, sharks, seabirds, etc., that may be encountered on these more distant fishing grounds.

Response: NMFS disagrees. The EIS considered the potential impacts on non-pollock groundfish, squid, sharks, and seabirds. The EIS discusses potential interactions of the alternatives on non-pollock fish species in Chapters 7 and seabirds in Chapter 8.

9.9 Chapter 8 comments

These comments are on Chapter 8; marine mammals, seabirds, EFH, and the ecosystem. Chapter 8 was revised for the FEIS to include an analysis of Alternative 5 in Sections 8.1.4.4, 8.1.5.4, 8.1.6.4, 8.2.6.4, 8.3.2, 8.4.6, and 8.4.7. Section 8.1 Marine Mammals was updated to reflect changes in the status of marine mammals.

Comment 8-1: The FEIS would be enhanced if the findings in Section 8.2.4.1 could be incorporated into the final analyses and appropriately cited. "The USFWS has been working with Dr. Paul Sievert and Dr. Havier Arata of the U. S. Geological Survey to develop a status assessment of Layson and Black-footed Albatrosses . . . "

Response: NMFS agrees and has added the following reference for Section 8.2; Arata, J.A., Sievert, P.R., and Naughton, M.B., 2009, Status assessment of Laysan and black-footed albatrosses, North Pacific Ocean, 1923–2005: U.S. Geological Survey Scientific Investigations Report 2009-5131, 80 p.

Comment 8-2: Harvesting pollock is the main reason the Steller sea lion numbers are diminishing.

Response: Steller sea lions have experienced a population decline, and pollock is an important prey species for Steller sea lions. Steller sea lion diet is dependent on the type of fish that occurs in the area where Steller sea lions forage. Stomach analysis of Steller sea lions taken in the Eastern Bering Sea in the 1980s showed pollock is an important prey species. NMFS is preparing a biological opinion which will take a hard look at the effects of the groundfish fisheries on Steller sea lions and their critical habitat. This document will contain the latest scientific information on Steller sea lions and the potential effects of the groundfish fisheries, including the effects of the pollock fishery on Steller sea lions, on their designated critical habitat, and on their recovery. A draft of the biological opinion is scheduled for release in August 2009. We may know more at that time whether harvesting pollock could be a main reason for the Steller sea lion population decline.

Comment 8-3: High Chinook salmon bycatch affects the very ecosystem on which all species depend upon, marine birds, mammals, crab, squid and all fish. Even your agency reports continuing declines of Northern Fur Seal and Steller Sea Lions in the Bering Sea. Removal of salmon from streams will also have a hugely negative effect on those ecosystems as many mammals such as bear, wolves and bald eagles depend upon returning salmon for survival.

Response: NMFS agrees that Chinook salmon are an important part of the marine ecosystems of the Bering Sea. The effects of salmon bycatch on Northern fur seals and Steller sea lions depend on the amount of salmon eaten by these species. Northern fur seals eat mostly pollock, and Steller sea lions usually eat salmon at times and locations where the fish are gathered for returning to streams to spawn. Neither of these marine mammals is primarily dependent on salmon for prey. Stomach samples from Steller sea lions taken in the Bering Sea in the 1980s did not contain salmon, but this may have been due to the timing or location of the sampling. Northern fur seal and Steller sea lions appear to be affected by fish abundance. Whether and what extent fish abundance is affected by fishing or environmental change are unknown. Nor do researchers know how alteration of fish abundance (either pollock or salmon) influences fur seal or Steller sea lion population trends.

NMFS agrees that the population of northern fur seals continues to decline as seen in decreasing pup counts in the Pribilof Islands. The only Steller sea lion trend site surveyed in the Bering Sea is Bogoslof/Fire Island. This site is grouped with other trend sites in the eastern Aleutian Islands group. Since 2004, the abundance of Steller sea lions in the eastern Aleutian Islands group has consistently increased, averaging 7% annually.

NMFS agrees that salmon play an important role in the coastal terrestrial ecosystems, by bringing marine nutrients into the inland environment as the salmon are taken from the streams and consumed by terrestrial predators. The impact of salmon bycatch on the terrestrial environment will depend on the origin of the salmon caught, and the amount of salmon that is prevented from returning to the natal streams by pollock fishery bycatch. We currently have information to a regional level for the origin of salmon incidentally taken in the pollock fishery. Future genetic research on bycaught salmon should provide finer details on the salmon origin. It is not currently possible to determine the level of effect of salmon bycatch on terrestrial ecosystems, especially to an individual stream level.

9.10 Environmental Justice Analysis Comments

These comments are on DEIS Chapter 9; environmental justice. For the Final EIS and Final RIR, the environmental justice analysis was combined with the RIR in Volume II. The environmental justice analysis is now RIR Chapter 8. This change was in large part a response to public comments. Additionally, in response to public comments, a number of substantive changes were made that are detailed in the following comments and responses.

Comment 9-1: The environmental justice analysis is inadequate and only describes potential pollock industry employment impacts.

Response: The environmental justice analysis in the Final RIR Chapter 8 covers a wide range of impacts to identified low income and minority communities, including impacts associated with subsistence, commercial, and sport harvest of salmon. RIR Section 8.3 describes employment in the shoreside pollock process sector. This section does include relatively more quantitative descriptive information than other sections of the RIR.

Nevertheless, the environmental justice analysis provides quantitative descriptive information on salmon fisheries permit holder revenues, and directs the reader to the economic analyses for more information on salmon fishing and processing jobs. The RIR contains considerable quantitative information on employment and revenues in non-pollock Western Alaskan fisheries and fish processing industries.

Comment 9-2: The DEIS does not adequately analyze the EJ implication of the action. Increased salmon bycatch places a disproportionately high burden on Native Alaskan communities because of the central importance of salmon. The DEIS does identify the impacted minority populations required under Executive Order 12898. However the DEIS is severely inadequate in assessing the disproportionate impacts placed on these populations.

Response: NMFS disagrees that the environmental justice section is inadequate. The environmental justice analysis relies on the extensive treatment of the importance of subsistence, commercial, and sport uses of Chinook salmon, the prohibited species donation program, chum salmon, the community development program, pollock deliveries to shoreside processors, marine mammals, seabirds, groundfish, forage fish, and prohibited species, that are provided in other parts of the RIR as well as in RIR Chapter 8 itself. Several of these treatments, including the importance of subsistence use of Chinook salmon and the potential impact son CDQ groups have been expanded, in response to public comments, in the Final RIR. The discussions are meant to provide sufficient background to support the analytical discussions, and are not meant to be encyclopedic. They do clearly describe the significance of Chinook salmon in Western Alaska. The analysis evaluates the impacts of the alternatives for six regions with respect to (a) Chinook uses, (b) CDQ entity impacts, (c) minorities in pollock harvesting and processing, and (d) users of chum salmon, marine mammals, seabirds, and other fish species.

Comment 9-3: In the Environmental Justice chapter, characterizing our time immemorial fishing and hunting tradition as an "underground economy" is terribly hurtful and untrue. Underground economies are commonly understood to be illegal, black market, or purpose fully hidden. To describe the mixed economy of rural Alaska in this way exposes the ignorance of the agency as to the reality of subsistence and subsistence exchanges. Customary trade is legal laws and regulations exist in both the State and Federal regulatory system that legitimize customary trade transactions.

Response: This concern is raised by the following sentence in the Draft EIS. "Significant numbers of transactions also appear to take place in barter or informal trades and exchanges in informal markets which constitute an ‘underground economy.’" NMFS meant to emphasize the undocumented nature of these transactions, and did not intend to imply that these were secret or illegal transfers of Chinook salmon. NMFS has rewritten the sentence in RIR Section 8.3 to read, "Significant numbers of transactions also appear to take place through undocumented barter and customary trade."

Comment 9-4: The DEIS notes that its analysis is based solely on information from the "above-ground" economy. For all intents and purposes, it is stating that some of the most important aspects of coastal communities, and the ones that are likely to be most impacted by the proposed actions, are being purposefully ignored.

Response: NMFS removed the term "above-ground economy" because it was meant to contrast with another expression, "underground economy," that occurred in the preceding paragraph, and that was also removed. See response to comment 9-3. NMFS substituted "undocumented" as a descriptor for transactions in the preceding paragraph, and substituted "documented" as the descriptor in this paragraph.

The purpose of the analysis in which this sentence occurs is to determine whether there are low income communities in the region. Leaving out a source of value in this context can only make it more likely to determine that there are low income populations in the region. Under the circumstances this may be justified as providing a precautionary perspective. In any event, any population engages in undocumented non-market activity that is not entered into income statistics used to make income status determinations. Once the low income determination is made, NMFS does discuss the undocumented barter and customary trade that take place and provide value to local populations.

Comment 9-5: NMFS's lack of understanding can be seen in Section 9.4.2 with the repeated uses of the term "evolve." To use the term "evolve" is to imply that a society constantly working towards something better than what it currently is (or was). This linear view of change, as applied in the DEIS, implies that successfully adapting to a monetary economy is the next step in acculturation into a Euro-North American lifestyle (and the "above-ground economy").

Response: NMFS used the term "evolve" to refer to the changes in the state of the Native Alaskan cultural system and practices through time as Native communities come in contact with changing outside economic, cultural, or physical influences. NMFS does not believe it has used the term in the sense described in the comment. For example, it refers to the evolution of the pre-contact Native cultures and to evolution of the mixed subsistence-market economies "somewhat independently of the broader culture."

NMFS removed the word "evolve" from the following sentence: "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'." The original quotation from Wolfe (1984) referred to adaptation rather than evolution, and the word "evolve" used here may not convey the author's intent.

Comment 9-6: The EJ section fails to recognize the history of racism against Native Alaskans in the North Pacific by the seafood industry and the enslaving of Aleut fishermen by the U.S. Bureau of Fisheries. Racial stratification still occurs under this Council's watch. The DEIS proves that this racial discrimination continues with nary a word from the Council, except higher quotas to the corporations practicing racial discrimination. The International Covenant on Civil and Political Rights says "In no case may a people be deprived of its own means of subsistence".

Response: The analysis is concerned with the alternatives under consideration and their potential for imposing a disproportionate adverse impact on minority and low income communities. By addressing the impact on western Alaska subsistence and other resources uses, this analysis addresses the requirements of the International Covenant.

Comment 9-7: The potential impact to marine mammals is of key concern to our tribal members. The EIS does not adequately describe the effects of the potential loss of marine mammal hunting opportunities, cultural effects, or social effects.

Response: NMFS believes the EIS adequately addresses the marine mammal issues raised by the alternatives. Section 8.1 discusses the impacts of the actions on marine mammals themselves. RIR Section 8.4 discusses the subsistence importance of marine mammals, and RIR Section 8.5 draws on Section 8.1 and RIR Section 8.4 to discuss the implications for relevant communities.

Comment 9-8: Because the benefits to western Alaska from the Bering Sea pollock fishery have been increasing at a significant pace, it may be difficult to fully describe the situation. Relevant document include annual reports of all six CDQ groups for the past few years, the State's Blue Ribbon Report on the CDQ program, the 2007 WACDA report on the CDQ program, and the January 2009 Northern Economics study for the Marine Conservation Alliance, which includes a section on the CDQ program. Also, CVRF alone will be providing over 1,000 jobs for region residents in 2009, and continues to provide tens of millions of dollars of benefits to our region annually.

Response: NMFS has prepared an expanded CDQ section in the Final RIR Section 2.6. The Final RIR also has a complete listing of references and an expanded description of revenue derived from Bering Sea pollock fishery. Aggregate CDQ royalty data and estimated forgone royalty revenues are also described using the best available information and appear in RIR Section 6.11.3. The new CDQ section includes selected statistics about the aggregate benefits to CDQ communities as well as specific examples of fisheries infrastructure investments that could be affected by a decrease in Bering Sea pollock landings. The Northern Economics Report, January 2009, was not available at the time the DEIS was written but portions of it deemed not bound by data quality act review are incorporated into the revised CDQ section.

Comment 9-9: The DEIS presents the associated impacts of each alternative on minority and low income communities through a series of tables. For many readers, it is difficult to understand the scope of impacts when presented in tables. Thus the FEIS should highlight in a clear and descriptive fashion what the impacts are for each alternative. The DEIS fails to provide a meaningful analysis of how each alternative impacts the subsistence harvest and commercial salmon uses. A table highlighting impacts is not analysis. Nor is a table an adequate means of detailing how each alternative will affect western and Interior Alaska communities.

Response: Given the complexity of the discussion, which required a review of the impacts of four alternatives (and their components) across six regions with respect to four broad categories of resource users (Chinook salmon users, CDQ entity beneficiaries, minorities in pollock harvesting and processing, and users of other marine resources such as chum salmon, marine mammals, seabirds and other fish species), there is not one obviously best way to summarize the impacts. NMFS used the text tables to present the results of the analysis because they helped keep the various threads of the analysis in view and facilitated comparisons of the information. A text approach would have had to make use of a large number of headings and subheadings to keep the elements in perspective and to that extent would have become somewhat like an extended table.

NMFS believes it has provided a meaningful and understandable analysis of the impacts. The tables are not the analysis, but the method of organizing the analysis in a coherent fashion. The cells in the tables draw on other sections of the Final EIS and Final RIR, and pull together and highlight the differential impacts of the alternatives on different populations of minority and low income resource users in the different areas.

Comment 9-10: In considering the issue of meeting the need for food among economically disadvantaged people, it should also be noted that salmon bycatch in the pollock fishery is often used for this exact purpose through the Prohibited Species Donation ("PSD") program which was initiated in 1996 to reduce the amount of protein being lost. The PSD program allows salmon bycatch to be retained and distributed to economically disadvantaged individuals by non-profit hunger relief organizations. While these individuals are not subsistence fishermen in Alaska, the facts are that during the 12 years the PSD program has been in place, the non-profit group administering the program has received a Marine Stewardship Award and has distributed 2 million pounds of steaked and finished salmon to poor and homeless people. DEIS at 527 - 529. This program provides nearly 650,000 meals each year to people who have access to "meager and often inadequate food." Id. at 529. Over its 12 year life, the PSD program has provided approximately 7.8 million meals to the poor and homeless.

Response: NMFS agrees, and encourages participation in the PSD program to reduce waste and provide high quality protein to those in need. However, these programs do not necessarily address the special needs of minority populations, or support minority cultures as they would if the fish were harvested in Alaska subsistence fisheries. The volumes supplied are small compared to overall food needs of low income persons in the U.S. Thus, these programs were not considered to be a significant source of disproportionate impacts on minority or low income communities. RIR Section 2.5 provides a more extensive discussion of this program.

Comment 9-11: On p.461, the DEIS analyzes the Prohibited Species Donation Program and notes that none of the salmon bycatch donated through the program makes it to Western Alaska villages, who are most affected by increased salmon bycatch. Consider the Tanana Chiefs' proposal presented to the Council at its February 2009 meeting, which would require the pollock fleet to package and ship salmon PSC to Western Alaska villages with the pollock industry absorbing the cost. Although this proposal will not substitute for adult equivalent Chinook salmon that may be available to these communities otherwise, nor provide a substitute to the cultural traditions the members of these communities engage in while harvesting Chinook salmon, analysis of this proposal may uncover whether an economic incentive to reduce salmon bycatch through this mechanism exists.

Response: Regulations at 50 CFR 679.26 require any salmon donated to be handled by an authorized distributor. Any organization that can meet the requirements for a PSD program permit may apply to NMFS to become an authorized distributor. To date, only one authorized distributor, SeaShare, is permitted to handle donated salmon. Because of the logistics of handling and shipping the fish and the limited resources for the program, only Pacific Northwest residents have benefited from the donated salmon. The PSD program is currently a voluntary program, with participants paying the cost of handling the fish. Having more authorized distributors that could provide donated salmon to Western Alaska communities would be a good way to reduce salmon waste in the pollock fishery. More information about the PSD program is available at http: //www.fakr.noaa.gov/ram/psd.htm. A mandatory program, as recommended by the commenter, would require a separate analysis and Council action before rulemaking and implementation.

Comment 9-12: The chapter on Environmental Justice is lacking an appropriate scale analysis of the impacts to low-income communities in western Alaska. The EJ analysis fails to apply the EJ principles to Alaska Native coastal communities in detail or to provide much analysis concerning them. Why does the analysis spend more time addressing potential impacts to minority populations working within the pollock industry than on resident Alaska Native populations which are likely to experience far greater impacts?

Response: The Environmental Justice section used a regional rather than individual community approach to the analysis. Potentially affected populations were divided among six regions (Kotzebue Sound, Norton Sound, the Yukon River and river delta, the Kuskokwim River and river delta, Bristol Bay, the Alaska Peninsula, Pribilof Islands, and Aleutian Islands, and Persons living outside western and interior Alaska). The division reflected a balance between a consideration of regionally variation and analytical tractability. The analysis does not devote more space to the impacts on pollock industry populations than it does to the impacts on western Alaska Natives.

Comment 9-13: For thousands of years, Alaska Native communities have long used the marine resources of the Bering Sea for both subsistence practices and cultural identity. It is also well-documented that those who live in the region year-round have high cost of living expenses. The data on these minority populations should be considered by the Council when considering all alternatives. Although NOAA Fisheries recognizes the importance of the resources to these communities, the agency has inadequately addressed the disproportionate impacts of Chinook salmon bycatch on these communities. As a result of high fuel prices in combination with a rapidly declining economy, the importance of subsistence food to physical and cultural survival in Western Alaska has become increasingly more important. In this case, salmon bycatch results in a disproportionately adverse economic impact on subsistence and commercial economies in Western Alaska communities dependent on salmon.

Response: NMFS believes the EJ analysis, supported by the extensive background information and analysis presented in other chapters of the Final EIS and Final RIR, addresses the issues raised in the comment. The Final RIR discusses the importance of salmon to the regional culture, the importance of subsistence salmon as a food source, and their importance as a source of income, the high cost of living in the region and the high levels of poverty and unemployment and relatively low incomes in Western Alaska. NMFS has more closely integrated the economic analyses with the EJ analysis so that readers of the EJ analysis will be more aware of the socio-economic information contained in other parts of the Final RIR and upon which the EJ analysis depends. This has been done by moving the EJ analysis into a chapter of the Final RIR (Chapter 8) so that it follows other analyses contained in the RIR, as well as by eliminating duplicative of information.

Comment 9-14: Chapter 9 states that poverty and income statistics should be adjusted to reflect monetary value of subsistence production to provide a relatively comparable measure of income. The estimation of this measure would illustrate the economic hardship incurred by Alaska Native tribes and communities as a result of potential loss of subsistence salmon resources. For instance, what would be the cost of a person living in Rampart on the Yukon River to replace their subsistence diet with an equivalent proxy protein source? This estimation should also incorporate average income in relation to average food costs as they relate to the cost of harvesting subsistence salmon, a reasonable subsistence proxy that could replace salmon, and a reasonable commercially-purchased proxy that would substitute subsistence salmon. Nonetheless, the Council should not neglect the value of the subsistence harvest of salmon to Native and family traditions, which are considered intrinsic values within the Alaska Native community.

Response: Lacking data on subsistence household food expenditures it is not possible to quantify replacement costs. NMFS is not aware of any study, or data source, that documents subsistence household food expenditures in Western Alaska and the available evaluations studies, as discussed in the EIS, are not a suitable proxy. Furthermore, the value of subsistence use of Chinook salmon in Western Alaska likely exceeds replacement food costs due to the cultural significance of the subsistence lifestyle. Thus, replacement cost estimation is neither possible, nor a true representation of the value of subsistence harvest. Nonetheless, in recognition of the apparent imbalance in the treatment subsistence uses of Chinook salmon, subsistence information has been reorganized into a new RIR Section 3.3, and additional information is provided in RIR Section 3.2 to better reflect the importance of subsistence. This information was presented to the Council prior to final action.

Comment 9-15: Substantial information for evaluating and estimating subsistence economic values exists and additional information should be sought. On p.453, the DEIS notes that the Magdanz study of 2007 analyzed subsistence consumption for the Norton Sound and Port Clarence areas. It cited that "up to a third of the [subsistence] meat and fish was salmon." There are other studies that show regions in the Bering Sea with even higher consumptions of subsistence salmon. For example, in a study cited by the Alaska Department of Community and Economic Development, on its website at: http://www.dced.state.ak.us/dca/AEISlBristol/Subsistence/BristoISubsistenceNarrative.htm, accessed in December of 2007, the Department said that "the average; subsistence fish consumption for Bristol Bay residents' accounts for 55 percent of all subsistence foods utilized."

Response: The estimates cited on page 453 and 454 of the DEIS were meant to illustrate the propositions that "Subsistence foods in general are important components of regional diets," and that "Chinook salmon varies in importance in regional diets, and can be significant." NMFS believes that the citations from Magdanz and Ballew at al. adequately supported these propositions. Final RIR Section 8.4, in which this discussion occurs, also places the importance of subsistence foods in the context of the high cost of living and of alternative food sources in rural Alaska, of their distribution through different types of gifts and exchange, and of their cultural importance to the Native communities. NMFS attempted to access the suggested web site from the Alaska Department of Community and Economic Development in March 2009, and found that the Department had removed the content from the site and had indicated that it removed the material because of concerns about outdated and inaccurate information. The Department of Commerce website was formerly described as the Alaska Economic Information System (AEIS).

Comment 9-16: On p.459, the DEIS evaluates the costs of subsistence fishing in Holy Cross and Tanana, which included costs for gas, clothing, equipment and other supplies. These subsistence fishing expenses are expected to stay the same or rise in the future according to economic projections, so it is important to for the Council to consider this in any decision-making. It is also important that the Council continue to evaluate the living expenses for residents of these communities compared to urban centers of Alaska such as in Anchorage. Therefore, while it may be difficult, it is not impossible to conduct an economic analysis of the value of subsistence salmon in the rural Alaska Native economy.

Response: The environmental justice analysis reported these examples to illustrate the importance of access to cash or credit for participation in modern capital intensive subsistence harvests. This, in turn, helped to illustrate the importance of income from commercial Chinook salmon fishing. The analysis also discusses the relatively high cost of living in rural Alaska. Much of this information has been enhanced and the Final RIR treatment subsistence uses of Chinook salmon, subsistence information has been reorganized into RIR Section 3.3, and additional information is provide to better reflect its importance in RIR Section 3.2. This information was presented to the Council prior to final action.

Comment 9-17: On p, 474, the DElS notes that increased salmon bycatch may also adversely affect rural and indigenous people on the Yukon River in Canada. Under Executive Order 12898, NOAA Fisheries is only required to address minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Marianas Islands. However, because salmon is a transboundary migratory species, NOAA Fisheries has an ethical and moral obligation to consider the effects of salmon bycatch on low-income populations wherever they occur. If there are available data on subsistence harvest of salmon in Russia or Canada, the EIS should consider these potential impacts. NOAA Fisheries has jurisdiction over the fisheries that affect the ecosystems, species composition, and thus communities throughout the salmon-spawning watersheds that feed into the North Pacific. The Council should therefore consider all available data on the health of the salmon runs in Canada and Russia and the level to which those runs support subsistence harvest. This would allow the Council and the public to further understand the impacts of salmon bycatch for all peoples who depend on salmon for subsistence purposes whether in the Kuskokwim River in Alaska, the Yukon River in Canada, or the Bolshaya River in Kamchatka. While genetic information indicates that the number of Russian salmon captured in the U.S. pollock industry is relatively small, like with the runs of the Pacific Northwest, a small number may constitute the entire run in some cases. Thus, the DEIS should acknowledge the transboundary nature of salmon stocks and the potential implications that it may have on other indigenous cultures.

Response: The environmental justice analysis includes a paragraph alluding to potential impacts to minority and low income populations in Canada's Yukon Territory. However, given the explicit instructions at the start of the executive order to examine effects on "on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands," (E.O. 12898) NMFS has not done an environmental justice analysis for the Canadian populations. The instructions of the Executive Order are very clear, and consistent with other common evaluation practices. For example, cost and benefit analysis is routinely carried out from an accounting stance that restricts it to national residents.

RIR Chapter 3 does discuss historic trends in Canadian Yukon salmon catches. Specifically, Figure 3-24 displays annual commercial Chinook salmon catch for the mainstem of the Canadian Yukon from 1961-2007 and the underlying data, including subsistence and porcupine aboriginal catches, is contained in Table 3-13. In the Final RIR, NMFS generalized the short existing discussion on effects in Canada to note the potential for effects on minority or low income populations outside of the United States and Canada, but NMFS continued to restrict the analysis itself to residents of the U.S.

Comment 9-18: The DEIS limits its focus to the direct economic impacts and nourishment losses. However, there are impacts beyond these that must be considered. For example, there is no analysis of the impact of bycatch loss of salmon on the culture and traditions of the villages throughout western and interior Alaska, especially the subsistence way of life and the economic viability and cultural integrity of small communities. The effects of the salmon loss from bycatch reach far beyond the fishermen and the dining table; loss affects families throughout the region, impacting the family unity fostered through the work of harvesting, cutting, smoking and sharing the fish. Additionally, with lower harvest numbers, communities may be forced to spend more time, if possible, harvesting salmon to meet their subsistence needs. Some may not extend the time they spend harvesting salmon because a longer season fails to allow for adequate drying or prevents having enough time to pick berries. These indirect impacts are not addressed in the DEIS. The DEIS cites only public comments for evidence that Chinook salmon are important to the cultural, spiritual and nutritional needs of Alaska Native people, and 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 way of life. What are the impacts along the Yukon and Kuskokwim? The DEIS fails to address this important question in a manner that provides decision makers with enough information to determine whether one alternative is more beneficial than another. There are numerous books and peer-reviewed papers examining this essential role of subsistence in both qualitative and quantitative means.

Response: The Final RIR describes subsistence harvests of Chinook salmon and provides detailed descriptions of regional subsistence salmon fisheries throughout western Alaska. NMFS has modified the analysis from the draft with a more extensive discussion of the subsistence economy and culture and has tied the analysis more closely to existing material on subsistence the economic analysis in the RIR. The treatment of subsistence uses of Chinook salmon has been reorganized into a RIR Section 3.3, and additional information is provided to better reflect its importance in RIR Section 3.2. This information was presented to the Council prior to final action.

NMFS believes that the current discussion provides decision makers with sufficient information to evaluate the alternatives before them. The descriptive material in the analysis, and the comparisons of the alternatives, do contrast five regions of Western Alaska with respect to Chinook salmon. Separate regional analyses are provided for the Yukon River and the Kuskokwim River.

Comment 9-19: The goal of E.O. 12898 is to identify disparate impacts to minority populations. It is important to note the significantly different impacts on Native populations who depend on salmon for sustenance and livelihood as opposed to non-resident processing workers for whom neither livelihood nor culture is tied to pollock processing communities. Further, in assessing disparate impacts, the median family incomes, which far exceed those in Western Alaska salmon-dependent communities, must be addressed.

Response: The environmental justice analysis does provide separate descriptions of the relationships between different minority populations and the resources that might be impacted by this action. The goal of an environmental justice analysis is to identify "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." (E.O. 12898) Disproportion refers to impacts relative to impacts on the overall society. The analysis did not seek to compare low income and minority populations with one another to determine relative burdens, but it did seek to describe the potential for disproportionate impacts on each population to the extent available information permitted. NMFS is unaware of a source of information on median family incomes for non-resident pollock processing plant workers.

Comment 9-20: (9-24) The 2000 census data in Table 9.2 is old and outdated.

Response: An environmental justice analysis evaluates the potential for a federal agency to impose "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." The starting point in this analysis is a threshold analysis to determine whether or not minority or low income populations occur in the action area. RIR Section 8.2 provides this threshold analysis for the presence of low income populations. RIR Table 8-2 provides information on labor force, employment status, unemployment, poverty and income for regional census districts and boroughs. The analysis uses 2000 census data and documents that low income populations are present in the area. The 2000 census data is sufficient for that purpose.

Comment 9-21: DEIS Section 9.4.8. on page 464, states that pollock allocations benefit member communities, they do not provide significant benefits to non-member communities. CDQ groups do benefit non-CDQ communities. For example, Coastal Villages Regional Fund (CVRF) provides a market to hundreds of salmon fishermen from Bethel and other non-member villages, paid for with BSAI pollock funds. More than 10 percent of the hundreds of jobs provided in CVRF's seafood plants are held by residents from non-CVRF member western Alaska villages and CVRF conducts regular employment recruitment in Bethel and in other communities outside our member communities. CVRF employs around 40 people at our administrative office in Anchorage, AK. CVRF generated/supports many indirect jobs as a result of our economic activity, such as flights throughout the region and hotels and meals in our regional hub of Bethel.

Response: NMFS agrees that CDQ revenues benefit non-member communities. Additional information about the CDQ Program's indirect benefits is included in the Final RIR. An expanded evaluation of CDQ revenue, benefits, and investments and the potential effects of the proposed action on CDQ royalties are also included and was provided to the Council prior to final action in April 2009. This information includes the benefits described in the publicly available CDQ annual reports like, employment, educational opportunities, scholarships, and fisheries related markets.

NMFS has prepared an expanded CDQ section which is presented in RIR Section 2.6. The Final RIR also has a complete listing of references and an expanded description of revenue derived from Bering Sea pollock fishery. Aggregate CDQ royalty data and estimated forgone royalty revenues are also described, using the best available information, and appear in RIR Section 6.11.3. The new CDQ section includes selected statistics about the aggregate benefits to CDQ communities, as well as specific examples of fisheries infrastructure investments that could be affected by a decrease in Bering Sea pollock landings.

9.11 Economic Analysis Comments

These comments are on the DEIS Chapter 10; potentially affected salmon fisheries, economic benefits of Chinook salmon savings, and pollock industry revenue and cost effects. For the final document, the RIR was separated from the Final EIS as Volume II. For the Final RIR, the environmental justice analysis was combined with the RIR into a new Chapter 8. This change was in large part a response to public comments. The Final RIR was revised to include an analysis of Alternative 5 in Chapters 5, 6, 7, and 8.

Largely in response to public comments, additional substantive changes were made to the Final RIR in Section 2.6 The CDQ Program, Section 3.2 Importance of subsistence, Section 3.3 Discussions of subsistence harvest by region, Section 5.6 Identification of regions and communities principally dependent on commercial salmon fisheries, and Section 6.11 Potential impacts on pollock fishery dependent communities. The revised sections on subsistence, the CDQ Program, price information, and shoreside impacts were provided to the Council and public as appendices to the preliminary CAR for Council final action in April 2009. Specific changes to the RIR are detailed in the response to comments below.

Comment 10-1: The DEIS fails to meet even the minimum standards of adequacy for economic analysis.

Response: NMFS acknowledges that the use of potentially forgone first wholesale gross revenues is not an ideal reflection of the expected economic costs (or, conversely, benefits if the catch reduction can be mitigated by actions of the operator) attributable to the proposed changes in Chinook bycatch management. See response to comment 10-83 for an explanation of the reasons for adopting this analytical approach.

In order to estimate "profits", one must have data on costs, not simply revenues. NMFS does not have data to estimate net impacts until such time the Council develops a socioeconomic data collection program that requires the industry to submit cost data under new MSA authority. These gross receipts may, of course, not be, in any meaningful way, indicative of realized net revenues, but by default serve as the best available "proxy" for economic earnings in these fisheries.

It must also be noted that "maximizing profit" is only one, among several possible motivating factors that may be "assumed" to define the objectives of a business enterprise.

Absent accurate, verifiable cost data and operational information for the pollock trawl fleets operating in the Bering Sea, gross revenue estimates constitute the "best" empirical economic information available. NMFS fully acknowledges that changes in first wholesale (or ex vessel, as appropriate) revenues cannot be regarded as indicative of net results. That said, these estimates represent the current limit of NMFS' ability to empirically characterize the expected sectoral outcome in the pollock fishery, attributable to changes in Chinook bycatch management under consideration. And, further, this explains the very extensive reliance upon, and systematic treatment of, "qualitative" cost and benefit analysis, reflected in the RIR, as required under E.O.12866.

The response to this comment has been incorporated into the first several pages of RIR Chapter 6.

Comment 10-2: Unfortunately, the quality and comprehensiveness of the economic impacts analysis included in the DEIS are on a par with the welfare analysis in the DEIS. That is to say, they are simply omitted. No changes in employment or economic impacts are provided for any of the alternatives for any of the locations in Alaska or Seattle that are likely to be affected. No changes in employment or investment values are provided for any of the CDQ groups in western Alaska that have substantial ownership investments and gain employment opportunities in the pollock fishery (e.g., see Coastal Villages Regional Fund 2008, p.24). No changes in economic activity are estimated or presented for any of the commercial salmon fisheries that are likely to be affected by reduced salmon bycatch in the pollock fishery.

Response: Parts of the response to this comment has been incorporated into the first several pages of RIR Chapter 6. Additionally, this comment has been addressed with the addition of Section 6.11, which includes analysis of potential impacts on shoreside value added processing revenue as well as on CDQ royalties. The CDQ program, including ownership interests and royalties received from the pollock fishery, is also described in RIR Chapter 2. The limitation of the analysis with regard to defining catches of Chinook salmon by user groups is discussed in RIR Chapter 5. Included in Section 5.6 is the identification of regions and communities that are dependent on salmon fisheries as well as the importance of Chinook salmon to limited entry permit holders in Western Alaska.

Comment 10-3: The issue is not a matter of accepting a hard cap; we can see the pressure on the Council to take that step and know that it is a likely action that our member companies must prepare for. The real issue is what can be expected to result from a hard cap set at an arbitrary level. The analysis predicts some of the potential costs and benefits. The predicted costs, while sorely underestimated, are enormous and would include the loss of thousands of jobs. The estimated benefits are not measurably predictable.

Response: NMFS disagrees with the assertion that the hard caps defined in the alternative set, including the preferred alternative, are arbitrary. The Council has put forward for analysis an alternative set that encompasses historic Chinook salmon bycatch levels in the pollock fishery. The alternative set includes provisions for sector level allocations, again based on several possible metrics of historic bycatch levels in the pollock fishery. The combinations of these options exceed several hundred in number and the analysis contained in the EIS and RIR has considered a subset of those combinations in order to provide tractable range estimates of potential impacts. This analysis provides the Council with needed information to make an informed choice regarding a practicable level of Chinook salmon bycatch.

In addition, the comment misinterprets the numerical estimates of "potentially forgone gross revenues" and "gross revenues at risk", identified in the RIR. As explained therein, these gross estimates reflect highly simplified assumptions about the outcome of competing alternative bycatch rules. In a sense, they are intended to portray the "worst case" outcome if the pollock fishery was required to forgo a specific catch amount in response to each of the Chinook bycatch prohibition actions being examined. As the text clearly indicates, there is no expectation that this outcome will be realized as a result of any of the proposed Chinook bycatch management measures under consideration. The RIR is very clear that these "techniques" are employed solely to provide a crude approximation of the first wholesale gross dollar value associated with unharvested pollock, by sector, processing mode, etc. In RIR Section 6.6, which details the methods used to calculate potentially forgone gross revenues and/or revenue at risk, the text states "gross revenues at risk are forgone **only** if a fishing fleet is unable to modify its operations to accommodate the imposed (Chinook bycatch) limits and, thus, cannot make up displaced catches elsewhere ..." The analysis goes on to address the expected results of less extreme catch reduction levels, resulting from industry changes in operational practices (e.g., gear changes, location changes, timing changes). In every case, the RIR emphasizes that these estimates are incomplete, owing to the absence of industry cost and operational data, market information, pricing structure, etc. As "gross revenue" measures, these numerical results cannot even be interpreted as being indicative of the net impacts the industry could be expected to incur as a result of implementation of any one of the several bycatch alternatives.

Regarding the benefits that may accrue from the proposed action, NMFS agrees that is only able to assert that the bycatch of Chinook salmon in the pollock fishery 'may' be affecting stocks of western Alaska Chinook and associated subsistence, commercial, and sport fisheries. Our knowledge of these complex ecological, biological, and economic relationships remains incomplete at this time. That being said, these data deficiencies do not remove the NMFS's obligation to use the "best available scientific information" to evaluate, in this case, Chinook bycatch reduction alternative actions in the Bering Sea pollock fisheries.

Comment 10-4: The choice of time period (2003 through 2007) for the cost/benefit analysis is inappropriate and should be increased to more accurately represent historical bycatch, rather than the highest five years. In addition, the revenue at risk should be viewed as an upper bound. While this is noted in a footnote (pg 653), this analytical problem should be addressed quantitatively as well by providing revenue at risk with a set percent reduction in historical levels to account for the behavioral change a hard cap will produce; for example, a 20% bycatch reduction could be applied across the board to account for reductions from using salmon excluder devices, which would likely become more prominent under a hard cap.

Response: NMFS disagrees that the time period for the analysis is inadequate. The response to this comment has been incorporated into the first pages of RIR Chapter 6.

9.11.1 Comments on CDQ issues

Comment 10-5: A hard cap could inflict far more economic pain in western Alaska than economic gain. The DEIS suggests that western Alaska communities will receive very little benefit as a result of the Chinook caps in the Bering Sea pollock fishery. The return of an estimated 9,710 Chinook salmon to the Kuskokwim river and 14,938 Chinook salmon to the Yukon river under the lowest Alternative 2 cap of 29,300 Chinook salmon would have little or no discernible benefit in either subsistence or local commercial fisheries but could have a crippling effect on the tens of millions of dollars entering the economy each year from the Bering Sea pollock fishery.

Response: Comment acknowledged.

Comment 10-6: The statement on page 498 that "less than 1% of the Bering Sea catch is harvested by vessels owned by Alaska residents" and that this percentage has "remained stable since 2002..." is inaccurate. The CDQ groups are heavily invested in the Bering Sea pollock fishery and the level of investments that the CDQ groups have made in the pollock fishery has increased significantly in recent years. One commenter noted that the CDQ groups own approximately 33% other at-sea pollock processing fleet and that this fleet, when CDQ catch is included, harvests nearly 50% of the Bering Sea pollock quota each year. CDQ groups also have ownership interests in at least one mothership (the MS Golden Alaska), and in numerous pollock catcher vessel. Another commenter noted that a thorough review of Alaskan and CDQ investment in the pollock industry would show that Alaskans have more than a 30% stake in this fishery. The DEIS should be revised to include accurate information about the Alaskan ownership of pollock vessels by the CDQ groups.

Response: NMFS agrees that the statement on DEIS page 498 is incorrect. This deficiency was noted by the Council at its June meeting and analysts were requested to include more information about CDQ entity ownership of the Bering Sea pollock fleet. Analysts provided that information in the DEIS in Chapter 9 and Table 9-5 on pages 464 of the DEIS. However, analysts failed to remove the inaccurate statement on page 498. That statement has been removed in the Final RIR.

Although NMFS acknowledges that CDQ entities have investments in BSAI fisheries, it is difficult for NMFS to confirm the figures given for investments in the Bering Sea pollock fishery. CDQ investments by species or group have not been supplied to NMFS since 2005. As mandated by the 2006 reauthorization Magnuson Stevens Act, NMFS is no longer authorized to request this type of data. NNFS also acknowledge that the analysis would benefit from this information and has prepared a new CDQ section including estimation of potentially forgone pollock royalties to the individual CDQ entities under the Alternatives. The revised CDQ treatment appeared as an Appendix to the Preliminary Comment Analysis report presented to the Council in April, 2009 and is included in the Final RIR in Section 2.6 and Section 6.11.3.

Comment 10-7: None of the alternatives appear to give the CDQ Program a fair pro rata share of the Chinook salmon bycatch allocations. These alternatives penalize the CDQ group's "clean" fishing history and may also violate the CDQ requirements in the MSA. Section 305(i) (1)(B)(iv) of the MSA requires that harvest of CDQ allocations for species with fishing cooperatives, as exist under the AFA, shall be regulated no more restrictively than for other participants in the applicable sector, including with respect to the harvest of non-target species.

Response: Alternative 2, component 2, option 1 would allocate the same percentage of the Chinook salmon hard cap to each sector as the percentage allocation of pollock that sector receives under the American Fisheries Act. Therefore, this alternative does provide the Council the option of allocating among the sectors a pro rata share of Chinook salmon equal to the sector's pollock allocations.
NMFS does not agree that any of the alternatives would be inconsistent with the CDQ regulation of harvest provision of section 305(i) (1)(B)(iv) of the MSA. Each of the alternatives and options analyzed appears to apply the same type of Chinook salmon management measures to the CDQ Program and its allocations of Chinook salmon bycatch as would be applied to the other pollock sectors.
It would be difficult to confirm the statement that the CDQ entities have fished more cleanly, or have harvested pollock with lower salmon bycatch rates than the other sectors because operators of vessels harvesting both CDQ and non-CDQ pollock on the same fishing trip have the option of assigning a haul of pollock to either the CDQ entity's quota or to the vessels quota after the crew assesses the bycatch in that haul. NMFS regulations allow up to 2 hours after the fishing gear is retrieved to record the assignment of the haul in the vessel's logbook. Historically, because the CDQ entities were constrained by multiple hard caps for other groundfish species and prohibited species and the non-CDQ pollock fisheries were not, some CDQ entities would request that the vessel operators assign the lower bycatch hauls to the CDQ entity and the higher bycatch hauls to the non-CDQ pollock fisheries. This would result in it appearing that the CDQ entities were fishing with lower bycatch rates than the non-CDQ pollock fisheries.

Comment 10-8: The DEIS fails to incorporate up-to-date and accurate descriptive information regarding the investments of CDQ groups in the BSAI pollock fishery and the benefits to CDQ and non-CDQ communities derived from these investments. CDQ groups are well vested in the BSAI pollock fishery and own 30-40% of the companies involved in the fishery. CDQ entities accrue tens of millions of dollars per year from their investments in the pollock catcher processor fleet in addition to the royalties they derive from leasing their CDQ allocations. This revenue makes it possible for the CDQ groups to invest in local communities. The DEIS fails to account for the benefits of jobs, wages, near shore fishery opportunities, scholarships, and other significant economic development activities in Western Alaska communities that are funded almost entirely by the BSAI pollock fishery.

Response: NMFS recognized the need to update and augment the CDQ information in the DEIS. In response to comments, NMFS has conducted a literature review of publicly available information on the investments, royalties, and benefits to communities benefits associated with the CDQ entities. NMFS has also consolidated existing CDQ background information from Section 3.4.4.2 (page 153) and Section 9.4.8 (page 462) of the DEIS into the new RIR Section 2.6. This new section incorporates the best available information regarding vessel ownership, royalty and investment revenue generated for CDQ entities by the Bering Sea pollock fishery, and community benefits such as jobs, wages, near shore fishery investments, scholarships, and other significant economic development activities. In addition, a treatment of the potential effects on CDQ Royalties under the Alternatives 4 and 5 is provided in RIR Section 6.11.3. The Council was provided with this information, as an appendix to the Preliminary Comment Analysis Report, prior to taking final action in April of 2009.

Note that it is difficult for NMFS to confirm the estimates provided in the public comment. Until 2006, NMFS received detailed annual financial audits from each CDQ entity (for 2005 and previous years). The audits included detailed revenue information and royalties paid, by species or species group, for the CDQ allocations. NMFS has not been authorized to require financial audits since the 2006 amendments to the Magnuson-Stevens Act. Therefore, we now rely on information from the CDQ entities publically available annual reports prepared primarily for residents of the member communities. Some of the CDQ entities choose to include specific information on revenue sources and investments, while others choose not to provide this level of detail in their annual reports.

Comment 10-9: Several commenters made specific suggestions for improving the descriptive information about CDQ entities in the FEIS:

- Page 154, Section 3.4.4.2, that states "CDQ groups had a total of $134 million in revenue in 2005, earned primarily from pollock royalties" is misleading and incorrect.
- CDQ interests own approximately 33% other at-sea (CP) pollock processing fleet-a fleet that, when CDQ catch is included, harvests nearly 50% of the Bering Sea pollock quota each year. CDQ groups also have ownership interests in at least one mothership (the MS GOLDEN ALASKA), and in numerous pollock catcher vessels.
- The CVS Goodnews Bay/Platinum operation is the largest investments in CDQ history at over $35 million. Over 600 permit holders delivered 412,000 pounds of halibut and 2.8 million pounds of salmon to CVS facilitates in 2007. Western Alaska CDQ groups have invested in the pollock industry and have approximately 40% ownership in companies involved with this fishery.
- Add relevant information on CDQ investments in the BSAI pollock fishery and other pollock sectors to tables to the Executive Summary in the sections on the Bering Sea pollock fishery and the costs of forgone harvest in the pollock fishery, and tables ES-20, 21, and 22.

Response: Comments acknowledged. See response to comment 10-8.

Comment 10-10: In western Alaska, the CDQ Program provides significant (85%) funding to support salmon related infrastructure including processing plants, fishery support centers, and fishing vessels that benefit both CDQ and non-CDQ members. CDQ revenue largely derives from the BSAI pollock fishery; therefore, any measure limiting the pollock fishery could impact salmon fishermen.

Response: Comment acknowledged. See response to comment 10-8.

Comment 10-11: For many residents of CDQ communities, the opportunities from the CDQ program are an alternative to subsistence. Adoption of restrictions on the pollock fishery of the magnitude under consideration threaten that alternative. Rather than helping subsistence fishermen, Alternatives 2-4 may create subsistence fishermen. The DEIS emphasizes the importance of subsistence harvests, but the DEIS ignores the fact that the CDQ program provides an alternative to subsistence dependency for many people in CDQ communities, an alternative threatened by the proposed restrictions on the pollock fishery. In something of an understatement, the DEIS concedes that "[a]nything that tends to diminish economic activity in these communities ... can do disproportionate harm...." Id. at 706. Nevertheless, the DEIS conducts no analysis of, and fails to account for, these acknowledged harms that will flow from restrictions on the pollock fishery.

Response: Comment acknowledged. See response to comment 10-8.

Comment 10-12: CDQ communities derive tens of millions of dollars per year from revenue derived from the BSAI pollock fishery. These investments are at risk under some of the Chinook salmon bycatch measures under consideration. Funding for CDQ projects could be severely impacted. The failure of the DEIS to evaluate these impacts on the "economic engine" driving the development of opportunities in CDQ and non-CDQ communities is a major flaw in the document, making it inadequate in its role in "informed decision making".

Response: In response to this and similar comments, NMFS has revised the analysis in RIR Section 2.6 and RIR Section 6.11.3 take into account pollock revenue and community investments of CDQ entities. Analysis has been expanded drawing from the publicly available annual reports and a recently released economic report. To better inform the public and decision makers, this section incorporates the best available information regarding vessel ownership, revenue generated by investments in the Bering Sea pollock fishery, and community benefits such as jobs, wages, near shore fishery investments, scholarships, and other significant economic development activities. Chapter 10 Section 10.5.2 (page 652) and Chapter 10 Section 10.5.6 (page 706) of the DEIS addressed the impacts of hard caps and reduced pollock landings on fishery dependent communities including CDQ entities and other entities well vested in onshore processing. This information is now contained in RIR Section 2.6 and RIR Section 6.11.3. In addition, the Final RIR provides analysis of the potential impacts on shoreside value added processing revenue in Section 6.11.2. The discussion in response to comment 10-6 may also be relevant.

Comment 10-13: DEIS Section 9.4.8, states that CDQ groups have invested in inshore processing plants for salmon and halibut. This section does not mention that these operations are fully subsidized by the pollock fishery. This section also incorrectly states that CVRF made loans to two aluminum welding businesses for boat repair and buildings in Eek and Hooper Bay. The CVS is completing the construction of a $35 million salmon processing facility in Goodnews Bay/Platinum operation is the largest investments in CDQ history at over $35 million. Over 600 permit holders delivered 412,000 pounds of halibut and 2.8 million pounds of salmon to CVS facilitates, including the Quinhagak plant, in 2007. CVRF planned, constructed, and operates a total of 14 Fisheries Support Centers in the communities of Scammon Bay, Hooper Bay, Chevak, Tununak, Toksook Bay, Nightmute, Mekoryuk, Chefonak, Kwigillingok, Kongiganak, Napakiak, Napaskiak, Eek, and Goodnews Bay. In addition CVRF operates six halibut plants in the region. Annually, CVRF employs approximately 340 workers at 7 processing plants in the region, with an additional 120 expected with the opening of the Goodnews Bay/Platinum salmon plant. All of these benefits were paid for with earnings from the BSAI pollock fishery. The 2007 WACDA report includes more detailed data on the CDQ investments and benefits.

Response: NMFS has revised the CDQ background information in the Final RIR take into account CVRF's comments. See response to comment 10-8.

9.11.2 Comments on the importance of Chinook salmon

Comment 10-14: One of the major categories of benefits the DEIS cites as justifying restrictions on the pollock fleet is "passive use (or non-use) benefits." DEIS at 625. There are multiple conceptual and analytical defects in relying on non-use values to justify restricting the pollock fleet. The DEIS defines "passive (or non-use)" values as the value of knowing that the resource exists "and will continue to exist in perpetuity." DEIS at 627. The General Accountability Office defines nonuse values as the "pleasure of knowing that the resource exists." General Accounting Office, Natural Resource Damages of the Department of Energy, GAO/RCED-96-260R, August 16,1996, at 19. In short, passive use values are the psychological value of knowing that the resource exists. However, the DEIS offers no proof that such values exist as to Chinook salmon specifically and, if they exist as to Chinook, that they are damaged, and if they are damaged, by how much. Nevertheless, the DEIS concludes, without analysis, evidence, or support, that non-use values can be used to justify bycatch restrictions. Such "analysis" does not comply with NEPA.

Response: The comment pertains specifically to DEIS Section 10.5.1.1 (now contained in the Final RIR Section 5.1). This discussion of passive-use values is an element of the RIR. The RIR is mandated by Executive Order 12866 (E.O.12866), which states, in relevant part:

> 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.

As the E.O. passage specifies, all costs and all benefits must be included in a regulatory impact analysis, not only those that are market-based and/or readily amendable to monetization. In point of fact, passive-use values are not, as the commenter suggests, "psychological", but instead reflect economic value (in the classic sense of that term) held by individuals. While the estimation of these values is challenging, there is no serious dispute that passive-use values are real measures of human welfare (i.e., utility), which is the foundation of microeconomic science. Attribution of passive-use value(s) has been adopted and widely employed in the field of natural resource management; empirical estimation techniques have been endorsed for use by NOAA's Blue Ribbon Panel (ca.,1990); and the use of these techniques and resulting passive-use estimates sanctioned by the U.S. Federal Courts.

To the assertion by the commenter that the analysis "offers no proof that such values exist as to Chinook salmon...", NMFS points to the significant expression of public interest and concern, especially by non-commercial fishing interests, in the matter of Chinook (and chum) salmon bycatch. While several examples can be readily cited, perhaps the most unambiguous of these is the extraordinary cultural and social value held for Chinook salmon, by many American Native peoples (and non-natives, alike). Documentation of these Chinook salmon values are reflected in treaty agreements, both between Native American Tribal entities and the U.S. government, as well as internationally (e.g., numerous U.S.-Canada, historically, U.S.-Japan-U.S.S.R. salmon treaties).

Finally, a careful reading of Section 5.1, cited by the commenter, does not suggest, as asserted, that "non-use values justify restricting the pollock fleet." Instead, the referenced section merely observes that changes in Chinook salmon bycatch will likely result in a wide range of human welfare impacts and, among these, are welfare changes attributable to those who hold passive-use (or non-use, existence, bequest, etc.) value for this species. NMFS believes this is a reasonable, fully justified, and wholly supported conclusion and, notes further, in full compliance with E.O.12866 requirements.

Comment 10-15: The first fundamental problem with relying on existence values to justify restricting the pollock fishery is that there is no threat to the existence of the Chinook salmon resource caused by the pollock fishery. One searches the DEIS in vain for any claim, let alone proof, that the incidental take of Chinook salmon in the pollock fishery threatens the existence of that species. Any psychological existence values that are alleged to exist are satisfied if the resource exists.

Response: This comment reflects a misunderstanding of the meaning of "existence value." The response to this comment has been incorporated into the Final RIR in Section 5.1.1, Passive Use Benefits. Perhaps use of an alternative, but equivalent term, "passive-use value", will resolve the confusion. Fundamentally, passive-use value reflects the utility an individual derives from knowing that the resource of interest (e.g., Chinook salmon) exists in a given state of being, even though no use is ever expected to be made of it by the holder of the value. Such values are not, in any way, correlated with the risk of "extinction", as implied by the commenter. Indeed, the "source" of the passive-use value need not even be a living thing (i.e., the earliest work on passive-use described values placed on free flowing rivers by individuals who reported no intention of ever visiting these rivers). Passive-use values are actual, measurable, and legitimate aspects of society's preferences for, in this case, fishery resource management.

As such, passive-use values must be accounted for, to the extent practicable, in evaluating the benefits and costs of the proposed Chinook bycatch action. Along with the other sources of "benefits" and "costs", passive-use values contribute to a full accounting of the net benefit to the Nation (possibly negative) accruing from the tradeoff of Chinook bycatch for pollock harvests in the Bering Sea. This is a requirement of Presidential Executive Order 12866.

Comment 10-16: The second fundamental problem with relying on existence non-use values to justify restrictions on the pollock fishery is that people generally do not place an existence value on Chinook salmon per se. The DEIS admits that "few" people who attribute existence values to marine resources "would likely be able to either explicitly recognize or express" such values for the living marine resources of the Bering Sea. DEIS at 628. If people are unable to "express," or even recognize, non-use values for the living marine resources of the Bering Sea, how can there be an identifiable and distinct existence value for just one species of salmon? The DEIS admits this analytical defect when it states that "isolating a passive-use value unique to Chinook salmon taken in the Bering Sea ... presents conceptual problems." Id. The DEIS states that salmon has a cultural existence value to the Native peoples of Alaska. Id. at 627. No one disputes, diminishes, or disrespects the cultural values of Alaska's Native Americans. The problem is that the DEIS contains not one shred of evidence that the Chinook salmon bycatch in the pollock fishery prevents Native peoples from harvesting sufficient Chinook salmon to meet their cultural needs.

Response: The commenter appears to misunderstand the concept of "passive-use" (e.g., as most clearly reflected in the final sentence of the comment). Passive-use values (or, existence values, or non-use values) exist completely independent of, and in addition to, "use-values". Therefore, whether (as the comment asserts) "... the Chinook salmon bycatch in the pollock fishery prevents Native peoples from harvesting sufficient Chinook salmon to meet their cultural needs", is completely irrelevant to the existence, size, and source of non-use values. Furthermore, whether "few" or many people are able to express or even identify attributable non-use values for Chinook salmon taken as bycatch in the pollock trawl fishery is an empirical question, still open to exploration. As such, NMFS has not sought to characterize the size or scope of such non-use values, only identify their probable existence within the context of the proposed Chinook bycatch reduction action. To do the former might bias the assessment. To fail to do the latter would result in an incomplete and technically deficient RIR, based upon the requirements of E.O.12866.

Comment 10-17: Compounding the fundamental analytical defects in the non-use values analysis is the statement in the DEIS that non-use values are measured by contingent valuation methodology ("CVM") and that CVM has been "carefully reviewed and accepted (when employed appropriately) by the federal courts." DEIS at 627, citing Ohio v. United States Department of the Interior, 880 F.2d 432 (D.C. Cir. 1989). The argument appears to be that non-use values must exist as to Chinook salmon because the courts have said CVM is a way to measure non-use values. Such logic begs the question of whether non-use values actually exist as to Chinook salmon. In fact, the DEIS admits there has been no study of non-use values for Chinook salmon and, therefore, non-use values "cannot be further analyzed." Id. at 628.

Even if a CVM study were undertaken, there would be serious doubts about the results. The DEIS, after admitting that the Ohio court found CVM a valid procedure only "when employed appropriately," neglects to mention that no court reviewing a CVM study has found it was employed appropriately. In the only two court cases flowing from the Ohio decision where CVM was employed as a separate basis for damage claims, the courts rejected the results because the CVM analysis produced such unrealistic valuations.

Response: To the extent this commenter argues that contingent valuation method is generally inappropriate, NMFS disagrees but notes that it did not conduct a CVM analysis. The section on Passive-Use Benefits concludes:

> 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. (DEIS at 628, Final RIR Section 5.1.1).

Because monetary estimates of passive uses cannot yet be derived, NMFS has assiduously avoided any suggestion of the potential magnitude of non-use impacts, choosing instead only to identify their likely existence. This is fully consistent with requirements contained in E.O. 12866 and NOAA Fisheries Guidance for Preparation of Economic Impact Analyses.

To the extent that this commenter argues that the non-use values of Chinook salmon are zero, NMFS also disagrees. While the RIR notes that NMFS is not aware of passive-use value estimates specifically for Chinook salmon lost to pollock bycatch in the Bering Sea, there have been several peer reviewed analyses, employing a range of estimation techniques, directed at measuring the passive-use value of Chinook (as well as other species of salmonids). See, for example, Passive Use Values of Wild Salmon and Free-Flowing Rivers. Dr. John Loomis, Agricultural Enterprises Inc. October 4, 1999, and the accompanying references thereto, available at: http://www.nww.usace.army.mil/lsr/reports/misc_reports/passive.htm .

In short, while NMFS notes the likely existence of passive-use values for Chinook salmon, NMFS did not attempt to analyze what those values may be in the context of Chinook taken as bycatch in the pollock fishery since there is no existing information on that issue of which NMFS is aware.

9.11.3 Comments on correcting specific items

Comment 10-18: DEIS Table 10-59 (pg 632) is incorrect. The "windows" subsistence fishing schedule 26 has been in place since 2000 on the Yukon River. This schedule restricts subsistence fishing time throughout the Yukon. Commercial fisheries were greatly reduced from 2003-2007, with harvests well below historical averages. In 2007 the commercial harvest was 33,629 Chinook, 30 percent below the recent 10-year average. These same comments apply to the text on page 633.

Response: NMFS disagrees with the assertion that the Table, now RIR Table 7-4 (also Table ES-14) and the text are incorrect. Regarding the Yukon River, this table specifically states that some key escapement goals were not met but that additional management measures were not put in place during 2003-2007. The "windows" fishing schedule referenced in the comment was depicted in Table 10-32 and as the comment indicates, "has been in place since 2000 on the Yukon River." Thus, the RIR documented this schedule, clearly identifies how it was set for the 2008 season, and notes, in Table 7-4 that no additional management measures were put in place from 2003-2007. Further, the commenter is correct in citing the downward trend in commercial Chinook harvest on the Yukon River. The RIR documents this trend in the Section 3.4 covering Commercial Fishery Situation and Outlook.

In an attempt to clarify what was intended by the summary of potential management implications in DEIS Table 10-59, this table was a revised for the Final RIR as Table 7-4 and DIES Table 10-32 was deleted to eliminate confusion. Changes from the previous version in Table 7-4 include further clarification on the difference between escapement goals on the Yukon and Treaty passage goals with Canada (and resulting

Canadian restrictions), clarification on more restrictive management measures in place prior to (and extending through) the time period being characterized in the analysis (Yukon and Kuskokwim), and specific measures in Norton Sound that were not specified in the previous draft of this table.
Comment 10-19: Correct the phrase "because subsistence enjoys a 'priority use' privilege . . ." used in the DEIS. ANILCA requires that non-wasteful subsistence uses of fish and wildlife resources shall be the priority consumptive use on the public lands of Alaska. Therefore, use of the words "privilege" and "enjoy" is a misrepresentation of the subsistence priority. These words should be deleted. The correct phrase should be "because subsistence is the priority use, superseded only by escapement needs, under both Federal and State regulations. . ."

Response: Comment acknowledged, and the Final RIR has been amended accordingly to provide: "Because the taking on public lands of fish for non-wasteful subsistence uses is accorded priority over the taking on such lands of fish for other purposes, superseded mainly by escapement needs, Chinook salmon bycatch savings from better control and avoidance of Chinook salmon interceptions in the trawl fisheries could accrue to subsistence users."

Comment 10-20: Page 537, last paragraph: It is likely that the subsistence harvests in 2008 was lower than in 2007 because the 2008 Chinook return was the lowest on record. Reference page 2 of ADF&G's 2008 Norton Sound season summary at: http://www.cf.adfg.state.ak.us/region3/finfish/salmon/catchval/08nssalsum.pdf.

Response: NMFS agrees that referenced run summary does indeed identify 2008 as the poorest Norton Sound Chinook salmon run on record. This information has been included in the Final RIR.

Comment 10-21: Page 530, last paragraph: makes a reference to "...approximately 4,500 households residing in 38 communities in the region..." this is incorrect. An accurate accounting of communities and households throughout the affected AYK region needs to be included throughout the EIS.

Response: NMFS agrees that an accurate accounting of communities and households in the AYK region should be included in the analysis and added the following information to the Final RIR in Chapter 3 to better address subsistence issues. According to ADF&G, the subsistence salmon harvests in the Arctic-Yukon-Kuskokwim region have cultural and practical significance to many of the approximately 120 communities, representing approximately 14,711 households and approximately 58,596 residents (in 2007) in the AYK region, in addition to the more than 57,000 residents in the Fairbanks North Star and Denali Boroughs, many of whom also depend upon AYK salmon stocks for dietary and other cultural needs. There are also Canadian residents who rely on AYK salmon stocks.

9.11.4 Comments on impacts to salmon users

Comment 10-22: S.E. Alaska communities are also impacted by bycatch in the BSAI pollock fishery. Communities like Sitka depend on the troll caught winter Chinook that are worth between 8 and 10 dollars per pound.

Response: NMFS acknowledges that some Chinook salmon taken as bycatch in the Bering Sea pollock fishery are of Southeast Alaska, British Columbia Canada, and Pacific Northwest origin. However; the available genetic data is not sufficient to attribute numbers of bycaught Chinook salmon to specific river systems or harvest fisheries. As a result, it is not possible to estimate impacts of past Chinook salmon bycatch, or potential benefits in terms of Chinook salmon that may be "saved" by the proposed action, on harvest fisheries by individual river systems in Southeast Alaska, British Columbia, or the Pacific Northwest. Instead, general trends may be inferred in aggregate for these regions.

Comment 10-23: The DEIS assumes there are benefits to the sport fisheries without conducting any analysis to determine if the facts support that assumption. If the DEIS had done the analysis, it would have discovered there is no factual basis to support the assumption that sport fishermen will derive measurable benefits from restricting the pollock fishery. The facts do not justify the DEIS's assumption that Chinook salmon is a major contributor to in-river sport fisheries, let alone that these fisheries will derive measurable benefits from restrictions on the pollock fishery, particularly given the small numbers of AEQ salmon that would return to the rivers and other end uses of these fish.

Response: Based upon the best available scientific information, NMFS has asserted that the bycatch of Chinook salmon in the pollock fishery 'may' be affecting stocks of western Alaska Chinook and associated subsistence, commercial, and sport fisheries. Our knowledge of these complex ecological, biological, and economic relationships remains incomplete at this time. That being said, these data deficiencies do not remove NMFS's obligation to use the "best available scientific information" to evaluate, in this case, Chinook bycatch reduction alternative actions in the Bering Sea pollock fisheries, and their potential to benefit those with historical Chinook salmon allocation rights, including sport fishermen.

Comment 10-24: The importance of subsistence harvests, and the benefits of reductions in salmon bycatch are well characterized on page 531. This type of qualitative description accurately describes the potential impacts in a manner which many of the quantitative analyses miss and should be repeated and stressed throughout the analysis.

Response: NMFS appreciates the comment and, based on this and other comments, NMFS has revised the discussion on the subsistence harvest of Chinook salmon and the impacts to subsistence users. See Final RIR Sections 3.1 through 3.3 for this coverage.

Comment 10-25: Under any scenario Nome subsistence fishermen will be dealt a heavy blow to their lifestyle and all of western Alaska will carry the entire burden of NMFS management.

Response: NMFS acknowledges the comment.

Comment 10-26: The DEIS does not sufficiently discuss the potential economic impacts to coastal communities. The contribution of the pollock industry to the declining salmon runs in western Alaska is not sufficiently analyzed. While there is a lack of data on certain topics such as determining the river of origin for each bycaught fish, this information is vital to assessing impacts to coastal communities reliant on subsistence harvests. This is particularly important because declining salmon returns have already had impacts on coastal communities. If anything, this lack of data should make NMFS extremely conservative when it comes to assessing allowable bycatch, which is not the case with this EIS.

Response: NMFS cannot provide community-level impact analysis for this action, due to the inability to directly link Chinook salmon bycatch with in-river runs of Chinook in any particular community. The RIR uses the best available information on subsistence (Section 3.2 and 3.3), commercial (Section 3.4), and sport and personal use (Section 3.5) Chinook salmon fisheries, which is provided and presented by region. The section provides extensive background information on the subsistence (and commercial and recreational) Chinook salmon fisheries in western Alaska river systems likely most affected by Chinook salmon bycatch. The regions are based on the ADF&G management areas (Kotzebue, Norton Sound, Kuskokwim River/Bay, Yukon, and Bristol Bay). In addition, information on regions and communities that are dependent on salmon fisheries is provided in RIR Section 5.6.

The estimates of Chinook salmon saved are used as the measure of economic benefits of the alternatives and options, as described in RIR Chapter 5 as well as in the comparative analysis of RIR Chapter 7.

While not possible to resolve on a community level, the analysis states that it is reasonable to assume that any additional Chinook salmon (i.e., 'salmon saved') would benefit escapement and harvest to the identified river systems, and the communities located and/or dependent upon those river systems.

The comment notes the need to assess impacts on coastal communities specifically reliant on subsistence harvests. While NMFS is limited to a regional assessment of potential impacts to subsistence users, NMFS agrees that the analysis needed to further emphasize the significance of subsistence harvests and attempt to identify those communities that have had historical Chinook salmon subsistence harvests. As a result, Section 3.3, Subsistence Harvests by Region, was included in the Final RIR.

Comment 10-27: The DEIS does address the costs of forgone harvest in the pollock fishery but makes no assessment of the costs of forgone subsistence salmon harvests. Unfortunately, the DEIS seems to disproportionately focus on the practicability of bycatch as it relates to the pollock sector. Communities such as Unalakleet have, at various times, forgone subsistence salmon fishing in order to help conserve stocks in the hope of increasing future returns. This is necessary due, in part, to the high incidence of bycatch in the pollock fishery which intercepts Chinook and other salmon prior to them reaching subsistence fishing grounds. There is no such thing as "surplus" fish that can be sacrificed for bycatch because every fish that returns to our rivers is important for meeting our subsistence needs and continuing our traditional way of life. The issue of practicability of bycatch levels becomes much more acute when considering the economic conditions of the remote Alaska communities with comparatively limited food and economic resources.

Response: The Final RIR, in Section 5.1, discusses the difficulties in estimating the costs of forgone subsistence salmon harvests, and the reasons why this assessment was not made. RIR Section 5.1 states that 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 either commercial, subsistence, or sport fisheries.

Exactly how those fish would be used (i.e., in what fishery would they have been caught; whether they would have returned to spawn, etc.) is the fundamental, and very 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 salmon that might be taken in each of the various fisheries is a function of many variables, as discussed in RIR Section 5.1. 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.

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. Making estimates of changes to the gross revenues to the commercial Chinook salmon fishery may even bias the true subsistence value, when the non-monetary value of subsistence harvests is significant and not reflected in terms of gross revenues. In sum, RIR Section 5.1 outlines the reasons why the economic analysis does not provide estimates of a monetary value of forgone subsistence salmon harvests. The analysis relies on a discussion of subsistence use and AEQ estimates of Chinook salmon saved as the measure of economic benefits of the alternatives and options.

Comment 10-28: The bycatch of Chinook salmon has a negative impact to the coastal areas of Bristol Bay, Yukon-Kuskokwim coastal and rivers, Norton Sounds and Canada, that depend on the Chinook salmon resources for subsistence and commercial fishing. The bycatch of Chinook salmon in 2007 is very alarming and it is no wonder that Chinook salmon numbers are declining in these coastal areas.

Response: NMFS acknowledges the comment. The degree to which levels of bycatch are related to declining returns to salmon streams in western Alaska and elsewhere is not well known and the potential benefits of the proposed action, in terms of Chinook salmon not taken as bycatch are analyzed in Final RIR in Sections 5.3 through 5.5.

Comment 10-29: Cumulative impacts on salmon populations, coupled with a lack of a cap on bycatch for BSAI salmon can potentially be devastating to local communities, especially indigenous peoples throughout Alaska, Russia, and Canada, as well as Pacific Northwest residents who were dramatically affected by the Pacific Coast salmon fishery shutdown in 2008.

Response: NMFS acknowledges the comment.

Comment 10-30: The economic analysis does not include the ability of salmon to multiply at an exponential rate. Salmon intercepted by the pollock fishery would have recruited exponentially in the rivers. The analysis does not cover the economic impacts to the coastal communities from the loss of increased salmon returns.

Response: Regarding the impact on numbers of salmon allowed to spawn, NMFS appreciates that salmon spawning output affects subsequent returns. However, the estimates of reduced numbers of returning salmon due to bycatch are provided in the analysis as are escapement goals and directed salmon harvest (subsistence and commercial) levels. The bycatch may more closely affect catch allowances for salmon fisheries since escapement goals are direct management targets (i.e., the managers set the salmon fishery allowance after accounting for the desired level of salmon escapement). If bycatch mortality of returning salmon was completely discounted from escapement levels (i.e., salmon fishery managers did not follow escapement goals) then subsequent returns may be affected. However, the relationship between spawning abundance and subsequent recruitment for nearly all fish stocks (and in particular for salmon) is highly variable due to environmental conditions. This level of variability is much higher than the variability caused by a few percentage point differences in spawning escapement (unless the stock is critically endangered).

Comment 10-31: The dramatic rise in Chinook salmon bycatch by the pollock fishery cannot be allowed to continue to threaten the future sustainability of the Yukon River salmon stocks and the continuation of a subsistence way of life in Interior Alaska.

Response: NMFS acknowledges the comment. The degree to which levels of bycatch are related to declining returns to salmon streams in western Alaska and elsewhere is not well known. Based on the analysis in RIR Section 5.1, the most that can be concluded with available information is that (1) a portion of the salmon caught in the Bering Sea pollock fishery is from the Yukon River, (2) an estimate the amount of that salmon that could return to Yukon under different bycatch levels, and (3) these additional Chinook salmon would have likely increased escapements and contributed to subsistence and commercial harvests. The maximum amount of AEQ Chinook salmon estimated to return to the Yukon under the alternatives would have been 14,938 Chinook salmon in 2007, which can be compared to the 2007 combined subsistence, commercial, and sport catch of 92,876 Chinook salmon in the Yukon River (see Final RIR Table 7-6).

Comment 10-32: The DEIS is written from a commercial fisheries perspective and that is not lost on those whose livelihoods rely on subsistence resources like Chinook salmon. DEIS goes to great lengths to analyze economic impacts the alternatives will have on the pollock industry. No similar approach is taken to estimate the cultural and economic impacts to WAK including the cost of replacing subsistence with store-bought foods. A more comprehensive examination is needed.

Response: NMFS agrees that the analysis provides extensive treatment of a wide range of alternatives and their associated options. This treatment is necessary due to the expansiveness of the alternative set that the Council put forward for analysis in the EIS and RIR. It is also important to recognize that the proposed action is to directly regulate Chinook salmon bycatch in the Bering Sea pollock fishery. Thus, the economic impact analysis is necessarily focused on potential impacts on pollock fishery participants due to the fact that they are the entities that will be directly regulated under the proposed action. A similar approach to estimating impacts on Chinook salmon users is not possible because the alternatives do not directly regulate salmon fisheries.

The analysis does include extensive treatment of existing conditions in western Alaska Chinook salmon fisheries. This information begins in the Final RIR in Chapter 3. This information is presented by river system with further breakout by district where available information warranted. The Norton Sound area for example is further broken down by Shaktoolik and Unalakleet Rivers and the Alaska Yukon river information is provided by district for all six districts. This information was provided to document, to the best of our ability and with the best available scientific information, trends in Chinook salmon catch in Western Alaska subsistence, commercial, sport, and personal use fisheries and serves to inform the Council and the public of those trends.

The analysis also develops estimates of potential benefits in terms of AEQ Chinook salmon "saved" under the alternatives. The benefits estimates are provided (see RIR Table 7-1) for the preferred alternatives and a subset of hard cap alternatives. The analysis also compares AEQ Chinook salmon savings for major river systems (Kuskokwim, Yukon, Bristol Bay) with ADF&G reported commercial, subsistence, and sport catches of Chinook salmon (see RIR Tables 7-5 through 7-8). However, available genetic information does not allow estimation of AEQ Chinook salmon savings at the natal stream level of resolution. Thus, presently available scientific information does not allow estimation of potential increases in escapement or of potential numbers of Chinook salmon that may be made available for harvest in subsistence, commercial, sport, or personal use fisheries. As a result, it is not possible to estimate effects on subsistence food supply, commercial harvest and associated revenue, or sport and personal use catches. It is likewise not possible to estimate effects on fishing opportunities that may occur.

NMFS is not aware of any study, or data source, that documents subsistence household food expenditures in Western Alaska and the available evaluations studies are not a suitable proxy. Furthermore, the value of subsistence use of Chinook salmon in Western Alaska likely exceeds replacement food costs due to the cultural significance of the subsistence lifestyle. Thus, replacement cost estimation is neither possible, nor a true representation of the value of subsistence harvest. Nonetheless, in recognitions of the apparent imbalance in the treatment subsistence uses of Chinook salmon, a reorganizing subsistence information section has been developed and appears in the Final RIR in Sections 3.2 and 3.3. A draft of the new subsistence section was included, and provided to the Council, in the Preliminary Comment Analysis Report as Appendix 9.

Comment 10-33: WAK Chinook salmon fisheries have been severely cut back for several years to the point of complete closure in some districts. Solutions to the bycatch problem have been unfairly placed on salmon fishermen and the burden should be shared by the pollock industry. Any action should place priority on preservation of salmon runs and subsistence fishermen over that of preserving the profits of the pollock fishery.

Response: NMFS acknowledges the comment.

Comment 10-34: In lieu of analysis, the DEIS points to the importance of subsistence. The DEIS asserts that fish comprise as much as 85% (by weight) of the subsistence fish and wildlife harvested in western Alaska and, of that amount, salmon contributes as much as 53%, or 650 pounds per capita (p. 531). The issue is not the importance of subsistence but whether restricting the pollock fishery makes a real difference in the amount of fish that would be available for subsistence.

Response: The purpose of the analysis is to estimate and/or characterize the potential impacts of the alternative measures to minimize Chinook salmon bycatch in the pollock fishery on the levels of Chinook salmon bycatch of in-river returns of adult Chinook salmon. Understanding importance of subsistence to the people that live in western and interior Alaska is fundamental to understanding the impacts of the alternatives on subsistence users because it provides an understanding of the intensity of the unique risks when the degree of possible effects are uncertainty. While NMFS is limited to a regional assessment of potential impacts to subsistence users, NMFS agreed that the analysis should be improved and, to that end, has developed an improved subsistence information section in RIR Sections 3.2 and 3.3.

As explained in the Final RIR in Chapter 5, NMFS cannot provide a quantitative analysis of the impacts on subsistence harvest, due to the inability to directly link Chinook salmon bycatch with in-river runs of Chinook salmon in any particular river system. The RIR uses the best available information, which is provided and presented by region (RIR Chapter 3). This section provides extensive background information on the subsistence (and commercial and recreational) Chinook salmon fisheries in western Alaska river systems likely most affected by Chinook salmon bycatch. The regions are based on the ADF&G management areas (Kotzebue, Norton Sound, Kuskokwim River/Bay, Yukon, and Bristol Bay). RIR Section 5.1 states that 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 subsistence fisheries (or commercial or recreational fisheries) in the various river systems of western Alaska, and further, in any particular community, under the proposed range of alternatives. The analysis relies on a discussion of subsistence use and AEQ estimates of Chinook salmon saved, with a particular focus on river systems in western Alaska, given the ability to resolve some of those river systems singularly. The estimates of Chinook salmon saved are used as the measure of economic benefits of the alternatives and options. The analysis states that it is reasonable to assume that any additional Chinook salmon (i.e., 'salmon saved') would benefit escapement and harvest to the identified river systems, and the individual dependent upon those river systems for subsistence.

Comment 10-35: DEIS does not recognize the subsistence way of life. If the pollock catch is reduced, it costs the fleet money. If salmon do not return to our rivers, subsistence fishermen do not have enough to eat. When the offshore fleet takes salmon without appropriate restraints, subsistence families from the Bering Sea to Canada pay the price. A qualitative analysis of impacts must be included in the analysis to accurately assess the impacts of the proposed action on Native populations.

Response: NMFS agreed that the analysis contained in the DEIS could be improved and, to that end, has developed an improved subsistence information section in the Final RIR in Sections 3.2 and 3.3. Note that NMFS cannot provide a community-level impact analysis for this action, due to the inability to directly link Chinook salmon bycatch to any particular natal stream (due to data limitations). The analysis assesses the amount of 'salmon saved' under each alternative scenario, by river system, but cannot go so far as to assess the number of Chinook salmon saved that would then be used by a particular user group (e.g., subsistence, commercial, recreational salmon fishermen). The Final RIR uses the best available information, which is provided and presented by region (RIR Section 3.3). This section provides extensive background information on the subsistence (and commercial and recreational) Chinook salmon fisheries in western Alaska river systems likely most affected by Chinook salmon bycatch.

Comment10-36: One weakness of the commercial fisheries catch data presented in the DEIS is that there is no distinction for Chinook caught in a directed fishery. This understates the potential impact of returning more Chinook to the nearshore environment were they could contribute to a directed Chinook fishery. The difference in value to the fisherman can be profound. For example on the Nushagak, in 2006 the average price for Chinook in the June directed fishery was $2.50-3.50/lb depending on market, while for the year as a whole it averaged $0.71/lb. Nearly all of the Chinook were caught incidentally in the sockeye fishery at far less value. In 2007, the RIR shows a commercial harvest of 51,350 Chinook, but there was essentially no directed fishery.

Response: NMFS acknowledges that the available commercial catch data does not differentiate between Chinook taken in a directed fishery versus incidentally in a directed fishery for another salmon species. As a result, the available data may, as the commenter asserts, understate the commercial value of Chinook salmon if they were all taken in a directed Chinook salmon fishery. This would be a fundamental problem if the analysis relied on the average price to value potential increases in commercial harvest of Chinook salmon. However, available genetic information does not allow estimation of AEQ Chinook salmon savings at the natal stream level of resolution. Thus, presently available scientific information does not allow estimation of potential increases in numbers of Chinook salmon that may be made available for harvest in commercial fisheries, much less whether they would be taken in a directed fishery or incidental to another fishery. As a result, it is not possible to estimate effects on commercial revenue. Thus, underestimation of potential value is not a problem in the analysis; however, it is an issue to be noted in the historical treatment of commercial Chinook salmon values contained in RIR Section 3.4. NMFS has included this annotation in the Final RIR in the opening paragraphs of Section 3.4, Commercial Chinook Salmon Fisheries by Region.

Comment 10-37: The Magnuson-Stevens Act requires that management "minimize bycatch to the extent practicable." A high Chinook salmon bycatch cap is not practicable for salmon-dependent communities. The DEIS focuses on what is practicable for the pollock sector. The document considers the cost to the pollock fleet if a bycatch cap causes the pollock fleet to forego some of the pollock allowable catch. But there is a stark contrast between wealth in the pollock fleet and small village economies.

Little consideration is given in the document to what is practicable for salmon-dependent villages. Enduring a situation in which there is not enough salmon for subsistence or small-scale commercial harvest, or failure to even meet Yukon River escapement to Canada, is not practicable for the villages. The cultural and economic costs are high to all people living a subsistence way of life along the rivers and especially the Yupik, Inupiaq and Athabascan peoples who have thrived on the land for thousands of years in ways that are inseparable from natural resources including Chinook salmon. That this cannot be measured in monetary terms is not a reason to bypass the effect of continued interception of Chinook salmon in the pollock fishery. Any salmon that is allowed to be taken as bycatch at sea is a reallocation of those fish away from the rivers and the people who historically rely on them.

Response: Comment acknowledged. The EIS and RIR do not offer any final determination on practicability in terms of applying National Standard 9 to the alternatives under consideration or in conjunction with the balancing of all National Standards. Instead, the EIS and RIR endeavor to analyze all impacts from the alternatives in order to disclose such information to the public and provide the decision-makers with the necessary information to balance the National Standards and render a final decision.

NMFS appreciates the comment emphasizing the importance of Chinook salmon to subsistence users and their cultures. With respect to the practicability determination under National Standard 9, NMFS has promulgated guidelines which provide that a "determination of whether a conservation and management measure minimizes bycatch or bycatch mortality to the extent practicable, consistent with other national standards and maximization of net benefits to the Nation, should consider" ten factors, three of which are: changes in the economic, social, or cultural value of fishing activities and non-consumptive uses of fishery resources; changes in the distribution of benefits and costs; and social effects. 50 C.F.R. § 600.350(d)(3)(i) (H)-(J). Further, those guidelines provide that, when faced with uncertainty, the "Councils should adhere to the precautionary approach . . . ." Id. § 600.350(g)(3)(ii). Accordingly, the Council made this determination and considered each relevant factor when it took final action to recommend Alternative 5 as Amendment 91. Likewise, NMFS will make this determination and consider each relevant factor when making the decision to approve, partially approve, or disapprove Amendment 91 and issue the Record of Decision.

Comment 10-38: Not only does the DEIS offer no proof to support its assumption that it is taking subsistence fishermen longer to catch their subsistence harvest and that bycatch is the cause of any such delay, but the DEIS studiously ignores, and does not analyze, other factors that might be contributing to any slower subsistence harvest that may be occurring, such as food limitations, water pollution, habitat degradation, and ichthyophonus. Rather than examining these factors to determine if they are the real cause of any increased time required to take the subsistence harvest, the DEIS just assumes any problem is caused by the pollock fishery.

Response: The EIS and RIR do not assume that the Chinook salmon bycatch in the pollock fishery has caused an increase in the time required to harvest Chinook salmon for subsistence, nor does it explain the many factors involved in the amount of time a given subsistence user spends harvesting Chinook salmon. The EIS and RIR provide information that there is a relationship between Chinook salmon abundance and the length of time necessary to harvest salmon for subsistence as one factor in understanding the costs associated with subsistence harvests. The commenter is misinterpreting the description of existing conditions as an impacts analysis of the status quo level of bycatch. The document makes it clear that, based on existing information, we do not have a causal link between the number of salmon caught as bycatch and the annual in-river abundance of salmon which means we do know how any given level of bycatch would change the amount of time necessary to harvest Chinook salmon. The EIS explains this uncertainty and provides the best available information. The EIS impacts analysis provides an estimate of the number of Chinook salmon saved by major river system under each alternative and the RIR discusses what that could potentially mean to the subsistence users.

However, NMFS recognized the the subsistence information in the DEIS should be augmented. To that end, NMFS has developed a reorganized subsistence information section that appears in the Final RIR in Sections 3.2 and 3.3. A draft of the new subsistence section was included, and provided to the Council, in the Preliminary Comment Analysis Report as Appendix 9.

Comment 10-39: The DEIS does not provide the basic data about how many subsistence fishermen actually have commercial salmon limited entry permits in order to support the assumption in the DEIS that subsistence fishermen could enter the commercial fishery if they could finish their subsistence harvest in less time. At the outset, the claim that this benefit exists hardly seems supportable when it is likely that eliminating the entire Chinook bycatch by the pollock fleet would increase the subsistence harvest by between one-tenth of a fish and 1.7 fish per household in the Norton Sound, Kuskokwim and Yukon regions, and by less than three fish per permit holder in Bristol Bay. The DEIS'S assumption of benefits is further eroded by the fact that a person can participate in the commercial salmon fishery only if that person holds a limited entry salmon commercial fishing permit. If one compares the number of subsistence households with the number of commercial fishing permits, one finds little support for the DEIS'S assumption that subsistence fishermen can shift into the commercial salmon fishery. And assuming 100% of the Chinook salmon bycatch stops, the DEIS does not explain how increasing the subsistence harvest by less than three fish per subsistence permit holder really shortens the time needed to complete the subsistence harvest for a subsistence fishermen.

Response: The commenter has failed to identify text in the RIR that asserts that "subsistence fishermen could enter the commercial fishery if they could finish their subsistence harvest in less time." The RIR identifies current subsistence fishing schedules and, using information from ADF&G annual management reports, identifies the fact that in many areas commercial and subsistence fishing openings do not occur simultaneously. To our knowledge, data linking subsistence fishing households with commercial limited entry permits does not presently exist. Furthermore, the commenter's assertion that this linkage is meaningful is not accurate for several reasons. First, it ignores the fact that each limited entry permit holder may have crew members, several in some cases, which may also be members of separate (from the limited entry license holder) subsistence use families. There is no data collection mechanism in place to document crew member participation by limited entry permit. Furthermore, the crew member's home address, as identified on the crew member license, may not be in close proximity to the location of the commercial and/or subsistence fishery they participate in. Second, the assertion ignores the reality that subsistence harvesting activities are highly collaborative. In extended families there may be several subsistence families working together and the funding of their subsistence harvesting activity (e.g. fuel and equipment costs) may be dependent on commercial fisheries revenue from a single limited entry permit holder, or even a single commercial crew member. For these reasons, the assertion that there is a direct relationship between limited entry licenses and numbers of subsistence families is without merit.

Comment 10-40: The DEIS, without explanation or analysis, states that Chinook bycatch reduction could be "quite important" to commercial fishermen. DEIS at 629. Given the minimal contribution of Chinook salmon to western Alaska commercial salmon fisheries, and the small amount of AEQ fish that would actually return to western Alaska, the DEIS'S optimism is without factual foundation. The DEIS assumes benefits will flow to commercial salmon fishermen and bases the bycatch reduction plan, in part, on that assumption. However, the DEIS contains no analysis to support that assumption. If the DEIS had done the analysis, the DEIS would have found the facts do not support the assumption that commercial salmon fishermen will benefit from restrictions on the pollock fishery. Apparently doubting whether the facts support its assumption, the strongest statement in the DEIS on this issue is that an increased number of in-river Chinook "may" enhance commercial fishery opportunities. DEIS at 629.

The assumption that commercial fishermen will benefit from Chinook salmon bycatch reduction fails for three reasons. First, the AEQ mortality by river system is so small that eliminating 100% of the Chinook bycatch in the pollock fishery will offer little benefit to commercial salmon fishermen. In fact, the increase in the number of fish taken by commercial fishermen would be less than one to under three fish annually per commercial fisherman depending on the area. This is hardly the economic boom assumed in the DEIS. Second, in many river systems commercial Chinook salmon fisheries "have not occurred in recent years." DEIS at 626. There can be no expectation that a commercial fishery will suddenly become a possibility if a bycatch reduction plan is implemented, particularly given the low numbers of additional Chinook that would return to rivers. Third, Chinook salmon is simply not a large contributor to the in-river commercial fishery and to the income of commercial fishermen relative to income from other salmon fisheries. Reductions in Chinook salmon bycatch in the pollock fishery will, even under the most optimistic hopes, have only limited effects on the income of in-river commercial fishermen. Even then, it is difficult to see how successful a commercial fishery for Chinook salmon could be given the high levels of ichthyophonus infestation in western Alaska rivers such as the Yukon.

Response: The commenter prefaces the argument challenging statements, contained in the RIR, regarding the potential importance of commercial Chinook salmon harvests in western Alaska with the statement "Given the minimal contribution of Chinook salmon to western Alaska commercial salmon fisheries..." NMFS disagrees with this assertion. The statement ignores the fact that historically the numbers and value of Chinook salmon taken in Western Alaska commercial fisheries have been considerably larger than at present. Further, the commercial value of Chinook salmon catches has historically represented a large proportion of total commercial salmon fishery value in several regions. This fact is clearly documented in the Final RIR in Section 3.4.

RIR Chapter 3 depicts a trend of sharp declines in commercial Chinook salmon catches during the late 1990s and through the 2000s in all regions of Western Alaska except Bristol Bay. These declines coincide with increased salmon bycatch in the Bering Sea pollock fisheries and available genetic data has linked Chinook salmon taken in the Bering Sea pollock fishery with the major river systems of the Kuskokwim, Yukon, and Bristol Bay. A lack of genetic data precludes linkage to Norton Sound. Thus, the statement "Given the minimal contribution of Chinook salmon to western Alaska commercial salmon fisheries..." is incorrect in light of the factual historic information provided in the analysis.

The commenter goes on to say "...and the small amount of AEQ fish that would actually return to western Alaska, the DEIS'S optimism is without factual foundation." The analysis contained in the RIR Chapter 7 provides a comparison of the AEQ Chinook salmon savings, by river system, with the numbers of Chinook salmon caught in subsistence, commercial, and sport fisheries (See RIR Tables 7-5 through 7-8). The AEQ Chinook salmon savings estimates will, of course, show the highest numbers of salmon saved in years when the bycatch is highest, and considerably smaller numbers when bycatch is relatively low. A careful review of RIR Table 7-8 shows that in 2007, the highest bycatch year, the AEQ Chinook salmon savings for the Kuskokwim, Alaska Yukon, and Bristol Bay combined, under the most restrictive hard cap, would have been 37,345 fish, which is nearly 40 percent of the total commercial harvest of 96,483 Chinook salmon for that combined area in 2007. It is true that when disaggregated to river systems these numbers appear small. However, the fact remains that in the highest bycatch year in the analytical timeframe and under the most restrictive hard cap 40 percent of the commercial harvest in 2007 would have been returned to Western Alaska rivers as adults. Thus, the statement made by the commenter that "Given....and the small amount of AEQ fish that would actually return to western Alaska, the DEIS'S optimism is without factual foundation" is, itself, without factual foundation. Furthermore, 40 percent of the total commercial catch of Western Alaska Chinook salmon is clearly an "important" amount of potential commercial harvest. In light of the factual information provided above, NMFS disagrees with the assertion of failure on the three parts offered by the commenter.

Comment 10-41: The DEIS contains no analysis to support its assertion that if there were more Chinook salmon in Alaska's rivers, the time and resources expended by subsistence fishermen to meet their subsistence needs would be reduced, thus allowing subsistence fishermen to pursue other subsistence or income producing activities. DEIS at 531, ES 21. Given that the benefit of catching subsistence fish faster is the principal benefit relied upon to justify severe restrictions on the pollock fishery, it is curious that the DEIS offers no proof to support the existence of this benefit. The DEIS does not, for example, provide even the most basic data to show that subsistence fishermen are actually needing more time to catch their subsistence harvest, let alone that any such delay is caused by the loss of between one-tenth of a fish and three fish a year to pollock bycatch.

Response: The text included in the executive summary, states that "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." This information is taken directly for ADF&G official run summaries and represents the official reporting of subsistence harvest conditions. It is logical to assume that if more time is needed to harvest needed subsistence catch that less time will be available to subsistence harvesters for other opportunities, such as in wage earning employment.

Comment 10-42: Adequately assess the full direct, indirect, and cumulative impacts to the subsistence way of life for western and Interior Alaska villages. Little attempt was made to address the impacts of the alternatives on subsistence users. The ADF&G Subsistence Division would be an invaluable asset to help NMFS improve the significant deficiencies throughout the DEIS.

Response: NMFS agrees and provided a more complete description of subsistence users their Chinook harvest, and the significance of this fishery to western Alaska in the Final RIR. Subsistence uses of wild resources are defined in Alaska state law as 'noncommercial, customary, and traditional uses' for a variety of purposes, including: direct personal or family consumption; for the making and selling of handicraft articles out of non-edible byproducts of resources; and for the customary trade, barter, or sharing for personal or family consumption. The analysis has been revised to better emphasize that subsistence is a complex system that is tied to Alaska Native peoples food, traditions, and culture, and typically involves the community, not just the individual fisherman. We have developed a reorganized subsistence information section that appears in the Final RIR in Sections 3.2 and 3.3.

NMFS cannot provide community/village level impact analysis for this action, due to the inability to directly link Chinook salmon bycatch with in-river runs of Chinook in any particular community. The Final RIR uses the best available information, which is provided and presented by region (RIR Section 5.3). This section provides extensive background information on the subsistence (and commercial and recreational) Chinook salmon fisheries in western Alaska river systems likely most affected by Chinook salmon bycatch. The regions are based on the ADF&G management areas (Kotzebue, Norton Sound, Kuskokwim River/Bay, Yukon, and Bristol Bay). In addition, RIR Section 5.1 states that 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 subsistence fisheries (or commercial or recreational fisheries) in the various river systems of western Alaska. This section notes that while it is difficult to assess the specific impacts of additional AEQ Chinook to a given river system, it is reasonable to assume that any additional fish would benefit escapement and harvest.

Comment 10-43: moved to comment 1-6

Comment 10-44: How can any American defend giving Japan and Norway more fishing quotas than the local villages?

Response: This question is out of the scope of the management measures currently being considered. NMFS notes that this document is intended to provide decision-makers and the public with an evaluation of the predicted environmental, social, and economic effects of alternatives measure to minimize Chinook salmon bycatch in the Bering Sea pollock fishery.

9.11.5 Comments on the importance of salmon and existing conditions

NMFS acknowledges the following comments on the importance of Chinook salmon and the current status of the Chinook salmon resource and the individuals who rely on Chinook salmon.

- The 2008 Chinook salmon run was very poor on the Yukon River, as well as throughout Western Alaska. On the Yukon, subsistence fishing time was reduced by half in Alaska part way through the season, and people met 40 percent of less of their subsistence needs in some places. In Canada, subsistence (aboriginal) fishers voluntarily restricted themselves to half of their historic take. In one community these voluntary restrictions resulted in a total Chinook harvest of only 160 Chinook salmon. The aboriginal harvest for the entire Canadian portion of the run was 2,766 fish, based on preliminary data. There was no directed commercial Chinook salmon fishery on the Yukon in 2008, and the commercial chum fishery was delayed to allow Chinook salmon to pass through, reducing the chum salmon harvest as well. Despite these restrictions, estimated

Chinook salmon spawning escapement into Canada was only 32,700 fish, 27 percent below the Yukon River Panel agreed upon goal of 45,000 fish. The outlook for this coming summer is no better: ADF&G and U.S. Fish and Wildlife Service are preparing users for further subsistence restrictions in 2009, and have already stated that it is unlikely that a commercial Chinook salmon fishery will be allowed. Fishermen and women throughout the watershed are participating in teleconferences to develop management measures which can be used to restrict their own subsistence harvest to provide escapements to ensure health salmon runs in the future.

- Many Yukon River drainage fishers have been reluctant to consider in-river regulatory gear changes. When they see that, in 2007, approximately 29,000 Yukon River-bound Chinook salmon were harvested as bycatch in the BSAI pollock fishery. That bycatch amount equates to 57% of the total U.A. Chinook salmon subsistence harvest in the Yukon River, and exceeds the 2007 Canadian border passage mark/recapture estimate of 24,000 Chinook salmon. In 2008, the spawning escapement goal in Canada of not less than 45,000 Chinook was not met. The 2009 salmon run is projected to be very low, with restrictions on subsistence fishing and no commercial fishing likely.

- In the past, Chinook salmon provided not only for summer and fall subsistence harvest, but also as a source for jobs for many youth in villages in the region. Before 1998, commercial fishermen had harvest guidelines up to 225,000 Chinook salmon. Last year, there was not Chinook fishery. Commercial fishermen harvested approximately 4,000 Chinook only in incidental catches to the chum fishery. Before 1998, the subsistence fishermen would achieve their goals relatively quickly after the arrival of the Chinook salmon. Now, it takes longer due to the harvest windows and areas restrictions, which limits time available to pursue other critical activities essential to subsistence based life.

- A healthy and thriving salmon fishery is vital to the Native communities of the Yukon and Kuskokwim Rivers' traditional subsistence way of life. Chinook salmon is the major harvested fish for people of the Yukon and Kuskokwim Rivers. The Native villages of the area are among the poorest in the United States as measured by monetary income and jobs. The Lower Yukon and Lower Kuskokwim Rivers also support a small commercial salmon fishery that serves as a crucial income source for the people who live there. However, Chinook and other salmon fisheries are in decline on the Yukon River and the State has shut down the commercial fishery due to poor runs. As a result, the Yukon River communities have lost a major income source from commercial salmon fisheries.

- Subsistence users carry the burden of conservation, even though the causes of the salmon decline are definitely not the result of our subsistence users along the Yukon River. To our understanding, there may not be enough Chinook salmon for our subsistence users this coming summer. Since the mid 1980's, subsistence users have been first hand dealing with the task of rebuilding our salmon stocks by reducing the amount of salmon available for subsistence fishing.

- The subsistence and commercial in-river fishermen and their communities are incurring extreme expense from the increasing fishing restrictions, high fuel costs, and their decreasing catch per unit of effort from the pollock fishery's salmon bycatch. Rural villages are declining in population because of the increasing high cost of living in rural Alaskan communities. Couple these challenges with the declining size of the returning Chinook salmon and fewer large females reaching the spawning grounds and we may be looking at a serious conservation concern that may result in a serious burden on subsistence fishermen that they are unable to withstand.

Continuation of a subsistence way of life and the economic underpinnings of our villages depend on viable and sustainable salmon stocks.

- Salmon is an irreplaceable resource that must be protected by all means. The recent high salmon bycatch in the pollock fishery threaten salmon and the Alaska Native way of life. Salmon serves an important cultural and economic role in Alakanuk and throughout Western Alaska. Salmon provides a primary source of food for local residents, and the commercial salmon harvest provides the only means of income for many who live in the remote villages of the Yukon River.

- Chinook salmon are a fully allocated species, vitally important to subsistence, commercial, and recreational users throughout Alaska. They remain a cornerstone resource in meeting the needs of rural Alaskans, and have been the foundation of subsistence and commercial economies in remote Alaska for many generations.

- Significant reduction in bycatch is necessary to preserve the subsistence way of life. The incredibly high bycatch numbers associated with the pollock fishery in recent years is alarming to say the least. Bycatch of Chinook salmon threatens the western Alaska salmon populations and those that depend on these salmon to maintain their subsistence way of life as well as commercial harvests. Those in the western Alaska villages are witnessing a troublesome decline in what was once a sustainable subsistence harvest. Additionally, because of the decline, regulation of subsistence fisheries continues to tighten, increasing the difficulty for families to harvest salmon, especially in upriver villages. The continued interception of Chinook salmon in the Bering Sea will continue to keep these traditional fisheries depressed.

9.11.6 Comments on consumers and markets

Comment 10-45: Pollock buyers have been willing and able to accept supply uncertainty due to changing biomass size, the type of uncertainty and risk associated with bycatch-related closures will likely cause some of the large end-users to shift usage from pollock to other species. Chapter 10 suggests that if the pollock fishery were shut down prematurely due to a hard bycatch cap or if the fishery were unable to catch the quota due to a large area closure, there would be a loss of revenue due to the forgone production, but that loss would be mitigated by an increase in price as a result of the reduced supply. This severely understates the negative impact of such a closure on the market for U.S.-produced pollock products. We believe strongly that a bycatch management system which substantially increases the risk that the fishery will be closed prior to reaching the quota with little or no advance notice removes the strongest advantage the fishery holds in world wild whitefish markets, the reliability of the supply. Without the confidence that the quota will be taken, large restaurant chains and large processors that produce breaded and battered products will be unwilling to enter into long-term agreements or create marketing campaigns or promotions that require a stable supply of raw material. Single-frozen pollock fillet blocks from the U.S. fishery will lose their current advantage in the marketplace and large customers who are unwilling to risk abruptly running out of product will convert to the more reliable supplies of aqua-cultured finfish or simply drop whitefish menu offerings altogether. The negative effect on prices and quantities demanded from the fishery would be dramatic-and perhaps permanent.

Response: It is not disputed that a reduction in harvest of pollock would have impacts on pollock product supply in domestic and export markets. The RIR qualitatively discusses the general implications for markets and consumers. However, presently available data and models do not allow estimation of consumer surplus and/or producer surplus in final product markets and these measures are the appropriate economic welfare measures to consider. See response to comment 10-99.

More importantly, the proposed action is not to close the pollock fishery it is to incentivize the avoidance of Chinook salmon bycatch and that is why the impacts are reported as potentially forgone revenue or revenue at risk, depending on alternative. The RIR does not identify these impact estimates as lost revenue specifically because mitigation of the impacts via harvesting behavior changes are expected as that is the point of incentivizing avoidance of prohibited species bycatch. Furthermore, the Council's preferred alternative, Alternative 5, modifies the strict hard cap formulations contained in Alternative 2 by including provisions for an industry managed IPA to reduce Chinook salmon bycatch to levels below the strict hard cap via industry derived incentives and a performance standard. Clearly, the Council's intent is to incentivize Chinook salmon bycatch avoidance in order to minimize bycatch and the hard cap used in the potentially forgone revenue analysis is one part of the incentive. The implication is that the pollock industry will change behavior so that they do not face all of the potential forgone revenue, and/or revenue at risk estimated in the analysis as direct losses in revenue due to direct contraction in pollock harvest.

Comment 10-46: Closure of the directed pollock fishery due to Chinook salmon bycatch regulations would deprive the U.S. and world of substantial quantities of high-quality, relatively low-cost protein. Assuming an average of four ounces of fish per meal, for every 100,000 mt of pollock lost, we forego protein for more than 250 million meals, or enough to feed the combined populations of Dallas, Detroit, Indianapolis, Seattle, San Francisco, and Anchorage one meal per week for an entire year. Source: National Marine Fisheries Service Processed Product Reports.

Response: It is not disputed that a reduction in harvest of pollock would have impacts on pollock product supply in domestic and export markets. The RIR qualitatively discusses the general implications for markets and consumers. However, presently available data and models do not allow estimation of consumer surplus and/or producer surplus in final product markets and these measures are the appropriate economic welfare measures to consider. See response to comment 10-99.

More importantly, the proposed action is not to close the pollock fishery it is to incentivize the avoidance of Chinook salmon bycatch and that is why the impacts are reported as **potentially** forgone revenue or revenue **at risk**, depending on alternative. The RIR does not identify these impact estimates as **lost** revenue specifically because mitigation of the impacts via harvesting behavior changes are expected as that is the point of incentivizing avoidance of prohibited species bycatch. Furthermore, Alternatives 4 and 5 modify the strict hard cap formulations contained in Alternative 2 by including provisions for an industry incentive plan to reduce Chinook salmon bycatch to levels below the hard cap via industry derived incentives. Clearly, the Council's intent is to incentivize Chinook salmon bycatch avoidance in order to reduce it and the hard cap used in the potentially forgone revenue analysis is one part of the incentive. The implication is that the pollock industry will change behavior so that they do not face all of the potential forgone revenue, and/or revenue at risk estimated in the analysis as direct losses in revenue due to direct contraction in pollock harvest.

One final response to this comment is in order. The RIR was developed in compliance with Executive Order 12866. The Executive Order specifies a cost-benefit analytical framework, either qualitatively or quantitatively where possible, and consideration of the implications for net national benefits. It is important to understand that the Office of Management and Budget has determined that effects on non-us citizens do not enter into the net national benefit calculation defined as the appropriate analytical metric in Executive Order 12866. Thus, implications on world markets, world food supply, and non-US consumers are not appropriate considerations in the analysis contained in the RIR.

Comment 10-47: The DEIS does not consider or evaluate the market implications of premature closures or the effects such closures would have on the U.S. balance of payments in seafood products. Nor does it consider the effect that such closures would have on the viability of members as reliable suppliers to the world market for seafood. The DEIS is devoid of such considerations even though food production and seafood exports were principal objectives of Congress when the Magnuson Act was passed in 1976, and when the "maintenance of optimum yield on a continuing basis" requirement of National Standard 1 was first implemented.

Response: As discussed in response to comment 10-46, the appropriate metric for evaluation in a RIR is the cost-benefit metric with a consideration of effects on net national benefits. The U.S. Balance of Payments is an accounting metric that is outside the scope of the required economic analysis. And, as pointed out in the response to comment 10-46, the world market for seafood products is also not an appropriate consideration in an RIR. As to the viability of seafood suppliers, we reference the discussion in response to comment 10-46 regarding the intent of the Council to incentivize Chinook salmon bycatch avoidance as opposed to an intent to prematurely close the pollock fishery.

Comment 10-48: The DEIS fails to analyze the job loss and revenue implications of the market disruption that will occur because of additional bycatch restrictions. The DEIS ignores the fact that "forgone revenue" comes from forgone product - and forgone product means end use purchasers will need to secure alternative sources of supply. Forgone product of the magnitude envisioned by Alternatives 2-4 will cause end use purchasers to turn away from the Alaska market as a source of supply, multiplying the economic impacts and hardships caused by Alternatives 2-4. Again, the DEIS does not even recognize the issue, much less analyze it. The net result for Alaska, its workers, and the nation, is that Alaska's fish products will not be as desirable as they are today. Simple supply and demand economics means prices for Alaska's fish will fall. The well settled business principle that end users need assured supplies to support production lines and marketing programs means less demand and fewer purchase orders. Lower prices and less demand means fewer jobs. It also means lower revenue for those who remain in the fishery. Finally, it means lower revenue for CDQ communities and for other communities that depend on fish taxes. And absolutely none of these issues are considered in the DEIS.

Response: The statement that the "The DEIS ignores the fact that "forgone revenue" comes from forgone product - and forgone product means end use purchasers will need to secure alternative sources of supply" is a misstatement of fact. The EIS evaluates the effect of the alternatives on pollock harvest. The RIR then converts potential forgone pollock harvest to potential forgone revenue using the round weight equivalent first wholesale price per metric ton of retained pollock harvest (see response to comment 10-71 for more information on prices used in the analysis). Thus, the analysis addresses potential forgone revenue at the first wholesale product market level, which clearly identified potential effects on all first wholesale products derived from Bering Sea pollock.

As indicated in the response to comment 10-46, the proposed action incentivizes bycatch avoidance and identifies "potential" forgone revenue with the expectation that industry will attempt to mitigate these losses by avoiding bycatch. Thus, these impacts are worst case upper bound impacts and would only occur if industry does not modify harvesting behavior to avoid Chinook salmon bycatch. As such, the commenter's assertion of a cascading negative effect on pollock markets relies on a series of questionable assumptions. First, given the large size of the pollock fishery, it is no simple matter for world purchasers to "turn away" from Alaska pollock. It is just as likely that contraction in pollock supply will drive pollock prices up considerably. An increase in pollock prices were observed, for example, in 2007 when TAC was reduced and comments 10-85 have asserted significant price increases have occurred since 2005. Thus, it has been observed that contraction in pollock supply, as predicted by basic supply and demand economics, drives prices up, not the other way around. As a result, assertions of job losses due to reduced prices are questionable and NMFS does not agree with this highly assumptive projection of impacts in absence of consideration of the likelihood that industry will modify harvesting behavior to minimize Chinook salmon bycatch when faced with a binding constraint of a hard cap.

Comment 10-49: Forgone revenue does not capture the impact that unanticipated interruption in the production of pollock-based products would have on the market for the products produced by the nation's largest fishery or on the role that Alaska pollock currently plays as the "'whitefish of choice" in seafood markets around the world. In terms of food production alone, every one thousand tons of forgone pollock catch equates to approximately 2.4 million meals of low-cost seafood that would otherwise be available to US and other consumers around the world. In terms of food production alone, every one thousand tons of forgone pollock catch equates to approximately 2.4 million meals of low-cost seafood that would otherwise be available to US and other consumers around the world. Based on recent catch and bycatch rates as depicted in the DEIS, the difference between a "hard" bycatch cap of 68,392 and a cap of 47,591 Chinook could result in hundreds of thousands of tons of forgone pollock harvest. To put that in perspective, each hundred thousand tons of forgone harvest represents enough raw material to provide every man, woman and child in Alaska a seafood dinner once a week for more than seven years. The forgone revenue analysis fails to disclose that such a stunning reduction in seafood production would result from the choice of one cap over the other. It must be remembered that seafood production is one of the most important objectives insofar as National Standard 1 of the Magnuson Stevens Act is concerned.

Response: The RIR does discuss market implications; however, presently available data and models do not allow estimation of consumer surplus and/or producer surplus in final product markets, and these measures are the appropriate economic welfare measures to consider. It must also be remembered that in balancing National Standard 1, the Council must consider National Standard 9 which requires minimization of bycatch to the extent practicable. It is up to the Council, and ultimately the Secretary of Commerce, to determine the practicable level of Chinook salmon bycatch reduction in consideration of all of the national standards.

NMFS disagrees with the characterization of potentially forgone pollock harvest as potential pollock consumption in Alaska. Very little pollock harvested in the Bering Sea is consumed in Alaska. Much of the product is exported, as the commenter has already confirmed in several related comments on importance of pollock in world markets. As has been pointed out in the response to comment 10-46, it is inappropriate for a RIR analysis to consider effects on pollock harvest that accrue to non-us citizens. Thus, this characterization is misleading at best as few Alaska resident consumers benefit directly from pollock production.

Comment 10-50: The DEIS ignores the fact that the U.S. exports close to $1 billion of Bering Sea pollock products annually to countries around the world. "Forgone revenue" comes from less product, and fewer exports means an increased U.S. trade deficit. The DEIS does not analyze this issue.

Response: NMFS disagrees that the RIR ignores the importance of exports of pollock fishery products. RIR Section 2.3 provides data compiled by the Alaska Fisheries Science Center on the Market Disposition of Alaska Pollock, which includes discussion of exports. Furthermore, as discussed in response to comment 10-46, the appropriate metric for evaluation in a RIR is the cost-benefit metric with a consideration of effects on net national benefits. The U.S. trade deficit is an accounting metric that is outside the scope of the required economic analysis. And, as pointed out in the response to comment 10-46, the world market for seafood products is also not an appropriate consideration in an RIR.

Comment 10-51: On page 702, the reader is led to believe that welfare changes cannot be measured with current information about the demand for different fish species and products. Yet, for the past 30 years NMFS has collected and analyzed information about fish prices and the quantities consumed by the public. Indeed, NMFS is the nation's pre-eminent source for information about seafood markets and trade. The current version of the Economic Status of the Groundfish Fisheries Off Alaska, 2008, produced by the NMFS Alaska Fisheries Science Center, is approximately 300 pages and documents the prices paid and catch quantities landed for all groundfish off Alaska (Hiatt et al. 2008). The current Fisheries of the

United States 2007 (NMFS 2008) includes data and information on U.S. commercial fishery landings, world fisheries, U.S. production of processed fishery products, U.S. imports, U.S. exports, and the U.S. supply fishery products, including per-capita estimates of consumption and value added. It is not correct to state that welfare changes cannot be measured with the available information. The DEIS simply does not do the analysis.

Response: The ability to mathematically derive welfare measures is fundamentally dependent upon empirical data on, among others, input prices, costs, capital investment, debt service, consumer demand, sources of supply, market structure, substitutes and complements, measures of consumer responsiveness to changes in price, quantity, quality, income, tastes, and preferences. Exogenous factors also influence rigorous derivation of these welfare measures, such as, currency exchange rates, tariffs, political and economic instability. Very few of these necessary data are available to NMFS, at present. NMFS does not have data to estimate net impacts until such time the Council develops a socioeconomic data collection program that requires the industry to submit cost data under new MSA authority. At present, the analysts must employ methods and strategies predicated on extremely limited data and virtually non-existent economic modeling of these resources and uses.

Comment 10-52: The DEIS also fails to recognize, let alone analyze, the inflationary and consumer impact of "forgone revenue." Revenue is forgone because there is less product to sell. Basic supply and demand principles suggest the consumer is the victim in that the consumer will now pay higher prices.

Response: The RIR does discuss the potential for effects on consumers (RIR Section 6.3) and identifies that reductions in product supply will likely lead to inflationary pressures on prices, resulting in improvements in producer surplus that will, to an unknown extent, offset reduced consumer surplus. However, as pointed out in the response to comment 10-51, our ability to mathematically derive these changes in welfare measures is limited by a lack of data on industry costs. Both comments cite "basic supply and demand principles" for these assertions.

Comment 10-53: The DEIS provides even less information about changes in consumer welfare than it does about producer welfare. The only mention of consumer surplus is a brief summary of the results of several studies on the estimated values of subsistence and sport catches of salmon. DEIS at 532. Apparently, the results are dismissed simply because they show very low implicit values (consumer surplus) for subsistence and sport-caught salmon. The only mention of consumer benefits is the single occurrence within a brief discussion about costs to consumers. DEIS at 702. As such, the DEIS contains no information about the potential for and/or scale of the changes in consumer welfare that may accompany the bycatch management alternatives. DEIS at 702. In particular, the DEIS contains no mention of the suspected size of the changes in U.S. consumer welfare for any alternative of lower pollock catches, or how these changes might compare to changes in the welfare of salmon users due to assumed increases in Chinook salmon returns to western Alaska river systems.

The DEIS goes on to state that: 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. DEIS at 702. However the market conditions under which this assertion could be considered even approximately correct are so restrictive that the statement does nothing but mislead the public (e.g., see Just, Hueth, and Schmitz, Chapter 9 Multimarket Analysis and General Equilibrium Considerations).

Response: The RIR examines the few available studies that have attempted to value subsistence and sport caught catches using non-market analysis methods in Section 5.1. The RIR provides a clear reason why a "benefits transfer" approach is not appropriate in this case. The DEIS at page 532 stated:

> "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. 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."

Note that the actual value of the consumer surplus estimates was not mentioned. Thus, the commenter's assertion that "the results were dismissed simply because they show very low implicit values (consumer surplus) for subsistence and sport-caught salmon" is not a statement of fact and seriously misrepresents what is contained in the RIR.

The remainder of the comment has previously been treated. See responses to comments 10-51, 10-52, and 10-83. However, this comment and others regarding the coverage of the importance of subsistence contained in DEIS Chapters 9 and 10 indicated a need to combine those treatments and clarify the importance of subsistence to Western Alaska residents. Initially that re-draft was provided in an appendix to the Preliminary CAR and was subsequently inserted in the Final RIR in Section 3.2 and 3.3. The new information contained in section 3.2 replaces the quoted text identified above and provides considerably expanded treatment of subsistence use.

9.11.7 Comments on other costs

Comment 10-54: Monitoring of hard caps on an individual vessel by vessel basis will require additional observers. DEIS should evaluate the number of extra observers needed to monitor vessel-specific salmon bycatch numbers and the costs associated with such extra coverage.

Response: The Final RIR in Section 6.4.1 evaluates the number of extra observers necessary under the alternatives and the costs associated with that extra coverage.

Comment 10-55: These economic costs, never examined by the DEIS, represent only one part of the overall costs of being forced to travel long distances to fish. The economic costs pale in comparison to the possible human costs. The Bering Sea is a dangerous place at any time of the year. In the winter "A" season, it is particularly forbidding. Forcing fishermen to travel farther in freezing temperatures and icing conditions increases the risk of injury and loss of life, issues the DEIS does not examine except to say this might be an issue. Human safety is indeed an issue, codified in National Standard 10 of the MSA, 16 U.S.C. § 1851(a)(10).

Response: The RIR does discuss vessel safety (Section 6.2) and NMFS acknowledges that human safety is of critical importance in the management of fisheries. Unfortunately, it is not possible to predict the changes in behavior that the industry might undertake to avoid Chinook salmon bycatch and the effect on vessel, and human, safety. It is important to recognize that the AFA pollock fishery is a rationalized fishery operating under a cooperative structure. A careful review of the alternative set reveals that Alternatives 2, 4, and 5 contain provisions for cooperative level allocations, rollovers, and transfers. Thus, the alternative set includes measures to mitigate the possibility for a "race for fish" that could occur under unallocated bycatch caps. These provisions also provide some mitigation of the associated impacts on vessel, and human, safety that might exist if a "race for fish" were created due to a bycatch cap.

Comment 10-56: The costs and lost revenues that have been incurred by the pollock fleet over the years, and those that will be incurred to avoid and minimize Chinook bycatch in the future have not been adequately characterized in the DEIS. The industry has independently changed fishing practices in an effort to reduce salmon bycatch. They have developed the salmon excluder device for their trawl gear, and they have voluntarily closed areas even though such closures have reduced revenues and increased expenses. The industry, through Sea State, Inc., has developed a real-time monitoring system for the fleet. The harvesters have also developed and implemented all of the inter-cooperative agreements and continue to work on incentive plans to reduce Chinook bycatch, and they have participated in funding many other research projects. These costs and lost revenues have been and will continue to be huge.

Response: NMFS acknowledges the attempts that industry has made to avoid Chinook salmon bycatch. In fact, the Final RIR in Section 2.4 contains most of the content of the Sea State report to the Council on the operation of the Voluntary Rolling Hotspot System through 2007. Unfortunately, cost of production data with which to evaluate the costs to industry of their efforts to avoid Chinook salmon bycatch via the VRHS has not been provided by industry. Thus, it is not possible to estimate operating cost impacts of the VRHS system or of similar costs that might occur under the alternatives under consideration in the proposed action. NMFS acknowledges the work the industry has undertaken to develop, and maintain, the intercooperative agreements. And, while it is understood that those activities are not costless, the information needed to assess these costs, such as attorney fees and contracted bycatch monitoring fees are proprietary and have not been provided by industry. Finally, NMFS also acknowledges the work that has been done to develop salmon excluder devices. However; such devices are in experimental stage of development and it is not presently clear how effective they will be, how may vessel operators will voluntarily use them, and what average reduction in bycatch might be brought about via their use.

Comment 10-57: The DEIS suggests that pollock fishing vessels, catcher processors and/or motherships can mitigate losses imposed by salmon bycatch caps by shifting to other groundfish fisheries. DEIS at 692. The DEIS is wrong. The opportunities for pollock vessels to participate in non-pollock fisheries have been severely limited by (1) the "sideboard" restrictions imposed on pollock fishing vessels and processors by Section 211 of the AFA, 16 U.S.C. § 1851, Note, (2) restrictions imposed by the license limitation provisions of the BSAI Groundfish Fishery Management Plan, (3) the provisions of Amendments 80 and 85 that allocate opportunities to participate in non-pollock groundfish fisheries to vessels that do not also fish for pollock, and (4) Steller sea lion mitigation measures that establish seasonal restrictions on the fishery. The net effect of these "sideboards" and other restrictions is that pollock vessels and processors cannot make up lost pollock harvest by transferring to new groundfish fisheries.

Response: NMFS acknowledges that the ability of AFA pollock vessels to shift to other groundfish fisheries is limited by the cited regulatory amendments and sideboards. However, the RIR did not assert that pollock operations could switch to a new groundfish fishery. The RIR states that pollock vessels may mitigate by "...(3) switching to a different target fishery (e.g. yellow fin sole)." It is true that AFA pollock operations have very limited access to other groundfish fisheries in the Bering Sea and that situation has been acknowledged in the EIS and RIR.

Comment 10-58: The DEIS fails to consider the loss in value of the raw fish due to decreases in fish quality caused by the extended travel time that would be required to deliver the fish to the processor.

Generally, a catcher vessel seeks to deliver its fish within 48 hours of its first tow on the fishing grounds. If this delivery time is extended beyond 48 hours, the value of the fish is reduced because of the quality or grade of final product the processor can produce. This is particularly true in the "A" season when roe quality decreases with the additional time fish are held on the vessel.

Response: The Final RIR, in Section 6.3.1., Product Quality and Revenue Impact, contains a discussion of the implications of longer travel time on quality and value of pollock. That discussion notes that longer travel time may lead to reduced quality and value. Unfortunately, the potential impact cannot be addressed quantitatively because it is not possible to predict exactly how changes in harvesting behavior to avoid Chinook salmon bycatch will affect the spatial and temporal patterns of future pollock harvesting.

Comment 10-59: The DEIS assumes pollock fishermen will move to new pollock fishing grounds if Alternative 2, 3, or 4 is adopted. DEIS at 165. Since the pollock fleet is already fishing the most productive and economic areas, it goes without saying that Alternatives 2-4 will impose additional costs on the fleet, but the DEIS does not analyze these costs. Nor does it examine the impacts of increased energy consumption. The DEIS fails to consider the enormously increased energy usage that will flow from Alternatives 2-4 at a time when energy conservation is a national priority, and these additional energy costs do not include all the additional operational and repair costs associated with longer trips. The DEIS does not provide the basis for making an informed decision regarding these issues because the DEIS has no analysis of these issues.

Response: This comment response has been inserted in the Final RIR in Chapter 6, Pollock Industry Impact Analysis, to clarify the limitation of the analysis as well as the obligation of NMFS under the various legal mandates identified here. Quantitative estimation of the cost impacts of the proposed alternatives requires extensive data on operating costs, including, but not limited to, expenditures and consumption of fuel. However, the pollock fishing sectors operating in the U.S. EEZ off Alaska have, over many years, consistently (although, certainly not uniquely) refused to provide company level, much less operational level, cost data that would permit NMFS to empirically estimate the operational cost impacts on the sector, attributable to this proposed action. In the absence of these data, it is not possible to estimate cost effects, including increased fuel consumption. Thus, at present, the analysts must employ methods and strategies predicated on extremely limited data and virtually non-existent economic modeling of these resources and uses.

Confronted with these facts, NMFS is nonetheless legally obligated to analyze, to the fullest extent practicable, the benefits and costs (as well as their expected distribution) of the proposed management actions being considered. These mandates (e.g., E.O.12866, OMB Circular A-4, MSA) recognize and explicitly provide for adoption of qualitative analytical strategies and approaches to evaluating benefits and costs in the absence of fully adequate empirical data and quantitative models. The RIR provides a qualitative discussion of the potential effects on variable costs (Section 6.1.2) and provides information on rising fuel costs in western Alaska in recent years (RIR Figure 6-1). Thus, the RIR adheres to the requirements of the aforementioned mandates and does provide, using the best scientific information, a basis for making an informed decision.

9.11.8 Comments on pollock-dependent communities

Comment 10-60: Salmon bycatch limits that prematurely close the pollock fishery or otherwise reduce landings and associated tax revenues will be felt throughout Alaska, but particularly in rural areas that depend on the pollock industry. Between 2000 and 2007, the two state fisheries taxes applied to the pollock fishery generated an average of $9,875,000 in annual revenue to the State from landings in the Aleutians/Pribilof region alone. DEIS at 502, Table 10-4. Although the DEIS admits that implementation of Alternative 2 could have resulted in lost tax revenue to the State of up to $5.8 million in 2007, and that implementation of Alternative 4 could have resulted in lost tax revenue to the State of up to $3.5 million in 2007 (ld. at 708, Table 10 - 114:709, Table 10-1 15), the DEIS makes no effort to examine the impacts on local governments and their residents of revenue reductions of this magnitude. Local governments provide a wide array of services including schools and pubic health programs. All of those programs could be at risk from limitations on the pollock harvest. And none of these consequences are considered in the DEIS.

Response: The commenter correctly identifies the available information on tax revenue impacts contained in the RIR. The Final RIR provides this information in Chapter 2 and Chapter 6. It is important to note that this information was gathered via special request from the Alaska Department of Revenue. NMFS requested a breakout of this data by community and/or ports. However, as stated in the RIR "Unfortunately, confidentiality restrictions do not allow tax data to be shown for specific ports or communities." The Alaska Department of Revenue simply will not release the pollock specific tax impact data contained in the RIR at anything other than the aggregated level shown. Thus, is it is not possible to show community level tax effects.

Comment 10-61: The dependence of different communities on fish taxes to provide essential services to community residents will vary but, for many communities, it is very significant. Although the DEIS admits that these fishery dependent communities "rely heavily upon tax revenues associated with fishing activities" (DEIS at 705-706), the DEIS makes no effort to quantify or evaluate the impacts notwithstanding the fact that data is available. For example, in the City of Unalaska, the fishing industry accounts for over 90% of all jobs and, in FY 2006, the city's share of the two state fishery taxes plus the city's raw fish tax totaled $11,371,533, or 43% of the city's general revenues. Northern Economics 2009 at 55. In Akutan, over 70% of the community's tax revenue is pollock related. In King Cove that number is 20% and in Sand Point it is 50%.

Response: As noted in the response to comment 10-60, it is not possible to disaggregate pollock fishery taxes to the community level without violating confidentiality restrictions. NMFS has identified the importance of these tax revenues at the regional level and has included estimated of impacts to tax collections under the alternatives in the Final RIR in Section 6.11.4. NMFS does not dispute the importance of fishing industry jobs in dependent communities and has provided information compiled by ADOL on the seafood processing workforce and wage earnings in the Aleutian and Pribilof Islands region in the Final RIR in Section 6.11.1.

Analysis of potential employment effects is problematic for several reasons. First, employment data for pollock harvesting sectors is not systematically collected. Thus, it is not possible, with presently available data, to equate potentially forgone revenue estimates with employment impacts. Second, there is no systematic data collection underway to document shoreside expenditures in the support sectors. Thus, it is not possible to equate estimated potentially forgone revenue with shoreside expenditures and subsequent effects on the services and support sectors. Third, employment in shoreside plants, though estimated by ADOL and reported in the RIR is not reported specifically for pollock processing operations. Thus, it is difficult to determine the level of employment effects that might occur from potential contraction of the pollock fishery.

NMFS disagree with the assertion that data available in "Northern Economics 2009" was available to the analysts. The referenced report is dated January of 2009. The DEIS was made available to the public in December of 2008 and, thus, was completed prior to the availability of the Northern Economics report. In addition, the Northern Economics report is an industry funded analysis that provides coverage of the aggregated groundfish fishery but not specifically of the pollock fishery. Thus, specific effects on, and associated with, the pollock fishery cannot be directly determined from the information provided in the referenced report. Furthermore, the Northern Economics report is not published in a peer reviewed professional journal, and has not previously been vetted through, for example, the Council's Scientific and Statistical Committee. Thus, the input-output (multiplier analysis) modeling contained in the Northern Economics report does not meet agency requirements for peer review under the Data Quality Act and cannot be considered "best scientific information" without meeting peer review requirements.

Comment 10-62: A salmon bycatch cap that could close the Bering Sea pollock fishery will have significant economic impacts on Alaskan communities, particularly villages in rural areas that have no way to offset revenue losses from the closure of such a significant fish as pollock. The impact of a drop in fish harvests is amply demonstrated by what happened to the City of St. Paul in the Pribilof Islands when Bering Sea snow crab landings fell. In 1999, the operating revenue for St. Paul was $11,672 per capita. When the snow crab fishery collapsed in 2000, St. Paul's operating revenue fell almost 50% to $6,491 per capita. Northern Economics 2009 at 55. The impact of that revenue loss on the City and its residents was enormous and some of the effects are felt in the community even today.

Response: NMFS does not dispute that a contraction in fishery landing will have economic impacts on fishing communities. The analysis of potentially forgone revenue for the shoreside sector documents these potential effects. That analysis uses the total round weight equivalent first wholesale value derived from all pollock products processed by shoreside processors for each of the years analyzed divided by total retained tons of pollock harvested by catcher vessels delivering to shoreside processors. The price that results is inclusive of all processing value added to the first wholesale level by shoreside processing plants. Multiplication of this price by the potentially forgone pollock harvest estimated under the alternatives provides an estimate of impact that is inclusive of many community level impacts. In other words, the total value added at first wholesale level is inclusive of payment to labor and capital. It is difficult with available information to disaggregate those effects. NMFS acknowledges that the presentation of this information in the DEIS was not sufficiently clear and has expanded the community effects information for Council final action and in the Final RIR in Sections 5.6 and 6.11.

Comment 10-63: The DEIS makes no effort to examine the job losses that will occur because of lost revenues. It is elementary economics that when employers have less product to harvest, process, and sell (i.e., forgone revenue) they need fewer workers. Forgone revenue is not some abstract figure. It is a figure that means lost jobs. The DEIS, so concerned about increasing the subsistence harvest by one or two fish per household, ignores the fact that the price of that gain is that thousands of men and women will lose their jobs in the pollock industry and in the related and dependent support, service, and distribution sectors. And many of these people will be in economically stressed CDQ communities. The insensitivity of the DEIS to this aspect of Alternatives 2-4 is appalling. Having chosen to ignore the human impact of "forgone gross revenue," the DEIS also ignores the cascading impact of higher unemployment in terms of lower income tax revenues, reduced governmental services, increased unemployment compensation claims, and associated social costs.

Response: The proposed action is not to close the pollock fishery, it is to incentivize the avoidance of Chinook salmon bycatch and that is why the impacts are reported as **potentially** forgone revenue or revenue **at risk**, depending on alternative. The RIR does not identify these impact estimates as **lost** revenue specifically because mitigation of the impacts via harvesting behavior changes are expected as that is the point of incentivizing avoidance of prohibited species catch. Furthermore, Alternatives 4 and 5 modify the hard cap formulations contained in Alternative 2 by including provisions for an industry incentive plan to reduce Chinook salmon bycatch to levels below the strict hard cap via industry derived incentives. Clearly, the Council's intent is to incentivize Chinook salmon bycatch avoidance in order to reduce it and the hard cap used in the potentially forgone revenue analysis is one part of the incentive. The implication is that the pollock industry will change behavior so that they do not face all of the potential forgone revenue, and/or revenue at risk estimated in the analysis as direct losses in revenue due to direct contraction in pollock harvest.

Analysis of potential employment effects is problematic for several reasons. First, employment data for pollock harvesting sectors is not systematically collected. Thus, it is not possible, with presently available data, to equate potentially forgone revenue estimates with employment impacts. Second, there is no systematic data collection underway to document shoreside expenditures in the support sectors. Thus, it is not possible to equate estimated potentially forgone revenue with shoreside expenditures and subsequent effects on the services and support sectors. Third, employment in shoreside plants, though estimated by ADOL and reported in the RIR, is not reported specifically for pollock processing operations. Thus, it is difficult to determine the level of employment effects that might occur from potential contraction of the pollock fishery.

The analysis of potential forgone revenue for the shoreside sectors uses value data, and hence prices, that are inclusive of many community level impacts. See response to comment 10-62. In other words, the total value added at first wholesale level is inclusive of payment to labor and capital. It is difficult with available information to disaggregate those effects. NMFS acknowledges that the presentation of this information in the DEIS is not sufficiently clear and has expand the discussion of community effects for Council final action and in the Final RIR in Section 5.6 and Section 6.11.

Comment 10-64: The FEIS should include an analysis of the financial impacts on the ability of stakeholders to repay loans. Banking institutions that provide financing to companies and vessels engaged in the Bering Sea pollock fishery will be impacted in the tens of millions of dollars. For banking institutions to continue financing fishing operations, vessels must be able to generate sufficient cash flow to service debt. Likewise, companies engaged in servicing the fleet look to banks to fund their operations until the fleet is able to repay them for services rendered. Depending on the option chosen, caps might result in forgone pollock harvest worth hundreds of millions of dollars to the pollock industry. Such losses would have significant impacts in terms of lost revenues, jobs, and other economic activity including banks.

Response: Financing of operations via various banking arrangements, such as loans and operational lines of credit, are wholly proprietary arrangements. Thus, it is not possible to assess potential impacts on these functions. Furthermore, the purpose of the proposed action is to minimize Chinook salmon bycatch, not to prematurely close the pollock fishery. To this end, the industry is expected to modify behavior to avoid Chinook salmon bycatch and, in so doing, mitigate potential forgone revenue. Further, reductions in pollock product supply may actually increase prices and total revenue, thereby improving the ability of pollock fishery participants to repay debt.

Comment 10-65: Support sector businesses in pollock-dependent communities could be devastated by a restrictive hard cap on Chinook bycatch that could potentially close the pollock fishery.

Response: The purpose of the proposed action is to minimize Chinook salmon bycatch, not to prematurely close the pollock fishery. To this end, the industry is expected to modify behavior to avoid Chinook salmon bycatch and, in so doing, mitigate potential forgone revenue. It is true that harvesting behavior changes may result in increased variable operating costs for pollock harvesting operations and such cost effects may actually result in greater shoreside support sector expenditures. NMFS acknowledges that the presentation of this information in the DEIS is not sufficiently clear and has expand the discussion of community effects for Council final action and in the Final RIR in Section 5.6 and Section 6.11.

Comment 10-66: The DEIS thoroughly analyzes the benefits of the proposed Chinook bycatch hard caps that are designed to provide additional fish for salmon fishermen in Western Alaska, however, the DEIS is altogether lacking in any meaningful analysis of the direct and indirect economic consequences that could cost hundreds of millions of dollars in lost revenues for pollock-dependent communities in Southwest Alaska and the State of Alaska. Expand the analysis of the preferred alternative to include a full cost benefit analysis of the impacts to all areas of western Alaska, including all fisheries-dependent communities and CDQ groups, before the Council takes final action on the proposed Chinook bycatch amendment.

Response: NMFS does not agree with the assertion that the "DEIS is altogether lacking in any meaningful analysis of the direct and indirect economic consequences that could cost hundreds of millions of dollars in lost revenues for pollock-dependent communities in Southwest Alaska and the State of Alaska."

Shoreside processing sector potential forgone revenue impacts are estimated in the RIR and include impacts inclusive of value added processing and associated payments to labor and capital within communities. This is because the price used to estimate impacts on the shoreside sector is inclusive of all value added processing, at shoreside plants, to the first wholesale level. See response to comment 10-71. Thus, it is important to note that the analysis does include shoreside processing impacts, just not at the port or community level. Unfortunately, confidentiality restrictions prevents providing shoreside sector impacts at the port or community level.

Analysis of potential employment effects within communities is problematic for several reasons. First, employment data for pollock harvesting sectors is not systematically collected. Thus, it is not possible, with presently available data, to equate potentially forgone revenue estimates with employment impacts. Second, there is no systematic data collection underway to document shoreside expenditures in the support sectors. Thus, it is not possible to equate estimated potentially forgone revenue with shoreside expenditures and subsequent effects on the services and support sectors. Third, employment in shoreside plants, though estimated by ADOL and reported in the RIR, is not reported specifically for pollock processing operations. Thus, it is difficult to determine the level of employment effects that might occur from potential contraction of the pollock fishery.

The RIR also contains available information on tax revenue impacts. It is important to note that this information was gathered via special request from the Alaska Department of Revenue. NMFS requested a breakout of this data by community and/or ports. However, as stated in the RIR, "Unfortunately, confidentiality restrictions do not allow tax data to be shown for specific ports or communities." The Alaska Department of Revenue simply will not release the pollock specific tax impact data contained in the RIR at anything other than the aggregated level shown. Thus, is it is not possible to show community level tax effects, which would be a large component of state and local revenues the comments is asserting must be considered. NMFS has identified the importance of these tax revenues at the regional level and has included estimated of impacts to tax collections under the alternatives in Section 6.11.4 of the Final RIR.

Comment 10-67: The economic analysis must be expanded to consider the direct and indirect costs associated with each of the proposed alternatives before the Council takes final action. Specifically, the analysis should describe the impacts, in terms of lost revenues (including lost city and state tax revenue), jobs and other economic activity, for companies that provide goods and services to the pollock industry. Without a full understanding of the potential costs of the proposed alternatives, the Council will not have the information it needs to make an informed decision as to what the appropriate balance should be between the benefits that the proposed caps might provide to salmon fisheries on the one hand and the costs to the pollock fishermen and their related support industries on the other.

Response: As noted in the response to comment 10-60, it is not possible to disaggregate pollock fishery taxes to the community level without violating confidentiality restrictions. NMFS has identified the importance of these tax revenues at the regional level and has included estimated of impacts to tax collections under the alternatives in Section 6.11.4 of the Final RIR.

Analysis of potential employment effects is problematic for several reasons. See response to comment 10-66.

The purpose of the proposed action is to minimize Chinook salmon bycatch, not to prematurely close the pollock fishery. To this end, the industry is expected to modify behavior to avoid Chinook salmon bycatch and, in so doing, mitigate potential forgone revenue. It is true that harvesting behavior changes may result in increased variable operating costs for pollock harvesting operations and such cost effects may actually result in greater shoreside support sector expenditures. NMFS acknowledges that the presentation of this information in the DEIS is not sufficiently clear and has expand the discussion of community effects for Council final action and in the Final RIR in Section 5.6 and Section 6.11.

9.11.9 Comments on the balance of costs and benefits

Comment 10-68: Perhaps the most telling statement in the DEIS is the admission that the bycatch of Chinook salmon in the pollock fishery "may" be affecting stocks of western Alaska Chinook and associated subsistence, commercial and sport fisheries. DEIS at 625. In a 762 page document, the DEIS can only conclude there "may" be an effect. Had the DEIS done a complete analysis, it would have found that the adverse effects it assumes "may" exist are illusory or of no measurable significance. In stark contrast, the DEIS admits that the proposed restrictions on the pollock fishery will have clear and identifiable adverse impacts that reach up to $500,000,000 in lost revenue. However, had the DEIS done a complete and accurate analysis, it would have found that these adverse economic impacts were significantly and measurably understated in the DEIS. The actual impact to the nation is well over $1 billion. Had the DEIS done a complete analysis as required by NEPA, it would have found that these numbers mask the impact of job losses. Had the DEIS done a complete and accurate analysis, it would also have found that the proposed restrictions on the pollock fleet will impose severe hardships on economically disadvantaged CDQ communities, many residents of which find CDQ related jobs as an alternative to subsistence.

Response: The comment opens with a statement of fact. Based upon the best available scientific information, the most NMFS is able to assert is "that the bycatch of Chinook salmon in the pollock fishery 'may' be affecting stocks of western Alaska Chinook and associated subsistence, commercial, and sport fisheries." Our knowledge of these complex ecological, biological, and economic relationships remains incomplete at this time. That being said, these data deficiencies do not remove the Agency's obligation to use the "best available scientific information" to evaluate the alternatives. Whether impacts on western Alaska Chinook, attributable to bycatch losses in the pollock fisheries, are "illusory or of no measurable significance", as asserted by the commenter, is first and foremost a policy determination. Essentially, the Secretary of Commerce, with advice from the Council, must decide what society is "willing-to-pay", in terms of numbers of Chinook salmon lost to bycatch, to harvest the pollock TAC. Monetized, quantified, and/or qualitative descriptions of the suite of likely impacts (positive and negative) are mandated by law and executive order, to inform the decision-makers and the public of the expected trade-offs being contemplated. Armed with this analysis, and other relevant information, the Secretary of Commerce, on behalf of the American people, will weight the relative importance of competing needs and interests on making a final decision. What one group may regard as illusory or of no measurable significance, others may weight as critically important.

The comment misinterprets the numerical estimates of "potentially forgone gross revenues" and "gross revenues at risk", identified in the RIR. As explained therein, these gross estimates reflect highly simplified assumptions about the outcome of competing alternative bycatch rules. In a sense, they are intended to portray the "worst case" outcome if the pollock fishery was required to forgo a specific catch amount in response to each of the alternatives being examined. As the text clearly indicates, there is no expectation that this outcome will be realized as a result of any of the proposed alternatives under consideration. The RIR is very clear that these "techniques" are employed solely to provide a crude approximation of the first wholesale gross dollar value associated with unharvested pollock, by sector, processing mode, etc. The RIR states "As noted above, gross revenues at risk are forgone only if a fishing fleet is unable to modify its operations to accommodate the imposed (Chinook bycatch) limits and, thus, cannot make up displaced catches elsewhere ...” The analysis goes on to address the expected results of less extreme catch reduction levels, resulting from industry changes in operational practices (e.g., gear changes, location changes, timing changes). In every case, the RIR emphasizes that these estimates are incomplete, owing to the absence of industry cost and operational data, market information, pricing structure, etc. As "gross revenue" measures, these numerical results cannot even be interpreted as being indicative of the net impacts the industry could be expected to incur as a result of implementation of any one of the alternatives. The commenter's assertion that the "actual impact to the nation is well over $1 billion", is simply not subject to objective evaluation, given available data.

Finally, NMFS disagrees that the RIR has not addressed the adverse impacts that may accrue to CDQ communities, although those impacts could have been more effectively presented. Thus, NMFS has revised the presentation of impacts on communities, including explicit treatment of CDQ communities in the Final RIR in Section 6.11.3.

Comment 10-69: Healthy pollock resources off Alaska provide benefits to the State of Alaska. Further work is needed to improve stock of origin and age distribution estimates of Chinook salmon taken in the pollock fishery and to better understand the relationship of Chinook salmon encounters in the pollock fishery with abundance.

Response: NMFS acknowledges the comment.

Comment 10-70: Given all that is missing from the putative analysis of costs and benefits contained in the analysis, it strains credulity to read that any action taken to reduce salmon bycatch in the pollock fishery" will result in an aggregate welfare improvement to society, offsetting any apparent welfare reduction in the retail/wholesale domestic seafood/fish products commercial marketplace." DEIS at 702.

Response: NMFS is the first to agree that the quality, quantity, and availability of reliable, verifiable, and consistent cost and benefit data, supported by empirical studies of key aspects of: (1) the commercial pollock fishery, (2) those of Chinook salmon users and uses, and (3) their intersection within the context of Chinook salmon bycatch in the Bering Sea pollock fishery, are severely limited. Notwithstanding these facts, NMFS is required by law to utilize the "best available data and information", supported by relevant theory, interpretation, and accepted practice, to prepare an objective analysis of the expected costs and benefits (and, in addition, their likely distribution) across users and uses. Whenever meaningful quantification of such benefits and costs can be made, NMFS has done so. When quantification is not feasible, all relevant costs and benefits must still be considered, even if only qualitatively. Only through a systematic and comprehensive accounting of every relevant economic and socioeconomic element of the proposed suite of actions can the public be informed of the trade-offs it is contemplating. That is, the RIR is intended to inform, to the fullest extent practicable, the public (and those charged with decision making on their behalf) of the costs and benefits that can be anticipated from each competing alternative action being considered... and to whom each is likely to accrue. NMFS believes it has prepared an analysis that meets both the spirit and letter of this mandate. NMFS does acknowledge that portions of the analytical presentation would benefit from reorganization, and has undertaken these changes in the Final RIR.

9.11.10 Comments on the forgone revenue analysis

Comment 10-71: The use of 2005 or 2006 prices in Chapter 10 significantly understates the value of the pollock fishery in Alaska. The market data, including wholesale price data, cited in Chapter 10 is taken from the "2007 Economic SAFE Report." Wholesale prices, and hence, the wholesale value of the fishery, are derived from product prices through 2005, or at best, 2006. Given that prices for fillets made from U.S. pollock have increased substantially since 2006, the use of 2005 or 2006 prices significantly understates the value of the pollock fishery in Alaska. The product market values used in Chapter 10 to calculate forgone revenues greatly understates recent pricing and consequently, even the limited forgone revenue analysis makes projections that are far below predicted actual losses. The DEIS's computations grossly underestimate the revenue loss to the pollock fishery caused by Alternatives 2-4.

Response: The analysis of potential forgone revenue has estimated the date on which the pollock fishery would have hit the various Chinook salmon bycatch caps in each of the years 2003-2007 in order to conduct a retrospective analysis to answer the question of what would have happened had the proposed action been in place in those years. The estimate of potentially forgone pollock harvest that results is then multiplied by a price to estimate potentially forgone revenue. Since the impact estimate is calculated in terms of the metric tons of pollock catch potentially forgone, it is necessary to use a price that is reflective of the total value of that catch. This process is necessarily complicated by the fact that pollock is processed into several product forms, not just fillet block, and is processed both at sea (CPs and Motherships) and in shoreside processing facilities that receive deliveries from Catcher Vessels. Thus, reported values in the offshore sector (CPs and Motherships) are inclusive of all processing value added to the first wholesale level, which is also the point of departure for export of pollock products. And, as has been pointed out in responses to comment 10-46, effects in export markets are not an appropriate consideration in a RIR. Thus, this is a logical level at which to value potential impacts because exports and effects on export markets is exogenous to this level of valuation. Further, potential welfare impacts in domestic markets cannot be determined with available data. See response to comment 10-83. Thus, first wholesale value is an appropriate value to capture the total quantifiable domestic market effect on potential forgone pollock harvest and revenue.

The analysis is complicated by the fact that deliveries to shoreside plants by Catcher Vessels are paid an ex-vessel price that is considerably less than, and thus not comparable to, the first wholesale value. To provide comparable first wholesale values for both the offshore and inshore sectors, the analysis does not use ex-vessel value and, instead, calculates a shoreside sector price that is inclusive of all processed value added. This is done by annually aggregating the total value of all pollock products processed by shoreside processors, as reported by industry to NMFS in the COAR report and compiled by the NMFS AFSC, and dividing that value by the total round weight of retained metric tons of pollock harvested by Catcher Vessels in the Bering Sea pollock fishery as reported in the e-landings catch accounting system.

This calculation provides a round weight equivalent first wholesale value for the shoreside sector that can be multiplied by estimates of potentially forgone pollock harvest, in round metric tons, to determine potentially forgone revenue at the first wholesale level. This is done annually from 2003 through 2006 in the RIR for each of the sectors and these prices are reported in Table 6-4. These are the prices that are applied by year for each year from 2003 through 2007. Note however, that the 2007 price was not yet available when the analysis was completed for the DEIS. Updated pricing data for 2007 has been obtained and was provided to the Council prior to final action and is updated in the the Final RIR in Chapter 6.

NMFS disagrees with the assertion that the prices used are outdated and underreport pollock impacts. The total valuation used in the analysis is that provided by industry. Further, it accounts for the first wholesale value of all product forms, not just the highest valued product forms. Finally, it is applied at a level that is consistent across sectors and complies with agency obligations under Executive Order 12866. This comment response has also been inserted into Final RIR in Section 6.6, Calculation of Potentially Forgone Pollock Revenue and Pollock Revenue at Risk, in order to clarify the methodology used in this analysis as well as to reiterate the agency's obligations under E.O 12866.

Comment 10-72: Chapter 10 relies on outdated wholesale values as the indicator of the value of the investment at risk in the pollock industry and ignores employment in the industry and support sectors, fuel costs, government benefits, and so on. The analysis uses out of date wholesale values when current values are available. Chapter 10 relies on outdated wholesale values as the indicator of the value of the investment at risk in the pollock industry and ignores employment in the industry and support sectors, fuel costs, government benefits, and so on. The analysis uses out of date wholesale values when current values are available. Chapter 10's estimate of forgone wholesale revenue understates the loss by 49%-69% because Chapter 10 uses prices that no longer reflect the marketplace. The Urner Barry Price Report, a widely respected and relied upon data source, shows that pollock fillet block prices have increased 49% since 2006 and 69% since 2005. This increase is confirmed by the rise in prices for exported product. The two largest European destinations for pollock fillets are Germany and the Netherlands. Between 2005 and 2008, the price of Alaska pollock fillets exported to the Netherlands FOB Alaska increased from $0.99 to $1.53 per pound (63%). In Germany, the price FOB Alaska increased in the same years from $1.05 to 1.65 per pound (64%). These export prices understate the price of pollock fillet blocks because there are piece block and lower price items included. In other words, computation of forgone wholesale revenue is significantly underestimated because Chapter 10 fails to use the best and most current data. Even using outdated prices that underestimate forgone revenue by 49% - 69%, Chapter 10 states that the proposed bycatch reduction measures could cost up to $500,000,000. DEIS at 656-687.

Response: See response to comments 10-71.

Comment 10-73: Pollock accounts for more than one-third of all U.S. fisheries landings by volume. Northern Economics Inc., The Seafood Industry in Alaska's Economy, January 2009 ("Northern Economics 2009") at ES 2, 18. In 2007, the first wholesale value of the pollock harvest was $1.248 billion. DEIS at ES 2. However, this number does not reflect the multiplier effect of additional economic activity generated by the pollock fishery. The U.S. seafood industry generates an additional $600,000 in direct and indirect outputs for every $1 million of wholesale value. See, The Seafood Industry in Alaska's Economy, a recent report by Northern Economics, Inc, January 2009, at p. 44. Thus, the 2007 dollar value of Alaska's pollock fishery to the nation was $2.029 billion. And that number understates current value because wholesale pollock prices increased in 2008. The forgone revenue analysis does not include any consideration of the economic multipliers that are associated with revenue generated from the fishing industry in Alaska.

Response: Executive Order 12866 clearly defines the cost-benefit framework of applied welfare economics as the appropriate analytical framework for assessing impacts of Federal regulations. Multiplier analysis is derived generally from models that account for the flow of transfers of goods and services in an economy and are not consistent with the cost-benefit theoretical framework. In fact, multiplier, or Input-Output analysis as it is called, is not identified in the Executive Order.

Further, the referenced multiplier estimate is not specific to the pollock fishery and is not specific to the Bering Sea region. It is a statewide multiplier that combines all sectors of the seafood industry together. In addition, the Northern Economics report is an industry funded analysis that provides coverage of the aggregated groundfish fishery but not specifically of the pollock fishery. Thus, specific effects on, and associated with, the pollock fishery cannot be directly determined from the information provided in the referenced report. Furthermore, the Northern Economics report is not published in a peer reviewed professional journal, and has not previously been vetted through, for example, the Council's Scientific and Statistical Committee. Thus, the Northern Economics report does not meet agency requirements for peer review under the Data Quality Act and cannot be considered "best scientific information" without meeting peer review requirements.

Comment 10-74: The second reason Chapter 10 grossly underestimates the actual forgone revenue caused by adopting Alternatives 2-4 is that it does not include all the items that must be accounted for in calculating revenue loss to the nation. Chapter 10 completely ignores the multiplier effects of economic activity. Chapter 10 defines the term "forgone lost revenue" as the "revenue that the fleet, or sectors within it, would be allowed to earn...." DEIS at 656. This definition alone documents the incomplete and inadequate analysis in Chapter 10. Chapter 10 fails to recognize, and therefore excludes, the economic multipliers associated with this revenue loss. Applying these multipliers, the loss to the nation approaches $1 billion using Chapter 10's outdated wholesale revenue calculations. Using current wholesale prices, the loss to the nation is well over $1 billion.

Response: See response to comment 10-73.

Comment 10-75: Using forgone revenue as a measure of the economic impact of the premature closure of the BSAI pollock fishery is a gross over simplification that significantly understates the economic consequences of the proposed alternatives under consideration. fails to inform the Council, the agency and the public of the true distributional and other impacts that such closures would have on: seafood production, international trade and the US balance of payments, jobs, markets, consumers, support industries (e.g., banks, fuel suppliers, shipping companies, equipment manufacturers, cold storages, airlines, travel agencies and other such vendors who supply goods and services to the industry), invested capital, and a host of other consequences that would flow from such a closure.

Response: NMFS acknowledges that the use of potentially forgone first wholesale gross revenues is not an ideal reflection of the expected economic costs (or, conversely, benefits if the catch reduction can be mitigated by actions of the operator) attributable to the proposed changes in Chinook bycatch management. An explanation of the reasons for adopting this analytical approach is summarized in response to comment 10-83.

In order to estimate "profits", one must have data on costs, not simply revenues. NMFS does not have data to estimate net impacts until such time the Council develops a socioeconomic data collection program that requires the industry to submit cost data under new MSA authority. In the absence of these data, it is possible only to report empirical estimates of gross revenues. These gross receipts may, of course, not be, in any meaningful way, indicative of realized net revenues, but by default serve as the best available "proxy" for economic earnings in these fisheries. It must also be noted that "maximizing profit" is only one, among several possible motivating factors that may be "assumed" to define the objectives of a business enterprise.

Absent accurate, verifiable cost data and operational information for the pollock trawl fleets operating in the Bering Sea, gross revenue estimates constitute the "best" empirical economic information available. NMFS fully acknowledges that changes in first wholesale (or ex vessel, as appropriate) revenues cannot be regarded as indicative of net results. That said, these estimates represent the current limit of NMFS' ability to empirically characterize the expected sectoral outcome in the pollock fishery, attributable to changes in Chinook bycatch management under consideration. And, further, this explains the very extensive reliance upon, and systematic treatment of, "qualitative" cost and benefit analysis, reflected in the RIR, as required under E.O.12866.

Comment 10-76: Chapter 10 overstates the impact to pollock fleet as there is sufficient certainty about behavior changes. Industry will not sit passively when a hard cap is in place. In developing their ICAs, they have already identified a grocery list of options to help them remain below a hard cap. Clearly, saving will occur. Even in 2007, it may have been possible to stay under a 68,392 hard cap. To do that the industry would use the fixed A season closure, and not fish in late September and October. The increased closure areas in the 2008 VRHS system would have saved additional salmon, and that curtailing the fishery in late September probably wouldn't have been necessary. Adding a hard cap would surely have incentivized the fleet to not fish around the edges of closures, etc., which would make staying under the hard cap fairly easy for the average performer. More importantly, per Kochin et al., "A hard cap of 47,591 appears to be a reasonable balance between protecting Chinook salmon and allowing the pollock fishery to be harvested." We feel that taking additional measures to get down to that level, while difficult, is a reasonable goal. Mostly, substandard performers are going to have to mend their ways. The fleet will have to make Chinook avoidance a priority. Given the situation in western Alaska, we feel that is warranted.

Response: NMFS acknowledges the comment. NMFS disagrees with the comments that the estimates of impact to the pollock fleet are overstated. See response to comment 10-68.

Comment 10-77: Parts of the pollock industry may struggle to harvest their TAC share under the Alternative 4 47,591 hard cap, but most operators will be impacted far less than Chapter 10 suggests. Using a retrospective analysis similar to that used in Chapter 10, but assuming savings similar to those suggested by Kochin et al., shows that only seasons similar to 2006 and 2007 A seasons would have been challenging. A 47,591 hard cap would focus the necessary minds on the problem of Chinook bycatch and the likelihood of forgone harvest is low.

Response: The analysis of impacts of Alternative 4 and Alternative 5, in terms of potentially forgone revenue is presented in the Final RIR in Table 6-26 and 6-27. This analysis shows, as the commenter has pointed out, that there are potential impacts to the A season pollock fishery in 2003, 2006, and 2007. In the B season, potential impacts are spread across 2004, 2005, 2006 and 2007, depending on rollover provisions. As discussed in the response to comment 10-46, the proposed action is not to close the pollock fishery it is to incentivize the avoidance of Chinook salmon bycatch and that is why the impacts are reported as potentially forgone revenue or revenue at risk, depending on alternative. The RIR does not identify these impact estimates as lost revenue specifically because mitigation of the impacts via harvesting behavior changes are expected as that is the point of incentivizing avoidance of prohibited species bycatch.

Comment 10-78: The pollock industry will react to a hard cap by mending their behavior. The better performing cooperatives do enough better than the average that their losses would be far less than their prorata share of the Chinook salmon bycatch. The worst performers should be able to match the best.

Response: NMFS acknowledges the comment.

Comment 10-79: The industry will make considerable efforts to avoid Chinook when faced with a hard cap. Using historic bycatch with no savings due to avoidance measures greatly overstates the impact of a hard cap. The industry could have stayed under a hard cap of 68,600 if they'd had the current VRHS system, including the fixed A season closure in place, and had not fished in October.

Response: The analytical timeframe of 2003 through 2007 was chosen because it represents a range of Chinook salmon bycatch conditions that accurately represent the status quo conditions. Those status quo conditions include observed high levels of Chinook salmon bycatch under present regulations that provide an exemption to Chinook salmon savings area closures for operators that participate in the VRHS. The analytical period encompasses years when the VHRS was in place, either via industry initiative, via an experimental fishery, or as a formal program under present regulations. Thus, NMFS does not agree with the implication that the analysis did not include effects of the VRHS.

Comment 10-80: While we recognize the limits the analysts must deal with, using gross wholesale value for any forgone harvest as the primary metric greatly overstates the impact of forgone harvest. Earnings Before Interest, Taxes, Depreciation and Amortization or EBITDA per marginal ton is far more useful for evaluating the impacts to the direct participants. If a measure of impact to indirect participants is needed that should be developed separately.

Response: EBITDA is a measure of net income calculated by subtracting expenses (excluding tax, interest, depreciation, and amortization), from revenue. Thus, calculating EBITDA requires information on cost of production, which is not available for the pollock fishery. NMFS does not necessarily disagree that, were cost data available, the EBITDA measures would be a potential representation of effects on net income. However, it is also important to recognize that, as discussed in the response to comment 10-46, the proposed action is not to close the pollock fishery it is to incentivize the avoidance of Chinook salmon bycatch and that is why the impacts are reported as potentially forgone revenue or revenue at risk, depending on alternative. The RIR does not identify these impact estimates as lost revenue specifically because mitigation of the impacts via harvesting behavior changes are expected as that is the point of incentivizing avoidance of prohibited species bycatch. Thus, NMFS does not agree with the assertion that the analysis overstates impacts.

Comment 10-81: The "forgone revenue" test in Chapter 10 is simply inadequate to inform the Council of the economic consequences that would flow from the adoption of a cap that the industry cannot practicably accommodate the "practicability" test imposed by National Standard 9's bycatch reduction requirement. The Guidelines for National Standard 9 specifically require that consideration be given to "Changes in the distribution of benefits and costs" in determining whether or not bycatch reduction measures are "practicable" (See, National Standard Guidelines, 50 CFR. 600.350 (3)(1)). The forgone revenue test does not enable the Council to make such determinations.

Response: NMFS's guidelines for National Standard 9 provides that any determination of whether a conservation and management measure minimizes bycatch or bycatch mortality to the extent practicable should consider 10 factors, one of which is the "Changes in the distribution of benefits and costs." 50 C.F.R. § 600.350(d)(3)(i) (I). The other factors include:

> population effects for the bycatch species; ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem); changes in the bycatch of other species of fish and the resulting population and ecosystem effects; effects on marine mammals and birds; changes in fishing, processing, disposal, and marketing costs; changes in fishing practices and behavior of fishermen; changes in research, administration, and enforcement costs and management effectiveness; changes in the economic, social, or cultural value of fishing activities and non-consumptive uses of fishery resources; and social effects.

NMFS acknowledges that the use of potentially forgone first wholesale gross revenues is not an ideal reflection of the expected economic costs (or, conversely, benefits if the catch reduction can be mitigated by actions of the operator) attributable to the proposed alternatives. An explanation of the reasons for adopting this analytical approach is summarized in response to comment 10-83.

In order to estimate "profits", one must have data on costs, not simply revenues. NMFS does not have data to estimate net impacts until such time the Council develops a socioeconomic data collection program that requires the industry to submit cost data under new MSA authority. These gross receipts may, of course, not be, in any meaningful way, indicative of realized net revenues, but by default serve as the best available "proxy" for economic earnings in these fisheries.

It must also be noted that "maximizing profit" is only one, among several possible motivating factors that may be "assumed" to define the objectives of a business enterprise. The RIR is very clear that these "techniques" are employed solely to provide a crude approximation of the first wholesale gross dollar value associated with unharvested pollock, by sector, processing mode, etc. In Section 6.6, the Final RIR text states "As noted above, gross revenues at risk are forgone only if a fishing fleet is unable to modify its operations to accommodate the imposed (Chinook bycatch) limits and, thus, cannot make up displaced catches elsewhere ..." The analysis goes on to address the expected results of less extreme catch reduction levels, resulting from industry changes in operational practices (e.g., gear changes, location changes, timing changes). In every case, the RIR emphasizes that these estimates are incomplete, owing to the absence of industry cost and operational data, market information, pricing structure, etc. As "gross revenue" measures, these numerical results cannot even be interpreted as being indicative of the net impacts the industry could be expected to incur as a result of implementation of any one of the several bycatch alternatives.

In addition, the proposed action is not intended to close the pollock fishery; it is intended to minimize Chinook salmon bycatch and that is why the impacts are reported as potentially forgone revenue or revenue at risk, depending on alternative. The RIR does not identify these impact estimates as lost revenue specifically because mitigation of the impacts via harvesting behavior changes are expected as that is the point of incentivizing avoidance of prohibited species bycatch. Furthermore, Alternatives 4 and 5 modify the hard cap formulations contained in Alternative 2 by including provisions for an industry incentive plan to give the industry flexibility in complying with the hard cap. Clearly, the Council's intent is to incentivize Chinook salmon bycatch avoidance in order to minimize it to the extent practicable and the hard cap used in the potentially forgone revenue analysis is one part of the incentive. The implication is that the pollock industry will change behavior so that they do not face all of the potential forgone revenue, and/or revenue at risk estimated in the analysis as direct losses in revenue due to direct contraction in pollock harvest.

Absent accurate, verifiable cost data and operational information for the pollock trawl fleets operating in the Bering Sea, gross revenue estimates constitute the "best" empirical economic information available. NMFS fully acknowledges that changes in first wholesale (or ex vessel, as appropriate) revenues cannot be regarded as indicative of net results. That said, these estimates represent the current limit of NMFS' ability to empirically characterize the expected sectoral outcome in the pollock fishery, attributable to the alternatives under consideration. And, further, this explains the very extensive reliance upon, and systematic treatment of, "qualitative" cost and benefit analysis, reflected in the RIR, as required under E.O.12866.

Comment 10-82: By assuming no change in behavior on the part of the pollock fleet in response to possible closure before the TAC is harvested, the methodology is patently false, and this is explicitly recognized in the DEIS. Citing a lack of good data, however, the DEIS refuses to explore the impacts of a reasonable range of increased costs of the fleet of catch all or most of the TAC. Instead, the DEIS offers an approach that systematically exaggerates the costs of bycatch reduction by a very large, but indeterminate amount, and ultimately mislead any effort to understand the impacts of the alternatives.

Response: The comment misinterprets the numerical estimates of "potentially forgone gross revenues" and "gross revenues at risk", identified in the RIR. As explained therein, these gross estimates reflect highly simplified assumptions about the outcome of competing alternatives. In a sense, they are intended to portray the "worst case" outcome if the pollock fishery was required to forgo a specific catch amount in response to each of the Chinook bycatch prohibition actions being examined. As the text clearly indicates, there is no expectation that this outcome will be realized as a result of any of the proposed alternatives under consideration. The RIR is very clear that these "techniques" are employed solely to provide a crude approximation of the first wholesale gross dollar value associated with unharvested pollock, by sector, processing mode, etc. In Section 6.6, the Final RIR states "As noted above, gross revenues at risk are forgone only if a fishing fleet is unable to modify its operations to accommodate the imposed (Chinook bycatch) limits and, thus, cannot make up displaced catches elsewhere ..." The analysis goes on to address the expected results of less extreme catch reduction levels, resulting from industry changes in operational practices (e.g., gear changes, location changes, timing changes). In every case, the RIR emphasizes that these estimates are incomplete, owing to the absence of industry cost and operational data, market information, pricing structure, etc. As "gross revenue" measures, these numerical results cannot even be interpreted as being indicative of the net impacts the industry could be expected to incur as a result of implementation of any one of the several bycatch alternatives.

Comment 10-83: The purpose of the DEIS is to provide 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. As such, it's theoretical basis and methods should correspond to those generally accepted and employed by practitioners of applied welfare economics. The main components of welfare economics can be summarized as the concepts of producer and consumer welfare and the development of methods for their measurement. Producer welfare concepts include producer surplus, economic rent, and profits. Consumer welfare concepts include primarily product demand curves, consumer willingness to pay, and consumer surplus. The DEIS contains very little of substance concerning these concepts and their measurement. On these grounds alone, it simply cannot be considered a sufficient or satisfactory accounting of the changes in producer and consumer welfare that are likely to accompany the alternative management measures contemplated to reduce Chinook salmon bycatch. It provides very little if any useful input into the policy-making process as regards potential welfare changes to U.S. citizens.

Response: NMFS acknowledges the absence of empirical estimates of consumer surplus and producer surplus changes that might be expected in response to one or another of the suite of proposed Chinook bycatch management actions. The ability to mathematically derive these welfare measures in fundamentally dependent upon empirical data on, among others, input prices, costs, capital investment, debt service, consumer demand, sources of supply, market structure, substitutes and complements, measures of consumer responsiveness to changes in price, quantity, quality, income, tastes, and preferences. Exogenous factors also influence rigorous derivation of these welfare measures, such as, currency exchange rates, tariffs, political and economic instability. Very few of these necessary data are available to NMFS, at present. Similarly, economic modeling, specific to Chinook bycatch in the Bering Sea pollock fishery, is also presently unavailable, although work is underway at NMFS AFSC on aspects of these analytical needs. NMFS does not have data to estimate net impacts until such time the Council develops a socioeconomic data collection program that requires the industry to submit cost data under new MSA authority. At present, the analysts must employ methods and strategies predicated on extremely limited data and virtually non-existent economic modeling of these resources and uses.

Confronted with these facts, NMFS is nonetheless legally obligated to analyze, to the fullest extent practicable, the benefits and costs (as well as their expected distribution) of the proposed management actions being considered. These mandates (e.g., E.O.12866, OMB Circular A-4, MSA) recognize and explicitly provide for adoption of analytical strategies and approaches to evaluating benefits and costs in the absence of fully adequate empirical data and quantitative models. These provisions can be found in the introductory paragraphs of the RIR, describing Executive Order 12866 procedural requirements. The subject RIR adheres to these requirements.

Comment 10-84: The DEIS adopts forgone pollock revenue as its measure of the costs and benefits to the pollock fishery of the alternative bycatch management options under consideration. Adoption of forgone pollock revenue as a measure of costs and benefits is misleading because the measure is neither a cost nor a benefit. Additionally, this measure bears no direct relationship to generally accepted concepts of producer welfare that have been in use since the 1940s.

Response: NMFS acknowledges that the use of forgone first wholesale gross revenues is not an ideal reflection of the expected economic costs (or, conversely, benefits if the catch reduction can be mitigated by actions of the operator) attributable to the proposed changes in Chinook bycatch management. An explanation of the reasons for adopting this analytical approach is summarized in response to comment 10-83. Absent accurate, verifiable cost data and operational information for the pollock trawl fleets operating in the Bering Sea, gross revenue estimates constitute the "best" empirical economic information available. NMFS fully acknowledges that changes in first wholesale (or ex vessel, as appropriate) revenues cannot be regarded as indicative of net results. That said, these estimates represent the current limit of NMFS' ability to empirically characterize the expected sectoral outcome in the pollock fishery, attributable to the alternatives under consideration. And, further, this explains the very extensive reliance upon, and systematic treatment of, "qualitative" cost and benefit analysis, reflected in the RIR, as required under E.O.12866.

Comment 10-85: Even the most introductory text on welfare economics will point to profits as the most obvious measure of producer welfare, given that maximizing profit is the assumed objective of any business enterprise. No discussion of pollock producer profits or their relationship to forgone revenues appears in the DEIS. Evidently it is the opinion of the DEIS that the statement on page 264 is sufficient to support the omission of any serious discussion of producer welfare concepts and changes other than forgone pollock revenues.

Response: NMFS notes that even the most introductory text on welfare economics will also recognize that, in order to estimate "profits", one must have data on costs, not simply revenues. NMFS does not have data to estimate net impacts until such time the Council develops a socioeconomic data collection program that requires the industry to submit cost data under new MSA authority. In the absence of these data, it is possible only to report empirical estimates of gross revenues. These gross receipts may, of course, not be, in any meaningful way, indicative of realized net revenues, but by default serve as the best available "proxy" for economic earnings in these fisheries.

It must also be noted that "maximizing profit" is only one, among several possible motivating factors that may be "assumed" to define the objectives of a business enterprise.

Comment 10-86: The discussion of variable cost changes in the DEIS contains no discussion of the concept of rent as it relates to changes in producer welfare. DEIS at 695-697. An alternative to profit, defined by Marshall as the excess of gross receipts over their prime cost --- that is, over the extra cost that the firm incurs in order to produce those things which it could have escaped if it had not produced them, is termed rent. Marshall. A., Principles of Economics, 1930. The concept is called rent because it is a rent on fixed factors employed by the firm but, unlike factor rent, may not persist over a long period of time. Specifically, rent is defined as the excess of gross receipts over total variable costs. Marshall went on to suggest the area below the price line and above the supply curve, commonly called producer surplus, as a measure of this benefit.

Response: The comment correctly identifies the concept of "rents" (also termed quasi-rent) in the context of marginal productivity theory. Quantitative estimation of rents requires comparison of a firm's gross revenues and its costs. As the commenter also notes, the graphic representation of this economic concept is approximated (at least under specific assumptions) by the area above the supply curve, below the price line (i.e., producer's surplus). As has been explained in the RIR, and treated elsewhere in the response to comments, fixed and variable cost data are not available for use in this impact analysis. Absent firm-level cost data, empirical estimation of changes in producer's surplus, or quasi-rents, or the Marshallian expression of "rent" (referenced in the comment), is not possible. The RIR does, notwithstanding the empirical limits on estimation, explicitly treat the topic of "producer's surplus" impacts and their relevance to an evaluation of the Chinook bycatch reduction action alternatives. Therefore, NMFS finds that the absence of an explicit use of the term "rents" does not constitute a deficiency in the document.

Comment 10-87: If the DEIS had informed the public as to the nature and composition of producer welfare measures, then it might have been discovered that the pollock CDQ groups collect royalty payments from the lease of pollock harvest privileges, and that these royalty payments could be used as a basis for approximating changes in producer welfare (profits or rent) due to the alternative management measures. A very simple assumption in this regard would be that producer rents are approximately twice the annual per-ton pollock lease values received by the CDQ groups (i.e., it could be assumed that a competitive negotiation leads to an approximate splitting of the rents). NMFS has access to information on pollock lease values received by the CDQ groups to fulfill its responsibilities as regards CDQ program administration and oversight. The advantage of this approach is that it does not mislead the public by (1) declaring that a revenue is a cost, and (2) stating that the analysis is based on the best available science and data.

Response: The commenter makes an interesting observation. However, contrary to the assertion that NMFS has access to CDQ pollock lease data, the agency actually received information about royalties paid, by species or species group, for the CDQ allocations only until 2005. NMFS lost the authority to require the accurate submission of annual reports that provided this specific information, as a result of the 2006 amendments to the Magnuson-Stevens Act. For 2006 and beyond, NMFS has been limited to reliance upon unverifiable information about royalties, published by the CDQ entities in annual reports prepared primarily for residents of the member communities. These annual reports are available to the public. Some of the CDQ entities choose to include specific information about royalties, while others choose not to provide this level of detail in their annual reports.

On the technical reasoning presented in the comment, NMFS agrees that, if consistent, comprehensive, and reliable data were currently available, CDQ royalty payments might be employed as a baseline "proxy" from which to extrapolate rents, although only within the CDQ-portion of the pollock directed fishery. It is less clear that these results, were they amenable to estimation, would be generalizable across the majority of the pollock fishery (i.e., the non-CDQ seasons). Historically, CDQ allocations have been available for harvest during periods and in areas not open to non-CDQ operations. Precisely how these factors would impact accrual of rents is, by-in-large, purely speculative. It also suggests that the use of royalty payments to approximate resource rents could, under the best of circumstances, only inform one of the gross magnitude of "rents" uniquely attributable to CDQ pollock harvests in that time period/area. That is, if CDQ pollock is taken where and when non-CDQ fishing is closed, it could be argued, its value (and, thus, any rent generated) is not generalizable to periods when commercial fishing is occurring. While this represents an interesting hypothesis to contemplate, empirical evaluation would require data which are not currently available for use in this analysis.

NMFS also recognizes that fractional ownership interests (and other forms of "affiliation") are not well documented in available data, making interpretation of the "selectively" (and wholly voluntarily) reported CDQ royalty payment information difficult to objectively assess. Nonetheless, to better inform the decision making process, NMFS prepared additional background information on the CDQ groups, their ownership interests in the pollock fishery, their royalty revenue history, and an assessment of how CDQ royalties may be affected by the proposed action. The additional CDQ information is contained the Final RIR in Sections 2.6 and 6.11.3.

Comment 10-88: Although changes in producer profits are a useful measure of changes in producer welfare for many regulatory changes, this is not the case for a policy change that prevents a firm from producing during a period. In such case, a firm would be willing to pay more than its current profits to remain in production because its fixed costs cannot be avoided even if production is shut down. The DEIS discussion regarding fixed costs contains no discussion of this concept as it relates to changes in producer welfare. DIES at 693.

Response: NMFS agrees that regulatory closure of the pollock fishery during a period when fishing would otherwise voluntarily occur requires an operator to incur the full fixed cost of that period of inactivity. This outcome represents precisely the economic incentive to avoid Chinook bycatch in the pollock fishery that the Council envisioned for this action. A more elaborate treatment of the theory of production under output constraints is unnecessary.

Fundamentally, it does not matter whether, as the comment asserts, "... a firm would be willing to pay more than its current profits to remain in production...", if it fails to remain under the Chinook bycatch cap. In effect, society has expressed its "willingness-to-pay" (i.e., its maximum tolerance for losses of PSC to bycatch) as a fixed "cap" on Chinook bycatch mortality. If a firm (or, as appropriate, sector, industry) exceeds that threshold, it must cease operation, incurring whatever costs (e.g., fixed, variable, penalties, fines) that may accrue, no matter what the "price it would be willing to pay to continue operation". This is, after all, the purpose of PSC limits and, in the present context, the unambiguous source of the economic incentive for pollock operators to undertake any action required to remain below that Chinook bycatch closure threshold.

Comment 10-89: After admitting that Alternative 4 will result in forgone catch, Chapter 10 fails to examine the economic impact of lost harvest on the economics of catcher vessels, catcher processors, and onshore processors. For example, many processing facilities were constructed based on economic assumptions associated with a certain product throughout. Reductions in the pollock harvest forced by salmon bycatch restrictions could fundamentally alter the basic economic viability of many parts of the pollock fishery - and that too will be reflected in lower wages and lost jobs.

Response: NMFS disagrees with the assertion that the analysis "fails to examine the economic impact of lost harvest on the economics of catcher vessels, catcher processors, and onshore processors." The analysis provides estimates of potentially forgone revenue, under the alternatives, for the Catcher Processor sector, the Mothership Sector, and the Shoreside sector at the first wholesale level of economic value. This analysis is conducted retrospectively by year for 2003-2007 and provides seasonal breakout, CDQ breakout, the effect of transferability provisions and the effects of rollovers on the estimated potential forgone revenue. This information is included in the Final RIR in Chapter 6.

It is important to note that shoreside processing sector potential forgone revenue impacts estimated in the RIR, are embedded within the overall shoreside sector impacts. That is, both the Catcher-Vessel impacts and the shoreside processor impacts are combined at the first wholesale level. See response to comment 10-71 for justification of this methodology. This is because the price used to estimate impacts on the shoreside sector is inclusive of all value added processing, at shoreside plants, to the first wholesale level. Thus, it is important to note that the analysis does include shoreside processing impacts, just not at the port or community level. Confidentiality prevents taking the shoreside impacts to the port or community level. However, an analysis of the potential effects on the shoreside value added processing component, as a subset of the overall shoreside sector impacts was prepared for the Final RIR in Section 6.11.2. This analysis was presented to the Council in an appendix to the Preliminary Comment Analysis Report.

As has been stated in the response to comment 10-46, the proposed action is not to close the pollock fishery it is to incentivize the avoidance of Chinook salmon bycatch and that is why the impacts are reported as potentially forgone revenue or revenue at risk, depending on alternative. The RIR does not identify these impact estimates as lost revenue specifically because mitigation of the impacts via harvesting behavior changes are expected as that is the point of incentivizing avoidance of PSC species.

Comment 10-90: The forgone revenue analysis does not adequately in form the Council as to the costs associated with management measures that could result in premature closures of the pollock fishery. Using forgone revenue as a measure of the economic impact of the premature closure of the BSAI pollock fishery is a gross oversimplification that significantly understates the economic consequences and does not include any consideration of economic multipliers. The DEIS fails to inform the Council, the agency and the public of the economic consequences that would flow from the proposed alternatives to close the fishery prematurely. The economic impact of an unanticipated interruption in pollock production does not accommodate the 'practicability test' imposed by National Standard 9.

Response: NMFS acknowledges that the use of potentially forgone first wholesale gross revenues is not an ideal reflection of the expected economic costs (or, conversely, benefits if the catch reduction can be mitigated by actions of the operator) attributable to the proposed changes in Chinook bycatch management. An explanation of the reasons for adopting this analytical approach is summarized in response to comment 10-83.

In order to estimate "profits", one must have data on costs, not simply revenues. NMFS does not have data to estimate net impacts until such time the Council develops a socioeconomic data collection program that requires the industry to submit cost data under new MSA authority. These gross receipts may, of course, not be, in any meaningful way, indicative of realized net revenues, but by default serve as the best available "proxy" for economic earnings in these fisheries.

It must also be noted that "maximizing profit" is only one, among several possible motivating factors that may be "assumed" to define the objectives of a business enterprise.

Absent accurate, verifiable cost data and operational information for the pollock trawl fleets operating in the Bering Sea, gross revenue estimates constitute the "best" empirical economic information available. NMFS fully acknowledges that changes in first wholesale (or ex vessel, as appropriate) revenues cannot be regarded as indicative of net results. That said, these estimates represent the current limit of NMFS' ability to empirically characterize the expected sectoral outcome in the pollock fishery, attributable to the alternatives under consideration. And, further, this explains the very extensive reliance upon, and systematic treatment of, "qualitative" cost and benefit analysis, reflected in the RIR, as required under E.O.12866.

Comment 10-91: Any analysis of costs that examines only industry-wide or sector level consequences is certain to grossly underestimate aggregate costs incurred by individual operators. Chinook salmon bycatch is highly variable annually and varies among vessels. The DEIS has not analyzed the impact of protective measures on individual fishing companies or individual vessels.

Response: NMFS agrees with the comment and acknowledges that sector or industry-wide aggregation within an analysis will tend to "smooth" the variability of impacts that actually exist within the assessed population (i.e., highs offset lows). Unfortunately, the analysis of "... costs incurred by individual operators" and/or impacts "... on individual fishing companies or individual vessels", requested by the commenter, (1) cannot be performed, given the composition and detail of the empirical data available to NMFS, and (2) could not be presented, even if the necessary data were available, owing to data confidentiality laws. For these reasons, qualitative and descriptive treatment of expected economic and socioeconomic impacts, their distribution, and intensity are a fundamental part of preparation and presentation of an RIR.

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10.1 Lead Preparers

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, 9, and the Executive Summary.

James N. Ianelli (AFSC) graduated from Humboldt State University (B.S. Fisheries) and received his Ph.D. in Fisheries Science from the University of Washington, Seattle in 1993. He has worked for the National Marine Fisheries Service, Alaska Fisheries Science Center for 16 years. Dr Ianelli is the Co-Chair of the Council's Gulf of Alaska Fishery Management Plan Team, and is the primary stock assessment author for Eastern Bering Sea pollock. Dr Ianelli developed the methodology for pollock and Chinook impact assessment used in the EIS, and developed the Adult Equivalency bycatch methodology and analysis. Dr Ianelli was a primary author on Chapters 3, 4 and 5 of the EIS, and provided data for Chapters 4, 5, 6, 9, and the RIR.

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12.0 DISTRIBUTION LIST

NMFS sent the Final EIS and Final RIR to the following individuals and organizations. NMFS also posted these documents for download on the NMFS Alaska Region web page at: http://www.fakr.noaa.gov/sustainablefisheries/bycatch/default.htm.

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Algaaciq Tribal Government

Association of Village Council Presidents

Bering Sea Elders Advisory Group

Chinik Eskimo Community, Native Village of Golovin

Doyon Ltd.

Emmonak Corporation

Emmonak Traditional Council

Kawerak, Inc.

Kongiganak Traditional Council

Native Village of Eek

Native Village of Kipnuk

Native Village of Kwigillingok

Native Village of Marshall

Native Village of Napakiak

Native Village of Nunapitchuk

Native Village of Unalakleet

Nome Eskimo Community

Norton Sound Economic Development Corporation

Organized Village of Kwethluk

Orutsararmiut Native Council

Ruby Tribal Council

St. Mary's Native Corporation

Stebbins Community Association

Tanana Chiefs Conference

Village of Kotlik

Yukon River Panel

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Alaska Resources Library and Information Services
Alaska State Library
Anchorage Municipal Libraries
At-Sea Processors Association
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