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Draft

Environmental Impact Statement

for

Bering Sea/Aleutian Islands Chinook Salmon

Bycatch Management

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North Pacific Fishery Management Council

National Marine Fisheries Service

Note: This document will be revised to form the Draft Environmental Impact Statement

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ACRONYMS & ABBREVIATIONS USED IN THE EIS

ABC	acceptable biological catch
ADF&G	Alaska Department of Fish and Game
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center (of the National Marine Fisheries Service)
AI	Aleutian Islands
ALT	Alaska Local Time
AP	North Pacific Fishery Management Council’s Advisory Panel
B	biomass
BSAI	Bering Sea and Aleutian Islands
Bx%	biomass that results from a fishing mortality rate of Fx%
BY	Brood year
C	Celsius or Centigrade
C.F.R.	Code of Federal Regulations
CDP	community development plan
CDQ	community development quota
CI	Confidence interval
cm	centimeter(s)
COBLZ	C. Opilio Bycatch Limitation Zone
Council	North Pacific Fishery Management Council
CVOA	catcher vessel operational area
DAH	domestic annual harvest
DAP	domestic annual processed catch
DSR	demersal shelf rockfish
E.	East
EEZ	exclusive economic zone
EFH	essential fish habitat
ESA	Endangered Species Act
F	fishing mortality rate
FMP	fishery management plan
FOCI	Fisheries-Oceanography Coordinated Investigations
ft	foot/feet
FX%	fishing mortality rate at which the SPR level would be reduced to X% of the SPR level in the absence of fishing
GHL	guideline harvest level
GMT	Greenwich mean time
HAPC	habitat area of particular concern
IFQ	individual fishing quota
IPHC	International Pacific Halibut Commission
IR/IU	Improved Retention/Improved Utilization Program
JVP	Joint venture processed catch
kg	kilogram(s)
km	kilometer(s)
lb	pound(s)
LLP	license limitation program
LOA	length overall
m	meter(s)
M	natural mortality rate
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
mm	millimeter(s)
MMPA	Marine Mammal Protection Act
MSY	maximum sustainable yield
mt	metric ton(s)
N.	North
nm	nautical mile

NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
OFL	overfishing level
OY	optimum yield
PBR	potential biological removal
pdf	probability density function
POP	Pacific ocean perch
ppm	part(s) per million
ppt	part(s) per thousand
PRD	Protected Resources Division (of the National Marine Fisheries Service)
PSC	prohibited species catch
QS	quota share(s)
RKCSA	Red King Crab Savings Area
S.	South
SAFE	Stock Assessment and Fishery Evaluation
SPR	spawning per recruit
SSC	North Pacific Fishery Management Council's Scientific and Statistical Committee
TAC	total allowable catch
TALFF	total allowable level of foreign fishing
U.S.	United States
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
U.S. GLOBEC	United States Global Ocean Ecosystems Dynamics
USSR	United Soviet Socialist Republics
W.	West
°	degrees
‘	minutes
%	percent

EXECUTIVE SUMMARY

This Environmental Impact Statement/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EIS/RIR/IRFA) provides decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative Chinook salmon bycatch reduction measures for the Bering Sea pollock fishery. The EIS/RIR/RIFA is intended to serve as the central decision-making document for management measures developed by the North Pacific Fishery Management Council (Council or NPFMC) and the National Marine Fisheries Service (NMFS or NOAA Fisheries) and to implement the provisions of the proposed action. If a preferred alternative is adopted, this EIS will result in an amendment to the Bering Sea/Aleutian Islands Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP), and associated regulatory changes.

Purpose and Need

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

The Council and NMFS have limited the scope of this EIS to measures that address Chinook salmon bycatch, because of the need for immediate action to reduce Chinook bycatch. Chinook salmon is a highly valued species and a species of concern that warrants specific protection measures. The Council is also concerned about non-Chinook salmon bycatch in the Bering Sea pollock trawl fishery, and had originally intended to address non-Chinook salmon as part of this action. Existing measures to reduce non-Chinook salmon bycatch will remain in place, however, and the Council will address revising them in a subsequent action.

Description of Alternatives

Three broad alternatives are considered in this analysis. These alternatives are not intended to be mutually exclusive, and the Council may choose to select elements from more than one alternative to formulate its preferred alternative.

Alternative 1: Status Quo

Alternative 2: Hard cap

Alternative 3: Triggered closures

There are detailed options and suboptions for each alternative, as described below.

Alternative 1: Status Quo

Alternative 1 retains the current program of Chinook Salmon Savings Area (SSA) closures triggered by separate non-CDQ and CDQ Chinook caps. Pollock vessels participating in the salmon bycatch reduction inter-cooperative agreement (ICA), under regulations implemented for BSAI FMP Amendment 84, are exempt from these closures. Only vessels directed fishing for pollock are subject to the SSA closures and ICA regulations.

Alternative 2: Hard cap

Alternative 2 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.

Four components, and options for each component, are included under this alternative. These components describe how the cap is formulated (Component 1), whether and how to allocate the cap to sectors (Component 2), whether and how salmon can be transferred among sectors (Component 3), and whether and how the cap is allocated to cooperatives (Component 4).

Component 1: Hard cap formulation

Two options provide different ways to establish the cap level. The annual cap will be allocated between the A and B seasons. Absent further Council action under Components 2 and 4, the hard cap will be managed at the fishery level, resulting in separate hard caps for the CDQ Program, and the combined non-CDQ fleet.

Option 1: Select from a range of numbers

The Council may choose an annual hard cap (which is subsequently apportioned seasonally per options below) from within a specified range of numbers (Table 1).

Table 1 Range of numbers for overall hard cap

Suboption	Overall fishery cap (number of Chinook salmon)	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

For the analysis in this EIS, only a subset of the range is used to understand the impacts of the alternative. The subset includes the upper and lower endpoints of the range, and two equidistant midpoints (Table 2).

Table 2 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

Option 2: Index Cap (cap set relative to salmon returns)

Under this option, the Council would specify an acceptable run-size impact level (and a maximum probability of error), for a candidate river system. This impact level would feed into an established procedure that calculates a corresponding overall salmon bycatch cap level. The procedure could be modified as scientific information improves. The range of values analyzed for this option in the EIS are equivalent to those in Table 2; the distinction lies in the process employed to set, modify, and update the cap itself.

Options 1-1 through 1-4: Seasonal allocation of caps
The annual caps under either Option 1 or Option 2 will be allocated seasonally. Four options determine how the specified cap could be seasonally allocated (Table 3).

Table 3 Seasonal distribution of caps between the A and B seasons

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

Component 2: Sector Allocation

If this component is selected, the hard cap would be managed at the sector level for the fishery. This would result in separate sector level caps 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. The sector allocation could occur in one of 5 different ways (Table 4).

Table 4 Sector allocation of caps

Component 2	Options	CDQ	Inshore CV	Mothership	Offshore CP
Not selected	--	7.5 %	92.5 %; managed at the combined fishery-level for all three sectors		
Selected	Option 1	10 %	45 %	9 %	36 %
	Option 2a	3 %	70 %	6 %	21 %
	Option 2b	4 %	65 %	7 %	25 %
	Option 2c	4 %	62 %	9 %	25 %
	Option 2d	6.5 %	57.5 %	7.5 %	28.5 %

Component 3: Sector Transfer

This component is only available if Component 2 is also selected. If Component 3 is selected, it would determine by which of two mechanisms salmon could be moved between sectors, to allow a sector to continue fishing for pollock even if their sector-specific bycatch limit (as defined under the options in Component 2) is reached (Table 5).

Table 5 Transferring salmon amongst sectors

Component 3	Options	Sector Transfer		
Not selected	--	No transfer of salmon across sectors		
Selected	Option 1	Caps are transferable by sector, transfers initiated by industry		
		Suboption Maximum amount of transfer limited to the following percentage of salmon remaining:	a	50 %
			b	70 %
			c	90 %
	Option 2	NMFS rolls over unused salmon bycatch to sectors still fishing, based on proportion of pollock remaining to be harvested		

Component 4: Cooperative provisions

This component is only available if the Council recommends allocating salmon bycatch among the sectors under Component 2. Component 4 would further allocate the inshore sector's transferable or non-transferable salmon bycatch allocations to the inshore cooperatives (Table 6).

Table 6 Inshore cooperative-level salmon allocations, and transfer options

Component 4		Options	Cooperative Provisions		
Not selected		--	Allocation managed at combined inshore CV sector-level		
Selected	Allocation	--	Allocations of inshore CV sector salmon bycatch cap to cooperatives mirrors the proportions of the 2008 pollock quota allocations to cooperatives		
	Transfer	Option 1	Transfer or lease pollock among cooperatives, for season or year		
		Option 2	Caps are transferable by cooperative, transfers initiated by industry		
			Suboption Maximum amount of transfer limited to the following percentage of salmon remaining:		
			Suboption Maximum amount of transfer limited to the following percentage of salmon remaining:	a	50 %
				b	70 %

Alternative 3: Triggered Closures

Triggered closures are regulatory time and area closures that are invoked when specified cap levels are reached. Cap levels for triggered closures would be formulated using one of the options described under Alternative 2. Closures may involve a single area (as in the A season) or multiple areas (as 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.

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).

Component 1: Trigger caps

The trigger caps considered under Alternative 3 parallel Component 1, with all its options, under Alternative 2 (Table 1 to Table 3).

Component 2: Management

Triggered area closures could be managed in a number of different ways, depending on the combination of components and options selected by the Council. Under Component 2, without Option 1 (management by the intercooperative agreement) or under Components 3 and 4, NMFS would manage a single trigger cap for the non-CDQ pollock fisheries. Once the trigger cap is reached, NMFS would close the trigger areas, selected by the Council under Component 5, to directed fishing for pollock by all vessels fishing for the non-CDQ sectors.

Under Component 2, Option 1, a NMFS-approved salmon bycatch reduction intercooperative agreement (ICA) would manage, through its contract, any subdivision of the seasonal trigger caps at the sector level, inshore cooperative, or individual vessel level. The ICA would enforce the area closures 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 proscribed 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 require that the ICA include a provision such that once the overall trigger cap selected under Component 1 is reached, the area(s) selected under Component 5 would be closed to ICA participants.

Component 3: Sector Allocation

Sector allocation options under Alternative 3 are equivalent to those under consideration for Component 2, Alternative 2 (Table 4). Upon reaching a sector-specific cap, that sector would be prohibited from fishing in the area selected under Component 5 for the remainder of the season.

Component 4: Sector Transfer

Sector transfer provisions are equivalent to those under consideration for Component 3, Alternative 2 (Table 5). Options under this component may be selected only if the Council recommends allocating the salmon bycatch trigger cap among the sectors.

Component 5: Area Closures

Two different area closures are proposed for Chinook under this component. The areas differ by season. For the A season closure (Fig. 2), once triggered the area would remain closed for the remainder of the season. For the B season closures (Fig. 2), all three areas close simultaneously. If the B season areas are triggered prior to August 15th, the areas would remain open until August 15th and then close for the remainder of the year. If triggered anytime after August 15th, the area would close immediately and remain closed for the duration of the season.

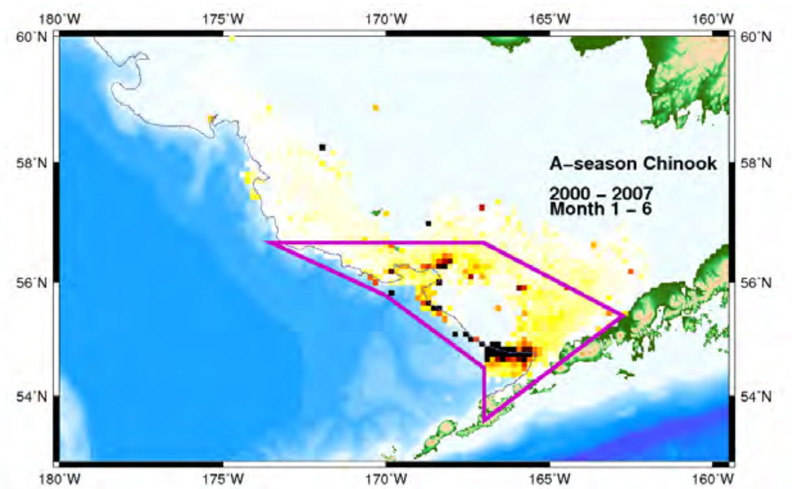


Fig. 1 Proposed A season area closure under Alternative 3.

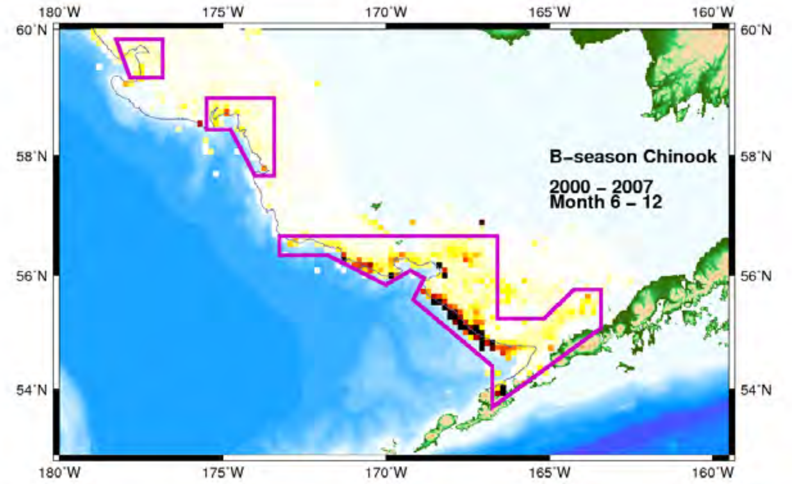


Fig. 2 Proposed B season area closures under Alternative 3.
Note: all three areas close simultaneously.

Environmental Consequences of the Alternatives

Due to the complexity of the alternatives, the number of possible combinations of options and sub-options within the suite of alternatives, and the need for contrast in order to understand the relative impact of alternative combinations, a subset of actual cap combinations was analyzed in detail. This subset included the four annual caps identified for impact analysis (Table 2), three of the four seasonal distribution options (Table 3), and three of the five sector allocation options (Table 4). This subset of options, while still complex, provides a simplified approach to evaluating distinctions between alternatives and options, and provides an overview of the entire range of impacts for the broader suite of alternatives and options in this analysis. The subset of combinations was analyzed for impacts on pollock, Chinook salmon, chum salmon, and the related economic analyses included in the RIR. For the remaining resource categories considered in this analysis, marine mammals, seabirds, other groundfish, EFH and environmental justice, impacts of the suite of alternatives were evaluated qualitatively.

Pollock stocks

The management measures to reduce Chinook salmon bycatch would likely result in the fishery closing earlier, before the full pollock TAC could be harvested (based on 2003-2007 data and assuming the behavior of the fishermen would be the same). The proposed Chinook management measures generally mean that it will be more difficult to catch the full TAC for EBS pollock. Consequently, the pollock fishing mortality rates may be lower than biologically acceptable levels which would reduce the impact of fishing on the stock. If Alternative 2 (hard caps) are selected, the fishermen will go to greater extremes to avoid salmon bycatch, and this may impact pollock stocks accordingly.

Operating under seasonal hard caps (fleet-wide or by sector) 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 of maintaining spawning biomass would remain central to the assessment. Changes in fishing patterns could result in lower ABC 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- 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. Again, these factors 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 ABC and TAC.

The impact of Alternative 3 (triggered closures) on pollock fishing was evaluated in a similar way. The assumption that the pollock TAC may be attainable depends on the difficulty in finding pollock after the closure areas are triggered. The data show that in some years, the catch rate is consistently higher outside of the trigger area whereas in other years it is consistently lower for at-sea processors and shore-based catcher vessels 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 Alternative 2, the same impacts under triggered closures (Alternative 3) would apply: it seems likely that the fleet would fish earlier in the summer season and would tend to fish in places further away from the core fishing grounds north of Unimak Island. Both of these effects have would appear to result in catches of pollock that were considerably smaller in mean sizes-at-age. The consequence of this impact would, based on future assessments, likely result in smaller quotas since the resource utilization would be accumulating the benefits of the summer-season growth period.

Chinook salmon

The individual combinations of management options evaluated were reduced to 36 (combinations of four hard caps, three A-B season splits, and three sector-specific allocations), as described above. The analysis evaluated data from 2003-2007 for seasonal patterns in bycatch, for the fleet as a whole and for each sector separately. For each year, 2003-2007, the date that a proposed cap would have gone into effect was estimated, and from there, the subsequent values of foregone catch were tabulated along with total salmon bycatch levels. Since most of the management combinations evaluated distribute the bycatch cap by season and to sectors, the overall annual Chinook bycatch totals would have fallen below the overall annual cap for the analysis period. This is due to the fact that the inter-annual variability is such that in some years, a sector will close for a season, while other sectors remain open (all sectors within both seasons would need to reach their cap for the fleet to reach the total bycatch cap).

For the 36 scenarios, the hypothetical annual bycatch would have been the highest (77,240 Chinook) in 2007 under Option 2a, with a 50:50 A/B split, and an overall cap of 87,500. The lowest hypothetical bycatch scenario was also recorded from 2007 (9,360 Chinook) for option 2d, a 70:30 A/B split, and an overall cap of 29,300.

Propagating the hypothetical bycatch numbers forward to compute adult equivalent impacts (AEQ bycatch) provides a means to evaluate the impact of bycatch on spawning stocks of Chinook salmon as a whole. This is critically important in order to assess the impacts of any annual bycatch tally to subsequent mature returning salmon since much of the Chinook bycatch are immature. For each of the 36 alternatives analyzed, had these measures been in place (and assuming that fleet behavior is well approximated) results indicate that fewer Chinook would have been removed from the system, except in years where bycatch level was already low (e.g., in 2003 when the AEQ was less than 1% higher for the cap option set at 87,500 and A-B split at 58/42 under option 2d). On average, the different options resulted in AEQ bycatch that was from 88% to 34% of the estimated AEQ mortality that was estimated to have occurred. This implies that if in a particular year the AEQ bycatch mortality had translated to a 4% impact rate (defined as the AEQ mortality divided by the actual number of returning salmon in that year) to a particular river system, then the added management measures would lower that rate to 1.4% - 3.5%.

The next step in evaluating bycatch impacts is to relate the AEQ values to particular river systems and regions where the Chinook would have spawned. 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, 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 west Alaska Chinook based on Myers et al.'s (2003) proportions were derived. 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. Under the most constraining option, the number of AEQ Chinook saved to these rivers would have been over 26,000 in 2006 and over 33,000 in 2007.

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

Chum salmon

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. Impacts were evaluated three ways: hard caps alone; hard caps in combination with triggered area closures; and the possible effect of concentrating effort earlier in the B-season so that Chinook bycatch could be minimized. The first two effects resulted in reducing the overall chum salmon bycatch whereas the planned shortened season lengths results were variable, but resulted in about the same overall amounts of bycatch than if the season had not been shortened.

Other groundfish

The hard cap would not be expected to drastically change the footprint of the fishery from the status quo. Groundfish fishery management, which 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 the status quo. 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 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

The impacts of the alternatives on other prohibited species (i.e. besides Chinook and non-Chinook salmon examined separately) are evaluated in this analysis. 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 prohibited species catch limits constrain the catch of these species in the Bering Sea trawl fisheries and this is anticipated to limit any impacts for those species.

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

Other marine resources

Potential impacts of the alternatives on marine mammals and seabirds are expected to be limited. Alternative 2, for hard caps, would potentially lead to a decrease in the incidental takes of marine mammals and seabirds due to relative constraints by season on the pollock fishery. Alternative 3 could impact marine mammals if the fishery were shifted northward outside of the large scale area closure. However, the current protection measures and area closures for marine mammals remain in place, and reduce the interaction with Steller sea lions, and northern fur seals in these regions. The overall effect of shifting the pollock fishery and the resulting incidental takes of seabirds and marine mammal species such as bearded seals, killer whales, Dall's porpoise and fin whales is unknown given the lack of precise information in these regions. A northward shift in the pollock fishery outside of the triggered closure would likely decrease interaction with Steller sea lions as they are primarily taken in the southern portion of the Bering Sea.

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

Environmental Justice

The disproportionality of the adverse impact to identified minority or low-income populations is the key factor under environmental justice analysis. A significant proportion of the population in the impacted area is Alaska Native. The alternatives may disproportionately affect low income or minority communities by reducing salmon bycatch and increasing the numbers of Chinook salmon returning to natal streams in western Alaska. The alternatives may disproportionately impact low income or minority communities by affecting the way pollock vessels interact with a number of resources including chum salmon, marine mammals, seabirds, essential fish habitat, other groundfish species, forage species, prohibited species as well as by affecting the resources available to CDQ groups, and by affecting the shoreside deliveries of pollock by catcher vessels.

Regulatory Impact Review

This Regulatory Impact Review (RIR) examines the costs and benefits of a proposed regulatory amendment to change Chinook salmon bycatch reduction measures in the Bering Sea and Aleutian Islands (BSAI) area pollock trawl fishery.

Market failure rationale

The OMB guidelines for analysis under E.O. 12866 state that

> in order to establish the need for the proposed action, the analysis should discuss whether the problem constitutes a significant market failure. If the problem does not constitute a market failure, the analysis should provide an alternative demonstration of compelling public need, such as improving governmental processes or addressing distributional concerns. If the proposed action is a result of a statutory or judicial directive, that should be so stated.[1]

[1] Memorandum from Jacob Lew, OMB director, March 22, 2000. "Guidelines to Standardize Measures of Costs and Benefits and the Format of Accounting Statements" Section 1.

Groundfish that are the target of the BSAI trawl fisheries, and the salmon bycatch these fisheries take, are both common property resources. However, both are subject to systems of stock and allocation management. These management systems include forms of ownership of access and/or harvest allocation privileges. Trawl vessels operating in the BSAI groundfish fisheries do not have ownership or access privileges to salmon. Similarly, salmon harvesters operating in the waters of and off Alaska do not have ownership or access privileges to groundfish.

Bycatch of salmon in the BSAI trawl fisheries reduces the common property pool of the salmon resource. Such reductions may reduce the targeted subsistence, commercial, personal use, and sport catch of salmon, and thereby the revenue of salmon harvesters who have ownership of salmon access privileges (e.g. Alaska Limited Entry permits) and/or established harvesting rights (e.g. subsistence) and harvesting history. This may, over time, reduce the value of salmon access ownership privileges as well as reducing the socioeconomic and cultural benefits for subsistence users. The market; however, has no mechanism by which groundfish harvesters may compensate salmon harvesters for such losses. Further, the market cannot value the cultural significance of the subsistence lifestyle. Thus, salmon bycatch reduction measures are imposed to reduce, to the extent practicable, this market failure. The goal of the action considered in this RIR is to improve salmon bycatch reduction in the BSAI pollock trawl fisheries and, thereby, further mitigate the effects of market failure.

Potentially Affected Fisheries

This RIR provides an overview of the directly affected BSAI pollock trawl fishery. A detailed treatment of the Western Alaska Chinook salmon fisheries, and dependent communities, that are thought to be most affected by Chinook salmon bycatch in the pollock fishery is also provided. The discussion of potentially affected salmon fisheries is intended to determine which Western Alaska Chinook salmon fisheries have been experiencing declining Chinook runs in recent years and whether related harvest fisheries opportunities have been impacted.

The BSAI Pollock fishery

Until 1998, the Bering Sea directed pollock fishery had been 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 BSAI directed pollock fishery TAC among the competing sectors of the fishery. The AFA also allowed for the development of pollock industry cooperatives. Ten such cooperatives were developed as a result of the AFA: seven inshore co-ops, two offshore co-ops, and one mothership co-op. In the 2006 Bering Sea pollock trawl fishery, 90 catcher vessels participated in harvesting pollock, a slight decline since 2002, when 98 vessels participated in the fishery. Catcher processors also declined in the same period, from 31 operating the BSAI in 2002 to 19 by 2006.

Pollock is apportioned in the BSAI between inshore, offshore, and mothership sectors after allocations are subtracted for the CDQ program and incidental catch allowances. The BSAI pollock fishery is further divided into two seasons – the winter “A” roe season and the summer “B” season, which is largely non-roe.

The pollock fishery in waters off Alaska is the largest U.S. fishery by volume, and the economic character of that fishery centers on the products produced from pollock. In the U.S., Alaska pollock catches are processed mainly for roe, surimi, and fillet products. Fillet production has increased particularly rapidly due to increased harvests, increased yields, and the shift by processors from surimi to fillet production made possible under the AFA.

Export of Alaska pollock products constitutes a major aspect of the U.S. pollock industry. Almost all U.S. pollock roe is exported, primarily to Japan and Korea, along with a substantial part of U.S. surimi; and American producers of fillets also have increased exports, especially to Europe where a stronger market for U.S. pollock has emerged from the declining catch of other whitefishes in European waters and the depreciation of the dollar against the Euro.

In October 2005, to reduce the pollock fisheries' bycatch of Pacific salmon, the North Pacific Fisheries Management Council (Council) adopted Amendment 84 to the BSAI Fisheries Management Plan. The Council developed Amendment 84 to attempt to resolve the bycatch problem through the AFA pollock cooperatives. The amendment exempts pollock vessels from Chinook and Chum Salmon Savings Area closures if the vessels participate in an intercooperative agreement (ICA) to reduce salmon bycatch. Through the ICA, the cooperatives reduce salmon bycatch by a method called the ''voluntary rolling hotspot system'' (VRHS).

While the inter-cooperative reports on Chinook salmon bycatch indicate that the VRHS has reduced Chinook salmon bycatch rates compared with what they would have been without the measures, concerns remain because of escalating amounts of Chinook salmon bycatch through 2007. From 1990 through 2001, the Bering Sea Chinook salmon bycatch average was 37,819 salmon annually. Since 2002, Chinook salmon bycatch numbers have increased substantially. The averages from 2002 to 2007 were 82,311 Chinook salmon, with a bycatch peak of 122,000 Chinook salmon in 2007.

Western Alaska Salmon Fisheries

This RIR provides an extensive treatment of Chinook salmon fisheries in Western Alaska. The major Chinook fisheries occur in the Norton Sound Region, Kuskokwim area, The Yukon River, and in the Nushagak and Togiak Districts of the Bristol Bay Region.

Norton Sound

The Alaska Board of Fisheries (BOF) made several changes to regulations at meetings in February and March 2007 for the management of Norton Sound salmon. The BOF changed the stock of concern classification for Subdistrict 1 (Nome) chum salmon from a management concern to a yield concern. Subdistricts 2 and 3 (Golovin and Moses Point) chum salmon stocks and Subdistricts 5 and 6 (Shaktoolik and Unalakleet) Chinook salmon stocks were continued as stocks of yield concern.

A Chinook salmon management plan for Subdistricts 5 and 6 (Shaktoolik and Unalakleet) was established to address the poor Chinook salmon runs in the 2000s. This plan placed a series of restrictions on subsistence harvest of Chinook salmon. Overall subsistence salmon harvest in the Norton Sound region peaked in 1996), with 129,046 fish caught. A downward trend in overall harvest occurred in the late 1990s, but the 2002 harvest of 103,488 fish was above historic averages. Since then, overall harvest has trended downward and the 2007 harvest of 48,694 fish was well below the 84,950 fish five year average. Within these overall trends are downward trends in subsistence catch of Chinook salmon since the late 1990s. Norton Sound area subsistence Chinook harvests peaked in 1997 at 8,989 fish. Since then, subsistence Chinook harvests have declined in nearly every year and the 2007 harvest of 2,646 fish was the lowest level recorded since 1994. Note; however, that prior to 1994, and between 2004-2006, subsistence surveys were not completed in all subdistricts.

Within the Norton Sound area, the subdistricts that have been most affected by declining Chinook salmon runs have been the Shaktoolik and Unalakleet subdistricts In the Shaktoolik subdistrict, the peak subsistence Chinook Catch of 1,275 fish occurred in 1995. Since then, catch declined through the late 1990s before rising to 1,230 fish in 2002. Since 2002, Shaktoolik subsistence Chinook catches have trended downward to a low of 382 fish in 2006. The 2007 harvest of 515 fish was well below the 5 and 10 year averages.

In the Unalakleet district, the peak subsistence Chinook catch of 6,325 fish occurred in 1997. Since then, the catch has trended downward through the 2000s. The 2007 harvest of 1,665 fish was the lowest level recorded since complete surveys began in 1994.

Norton Sound commercial Chinook catches trended downward in the late 1990s and early 2000s. As recently at 1997, more than 12,000 Chinook were commercially harvested in the region; however, by 2000 the harvest had declined to 752 fish. By 2004, no commercial Chinook harvest was allowed.

Norton Sound Region Chinook value peaked in 1985 at $452,877, when it represented more then 55 percent of the overall value. Chinook value has fluctuated since the 1980s and rose to $225,136 in 1997 when it was nearly 62 percent of the overall value. During the 2000s, Chinook value has declined as the run has declined and has been restricted to incidental catch value since 2004. In 2007, no value was earned form from Chinook target fisheries and just $113 was earned from incidental catch in other salmon fisheries. Similar to subsistence Chinook catch, the impact of declines in commercial Chinook catch have been felt most in the Shaktoolik and Unalakleet districts.

Kuskokwim Area

From the beginning of the 2007 season there was a good showing of Chinook, chum, and sockeye salmon throughout the Kuskokwim Area; however, run timing for these species was approximately 5 to 7 days late compared to average. Chinook salmon abundance was characterized as average to above average while sockeye and chum salmon abundance was characterized as above average. Coho salmon abundance was characterized as average to below average with overall early run timing. Amounts necessary for subsistence use is expected to have been achieved throughout the area.

The Alaska Board of Fisheries (BOF) met in Anchorage from January 31 to February 5, 2007, to review regulatory fisheries proposals concerning the Arctic-Yukon-Kuskokwim (AYK) areas. The BOF discontinued the stock of yield concern designations for the Kuskokwim River Chinook and Chum stocks based on Chinook and chum salmon runs being at or above the historical average each year since 2002.

Yukon River

In response to the guidelines established in the Sustainable Salmon Policy, the BOF discontinued the Yukon River summer and fall chum salmon as stocks concern during the February 2007 work session. The Yukon River Chinook salmon stock was continued as a stock of yield concern based on the inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above the stock’s escapement needs since 1998.

There was an increasing trend in overall Lower Yukon subsistence catch through the early 1990s. Since 1993, when lower Yukon total subsistence Chinook catch was 28,513 fish, catch has trended downwards. The 2007 lower Yukon Chinook subsistence catch of 20,514 fish was below the ten year average but above the 5 year average. In Districts 1 and 3 the 2007 catch was below both the 5 and 10 year averages; however, the 2007 district 2 subsistence Chinook catch of 10,496 was the greatest since 2001 and well above both the 5 and 10 year averages.

Historic subsistence Chinook catch numbers in the Upper Yukon River, by district have been at historically high levels during the early to mid 2000s, and above averages in 2007. District 4 2007 catches were below the 5 year average and close to the 10 year average, while Districts 5 and 6 had catches greater than both averages in 2007. Canadian aboriginal subsistence catch declined steadily in the 2000s. The 2007 catch of 5,000 fish is well below the 5 and 10 year averages of 6,375 and 6,801, respectively. The small Porcupine aboriginal catch has exceeded the 5 and 10 year averages in each of the years since 2003.

Lower Yukon Chinook commercial harvests have trended downwards since the mid 1990s when nearly 120,000 Chinook were harvested. By 2001, there were no commercial Chinook openings in the Yukon River. Since 2001, the Chinook run has improved enough to allow for commercial openings with a peak harvest during that period of 52,548 in 2004. Since 2004, however, runs have weakened and catch has fallen steadily.

The 2007 lower Yukon Chinook catches were well below the five year and ten year averages in Districts one and 2 as well as overall. In district 3, the 2007 commercial Chinook catches were the first recorded since 1999. Historically, however, District 3 has had commercial Chinook harvests numbering more than 5,000 fish. Overall, upper Yukon commercial Chinook harvests have been well below historic levels during the 2000s, and the 2007 harvests were below 5 year and 10 year averages in all parts of the Upper Yukon.

Alaska Yukon Chinook commercial harvest value peaked in 1992 at just over $10 million, approximately 99 percent of which came from the lower Yukon. As harvest trended downward in the late 1990s so did Chinook value and by 2001, there were no commercial Chinook openings in the Yukon River, partly due to the need to conserve chum stocks. Since 2001, the Chinook and chum runs have improved enough to allow for commercial openings; however, the catch, and value, are still much lower than historic levels and the 2007 harvest was worth just under $2 million.

The 2008 run is expected to be below average and similar to the 2007 run, although, it is anticipated that the 2008 run will provide for escapements, support a normal subsistence harvest, and a below average commercial harvest. If inseason indicators of run strength suggest sufficient abundance exists to have a commercial Chinook salmon fishery, the U.S. commercial harvest could range from 5,000 to 30,000 Chinook salmon including the incidental harvest taken during anticipated summer chum salmon directed periods. The run of Canadian-origin Upper Yukon River Chinook salmon in 2008 is expected to be below average. The preseason outlook is for approximately 111,000 Canadian-origin Chinook salmon. However, due to the relationship between the expected and observed run size in 2007, expected 2008 run size could be as low as 80,000 fish.

Bristol Bay Region

In 2007, Chinook salmon escapement into the Nushagak River was 60,000, 80% of the 75,000 inriver goal. Harvest was 51,000 Chinook in the Nushagak District. Peak Chinook salmon production in the early 1980’s resulted in record commercial harvests and growth of the sport fishery. Declining run sizes and the question of how to share the burden of conservation among users precipitated the development of a management plan for Nushagak Chinook salmon. Since the plan was adopted in 1992, the Nushagak-Mulchatna Chinook Salmon Management Plan (NMCSMP) has governed management of the Nushagak Chinook salmon fisheries (5 AAC 06.361). The plan was amended in 1995, 1997, and 2003.

Bristol Bay Subsistence Chinook harvests hit a 20 year high of 21,231 in 2003 but have fallen significantly with 12,617 and 16,002 fish harvested bay wide in 2006 and 2007 respectively. The 20 year average is presently 15,438. While it appears that subsistence Chinook harvests in the Bristol Bay area have improved over historic levels, there were declines in subsistence Chinook harvests in the Naknek-Kvichak District during the late 1990s and early 2000’s. The Nushagak District had a similar decline, rebounded to a record catch in 2003, but then declined for the next four years before recovering to 13,615 fish, or just above the 10 year average, in 2007.

Overall, Bristol Bay commercial Chinook salmon harvests in 2007 were below the recent 20-year averages in all districts. The 2007 bay-wide commercial harvest of 62,670 Chinook was below the 20-

year average of 66,607. The main factor here was the unexpected shortfall in the Nushagak District where the harvest was only 51,350. This was well below the expected harvest of 140,000.

Alternatives Considered

The analysis of alternatives considers two action alternatives as well as multiple components and options under each alternative. Alternative 2 is a hard cap on Chinook salmon bycatch while Alternative 3 would invoke a large area closure when a triggering amount of Chinook salmon are caught. These alternatives contain multiple components and options that would provide for sector level allocations, a range of seasonal split options, a range of bycatch allocations options, the potential for transferability or rollovers of unused bycatch allocations, cooperative level allocations and transfers as well as the possibility of a system similar to the present VRHS system. Given the extensive number of combinations of possible scenarios, the analysis has focused on a subset of those combinations in order to attempt to define direct adverse effects in terms of potentially foregone revenue and revenue at risk and potential benefits in terms of the number of salmon potentially not bycaught, or "saved."

The various provisions for transferability, rollovers, and cooperative provisions are treated qualitatively and in a generally comprehensive way. Such options allow flexibility with regard to allowing more pollock to be harvested by moving bycatch allocations around to those who are in need of them most. As such these provisions would likely improve the economic yield of the pollock fishery by mitigating impacts on revenue. However, if greater salmon conservation than a hard cap or triggered closure might provide is a goal, then limiting transferability would tend to save more Chinook salmon and several levels of limits are available in the alternative set.

Management and Enforcement Implications

Due to the complexity of the alternative set and the large number of combinations of alternatives, components and options, management and enforcement issues have been given extensive treatment within the sections on analysis of each alternative in this RIR. Due to the complexity of the issues, it is not possible to adequately summarize that treatment here. Thus, careful consideration of management and enforcement issues described within the text is necessary to understand the implication of the proposed actions.

Direct Effects Alternative 2: Hard Caps.

Salmon Saved

This RIR draws heavily on an analysis of hypothetical reductions in coastal-west Alaska specific adult equivalent Chinook salmon bycatch areas that is contained within the EIS. The values are based on median Adult Equivalency (AEQ) values and mean proportions regional assignments within strata (A-season, and NW and SE B seasons) genetics data collected from 2005-2007. The proportional breakouts of west Alaska Chinook is from Myers et al. 2004. The RIR reproduces output from the AEQ analysis for Western Alaska River System, specifically the Yukon, Bristol Bay, and Kuskokwim areas.

The potential benefit of Chinook salmon bycatch reduction, in terms of Yukon River salmon adult equivalency, increases as the cap decreases and bycatch increases the greatest adult equivalence benefits would have occurred in years when bycatch was highest (i.e. 2007). For the Yukon River, maximum estimated adult equivalent salmon benefits, in numbers of fish, are 13,300 fish under the most constraining hard cap of 29,300 Chinook in the 2007 year. As the hard cap is increased, the benefits in terms of AEQ estimates necessarily decrease as more Chinook are allowed to be bycaught. With a hard cap of 48,700 Chinook the maximum benefit of 10,027 fish is from the 2007 year. The low end AEQ estimate of 738 fish occurs in the 2004 year. As the cap is further increased, the AEQ estimates decrease and with the highest cap of 87,500 Chinook maximum benefit of 5,499 fish is estimated for the 2007 year. The least benefit under this cap is actually negative. A thorough review of the tabular data shows a nearly continuous range of potential benefits, in numbers of adult Chinook, from less than zero to 13,300.

For the Bristol Bay Region, the maximum estimated AEQ salmon benefits, in numbers of fish, are 11,305 fish under the most constraining hard cap of 29,300 Chinook in 2007. With a hard cap of 48,700 Chinook the maximum benefit of 8,523 fish is from the 2007 year. The low end AEQ estimate, under a 48,700 cap, of 653 fish occurs in the 2004 year. As the cap is further increased, the AEQ estimates decrease and with the highest cap of 87,500 Chinook maximum benefit of 4,674 fish is estimated for the 2007 year. The least benefit under this cap is actually negative. A thorough review of the tabular data shows a nearly continuous range of potential benefits, in numbers of adult Chinook, from less than zero to 11,305, depending on cap, split, option, and year.

For the Kuskokwim Region, the maximum estimated adult equivalent salmon benefit in numbers of fish is 8,645 fish under the most constraining hard cap of 29,300 Chinook in the 2007 year. With a hard cap of 48,700 Chinook the maximum benefit of 6,517 fish is from the 2007 year. The low end AEQ estimate, under a 48,700 cap, of 671 fish occurs in the 2004 year. As the cap is further increased, the AEQ estimates decrease and with the highest cap of 87,500 Chinook maximum benefit of 3,574 fish is estimated for the 2007 year. The least benefit under this cap is negative. A thorough review of the tabular data shows a nearly continuous range of potential benefits, in numbers of adult Chinook, from less than zero to 8,645 depending on cap, split, option, and year.

The maximum benefit to the Western Alaska region would be approximately 33,250 fish during the most severe bycatch year of 2007, and for the most restrictive cap and option as discussed previously. In the 2004 year, the lowest bycatch year in the period, that maximum benefit is 11,328. The minimum benefit in the 2007 year would have been 3,167 fish, but in 2004, the minimum is estimated to be negative. These data demonstrate that the scenarios analyzed here have a broad range of potential benefits that depend on the level of cap and the severity of the bycatch year as well as on how restrictive the splits and/or options are. Further, not all scenarios provide salmon savings benefit.

Potentially Foregone Revenue

Under the Chinook salmon bycatch hard cap scenarios included in this alternative, the pollock trawl fishery, and/or specific sectors that participate in it (depending on allocations of hard caps) would be required to stop fishing once a specific hard cap is reached. In such a circumstance, any remaining TAC that is not harvested when the cap is reached would remain unharvested unless specific provisions of the hard cap alternative dealing with transfers, rollovers, and/or cooperative level management are applied in order to mitigate potential losses in revenue due to unharvested pollock TAC.

The RIR provides hypothetical estimates of foregone pollock first wholesale revenue by year and season under Chinook bycatch option for fleet wide caps, and for CDQ versus non-CDQ. As expected, the greatest impact would have occurred in the highest bycatch year (2007) and under the most restrictive bycatch cap of 29,300. In the A season, the greatest effect occurs under the 50/50 seasonal split because of the higher roe pollock price in the A season. The B season impact has the reverse situation with effects being greatest under the 70/30 split, which constrains B season revenue more. The maximum A season impact was $529.4 million in 2007 under the 50/50 split and the 29,300 cap. That value is composed of $482.7 million from non-CDQ and $46.7 million from CDQ fisheries. In the B season, the maximum impact is $179.9 million in 2007 with the 293,300 cap and the 70/30 split. In percentage terms the A season maximum impact represents 84 percent of total revenue and the B season total impact is 30 percent of total B season revenue.

As is expected, as the hard cap is increased the impacts decrease. However, in the 2007 year when bycatch was highest, even the 87,500 cap would have resulted in total foregone revenue of $322.6 million in the A season, with no CDQ impact. The impact would have been $72.9 million in the B season, with CDQ impact only under the 70/30 split. These values are 51% and 12% of total revenue for the A and B seasons respectively. Thus, in a high bycatch year, even the highest cap has significant potential impacts. Also evident is that as the cap increases, the effect of the split is increased. For example, the $322.6 million A season impact under the 50/50 split would have been $134.8 million under the 70/30 split. The reverse pattern is, of course, observed in the B season.

Impacts estimated for 2004, which is among the lowest bycatch year, are considerably smaller than those estimated for 2007 but are still significant in some cases. In the 2004 A season total impact under the 29,300 cap is estimated to have been $128 million under the 50/50 split, all coming from non-CDQ fishery participation. Under the 70/30 split that amount drops to $64.3 million. With the exception of $200.000 in estimated impact under the 50/50 split and a 48,700 cap, none of the other caps would have caused foregone revenue impacts in 2004. In the B season, 2004 foregone revenue estimates are greatest under the 29,300 cap and 70/30 split, where $82.7 million is the estimated impact.

Overall, the impacts of the hard caps are greatest in the A season, when roe value is highest and in the years when bycatch has been largest. Further, the seasonal split definitely affects the impact values. Even in the second highest bycatch year of 2006, A season impacts under even the largest cap of 87,500 Chinook are estimated have been $183.6 million, which is 29 percent of total first whole sale revenue in the pollock fishery. However, in lower bycatch years of 2003, 2004, and 2005, there was very little A season impact at the 68,100 cap level, and in percentage terms, this is also true of the B season. The RIR also provides these effects broken out by sector and by year in a series of lookup tables.

Direct Effects of Alternative 3: Triggered Closures

Salmon Savings:
The triggered Closures analyzed here are based on hard caps that are formulated in the same manner as those formulated under Alternative 2. In other words, the triggers may be chosen from within the set of hard caps and would be used to trigger the closure areas identified in the Alternative set (discussed in detail in the EIS) for the A and B seasons. The difference here is that the triggered closure does not cap salmon bycatch but rather used the cap number to trigger the closure, which moves fishing effort outside of the trigger-closure area.

To determine the effects of the triggered closure on salmon bycatch, the EIS presents an analysis of both pollock catch and Chinook salmon bycatch within and outside the trigger-closure area in each of the years 2003-2007. That methodology has estimated the numbers of Chinook salmon that are potentially saved by moving effort outside of the closure areas and the following tables, taken from the EIS, document those numbers as potential benefits in terms of the number of Chinook potentially saved under each trigger, option, and seasonal split. These estimates are based on changed catch rates of Chinook inside and outside the trigger-closure area. The AEQ analysis presented previously in the discussion of Alternative 2 has not been specifically re-created for the trigger-closure analysis at this time, thus it is not possible to relate these savings in Chinook salmon to specific Western Alaska River systems.

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

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

Revenue at Risk

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

The data show that in the highest bycatch years and under the most restrictive trigger levels, revenue at risk would be about $485 million in the A season for all vessels combined. That represents 77% of the 2007 estimated total A season first wholesale revenue of the pollock fleet. As the trigger is increased, the impacts decrease; however, the least restrictive A season trigger (70/30 split) of 87,500 still results in $125.2 million in revenue at risk, or a bout 21% of the overall first wholesale revenue of all pollock vessels combined. In lower bycatch years (e.g. 2003, 2004, and 2005), the larger triggers of 87,500 and 68,100 do not cause triggers to be hit, and thus there is no revenue at risk. However, in the low bycatch year of 2004 even the lowest trigger of 29,300 would place $33.2 million (70/30 split) to $97.4 million (50/50s split) 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 17 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, more than $50 million, or 8 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.

RIR Conclusions

This RIR represents an initial review draft analysis of potential effects of a wide range of Chinook salmon bycatch alternatives on the BSAI pollock trawl fleet and attempts to demonstrate benefits in terms of the numbers of Chinook salmon that would be saved by the alternatives. This analysis has demonstrated that potential impacts range from zero to more than half a billion dollars under the most restrictive scenario and in the highest bycatch year, and that even the least restrictive measures may have large consequences in terms of foregone revenue and/or revenue at risk in high bycatch years. What has also been shown is that in those cases of greatest impact, there is also the potential for the greatest benefit in terms of Chinook salmon saved, with as many as 32,250 fish estimated to return to Western Alaska Rivers as adults. It is hoped that this initial analysis of this very complex alternative set will provide sufficient information for selection of a preliminary preferred alternative that can be analyzed with greater specificity regarding both direct and indirect effects.

Initial Regulatory Flexibility Analysis

The document contains an Initial Regulatory Flexibility Analysis (IRFA) which evaluates the impacts of the alternatives under consideration on directly regulated small entities to address the statutory requirements of the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA). The only small entities directly regulated by this action are the six Western Alaska CDQ groups. This IRFA is preliminary until NMFS develops the implementing regulations for this action.

Next step for the Council: Identifying a preliminary preferred alternative

The interplay between all of the alternatives, options and suboptions provides a complicated suite of combinations for analysis. Thus to the extent practicable, analysts summarized the impacts quantitatively, for the main impact categories (pollock, Chinook and chum salmon, economic impacts), as well as qualitatively, by reducing the analyzed range to 36 combinations as described previously.

All caps apply either to the A-season or the B-season. Options under Alternative 2 (or Alternative 3) Component 1, Options 1-1 to 1-4 (Section 2.2.1.3) provide the relative distribution of an annual cap by season. The seasonal cap allocations influence the extent to which different overall fishery cap levels would be constraining. While a suboption may permit underages (i.e., when catch is less than the cap level within a season) to be rolled over from the A season to the B season, within a calendar year, overages are not permitted and reaching a seasonal cap would result in a closure for the remainder of that season for the fishery (or if subdivided, sector) that reached the respective cap. The combination of which seasonal allocations are selected with how sector caps are distributed drives the degree to which individual sectors are constrained and affects total bycatch numbers by sector differently in different years (Table 8). The selection of seasonal/sector caps will depend on trade-offs for salmon saved and pollock foregone (Fig. 3).

As the Council begins to identify the choice of a preferred alternative or select specific aspects to be included in a preferred alternative, it will greatly enhance staff’s ability to ensure those specific impacts are analyzed in the different combinations in which they occur.

Table 9 summarizes the specific choices for the Council in building a preferred alternative. As noted previously, the preferred alternative may be constructed of a combination of elements from the range of alternatives. This table is provided to assist the Council and the public with understanding step-by-step what each of the decision points are in building a preferred alternative. Should the Council identify a preferred alternative in June, it will be included in the analysis prior to the draft EIS being released for public comment and review in the summer of 2008.

This version of the EIS is put forward as an initial review draft at the June 2008 Council meeting, to assist the public and the Council with understanding the analysis to date. This document will be modified following review at the June meeting, and will be published as a draft EIS, for public comment over the summer.

Table 7 Hypothetical Chinook salmon bycatch mortality **totals** under each cap and management option, 2003–2007. The shading relate to the relative magnitude of bycatch for each policy and year.

Cap	AB Split	Option	2003	2004	2005	2006	2007
87,500	50/50	opt1(AFA)	46,993	49,509	52,176	49,972	59,529
		opt2a	40,080	53,496	57,425	59,638	77,243
		opt2d	46,108	54,028	52,176	64,624	70,634
	58/42	opt1(AFA)	46,993	43,657	45,534	59,541	72,421
		opt2a	43,797	53,243	58,454	73,568	76,512
		opt2d	46,993	49,509	52,176	61,046	70,403
	70/30	opt1(AFA)	46,993	40,893	42,522	58,102	73,960
		opt2a	45,686	45,847	45,534	70,063	70,633
		opt2d	46,993	43,125	45,534	69,757	75,230
68,100	50/50	opt1(AFA)	44,606	43,657	45,534	40,133	47,329
		opt2a	39,344	50,215	48,403	56,272	60,442
		opt2d	40,474	49,509	51,340	42,806	50,835
	58/42	opt1(AFA)	46,993	40,893	45,534	40,133	54,534
		opt2a	39,293	47,271	49,560	54,763	58,283
		opt2d	44,128	43,657	45,534	51,492	58,027
	70/30	opt1(AFA)	46,993	38,192	40,441	51,094	56,959
		opt2a	38,927	41,474	44,581	59,964	60,411
		opt2d	46,666	39,771	42,522	52,063	62,088
48,700	50/50	opt1(AFA)	33,736	38,202	35,897	32,097	34,497
		opt2a	34,470	37,152	37,741	32,151	35,951
		opt2d	36,668	40,586	39,919	32,708	39,951
	58/42	opt1(AFA)	36,655	38,192	38,549	32,239	29,088
		opt2a	34,279	37,147	39,146	28,949	35,915
		opt2d	38,337	38,806	40,106	32,097	41,904
	70/30	opt1(AFA)	42,505	34,473	39,359	34,057	35,717
		opt2a	37,063	33,073	37,369	43,711	42,388
		opt2d	39,435	36,365	39,605	29,950	37,453
29,300	50/50	opt1(AFA)	22,634	23,892	22,318	18,412	12,670
		opt2a	23,864	24,893	26,017	24,714	15,010
		opt2d	25,416	25,145	25,359	17,725	14,765
	58/42	opt1(AFA)	23,562	24,293	25,140	16,848	17,482
		opt2a	24,909	26,910	24,863	24,519	12,285
		opt2d	24,495	27,857	24,568	22,482	13,925
	70/30	opt1(AFA)	24,168	25,313	24,844	19,323	16,378
		opt2a	27,678	25,689	27,761	20,035	19,209
		opt2d	25,295	25,325	27,037	21,154	9,358

Table 8 Hypothetical adult equivalent Chinook salmon bycatch mortality **totals** under each cap and management option, 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. The shadings and the pies relate to the relative AEQ bycatch for each policy and year.

	2003	**2004**	**2005**	**2006**	**2007**	
No Cap	**33,215**	**41,047**	**47,268**	**61,737**	**78,814**	
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%

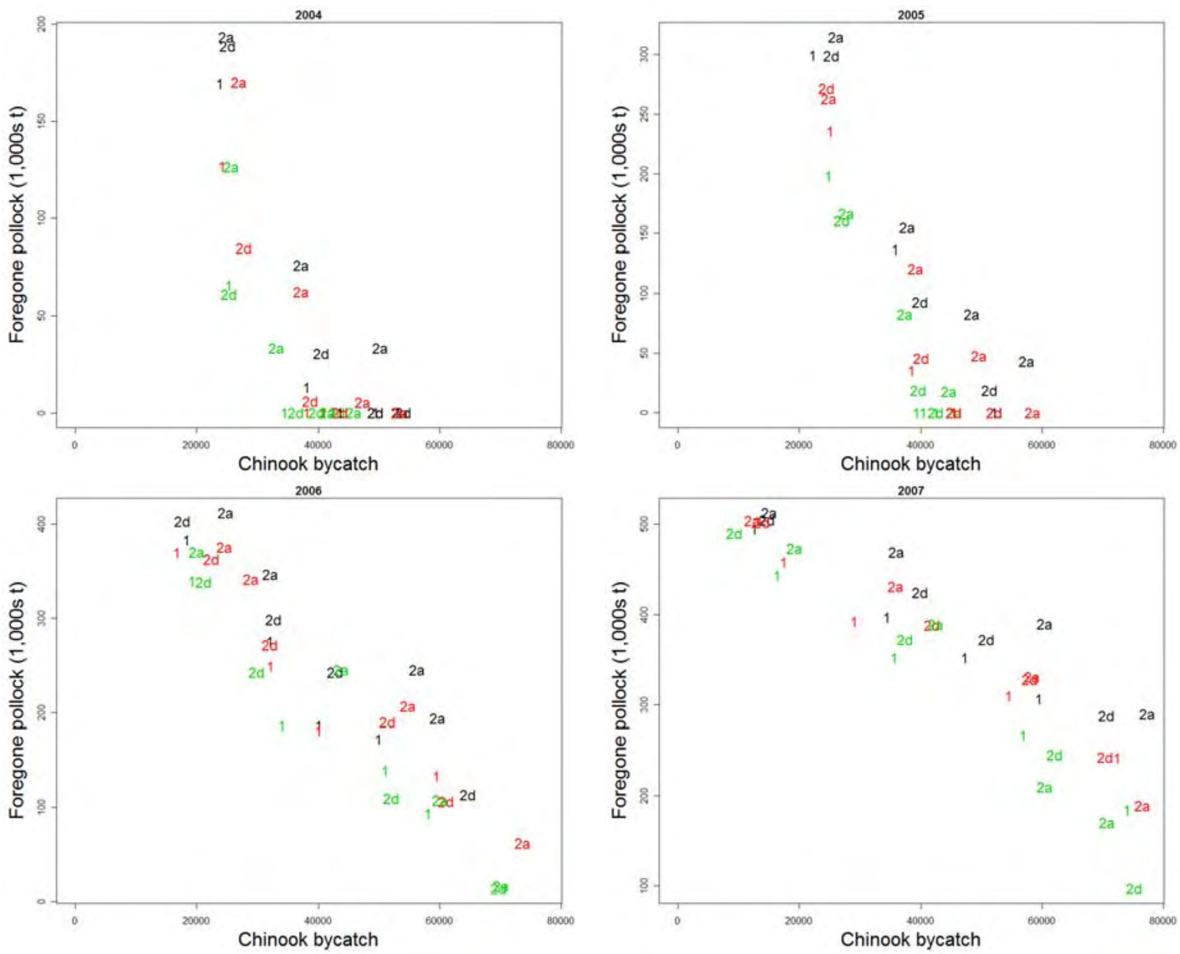


Fig. 3 Examples of trade-offs in hypothetical Chinook AEQ bycatch (horizontal axis) and foregone pollock (vertical axis) had the suite of 36 management options been in plact for 2004 (upper left) through 2007 (lower right). The symbols plotted denote the sector split options and the colors represent the different A-B season splits.

Table 9 Preferred alternative choices

<table>
<tr><td rowspan="2">Do you want to retain the existing triggers and closures?
(Alternative 1)</td><td>No</td><td>Existing salmon PSC limits and salmon savings areas will be removed from the FMP</td></tr>
<tr><td>Yes</td><td>Existing salmon PSC limits and salmon savings areas will remain in the FMP; exemption from the area closures will continue to apply to vessels participating in VRHS system</td></tr>
</table>

<table>
<tr><td rowspan="14">Do you want a hard cap?
(Alternative 2)</td><td>No</td><td colspan="6">No hard cap</td></tr>
<tr><td rowspan="13">Yes</td><td rowspan="2">How to formulate it?
(Component 1)</td><td colspan="4">Option 1 (i-viii): Select from a range of numbers</td><td>Suboption: adjust periodically based on updated bycatch information</td></tr>
<tr><td colspan="4">Option 2: Index cap is set relative to salmon returns</td><td></td></tr>
<tr><td>How to apportion the cap by season?
(Component 1)</td><td colspan="5">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)</td></tr>
<tr><td rowspan="10">Subdivide among sectors?
(CDQ, inshore CV, mothership, offshore CP)</td><td>No</td><td colspan="4">separate cap only for CDQ Program, otherwise cap applies to all non-CDQ sectors as a whole</td></tr>
<tr><td rowspan="9">Yes</td><td rowspan="2">How?
(Component 2)</td><td colspan="3">Option 1: same as pollock allocations, 10% CDQ, 45% inshore CV, 9% mothership, 36% offshore CP</td></tr>
<tr><td colspan="3">Option 2 (a-c): Cap is set based on historical average bycatch use by sector
Option 2 (d): Midpoint of the range provided by Option 1 and 2 (a-c)</td></tr>
<tr><td rowspan="2">Allow bycatch transfers among sectors?
(Component 3)</td><td colspan="3">Option 1: yes, transferable salmon bycatch caps</td></tr>
<tr><td colspan="3">Option 2: NMFS rolls over unused salmon bycatch to sectors that are still fishing</td></tr>
<tr><td rowspan="5">Subdivide inshore CV cap among cooperatives?
(Component 4)</td><td>No</td><td colspan="2">Inshore CV cap applies at sector level</td></tr>
<tr><td rowspan="4">Yes</td><td colspan="2">Inshore CV cap will be subdivided among cooperatives based on the cooperative's pollock allocation</td></tr>
<tr><td rowspan="3">Allow bycatch transfers among cooperatives?</td><td>Option 1: no, cooperatives may lease pollock to another cooperative</td></tr>
<tr><td>Option 2: yes, industry may initiate transfers</td></tr>
<tr><td>Suboption: NMFS rolls over unused salmon bycatch to cooperatives that are still fishing</td></tr>
</table>

Table 9 Preferred alternative choices **(continued)**

Do you want a new triggered closure? (Alternative 3)	**No**	No trigger caps and closures			
	Yes	**How to formulate cap?** (Component 1; same options as for hard cap)	Option 1 (i-viii): Select from a range of numbers		Suboption: adjust periodically based on updated bycatch information
			Option 2: Index cap is set relative to salmon returns		
		How to apportion the cap by season? (Component 1)	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)		
		How will the cap be managed? (Component 2)	NMFS would manage the trigger closures.		
				Option: Allow participants in the intercooperative agreement to manage their own cap. NMFS continues to manage trigger closures for non-participants.	
		Subdivide cap among sectors? (CDQ, inshore CV, mothership, offshore CP)	**No**	separate cap only for CDQ Program, otherwise cap applies to all non-CDQ sectors as a whole	
			Yes	**How?** (Component 3; same options as for hard cap)	Option 1: same as pollock allocations, 10% CDQ, 45% inshore CV, 9% mothership, 36% offshore CP
					Option 2 (a-c): Cap is set based on historical average bycatch use by sector Option 2 (d): Midpoint of the range provided by Option 1 and 2 (a-c)
				Allow transfer among sectors? (Component 4; same options as for hard cap)	Option 1: yes, transferable salmon bycatch caps
					Option 2: NMFS rolls over unused salmon bycatch to sectors that are still fishing
		Apportion by season?			
		What areas? (Component 5; Council may select both A and B season closures)	Option 1: A season closure		Suboption: adjust periodically based on updated bycatch information
			Option 2: B season closures		
		Duration of closures?	A-season: once triggered, areas remain closed for remainder of season B-season: If trigger is reach prior to August 15^{th}, areas remain open until August 15^{th} and then close for remainder of season		

1.0 INTRODUCTION

This Environmental Impact Statement/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EIS/RIR/IRFA) provides decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative Chinook salmon bycatch reduction measures for the Bering Sea pollock fishery. The EIS/RIR/RIFA is intended to serve as the central decision-making document for management measures developed by the National Marine Fisheries Service (NMFS or NOAA Fisheries) and the North Pacific Fishery Management Council (Council or NPFMC) to implement the provisions of the proposed action. NMFS decided to prepare an EIS in compliance with the National Environmental Policy Act (NEPA) to assist agency planning and decision-making. The EIS contains two appendices: an RIR, as required by Executive Order 12866, and an IRFA, as required by the Regulatory Flexibility Act.

The Council developed the following problem statement for Bering Sea 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/RIR/RIFA examines three alternatives to reduce Chinook salmon bycatch in the Bering Sea pollock fishery. These alternatives are described in detail in Chapter 2. The EIS evaluates the environmental consequences of each of these alternatives with respect to nine major issues:

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

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

1.1 What is this Action?

The proposed action is to minimize Chinook salmon bycatch in the Bering Sea pollock fisheries. The Bering Sea pollock fishery catches an average of 84% of the Chinook salmon taken incidentally as bycatch in the Bering Sea and Aleutian Islands (BSAI) groundfish trawl fisheries. The Council is considering alternative ways to manage Chinook salmon bycatch, including replacing the current Chinook Salmon Savings Areas and salmon bycatch reduction inter-cooperative agreement in the Bering Sea with salmon bycatch limits or new regulatory closures based on current salmon bycatch information.

1.2 Purpose and Need for this Action

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

Several management measures are being used to reduce Chinook salmon bycatch in the Bering Sea pollock fishery. Chinook salmon taken incidentally in groundfish fisheries are classified as prohibited species and, as such, must be either discarded or donated through the Pacific Salmon Donation Program. In the mid-1990s, NMFS implemented regulations recommended by the Council to control the bycatch of Chinook salmon taken in the Bering Sea pollock fishery. These regulations established the Chinook Salmon Savings Areas and mandated year-round accounting of Chinook salmon bycatch in the pollock fishery. Once Chinook salmon bycatch levels reached a specified amount in a Chinook Salmon Savings Area, the area would be closed to pollock fishing. These areas were adopted based on historic observed salmon bycatch rates and were designed to avoid high spatial and temporal levels of salmon bycatch.

The Council started considering revisions to salmon bycatch management in 2004 when information from the fishing fleet indicated that it was experiencing increases in salmon bycatch following the regulatory closure of the Chinook Salmon Savings Area. While the non-CDQ fleet could no longer fish inside the

Chinook Salmon Savings Area, vessels fishing on behalf of the CDQ groups were still able to fish inside the area because the CDQ groups had not yet reached their Chinook salmon prohibited species catch limit. Much higher salmon bycatch rates were reportedly encountered outside of the closure areas by the non-CDQ fleet than experienced by the CDQ vessels fishing inside. Further, the closure areas increased costs to the pollock fleet and processors.

To address this problem, the Council examined other means to minimize salmon bycatch that were more flexible and adaptive. Since 2006, the pollock fleet has been exempted from regulatory closures by participation in a salmon bycatch reduction inter-cooperative agreement to establish a voluntary rolling hotspot system (VRHS). The VRHS has been operational by the fleet since 2002 (for Chinook avoidance, 2001 for chum bycatch) and is intended to increase the ability of pollock fishery participants to minimize salmon bycatch by giving them more flexibility to move fishing operations to avoid areas where they experience high rates of salmon bycatch. The exemption to area closures was first implemented through an exempted fishing permit and subsequently, in 2007, through Amendment 84 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands (FMP).

In light of the high amount of Chinook salmon bycatch in recent years, the Council and NMFS are considering measures to effectively reduce bycatch to the extent practicable while achieving optimum yield from the pollock fishery. While the inter-cooperative reports on Chinook salmon bycatch indicate that the VRHS has reduced Chinook salmon bycatch rates compared with what they would have been without the measures, concerns remain because of escalating amounts of Chinook salmon bycatch through 2007. From 1990 through 2001, the Bering Sea Chinook salmon bycatch average was 37,819 salmon annually. Since 2002, Chinook salmon bycatch numbers have increased substantially. The averages from 2002 to 2007 were 82,311 Chinook salmon, with a bycatch peak of 122,000 Chinook salmon in 2007.

The Council and NMFS decided to limit the scope of this action to Chinook salmon, leaving in place the existing non-Chinook salmon bycatch reduction measures, because of the need for immediate action to reduce Chinook salmon bycatch. Chinook salmon is separated from non-Chinook salmon because Chinook salmon is a highly valued species and a species of concern that warrants specific protection measures. Additionally, the Council and NMFS expect the Chinook salmon bycatch reduction measures under consideration to also reduce non-Chinook salmon bycatch. The Council will address non-Chinook salmon bycatch in the Bering Sea pollock trawl fishery with a subsequent action.

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 the State of Alaska's territorial sea (extending to 3 nm from shore) to 200 nm (4.8 km to 320 km) off its coast. 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 salmon caught as bycatch and in the 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, and the western United States.

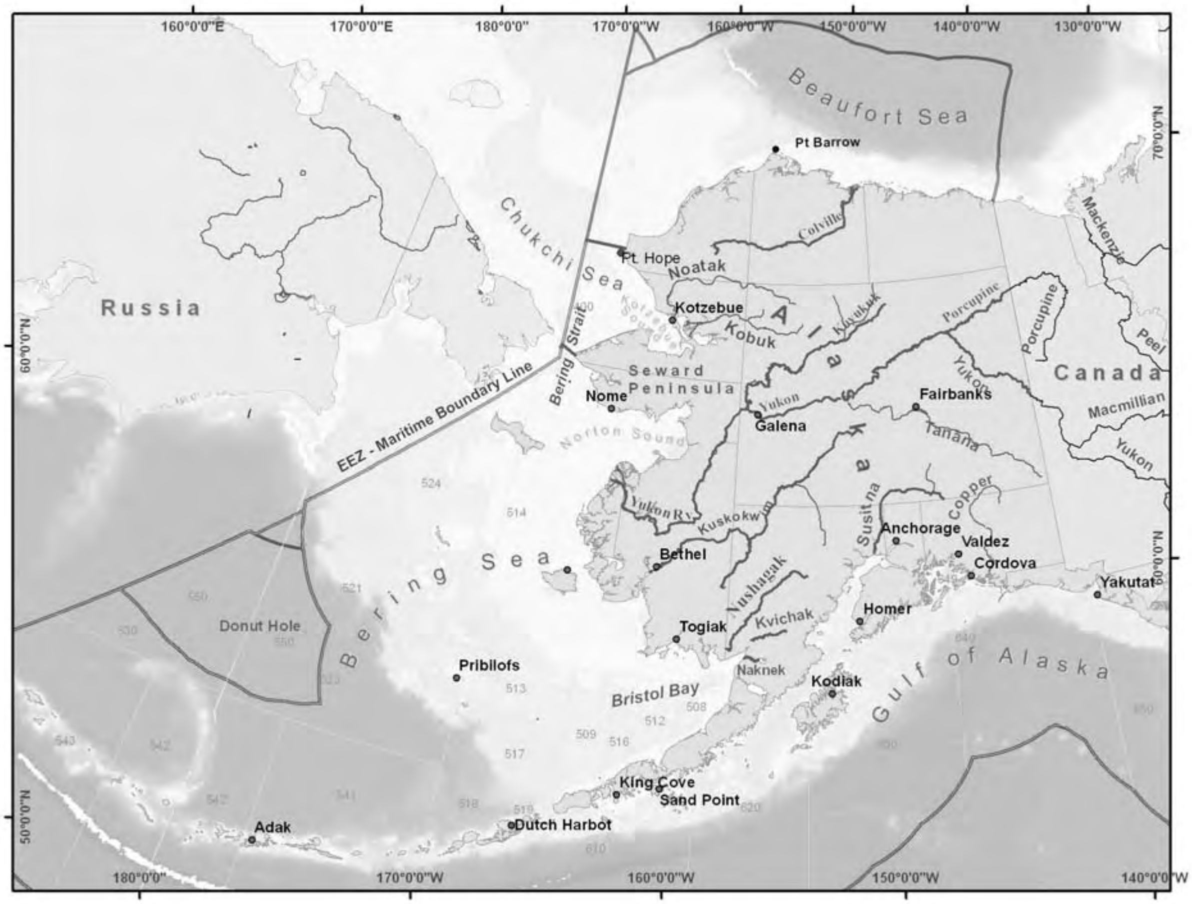


Fig. 1-1 Map of the Bering Sea and Major Salmon Producing Rivers in Alaska and Northwest Canada

1.4 Public Participation

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

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

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

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

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

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

1.4.1 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 Section 161 of the Consolidated Appropriations Act of 2004 (Public Law 108-199, 188 Stat. 452), as amended by 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 1.6 on the relationship of this action to federal law.

To start the consultation process, NMFS mailed letters to approximately 660 Alaska tribal governments, ANCSA corporations, and related organizations on December 28, 2007. The letters provided information about the EIS process and solicited consultation and coordination with Alaska Native representatives. NMFS received 12 letters from tribal government and ANCSA corporation representatives, which were summarized and included in the scoping report. Additionally, a number of tribal representatives and tribal organizations provided written public comments and oral public testimony to the Council during the Council meetings where the Council deliberated on salmon bycatch management.

[placeholder for information on the letter NMFS will send to the tribal governments and ANCSA corporations announcing the release of the Draft EIS and solicit input on the draft EIS. The letter will include a copy of the executive summary and provide information on how they can obtain a copy of the draft EIS or download and electronic copy.]

1.4.2 Cooperating Agencies

The Council for Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA emphasize 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 has agreed to participate in the development of this EIS and provide data, staff, and review for this analysis. ADF&G has an integral role in the development of this EIS because it manages the commercial salmon fisheries, collects and analyzes salmon biological information, and represents the people who live in Alaska.

Additionally, during the October and December 2007 and the February, and April 2008 Council meetings, 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 were notified of the intent to prepare an EIS and were informed throughout the development of the document though staff presentations at Council meetings.

1.4.3 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 in Appendix 1. Comments identified the following alternatives and issues for analysis in the EIS.

1.4.3.1 Alternative management measures identified during scoping

Chapter 2 describes the alternatives the Council and NMFS determined best accomplish the proposed action's purpose and need. Chapter 2 also describe the alternatives raised during scoping that were considered but not carried forward, and discuss 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 (ESA), 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 inter-cooperative salmon bycatch agreement 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

1.4.3.2 Issues identified during scoping

This section summarizes issues raised during the scoping process. To the extent practicable and appropriate, the EIS addresses these issues.

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 salmon bycatch reduction inter-cooperative agreement.

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 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.

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, recreational, 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.

Additional Issues

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

1.5 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.

1.6 Relationship of this Action to Federal Law

While NEPA is the primary law directing the preparation of this EIS, a variety of other federal laws and policies require environmental, economic, and socioeconomic analyses of proposed federal actions. This section addresses the CEQ regulations, at 50 CFR 1502.2(d), that require an EIS to state how alternatives considered in it and decisions based on it will or will not achieve the requirements of sections 101 and 102(1) of NEPA and other environmental laws and policies. This EIS/RIR/IRFA contains the required analysis of the proposed federal action and its alternatives to ensure that the action complies with these additional federal laws and executive orders:

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

The following provides details on the laws and executive orders directing this analysis.

1.6.1.1 National Environmental Policy Act

NEPA (42 U.S.C. 4331, *et seq*.) 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 taken.

Title II, Section 202 of NEPA (42 U.S.C. 4332) 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. A 1999 revision and update to the Administrative Order includes specific guidance regarding categorical exclusions, especially as they relate to endangered species, marine mammals, fisheries, and habitat restoration. The Administrative Order also expands on guidance for consideration of cumulative impacts and "tiering" in the environmental review of NOAA actions. 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.

1.6.1.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act (16 U.S.C. 1801, *et seq*.) 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. Each FMP contains a suite of additional management tools that together characterize the fishery management regime. These management tools are either a framework type measure, thereby allowing for annual or periodic adjustment using a streamlined notice process, or are conventional measures that are fixed in the FMP and its implementing regulations and require a formal plan or regulatory amendment to change.

The Sustainable Fisheries Act of 1996 (SFA; Public Law 104-297) reauthorized and made significant amendments to the Magnuson-Stevens Act. While the original focus of the Magnuson-Stevens Act was to assert jurisdiction over the fisheries within the exclusive economic zone of the U.S., the SFA included provisions aimed at the development of sustainable fishing practices in order to guarantee a continued abundance of fish and continued opportunities for the U.S. fishing industry. The SFA included provisions to prevent overfishing, ensure the rebuilding of overfished stocks, minimize bycatch, identify and conserve essential fish habitat, and address impacts on fish habitat. Finally, the SFA codified the Alaskan community development quota (CDQ) program already adopted by the Council and commissioned a National Academy of Sciences study of the CDQ program.

The SFA emphasizes the need to protect fish habitat. Under the law, regional councils prepared amendments identifying essential fish habitat (EFH) as areas necessary to manage fish species for their basic life histories. 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.

The actions under examination in this EIS are Chinook salmon bycatch reduction measures for the Bering Sea pollock fishery. In line with NMFS policy of blending EFH assessments into existing environmental reviews, NMFS intends the analysis contained in this EIS to also serve as an EFH assessment. An EFH consultation will be carried out with the NMFS Alaska Region's Habitat Division before the publication of the implementing regulations.

The Magnuson-Stevens Reauthorization Act of 2006 (MSRA; Public Law 109-479) made significant amendments to the Magnuson-Stevens Act. However, none of these amendments directly impacts the alternatives under consideration for this proposed action.

1.6.1.3 Endangered Species Act

The ESA of 1973 as amended (16 U.S.C. 1531, *et seq.*), 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.

In addition to listing species under the ESA, the critical habitat of a newly listed species must be designated concurrent with its listing 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. Some species, primarily the cetaceans (whales), which were listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

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

This EIS contains pertinent information on the ESA-listed species that occur in the action area and that have been identified in previous consultations as potentially impacted by the Bering Sea pollock fishery and an analysis of the impacts of the alternatives in the chapters addressing those resource components. Impacts on ESA-listed salmon are discussed in Chapter 5. Impacts on ESA-listed marine mammals and seabirds are discussed in Chapter 8. Before the publication of implementing regulations, a Section 7 ESA consultation will be carried out for the proposed action with the NMFS Alaska Region's Protected Resources Division for listed marine mammals, NMFS Northwest Region for listed salmon, and USFWS for listed seabirds.

1.6.1.4 Marine Mammal Protection Act

Under the MMPA of 1972 (16 U.S.C. 1361, *et seq.*), as amended, NMFS has a responsibility to conserve marine mammals, specifically cetaceans and pinnipeds (other than walrus). The USFWS is responsible for all other marine mammals in Alaska including sea otter, walrus, and polar bear. Congress found that certain species and stocks of marine mammals are or may be in danger of extinction or depletion due to human activities. Congress also declared that marine mammals are resources of great international significance.

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

[2] The term "take" under the ESA means "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct" (16 U.S.C. § 1533(19)).

1.6.1.5 Administrative Procedure Act

The APA (5 U.S.C. 552, *et seq.*) 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.

Except for emergency or interim rules, a proposed rule is designed to give interested or affected persons the opportunity to submit written comments regarding the proposed action. 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.

1.6.1.6 Regulatory Flexibility Act (RFA)

The RFA of 1980 (5 U.S.C. 601, *et seq*.), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996, requires federal agencies to consider the impact of their regulatory proposals on directly regulated small entities, analyze alternatives that minimize small entity impacts, 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, it must decide whether to conduct a full regulatory flexibility analysis or to certify that the proposed rule will not have a significant economic impact on a substantial number of small entities.

Unless an agency can certify that an action will not have a significant impact on a substantial number of small entities, the agency must prepare an initial regulatory flexibility analysis (IRFA) for IRFA for actions subject to the RFA to accompany a proposed rule, and a final regulatory flexibility analysis (FRFA) to accompany the final rule. NMFS has published revised guidelines, dated August 16, 2000, for RFA analyses; they include criteria for determining if the action would have a significant impact on a substantial number of small entities. The NMFS guidelines can be found at http://www.nmfs.noaa.gov/sfa/prorules.html.

NMFS prepared an IRFA for the proposed regulations implementing the salmon bycatch reduction measures to evaluate the adverse impacts of this action on directly regulated small entities, in compliance with the RFA. The IRFA is included in this EIS as Appendix 2. NMFS will prepare an FRFA for the final implementing regulations.

1.6.1.7 Executive Order 12866: Regulatory planning and review

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

The purpose of an RIR is to assess the potential economic impacts of a proposed regulatory action. As such, it can be used to satisfy NEPA requirements and serve as a basis for determining whether a proposed rule will have a significant impact on a substantial number of small entities under the RFA. The RIR is frequently combined with an EIS and an IRFA in a single document that satisfies 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 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.

NMFS prepared an RIR to identify economic impacts and assess of costs and benefits of the proposed salmon bycatch reduction measures. The RIR is included in this EIS as Appendix A.

1.6.1.8 Information Quality Act

The Information Quality Act (IQA) (Section 515 of Public Law 106-554) directs the OMB to issue government-wide policy and procedural guidance to all federal agencies to ensure and maximize the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies. The OMB's guidelines require agencies to develop their own guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by the agency. NOAA published its guidelines in September 2002 (available online at http://www.noaanews.noaa.gov/stories/iq.htm). Pursuant to the IQA, this information product has undergone a pre-dissemination review by NMFS, completed on [insert date].

1.6.1.9 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA, 16 U.S.C. 1451, *et seq.*) 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) (16 U.S.C. 1456(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.

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

Executive Order 13175 on consultation and coordination with Indian tribal governments establishes the requirement for regular and meaningful consultation and collaboration with Indian tribal governments in the development of federal regulatory practices that significantly or uniquely affect their communities; to reduce the imposition on unfunded mandates on Indian tribal governments; and to streamline the application process for and increase the availability of waivers to Indian tribal governments. This Executive Order requires federal agencies to have an effective process to involve and consult with representatives of Indian tribal governments in developing regulatory policies and prohibits regulations that impose substantial, direct compliance costs on Indian tribal communities. Additionally, Section 161 of the Consolidated Appropriations Act of 2004 (Public Law 108-199), as amended by Section 518 of the Consolidated Appropriations Act of 2005 (Public Law 108-447), extends the consultation requirements of Executive Order 13175 to Alaska Native corporations. 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 section 161 of Public Law 108-199 to replace Office of Management and Budget with all federal agencies.

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

1.6.1.11 Executive Order 12898: Environmental Justice

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

1.6.1.12 Alaska National Interest Lands Conservation Act

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

ANILCA defines "public lands" as lands situated "in Alaska" which, after December 2, 1980, are federal lands, except those lands selected by or granted to the State of Alaska, lands selected by a 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 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 evaluates the consequences of its proposed actions on subsistence uses and aims to protect such uses pursuant to other laws, such as NEPA and the Magnuson-Stevens Act. 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.

1.6.1.13 Pacific Salmon Treaty and the Yukon River Agreement

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

1.6.1.14 American Fisheries Act

The AFA of 1998 (Public Law 105-277, Division C, Title II) established a cooperative management program for the pollock fisheries of the BSAI. The purpose of the AFA was to tighten U.S. vessel ownership standards and to provide the BSAI pollock fleet the opportunity to conduct its fishery in a more rational manner while protecting non-AFA participants in the 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. 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 in Appendix 1 contains a detailed discussion of the pollock fishery under the AFA and the relationship between the salmon bycatch management and the AFA.

1.7 Related NEPA Documents

The NEPA documents listed below have detailed information on the Bering Sea pollock fishery, and on the natural resources and the economic and social activities and communities affected by that fishery, and on the salmon resource and salmon bycatch in the federal groundfish fisheries. These documents contain valuable background for the proposed action.

1.7.1.1 Final Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis for Modifying Existing Chinook and Chum Salmon Savings Areas (October 2007).

This document analyzed Amendment 84 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area. Amendment 84 implemented a salmon bycatch inter-cooperative agreement and the voluntary rolling hotspot system (VRHS). Amendment 84 and its implementing regulations improve the ability of pollock fishery participants to minimize salmon bycatch by giving them more flexibility to move fishing operations to avoid areas with high rates of salmon bycatch. Amendment 84 allows participants in the pollock fisheries to be responsive to current bycatch rates and fish in areas with relatively lower salmon bycatch rates, rather than rely on static closure areas that were established based on historical bycatch rates. This document includes extensive background information on salmon biology, stock status and ecological role, and North Pacific salmon fisheries management. This EA/RIR/IRFA is available on the NMFS Alaska Region website at: http://www.fakr.noaa.gov/analyses/amd84/Am84_EARIRFRFAfr.pdf

1.7.1.2 Alaska Groundfish Harvest Specifications Final EIS (January 2007)

NMFS prepared the Alaska Groundfish Harvest Specifications Final EIS for the harvest strategy used to set the annual harvest specifications. The EIS examines alternative harvest strategies for the federally managed groundfish fisheries in the Gulf of Alaska and the BSAI management areas that comply with federal regulations, the FMPs, and the Magnuson-Stevens Act. The EIS evaluates the environmental, social, and economic effects of alternative harvest strategies. The preferred alternative established a harvest strategy for the BSAI and Gulf of Alaska groundfish fisheries necessary for the management of the groundfish fisheries and the conservation of marine resources, as required by the Magnuson-Stevens Act and as described in the management policy, goals, and objectives in the FMPs. This EIS is available on the NMFS AKR website at: http://www.fakr.noaa.gov/analyses/specs/eis/final.pdf

1.7.1.3 Alaska Groundfish Programmatic Supplemental EIS (PSEIS, June 2004)

Managing salmon bycatch in the Bering Sea pollock fisheries follows the policy direction set in the PSEIS's preferred alternative. In June 2004, NMFS completed the PSEIS which analyzed the impacts of alternative groundfish fishery management programs on the human environment. NMFS issued a Record of Decision on August 26, 2004, with the simultaneous approval of Amendments 74 and 81 to the FMPs. This decision implemented a policy for the groundfish fisheries management programs that is ecosystem-based and is more precautionary when faced with scientific uncertainty. For more information on the PSEIS, see the NMFS Alaska Region website at: http://www.fakr.noaa.gov/sustainablefisheries/seis/default.htm.

The PSEIS is the overarching analytical framework that will be used to define future management policy with a range of potential management actions. First, it serves as the central environmental document supporting the management of the GOA and BSAI groundfish fisheries. The historical and scientific information and analytical discussions contained therein are intended to provide a broad, comprehensive analysis of the general environmental consequences of fisheries management in the exclusive economic zone off Alaska. Second, the document provides agency decision-makers and the public with an analytical reference to make informed policy decisions for managing the groundfish fisheries and to set the stage for future management actions. Third, it describes and analyzes current knowledge about the physical, biological, and human environment to assess impacts resulting from past and present fishery activities. The PSEIS brings the decision-maker and the public up to date on the current state of the environment, while describing the potential environmental consequences of alternative policy approaches and their corresponding management regimes for the groundfish fisheries off Alaska.

Amendments and actions since completion of the PSEIS derive from the chosen policy direction set for the PSEIS' preferred alternative. As stated in the PSEIS, any specific FMP amendments or regulatory actions proposed in the future will be evaluated by subsequent environmental assessments (EAs) or EISs that incorporate by reference information from the PSEIS but stand as case-specific NEPA documents and offer more detailed analyses of the specific proposed actions. As a comprehensive foundation for management of the GOA and BSAI groundfish fisheries, the PSEIS functions as a baseline analysis for evaluating subsequent management actions and for incorporation by reference into subsequent EAs and EISs that focus on specific federal actions.

The CEQ regulations encourage agencies preparing NEPA documents to incorporate by reference the general discussion from a programmatic EIS and concentrate solely on the issues specific to the EIS subsequently prepared. According to the CEQ regulations, whenever a programmatic EIS has been prepared and a subsequent EIS is then prepared on an action included within the larger program or policy, the subsequent EIS shall concentrate on the issues specific to the subsequent action. The subsequent EIS need only summarize the issues discussed and incorporate discussions in the PSEIS by reference (see 40 CFR 1502.20).

1.7.1.4 American Fisheries Act Amendments 61/61/13/8 EIS (February 2002)

The American Fisheries Act (AFA) EIS was prepared to evaluate sweeping changes to the conservation and management program for the pollock fishery of the BSAI 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. 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 EIS is available on the NMFS Alaska Region website at:

http://www.fakr.noaa.gov/sustainablefisheries/afa/final_eis/cover.pdf.

2.0 DESCRIPTION OF ALTERNATIVES

This analysis is focused on measures to reduce Chinook salmon bycatch in the pollock fishery in the Eastern Bering Sea. This chapter provides a detailed overview of the alternatives and options under consideration in this analysis. The Council may also formulate different alternatives to be analyzed by selecting aspects of the alternatives listed below. Section 2.5 of this chapter provides additional information and structure for formulating the Council's preferred alternative.

Three broad alternatives are considered in this analysis:

Alternative 1: Status Quo

Alternative 2: Hard cap

Alternative 3: Triggered closures

A detailed description of the components and options for each of the three alternatives under consideration is contained later in this chapter. Specific cap levels under consideration for each component and option are contained in this chapter as well as the subset of numbers carried forward through the impact analysis in Chapters 4-8 of the EIS and sections A4–A6 of the RIR. To avoid unnecessary repetition, many aspects of the alternatives are presented in this chapter only, and cross-referenced later in the document as applicable.

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

Note that these alternatives are not intended to be mutually exclusive, and the Council may choose to select elements from more than one alternative to formulate its preferred alternative (see Section 2.5). Under the description of each alternative below, information is provided on the specific elements and options of the alternatives, as well as how the CDQ Program would be treated under that alternative.

2.1 Alternative 1: Status Quo (Chinook)

Alternative 1 retains the current program of Chinook Salmon Savings Area (SSA) closures triggered by separate non-CDQ and CDQ Chinook caps, along with the exemption to these closures by pollock vessels participating in the salmon bycatch inter-cooperative agreement (ICA) under regulations implemented for Amendment 84. Only vessels directed fishing for pollock are subject to the SSA closures and ICA regulations.

The Chinook Salmon Savings Areas were established under BSAI Amendment 21b and revised under BSAI Amendment 58. If 29,000[3] Chinook salmon are caught by vessels participating in the pollock fisheries, the directed pollock fishing becomes prohibited in the savings areas. The timing of the closure depends upon when the limit is reached:

1. If the limit is triggered before April 15, the areas close immediately, through April 15. After April 15, the areas re-open, but are again closed from September 1 through 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 close immediately through the end of the year.

[3] This number includes the allocation of 2,175 Chinook salmon (7.5% of the limit) to the CDQ Program. The remaining 26,825 Chinook salmon are allocated as a prohibited species catch limit to the non-CDQ pollock fisheries.

BSAI amendment 58 modified the initial Chinook salmon savings area measures (established under amendment 21b, ADF&G 1995a). Modifications resulting from amendment 58, implemented in 1999, included: a revised Chinook trigger limit, reduced from 48,000 to 29,000 over a four year period; year-round accounting of Chinook bycatch in the pollock fishery beginning on January 1 of each year; revised boundaries for the savings area closures; and new closure dates. The initial Chinook Salmon Savings Areas included an area south of the Pribilof Islands. This area was removed as a savings area under Amendment 58 (NMFS 1999). The revision to the closure dates under amendment 58 specified an additional closure from September 1–December 31, under the conditions listed in bullets 1-3 above.

Amendment 84 to the BSAI groundfish FMP exempted vessels from closures of both the Chum and Chinook SSAs provided they participate in the salmon bycatch ICA with the voluntary rolling hot spot (VRHS) system (NPFMC 2005). The VRHS system enables participants in the pollock fisheries to be responsive to current bycatch rates, and to fish in areas with relatively lower salmon bycatch rates, rather than rely on the static closure areas that were established based on historical bycatch rates.

Under the status quo, the CDQ Program receives allocations of 7.5 percent of the BS and AI Chinook salmon PSC limits. The CDQ allocation is further allocated among the six CDQ groups based on percentage allocations currently in effect.. Each CDQ group would continue to be prohibited from fishing inside the Chinook salmon saving areas once that group's salmon bycatch limit is reached. In addition, the CDQ groups would continue to be exempt from the salmon savings area closures in the Bering Sea if they participate in the salmon bycatch ICA.

The status quo program also retains the current program of Chum Salmon Savings Area (SSA) closures triggered by separate non-CDQ and CDQ chum caps, with the fleet’s exemption to these closures as per regulations for Amendment 84.

For chum salmon, the Chum Salmon Savings Area was established in 1994 by emergency rule, and then formalized in the BSAI Groundfish FMP in 1995 under Amendment 35 (ADF&G 1995b). This area is closed to directed fishing for pollock from August 1 through August 31. Additionally, if 42,000[4] “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.

2.2 Alternative 2: Hard Cap (Chinook)

Alternative 2 would establish a Chinook salmon bycatch cap on the pollock fishery which, when reached, would require all directed pollock fishing to cease. Only those Chinook caught by vessels participating in the directed pollock fishery would accrue towards the cap, and fishery closures upon achievement of the cap would apply only to directed fishing for pollock. 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-specific cap); and at the cooperative level (the sector-level cap for the inshore sector is further subdivided and managed at the individual cooperative level).

[4] 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.

In order to select this alternative, the Council must choose one of the options under Component 1, Hard Cap Formulation (see below). If the Council does not select any options under the further components, Alternative 2 would be applied at the fishery level, as a single hard cap to all combined sectors. The CDQ Program would receive an allocation of 7.5% of any hard cap established for Chinook salmon in the BS. 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 CDQ once its cap is reached because further directed fishing for pollock would likely result in exceeding the cap.

The remaining 92.5% of the hard cap would be allocated to the non-CDQ sectors (inshore catcher vessel sector, offshore catcher processor sector, and mothership sector) combined. All bycatch of Chinook salmon by any vessels in any of these three sectors would accrue against the cap, and once the cap was reached, NMFS would prohibit directed fishing for pollock by all three of these sectors at the same time.

As described below, hard caps will be apportioned by season according to one of the options in Component 1 (Options 1-1 through 1-4). If the hard cap is to be subdivided by sector (under Component 2), two options are provided for the allocation. Options for sector transfer are included in Component 3. Further subdivision of an inshore sector cap to individual inshore cooperatives is discussed under Component 4 (cooperative provisions).

2.2.1 Component 1: Hard Cap Formulation

Component 1 would establish the annual hard cap number by one of two methodologies: Option 1, based upon averages of historical numbers and other considerations as noted below, or Option 2, which uses a modeling methodology to establish a framework for periodically setting the cap based upon relative impact rates on salmon returns. Component 1 sets the way the overall cap is formulated; this can be either applied to the fishery as a whole, or applying Components 2 and 4, may be subdivided by sector (Component 2) and cooperative (Component 4). All annual caps are apportioned by season.

2.2.1.1 Option 1: Range of numbers for hard cap formulation

A range of numbers is established for considering hard caps for Chinook salmon. Table 2-1 lists the numbers in numerical order, highest to lowest, for overall caps. As listed here, the CDQ allocation of the cap is 7.5% of the total cap, with the remainder for the combined non-CDQ fishery.

Table 2-1 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 cap (number of Chinook salmon)	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 originating rationale (by suboption number) for each cap listed in Table 2-1. 87,500 Chinook salmon (suboption i) represents the upper end of the range included in the BSAI fishery Incidental Take Statement (ITS). This amount is related to the ESA consultation on the incidental catch of

ESA-listed salmonids in the BSAI groundfish trawl fisheries. The ITS represents a recent range of observations for Chinook bycatch in the BSAI trawl fisheries (NMFS 1-11-07 supplemental Biological Opinion). An ITS specifies the expected take of an ESA-listed species for the activity consulted on. The ESA-listed salmonids originate in the 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 5.3.7 on ESA-listed species.

Suboptions ii-vi refer to average bycatch numbers by the pollock pelagic trawl fishery over a range of historical year combinations, from 1997 through 2006. Suboption (ii) is the 3-year average from 2004–2006; (iii) is the 5-year average from 2002–2006; (iv) is the 10-year average (1997–2006), with the lowest year (2000) dropped prior to averaging, as an injunction on the fishery altered normal fishing patterns in that year. Suboption (v) is the straight 10-year average (including all years 1997–2006), while (vi) is the 10-year average (1997-2006), but with the highest year of bycatch (2006) dropped prior to averaging, providing contrast with suboption (iv).

The final two suboptions under consideration are the 5-year average from 1997–2001 (suboption vii) and the 10-year average 1992-2001 (suboption viii). These year combinations were chosen to include consideration of 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 itself are contained in Chapter 1.

For analytical purposes only, a subset of the numbers included in the 8 suboptions will be used in this document to assess the impacts on the pollock fishery of operating under a hard cap. This subset approximates the upper and lower endpoints of the suboption range, and two equidistant midpoints (Table 2-2).

Table 2-2 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

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

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

2.2.1.2 Option 2: Index Cap (cap set relative to salmon returns)

Under this option, hard caps will be based on analysis and will consider run-size impacts. Since this approach involves a number of uncertain components (e.g., river-of-origin, ocean survival, future expected run-size), the cap could be derived from estimated probabilities that account for this uncertainty. This option provides a framework so that the hard cap regulation could be modified as scientific information improves. Such changes in the cap are envisioned on a periodic basis (say every 2 to 5 years) as data and input variables critical to the model calculations improve and merit revising the cap levels.

Variables and data that are likely to change with improved scientific information include river of origin information on the stock composition of bycatch samples, stock size estimates by river system, and age-specific survival of salmon returning to individual river systems.

The developed modeling methods are designed to account for uncertainty, both due to natural variability and observation (measurement) errors. The cap formula would be based on the selection of an acceptable impact level (at a specified probability) for a set of rivers or systems. This impact level would then be used to back-calculate the cap level. For example, a framework for this option might be to establish a bycatch hard cap that has only a 10% probability of exceeding a 10% impact level on a particular run. The impact measure relates the historical bycatch levels to the subsequent returning salmon run *k* in year *t*:

$$u_{t,k} = \frac{C_{t,k}}{C_{t,k} + S_{t,k}}$$

where $C_{t,k}$ and $S_{t,k}$ are the bycatch and stock size estimates of Chinook salmon. The calculation of $C_{t,k}$ includes the bycatch in year *t* of salmon returning to spawn in year *t* as well as the bycatch of the same cohort from previous years (i.e., at younger, immature ages). This latter component needs to be decremented by ocean survival rates (while accounting for uncertainty). Additionally, uncertainty of age-assignments and river-of-origin, as well as uncertainty of run-size, impact these values. A complete description of the model, estimation procedure, and input values are detailed in Appendix C.

Under this option, the Council would specify an acceptable run-size impact level (and a maximum probability of error), by river system, in order to implement the procedure to calculate a corresponding salmon bycatch cap level. For regulatory purposes, the adopted procedure must be based on objective criteria and may not be discretionary in nature. Clearly, the decision as to what is an acceptable run size impact level is discretionary, and therefore the Council's decision of what is acceptable must be an approved fixed value that can vary only with completely revised analysis. The acceptable value is thus a policy decision before the Council. Other non-discretionary aspects of the approach may be modified as information improves following standard scientific guidelines and review by the SSC. For the present analysis, a range of impact levels and corresponding cap levels are provided to the Council for consideration and comparison with the fixed value cap levels specified under Option 1.

In order to adopt this option to establish indexed caps which are set in regulation, the Council must choose both the candidate stock for which to index the cap, as well as the acceptable impact level upon that stock. This would be accomplished in the following manner:

1. In this analysis, the Council is provided information on impact levels for each of the 9 aggregate groups for which we have available recent genetic stock of origin data. These groups are: Coastal western Alaska (including lower Yukon, Kuskokwim, Bristol Bay), middle Yukon, upper Yukon, Northern Alaska Peninsula, Cook Inlet, Pacific Northwest (including stocks from BC, CA, WA, and OR), Trans-boundary Rivers/Southeast Alaska, Russia, and “other”. A full listing of the individually resolved rivers in each of these aggregate categories is contained in Appendix C.

2. **Decision point #1**: The Council will select one river system to serve as the candidate index for impact levels of bycatch upon all streams. In making the decision as to which stock is most appropriate as a candidate choice, the Council should consider factors such as relative information availability for run size estimates and age-specific survival to the river system. Some systems have better available information than others, as this analysis describes, and a candidate river or river system should be chosen from among those where more precise information is available.

3. **Decision point #2**: The Council will select an appropriate impact level threshold for the candidate river system (selected under decision point #1). This analysis indicates what the estimated impact levels are of historical bycatch on these rivers as well as what the impact would have been

historically of proposed cap levels (see Chapter 5 and Appendix C for additional details on the analysis and estimated impacts by river). This provides the context from which the Council may choose an appropriate impact level. Once selected, bycatch caps would be established so as to remain below this level.

These are the two decisions required by the Council in order to establish an indexed cap. From there, the impact level and the candidate system upon which caps are indexed are fixed in regulations. The cap level itself is back-calculated from the impact level. This cap level will be established as a numerical cap, but can fluctuate higher or lower depending on additional scientific information on relative impact levels as evaluated by the SSC. Re-estimation of the cap is envisioned to occur every 2-4 years depending on the availability of new information. As described previously, information which could influence the estimate of relative impact level includes new estimates of stock of origin proportions in the bycatch, new run-size information, and age-specific survival of salmon returning to river systems (e.g., to the candidate system). An analysis would be done on a periodic basis (a time period to be specified in regulations) to estimate the relative impact rate on the candidate stock. If the impact rate at the current cap level is higher than the specified impact rate in regulation, the corresponding cap level would be decreased to remain below this impact level. Likewise if new estimates of stock run size or other information included in the analysis led to a lower level of impact than previously estimated, the revised cap level could be higher. New cap levels would be specified in regulation in conjunction with an existing regulatory process (e.g., the harvest specifications process). As with groundfish acceptable biological catch (ABC) specifications, the SSC will be charged with reviewing new information and making scientifically-based cap recommendations to the Council.

If the Council wished to modify the impact rate or the candidate stock, then an FMP amendment process would be initiated to reevaluate how the bycatch cap is formulated. Otherwise, modifications to the cap level based upon incorporation of new scientific information would be explicitly included in the regulatory process and as such would require analysis but not an FMP amendment nor decision by the Council.

As an example, the Council could choose as their candidate stock the aggregate coastal western Alaska stocks, which are comprised of the lower Yukon River, the Kuskokwim River and Bristol Bay rivers. Based upon recent genetic information weighted according to catch by area and year (see Chapter 5.2.3.1 and Appendix C for additional information on methodology and results), this group represents ~68% of the A season bycatch and between 35-70% of the B season bycatch (depending upon area). Analysis of median relative impact rate indicates that a fixed 5% impact rate would constrain the fishery from higher impacts on this stock than historical levels have indicated, while a lower impact rate such as 4%,would limit the fishery to impact rates on this stock that are below historical levels. A 4% impact rate would translate into a cap of approximately 68,100 Chinook (Fig. 2-1). Since the scale of the impact rates depend on a number of assumptions, the Council may wish to select a value relative to a particular year. For example, the cap level could be set to ensure that the impact is *no greater than* the estimate for a particular year or period of years.

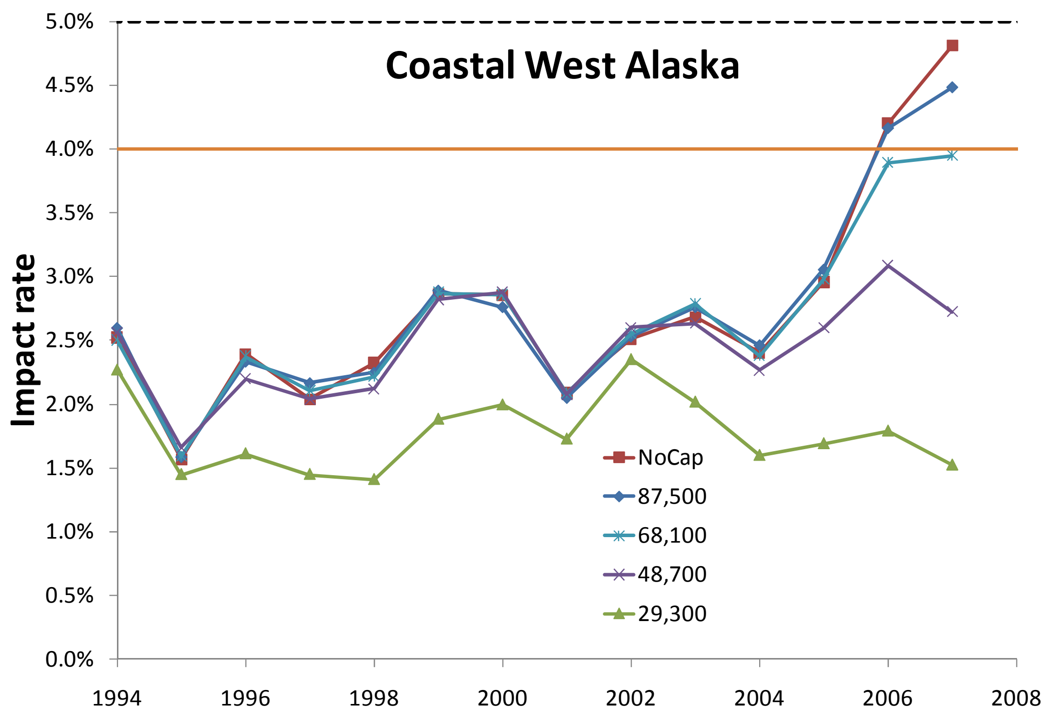


Fig. 2-1 Examples of impact level thresholds for establishing index-based cap levels
The dashed line represents a 5% impact rate threshold, while the solid line represents a 4% impact level threshold.

2.2.1.3 Seasonal distribution of caps

Any hard cap shall be apportioned 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 distribution of caps are available under Components 1, 2, 3, and 4 and would be applied at the same level as the allocations of the salmon bycatch hard caps.

Table 2-3 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 2-2). 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.

Table 2-3 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.

In analyzing the alternatives, 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.

2.2.2 Component 2: Sector Allocation

If this component is selected, the hard cap would be managed at the sector level for the fishery. 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 catch of 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 unless they too reach their specific sector level cap. The CDQ allocations would continue to 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 is salmon bycatch allocation.

Options for hard caps are as specified under Component 1, with explicit seasonal distribution of caps as described in Options 1-1 through 1-4. If Component 2 is selected, the resulting overall fishery hard cap would then be subdivided into sector level caps using one of the following: Option 1, or Option 2a-2d, described below.

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.

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 allocatons of 45% inshore CV, 9% mothership and 36% offshore CP.

This option is intended to follow the percentage allocation established for pollock under the AFA. Application of these percentages results in the following range of caps by sector, based upon the range of caps in Component 1, Option 1 (Table 2-4). Note that here the CDQ allocation of salmon is higher than under status quo (10% rather than 7.5%).

Table 2-4 Annual sector split of 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

For analytical purposes, Table 2-5 lists the range of sector cap levels under Option 1 for the A season (applying the seasonal allocation options listed in Table 2-3), and Table 2-6 for the B season, which will be utilized to evaluate the impact of Component 2, Option 1. Non-shaded numbers form the basis for the detailed impact analysis.

Table 2-5 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 2-6 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 bycatch use by sector

There are four suboptions for Option 2.

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%

Under Option 2, the subdivision of caps to each sector is based upon 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 for the overall cap formulation, the historical years do not consider the most recent (and historical high) year of 2007.

Option 2a uses the historical averages of percent bycatch by sector from 2004–2006. 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 2-7).

Table 2-7 Annual sector split of 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 (2002-2006). 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 2-8).

Table 2-8 Annual sector split of 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 (1997-2006). 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 2-9).

Table 2-9 Annual sector split of 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 2-10).

Table 2-10 Annual sector split of 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

For analytical purposes, Table 2-11 - Table 2-14 list the range of sector cap levels for the A season under Options 2a-2d (applying the seasonal allocation options listed in Table 2-3), which will be utilized to evaluate the impact of Component 2. Shaded numbers were omitted from detailed impact analysis.

Table 2-11 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 distribution	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 2-12 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 distribution	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 2-13 A-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	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 2-14 A-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	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

For analytical purposes, Table 2-15 - Table 2-18 list the range of sector cap levels for the A season under Options 2a-2d (applying the seasonal allocation options listed in Table 2-3), which will be utilized to evaluate the impact of Component 2. Shaded numbers were omitted from detailed impact analysis.

Table 2-15 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 2-16 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 2-17 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 2-18 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

Options under this component may be selected only if the Council recommends allocating salmon bycatch among the sectors under Component 2.

If the Council does recommend salmon bycatch allocations to the sectors under Component 2 but does not select one of these options, the salmon bycatch available to each sector could not change during the year and NMFS would close directed fishing for pollock once each sector reached its Chinook salmon bycatch allocation. 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.

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

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 trigger caps among the sectors and CDQ groups. (NMFS does not actively manage the salmon bycatch allocations).

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 completed all of its pollock harvest with some salmon remaining, it could only transfer up to a specified percent of that salmon bycatch to another entity with pollock still remaining for harvest. 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, initiated by the entity receiving a salmon bycatch cap, for NMFS to move a specific amount of a salmon bycatch cap from one entity to another entity.

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

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

Once transferable salmon bycatch hard caps are allocated to a legal entity representing an AFA sector or to a CDQ group, NMFS does not actively manage these allocations. Each entity receiving a transferable hard cap would be prohibited from exceeding that cap and would be responsible to control its pollock fishing to prevent exceeding its salmon bycatch cap. Any overages of the salmon bycatch cap would be reported to NMFS Enforcement for possible enforcement action against the responsible entity.

2.2.3.1.1 Salmon bycatch monitoring under sector transfers

To ensure effective monitoring and enforcement of transferable salmon bycatch caps, NMFS recommends the following additional monitoring requirements be implemented for the inshore sector:

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

Existing monitoring requirements in place for catcher/processors and motherships participating in the AFA pollock fisheries, including the directed fisheries for pollock CDQ, are adequate to obtain the salmon bycatch information needed to account for and transfer Chinook salmon among industry sectors.

2.2.3.2 Option 2: Rollover unused salmon bycatch to other sectors

Option 2) NMFS actively manages the salmon bycatch allocations to the non-CDQ sectors and would rollover unused salmon bycatch to other sectors still fishing 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 another through a notice in the Federal Register. Rollovers are an alternative to allowing one sector to voluntarily transfer salmon bycatch to another sector.

Under this option, if a non-CDQ AFA sector has completed harvest of its pollock allocation without using all of its salmon bycatch allocation, and sufficient salmon bycatch remains to be reapportioned, NMFS would reapportion the unused amount of salmon bycatch to other AFA sectors, including CDQ. 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 year. Successive reapportionment actions would occur as each non-CDQ sector completes harvest of its pollock allocation.

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

2.2.4 Component 4: Cooperative provisions

Options under this component may be selected only if the Council recommends allocating salmon bycatch among the sectors under Component 2 and makes an allocation of salmon bycatch to the inshore sector. Component 4 would allow further allocation of transferable or non-transferable salmon bycatch allocations to the inshore cooperatives.

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

The initial allocation of salmon by cooperative within the shore-based CV fleet or to the open access fishery would be based upon the proportion of total sector pollock catch associated with the vessels in the cooperative or open access fishery. The annual pollock quota for this sector is divided up by applying a formula in the regulations which allocates catch to a cooperative or the open access fishery according to the specific sum of the catch history for the vessels in the cooperative or the open access fishery. Under 679.62(e)(1), the individual catch history of each vessel is equal to the sum of inshore pollock landings from the vessel's best 2 of the 3 years 1995 through 1997, and includes landings to catcher/processors for vessels that made landings of 500 mt or more to catcher/processors from 1995 through 1997. Each year, fishing permits are issued by cooperative, with the permit application listing the vessels added or subtracted. Fishing in the open access fishery is possible should a vessel leave their cooperative, and the shore-based CV quota allocation is partitioned to allow for an allocation to an 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 shore-based CV fleet based upon Component 2, Options 1 and 2 applied to Component 1 Options 1 and 2 (Table 2-4, Table 2-7 to Table 2-10). The cooperative level allocations are listed in Table 2-19 to

Table 2-23. All inshore sector catcher vessels have been part of a cooperative since 2005. However, if this component is selected by the Council, regulations would accommodate allocations of an appropriate portion of the salmon bycatch cap to the open access fishery if, in the future, a vessel or vessels did not join a cooperative.

For analytical purposes, the range of cooperative allocations will be analyzed using a subset of the full range under consideration, as indicated previously. Allocations as shown in Table 2-19 to

Table 2-23 are based upon annual cap suboptions only. However, these annual allocations are further apportioned by season according to Options 1-1 through 1-4 (Table 2-3). The range of inshore cooperative and open access fishery level allocations resulting from application of the sector split options to the range of seasonal apportionments for the subset of caps for analysis are shown in Table 2-24 through
Table 2-28.

Table 2-19 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 sector allocation *	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet coop	2.876% Peter Pan Fleet coop	12.191% Unalaska coop	24.256% Unisea Fleet coop	18.906% Westward Fleet coop	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% CV after CDQ)

Table 2-20 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 coop	2.876% Peter Pan Fleet coop	12.191% Unalaska coop	24.256% Unisea Fleet coop	18.906% Westward Fleet coop	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 2-21 Annual inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, resulting from application of Component 2, Option 2b allocation to the inshore CV fleet (average historical bycatch from 2002-2006)

Suboption	Overall fishery cap	Resulting inshore sector allocation*	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet coop	2.876% Peter Pan Fleet coop	12.191% Unalaska coop	24.256% Unisea Fleet coop	18.906% Westward Fleet coop	0.000% 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 2-22 Annual inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, resulting from application of Component 2, Option 2c allocation to the inshore CV fleet (average historical bycatch from 1997-2006)

Suboption	Overall fishery cap	Resulting inshore sector allocation*	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet coop	2.876% Peter Pan Fleet coop	12.191% Unalaska coop	24.256% Unisea Fleet coop	18.906% Westward Fleet coop	0.000% 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 2-23 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 coop**	**Peter Pan Fleet coop**	**Unalaska coop**	**Unisea Fleet coop**	**Westward Fleet coop**	**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 2-24 Seasonal inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, using Component 2, 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%
Sector and seasonal allocation options	Overall fishery cap level Chinook	Resulting Inshore sector allocation*	Akutan CV Assoc	Arctic Enterprise Assoc	Northern Victor Fleet coop	Peter Pan Fleet coop	Unalaska coop	Unisea Fleet coop	Westward Fleet coop	open access AFA vessels
Option 1:	87,500	27,563	8,584	316	2,613	793	3,360	6,686	5,211	0
70/30 A	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:	87,500	11,813	3,679	135	1,120	340	1,440	2,865	2,233	0
70/30 B	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:	87,500	22,838	7,113	262	2,165	657	2,784	5,539	4,318	0
58/42A	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:	87,500	16,538	5,151	190	1,568	476	2,016	4,011	3,127	0
58/42B	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:	87,500	19,688	6,132	226	1,867	566	2,400	4,775	3,722	0
50/50 (A	68,100	15,323	4,772	176	1,453	441	1,868	3,717	2,897	0
and B)	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 2-25 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 coop	2.876% Peter Pan Fleet coop	12.191% Unalaska coop	24.256% Unisea Fleet coop	18.906% Westward Fleet coop	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 2-26 Seasonal inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, using Component 2, Option 2b, and seasonal distribution options

Cap Suboption and seasonal allocation	Overall fishery cap level Chinook	Resulting Inshore sector allocation*	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet coop	2.876% Peter Pan Fleet coop	12.191% Unalaska coop	24.256% Unisea Fleet coop	18.906% Westward Fleet coop	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 2-27 Seasonal inshore cooperative allocations of Chinook salmon hard caps, in numbers of fish, using Component 2, Option 2c, and seasonal distribution options

Cap Suboption and seasonal allocation	Overall fishery cap level Chinook	Resulting Inshore sector allocation*	Inshore cooperative allocation: 31.145% Akutan CV Assoc	1.146% Arctic Enterprise Assoc	9.481% Northern Victor Fleet coop	2.876% Peter Pan Fleet coop	12.191% Unalaska coop	24.256% Unisea Fleet coop	18.906% Westward Fleet coop	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 2-28 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 coop	Peter Pan Fleet coop	Unalaska coop	Unisea Fleet coop	Westward Fleet coop	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 Council selected sector allocations under Component 2 and further allocated the inshore sector allocation among the cooperatives and the inshore open access fishery (if the inshore open access fishery existed in a particular year) under Component 4.

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

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

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

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

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

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

2.2.4.1.1 Salmon bycatch monitoring under Component 4

To ensure effective monitoring and enforcement of salmon bycatch hard caps allocated to the inshore cooperatives, NMFS recommends the following additional monitoring requirements be implemented for the inshore sector:

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

2.3 Alternative 3: Triggered closures (Chinook)

Triggered closures are regulatory time and area closures that are invoked when specified cap levels are reached. Cap levels for triggered closures would be formulated in a way similar to 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 BS 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).

2.3.1 Component 1: Trigger cap formulation

The trigger cap amount would be within the range of hard caps established under Alternative 2 (Table 2-1, page 20).

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 2.2.1.3).

2.3.2 Component 2: Management

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

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

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

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

2.3.2.1 Option 1: Allow ICA management of triggered closures

Under Option 1, a NMFS-approved salmon bycatch reduction intercooperative agreement (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 proscribed 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 apply to any vessels not participating in the ICA. NMFS would continue to manage triggered area closures for vessels not participating in the ICA as described in Section 2.3.2 above. Vessels participating in the ICA would be exempt from NMFS's area closures, and would instead be subject to the ICA closures. If the Council does not select any sector allocation of the trigger caps under Component 3, the area closures that would result from NMFS management and ICA management would occur at the same time. NMFS's closure would apply to vessels not participating in the ICA and the ICA's closure would apply to vessels participating in the ICA.

Under Component 3, the NMFS-managed seasonal caps may be further subdivided among the inshore, catcher/processor, or mothership sectors. The ICA, however, would operate only under the fishery-level seasonal caps established under Component 1. If the Council does select 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) unless they reach their sector salmon bycatch cap. Pollock fishing could continue outside of the closure areas until either the pollock allocation to the sector is reached or the pollock fishery reaches a seasonal (June 10) or annual (November 1) closure date.

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

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

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

2.3.4 Component 4: Sector Transfer

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

Options 1 and 2 are mutually exclusive, which means that the Council may select 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. But, the Council could not select both Option 1 and Option 2.

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. (NMFS does not actively manage the salmon bycatch allocations).

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 to another entity.

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

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

Once transferable salmon bycatch trigger caps are allocated to a legal entity representing an AFA sector or to a CDQ group, NMFS does not actively manage these trigger cap allocations. Each entity receiving a transferable trigger cap would be prohibited from fishing within the closure area(s) once the trigger cap was reached.

If transferable trigger caps were recommended by the Council, 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. It is also possible that a sector or CDQ group could be closed out of the area after reaching its salmon bycatch cap, transfer in more salmon bycatch, and allow the area to reopen again for that sector of CDQ group.

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

2.3.4.1.1 Salmon bycatch monitoring under Option 1 (transferable sector trigger caps)

The revisions to monitoring requirements for the inshore sector for transferable salmon bycatch trigger caps are the same as NMFS recommended for transferable hard caps under Alternative 2, Component 3 (section 2.2.3.1.1, page 34):

2.3.4.2 Option 2: Rollover unused salmon bycatch

Option 2) NMFS actively manages the salmon bycatch trigger cap allocations to the sectors and would rollover unused salmon bycatch from the sector level trigger caps to other sectors still fishing based on the proportion of pollock remaining for harvest by each sector.

Option 2 could apply if the Council selected to allocate the non-CDQ trigger caps among the inshore, catcher/processor, and mothership sectors and the Council decided (1) not to recommend Component 2 Option 1 to allow ICA management of the trigger caps, (2) not to allow transferable trigger caps among the sectors (Component 4, Option 1), or (3) the non-CDQ AFA sectors could not form the legal entity necessary to receive transferable salmon bycatch caps. Under Option 2, NMFS would rollover or reapportion the salmon bycatch trigger caps among the sectors. A reapportionment of salmon bycatch would occur if a sector completed harvest of its pollock allocation and had some salmon bycatch trigger cap allocation remaining. 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 and B season. The areas described below are designed to cover where 90% of Chinook bycatch has occurred from the years 2000-2007. In the A season, the designated area closes immediately when triggered and remains closed for the duration of the A season. In the B season, three areas close simultaneously when the trigger is reached and remain closed for the duration of the B season (until December 31st). If the trigger for the B season is reached prior to August 15th, the areas would remain open and close on August 15th through December 31st.

Area options are indicated below for the A season (Fig. 2-2) and B season (Fig. 2-3). Coordinates for these areas are in Table 2-29 and Table 2-30.When trigger caps are reached (either by the fishery or, if the Council selects Component 3, by sector), the area closes for the remainder of the season (with the exception of timing constraints for the B season closure to not close prior to August 15th).

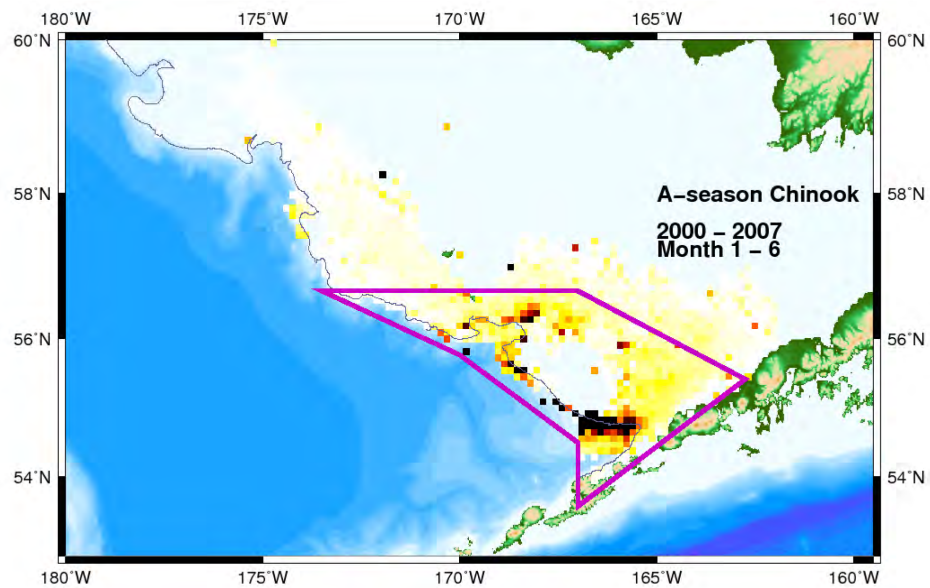


Fig. 2-2 Proposed A-season trigger closure, encompassing 90% of Chinook bycatch in 2000-2007.

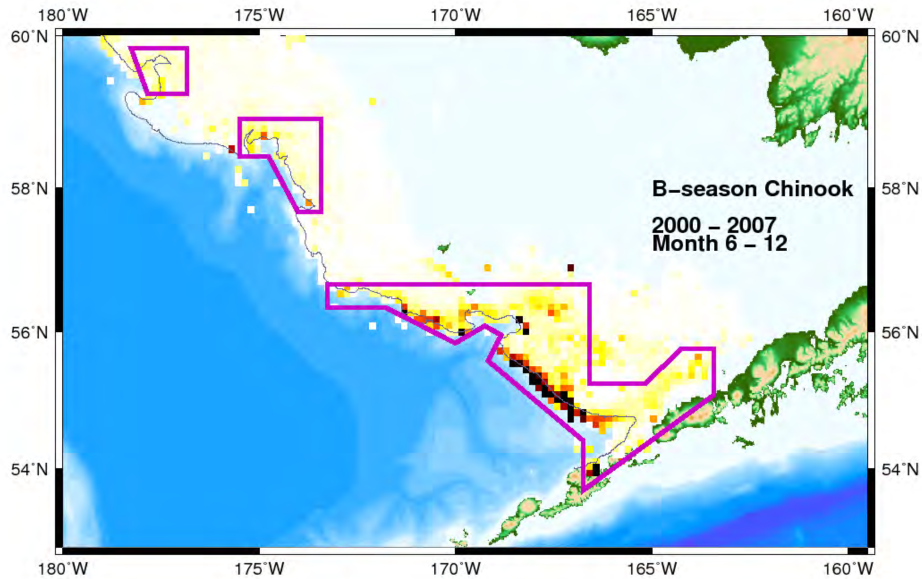


Fig. 2-3 Proposed B-season trigger closures, encompassing 90% of Chinook bycatch in 2000-2007.

Table 2-29 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 2-30 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

Proposed area closures are formulated based upon the area where, on average, 90% of the Chinook bycatch occurred over the time period 2000-2007. Historically since 1991, this A-season area has comprised between 72-100% of the bycatch in this time period (Table 2-31). 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 2-32 and Table 2-33).

Table 2-31 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 2-32 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 2-33 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 2-34). 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 2-35 and Table 2-36).

Table 2-34 Chinook salmon, in numbers of fish, taken as bycatch in the combined (CDQ and non-CDQ) pollock fishery during the B-season, by sector, inside and outside of proposed closure areas

Year	Outside of B-season areas			Outside	Inside of B-season areas			Inside	Total	Percent
	M	CP	CV	Subtotal	M	CP	CV	Subtotal		Inside
1991	30	80	80	190	87	291	1,059	1,438	1,628	88%
1992	0	92	11	103	1,509	6,746	1,549	9,804	9,907	99%
1993	83	2,365	70	2,517	6,417	9,460	2,546	18,423	20,941	88%
1994	164	1,214	107	1,486	402	1,585	1,108	3,095	4,581	68%
1995	70	330	16	416	582	1,128	750	2,460	2,877	86%
1996	1,164	1,506	644	3,314	4,950	1,705	9,294	15,950	19,264	83%
1997	2,117	3,917	1,849	7,883	3,405	1,804	20,681	25,891	33,774	77%
1998	1,341	2,294	1,825	5,460	5,040	1,567	25,582	32,188	37,648	85%
1999	38	725	773	1,537	336	1,862	1,686	3,883	5,420	72%
2000	246	401	392	1,039	0	157	220	377	1,416	27%
2001	5	895	19	918	1,314	8,963	3,738	14,015	14,933	94%
2002	74	95	31	200	1,675	1,291	9,021	11,986	12,186	98%
2003	598	1,422	354	2,375	1,339	2,621	6,778	10,738	13,113	82%
2004	995	1,759	1,393	4,147	1,131	2,530	22,182	25,843	29,990	86%
2005	720	2,466	1,552	4,738	145	1,840	31,471	33,456	38,194	88%
2006	160	619	854	1,633	41	931	21,427	22,399	24,033	93%
2007	958	1,577	1,017	3,553	2,585	5,383	40,697	48,665	52,218	93%
Average 1991-2007	516	1,280	646	2,442	1,821	2,933	11,752	16,507	18,948	87%
Average 2000-2007	470	1,154	702	2,325	1,029	2,965	16,942	20,935	23,260	90%

Table 2-35 Chinook salmon, in numbers of fish, taken as bycatch in the non-CDQ pollock fishery during the B-season, by sector, inside and outside of proposed closure areas

Year	Outside of B-season areas			Outside	Inside of B-season areas			Inside	Total	Percent
	M	CP	CV	Subtotal	M	CP	CV	Subtotal		Inside
1991	30	80	80	190	87	291	1,059	1,438	1,628	88%
1992	0	92	11	103	1,509	6,746	1,549	9,804	9,907	99%
1993	83	2,365	70	2,517	6,417	9,460	2,546	18,423	20,941	88%
1994	164	1,214	107	1,486	402	1,585	1,108	3,095	4,581	68%
1995	66	173	16	254	551	371	746	1,668	1,922	87%
1996	1,164	1,451	644	3,260	4,669	217	9,225	14,111	17,371	81%
1997	2,117	3,701	1,849	7,668	1,367	1,576	20,579	23,522	31,190	75%
1998	704	1,858	1,804	4,366	3,791	221	25,325	29,338	33,704	87%
1999	15	658	773	1,446	48	1,184	1,657	2,889	4,336	67%
2000	169	316	302	787	0	117	192	310	1,097	28%
2001	0	861	19	880	813	8,817	3,738	13,368	14,248	94%
2002	74	69	31	175	1,530	815	9,021	11,366	11,540	98%
2003	573	1,156	354	2,083	1,259	2,104	6,778	10,140	12,224	83%
2004	827	905	1,393	3,124	1,122	1,706	22,182	25,011	28,135	89%
2005	551	2,165	1,552	4,268	138	1,757	31,471	33,366	37,634	89%
2006	137	537	854	1,528	27	893	21,427	22,348	23,876	94%
2007	753	1,520	1,017	3,290	1,110	4,611	40,697	46,418	49,707	93%
Average 1991-2007	437	1,125	640	2,201	1,461	2,498	11,724	15,683	17,885	88%
Average 2000-2007	385	941	690	2,017	750	2,603	16,938	20,291	22,308	91%

Table 2-36 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 later in this document (section 5.4.4) will focus upon 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. Trigger levels are the same as those under Alternative 2 for hard caps. The caps selected for spatial analysis are representative both of the range of caps under consideration as well as the 90% threshold of some select caps to evaluate the broad range of potential impacts. The analysis also considers a threshold of 90% of the trigger cap levels, as under ICA management (Component 1, Option 1), such a threshold may be considered.

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

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

2.4 Comparison of Alternatives

This section provides an overview comparison across alternatives. This comparative section reviews both general information about the alternatives, and examines specific components and options within alternatives which provide the greatest contrast. While general impacts of various components and options amongst alternatives are summarized here, specific details of the impacts of each component and option are included in the impact analysis section of the EIS and RIR, by resource category or fishery.

2.4.1 Overview of the structure of alternatives

Two main elements define the alternatives: hard caps and time/area closures (Table 2-37). These may be combined into a preferred alternative that includes some aspects of both, or may be considered separately as meeting different objectives for bycatch management. Elements of the status quo alternative may also be folded into a preferred alternative.

Table 2-37 Elements of the decision, as structured by alternative

	Salmon Bycatch Cap		**Area Closures**		**Exempt pollock vessels participating in a salmon bycatch intercooperative agreement (ICA) from area closures**
	Hard	**Trigger**	**Fixed**	**Trigger**	
Alternative 1: Status quo	--	Yes	--	Yes	Yes
Alternative 2: Hard cap	Yes	--	--	--	--
Alternative 3: Triggered closure	--	Yes	--	Yes	Option for ICA entity to manage closures, but not exemption from closures

Some elements of the hard cap alternative (Alternative 2) overlap with the triggered closure alternative (Alternative 3). There are three main elements to the hard cap alternative: (1) how is the cap established (both the overall fishery cap level and its seasonal distribution); (2) should the cap be allocated to sectors (and further to cooperatives within the inshore CV sector), and if so, how should this allocation occur; and (3) if the cap is reached, what transfer options are available to the fleet to continue harvesting the pollock quota.

The first choice, how to select a fishery-level cap (Component 1 under Alternatives 2 and 3; Section 2.4.2), is consistent in methodology options for both a hard cap and a triggered closure cap, although should both be considered concurrently, the level of cap selected in the preferred alternative may differ amongst the two. The application of the seasonal distribution options strongly affects the degree to which the caps are constraining (Section 2.4.3). Whether to subdivide caps by sector is a major decision point under Alternative 2. Section 2.4.4 provides additional information on the current suite of allocation options by sector (Component 2) and resulting caps (and whether these caps would have constrained the sector's catch had they been in place in recent years). How the caps are subdivided by sector is consistent whether applied to a hard cap or a trigger cap, under either Alternative 2 (Component 2) or Alternative 3 (Component 3). Thus the following discussion comparing sector allocation options (while explicitly referring to hard caps) may be considered to apply to either. Further discussion of specific caps in relation to the cooperative level (inshore CV allocation subdivided to cooperatives; Alternative 2, Component 4) is provided in the discussion as well (Section 2.4.5). Cooperative provisions only exist under the hard cap alternative (Alternative 2); there are no options to subdivide trigger caps to the cooperative level.

2.4.2 Comparison of cap formulation options under Component 1 (Alternatives 2 and 3)

The cap formulation options are described in detail in Section 2.2.1, page 20. Two options are included for formulation of the actual cap level under either Alternative 2 or 3. Under Option 1, a range of cap numbers is provided. A cap selected based upon Option 1 would result in a number fixed in regulation. Any modification to this number (as well as the seasonal distribution thereof per Options 1-1 to 1-4, Section 2.2.1.3) would require an FMP amendment. Option 2 provides a mechanism for a more flexible cap level which can be modified depending upon new information related to stock of origin proportions in the bycatch, run size information and information on age-specific survival by river system. Thus if new information on relative impacts of bycatch by river system indicates that the Council's selected level for a bycatch cap is improperly specified, Option 2 provides a mechanism to modify the cap without the need for an FMP amendment. Option 1 does not provide that flexibility and any modification to the selected cap level under Option 1 would require an FMP amendment.

2.4.3 Comparison of seasonal distribution options of fishery-level cap (Component 1, Options 1-1 to 1-4)

All caps apply either to the A-season or the B-season. Options under Alternative 2 (or Alternative 3) Component 1, Options 1-1 to 1-4 (Section 2.2.1.3) provide the relative distribution of an annual cap by season. While a suboption may permit underages (i.e., when catch is less than the cap level within a season) to be rolled over from the A season to the B season, within a calendar year, overages are not permitted and reaching a seasonal cap would result in a closure for the remainder of that season for the fishery (or if subdivided, sector) that reached the respective cap. 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 is also broken out by season. Section 5.4.1 provides additional information to evaluate how seasonal caps may affect salmon stocks and includes an evaluation of threshold levels for seasonal bycatch removals.

In order to compare and contrast across seasonal and sector-split (Section 2.4.4) options, the subset of cap levels used for the analysis, by season (Table 2-3), were compared against actual catch of Chinook 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, Section 2.4.4) for the years 2003-2007. Weekly data from NMFS Regional Office were used to approximate when the cap would have been reached. The day of occurrence 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 would have been 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 foregone 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 as closure notifications are issued for when PSC limits/caps are projected to be reached). A suboption under the seasonal distribution options would allow the unused portion of the A-season salmon bycatch cap to roll over to the B-season. For the purposes of this analysis, however, any remaining unused portion of the bycatch cap was not rolled over and added to the B-season cap.

Seasonal distributional effects are evaluated individually at the fleet-wide level (Table 2-38 and Table 2-39) as well as in conjunction with sector split options for magnification of specific effects at the sector level (see section 2.4.4 below). For evaluation of impacts in this analysis, a subset of seasonal allocation options was chosen. The options included in detailed evaluation include seasonal distribution by the following percentage application by season (A/B): 70/30 (Option 1-1), 58/42 (Option 1-2) and 50/50 (Option 1-4). To facilitate the examination of contrasting options, 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 tables indicate the date the cap would have been reached by CDQ and non-CDQ fleets by season and year (Table 2-38). This date results in an associated foregone pollock level due to the (hypothetical) fishery closures for that entity at that time in that year (Table 2-39). Also included for comparison of relative impacts of cap levels are the actual Chinook catches had the fleet-wide caps been in place in those years (Table 2-40). For the fleet-wide (i.e., CDQ and non-CDQ) cap considerations, a first-order evaluation was conducted by examining the relative constraint at the highest cap level (87,500), understanding that all caps below this level will be by nature more constraining. The highest cap (87,500) does not constrain the CDQ fleet regardless of seasonal distribution, while for the non-CDQ fleet the highest cap is constraining in 2 of 5 years (A season) and 3 of 5 years (B season), with the constraint varying based on seasonal distribution option (the 50/50 split and 58/48 splits are more constraining in the A season while the 70/30 split is more constraining in the B season).

Table 2-38 Hypothetical closure dates by year and season under Chinook bycatch cap options for fleet-wide caps (CDQ receives 7.5% of the Chinook cap)

Fleet-wide caps			A season					B season				
A/B Split	Cap	Sect	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
50/50	87,500	CDQ	---	---	---	---	---	---	---	---	---	---
		NonCDQ	---	---	---	22-Feb	9-Feb	---	---	---	---	25-Oct
	68,100	CDQ	---	---	---	---	5-Mar	---	---	---	---	---
		NonCDQ	26-Mar	---	---	14-Feb	2-Feb	---	---	21-Oct	---	18-Oct
	48,700	CDQ	---	---	---	---	22-Feb	---	---	---	---	17-Oct
		NonCDQ	23-Feb	24-Mar	2-Mar	7-Feb	28-Jan	---	20-Oct	6-Oct	25-Oct	8-Oct
	29,300	CDQ	1-Mar	17-Mar	5-Mar	3-Mar	15-Feb	---	19-Sep	---	---	10-Oct
		NonCDQ	12-Feb	28-Feb	11-Feb	3-Feb	24-Jan	---	30-Sep	23-Sep	6-Oct	26-Sep
58/42	87,500	CDQ	---	---	---	---	---	---	---	---	---	---
		NonCDQ	---	---	---	28-Feb	14-Feb	---	---	24-Oct	---	20-Oct
	68,100	CDQ	---	---	---	---	14-Mar	---	---	---	---	19-Oct
		NonCDQ	---	---	---	19-Feb	6-Feb	---	27-Oct	10-Oct	---	12-Oct
	48,700	CDQ	---	---	---	---	26-Feb	---	29-Sep	---	---	15-Oct
		NonCDQ	7-Mar	---	22-Mar	9-Feb	30-Jan	---	12-Oct	2-Oct	17-Oct	4-Oct
	29,300	CDQ	5-Mar	---	15-Mar	8-Mar	16-Feb	---	15-Sep	---	---	8-Oct
		NonCDQ	15-Feb	4-Mar	15-Feb	4-Feb	25-Jan	13-Oct	25-Sep	16-Sep	30-Sep	19-Sep
70/30	87,500	CDQ	---	---	---	---	---	---	---	---	---	18-Oct
		NonCDQ	---	---	---	22-Mar	25-Feb	---	24-Oct	8-Oct	---	10-Oct
	68,100	CDQ	---	---	---	---	---	---	29-Sep	---	---	15-Oct
		NonCDQ	---	---	---	24-Feb	12-Feb	---	12-Oct	2-Oct	17-Oct	4-Oct
	48,700	CDQ	---	---	---	---	5-Mar	---	19-Sep	---	---	10-Oct
		NonCDQ	26-Mar	---	---	14-Feb	2-Feb	---	30-Sep	23-Sep	6-Oct	26-Sep
	29,300	CDQ	15-Mar	---	---	17-Mar	19-Feb	19-Sep	9-Sep	---	---	2-Oct
		NonCDQ	18-Feb	12-Mar	21-Feb	6-Feb	26-Jan	4-Oct	11-Sep	3-Sep	18-Sep	12-Sep

Table 2-39 Hypothetical forgone pollock catch, in mt, by year and season under Chinook bycatch options for fleet-wide caps

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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		NonCDQ	0	0	0	0	0	0	0	0	0	176,014	112,487	1,079	309,272	242,868	129,269
	87,500 Total		0	0	0	0	0	0	0	0	0	176,014	112,487	1,079	309,272	242,868	129,269
	68,100	CDQ	0	0	0	0	0	0	0	0	0	0	0	0	8,533	892	0
		NonCDQ	3,027	0	0	0	0	0	0	0	0	250,579	180,814	171,589	377,162	313,007	245,402
	68,100 Total		3,027	0	0	0	0	0	0	0	0	250,579	180,814	171,589	385,695	313,898	245,402
	48,700	CDQ	0	0	0	0	0	0	0	0	0	0	0	0	30,907	19,749	8,524
		NonCDQ	184,369	130,600	2,991	200	0	0	108,279	74	0	325,205	320,656	250,542	384,729	381,690	377,131
	48,700 Total		184,369	130,600	2,991	200	0	0	108,279	74	0	325,205	320,656	250,542	415,636	401,439	385,655
	29,300	CDQ	22,302	20,538	937	365	0	0	3,380	36	0	19,514	9,569	1,060	40,824	40,373	31,665
		NonCDQ	313,710	248,828	243,159	131,333	125,744	66,134	304,807	243,425	177,171	406,640	333,796	329,690	462,775	460,354	456,722
	29,300 Total		336,012	269,366	244,097	131,698	125,744	66,134	308,187	243,461	177,171	426,154	343,365	330,750	503,599	500,727	488,387
B	87,500	CDQ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,358
		NonCDQ	0	0	0	0	0	1,812	0	1,695	24,544	0	0	0	16,760	19,785	69,902
	87,500 Total		0	0	0	0	0	1,812	0	1,695	24,544	0	0	0	16,760	19,785	72,260
	68,100	CDQ	0	0	0	0	0	3,450	0	0	0	0	0	0	0	2,186	2,784
		NonCDQ	0	0	0	0	1,193	18,455	13,256	23,630	43,814	0	0	22,455	44,797	69,099	92,834
	68,100 Total		0	0	0	0	1,193	21,905	13,256	23,630	43,814	0	0	22,455	44,797	71,285	95,618
	48,700	CDQ	0	0	0	0	3,441	15,301	0	0	0	0	0	0	2,497	2,782	5,237
		NonCDQ	0	0	0	9,695	18,443	47,046	42,224	43,804	100,699	3,037	22,435	81,109	70,551	92,824	112,466
	48,700 Total		0	0	0	9,695	21,885	62,347	42,224	43,804	100,699	3,037	22,435	81,109	73,048	95,606	117,703
	29,300	CDQ	0	0	23,904	15,283	28,402	45,305	0	0	0	0	0	0	5,235	5,353	7,363
		NonCDQ	0	2,672	20,194	47,021	48,446	98,938	100,667	139,533	183,159	81,058	84,063	167,749	112,454	135,034	164,449
	29,300 Total		0	2,672	44,097	62,304	76,848	144,243	100,667	139,533	183,159	81,058	84,063	167,749	117,689	140,386	171,812

Table 2-40 Chinook catches, in numbers of fish, from 2003-2007 for fleet wide (with 7.5% designated to CDQ) had different hard caps been in place.

Seas	Cap	Sector	2003			2004			2005			2006			2007		
			50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	1,693	1,693	1,693	1,140	1,140	1,140	1,296	1,296	1,296	1,580	1,580	1,580	3,091	3,091	3,091
		NonCDQ	32,115	32,115	32,115	22,821	22,821	22,821	26,377	26,377	26,377	34,356	45,019	55,427	31,618	41,159	55,903
	87,500 Total		33,808	33,808	33,808	23,961	23,961	23,961	27,673	27,673	27,673	35,936	46,599	57,007	34,709	44,250	58,994
	68,100	CDQ	1,693	1,693	1,693	1,140	1,140	1,140	1,296	1,296	1,296	1,580	1,580	1,580	2,414	2,879	3,091
		NonCDQ	30,226	32,115	32,115	22,821	22,821	22,821	26,377	26,377	26,377	29,090	34,356	34,356	20,939	31,618	41,159
	68,100 Total		31,919	33,808	33,808	23,961	23,961	23,961	27,673	27,673	27,673	30,670	35,936	35,936	23,353	34,497	44,250
	48,700	CDQ	1,693	1,693	1,693	1,140	1,140	1,140	1,296	1,296	1,296	1,580	1,580	1,580	1,309	1,926	2,414
		NonCDQ	21,874	24,434	30,226	22,027	22,821	22,821	20,680	25,913	26,377	14,248	14,248	29,090	20,939	20,939	20,939
	48,700 Total		23,567	26,127	31,919	23,167	23,961	23,961	21,976	27,209	27,673	15,828	15,828	30,670	22,248	22,865	23,353
	29,300	CDQ	1,098	1,098	1,537	1,033	1,140	1,140	1,096	1,246	1,296	653	1,129	1,340	502	502	1,309
		NonCDQ	10,188	15,445	15,445	13,195	13,195	16,558	9,160	13,655	18,218	8,446	14,248	14,248	1,492	1,492	1,492
	29,300 Total		11,286	16,543	16,982	14,228	14,335	17,698	10,256	14,901	19,514	9,099	15,377	15,588	1,994	1,994	2,801
B	87,500	CDQ	872	872	872	1,826	1,826	1,826	637	637	637	157	157	157	2,529	2,529	1,235
		NonCDQ	12,313	12,313	12,313	28,241	28,241	23,133	39,580	31,531	23,771	24,248	24,248	24,248	33,134	33,134	20,022
	87,500 Total		13,185	13,185	13,185	30,067	30,067	24,959	40,217	32,168	24,408	24,405	24,405	24,405	35,663	35,663	21,257
	68,100	CDQ	872	872	872	1,826	1,826	1,294	637	637	637	157	157	157	2,529	1,235	1,235
		NonCDQ	12,313	12,313	12,313	28,241	23,133	16,979	30,136	23,771	17,082	24,248	24,248	16,873	27,361	20,022	14,178
	68,100 Total		13,185	13,185	13,185	30,067	24,959	18,273	30,773	24,408	17,719	24,405	24,405	17,030	29,890	21,257	15,413
	48,700	CDQ	872	872	872	1,826	1,294	1,041	637	637	637	157	157	157	1,235	1,235	777
		NonCDQ	12,313	12,313	12,313	21,007	16,979	11,347	17,082	17,082	11,389	20,632	16,873	11,206	20,022	14,178	12,337
	48,700 Total		13,185	13,185	13,185	22,833	18,273	12,388	17,719	17,719	12,026	20,789	17,030	11,363	21,257	15,413	13,114
	29,300	CDQ	872	872	494	1,041	721	392	637	637	637	157	157	157	777	777	527
		NonCDQ	12,313	10,845	7,699	11,347	11,347	7,843	11,389	9,618	7,889	11,206	11,206	7,152	12,337	9,486	5,261
	29,300 Total		13,185	11,717	8,193	12,388	12,068	8,235	12,026	10,255	8,526	11,363	11,363	7,309	13,114	10,263	5,788

The 70/30 seasonal distribution is more constraining than other seasonal distribution options in the B seasons at both the fleet-level as well as when subdivided and applied at the sector level (section 2.4.4). 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.

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. For example, in 2006 under the 70/30 allocation, the non-CDQ fleet would have been constrained on March 24th with foregone 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 foregone pollock of 176,014 mt (Table 2-39).

For overall catches of Chinook, the highest cap scenario is utilized for initial evaluation with 2007 as an example of change over options by seasonal allocation. Here 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, the actual catches of Chinook in that year would have ranged from 70,367 (50/50 split) to 80,251 (70/30 split), while the actual catch of Chinook under various scenarios is less than the cap level depending upon relative seasonal constraints by fleet (Table 2-40).

2.4.4 Comparison of sector allocation options, by season (Alternative 2, Component 2; Alternative 3, Component 3)

One of the main decision points in the alternatives is whether to subdivide caps by sector, and by what allocative means. Summarizing constraints by sector becomes progressively more complex given the inter-play between the seasonal distribution options, the range of caps under consideration and the range of options for sector subdivision of these caps. Tabular information is provided to summarize the main combinations of these options (annual cap starting point, seasonal allocation, sector split) which result in the least significant and most significant constraints on the fleet, as well as the hypothetical impact of sector allocation constraints on overall Chinook catch. Actual economic impacts of these constraints, comparing foregone pollock harvest with foregone revenue estimates, are provided in the RIR. This section is provided here to highlight those combinations of options resulting in the greatest range of impacts, in order to focus discussion of those impacts in sections of the EIS and RIR.

The main sector split options that are provided for impact analysis in this document are those which provide the greatest contrast amongst the options under consideration. Thus for analysis and contrast, the following tables combine a subset of the sector split options with the subset of seasonal distribution options described above. The subset of sector split (Alternative 2, Component 2) options include the following: Option 1 (AFA pollock percentages), Option 2a (3-year average bycatch by sector, 2004–2006) and Option 2d (mid-point of ranges under consideration by sector). These three options encompass the range of impacts (high, medium and low) for each sector. Options that are considered but not included in detailed analysis (Option 2b and Option 2c) did not provide meaningful contrast within the analytical range under consideration.

The following tables summarize the relative degree of constraint that the proposed seasonal and sector-specific caps would have imposed on each sector, by season for the years 2003–2007. Table 2-41 through Table 2-43 provide the A and B season dates on which the sector cap, under each option, would have constrained the sector; Table 2-44 through Table 2-48 list the forgone pollock catch, by year, that would be associated with a constraint on that date; and Table 2-49 through Table 2-53 list the associated Chinook catch and the percentage catch reductions that would have occurred had the fishery been constrained.

Table 2-41 Hypothetical closure dates, by year and season, under Chinook salmon hard cap sector allocation Option 1 (Chinook bycatch allocated to sector proportional to pollock allocation).

opt1(AFA)			A					B				
AB Split	Cap	Sect	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
50/50	87,500	CDQ	---	---	---	---	---	---	---	---	---	---
		M	---	---	---	23-Feb	15-Feb	---	---	---	---	---
		P	---	---	---	21-Mar	13-Feb	---	---	---	---	---
		S	---	---	---	10-Feb	2-Feb	---	23-Oct	8-Oct	22-Oct	10-Oct
	68,100	CDQ	---	---	---	---	---	---	---	---	---	---
		M	---	---	---	18-Feb	2-Feb	---	---	---	---	---
		P	15-Mar	---	---	11-Mar	8-Feb	---	---	---	---	---
		S	23-Mar	---	---	7-Feb	29-Jan	---	12-Oct	3-Oct	13-Oct	5-Oct
	48,700	CDQ	---	---	---	---	3-Mar	---	---	---	---	25-Oct
		M	15-Mar	---	---	8-Feb	28-Jan	---	---	---	---	---
		P	19-Feb	---	1-Mar	21-Feb	4-Feb	---	---	---	---	---
		S	27-Feb	17-Mar	24-Feb	5-Feb	25-Jan	---	2-Oct	27-Sep	2-Oct	29-Sep
	29,300	CDQ	12-Mar	---	---	14-Mar	18-Feb	---	27-Sep	---	---	14-Oct
		M	13-Feb	26-Feb	17-Feb	3-Feb	24-Jan	9-Oct	23-Oct	---	---	18-Oct
		P	11-Feb	1-Mar	11-Feb	8-Feb	26-Jan	---	---	---	---	23-Oct
		S	12-Feb	24-Feb	10-Feb	30-Jan	23-Jan	14-Oct	16-Sep	10-Sep	17-Sep	14-Sep
58/42	87,500	CDQ	---	---	---	---	---	---	---	---	---	---
		M	---	---	---	28-Feb	28-Feb	---	---	---	---	---
		P	---	---	---	---	18-Feb	---	---	---	---	---
		S	---	---	---	16-Feb	7-Feb	---	14-Oct	5-Oct	16-Oct	6-Oct
	68,100	CDQ	---	---	---	---	---	---	---	---	---	---
		M	---	---	---	21-Feb	10-Feb	---	---	---	---	---
		P	---	---	---	15-Mar	11-Feb	---	---	---	---	---
		S	---	---	---	9-Feb	31-Jan	---	7-Oct	1-Oct	8-Oct	2-Oct
	48,700	CDQ	---	---	---	---	9-Mar	---	---	---	---	18-Oct
		M	27-Mar	---	---	10-Feb	30-Jan	---	4-Nov	---	---	26-Oct
		P	21-Feb	---	14-Mar	26-Feb	6-Feb	---	---	---	---	---
		S	8-Mar	---	7-Mar	6-Feb	26-Jan	---	28-Sep	22-Sep	26-Sep	21-Sep
	29,300	CDQ	---	---	---	---	21-Feb	---	23-Sep	---	---	12-Oct
		M	17-Feb	3-Mar	25-Feb	5-Feb	25-Jan	7-Oct	15-Oct	---	---	13-Oct
		P	13-Feb	5-Mar	15-Feb	10-Feb	27-Jan	---	---	---	---	18-Oct
		S	15-Feb	1-Mar	13-Feb	1-Feb	23-Jan	8-Oct	12-Sep	1-Sep	13-Sep	12-Sep
70/30	87,500	CDQ	---	---	---	---	---	---	---	---	---	---
		M	---	---	---	---	---	---	---	---	---	---
		P	---	---	---	---	1-Mar	---	---	---	---	---
		S	---	---	---	21-Feb	14-Feb	---	5-Oct	29-Sep	5-Oct	30-Sep
	68,100	CDQ	---	---	---	---	---	---	---	---	---	18-Oct
		M	---	---	---	24-Feb	21-Feb	---	4-Nov	---	---	26-Oct
		P	---	---	---	---	16-Feb	---	---	---	---	---
		S	---	---	---	13-Feb	4-Feb	---	28-Sep	22-Sep	26-Sep	21-Sep
	48,700	CDQ	---	---	---	---	---	---	27-Sep	---	---	14-Oct
		M	---	---	---	18-Feb	2-Feb	9-Oct	23-Oct	---	---	18-Oct
		P	16-Mar	---	---	11-Mar	8-Feb	---	---	---	---	23-Oct
		S	23-Mar	---	---	7-Feb	29-Jan	13-Oct	16-Sep	10-Sep	17-Sep	14-Sep
	29,300	CDQ	---	---	---	---	25-Feb	---	14-Sep	---	---	7-Oct
		M	25-Feb	26-Mar	10-Mar	6-Feb	26-Jan	4-Oct	27-Sep	---	---	25-Sep
		P	16-Feb	11-Mar	21-Feb	15-Feb	1-Feb	10-Oct	---	14-Sep	---	2-Oct
		S	20-Feb	9-Mar	17-Feb	3-Feb	24-Jan	3-Oct	6-Sep	22-Aug	7-Sep	9-Sep

Table 2-42 Hypothetical closure dates by year and season under Chinook salmon hard cap sector allocation Option 2a.

opt2a			A					B				
AB Split	Cap	Sect	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
50/50	87,500	CDQ	6-Mar	---	---	9-Mar	19-Feb	---	30-Sep	---	---	16-Oct
		M	---	---	---	14-Feb	30-Jan	---	---	---	---	---
		P	19-Feb	---	4-Mar	21-Feb	5-Feb	---	---	---	---	---
		S	---	---	---	23-Feb	23-Feb	---	---	28-Oct	---	25-Oct
	68,100	CDQ	26-Feb	12-Mar	3-Mar	1-Mar	12-Feb	---	14-Sep	---	---	8-Oct
		M	6-Mar	---	---	6-Feb	29-Jan	---	---	---	---	---
		P	18-Feb	11-Mar	23-Feb	14-Feb	28-Jan	---	---	---	---	---
		S	---	---	---	22-Feb	7-Feb	---	---	12-Oct	---	17-Oct
	48,700	CDQ	11-Feb	3-Mar	22-Feb	28-Feb	11-Feb	25-Sep	13-Sep	---	---	1-Oct
		M	18-Feb	4-Mar	24-Feb	6-Feb	22-Jan	9-Oct	28-Oct	---	---	25-Oct
		P	10-Feb	3-Mar	8-Feb	6-Feb	21-Jan	---	---	---	---	25-Oct
		S	---	---	---	7-Feb	30-Jan	---	14-Oct	4-Oct	19-Oct	8-Oct
	29,300	CDQ	2-Feb	23-Feb	14-Feb	19-Feb	3-Feb	2-Sep	5-Sep	14-Sep	---	23-Sep
		M	3-Feb	10-Feb	1-Feb	22-Jan	21-Jan	7-Oct	28-Sep	---	---	2-Oct
		P	2-Feb	9-Feb	31-Jan	29-Jan	20-Jan	10-Oct	---	15-Sep	---	2-Oct
		S	26-Feb	18-Mar	24-Feb	5-Feb	22-Jan	---	28-Sep	26-Sep	3-Oct	23-Sep
58/42	87,500	CDQ	14-Mar	---	---	17-Mar	20-Feb	---	22-Sep	---	---	9-Oct
		M	---	---	---	22-Feb	31-Jan	---	---	---	---	---
		P	27-Feb	---	---	1-Mar	5-Feb	---	---	---	---	---
		S	---	---	---	24-Mar	23-Mar	---	---	20-Oct	---	17-Oct
	68,100	CDQ	5-Mar	---	11-Mar	9-Mar	12-Feb	10-Oct	14-Sep	---	---	8-Oct
		M	21-Mar	---	---	7-Feb	30-Jan	17-Oct	5-Nov	---	---	26-Oct
		P	19-Feb	19-Mar	3-Mar	21-Feb	5-Feb	---	---	---	---	2-Nov
		S	---	---	---	23-Feb	15-Feb	---	28-Oct	12-Oct	27-Oct	9-Oct
	48,700	CDQ	11-Feb	11-Mar	23-Feb	28-Feb	11-Feb	17-Sep	6-Sep	30-Sep	---	30-Sep
		M	19-Feb	12-Mar	4-Mar	6-Feb	22-Jan	8-Oct	20-Oct	---	---	17-Oct
		P	11-Feb	3-Mar	15-Feb	6-Feb	28-Jan	---	---	---	---	17-Oct
		S	---	---	---	7-Feb	30-Jan	---	13-Oct	3-Oct	11-Oct	1-Oct
	29,300	CDQ	10-Feb	24-Feb	21-Feb	20-Feb	11-Feb	1-Sep	29-Aug	7-Sep	---	23-Sep
		M	10-Feb	17-Feb	8-Feb	29-Jan	21-Jan	29-Sep	27-Sep	---	---	24-Sep
		P	2-Feb	9-Feb	31-Jan	5-Feb	20-Jan	2-Oct	24-Sep	7-Sep	---	24-Sep
		S	6-Mar	26-Mar	3-Mar	6-Feb	22-Jan	---	27-Sep	18-Sep	25-Sep	16-Sep
70/30	87,500	CDQ	---	---	---	---	21-Feb	3-Oct	14-Sep	---	---	8-Oct
		M	---	---	---	23-Feb	15-Feb	17-Oct	28-Oct	---	---	25-Oct
		P	21-Mar	---	---	16-Mar	6-Feb	---	---	---	---	26-Oct
		S	---	---	---	---	---	---	21-Oct	4-Oct	19-Oct	9-Oct
	68,100	CDQ	13-Mar	---	---	17-Mar	20-Feb	17-Sep	6-Sep	30-Sep	---	30-Sep
		M	---	---	---	15-Feb	31-Jan	8-Oct	20-Oct	---	---	17-Oct
		P	20-Feb	---	11-Mar	1-Mar	5-Feb	---	---	---	---	17-Oct
		S	---	---	---	10-Mar	16-Mar	---	13-Oct	3-Oct	11-Oct	1-Oct
	48,700	CDQ	26-Feb	12-Mar	3-Mar	1-Mar	12-Feb	2-Sep	5-Sep	14-Sep	---	23-Sep
		M	6-Mar	---	---	6-Feb	29-Jan	7-Oct	28-Sep	---	---	2-Oct
		P	18-Feb	11-Mar	23-Feb	14-Feb	28-Jan	10-Oct	---	15-Sep	---	2-Oct
		S	---	---	---	22-Feb	7-Feb	---	28-Sep	26-Sep	3-Oct	23-Sep
	29,300	CDQ	10-Feb	2-Mar	22-Feb	20-Feb	11-Feb	1-Sep	29-Aug	29-Aug	---	1-Sep
		M	11-Feb	25-Feb	16-Feb	29-Jan	21-Jan	29-Sep	12-Sep	22-Sep	---	2-Sep
		P	10-Feb	17-Feb	7-Feb	5-Feb	21-Jan	9-Sep	1-Sep	30-Aug	---	10-Sep
		S	21-Mar	---	---	6-Feb	29-Jan	16-Oct	12-Sep	4-Sep	10-Sep	9-Sep

Table 2-43 Hypothetical closure dates by year and season under Chinook salmon hard cap section allocation Option 2d.

opt 2d			A					B				
AB Split	Cap	Sect	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
50/50	87,500	CDQ	---	---	---	---	9-Mar	---	---	---	---	---
		M	---	---	---	19-Feb	5-Feb	---	---	---	---	---
		P	18-Mar	---	---	11-Mar	8-Feb	---	---	---	---	---
		S	---	---	---	19-Feb	11-Feb	---	---	14-Oct	---	16-Oct
	68,100	CDQ	---	---	---	---	28-Feb	---	---	---	---	20-Oct
		M	28-Mar	---	---	10-Feb	30-Jan	---	---	---	---	---
		P	21-Feb	---	6-Mar	25-Feb	5-Feb	---	---	---	---	---
		S	---	---	---	10-Feb	1-Feb	---	23-Oct	8-Oct	22-Oct	10-Oct
	48,700	CDQ	17-Mar	---	---	---	20-Feb	---	29-Sep	---	---	15-Oct
		M	24-Feb	15-Mar	9-Mar	6-Feb	26-Jan	24-Oct	4-Nov	---	---	26-Oct
		P	15-Feb	9-Mar	18-Feb	13-Feb	31-Jan	---	---	---	---	---
		S	17-Mar	---	24-Mar	6-Feb	27-Jan	---	10-Oct	2-Oct	10-Oct	3-Oct
	29,300	CDQ	21-Feb	10-Mar	25-Feb	1-Mar	13-Feb	---	16-Sep	---	---	8-Oct
		M	10-Feb	18-Feb	10-Feb	30-Jan	23-Jan	7-Oct	14-Oct	---	---	13-Oct
		P	8-Feb	17-Feb	6-Feb	5-Feb	24-Jan	---	---	---	---	14-Oct
		S	17-Feb	5-Mar	15-Feb	2-Feb	24-Jan	---	26-Sep	19-Sep	22-Sep	19-Sep
58/42	87,500	CDQ	---	---	---	---	---	---	---	---	---	24-Oct
		M	---	---	---	22-Feb	13-Feb	---	---	---	---	---
		P	---	---	---	16-Mar	11-Feb	---	---	---	---	---
		S	---	---	---	23-Feb	16-Feb	---	26-Oct	10-Oct	25-Oct	11-Oct
	68,100	CDQ	---	---	---	---	5-Mar	---	---	---	---	17-Oct
		M	---	---	---	18-Feb	1-Feb	---	---	---	---	---
		P	28-Feb	---	---	3-Mar	7-Feb	---	---	---	---	---
		S	---	---	---	16-Feb	6-Feb	---	14-Oct	5-Oct	15-Oct	6-Oct
	48,700	CDQ	---	---	---	---	22-Feb	---	25-Sep	---	---	13-Oct
		M	11-Mar	---	---	8-Feb	27-Jan	11-Oct	27-Oct	---	---	22-Oct
		P	17-Feb	16-Mar	26-Feb	18-Feb	3-Feb	---	---	---	---	26-Oct
		S	27-Mar	---	---	8-Feb	29-Jan	---	5-Oct	28-Sep	5-Oct	30-Sep
	29,300	CDQ	1-Mar	17-Mar	5-Mar	3-Mar	15-Feb	1-Oct	12-Sep	---	---	6-Oct
		M	12-Feb	24-Feb	16-Feb	3-Feb	24-Jan	5-Oct	1-Oct	---	---	3-Oct
		P	9-Feb	28-Feb	9-Feb	7-Feb	25-Jan	---	---	20-Sep	---	6-Oct
		S	21-Feb	13-Mar	18-Feb	4-Feb	25-Jan	17-Oct	18-Sep	14-Sep	18-Sep	15-Sep
70/30	87,500	CDQ	---	---	---	---	---	---	1-Oct	---	---	16-Oct
		M	---	---	---	1-Mar	1-Mar	---	---	---	---	---
		P	---	---	---	---	16-Feb	---	---	---	---	---
		S	---	---	---	17-Mar	22-Mar	---	12-Oct	3-Oct	13-Oct	5-Oct
	68,100	CDQ	---	---	---	---	---	---	25-Sep	---	---	13-Oct
		M	---	---	---	21-Feb	10-Feb	11-Oct	27-Oct	---	---	22-Oct
		P	---	---	---	14-Mar	10-Feb	---	---	---	---	26-Oct
		S	---	---	---	21-Feb	14-Feb	---	4-Oct	28-Sep	5-Oct	30-Sep
	48,700	CDQ	---	---	---	---	28-Feb	---	16-Sep	---	---	8-Oct
		M	28-Mar	---	---	10-Feb	30-Jan	7-Oct	14-Oct	---	---	13-Oct
		P	21-Feb	---	7-Mar	25-Feb	5-Feb	---	---	---	---	13-Oct
		S	---	---	---	10-Feb	1-Feb	---	26-Sep	19-Sep	22-Sep	19-Sep
	29,300	CDQ	7-Mar	---	---	10-Mar	17-Feb	15-Sep	7-Sep	27-Sep	---	30-Sep
		M	17-Feb	3-Mar	26-Feb	5-Feb	25-Jan	30-Sep	22-Sep	13-Oct	---	13-Sep
		P	12-Feb	3-Mar	14-Feb	9-Feb	26-Jan	28-Sep	17-Sep	8-Sep	---	23-Sep
		S	3-Mar	21-Mar	1-Mar	5-Feb	26-Jan	7-Oct	10-Sep	29-Aug	12-Sep	11-Sep

Table 2-44 Hypothetical forgone pollock catch, in mt, by season and sector under Chinook salmon hard cap sector allocation options for 2003.

2003			opt1 (AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0	0	0	20,158	7,826	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	96,403	77,278	21,454	22,130	0	0
		S	0	0	0	0	0	0	0	0	0
	87,500 Total		0	0	0	116,561	85,104	21,454	22,130	0	0
	68,100	CDQ	0	0	0	37,301	21,437	8,343	0	0	0
		M	0	0	0	10,189	2,410	0	19	0	0
		P	22,491	0	0	99,692	97,845	95,074	95,568	76,553	0
		S	1,401	0	0	0	0	0	0	0	0
	68,100 Total		23,892	0	0	147,183	121,693	103,416	95,587	76,553	0
	48,700	CDQ	0	0	0	48,057	47,756	37,294	766	0	0
		M	2,785	28	0	22,209	21,796	10,184	16,153	7,690	16
		P	97,084	94,819	22,466	127,140	125,500	99,679	100,033	98,240	95,550
		S	90,166	37,904	1,389	0	0	0	14,291	831	0
	48,700 Total		190,035	132,750	23,856	197,405	195,053	147,157	131,242	106,761	95,566
	29,300	CDQ	8,148	0	0	51,899	48,624	48,353	44,328	22,243	19,951
		M	28,630	22,088	16,109	37,246	29,542	28,899	29,301	28,765	22,072
		P	126,818	125,127	99,316	155,741	154,835	128,755	129,019	127,681	125,673
		S	158,705	126,121	123,209	91,428	60,538	13,805	124,692	122,211	60,708
	29,300 Total		322,301	273,337	238,633	336,314	293,540	219,812	327,340	300,899	228,404
B	87,500	CDQ	0	0	0	0	0	2,071	0	0	0
		M	0	0	0	0	0	1,158	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	0	0	0	0	0	0	0	0	0
	87,500 Total		0	0	0	0	0	3,229	0	0	0
	68,100	CDQ	0	0	0	0	21	24,610	0	0	0
		M	0	0	0	0	1,059	3,368	0	0	1,188
		P	0	0	0	0	0	0	0	0	0
		S	0	0	0	0	0	0	0	0	0
	68,100 Total		0	0	0	0	1,080	27,978	0	0	1,188
	48,700	CDQ	0	0	0	10,863	24,599	51,807	0	0	0
		M	0	0	3,205	2,939	3,366	4,006	2	1,187	3,606
		P	0	0	0	0	0	339	0	0	0
		S	0	0	1,715	0	0	0	0	0	0
	48,700 Total		0	0	4,920	13,802	27,965	56,153	2	1,187	3,606
	29,300	CDQ	0	0	0	51,792	52,696	54,052	0	1,962	25,243
		M	3,199	3,584	4,163	4,002	7,733	8,144	3,600	3,922	7,888
		P	0	0	254	332	3,769	22,870	0	0	3,851
		S	1,687	14,503	28,900	0	0	2,377	0	927	15,217
	29,300 Total		4,885	18,088	33,317	56,126	64,199	87,444	3,600	6,811	52,199

Table 2-45 Hypothetical forgone pollock catch, in mt, by season and sector under Chinook salmon hard cap sector allocation options for 2004

2004			opt1 (AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	0	0	0	0	0	0	0	0	0
	87,500 Total		0	0	0	0	0	0	0	0	0
	68,100	CDQ	0	0	0	3,925	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	29,340	5,088	0	0	0	0
		S	0	0	0	0	0	0	0	0	0
	68,100 Total		0	0	0	33,266	5,088	0	0	0	0
	48,700	CDQ	0	0	0	13,464	5,064	3,917	0	0	0
		M	0	0	0	5,227	1,698	0	352	0	0
		P	0	0	0	57,292	55,245	29,318	29,907	5,688	0
		S	12,967	0	0	0	0	0	0	0	0
	48,700 Total		12,967	0	0	75,983	62,007	33,235	30,259	5,688	0
	29,300	CDQ	0	0	0	24,655	24,044	14,268	4,378	350	0
		M	11,255	5,016	0	26,232	18,684	11,511	18,339	11,383	4,989
		P	56,891	54,779	28,713	128,084	126,560	100,623	100,940	57,969	55,461
		S	101,177	66,910	36,923	14,112	414	0	64,926	14,899	502
	29,300 Total		169,322	126,705	65,636	193,082	169,701	126,402	188,584	84,601	60,952
B	87,500	CDQ	0	0	0	4,517	15,260	29,375	0	0	2,605
		M	0	0	0	0	0	839	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	1,179	14,423	28,629	0	0	6,791	0	836	15,307
	87,500 Total		1,179	14,423	28,629	4,517	15,260	37,004	0	836	17,912
	68,100	CDQ	0	0	0	27,694	28,868	45,713	0	0	4,442
		M	0	0	7	0	38	3,084	0	0	894
		P	0	0	0	0	0	0	0	0	0
		S	15,167	28,266	37,867	0	1,100	15,792	1,205	14,479	28,652
	68,100 Total		15,167	28,266	37,875	27,694	30,005	64,589	1,205	14,479	33,988
	48,700	CDQ	0	0	3,796	29,784	45,707	47,251	3,205	4,435	28,210
		M	0	7	1,176	987	3,083	9,003	11	892	3,652
		P	0	0	0	0	0	0	0	0	0
		S	28,923	37,863	66,671	14,112	15,782	37,498	15,976	28,647	38,150
	48,700 Total		28,923	37,870	71,643	44,883	64,572	93,752	19,191	33,974	70,012
	29,300	CDQ	3,777	14,487	28,717	47,240	60,298	60,963	28,191	29,286	46,079
		M	1,171	3,649	9,405	8,991	9,652	23,297	3,651	8,785	17,447
		P	0	0	0	0	1,707	24,782	0	0	3,916
		S	66,658	67,412	91,922	37,488	38,074	66,972	38,142	50,469	90,778
	29,300 Total		71,606	85,548	130,044	93,720	109,732	176,014	69,985	88,539	158,220

Table 2-46 Hypothetical forgone pollock catch, in mt, by season and sector under Chinook salmon hard cap sector allocation options for 2005

2005			opt1 (AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	42,708	0	0	0	0	0
		S	0	0	0	0	0	0	0	0	0
	87,500 Total		0	0	0	42,708	0	0	0	0	0
	68,100	CDQ	0	0	0	11,604	2,842	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	71,056	44,828	17,785	18,460	0	0
		S	0	0	0	0	0	0	0	0	0
	68,100 Total		0	0	0	82,660	47,670	17,785	18,460	0	0
	48,700	CDQ	0	0	0	22,548	21,334	11,599	0	0	0
		M	0	0	0	11,464	4,273	0	85	0	0
		P	43,709	1,494	0	120,999	94,852	71,039	92,724	45,408	18,435
		S	92,796	33,715	0	0	0	0	46	0	0
	48,700 Total		136,505	35,209	0	155,010	120,459	82,638	92,855	45,408	18,435
	29,300	CDQ	0	0	0	34,189	24,838	23,743	20,246	3,344	0
		M	19,477	11,189	46	33,508	26,538	19,820	26,360	19,649	4,785
		P	120,586	94,459	70,588	152,222	151,010	123,074	123,413	121,694	95,034
		S	159,298	129,990	127,648	94,569	60,558	0	128,840	126,845	60,768
	29,300 Total		299,361	235,638	198,283	314,488	262,944	166,637	298,859	271,532	160,587
B	87,500	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	21,875	36,695	52,973	1,497	13,078	35,965	19,793	21,325	37,268
	87,500 Total		21,875	36,695	52,973	1,497	13,078	35,965	19,793	21,325	37,268
	68,100	CDQ	0	0	0	0	0	96	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	37,177	38,151	70,555	20,296	21,748	37,583	21,916	36,731	53,000
	68,100 Total		37,177	38,151	70,555	20,296	21,748	37,679	21,916	36,731	53,000
	48,700	CDQ	0	0	0	0	93	5,462	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	27,981	0	0	0
		S	53,331	70,550	88,977	36,493	37,576	53,637	37,702	52,994	70,943
	48,700 Total		53,331	70,550	88,977	36,493	37,669	87,081	37,702	52,994	70,943
	29,300	CDQ	0	0	0	5,455	9,593	13,781	0	0	262
		M	0	0	0	0	0	9,001	0	0	2,215
		P	0	0	27,537	27,942	48,725	73,400	0	13,916	49,121
		S	88,968	125,252	148,561	53,626	70,839	105,794	70,932	88,732	125,524
	29,300 Total		88,968	125,252	176,099	87,022	129,156	201,977	70,932	102,647	177,122

Table 2-47 Hypothetical forgone pollock catch, in mt, by season and sector under Chinook salmon hard cap sector allocation options for 2006

2006			opt1 (AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0	0	0	9,338	1,128	0	0	0	0
		M	7,656	2,436	0	19,404	9,561	8,216	9,057	7,936	2,418
		P	696	0	0	75,155	50,555	8,288	8,658	6,781	0
		S	163,745	130,857	93,329	90,223	538	0	95,770	91,687	11,747
	87,500 Total		172,097	133,293	93,329	194,120	61,783	16,504	113,485	106,405	14,165
	68,100	CDQ	0	0	0	19,866	10,114	1,528	0	0	0
		M	9,519	8,473	6,903	27,576	27,083	19,055	26,806	9,737	8,429
		P	8,857	7,011	0	100,767	76,409	51,445	51,867	49,730	7,607
		S	168,111	165,659	131,854	97,110	93,242	35,663	163,854	130,948	93,484
	68,100 Total		186,487	181,143	138,757	245,319	206,848	107,691	242,527	190,415	109,520
	48,700	CDQ	0	0	0	21,190	20,658	19,860	0	0	0
		M	27,352	26,823	9,512	28,453	28,101	27,572	27,903	27,462	26,801
		P	75,747	51,228	8,843	130,488	129,038	100,756	101,061	76,752	51,852
		S	172,477	170,723	168,093	166,388	163,660	97,082	169,432	167,192	163,831
	48,700 Total		275,575	248,774	186,448	346,520	341,458	245,270	298,396	271,406	242,483
	29,300	CDQ	1,377	0	0	32,319	31,838	31,116	20,181	19,487	9,213
		M	37,947	28,350	27,873	48,257	38,560	38,127	38,397	38,037	28,337
		P	130,203	128,708	100,442	157,797	133,225	131,916	132,150	130,966	129,191
		S	213,627	212,549	210,932	173,179	171,538	169,077	211,755	173,663	171,641
	29,300 Total		383,154	369,607	339,247	411,552	375,160	370,237	402,484	362,154	338,382
B	87,500	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	2,369	16,791	51,273	0	0	15,716	0	1,574	31,642
	87,500 Total		2,369	16,791	51,273	0	0	15,716	0	1,574	31,642
	68,100	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	31,485	33,166	75,284	0	2,185	32,186	2,429	16,844	51,328
	68,100 Total		31,485	33,166	75,284	0	2,185	32,186	2,429	16,844	51,328
	48,700	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	52,005	75,273	102,616	16,494	32,174	52,630	32,391	51,317	100,590
	48,700 Total		52,005	75,273	102,616	16,494	32,174	52,630	32,391	51,317	100,590
	29,300	CDQ	0	0	0	0	0	0	0	0	0
		M	0	0	0	0	0	0	0	0	0
		P	0	0	0	0	0	0	0	0	0
		S	102,596	123,886	137,539	52,606	75,882	123,384	100,564	102,060	124,281
	29,300 Total		102,596	123,886	137,539	52,606	75,882	123,384	100,564	102,060	124,281

Table 2-48 Hypothetical forgone pollock catch, in mt, by season and sector under Chinook salmon hard cap sector allocation options for 2007

2007			opt1 (AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0	0	0	32,259	31,706	30,877	7,668	0	0
		M	20,516	6,362	0	35,056	34,383	20,894	27,895	20,705	6,334
		P	90,321	70,523	52,285	122,086	120,514	118,157	118,578	91,456	88,815
		S	195,946	165,042	131,609	100,269	2,042	0	133,582	130,281	2,198
	87,500 Total		306,783	241,927	183,894	289,670	188,645	169,928	287,723	242,442	97,346
	68,100	CDQ	0	0	0	41,022	40,603	31,950	19,399	8,493	0
		M	34,351	21,068	12,063	35,990	35,465	34,679	35,170	34,515	21,038
		P	118,803	91,672	89,075	148,007	123,040	121,206	121,533	119,873	92,230
		S	199,131	197,342	166,208	164,203	131,538	21,672	196,025	165,148	131,734
	68,100 Total		352,286	310,081	267,346	389,222	330,647	209,506	372,128	328,029	245,002
	48,700	CDQ	8,888	7,725	0	41,768	41,469	41,019	31,548	30,881	19,389
		M	35,751	35,189	34,346	45,051	44,648	35,986	44,421	35,869	35,166
		P	122,536	121,037	118,788	184,499	149,054	148,000	148,188	123,301	121,521
		S	229,763	228,386	199,118	197,874	195,884	164,179	200,095	198,461	196,009
	48,700 Total		396,939	392,337	352,251	469,193	431,055	389,184	424,253	388,512	372,084
	29,300	CDQ	31,858	31,241	19,998	48,575	42,334	42,064	41,200	40,809	32,205
		M	45,296	44,933	44,387	46,054	45,811	45,448	45,675	45,372	44,918
		P	184,265	148,894	147,807	187,474	186,755	185,677	185,869	184,894	183,431
		S	233,193	232,364	231,121	230,315	229,026	199,836	231,754	230,695	229,107
	29,300 Total		494,612	457,431	443,314	512,418	503,927	473,024	504,499	501,770	489,660
B	87,500	CDQ	0	0	0	2,998	5,233	5,443	0	1,167	2,614
		M	0	0	0	0	0	2,619	0	0	0
		P	0	0	0	0	0	5,198	0	0	0
		S	39,362	40,200	53,563	9,415	24,271	39,711	24,475	38,978	52,578
	87,500 Total		39,362	40,200	53,563	12,413	29,504	52,971	24,475	40,146	55,192
	68,100	CDQ	0	0	2,286	5,287	5,396	7,397	1,215	2,465	2,983
		M	0	0	2,269	0	2,432	5,447	0	0	2,675
		P	0	0	0	0	203	14,938	0	0	4,791
		S	52,509	53,245	71,474	24,950	39,274	52,816	39,391	40,224	53,582
	68,100 Total		52,509	53,245	76,029	30,237	47,305	80,598	40,606	42,689	64,032
	48,700	CDQ	1,155	2,283	2,853	7,310	7,397	9,980	2,735	2,981	5,335
		M	0	2,267	5,357	2,770	5,446	9,528	2,286	2,673	5,579
		P	0	0	5,529	5,721	14,932	29,967	0	4,782	15,095
		S	53,819	71,471	85,600	40,065	52,811	61,216	52,906	53,578	71,691
	48,700 Total		54,974	76,021	99,340	55,865	80,585	110,691	57,926	64,015	97,701
	29,300	CDQ	2,849	5,147	5,382	9,978	10,050	13,643	5,333	5,435	7,428
		M	5,353	5,567	12,449	9,525	12,532	22,040	5,576	9,471	18,003
		P	5,510	14,765	29,851	29,956	37,605	58,892	15,081	22,844	37,689
		S	85,594	85,943	86,466	61,212	71,633	85,740	71,685	72,055	86,103
	29300 Total		99,307	111,422	134,148	110,673	131,820	180,315	97,676	109,805	149,222

Table 2-49 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 2-50 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 2-51 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 2-52 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 2-53 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%

Overall the inshore CV sector is most impacted by sector split constraints in general, and particularly in the A season, over the years examined. The offshore CP fleet experiences the next most significant constraint by sector, 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 (2006, 2007) years 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 2-42).

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 2-42).

For the mothership fleet and CDQ fleets, Option 2a provides 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 2-42). The combination of seasonal distributions with allocations to the fleet, however, has less of an overall impact than the driving aspect of the sector allocation options themselves.

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.

Finally, as an indication of the relative amount of Chinook catch on an annual basis under each option and seasonal distribution, the annual totals for 2007 by cap, sector, season and option are shown (Table 2-54). For each sector split option, and seasonal distribution option, the actual catch realized due to the combination of seasonal constraints by sector is less than the annual cap specified under each cap scenario.

Table 2-54 Annual totals of hypothetical Chinook salmon bycatch levels, in numbers of fish, under different 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

2.4.5 Cooperative-level impacts – Alternative 2, Component 4

Cooperative provisions for the inshore CV fleet are examined qualitatively in this analysis. Cooperative provisions apply under the hard cap alternative only and do not apply for triggered caps. Many monitoring and enforcement issues apply specifically to the application of cooperative level bycatch caps, which are highlighted further in this analysis. The inshore CV fleet currently has lower levels of observer coverage, and the ability to assign salmon bycatch caps to the cooperative level will require 100% observer coverage. A comparison of the range of seasonal distribution options combined with sector split options results in very small caps under some options at the individual cooperative level. This is particularly apparent for the combination of Option 1 sector allocation to the inshore CV fleet with the seasonal allocation of 30-50% B-season allocation (Options 1-1, 1-4). These combinations result in cooperative-level caps as low as 45-76 fish, respectively.

2.4.6 Alternative 3, Trigger cap impacts

Trigger caps will be based on hard cap formulation. Similar issues as raised above regarding the relative constraints by cap level, depending upon sector split options, apply equally to the trigger cap formulations.

2.5 Identifying a Preferred Alternative

Prior to final action, the Council must identify a preferred alternative from amongst the various components and options presented in the range of alternatives. Ideally, the Council will begin to identify a preliminary preferred alternative (PPA) as early in the process as possible in order to focus both public comment and the framing of additional analysis. The PPA does not obligate the Council to proceed in that direction for its preferred alternative at final action. While not required, it is beneficial to the public to have a preferred alternative identified in the draft EIS that is circulated for public comment. The Council should ideally indicate its PPA at the June Council meeting. Given the complexity of alternatives and the potential combinations involved in mixing and matching components and options across alternatives, it is particularly important to identify the preferred alternative as early in the process as possible so that the specific combination of elements for the PPA can be analyzed together as a stand-alone alternative in comparison with other alternatives in the analysis, and incorporated into the draft for public review and comment.

Table 2-55 summarizes the specific choices for building a preferred alternative. As described previously, the preferred alternative may be constructed of a combination of elements from the range of alternatives. The table is provided to assist the Council and the public in understanding step-by-step what each of these decision points are in building a preferred alternative. Following Table 2-55, a discussion of the potential issues with combining certain aspects of alternatives within the preferred alternative is provided.

Table 2-55 Preferred alternative choices

Do you want to retain the existing triggers and closures? (Alternative 1)	**No**	Existing salmon PSC limits and salmon savings areas will be removed from the FMP
	Yes	Existing salmon PSC limits and salmon savings areas will remain in the FMP; exemption from the area closures will continue to apply to vessels participating in VRHS system

Do you want a hard cap? (Alternative 2)	**No**	No hard cap					
	Yes	**How to formulate it?** (Component 1)	Option 1 (i-viii): Select from a range of numbers	Suboption: adjust periodically based on updated bycatch information			
			Option 2: Index cap is set relative to salmon returns				
		How to apportion the cap by season? (Component 1)	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)				
		Subdivide among sectors? (CDQ, inshore CV, mothership, offshore CP)	**No**	separate cap only for CDQ Program, otherwise cap applies to all non-CDQ sectors as a whole			
			Yes	**How?** (Component 2)	Option 1: same as pollock allocations, 10% CDQ, 45% inshore CV, 9% mothership, 36% offshore CP		
					Option 2 (a-c): Cap is set based on historical average bycatch use by sector Option 2 (d): Midpoint of the range provided by Option 1 and 2 (a-c)		
				Allow bycatch transfers among sectors? (Component 3)	Option 1: yes, transferable salmon bycatch caps		
					Option 2: NMFS rolls over unused salmon bycatch to sectors that are still fishing		
				Subdivide inshore CV cap among cooperatives? (Component 4)	**No**	Inshore CV cap applies at sector level	
					Yes	Inshore CV cap will be subdivided among cooperatives based on the cooperative's pollock allocation	
						Allow bycatch transfers among cooperatives?	Option 1: no, cooperatives may lease pollock to another cooperative
							Option 2: yes, industry may initiate transfers
							Suboption: NMFS rolls over unused salmon bycatch to cooperatives that are still fishing

Table 2-55 Preferred alternative choices (continued)

Do you want a new triggered closure? (Alternative 3)	**No**	No trigger caps and closures	
	Yes	**How to formulate cap?** (Component 1; same options as for hard cap)	Option 1 (i-viii): Select from a range of numbers — Suboption: adjust periodically based on updated bycatch information Option 2: Index cap is set relative to salmon returns
		How to apportion the cap by season? (Component 1)	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)
		How will the cap be managed? (Component 2)	NMFS would manage the trigger closures. **Option: Allow participants in the intercooperative agreement to manage their own cap.** NMFS continues to manage trigger closures for non-participants.
		Subdivide cap among sectors? (CDQ, inshore CV, mothership, offshore CP)	**No**: separate cap only for CDQ Program, otherwise cap applies to all non-CDQ sectors as a whole
			Yes – **How?** (Component 3; same options as for hard cap): Option 1: same as pollock allocations, 10% CDQ, 45% inshore CV, 9% mothership, 36% offshore CP Option 2 (a-c): Cap is set based on historical average bycatch use by sector Option 2 (d): Midpoint of the range provided by Option 1 and 2 (a-c)
			Yes – **Allow transfer among sectors?** (Component 4; same options as for hard cap): Option 1: yes, transferable salmon bycatch caps Option 2: NMFS rolls over unused salmon bycatch to sectors that are still fishing
		Apportion by season?	
		What areas? (Component 5; Council may select both A and B season closures)	Option 1: A season closure Option 2: B season closures Suboption: adjust periodically based on updated bycatch information
		Duration of closures?	A-season: once triggered, areas remain closed for remainder of season B-season: If trigger is reach prior to August 15th, areas remain open until August 15th and then close for remainder of season

2.5.1 Combining Alternative 3 with Alternative 2

Triggered closures under Alternative 3 could be considered as stand alone management measures, or in combination with a hard cap under Alternative 2. Selecting a hard cap approach under Alternative 2 could create sufficient incentives for the pollock fishery participants to implement their own triggered closures or rolling hot spot closures to avoid reaching the hard cap without the administrative, monitoring and management infrastructure necessary to support a NMFS-managed trigger closure under Alternative. Further, combining Alternatives 2 and 3 could raise different policy considerations and fishery incentives depending whether hard caps or triggered closures are the primary management tool to control salmon bycatch.

Alternative 3 as a stand-alone measure

If Alternative 3 is selected as a stand-alone measure, the absolute number of Chinook salmon that may be taken by a sector during a year would not be specified except for the threshold level of bycatch that would trigger the closure area. If the closure was triggered for a sector, then subsequent directed fishing for pollock could still occur in the Bering Sea outside the closure area, although catch per unit effort rates for pollock and associated salmon bycatch rates may be significantly reduced (further discussion in Section 4.2.3).

If the Council does not select Alternative 3's Component 2, Option 1, ICA management, NMFS would monitor and manage the non-CDQ pollock fishery so that the regulatory time/area closure of directed fishing for pollock would be implemented once estimated bycatch reached the trigger cap amount. A CDQ group would be prohibited from directed fishing for pollock in the regulatory time/area closure once its portion of the Chinook salmon trigger cap is reached.

Under Option 1, pollock fishery participants in a voluntary ICA implemented through NMFS regulations would be subject to the triggered regulatory time/area closures selected by the Council under Component 5. However, ICA participants (including participating CDQ groups) would be exempt from the regulatory provisions governing NMFS management of sector and CDQ group trigger caps (Component 3) and transfer provisions (Component 4). Because no guarantee exists that all pollock fishery participants would join a voluntary ICA, Option 1 would still require that a Federal infrastructure to monitor and manage Components 2 through 4 be established in regulations.

Further, the current regulatory provisions for the existing ICA exemption to *non-Chinook* salmon savings area closures established under Amendment 84 to the FMP would remain in regulations. New ICA provisions and associated regulatory provisions would be required to support a modified ICA for Chinook salmon bycatch avoidance. Component 2, Option 1 does not exempt ICA participants from the triggered closure area once the ICA's seasonal trigger cap is reached. This is a notable difference from the current ICA exemptions under Amendment 84, and creates interplay with Alternative 2 should both a hard cap and triggered closure be selected.

Alternative 3 in combination with Alternative 2

If a hard cap is selected under Alternative 2, a triggered closure under Alternative 3 could still be established. The trigger closure would be the first step of a staggered progression of management measures implemented as salmon bycatch levels increase over the season; the second step would be to close directed fishing for Bering Sea pollock to a fishery or sector for the remainder of a season or fishing year. Under Alternative 3, the triggered closures would be selected, and two threshold levels of Chinook salmon bycatch would be established for each fishery or sector allocation: the threshold amount that would close directed fishing for pollock in the triggered closure area and the hard cap level that would subsequently close the Bering Sea to directed fishing for pollock to that fishery sector. The option for ICA management of trigger closure areas under contract agreements, under Alternative 3, Component 2, Option 1, could still be selected, but NMFS would still manage closures for non-ICA participants, and would be responsible for prohibiting directed fishing by a fishery or sector once that sector's final bycatch threshold was reached.

One of two perspectives should be considered if Alternatives 2 and 3 are combined. The first would consider the hard cap under Alternative 2 as the primary management tool, and the trigger closures under Alternative 3 would be a means to slow the fleet's progression toward reaching the cap. The other perspective would be to consider the trigger closure as the primary management tool, and the hard cap would be a back stop should excessive bycatch continue.

If a hard cap is the primary tool, it could provide sufficient incentive for the pollock cooperatives to form an ICA to manage bycatch based on inseason experience and using the triggered closure or other rolling hot spot program as a means to control bycatch rates. In other words, pollock fishery participants are put in the position of developing a defensive bycatch reduction program so that pollock harvest is optimized before reaching the cap. Obviously, a cap at the upper end of the range considered under Alternative 2 would provide greater flexibility to the pollock fleet to manage itself in a manner that enhances the probability of harvesting available pollock before the fishery is closed. Presumably, if a hard cap is selected at a mid to lower end of the range, Alternative 3 could become prohibitively restrictive and Alternative 2 alone might best position the pollock fleet to optimize the harvest of available pollock.

Under the second perspective, with the trigger closure area as the primary tool, bycatch would be maintained within a range in most years; this range would be largely controlled by the trigger level established under Alternative 3 which closes sectors or ICA participants out of the trigger area. For example, a trigger level of 75 percent of the hard cap could result in substantial bycatch reduction, even if the hard cap was set at a fairly high level. The hard cap would serve as a backstop, and given a buffer of 25 percent between the trigger and hard cap, fishing outside the trigger area closure likely would not result in the cap being reached except in years of unusually high abundance. If Alternatives 2 and 3 are combined, this approach may better support a decision to select a cap at the higher range of options under Alternative 2.

Combining Alternatives 2 and 3 would place the burden on NMFS to monitor twice the number of allocations (threshold and hard cap levels). A hard cap alone could provide sufficient incentives for ICA participants to initiate time/area closures to reduce Chinook salmon bycatch rates in a manner that optimizes pollock harvest before the hard cap is reached and the pollock fishery closed. Combining Alternatives 2 and 3 may provide additional tools to the pollock fishery to maintain bycatch within a cap under an ICA, although whether or not these additional tools would be applied likely depends on the level of hard cap selected under Alternative 2. A summary of these management options is presented in Table 2-56.

Table 2-56 Management implications of Alternatives 2 and 3, alone or in combination

Alternative	Component	ICA participants in pollock fishery	Non-ICA participants in pollock fishery	Hard cap on salmon bycatch?
Alternative 3 alone	Management of cap (Component 2)	• NMFS closes trigger area when the non CDQ fishery or sector specific threshold bycatch level is reached. CDQ groups are prohibited from fishing in the area once their trigger cap is reached.		no
	ICA management (Component 2, Option 1)	• ICA participants manage the triggered closure area under modified ICA regulatory provisions for Chinook salmon • current non-Chinook salmon ICA provisions implemented under Amd 84 remain in regulations	• NMFS closes trigger area to non ICA participants in the non CDQ fishery or sector when threshold bycatch level reached. CDQ groups not participating in the ICA comply with area closures.	no
Alternative 3 in combination with Alternative 2	Management of cap (Component 2)	• Same as Alternative 3 + Bering Sea pollock sector closed when hard cap allocation reached		yes
	ICA management (Component 2, Option 1)	• Same as Alternative 3 + Bering Sea closed to pollock sector when hard cap allocation reached	• Same as Alternative 3 + Bering Sea closed to pollock sector when hard cap allocation reached	yes
Alternative 2 alone		• Opportunity continues for voluntary Chinook salmon ICA without regulatory provisions • current non-Chinook salmon ICA provisions implemented under Amd 84 remain in regulations • Bering Sea closed to relevant pollock fishery when its hard cap allocation reached	• Current non Chinook salmon ICA provisions implemented under Amd 84 remain in regulations. • Bering Sea closed to relevant pollock fishery when its hard cap allocation reached	yes

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 a 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, are no longer part of this analysis.

The Council, in February 2007, established a Salmon Bycatch Workgroup (SBW) committee, comprising members of the public 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. 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 on the development of alternatives for analysis, as necessary.

The Salmon Bycatch Workgroup met 4 times, in March 2007, May 2007, August 2007 and November 2007. These meetings were all 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 was provided to the Council at its subsequent meeting (April 2007, June 2007, October 2007, and December 2007). Based upon the recommendations from the Council's Salmon Bycatch Workgroup in August 2007, the Council initially considered a broader range of numbers for Chinook caps. These numbers ranged from 14,000 to 114,000 fish, based on various methodologies for increasing or decreasing a cap above or below historical averages and highest years of bycatch. At the December 2007 Council meeting, the Council modified the range under consideration so that the highest number in the alternatives is 87,500 fish annually. The Council's intent with this action is to reduce salmon bycatch 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 Salmon Bycatch Workgroup resulting from their November 2007 meeting.

One of the major alternative sets that is 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, i.e. hard caps on the pollock fishery and triggered time/area closures. The chum salmon alternatives were last modified by the Council in April 2008 in conjunction with finalizing the Chinook alternatives (see April 2008 Council motion at http://www.fakr.noaa.gov/npfmc/current_issues/bycatch/salmonbycatch408motion.pdf). At that time, the Council moved to bifurcate the analysis of management measures by species such that the EIS on its current timeline would focus upon 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. Additionally, the management measures put in place for Chinook are also likely to reduce chum salmon bycatch (discussed as part of the impacts analysis in this document). Further discussion of the chum management measures alternative set is scheduled for the October 2008 Council meeting.

During the development of alternatives process 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 folded into 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 folded into 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 was 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 their 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."**

3.0 AFFECTED ENVIRONMENT

This chapter provides a brief discussion on the affected environment and regime shift considerations relevant to understanding the Bering Sea ecosystem. This chapter also provides a discussion of 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.

The action area effectively covers all of the Bering Sea under U.S. jurisdiction, with 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 habitats and along salmon migration routes. Chinook salmon caught as bycatch in the Bering Sea pollock fishery may originate from Asia, Alaska, Canada, and the western United States.

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 PSEIS (NMFS 2004) and Chapter 3 of the 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. Chapter 3 of the EFH EIS contains a description of the range and distribution of Chinook and chum salmon. Rather than duplicate an affected environment description here, readers are referred to those documents. Both of these public documents are available on the NMFS Alaska Region website at www.fakr.noaa.gov.

A large body of information exists on the life histories and general distribution of salmon in Alaska. The locations of many freshwater habitats used by salmon are described in documents organized and maintained by the Alaska Department of Fish & Game (ADF&G). Alaska Statute 16.05.870 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* (Catalog) (ADF&G 1998a) and the *Atlas to the Catalog of Waters Important for Spawning, Returning or Migration of Anadromous Fishes* (Atlas) (ADF&G 1998b). The Catalog lists water bodies documented to be used by anadromous fish. The Atlas shows locations of these waters and the species and life stages that use them. The Catalog and Atlas are divided into six volumes for the six resource management regions established in 1982 by the Joint Boards of Fisheries and Game. Additional information on salmon streams is available from the ADF&G web site at: http://www.state.ak.us/adfg/habitat.

3.1 Regime shift considerations

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.

3.1.1 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.

3.1.2 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.

3.1.3 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.

3.1.4 Acidification

There is direct evidence of ocean acidification, observed as a decrease in pH and increase in carbon in the surface waters of a large section of the northeast Pacific Ocean (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 pteropods and corals (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.

Research is ongoing to better understand ocean acidification and the potential effects on fisheries from the changing chemical properties of the ocean. Section 701 of the MSRA requires that the Secretary of Commerce request the National Research Council study of the acidification of the oceans and how this process affects the United States, but no funding is available at this time to support this research (Regina Spallone, NMFS Headquarters, pers. comm. 3/14/08).

3.1.5 Recent ecosystem trends

The following is a summary of recent trends from the 2007 SAFE report Ecosystem Considerations chapter that are relevant to the Bering Sea and this proposed action.

3.1.5.1 Fishing Effects on Ecosystems

- No significant adverse impacts of fishing on the ecosystem relating to predator/prey interactions, energy flow/removal, or diversity were noted, either in observed trends or ecosystem-level modeling results
- No BSAI groundfish stock or stock complex is overfished and no BSAI groundfish stock or stock complex is being subjected to overfishing. Two crab stocks are overfished.

Chinook salmon bycatch increased in recent years and for all of Alaska was essentially unchanged in 2006 compared to 2005, but it increased by about 18% in the BSAI where, in 2006 for the first time ever, the Chinook SSA was closed to fishing during the pollock ‘A’ season. The closure resulted in a large economic impact on the pollock fishery during the winter roe season.

- The “other salmon” bycatch (primarily chum) has also increased dramatically in 2003-2005 and decreased by about 54% in 2006. The increases in 2003 and 2005 and the decrease in 2006 are in line with changes in salmon abundance.
- Non-target catch of Habitat Areas of Particular Concern biota and non-specified biota has decreased and non-target forage fish catch has increased in the BSAI.
- Analysis of the trends in the size of eastern Bering Sea fishes indicates there has not been a systematic decline in the amount of large fish from 1982 to 2006.

3.1.5.2 Ecosystem Trends

- Demersal groundfish species in the BSAI had above-average recruitments from the mid- or late 1970s to the late 1980s, followed by below-average recruitments during most of the 1990s. There is an indication for above-average recruitment from 1994-2000 (with the exception of 1996). In the Gulf of Alaska, recruitment has been below average across stocks since 2001.
- Annual groundfish surplus production in the eastern Bering Sea decreased between 1978 and 2005. Declines in production may be a density-dependent response to observed increases in biomass and aging populations of groundfish.
- There was a larger than expected return of age-4 and age-5 Togiak herring in the 2006 fishery, suggesting a strong recruitment event in the future.
- Jellyfish catch-per-unit-effort in the Bering Sea survey continues to be low.
- Eulachon catch per unit effort sampled in the NMFS bottom trawl survey was the highest of the last 4 years in the eastern Bering Sea.
- The overall trend for the western stock of Steller sea lions in Alaska through 2007 is either stable or declining slightly.
- Pribilof Islands northern fur seal pup production continued to decrease in 2006; whereas, Bogoslof Island pup production increased (1995-2007). Neither trend is due solely to migration between islands.
- Trends in harbor seal populations are mixed, but overall populations are lower than they were in the 1970s and 1980s. Harbor seal populations in the Bering Sea and Aleutian Islands have decreased from the late 1970s to the 1990s.
- Reliable estimates for the current minimum population size, abundance, and trend of the Alaska stocks of bearded, ribbon, ringed or spotted seals are unavailable.

3.2 Reasonably Foreseeable Future Actions

This section lists the reasonably foreseeable actions that may affect resource components 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 3-1 summarizes the reasonably foreseeable "actions" identified in this analysis that are likely to have an impact on a resource component within the action area and timeframe. Actions are understood to be human actions (e.g., a proposed rule to designate northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). Identification of actions likely to impact a resource component, or change the impacts of any of the alternatives, within this action's area and time frame will allow the public and Council to make a reasoned choice among alternatives.

CEQ regulations require a consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. This is interpreted as indicating actions that are more than merely possible or speculative. Actions have been considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or the publication of a proposed rule. Actions simply "under consideration" have not generally been included because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen.

Table 3-1 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

Discussions of reasonably foreseeable future actions are included in each subsequent chapter 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.

3.2.1 Developments in ecosystem-sensitive management[5]

3.2.1.1 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 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 available at the AFSC website at: http://www.afsc.noaa.gov/ABL/occ/ablocc_basis.htm.

In 2008, North Pacific Research Board (NPRB) and 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

[5] 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.

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, the AFSC's Fishery Interaction Team (FIT), formed in 2000 to investigate the ecological impacts of commercial fishing, is focusing on the impacts of Pacific cod, pollock, and Atka mackerel fisheries on Steller sea lion populations (Connors and Logerwell 2005). The AFSC's Fisheries and the Environment (FATE) program is investigating potential ecological indicators for use in stock assessment (Boldt 2005). The AFSC's Auke Bay Lab and RACE Division map the benthic habitat on important fishing grounds, study the impact of fishing gear on different types of habitats, and model the relationship between benthic habitat features and fishing activity (Heifetz et al. 2003). Other AFSC ecosystem programs include the North Pacific Climate Regimes and Ecosystem Productivity Program, the Habitat and Ecological Processes program, and the Loss of Sea Ice program (J. Boldt, pers. comm., September 26, 2005). More information on these research programs is available at the AFSC website at: http://www.afsc.noaa.gov.

3.2.1.2 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.

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).

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. NMFS has completed a new species and critical habitat designation for the North Pacific right whale (*Eubaleana japonica*) (73 FR 12024, March 6, 2008, and 73 FR XXXX, date,). NMFS completed reinitiation of Section 7 consultation on this species and designated critical habitat and determined that the groundfish fisheries were not likely to adversely affect the North Pacific right whales or their designated critical habitat.(NMFS 2008 cite memo)

The Council is in the process of considering revisions to the Steller sea lion protection measures applicable to the pollock fishery. NMFS and the Council are developing an EIS to analyze the impacts of this proposed action. 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). The new FMP-level Biological Opinion includes a thorough review and synthesis of the 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 1992 recovery plan (NMFS 2008b). From this new information, revisions to the Steller sea lion protection measures are being 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. Additionally, the revisions are designed to minimize the bycatch of prohibited species and other groundfish and minimize adverse impacts to other threatened and endangered species.

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 2005b). 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 developed for the fisheries to mitigate potential adverse effects.

NMFS has received a petition for listing of ribbon seals as threatened or endangered under the ESA (Center for Biological Diversity 2007) and found that the petition presents substantial scientific or commercial information indicating that the petition action may be warranted (73 FR 16617). NMFS has therefore began a status review to determine if listing is warranted. Ribbon seals are potentially affected by the diminishing sea ice in the Bering Sea and Arctic regions as they are dependent on sea ice for important activities such as resting and reproduction. Listing of this species would require ESA consultation on federal actions that may adversely affect ribbon seals or any designated critical habitat. One ribbon seal has been observed taken in the pollock trawl fishery between 2000 and 2004 (Angliss and Outlaw 2007), and therefore, any listing of this species may require an ESA consultation for the groundfish fisheries and potential protection measures. Although NMFS has prioritized its review of ribbon seals, it has also announced its intention to initiate status reviews for all ice seals, including bearded, ringed, and spotted seals.

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. Ecosystem protection is supported by an extensive program of research into ecosystem components and the integrated functioning of ecosystems, carried out at the AFSC. An exempted fishing permit (EFP) currently is being considered to support continued development of an excluder device for pollock trawl gear to reduce salmon bycatch in the BSAI (73 FR 13210, March 12, 2008). Use of such a device would lessen the potential impact on the ecosystem by the pollock trawl fishery.

3.2.1.3 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 recent 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 coordination and 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 coordination and cooperative understanding 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.

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.

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.

3.2.2 Developments in traditional management tools

3.2.2.1 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.

3.2.2.2 Increasing enforcement responsibilities

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 U.S. Coast Guard (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. Likewise, the NOAA Office for Law Enforcement (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.

The USCG conducts fisheries enforcement activities in the EEZ off Alaska in cooperation with NOAA OLE. 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.

3.2.2.3 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.

NMFS is investigating the use of shipboard video monitoring to ensure compliance with full retention requirements in other regions. In the Alaska Region, NMFS has implemented video monitoring to monitor catch sorting actions of crew members inside fish holding bins and investigating the use of video to monitor regulatory discards. An EFP for continued development of the capability to do video monitoring of rockfish catch in the GOA is currently under consideration by NMFS and Council (73 FR 14226, March 14, 2008). NMFS is hopeful that these investigations could lead to regulations that allow use of video monitoring to supplement observer coverage in some fisheries. Electronic monitoring technology is evolving rapidly, and it is probable that video and other technologies will be introduced to supplement current observer coverage and enhance data collection in some fisheries. Video monitoring has not been sufficiently tested to ensure compliance with a no discard requirement at this time, but NMFS would support and encourage research to explore the feasibility of video for this use.

In addition to the technical aspects of video monitoring, several other issues related to video must be resolved. These include the amount of staff time and resources that would be required to review video footage, curation and storage questions, and the costs to NMFS and the fishing industry. Until these issues are resolved, NMFS will continue to implement existing proven monitoring and catch estimation protocols.

3.2.2.4 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. NMFS and the Council are currently considering the issuance of a new EFP to allow the continued development and testing of the salmon excluder device (73 FR 13210, March 12, 2008). 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.

3.2.3 Actions by Other Federal, State, and International Agencies

3.2.3.1 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 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 (see section 5.3.1).

3.2.3.2 Hatchery releases of salmon

Hatcheries produce salmon fry and release these small salmon into the ocean to grow and mature before returning as adults to the hatchery or local rivers and streams for harvest or breading. Hatchery production increases the numbers of salmon in the ocean beyond what is produced by the natural system. A number of hatcheries produce salmon in Korea, Japan, Russia, the US, and Canada. The North Pacific Anadromous Fish Commission summarizes information on hatchery releases, by country and by area, where available. It is reasonably foreseeable the hatchery production will continue at a similar level into the future (see sections 5.1.2, 6.1.2 and RIR section A3.1.1).

3.2.3.3 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 upcoming 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 of development, unlikely to significantly impact fisheries and essential fish habitat (MMS 2003).

3.2.3.4 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.

3.2.3.5 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.

3.2.4 Private actions

3.2.4.1 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 (see EIS section 4.2 and RIR section A2.1).

Commercial salmon fisheries exist throughout Alaska, in marine waters, bays, and rivers (see EIS sections 5.23, 6.23, and RIR section A2.2 .

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.

3.2.4.2 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 has 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 the Alaska Department of Fish and Game. 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.

3.2.4.3 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 (see RIR sections A2.2.1–A2.2.5).

3.2.4.4 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 (see RIR sections A2.2–A2.2.5).

3.2.4.5 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 recreational 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 (S. Miller, pers. comm., September 2005). In southwest Alaska copper, gold, and molybdenum may be mined at the prospective Pebble mine (www.pebblepartnership.com).

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 (S. Miller, pers. comm., September 2005).

4.0 WALLEYE POLLOCK

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 semidemersal, 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).

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 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 EZZ, and seasonally within the eastern Bering Sea is unclear. General migratory movements of adult pollock on and off the eastern Bering Sea shelf tend to follow a pattern of movement to the outer shelf edge and deep water in the winter months, to spawning areas in the springtime, and to the outer and central shelf during the summer months to feed (Smith 1981).

Japanese mark-recapture studies during the summer/autumn feeding seasons have revealed that pollock migrate across the Bering Sea (Dawson 1989) suggesting the interchange of pollock between Russian and U.S. waters. There are concerns that Russian fisheries may be harvesting U.S. managed pollock stocks resulting in a higher fishing mortality. Although the few tagging studies in the Bering Sea have not provided information on spawning migrations, homing to specific spawning sites, and the characteristic of migrating populations as schools or individuals, tagging studies around Japan have been more informative. Mark-recapture studies in which pollock were tagged during the spawning season (April) in Japanese waters revealed migrations for spawning site fidelity, but diffuse mixing during the summer feeding season (Tsuji 1989).

4.1.1 Food habits/ecological role

In North American waters, pollock are most prevalent in the eastern Bering Sea. Because of their large biomass, pollock provide an important food source for other fishes, marine mammals as Steller sea lions (*Eumetopias jubatus*), northern fur seals (*Callorhinus ursinus*), and fin whales (*Balaenoptera physalus*), and marine birds as the northern fulmars (*Fulmarus glacialis*), kittiwakes (*Rissa tridactyla, Rissa brevirostris*), murres (*Uria aalge, Uria lomvia*), and puffins (*Fratercula corniculata, Lunda cirrhata*) (Kajimura and Fowler 1984). These predator-prey relationships between pollock and other organisms are an integral part of the balance that makes the eastern Bering Sea one of the most highly productive environments in the world.

In comparisons of the Western Bering Sea (WBS) with the Eastern Bering Sea using mass-balance food-web models based on 1980-85 summer diet data, Aydin et al. (2002) found that the production in these two systems is quite different. On a per-unit-area measure, the western Bering Sea has higher productivity than the EBS. Also, the pathways of this productivity are different with much of the energy flowing through epifaunal species (e.g., sea urchins and brittlestars) in the WBS whereas for the EBS, crab and flatfish species play a similar role. In both regions, the keystone species in 1980-85 were pollock and Pacific cod. This study showed that the food web estimated for the EBS ecosystem appears to be relatively mature due to the large number of interconnections among species. In a more recent study based on 1990-93 diet data (see Boldt et al. 2007 for methods), pollock remain in a central role in the ecosystem. The diet of pollock is similar between adults and juveniles with the exception that adults become more piscivorous (with consumption of pollock by adult pollock representing their third largest prey item). In terms of magnitude, pollock cannibalism may account for 2.5 million t to nearly 5 million t of pollock consumed (based on uncertainties in diet percentage and total consumption rate).

Regarding specific small-scale ecosystems of the EBS, Ciannelli et al. (2004) presented an application of an ecosystem model scaled to data available around the Pribilof Islands region. They applied bioenergetics and foraging theory to characterize the spatial extent of this ecosystem. They compared energy balance, from a food web model relevant to the foraging range of northern fur seals and found that a range of 100 nautical mile radius encloses the area of highest energy balance representing about 50% of the observed foraging range for lactating fur seals. This suggests that fur seals depend on areas outside the energetic balance region. This study develops a method for evaluating the shape and extent of a key ecosystem in the EBS (i.e., the Pribilof Islands). Subsequent studies have examined spatial and temporal patterns of age zero pollock in this region and showed that densities are highly variable (Winter et al. 2005, Swartzman et al. 2005).

The impact of predation by species other than pollock may have shifted in recent years. In particular, the increasing population of arrowtooth flounder in the Bering Sea is a concern, especially considering the large predation caused by these flatfish in the Gulf of Alaska. Overall, the total non-cannibal groundfish predator biomass has gone down in the Bering Sea according to current stock assessments, with the drop of Pacific cod in the 1980s exceeding the rise of arrowtooth in terms of biomass (e.g., Fig. 4 in Boldt 2007). This also represents a shift in the age of predation, with arrowtooth flounder consuming primarily age-2 pollock, while Pacific cod primarily consume larger pollock. However, the dynamics of this predation interaction may be quite different than in the Gulf of Alaska. A comparison of 1990-94 natural mortality by predator for arrowtooth flounder in the Bering Sea and the Gulf of Alaska shows that they are truly a top predator in the Gulf of Alaska. In the Bering Sea, pollock, skates, and sharks all prey on arrowtooth flounder, giving the species a relatively high predation mortality.

The predation on small arrowtooth flounder by large pollock gives rise to a specific concern for the Bering 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.

4.2 Groundfish Fisheries

Pollock continues to represent over 40% of the global whitefish production with the market disposition split fairly evenly between fillets, whole (head and gutted), and surimi. An important component of the commercial production is the sale of roe from pre-spawning pollock. Pollock are considered a relatively fast growing and short-lived species and currently represents a major biological component of the Bering Sea ecosystem.

In the U.S. portion of the Bering Sea three stocks of pollock are identified for management purposes. These are: Eastern Bering Sea which consists of pollock occurring on the Eastern Bering Sea shelf from Unimak Pass to the U.S.-Russia Convention line; the Aleutian Islands Region encompassing the Aleutian Islands shelf region from 170°W to the U.S.-Russia Convention line; and the Central Bering Sea—Bogoslof Island pollock. These three management stocks undoubtedly have some degree of exchange. The Bogoslof stock forms a distinct spawning aggregation that has some connection with the deep water region of the Aleutian Basin. In the Russian EEZ, pollock are considered to form two stocks, a western Bering Sea stock centered in the Gulf of Olyutorski, and a northern stock located along the Navarin shelf from 171°E to the U.S.- Russia Convention line. There is some indication (based on contiguous surveys) that the fishery in the northern region may be a mixture of Eastern and western Bering Sea pollock with the former predominant. Bailey et al. (1999) present a thorough review of population structure of pollock throughout the north Pacific region. Genetic differentiation using microsatellite methods suggest that populations from across the North Pacific Ocean and Bering Sea were similar. However, weak differences were significant on large geographical scales and conform to an isolation-by-distance pattern (O'Reilly and Canino, 2004; Canino et al. 2005).

From 1954 to 1963, pollock were harvested at low levels in the Eastern Bering Sea and directed foreign fisheries began in 1964. Catches increased rapidly during the late 1960s and reached a peak in 1970-75 when they ranged from 1.3 to 1.9 million t annually. Following a peak catch of 1.9 million t in 1972, catches were reduced through bilateral agreements with Japan and the USSR.

Since the advent of the U.S. EEZ in 1977 the annual average Eastern Bering Sea pollock catch has been 1.2 million t and has ranged from 0.9 million t in 1987 to nearly 1.5 million t in recent years. Stock biomass has apparently ranged from a low of 4-5 million t to highs of 10-12 million t (Fig. 4-1). United States vessels began fishing for pollock in 1980 and by 1987 they were able to take 99% of the quota. Since 1988, only U.S. vessels have been operating in this fishery. By 1991, the current NMFS observer program for north Pacific groundfish-fisheries was in place.

Foreign vessels began fishing in the mid-1980s in the international zone of the Bering Sea (commonly referred to as the "Donut Hole"). The Donut Hole is entirely contained in the deep water of the Aleutian Basin and is distinct from the customary areas of pollock fisheries, namely the continental shelves and slopes. Japanese scientists began reporting the presence of large quantities of pollock in the Aleutian Basin in the mid-to-late 1970's, but large scale fisheries did not occur until the mid-1980s. In 1984, the

Donut Hole catch was only 181 thousand t. The catch grew rapidly and by 1987 the high seas catch exceeded the pollock catch within the U.S. Bering Sea EEZ. The extra-EEZ catch peaked in 1989 at 1.45 million t and has declined sharply since then. By 1991 the Donut Hole catch was 80% less than the peak catch, and data for 1992 and 1993 indicate very low catches. A fishing moratorium was enacted in 1993 and only trace amounts of pollock have been harvested from the Aleutian Basin by resource assessment fisheries.

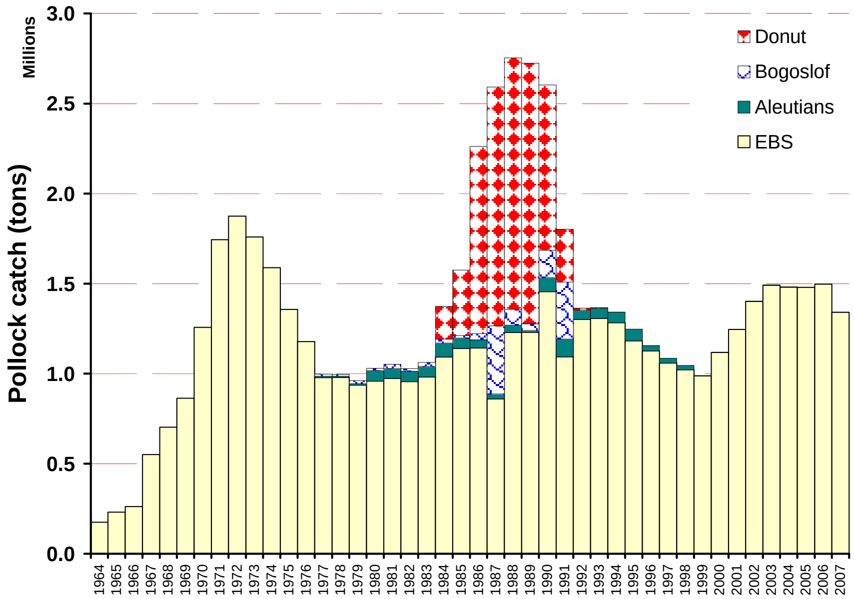


Fig. 4-1 Alaska pollock catch estimates from the Eastern Bering Sea, Aleutian Islands, Bogoslof Island, and Donut Hole regions, 1964-2007

4.2.1 NMFS surveys and stock assessment

The 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. 4-2).

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. 4-3; 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.

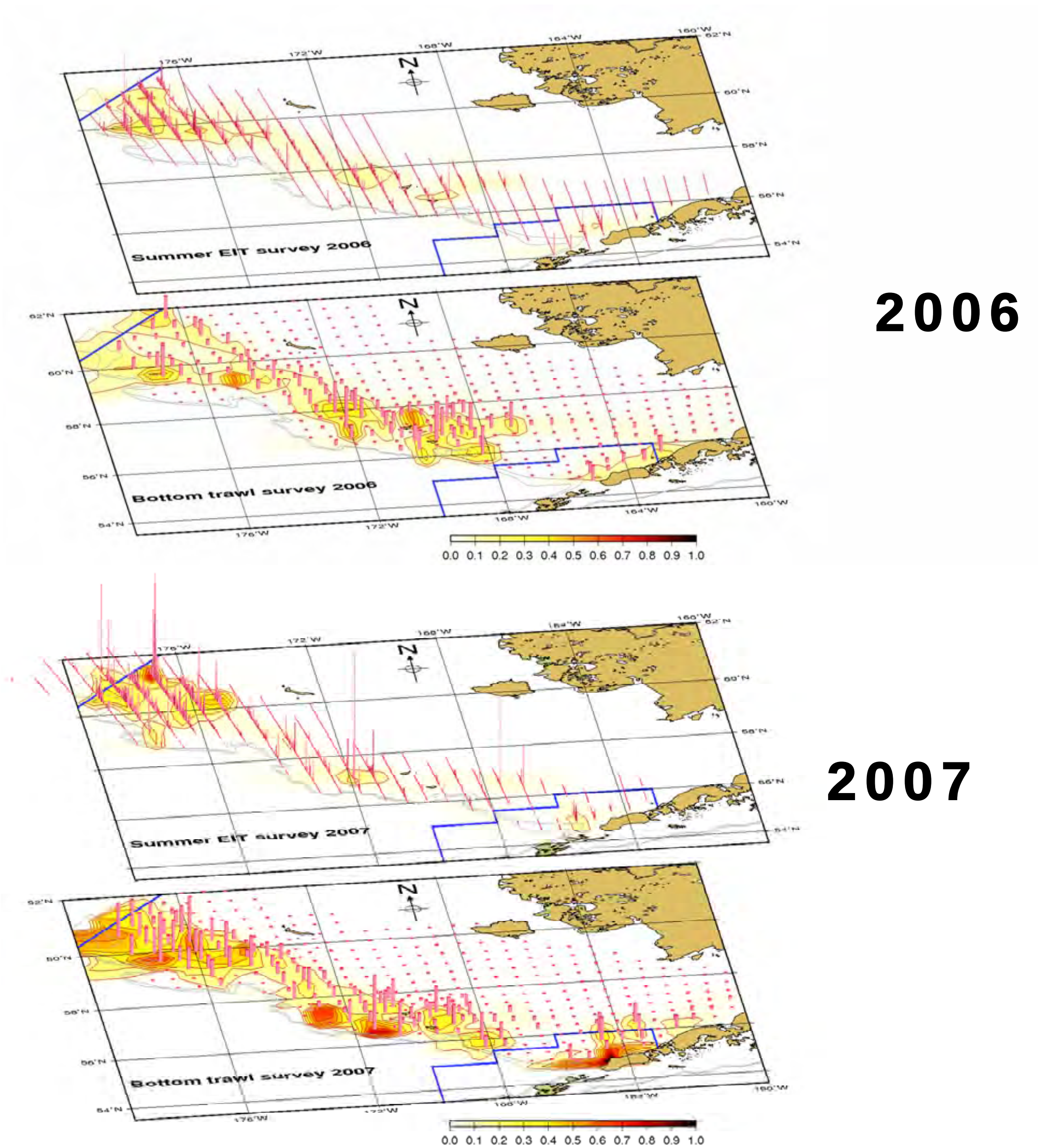


Fig. 4-2 Echo-integration trawl survey results for 2006 and 2007. The lower Fig. is the result from the BTS data in the same years. Vertical lines represent biomass of pollock as observed in the different surveys

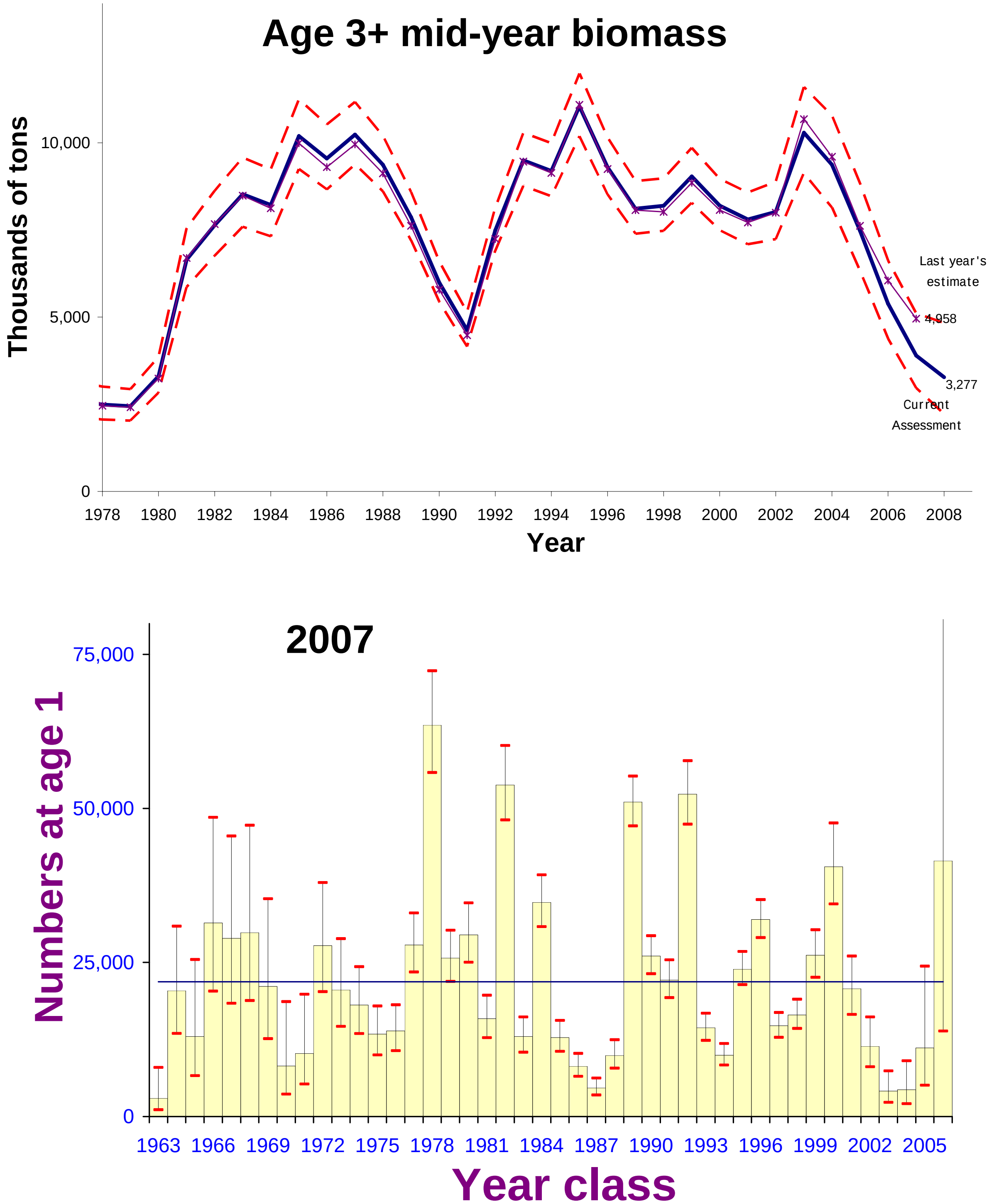


Fig. 4-3 Estimated age 3+ EBS mid-year pollock biomass, 1978-2008 (top) and age-1 year-class strengths. Approximate upper and lower 95% confidence limits are shown by dashed lines and error bars.

4.2.2 Impact analysis methods

General

The approach to evaluate the impact of the alternative management measures for Chinook bycatch involved evaluating spatial patterns and the overall reduction in the ability to catch the full allowable pollock quotas. 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.

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 to pre and post August 31st.

Alternative 3: Triggered closure areas

Because the areas in 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 some specified trigger salmon bycatch levels would have been reached, then simply summing values from that date onwards till the end of the season. For example, to compute the expected foregone pollock that would have occurred given a cap in a given year one simply needs to examine the cumulative daily bycatch records of Chinook and find the date that the cap was exceeded (e.g., Sept 15th) then compute 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 "foregone pollock" that might have accrued had one of the different salmon bycatch measures been selected.

4.2.3 Summary of impacts results on pollock

Alternative 2 (Hard Caps) and Alternative 3(Triggered caps) Impacts

The same range of caps were used for both Alternative 2 and Alternative 3 thus the timing for reaching cap levels and affecting the pollock fishery is the same. Under Alternative 2 the fishery is closed and the remaining pollock catch is foregone while under Alternative 3 the fishery is closed out of a large portion of the pollock fishing grounds (Fig. 2-2 and Fig. 2-3) but can continue fishing in different areas. The effect of the cap (and resulting foregone pollock) is presented first, while the impact of moving out of the area and continuing to fish elsewhere follows. Parallel impacts are noted to occur under both alternatives.

Both Alternatives 2 and 3 would likely impact the fishery by closing earlier, prior to when the full TAC was obtained (based on 2003-2007 data and assuming the behavior of the fishermen was the same). This is illustrated in Table 4-1 and Table 4-6 for different years had alternative cap and seasonal splits been implemented for A and B seasons, respectively. Table 4-2 and Table 4-7 show that in most years, there would have been considerable levels of pollock remaining to be caught after a cap was reached (also for A and B seasons, combined fleet). Corresponding sector-specific results are shown in Table 4-3 - Table 4-5 (for the A-season) and in Table 4-7 - Table 4-10 for the B-season.

Alternatives 2 and 3 both generally imply that it will be more difficult to catch the full TAC for EBS pollock. This means that the pollock fishing mortality rates may be lower than biologically acceptable levels and would hence reduce the impact of fishing on the stock. Given hard caps, the fishermen will go to greater extremes to avoid salmon bycatch and the extent that this impacts 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 on maintaining spawning biomass would remain central to the assessment. However, the change in fishing pattern could result in lower ABC (TAC) levels overall 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 4-11.

Results indicate that pollock lengths-at-age and weights-at-age are smaller earlier in the season (Fig. 4-4). 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 are computed each but would likely result in a lower ABC (and perhaps TAC), if all other factors are equal.

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. 4-5). 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 bigger. 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 (TAC) recommendations.

Alternative 3: Triggered closures

The veracity of the assumption that the pollock catch may be attainable depends on the difficulty in finding pollock after the closure areas are triggered. The data show that in some years, the catch rate is consistently higher outside of the trigger area whereas in other years it is consistently lower for the at-sea processors and shore-based catcher vessels and for the fleet as a whole (Fig. 4-6 - Fig. 4-11). Without evaluating a full catch-rate model accounting 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 quota given 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 presented above, the same impacts under triggered closures would apply. Namely that it seems likely that the fleet would fish earlier in the summer season and would tend to fish in places further away from the core fishing grounds north of Unimak Island. Both of these effects have would appear to result in catches of pollock that were considerably smaller in mean sizes-at-age. The consequence of this impact would, based on future assessments, likely result in smaller quotas since the resource utilization would be accumulating the benefits of the summer-season growth period.

Table 4-1 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 4-2. Remaining pollock catch estimated from **all vessels** at the time A-season trigger-closures were invoked on the dates provided in Table 4-1.

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 4-3 Remaining pollock catch estimated from **at-sea processors** at the time A-season trigger-closures were invoked on the dates provided in Table 4-1.

Pollock Cap scenario		CAP	At-sea processors, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250					57,380
	1-2: 58/42	50,750				32,495	114,870
	1-3: 55/45	48,125				74,155	117,816
	1-4: 50/50	43,750				102,435	121,417
68,100	1-1: 70/30	47,670				78,162	117,816
	1-2: 58/42	39,498				114,607	133,134
	1-3: 55/45	37,455				119,214	137,803
	1-4: 50/50	34,050				127,007	145,973
48,700	1-1: 70/30	34,090				127,007	145,973
	1-2: 58/42	28,246	61,622			160,555	163,773
	1-3: 55/45	26,785	69,744		12,165	160,555	170,023
	1-4: 50/50	24,350	86,804		63,350	168,087	179,879
29,300	1-1: 70/30	20,510	142,483	29,118	95,696	182,192	192,671
	1-2: 58/42	16,994	153,534	62,258	134,210	187,258	205,379
	1-3: 55/45	16,115	156,707	65,354	142,525	187,258	205,379
	1-4: 50/50	14,650	162,422	85,213	147,369	187,258	205,379

Table 4-4 Remaining pollock catch estimated from **shore-based catcher vessels** at the time A-season trigger-closures were invoked on the dates provided in Table 4-1.

Pollock Cap scenario		CAP	Shore-based catcher vessels, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250					52,892
	1-2: 58/42	50,750				36,681	113,198
	1-3: 55/45	48,125				66,745	115,146
	1-4: 50/50	43,750				105,560	120,188
68,100	1-1: 70/30	47,670				72,544	115,146
	1-2: 58/42	39,498				118,657	136,116
	1-3: 55/45	37,455				122,460	142,134
	1-4: 50/50	34,050				134,426	150,122
48,700	1-1: 70/30	34,090				134,426	150,122
	1-2: 58/42	28,246	37,427			167,556	168,466
	1-3: 55/45	26,785	46,908		24,503	167,556	169,944
	1-4: 50/50	24,350	64,618		67,047	178,948	175,269
29,300	1-1: 70/30	20,510	114,917	34,006	102,827	192,424	196,449
	1-2: 58/42	16,994	129,926	61,607	136,775	196,527	210,593
	1-3: 55/45	16,115	133,210	66,453	143,189	196,527	210,593
	1-4: 50/50	14,650	142,168	84,355	148,367	196,527	210,593

Table 4-5 Remaining pollock catch estimated from **mothership operations** at the time A-season trigger-closures were invoked on the dates provided in Table 4-1.

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 4-6 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 4-7 Remaining pollock catch estimated from **all vessels** at the time B-season trigger-closures were invoked on the dates provided in Table 4-6.

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 4-8 Remaining pollock catch estimated from **at-sea processors** at the time B-season trigger-closures were invoked on the dates provided in Table 4-6.

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 4-9 Remaining pollock catch estimated from **shore-based catcher vessels** at the time B-season trigger-closures were invoked on the dates provided in Table 4-6.

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 4-10 Remaining pollock catch estimated from **mothership operations** the time B-season trigger-closures were invoked on the dates provided in Table 4-6.

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 4-11 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

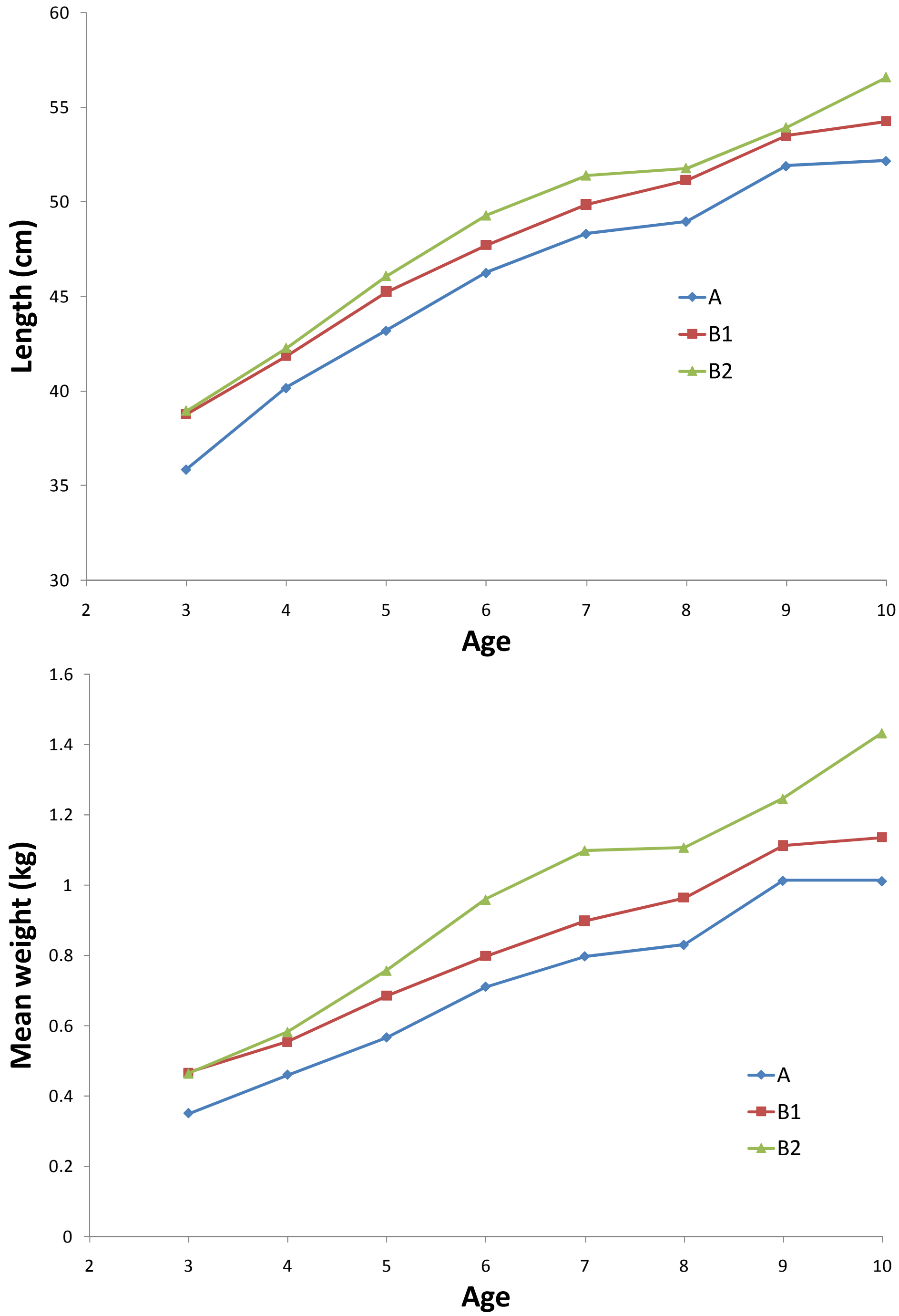


Fig. 4-4 Mean length (top panel) and mean weight (bottom) at age for EBS pollock based on fishery observer data from 2000-2007 broken out by A-season (Jan 20th – May 31st) and two B-season time frames: June 1st – August 31st (B1) and September 1st – December 31st

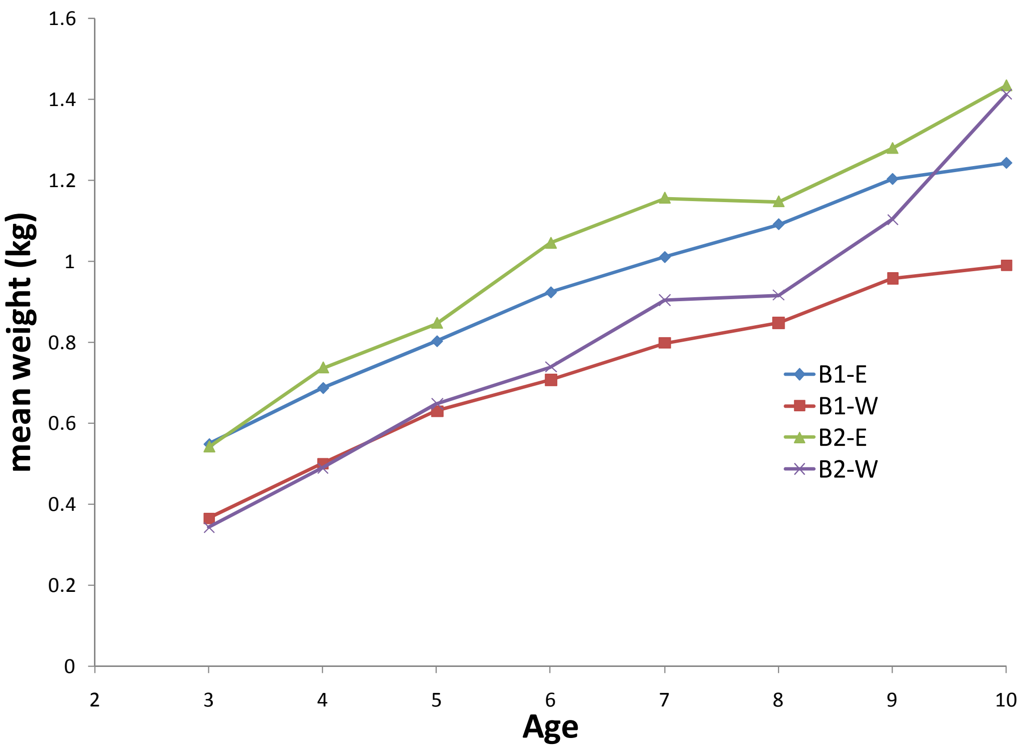


Fig. 4-5 Mean weight at age for EBS pollock based on fishery observer data from 2000-2007 broken out by two B-season time frames: June 1st – August 31st (B1) and September 1st – December 31st and geographically by east of 170°W (E) and west of 170°W (W)

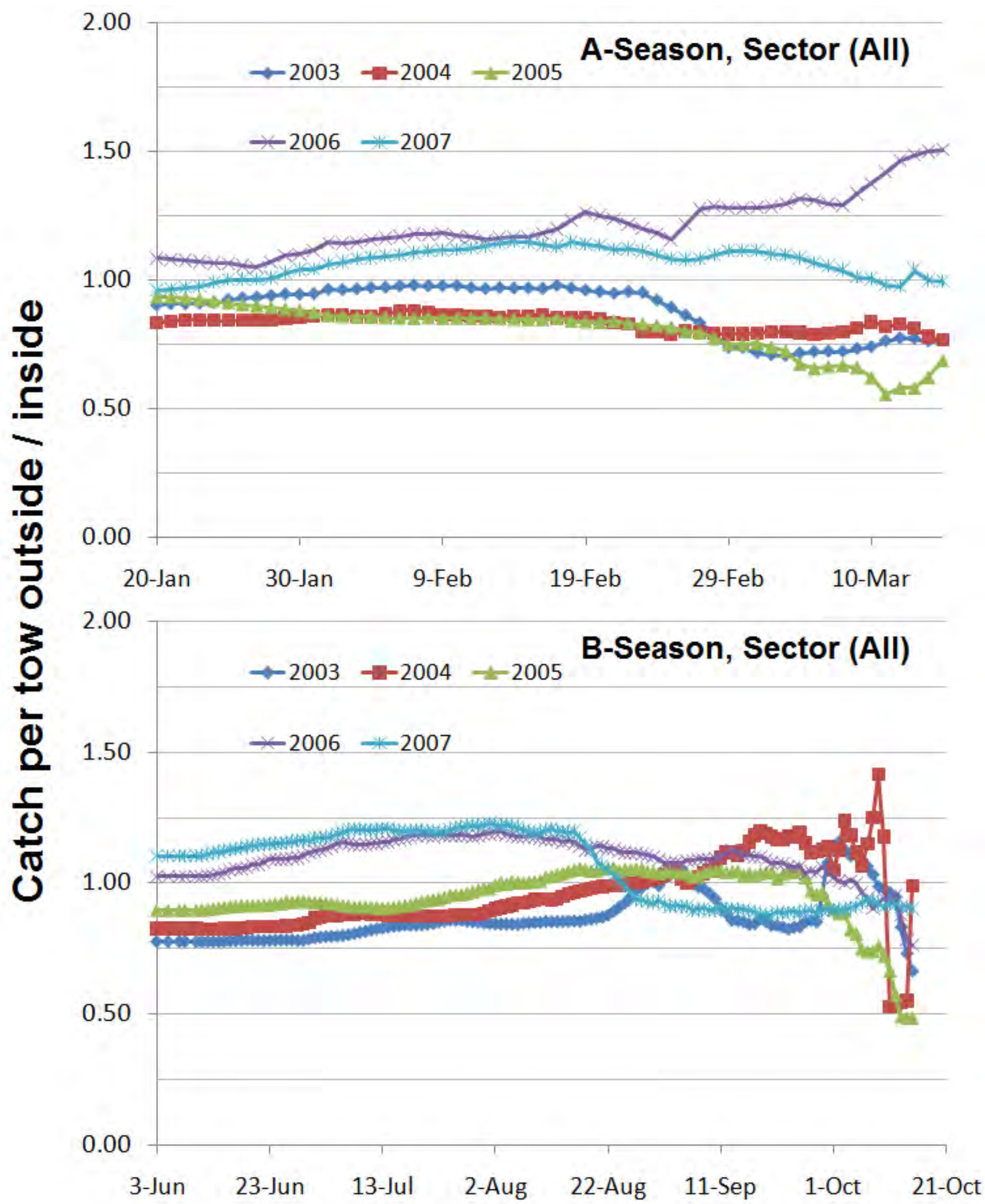


Fig. 4-6 Relative catch rates of pollock for all vessels combined by tow of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through to the end of the season

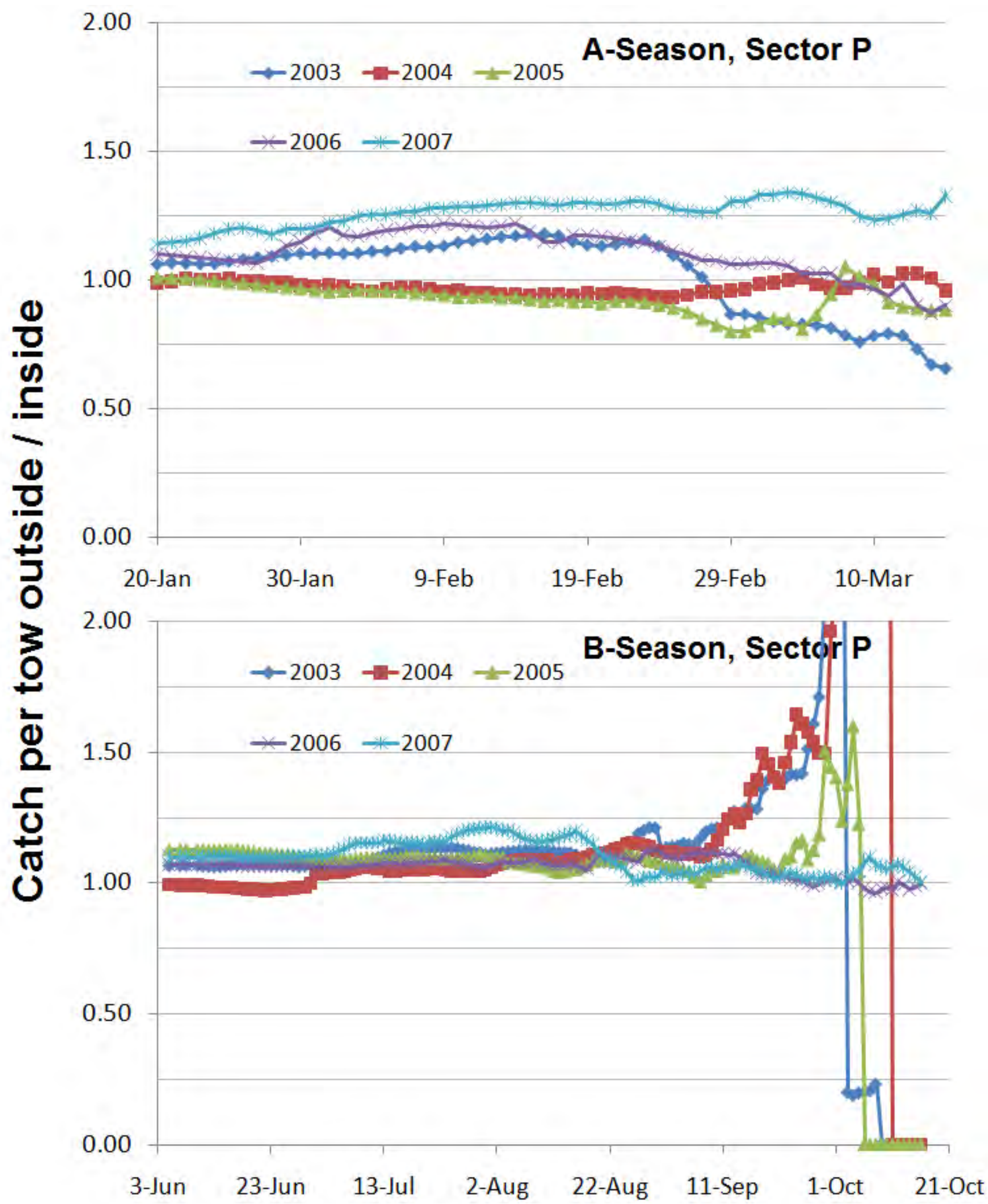


Fig. 4-7 Relative catch rates of pollock for at-sea processors by tow of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date through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

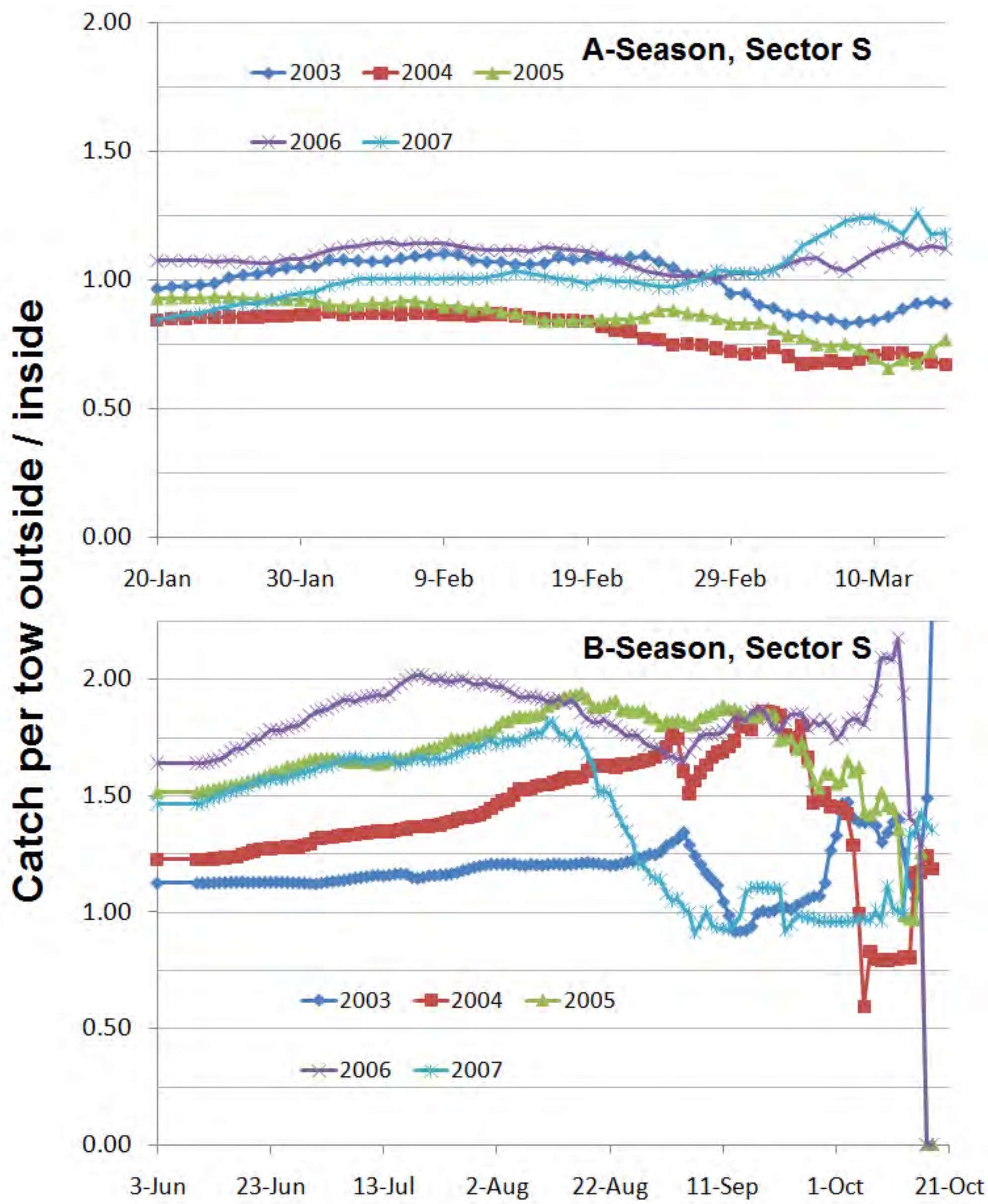


Fig. 4-8 Relative catch rates of pollock for shorebased catcher vessels by tow of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that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

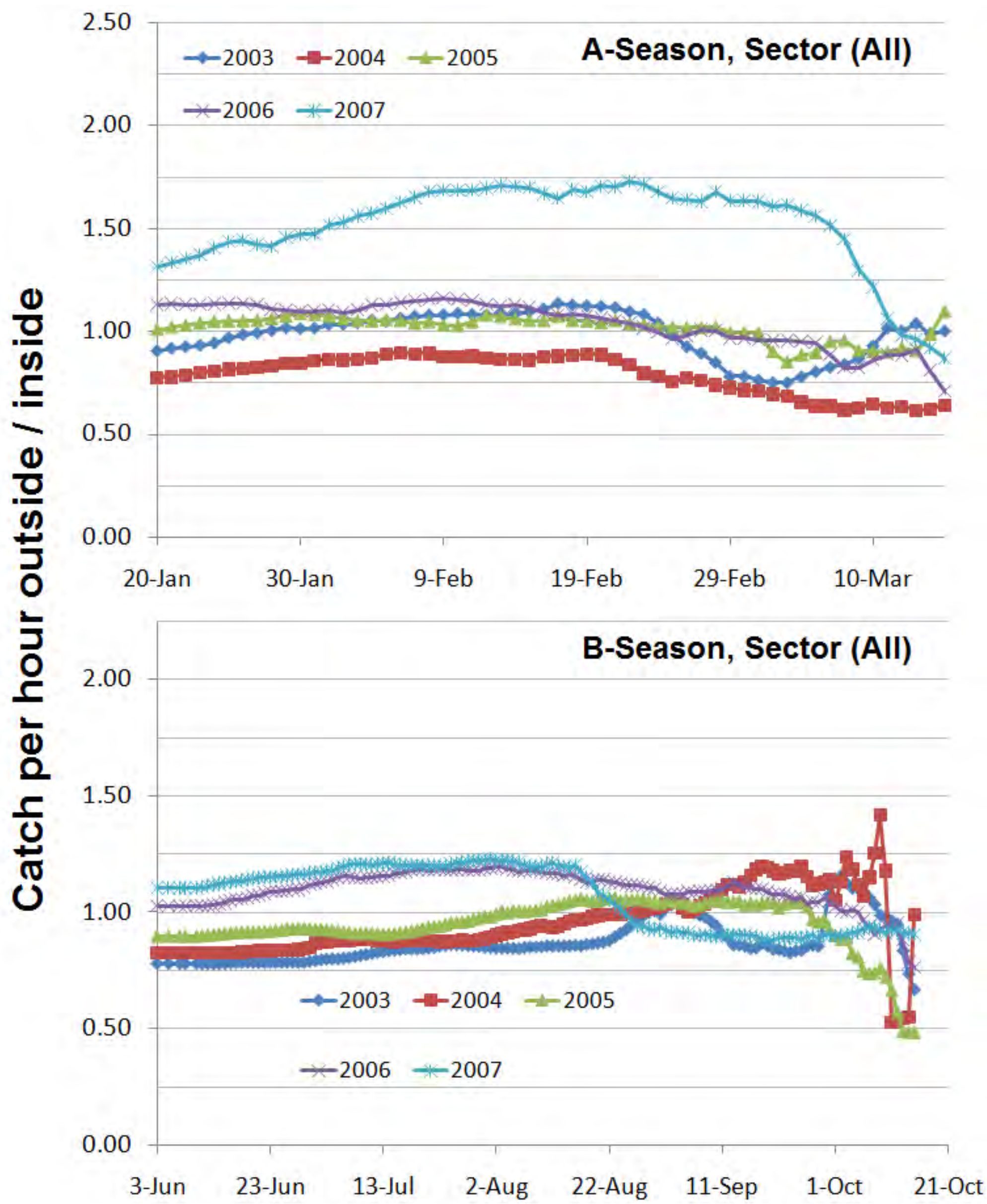


Fig. 4-9 Relative catch rates of pollock for all vessels combined by hour of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date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

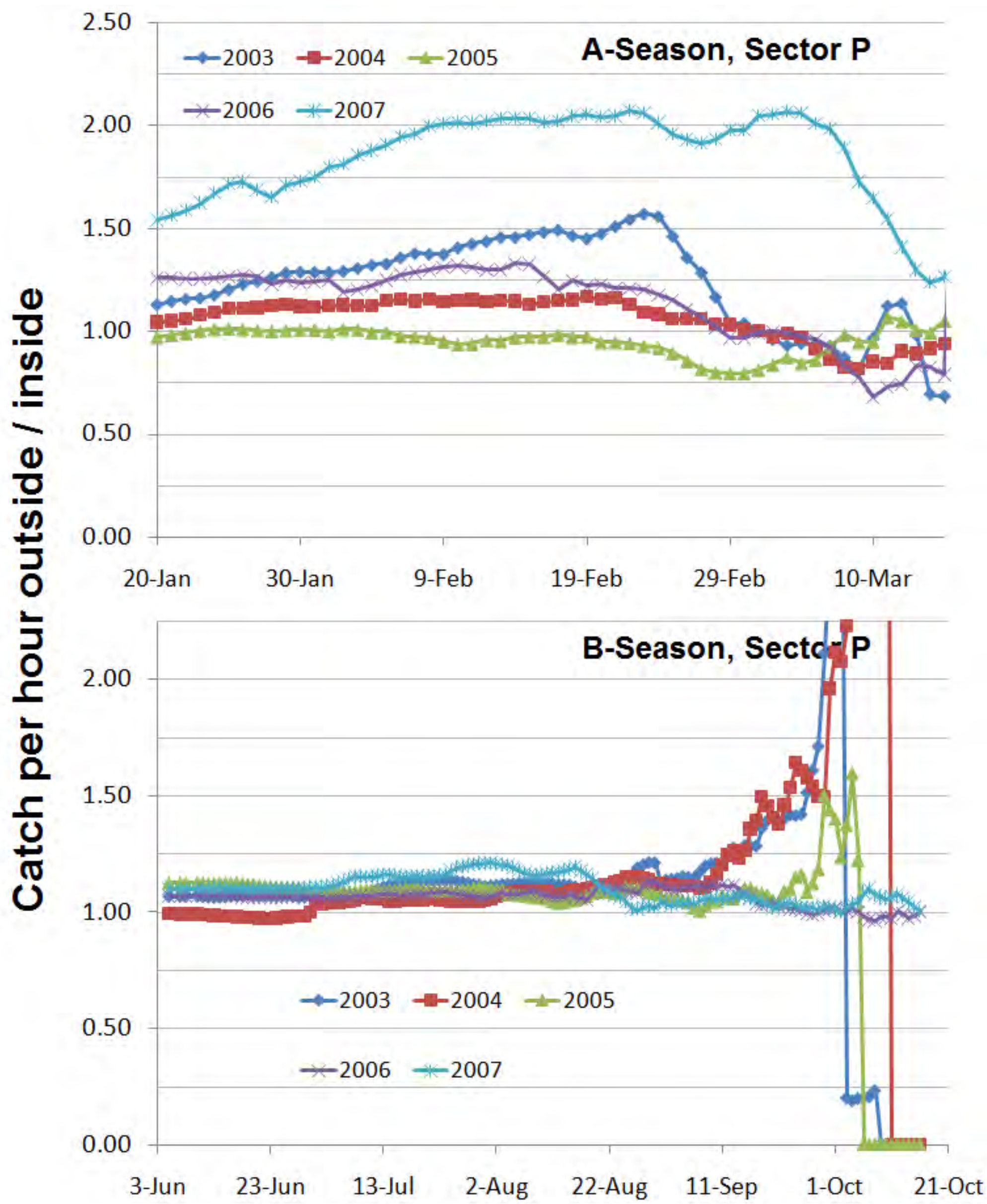


Fig. 4-10 Relative catch rates of pollock for at-sea processors by hour of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for that date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

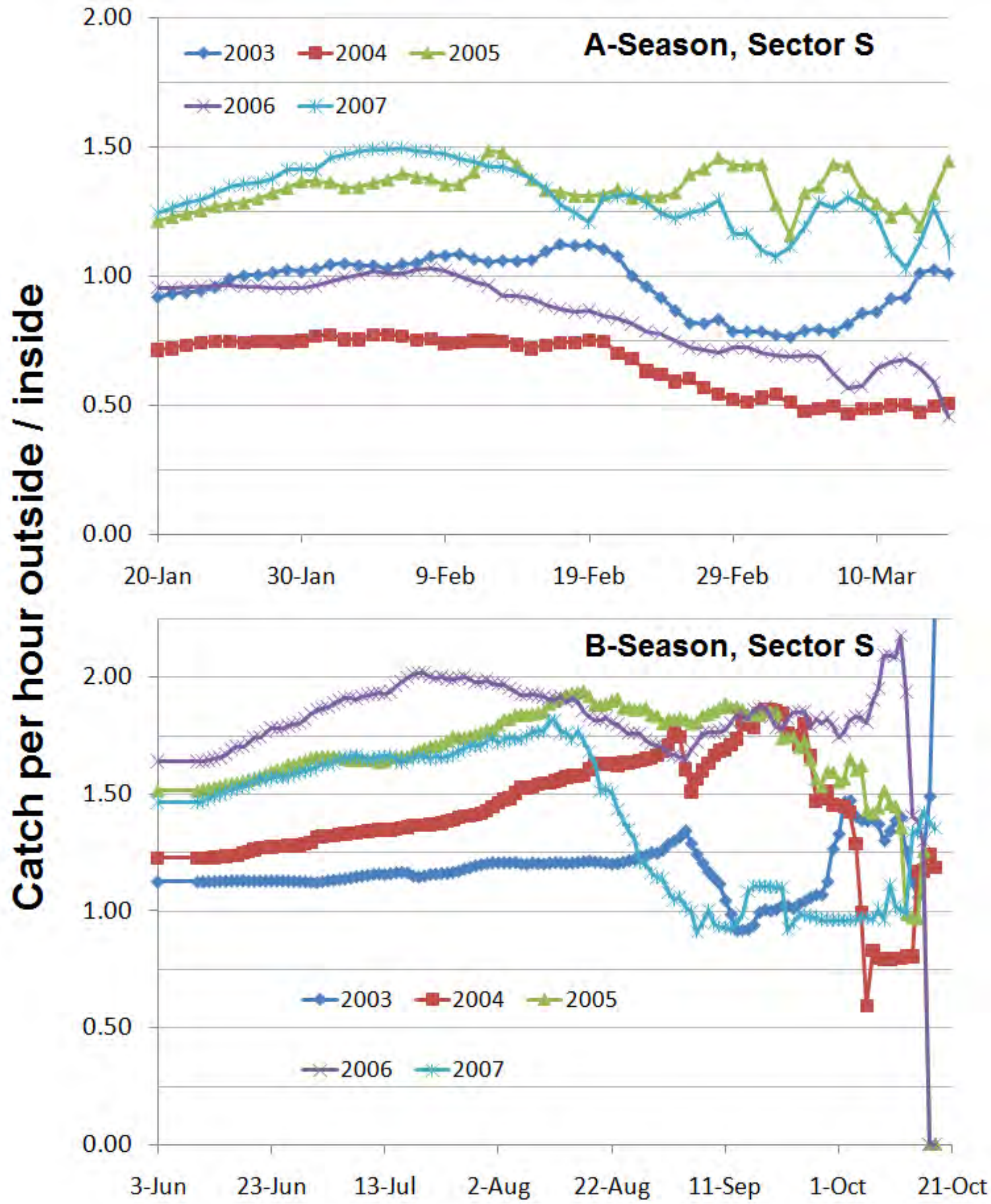


Fig. 4-11 Relative catch rates of pollock for shorebased catcher vessels by hour of outside area relative to inside trigger closure region for A-season (top) and B-season (bottom), 2003-2007. A value of one for a given date indicates that the means for catch rates outside and inside are the same for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

4.3 Reasonably foreseeable 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 discussed in the previous sections, and incorporated into the impacts discussion above. Section 3.2 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 Council is considering action on salmon bycatch measures for chum salmon. A suite of alternative management measures was proposed in April 2008, and that analysis will be brought back to the Council in October 2008. 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.

5.0 CHINOOK SALMON

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 Alaska Department of Fish and Game (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 Chinooks in fresh water feed on plankton, then later eat insects. In the ocean, they eat a variety of organisms including herring, pilchard, sandlance, 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, and recreational fisheries. 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 fishers all year.

5.1.1 Food habits/ecological role

Western Alaskan salmon runs experienced dramatic declines from 1997 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 BASIS evaluations have examined the food habits from Pacific salmon in the Bering 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 that there was diet overlap between sockeye and chum salmon in the Aleutian Islands when both species consumed macro-zooplanton but this was reduced when chum salmon consumed mostly gelatinous zooplankton (Davis et al. 2004). 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 lampfish, 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 euphausids (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., 20904). However notably on the shelf, both chum and Chinook consumed juvenile walleye pollock, with Chinook salmon consuming somewhat larger (60-190 mm SL) than those consumed by chum salmon (45-95 mm SL) (Davis et al., 2004). Other fish consumed by Chinook salmon included herring and capelin while chum salmon stomach contents also included sablefish and juvenile rockfish (Davis et al., 2004).

General results from the study found that immature chum are primarily predators of macrozooplankton while Chinook tend to prey on small nektonic prey such as fish and squid (Davis et al., 2004). Prey compositions shifts between species and between seasons in different habitats and a seasonal reduction in diversity occurs in both chum and Chinook diets from summer to fall (Davis et al., 2004). Reduction in prey diversity was noted to be caused by changes in prey availability due to distribution shifts, abundance changes or progression of life-history changes which could be the result of seasonal shift in environmental factors such as changes in water temperature and other factors (Davis et al., 2004).

Davis et al. (2004) found that diet overlap estimates between Chinook and sockeye salmon and Chinook and chum salmon were lower than the estimates obtained for sockeye and chum salmon, suggesting a relatively low level of inter-specific food competition between immature chinook and immature sockeye or chum salmon in the Bering Sea because Chinook salmon were more specialized consumers. In addition, the relatively low abundance of immature Chinook salmon compared to other species may serve to reduce intra-specific competition at sea. Consumption of nektonic organisms (fish and squid) may be efficient because they are relatively large bodied and contain a higher caloric density than zooplankton, such as pteropods and amphipods (Tadokoro et al. 1996, Davis et al. 1998). However, the energetic investment required of Chinook to capture actively swimming prey is large, and if fish and squid prey abundance are reduced, a smaller proportion of ingested energy will be available for salmon growth (Davis et al. 1998). Davis et al. (2004) hypothesized that inter- and intra-specific competition in the Bering Sea could negatively affect the growth of chum and Chinook salmon, particularly during spring and summer in odd-numbered years, when the distribution of Asian and North American salmon stocks overlap. Decreased growth could lead to reduction in salmon survival by increasing predation (Ruggerone et al. 2003), decreasing lipid storage to the point of insufficiency to sustain the salmon through winter when consumption rates are low (Nomura et al. 2002), and increasing susceptibility to parasites and disease due to poor salmon nutritional condition.

5.1.2 Hatchery releases

Commercial salmon fisheries exist around the Pacific Rim with most countries releasing salmon fry in varying amounts by species. The North Pacific Anadromous Fish Commission summarizes information on hatchery releases by country and by area where available. Reports submitted to the NPAFC were used to summarize hatchery information by Country and by US state below (Table 5-1, Table 5-2). For more information see the following: Russia (Anon., 2007; TINRO-centre 2006; 2005); Canada(Cook and Irvine, 2007); USA (Josephson, 2007; Eggers, 2006; 2005; Bartlett, 2007; 2006; 2005).

Chinook salmon hatchery releases by country are shown below in Table 5-1. There are no hatchery releases of Chinook salmon in Japan and Korea and only a limited number in Russia. Hatchery releases in each region have decreased in recent years.

Table 5-1 Hatchery releases of juvenile Chinook salmon, in millions of fish

Year	Russia	Japan	Korea	Canada	USA	TOTAL
1999	0.6	-	-	54.4	208.1	263.1
2000	0.5	-	-	53.0	209.5	263.0
2001	0.5	-	-	45.5	212.1	258.1
2002	0.3	-	-	52.8	222.1	275.2
2003	0.7	-	-	50.2	210.6	261.5
2004	1.17	-	-	49.8	173.6	224.6
2005	0.84	-	-	43.5	184.0	228.3
2006	0.78	-	-	41.3	181.2	223.3
2007*	*	*	*	*	*	*

*2007 data not available until Fall 2008

For Chinook salmon fry, the United States has the highest number of annual releases (81% of total in 2006), followed by Canada (18%). In Canada, enhancement projects have been on-going since 1977 with approximately 300 different projects for all salmon species (Cook and Irvine, 2007). Maximum production for Chinook releases was reached in 1991 with 66 million fish in that year (Cook and Irvine, 2007). Releases of Chinook in 2006 occurred in the following regions: Yukon and Transboundary River, Skeena River, North Coast, Central Coast, West Coast and Vancouver Island, Johnstone Strait, Straits of Georgia, and the Lower and Upper Fraser rivers. Of these the highest numbers were released in the West Coast Straits of Georgia (20 million fish) followed by Vancouver Island area (12.4 million fish) the Lower Fraser River (3.3 million fish) (Cook and Irvine, 2007).

Of the US releases however, a breakout by area shows that the highest numbers are coming from the State of Washington (61% in 2006), followed by California (16% in 2006), and then Oregon (11% in 2007) (Table 5-2). Hatcheries in Alaska are located in Southcentral and southeast Alaska; there are no enhancement efforts for the AYK region. Since 2004 the number of hatcheries has ranged from 33 (2004–2005) to 31 (2006) with the majority of hatcheries (18–22) located in southeast Alaska, while 11 hatcheries are in Cook Inlet and 2 in Kodiak (Eggers, 2005; 2006; Josephson, 2007).

Table 5-2 USA west coast hatchery releases of juvenile Chinook salmon, in millions of fish

Year	Alaska	Washington	Oregon	California	Idaho	WA/OR/CA/ID (combined)	TOTAL
1999	8.0	114.5	30.5	45.4	9.7		208.1
2000	9.2	117.4	32.3	43.8	6.8		209.5
2001	9.9	123.5	28.4	45.0	5.4		212.1
2002	8.4					213.6	222.0
2003	9.3					201.3	210.6
2004	9.35	118.2	17.0	27.4	1.7	164.2	173.6
2005	9.46	117.7	19.2	28.8	8.7	174.5	184.0
2006	10.2	110.5	19.2	29.4	12.0	171.0	181.2
2007*	*	*	*	*	*	*	

*2007 data not available until Fall 2008

5.1.3 BASIS surveys

The Bering-Aleutian Salmon International Survey (BASIS) is an NPAFC-coordinated program of pelagic ecosystem research on salmon and forage fish in the Bering Sea (Fig. 4-2). 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 (YRJTC 2008).

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 (YRJTC 2008).

Fig. 4-3 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 (YRJTC 2008).

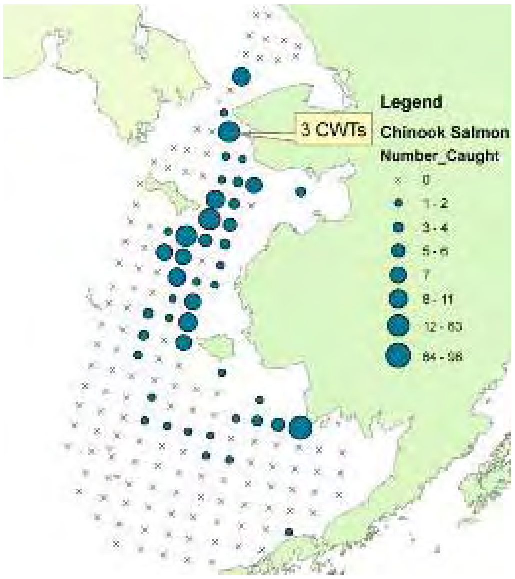


Fig. 5-1 U.S. BASIS juvenile Chinook salmon catches in 2007. The location of three coded-wire tag (CWT) recoveries is noted in the callout box.

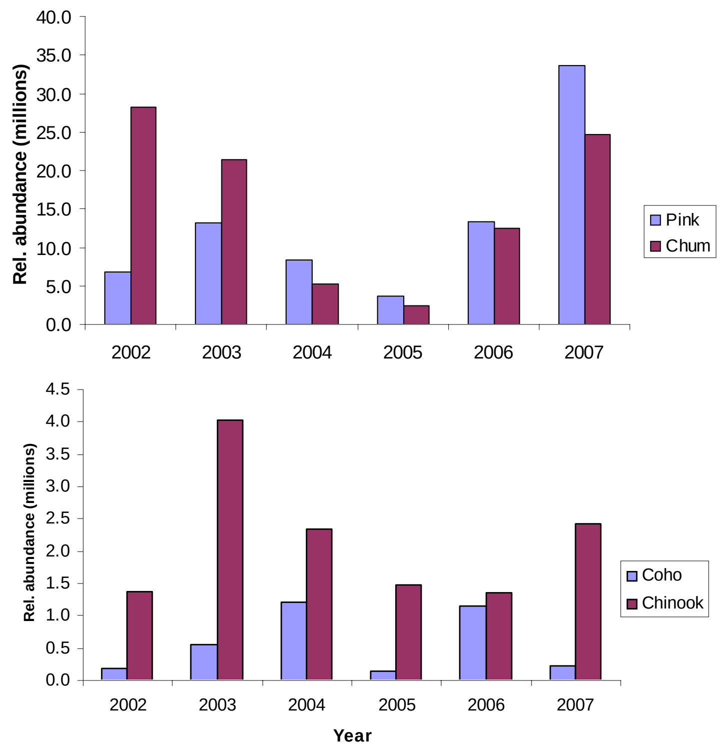


Fig. 5-2 Relative abundance of juvenile salmon in the Northern Shelf Region (60°N-64°N latitude) of the U.S. BASIS survey, 2002-2007.

5.1.4 Migration corridors

BASIS surveys have established that the distribution and migration pathways of western Alaska juvenile salmon varies 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; YRJTC 2008).

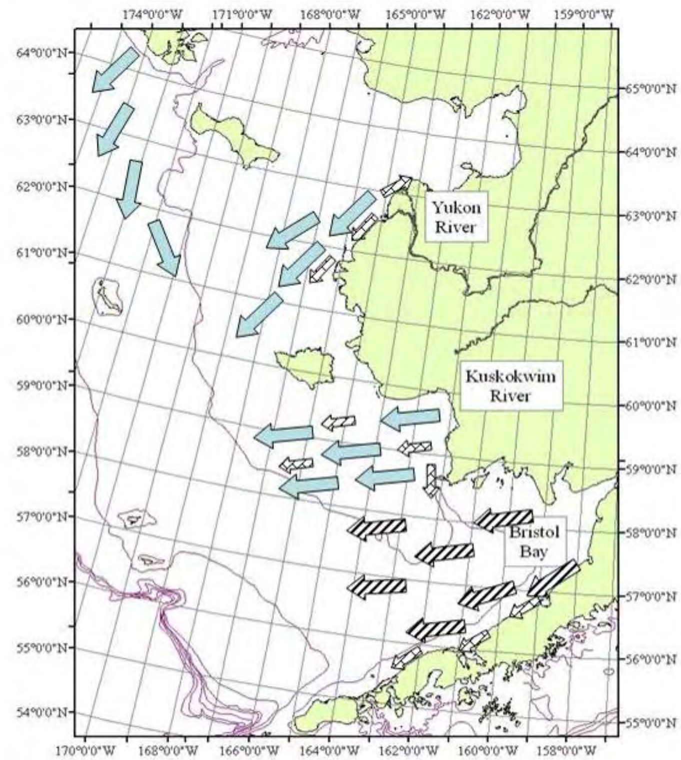
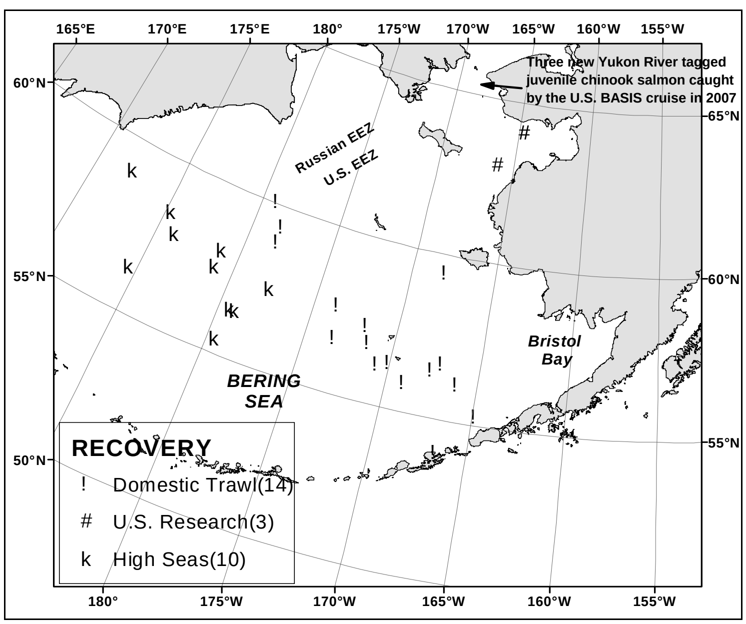


Fig. 5-3 Seaward migration pathways for juvenile chum (solid arrow), sockeye (slashed line arrow), coho, and Chinook (boxed line arrow) salmon along the eastern Bering Sea shelf, August through October. Source: Farley et al 2006.



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 (from YRJTC 2008).

5.2 Historical Bycatch in Groundfish Fisheries

5.2.1 Overview of Chinook bycatch in all groundfish fisheries

Overall salmon bycatch levels are estimated based on extensive observer coverage. For the pollock fishery, the vast majority of tows are observed either directly at sea or based on offloading locations aboard motherships or 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 catch levels of prohibited species bycatch, such as salmon and halibut, and of target groundfish species. The process of applying observer data (in addition to other landings information) to evaluate fishery season length has relied on a pragmatic approach that expands the observed bycatch levels to extrapolate to unobserved fishing operations. More statistically rigorous estimators have been developed (Miller 2005) that can be applied to the North Pacific groundfish fisheries but these so far have not been implemented for inseason management purposes. Nonetheless, these estimators suggest that for the Eastern Bering Sea pollock fishery, the levels of salmon bycatch are precisely estimated with coefficients of variation of around 5%. This indicates that, assuming that the observed fishing operations are unbiased relative to unobserved tows, the total salmon bycatch levels are precisely estimated for the fleet as a whole. For the purposes of this analysis, imprecision on the total annual salmon bycatch is considered negligible.

Annual bycatch of Chinook salmon in the BSAI groundfish fisheries from 1992–2007 has increased substantially in recent years (Fig. 5-5) 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 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. This analysis focuses solely on measures to reduce bycatch in the pollock trawl fishery.

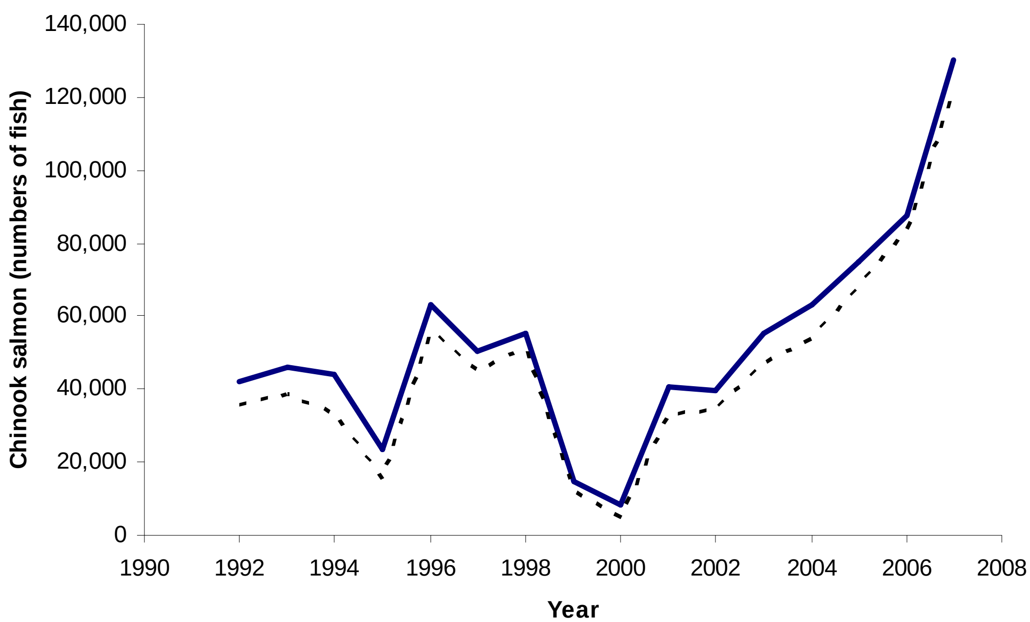


Fig. 5-5 Annual Chinook salmon catch in all BSAI groundfish fisheries (solid line) and pollock trawl fishery only (dotted line) 1992-2007.

5.2.2 Pollock fishery bycatch of Chinook

Total catch of Chinook bycatch in the pollock fishery reached an historic high in 2007 at 121,909 fish (Fig. 5-6, Table 5-3). Chinook bycatch is taken in both A and B seasons in the pollock fishery. The A season catch in 2007 was the highest historical A season catch at 69,542, while the B season catch was also at an historical high at 52,367 (Table 5-4). Bycatch in the 2008 A season was lower than any year since 2000 (Fig. 5-6, Table 5-4). However, while a positive indication that overall annual bycatch in 2008 may be lower than the high levels of recent years, there have been years where the A season bycatch level did not drive the overall bycatch trend in that year (Fig. 5-7). 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).

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. 5-8 through Fig. 5-11). The pattern for B-season Chinook bycatch rates as a whole is shown in Fig. 5-12. 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. 5-13)

5.2.2.1 Pollock fishery bycatch of Chinook by sector

Bycatch of Chinook varies seasonally by season and by sector (Fig. 5-14 and Fig. 5-15; Table 5-4). Since 2002 the shoreside CV fleet has consistently had the highest bycatch by sector in the A season, but prior to that offshore catcher processor catch was higher on an seasonal basis (Fig. 5-14). Catch by the mothership sector in the A season has always been lower than the other two sectors.

Similarly in the B season, historically the inshore CV fleet has had the highest bycatch by sector since 1996 (except for 2001), followed by the offshore CP fleet (Fig. 5-15). 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. 5-16; Table 5-6). Interestingly while total catch for the mothership fleet was lower than the CP fleet in 2006, their relative rate was higher (Fig. 5-16). In the B season, the inshore fleet has the highest bycatch rates followed consistently in almost all years by the mothership fleet (Fig. 5-17).

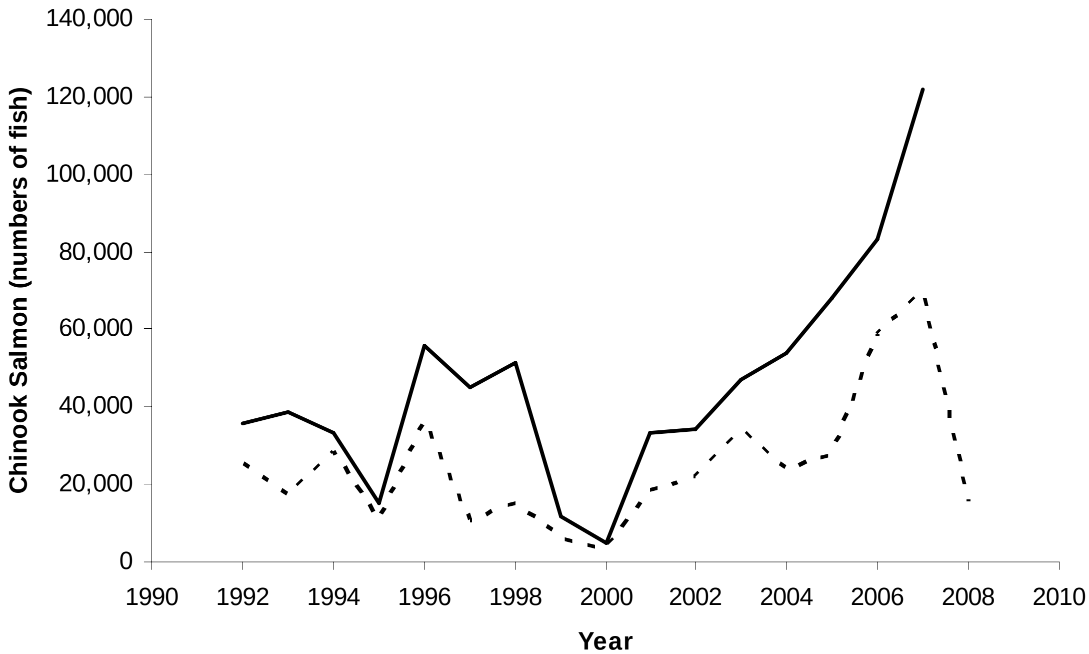


Fig. 5-6 Chinook salmon catch in pollock trawl fishery annually (solid line) compared with A season only (dotted line).

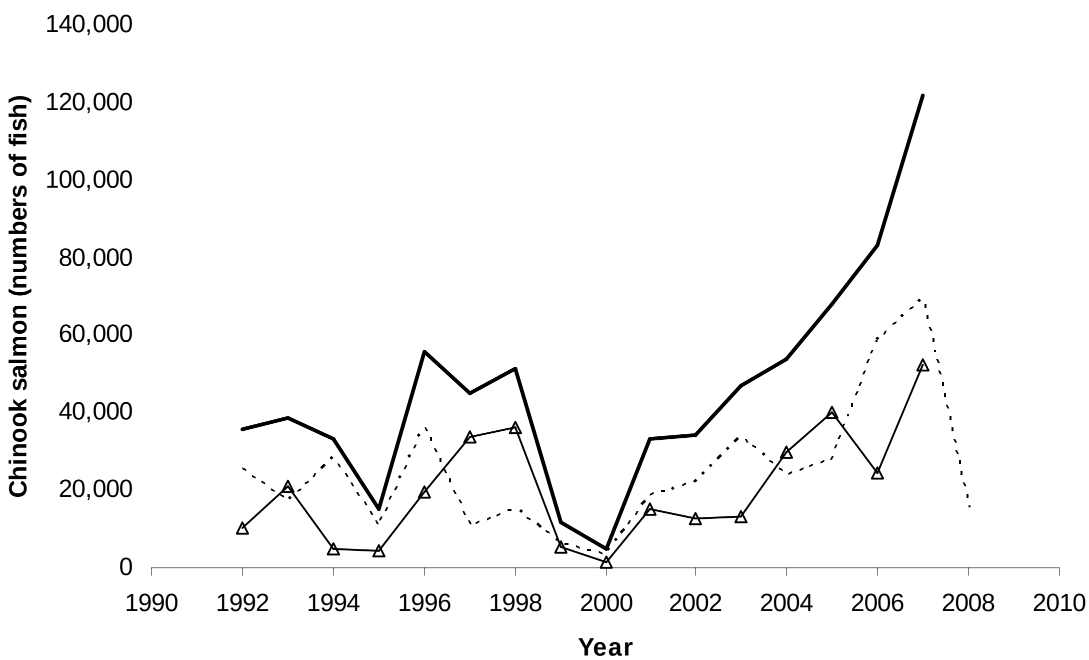


Fig. 5-7 Chinook salmon catch in pollock trawl fishery: annually 1992-2007(solid line) , A season 1992-2008(dotted line) and B season 1992-2007 (triangles).

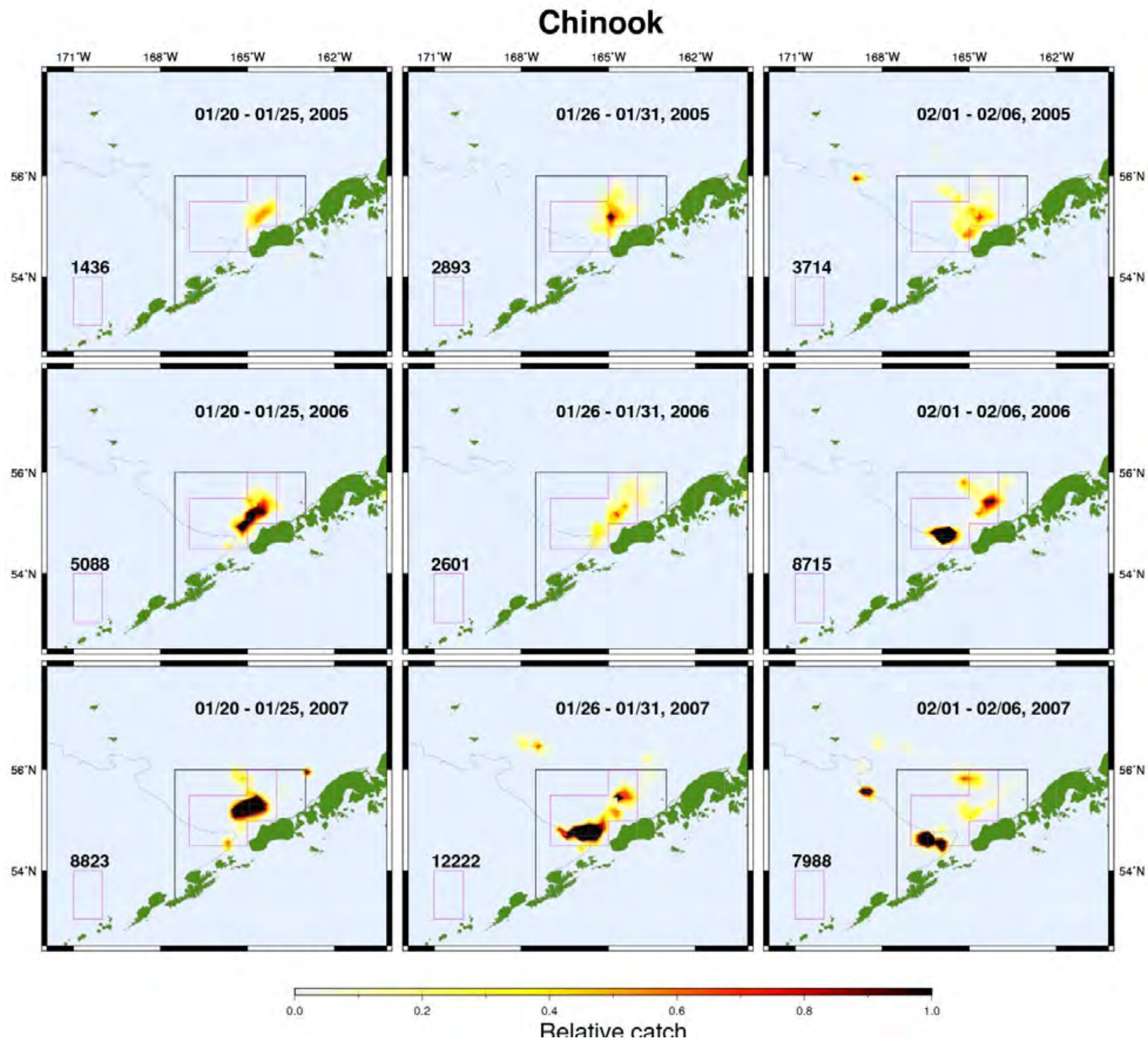


Fig. 5-8 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting Jan 20th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

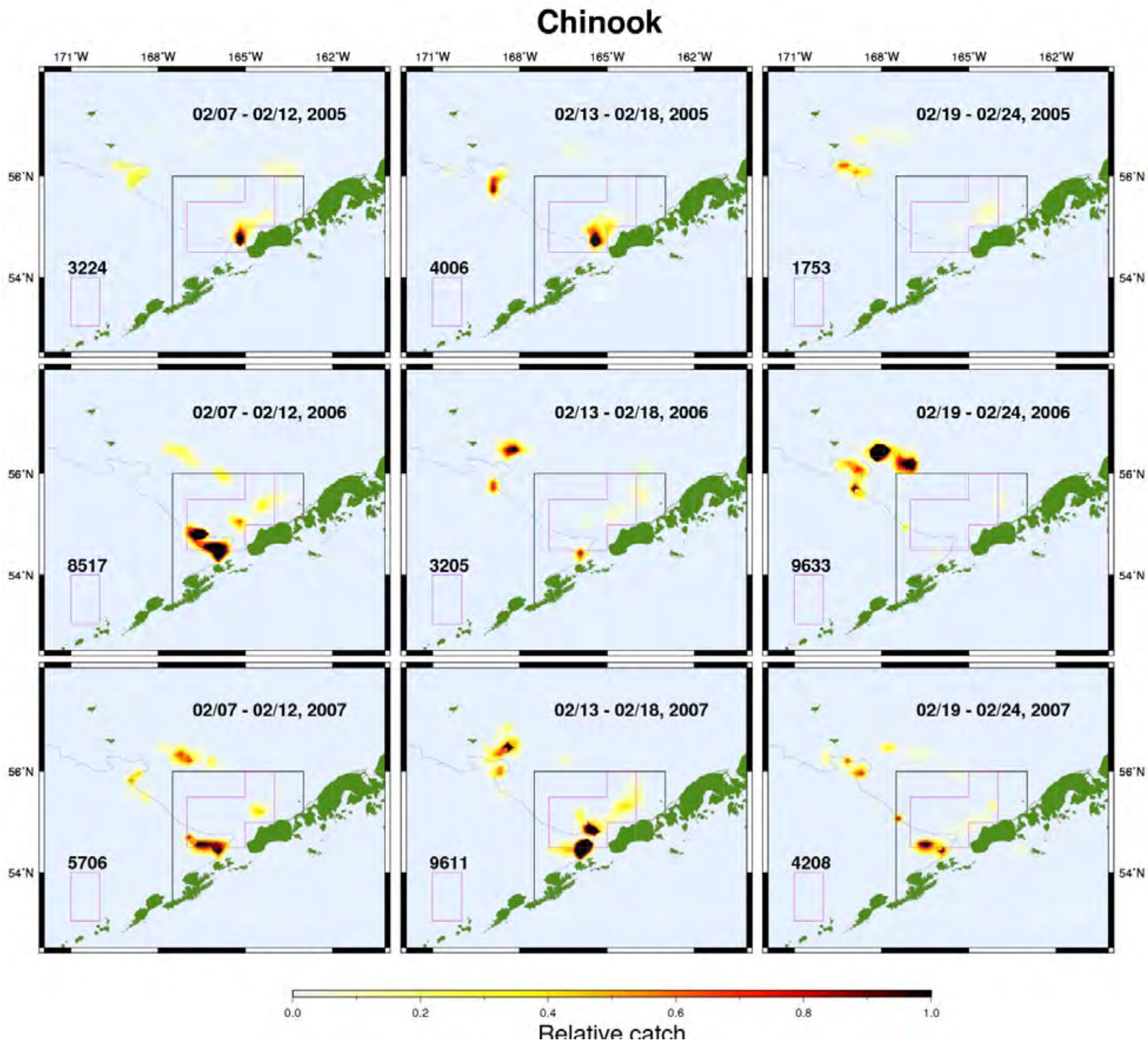


Fig. 5-9 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting Feb 7th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

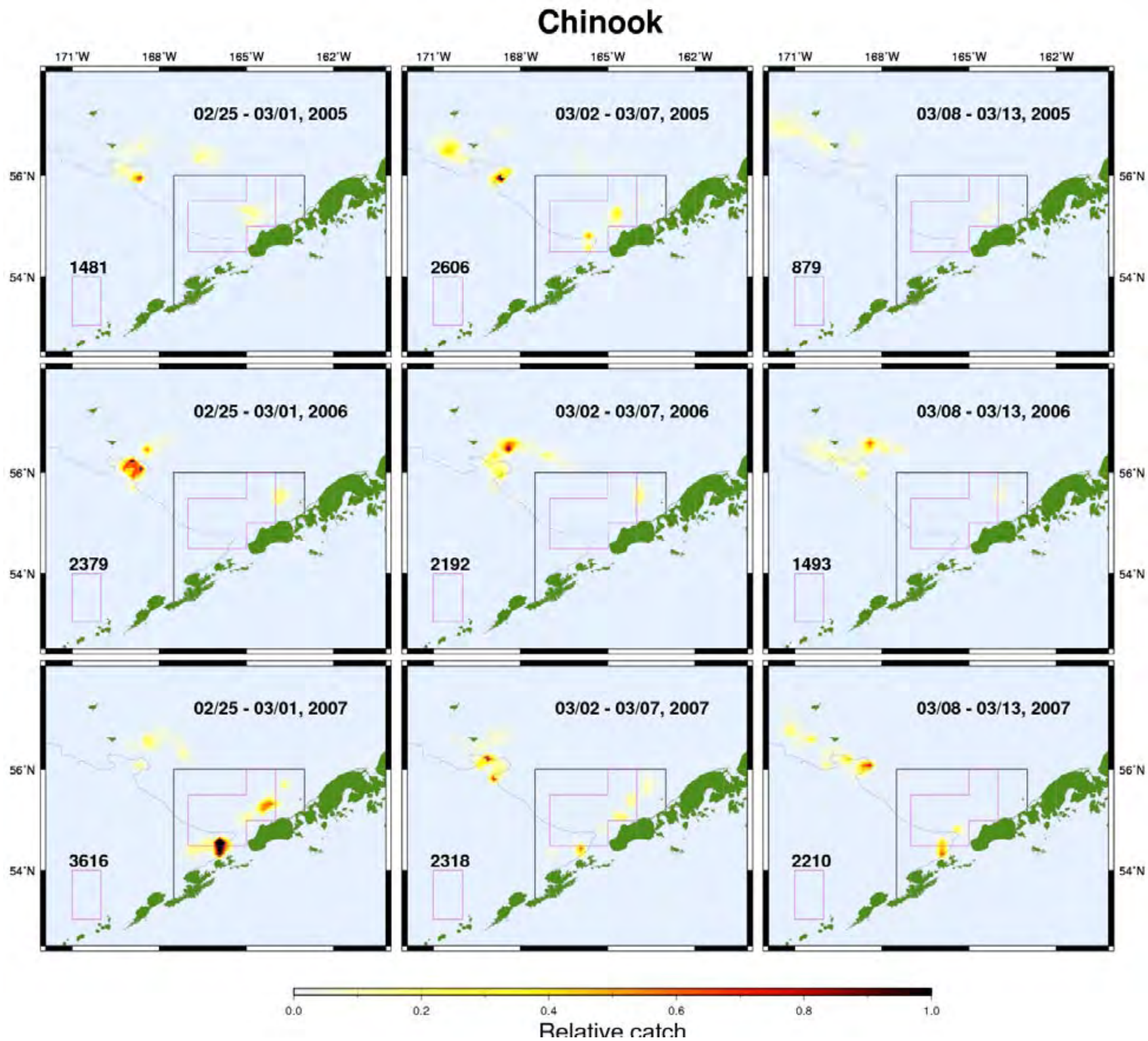


Fig. 5-10 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting Feb 25th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

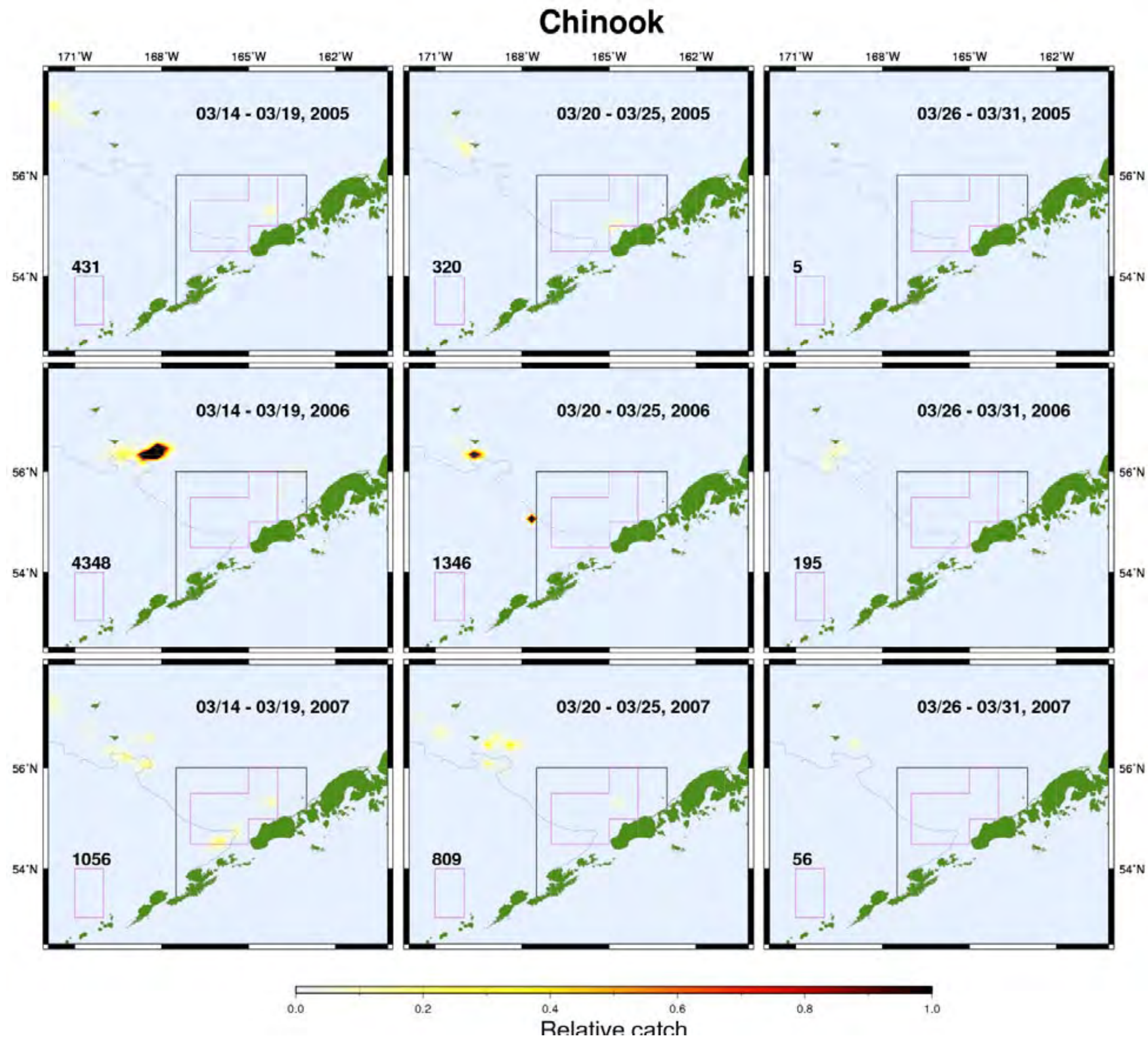


Fig. 5-11 Chinook salmon bycatch in the EBS pollock fishery for 2005-2007 (rows) from three sets of 5-day windows starting March 14th. Numbers in lower left side of panel indicate observed numbers of Chinook caught in that period.

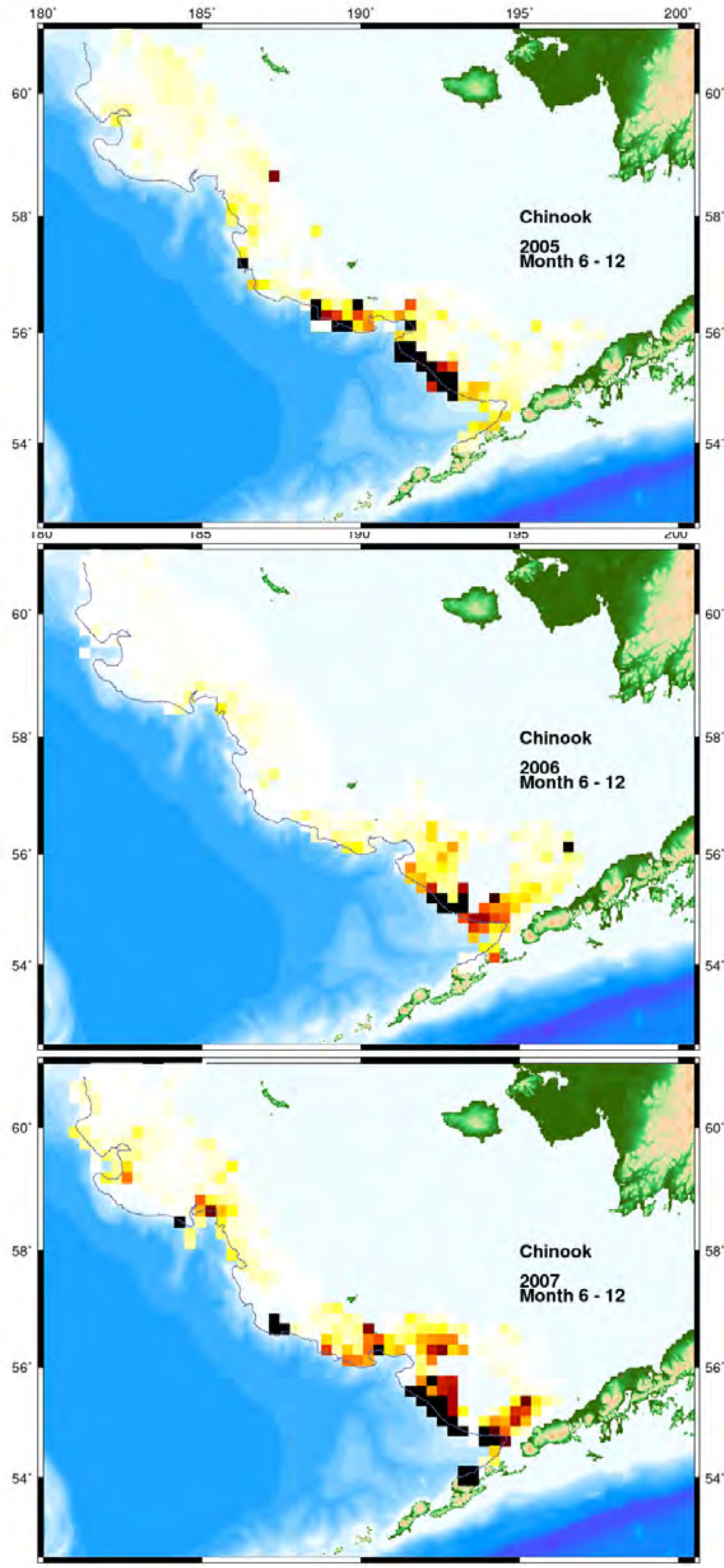


Fig. 5-12 Chinook salmon bycatch rates (darker colers mean higher numbers of Chinook / t of pollock) in the EBS pollock fishery for 2005-2007 B-season.

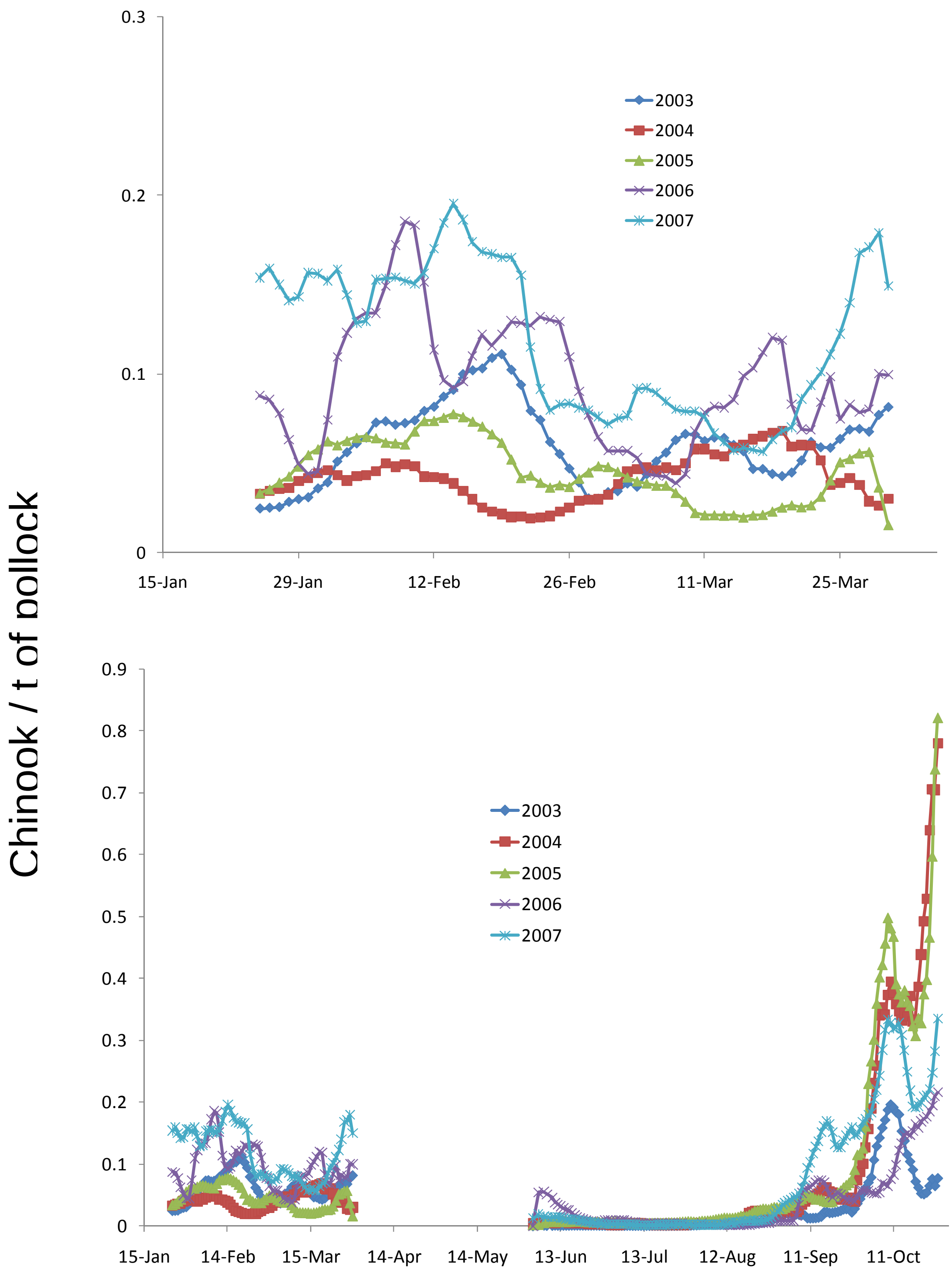


Fig. 5-13 Seasonal trends in Chinook bycatch rates (number / t) for the A-season (top) and for the entire year (bottom) 2003-2007.

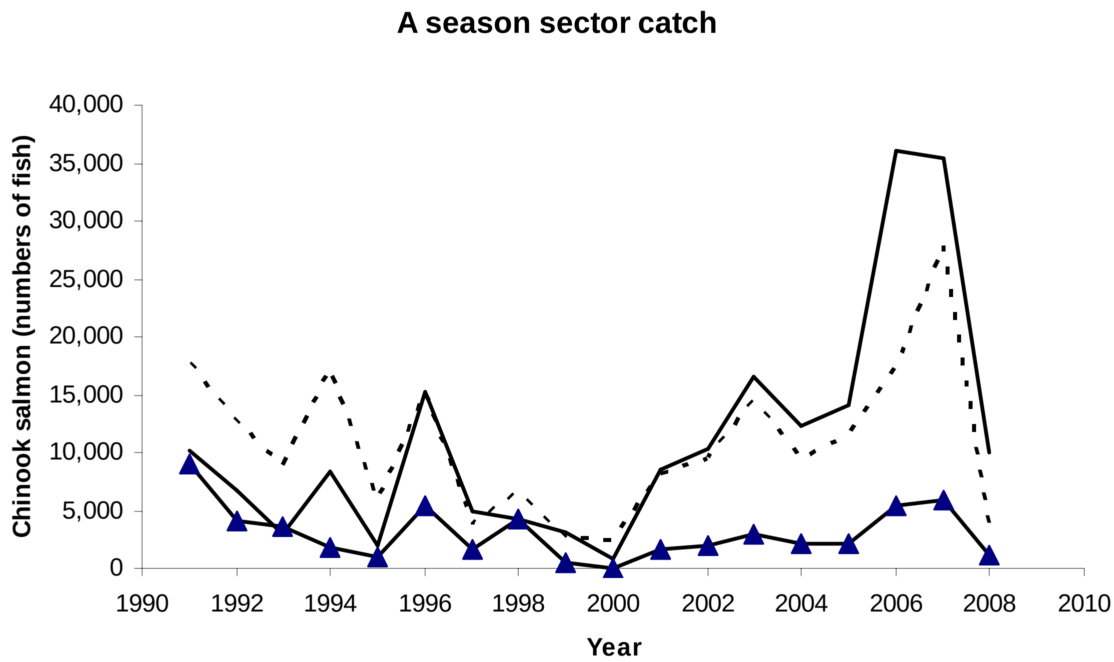


Fig. 5-14 Chinook salmon catch by sector in pollock fishery A season 1991-2007. Data are shown by inshore catcher vessel sector (solid line), offshore catcher processor (dotted line with diamonds) and mothership sector (solid line with triangles).

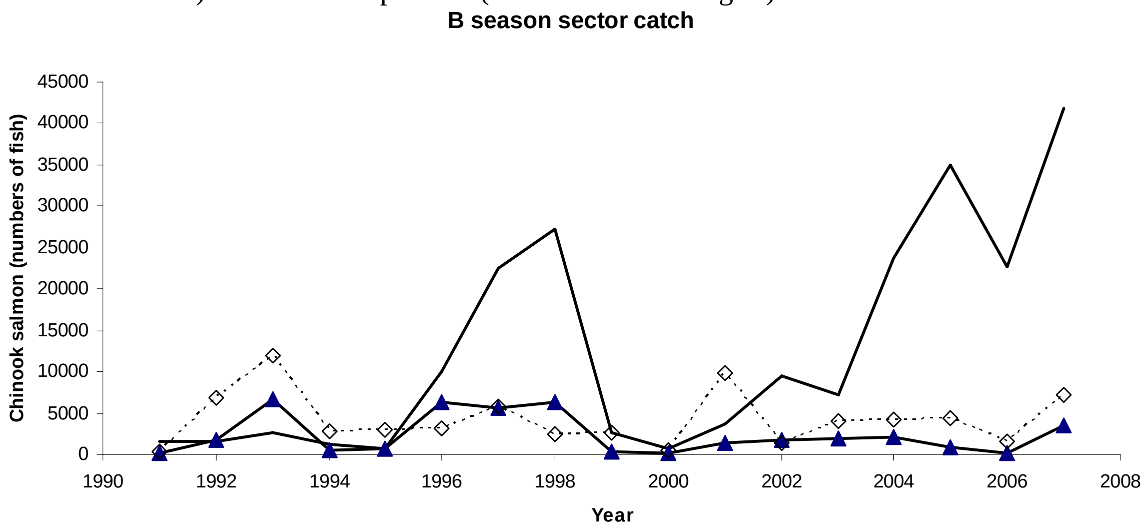


Fig. 5-15 Chinook salmon catch by sector in pollock fishery B season 1991-2007. Data are shown by inshore catcher vessel sector (solid line), offshore catcher processor (dotted line with diamonds) and mothership sector (solid line with triangles).

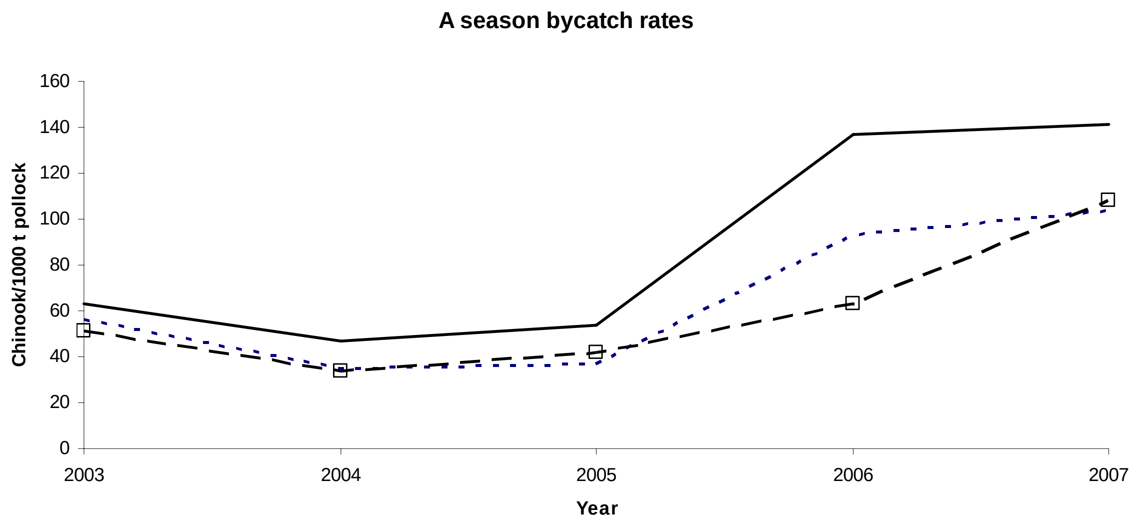


Fig. 5-16 A season bycatch rates by sector (Chinook/1000 t pollock). Inshore catcher vessel (solid line), offshore catch processor (dashed line with squares) and mothership sector (dotted line), 2003-2007.

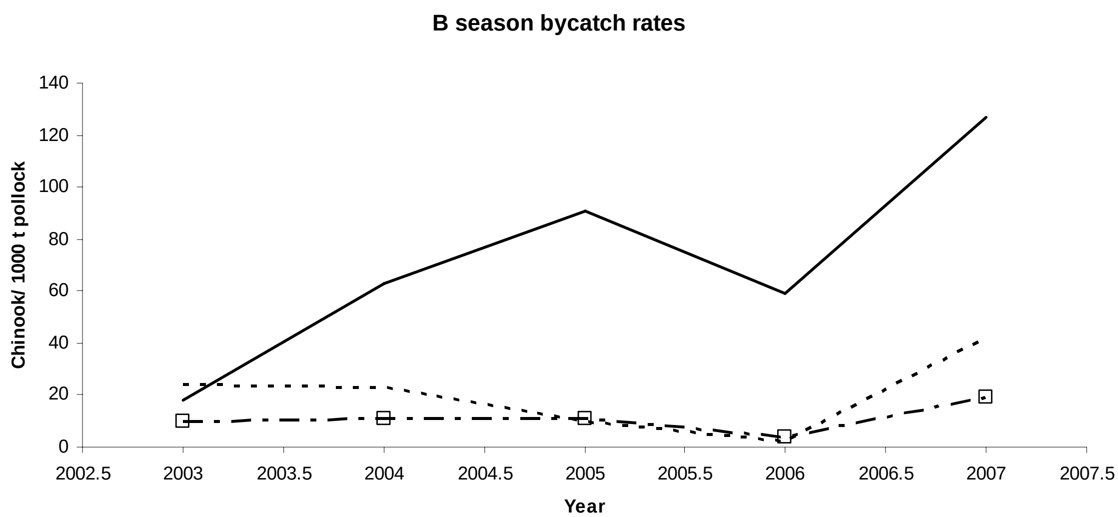


Fig. 5-17 B season bycatch rates by sector (Chinook/1,000 t pollock). Inshore catcher vessel (solid line), offshore catch processor (dashed line with squares) and mothership sector (dotted line), 2003-2007.

Table 5-3 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 5/2/2008. 'na' indicates that data were not available in that year.

Year	Annual with CDQ	Annual without CDQ	Annual CDQ only	A season	B season	A season	B season	A season	B season
				With CDQ		Without CDQ		CDQ only	
1991	na	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	54,028	51,062	2,966	23,961	30,067	22,821	28,241	1,140	1,826
2005	67,890	65,957	1,933	27,673	40,217	26,377	39,580	1,296	637
2006	83,257	81,520	1,737	58,900	24,358	57,320	24,201	1,580	157
2007	121,909	116,289	5,620	69,542	52,367	66,451	49,838	3,091	2,529
2008	15,660	15,127	533	15,660	na	15,024	na	533	na

Table 5-4 Chinook bycatch by sector for the EBS pollock fleet, 1991-2008 as of [May 5, 2008]

	A-season			A	B-season			B	Annual
YEAR	M	P	S	Total	M	P	S	Total	Total
1991	9,001	17,645	10,192	36,838	152	397	1,667	2,216	39,054
1992	4,057	12,631	6,725	23,413	1,766	6,889	1,604	10,259	33,672
1993	3,529	8,869	3,017	15,415	6,657	11,932	2,615	21,204	36,619
1994	1,790	17,149	8,346	27,285	572	2,826	1,207	4,605	31,890
1995	971	5,971	2,040	8,982	667	2,973	781	4,421	13,403
1996	5,481	15,276	15,228	35,985	6,322	3,222	9,944	19,488	55,472
1997	1,561	3,832	4,954	10,347	5,702	5,721	22,550	33,973	44,320
1998	4,284	6,500	4,334	15,118	6,361	2,547	27,218	36,127	51,244
1999	554	2,694	3,103	6,352	374	2,590	2,662	5,627	11,978
2000	19	2,525	878	3,422	253	568	717	1,539	4,961
2001	1,664	8,264	8,555	18,484	1,319	9,863	3,779	14,961	33,444
2002	1,976	9,481	10,336	21,794	1,755	1,386	9,560	12,701	34,495
2003	2,892	14,428	16,488	33,808	1,940	4,044	7,202	13,185	46,993
2004	2,092	9,492	12,376	23,961	2,076	4,289	23,701	30,067	54,028
2005	2,111	11,421	14,097	27,630	888	4,343	34,986	40,217	67,847
2006	5,408	17,306	36,039	58,753	200	1,551	22,654	24,405	83,159
2007	5,860	27,943	35,458	69,261	3,544	7,148	41,751	52,443	121,704
2008	1,102	3,990	10,033	15,124					15,124

Table 5-5 Catch of pollock and Chinook along with Chinook rate (per 1,000 t of pollock) by sector and season, 2003-2007.

Pollock (t)

Season	Year	2003	2004	2005	2006	2007
A	M	51,811	60,222	57,802	58,134	56,526
	P	280,505	275,625	273,977	274,279	257,647
	S	260,212	262,570	259,002	262,997	250,726
A	Sub-total	592,528	598,417	590,780	595,410	564,899
B	M	80,817	90,736	89,225	89,303	84,978
	P	413,512	401,570	403,537	405,586	372,737
	S	393,550	378,855	386,473	381,981	327,962
B	Sub-total	887,879	871,160	879,236	876,870	785,677
	Annual Total	1,480,408	1,469,577	1,470,016	1,472,280	1,350,576

Chinook bycatch

	Year	2003	2004	2005	2006	2007
A	M	2,892	2,092	2,111	5,408	5,860
	P	14,428	9,492	11,421	17,306	27,943
	S	16,488	12,376	14,097	36,039	35,458
A	Sub-total	33,808	23,961	27,630	58,753	69,261
B	M	1,940	2,076	888	200	3,544
	P	4,044	4,289	4,343	1,551	7,148
	S	7,202	23,701	34,986	22,654	41,751
B	Sub-total	13,185	30,067	40,217	24,405	52,443
	Annual Total	46,993	54,028	67,847	83,159	121,704

Chinook / 1,000 t of pollock

	Year	2003	2004	2005	2006	2007	Mean
A	M	56	35	37	93	104	65
	P	51	34	42	63	108	59
	S	63	47	54	137	141	88
	A-season average	57	40	47	99	123	73
B	M	24	23	10	2	42	20
	P	10	11	11	4	19	11
	S	18	63	91	59	127	70
	B-season average	15	35	46	28	67	37
	Average	32	37	46	56	90	52

Table 5-6 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), 2003-2006.

Season	Year	2003	2004	2005	2006	2007
A	M	98%	87%	78%	94%	85%
	P	90%	86%	89%	64%	88%
	S	111%	118%	116%	139%	115%
B	M	162%	66%	22%	8%	62%
	P	66%	31%	24%	14%	29%
	S	123%	181%	198%	213%	191%
A+B	M	115%	75%	44%	67%	74%
	P	84%	55%	50%	49%	62%
	S	114%	153%	165%	161%	148%

5.2.3 Bycatch stock of origin

5.2.3.1 Genetic estimates of Chinook bycatch stock of origin

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 NOAA Fisheries Groundfish Observer Program database (Myers et al. 2004). Results indicated that bycatch samples were dominated by younger (age 1.2) fish in summer and older (age 1.3 and 1.4) fish in winter (Myers et al. 2004). The stock structure was dominated by western Alaskan stocks, with the estimated 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 5-7, Myers et al., 2004).

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. (2004), 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. 2004). 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. 2004). 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.

More recent analyses of bycatch samples from are underway (Templin et al *In prep*). Alaska Department of Fish and Game has developed a DNA baseline to resolve the stock composition mixtures of Chinook salmon in the Bering Sea (Templin et al. In prep.). This baseline includes 24,100 individuals sampled from over 175 rivers from the Kamchatka Peninsula, Russia, to the Central Valley in California (see Appendix C for list of rivers). The genetic stock identification (GSI) study used classification criteria whereby the accuracy of resolution to region-of-origin is 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 the following: 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 observation regarding the seasonal and regional differences in stock origin of bycatch samples (Myers et al. 2004), bycatch samples were stratified by year, season and region (Table 5-8).

This 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 NMFS Regional Office; see Appendix C for details).

The samples used in the analysis were obtained during a feasibility study to evaluate using scales and other tissues as collected by the NMFS observer program for genetic sampling. Unfortunately, during this feasibility study, the collected samples failed to cover the bycatch in groundfish fisheries in a comprehensive manner. For example, in 2005 most sampling was completed prior to the month (October) when most of the bycatch occurred (Fig. 5-13).

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 and Templin, In Prep; Table 5-8) 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 5-9) 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. 5-19). Applying the stock composition results presented in Table 5-9 over different years and weighted by catch gives stratified proportions that have similar characteristics to the raw genetics data (Table 5-8). 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 (see Appendix C). 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 5-8). Accounting for sampling variability, the mean stock compositions by strata are shown in Table 5-9. While stock units differ from previous studies in levels of aggregation, results are similar to the scale-pattern study presented by Myers and Rogers (1998) and Myers et al. (2004; Table 5-10). 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 5-10).

For purposes of evaluation of impacts of alternatives on individual river systems, the most recent estimates (Seeb and Templin, In Prep) are the main reference for evaluating the impact of bycatch on the 9 sets of river systems (see appendix C).

Additional funding and research focus is being directed towards both collection of samples form 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 5-7 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(2004)). 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. Bold font emphasizes results for western Alaska subregional stocks.

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 5-8 ADFG 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 and Templin (in Prep).*

Year / Season / Area	PNW	Coast W AK	Cook Inlet	Middle Yukon	N AK Penin	Russia	TBR	Upper Yukon	Other
2005 B SE	45.3%	34.2%	5.3%	0.2%	8.8%	0.6%	3.3%	0.0%	2.4%
N = 282	(0.032)	(0.032)	(0.019)	(0.003)	(0.021)	(0.005)	(0.016)	(0.001)	(0.015)
2005 B NW	6.5%	70.9%	2.2%	4.7%	6.7%	2.0%	3.5%	2.8%	0.7%
N = 489	(0.012)	(0.047)	(0.011)	(0.013)	(0.042)	(0.007)	(0.012)	(0.009)	(0.008)
2006 B SE	38.4%	37.2%	7.5%	0.2%	7.0%	0.6%	4.3%	0.1%	4.7%
N = 304	(0.029)	(0.032)	(0.020)	(0.004)	(0.019)	(0.005)	(0.017)	(0.002)	(0.020)
2006 B NW	6.4%	67.3%	3.0%	8.0%	2.1%	3.3%	0.5%	8.0%	1.4%
N = 286	(0.016)	(0.035)	(0.020)	(0.020)	(0.016)	(0.013)	(0.007)	(0.019)	(0.014)
2006 A All	22.9%	38.2%	0.2%	1.1%	31.2%	1.1%	1.1%	2.3%	1.9%
N = 801	(0.015)	(0.038)	(0.004)	(0.005)	(0.039)	(0.004)	(0.007)	(0.006)	(0.011)
2007 A All	9.4%	75.2%	0.1%	0.5%	12.0%	0.2%	0.1%	0.1%	2.4%
N = 360	(0.016)	(0.031)	(0.004)	(0.005)	(0.025)	(0.003)	(0.002)	(0.003)	(0.014)

Table 5-9 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 5-8 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)

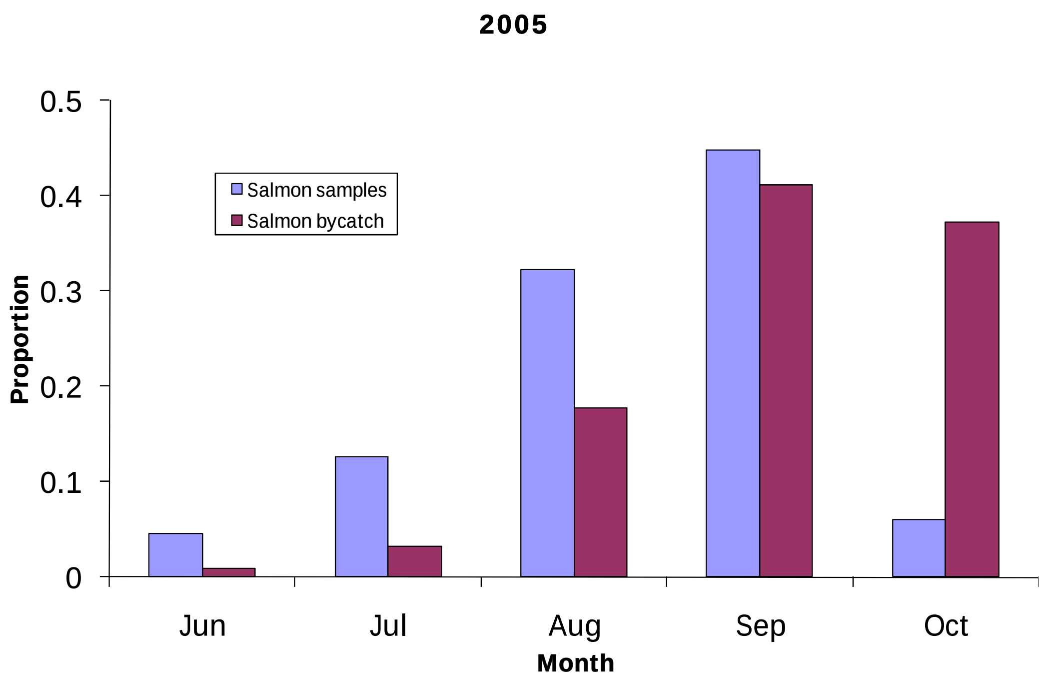
Table 5-10 Comparison of stock composition estimates for three different studies on Chinook bycatch samples taken from trawl fisheries in the eastern Bering Sea. .

Study		Myers and Rogers (1998)			Myers et al (2004)			Templin/Seeb (prelim)		
Years sampled		1979-1982			1997-1999			2005-2007[1]		
Stocks and estimated aggregate % composition in bycatch	Western AK	60%			56%					
		Yukon	Bristol Bay	Kusko-kwim	Yukon	Bristol Bay	Kusko-kwim			
		17%	29%	24%	40%	34%	26%			
Smaller scale breakouts (where available) listed to the right (with associated % contrib. of aggregate below)	Coastal WAK							48%		
								Lower Yukon	Kuskokwim	Bristol Bay
								Na	Na	Na
	Middle Yukon							3%		
	Upper Yukon							3%		
	NAK Penin							13%		
	Cook Inlet	17%			31%			4%		
	SEAK/Can	9%			8%					
	TBR							2%		
	PNW[2]							23%		
	Russia	14%			5%			2%		
	Other[3]							3%		

[1] note for purposes of comparison, only 2006 stock composition estimates *averaged annually and across regions* are shown here.

[2] PNW is an aggregate of over 150 stocks from British Columbia, Washing, Oregon and California. For a full list of stocks included see Templin et al *In prep*

[3] 'other' is comprised of minor components after aggregation to major river systems as described in Templin et al *In prep.*



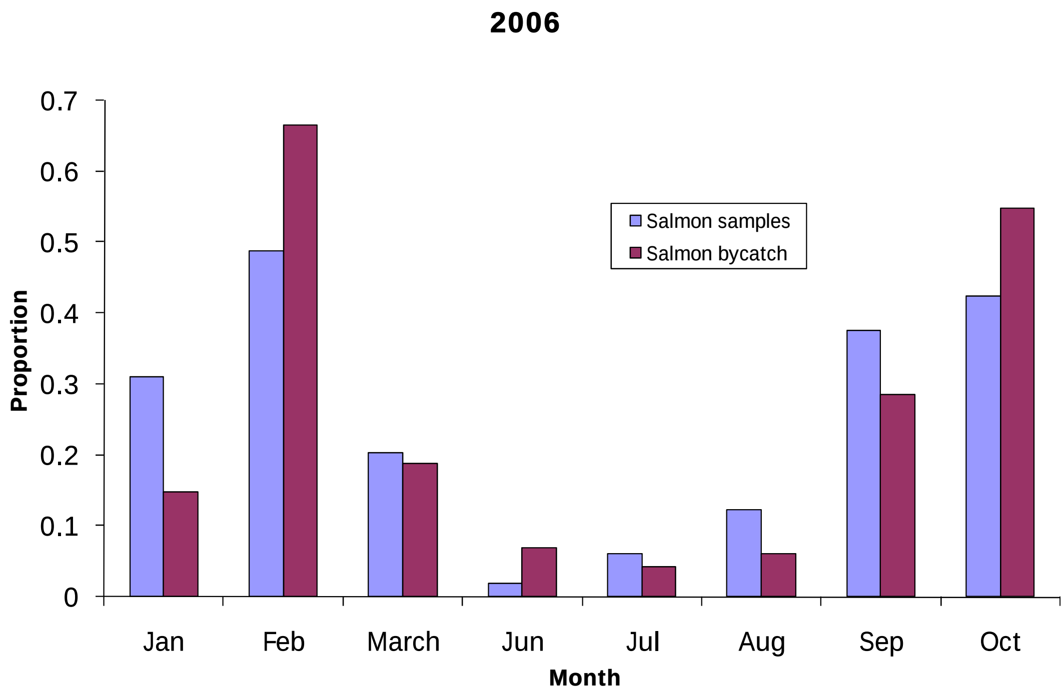
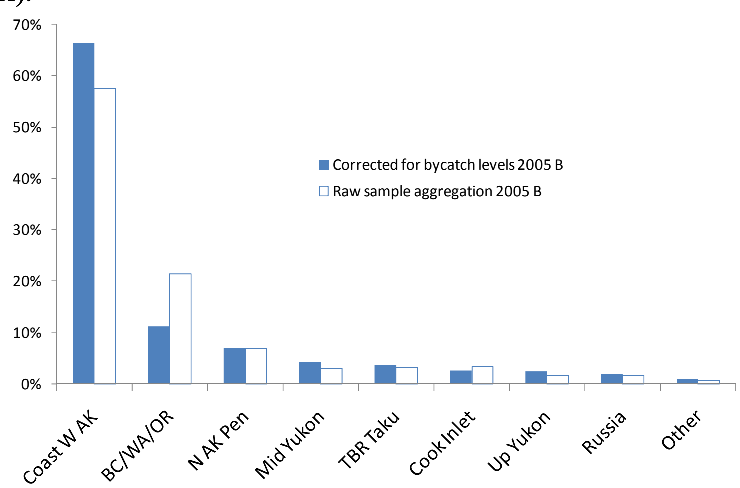


Fig. 5-18 Proportion of Chinook salmon samples collected for genetics compared to the proportion of bycatch by month for 2005 B-season only (top panel) and 2006 A and B season combined (bottom panel).



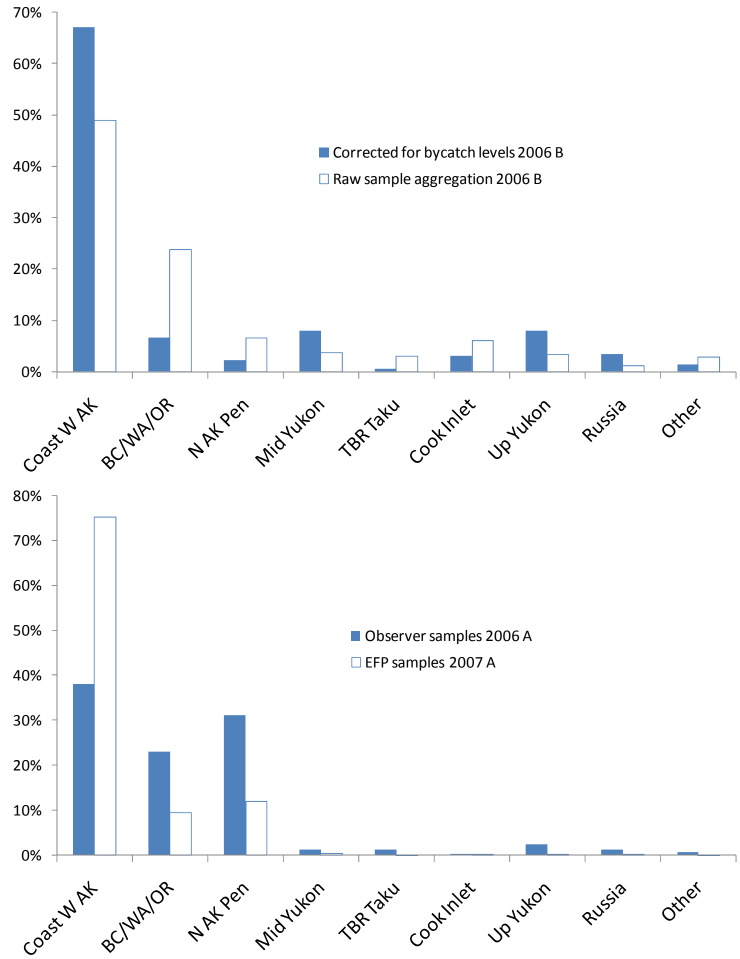


Fig. 5-19 Chinook salmon bycatch results by reporting region for 2005 B season (top), 2006 B season (middle), and the 2006 and (partial sample) of 2007 A seasons (bottom). The top two panels include uncorrected results where bycatch differences between regions (east and west of 170°W) are ignored (empty columns).

5.2.3.2 Coded Wire Tag (CWT) information

Information in this section is primarily from the 2007 supplemental biological opinion on the effects of the BSAI groundfish fishery on ESA-listed salmon and steelhead (NMFS 2007) and recent inseason management data on salmon bycatch. There are currently nine ESA-listed Chinook salmon evolutionary significant units (ESUs). 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 Alaska Fisheries Science Center, Auk 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). 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.

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. With the exception of one observed CWT recovery from the Upper Columbia River Spring Chinook ESU in the GOA in 1998, no Chinook salmon from ESA-listed ESUs other than UWR and LCR has ever been recovered in either the GOA or BSAI fisheries. Consistent with the general conclusions from past ESA Section 7 consultations, and based on the absence of observed recoveries in the BSAI groundfish fishery and few recoveries in the GOA fishery over the last 23 years, and general understanding of the ocean distribution of these ESUs, NMFS concluded that the effects of the BSAI groundfish fishery on Sacramento River Winter-run Chinook, Upper Columbia River Spring-run Chinook, Snake River Fall-run Chinook, Snake River Spring/Summer-run Chinook, Puget Sound Chinook, Central Valley Spring-run Chinook, or California Coastal Chinook salmon are discountable in that the take of listed Chinook salmon from these ESUs is extremely unlikely to occur.

Table 5-11 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

Since 1984 there have been ten and nine observed CWT recoveries in the BSAI groundfish fishery of UWR and LCR Chinook, respectively (Mecum 2006b). 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 5-11). 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). As a result, the CWT information can be used to characterize that the take of listed UWR and LCR Chinook in the fishery as an occasional, but relatively rare event.

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 5-11). 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 5-11, 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 5-11). 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 be expected to survive long enough 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 the fish caught in the BSAI fishery are roughly half age 3 and half 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.

5.3 Salmon assessment overview by river system or region

5.3.1 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. 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).

5.3.1.1 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 the department and will be expressed as a range based on factors such as salmon stock productivity and data uncertainty; the department 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 the department and will be stated as a range that takes into account data uncertainty; the department 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 the department 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 individual stock status section 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.

5.3.1.2 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. 5-20). 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.

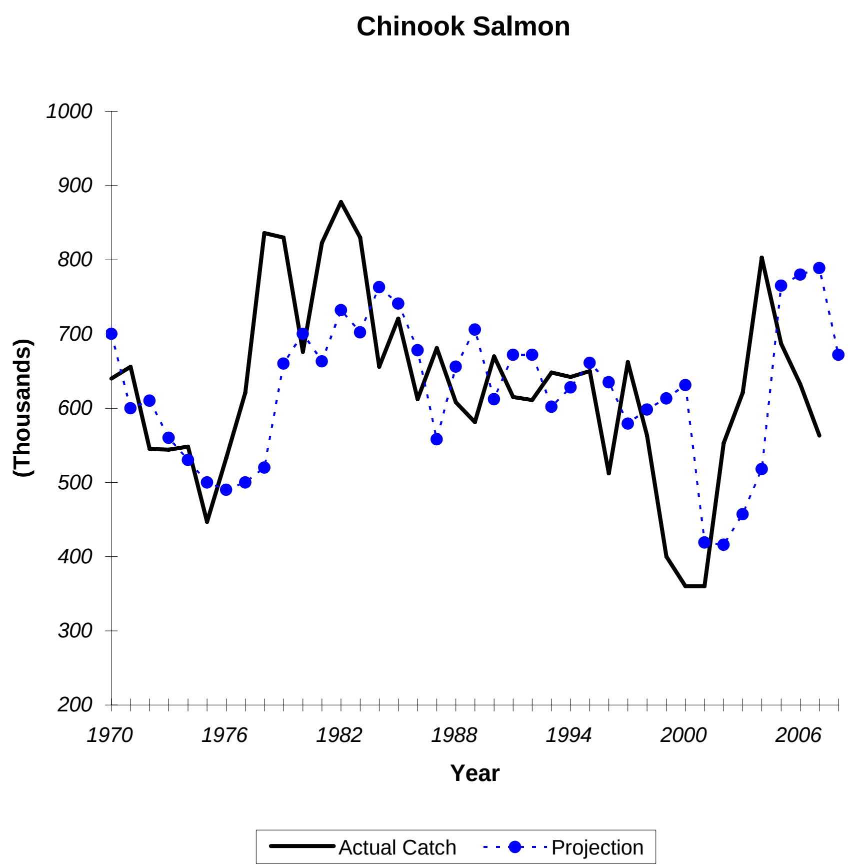


Fig. 5-20 Relationship between actual catch and projected catch in thousands, for Alaskan Chinook salmon fisheries from 1970 to 2007, with the 2008 projection (source Nelson et al. 2008).

5.3.2 Norton Sound Chinook

Norton Sound is comprised of two districts, the Norton Sound District and Port Clarence District. There are few Chinook salmon in the Port Clarence District. In the Norton Sound District, only the eastern area has sizable runs of Chinook salmon and the primary salmon producing rivers are in the Shaktoolik and Unalakleet subdistricts. The Shaktoolik and Unalakleet Subdistricts Chinook salmon stock was classified as a stock of concern in January 2004 and in 2007 the BOF continued this designation. This stock is classified as a stock of yield concern. The classification was in response to decreasing Chinook salmon harvests. The BOF adopted a new management plan in 2007 for Unalakleet River Chinook which incorporates a restrictive subsistence fishing schedule as escapement goals had not been met since 2003 even with commercial fishing closed.

Stock assessment and historical stock estimates

Run sizes are not estimated for Norton Sound Chinook stocks except for the Unalakleet River. Escapement is assessed for major index river systems of Norton Sound. Escapement goals are established for 3 stocks of Chinook in the Norton Sound Area, all are SEGs: Fish River/Boston Creek (SEG= >100), Kwiniuk River (SEG = 300-550) and North River (Unalakleet River) (SEG = 1,200-2,600). Other rivers have either aerial surveys or tower counts for enumeration but data was deemed insufficient to establish escapement goals for those stocks. While aerial and tower enumeration methods are available on the Niukluk River, an escapement goal for this stock was not established due to the rationale that it was a very small Chinook salmon system and was not representative of the larger Fish River drainage (ADF&G 2004).

Assessments are often qualitative relative to historical escapement goals for indexed areas (Menard, 2007). Escapement projects in the district include counting towers on the Kwiniuk and Niukluk Rivers, a test net operated on the Unalakleet River and a weir on the Nome River. Weir projects also exist on the Snake, Eldorado and Pilgrim Rivers while counting towers are used on the North River, and Pikmiktalik River. A weir is also operated at the headwaters of Glacial Creek which flows from Glacial Lake into the Sinuk River. The primary goal of this weir is for operation during the peak sockeye passage. Currently the only escapement project operating specifically for Chinook enumeration is the North River counting tower, located on a tributary of the Unalakleet River (J. Menard, pers com.).

The Unalakleet test net catches, the North, Kwiniuk and Niukluk River towers, aerial surveys and subsistence reports are the primary assessment tools for judging run strength of Chinook salmon in Norton Sound. Total escapement for Norton Sound Chinook is a combination of the observed escapements in the Kwiniuk, Niukluk, Nome, Snake Rivers (1995-2007), North River (starting 1996), and Eldorado River (starting 1997) with historical catch data (Table 5-12 and Menard 2007). The escapement goal range for the North River is 1,200 to 2,600 Chinook salmon while the escapement goal for the Unalakleet River and Old Woman River index area is 550 to 1,100 Chinook salmon aerial counts. For a commercial fishery to occur the department must project an escapement minimum of 1,900 Chinook salmon past the North River tower. Norton Sound Chinook salmon are fully exploited and management strives to protect the early portion of the return from overharvesting and to provide adequate escapements (Menard, 2005).

Table 5-12 Total escapement for Chinook salmon for Kwiniuk (1995-2007), Niukluk, Nome, and Snake Rivers (1995-2006), North River (1996-2007), and Eldorado River (1997-2007).

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]

Source: Menard 2007.

[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.

The 2007 Chinook salmon run was below average throughout most of Norton Sound. The Unalakleet test net catch was approximately double the 5-year average and 25% above the 10-year average. However, improved catches this year may be attributed to the reduced subsistence fishing time and closure of both subsistence and sport fishing for Chinook salmon. The North River tower count of 1,950 Chinook salmon represented the first time in which the escapement goal range of 1,200 to 2,600 fish had been reached since 2003 (Fig. 5-21). On July 25, aerial surveys were conducted of the Shaktoolik, Unalakleet, Old Woman, and North Rivers under good to excellent viewing conditions. Counts were 412, 642, 179, and 554 Chinook respectively. The Shaktoolik River aerial survey SEG (400-800) was reached for the first time since it was established in 1999, as was the combined Old Woman/Unalakleet River SEG of 550-1,100, also established in 1999 (Menard 2007). Unfortunately, the tower-based SEG (300-500) at the Kwiniuk River failed to be reached for the second consecutive year and has not been achieved in 5 of 9 years since 1999. The 823 Chinook salmon enumerated during an aerial survey of the Tubutulik River was well above average and the fourth highest aerial survey count since 1980. Chinook salmon passage at the Niukluk River tower was below average and the Pilgrim River Chinook salmon escapement was average.

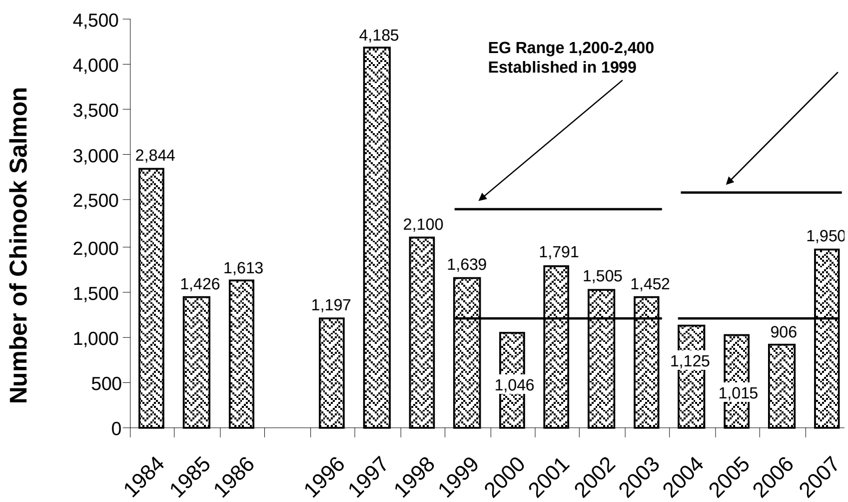


Fig. 5-21 Estimated Chinook salmon passage compared to the escapement goal range 1984-1986 and 1996-2007, North River counting tower, Unalakleet River drainage, Norton Sound.

In 2007, the Unalakleet river escapement goals were met, largely as a result of the subsistence fishing schedule with escapement windows and an early closure on July 4th (S. Kent, pers. comm.). However, concerns remain with the escapement quality which has led ADF&G staff to consider implementing mesh-size restrictions in the spring. Stock status concerns are based on an analysis of historical ASL data from the test fishery (5 7/8" mesh) and ASL data collected this past season from escapement (sampling with beach seines). The percentage of 6-year olds in the test fishery samples averaged about 40% from 1985-1999, and then plummeted to 20% since 2000 (Fig. 5-22). There has also been an observed decline in 7-year old fish in the test fishery; none have been observed in the test fishery since 2004. Twenty-five percent of the catch was comprised of 4-year olds between 1985-1999. This proportion increased to 40% since 2000, and 70% since 2005. Additionally, the observed sex ratio has gone from about 50:50 (1985-1999) to about 80% male since 2000. Similarly high percentages of 4-year olds and males were also observed in upper main stem of the Unalakleet River this summer during the department's beach seining project, potentially indicating 4-year olds are comprising a larger segment of the return than in previous years. (S. Kent, pers com.)

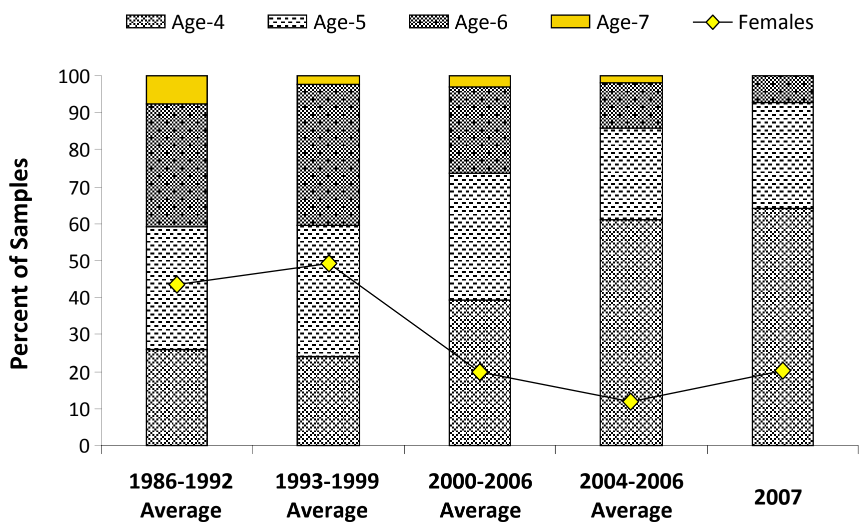


Fig. 5-22 Chinook salmon age and sex composition trends observed in the Unalakleet River test net samples (5 7/8" stretched mesh), 1986-2007, Norton Sound (From S. Kent, ADF&G).

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. No fishery is anticipated for Chinook salmon in 2008 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 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.).

5.3.3 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. 5-23).) through genetic stock identification. The Upper Yukon is the Canadian-Origin Yukon Chinook stocks. Total run estimates for the Yukon includes 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.

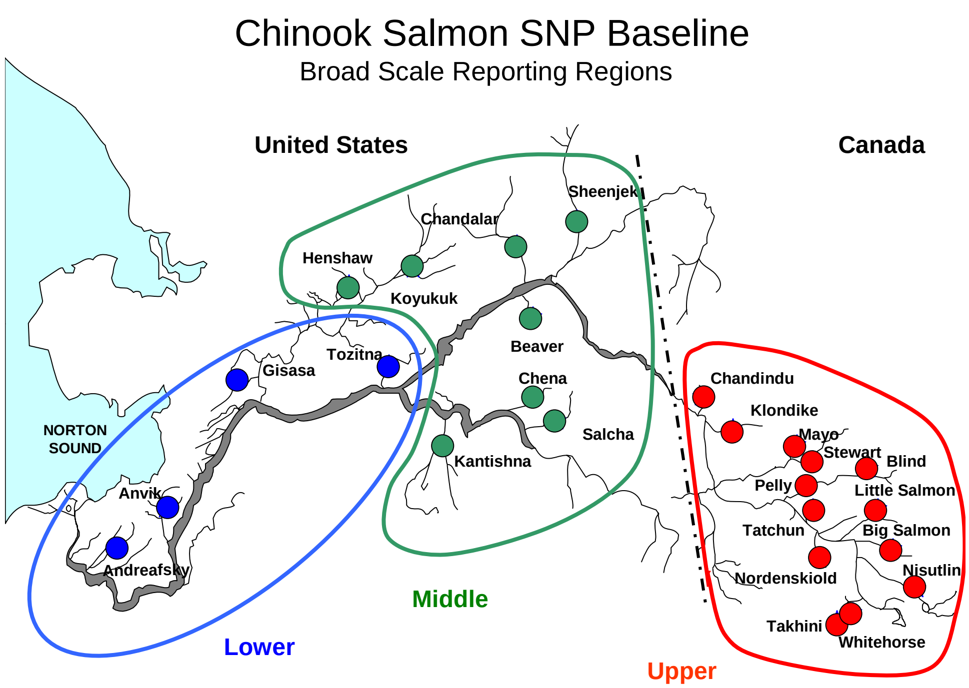


Fig. 5-23 Stock group delineations of the Yukon River: lower, middle and upper

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 Alaska Board of Fisheries (BOF). This determination for Yukon River Chinook salmon was made at the September 2000 BOF meeting, continued after review in January 2004, and upheld again after review in January 2007. The Yukon River Chinook salmon stock continues to meet the definition of a yield concern based on low harvest levels from 1998-2006.

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) mark-recapture estimates of run abundance, (4) various escapement assessment efforts in tributaries (e.g. tower counts, aerial surveys, weirs), (5) commercial and subsistence catch data and (6) catch per effort data from monitored fisheries (Fig. 5-24) (Clark et al 2006). ADF&G, several Federal agencies, the Canadian Department of Fisheries and Oceans (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 Alaskan Yukon salmon fisheries.

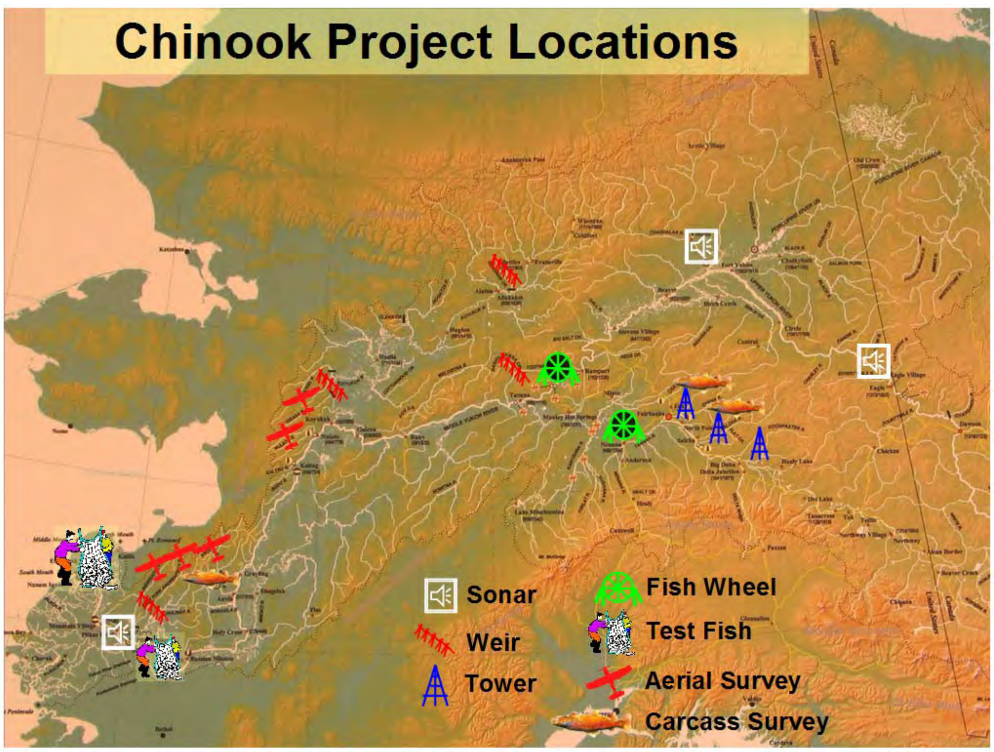


Fig. 5-24 Project location for assessing Yukon River Chinook salmon (from D. Evenson, ADF&G)

Tributary escapements have been monitored with counting tower projects in the Chena and Salcha rivers and with aerial surveys in the Andreafsky, Anvik, Gisasa, and Nulato rivers. Biological escapement goals (BEGs) have been established for the Chena and Salcha rivers in the Tanana River drainage (Table 5-13). Sustainable escapement goals (SEGs) for aerial survey assessments have been established for the East and West Fork Andreasky, Anvik, Nulato and Gisasa rivers. Chinook salmon escapement goals were generally met throughout the Alaska portion of the Yukon River drainage the past 5 years 2003–2007.

Table 5-13 Yukon River escapement goals set for Chinook salmon in 2005, continued from 2006 through 2008.

Stream	Current Goal	Type of Goal
East Fork Andreafsky River Aerial	960–1,900	SEG
West Fork Andreafsky River Aerial	640–1,600	SEG
Anvik River Index Aerial	1,100–1,700	SEG
Nulato River Aerial (Forks Combined)	940–1,900	SEG
Gisasa River Aerial	420–1,100	SEG
Chena River Tower	2,800–5,700	BEG
Salcha River Tower	3,300–6,500	BEG

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. 5-25 (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 5-14, Table 5-15). In the Anvik River, the SEG is 1,100-1,700 fish; escapement observations were not obtained in 1998, 1999, and 2003. The Chinook salmon SEG in the Nulato River is 940-1,900 fish; escapement observations were not obtained in 1996, 1997, 1999, 2000, 2003, and 2004. The Gisasa River Chinook salmon population has an SEG of 420-1,100 fish; escapement observations were not obtained in 1996-2000 and 2003 (Fig. 5-26, Fig. 5-27). 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. Upper ranges of the biological escapement goals for the Chena and Salcha rivers were not exceeded in 2007 (Table 5-14).

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 Department of Fisheries and Oceans (DFO) mark and recapture passage estimate, from 2001–2005 (Table 2; Fig. 3). 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 Interim Management Escapement Goal (IMEG) of 45,000 Chinook salmon based on the Eagle sonar project passage estimate (Fig. 5-28, Fig. 5-29).

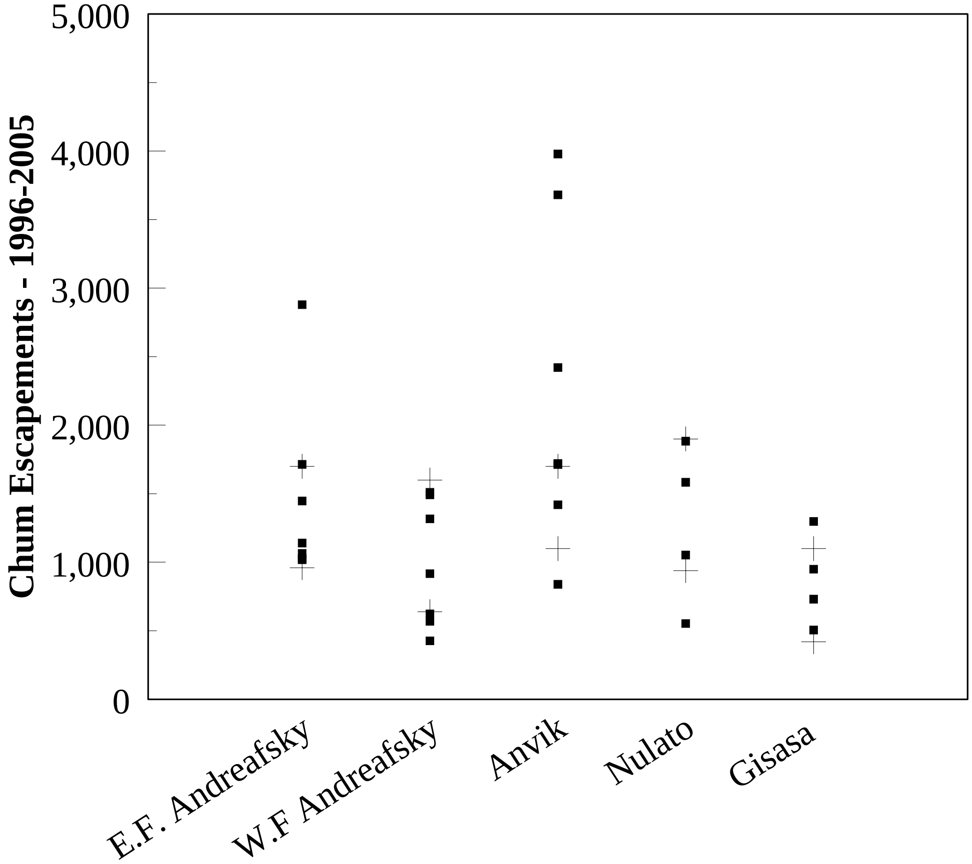


Fig. 5-25 Chinook salmon escapements from 1996-2005 for five Yukon stocks assessed by aerial survey that have sustained escapement goals (annual escapements shown as solid squares, lower and upper ends of sustained escapement goal ranges shown as + signs).

Table 5-14 Chinook salmon aerial survey indices for selected spawning areas in the Alaskan portion of the Yukon River drainage, 1961–2007.

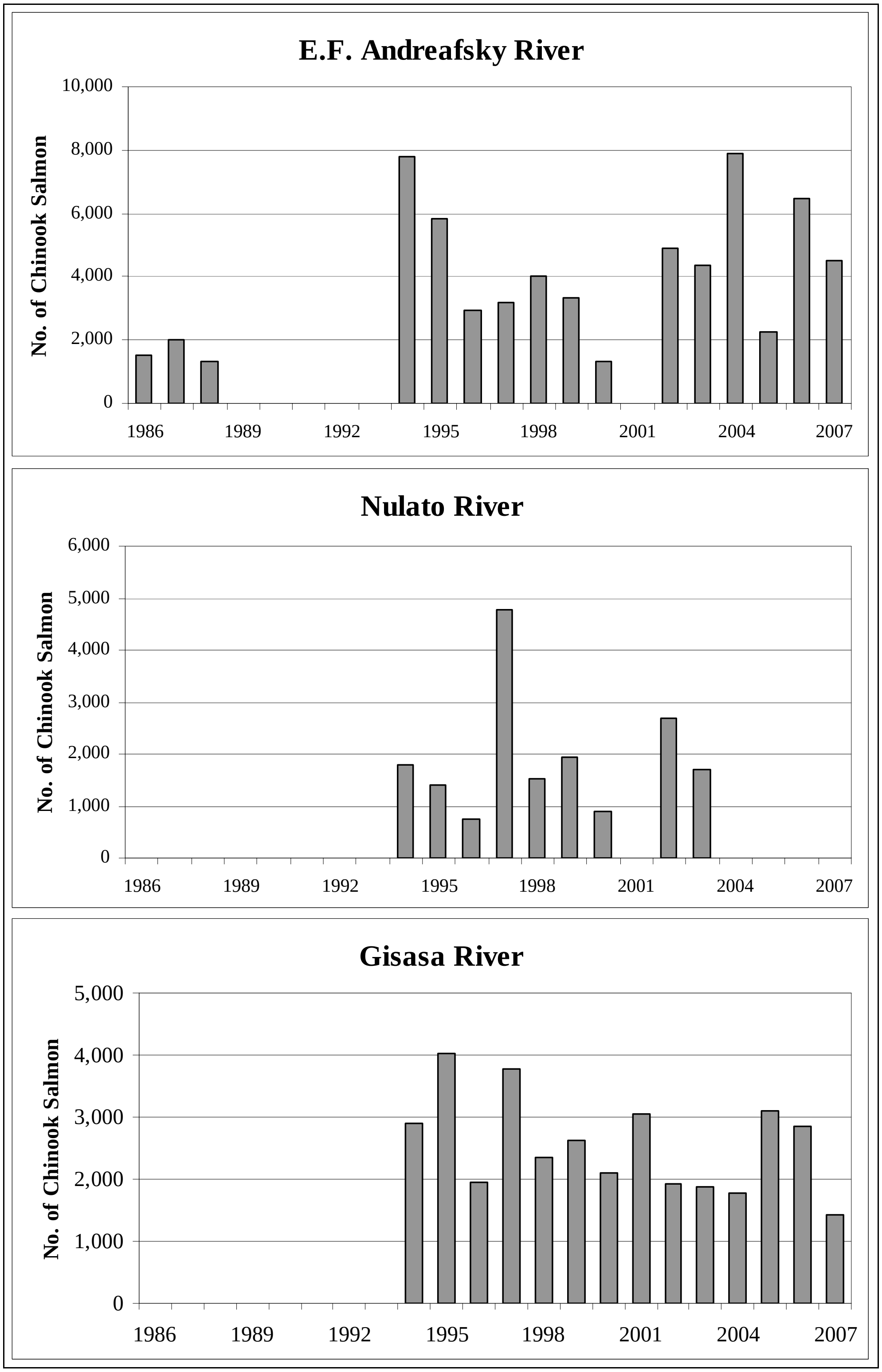
Year	Andreafsky River		Anvik River		Nulato River			Gisasa River
	East Fork	West Fork	Drainage Wide Total	Index Area	North Fork	South Fork	Both Forks	
1961	1,003		1,226		376 a	167		266 a
1962	675 a	762 a						
1963								
1964	867	705						
1965		344 a	650 [a]					
1966	361	303	638					
1967		276 a	336 [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 5-15 Chinook salmon escapement counts for selected spawning areas in the Alaskan portion of the Yukon River drainage, 1986–2007.

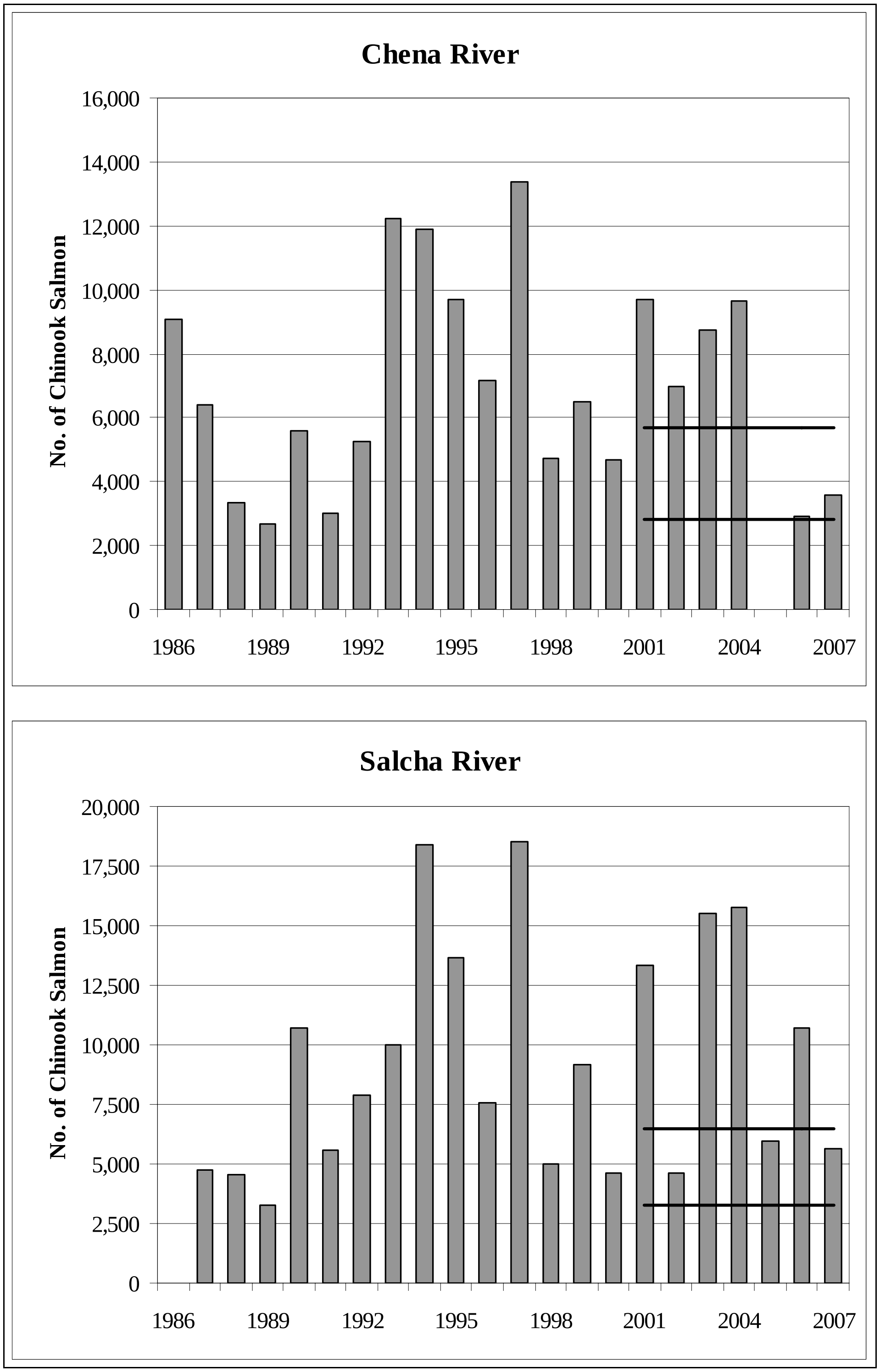
	Andreafsky River		**Nulato River Tower**	**Gisasa River Weir**		**Chena River**		**Salcha River**	
Year	No. Fish	% Fem.	No. Fish	No. Fish	% Fem.	No. Fish	% Fem.	No. Fish	% Fem.
1986	1,530	23.3[a]				9,065	20.0[d]		35.8
1987	2,011	56.1[a]				6,404	43.8[d]	4,771	47.0[d]
1988	1,339	38.7[a]				3,346	46.0[d]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



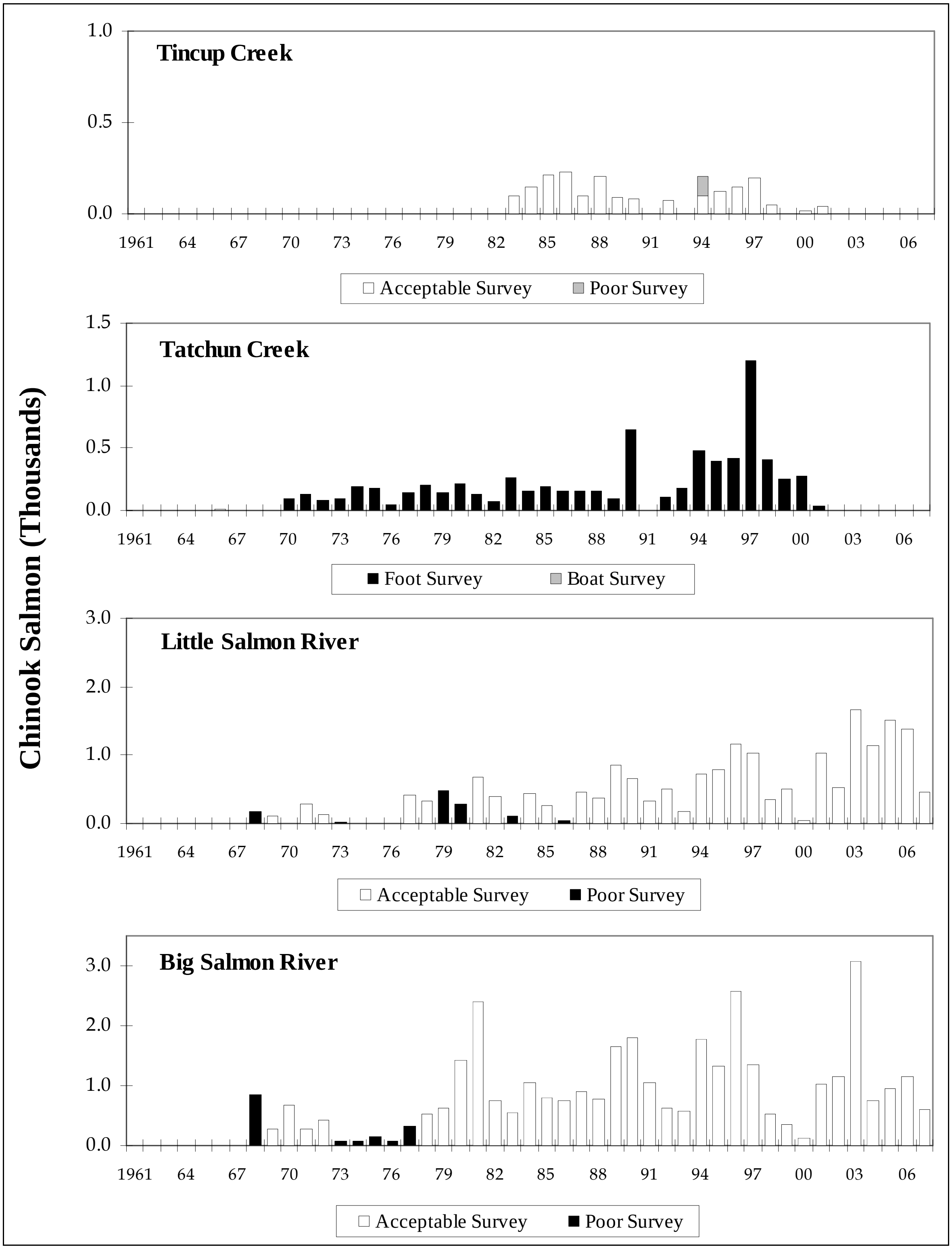
Note: The vertical scale is variable.

Fig. 5-26 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. 5-27 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. 5-28 Chinook salmon escapement data for selected spawning areas in the Canadian portion of the Yukon River drainage, 1961–2007

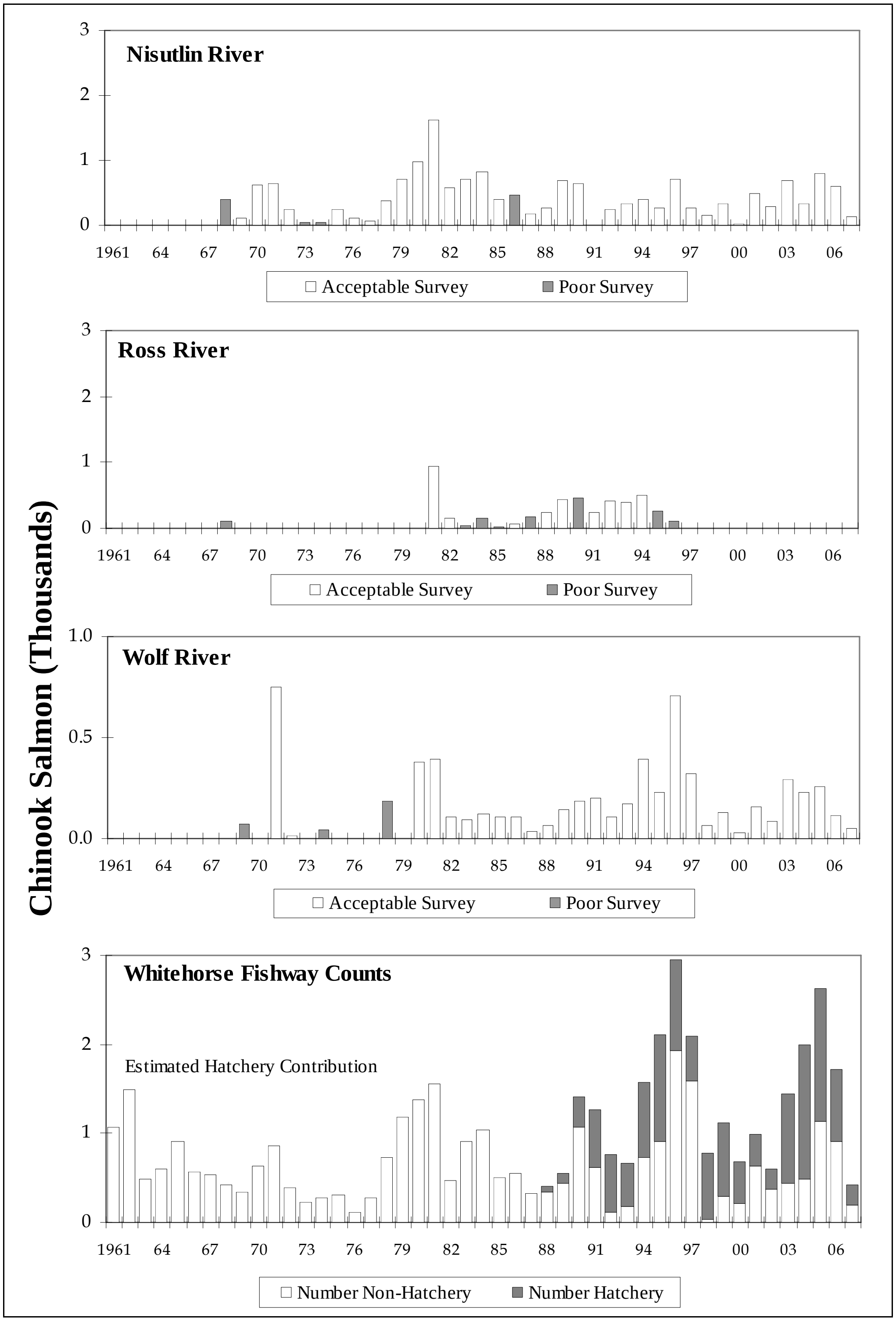


Fig. 5-29 Chinook salmon escapement data for selected spawning areas in the Canadian portion of the Yukon River drainage, 1961–2007.

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 5-14), harvests below Pilot Station, and 2 times the East Fork Andreafsky weir counts (Table 5-17, 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 adversely affected the quality of those estimates. New technology (DIDSON sonar) and more appropriate net selectivity models (Bromaghin 2005) have greatly improved Chinook salmon population estimates at Pilot Station since 2005. No brood table has been constructed for these data.

Table 5-16 Pilot Station sonar project estimates, Yukon River drainage, 1995, 1997–2007 (Source YRJTC, 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 5-17 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					Total Run Pilot + harvest below		
Year	Comm. fishery.	Subsist. fishery	Test Fishery	Comm. fishery	Subsist. fishery	Test Fishery	Comm. fishery	Subsist. fishery	East Fork Andreafsky River	Pilot Station Sonar	Total	Canadian Origin	Prop. Cana-dian
1995	76,106	5,960	2,078	41,458	9,037	74	14,744	3,291	5,841	162,945	291,305	169,793	0.583
1997	66,384	7,550	2,791	39,363	9,350	20	9,800	1,511	3,186	195,647	316,166	161,700	0.511
1998	25,413	7,242	878	16,806	9,455	48	6,277	1,711	4,011	87,852	147,728	88,283	0.598
1999	37,161	6,848	1,049	27,133	10,439	156	11,279	2,780	3,347	144,723	220,144	110,446	0.502
2000	4,735	5,891	275	3783	9,935	322	968	3,279	1,344	44,428	67,810	52,843	0.779
2001[c]	0	7,089	0	0	13,442	0	0	4,498	3,596	99,403	122,628	85,658	0.699
2002	11,159	5,603	416	11,434	8,954	34	4,258	2,290	4,896	123,213	164,057	81,486	0.497
2003	22,750	6,332	561	14,178	16,773	46	4,808	2,059	4,383	268,537	331,076	149,978	0.453
2004	28,403	5,880	637	24,164	9,724	70	6,481	1,990	7,912	156,606	232,837	119,743	0.514
2005	16,694	5,058	310	13,413	9,156	0	2,819	1,804	2,239	159,441	203,927	124,178	0.609
2006	23,748	5,122	817	19,843	8,039	0	4936	1897	6,463	169,403	233,065	119,788	0.514
2007	18,615	5,353	849	13,302	8,973	0	2521	1897	4,504	125,305	176,987	82,869	0.468

[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 (Clark 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[6]. 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).

Assuming an approximately normal return of 5-year-old and 6-year-old fish, the 2007 run was expected to be average to below average and similar in abundance to the 2006 run. It was anticipated the run would provide for escapements, support a normal subsistence harvest, and a below average commercial harvest. Therefore, ADF&G developed a conservative preseason management strategy in 2007 with a potential harvest ranging from 30,000 to 60,000 Chinook salmon (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).

The border passage estimate from the Eagle sonar project was approximately 41,200 Chinook salmon. However, the escapement target into Canada, which is based on the Canadian Department of Fisheries and Oceans fish wheel mark–recapture border passage estimate, and is currently being managed at the rebuilt escapement level of 33,000–43,000 Chinook salmon, was not met in 2007. The border passage estimate provided by the Canadian assessment project was approximately 17,000 fish. However, the escapement target had been achieved consistently from 2001–2005. In summary, the 2007 Chinook salmon run was weaker than the run of 2006, and below the recent 10-year average of 210,000 Chinook salmon.

6 Salmon ages given in this document represent the combined freshwater and saltwater age.

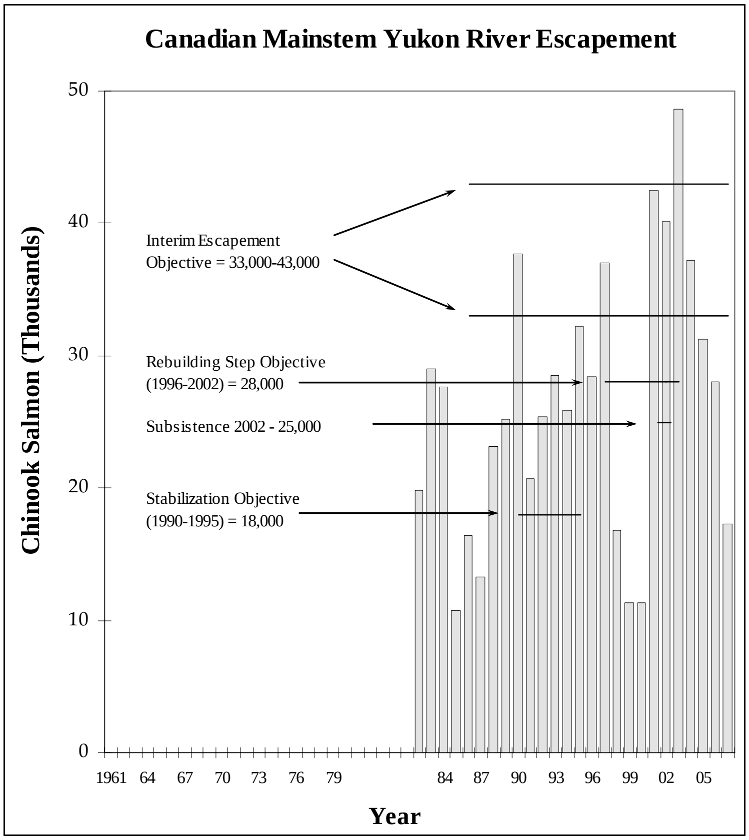


Fig. 5-30 Estimated total Chinook salmon spawning escapement in the Canadian portion of the mainstem Yukon River drainage based on Canadian mark-recapture, 1982–2007. Note: Horizontal lines represent the interim escapement objective range of 33,000–43,000 salmon, the rebuilding step objective of 28,000 salmon and the stabilization objective of 18,000 salmon.

5.3.3.1 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 is 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 (Clark 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 may provide break-through technology for annual assessment of Chinook salmon in the Yukon River drainage (Clark et al 2006).

The 2008 run is expected to be below average and similar to the 2007 run, although, it is anticipated that the 2008 run will provide for escapements, support a normal subsistence harvest, and a below average commercial harvest. Initial U.S. management will be based on preseason projections and shifted to inseason project assessment as the run develops.

The management strategy for 2008 will be to continue the regulatory subsistence salmon fishing schedule until run assessment indicates a harvestable surplus for additional subsistence opportunity and other uses. From 2002–2005, ADF&G delayed commercial fishing until near the midpoint of the run to ensure escapement and subsistence needs would be met due to the uncertainty of the runs during these years. Because of the unexpected weak run in 2007, Chinook salmon directed commercial fishing in 2008 will be delayed until the projected midpoint of the run. At that time, Chinook salmon directed openings will only be considered if a surplus can be identified, based on the current run assessment information. However, there is a possibility that the run may not be large enough to support even a small directed commercial fishery. If inseason indicators of run strength suggest sufficient abundance exists to have a commercial Chinook salmon fishery, the U.S. commercial harvest could range from 5,000 to 30,000 Chinook salmon including the incidental harvest taken during anticipated summer chum salmon directed periods.

For the Canadian portion of the stock, the S/R model predicts a total run of 111,000 Canadian-origin Chinook salmon in 2008. However, the estimated run size in 2007 was approximately 30% lower than expected for unknown reasons but possibly related to poorer marine survival. If these effects are similar in 2008, a run as low as 80,000 Canadian-Origin Upper Yukon Chinook salmon may be possible.

The performance of run outlooks developed from S/R models for the upper Yukon stock for the 1998 to 2006 period and the average of a S/R and sibling outlook which was used in 2007 are presented in Table 5-18. 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 age-6 (2001) brood year spawning escapements were above average, the 2007 run was weak and the total spawning escapement was below target levels. It is therefore prudent to enter the 2008 season, which also has good brood year escapements, with the expectation that conservation measures will likely be required.

Table 5-18 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

5.3.3.2 Exploitation rates

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 Department of Fisheries and Oceans (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 fall 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 radio telemetry (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. 5-31). The JTC also recommended using the Eagle sonar project in the future as the primary assessment of border passage (JTC 2008).

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 (Fig. 5-33). 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 fishers exert on the Canadian stock was calculated (Fig. 5-32). Associated exploitation rates exerted by Alaskan fishers on this stock ranged from 39% in 2001 to 76% in 1987 (Fig. 5-32). Average exploitation rates during the period 2001–2005 decreased by 19% from the 1989–1998 average (Fig. 5-32). Recent exploitation rates are therefore low compared to rates during the 1970s, 1980s, and 1990s.

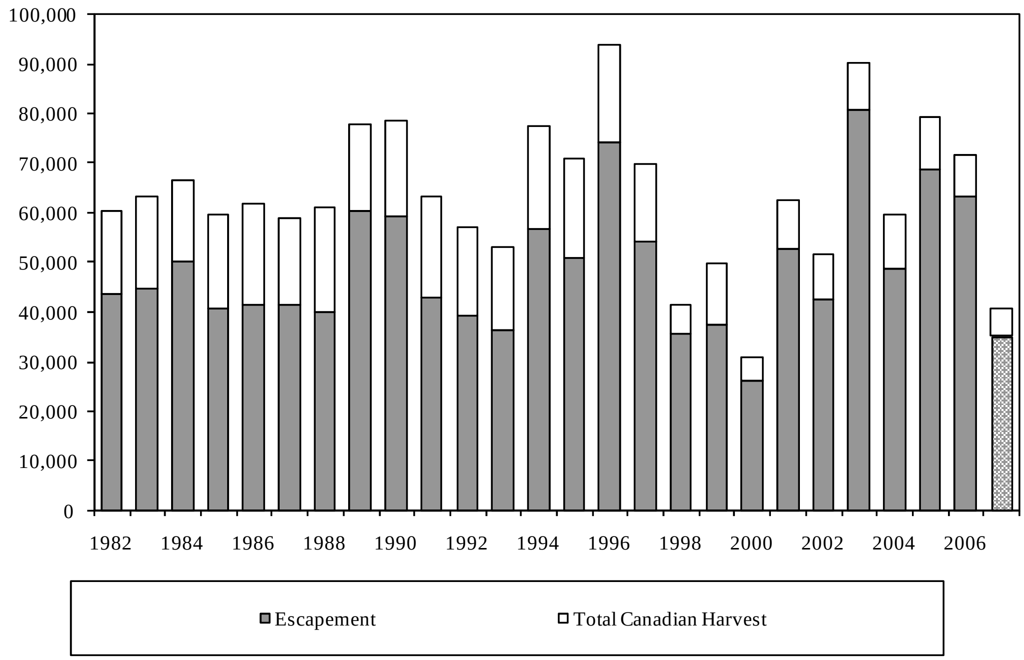


Fig. 5-31 Canadian harvests of Yukon River chinook salmon and the estimated escapement, 1982-2007.

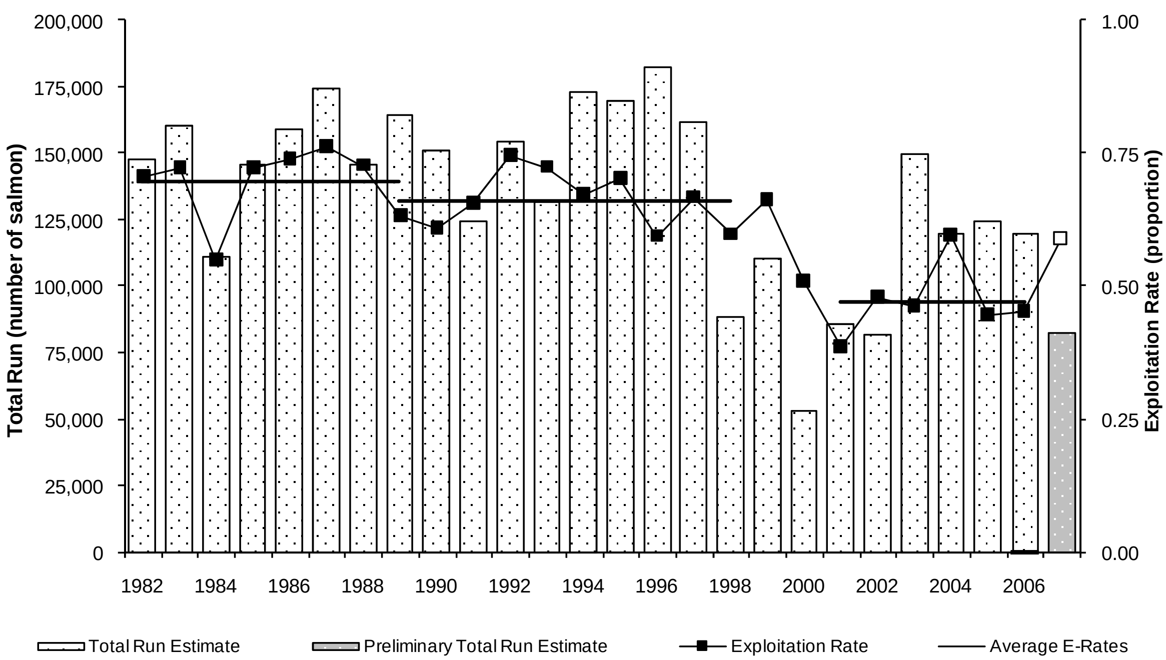


Fig. 5-32 Annual total run estimates and associated U.S. exploitation rates on Canadian-origin Yukon River Chinook salmon, 1982–2007. *Note: All estimates are based on the Canadian DFO mark–recapture border passage estimate of Chinook salmon passing into Canada.*

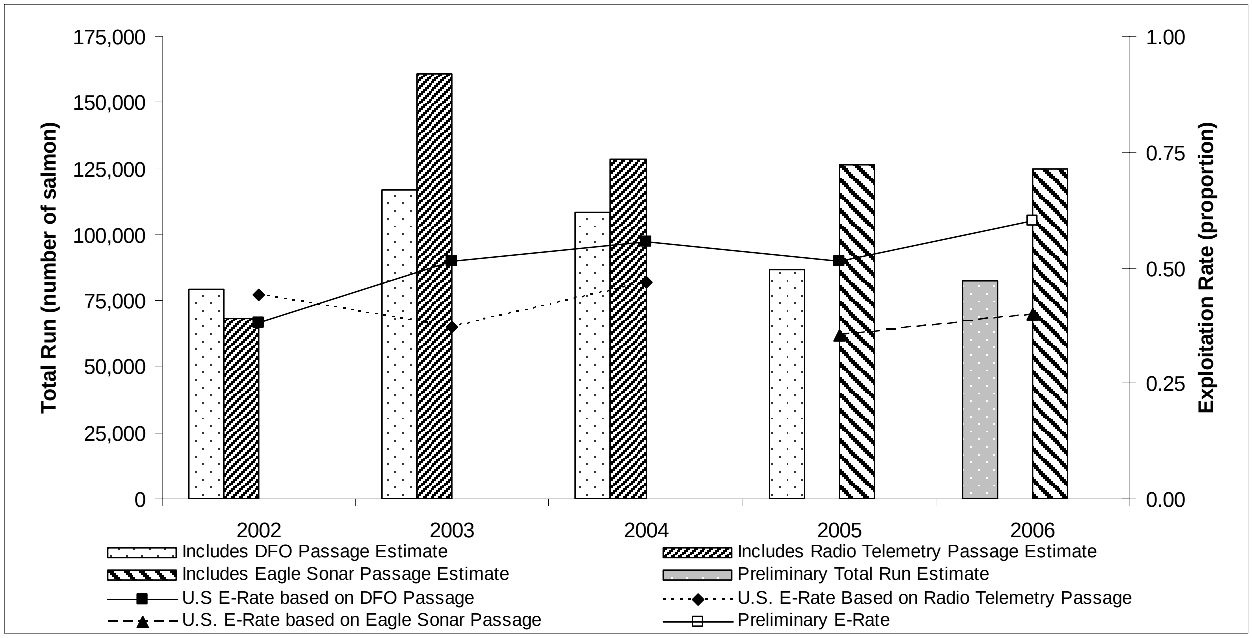


Fig. 5-33 Annual total run estimates and associated U.S. exploitation rates on Canadian-origin Yukon River Chinook salmon based on Canadian DFO mark–recapture estimates, 2002–2006, Alaskan radio telemetry mark–recapture estimates, 2002–2004 and Alaskan border sonar estimates, 2005 and 2006.

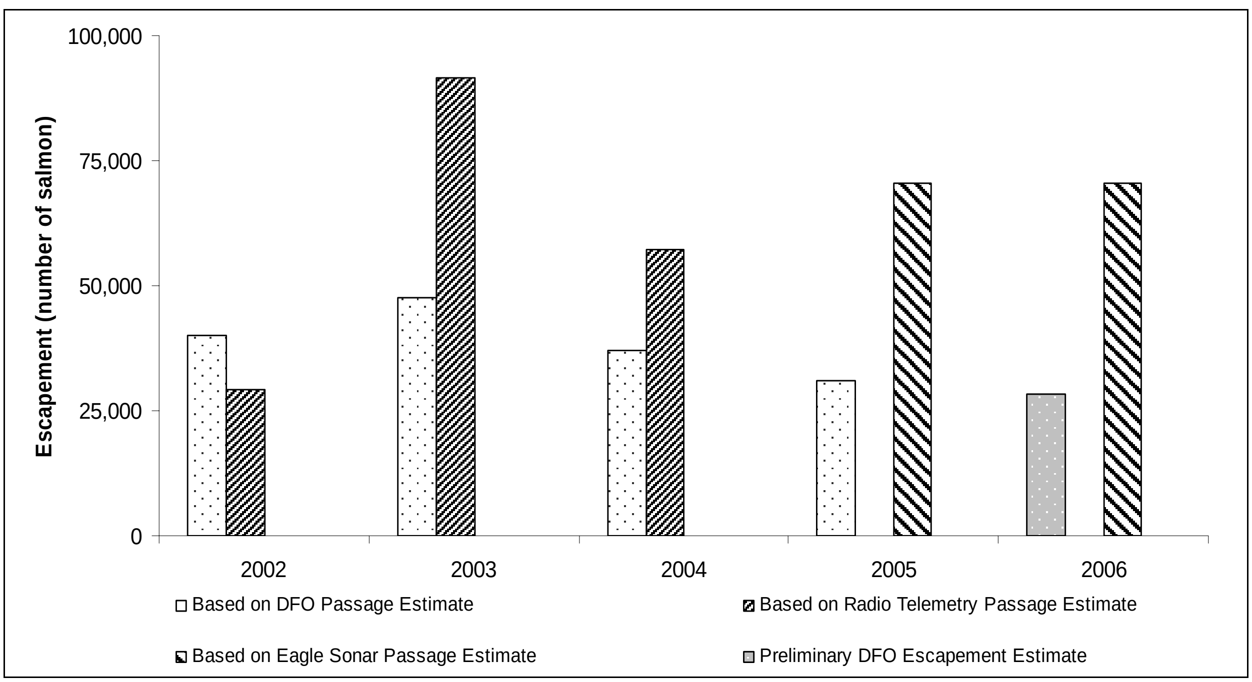


Fig. 5-34 Annual Chinook salmon escapement estimates for the mainstem Yukon River in Canada based on the estimated number of Chinook salmon passing into Canada generated by the Canadian DFO mark–recapture estimate, ADF&G radiotelemetry mark–recapture estimate and the ADF&G sonar passage estimate, 2002–2006.

During the years 2001–2004, a radiotelemetry, mark–recapture project was implemented to estimate the Chinook salmon passage past Russian Mission (RM 213). Starting in 2002, this project provided an independent estimate of the number of Chinook salmon passing into Canada. This estimate was based on the proportion of radio-tagged fish passing the Canadian border. Estimated total annual border passage of Chinook salmon into Canada during this period averaged about 69,100 fish and ranged from approximately 38,300 fish in 2002 to approximately 101,000 fish in 2003. During this period and using this method to determine border passage, the estimated exploitation rate exerted on the Canadian-origin Chinook salmon stock by Alaskan fishers averaged about 43%, ranging from 37% in 2003 to 47% in 2004 Fig. 5-33). Corresponding exploitation rates based on the Canadian DFO border passage estimate averaged 48% and ranged from 38% in 2002 to 56% in 2004 (Fig. 5-33).

Because of the marked difference between the Canadian DFO mark–recapture and the ADF&G radiotelemetry border passage estimates, ADF&G initiated a sonar project at Eagle, Alaska in 2005 to more accurately estimate salmon passage into Canada on the mainstem Yukon River. The estimated number of Chinook salmon passing into Canada was approximately 81,500 and 75,000 fish in 2005 and 2006 respectively. Using the passage estimates derived from sonar operations, Alaskan fishers exerted an exploitation rate on Canadian-origin Chinook salmon of 35% in 2005 and 40% (preliminary estimate) in 2006 (Fig. 6). Corresponding exploitation rates estimated based on the Canadian DFO border passage estimate were 51% and 60% (preliminary estimate), respectively (Fig. 5-33).

Because the different population estimation methods result in markedly different estimates of Chinook salmon passing into Canada, associated Chinook salmon estimates of escapement on the spawning grounds in the mainstem Yukon River in Canada also differ markedly. Escapements derived from the border passage estimate using radiotelemetry, mark–recapture techniques ranged from 27% below the Canadian DFO escapement estimate in 2004 to nearly double the Canadian DFO escapement estimate in 2003. The Chinook salmon escapement estimate derived from the ADF&G sonar passage estimate was approximately 2.3 and 2.5 times the Canadian DFO escapement estimate for 2004 and 2005, respectively (Fig. 5-34).

5.3.3.3 Ichtyophonous

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 2002, ADF&G directed research to determine management and conservation implications of *Ichthyophonus* in Yukon River Chinook salmon. 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); ADF&G continued to monitor infection rates at Emmonak which resulted in infection rates of 22%, 24%, and 16% for the years 2004 through 2006 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. Spawning success was evaluated based on a classification of spawn-out rates including spawned out, partially spawned out and did not spawn. Samples collected from female Chinook salmon from the spawning grounds in 2005 indicated that 44% of the sample was infected with *Ichthyophonus,* while 43% were uninfected. Of these salmon only 10% of the infected and 6% of the uninfected salmon were classified as partially spawned out and 1% of the infected and 2% of the uninfected were classified as did not spawn. These results are similar to observations in 2004 Chena River samples. The comparisons between spawning success of infected and uninfected Chinook salmon, based on samples collected in 2004 and 2005, do not appear significantly different (Hayes et al., 2006).

5.3.4 Kuskokwim River 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 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, although District 2 has been inactive for commercial fishing since the late 1990's. District 4, the Quinhagak fishing district, is a marine fishing area that encompasses about 5 miles of shoreline adjacent to the village of Quinhagak. The Kanektok and Arolik Rivers are the primary salmon spawning streams that enter District 4. District 5, the Goodnews Bay fishing district, a second marine fishing area, was established in 1968. District 5 encompasses the marine water within Goodnews Bay and the Goodnews River is the major salmon spawning stream that enters District 5 (Clark et al 2006). Mainland streams north of the Kuskokwim River and streams of Nelson, Nunivak, and St Matthew Islands are not typically surveyed for salmon.

The Board of Fisheries 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 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 Board of Fisheries 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 Board of Fisheries management plans, improved inseason and postseason stock status information, and more intensive inseason by user groups of salmon fisheries management (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 have been greatly reduced as a result of declining markets and participation and more precautionary management approaches implemented over the last 10 years.

5.3.4.1 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. Inseason run timing models are used to predict subsequent escapement levels using historic run information (Clark et al 2006).

ADF&G, either on its own or in collaboration with other organizations, conducts detailed, on-the-grounds, escapement monitoring of salmon in more than a dozen locations in the Kuskokwim area. Assessment of salmon escapement using aerial surveys has been conducted in the Kuskokwim Area since the late 1950s, and forms the most extensive escapement time series available. Water bodies are typically surveyed only one time each season, and are intended to index relative abundance of salmon escapement, as opposed to providing an estimate of total escapement (Molyneaux and Brannian 2006). Additionally, nine streams in the area have salmon escapements monitored with the aid of weirs or sonar deployment, although not all of these specifically monitor Chinook salmon escapement. Most of the streams have been monitored for fewer than 10 years, and in some cases the time series includes years in which the monitoring was done with counting towers instead of weirs. Data is also available from two recent radiotelemetry and mark-recapture studies that estimate abundance of Chinook in the Holitna River drainage and the Kuskokwim River from the Aniak River upstream. Fig. 5-35 illustrates the location of escapement projects in the management area.

Fig. 5-35 Escapement projects in the Kuskokwim management area. Note that Kanektok and Goodnews river systems (diamonds) should also be indicated as having weirs and surveys.

The Board of Fisheries has identified escapement goals for Chinook salmon in the Kuskokwim management area, which are listed in Table 5-19.

Table 5-19 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	240-1,200	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	SEG	2007
Goodnews River (North Fork)	aerial survey	640-3,300	SEG	2005
Kanektok River	aerial survey	3,500-8,000	SEG	2005

Table 5-20 and Table 5-21 provide historical counts of Chinook salmon escapement from aerial surveys and the Kogrukluk weir. Escapement goals have been met or exceeded since 2002, at all of the ten rivers for which escapement goals have been specified, in years for which data is available. Salmon stocks in this area are healthy and could support additional fishing (Clark et al 2006).

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. 5-36 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 (ADFG 2007a).

Table 5-20 Aerial survey counts of Chinook salmon in Kuskokwim River spawning tributary index areas and Kogrukluk weir Chinook salmon passage, 1975 - 2007.

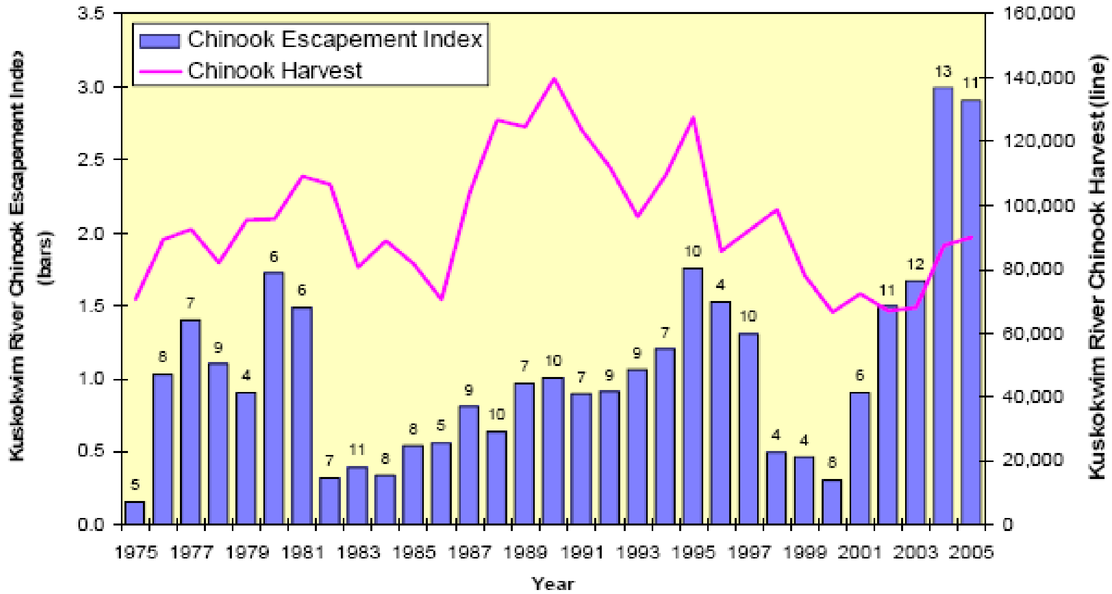
Year	Lower Kuskokwim River [a]				Middle Kuskokwim River [a]							Upper Kuskokwim River [a]		
	Eek	Kweth-luk Canyon C.	Kisara-lik	Tuluk-sak	Aniak	Kip-chuk (Aniak)	Salmon (Aniak)	Holo-kuk	Oska-walik	Holitna	Kogruk-luk Weir	Gagaray ah	Chee-neetnuk	Salmon (Pitka)
1975					202	94								
1976		997								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 5-21 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 Chinook salmon escapement index is a composite of median historical escapements for the 13 possible aerial survey index streams (from Sandone 2007).

Fig. 5-36 Kuskokwim River Chinook Salmon Escapement Index, 1975-2006.

Data collected since 2002 are available to estimate the total run of Chinook salmon to the Kuskokwim River (Table 5-22). Annual total run of Chinook salmon for 2002-2005 is estimated as total catch plus drainage-wide escapement upstream of the Eek River confluence (Eek River was excluded because of its proximity downstream of nearly all commercial and subsistence fishing). Escapement was estimated each year from the 2002-2005 radio tag mark-recapture estimates, coupled with the array of escapement projects in the drainage. The estimates provided here likely underestimate the actual total abundance (Doug Molyneaux, pers. comm., 3-16-08).

Table 5-22 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 judgement.

5.3.4.2 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. The 2008 commercial harvest outlook for the Kuskokwim River is 30,000-50,000 Chinook salmon; for Kuskokwim Bay, the outlook is 17,000-31,000 Chinook salmon (Nelson et al 2008).

5.3.5 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. 6-8). 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.

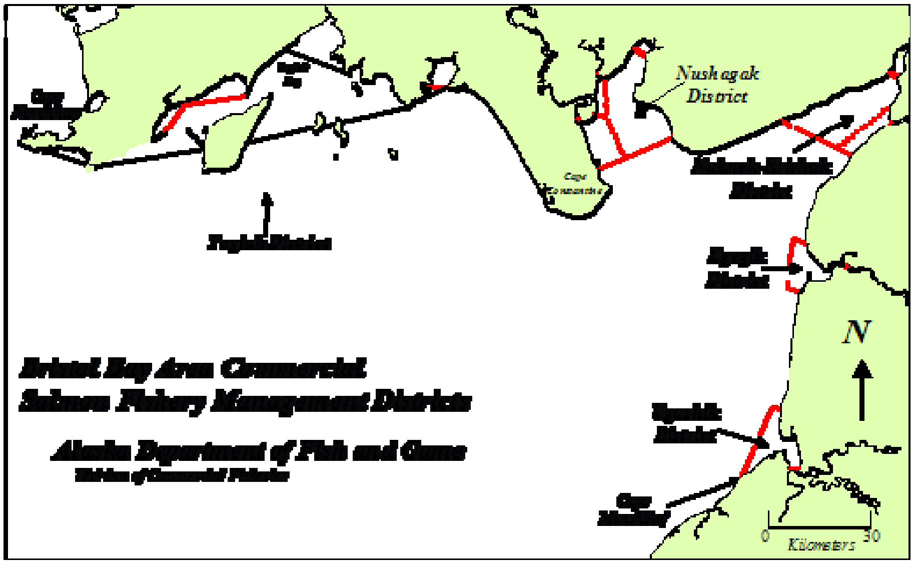


Fig. 5-37 Bristol Bay area commercial salmon fishery management districts.

5.3.5.1 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 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 5-23 provides a summary of escapement and total run size for Chinook salmon in the Nushagak District, from 1987-2007. Table 5-24 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 5-25).

Table 5-23 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 5-24 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 5-25 Nushagak River Chinook spawning escapement and return, by brood year (expressed as a percentage).

Brood Year	Spawning Escapement	Age Group 1.1	1.2	1.3	1.4	1.5	Total %
1986	33,854	0.0	19.8	41.3	37.0	1.6	100
1987	75,891	0.3	21.8	33.0	41.8	3.0	100
1988	50,946	0.3	17.6	30.2	50.8	1.0	100
1989	72,601	1.0	19.1	38.9	39.2	1.7	100
1990	55,931	0.6	33.5	36.2	29.0	0.6	100
1991	94,733	0.8	27.9	39.7	29.5	2.0	100
1992	74,094	0.5	16.6	29.6	52.7	0.4	100
1993	86,706	0.9	22.2	57.3	18.6	1.0	100
1994	83,103	1.3	24.4	30.7	40.1	3.6	100
1995	77,018	1.1	14.4	26.2	54.9	3.1	100
1996	42,228	0.5	16.8	31.2	49.7	1.6	100
1997	82,000	0.3	24.7	40.7	33.2	1.0	100
1998	108,037	0.3	20.4	37.4	40.6	1.2	100
1999	54,703	0.3	15.6	44.9	38.5	0.7	100
2000	47,674	0.2	21.8	43.1	34.6	0.2	100
2001	83,272	0.1	27.9	52.1	20.0	0.0	
2002	79,790	[a]	[a]	[a]	[a]	[a]	
2003	67,993	[a]	[a]	[a]	[a]	[a]	

[a] Incomplete returns from brood year escapement.
Source: Tim Baker, ADF&G.

5.3.5.2 Forecasts and precision of estimates

The 2008 forecast for Chinook salmon returning to the Nushagak River is 160,000 fish (68% age-1.3 and older). Information on the Nushagak River Chinook salmon forecast is taken from Brazil et al 2007. This forecast is 1.1% less than the 10-year mean; the 80% confidence bounds for the forecast ranged from 87,000 to 233,000. Nushagak River Chinook salmon are managed according to the Nushagak/Mulchatna Chinook Salmon Management Plan. This plan directs the commercial fishery to be managed for an inriver goal of 75,000 Chinook salmon, while the sport fishery is to be managed for a guideline harvest of 5,000 fish, if the projected inriver escapement is between 65,000 and 75,000 fish. Based on the preseason forecast and the inriver goal, 85,000 Chinook salmon should be available for commercial harvest. It is anticipated that actual harvest will be closer to 56,000 based on the average exploitation rate of 36% during the previous five years (2003-2007).

Age composition of the forecasted run is <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. There is uncertainty around the 2008 forecast; one factor is that the 2007 return of age 1.2 Chinook salmon was the largest in the last 20 years, and it is unknown what effect this will have on age 1.3 fish in 2008.

The forecasts have varied widely in the last 5 years (2003-2007). The forecast run differences have ranged from 59% below in 2004 to 41% above in 2007. Overall, there has been a tendency for the forecasts to be biased low and expected harvests to be high. The five previous total run forecasts (have averaged 3% below the total run. There is greater uncertainty around the 2008 forecast because of total run being 41% below forecast in 2007.

Chinook salmon run strength in the Togiak River declined between 1994 and 1997, from a total run of 26,000 fish in 1994 down to 18,000 fish in 1997. For the last 5 years of complete surveys, escapement estimates have averaged over 11,300 Chinook salmon and have all exceeded 9,500, within 5% of the 10,000 fish escapement goal. Adequate yearly Chinook escapement can be attributed to reductions in the weekly fishing schedule during late June. Based on the anticipated Chinook run strength, reduction in the weekly fishing schedule is again likely for the 2008 season.

5.3.6 Gulf of Alaska and Pacific Northwest ESA-listed stocks

5.3.6.1 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. 5-38). Inseason management of Cook Inlet commercial salmon fisheries is based upon salmon run abundance and timing indicators. Catch data, catch per effort data, test fish data, catch composition data, and escapement information from a variety of sources is used to assess stock strength on an inseason basis. For Chinook salmon, surveys are made to index escapement abundance (Clark et al 2006).

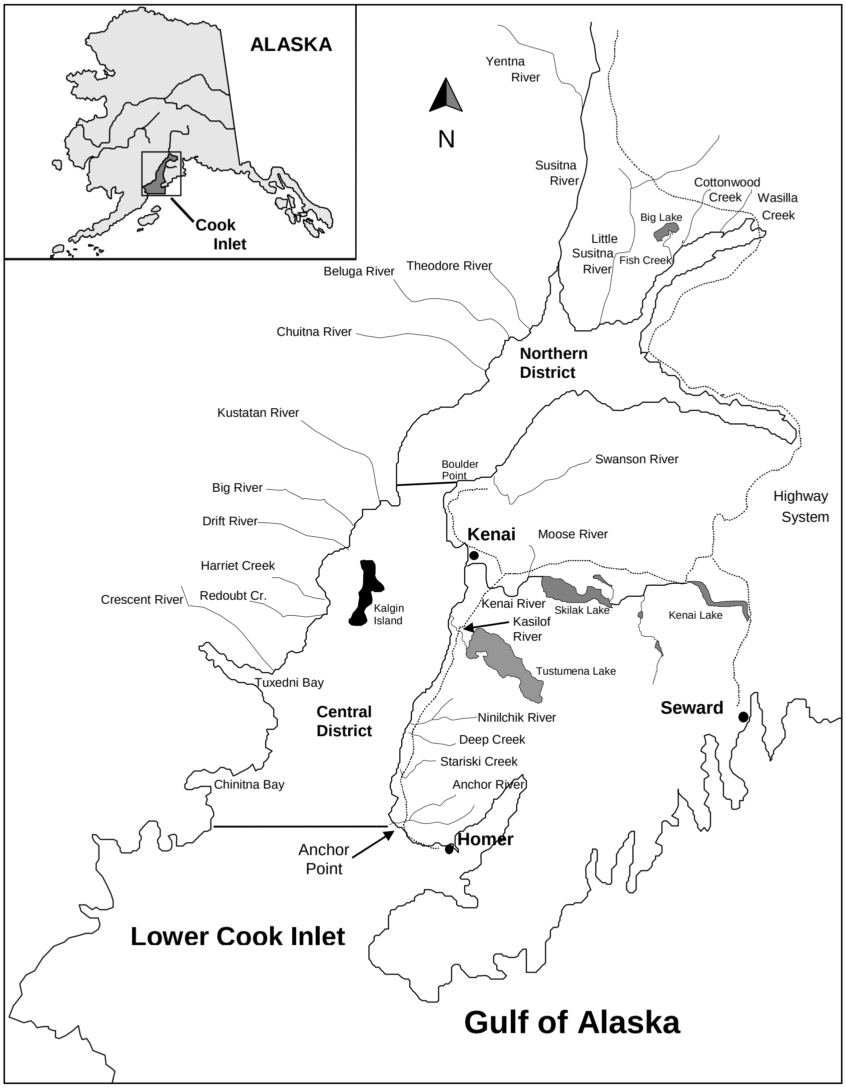


Fig. 5-38 Major Tributaries of the Cook Inlet Basin.

There are three biological escapement goals (Kenai River early and late runs, Deshka River) and 18 sustainable escapement goals in effect for Chinook salmon spawning in Upper Cook Inlet. After experiencing a significant downturn in the early to mid-1990s, Northern District Chinook salmon stocks continue to trend sharply upward and most escapement goals are being met or exceeded. For the years 2000-2004, for the 15 Upper Cook Inlet populations with the most complete escapement observations, 97% of observed escapement exceeded the lower end of the escapement goal range (Clark et al 2006). Late-run Kenai River Chinook salmon runs are estimated by sonar, and have been relatively stable.

The recent 5-year average commercial harvest was used to forecast the harvest of Chinook salmon in 2008 for the Upper Cook Inlet. The commercial harvest estimate for Chinook salmon is 23,000 fish.

There are 3 SEGs in effect for Chinook in the Lower Cook Inlet. Chinook salmon is not normally a commercially important species in the Lower Cook Inlet. The 2007 harvest totaled just under 500 fish, of which virtually all came from the Halibut Cove Subdistrict (Nelson et al 2008). Very little escapement information is available for this area.

5.3.6.2 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). 11 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 5-26 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 totala	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).

5.3.7 Pacific Northwest Stocks - ESA-listed Chinook stocks

The only ESA-listed salmon or steelhead likely to be affected by the BSAI groundfish fishery are Upper Willamette River (UWR) Chinook salmon and Lower Columbia River (LCR) Chinook salmon (NMFS 2007a). This section on species status is therefore limited to a review of information related to the status of those two evolutionary significant units (ESUs). 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). 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).

5.3.7.1 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).

The Willamette/Lower Columbia Technical Recovery Team (W/LC TRT) identified seven independent populations within this ESU: 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 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).

Historically, natural origin spring Chinook spawned in nearly all east side Willamette tributaries above Willamette Falls. During 1952-1968 the U.S Army Corps of Engineers constructed dams on all the major east side tributaries above Willamette Falls, blocking over 400 stream miles of rearing area for natural origin spring Chinook. Some residual spawning areas remain, including about two-thirds of the McKenzie River and about one-quarter of the North Fork Santiam River. However, these areas are affected by upstream dams through alteration of flows and temperature. Additionally, the majority of the Clackamas River, which is below Willamette Falls, remains accessible, although the 3-dam complex (river miles (RM) 23-31) has impacted migration and rearing conditions in the mainstem Clackamas.

Seven artificial propagation programs are considered to be part of the ESU: the McKenzie River Hatchery (Oregon Department of Fish and Wildlife (ODFW) stock # 24), Marion Forks/North Fork Santiam River (ODFW stock # 21), South Santiam Hatchery (ODFW stock # 23) in the South Fork Santiam River, South Santiam Hatchery (ODFW stock # 23) in the Calapooia River, South Santiam Hatchery (ODFW stock # 23) in the Mollala River, Willamette Hatchery (ODFW stock # 22), and Clackamas hatchery (ODFW stock # 19) spring-run Chinook hatchery programs (NMFS 2005b).

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 (Fig. 5-39). 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 as evidenced by the relatively shortened aspect of the diamonds representing population status. Overall, these chinook populations, and therefore the ESU, can be characterized as having a high risk of extinction.

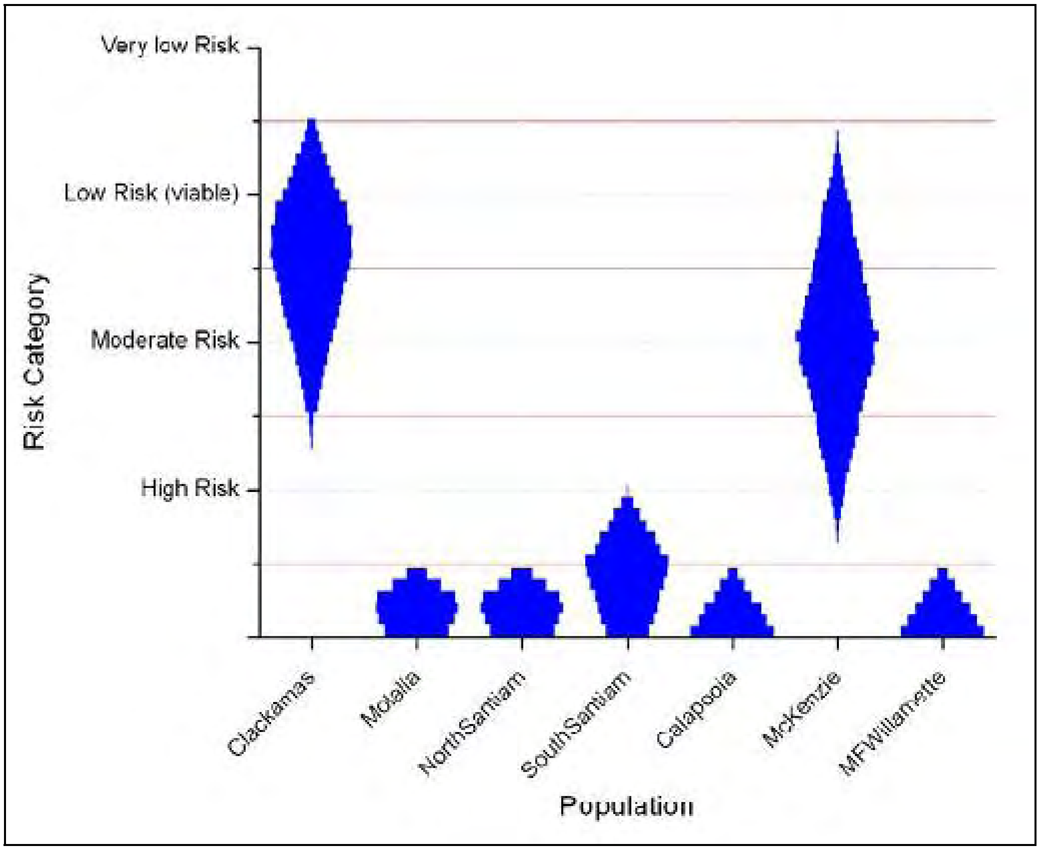


Fig. 5-39 Risk of Extinction for Upper Willamette River Chinook Salmon Populations (McElheny et al. 2007)

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 (Fig. 5-40 and Fig. 5-41).

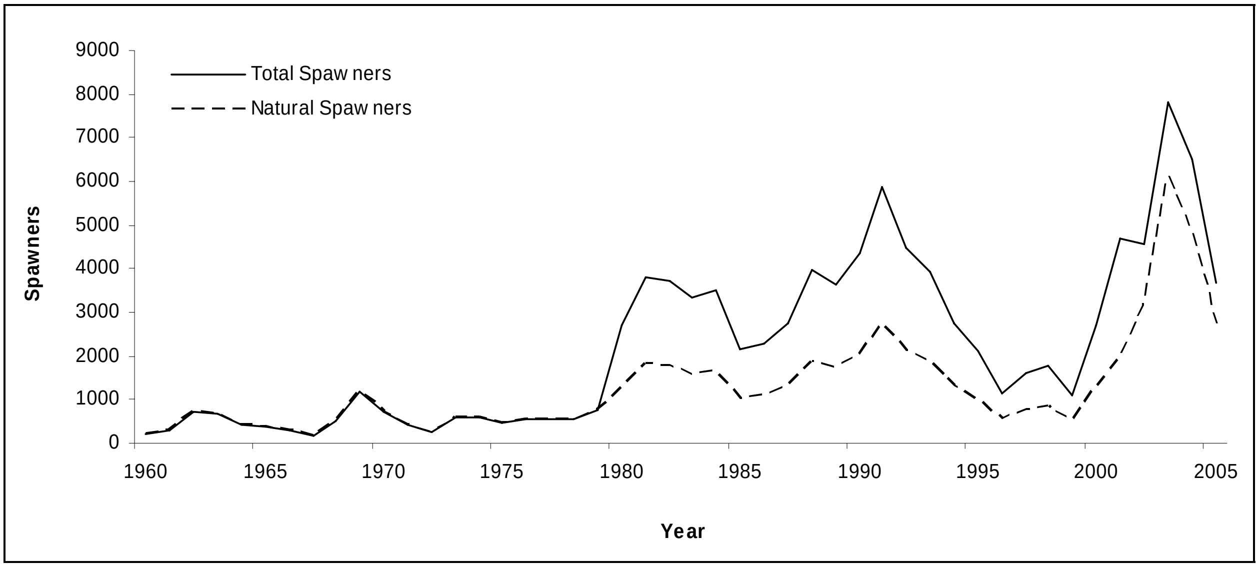


Fig. 5-40 Clackamas River Spring Chinook spawners by year.

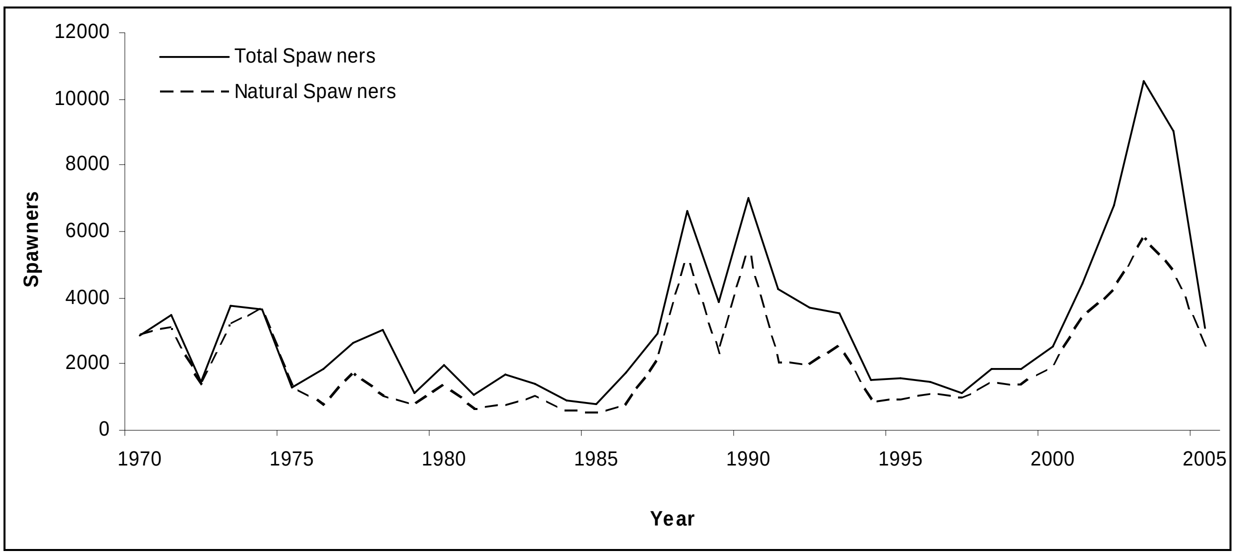


Fig. 5-41 McKenzie River Spring Chinook spawners by year.

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 (Fig. 5-42). 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%.

Fig. 5-42 Upper Willamette Spring Chinook fishery mortality rate from 1970 through 2005.

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

Critical Habitat

Critical habitat for UWR Chinook was designated on September 2, 2005 (70 FR 52858). Offshore marine areas, including those in the BSAI, were not included as designated critical habitat.

5.3.7.2 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). Not included in this ESU are stream-type spring Chinook salmon found in the Klickitat

River (which are considered part of the Middle Columbia River Spring Chinook ESU) or the introduced Carson spring Chinook salmon strain. Tule fall Chinook salmon in the Wind and Little White Salmon rivers are included in this ESU, but not introduced upriver bright fall Chinook salmon populations in the Wind, White Salmon, and Klickitat rivers. The Cowlitz, Kalama, Lewis, Washougal, and White Salmon rivers constitute the major systems on the Washington side; the lower Willamette and Sandy rivers are foremost on the Oregon side.

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).

5.3.7.2.1.1 Life History Types

The LCR Chinook salmon ESU exhibits three major life history types: fall-run ("tules"), late fall-run ("brights"), and spring-run. 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. This is consistent with information that fall-run populations generally have a more southerly ocean distribution. The following discussion therefore emphasizes information related to the status of the spring populations in the LCR ESU.

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.

Fall Chinook salmon predominate in the LCR salmon runs. Tule-type fall Chinook salmon, differentiated from bright fall Chinook salmon by their dark skin coloration and advanced state of maturation at the time of freshwater entry, begin returning to the Columbia River in mid-August and spawn within a few weeks. Bright fall Chinook salmon populations typically return to the fresh water later than tule fall Chinook salmon and spawn between late September and early November. Most fall Chinook salmon emigrate to the marine environment as subyearlings. Adult fall tule Chinook salmon return to tributaries in the LCR at 3 and 4 years of age, compared to 4 to 5 years for bright Chinook salmon and spring-run fish. Marine coded-wire-tag recoveries for LCR tule stocks tend to occur off the British Columbia and Washington coasts, although a small proportion of the tags are recovered in Alaskan waters. None of the Alaska tule recoveries include ESA-listed ESUs. (Adrian Celewycz, NMFS Ted Stevens Marine Research Institute, personal communication, 4/18/08)

5.3.7.2.1.2 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. Spring Chinook salmon in the Clackamas River are considered part of the UWR Chinook salmon ESU. 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 (Fig. 5-43). The W/LCTRT provided recommendations for minimum abundance thresholds (MAT). For Chinook populations in a medium sized basin like the Sandy, the MAT 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.

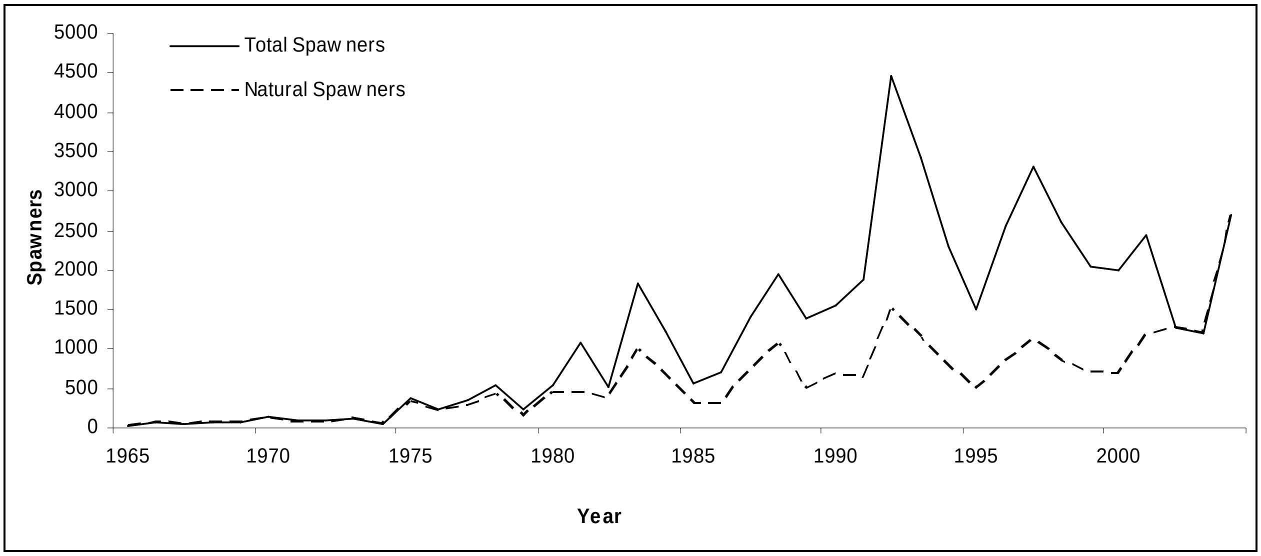


Fig. 5-43   Sandy River spring Chinook spawners from 1965–2004.

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 (Fig. 5-44, Fig. 5-45, and Fig. 5-46). 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.

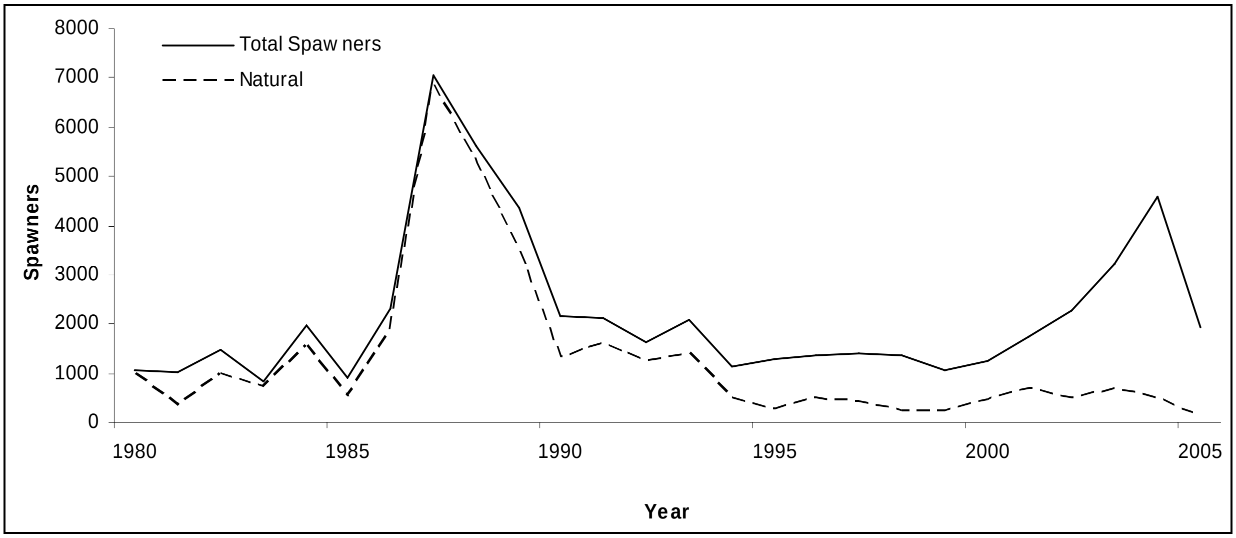


Fig. 5-44 Lewis River spring Chinook spawners from 1980–2005.

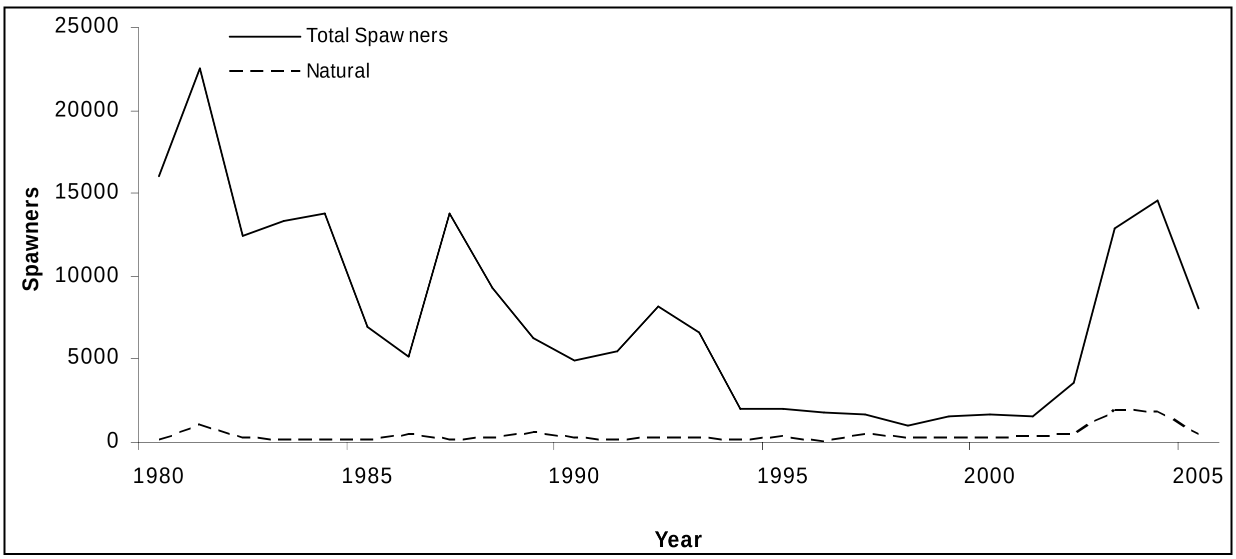


Fig. 5-45 Cowlitz River spring Chinook spawners from 1980–2005.

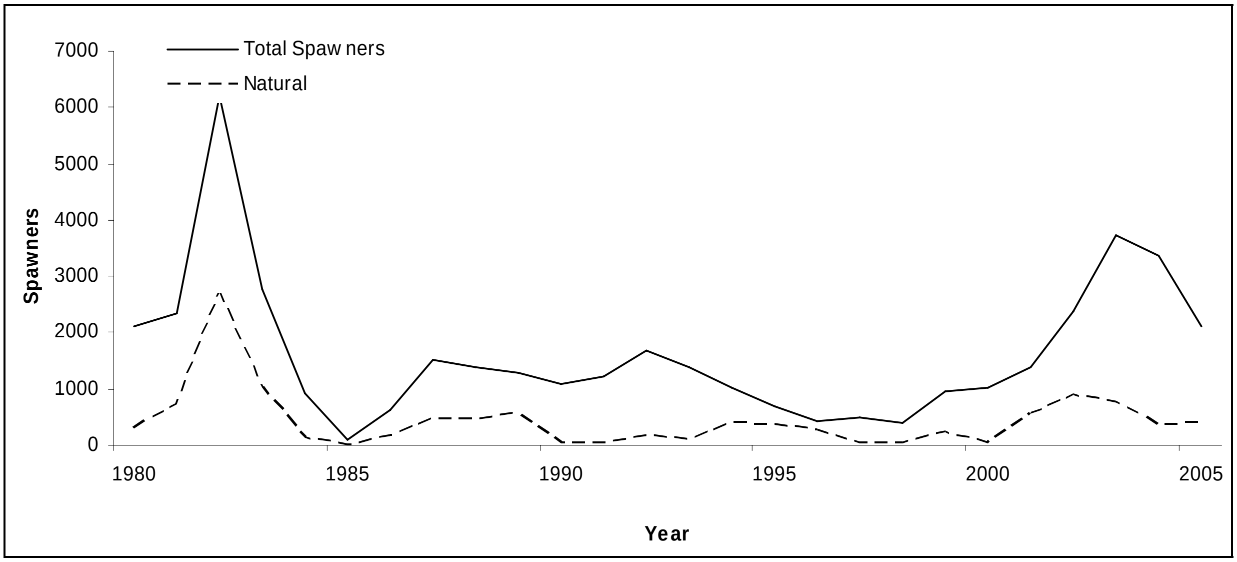


Fig. 5-46 Kalama River spring Chinook spawners from 1980–2005.

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 (see Fig. 5-42 for example) 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%.

5.3.7.2.1.3 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 (Fig. 5-47). 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 as evidenced by the relatively shortened aspect of the diamonds representing population status. 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 ESU is high.

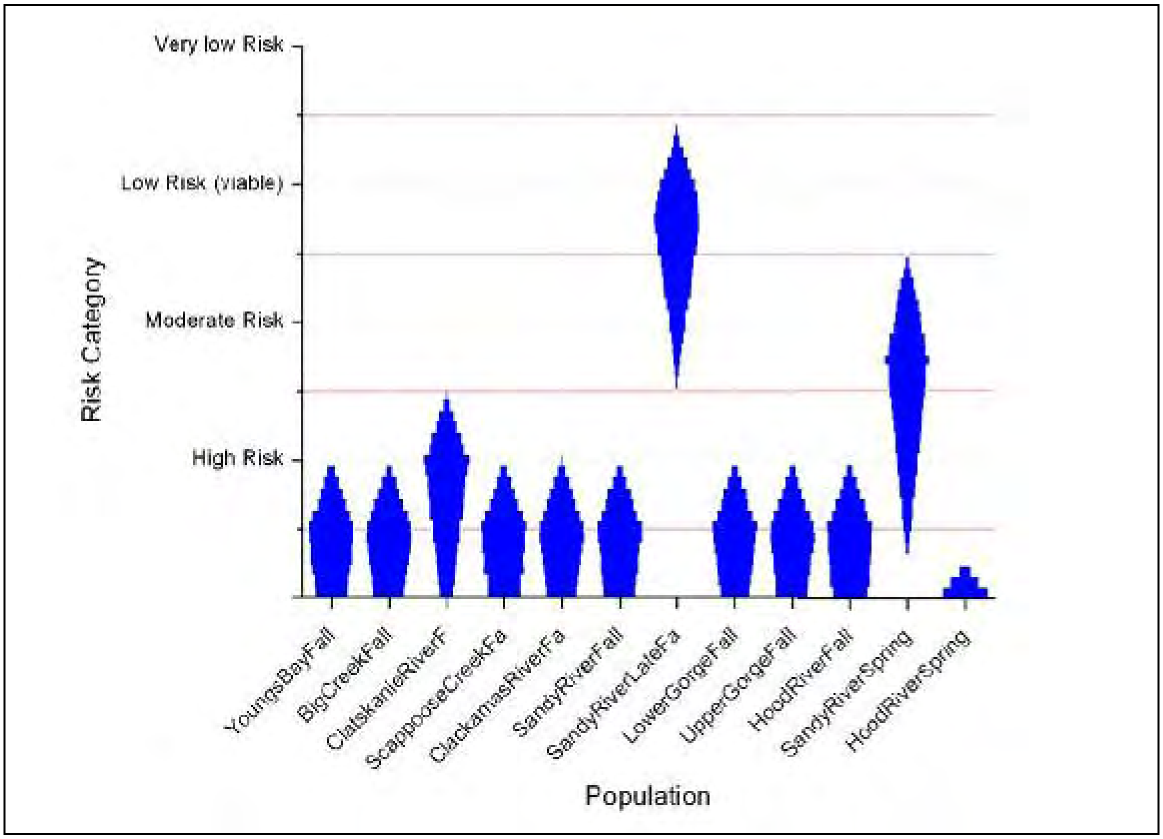


Fig. 5-47 Lower Columbia River Chinook Salmon ESU Extinction Risk (McElheny et al. 2007)

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

Critical Habitat

Critical habitat for LCR Chinook was designated on September 2, 2005 (70 FR 52858). Offshore marine areas, including those in the BSAI, were not included as designated critical habitat.

5.4 Impacts on Chinook

5.4.1 Methods for hard cap impact analysis (Alternative 2)

The approach used to evaluate how hard cap alternatives and options may impact future conditions (for both Chinook and pollock) was to apply the various alternatives to the recent past as observed (for 2003-2007). That way the alternatives could be easily compared to status quo (no cap). The steps involved first estimating how Chinook bycatch (and pollock catch) might have changed in each year under the different cap options. Then given these, the next task was to estimate how the different numbers would propagate to adult equivalent spawning salmon so that relative impacts could be ascertained.

As described in Chapter 2, a subset of the options under consideration is included here for detailed impact analysis. These include the following seasonal (A/B % allocation) options: 70/30, 58/42, 50/50 along with the following sector split allocations:

	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%

As presented in Chapter 2, the treatment of the data involved finding the date when some specified salmon bycatch levels would have been reached, then simply summing values from that date onwards till the end of the season to estimate the number of salmon saved. Tables of when caps would have been reached under each scenario (fleetwide and then separately by sector) are included in Chapter 2, Table 2-38 - Table 2-43. 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 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 that the fleet (or sector) caught from Sept 16 till the end of the season;

Tables indicting the fleet-wide and sector specific amount of salmon saved (in absolute numbers of salmon) were constructed. Corresponding levels of pollock that was foregone under these scenarios is presented in Table 2-44 through Table 2-48 (since these are mainly fishery-related issues) and discussed further in the RIR. The impact of the foregone pollock on the pollock population is discussed in Chapter 4, Section 4.2.3.

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. The AEQ bycatch applies the extensive observer datasets on the length frequencies of Chinook salmon found as bycatch and converting these to ages, appropriately accounting for the time of year that catch occurred. With the available age data, 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 how any given year of bycatch affects future potential spawning runs of salmon. The details of this approach and the data are given in Appendix C.

Evaluating impacts to specific stocks were done by using historical scale-pattern analysis (Myers et al. 1984, Rogers and Myers 1988, Myers et al. 2003), and genetics studies (Templin and Seeb In Prep.) from samples collected in 2005-2007 (further details are provided in Appendix C). 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 space) and accounting for changes in the bycatch when sector-specific caps were reached. To illustrate this effect, tables were constructed that shows how the percentage of bycatch within each of the strata would change.

5.4.2 Summary of hard cap (Alternative 2) impacts

Each CAP alternative (A-B season and sector splits) has a different consequence for anticipated relative regional bycatch locale. For example, if the shore-based fleet receives a relatively lower allocation of Chinook bycatch, then the amount of salmon bycatch anticipated to occur in the SE region 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 5-27).

Results of expanding the bycatch adult equivalents to regions show the degree to which different alternatives might have varied had they been applied historically (2003-2007, Table 5-28). Each of the 36 alternatives presented result in fewer salmon being removed from the system, except in years where bycatch level was already low (e.g., in 2003 when the AEQ was less than 1% higher for the cap option set at 87,500 and A-B split at 58/42 under option 2d; Table 5-28). On average, the different options resulted in AEQ bycatch that was from 88% to 34% of the estimated AEQ mortality that was estimated to have occurred. This implies that if in a particular year the AEQ bycatch mortality had translated to a 4% impact rate (defined as the AEQ mortality divided by the actual number of returning salmon in that year) to a particular river system, then the added management measures would lower that rate to 1.4% - 3.5%.

Breaking the AEQ bycatch to Chinook stock specific impacts for each year is shown in Table 5-29 - Table 5-33. In these tables, the measure is presented as the estimated 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 some years, some management options appear to actually *increase* the AEQ bycatch compared to the baseline estimates in some years. This can occur since the caps because of the cumulative effect of the AEQ application. For example, the Pacific northwest (PNW) stocks show an increased AEQ value from the baseline for several of the options for 2003 (Table 5-29). Note from Table 5-27 that the stratum-specific proportion of bycatch under these options changes from the baseline, and in 2003 result in more allocation of bycatch to the south-east portion during the B-season. Consequently, noting that 45% of the bycatch for this stratum (B SE; Table 5-9) is estimated to return to the PNW region, then management actions that increase the relative proportion of bycatch in this strata (as shown in Table 5-27) will result in an increase mortality attributed to the PNW.

In a high-bycatch year such as 2007 (Table 5-33), some management options also result in higher AEQ salmon mortalities for some systems (e.g., for a number of options for the middle Yukon and Upper Yukon rivers). Given that Chinook from these rivers tend to be found most commonly in the NW during the B season, and that the proportion attributed to that stratum increases from the estimated 8% shown in Table 5-27 to over 44% for some options, the relative stock composition of the AEQ bycatch as a whole can change. These complexities reveal the difficulty in predicting how any management action will affect specific stocks of salmon, particularly since their relative effects appears to vary in different years.

The western Alaska stocks were singled out for closer scrutiny. Since the genetics results are limited in the ability to distinguish among these 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 west Alaska Chinook based on Myers et al.'s (2003) proportions are shown in Table 5-34 - Table 5-36 for each year and river system. To further summarize these tables, we constructed a range of hypothetical reductions in coastal-west Alaska AEQ values (Table 5-37)**.** 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 5-37). Under the most constraining option, the number of AEQ Chinook saved to these rivers would have been over 26,000 in 2006 and over 33,000 in 2007.

5.4.3 Methods for triggered closure impact analysis (Alternative 3)

To evaluate cap trigger dates a database was created which expanded observer data proportionally from within NMFS 3-digit area, month, and sector (and CDQ) to match NMFS regional office statistics as of April 30th 2008. This allowed spatial components to be evaluated while providing facility to work with estimates that add up to the official total estimates maintained by the NMFS RO. The trigger areas considered were different for the A and B seasons hence each observer observation was classified as falling within or outside of these areas as part of the database. The individual haul records were then aggregated up 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 selected for the focus of 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 till the end of the season. 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 15th);
2) Compute the number of pollock that the fleet (or sector) caught from Sept 16th till the end of the season;
3) Compute the average Chinook / t of pollock ***outside of trigger area*** from Sept 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 presented in section 5.4.1. The genetics data and accounting methods were unavailable at the resolution required to evaluate the impact of closing a trigger at different times of the year.

5.4.4 Summary of triggered closure impacts

Table 5-38 and Table 6-13 show the dates over different years that alternative cap and seasonal splits would have invoked a triggered closure area for A and B seasons, respectively. Table 5-39 and Table 5-49 show the expected Chinook bycatch by all vessels combined for management alternatives had the closure been triggered on the dates provided in Table 5-38 and Table 6-13 while the numbers of reported salmon saved are provided in Table 5-40 and Table 5-50. Analogous values for remaining pollock are provided in Chapter 4 and show the amount that was caught after the trigger closure would have been in effect. (also for A and B seasons, combined fleet). The sector specific results are provided in Table 5-41 - Table 5-46 (A season) and in Table 5-52 - Table 5-57 (B season). Note that the numbers in these tables reflect only Chinook bycatch taken by the pollock fleet; the numbers of AEQ would be different.

Table 5-27 Proportions of the bycatch occurring within each stratum under the different management options for 2003-2007. The actual observed proportion of the bycatch in each year is shown in the shaded top row.

	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%
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%

Table 5-28 Hypothetical adult equivalent Chinook salmon bycatch mortality **totals** under each cap and management option, 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	
No Cap	**33,215**	**41,047**	**47,268**	**61,737**	**78,814**	
Cap, AB, sector						Mean % of actual
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%

Table 5-29 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**
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

Table 5-30 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**
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

Table 5-31 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**
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

Table 5-32 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**
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

Table 5-33 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	**16,167**	**39,464**	**1,457**	**657**	**8,725**	**465**	**1,024**	**563**	**1,543**	**70,066**
Cap, AB, sector										
87,500 70/30 opt2d	7,562	3,452	828	-145	1,175	39	542	-140	356	13,670
87,500 70/30 opt2a	7,367	5,452	744	-156	1,704	32	492	-146	413	15,902
87,500 70/30 opt1	8,337	6,902	853	-122	2,004	58	566	-117	479	18,961
87,500 58/42 opt2d	7,318	7,288	665	-199	2,256	15	447	-179	475	18,085
87,500 58/42 opt2a	4,148	4,683	368	-104	1,401	12	248	-93	284	10,947
87,500 58/42 opt1	7,212	8,116	671	-123	2,314	43	452	-113	482	19,054
87,500 50/50 opt2d	5,901	8,741	431	-216	2,656	-10	299	-187	480	18,095
87,500 50/50 opt2a	5,933	7,779	411	-306	2,591	-45	285	-265	470	16,854
87,500 50/50 opt1	7,435	13,756	618	-4	3,508	93	430	-5	636	26,467
68,100 70/30 opt2d	8,649	11,252	889	78	2,710	141	598	57	581	24,954
68,100 70/30 opt2a	8,594	9,315	902	22	2,330	119	602	7	531	22,423
68,100 70/30 opt1	9,036	12,782	932	136	2,984	169	628	107	627	27,401
68,100 58/42 opt2d	6,926	14,499	601	124	3,440	137	420	105	619	26,872
68,100 58/42 opt2a	7,325	12,610	647	21	3,167	102	446	15	594	24,927
68,100 58/42 opt1	8,868	16,603	800	120	3,985	160	553	99	741	31,930
68,100 50/50 opt2d	8,019	17,586	615	34	4,405	115	437	30	762	32,003
68,100 50/50 opt2a	8,848	11,450	603	-481	3,877	-78	419	-417	701	24,922
68,100 50/50 opt1	8,956	18,497	757	111	4,484	158	529	93	802	34,387
48,700 70/30 opt2d	10,979	22,259	1,027	297	5,070	257	710	250	940	41,789
48,700 70/30 opt2a	10,933	17,624	1,031	92	4,302	176	703	71	838	35,769
48,700 70/30 opt1	11,209	21,136	1,092	307	4,766	264	750	256	911	40,691
48,700 58/42 opt2d	11,054	20,869	953	76	5,158	171	661	61	943	39,946
48,700 58/42 opt2a	11,541	22,816	978	98	5,609	186	682	81	1,012	43,001
48,700 58/42 opt1	12,017	23,712	957	-10	6,054	149	671	-11	1,074	44,612
48,700 50/50 opt2d	10,492	21,804	864	94	5,358	171	606	80	951	40,419
48,700 50/50 opt2a	9,503	24,667	723	213	5,847	205	521	187	985	42,851
48,700 50/50 opt1	10,542	24,126	796	71	5,994	162	568	63	1,027	43,350
29,300 70/30 opt2d	13,488	31,737	1,102	284	7,504	284	781	245	1,303	56,728
29,300 70/30 opt2a	13,223	28,756	1,239	454	6,408	348	861	386	1,172	52,846
29,300 70/30 opt1	13,288	30,339	1,175	399	6,921	326	824	341	1,232	54,846
29,300 58/42 opt2d	12,667	31,263	959	198	7,554	239	689	174	1,281	55,025
29,300 58/42 opt2a	12,614	31,301	964	222	7,517	248	692	194	1,276	55,027
29,300 58/42 opt1	13,280	30,614	1,147	362	7,065	312	806	310	1,248	55,142
29,300 50/50 opt2d	12,292	32,345	950	324	7,578	284	684	283	1,278	56,018
29,300 50/50 opt2a	11,671	31,437	865	276	7,443	257	628	243	1,242	54,062
29,300 50/50 opt1	12,747	32,565	1,028	367	7,549	307	734	318	1,290	56,906

Table 5-34 Hypothetical reductions in coastal-west Alaska specific adult equivalent Chinook salmon bycatch from the **Yukon,** 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. The proportional breakouts of west Alaska Chinook is from Myers et al. 2004; median AEQ estimates are shown in the second row.

Yukon	**2003**	**2004**	**2005**	**2006**	**2007**
No Cap	**8,484**	**9,180**	**10,990**	**14,887**	**16,274**
Cap scenario					
87,500 70/30 opt2d	561	-2	1,267	2,107	1,267
87,500 70/30 opt2a	421	691	819	1,861	2,060
87,500 70/30 opt1	468	353	2,017	3,581	2,666
87,500 58/42 opt2d	106	182	448	3,524	2,764
87,500 58/42 opt2a	478	-29	-1	1,223	1,794
87,500 58/42 opt1	498	340	1,244	3,774	3,152
87,500 50/50 opt2d	409	574	373	2,597	3,335
87,500 50/50 opt2a	1,096	555	1,452	2,588	2,884
87,500 50/50 opt1	161	400	837	4,718	5,499
68,100 70/30 opt2d	254	787	1,704	4,388	4,555
68,100 70/30 opt2a	1,128	1,176	2,167	3,012	3,738
68,100 70/30 opt1	211	537	1,910	4,615	5,210
68,100 58/42 opt2d	501	242	1,588	4,454	5,892
68,100 58/42 opt2a	1,422	526	1,229	3,780	5,059
68,100 58/42 opt1	366	640	1,621	5,772	6,729
68,100 50/50 opt2d	1,118	723	1,475	5,415	7,060
68,100 50/50 opt2a	1,073	954	1,614	4,824	4,221
68,100 50/50 opt1	572	184	1,654	5,810	7,480
48,700 70/30 opt2d	1,390	1,032	2,833	7,070	9,122
48,700 70/30 opt2a	1,287	1,522	3,236	6,405	7,115
48,700 70/30 opt1	974	768	2,555	6,638	8,680
48,700 58/42 opt2d	1,466	1,093	2,307	7,247	8,403
48,700 58/42 opt2a	1,921	2,342	2,806	8,068	9,198
48,700 58/42 opt1	1,831	1,345	2,696	7,239	9,476
48,700 50/50 opt2d	1,445	1,489	2,675	7,682	8,791
48,700 50/50 opt2a	1,880	1,892	3,314	8,236	10,027
48,700 50/50 opt1	2,348	1,770	3,034	7,585	9,704
29,300 70/30 opt2d	3,690	3,469	4,989	9,786	12,906
29,300 70/30 opt2a	3,170	3,185	4,796	9,689	11,838
29,300 70/30 opt1	3,794	3,589	5,303	10,034	12,432
29,300 58/42 opt2d	4,046	3,789	5,316	9,782	12,654
29,300 58/42 opt2a	3,892	3,869	5,767	9,424	12,687
29,300 58/42 opt1	4,062	4,245	5,723	10,400	12,514
29,300 50/50 opt2d	4,027	3,989	5,871	10,264	13,181
29,300 50/50 opt2a	4,284	3,938	5,636	9,659	12,782
29,300 50/50 opt1	4,676	4,531	6,309	10,522	13,300

Table 5-35 Hypothetical reductions in coastal-west Alaska specific adult equivalent Chinook salmon bycatch from the **Bristol Bay,** 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. The proportional breakouts of west Alaska Chinook is from Myers et al. 2004; median AEQ estimates are shown in the second row.

Bristol Bay	**2003**	**2004**	**2005**	**2006**	**2007**
No Cap	**7,211**	**7,803**	**9,342**	**12,654**	**13,833**
Cap scenario					
87,500 70/30 opt2d	477	-1	1,077	1,791	1,077
87,500 70/30 opt2a	358	587	696	1,582	1,751
87,500 70/30 opt1	398	300	1,714	3,044	2,266
87,500 58/42 opt2d	90	155	381	2,996	2,349
87,500 58/42 opt2a	406	-24	-1	1,039	1,525
87,500 58/42 opt1	424	289	1,057	3,207	2,679
87,500 50/50 opt2d	348	488	317	2,207	2,835
87,500 50/50 opt2a	932	472	1,235	2,200	2,451
87,500 50/50 opt1	136	340	712	4,011	4,674
68,100 70/30 opt2d	216	669	1,448	3,730	3,872
68,100 70/30 opt2a	959	999	1,842	2,561	3,177
68,100 70/30 opt1	180	456	1,624	3,923	4,429
68,100 58/42 opt2d	426	205	1,350	3,786	5,008
68,100 58/42 opt2a	1,209	447	1,045	3,213	4,300
68,100 58/42 opt1	311	544	1,378	4,906	5,720
68,100 50/50 opt2d	950	615	1,254	4,603	6,001
68,100 50/50 opt2a	912	811	1,372	4,101	3,588
68,100 50/50 opt1	487	156	1,406	4,938	6,358
48,700 70/30 opt2d	1,182	877	2,408	6,009	7,754
48,700 70/30 opt2a	1,094	1,294	2,750	5,444	6,047
48,700 70/30 opt1	828	653	2,172	5,642	7,378
48,700 58/42 opt2d	1,246	929	1,961	6,160	7,142
48,700 58/42 opt2a	1,633	1,991	2,385	6,858	7,818
48,700 58/42 opt1	1,557	1,144	2,292	6,153	8,055
48,700 50/50 opt2d	1,228	1,266	2,274	6,530	7,472
48,700 50/50 opt2a	1,598	1,608	2,817	7,000	8,523
48,700 50/50 opt1	1,996	1,504	2,579	6,447	8,249
29,300 70/30 opt2d	3,137	2,948	4,241	8,318	10,970
29,300 70/30 opt2a	2,695	2,708	4,077	8,235	10,063
29,300 70/30 opt1	3,225	3,051	4,507	8,529	10,567
29,300 58/42 opt2d	3,439	3,221	4,518	8,314	10,756
29,300 58/42 opt2a	3,308	3,289	4,902	8,010	10,784
29,300 58/42 opt1	3,452	3,608	4,865	8,840	10,637
29,300 50/50 opt2d	3,423	3,391	4,990	8,724	11,204
29,300 50/50 opt2a	3,641	3,347	4,791	8,210	10,865
29,300 50/50 opt1	3,975	3,851	5,363	8,944	11,305

Table 5-36 Hypothetical reductions in coastal-west Alaska specific adult equivalent Chinook salmon bycatch from the **Kuskokwim,** 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. The proportional breakouts of west Alaska Chinook is from Myers et al. 2004; median AEQ estimates are shown in the second row.

Kuskokwim	**2003**	**2004**	**2005**	**2006**	**2007**
No Cap	**5,514**	**5,967**	**7,144**	**9,677**	**10,578**
Cap scenario					
87,500 70/30 opt2d	365	-1	824	1,369	823
87,500 70/30 opt2a	274	449	532	1,210	1,339
87,500 70/30 opt1	304	229	1,311	2,328	1,733
87,500 58/42 opt2d	69	118	291	2,291	1,797
87,500 58/42 opt2a	310	-19	-1	795	1,166
87,500 58/42 opt1	324	221	808	2,453	2,049
87,500 50/50 opt2d	266	373	243	1,688	2,168
87,500 50/50 opt2a	712	361	944	1,682	1,874
87,500 50/50 opt1	104	260	544	3,067	3,574
68,100 70/30 opt2d	165	512	1,108	2,852	2,961
68,100 70/30 opt2a	733	764	1,409	1,958	2,430
68,100 70/30 opt1	137	349	1,242	3,000	3,387
68,100 58/42 opt2d	326	157	1,032	2,895	3,829
68,100 58/42 opt2a	925	342	799	2,457	3,288
68,100 58/42 opt1	238	416	1,054	3,751	4,374
68,100 50/50 opt2d	727	470	959	3,520	4,589
68,100 50/50 opt2a	698	620	1,049	3,136	2,744
68,100 50/50 opt1	372	119	1,075	3,776	4,862
48,700 70/30 opt2d	904	671	1,841	4,595	5,929
48,700 70/30 opt2a	837	989	2,103	4,163	4,624
48,700 70/30 opt1	633	499	1,661	4,314	5,642
48,700 58/42 opt2d	953	710	1,499	4,710	5,462
48,700 58/42 opt2a	1,249	1,522	1,824	5,244	5,979
48,700 58/42 opt1	1,190	875	1,753	4,705	6,160
48,700 50/50 opt2d	939	968	1,739	4,994	5,714
48,700 50/50 opt2a	1,222	1,230	2,154	5,353	6,517
48,700 50/50 opt1	1,526	1,150	1,972	4,930	6,308
29,300 70/30 opt2d	2,399	2,255	3,243	6,361	8,389
29,300 70/30 opt2a	2,061	2,071	3,117	6,298	7,695
29,300 70/30 opt1	2,466	2,333	3,447	6,522	8,080
29,300 58/42 opt2d	2,630	2,463	3,455	6,358	8,225
29,300 58/42 opt2a	2,530	2,515	3,749	6,126	8,246
29,300 58/42 opt1	2,640	2,759	3,720	6,760	8,134
29,300 50/50 opt2d	2,617	2,593	3,816	6,672	8,568
29,300 50/50 opt2a	2,784	2,560	3,664	6,279	8,308
29,300 50/50 opt1	3,040	2,945	4,101	6,839	8,645

Table 5-37 Range of hypothetical reductions in west Alaska specific adult equivalent Chinook salmon bycatch**.** These are based on median AEQ values applied to mean proportional assignments to regions within each stratum (A-season, and NW and SE B seasons) based on genetics data collected from 2005–2007. The proportional breakouts of west Alaska Chinook is from Myers et al. 2004 and is shown on the second row. Bottom 5 shaded lines represent the AEQ mortality that is estimated to have occurred.

	Year	Coastal WAK	Yukon 40%	Bristol Bay 34%	Kuskokwim 26%
Min	2003	265	106	90	69
	2004	-72	-29	-24	-19
	2005	-3	-1	-1	-1
	2006	3,056	1,223	1,039	795
	2007	3,167	1,267	1,077	823
Max	2003	11,691	4,676	3,975	3,040
	2004	11,328	4,531	3,851	2,945
	2005	15,773	6,309	5,363	4,101
	2006	26,305	10,522	8,944	6,839
	2007	33,250	13,300	11,305	8,645
	Actual AEQ Chinook bycatch estimate (median)				
	2003	33,215	13,286	11,293	8,636
	2004	41,047	16,419	13,956	10,672
	2005	47,268	18,907	16,071	12,290
	2006	61,737	24,695	20,991	16,052
	2007	78,814	31,525	26,797	20,492

Table 5-38 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 5-39 Expected Chinook catch by **all vessels** if A-season trigger-closure was invoked on the dates provided in Table 67.

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 5-40 Expected Chinook *saved* by **all vessels** if A-season trigger-closure was invoked on the dates provided in Table 67.

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 5-41 Expected Chinook catch by **at-sea processors** if A-season trigger-closure was invoked on the dates provided in Table 67.

Chinook catch Cap scenario		CAP	**2003**	**2004**	**2005**	**2006**	**2007**
			At-sea processors, A season				
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 5-42 Expected Chinook *saved* by **at-sea processors** if A-season trigger-closure was invoked on the dates provided in Table 67.

Chinook Salmon saved Cap scenario		**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
				Sector P, A season			
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 5-43 Expected Chinook catch by **shore-based catcher vessels** if A-season trigger-closure was invoked on the dates provided in Table 67.

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 5-44 Expected Chinook *saved* by **shore-based catcher vessels** if A-season trigger-closure was invoked on the dates provided in Table 67.

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 5-45 Expected Chinook catch by **mothership operations** if A-season trigger-closure was invoked on the dates provided in Table 67.

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 5-46 Expected Chinook *saved* by **mothership operations** if A-season trigger-closure was invoked on the dates provided in Table 67.

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 5-47 Remaining pollock catch estimated from **mothership operations** at the time A-season trigger-closures were invoked on the dates provided in Table 67.

Pollock Cap scenario		CAP	Mothership operations, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250					8,566
	1-2: 58/42	50,750				4,425	21,811
	1-3: 55/45	48,125				8,149	23,280
	1-4: 50/50	43,750				15,074	24,711
68,100	1-1: 70/30	47,670				8,906	23,280
	1-2: 58/42	39,498				19,132	29,234
	1-3: 55/45	37,455				20,506	29,952
	1-4: 50/50	34,050				23,460	31,071
48,700	1-1: 70/30	34,090				23,460	31,071
	1-2: 58/42	28,246	7,416			29,722	33,893
	1-3: 55/45	26,785	8,263		815	29,722	34,800
	1-4: 50/50	24,350	11,161		9,346	32,553	36,592
29,300	1-1: 70/30	20,510	21,057	3,391	15,615	36,336	40,955
	1-2: 58/42	16,994	23,311	7,723	24,724	36,411	44,201
	1-3: 55/45	16,115	23,827	8,516	26,715	36,411	44,201
	1-4: 50/50	14,650	24,295	12,770	27,587	36,411	44,201

Table 5-48 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 5-49 Expected Chinook catch by **all vessels** if B-season trigger-closure was invoked on the dates provided in Table 72.

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 5-50 Expected Chinook *saved* by **all vessels** if B-season trigger-closure was invoked on the dates provided in Table 72.

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 5-51 Remaining pollock catch estimated from **all vessels** at the time B-season trigger-closures were invoked on the dates provided in Table 72.

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 5-52 Expected Chinook catch by **at-sea processors** if B-season trigger-closure was invoked on the dates provided in Table 72.

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 5-53 Expected Chinook *saved* by **at-sea processors** if B-season trigger-closure was invoked on the dates provided in Table 72.

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 5-54 Expected Chinook catch by **shorebased catcher vessels** if B-season trigger-closure was invoked on the dates provided in Table 72.

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 5-55 Expected Chinook *saved* by **shorebased catcher vessels** if B-season trigger-closure was invoked on the dates provided in Table 72.

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 5-56 Expected Chinook catch by **mothership operations** if B-season trigger-closure was invoked on the dates provided in Table 72.

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 5-57 Expected Chinook *saved* by **mothership operations** if B-season trigger-closure was invoked on the dates provided in Table 72.

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

5.5 Reasonably foreseeable 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 discussed in the previous sections, and incorporated into the impacts discussion above. Section 3.2 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 Council is considering action on salmon bycatch measures for chum salmon. A suite of alternative management measures was proposed in April 2008, and that analysis will be brought back to the Council in October 2008. 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.

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* (Walbaum)), and pink salmon (*Oncorhynchus gorbuscha*). As chum salmon represent over 95% of 'other salmon' caught as bycatch in the groundfish fisheries, this section will focus on chum salmon.

6.1 Overview of Chum salmon biology and distribution

The overview information in this section is extracted from Bukliss (1994). Other information on Chum salmon may be found at the Alaska Department of Fish and Game (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 fishers 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

Western Alaskan salmon runs experienced dramatic declines from 1997 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 BASIS evaluations have examined the food habits from Pacific salmon in the Bering 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 that there was diet overlap between sockeye and chum salmon in the Aleutian Islands when both species consumed macro-zooplanton but this was reduced when chum salmon consumed mostly gelatinous zooplankton (Davis et al. 2004). 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).

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).

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., 20904). 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 there was diet overlap between sockeye and chum salmon in the Aleutian Islands when both species consumed macro-zooplanton but this was reduced when chum salmon consumed mostly gelatinous zooplankton (Davis et al. 2004). This study also found that there was diet overlap 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.

6.1.2 Hatchery releases

Commercial salmon fisheries exist around the Pacific Rim with most countries releasing salmon fry in varying amounts by species. The North Pacific Anadromous Fish Commission summarizes information on hatchery releases by country and by area where available. Reports submitted to the NPAFC were used to summarize hatchery information by Country and by US state below (Table 6-1, Table 6-2). For more information see the following: Russia (Anon., 2007; TINRO-centre 2006; 2005); Canada(Cook and Irvine, 2007); USA (Josephson, 2007; Eggers, 2006; 2005; Bartlett, 2007; 2006; 2005); Korea (SRT 2005, 2006). Chum salmon hatchery releases by country are shown below in Table 6-1.

For Chum salmon, Japanese hatchery releases far exceed releases by any other Pacific Rim country. This is followed by the US and Russia. A further break-out of hatchery releases by area in the US show that the majority of chum salmon fry releases occur in the Alaska region (Table 6-2).

Combined Asian hatchery releases in 2006 (Russia, Japan, Korea) account for 76% of the total releases while Alaskan chum releases account for 24% of the total releases. Chum enhancement projects in Alaska are not active in the AYK region.

Table 6-1 Hatchery releases of juvenile chum salmon in millions of fish

Year	Russia	Japan	Korea	Canada	US	Total
1999	278.7	1867.9	21.5	172.0	520.8	2,860.9
2000	326.1	1817.4	19.0	124.1	546.5	2,833.1
2001	316.0	1831.2	5.3	75.8	493.8	2,722.1
2002	306.8	1851.6	10.5	155.3	507.2	2,831.4
2003	363.2	1840.6	14.7	136.7	496.3	2,851.5
2004	363.1	1817.0	12.9	105.2	630.2	2,928.4
2005	387.3	1844.0	10.9	131.8	596.9	2,970.9
2006	344.3	1858.0	7.3	107.1	578.8	2,895.5
2007	*	*	13.8	*	*	

*2007 data not yet available

Table 6-2 US west coast hatchery releases of juvenile chum salmon in millions of fish

Year	Alaska	Washington	Oregon	California	Idaho	Combined WA/OR/CA/ID	Total
1999	460.9	59.9	0	0	0		520.8
2000	507.7	38.8	0	0	0		546.5
2001	465.4	28.4	0	0	0		493.8
2002	450.8	56.4	0	0	0		507.2
2003	435.6	60.7	0	0	0		496.3
2004	578.5					51.7	630.2
2005	549.0					47.9	596.9
2006	541.2					37.6	578.8

6.1.3 BASIS surveys

The Bering-Aleutian Salmon International Survey (BASIS) is an NPAFC-coordinated program of pelagic ecosystem research on salmon and forage fish in the Bering Sea. 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 (YRJTC 2008).

The primary findings from the past 5 years (2002–2006) indict that there were 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 CPUE of juvenile salmon fell sharply during 2006 in the southeast Bering Sea region. It is speculated that spring sea surface temperatures (SSTs) 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.

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. (YRJTC 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 th. t (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. 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(.YRJTC 2008). Auke Bay Laboratories are currently conducting genetic stock identification on these samples to determine river of origin.

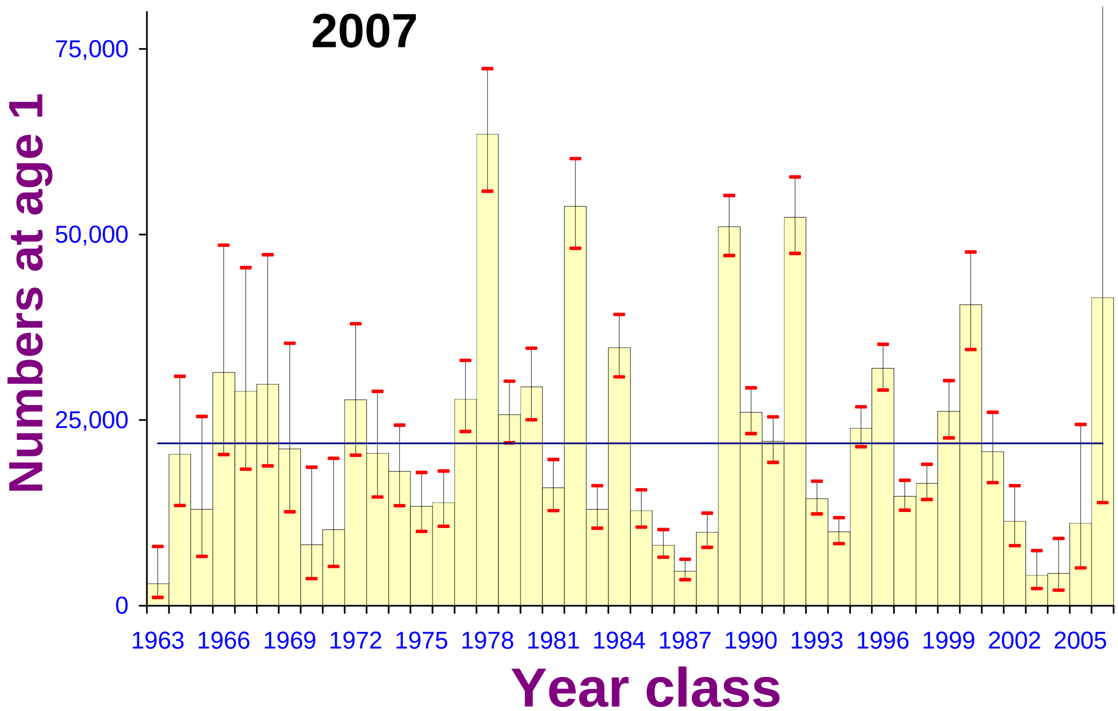


Fig. 4-3 shows the relative abundance of juvenile salmon in the Northern Shelf Region of the Bering Sea as determined by the U. S. BASIS cruises from 2002 to 2007. The very low numbers of chum juveniles in 2004 may explain the relatively low chum salmon bycatch in the BSAI groundfish fishery in 2007. The numbers of juvenile chum salmon appear to be rebounding in 2006 and 2007. (YRJTC 2008).

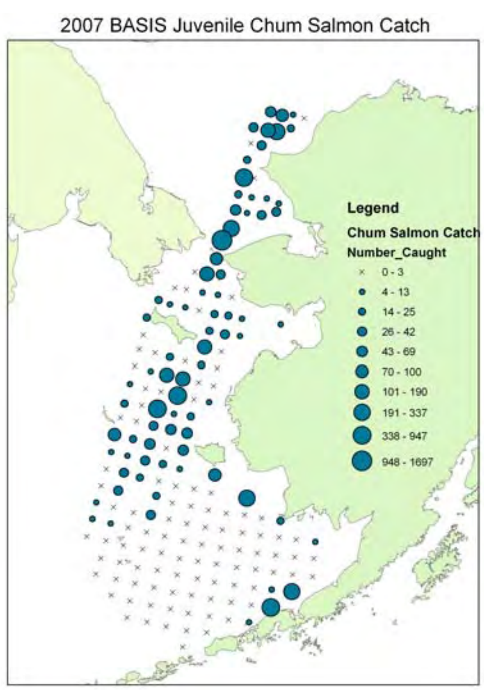


Fig. 6-1 U.S. BASIS juvenile Chum salmon catches in 2007

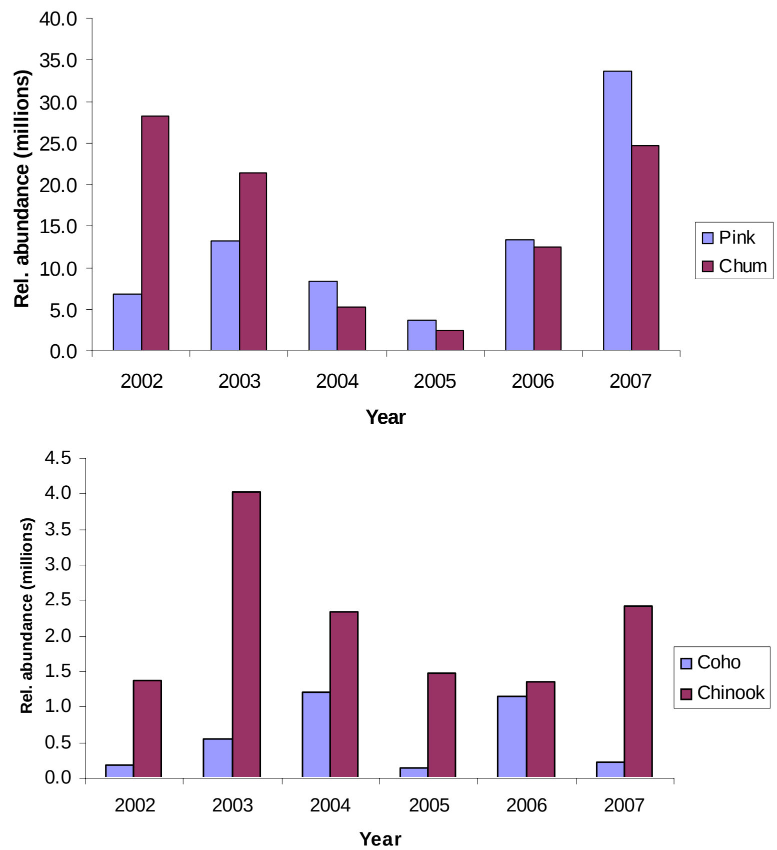


Fig. 6-2 Relative abundance of juvenile salmon in the Northern Shelf Region (60°N-64°N latitude) of the U.S. BASIS survey

6.1.4 Migration corridors

BASIS surveys have established that the distribution and migration pathways of western Alaska juvenile salmon varies by species. Fig. 6-3 and the following information are taken from Farley et al (2006). 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.

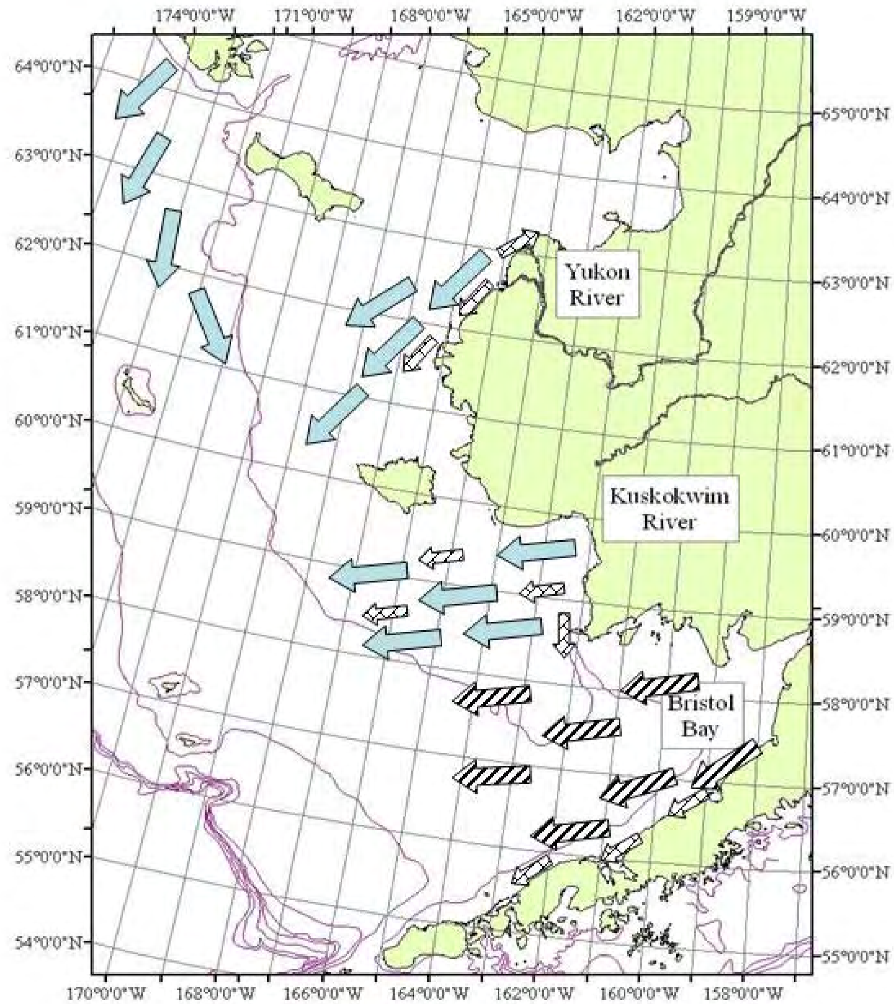


Fig. 6-3 Seaward migration pathways for juvenile chum (solid arrow), sockeye (slashed line arrow), coho, and Chinook (boxed line arrow) salmon along the eastern Bering Sea shelf, August through October. Source: Farley et al. 2006

6.2 Historical Bycatch in Groundfish Fisheries

6.2.1 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 6-3).

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 6-4.

Total catch of non-Chinook salmon in the pollock fishery reached an historic high in 2005 at 705,963 fish (Table 6-4; 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 (ADF&G 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 6-3 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

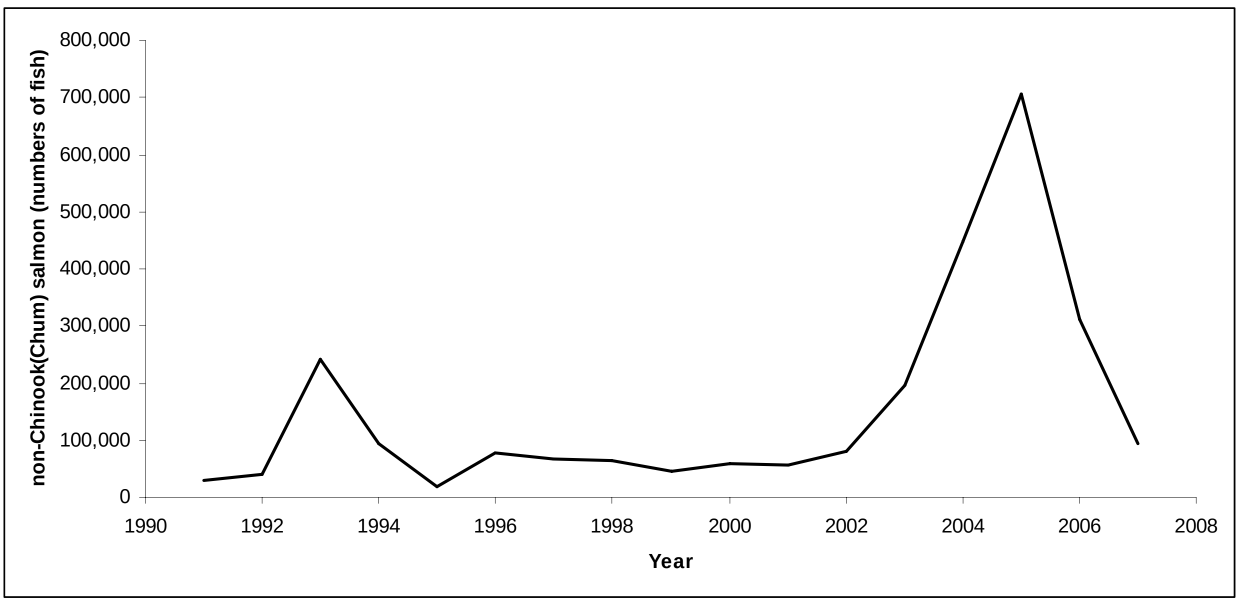


Fig. 6-4 Non-Chinook salmon bycatch in the EBS pollock trawl fishery 1991-2007. Note 1991-1993 values do not include CDQ

Table 6-4 Non-Chinook salmon catch (numbers of fish) in the BSAI pollock trawl fishery (all sectors) 1991-2008, CDQ is indicated separately and by season where available. Data retrieval from 4/30/2008. ‘na’ indicates that data were not available in that year

Year	Annual with CDQ	Annual without CDQ	Annual CDQ only	A season	B season	A season	B season	A season	B season
				With CDQ		Without CDQ		CDQ only	
1991	Na	28,951	na	na	na	2,850	26,101	na	na
1992	na	40,274	na	na	na	1,951	38,324	na	na
1993	na	242,191	na	na	na	1,594	240,597	na	na
1994	92,672	81,508	11,165	3,991	88,681	3,682	77,825	309	10,856
1995	19,264	18,678	585	1,708	17,556	1,578	17,100	130	456
1996	77,236	74,977	2,259	222	77,014	177	74,800	45	2,214
1997	65,988	61,759	4,229	2,083	63,904	1,991	59,767	92	4,137
1998	64,042	63,127	915	4,002	60,040	3,914	59,213	88	827
1999	45,172	44,610	562	362	44,810	349	44,261	13	549
2000	58,571	56,867	1,704	213	58,358	148	56,719	65	1,639
2001	57,007	53,904	3,103	2,386	54,621	2,213	51,691	173	2,930
2002	80,652	77,178	3,474	1,377	79,274	1,356	75,821	21	3,453
2003	195,135	186,779	8,356	3,946	191,189	3,709	183,070	237	8,119
2004	447,626	437,429	10,197	438	447,187	409	437,019	29	10,168
2005	705,963	698,270	7,693	599	705,364	567	697,703	32	7,661
2006	310,545	309,343	1,202	2,525	308,020	2,460	306,883	65	1,137
2007	94,072	87,592	6,480	8,546	85,526	7,390	80,202	1,156	5,324
2008	253	253	0	0	na	253	na	0	na

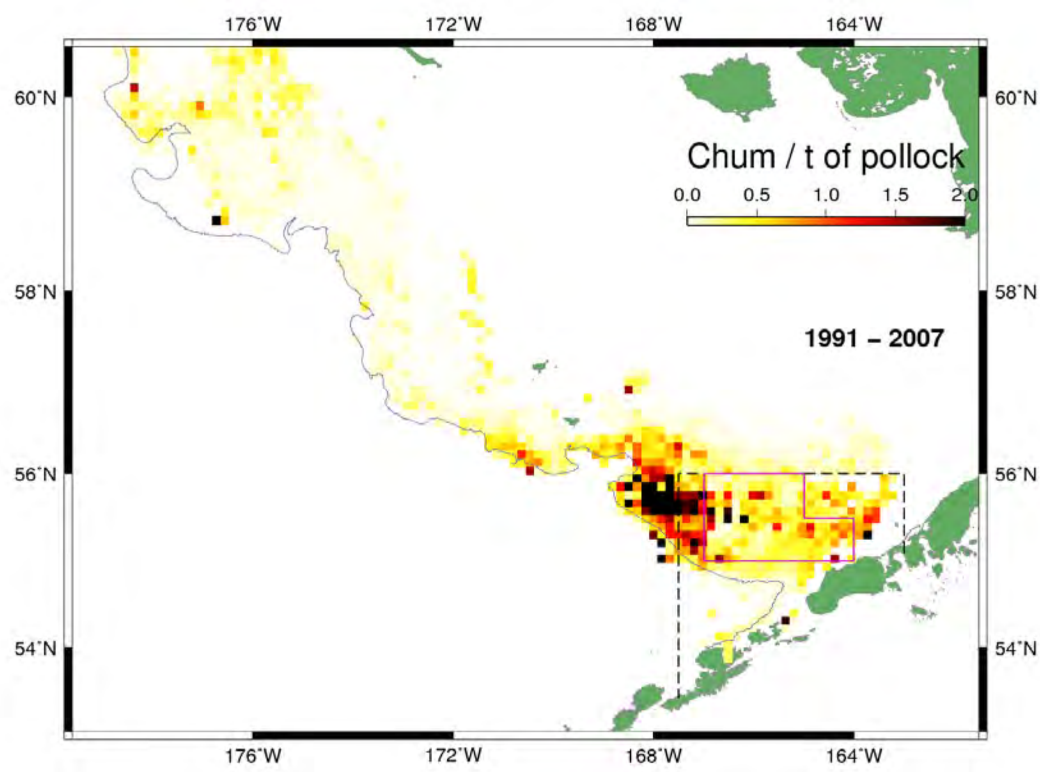


Fig. 6-5 Historical chum B-season bycatch rates 1991-2007. Note the Chum Salmon Savings Area closure (solid line) and the Catcher Vessel Operational Area (dotted line)

6.2.2 Bycatch stock of origin overview

A study conducted by the National Marine Fisheries Service evaluated bycatch samples of chum salmon from the 1994-1995 pollock trawl fishery in the Eastern Bering Sea and employed genetic stock identification (GSI) methodology to evaluate the stock composition of these bycaught fish (Wilmot et al., 1998). Results from this study indicated that in 1994 between 39-55% of samples were of Asian origin, 20-35% were western Alaskan stocks, and 21-29% were from the combined Southeasten Alaska, British Columbia and Washington stocks. (Wilmot et al., 1998). The 1995 samples indicated a range of 13-51% Asian, 33-53% western Alaska, and 9-46% Southeastern Alaska, British Columbia or Washington stocks (Wilmot et al., 1998). Estimates for immature versus maturing fish differed with both years indicating that maturing fish indicating a higher contribution from BC than the contribution from the immature fish (Wilmot et al., 1998). Differences in relative stock composition also varied temporally throughout the B season and by region (Wilmot et al. 1998). Additional work is currently underway at the 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 (GSI) 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.

6.3 Salmon assessment overview by river system or region

6.3.1 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.

6.3.2 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 6-5 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.

Department 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 the department 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 6-5 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 [a]	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.).

6.3.3 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.

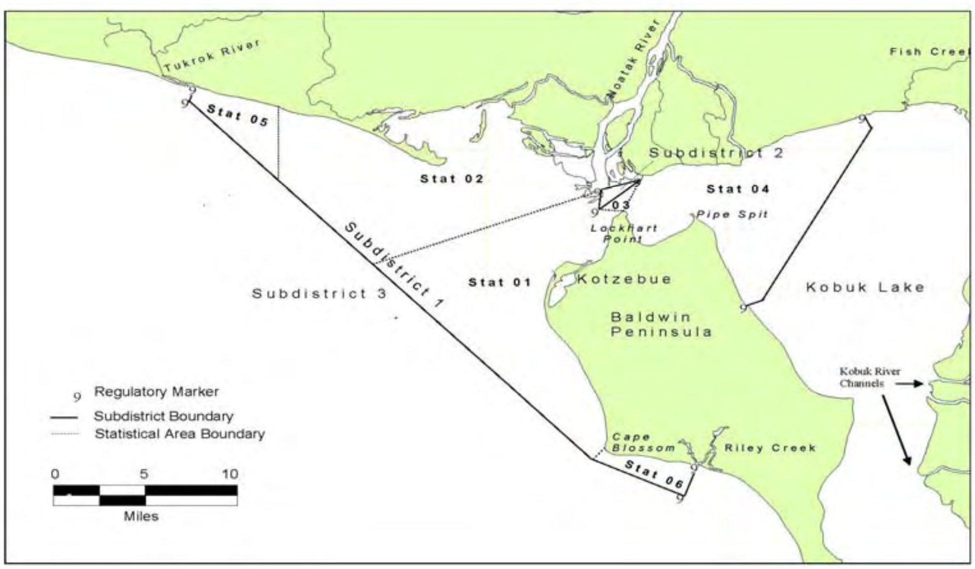


Fig. 6-6 Kotzebue Fishery Management Area

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 fishers 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).

6.3.4 Yukon River Chum

As with Chinook salmon management along the Yukon(see section 5.1), 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.

6.3.4.1 Stock assessment and historical run estimates

Yukon River chum salmon consists of an earlier and typically more abundant summer run and a later fall salmon run. Yukon chum salmon are harvested in commercial, subsistence and personal use fisheries.

The following information on assessment and stock status of Yukon River summer and fall chum stocks is excerpted from the Joint Technical Committee of the Yukon River US/Canada Panel Report (JTC 2008).

Yukon Summer Chum:

The strength of the summer chum salmon runs in 2008 will be dependent on production from the 2004 (age-4 fish) and 2003 (age-5-fish) escapements as these age classes generally dominate the run. The total run during 2002 and 2003 was approximately 1.2 million summer chum salmon in each year, though tributary escapements were highly variable. It appears that production has shifted from major spawning tributaries in the lower portion of the drainage, such as the Andreafsky and Anvik rivers over the last 5 years, to higher production in spawning tributaries upstream.

In 2007, the return from the 2003 brood year produced a higher than average percentage of age-4 fish. Since summer chum salmon exhibit a strong sibling relationship from age-4 fish to age-5 fish, an above average percentage of age-5 fish is expected in 2008. The 2008 run is estimated using the Anvik River brood table, sibling relationships between age-4 and age-5 fish, and the 5-year average ratio between the Anvik River and Pilot Station Sonar. It is expected that approximately 600,000 summer chum salmon will return to the Anvik River in 2008 and the total run in the Yukon River could be approximately 2.0–2.5 million summer chum salmon which constitutes an average run.

The 2008 run is anticipated to be near average and provide for escapements and support a normal subsistence and commercial harvest. Summer chum salmon runs have exhibited steady improvements since 2001 with a harvestable surplus in each of the last 5 years (2003–2007). If inseason indicators of run strength suggest sufficient abundance exists to allow for a commercial fishery, the commercial harvest surplus in Alaska could range from 500,000 to 900,000 summer chum salmon. The actual commercial harvest of summer chum salmon in 2008 will likely be dependent on market conditions and may be affected by a potentially poor Chinook salmon run, as Chinook salmon are incidentally harvested in chum salmon-directed fisheries.

Yukon Fall chum

Yukon River drainage-wide estimated escapements of fall chum salmon for the period 1974 through 2002 have ranged from approximately 180,000 (1982) to 1,500,000 (1975), based on expansion of escapement assessments for selected stocks to approximate overall abundance (Eggers 2001). Escapements in these years resulted in subsequent returns that ranged in size from approximately 311,000 (1996 production) to 3,000,000 (2001 production) fish, using the same approach to approximating overall escapement. Corresponding return per spawner rates ranged from 0.3 to 9.0, averaging 2.1 for all years combined (1974–2001).

A considerable amount of uncertainty has been associated with these run projections particularly recently because of unexpected run failures (1997 to 2002) followed by a strong improvement in productivity from 2003 through 2006. Weakness in salmon runs prior to 2003 has generally been attributed to reduced productivity in the marine environment and not as a result of low levels of parental escapement. Similarly, the recent improvements in productivity may be attributed to the marine environment. Projections have been presented as ranges since 1999 to allow for adjustments based on more recent trends in production. Historical ranges included the normal point projection as the upper end and the lower end was determined by reducing the projection by the average ratio of observed to predicted returns from 1998 to each consecutive current year through 2004. In 2005, the average ratio of the years 2001 to 2004 was used, in attempts to capture some of the observed improvement in the run.

Table 6-6 Preseason Upper Yukon River Chum salmon outlooks and observed run sizes for the 2000–2007 period

Year	Expected Run Size (Preseason)	Observed Run Size (Post season)	Proportion of Expected Run
2000	127,800	52,800	0.41
2001	126,600	86,700	0.68
2002	114,700	81,500	0.72
2003	116,900	150,000	1.28
2004	123,500	119,700	0.97
2005	121,700	124,200	1.02
2006	115,900	119,800	1.03
2007	118,500	82,900	0.70
	Average (1998 to 2007)		0.85

Yukon River fall chum salmon return primarily as age-4 and age-5 fish, although age-3 and age-6 fish also contribute to the run (JTC, 2008). The 2008 run will be comprised of parent years 2002 to 2005 (Table 6-6). 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 6-7 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 6-8 Projected return of fall chum salmon based on parent year escapement for each brood year and predicted return per spawner (R/S) rates, Yukon River, 2002–2005

Brood Year	Escapement	Estimated production (R/S)	Estimated Production	Contribution based on age	Current Return
2002	397,977	1.71	533,289	1.0%	10,083
2003	695,363	1.83	1,140,395	32.9%	346,163
2004	537,873	2.01	925,142	64.3%	675,059
2005	2,035,183	0.52	1,058,295	1.8%	19,345
Total expected run (unadjusted)					1,050,649
Total expressed as a range based on the forecasted vs. observed returns from 1987 to 2007 (80% CI):					890,000 to 1.2 million

The 2001 brood year produced exceptionally well with a return of approximately 3.0 million fish including record contributions in nearly all age classes. Return of age-4 fish from even-numbered brood years during the time period 1974 to 2001 typically average 385,000 chum salmon, and ranges from a low of 175,000 for brood year 1988 to a high of 2.2 million for brood year 2001. Based on the high production years from 1974 to 1983, the return of even-numbered brood years averages 436,000 chum salmon. Return of age-5 fish from even-numbered brood years during the time period 1974 to 2001 typically averages 187,000 chum salmon, and ranges from a low of 57,000 for brood year 1998 to a high of 675,000 for brood year 2001. The estimated 2002 brood year return appears to be above average for an even-numbered year and the 2003 brood year is on track to contribute an average return for an odd-numbered year.

If the 2008 run size is near the projected range of 890,000 to 1,200,000 million, it will be well above the upper end of the BEG range of 600,000 fall chum salmon. A run of this projected size should support normal subsistence fishing activities and provide opportunity for commercial ventures where markets exist. The strength of the run will be monitored inseason to determine appropriate management actions and levels of harvest based on stipulations in the Alaska *Yukon River Drainage Fall Chum Salmon Management Plan*.

Canadian-Origin Upper Yukon River Fall Chum Salmon

The outlook for the 2008 Upper Yukon River fall chum salmon run is an above average run of 229,000 fish. The average Upper Yukon River fall chum salmon run size for the 1998–2007 period was estimated to be 181,000 fish.

The 2008 Upper Yukon River fall chum salmon outlook was developed using the potential production from the 2002–2005 brood years which will produce the 3 to 6 year old fish returning in 2008. For even-year returns, on average, 51% of Upper Yukon River adult fall chum salmon return as age-4 and 47% return as age-5. The major portion of the 2008 fall chum salmon run will originate from the 2003 and 2004 brood years. The estimated escapements for these years were 142,683 and 154,080 fish, respectively, based on the Fisheries and Oceans Canada (DFO) mark–recapture program[7]; both years exceeded the escapement goal for rebuilt Upper Yukon River fall chum salmon of >80,000 fish (REF). 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

[7] Unlike Chinook salmon, the mark-recapture estimates for fall chum salmon generally agree with the Eagle sonar estimates.

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% [8] 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 X}.

Table 6-9 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 1990's 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

[8] 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.

Fishing Branch River escapement goal range of 50,000 to 120,000 fall chum salmon established under the Yukon River Salmon Agreement (Appendix Table A17). 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[9], 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 6-10).

Table 6-10 Preseason outlook for the 2008 Fishing Branch River fall chum salmon run developed using brood year escapement data, a return per spawner value of 2.5 and an average age composition

Brood Year	Escapement	Estimated Production @ 2.5 (R/S)	Contribution based on age	Expected 2007 Run
2003	29,519	73,798	47.1%	34,738
2004	20,274	50,685	49.8%	25,250
		Sub-total		59,988
	Total expected run (expanded for other age classes and rounded)			62,000

The 2008 outlook is the estimated number of fish entering the mouth of the Yukon River and this number will be decreased by U.S. and Canadian fisheries prior to the fish being counted at the Fishing Branch River weir. It has been difficult to accurately estimate the U.S. harvest rate (and catch) of Porcupine stocks, although DNA analyses may improve this situation in the near future. Nevertheless, the 2008 Fishing Branch River fall chum salmon run may be sufficiently strong to exceed the 1997–2006 average weir escapement of 29,577 fall chum salmon.

As was observed with the Upper Yukon River fall chum salmon stocks, the postseason estimates of the estimated Porcupine River fall chum salmon run sizes were consistently below preseason outlooks throughout the period 1998 to 2002 (Table 6-9). 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.

[9] 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.

Table 6-11 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

6.3.5 Kuskokwim River

The Kuskokwim management area includes the Kuskokwim River drainage, all waters of Alaska that flow into the Bering Sea between Cape Newenham and the Naskonat Peninsula, as well as Nelson, Nunivak, and St Matthew Islands. The management area is divided into 5 districts. District 1, the lower Kuskokwim District, is located in the lower 125 miles of the Kuskokwim River from Eek Island upstream to Bogus Creek. District 2 is about 50 miles in length and is located in the middle Kuskokwim River from above District 1 to the Kolmokov River near Aniak. An upper Kuskokwim River fishing district, District 3, was defined at Statehood, but has been closed to commercial fishing since 1966. Salmon returning to spawn in the Kuskokwim River are targeted by commercial fishermen in District 1 and 2. District 4, the Quinhagak fishing district, is a marine fishing area that encompasses about 5 miles of shoreline adjacent to the village of Quinhagak. The Kanektok and Arolik Rivers are the primary salmon spawning streams that enter District 4. District 5, the Goodnews Bay fishing district, a second marine fishing area, was established in 1968. District 5 encompasses the marine water within Goodnews Bay and the Goodnews River is the major salmon spawning stream that enters District 5 (Clark et al 2006). Mainland streams north of the Kuskokwim River and streams of Nelson, Nunivak, and St Matthew Islands are not typically surveyed for salmon.

Management of Kuskokwim area salmon fisheries is complex. Annual run sizes and timing is often uncertain when decisions must be made, mixed stocks are often harvested several weeks and hundreds of miles from their spawning grounds, allocative issues divide downriver and upriver users as well as subsistence, commercial, and sport users, and the Kuskokwim area itself is immense. In 1988, the Board of Fisheries 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 Board of Fisheries 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.

6.3.5.1 Methodology and historical run estimates

Inseason management of the various Kuskokwim area salmon fisheries is based on salmon run abundance and timing factors, including data obtained through the Bethel test fishery, subsistence harvest reports, tributary escapement monitoring projects, and when available, commercial catch per unit effort data. Inseason run timing models are used to predict subsequent escapement levels using historic run information (Clark et al 2006).

Kuskokwim River chum salmon are an important subsistence species as well as the primary commercially targeted salmon species on the Kuskokwim River in June and July. Kuskowim River chum salmon were designated a stock of concern under yield concern in September 2000 and this designation was continued in September 2003. Since 2000 however chum salmon runs on the Kuskokwim have been improving and in January 2007, the Board of Fisheries discontinued this designation. Escapement is evaluated through enumeration at weirs on six tributary streams, sonar on the Aniak River and in recent years by a mainstream mark and recapture project near the Upper Kalskag River. Escapement information review indicates that chum salmon escapement was below average from 1999-2000. However since 2001 escapement has been average or better (Bergstrom and Whitmore 2004). Declining salmon markets for chum have increased the difficulty of evaluating the abundance of chum salmon in the Kuskokwim (Bergstrom and Whitmore, 2004). While a harvestable surplus was identified in 2002 and 2003, no market existed for the fishery.

Historic run reconstruction for 1976-2000 was evaluated by Shotwell and Adkison (2004). More recent run reconstruction work is currently underway for the Kuskokwim. Preliminary results are shown in Fig. 6-7 (Bue, in prep). These indicate that while the stock was increasing since 2003 and in general since a low in 2000, recent years appear to be declining (Fig. 6-7).

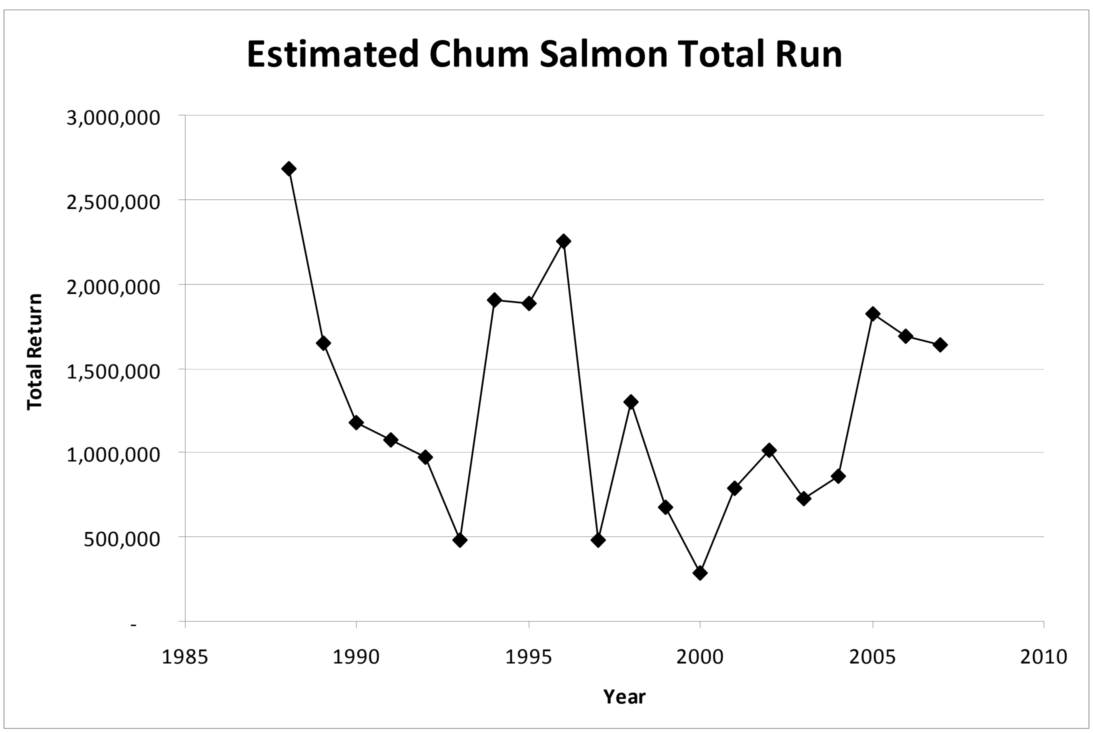


Fig. 6-7 Preliminary run reconstruction for Kuskokwim chum salmon (B. Bue preliminary data, in prep)

6.3.5.2 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.

6.3.6 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. 6-8). Salmon management in Bristol Bay is primarily directed at the commercially harvested sockeye salmon which are found throughout the Bay.

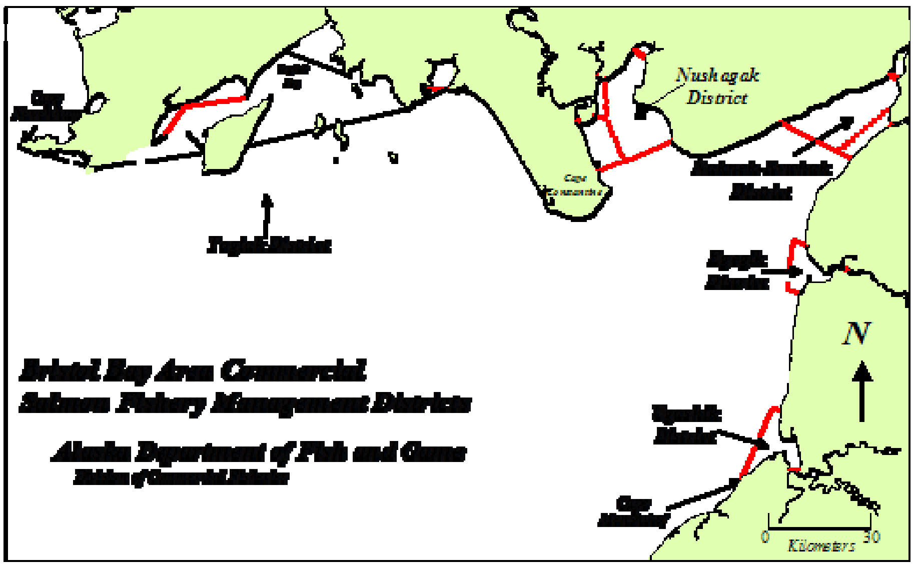


Fig. 6-8 Bristol Bay area commercial salmon fishery management districts

6.3.6.1 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 (Table 6-12, Sands et al, 2008) for is shown in Table 6-12. Escapement and catch in the Nushagak has been increasing in recent years with 2006 well above the 20 year average (Table 6-12).

Table 6-12 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

6.3.7 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 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 Fig.s. 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).

6.4 Impacts on Chum

6.4.1 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. 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.

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.

6.4.2 Summary of impacts

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 (Fig. 6-9).

Analyses examining the impact of the Chinook triggered closure area shows that on average, the bycatch rate is about 4-fold higher inside the closure area than outside (Fig. 6-10). Therefore, any regulation or industry-activity that displaces fishing inside of the closure area is likely to reduce chum salmon bycatch levels.

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 (Fig. 6-11). 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 6-15). 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 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 6.2.2 (page 234) 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.

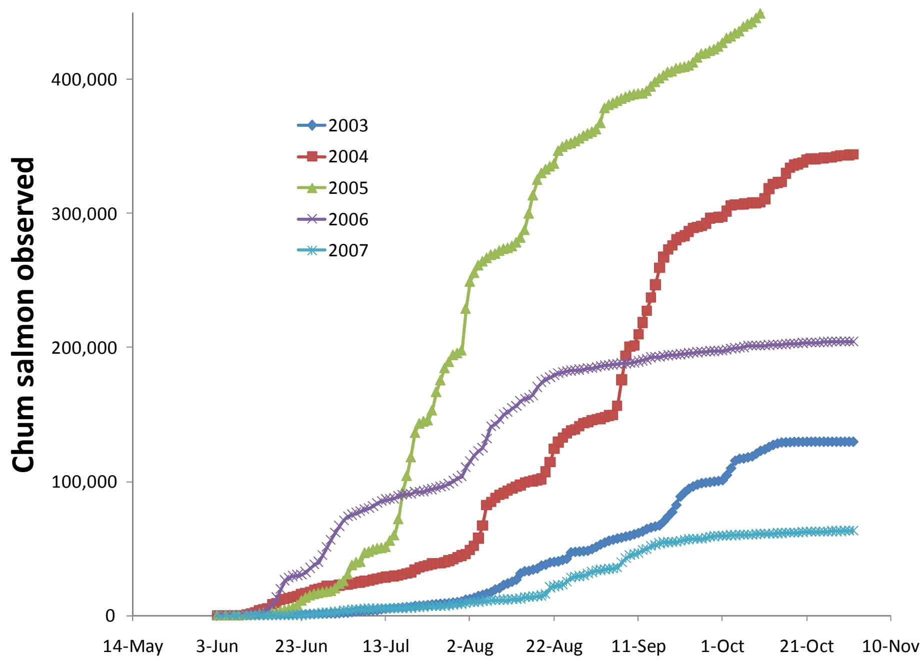


Fig. 6-9 Observed cumulative bycatch of chum salmon during the B-season, 2003-2007

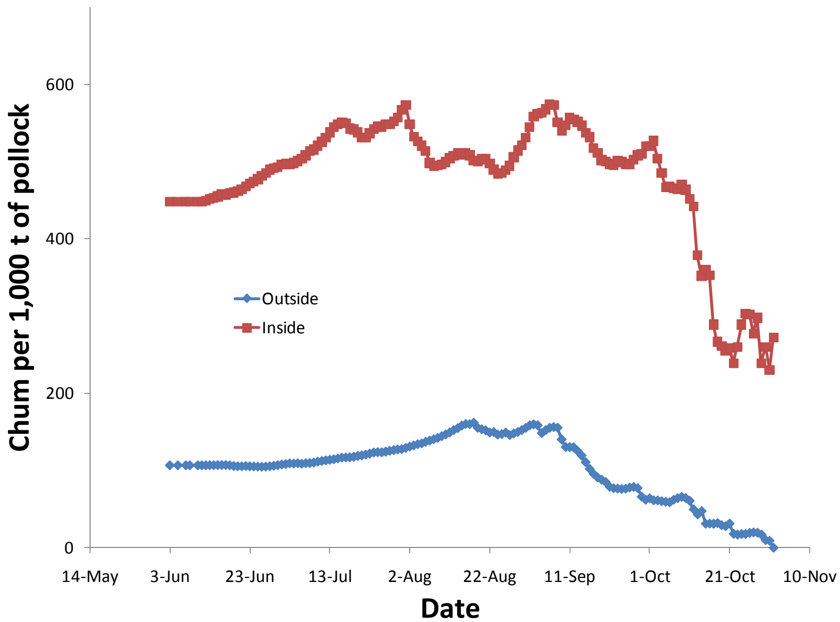


Fig. 6-10 Mean 2003-2007 chum bycatch rate (chum salmon per 1,000 t of pollock) inside and outside of Chinook salmon trigger closure area by date. Note that the numerator (chum numbers) were based solely on observer data whereas the pollock in the denominator was from the entire fleet. The chum rate on a given date represents the mean rate from that date till the end of the year.

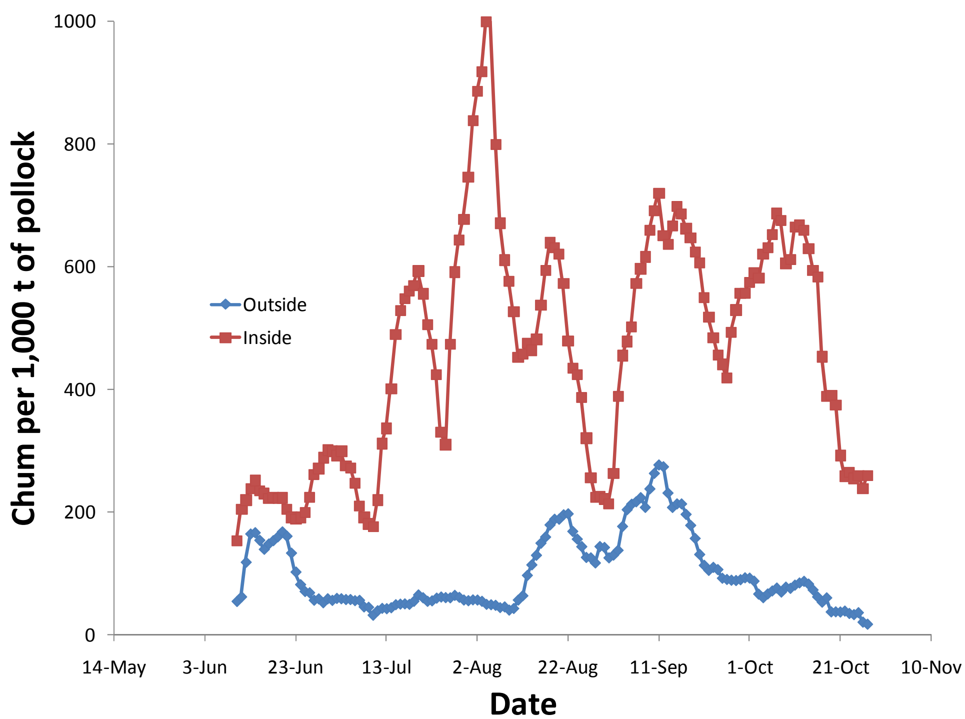


Fig. 6-11 Mean 2003-2007 chum bycatch rate (chum salmon per 1,000 t of pollock) inside and outside of Chinook salmon trigger closure area by date. Note that the numerator (chum numbers) were based solely on observer data whereas the pollock in the denominator was from the entire fleet. The chum rate on a given date represents the 10-day moving average.

Table 6-13 B-season 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 6-14 Expected chum catch remaining by **all vessels** if B-season trigger-closure was invoked on the dates provided in Table 72.

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 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

6.5 Reasonably foreseeable 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 discussed in the previous sections, and incorporated into the impacts discussion above. Section 3.2 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 Council is considering action on salmon bycatch measures for chum salmon. A suite of alternative management measures was proposed in April 2008, and that analysis will be brought back to the Council in October 2008. 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.

7.0 OTHER GROUNDFISH, OTHER PROHIBITED SPECIES & FORAGE FISH

The pollock fishery, and potential changes to the prosecution of the pollock fisheries 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.

Note: This section will need to be reviewed and may require revision based on the pollock and salmon effects described in this EIS. The pollock and salmon analyses were not available for explicit consideration in this chapter prior to submission. The following analysis is based on the information available at the time of writing this section.

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 replenished. 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 inseason management is to limit catch to the TAC and or ABC. Retention is prohibited 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, additional closures are imposed. To prevent overfishing, specific fisheries identified by gear and area that incur the greatest incidental catch are closed. Closures expand to other fisheries if the rate of take is not sufficiently slowed. Over fishing closures are rare.

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% 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.

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) has been moved to the ‘other rockfish’ category and northern, shortraker, and rougheye are 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. 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.

Table 7-1 Groundfish catch estimates (in metric tons) by species, in the Bering Sea pollock fishery, includes 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 closed due to salmon bycatch as participants in a program to avoid salmon. Some groundfish incidental catch has increased over the last several years. Explicitly attributing arrowtooth flounder or 'other flatfish' catch increase to only a change in behavior of the pollock fleet in response to salmon avoidance would be 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 where a species is caught before an OFL has been 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 the status quo. While the status quo does have an area closure, the ICA exemption allows the fishery to continue to some extent in alternate habitat. 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 Groundfish catch estimates (in metric tons) by species, in the Bering Sea pollock fishery average for years 2003-2007, by A season vs B season, includes 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

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 over fishing.

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. Chinook catch may not restrict or change the relative incidental catch of groundfish whether it is established at a fixed level or within an index 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, with one option having four sub options, are under considerations for sector allocations of the hard cap. 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 Groundfish catch estimates (in metric tons) by sector and species or species group, in the Bering Sea pollock fishery average for years 2003-2007

	Catcher/processors		Motherships		Shoreside		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 and 2, 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 has been closed under the ICA as a ‘salmon conservation area’ is that 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) as is currently under consideration management concerns 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 an 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.

7.3 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 of 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 likely very insignificant and will not be further analyzed.

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 coastwide 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.

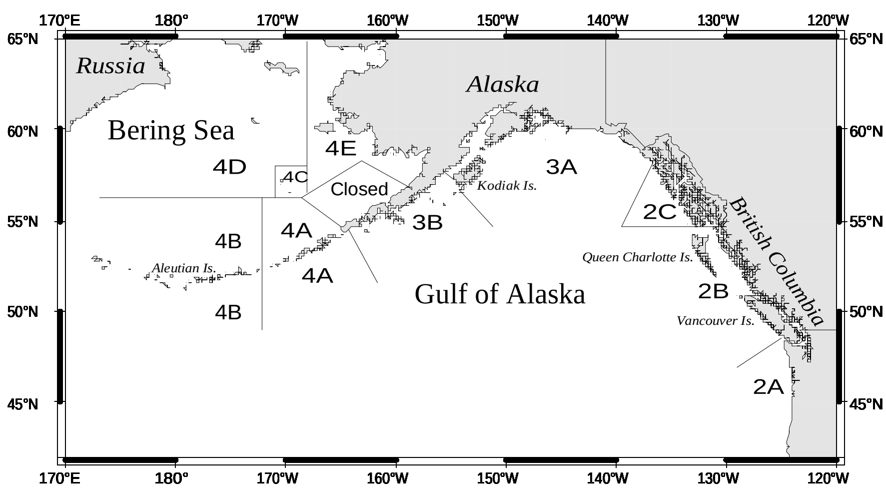


Fig. 7-1 IPHC regulatory areas in the northern Pacific Ocean and Bering Sea

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 PSC and Discard Mortality

Halibut discard in the GOA and BSAI is 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 Federal Fishery Management Plans (FMPs) for the Bering Sea and Aleutian Island (BSAI) and Gulf of Alaska (GOA), 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 GOA and 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. The report is 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 BSAI 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 Alaska Region. 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 5 (RIR) of this EIS provides a detailed overview of the methods used to estimate the total amount of halibut 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 Alaska Region to estimate halibut bycatch for the groundfish fisheries. The Region'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). 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 alternatives on prohibited species are reduced by existing management measures such that mitigate adverse impacts to prohibited species. The IPHC takes account of the halibut bycatch in the groundfish fisheries when setting halibut catch limits. 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 The total bycatch of Chinook, non-Chinook, and halibut, and total catch of pollock by trawl vessels in the BSAITable 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 The 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 ICA, which uses the vessel rolling hotspot system (VRHS) 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 2002, 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 [X?1.3.2].

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 foregone 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 (Alternative 2) 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.

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 AFA pollock vessels under Alternative 1. An increase in the halibut bycatch could occur if Alternatives 2 or 3 encourage pollock vessels to target non-pollock species or change fishing behavior. 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.

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 1.3.2). 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 2004b).

In the BSAI, the herring PSC limit for the groundfish trawl fisheries is set at one% of the estimated herring biomass. The annual herring PSC limit is apportioned into herring PSC allowances, by trawl fishery categories, and will be published along with the annual herring PSC limit in the *Federal Register* with the proposed and final groundfish harvest specifications. If the Regional Administrator 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).

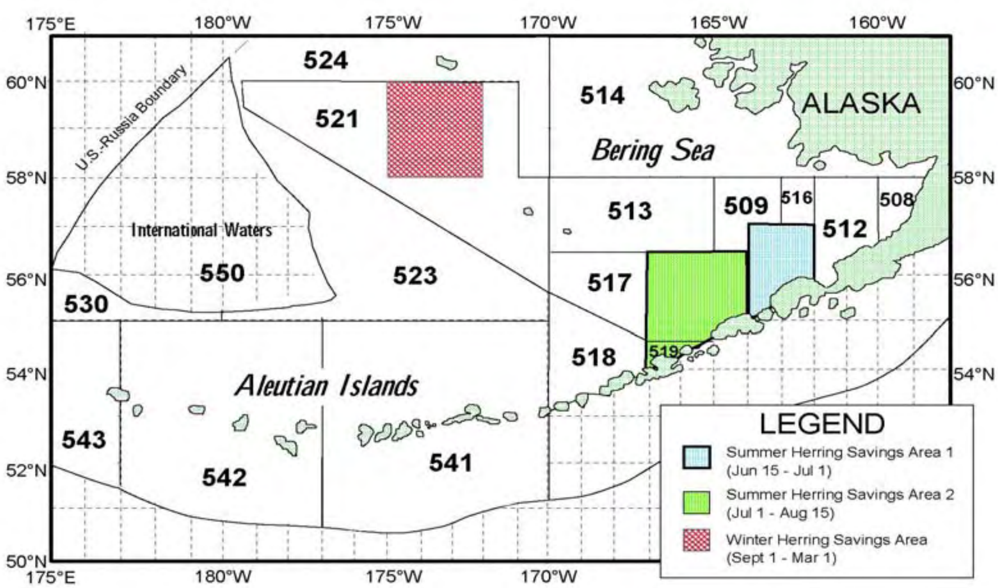


Figure 4 to Part 679. BSAI Herring Savings Areas
a. Map.

Fig. 7-2 The 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 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 alternatives 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 help 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 and 3 are not expected to change typical levels of herring catch. 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

Crab species caught as bycatch are treated as prohibited species in 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 in BSAI groundfish fisheries for the following species: red king crab, Tanner crab, and snow crab. Limits are 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

PSC limits for snow crab in groundfish trawl fisheries were established under Amendment 40 to the BSAI groundfish FMP, which became effective in 1998. 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 4.5 million snow crabs and a maximum PSC of 13 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. In 1998 the PSC limit for snow crab was further reduced by an additional 150,000 crabs as part of Amendment 57.

Amendment 80 to the BSAI groundfish FMP modified the snow crab PSC limits established by Amendment 40 (and modified by Amendment 57). Under Amendment 80, once the PSC limit is annually calculated as 0.1133% of the total snow crab abundance, 61.44% of the limit would be allocated to the head and gut (H&G) sector of the trawl fleet. To accommodate the potential PSC savings the sector would likely enjoy from development of cooperatives, the calculated allocation (61.44%) to the H&G sector would be reduced by 20%, which would be phased in at 5% per year over a four-year period starting in 2009. The AFA sectors of the trawl fleet would be limited to their sideboard amounts. The overall effect of this adjustment (and the limitation by the AFA sector to their sideboards) would be a reduction in the total limit (and overall PSC) for snow crab in the COBLZ. Additional information can be found in the EA/RIR/IRFA for Amendment 80.

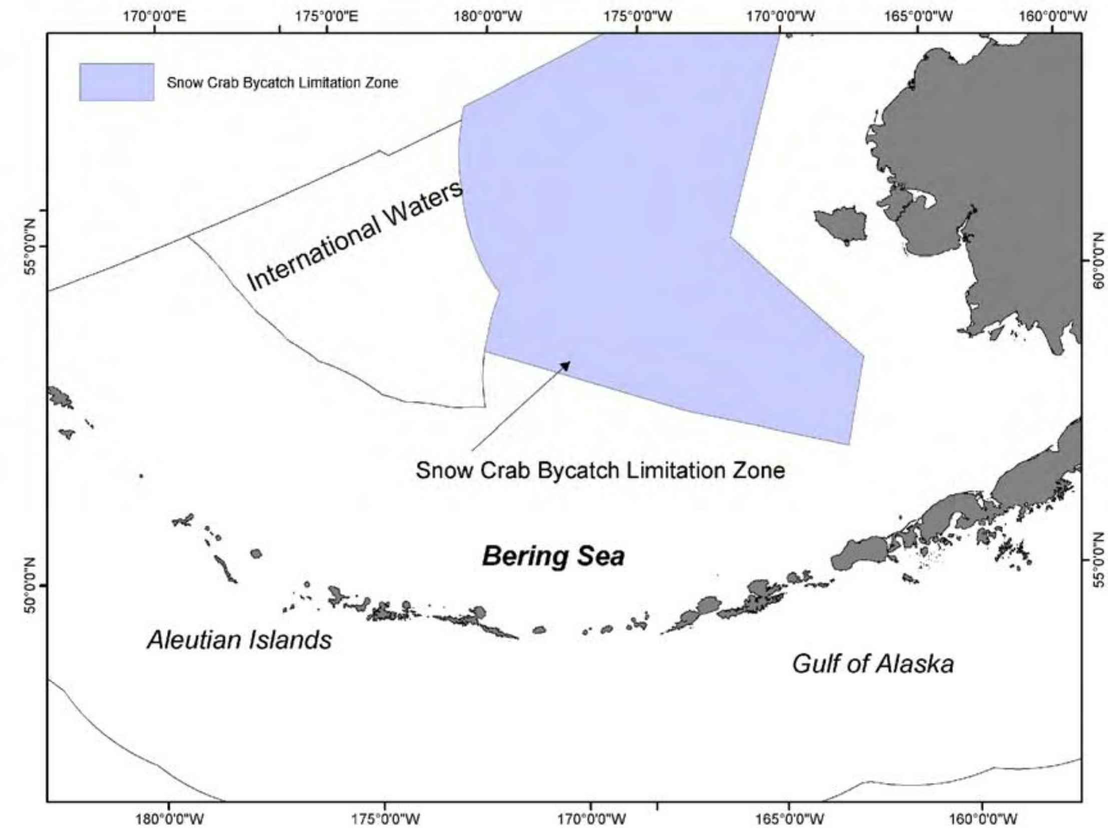


Fig. 7-3 *C. opilio* Bycatch Limitation Zone (COBLZ)

7.3.6.2 Red King Crab PSC limits

PSC limits for Zone 1 red king crab.	
Abundance	**PSC Limit**
Below threshold or 14.5 million lbs of effective spawning biomass (ESB)	33,000 crabs
Above threshold, but below 55 million lbs of ESB	97,000 crabs
Above 55 million lbs of ESB	197,000 crabs

PSC limits are based on the abundance of Bristol Bay red king crab as shown in the adjacent box. In 1999, the red king crab PSC limit was reduced by an additional 3,000 crabs. 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 35,000 red king crabs is established in Zone 1 (Fig. 7-3). In years when the stock is above the threshold but below 55 million pounds of effective spawning biomass, a PSC limit of 97,000 red king crabs is established. A 197,000 PSC limit is established in years when the Bristol Bay red king crab stock is rebuilt (above threshold and above 55 million pounds of effective spawning biomass). Based on the 2007 estimate of effective spawning biomass (73 million pounds), the PSC limit for 2008 was 197,000 red king crabs. The regulations specified that up to 35% of the PSC apportioned to the rock sole/flathead sole/other flatfish fishery category can be used in the 56º–56º10'N-strip of the Red King Crab Savings Area. The red king crab PSC limit has generally been allocated among the pollock/mackerel/other species, Pacific cod, rock sole, and yellowfin sole fisheries. 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.

Amendment 80 to the BSAI groundfish FMP modified the red king crab PSC limits. Under Amendment 80, once annually calculated according to the formula noted above, 62.48% of the Zone 1 limit would be allocated to the H&G sector of the trawl fleet. To accommodate the potential PSC savings the sector would likely enjoy from development of cooperatives, the calculated allocation (62.48%) to the H&G sector would be reduced by 20%, which would be phased in at 5% per year over a four-year period starting in 2009. The regulations specified that up to 25% of the annual PSC limit can be used in the 56º–56º10'N-strip of the Red King Crab Savings Area. The AFA sectors of the trawl fleet would be limited to their sideboard amounts. The overall effect of this adjustment (and the limitation by the AFA sector to their sideboards) would be a reduction in the total limit (and overall PSC) for red king crab. Additional information can be found in the EA/RIR/IRFA for Amendment 80.

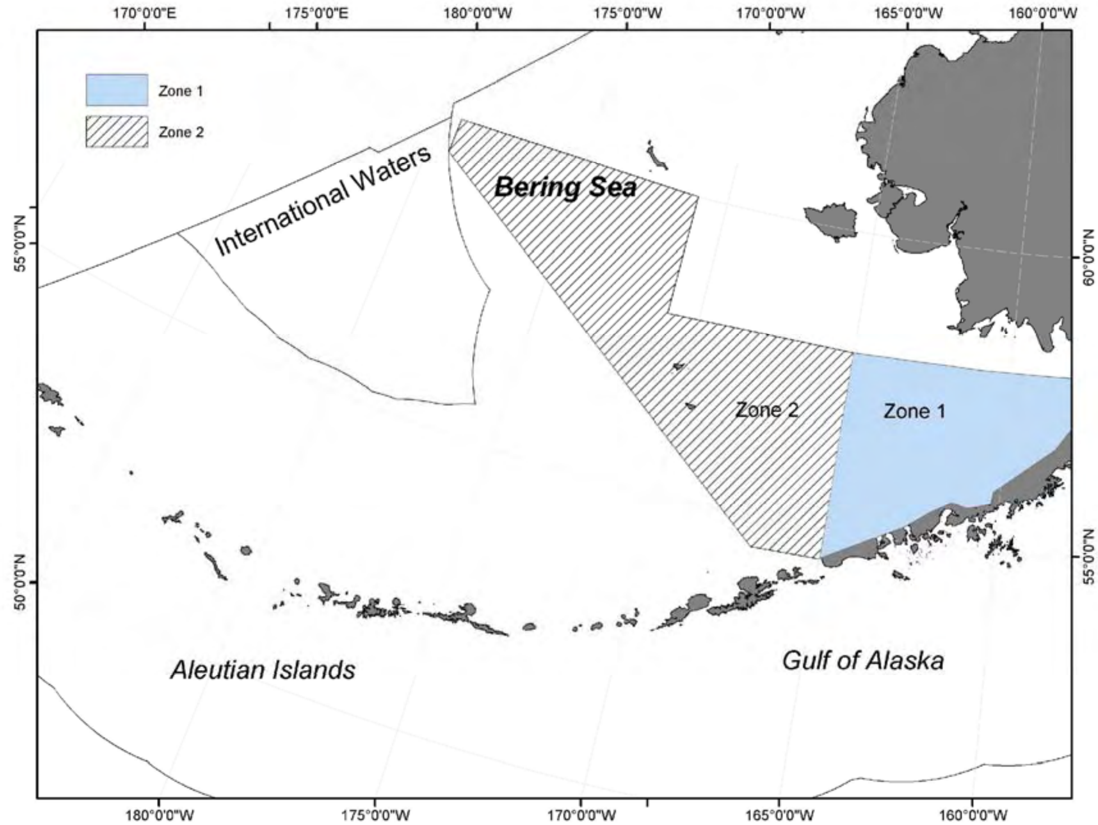


Fig. 7-4 Zones 1 and 2 for red king crab and Tanner crab

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	1,000,000
Zone 2	0-175 million crabs	1.2% of abundance
	175-290 million crabs	2,100,000
	290-400 million crabs	2,550,000
	over 400 million crabs	3,000,000

7.3.6.3 Tanner crab PSC limits

PSC limits are also established for Tanner crab under Amendment 41 to the BSAI FMP. These limits 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 2005 abundance (763 million crabs), and an additional reduction implemented in 1999, the PSC limit for Tanner in 2006 was 980,000 crabs (1,000,000 minus 20,000) in Zone 1 and 2,970,000 crabs (3,000,000 minus 30,000) in Zone 2. 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. 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.

Amendment 80 to the BSAI groundfish FMP modified the Tanner crab PSC limits. Under Amendment 80, once annually calculated according to the formula noted above, 52.64% of the Zone 1 limit and 29.59% of the Zone 2 limit would be allocated to the H&G sector of the trawl fleet. To accommodate the potential PSC savings the sector would likely enjoy from development of cooperatives, the calculated allocation (52.64% for Zone 1 and 29.59% for Zone 2) to the H&G sector would be reduced by 20%, which would be phased in at 5% per year over a four-year period starting in 2009. The AFA sectors of the trawl fleet would be limited to their sideboard amounts. The overall effect of this adjustment (and the limitation by the AFA sector to their sideboards) would be a reduction in the total limit (and overall PSC) for Tanner crab in Zone 1 and Zone 2. Additional information can be found in the EA/RIR/IRFA for Amendment 80.

7.3.7 Impacts on Crab

The impacts of the PSC limits and the total crab bycatch in the groundfish fisheries of these crab species were analyzed in the Alaska 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 alternatives 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. Table 7-6 shows the total number of crab PSC in the Bering Sea pollock fishery. Under Alternative 1, this bycatch would remain low and the impact would remain minor.

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 and 3 are not expected to change the pollock fishery in a manner that would increase bycatch of crab species to the extent that they would impact the abundance of these species. If crab bycatch did increase in the pollock trawl fishery, bycatch would be constrained by the existing PSC limits. Therefore, Alternatives 2 and 3 are expected to have minor 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.[10]

More information on the forage fish in Alaska's EEZ may be found in several NMFS and Council documents:

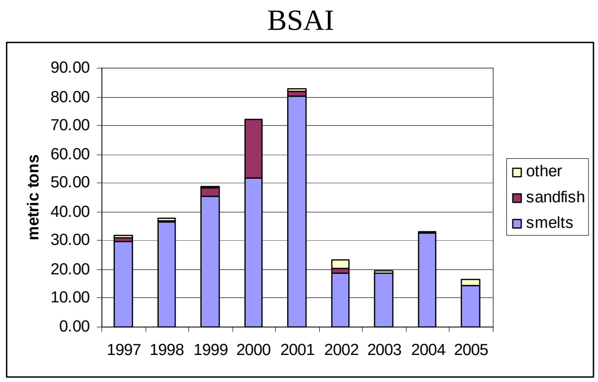
- The Council's Fishery Management Plans for the BSAI and GOA include discussions of forage species. As noted above, the FMPs define the species groups. Section 4.2.2 in each document describe essential forage fish habitat. Appendix D in each document provides some information on forage fish life history (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 AFSC estimates of aggregate forage fish species catch by year and species for the BSAI from 1997 to 2005. Most of the BSAI incidental catch consists of smelts (Family Osmeridae, including capelin, eulachon, and other smelts). Significant volumes of sandfish were also taken in the BSAI fisheries, but only in 2000. BSAI incidental catch of forage fishes ranged from just over 20 mt to just over 80 mt per year. BSAI smelt catch appears to be lower in recent years.

Most of this incidental catch is taken by pollock trawlers. 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.

[10] Under the FMPs, the forage fish category includes fish in the families Osmeridae, Myctophidae, Bathylagidae, Ammodytidae, Trichodontidae, Pholidae, Stichaeidae, Gonostomatidae, and the order Euphausiacea.



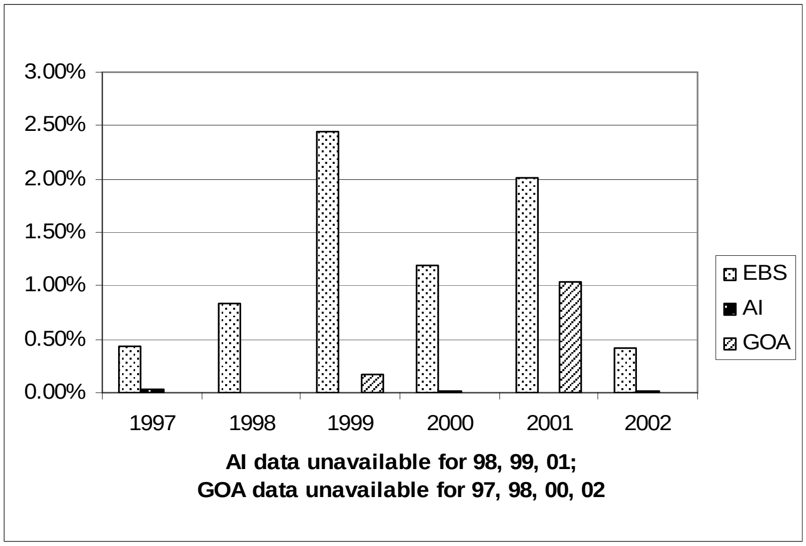
Source: Estimates supplied by S. Gaichas, AFSC. 2005 data through late October.

Fig. 7-5 Estimated aggregate annual incidental catch of forage fish species in all BSAI groundfish fisheries, 1997-2005

Estimates of biomass and seasonal distribution of biomass are poor for forage fish species. Bottom trawl surveys of groundfish conducted by NMFS are not designed to assess the biomass of forage fish species. Several important forage fish species are pelagic (capelin, eulachon, smelts) and appear in bottom trawls only sporadically. All four species tend to be small bodied and are not fully retained by the meshes of either survey or commercial trawl gears. The PSEIS notes that there is some evidence that smelt biomass has been at relatively low levels during the last 20 years (NMFS 2004).

The available information on biomass indicates that fishing rates on capelin and eulachon, which account for most forage fish catch, are low. Nelson estimates that smelt incidental catch in the central GOA, the region with the vast majority of GOA smelt bycatch, was probably less than 1% of the biomass in 1999 and 2001 (NPFMC 2003). The PSEIS indicates that incidental catches of forage fish within the range evaluated under the preferred alternative bookends are probably very low with respect to the forage fish populations (NMFS 2004). This is also indicated by Fig. 7-6 below, which shows smelt bycatch by management area as a percentage of the estimated management area’s eulachon biomass (note that Fig. 7-6 does not include 2005, a year with relatively high smelt bycatch in the GOA).

Based on biomass estimates prepared from bottom trawl surveys, it appears that in a typical year, exploitation rates are 2.2% or less. Because smelts are pelagic, biomass estimates based on trawl data are believed to be low, so that true exploitation rates may be even lower. More accurate biomass estimates prepared from echo-integration survey data suggest that biomass estimates based on bottom trawl survey data may underestimate by a factor of 20. Estimates based on food web modeling also suggest that biomass estimates from bottom trawl surveys are biased low (NPFMC 2005).



Source: data supplied by M. Sigler, September 22, 2005.

Fig. 7-6 Smelt bycatch as a percentage of estimated eulachon biomass

Ecopath food web models suggest that arrowtooth flounder, pollock, and squid are the three top predators of both capelin and eulachon (NPFMC 2005c). 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 30 mt and 80 mt in the BSAI. Status quo fishing rates in the BSAI 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. One possible direct impact is on sandfish which feed on small fish near the bottom in areas of potential fishing activity. The impact of fishing on sandfish prey is not known (NMFS 2005). 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. However, Pacific sandfish have demersal juvenile and adult life stages. The EFH EIS describes them as “ambush predators that lay in wait for prey buried under the sand.” The impact of bottom contact gear on sandfish is not known (NMFS 2005).

The Alternative 2 hard 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 forage fish from Alternative 1. The RIR in Appendix 1 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 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 Reasonably foreseeable 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

Future harvest specifications will affect forage species fishing mortality. Pollock trawl incidental catches of smelt appear to be the main source of forage stocks mortality in the groundfish fisheries. Thus, future catch in some years may be larger and may have a greater impact on smelts than the catch projected in this action.

7.6.3 Private actions

Ongoing fishing activity will continue to take other groundfish, prohibited species, and forage fish species as bycatch. Ongoing economic development of coastal Alaska, and increasing levels of marine transportation activity may interact adversely with populations of forage fish species. Development that may impact coastal and riverine spawning habitat may have the greatest potential for affecting these populations. However, development in Alaska remains small compared to development in other coastal states. Subsistence harvests of eulachon ("hooligan") occur in Alaskan waters.

8.0 OTHER MARINE RESOURCES

Note: The impacts analysis in this section willl need to be reviewed and may require revision based on the pollock and salmon effects described in this EIS. The pollock and salmon analyses were not available for explicit consideration in this chapter prior to submission. The following analysis is based on the information available at the time of writing this section.

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), 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) 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, North Pacific right whales, humpback whales, sperm whales, fin whales and bowhead whales) were completed in 2008 based on a review of 2005 though 2006 data (Angliss and Outlaw 2008). Northern elephant seals, and marine mammals under U. S. Fish and Wildlife Service (USFWS) jurisdiction (polar bear, walrus, and sea otters), were assessed in 2002 (Angliss and Outlaw 2008). The information from NMFS 2004 and Angliss and Outlaw 2006, 2007, and 2008 is incorporated by reference to this EIS. The Alaska Groundfish Harvest Specifications EIS also provides recent information on the effects of the groundfish fisheries on marine mammals including a detailed description of the status of ESA Section 7 consultations (Section 8.2 of NMFS 2007a). 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, North Pacific right whales, and Steller sea lions and their designated critical habitat (NMFS 2006 and Salveson 2008). A draft biological opinion on the status quo groundfish fishery in the BSAI and GOA is expected to be available in late 2008.

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. Steller sea lions and northern fur seals are the only marine mammals in Table 8-1 that may compete with the pollock fishery for prey; and therefore, may be indirectly affected by the pollock fishery. Marine mammals species listed in Table 8-2 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.

Table 8-1 Marine Mammals Potentially Affected by the Bering Sea Pollock Fishery

NMFS Managed Species		
Pinnipedia	***Species***	***Stocks***
	Steller sea lion*	Western U.S (west of 144E W long.) and Eastern U.S. (east of 144E W long.)
	Northern fur seal**	Eastern Pacific
	Harbor seal	Gulf of Alaska and Bering Sea
	Ringed seal	Alaska
	Bearded seal***	Alaska
	Ribbon seal	Alaska
	Spotted seal	Alaska
Cetacea	***Species***	***Stocks***
	Killer whale	Eastern North Pacific Alaska Resident, Eastern North Pacific GOA, Aleutian Islands, and Bering Sea transient, AT1 transient**, West Coast Transient
	Dall's porpoise	Alaska
	Humpback whale*	Western North Pacific, Central North Pacific
	North Pacific Right Whale[#]	Eastern North Pacific Stock
	Fin whale*	Northeast Pacific
	Minke whale	Alaska

Source: Angliss and Outlaw 2008 and List of Fisheries for 2008 (72 FR 66048, November 27, 2007)
*ESA-listed species.
**Listed as depleted under the Marine Mammal Protection Act.
*** Based on recent incidental take data from National Marine Mammal Laboratory, James Thomason, Personal Communication, April 28, 2008.
[#] Based on NMFS (2006) and Salveson (2008).

The following sections summarize status information for species listed in Table 8-1, including recent ESA activities for certain stocks.

8.1.1.1 Steller Sea Lion Status

Steller sea lions inhabit many of the shoreline areas of the BSAI, and uses these habitats as seasonal rookeries and year-round haulouts. The Steller sea lion has been listed as threatened under the ESA since 1990. In 1997 the population was split into two stocks or distinct population segments (DPS) based on genetic and demographic dissimilarities: the western and eastern stocks. Because of a pattern of continued decline in the Western DPS, it was listed as endangered on May 5, 1997 (62 FR 30772), while the Eastern DPS remained under threatened status. The Western DPS inhabits an area of Alaska approximately from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters. The Steller sea lions present in the action area would be primarily from the Western DPS.

Throughout the 1990s, particularly after 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. In 2001, a biological opinion was released that provided protection measures that would not jeopardize the continued existence of the Steller sea lion nor adversely modify its critical habitat; that opinion was supplemented in 2003. After court challenge, these protection measures remain in effect today (NMFS 2001, Appendix A). A detailed analysis of the effects of these protection measures is provided in the Steller Sea Lion Protection Measures Supplemental EIS (NMFS 2001).

The Bering Sea subarea has several pollock fishery closures in place for Steller sea lions including no transit zones, rookeries, haulouts, foraging area, and the Steller Sea Lion Conservation Area (**Error! Reference source not found.**). The proposed action would not change the pollock fishery, and groundfish closures associated with the five Steller sea lion sites located at Sea lion Rock, Bogoslof Island/Fire Island, Adugak Island, Pribilof Islands, and Walrus Islands and in the Bogoslof Foraging Area. The harvest of pollock in the Bering Sea subarea is temporally dispersed (§ 679.20) 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). The Western DPS of Steller sea lion is currently listed as endangered under the ESA and depleted under the MMPA. As a result, the stock is classified as a strategic stock. Steller sea lions using rookeries and haulouts in the Bering Sea are grouped with animals using these types of sites in the eastern Aleutian Islands.

For the eastern Aleutian Island trend sites, Steller sea lion nonpup counts increased from 2000 to 2004 by 23% and were stable comparing 2004 to counts in 2006 or 2007 (Fritz et al. 2008). Pup counts increased in the eastern Aleutian Islands trend area 25% comparing data collected in 2001 and 2002 to counts from 2005 to 2007. 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 stock appears to have stabilized (Fritz et al. 2008).

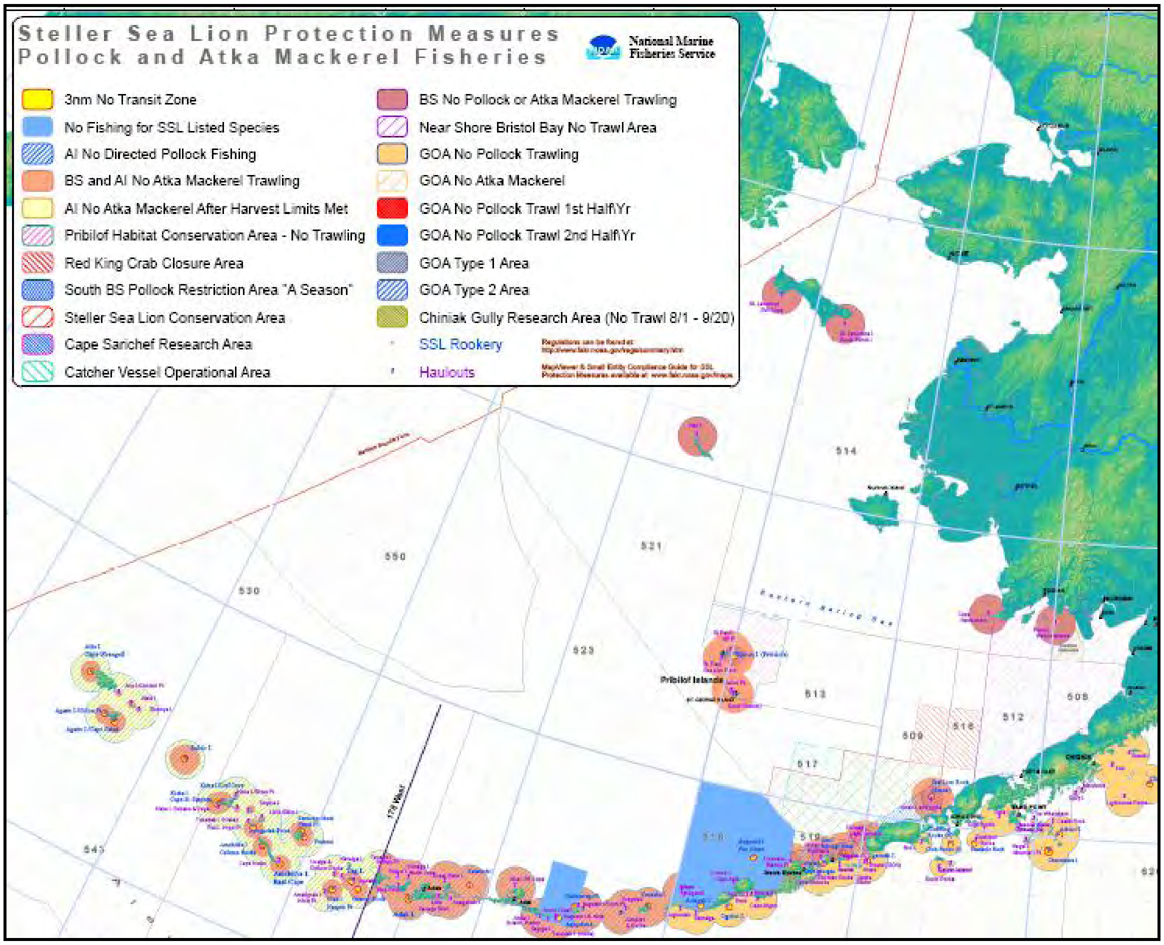


Fig. 8-1 Pollock Fishery Restrictions Including Steller Sea Lion Protection Areas of the Bering Sea Subarea

(Details of these closures are available through the NMFS Alaska Region website at http://alaskafisheries.noaa.gov/protectedresources/stellers/maps/Pollock_Atka0105.pdf)

8.1.1.2 Northern Fur Seal Status

Northern fur seals forage in the pelagic area of the Bering Sea and reproduce on the Pribilof and Bogoslof Islands (Fig. 8-2). Approximately 55% of the worldwide abundance of fur seals is found on the Pribilof Islands (NMFS 2007b). 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) 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 2007b). Recent pup counts show a continuing decline in the number of pups surviving in the Pribilof Islands. NMFS researchers found an approximately nine% decrease in the number of pups born between 2004 and 2006. The pup estimate decreased most sharply on Saint Paul Island. Saint George Island showed a small increase over 2004, though it still registered a decrease of three% from the 2002 estimate. (Available from *http://www.fakr.noaa.gov/newsreleases/2007/fursealpups020207.htm*). The Eastern Pacific stock of northern fur seal is classified as a strategic stock because it is designated as depleted under the MMPA (Angliss and Outlaw 2008).

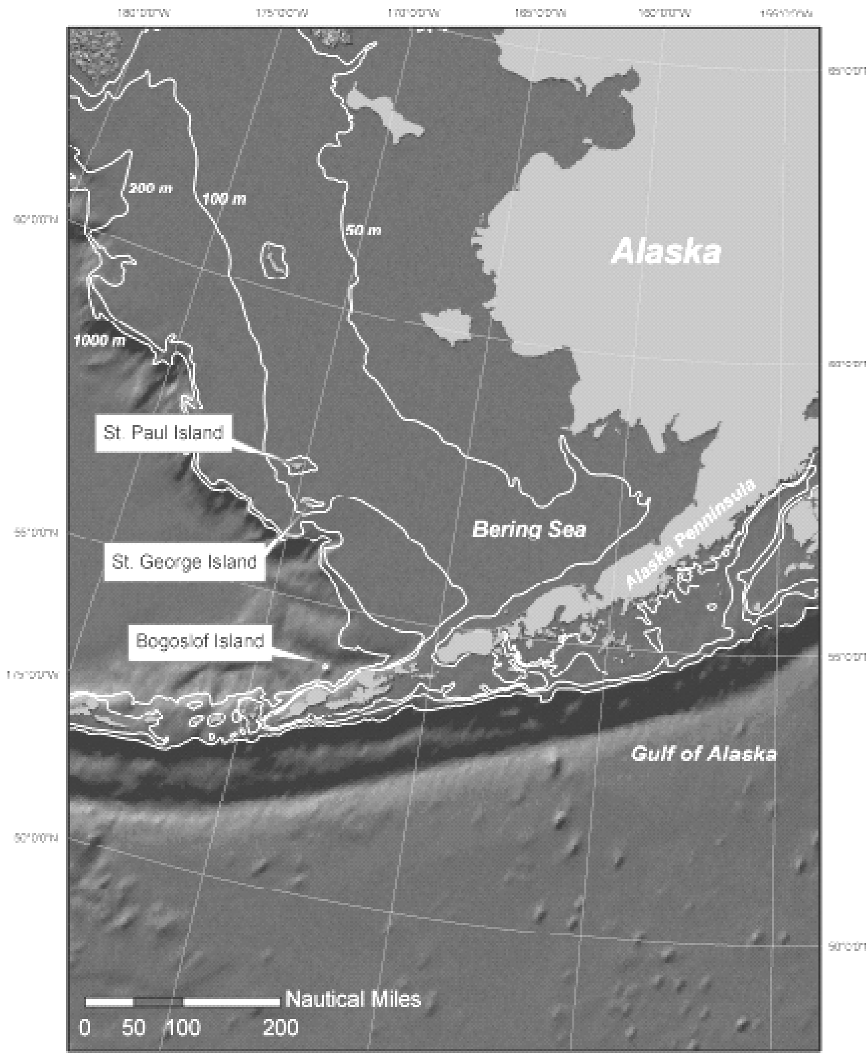


Fig. 8-2 Location of the three northern fur seal breeding areas within U.S. waters (Robson 2002)

Migration of fur seals is described in detail in 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

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).

8.1.1.3 Ice Seals Status

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 presents substantial information that a listing may be warranted and has started a status review of the species to determine whether listing is warranted (73 FR 16617, March 28, 2008). A decision on whether listing is warranted is due in December 2008. In addition, NMFS will review the status of the other ice seals in the Bering Sea (spotted, ringed, and bearded seals) with the first priority given to the ribbon seal because of the statutory deadline for the listing decision.

Ringed seals and bearded seals are distributed in the northern portion of the Bering Sea from Bristol Bay to north of St. George Island (Fig.s 12 and 13 in Angliss and Outlaw 2007). This distribution is north of the area likely to be closed during the A season under Alternative 3. No status information is available on these seals (Angliss and Outlaw 2007). Ribbon seals range throughout the offshore waters of the Bering Sea. No information on the status of ribbon seals is currently available (Angliss and Outlaw 2008). Spotted seals range throughout the Bering Sea waters, and no status information is currently available (Angliss and Outlaw 2007).

8.1.1.4 North Pacific Right Whale Status

The right whale is listed as endangered under the ESA, and therefore designated as depleted under the Marine Mammal Protection Act (MMPA). As a result, the stock is classified as a strategic stock. Reliable estimates of the minimum population size, population trends, and potential biological removal (PBR) are currently not available (Angliss and Outlaw 2008). Though reliable numbers are not known, the abundance of this stock is considered to represent only a small fraction of its precommercial whaling abundance (i.e., the stock is well below its Optimum Sustainable Population size). The estimated annual rate of human-caused mortality and serious injury seems minimal for this stock. The reasons for the apparent lack of recovery for this stock are unknown. Brownell et al. (2001) noted the devastating impact of extensive illegal Soviet catches in the eastern North Pacific in the 1960s, and suggested that the prognosis for right whales in this area was poor. In its review of the status of right whales worldwide, the International Whaling Commission (IWC) expressed "considerable concern" over the status of this population (IWC 2001), arguably the most endangered stock of large whales in the world.

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 is reinitiating of 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. 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 splitting of the entire northern right whale stock into two species, Atlantic and Pacific species. These new designations do not change the expected impacts on the right whales occurring in the Pacific and the previous finding for the Alaska fisheries of not likely to adversely affect the species or designated critical habitat (Brix 2006) is not likely to change for the status quo fishery.

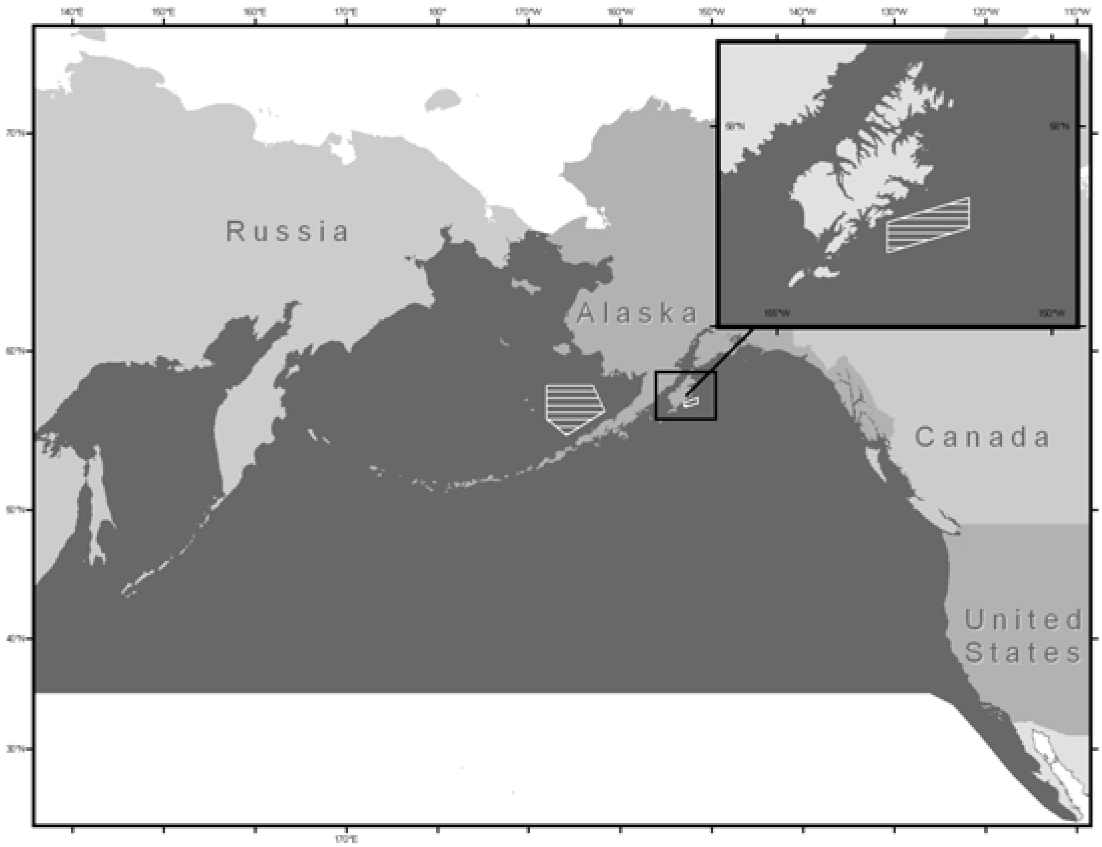


Fig. 8-3 North Pacific Right Whale Distribution and Critical Habitat shown in lined boxes. (Angliss and Outlaw 2008)

8.1.1.5 Harbor Seal Status

The Bering Sea stock of harbor seals is located primarily around the inner continental shelf between Nunivak Island and Bristol Bay and near the Pribilof Islands (Angliss and Outlaw 2008). The Gulf of Alaska stock is located primarily in the coastal waters (Angliss and Outlaw 2008) and may cross over into the Bering Sea coastal waters between islands. Moderate to large population declines have occurred in the Bering Sea and Gulf of Alaska stocks (Angliss and Outlaw 2008). Harbor seals are not listed as depleted under the MMPA or listed as threatened or endangered under the Endangered Species Act. Neither stock of harbor seals is classified as a strategic stock. The status of these stocks relative to their Optimum Sustainable Population (OSP) size is unknown.

8.1.1.6 Killer Whale Status

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 (Angliss and Outlaw 2008).

The AT1 Transient stock of killer whales was designated as depleted under the MMPA. Therefore, the AT1 Transient stock of killer whales is classified as a strategic stock. At least 11 animals were alive in

1998, but it appears that as of 2006, only 7 individuals may be alive (Angliss and Outlaw 2008). Therefore, the 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 1984 level. The AT1 Transient stock of killer whales is not listed as threatened or endangered under the ESA.

The eastern North Pacific Alaska resident; West Coast transient; and Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea transient stocks of killer whales are not listed as depleted under the MMPA or listed as threatened or endangered under the ESA (Angliss and Outlaw 2008, 2007, and 2006). The minimum abundance estimates for the Alaska Resident and West coast transient stocks are likely underestimated because researchers continue to encounter new whales in the Gulf of Alaska and western Alaskan waters. Because the population estimates are likely to be conservative, the PBRs are also conservative. These stocks are not classified as strategic stocks. Population trends and status of these stocks relative to their OSP sizes are currently unknown.

8.1.1.7 Dall's Porpoise Status

Dall's porpoise range in the offshore waters from coastal western Alaska in the Bering Sea (Fig. 30 in Angliss and Outlaw 2008). They are not listed as depleted under the MMPA or listed as threatened or endangered under the ESA (Angliss and Outlaw 2008). The Alaska stock of Dall's porpoise is not classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown.

8.1.1.8 Minke Whale Status

Minke whales are relatively common in the Bering and Chukchi Seas and in the inshore waters of the Gulf of Alaska (Mizroch 1992). Minke whales are not listed as depleted under the MMPA or listed as threatened or endangered under the ESA (Angliss and Outlaw 2007). The greatest uncertainty regarding the status of the Alaska minke whale stock pertains to the stock structure of this species in the eastern North Pacific. Because minke whales are considered common in the waters off Alaska and because the number of human-related removals is currently thought to be minimal, this stock is not considered a strategic stock. Reliable estimates of the minimum population size, population trends, PBR, and status of the stock relative to OSP are currently not available.

8.1.1.9 Fin Whale Status

Surveys in the central-eastern and southeastern Bering Sea in 1999 and 2000 and in coastal waters of the Aleutian Islands and the Alaska Peninsula from 2001 to 2003 provided information about the distribution and relative abundance of fin whales in these areas (Moore et al. 2000, 2002; Zerbini et al. 2006). Fin whale abundance estimates were nearly five times higher in the central-eastern Bering Sea than in the southeastern Bering Sea (Moore et al. 2002), and most sightings in the central-eastern Bering Sea occurred in a zone of particularly high productivity along the shelf break (Moore et al. 2000) (Fig. 8-4).

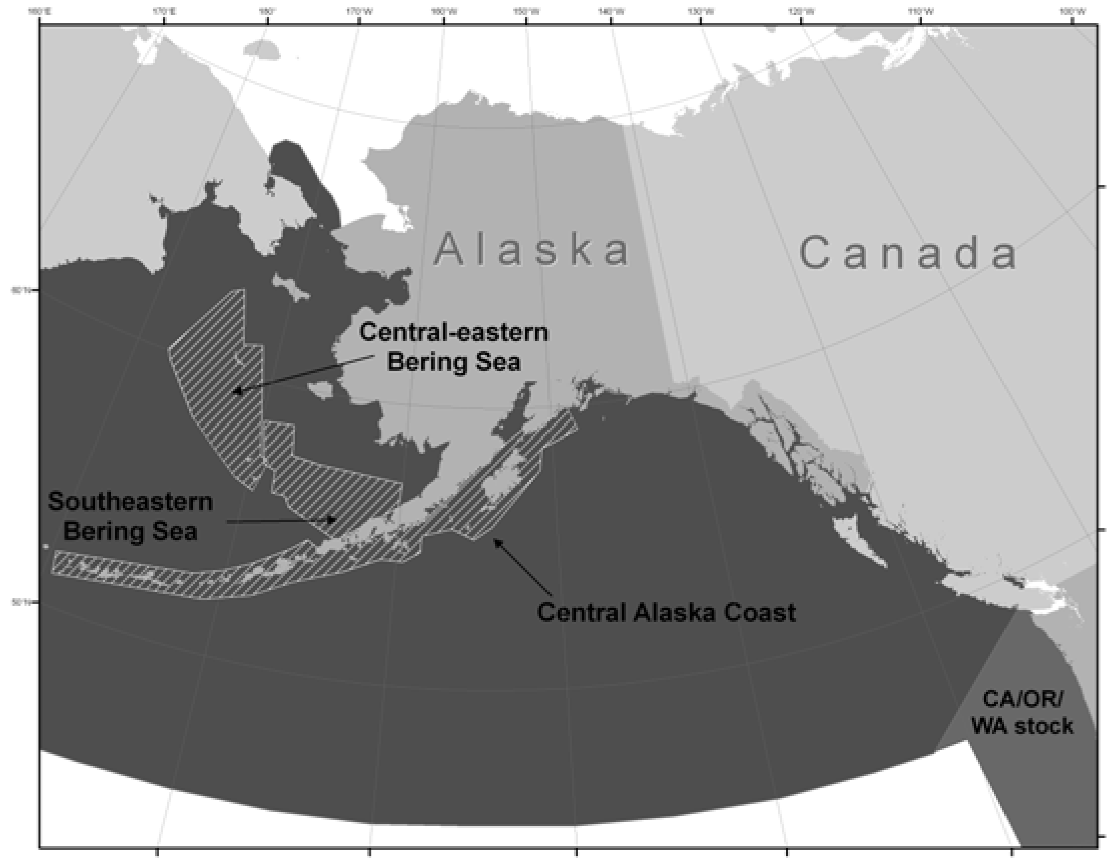


Fig. 8-4 Fin Whale Distribution and Survey Areas in lined locations (Angliss and Outlaw 2008)

Fin whales are designated as depleted under the MMPA. As a result, the Northeast Pacific stock is classified as a strategic stock. While reliable estimates of the minimum population size, population trends, and PBR are available for a portion of this stock, much of the North Pacific range has not been surveyed. Therefore the status of the stock relative to its OSP size is currently not available (Angliss and Outlaw 2008).

8.1.1.10 Humpback Whale Status

Humpback whales from the Western Pacific and Central Pacific stocks occur in Alaskan waters and may mingle in the North Pacific feeding area shown in Fig. 8-5 (Angliss and Outlaw 2008). Humpback whales present 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. The humpback whale is listed as endangered under the ESA, and therefore designated as depleted under the MMPA. As a result, the Western and Central North Pacific stocks of humpback whale are classified as strategic stocks. However, the status of these stocks relative to their OSP size is unknown.

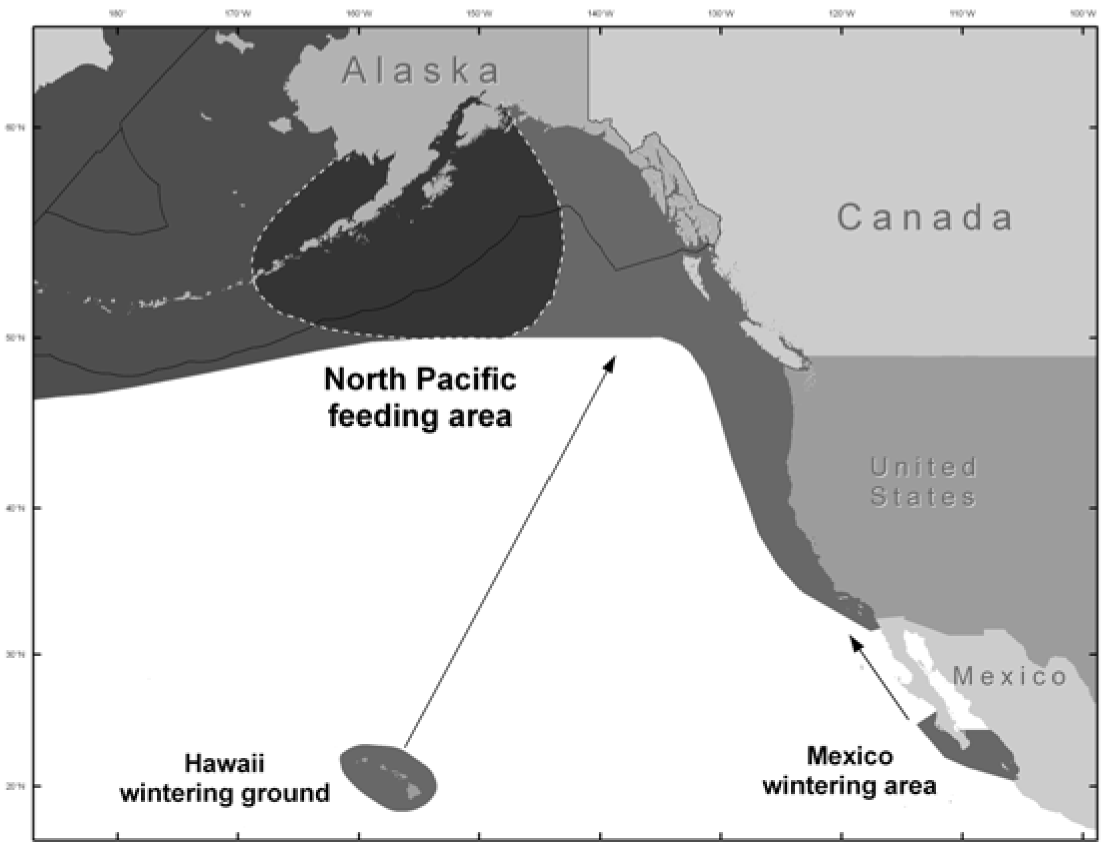


Fig. 8-5 Feeding area of Humpback Whales (Angliss and Outlaw 2008)

8.1.2 Effects on Marine Mammals

8.1.2.1 Incidental Takes

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 8-2 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). Overall, very few marine mammals are reported taken in the Bering Sea pollock fishery.

Table 8-2 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

Fishery	Marine Mammal Stocks Taken
	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 8-2, plus bearded and ringed seals. 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 8-3. Table 8-2 is based on the List of Fisheries for 2008, which is based on all previously reported injury or mortality. Table 8-3 is based on the 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 Northern and Alaska resident killer whales, and spotted seal. Bearded seals 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 8-4).

Table 8-3 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 several years of data, as available. The years chosen to average vary by species. Groundfish fisheries mortality calculated based on Angliss and Outlaw (2008).

Marine Mammal Species and Stock	Mean annual mortality, from BSAI pollock fishery	Total mean annual human-caused mortality *	Potential Biological Removal (PBR)
**Steller sea lions (western)	2.26	215.6	234
Northern fur seal	0	756	15,262
Harbor seal (BSAI)	0	176.2	603
Spotted seal	0	5,265	Undetermined
Ringed seal	0.71	9,567	Undetermined
Ribbon seal	0.2	193	Undetermined
Killer whale Eastern North Pacific AK resident	0	1.5	11.2
Killer whale, Eastern North Pacific Northern resident	0	0	2.16
Killer whale, GOA, BSAI transient	0.41	0.4	3.1
Dall's porpoise	1.89	29	Undetermined
**Humpback whale, Western North Pacific	0	0.2	1.3
**Humpback whale, Central North Pacific	0	5.0	12.9
Minke whale, Alaska	0.3	0.3	Undetermined
**Fin whale, Northeast Pacific	0	0.2	11.4

* Does not include research mortality. Other human-caused mortality is predominantly subsistence harvests for seals and sea lions.
** ESA-listed stock

Table 8-4 shows the months when incidental takes of marine mammals occurred in 2003, 2004, and 2006, the years when these data were collected. It is not possible to determine any seasonality to the incidental takes of killer whales 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. Steller sea lions appear to be taken in the A and B pollock fishing seasons.

Table 8-4 Marine Mammals taken in the pollock fishery in 2003, 2004, and 2006. Locations correspond to the areas depicted in **Error! Reference source not found.**. (Source: National Marine Mammal Laboratory 4-28-08)

SPECIES	DATE	LOCATION
Killer whale	20-Mar-03	Area 521
Dall's porpoise	20-Jul-04	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

Table 8-4 also shows the takes of marine mammals in locations in the Bering Sea in 2003, 2004, and 2006. Based on the very limited data in Table 8-4 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. Dall's porpoise and fin whale were taken in the summer, bearded seals in the fall and Steller sea lions throughout the year.

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 8-3). 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 8-4. 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.

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 which would reduce the potential for incidental takes in fishing areas that overlap with marine mammal occurrences. 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. The seasonal cap may be beneficial to bearded seals which appear to be more likely taken in the later part of the B season.

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 any effect on pollock fishing in a manner that would change the potential for incidental takes.

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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 8-4). Fishing under any of the alternatives and options would require vessels to comply with Steller sea lion protection measures and the Pribilof Islands Area Habitat Conservation Zone, reducing the potential for interaction with Steller sea lions and northern fur seals in these areas.

Any northward shift of the pollock fishery could potentially increase the risk of incidental takes of bearded seals, killer whales, Dall’s porpoise, and fin whales based on incidental takes shown in Table 8-4. 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 primarily taken in the southern portion of the Bering Sea, a northward shift of the pollock fishery due to the salmon area closures may reduce the potential for incidental takes of Steller sea lions. Due to the small number of incidental takes (Table 8-4) 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.

8.1.2.2 Harvest of Prey Species

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 the Steller sea lions and northern fur seals which potentially compete for prey with the groundfish fisheries (NMFS 2001, 2007b). Steller sea lions and northern fur seals depend on pollock and salmon as prey species (NMFS 2007a, 2007b).

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 walleye 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 2005) (Fig. 8-6). 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%.

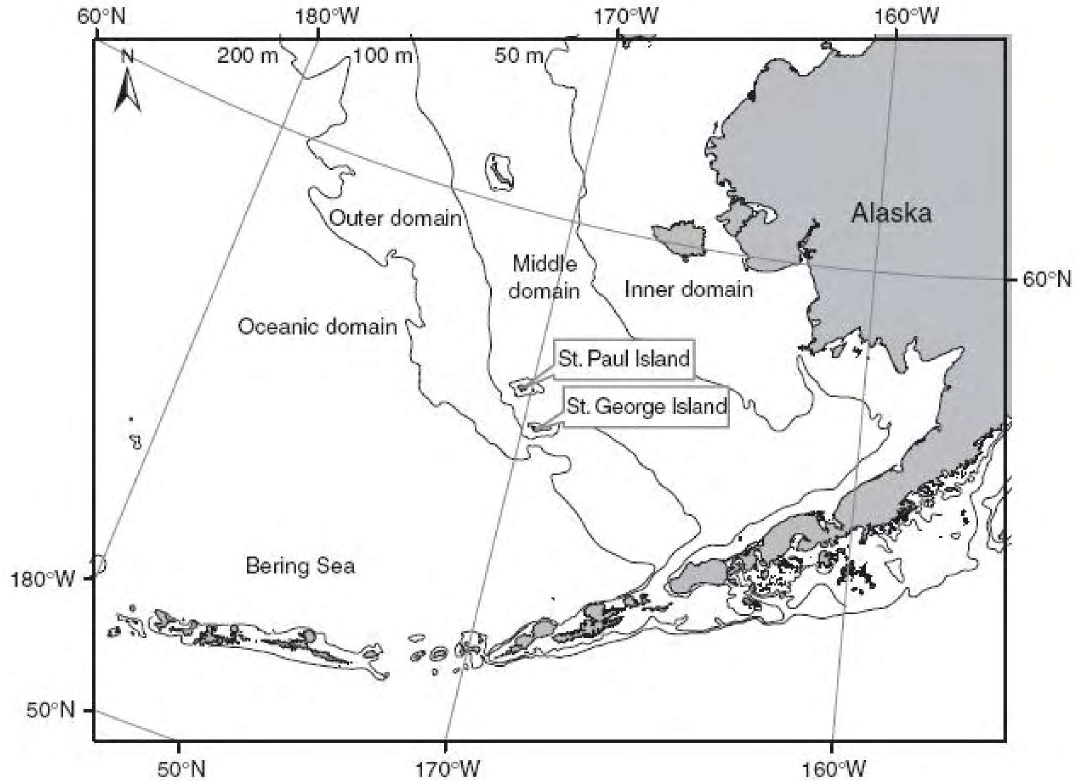

Fig. 8-6 Bering Sea Hydrographic Domains. Represents the Bering Sea areas where fur seal prey may occur (Zeppelin and Ream 2006)

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 Steller sea lions taken at sea in the winter of 1981in an area between the Pribilof and St. Matthew Islands (Caulkins 1998).

Salmon is a prey species of Steller sea lions (NMFS 2001), resident killer whales (NMFS 2004), and northern fur seals (NMFS 2007b). 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. Killer whales also eat salmon that are migrating to spawning streams in nearshore waters (NMFS 2004).

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 2005). Fur seals occur throughout Alaska waters, but their main rookeries are located in the Bering Sea near Bogoslof Island and the Pribilof Islands. 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.

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. 8-6). 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.

Alternative 2 Hard Cap

A hard cap on the amount of salmon taken in the pollock fishery could benefit Steller sea lions, resident killer whales, and northern fur seals if the cap prevents harvest of salmon and pollock that these species would have eaten. 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 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, and resident killer whales, and may or may not allow for more pollock prey depending on whether the fishery is closed before reaching its pollock TAC.

The index cap for Chinook salmon may be beneficial to those marine mammals that depend on the salmon stock that is the basis for the cap. For this particular salmon stock (or group of stocks), the control of bycatch would be based more on what we know about run size and may lead to more appropriate bycatch caps based on the natural history of the stock(s). Whether this is an advantage for other salmon stocks that marine mammals prey on depends on whether run returns for the other salmon stocks follow run returns for the stock used for the index. If the base salmon stock run return is predicted to be strong and a higher bycatch cap is set, this may have a detrimental impact on the returns of other salmon stocks with low returns. Higher bycatch caps in relation to a low run return for a stock not considered for the index would reduce available prey for killer whales, Steller sea lions, and fur seals dependent on the non-indexed stock(s). It may be more protective to aggregate the coastal western

Alaska stocks for developing the index cap so that setting the cap for one stock would not be as likely to allow excessive harvest of another stock and impact prey availability for marine mammals.

If the killer whales, northern fur seals, and Steller sea lions prey on migrating salmon, more prey may be available if the index cap allows for sufficient returns to support the salmon stocks and also the natural mortality expected from marine mammal predation. The natural mortality for salmon stocks in the ocean is highly uncertain (James Ianelli, personal communication 4-25-08) so it is unknown if the index cap could be set at a value that would provide for natural mortality due to marine mammal predation.

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 effect on pollock fishing that would change the potential competition for prey species between the pollock fishery and marine mammals.

Alternative 3 Triggered Closures

A pollock fishery closure of an area where Steller sea lions 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). The potential reduction in competition would depend on the foraging locations for Steller sea lions 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 fur seal prey. 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 appear 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).

Based on stomach samples collected in the 1980s, Steller sea lions may not have depended 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, because there is no evidence of the sea lions eating salmon in the northern portion of the Bering Sea.

For both fur 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 to both fur seals and Steller sea lions 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 (2005), 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.

8.1.2.3 Disturbance

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.

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.

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 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. 8-3). 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 on foraging whales.

Salmon closures in the southern portion of the Bering Sea 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. 8-5). 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 8-4) 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. 8-5.

Fin whales appear to gather in the northern portion of the Bering Sea, overlapping with the B season salmon area closures (Fig. 8-4). 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.

8.1.3 Reasonably Foreseeable 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.

8.1.3.1 Ecosystem-sensitive management

Increased attention to ecosystem-sensitive management is likely to lead to more consideration for the impact of the groundfish fisheries 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. Designating a separate species listing and critical habitat for North Pacific right whales would require a reinitiation of Section 7 consultation for the groundfish fisheries, if activities may affect the newly described species, North Pacific right whale, and its critical habitat. The consultation would identify any right whale protection measures needed for the groundfish fisheries. This potential future action is likely to increase protection for North Pacific right whales.

Modifications to Steller sea lion protection measures may 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 May 2008. 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 Reasonable Forseeable 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.

8.1.3.2 Fisheries Rationalization

Many of the resulting changes to the prosecution of the fisheries under rationalization programs would potentially reduce the impacts of fisheries on marine mammals. Future rationalization of the groundfish fisheries is expected to reduce fishing effort and improve manageability of the fisheries through better harvest and bycatch controls. A rationalization program would reduce the number of vessels that participate in the groundfish fisheries, thus decreasing the potential for incidental take, reducing the amount of marine debris, and reducing vessel disturbance. A rationalization program also would potentially reduce the effects of the fisheries on marine mammals by providing fishermen the time to improve fishing practices and avoid sensitive areas, such as rookeries. Increases in monitoring and observer coverage from implementing a rationalization program would increase our understanding of the impacts of these fisheries on marine mammals by providing better incidental take information and fishery locations. To the extent that the implementation of fisheries rationalization will likely result in reduced effort or modified fishing, the impacts of the proposed action will be reduced.

8.1.3.3 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.

8.1.3.4 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 recreational 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 8-5.

Table 8-5 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

Source: Angliss and Outlaw 2008

The mortalities listed in Table 8-5 are included in the total mean annual human caused mortalities in Table 8-3. 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.

8.1.3.5 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 8-3, 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; 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.

8.1.3.6 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. These include the trend towards ecosystem management and fisheries rationalization. Ecosystem-sensitive management and institutionalization of ecosystem considerations into fisheries governance are likely to increase our understanding of marine mammal populations. Fisheries rationalization may lead to reduced interactions to the extent that fewer operations remain in a fishery, and the remaining operations are better able to comply with protection measures. 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 (FWS) 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 FWS Beringian Seabird Colony Catalog (2004) represents the location, population size, and species composition for each colony based on the most recent information available (Fig. 8-1). 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 8-6 Seabird species in the BSAI (NMFS 2004)

Albatrosses Black-footed Short-tailed Laysan	**Gulls Glaucous-winged, Glaucous, Herring. Mew, Bonaparte's Sabine**	**Murres Common, Thick-billed**
Northern fulmar	**Jaegers Long-tailed, Parasitic, Pomarine**	**Guillemots Black, Pigeon**
Shearwaters Short-tailed, Sooty	**Eiders Common, King, Spectacled, Steller's**	**Murrelets Marbled, Kittlitz's, Ancient**
Storm petrels Leach's, Fork-tailed	**Kittiwakes Black-legged, Red-legged**	**Auklets Cassin's, Parakeet, Least, Whiskered, Crested**
Cormorants Pelagic, Red-faced, Double-crested	**Terns Arctic, Aleutian**	**Puffins Rhinoceros, Horned, Tufted**

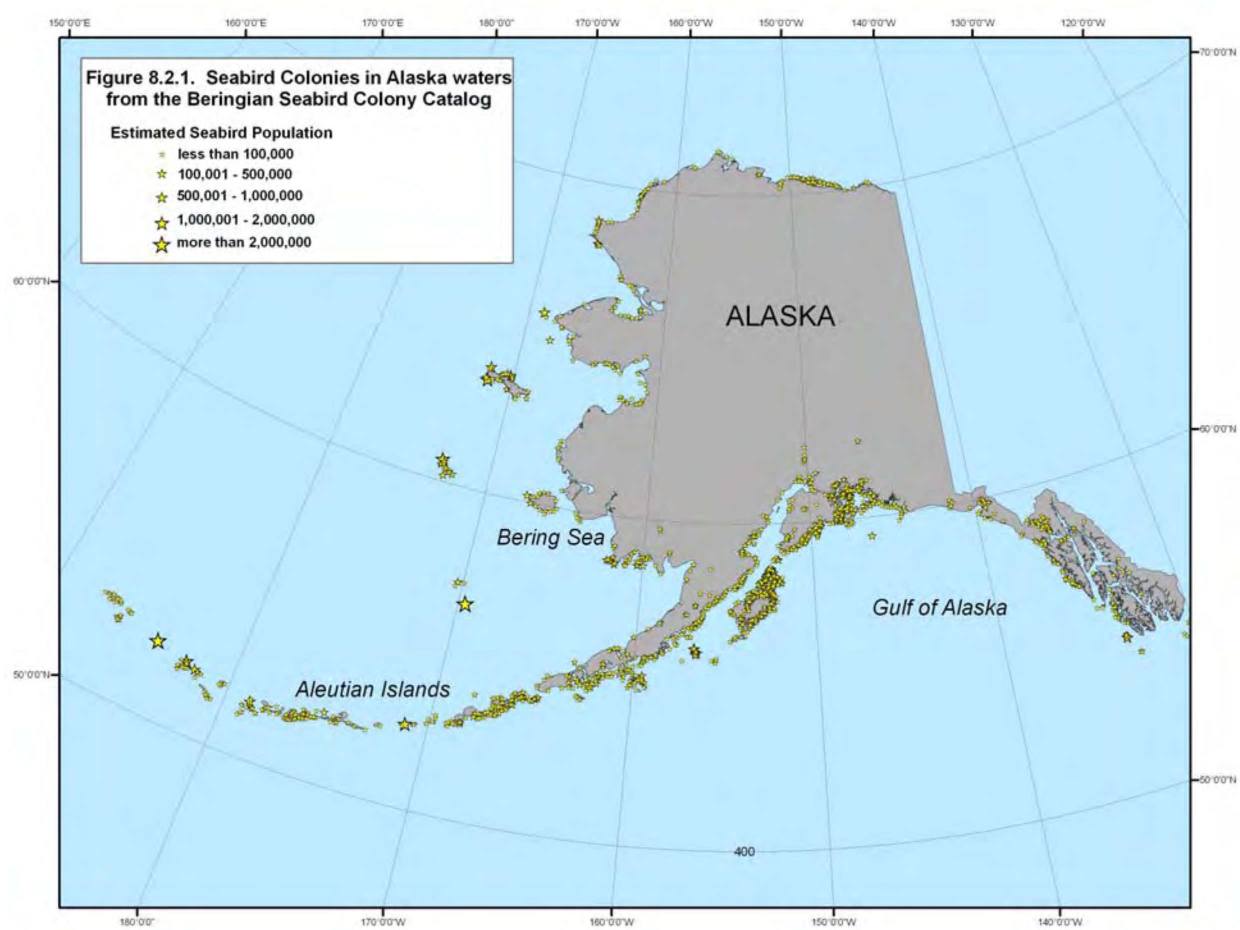

Fig. 8-7 Seabird colonies in the Bering Sea.

As noted in the PSEIS, seabird life history includes low reproductive rates, low adult mortality rates, long life span, and delayed sexual maturity. These traits make seabird populations extremely sensitive to changes in adult survival and less sensitive to fluctuations in reproductive effort. The problem with attributing population changes to specific impacts is that, because seabirds are long-lived animals, it may take years or decades before relatively small changes in survival rates result in observable impacts on the breeding population. Moloney et al (1994) estimated a 5- to 10-year lag time in detecting a breeding population decline from modeled hook-and-line incidental take of juvenile wandering albatross, and a 30- to 50-year population stabilization period after conservation measures were put in place.

More information on seabirds in Alaska's EEZ may be found in several NMFS, Council, and FWS documents :

- The URL for the FWS Migratory Bird Management program is at: http://alaska.fws.gov/mbsp/mbm/index.htm
- Section 3.7 of the PSEIS (NMFS 2004a) provides background on seabirds 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 and the 2006 issue is available at http://access.afsc.noaa.gov/reem/ecoweb/index.cfm

- 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).
- It is also described in Chapter 9 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007).
- And in the Ecosystems Considerations for 2007 chapter of the North Pacific Groundfish Stock Assessment and Fishery Evaluation Reports for 2006 (NMFS, 2005).
- The PSEIS describes the seabird species in the action area (NMFS 2004a, pp. 3.7-18 to 3.7-87).

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*).

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 (FWS 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 (FWS 2005). Efforts are currently underway to move STAL chicks 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. 8-2 and Fig. 8-3). There is no recorded take of these species in Alaska trawl fisheries, and no estimates produced by the AFSC (2006). Spectacled eider observations are reported in the NPPSD in Bristol Bay and Norton Sound (Fig. 8-2), still outside the normal distribution of the pollock trawl fleet. Therefore, potential impacts to these species are not analyzed further in this document.

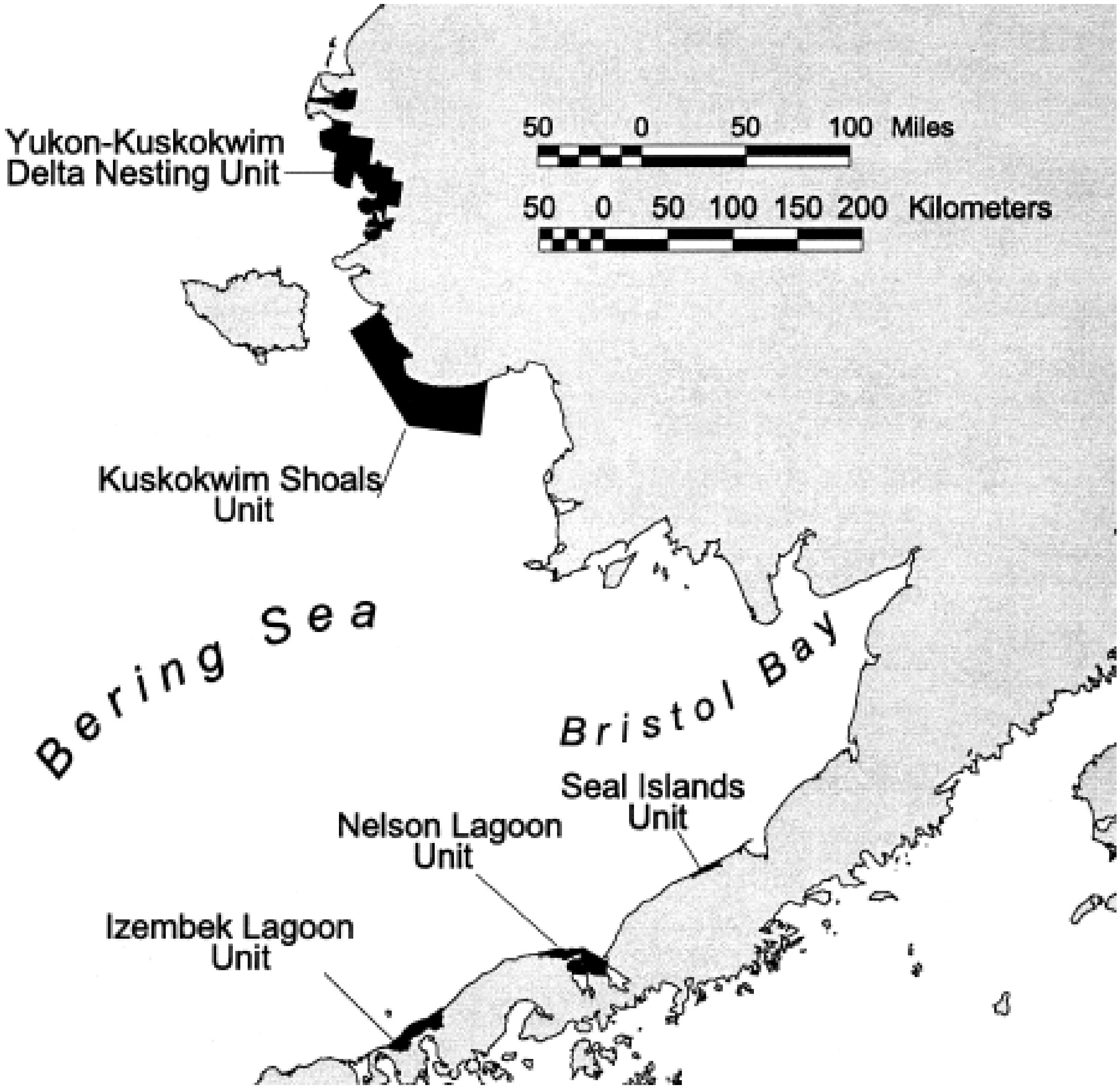

Fig. 8-8 Steller's Eider Critical Habitat (FWS 2001b)

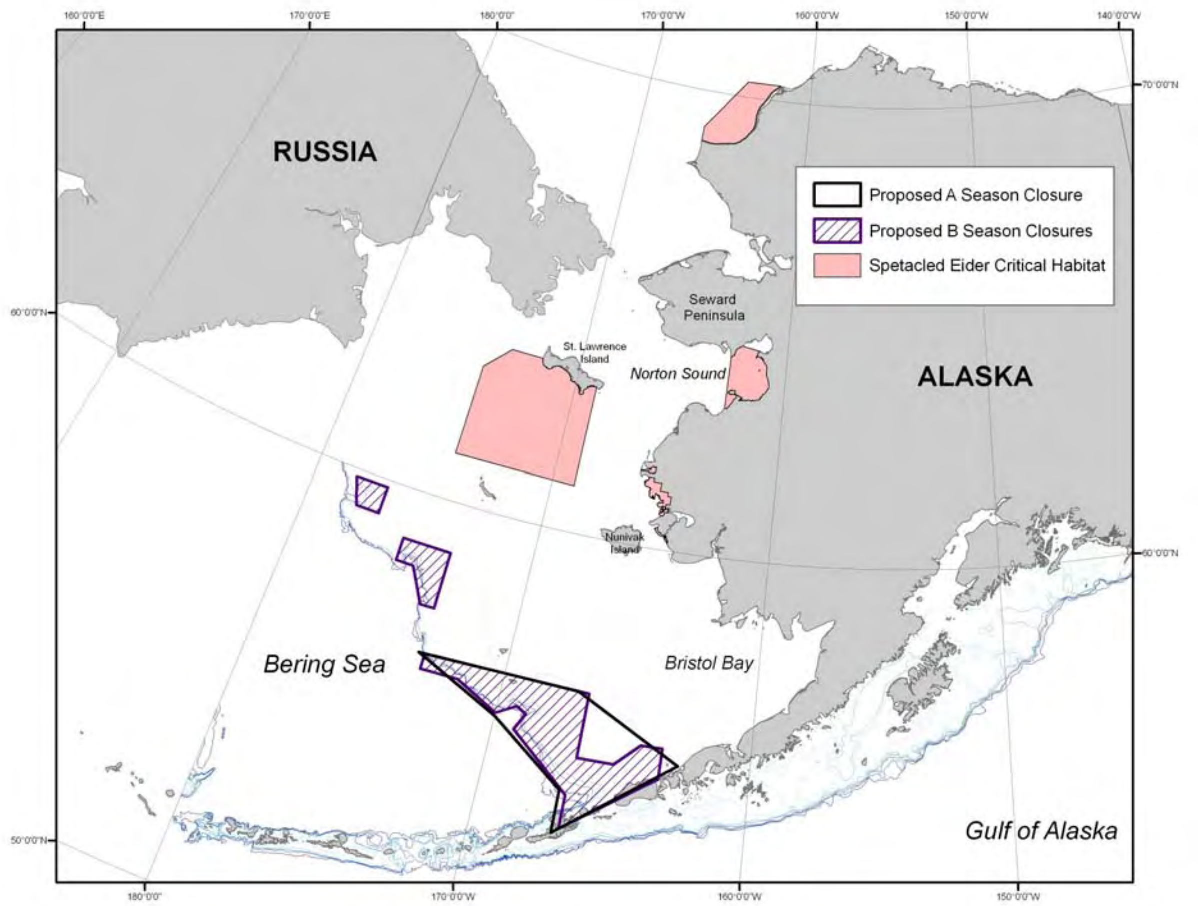

Fig. 8-9 Spectacled Eider Critical Habitat (FWS 2001a)

8.2.3 Other Seabird Species of Conservation Concern in the Bering Sea

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the FWS 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 (FWS 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, FWS (2002) lists 28 species of birds in Region 7 (Alaska Region). Many of these species do not interact with Alaska fisheries, and thus are not addressed in this analysis.

8.2.3.1 Black-footed albatross

Although not an ESA-listed species, the black-footed albatross (BFAL) 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 (FWS, 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 1st, 2004, the U.S. Fish and Wildlife Service received a petition to list the black footed albatross (*Phoebastria nigripes*) as a threatened or endangered species, and to designate critical habitat at the time of listing. The Service's response to the 90-day finding was deferred until October 9, 2007, due to insufficient resources. At that time, the Service found that the petition warranted further review. Following the publication of the black-footed albatross population status review, the Service began developing its 12-month finding indicating whether it believes a proposal to list this species as threatened or endangered is warranted. That 12-month finding is not yet available.

Melvin et al (2006) cites the fact that the World Conservation Union (IUCN) changed its conservation status of the species under the international classification criteria from vulnerable to endangered in 2003. Additionally, the FWS has been working with Dr. Paul Sievert and Dr. Javier Arata of the U.S. Geological Survey (USGS) to develop a status assessment of Laysan and Black-footed Albatrosses. This assessment is in response to growing concerns regarding the current status and population trends of these two north Pacific albatrosses, particularly the black-footed.

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 (FWS, 2006). A few BFAL are reported in the NPPSD in Bristol Bay (Fig. 8-14).

8.2.3.2 Red-legged kittiwake

The red-legged kittiwake is a small gull that breeds at only a few locations in the world, all of which are in the Bering Sea, (FWS, 2006). 80% 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 (FWS, 2006). They are listed as a FWS bird of conservation concern because recent severe population declines remain unexplained (NMFS 2004b), but could be due to irregular food supplies in the Pribilof Islands. Red-legged kittiwakes are present in the eastern Bering Sea, but have not been reported as taken by fisheries observers.

8.2.3.3 Kittlitz's murrelet

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 (Brachyramphus brevirostris) 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.

The FWS has conducted surveys for Kittlitz's murrelet in the Alaska Maritime National Wildlife Refuge over the past few years (FWS, 2006). These surveys have revealed substantial 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 (PSEIS 2004) and no estimates are presented by AFSC (2006). While KIMU have been observed in the Bering Sea (Fig. 8-7), their foraging techniques, diet composition, and the fact that they don't follow fishing vessels or congregate around them, reduce the likelihood of incidental take in groundfish fisheries (K. Rivera, NMFS, pers. comm.) (FWS 2006).

8.2.4 Status of Endangered Species Act Consultations on Groundfish and Halibut Fisheries

The FWS 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 FWS on the effects of the Pacific halibut fishery off Alaska on the short-tailed albatross. FWS issued a Biological Opinion in 1998 that concluded that the Pacific halibut fishery off Alaska was not likely to jeopardize the continued existence of the short-tailed albatross (FWS 1998b). FWS issued an Incidental Take Statement of two short-tailed albatross in a two year period (1998/1999, 2000/2001, 2002/2003, etc), reflecting what the agency anticipated the incidental take could be from the fishery action. Under the authority of ESA, FWS identified non-discretionary reasonable and prudent measures that NMFS must implement to minimize the impacts of any incidental take.

Two updated FWS Biological Opinions (BO) were recently 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 (FWS 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 (FWS 2003a).

Although FWS has determined that the short-tailed albatross is adversely affected by hook-and-line Pacific halibut and groundfish fisheries off Alaska, both FWS opinions concurred with NOAA Fisheries and concluded that the GOA and BSAI fishery actions are not likely to jeopardize the continued existence of the short-tailed albatross or Steller's edier or result in adverse modification of Steller's eider critical habitat. The FWS 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 FWS 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. FWS estimates that the STAL may be delisted in the year 2030, if new colony establishment is successful.

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 Fig.s to follow. NMFS is highly appreciative of FWS, Washington Seagrant, OSU, IPHC, and AFSC in their efforts to supply data and guidance in putting together this and other seabird-related analyses.

8.2.5.1 Washington Sea Grant Survey data

Melvin et al (2006) provide the most current and comprehensive data of seabird distribution patterns on 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. Seabird data were collected from four summer hook-and-line stock assessment surveys: IPHC halibut surveys, NMFS sablefish surveys, ADFG Southeast Inside sablefish surveys, and ADFG Prince William Sound sablefish surveys (see Melvin et al [2006] for survey protocol and description).

Researchers observed a total of 230,452 birds over three years at an average of 1,456 stations surveyed each year. 85% of all birds sighted were tubenose seabirds, 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. 3) 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 2006, Piatt 2006).

8.2.5.2 North Pacific Pelagic Seabird Observer Program

Between February 1 and October 31, 2007, seabird observers conducted surveys onboard ships of opportunity for a total of 275 days in the Bering, Chukchi, and Beaufort seas. While surveyors did observe short-tailed, blackfooted, and laysan albatrosses in the Bering Sea, their distributions were mostly limited to the Bering Sea shelf break (Fig. 8-7).

8.2.5.3 North Pacific Pelagic Seabird Database (NPPSD)

The 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. 8-17. Species of conservation concern and those more likely to interact with fishing vessels are highlighted in the Fig., but other species observed in this area include murres, loons, auklets, gulls, puffins, terns, northern fulmars, black-legged kittiwakes, short-tailed and sooty shearwaters and other species in smaller numbers.

8.2.5.4 Seabird observations from IPHC surveys

The International Pacific Halibut Commission (IPHC) stock assessment surveys document interactions with seabirds at all survey stations. Table 8-7lists the numbers of seabirds observed in each IPHC management area during the 2006 survey. Fig. 8-7shows the locations of the different areas. Many seabirds were observed in the Bering Sea in areas frequently fished by the Pollock trawl fleet.

Table 8-7 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.

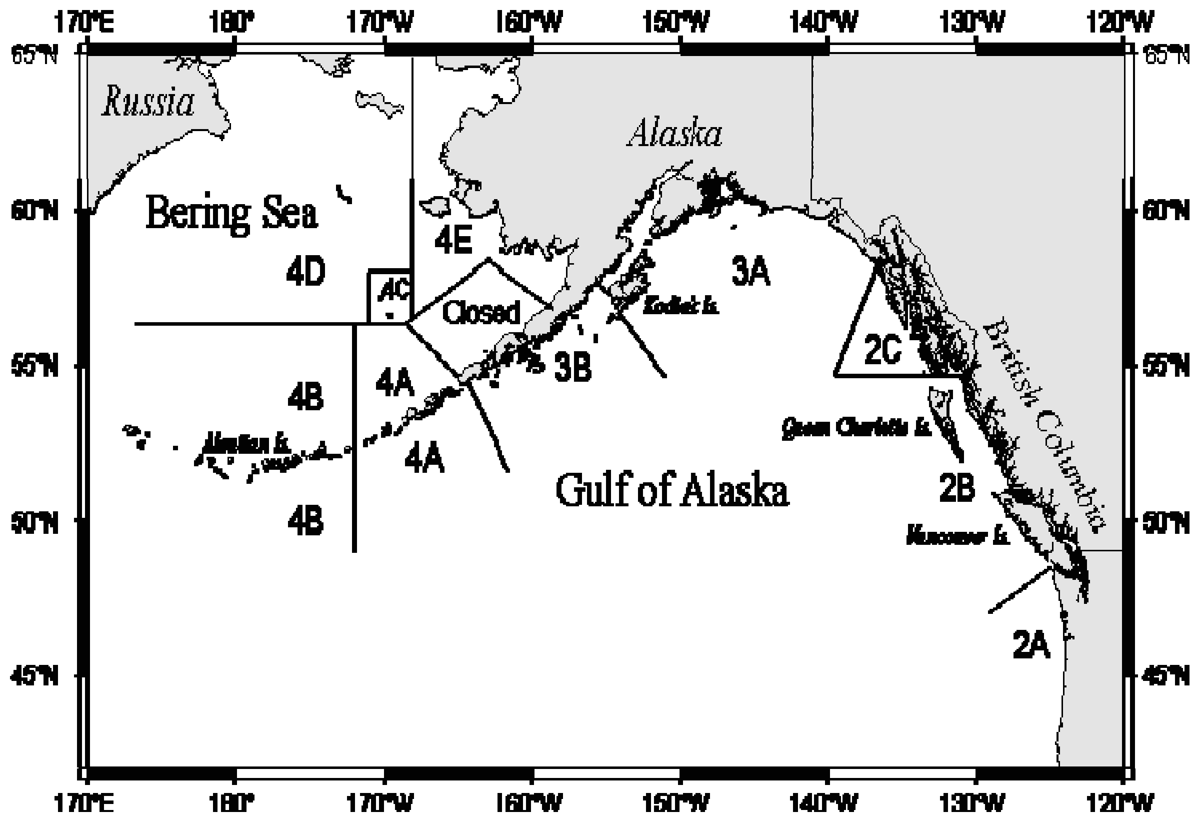

Fig. 8-10 IPHC Management areas in Alaska

8.2.5.5 Short-tailed albatross hotspots

Piatt et al (2006) discuss oceanic areas of seabird concentrations; they explain that STAL hotspots are characterized by vertical mixing and upwelling caused by currents and bathymetric relief and which persist over time (Fig. 22). The continual upwelling brings food to the surface and, thus, draws predators back for repeated foraging, especially Albatross species which forage at the surface due to their limited diving ability (Hyrenbach et al, 2002). Sightings data were compiled from the following sources: from 1988-2004 records from seabird observers on the FWS's research vessel M/V Tiglax; from incidental sightings by biologists, fishermen, seamen, fisheries observers and birdwatchers provided to the FWS; 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. 8-19). 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. 8-19).

8.2.5.6 STAL takes in Alaska fisheries

Table 8-8 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. 8-19 for a map of the take locations and note that no takes are reported from groundfish trawl fisheries (Table 8-8).

Table 8-8 Reported takes of STAL in Alaska fisheries (NPPSD 2004)

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

8.2.5.7 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. 8-19).

8.2.5.8 Satellite tracking of STAL (Suryan, 2006a and 2006b)

The FWS 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 (FWS 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).

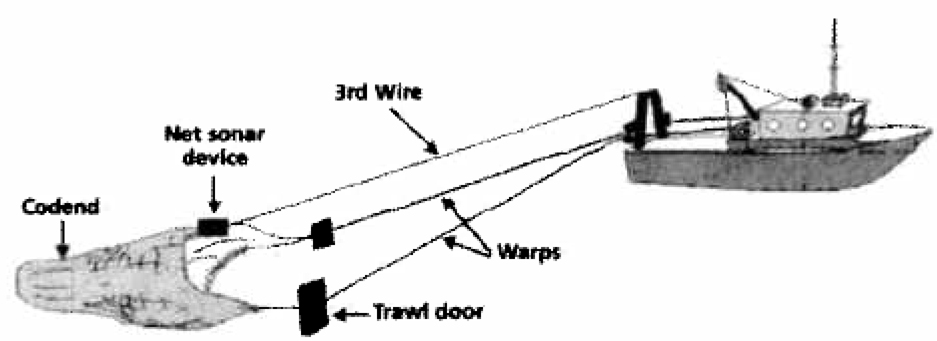

Fig. 8-11 Trawl vessel diagram. (Reproduced from Dietrich and Melvin 2007, courtesy of K Williams)

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. 8.2.5). In some trawl fisheries, equipment is mounted on the trawl net that sends signals to the vessel so net performance can be monitored. This is most important in midwater fisheries such as Pollock trawl, but is employed in some bottom-trawl fishing applications as well. Seabirds attracted to offal and discards from the ship may either strike the hard-to-see cable while in flight, or get caught and tangled in the cable while they sit on the water due to the forward motion of the vessel. Onboard observations of birds (including Laysan albatross) colliding with either of these cables have been made by both researchers and observers. Some birds that strike vessels or fishing gear fly away without injury, while others are injured or killed. When the cable or third wire encounters a bird sitting on the water, the bird can be forced underwater and drown. The main distinction between the two systems is the different location of the transducer cables and third wires. The transducer wires are deployed from the side of the ship and can be very close to where offal is discharged. There, they are not so likely to be hit by flying birds, but very likely to encounter swimming birds. Alternatively, transducer cables can be suspended from relatively long outriggers. This gets them out of the offal discharge area, but puts them more into the birds' flying zone. In contrast, trawl sonar cables (third wires) are deployed from the center of the stern, above the main deck, and can be above the water for longer distances. Thus, they are more likely to intersect the birds' flying zone than the concentration of swimming birds feeding on offal. These differences in location are likely to affect the probability and mechanism of bird strikes.

Up to the present, information on seabird interactions with transducer or third wire cables in Alaska has not been collected systematically. NMFS (2002a) reports that the 3000+ observation records by NMFS-certified observers from 1993 to 2001 include 25 definitive reports of birds specifically striking or being drowned by the 'third wire' on trawl gear, and one report of birds striking the main trawl cables. Many of the observer notes were not about the third wires, and all observations may not have been recorded, so encounter rates cannot be calculated from this information. The third wire incidents that were noted involved 92 birds, including about 30 northern fulmars and 19 Laysan albatross (NMFS 2002a; USFWS Observer Notes Database). Researchers have made similar reports.

There are presently no standardized observer data on seabird mortality from trawler third wire collisions in Alaskan waters. Direct collection of seabird-third wire interaction data is problematic, for several reasons. Any birds killed by third wire collisions would most likely not be recorded in the observers' sampling of the trawl haul, as it is unlikely that such birds would make their way into the trawl net. Some trawlers are conFig.d 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 incidental take limit (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 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 2007a). Fig. 8-12 shows the seabird species taken as bycatch in the Bering Sea trawl fisheries 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 8-9. 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 small.

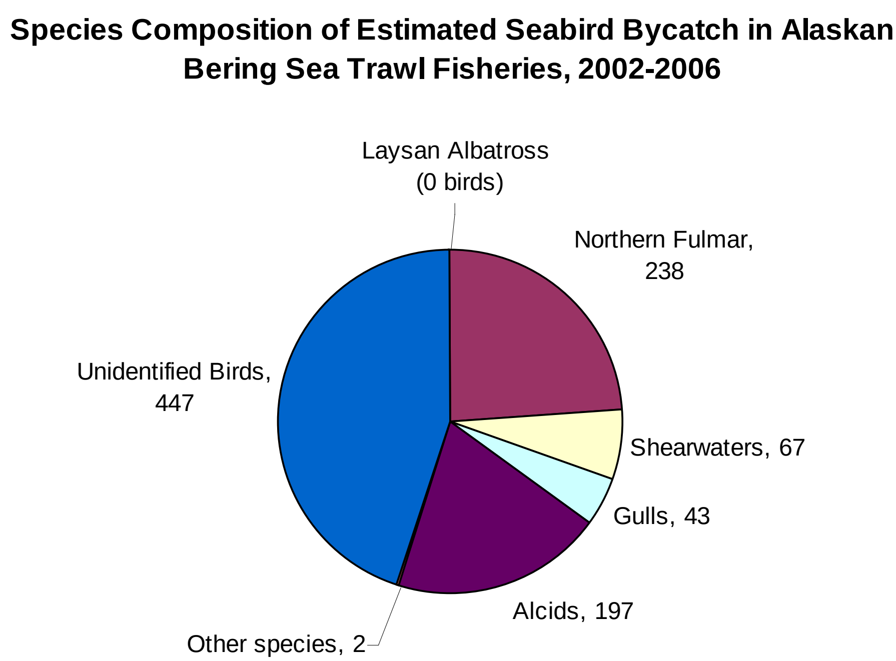

Fig. 8-12 Bycatch composition of seabirds in the Bering Sea trawl fisheries, 2002-2006 (Fig. from AFSC)

Table 8-9 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 2005 (Fig. 8-14) with summer albatross sightings. 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.

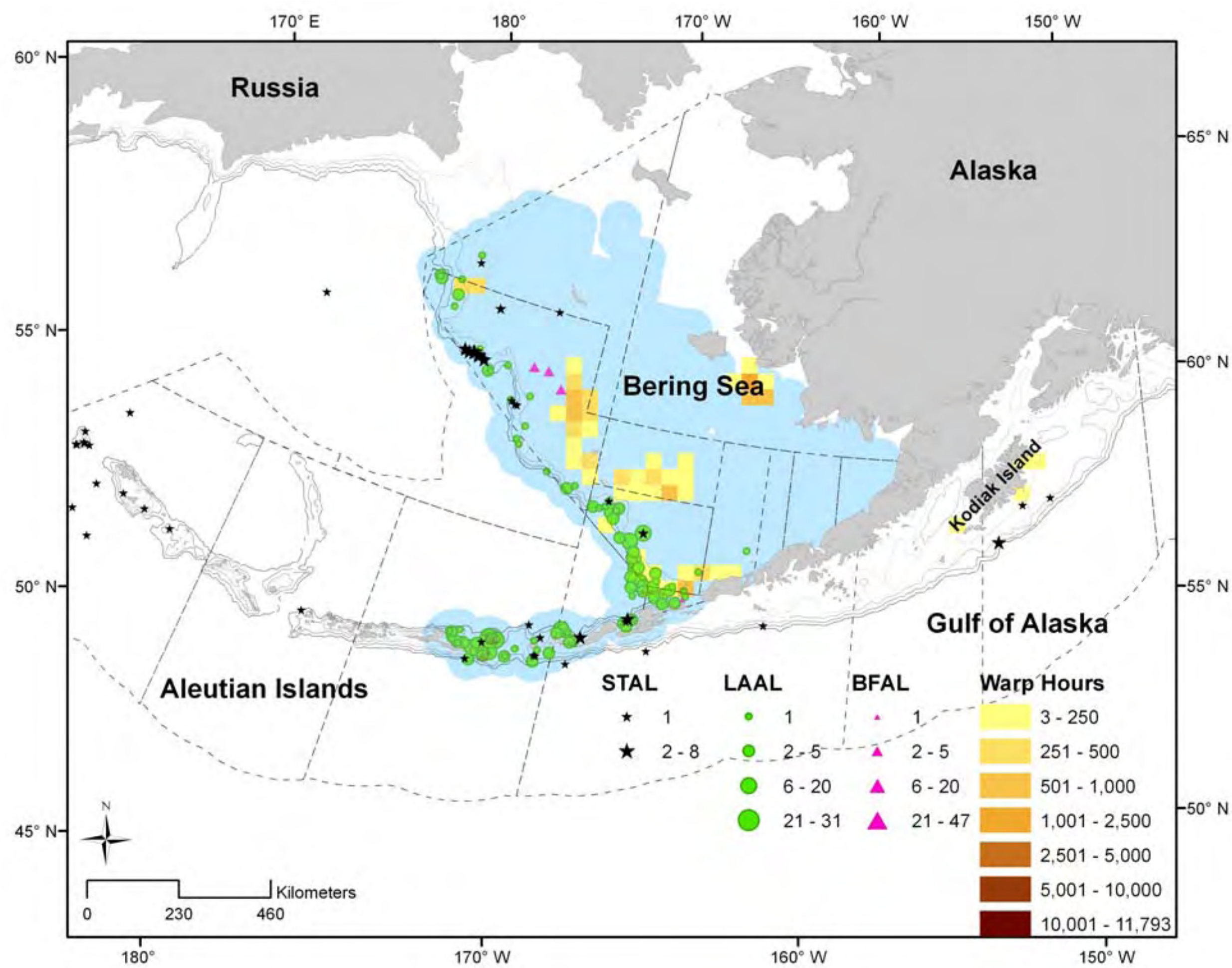

Fig. 8-13 Spatial distribution of warp hours in the Pollock trawl fishery and albatross sightings, 2004. Figure used with permission (Dietrich and Melvin 2007)

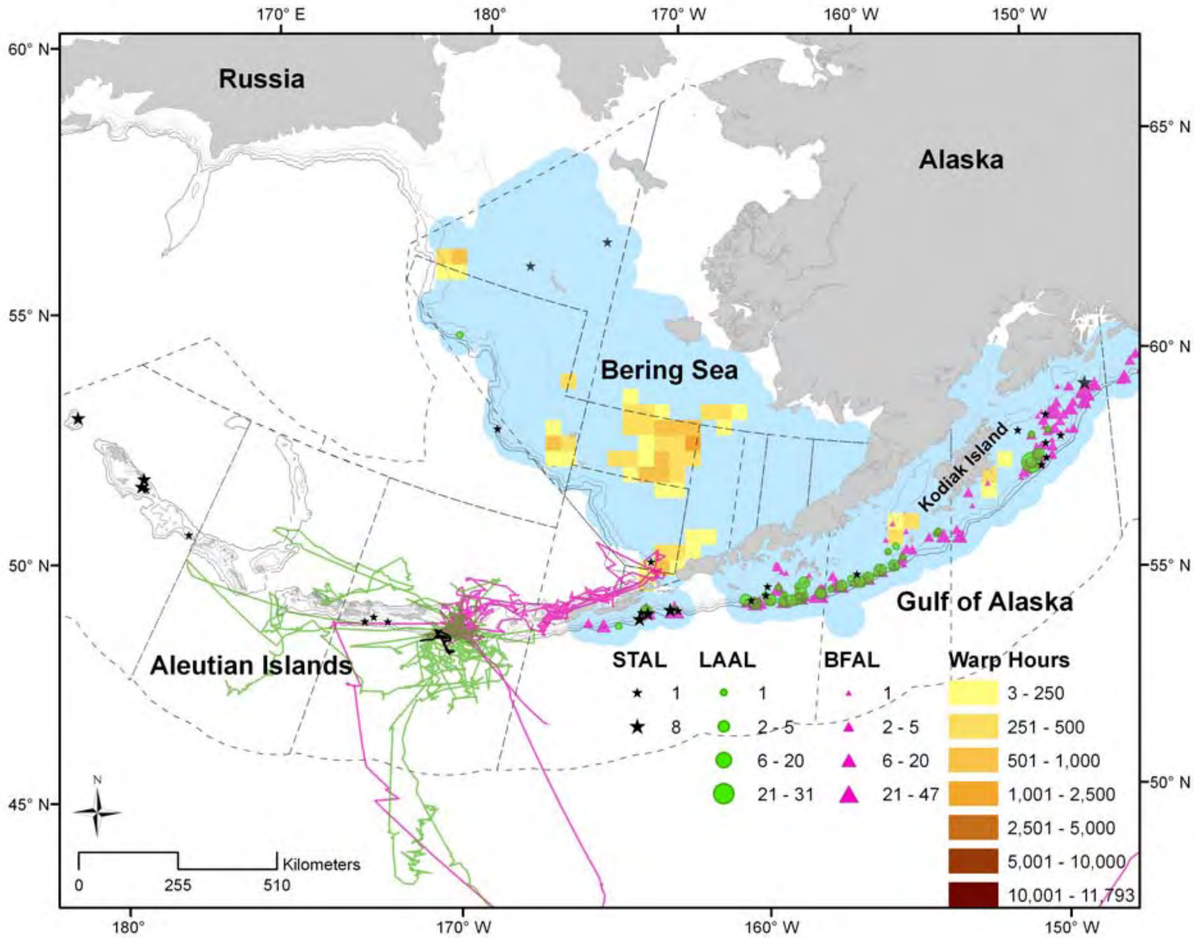

Fig. 8-14 Spatial distribution of warp hours in the Pollock trawl fishery and albatross sightings, 2005. Fig. used with permission (Dietrich and Melvin 2007)

Fig. 8-15shows the current spatial restrictions on the Pollock trawl fishery in the Bering Sea and Aleutian Islands. Steller sea lion haulouts near the Pribiliof, St. Lawrence, St. Matthew, Walrus, and Round Islands are protected out to various distances by closing those waters to Pollock trawl (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. 8-17shows that there are seabird colonies at most of these islands and nearshore in the Bogoslof area. Fig X shows the distribution of seabird species in these areas, and Fig X 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.

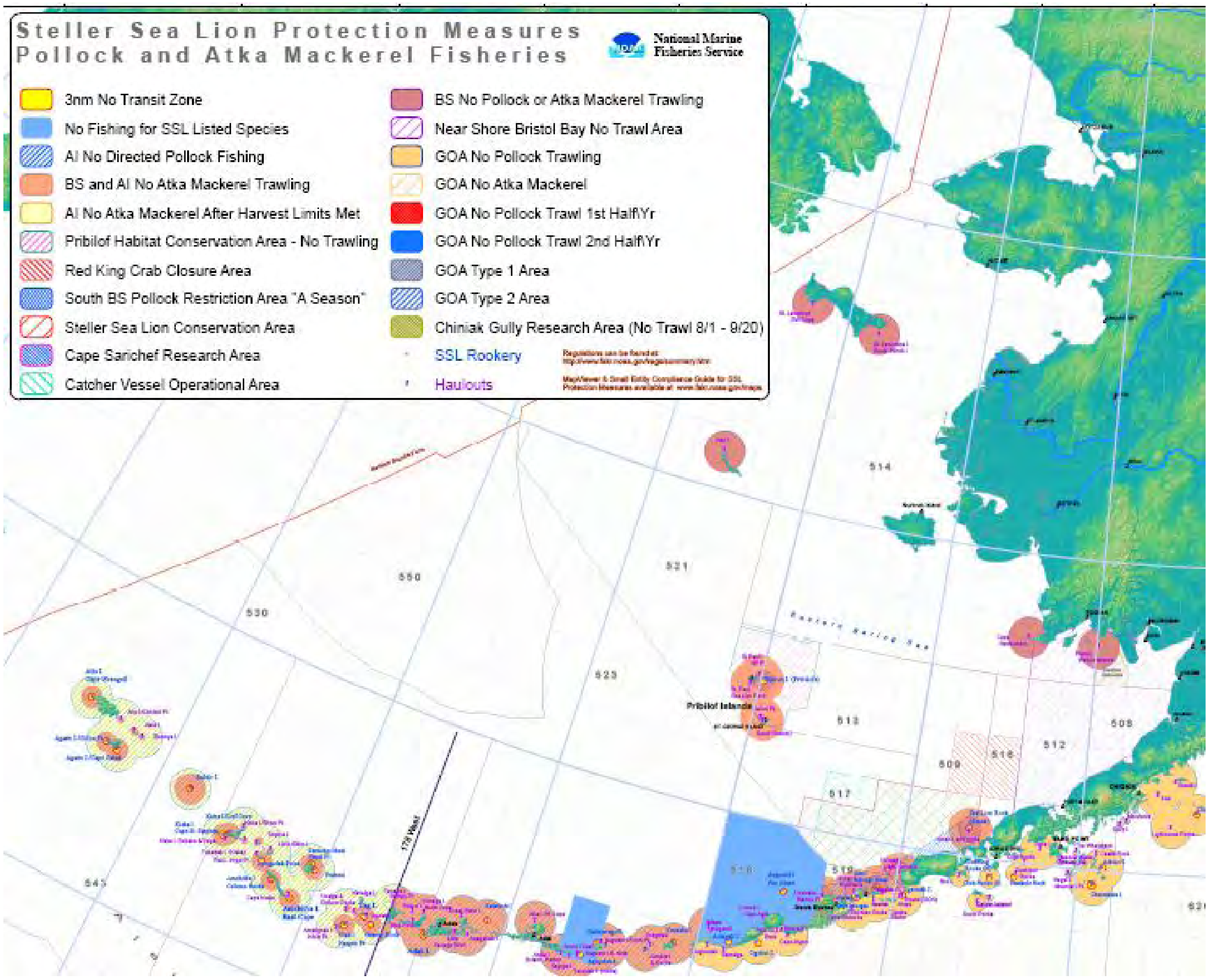

Fig. 8-15 Spatial restriction on the Pollock trawl fishery in the BSAI.

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. 8-16). Fig. 8-18shows 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.

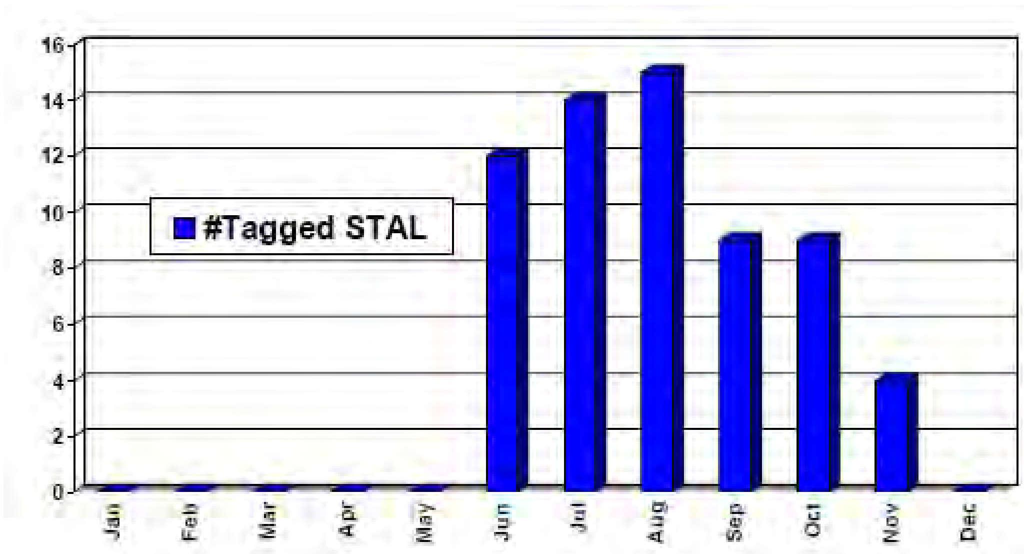

Fig. 8-16 Numbers of STAL tagged in 2002-2006 by month

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. 8-17shows 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. 8-18. 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. 8-18 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 (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. 8-18). 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.

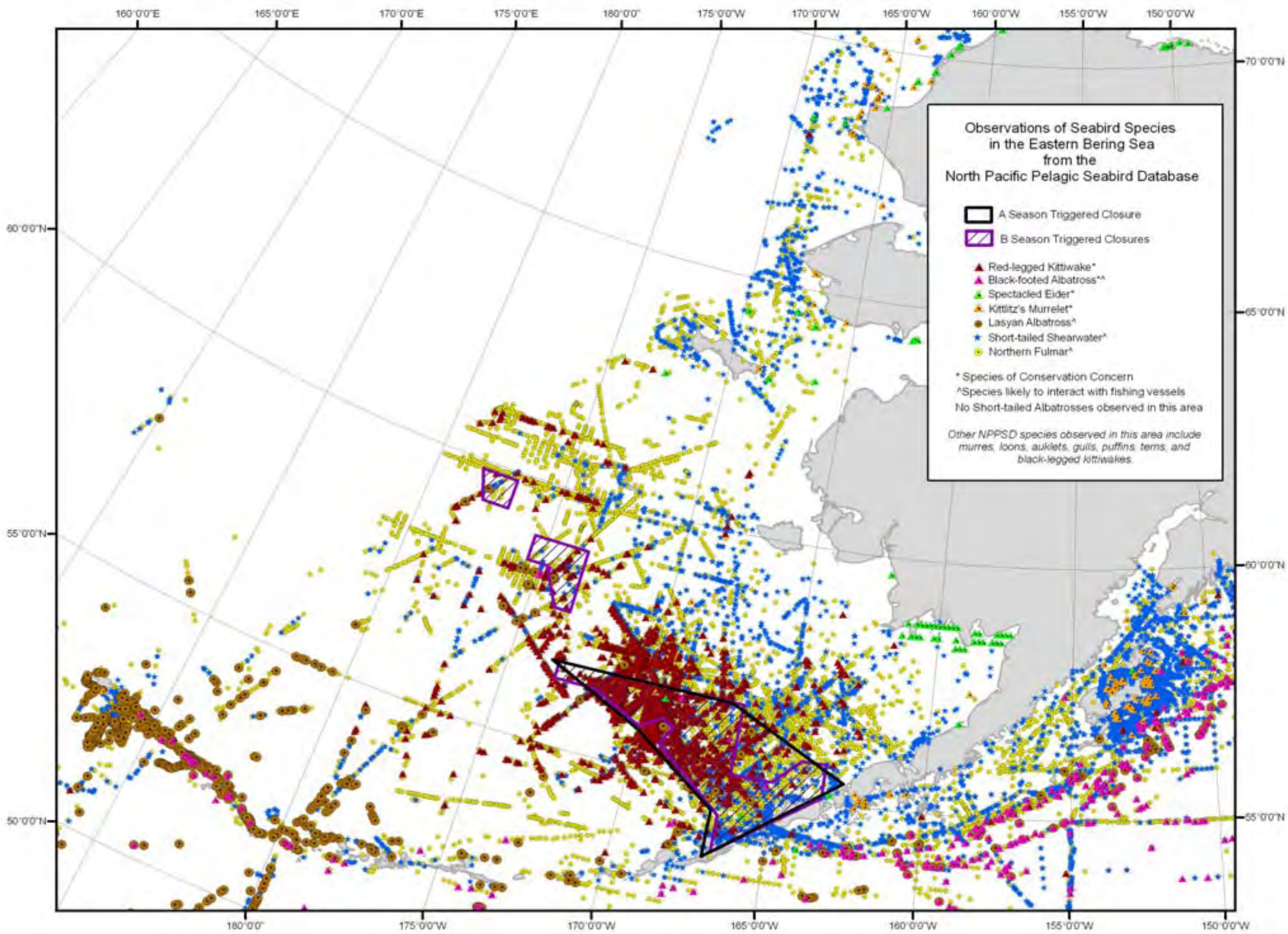

Fig. 8-17 Observations of seabird species in the Bering Sea with boundaries of triggered closure areas

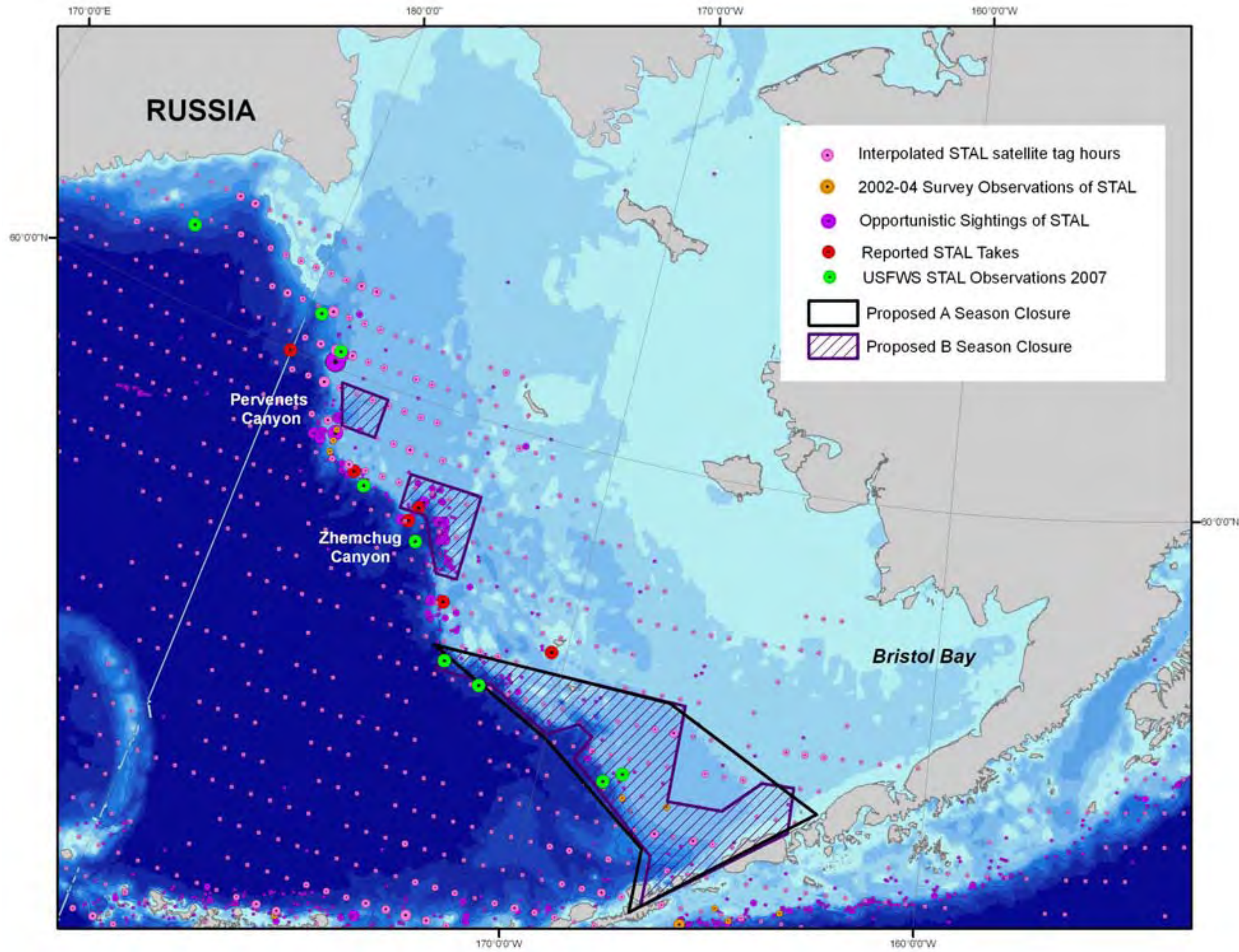

Fig. 8-18 Short-tailed albatross takes (NPPSD 2004) , satellite tag observations (Suryan 2006), survey data (Melvin et al 2006) and (Kuletz and Labunski unpublished) and Opportunistic Sightings of Short-tailed Albatrosses (Balogh et al 2006) in relation to area closure boundaries. Bigger dots in the 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).

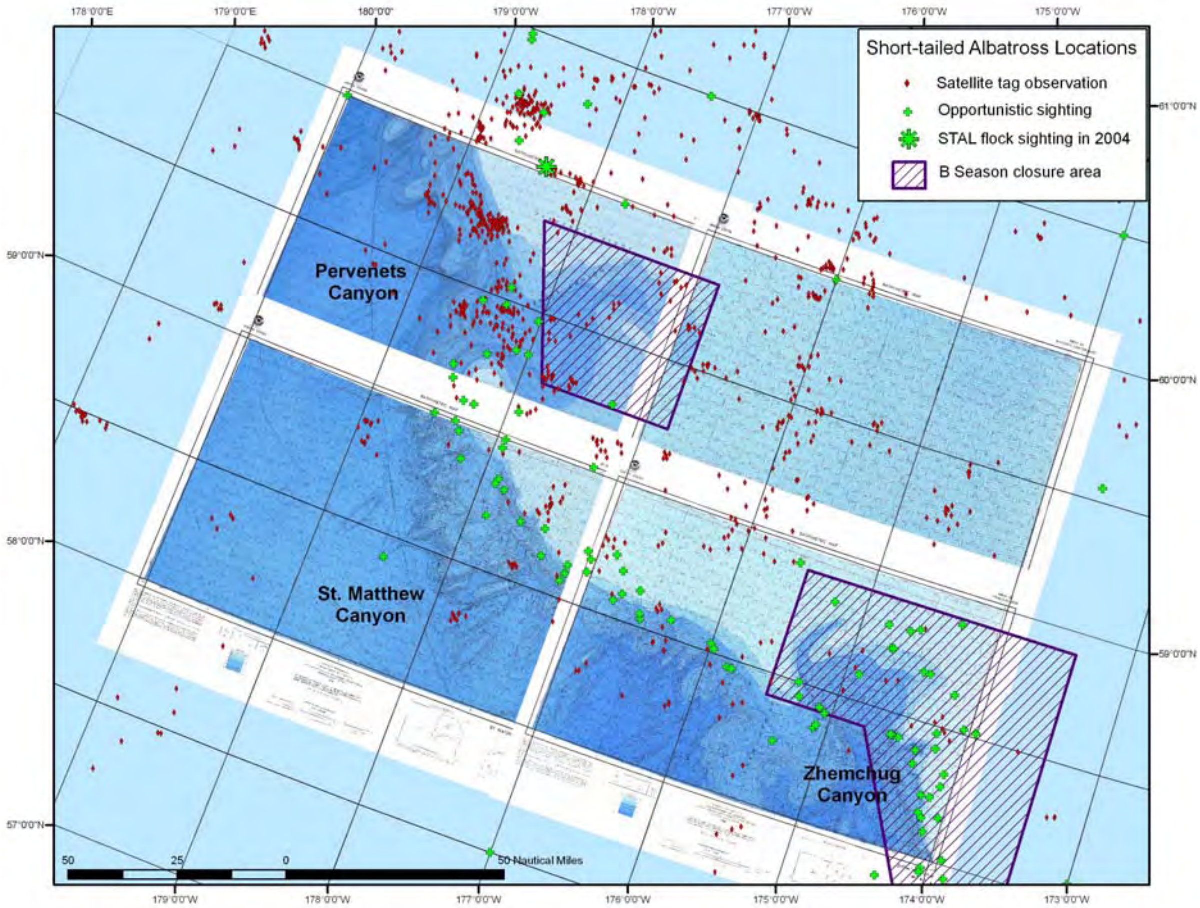

Fig. 8-19 STAL locations near Bering Sea Canyons and proposed B season closure areas.

8.2.7 Reasonably Foreseeable 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 8.2-5 lists stressors on seabirds species of concern in Alaska waters.

Table 8-10 Stressors on seabird species of concern in Alaska

Human Activity Stressor	**Species affected**
Gillnet fisheries	**Kittlitz's murrelet, Steller's eider**
Oil spills and leaks	**Kittlitz's murrelet, red-legged kittiwake, short-tailed albatross**
Other hook and line fisheries outside Alaska	**black-footed albatross**
Tourism/vessel traffic	**Kittlitz's murrelet**
Feather Hunting	**short-tailed albatross, black-footed albatross**
Ingestion of Plastics	**short-tailed albatross, black-footed albatross, laysan albatross**
Collisions with fishing vessels	**short-tailed albatross, Steller's eider, spectacled eider**
Introduced species	**black-footed albatross, red-legged kittiwake**
Military eradication programs	**black-footed albatross, laysan albatross**

8.2.7.2 Recovery of the Short-tailed Albatross

Because the short-tailed albatross population is rapidly increasing at approximately 7% annually (Zador et al. *in review*), the potential for interaction with North Pacific fisheries is also increasing. However, recent modeling of the impact of trawl mortality on the endangered STAL population suggests that even if the current estimated take (two birds in a 5 year period) was increased ten-fold, it would have little impact on the time course of achieving the species' proposed recovery goals, barring significant changes in non-trawl bycatch and a large volcanic eruption at the breeding colony (Zadar et al 2008).

8.2.7.3 Continuation of seabird protection measures in Alaska fisheries

As research continues on seabird and fisheries interactions in Alaska waters, gear modification solutions may arise that mitigate potential interactions between trawl cables and seabirds, particularly with short-tailed albatrosses, if the research suggests further mitigation is necessary. In the hook-and-line groundfish and halibut fisheries in Alaska, fishing vessels are required to use seabird avoidance gear in areas where interactions with seabirds are likely to occur. The use of this avoidance gear has likely contributed to a drastic decline in seabird bycatch in hook-and-line fisheries since 2001 (NMFS 2007). These protection measures help to minimize the total effect of Alaska fisheries on seabird populations in Alaska waters.

8.2.7.4 Actions by other Federal, State, and International Agencies

Currently the State of Alaska Department of Fish and Game 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. There are several species of conservation concern there and many other species that could potentially interact with trawl cables. The AFSC estimates of these takes are small relative to seabird population total estimates. Recent modeling suggests that even a large increase in trawl cable incidental takes of short-tailed albatross (the only seabird listed as endangered under the ESA) 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 8-11.

Table 8-11 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 seabirds distributions and their spatial overlap with seasonal Pollock trawl effort to make evaluate statements about seasonal hard caps.
	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.
	Other options and components	Other components of this alternative should not affect the amount of impacts to seabird populations.

8.3 Essential Fish Habitat

This chapter 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.

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.

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. Thus, salmon are not considered to be a benthic species. 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. The EFH EIS concluded that pelagic effects from fisheries are minimal because no information was found indicating significant effects of fishing on features of pelagic waters serving a habitat function for managed species. The Bering Sea pollock fishery only interacts with salmon habitat in the ocean, and the concerns about these interactions center on effects on bycatch of prey and prey availability. Salmon prey (copepods, squid, herring, and other forage fish) are subject to only a few targeted fisheries outside of the EEZ, such as the State of Alaska herring fisheries and international squid fishery. However, the pollock fishery does catch salmon prey species, including squid, capelin, eulachon, and herring. Currently, the catch of these prey species is very small relative to overall population size of these species, thus fishing activities are considered to have minimal and temporary effects on prey availability for salmon. Chapter 7 provides more information on the impacts of the Bering Sea pollock fishery on these prey species.

Appendix B to the EFH EIS also describes how pelagic trawl gear impacts benthic species and habitat (NMFS 2005). The EFH EIS notes that "pelagic trawls may be fished in contact with the seafloor, and there are times and places where there may be strong incentives to do so, for example, the EBS shelf during the summer" (NMFS 2005). Trawl performance standards for the directed pollock fishery at 50 CFR 679.7(a)(14) reduce the likelihood of pelagic trawl gear use on the bottom. However, concern exists about the contact of pelagic trawl gear on the bottom and the current standards used to limit bottom contact (from June 2006 minutes of the SSC and AP, available at: http://www.fakr.noaa.gov/npfmc/minutes/minutes.htm). Flatfish and crab bycatch in the pollock fishery also shows that pelagic gear contacts the bottom. The description of impacts by pelagic trawl gear on habitat in this document is based on the best available science, but may be considered controversial with some believing the impact may be more than described.

The results of the EFH EIS analysis of the effects of fishing on benthic habitat features determined the long-term effect index (LEI) to represent the proportion of feature abundances (relative to an unfished state) that would be lost if recent fishing patterns were continued indefinitely. The LEI was 10.9% for the biological structure of sand/mud and slope habitats of the eastern Bering Sea where fishing effort is concentrated, and recovery rates are moderately low. The analysis also calculated the proportion of each LEI attributable to each fishery. The pollock pelagic trawl fishery was the largest single component (4.6%) of the total effects on living structure in the eastern Bering Sea sand/mud habitat. The combined effects of the bottom trawl fisheries made up all of the remaining 6.3%. Nearly all (7.2%) of the LEI for living structure on the eastern Bering Sea slope was due to the pollock pelagic fishery. Based on this analysis, the EFH EIS determined that the fishing effects are not limited in duration and therefore not temporary. However, the EFH EIS considered LEIs of less than 11% as small.

The EFH EIS also evaluated the effects on managed species to determine whether stock condition indicates that the fisheries affect EFH in a way that is more than minimal. To conduct this evaluation, the analysts first reviewed the LEI from the fishing effects model to assess overlap with the distribution of each stock. The analysts then focused on habitat impacts relative to the three life-history processes of spawning/breeding, feeding, and growth to maturity. Finally, the analysts assessed whether available information on the stock status and trends indicated any potential influence of habitat disturbance due to fishing. Based on the available information, the EFH EIS analysis found no indication that continued fishing at the current rate and intensity would affect the capacity of EFH to support life history processes of any species. In other words, the effects of fishing of EFH would not be more than minimal.

Due to the nature of this action, the Bering Sea pollock fishery as modified by the proposed action is not predicted to have additional impacts beyond those identified in the EFH EIS. Based on the analysis presented in the EFH EIS and summarized above, NMFS concludes that Alternative 1 would impact EFH for managed species, but that the available information does not identify effects of fishing that are more than minimal. In other words, effects may occur but they would not exceed the minimal and temporary limits established by 50 CFR 600.815(a)(2).

The Alternative 2 hard 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 in Appendix 1 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. 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 could consider additional habitat conservation measures.

8.3.4 Reasonably Foreseeable 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.

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).

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 2008b), 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.

8.3.4.1 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.)

8.3.4.2 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.

8.3.4.3 Conclusions

All alternatives would have impacts on EFH similar to those concluded in the EFH EIS. NMFS concludes that all of the alternatives would affect EFH for managed species. However, best available information does not identify any effects of fishing as significantly adverse. In other words, effects may occur from fishing, however these effects do not exceed the minimal and temporary limits established by 50 CFR 600.815(a)(2). Alternative 2, to the extent that it closes the pollock fishery before the TAC is harvested, may 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.

9.0 ENVIRONMENTAL JUSTICE

Note: Impacts in this section will need to be reviewed and may require revision based on the pollock and salmon effects described in this EIS. The pollock and salmon analyses were not available for explicit consideration in this chapter prior to submission. The following analysis is based on the information available at the time of writing this section.

9.1 What is an environmental justice analysis[11]

This chapter is an analysis required under Executive Order (E.O.) 12899, Environmental Justice (59 FR 7629). Under this E.O., demographic information is used to determine whether minority populations or low-income populations are present in the area affected by the proposed action. If so, a determination must be made as to whether the implementation of the proposed action may cause disproportionately high and adverse human health or environmental impacts on those populations. The disproportionality of the adverse impact to identified minority or low-income populations is the key factor under environmental justice analysis. Adverse impacts that affect the wider population as a whole are not considered potential environmental justice impacts.

"Environmental" effects under E.O. 12898 are construed to encompass social and economic effects, and these are discussed in some detail in this section. Human health effects, as mentioned in E.O. 12898, appear to be less relevant to impacts potentially associated with the various management alternatives being considered in this document.[12]

There is no standardized methodology for identification or analysis of environmental justice issues. In determining what constitutes a minority "population," CEQ guidance states, "the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis." While no available federal guidance addresses the identification of low-income populations, a similar approach has generally been adopted when preparing NEPA documents (King 2001). The U.S. Environmental Protection Agency (EPA) has stated that addressing environmental justice concerns is entirely consistent with NEPA and that disproportionately high and adverse human health or environmental effects on minority or low-income populations should be analyzed with the same tools currently intrinsic to the NEPA process. NOAA environmental review procedures[13] state that, unlike NEPA, the trigger for analysis under E.O. 12898 is not limited to actions that are major or significant, and hence federal agencies are mandated to identify and address, as appropriate, "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

It is important to note the meaning of the term "population" as it is typically applied to environmental justice analyses, as well as how it has been applied in the context of Alaska fisheries in particular. While a "population" can mean a geographically localized set of people (for example, residents of a village,

[11] This section is based on the discussion in the Alaska Groundfish Harvest Specifications Final EIS (NMFS, 2007). The analysis was originally prepared by Michael Downs and Marty Watson of the consulting firm EDAW.

[12] E.O. 12898 does include language regarding the need to identify differential patterns of subsistence consumption of fish and wildlife, but it goes on to link this data collection with potential human health risks associated with the consumption of pollutant-bearing fish and wildlife. While subsistence in Alaska is associated more strongly with minority (Alaska Native) populations and low-income populations (those in rural areas with fewer commercial economic opportunities) than other populations, there is no indication that any of the alternatives being considered would result in a degradation of resources in a manner such that their consumption would result in a health risk elevated above existing conditions.

[13] NOAA *Environmental Review Procedures for Implementing the National Environmental Policy Act* (Issued 06/03/99).

town, or other spatially bounded community), a "population" could equally refer to a widely distributed set of people with a uniting or common set of circumstances, livelihoods, or lifeways that may be affected by the management alternatives. These could be very localized populations nodes (e.g., "population pockets" of workers living in group quarters at a series of processing plants in communities directly participating in the relevant fisheries) or they could be spread over very wide areas in a distribution pattern more closely resembling the total set of communities in a given region (e.g., residents of communities hundreds of miles removed from direct fisheries activities but that may nevertheless be affected by changes in access to subsistence resources that are themselves affected by the management action). Defining populations for environmental justice analysis of Chinook salmon bycatch in the Bering Sea pollock trawl fishery is challenging as the fishery literally spans an area offshore of thousands of miles of coastline that encompasses dozens of communities in Alaska, including many communities with high Alaska Native (i.e., minority) population percentages, as well as encompassing large numbers of participants from the Pacific Northwest.

9.2 What is the action area?

The action area is waters of the Bering Sea, is described in detail in Section 1.3. Note that it does not include the waters of the Aleutian Islands. This defines the scope of the analysis somewhat since it is not necessary to consider the allocation of pollock to the Aleut Enterprise Corporation.

The definition of the action area notes that impacts of the action may occur outside the action area in the freshwater habitat and migration routes of the salmon caught as bycatch. Chinook salmon caught as bycatch in the Bering Sea pollock fishery may originate from Asia, Alaska, Canada, and the western United States. Impacts may extend beyond those river systems, as subsistence harvesters distribute Chinook salmon through traditional gift and exchange networks. Thus persons in major cities not on the impacted river system, such as Anchorage, may be affected. Moreover, impacts may occur on shore in communities that process and arrange for the further distribution of pollock deliveries from catcher vessels.

9.2.1 Western and Interior Alaska Communities

Environmental justice issues are particularly important for Alaskan communities around the perimeter of the Bering Sea, island communities, interior Alaska communities on or dependent on the great river systems, such as the Kuskokwim and Yukon, and communities in the southern Chukchi Sea. The harvests are important for coastal regions with Aleut, Alutiiq, Yup'ik and Inuit populations, but also for Athabaskan Indian populations in interior Alaska.

As described Chapter 5, genetic analysis suggests that significant proportions of the Chinook salmon harvested by the pollock fishery in the Bering Sea originate in the rivers and streams of Western Alaska. Chinook salmon harvests are important components of subsistence and commercial fishery harvests in Western Alaska, and play an important role in the subsistence/market economies of these regions. Many public comments received during the scoping process for this EIS discussed how salmon serves an important cultural and economic role in the communities of Alakanuk, Eek, Nanakiak, Nunapitchuk, Emmonak, Kwethluk, Bethel, St. Mary's, Ruby, Nulato, Koyukuk, Kotlik, Galena, Kaltag, Fairbanks, Kongiganak, Quinhagak, Nenana, Minto, Marshall, and Hooper Bay, and throughout Western and Interior Alaska (NMFS 2008).

The pollock fishery also plays an important role in this region. Sixty-five western Alaska communities have an interest in the productivity of the pollock resource and the costs of harvesting pollock through their participation in the Community Development Quota program. Other communities, such as Dutch

Harbor/Unalaska, play an important role in the fishery through the processing of pollock landed by pollock catcher-vessels.

9.2.2 South Central, Southeast Alaska, Washington Island Waters and Oregon Coast Regions

Environmental justice is likely to be much less of an issue in the southcentral and southeast Alaska region communities than in western Alaska because, as suggested elsewhere, genetic evidence suggest that significantly smaller numbers of the Chinook salmon taken in the Bering Sea originate in these areas. In addition, there are no CDQ communities in these regions.

The greater Seattle area is the center for much of the economic activity related to the North Pacific pollock fishery. However, the geographic footprint of those activities is difficult to define, and it cannot be attributed to specific communities or neighborhoods in the same manner as Alaska communities may be linked to the fishery, as discussed in the PSEIS (NMFS 2004). Given the nature of engagement with the fishery, the Washington Inland Waters region does not have the same type of resident workforce focused in individual communities in a manner comparable to that seen in Alaska communities. Also, unlike the Alaska groundfish communities, the white portion of the population comprises a large majority of the overall population (i.e., racial or ethnic groups classified as minorities are mathematical minorities within the local overall population, unlike the relevant Alaska communities).

For these reasons, environmental justice is not considered a regional or community level issue for Bering Sea pollock initiatives for the greater Seattle area, or the Washington Inland Waters region as a whole. Although quantitative data are not available to confirm this, based on interview data it does not appear to be an issue for the regionally based catcher vessel fleet either. As there are no Alaska pollock shore-based processing entities in this region, the types of environmental justice issues associated with these workforces seen in some of the Alaska regions are not present in the Washington Inland Waters region. While it is possible that catcher/processor vessel workforces may have similar issues, no data are available to confirm this.

There is no indication from available information that environmental justice will be an issue in the Oregon Coast region. No plants processing Bering Sea pollock operate in this region, nor are any owned by residents of this region, so populations associated with this sector are not a concern.

9.3 Are minority or low income populations present?

9.3.1 Are minority populations present?

A significant part of the population in the impacted area is made up of Alaskan Natives. Table 9-1 shows the Alaska Native population within each of the U.S. census districts in the action area and compares these with the proportions of the U.S. and Alaskan populations that are made up of American Indian and Alaska Natives. Less than one% of the U.S. population, and about 16% of Alaska's population is made up of Native Americans; however none of the census districts in the action area is less than 44% Alaskan Native.

Table 9-1 Minority and Low Income Populations by Western Alaska Census District, 2000 Census

Area	Population	American Indian or Native Alaskan	Two or more races	Min native percentage of population	Max native percentage of population
United States	281,421,906	2,447,989	n.a.	~ 1	n.a.
Alaska	626,932	98,043	34,146	16	21
Lake and Peninsula	1,832	1,340	127	74	80
Bristol Bay	1,258	550	30	44	46
Dillingham	4,922	3,452	329	70	77
Bethel	16,006	13,114	617	82	86
Wade Hampton	7,028	6,503	177	93	95
Yukon-Koyukuk	6,551	4,644	256	71	75
Nome	9,196	6,915	387	75	79
Northwest Arctic	7,208	5,944	267	82	86
Aleutians west	5,465	1,145	189	21	24
Aleutians east	2,697	1,005	79	37	40

Source: U.S. Bureau of the Census. Minimum percentage assumes only persons characterized as “American Indian or Alaskan Native” are Alaska Natives. Maximum assumes that all of the persons of two or more races are at least half Alaska Native. “Two or more races” category has not been used for the United States as the number is unlikely to be comparable in interpretation to the Alaskan estimates.

There are a large number of indigenous peoples, with a diversity of life-styles and cultures, living within the action area. Cultural differences with implications for resource use may exist even between groups identified within one of the broad cultural-linguistic groupings commonly used.[14] The following brief list of minority ethnic groups within the region depends primarily on Langdon and Krauss (Langdon, 2002; Krauss, 1982). From North to South:

- Seward Peninsula, and the eastern shore of Norton Sound as far south as Unalakleet are occupied by the Inupiat Eskimo. Langdon distinguishes between the Norton Sound and Bering Straits Inupiat. The later includes the community of Wales at the end of the Seward Peninsula, and the King Island community. No one lives on King Island, but the people who used to, and their descendents, maintain themselves as a distinct community on the mainland. Landgon notes that the Bering Straits Inupiat traditionally tended to harvest larger sea mammals, while the Norton Sound Inupiat tended to harvest small sea mammals, land mammals, fish, and migratory waterfowl. The King Island people have now lived on the mainland in the vicinity of Nome for about 50 years and this would tend to acclimate them to regional subsistence patterns.

- The Athabaskan Indians are inland rather than maritime peoples. They inhabit the central core of Alaska. Athabaskan groups living along the Yukon and Kuskokwim River systems may be especially affected by this action. These include the:
    - Deghitan on the lower Yukon and Kuskokwim Rivers
    - Holikachuk on the lower middle Yukon and Innoko Rivers
    - Koyukon in the middle Yukon and Koyukuk Rivers
    - Tanana on the Lower Tanana River
    - Tanacross on the middle Tanana River

[14] Fienup-Riordan found that attitudes towards non-Native hunters could contrast “sharply” between Yup’ik on Nelson and Nunivak Islands. Nelson Islanders sought to treat a relatively new musk ox resource in a more traditional manner, while Nunivak Islanders were more willing to support guided hunting as a way of earning income as well as acquiring meat (Fienup-Riordan, 2002). The point is that there can be significant cultural divergences even among fairly closely related ethnic groupings.

- Gwich'in on the upper Yukon and Porcupine Rivers
- Han on the upper Yukon River
- Upper Tanana on the upper Tanana River
- Upper Kuskokwim on the upper Kuskokwim River

- The Yup'ik Eskimo occupy the great bulge formed by the Yukon and Kuskokwim River deltas and Nelson and Nunivak Islands. Langdon distinguishes between the Yukon, Kuskokwim, Bristol Bay and Delta Yup'ik and the Cup'ik of Nunavak Island. Membership in the different groups implies access to different resources and consequently somewhat different cultural practices. For example, he notes that Yup'ik communities along the resource rich Yukon and Kuskokwim Rivers tended to be larger than the communities of the Delta Yup'ik, who were further removed from these resources.

- The Unangan/Aleut occupy the Aleutian Islands. Langdon distinguishes between Eastern, Central, and Western Unangan.

- The Sugpiaq/Alutiiq are the Pacific Eskimos, occupying the Alaska Peninsula, Kodiak, the Gulf waters of the Seward Peninsula, and Prince William Sound. Langdon identifies the Koniag Alutiiq in the west, the Chugach Alutiiq in the east, and the Eyak in the area of the Copper River delta. Communities to the south side of the Alaska Peninsula are generally considered to be minimally impacted by this action. However part of the homeland of the Koniag Alutiiq lies on the north side of the peninsula to the west of Bristol Bay.

The key point is that there is a complex group of indigenous minority populations that occupy the impacted area. There are many cultural similarities, but there can also be significant cultural differences that may affect the way these populations interact with Chinook salmon, and other subsistence resources. Cultural differences may exist between broadly defined groups such as the Yup'ik and the Athabaskans, but also between smaller groups within these larger groupings.

9.3.2 Are low income populations present?

Many of the people in the action area have traditionally obtained significant amounts of food and materials by exploiting local resources. Paid jobs have been relatively scarce and often seasonal, and livings were earned in both the subsistence as well as the wage economy. These communities have been characterized by relatively low levels of labor force participation, high levels of unemployment, low per capita incomes, and high measured poverty rates. In part this reflects the inability of work and income statistics to measure activity outside of the formal marketplace. Significant numbers of transactions also appear to take place in barter or informal trades and exchanges in informal markets which constitute an "underground economy."

Because we are not in a position to systematically measure the contribution of subsistence or personal use harvest activity, and this informal production and trading activity, to income and consumption, the low income evaluation in this analysis is based on information from the formal, "above-ground" economy only.

Table 9-2 provides some income indicators, including the percentage of adults that are in the labor force, the percentage of adults that are unemployed, the percentage of persons in poverty, and per capita income. Labor force, unemployment, and income variables are difficult to interpret in these areas with their mixed subsistence/cash economies. A person's formal labor force participation may be relatively small compared to what it might be in more heavily monetized economy, nevertheless the person may be working very hard to earn a livelihood. Similarly, poverty and income statistics should really be adjusted to reflect the monetary value of subsistence production to provide a relatively comparable measure of income. On the other hand, a comparison of the income or poverty gap between the people in one of these areas and the rest of the state provides an indicator of the gap to be filled by subsistence activity.

Table 9-2 1999-2000 Employment, income, and poverty information for census districts and boroughs in the action area from the 2000 Census

Status	Total adults	In labor force	Out of labor force	Employed	Unemployed	Unemployment rate	% not working	% pop in poverty	Per capita income
Alaska	458,054	326,596	131,458	281,532	27,953	9%	29%	9%	22,600
Aleutians East Borough	2,337	1,854	483	1,086	768	41%	21%	22%	18,400
Aleutians West Census Area	4,637	3,788	849	3,252	473	12%	18%	12%	24,000
Bethel Census Area	10,269	6,446	3,823	5,481	936	15%	37%	21%	12,600
Bristol Bay Borough	908	649	259	581	68	10%	29%	9%	22,200
Dillingham Census Area	3,216	2,007	1,209	1,765	230	11%	38%	21%	16,000
Lake and Peninsula Borough	1,224	678	546	581	97	14%	45%	19%	15,400
Nome Census Area	6,176	3,745	2,431	3,107	608	16%	39%	17%	15,500
Northwest Arctic Borough	4,535	2,877	1,658	2,427	447	16%	37%	17%	15,300
Wade Hampton Census Area	4,094	2,399	1,695	1,825	574	24%	41%	26%	8,700
Yukon-Koyukuk Census Area	4,531	2,847	1,684	2,276	566	20%	37%	24%	13,700

Notes: Alaska Department of Labor and Workforce Development. Accessed at http://almis.labor.state.ak.us/?PAGEID=67&SUBID=114 on April 1, 2008.

9.4 How do minority or low income communities interact with impacted resources?

This section is organized to address five broad categories of resources considered earlier in this EIS: (1) Chinook salmon, (2) chum salmon, (3) pollock, (4) marine mammals and seabirds, and (5) other groundfish species, forage species, and other prohibited species. Much of the subsistence harvest background for the section on chum salmon will be found included in section on Chinook salmon and is not repeated in the chum salmon section to minimize duplication. The first section discusses the management of both Chinook and chum salmon.

9.4.1 Management of Chinook salmon fishing

The Alaska Department of Fish and Game (ADF&G), under the direction of the Alaska Board of Fisheries, manages sport, commercial, personal use, and State subsistence harvest on lands and waters throughout Alaska. However, on Federal lands and waters, the Federal Subsistence Board implements a subsistence priority for rural residents as provided by Title VIII of ANILCA. In providing this priority, the Board may, when necessary, preempt State harvest regulations for fish or wildlife on Federal lands and waters.

9.4.1.1 State management[15]

The State manages subsistence, personal use, and commercial harvests on waters flowing in state lands. The Federal government manages subsistence harvests on Federal lands.

The State defines subsistence uses of wild resources as noncommercial, customary, and traditional uses for a variety of purposes. These include:

> Direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption (AS 16.05.940[32]).

Under Alaska's subsistence statute, the Alaska Board of Fisheries must identify fish stocks that support subsistence fisheries and, if there is a harvestable surplus of these stocks, adopt regulations that provide reasonable opportunities for these subsistence uses to take place. Whenever it is necessary to restrict harvests, subsistence fisheries have a preference over other uses of the stock (AS 16.05.258).

Alaska Statue defines personal use fishing as the taking, fishing for, or possession of finfish, shellfish, or other fishery resources, by Alaska residents for personal use and not for sale or barter, with gill or dip net, seine, fish wheel, long line, or other means defined by the Board of Fisheries (AS 16.05.940[24]). Personal use fisheries are different from subsistence fisheries because they do not meet the criteria established by the Joint Board for identifying customary and traditional fisheries (5 AAC 99.010), or because they occur within nonsubsistence areas.

Personal use fishing is primarily managed by ADF&G, Sport Fish Division, but some regional or area fisheries for various species of fish are managed by the Division of Commercial Fisheries. For example, permitting for Southeast Alaska king crab personal use fisheries are handled out of the Southeast Regional office, Division of Commercial Fisheries, in Douglas, Alaska (Juneau). Generally fish may be taken for personal use purposes only under authority of a permit issued by ADF&G.

Also, Alaska Statute requires the Joint Board of Fisheries and Game to identify nonsubsistence areas where dependence upon subsistence is not a principle characteristic of the economy, culture, and way of life of the area or community (AS 16.05.258(c)). The Board of Fisheries may not authorize subsistence fisheries in nonsubsistence areas. Personal use fisheries provide opportunities for harvesting fish with gear other than rod and reel in nonsubsistence areas. The Joint Board has identified five nonsubsistence areas (5 AAC 99.015): Ketchikan Nonsubsistence Area, Juneau nonsubsistence Area, Anchorage-Matsu-Kenai Nonsubsistence Area, Fairbanks Nonsubsistence Area, and Valdez nonsubsistence Area.

Alaska subsistence fishery regulations do not in general permit the sale of resources taken in a subsistence fishery. However, State law does recognize "customary trade" as a potential subsistence use. Customary trade is limited to customary, traditional, and noncommercial exchanges (AS 16.05.940(33)). Alaska Statute defines customary trade as the limited noncommercial exchange, for minimal amounts of cash, as restricted by the appropriate board, of fish or game resources (AS 6.05.940(8)). At this time, the herring roe on kelp in Southeast Alaska may be used for customary trade (Magdanz 2007).

Finally, the State manages a large number of commercial salmon fisheries in waters from Southeast Alaska to the Bering Strait. Management of these fisheries is undertaken by the ADF&G Commercial

[15] The following discussion is based on the ADF&G web site http://www.adfg.state.ak.us/special/special_fisheries/personal_use.php accessed on April 7, 2008.

Fisheries Division, under the direction of the Alaska Board of Fisheries. Alaska's salmon fisheries are limited entry fisheries. Participants need to hold a limited entry permit for a fishery in order to fish in it. The numbers of these permits for each fishery are limited. The State originally issued permits to persons with histories of participation in the various salmon fisheries. Permits can be bought and sold, and persons have entered since the original limitation by buying permits on the open market. The RIR in appendix 1 provides more detailed information on State management of the commercial salmon fisheries.

9.4.1.2 Federal subsistence management

The Alaska National Interest Lands Conservation Act (ANILCA), passed by Congress in 1980, mandates that rural residents of Alaska be given a priority for subsistence uses of fish and wildlife. In 1989, the Alaska Supreme Court ruled that ANILCA's rural priority violated the Alaska Constitution. As a result, the Federal government manages subsistence uses on Federal public lands and waters in Alaska—about 230 million acres or 60% of the land within the state. To help carry out the responsibility for subsistence management, the Secretaries of the Interior and Agriculture established the Federal Subsistence Management Program (FSMP).

On July 1, 1990, the U.S. Departments of the Interior and of Agriculture assumed responsibility for implementation of Title VIII of ANILCA on public lands. The Departments administer Title VIII through by regulations in the Code of Federal Regulations. The Departments have established a Federal Subsistence Board and 10 Regional Advisory Councils to administer the Federal Subsistence Management Program. The Board's composition includes a Chair appointed by the Secretary of the Interior with concurrence of the Secretary of Agriculture; the Alaska Regional Director, U.S. Fish and Wildlife Service; the Alaska Regional Director, National Park Service; the Alaska State Director, Bureau of Land Management; the Alaska Regional Director, Bureau of Indian Affairs; and the Alaska Regional Forester, USDA Forest Service. Through the Board, these agencies participate in the development of regulations which establish the program structure, determine which Alaska residents are eligible to take specific species for subsistence uses, establish seasons, harvest limits, and methods and means for subsistence take of species in specific areas. The Regional Advisory Councils provide recommendations and information to the Board; review proposed regulations, policies and management plans; and provide a public forum for subsistence issues. Each Council consists of residents representing subsistence, sport, and commercial fishing and hunting interests.

9.4.2 Subsistence harvests of Chinook salmon

Alaskan residents harvest Chinook salmon for subsistence purposes. Chinook salmon consumption can be an important part of regional diets, and Chinook salmon and Chinook salmon products are distributed as gifts or through barter and small cash exchanges to persons who do not directly participate in the subsistence fishery.

Salmon returning to the Kuskokwin and Yukon Rivers and area streams are the nutritional and cultural foundation of that region. Public comments received during the scoping process explained that explained that salmon are of irreplaceable value 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. Comments state that strong returns of healthy salmon are critical to the future human and wildlife uses of those fish and to the continuation of the subsistence lifestyle.

Food costs and living expenses in general are high in rural Alaska. Materials have to be transported long distances with limited transportation and distribution infrastructures, consequently these services are expensive. Small populations may not be able to support the large numbers of firms that would provide for competitive markets. The Cooperative Extension Service of the University of Alaska Fairbanks routinely surveys communities to gather information on living costs. In December 2007, it found that it cost 189% more to purchase a week of food in Bethel than in Anchorage. Food costs in other communities in the action area were also higher than in Anchorage. In Kotzebue costs were 208% those in Anchorage, 218% in Naknek/King Salmon, and 171% in Nome (UAF Cooperative Extension Service). Note that food prices have been rising rapidly recently; to the extent that this is driven by increased demand in developing parts of the world, these price increases may persist.

Subsistence foods in general are important components of regional diets. For example, Magdanz et al (2007) reviewed several studies of subsistence consumption for the Norton Sound and Port Clarence areas. Average per capita consumption of subsistence foods was on the order of 600 pounds per year. Salmon accounted for a significant part of this with weights ranging from about 100 pounds to about 160 pounds per capita, depending on the study. One analysis of dietary sources of meat and fished showed that 75% was derived from subsistence sources and 25% from store bought meats. A third of the meat and fish was salmon, and the reminder was from land or marine mammal or other fish. In this region Chinook salmon accounted for 3% of meat and fish consumption, while chum salmon accounted for about 6% (Magdanz *et al.* 2007).

Chinook salmon varies in importance in regional diets, and can be significant. In 2002 the Alaska Native Health Board sponsored a survey of rural Alaskan eating habits as a first step in a program to determine potential contamination and to prioritize species for further investigation. The survey depended on participants self-reporting of consumption over the previous 12 months. Samples were not randomly selected or chosen on the basis of a systematic sampling plan. Not too much confidence can be placed on the precision of the estimates. Moreover, the survey represented consumption behavior at a single point in time: the period 2001-2002, and would reflect the availability of subsistence foods at that time. However, the survey results for Chinook salmon seem at least broadly consistent with regional Chinook salmon subsistence harvest information described below and provide a sense of the regional variation in consumption.

The survey results relevant to this action were summarized for four regional health corporations (Ballew *et al.* 2004).

- In the area of the Norton Sound Health Corporation, 151 surveyed persons reported consuming a total of 1,384 pounds of Chinook salmon products, or an average of nine pounds a piece. About half of this was consumed as a dried/smoked/salted product and the remainder as cooked, raw, or frozen. Chinook salmon was the 42nd most important food by weight in this region.
- Consumption was significantly higher in the area of the Yukon-Kuskokwim Health Corporation, where 224 respondents reported consuming 15,722 pounds of Chinook salmon, or an average of 70 pounds a person. About three-quarters was consumed dried, smoked, or salted, and most of the remainder as cooked. Chinook salmon was the fifth most important food by weight in this region.
- In the Bristol Bay Health Corporation Region, 132 surveyed persons consumed a total of 5,076 pounds of Chinook salmon, or an average of 38 pounds each. About two-thirds was consumed dried, smoked, or salted, and most of the remainder as cooked. Chinook salmon was the 12th most important food by weight in this region.
- In the Tanana Chiefs Conference Region, 33 surveyed persons consumed a total of 583 pounds of Chinook salmon, or an average of 18 pounds a person. Almost two-thirds was consumed dried, smoked, or salted, and most of the remainder as cooked. Chinook salmon was listed as the 16th most important food source, by weight in this region.

Subsistence Chinook salmon may be consumed directly by the person or family that harvests it. It may also be distributed to other parties in the community. Salmon may well be given or shared with other persons without the expectation that something specific will be given in exchange. Fish may be shared with family members or friends, in the region or outside of it. On the Tanana, "…salmon is given to individual elders, elders' residences and people who do not have access or ability to fish. Almost all the fishers interviewed stated that the first salmon caught were given away to share the taste of the first fish and bring luck to the fishers (Moncrieff 2007)."

Chinook salmon may also be exchanged for concrete considerations. At Holy Cross, Yukon River Chinook "is traded for a variety of items. Some people bring salmon or moose when they travel and give it as a gift to the family they stay with. One participant traded fish for pizza from another village: one pizza for one Chinook salmon, each valued at about $12. Others traded their salmon for Kuskokwim River fish, berries from the stores in Anchorage, berries from the other areas, or crafts or services. Trade relationships, active in the precontact era, continue to exist today (Moncrieff 2007)."

Some subsistence harvests of Chinook are sold under the term "customary trade." This is not legal under State law, but is for fish harvested from waters on Federal lands. Residents of Alakanuk report selling subsistence fish "if it was unplanned; they happened to have extra and someone needed it… According to respondents in this study, reasons given for selling fish today included helping others in need, avoiding waste, and having a source of cash to be used on subsistence supplies and household expenses" (Moncrieff 2007). Moncrieff (2007) suggests the sale of fish may be more common in Holy Cross, where the respondents who answered her questions about the income from sale of subsistence fish "earned an average of $1,360 annually." In many cases it is likely that cash exchanges represent compensation by one person for a share of the costs of subsistence fishing.

Fig. 9-1 below summarizes information from the most recent Alaska Subsistence Salmon Fisheries Annual Report. This is the report for 2005, published in December 2007 (ADF&G 2007). The Fig. summarizes the report's estimates of subsistence takes of Chinook, chum, and other salmon, by subsistence harvest area. The report has certain limitations. As the report notes:

> At the outset, it is important to recognize the limitations associated with the effort to present a comprehensive annual report on Alaska's subsistence fisheries. These limitations include:

- Annual harvest assessment programs do not take place for all subsistence fisheries. Programs are in place for most salmon fisheries, but few other finfish fisheries or shellfish fisheries have annual harvest monitoring programs.
- Annual harvest data are mostly, but not entirely, limited to fisheries classified as subsistence by regulation, which for salmon generally means fish taken with nets, seines, or fish wheels. In some parts of Alaska, substantial numbers of fish for home use are taken with rod and reel (in most areas considered sport gear by regulation) or are retained from commercial harvests. With the exceptions noted in the chapters one each area, these harvests are not included in the subsistence harvest estimates in this report because they are not covered in annual harvest assessments. Therefore, the harvest data in this report are a conservative estimate of the number of salmon being taken for subsistence use in Alaska. Underestimates of subsistence salmon harvests are a particular issue in the Southeast Region.
- Between management areas, and sometimes between districts within management areas, there is inconsistency in how subsistence harvest data are collected, analyzed, and reported.

In some areas there are no routine mechanisms for evaluating the quality of the subsistence harvest data. For example, in some areas it is not known if all subsistence fishers are obtaining permits and providing accurate harvest reports. This can result in a large underestimate of harvest (ADF&G 2007).

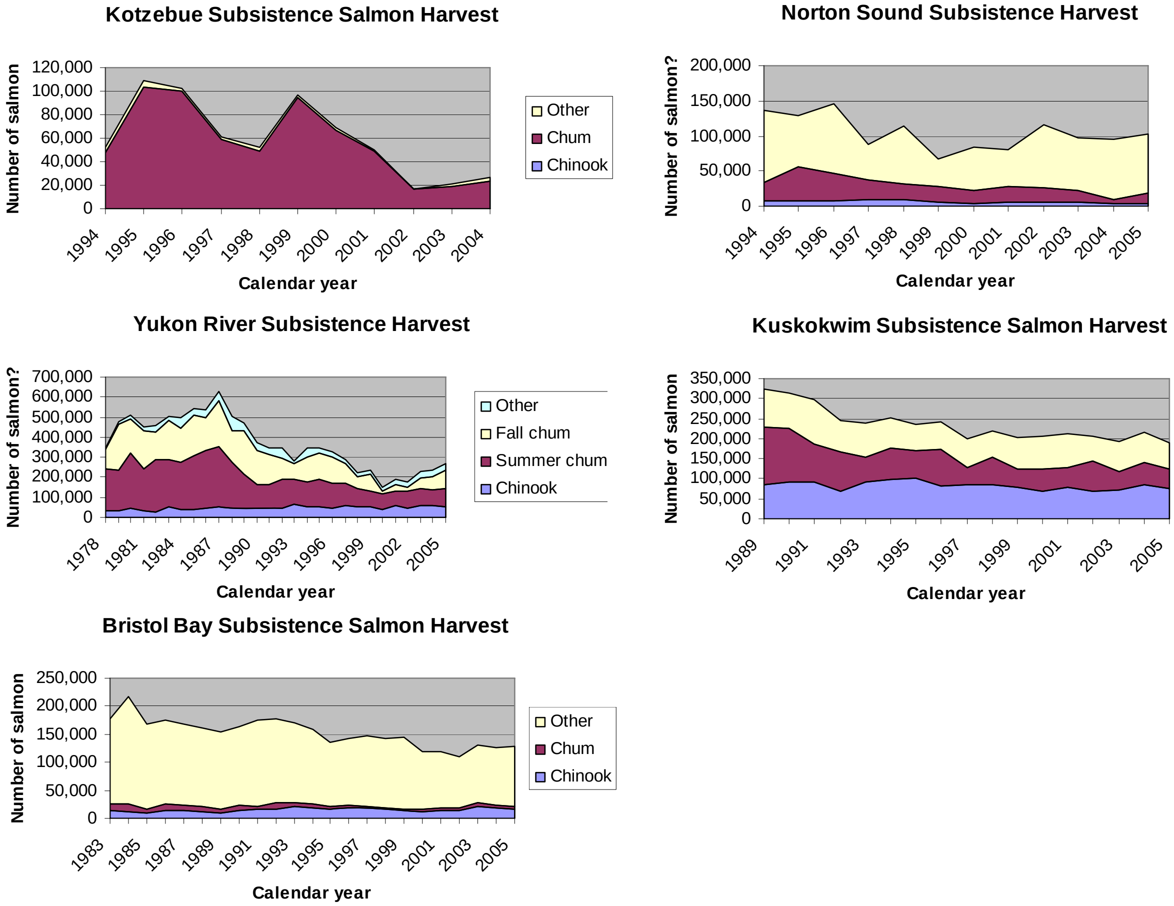

Fig. 9-1 Estimated Subsistence Harvests of Chinook, Chum, and Other Salmon, by key management regions (source: ADF&G 2007)

As Fig. 9-1 illustrates, the importance of subsistence Chinook harvests varies among the regions that may be affected by this action.

- Chinook salmon appears to be of relatively limited importance in subsistence harvests north of Cape Prince of Wales in Kotzebue Sound and on Alaska's north slope. Chinook salmon also appear to be of relatively limited importance along the Alaska Peninsula and Aleutians. Chinook did not appear to be more than 1% of subsistence harvests in Kotzebue between 1994 and 2004, no more than 3% on the Alaska Peninsula between 1985 and 2005, and to be almost 0% in the Aleutians in the same period. For simplicity, these areas have not been illustrated in Fig. 9-1.
- The Norton Sound region includes the Port Clarence and Norton Sound Districts. In this region, subsistence salmon harvests were dominated by chum salmon. For the district as a whole, Chinook accounted for between 4% and 10% of the subsistence salmon harvested between 1994 and 2005. Chinook were more important in the Region's more southerly Norton Sound District, where they accounted for between 4% and 11% of the salmon caught; in the more northerly Port Clarence District they accounted for between 0% and 2% of the salmon caught.
- Chinook salmon are clearly a key species on the Yukon River. Summer and Fall chum are still more important in numbers of fish, but Chinook currently account for a fifth to a fourth of the

number of fish harvested. Prior to the large declines in the chum harvests in the early 1990s, Chinook accounted for a significantly smaller proportion of the harvest: from 6% to 23%. As noted above, however, the count of each type of salmon doesn't account for other important considerations, including the relative size, flavor, and social significance.

- Chinook salmon are also, clearly, an important subsistence species on the Kuskokwim River Region. Between 1989 and 2005, Chinook account for between 26% and 43% of the annual subsistence salmon harvest.
- Chinook salmon are still somewhat important in the Bristol Bay Region, but distinctly less so than in the Yukon and Kuskokwim Regions. Since 1993, Chinook harvests have ranged between 9% and 16% of subsistence harvests; before that, from 1983 to 1993, they ranged between 5% and 9%.

The Native communities in the action area evolved primarily as hunter/gatherer subsistence societies. Trade of subsistence goods between communities has a long history in regional Native cultures. As Russians came into increasing contact with Natives on the Asian side of the Bering Straits from the 17th Century on, there was increasing trade in western manufactured goods and products, and increasing use of monetary sales as goods were exchanged. These processes have continued through today.

It is possible for hunter/gatherer societies to evolve and successfully adapt during contact with a monetary market economy "in the sense that the society is maintaining its essential organization around subsistence fishing, hunting, trapping, and gathering activities and traditional exchange, while at the same time, incorporating new forms of market production, wage employment, and imported technologies into the subsistence-based socio-economic system" (Wolfe 1984, Wolfe and Walker 1987). However, successful adaptation requires continued access to the resource base on which the subsistence activities depend.

Subsistence activities provide the material basis that allows these emerging mixed "subsistence-market" economies[16] to continue. They also provide a context within which the traditional subsistence hunting and gathering elements of these cultures can persist. As noted above, cultural practices in regional communities will vary between broad ethnic groupings and between smaller groups within these larger groupings. However, each of these hunter-gatherer subsistence communities was once organized completely around resource exploitation and these communities require access to these resources to support the personal relationships, and ways of thought, that emerged in those earlier times. The broader national community clearly places a value on the distinctive cultures of the communities in this region. It has taken numerous steps, for example in Federal and State subsistence regulations, the implementation of the Community Development Quota program, in whale co-management, and in other ways, to protect key elements of the traditional cultures and to allow them to evolve independently of the broader culture.

9.4.3 Commercial harvests of Chinook salmon

Many persons in the action area harvest Chinook and other species of salmon commercially. In a region in which there are relatively limited job opportunities, income from salmon fishing may be very important. The income is important for consumption purposes. Income from the Chinook fishery can be used for consumption purposes, making it possible to buy goods that cannot be produced locally. For example, foods from outside the region such as sugar, household consumables such as fuel, or household investments such as appliances. It is also important because it can be used to support subsistence hunting and fishing activity. This income could be used to purchase fuel, vehicles, other subsistence-related gear, or otherwise offset expenses required to engage in a range of subsistence pursuits. Thirdly, commercial fishing activity is important because commercial fishermen have the opportunity to use some of their harvest for subsistence.

[16] The term is from Wolfe and Walker, 1987.

It is also important to note that the geographic distribution of these potential impacts varies widely. Joint production impacts are confined to those individuals who own or have immediate access to vessels participating in the groundfish fisheries. The impacts of a potential loss of income would fall on a larger group of individuals, many of whom may live significant distances away from the coastal communities where commercial vessels are home ported. It should also be noted that these are both still relatively constrained areas compared to the potential subsistence salmon impacts discussed above. Though their geographic base may be narrow, the impacts on families may be much more immediate and of greater magnitude.

The importance of Chinook salmon varies by the region in which commercial salmon fishermen live and by the fisheries in which they participate. Table 9-3 and Table 9-4 summarize information on the importance of Chinook salmon revenues for Western Alaskan permit holders. Table 9-3 provides information on relative importance, and Table 9-4 provides information on absolute importance. Table 9-3 shows the% of the gross revenues earned by State of Alaska limited entry permit holders who live in a particular western or interior Alaska census district from salmon limited entry fisheries in Western Alaska. Table 9-4 shows the average revenues per person fishing received by these permit holders.

Table 9-3 Percent of commercial salmon revenue from Western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts that is attributable to Chinook harvests (source: AKFIN)

	Aleutians east	**Aleutians west**	**Bethel**	**Bristol Bay**	**Dillingham**	**Lake and Peninsula**	**Nome**	**Northwest**	**Wade Hampton**	**Yukon-Kuskokwim**
1991	1%	4%	11%	0%	1%	1%	41%	0%	81%	41%
1992	1%	4%	11%	0%	2%	1%	31%	3%	91%	51%
1993	1%	1%	7%	0%	2%	2%	25%	8%	93%	53%
1994	1%	1%	5%	0%	3%	1%	13%	3%	98%	17%
1995	1%	3%	10%	0%	2%	1%	9%	0%	89%	4%
1996	1%	2%	4%	0%	2%	0%	6%	0%	91%	2%
1997	1%	3%	18%	1%	3%	1%	51%	2%	96%	28%
1998	0%	0%	10%	0%	7%	1%	28%	4%	98%	40%
1999	0%	1%	9%	0%	0%	1%	32%	0%	99%	85%
2000	0%	0%	5%	0%	0%	0%	5%	0%	98%	5%
2001	0%	0%	5%	0%	1%	0%	2%	0%	0%	0%
2002	1%	0%	17%	0%	3%	1%	88%	4%	100%	28%
2003	0%	0%	8%	0%	1%	0%	14%	1%	97%	38%
2004	0%	0%	7%	0%	3%	0%	17%	1%	100%	15%
2005	0%	0%	11%	0%	3%	0%	2%	0%	79%	5%
2006	1%	0%	11%	0%	4%	1%	3%	0%	90%	5%
2007	1%	0%	7%	0%	1%	0%	3%	0%	80%	10%

Table 9-4 Average commercial salmon revenue from Western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts that is attributable to Chinook harvests; nominal dollars per year (Source: AKFIN)

	Aleutians east	Aleutians west	Bethel	Bristol Bay	Dillingham	Lake and Peninsula	Nome	Northwest	Wade Hampton	Yukon-Kuskokwim
1991	1,601	2,856	2,622	32	629	361	2,631	11	18,500	1,780
1992	2,314	1,894	3,790	124	2,285	966	2,725	125	24,841	2,137
1993	2,230	889	1,888	170	2,578	1,105	1,722	175	13,485	1,378
1994	1,493	806	1,666	134	3,187	964	1,651	98	12,068	1,999
1995	2,493	3,058	3,262	123	2,689	445	2,128	9	15,149	1,060
1996	582	722	976	54	1,975	275	1,271	5	10,379	677
1997	701	265	2,089	76	1,374	354	3,021	63	15,778	1,635
1998	607	320	1,288	63	3,715	220	1,295	68	5,599	1,270
1999	505	697	1,542	14	424	293	1,435	11	13,972	4,225
2000	512	21	704	13	339	29	278	6	2,050	1,097
2001	209	13	383	8	317	37	80	3	0	51
2002	573	6	897	16	716	130	1,335	221	6,399	1,162
2003	293	156	875	19	802	107	533	68	6,203	1,611
2004	792	99	1,207	17	2,052	74	1,299	34	9,510	1,862
2005	543	283	1,642	61	2,508	159	354	26	6,279	1,484
2006	849	297	1,767	108	3,277	474	528	28	11,135	1,368
2007	1,160	646	1,126	13	1,236	30	266	9	7,161	1,146

These tables suggest that commercial king salmon harvest income is most important for persons living in the following census districts:

- Bethel: Chinook salmon revenues accounted for between 4% and 18% of the revenues earned by permit holders in the Bethel census district over the period 1991-2005. Average revenues were as low as $383, but as high as $3,790. Over this period, about 44% of the Chinook revenues were earned by persons fishing in the Kuskokwim-Goodnews Bay set net fishery, and another 45% by persons in the Lower-Yukon-Cape Romanzof Fishery.
- Nome: Chinook salmon revenues accounted for between 2% and 88% of the revenues earned by persons operating in the Nome census district. Average revenues ranged from $80 to $2,725. Over this period, about 65% of the Chinook salmon revenues earned by these persons came from the Lower-Yukon Cape Romanzof set net fishery, and another 34% from the Norton Sound set net fishery.
- Wade-Hampton: In a normal year, Chinook salmon revenues accounted for between 79% and 100% of the commercial fishing revenues earned by residents of this census district. Average revenues from Chinook salmon in a normal year range between $2,050 and $24,841. Average revenues in a year averaged about $14,500 from 1991 to 1998 but only $6,092 from 2000 to 2007. In one year, 2001, Chinook did not account for any revenues for these fishermen. All the revenues earned by fishermen resident in this census area are earned in the Lower-Yukon Cape-Romanzov set net fishery.
- Yukon-Koyukuk: Chinook salmon revenues accounted for between almost 0% and 85% of gross revenues earned by persons living in the Yukon-Koyukuk census district. Average revenues ranged from $51 to $4,225. About 46% of the revenues earned by persons in this census district came from the Lower Yukon Cape Romanzov set net fishery, another 41% came from the Upper Yukon fish wheel fishery, and a further 12% came from the Upper Yukon set net fishery.

As noted earlier, regional communities depend on processed western foods as well as on subsistence foods. Access to these foods requires cash, and, in a region with limited job opportunities, the jobs associated with fishing, with operating as a skipper or crew, or as an employee in a regional processing or shipping business, can be an important source of this cash for a part of the community.

In modern times, successful subsistence hunting requires access to expensive capital and operating equipment. Moncrieff (2007) gathered information on typical subsistence fishing costs for several Yukon River communities. At Holy Cross,

> … Unavoidable costs described in the interviews included gas, motor oil, equipment repairs, and nets. Other costs may include gloves, rain pants, boots, insect repellent, burlap, twine, salt, and freezer bags. A fishing net, which costs $1,500 plus freight, may last four or five years with annual repairs or it may be list in river debris the first year it is purchased. Outboard motors have to be maintained and sometimes replaced. Gas in this Yukon River village was $3.20 a gallon in June 2004. Most participants felt that gas was the largest annual expense related to subsistence fishing…. (Moncrieff 2007)

At Tanana,

> All the participants were asked about costs of subsistence fishing. Without fail, everyone said gas was the highest cost, ranging from $245 to $1,500 for the fishing season. During the summer of 2005, gas at the pump in Tanana cost $3.60 a gallon. Other costs that were mentioned included supplies for keeping the fish wheel running (netting $400, replacement parts $750 to $1,000, roll of wire $600 and labor), groceries (as much as $1,500 a month), electric bill for the freezers ($50-$60 a month), replacement set gillnets (150 feet for $750), knives ($80-200), knife sharpeners, chainsaws, guns and ammunition, sleeping bags, tents, mosquito repellant, boat maintenance ($1,000 annually), rock sale, jars, rope, and tarps. (Moncrieff 2007)

Many of these costs are increasing rapidly with the increase in petroleum product process. Modern subsistence lifestyles therefore require access to significant amounts of cash to purchase equipment that cannot be made locally. While some subsistence harvests are sold, either legally or illegally, legal prohibitions on sale limit the volumes. Commercial fishing provides cash incomes that can be used to buy necessary equipment.
Commercial fishermen may also use some of their catches for subsistence purposes, while selling the rest. Thus commercially reported harvests undoubtedly include a subsistence component.

The commercial salmon fisheries provide jobs for the permit holders, and for the crew members they may employ. Processing distribution, and support activities within the region also provide additional job opportunities. The RIR for this action, in appendix 1, provides more information about these additional sources of jobs.

9.4.4 Sport harvests of Chinook salmon

Regional residents may harvest Chinook salmon for sport, using a State sport fishing license, and then use these salmon for essentially subsistence purposes. Regional sport fisheries, including Chinook salmon fisheries may also attract anglers from other places.

Anglers who come to the action area from elsewhere to sport fish may generate economic opportunities for local residents. However, they may also compete with local interests for the available Chinook salmon resources. Visits by outside anglers to some remote rural communities, perhaps to take advantage of a local business combining a bed and breakfast with guided fishing opportunities, might be controversial in some places. The Alaska Department of Community and Economic Development notes that:

> Tourism development is a relatively controversial issue in many parts of Alaska. While some locals oppose visitors to their villages, others wish to open bed and breakfasts. New economic opportunities may be desirable, but some Census Area residents fear being overwhelmed with unfamiliar faces or are wary of being put "on display" for visitors interested in Native Alaska culture. Some residents have the perception that tourism affects many people in the community but benefits only a few. These legitimate concerns should be addressed in preliminary tourism planning for the area and in each community.
>
> Tourism planning and development should also consider the region's subsistence activities and concerns about competition among resource user groups. Western Alaska has the highest subsistence activity in the state; subsistence hunting and fishing drive the economy in most villages. Cash income is used largely to support a traditional lifestyle. Locals place a high priority on protecting fishing, camping, and berry-picking sites. Poor fish returns and state disaster declarations in recent years have placed additional pressure on regulatory agencies to allocate scarce resource fairly. Also, some residents resent sport fishing and catch and release practices. They consider sport fishing to be "playing with food" and an activity that "shows no respect to the creator." Even catch and release practices are considered by the Yup'ik culture to be disrespectful to the fish.[17]

Sport fishing practices such as "catch and release" that might mitigate resource conflicts, may conflict with local ways of thinking in some areas. Fienup-Riordan (2002) points out that among coastal Yup'ik fishermen, releasing a fish once it has been caught can be a disrespectful act and may have implications for future catches:

> From their earliest years, Yup'ik men and women are taught that the bodies of fish must be treated with respect. Once they have taken a fish from the water, they must use every part of its body to ensure its return the following year. According to Sam Carter of Quinhagak, "It is a warning never to place a fish back in the water once it is caught because that will cause the river to be depleted of fish.

9.4.5 Prohibited Species Donation Program

Salmon that would otherwise have to be discarded by pollock fishermen, may be retained for distribution to low income persons (via hunger relief agencies, food bank networks, or food bank distributors) through the NMFS Prohibited Species Donation Program (PSD program, 50 CFR 679.26). The PSD program was initiated to reduce the amount of edible protein discarded under PSC regulatory requirements for salmon and halibut. Some groundfish fishing vessels cannot sort their catch at sea, but deliver their entire catch to an onshore processor or a processor vessel. In these cases, sorting and discarding of prohibited species occurs at delivery, after the fish have died. One of reasons for requiring the discard of prohibited species is that some of the fish will live if they are returned to the sea with a minimum of injury. However, all salmon die that are incidentally caught in the Alaska groundfish trawl fisheries (NMFS, 1996). Therefore, to reduce the waste of edible protein, the PSD program was begun. NMFS implemented the

[17] On the significance of respect towards salmon resources in Yup'ik culture, see Fienup-Riordan. See especially, Chapter 8, "Original Ecologists?: The Relationship between Yup'ik Eskimos and Animals." Based on her anthropological fieldwork, Fienup-Riordan argues that Nelson Island Yup'ik have traditional culture viewed animals as an infinitely renewable resource and did not identify a relationship between the numbers of animals harvested and the sustainability of the resource. However respectful behavior towards animals could affect their availability. Thus, a shortage of animals reflected an absence of respectful behavior in the past, rather than overharvest or other biological factors.

PSD program for salmon in 1996, and expanded the program in 1997 to include Pacific halibut delivered to shoreside processors by CVs using trawl gear. The first donations were received under the PSD program in 1996.

The PSD program allows enrolled seafood processors in the Bering Sea and Gulf of Alaska trawl groundfish fisheries to retain salmon and halibut bycatch for distribution to economically disadvantaged individuals through tax-exempt hunger relief organizations. Regulations prohibit authorized distributors and persons conducting activities supervised by authorized distributers from consuming or retaining prohibited species for personal use. They may not sell, trade, or barter any prohibited species that are retained under the PSD program. However, processors may convert offal from salmon or halibut that has been prepared for the PSD program into fish meal, fish oil, or bone meal, and retain the proceeds from the sale of these products. Fish meal production is not necessarily a profitable venture. The costs for processing and packaging the salmon are donated by the processors taking participating in the PSD program.

The NMFS Regional Administrator, Alaska Region, may select one or more tax-exempt organizations to be authorized distributors of the donated prohibited species. The number of authorized distributors selected by the Regional Administrator is based on the following criteria: (1) the number and qualifications of applicants for PSD permits; (2) the number of harvesters and the quantity of fish that applicants can effectively administer; (3) the anticipated level of bycatch of salmon and halibut; and (4) the potential number of vessels and processors participating in the groundfish trawl fisheries. After a selection notice is published in the Federal Register, a PSD permit is valid for three years, unless suspended or revoked. Regulations at 50 CFR 679.26 describe numerous requirements for authorized distributors; reporting and recordkeeping requirements for vessels or processors retaining prohibited species under the PSD program; and processing, handling, and distribution requirements for PSD program processors and distributors.

Since the program began, in 1996, SeaShare (formerly Northwest Food Strategies) of Bainbridge Island, Washington, has been the sole applicant for a PSD permit for salmon from NMFS, and, therefore, the only recipient of a PSD permit for salmon. Participation is voluntary. The participants are drawn from the pollock fishery and not all firms involved in the pollock fishery participate. NOAA presented SeaShare with a 2006 Marine Stewardship Award in 2006, evidence that the PSD program and its distributor SeaShare are effective. SeaShare is a 501(c)(3) tax-exempt organization that distributes seafood products through America's Second Harvest and its national network of food banks. The most recent selection notice for SeaShare was published in the *Federal Register* on July 15, 2005 (70 FR 40987). SeaShare applied for a permit renewal on March 20, 2008.

Many trawl vessels and all three major shoreside processors operating from Dutch Harbor have participated in the PSD program since its inception as a pilot program in 1994. The shoreside processors Alyeska Seafoods, Inc., and Unisea, Inc., have participated every year; Westward Seafoods, Inc., has participated less frequently. Thirty-six trawl catcher vessels are qualified to participate in the PSD program and deliver to these shoreside processors. Additionally, there are 17 trawl catcher/processors that currently participate in the salmon PSD program; however, catcher/processors may not participate in the halibut PSD program. With existing staff, SeaShare has stated that it could administer up to 40 processors and associated catcher vessels, about twice as many processors as it currently administers (SeaShare, 2008).

There is limited information available on the volumes of Chinook salmon entering this distribution network. Program statistics do not discriminate between Chinook and chum salmon, although very little salmon of other species is believed to enter the system. The total processed or finished weight of

Chinook and chum salmon distributed has ranged from about 38,700 pounds in 1999 up to about 483,400 pounds in 2005. In 2007, 87,300 pounds were distributed (SeaShare, personal communication, 2008).[18]

Table 9-5 lists the annual net amount of steaked and finished pounds of PSD salmon received by SeaShare and donated to the food bank system from 1996 through 2007 (SeaShare, personal communication, 2008). NMFS does not have the information to convert accurately the net weight of salmon to numbers of salmon. Note that salmon may be consolidated in temporary cold storage in Dutch Harbor awaiting later shipment, so salmon donated in November or December may appear in the results for the following year.

Table 9-5 Net Weight of Steaked and Finished PSD Salmon Received by SeaShare, 1996-2007

Year	Salmon (lbs.)
1996	89,181
1997	99,938
1998	70,390
1999	38,731
2000	62,002
2001	32,741*
2002	102,551
2003	248,333
2004	463,138
2005	483,359
2006	171,628
2007	87,330

*For a time in 2001, processors stopped retaining salmon under the PSD program because regulations prohibited them from processing and selling waste parts of salmon not distributed under the PSD program. The regulations were revised through a final rule published August 27, 2004, to allow processors to use this material for commercial products (69 FR 52609).

These programs provide an additional source of food for low income persons. They do not necessarily address the special needs of minority populations, or support minority cultures as they would if harvested in Alaska subsistence fisheries. The volumes supplied are probably modest compared to overall food needs of low income persons in the U.S. The program was not designed to create a market or destination for salmon bycatch, but to reduce the waste of bycatch inevitably taken. Industry participation in the program is not complete, and not all salmon taken as bycatch enters this distribution channel. NMFS is unable to determine the volume of Chinook salmon entering this channel. For these reasons, this analysis does not address impacts to this program any further.

The packaged PSD salmon is distributed through SeaShare to food banks located primarily in the Puget Sound area of the Pacific Northwest. Less than full truckload quantities of fish are distributed to Seattle-area food banks that use their freezer trucks to pick up the frozen salmon directly from the freight carriers. Sometimes full truckloads are made available to any qualified food bank within the America's Second Harvest network that is willing to pick it up with a freezer truck and pay for shipping expenses. Due to transportation costs, donated salmon usually stays in the Western U.S. Individual food banks distribute the salmon to soup kitchens, shelters, food pantries, and hospices (SeaShare, 2008). Over the 12 years that the salmon PSD program has been in place, nearly 2 million pounds of steaked and finished salmon have been donated through the program. Using an estimated four meals per pound of salmon, nearly 650,000 meals have been donated on average per year. The donated salmon provides a highly nutritious

[18] Jim Harmon, Program Manager for SeaShare. Personal communication, April 25, 2008.

source of protein in the diets of people who often have access to only meagre and inadequate food (NMFS, 1996).

Expenses for processing the salmon and delivery to the food banks are covered by donations. Fishermen participating in the PSD program must sort, retain, and deliver to an approved storage facility, all salmon destined for the PSD program. Their costs include space on the vessel to store the fish, and maintenance of the fish in suitable condition. Processors must accept delivery, fill out the appropriate paperwork, and process, refrigerate, package, and store the donated fish, incurring costs in time, labor, and equipment that must be borne by the processor. The PSD salmon must then be delivered from the processor to SeaShare, which then coordinates the temporary storage of the fish, its transportation, and its routing to eligible food banks. The transportation costs to Seattle are usually donated by various freight carriers. Participation in the PSD program is entirely voluntary, so an entity that found the program requirements onerous could stop participating without financial cost to itself (NMFS, 2003).

The PSD program reduces waste in fisheries with salmon PSC bycatch. Without this program, these fish would be discarded at sea, and would not be directly used by anyone (although discards would be available to scavengers, potentially benefitting future fish productivity). The PSD program encourages human consumption of these fish, without creating an economic incentive for fishing operations to target them. Under the PSD program, salmon that are unavoidably killed as bycatch are directly utilized as high quality human food, improving social welfare and reducing fishery waste.

9.4.6 Chum salmon

Chum salmon are also used for subsistence and commercial purposes, but play less of a role in sport harvests. The comments made about subsistence harvests apply to chum salmon. They are important for personal consumption and different kinds of exchange. Chum salmon harvests in the commercial fishery provide income for consumption purposes, income that can be used for investment and operating costs in subsistence operations, and some commercial harvests may be diverted to subsistence purposes. Chum salmon have traditionally played a larger role than Chinook salmon as food for dog teams in western Alaska and the interior. This role has fluctuated as the importance of dog teams for regional transportation purposes has fluctuated.

9.4.7 Community Development Quota Program

The CDQ Program was designed to improve the social and economic conditions in western Alaska communities by facilitating their economic participation in the BSAI fisheries. The large-scale commercial fisheries of the BSAI developed in the eastern Bering Sea without significant participation from rural western Alaska communities. These fisheries are capital-intensive and require large investments in vessels, infrastructure, processing capacity, and specialized gear. The CDQ Program was developed to redistribute some of the BSAI fisheries' economic benefits to adjacent communities by allocating a portion of commercially important BSAI species 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.

A total of 65 communities within a 50-mile radius of the Bering Sea met all of the qualifications and participate in the program through a total of six CDQ groups.[19] These communities have formed six non-

[19] The CDQ groups include the Aleutian Pribilof Island Community Development Association (APICDA), the Bristol Bay Economic Development Corporation (BBEDC), the Central Bering Sea Fishermen's Association (CBSFA), the Coastal Villages Region Fund (CVRF), the Norton Sound Economic Development Corporation (NSEDC), and the Yukon Delta Fisheries Development Association (YDFDA).

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. Geographically dispersed, they extend westward to Atka, on the Aleutian Island chain, and northward along the Bering coast to the village of Wales, near the Arctic Circle. The 2000 population of these communities was just over 27,000 persons of whom approximately 87% were Alaska Native. In general economic terms, CDQ communities are remote, isolated settlements with few commercially valuable natural assets with which to develop and sustain a viable, diversified economic base. As a result, economic opportunities have been few, unemployment rates have been chronically high, and communities (and the region) have been economically depressed.

The CDQ program ameliorates some of these circumstances by extending an opportunity to qualifying communities to directly benefit from the productive harvest and use of these publicly owned resources. The CDQ program was permanently institutionalized through the Magnuson-Stevens Act authorized by the U.S. Congress in 1996. Originally involving only the pollock fishery, in 1998, the program expanded to become multi-species. Currently, the CDQ program is allocated portions of the groundfish fishery that range from 10.7% for Amendment 80 species, 10% for pollock, and 7.5% for most other species.

CDQ groups also have invested in peripheral projects that directly or indirectly support commercial fishing for halibut, salmon, and other nearshore species. This includes seafood branding and marketing, quality control training, safety and survival training, construction and staffing of maintenance and repair facilities that are used by both fishermen and other community residents, and assistance with bulk fuel procurement and distribution. Several CDQ groups are actively involved in salmon assessment or enhancement projects, either independently or in collaboration with ADF&G. Salmon fishing is a key component of western Alaska fishing activities, both commercially and at a subsistence level. The CDQ Program provides a means to support and sustain both such activities.

CDQ groups have invested in inshore processing plants that process halibut, salmon, Pacific cod, crab, and other species. For example, the Coastal Villages Region Fund owns Coastal Villages Seafoods, which processes salmon and halibut. CDQ groups have invested in other local fisheries development activities as well. For example,

> A number of CDQ groups have also promoted investment in local, small-scale operations targeting salmon, herring, halibut or other species. Activities include funding permit brokerage services to assist with retention of limited entry salmon permits in CDQ communities, capitalizing revolving loan programs to provide financing to resident fishermen for the purchase of boats and gear and supporting market development for locally-harvested seafood products (Northern Economics 2002).

CDQ groups have also worked to develop regional fisheries infrastructure. The Norton Sound Economic Development Corporation has provided funding for a Nome seafood center; the Yukon Delta Fisheries Development Association has provided funding for the Emmonak Tribal Council's fish plant, and the Coastal Villages Region Fund made loans to two aluminum welding businesses for boar repair and building at Eek and Hooper Bay. CDQ groups provide educational opportunities for local residents, including college scholarships, and money for vocational and technical training (Northern Economics 2002)

One of the most tangible direct benefits of the CDQ Program has been employment opportunities for western Alaska village residents. CDQ groups have had some successes in securing career track employment for many residents of qualifying communities, and has opened opportunities for non-CDQ

Alaskan residents, as well. Jobs generated by the CDQ program included work aboard a wide range of fishing vessels, internships with the business partners or government agencies, employment at processing plants, and administrative positions. Many of the jobs by the program are associated with shoreside fisheries development projects in CDQ communities. This includes a wide range of projects, including those directly related to commercial fishing. Examples of such projects include building or improving seafood processing facilities, purchasing ice machines, purchasing and building fishing vessel, gear improvements, and construction of docks or other fish handling infrastructure.

CDQ groups provided about 2,000 full and part time jobs in 2005. CDQ wages vary as a% of total adjusted gross income within the region. A Northern Economics study from 2002 found that, in 1999, CDQ wages were about 2% of total adjusted gross income within the Norton Sound Economic Development Association communities, about 10% within the Yukon Delta Fisheries Development Association communities, about 5% within the Coastal Villages Region Fund communities, about 2% within the Bristol Bay Economic Development Corporation communities, about 10% with in the Aleutian Pribilof Islands Community Development Association communities, and about 9% within the Central Bering Sea Fisherman's Association (Northern Economics 2002, ADCCED).

The six CDQ groups had total revenues in 2005 of approximately $134 million. Pollock is the most important source of CDQ group revenues. In 2005, pollock royalties account for 80% of total royalties. Pollock royalties that year were almost $50 million (ADCCED).

While CDQ pollock allocations benefit member communities, they do not provide significant benefits to non-member communities. There are many non-member communities that may be affected by this action. Communities on the mid to upper Yukon, and tributary rivers of the Yukon are unlikely to be affected; similarly, communities above the lower fifty miles or so of the Kuskokwim are not members of CDQ groups. Most communities in Kotzebue Sound would not be included; however, communities in this area are dependent on chum and may not be greatly affected by an action to protect Chinook salmon. Residents of some of these communities may be affected indirectly to the extent that they can utilize CDQ group investments in infrastructure or market building.

9.4.8 Pollock deliveries to shoreside processors[20]

Previous studies have indicated that the Alaska communities with the strongest engagement in the North Pacific groundfish fishery are Unalaska, Akutan, Sand Point, and King Cove.[21] These four communities and their specific ties to the groundfish fishery were detailed in the PSEIS (NMFS 2004). The pollock TAC allocated to catcher vessels delivering to inshore AFA processors is divided among fishing cooperatives that have strong community orientations. Some 52% of the 2008 catcher vessel quota is allocated to three cooperatives associated with Dutch Harbor/Unalaska processors (the Unalaska Cooperative, the UniSea Fleet Cooperative, and the Westward Fleet Cooperative), and another 31% is allocated to a cooperative associated with an Akutan processor (the Akutan Catcher Vessel Association).

[20] This section is based on the discussion in the Alaska Groundfish Harvest Specifications Final Environmental Impact Statement (NMFS, 2007). The analysis was originally prepared by Michael Downs and Marty Watson of the consulting firm EDAW.

[21] As noted in Alaska Groundfish Fisheries PSEIS (NMFS 2004) there are also ties between the fishery to Adak, Chignik, False Pass, and St. Paul. However, these ties are far less pervasive and do not have the historical depth of the ties seen in Unalaska, Akutan, Sand Point, and King Cove. Due to these differences in existing conditions, the communities of Adak, Chignik, False Pass, and St. Paul are not detailed in this section, but each may experience impacts resulting from management actions under the various alternatives, if not to the degree seen in Unalaska, Akutan, Sand Point, and King Cove.

This suggests that Dutch Harbor, followed by Akutan, will receive the largest proportions of the landed pollock. In this section, existing community level information is summarized.[22]

These communities vary widely in their population structure. For example, Unalaska is the largest community but has the lowest Alaska Native population percentage, and King Cove and Sand Point have a much higher Alaska Native population component than either of the other two communities. While Akutan has a relatively low Alaska Native population percentage, the Alaska Native population is highly concentrated in one area and generally insulated from commercial groundfish-related activity and its associated non-Native population. Thus, the Alaska Native portion of the community at least in some ways bears the most resemblance to "village life" from an earlier era among the four communities.

As shown in Table 9-6 below, Unalaska has a far higher white or non-minority population percentage than the other three communities. Asian residents represent the largest population segment in Akutan, and the second largest in Unalaska (behind whites) and in King Cove (behind Alaska Natives), and the third largest in Sand Point (behind Alaska Natives and whites). These communities have quite different histories with respect to the growth of the different population segments present in the community in 2000.

Table 9-6 Racial and Ethnic Composition of Population, Selected Alaska Peninsula/Aleutian Islands Region Communities, 2000

Race/Ethnicity	**Unalaska**		**Akutan**		**King Cove**		**Sand Point**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
White	1,893	44.2	168	23.6	119	15.0	264	27.7
Black or African American	157	3.7	15	2.2	13	1.6	14	1.5
Native American/Alaska Native	330	7.7	112	15.7	370	46.7	403	42.3
Nat. Hawaiian/Other Pacific Islander	24	0.6	2	0.3	1	0.1	3	0.3
Asian	1,312	30.6	275	38.6	212	26.8	221	23.2
Some Other Race	399	9.3	130	18.2	47	5.9	21	2.2
Two Or More Races	168	3.9	11	1.5	30	3.8	26	2.7
Total	4,283	100	713	100	792	100	952	100
Hispanic*	551	12.9	148	20.8	59	7.4	129	13.6

* "Hispanic" is an ethnic category and may include individuals of any race (and therefore is not included in the total as this would result in double counting).
Source: U.S. Bureau of Census.

Table 9-7 Employment, Income, and Poverty Information, Selected Alaska Peninsula/ Aleutian Islands Region Communities, 2000

Community	**Total Persons Employed**	**Unemployed**	**Percent Unemployment**	**Percent Adults Not Working**	**Not Seeking Employment**	**Percent Poverty**	**Median Family Income**
Akutan	97	505	78.9	84.84	38	45.5	$43,125
King Cove	450	31	4.7	31.50	176	11.9	$47,188
Sand Point	427	190	22.8	48.67	215	16.0	$58,000
Unalaska	2,675	414	11.1	27.93	625	12.5	$80,829

Source: U.S. Bureau of the Census 2000.

[22] As noted above, this region also encompasses the Pribilof Island communities (St. George and St. Paul). While not having the same degree of direct engagement with the groundfish fisheries as the other communities specifically noted in this section, the Pribilof communities may experience impacts associated with groundfish management actions in a number of ways, as discussed in subsequent sections on impacts to CDQ communities and marine mammal-based subsistence. Existing conditions relevant to environmental justice analysis for these communities are discussed in more detail in those sections below.

One important constant across all of these communities is that each is a minority community in the sense that minorities make up a majority of the population in each community. Unalaska may be described as a plural or complex community in terms of the ethnic composition of its population. Although Unalaska was traditionally an Aleut community, the ethnic composition has changed with people moving into the community on both a short-term and long-term basis.

Akutan is a unique community in terms of its relationship to the Bering Sea groundfish fishery. It is the site of one of the largest shore plants in the region, but it is also the site of a village that is geographically and socially distinct from the shore plant. This duality of structure has had marked consequences for the relationship of Akutan to the fishery[23] and in turn highlights the fundamentally different nature of Akutan and Unalaska. Akutan, while deriving economic benefits from the presence of a large shore plant near the community proper, has not articulated large-scale commercial fishing activity with the daily life of the community as has Unalaska, nor has it developed the type of support economy that is a central part of the socioeconomic structure of Unalaska.

While U.S. Census Fig.s show Akutan had a population of 589 in 1990 and 713 in 2000, the Traditional Council considers the local resident population of the community to be around 80 persons, with the balance being considered non-resident employees of the seafood plant. This definition obviously differs from census, state, and electoral definitions of residency but is reflective of the social reality of Akutan. The residents of the village of Akutan, proper, are almost all Aleut.

Sand Point and King Cove share a more or less common development history, but one quite different from either Unalaska or Akutan.[24] Historically, both of these communities saw a large influx of non-resident fish tenders, seafood processing workers, fishers, and crew members each summer. For the last several decades, both communities were primarily involved in the commercial salmon fisheries of the area, but with the decline of the salmon fishery, plants in both communities have diversified into other species. In more recent years, the processing plants in both communities have become heavily involved in the groundfish fishery.[25]

[23] One example of this may be found in Akutan's status as a CDQ community. Initially (in 1992), Akutan was (along with Unalaska) deemed not eligible for participation in the CDQ program because the community was home to "previously developed harvesting or processing capability sufficient to support substantial groundfish participation in the BSAI …," though they met all other qualifying criteria. The Akutan Traditional Council initiated action to show that the community of Akutan, per se, was separate and distinct from the seafood processing plant some distance away from the residential community site, that interactions between the community and the plant were of a limited nature, and that the plant was not incorporated in the fabric of the community such that little opportunity existed for Akutan residents to participate meaningfully in the Bering Sea pollock fishery. That is, it was argued that the plant was essentially an industrial enclave or worksite separate and distinct from the traditional community of Akutan and that few, if any, Akutan residents worked at the plant). With the support of the APICDA and others, Akutan was successful in a subsequent attempt to become a CDQ community and obtained CDQ status in 1996.

[24] Sand Point was founded in 1898 by a San Francisco fishing company as a trading post and cod fishing station. Aleuts from surrounding villages and Scandinavian fishermen were the first residents of the community. King Cove was founded in 1911 when Pacific American Fisheries built a salmon cannery. Early settlers were mostly Scandinavian, European, and Aleut fishermen and their families.

[25] Their structural relationships to the fishery have diverged since the passage of the AFA. Processing facilities in both communities qualified as AFA entities; however, King Cove qualified for a locally based catcher vessel co-op while Sand Point did not.

Table 9-7 displays data on employment, income, and poverty[26] information for the relevant communities for 2000. The income range is large for the communities shown, with the median family income in Akutan being roughly half of that in Unalaska.

Additionally, Table 9-7 illustrates a potentially problematic aspect of the 2000 data. As shown in the PSEIS, in 1990 there was virtually no unemployment in these communities, no doubt due in large to the presence of fishery-related employment opportunities (NMFS 2004). A working knowledge of the fishing industry would seem to indicate the 2000 data are anomalous. For example, in 2000 the U.S. Census lists a total of 505 unemployed persons in Akutan. Given that the traditional village of Akutan consists of less than 100 persons (including all age groups, not just adults in the labor pool who could qualify as employed or unemployed), the overwhelming majority of persons enumerated as unemployed must have been idled seafood processing workers. While this unemployment may have been real in the sense that processing workers were present and not actively working when the census was taken, it is most likely an artifact of the timing of the census. Processing workers are not typically present in the community when the plant is idle for any extended period of time. Under normal conditions, there are no unemployed seafood processing workers present in the community (by design). The same type of data problem may be occurring in Sand Point and Unalaska, but this is not as clear as is the case for Akutan.

The contrast between these and the other communities is reflective of both lack of economic development in these communities and the nature of the workforce population in communities with shore plants, where large numbers of processing workers are present, tend not to have non-working adult family members present with them, and tend to be in the community exclusively for employment purposes.

Beyond the overall population, income, and employment Fig.s for the individual communities, it is important for the purposes of environmental justice analysis to examine information on the residential groundfish fishery workforces. It is likely that employment and income losses or gains associated with at least some of the proposed alternatives would be felt among the local seafood processing workers, and these workers do not comprise a representative cross section of the community demography.

One method to examine the relative demographic composition of the local processing workforces is to use group quarters housing data from the U.S. Census (keeping with the established practice of using U.S. Census data for environmental justice analysis). The group ethnicity-by-housing type data drawn from the 1990 census and the 2000 census (as well as subsequent sections augmenting this information with industry-provided Fig.s for 2000) was discussed in detail in the PSEIS and is summarized here.

Group housing in Unalaska is largely associated with the processing workforce. A majority of the population lived in group housing as of 1990 and the total minority population proportion was substantially higher in group quarters than in non-group quarters. The 2000 Fig.s showed a similar overall split between group quarters and non-group quarters populations, but the minority population distribution between and within housing types changed substantially in the 1990 to 2000 period. Although demographic categories changed somewhat between the 1990 and 2000 census, some relatively large changes are readily apparent. For example, in 1990, the “Asian or Pacific Islander” category accounted for 27% of group quarters population, and 42% by 2000.

[26] Poverty figures in this section are based on U.S. Census information which, in turn, is based on the Federal government’s official poverty definition. Families and persons are classified as below poverty if their total family income or unrelated individual income was less than the poverty threshold specified for the applicable family size, age of householder, and number of related children under age 18 present. The poverty thresholds are the same for all parts of the country and are not adjusted for regional, state, or local variations in the cost of living. The poverty thresholds are updated every year to reflect changes in the Consumer Price Index.

In general, in 2000 Unalaska had a substantially greater minority population in absolute and relative terms than it did in 1990, and this is readily apparent within the group quarters population that is largely associated with seafood processing workers. In other words, environmental justice is potentially a large concern if there is the potential for processing worker displacement, and one that has grown through time.

Group housing in Akutan is almost exclusively associated with the processing workforce. As of 2000, a total 89% of the population lived in group housing, which represents the extreme of the four communities considered in this region. In 2000, the racial and ethnic composition of the group and non-group housing segments were markedly different, with the non-group housing population being predominately Alaska Native (87%), and the group housing population having little Alaska Native/Native American representation (7%). Like Unalaska, overall minority population representation was higher in absolute and relative terms in the community as a whole and in both group and non-group quarters in 2000 than in 1990.

As with the other communities, group housing in King Cove is largely associated with the processing workforce (38% of the population in 2000). The distribution of ethnicity between housing types is striking. In 2000, the Alaska Natives/Native Americans comprised 75% of the non-group quarters population in the community; there was only one Alaska Native/Native American individual living in group quarters in the community. The “Asian” group comprised over 64% of the group quarters population in 2000, having risen substantially from 1990.

The white component of the population of King Cove was smaller in absolute and relative terms in 2000 than in 1990 for the community as a whole and in group quarters. Among non-group quarters residents, the number of white residents was larger in 2000 than in 1990 but still represented a smaller proportion of the non-group quarters population in 2000 than in 1990. In other words, environmental justice is clearly an issue of potential concern for the community as a whole and for the seafood processing-associated group quarters population in particular, and census counts suggest that minority representation has substantially increased over the period 1990 to 2000.

In Sand Point as of 2000, 36% of the population lived in group housing, which was only slightly less than the King Cove Fig. for that same year. In 2000, no Alaska Natives/Native Americans lived in group quarters in the community, but they comprised 66% of the population living outside of group quarters. As shown, the ethnic and racial diversity among group quarters residents was, in general, substantially less in 2000 than in 1990. Asians comprised over 60% of all persons living in group quarters in 2000 with persons of Hispanic origin accounting for about two-thirds of the remaining 40% of group quarters residents.

Information on 2000 workforce demographics was obtained for four of the six major groundfish shore plants in the Alaska Peninsula/Aleutian Islands region, as well as one of the two floating processors that are classified as inshore plants. At least some of the entities voluntarily providing these data consider them confidential or proprietary business information, but they agreed to provide the information if it was aggregated with data supplied by others such that details about individual operations were not disclosed. As a result of these concerns, communities cannot be discussed individually.

It can be stated that the total combined reported processing (and administrative) workforce of 2,364 persons was classified as 22.5% white or non-minority, and 77.5% minority. Reporting shore plants ranged from having a three-quarters minority workforce to an over 90% minority workforce. It is worth noting that different firms provided different levels of detail in the breakout of the internal composition of the minority component of their workforce. For some plants, the total minority Fig. was not disaggregated, and too few plants within this region provided detailed data to allow region-specific discussion.

In general, however, all of the shore plants in this region that provided detailed data have workforces that are 5% or less Black or African American and 5% or less Alaska Native/Native American (a pattern also seen in the detailed data from Kodiak plants). More variability was seen among other minority population components. The group classified as Asian/Pacific Islander was the largest minority group in two-thirds of the plants in any region reporting detailed data, and the group classified as Hispanic was the largest minority group in the remaining one-third. Two entities provided time series data. One provided data spanning a 10-year period, while the other provided information covering a 4-year span. For the former, the minority workforce component increased over time; for the latter, no unidirectional trend existed.

9.4.9 Marine Mammals/Seabirds

9.4.9.1 Marine mammals

The subsistence take of marine mammals is restricted to the Alaska Native portion of the population under the terms of the Marine Mammal Protection Act of 1972 (as reauthorized in 1994 and amended through 1997; the specific exemption for Alaska Natives is found in Section 101 [16 USC 1371]). The Alaska Native exemption within the MMPA allows for Alaska Natives who dwell on the coast of the North Pacific Ocean or Arctic Ocean to take marine mammals for the purposes of subsistence (or for the purposes of creating and selling authentic native handicrafts and articles of clothing). Chapter 8 analyses the impacts of the alternatives on marine mammals.

Humans harvest a wide range of marine mammals in the action area, including seals, whales, Steller sea lions, and walrus. The mammals provide food and materials for a wide range of equipment and utensils. For example, walrus hides stretched over a wooden frame provided the materials for construction on the traditional umiak. The Marine Mammal Protection Act and the Endangered Species Acts permit the sale of handicrafts made from marine mammal parts. Thus handicrafts made from marine mammal parts may be sold to generate cash incomes (NMFS, “Buying or Possessing…”).

Pollock fishing activities and changes in those activities could impact marine mammal populations though competition for marine mammal prey, by disturbing the animals, or by accidentally killing or injuring animals (“takes”) during the course of normal operations.

Steller sea lions are taken by a number of methods throughout the year. Unlike a number of other subsistence activities that are more broadly participatory, hunting for sea lions is a relatively specialized activity, and a relatively small core of highly productive hunters from a limited number of households account for most of the harvest. There has been some change in harvesting techniques in recent years, and there is also variation by region. Seasonality of sea lion harvest is quite variable and appears to be dependent on sea lion abundance and distribution.

Looking across regions, in 2003 approximately 51% of the total subsistence take of Steller sea lions occurred in the Aleutian Islands region, about 17% in the Kodiak Island region, about 15% in the Pribilof Island region, and about 12% in the North Pacific Rim region. The Southeast Alaska and South Alaska Peninsula regions accounted for about 3 and 2%, respectively, of the total subsistence take in 2003. In 2003 a total of 17 of the 62 surveyed communities reported harvesting sea lions, with 9 communities reporting takes of five or more sea lions. The seven top ranking communities were Atka (82 sea lions), Old Harbor (32 sea lions), St. Paul (18 sea lions), Unalaska (16 sea lions), St. George (14 sea lions), Tatitlek (14 sea lions), and Akutan (9 sea lions). These seven communities accounted for 185 sea lions, or 87% of the total Alaska subsistence take (Wolfe et al. 2004).

The number of individuals reporting hunting sea lions has declined substantially since the early 1990s. The estimated numbers of households that reported at least one member hunting sea lions were 199 (1992), 222 (1993), 210 (1994), 158 (1995), 130 (1996), 97 (1997), 111 (1998), 117 (2000), 98 (2001), 90 (2002), and 97 (2003). In general, declines in the numbers of sea lion hunters occurred at a time when sea lions became increasingly harder to find in local hunting areas and consequently more difficult and expensive to hunt. Rate of success, however, has not tracked in parallel with numbers of hunters or reported increases in time and effort necessary to hunt successfully. The proportion of unsuccessful hunting households for sea lions has been 30% (1992), 35% (1993), 40% (1994), 24% (1995), 35% (1996), 23% (1997), 33% (1998), 25% (2000), 21% (2001), 29% (2002), and 22% (2003) (Wolfe et al. 2004).

While the available information suggests some support for a direct relationship between the overall Steller sea lion population and the level of subsistence harvest, such support is not definitive and other factors cannot be excluded. Given the relatively small numbers involved, the concentrated efforts of a single hunter or just a few hunters can make relatively large percentage changes in community harvest totals. The weighting of factors is also not possible from the evidence available. It does appear that present Steller sea lion harvest methods are likely to be more successful, and certainly more efficient, when resource populations (and density) are higher. A number of factors may be at work, however, such that a recovery in Steller sea lion abundance may not necessarily result in a marked increase in subsistence take, but too little is known regarding the determinants of subsistence demand for Steller sea lions to reach any definitive conclusions.

On a community level, it is important to note that of all the communities identified in the text of the PSEIS (NMFS 2004) as having a documented Steller sea lion harvest, only Akutan and Unalaska are identified as “regionally important groundfish communities” with substantial direct participation in the fishery. In other words, where use of Steller sea lions is identified as important to the community subsistence base, the commercial groundfish fishery is generally not, and vice versa.

The PSEIS notes that fifty years ago, the harbor seal was so abundant in Alaska (and perceived to be in conflict with commercial salmon fisheries) that the state issued a bounty for the animal. State-sponsored bounties and predator control programs, as well as commercial harvest of harbor seals, occurred on a regular basis throughout the animal’s range until the passage of the MMPA. Both adult seals and pups were harvested for pelts. An estimated 3,000 seals, mostly pups, were harvested annually for their pelts along the Alaska Peninsula between 1963 and 1972, accounting for 50% of the pup production. (NMFS 2004)

The PSEIS goes on to note that harvest of harbor seals for subsistence purposes is likely the highest cause of anthropogenic mortality for this species since the cessation of commercial harvests in the early 1970s. Between 1992 and 1998, the statewide harvest of harbor seals from all stocks ranged between 2,546 and 2,854 animals, the majority of which were taken in southeast Alaska. Aside from their value as a food source, harbor seals play an important role in the culture of many Native Alaskan communities. (NMFS 2004)

The PSEIS provides the following regional information about the relationship between human induced mortality and PBR. The Bering Sea stock of harbor seals is approximately 13,000 animals, and the calculated PBR is 379 animals. The annual subsistence harvest from this stock from 1994 to 1996 was approximately 161 animals, 42% of PBR for this species. In 1998, 178 harbor seals from this stock were taken in the subsistence harvest. For the GOA stock, the calculated PBR is 868 animals. The average annual subsistence harvest from the GOA between 1992 and 1996 was 791 animals, representing 91% of the PBR for this stock. The latest available harvest data from 1998 (792) is comparable to the average subsistence harvest of harbor seals from previous years. For the southeast stock, the calculated PBR is

2,114 animals. The average annual subsistence harvest from southeast between 1992 and 1996 was 1,749 animals, representing 83% of the PBR for this stock (NMFS 2004).

The context of subsistence harvest of northern fur seals is much different from that of Steller sea lions, and subsistence effort is highly concentrated in the communities of St. Paul and St. George in the Pribilof Islands. The commercial harvesting of northern fur seals on the Pribilof Islands began shortly after the first known discovery of the islands in 1786. The commercial harvest was continued by the United States when the Pribilof Islands came under U.S. jurisdiction with the purchase of Alaska from Russia in 1867 and lasted until 1984. The method of subsistence harvest of northern fur seals on the Pribilof Islands is a direct outgrowth of the commercial harvest that took place on the islands and, due to this historical and legislative context, the organization of the subsistence harvest of northern fur seals is very different from the organization of the harvest of Steller sea lions elsewhere. The subsistence harvest of northern fur seals in the Pribilof Islands is conducted as an organized, land-based, group activity.

NMFS entered into co-management agreements with the Tribal Governments of St. Paul and St. George under Section 119 of the MMPA in 2000 and 2001, respectively. These agreements are specific to the conservation and management of northern fur seals and Steller sea lions in the Pribilof Islands, with particular attention to the subsistence take and use of these animals. To minimize negative effects on the population, the fur seal subsistence harvest has been limited to a 47-day harvest season (June 23-August 8) during which only sub-adult male seals may be taken. In addition, the Fur Seal Act authorizes subsistence harvest of fur seals by Native Americans dwelling on North Pacific Ocean coasts (but not for seal skins, which must be disposed of), but that harvest can only be from canoes paddled by less than five people each and without the use of firearms.

On St. Paul Island, annual subsistence take of northern fur seals ranged between 754 and 522 animals over the period 2000-2003. On St. George, the annual harvest ranged between 203 and 121 animals over this same period. St. Paul and St. George are predominately Alaska Native communities. In 2000, the total population of St. Paul was 532, 86% of whom were Alaska Native/Native American. St. George had a population of 152 in 2000, of whom 92% were Alaska Native/Native American. These communities are relatively isolated, even by rural Alaska standards, from other population centers and private sector economic opportunities are relatively limited in both communities as well.

While northern fur seal harvest is an essential component of subsistence in the Pribilof Islands, only three non-Pribilof communities, the Aleutian communities of Akutan, Nikolski, and Unalaska, show any level of harvest for northern fur seals for any year in which ADF&G harvest surveys were conducted. For Akutan, during the single year that shows up in the data, fur seal harvests accounted for about 2% of the total subsistence harvest in the community. This is based on pounds per person of total subsistence harvests for the community. For Nikolski and Unalaska, fur seal harvests accounted for about two-tenths of 1% and less than one-tenth of 1% of total community subsistence harvest, respectively.

As noted in the fur seal subsistence harvest EIS (NMFS 2005), the cumulative effect of the harvest of fur seal prey species (pollock) may result in a conditionally significant adverse impact on fur seals. Such an impact could potentially result in impacts on subsistence hunting opportunities, if the impacts result in a drop in fur seal population leading to a drop in subsistence harvest levels. However, the potential competition between fur seals and the pollock fishery is not well understood (Chapter 8). Higher pollock harvest under an alternative would result in a higher potential for prey competition compared to alternatives with a lower pollock TAC.

9.4.9.2 Seabirds

Alaskan's have been harvesting about 225,000 birds a year for subsistence purposes. Most of these are geese and ducks, but about 23,000 a year have been seabirds. Significant portions of the seabird harvest have taken place in the action area. St. Lawrence Island accounts for about 13,000 seabirds, while most of the rest are taken in the Yukon-Koskokwim Delta and the Bering Strait areas. Alaskans have also been harvesting about 113,000 bird eggs a year for subsistence purposes. The vast majority of these, about 95,000 a year, have been seabird eggs, and most of these have been taken in the action area. Particularly important components of the harvest come from the Northwest Arctic, the Bering Strait area, the Bristol Bay area, and St. Lawrence Island. Harvests are also taken, however, in the Yukon-Koskokwim, Alaska Peninsula, and Aleutian Island areas (AMBCC).[27]

Pollock fishing activities and changes in those activities could impact seabird populations though competition for seabird prey, by accidentally killing or injuring birds ("takes") during the course of normal operations, or by impacting benthic habitat used by the birds. Chapter 8 analyses the impacts of the alternatives on seabirds.

9.4.10 Groundfish/Forage Fish/Prohibited Species

9.4.10.1 Groundfish

Groundfish species are those species that support either a single species or mixed species target fishery, are commercially important, and for which a sufficient data base exists that allows each to be managed on its own biological merits. Accordingly, a specific TAC is established annually for each target species. Catch of each species must be recorded and reported. This category includes pollock, Pacific cod, sablefish, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, flathead sole, Alaska plaice, "other flatfish", Pacific ocean perch, northern rockfish, shortraker rockfish, rougheye rockfish, "other rockfish", Atka mackerel, and squid (Council, BSAI FMP, page 10). Chapter 7 provides an analysis on the impacts of the alternatives on non-pollock groundfish.

Subsistence use of groundfish resources in Alaska is described in detail in the PSEIS (NMFS 2004). The PSEIS provides relatively little detail about groundfish subsistence in western Alaska however. Elsewhere in the state, however, subsistence groundfish use levels appear to be low compared to use levels of subsistence resources overall, and in relation to other fish resources in particular. In general, groundfish are a relatively small part of subsistence consumption, ranging from close to zero up to about 9% of total resources consumed by weight, per capita, depending on the community and year. Commercial fisheries may target stocks, such as rockfish, that are also targeted by subsistence fishermen, but there is no indication that this dual use of stocks has resulted in detrimental impacts to groundfish subsistence utilization under existing conditions (NMFS 2007).

9.4.10.2 Forage fish

Forage fish species are those species which are a critical food source for many marine mammal, seabird and fish species. Forage fish species in the Bering Sea and Aleutian Islands region include Osmeridae family (eulachon, capelin, and other smelts), Myctophidae family (lanternfishes), Bathylagidae family (deep-sea smelts), Ammodytidae family (Pacific sand lance), Trichodontidae family (Pacific sand fish), Pholidae family (gunnels) Stichaeidae family (pricklebacks, warbonnets, eelblennys, cockscombs, and shannys), Gonostomatidae family (bristlemouths, lightfishes, and anglemouths), and Order Euphausiacea (krill) (Council, BSAI FMP, page 11). Chapter 7 provides an analysis on the impacts of the alternatives on forage fish.

[27] Average annual harvests appear to be rough estimates prepared by the Alaska Migratory Bird Co-Management Council on the basis of a number of different survey instruments, and appear to apply to the period 1995-2002.

Most forage fish harvests in the Bering Sea and Aleutian Islands consist of smelts (although significant volumes of sandfish were taken in 2001). From 2002 to 2005, BSAI forage fish harvests ranged between 10 and 35 metric tons. Pollock trawling accounted for almost all of the smelt harvest (NMFS 2007).

9.4.10.3 Prohibited species

Prohibited species are those species and species groups the catch of which must be avoided while fishing for groundfish, and which must be returned to sea with a minimum of injury except when their retention is authorized by other applicable law. Prohibited species in the Bering Sea include Pacific halibut, Pacific herring, Pacific salmon, Steelhead, King crab, and Tanner crab (Council, BSAI FMP, page 10-11).

Pacific salmon (Chinook and chum) have been dealt with in earlier sections. Several of the other species are the objects of fisheries carried out by commercial or subsistence fishermen from western Alaska (halibut, herring, steelhead) or of CDQ groups (crab species). Impacts on these species thus could have impacts on low income or minority communities in western Alaska.

Chapter 7 provides detailed background on the management of the bycatch of these species by the pollock fishery and discusses the potential impacts of the alternatives on these bycatches.

9.5 How will the alternatives affect minority or low income communities?

The potential actions may affect minority and low income communities within the region in several ways. These include: (1) changes in Chinook salmon returns to escapement, subsistence harvest, or commercial harvest, in Western and Interior Alaska and changes in salmon deliveries to food banks; (2) changes in pollock revenues earned through participation in CDQ programs, and changes in western Alaska pollock landings by catcher vessels (3) changes in the impacts of other resources that are exploited commercially or for subsistence by residents of western Alaska, including chum salmon, marine mammals, seabirds, other groundfish, forage species, and prohibited species.

Error! Reference source not found., **Error! Reference source not found.** and **Error! Reference source not found.** below summarize the impacts on low income or minority communities associated with one of these three classes of impacts. Each table has the same structure with a row for each of the major elements of each alternative and a cell in the right hand column that discusses the potential impacts on these communities.

Table 9-8 **Chinook** impacts on low income or minority communities

Alternative	Options/ suboptions, components	The alternatives may disproportionately affect low income or minority communities by reducing salmon bycatch and increasing the numbers of Chinook salmon returning to natal streams in western Alaska.
Alternative 1: Status quo	Status quo	Chinook mortality in the pelagic trawl groundfish fisheries increased rapidly from 2000 to 2007. The situation was so dynamic that it would not be very helpful to report an average harvest over that period. Catch grew from about 5,000 Chinook (CDQ and non-CDQ harvests) in 2000 to about 122,000 Chinook in 2007. As this is written in late April 2008, "A" season harvests have run far behind those in all the years since 2001. Significant numbers of these Chinook are believed to originate in western Alaska. The numbers of Chinook harvested by pelagic gear is greater than the numbers that would actually return to their natal river systems because of the natural mortality that would occur to these fish if they had avoided the trawl gear. This bycatch disproportionately affects minority and low income populations in the action area by reducing the productivity of subsistence and commercial fisheries, although the magnitude of the impact is unclear.
Alternative 2: Hard cap	Hard Cap level	All the hard caps would represent a reduction in Chinook bycatch from levels seen in some recent years (see Table 2 in Chapter 2). For analytical purposes, four hard caps between 29,300 and 87,500 Chinook salmon have been evaluated. The 87,500 Chinook limit is larger than all but one of the Chinook bycatches between 2000 and 2007; the 68,100 Chinook cap is larger than the first six year's bycatches in the series, and smaller than the last two; the 48,700 Chinook cap is approximately at the median; the 29,300 cap is smaller than all but one of these bycatches. Tighter constraints should mean more Chinook returning to low income and minority communities in the action area. Since Chinook bycatch disproportionately impacts these communities, tighter caps would reduce the size of this impact. Note that all hard caps would be implemented simultaneously with a seasonal allocation, and that a full appreciation of hard cap impacts has to take the seasonal distribution into account.
	Seasonal distribution of hard caps	Seasonal impacts on pollock harvest are described in Table 37 in Chapter 2. Tighter A season caps (50% as opposed to 70%) lead to earlier closures of the A season fishery, loss of pollock harvest, potentially reduced salmon bycatch, and potential increases in returns to river systems. On the other hand, they are associated with somewhat smaller reductions in pollock production in the "B" season, and presumably more Chinook bycatch. Fisheries would be constrained by the hard caps in any event, however, some configurations of seasonal allocations could tend to reduce bycatch below formal hard cap levels.
	Periodic adjustments or indexed cap	In the absence of a set of options for index levels, it is impossible to evaluate the potential for disproportionate impacts on low income or minority communities.
	Sector Allocation	These options affect pollock industry management of the program and should have no disproportionate impacts on low income or minority communities because of changes in Chinook bycatch.
	Sector Transfer	These options affect pollock industry management of the program and should have no disproportionate impacts on low income or minority communities because of changes in Chinook bycatch.
	Cooperative Provisions	These options affect pollock industry management of the program and should have no disproportionate impacts on low income or minority communities because of changes in Chinook bycatch.
Alternative 3: Triggered closures	Management	The arrangements for closing areas, and the exemption for vessels participating in a salmon bycatch reduction intercooperative agreement should not impact Chinook returns and thus should have no disproportionate impacts on low income or minority communities.
	Trigger cap formulation	The analysis of hard caps under Alternative 2 applies here to some extent, although they do not result in a complete closure of the fishery, but the closure of certain fishing areas. It is the area closures that have an impact on Chinook harvests, and this is discussed below, under "Area options."
	Sector allocation	These options affect pollock industry management of the program and should have no disproportionate impacts on low income or minority communities because of Chinook returns.
	Sector transfer	These options affect pollock industry management of the program and should have no disproportionate impacts on low income or minority communities because of Chinook returns.
	Area options	In the absence of information on the potential impact of these alternatives on Chinook bycatch (as of April 24, 2008) it is not possible to draw conclusions about this impact.

Table 9-9 Pollock impacts on low income or minority communities

Alternative	Options/ suboptions, components	The alternatives may impose disproportionate impacts on low income or minority communities by affecting the resources available to CDQ groups, and by affecting the shoreside deliveries of pollock by catcher vessels.
Alternative 1: Status quo	Status quo	Chinook mortality in the CDQ pelagic trawl groundfish fisheries did not follow the same pattern of increase observed in the non-CDQ fisheries. CDQ bycatch more than tripled from 2000 to 2001, fell in 2002, rose by about 50% between 2002 and 2004, declined from 2004 to 2006, then more than doubled in 2007. The 2008 catch is only available for the "A" season at this writing (late April 2008), however, the "A" season catch was dramatically smaller than at any time since 2000. During this period the CDQ groups were able to harvest substantially all of their CDQ pollock allocations. The revenues associated with this pollock harvest disproportionately accrue to the CDQ groups, and to 65 communities in western Alaska with significant low income and minority populations. During this period the pollock catcher vessel fleet was also able to harvest substantially all of its pollock allocations, making deliveries to plants in Unalaska/Dutch Harbor, Akutan, King Cove and Sand Point.
Alternative 2: Hard cap	Hard Cap level	All the hard caps reduce Chinook bycatch from levels seen in some recent years. Under every hard cap alternative, CDQ groups would get 7.5% of the hard cap (this percentage is different in the sectoral breakout alternatives – see the discussion later in this table). For analytical purposes, four hard caps between 2,198 and 6,563 Chinook salmon have been evaluated. The 6,563 Chinook limit is larger than all of the CDQ group Chinook bycatches between 2000 and 2007; it is at least twice the size of all but one of these; the 5,108 and the 3,653 Chinook caps are both larger than all but the 2007 bycatch; the 2,198 Chinook cap is larger than four of the bycatches, and less than four. This suggests that only one of the hard caps might frequently constrain CDQ pollock harvests, however any hard cap would be combined with a seasonal allocation, and some seasonal allocations might limit the ability of CDQ groups to fully harvest their pollock allocations. Further discussion is deferred to the part of this table that deals with seasonal distribution of hard caps. Higher hard cap levels would be less likely to constrain catcher vessel pollock harvests and deliveries to shoreside processing plants. They would thus be less likely to disproportionately impact low income or minority populations in communities where those plants are located (see the discussion below for the implications of sectoral and seasonal allocations).
	Seasonal distribution of hard caps	At the highest cap (6,563 Chinook for CDQ groups) the CDQ groups are unlikely to experience a decline in "A" season harvests, and have a relatively small likelihood of a decline in "B" season harvests. Otherwise, in general, tighter A season caps (50% as opposed to 70%) tend to lead to earlier closures of the "A" season fishery and potentially reduced pollock harvest. Conversely, tighter "A" season caps lead to smaller harvest declines in the "B" season. However, the volume of "A" season losses with a shift to tighter "A" season constraints appear to exceed the volume of "B" season gains. The fact that "A" season fish are more valuable because of their roe content exacerbates the impact. Reduction in the value of CDQ production would have a disproportionate impact on the minority and low income populations in the CDQ communities. The smaller the proportion of the Chinook cap allocated to the "A" season, the more likely it is that the catcher vessels will harvest a smaller amount of pollock in the "A" season, and the less binding their constraint in the "B" season is likely to be. Impacts are exacerbated by the fact that "A' season fish are more valuable.
	Periodic adjustments or indexed cap	In the absence of a set of options for index levels, it is impossible to evaluate the potential for disproportionate impacts on low income or minority communities.
	Sector Allocation	These options allocate smaller amounts of Chinook salmon bycatch to the CDQ groups than would otherwise be the case. Under Alternative 1, the CDQ groups receive 7.5% of the Chinook allocation. Under the sector allocation options, the CDQ groups receive from 3% to 10% of the allocations. In general, the smaller the percentage of the Chinook harvest assigned to the CDQ groups, the greater the likelihood that they will not be able to fully harvest their pollock allocation, and the larger the likely shortfall. Because these options tend to bear more heavily on the CDQ groups compared to other fleet segments, they appear to have a disproportionate adverse impact on minority and low income communities. Allocations to the CV sector range from 57.5% to 70%. Options that provide greater allocations to catcher vessels mean that more pollock will be delivered to shoreside processing plants and distribution networks, potentially providing more work in shoreside communities with minority or low income communities.
	Sector Transfer	Sectoral transfers offer greater potential for full harvest of pollock allocations. The more liberal these provisions are, the less likely that CDQ groups would not be able to fully harvest their allocations. It is not clear if the transfer or the rollover option would be more beneficial to the CDQ groups. The considerations that apply to CDQ groups apply as well to catcher vessels.
	Cooperative Provisions	These options affect the inshore fisheries cooperatives, but not the CDQ groups. They should have no disproportionate impacts on low income or minority communities simply because they are members of CDQ groups. This option applies to the catcher vessel fleet and may have differential impacts among communities, depending on the allocation among cooperatives, and the communities where different cooperatives deliver their pollock for processing.

Alternative 3: Triggered closures	Management	The choice of the trigger cap itself should have no impacts aside from the relative impacts discussed under the choice of the different hard caps above. The exemption for vessels participating in an ICA may provide more flexibility for catcher vessels.
	Trigger cap formulation	The analysis of hard caps under Alternative 2 applies here to some extent, although they do not result in a complete closure of the fishery, but the closure of certain fishing areas. It is the area closures that have an impact on CDQ pollock harvests, and this is discussed below, under "Area options."
	Sector allocation	The discussion under Alternative 2 should apply here.
	Sector transfer	The discussion under Alternative 2 should apply here.
	Area options	In the absence of information on the potential impact of these alternatives on Chinook bycatch (as of April 24, 2008) it is not possible to draw conclusions about this impact.

Table 9-10 **Other resource impacts** on low income or minority communities

Alternative	**Options/suboptions, components**	**Other Resource Impacts** *The alternatives may disproportionately impact low income or minority communities by affecting the way pollock vessels interact with a number of resources including chum salmon, marine mammals, seabirds, essential fish habitat, other groundfish species, forage species, prohibited species.*
Alternative 1: Status quo	Status quo	Pollock harvesting takes chum salmon, other groundfish species, forage species, and prohibited species as bycatch. Pollock harvesting can affect marine mammals and seabirds through several mechanisms, including competition for prey, disturbance, and direct takes. Pollock trawls are mid-water gear, but they can come in contact with the bottom and may impact the bottom. The Council has adopted a wide range of measures to mitigate the impacts of pollock fishing on some of these natural resources. The Alaska Groundfish Harvest Specifications Final EIS (NMFS 2007) provides a discussion of the impacts of groundfish fishing in general on these resource components and is a good summary reference to the potential impacts. As noted earlier in this chapter, many of these resources are used for subsistence purposes or to generate income in western Alaska.
Alternative 2: Hard cap	Hard Cap level	For analytical purposes, four hard caps between 29,300 and 87,500 Chinook salmon have been evaluated. Tighter constraints may result in less harvest of pollock. However, tighter constraints might mean more or less fishing effort. They may mean more activity if fishing operations spend more time prospecting for pollock schools that can be harvested with limited salmon bycatch; they might mean less effort if bycatch caps are reached and fisheries are closed. The actual impacts are dependent on what species will be impacted and how the changes may occur.
	Seasonal distribution of hard caps	Tighter A season caps (50% as opposed to 70%) lead to earlier closures of the A season fishery, reduced pollock harvest and fishing activity and reduced impact on the species considered in these categories. The actual impacts are dependent on what species will be impacted and how the changes may occur.
	Periodic adjustments or indexed cap	In the absence of a set of options for index levels, it is impossible to evaluate the potential for disproportionate impacts on low income or minority communities.
	Sector Allocation	These options affect pollock industry management of the program and should have no disproportionate impacts on low income or minority communities because of impacts on the resources considered here.
	Sector Transfer	These options affect pollock industry management of the program and should have no disproportionate impacts on low income or minority communities because of impacts on the resources considered here.
	Cooperative Provisions	These options affect pollock industry management of the program and should have no disproportionate impacts on low income or minority communities because of impacts on the resources considered here.
Alternative 3: Triggered closures	Management	The arrangements for closing areas, and the exemption for vessels participating in an salmon bycatch reduction intercooperative agreement should not impact the resources considered here and thus should have no disproportionate impacts on low income or minority communities.
	Trigger cap formulation	The analysis of hard caps under Alternative 2 applies here to some extent, although they do not result in a complete closure of the fishery, but the closure of certain fishing areas. It is the area closures that have an impact on Chinook harvests, and this is discussed below, under "Area options."
	Sector allocation	These options affect pollock industry management of the program and should have no disproportionate impacts on low income or minority communities because of impacts on the resources considered here.
	Sector transfer	These options affect pollock industry management of the program and should have no disproportionate impacts on low income or minority communities because of impacts on the resources considered here.
	Area options	In the absence of information on the potential impact of these alternatives on the resources considered here (as of April 24, 2008) it is not possible to draw conclusions about this impact.

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11.0 REFERENCES

[--THIS IS A PARTIAL LIST OF REFERENCES WHICH WILL BE COMPLETED FOLLOWING THE JUNE 2008 COUNCIL MEETING--]

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