Bering Sea Chum Salmon PSC Management Measures

Initial Review Draft Environmental Assessment

North Pacific Fishery Management Council

United States Department of Commerce
National Oceanic and Atmospheric Administration
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Executive Summary

This analysis examines the impacts of alternatives for new measures to reduce chum salmon bycatch (also known as prohibited species catch, or PSC) in the Bering Sea pollock fishery to the extent practicable while achieving optimum yield. A vast majority of the chum salmon PSC in the groundfish fisheries are taken by the pollock fishery.

The pollock fishery in waters off Alaska is the largest U.S. fishery by volume. In 1998, the American Fisheries Act (AFA) rationalized the fishery by identifying the vessels and processors eligible to participate in the Bering Sea pollock fishery and allocating specific percentages of the Bering Sea directed pollock fishery total allowable catch (TAC) among the competing sectors of the fishery. Each year, NMFS apportions the pollock TAC among the inshore catcher vessel (CV) sector, offshore catcher/processor (CP) sector, and mothership sector after allocations are made to the Community Development Quota (CDQ) Program and incidental catch allowances.

The Bering Sea pollock TAC is divided into two seasons –the A season (January 20 to June 10) and the B season (June 10 to November 1). The fleet targets pre-spawning pollock for their valuable roe in the A season and the TAC is typically reached by early April. The B season fishery focuses on pollock for fillet and surimi markets and the fleet harvests most of the B season TAC during June through early October.

Pollock is harvested with fishing vessels towing large pelagic trawl nets. Salmon in the Bering Sea can occur in the same locations and depths as pollock and are, therefore, are caught incidentally. Of the five species of Pacific salmon, Chinook salmon (*Oncorhynchus tshawytscha*) and chum salmon (*O. keta*) are most common in the salmon bycatch with Chinook salmon occurring in both ‘A’ and ‘B’ seasons of the fishery while chum salmon occur almost exclusively in the ‘B’ season.

Salmon are culturally, nutritionally, and economically significant to Alaska communities. Salmon are fully allocated and used in subsistence, commercial, and recreational fisheries in and off Alaska and, in the case of Chinook and chum salmon, in Canada. Therefore, NMFS manages Chinook and all other species of salmon as prohibited species in the BSAI groundfish fisheries, including the Bering Sea pollock fishery. Other salmon are designated as ‘non-Chinook salmon’ and here in this analysis described as ‘chum’ salmon due to it being comprised of over 99% chum salmon. As a prohibited species, salmon must be avoided as bycatch, and any salmon caught must either be donated to the Prohibited Species Donation Program for distribution to foodbanks or be returned to the sea as soon as is practicable with a minimum of injury, after an observer has determined the number of salmon and collected any scientific data or biological samples.

Several management measures are currently used to minimize chum salmon PSC in the Bering Sea pollock fishery. In the mid-1990s, the National Marine Fisheries Service (NMFS) implemented regulations recommended by the Council to control the bycatch of chum salmon taken in the Bering Sea pollock fishery. These regulations established a large-scale closure in the Bering Sea to the pollock fishery. An exemption to this closure for the pollock fishery was enacted in regulation in 2006 provided the fleet participated in an industry-initiated short-term area closure (rolling hot spot or RHS) program. The Council is now considering whether additional management measures are needed to minimize chum salmon PSC in the Bering Sea pollock fishery.

The Council's problem statement for this action is:

> Magnuson-Stevens Act National Standards direct management Councils to balance achieving optimum yield with bycatch reduction as well as to minimize adverse impacts on fishery dependent communities. Non-Chinook salmon (primarily made up of chum salmon) prohibited species bycatch (PSC) in the Bering Sea pollock trawl fishery is of concern because chum salmon are an important stock for subsistence and commercial fisheries in Alaska. There is currently no limitation on the amount of non-Chinook PSC that can be taken in directed pollock trawl fisheries in the Bering Sea. The potential for high levels of chum salmon bycatch as well as long-term impacts of more moderate bycatch levels on conservation and abundance, may have adverse impacts on fishery dependent communities.
>
> Non-Chinook salmon PSC is managed under chum salmon savings areas and the voluntary Rolling Hotspot System (RHS). Hard caps, area closures, and possibly an enhanced RHS may be needed to ensure that non-Chinook PSC is limited and remains at a level that will minimize adverse impacts on fishery dependent communities. The Council should structure non-Chinook PSC management measures to provide incentive for the pollock trawl fleet to improve performance in avoiding non-Chinook salmon while achieving optimum yield from the directed fishery and objectives of the Amendment 91 Chinook salmon PSC management program. Non-Chinook salmon PSC reduction measures should focus, to the extent possible, on reducing impacts to Alaska chum salmon as a top priority.

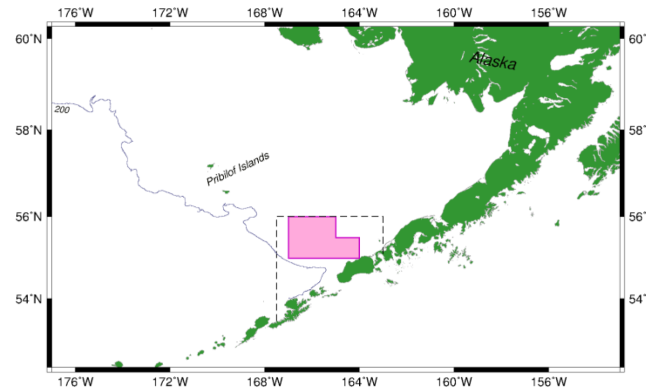
The analysis includes an Environmental Assessment (EA) that examines the effect of the alternatives on pollock, chum salmon, Chinook salmon, and other marine resources including groundfish species, ecosystem component species, marine mammals, seabirds, essential fish habitat and marine ecosystem. The analysis also includes are Regulatory Impact Review (RIR) that evaluates the social and economic consequences of the alternatives with respect to three major issues: economic impacts and net benefits to the Nation; Alaska Native, non-native minority, and low-income populations; and fisheries management and enforcement. The adjacent table shows the recent total allowable catch limits for pollock, as well as the number of Non-Chinook (i.e., chum) salmon caught incidentally in the fishery.

Recent history of Bering Sea pollock catch limits and the number of chum salmon incidentally caught in the pollock fishery.

Year	Pollock TAC	Chum salmon PSC (#)
2003	1,491,760	189,185
2004	1,492,000	440,468
2005	1,478,000	704,552
2006	1,487,756	309,630
2007	1,394,000	93,783
2008	1,000,000	15,267
2009	815,000	46,127
2010	813,000	13,222
2011	1,252,000	191,445
2012	1,200,000	22,213

The Council developed four alternatives for minimizing chum salmon PSC, each with a number of detailed options and sub-options. Given that chum PSC is taken almost exclusively during the B-season, management measures are considered only for the period June 10 to November 1. To the extent possible, the Council is considering some management measures which explicitly provide additional protection for western Alaskan chum stocks based on the stock composition of the chum salmon PSC. Genetic analyses on the chum salmon PSC indicate that the largest proportion of the bycatch originates from Asian stocks, with smaller components from western Alaska, the Alaskan Peninsula and SE Alaska-BC-Washington regions. Genetic analyses further indicate that Alaskan stocks are proportionately more common earlier in the summer (June-July) than later in the season (August-October) while proportions of other stocks increase later in the summer-fall. Some of the alternatives consider June-July timing to address this.

Alternative 1: Status Quo (No Action). Under this alternative, the current program to minimize chum salmon PSC would continue. Alternative 1 would retain the Chum Salmon Savings Area (SSA) closure in the Bering Sea. Closure of the Chum SSA is designed to reduce the total amount of chum incidentally caught by closing the area with high levels of salmon PSC in the early 1990s before the area was implemented. This area is closed to all trawling from August 1 through August 31, and if 42,000 non-Chinook salmon are caught in the Catcher Vessel Operational Area (CVOA) during the period August 15 through October 14, the area remains closed 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 PSC limit. Pollock vessels participating in a rolling hotspot inter-cooperative agreement (RHS ICA) approved by NMFS are exempt from the closure.



The RHS ICA operates in lieu of regulatory closures of the Chum SSA and requires industry to identify and close areas of high salmon PSC and move to other areas. The rolling hot spot program is a bycatch avoidance program whereby area closures are designated in the Bering Sea based upon recent observations of high bycatch. Closures are established by a private company, SeaState, and cooperatives within the pollock fishery are subject to these closures if their cooperative-level bycatch rate exceeds set thresholds. Cooperatives are placed into one of three 'Tiers' based upon their rate of bycatch in comparison to a base or average rate. Once closures are designated, cooperatives that are subject to the closures may not fish in those areas for a period of 4-7 days depending on their tier level. Closures are re-evaluated weekly and are subject to change or remain in place for an additional 4-7 days depending on prevailing bycatch rates. The fleet is subject to enforcement of the closures through a private contractual arrangement called and Inter-Cooperative Agreement (ICA). The ICA was amended for the 2011 season to remove and all provisions under the ICA related to Chinook bycatch management following implementation of Amendment 91. The current RHS is a chum-only agreement in the B-season, and the many of the required ICA provisions are established by regulation (§ 679.21(g)).

Alternative 2: Hard cap (PSC limit). Alternative 2 would establish separate chum salmon PSC limits for the pollock fishery in the B season, with accounting towards the cap beginning on June 10. When the PSC limit is reached, all directed fishing for pollock must cease for either the remainder of the year (Option 1a) or until August 1 (Option 1b). Only those chum salmon caught by vessels participating in the directed pollock fishery would accrue towards the cap. When the cap is reached, directed fishing for pollock would be prohibited during the applicable time frame. Alternative 2 contains components, and options for each component, to determine (1) the total hard cap amount and time frame over which the cap is applied, (2) whether and how to allocate the cap to sectors, (3) whether and how salmon bycatch allocations can be transferred among sectors, and (4) whether and how the cap is allocated to and transferred among catcher vessel (CV) cooperatives. The existing Chum Salmon Savings Area and associated trigger cap would be removed from regulation.

Component 1 – Component 1 would establish the annual PSC limit, based on a range of optional caps, with 10.7% allocated to the CDQ pollock fishery. There are two options considered to establish the hard cap. These options differ by whether the cap is established for the entire B season (Option 1a) or for June and July only (Option 1b). There are 6 options for caps under Option 1a, and 6 options for caps under Option 1b, of which three options encompassing the entire range were selected for analysis.

Component 2 – Component 2 would allow hard caps to be apportioned as sector-level caps for the three non-CDQ sectors: the inshore CV sector, the mothership sector, and the offshore CP sector. A fishery level cap would be managed by NMFS with inseason actions to close the fishery once the cap was reached. The CDQ fishery caps would be allocated and managed at the CDQ group level, as occurs under status quo. The hard caps could be apportioned to sectors as sector level caps based on the percentages in Table ES-0 3. Non-CDQ sector level caps would be managed by NMFS with inseason actions to close the fishery once the cap was reached. The inshore CV sector level cap could be allocated to cooperatives and the inshore CV limited access fishery. The cooperative transferable allocation amounts would be based on the proportion of pollock allocations received by the cooperatives.

Component 3 – Component 3 would provide sectors more opportunity to fully harvest their pollock allocations, by authorizing the ability to transfer sector allocations and/or rollover unused salmon bycatch. Options include: no transfers or rollovers, NMFS-approved transfers between sectors, and allowance for NMFS to roll-over unused bycatch allocation to sectors that are still fishing. A suboption for sector transfers would limit transfers to the 50%-90% of the salmon that is available to the transferring entity at the time of transfer.

Component 4 – Component 4 would allow allocation at the co-op level for the inshore sector, and apply transfer rules at the co-op level for the inshore sector. Sub-options can limit transfers to 50%-90% of salmon that is available to the transferring entity at the time of transfer. An additional option would allow NMFS to rollover unused bycatch allocation to inshore cooperatives that are still fishing.

Alternative 2 components and options selected for analysis. See Chapter 2 for full suite of options.

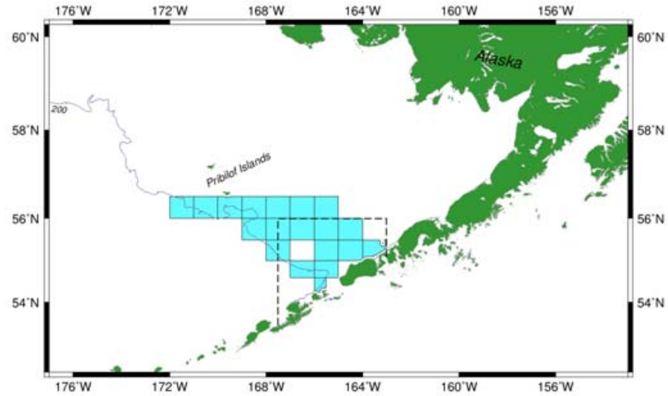
Component	Option	Non-Chinook total	CDQ	Non-CDQ
Setting the hard cap (Component 1)	Option 1a: Cap established for B season. Select cap from a range of numbers*	50,000	5,350	44,650
		200,000	21,400	178,600
		353,000	37,771	315,229
	Option 1b: Cap established for June and July. Select cap from a range of numbers	15,600	1,669	13,931
		62,400	6,677	55,723
		110,136	11,785	98,351

Component	Range of sector allocations (sector allocation abbreviation)	CDQ	Inshore CV	Mothership	Offshore CP
Sector allocation (Component 2)*	Option 2ii (1)	3.4%	81.5%	4.0%	11.1%
	Option 4ii (2)	6.7%	63.3%	6.5%	23.6%
	Option 6 (3)	10.7%	44.77%	8.77%	35.76%

Component	Option	Description	Suboption	Percentage
Sector transfers and rollovers (Component 3)	No transfers (Component 3 not selected)			
	Option 1	Caps are transferable among sectors and CDQ groups within a fishing season		
		Suboption: Maximum amount of transfer limited to:	a	50%
			b	70%
			c	90%
	Option 2	NMFS rolls over unused salmon PSC to sectors still fishing in a season, based on proportion of pollock remaining to be harvested.		

Component	Option	Description	Suboption	Percentage
Cooperative Allocation and transfers (Component 4)	No allocation	Allocation managed at the inshore CV sector level. (Component 4 not selected)		
	Allocation	Allocate cap to each cooperative based on that cooperative's proportion of pollock allocation.		
	Option: Cooperative Transfers	Option 1: Lease pollock among cooperatives in a season or a year		
		Option 2: Transfer salmon PSC (industry initiated)		
		Suboption Maximum amount of transfer limited to the following percentage of salmon remaining:	a	50%
			b	70%
			c	90%

Alternative 3: Triggered closure with intercooperative exemption. Alternative 3 would create new boundaries for the Chum Salmon Savings Area. The existing Chum Salmon Savings Area and associated trigger cap would be removed from regulation. The new boundaries encompass the area of the Bering Sea where historically 80% of non-Chinook prohibited species catch occurred from 2003-2011 (see adjacent figure). The trigger caps that would close this area are described below. The area closure would apply to pollock vessels that are not in a RHS system when total non-Chinook salmon PSC from all vessels (those in a RHS system and those not in a RHS system) reaches the trigger cap level. The trigger cap would be allocated between the CDQ and non-CDQ pollock fisheries, as currently done under status quo.



There is only one component for this alternative. Component 1 of this alternative sets the trigger PSC cap level for this large scale closure. PSC from all vessels will accrue towards the cap level selected. However if the cap level is reached, the triggered closure would not apply to participants in the RHS program.

Component 1: Fleet PSC management with non-participant triggered closure	Area	Triggered closure encompassing 80% of historical PSC. Participants in RHS would be exempt from the regulatory closure if triggered.			
	Option 1: cap	Select a cap from a range of numbers: 25,000 –200,000			
			Non-Chinook	CDQ	Non-CDQ
		1)	**25,000**	**2,675**	**22,325**
		2)	50,000	5,350	44,650
		3)	**75,000**	**8,025**	**66,975**
		4)	125,000	13,375	111,625
		5)	**200,000**	**21,400**	**178,600**

As part of Alternative 3, industry has proposed a new RHS that makes a number of modifications to the existing program in response to requests by the Council. The new proposal achieves several changes that are likely to be improvements that help meet the Council's goals of both Western Alaska chum and Chinook PSC reduction. These changes include an ability to incorporate new genetic information, a management change whereby closures operate at vessel- or platform-level rather than coop-level, and suspension of the chum closure program when Chinook PSC rates are higher. Other measures in the program will facilitate more efficient pollock harvest, which in some years is likely to reduce fishing in October, thus likely reducing Chinook PSC. These measures include a floor on the base rate so that closures are not unnecessarily implemented when they are not expected to be effective, and a change of the start-time of closures from 6pm to 10pm. A full description of the proposed new program is included in Chapter 2. This proposed RHS would replace the one in operation under Alternative 1 (status quo).

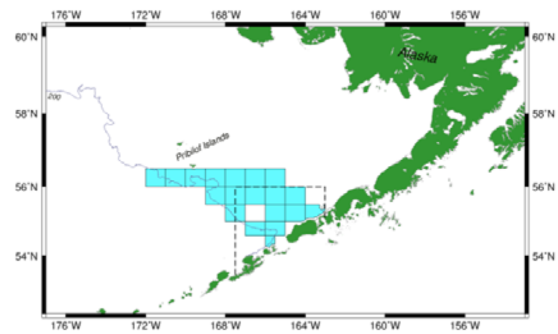
Alternative 4: Triggered closure with intercooperative exemption and options for non-exempt closures. As with Alternative 3, Alternative 4 would create new boundaries for the Chum Salmon Savings Area. The existing Chum Salmon Savings Area and associated trigger cap would be removed from regulation. The new boundaries encompass the area of the Bering Sea where historically 80% of non-Chinook prohibited species catch occurred from 2003-2011. The trigger caps that would close this area are described below, with accounting against the closure to being on June 10. The area closure would apply to pollock vessels that are not in a RHS system when total non-Chinook salmon PSC from all vessels (those in a RHS system and those not in a RHS system) reaches the trigger cap level.

The trigger cap would be allocated between the CDQ and non-CDQ pollock fisheries, as currently done under status quo. The revised RHS program proposed under Alternative 3 would also apply under this alternative.

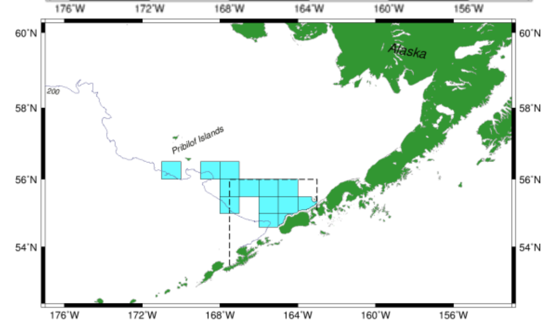
There are 6 components of Alternative 4. Component 1 of this alternative sets the trigger PSC cap level for this large scale closure. PSC from all vessels will accrue towards the cap level selected (ranging from 25,000 to 200,000), with accounting towards the cap beginning on June 10. However if the cap level is reached, the triggered closure would not apply to participants in the RHS program. Under Component 2 however, in addition to the large closure for non-participants, a select triggered area closure would apply to RHS participants. Four options of triggered closure areas and time frames are provided under Component 2. Note that the closure areas are larger under Option 1 because they are based on areas that incorporate a higher proportion of the historical chum salmon bycatch than in Option 2.

Option 1: A trigger closure would be established that encompasses 80% of historical non-Chinook salmon PSC estimates.

Suboption 1a) The trigger closure would apply for the B season. The adjacent figure shows the areas closed under this suboption.

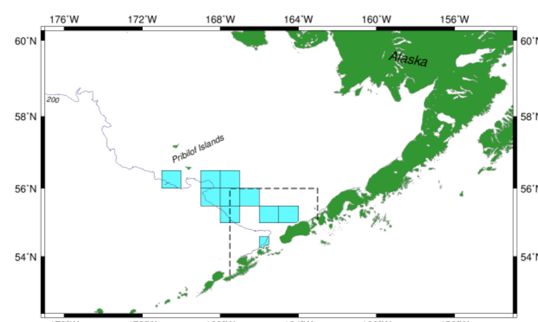


Suboption 1b) The trigger closure would apply for the months of June-July only. The adjacent figure shows the areas closed under this suboption.

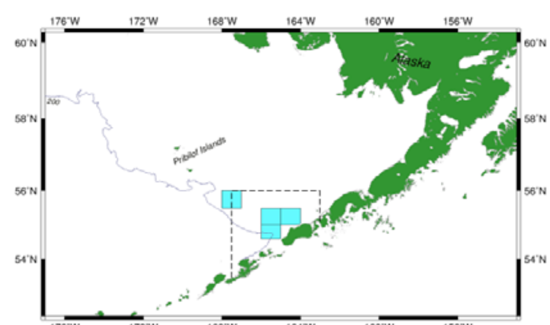


Option 2: A trigger closure encompassing 60% of historical non-Chinook salmon PSC estimates.

Suboption 2a) Trigger closure would only apply for B-season. The adjacent figure shows the areas closed under this suboption.



Suboption 2b) Trigger closure would apply for the June-July. The adjacent figure shows the areas closed under this suboption.



Component 3 then sets the trigger PSC cap level for the area selected under Component 2. Component 4 would allocate the trigger cap to at the sector level. Component 5 sets the sector-level rollover and transferability provisions. Component 6 would allocate the trigger cap for the inshore sector at the cooperative level. A summary of the components analyzed for Alternative 4 are listed in the table below.

Finally an option to this alternative as a whole includes the ability to specify just the goals and objectives of the revised RHS in regulation rather than specifying all provisions of the program in regulation as is done under Alternative 1 (status quo).

Alternative 4 components and options analyzed. The full range of options is described in Chapter 2.

Component	Option	Description
Component 1:Fleet PSC management with non-participant triggered closure	Area	Triggered closure encompassing 80% of historical PSC. Participants in RHS would be exempt from the regulatory closure if triggered.
	Option 1: cap	Select a cap from a range of numbers: 25,000 –200,000.

	Total Annual cap (option 1A or 2A)	CDQ	Non-CDQ	June-July cap(option 1B or 2B) Total June/July	CDQ	Non-CDQ
1)	25,000	2,675	22,325	7,800	835	6,965
2)	50,000	5,350	44,650	15,600	1,669	13,931
3)	75,000	8,025	66,975	23,400	2,504	20,896
4)	125,000	13,375	111,625	39,000	4,173	34,827
5)	200,000	21,400	178,600	62,400	6,677	55,723

Component	Option	Description
Component 2: Trigger Closure area and timing for RHS participants	**Option 1:** Area 80%	Triggered closure encompassing 80% of historical PSC for all RHS participants
	Suboption a: timing	Applies to remainder of B season if triggered
	Suboption b: Timing	Applies in June and July if triggered
	Option 2: Area 60%	Triggered closure encompassing 60% of historical PSC for all RHS participants
	Suboption a: timing	Applies to remainder of B season if triggered
	Suboption b: Timing	Applies in June and July if triggered
Component 3: PSC Cap levels for closure selected under Component 2 for RHS participants	Option 1a: PSC cap established for B season closure	Select cap from range of numbers: 25,000 – 200,000
	Option 1b: PSC cap established for June/July proportion	Select cap from range of numbers: 7,800 – 62,400

Component	Range of sector allocations (sector allocation abbreviation):	CDQ	Inshore CV	Mothership	Offshore CP
Component 4: Allocating the trigger cap to sectors	Option 2ii (1)	6.7%	63.3%	6.5%	23.6%
	Option 4ii (2)	10.7%	44.77%	8.77%	35.76%
	Option 6 (3)	3.4%	81.5%	4.0%	11.1%

Component	Option	Description		
Component 5: Sector transfers and rollovers	No transfers (Component 5 not selected)			
	Option 1	Caps are transferable among sectors and CDQ groups within a fishing season		
		Suboption: Maximum amount of transfer limited to:	a	50%
			b	70%
			c	90%
	Option 2	NMFS reallocates unused salmon PSC to sectors still fishing in a season, based on proportion of pollock remaining to be harvested.		
Component 6: Inshore Cooperative Allocation and transfers	No allocation	Allocation managed at the inshore CV sector level. (Component 6 not selected)		
	Allocation	Allocate cap to each inshore cooperative based on that cooperative's proportion of pollock allocation.		
	Option: Cooperative Transfers	Option 1	Lease pollock among cooperatives in a season or a year	
		Option 2	Transfer salmon PSC (industry initiated)	
		Suboption Maximum amount of transfer limited to the following percentage of salmon remaining:	a	50%
			b	70%
			c	90%
Option for Regs (applies to whole alternative)	Specify goals and objectives of RHS in regulations rather than all provisions			

Effects of the Alternatives

Quantitative analysis was completed on the potential environmental impacts of the alternatives on chum salmon, pollock, Chinook salmon, and related economic analyses. Chapter 3 describes the methodology for the quantitative analysis. For the remaining resource categories considered in this analysis - marine mammals, seabirds, other groundfish, essential fish habitat, ecosystem relationships, and environmental justice - impacts of the alternatives were evaluated largely qualitatively based on results and trends from the quantitative analysis.

Chum salmon impacts

Chapter 5 analyzes the impacts of the alternatives on chum salmon. First, estimates on the number of chum salmon saved under each alternative compared to Alternative 1 (status quo), are made based on the details of the alternatives and options. These estimates were then combined with data on the ages of chum salmon taken by the pollock fishery to provide annual estimates on the numbers of chum salmon that would have otherwise returned to spawn (referred to as adult equivalents or AEQ). Finally, the data from genetic samples available from 2005-2009 were combined with the AEQ and run size estimates (along with associated uncertainties) to evaluate impacts on specific chum salmon runs or groups of runs to different regions. This analysis assumes fishing behavior would be the same as that observed historical. It is likely that under new regulations and constraints the industry will modify fishing practices to avoid PSC. Consequently, evaluation of the alternatives applied retrospectively may over-estimate the impacts on chum salmon PSC.

Estimates of historical bycatch represent actual numbers of chum salmon taken and include benefits of existing management measures. The overall chum reduction under the current RHS program is estimated to range from 4-28% compared to management measures prior the use of this type of bycatch avoidance program. The modifications of the RHS program in Alternatives 3 & 4 lead to additional benefits beyond the status quo reduction, while the chum reduction from Alternative 2 is compared to the status quo.

The Council's problem statement for this analysis explicitly states that 'PSC reduction measures should focus, to the extent practicable, on reducing impacts to Alaskan chum salmon as a top priority.' Thus the analysis focuses on the relative impacts as characterized in AEQ to regions of origin and which management measures increase or decrease AEQ of Alaska stocks. AEQ bycatch takes into account the fact that some of the chum salmon taken in the pollock fishery would not have returned to their river of origin in that year. Based on their age and maturity, they might have returned one to two years later or they may not have survived to return to their spawning rivers. AEQ bycatch estimates provide a way to directly evaluate the impacts to spawning stocks and future mature returning chum salmon.

Combining the AEQ results with genetic analysis from 2005-2009 and estimates of run sizes (for coastal west Alaska and the Upper Yukon) provides the means to evaluate the historical impact of chum salmon bycatch. In particular, it provides estimates on how many salmon would have returned to specific river systems and regions had there been no pollock fishing. The stock composition mixtures of the chum salmon bycatch were based on samples collected from the Bering Sea pollock fishery. Results from a number of these analyses have been completed and presented to the Council (e.g., Guyon et al. 2010, Marvin et al. 2010, Gray et al. 2010, and McCraney et al. 2010). This analysis used the same approach and genetic breakouts to 6 individual regions to characterize region of origin for chum salmon bycatch but with a slightly different sample stratification scheme. The regions that could be clearly resolved using genetics were: East Asia (referred in analysis as 'Asia'), north Asia (referred in analysis as 'Russia'), coastal western Alaska (including all WAK systems with the exception of the upper/middle Yukon), upper/middle Yukon, Southwest Alaska (including river systems in Kodiak as well as North and South Peninsula stocks) and Pacific Northwest (which includes river systems from Prince William Sound to WA/OR in the lower 48).

Relative impacts to individual river systems depend on where and when the bycatch occurs. This can add to the inter-annual variability in results for the same caps, closures, and allocations between sectors. On average (based on 2005-2009 data) approximately 12% of the AEQ is attributed to the coastal western Alaskan regional grouping, while ~7% is attributed to the Upper Yukon (Fall chum). For the Southwest Alaska Peninsula stocks, the average AEQ over this period is ~2%, while for the combined PNW (including regions from Prince William Sound all the way to WA/OR), the average is 22%. Combined estimated Asian contribution is ~58% on average (for Russian stocks and Japanese stocks combined). Yearly estimates are presented in Chapter 3. This has ranged overall from 23,000-570,000 in aggregate (1994-2011).

For those systems where run size information is available, this impact analysis can be taken one step further to derive an impact rate of the removals due to the pollock fishery on the run size. Under the status quo, the average impact rates for Coastal west Alaska (0.49%), Upper Yukon (1.26%), and Southwest Alaska (0.40%) are very low. According to ADF&G managers, such low rates are unlikely to have had an impact on management considerations for these regions. The comparison of run sizes with AEQ mortality due to chum salmon PSC suggests that this relationship is correlated, indicating that the PSC is likely related to magnitude of returns. For these reasons, the overall impact of the status quo on chum salmon stocks is considered to be insignificant as it is unlikely to jeopardize the sustainability of these stocks. Alternatives 2, 3 and 4 are estimated to be either equivalent to status quo in estimated chum AEQ impacts (Alternative 3) or result in fewer PSC removals (Alternatives 2 and 4) than status quo. Thus, all of the alternatives under consideration are estimated to have an insignificant impact on chum salmon stocks as they are unlikely to jeopardize the sustainability of these stocks. Nonetheless alternatives are evaluated in comparison to status quo PSC removals to estimate potential means to minimize any adverse impact of the overall chum salmon PSC through different management strategies under Alternatives 2, 3 and 4.

For Alternative 2, nearly every option under consideration reduces of chum PSC, and consequently increases returns of adult salmon to their regions of origin. The largest reduction is estimated to occur under a hard cap of 50,000 chum salmon, option 1a for a B-season cap, which would have increased returns to Coastal western Alaska by an average of 20,300 chum. The average estimated run size for Coastal western Alaska for this period is 4.9 million. Under Alternative 1, the PSC mortality impact represents about 0.5% of the overall run size. Alternative 2 reduces this impact over all caps and options to a range of 0.09 – 0.35%. It seems unlikely that in-river management in Coastal west Alaska would have been modified further for this additional amount of returning fish aggregated over all rivers systems in the region, given the intricacies of in-season, in-river management. For Asian chum salmon however, some options (e.g., option 1b) result in slight increases in PSC mortality while others show negligible change.

The options under Alternative 2 which lead to greater PSC reduction are likely to confer a beneficial impact as the overall mortality of chum salmon would be reduced. None of the options are estimated to increase the western Alaskan chum salmon PSC in the pollock fishery, although some options have a differential impact by increasing the proportion of Asian stocks while reducing the impact to western Alaskan stocks. Nevertheless, Alternative 2 is likely to have insignificant impacts on chum salmon at the population level because it would not be reasonably expected to jeopardize the sustainability of chum salmon stocks.

Estimated impacts of Alternative 3 are similar to those under Alternative 1. While the best estimate of impacts on overall chum salmon PSC reduction under the revised RHS program is similar to the estimated reductions currently accruing by use of this program at present, the revised program does include provisions to better protect western Alaska chum salmon. These provisions allow for a slight increase in closures in June as well as spatially-explicit closures if genetic information indicates that a higher proportion of the bycatch in a location originates from western Alaskan stocks. A comparison of the differences between the two RHS programs and estimated impact is shown in the table below. More information on similar features and differences is contained in Chapter 5.

Program Feature	2011 Status quo	Alternative 3, proposed revision	Discussion of Impact
Adjusted base rate (3-week moving average)		Minimum rate of 0.10 required for closures.	Little impact on chum; possible improvement in pollock fishing.
Number of areas	Max 2 East of 168, 1 west of 168	No maximum	Ability to implement more small closures (optional)
Level of Tier status	Vessel/MS platform level	Cooperative-level	Potential for improvement in chum PSC reduction, though magnitude uncertain & unlikely to be large with same sized closures as status quo
Tier system	No closures for Tier 1 coops <0.75 of base rate; 4-day closures for Tier 2 coops with 75-125% of base rate; 7-day closures for Tier 3, >125% of base rate	June: no tier system, closures for all; July: <75% can stay in closure for 4-days, then leave; other vessels 7-day closures; August until end or Chinook suspension: same tiers as status quo, but Tier 2 vessels can fish for 4-days and then must leave instead of being excluded for 4 days	On average, minimal impact expected from these changes, although at times there could be stronger or weaker incentives to avoid areas. < 6 % of fishing during the 5-days after closures occurred in areas. For example, in June there is no tier system so therefore no link to individual or coop behavior. The change in Tier 2 status will allow more fishing in the closures in August and beyond.
Chum closures suspended after Chinook exceeds threshold		Chum closures removed in late August or September	Increased flexibility late in the season that could slightly increase chum bycatch, reduce Chinook, and better achieve TAC.
New Flexibility added		Potential focus on areas with more AK chum; flexibility to leave better pollock areas open when catch rates are similar	More likely and less costly to achieve TAC; potential slight reduction in Chinook because faster pollock fishing means less pollock caught in high Chinook bycatch period in October

Alternative 3 is estimated to have a similar overall chum PSC impact as status quo and thus an insignificant impact, as it is cannot be reasonably expected to jeopardize the sustainability of chum salmon stocks. Analysis indicates that there would have been a slight decrease in chum (less than 1 percent) in some years with the new June closures. However, behavioral changes in the future as a result of these explicit modifications to the program may result in greater western Alaska chum PSC reductions (and thus confer a beneficial impact over status quo) than the analysis may indicate. The revised program changes the closures to apply at the vessel rather than the cooperative-level, which could have a slight improvement in chum bycatch reduction than with the incentives contained in the current revised program. As noted in the analysis however, if stronger incentives were included, this provision could have a larger impact.

While Alternative 3 has the potential to provide more focus on Western Alaska salmon and reduce the possibility that the chum RHS program will negatively impact Chinook, some suggestions are provided in the analysis to increase the efficacy of the proposed revisions for the RHS program. Generally, the program could be required to specify and achieve performance goals, such as ensuring that PSC rates do not remain elevated or that additional closures will apply under high-PSC conditions. In a general sense, the Council has several means to alter the RHS program to further incentivize changes in behavior:

- Require stronger incentives (such as larger closures) that would expand to close more hotspots when they exist.
- Require the RHS program to achieve performance goals. The Council can require that industry develop a plan that it can demonstrate will prohibit vessels from fishing in high-PSC areas (at a threshold set by the Council). In other words, the Council may make a policy change from requiring a mechanism to requiring an observed outcome.

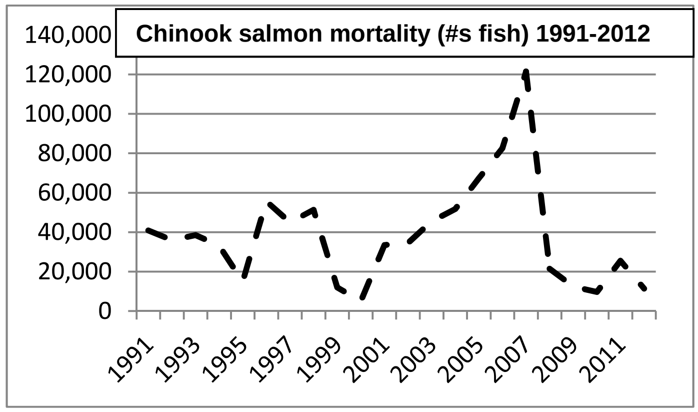
In all cases, actions should be tied to individual behavior so that vessels have incentives to reduce PSC where practicable to avoid being subject to closures or negative actions. Specific modifications that could be included are listed in Chapter 5. However, while these measures may better incentivize chum salmon PSC avoidance, there is uncertainty about how such additional chum measures have the potential to reduce economic benefits to the pollock fishery and to increase fishing during the high-Chinook incidental catch period at the end of the B season.

Alternative 4 also addresses fleet operation under a revised RHS system as with Alternative 3 but imposes additional triggered closures on top of those instituted under the proposed RHS system. The impact of imposing additional closures as compared with status quo PSC levels is to reduce chum salmon PSC and thus increase returns of salmon to spawning streams. The magnitude of this impact varies with the components and options selected. As with Alternative 2, options to apply management measures in June and July only are included to address the fact that there is a higher proportion of western Alaskan chum on the grounds during those months. While these options (options 1b and 2b) lead to generally smaller overall chum PSC reduction then B-season-wide measures (options 1a and 2a), they result in a greater proportion of the chum PSC savings accruing from western Alaska. Overall results in terms of relative impact rates to coastal western Alaska range from 0.24% – 0.41% across all caps and options. Impacts are generally insensitive to cap levels but vary more strongly across options. Similar to the other alternative, overall impacts of Alternative 4 are likely to be insignificant at the population level because would not be reasonably expected to jeopardize the sustainability of chum salmon stocks.

Chinook salmon impacts

The pollock fishery catches both chum salmon PSC and Chinook salmon PSC in the B-season. The timing of this catch is dissimilar amongst the two species, with Chinook salmon caught in the latter part of the B season and chum salmon caught throughout the B season. This pattern is reflected through Alternatives 2 and 4 specifically with the sub-options showing that measures which increase fishing later in the year may result in increased Chinook bycatch (i.e., negative savings)

Policy decisions for alternative management measures for chum salmon PSC reduction must also consider the potential impact on the PSC of Chinook salmon which results from imposing additional management measures on the same pollock fishery. 2011 was the first season of management under the new Chinook salmon PSC management program implemented by Amendment 91. Incidental catch of Chinook salmon by the pollock fishery participants in 2011 indicated that pollock fishery participants remained well below their limits. Total 2011 A season Chinook salmon PSC was 7,136 fish. This compares to Chinook salmon PSC ranging from 7,624 fish in the A season of 2010 to 69,139 fish in the A season of 2007. In the 2011 B-season incidental catch of Chinook salmon by the pollock fishery was also well below the seasonal PSC limits with a total B-season bycatch of 18,363. This is higher than B-season PSC in the previous 3 years but is substantially less than the B-season of 2007 where 52,360 fish were taken. The overall 2011 total Chinook PSC was 25,499. While this amount is higher than the recent years (driven by the increase in the B-season), the total was nonetheless well below both the overall PSC limit under Amendment 91 as well as the (lower) performance standard established under that management program. In contrast, in 2012, the A-season PSC was 7,773 fish while B-season catch was substantially lower at 3,577. Impacts of the current Chinook PSC management program were evaluated previously in the FEIS (NPFMC/NMFS 2009) and were found to not adversely impact Chinook salmon stocks. Alternatives are thus compared against the constraints of the current Chinook PSC management program under status quo to evaluate whether any protections would be diminished and thus potentially jeopardize the sustainability of Chinook salmon stocks as a result of chum PSC management measures.



For Alternative 2, the annual impact of chum salmon options indicate that Chinook salmon PSC will be decreased in many years under option 1a, especially for the lower cap levels. However, option 1b (which would close the fishery only within the June-July period) resulted in increased PSC of Chinook salmon because pollock fishing would be diverted to later in the year. All sectors are estimated to have a similar pattern between options. These impacts are considered to be insignificant overall, however, because they would not considerably diminish protections afforded to Chinook salmon under the provisions of Amendment 91 in the current management of the pollock fishery which would still be subject to the Chinook salmon PSC limits established in that amendment.

Under Alternative 3, Chinook PSC has the potential to be reduced from current levels given the modifications to the RHS programs which explicitly link the cessation of chum measures to a Chinook threshold. Under the status quo RHS program the regulations require that chum closures are implemented whenever fixed criteria for implementing them are met. Prior to the modifications of the RHS regulations following Amendment 91, the RHS was designed for both Chinook and chum closures. Under that program, Chinook closures were given priority over chum closures, to explicitly recognize the higher priority to conserve Chinook PSC in that program. When Chinook provisions were removed from the regulations due to the Chinook PSC management program implementation in 2011, there was no longer any recognition in the now chum-only RHS program of the priority on Chinook. As a result, under status quo, chum closures continue to move the fleet around and at times into areas of higher Chinook PSC well into September when Chinook rates tend to be higher. Under the Alternative 3 and 4 revised RHS, a Chinook threshold provides a benchmark whereby chum closures cease once the threshold for the Chinook rate (0.035 Chinook/mt pollock) is reached. This will avoid any potential exacerbation of Chinook PSC due to area closures for chum. Analysis of this threshold indicates that it would have been reached in every year 2003-2011 between the dates of August 25 and September 15 (depending upon the individual year). Thus under Alternative 3, Chinook PSC has the potential to be reduced somewhat from status quo, although the analysis cannot detect a change retrospectively based on relative rates inside and outside of imposed chum closures.

The revised RHS program provisions for Chinook are also implicit to Alternative 4 and thus any perceived reduction in Chinook as a result of this provision under Alternative 3 is also inherent to Alternative 4. However the effect of the additional layered triggered closures under this alternative can result in higher Chinook PSC under some cap and closure options than would be estimated under Alternative 3 or status quo. Some cap and closure options in some years would result in less Chinook PSC than status quo (and Alternative 3) however as with options under Alternative 2, any measure that diverts pollock catch to later in the B-season has a higher potential to increase Chinook salmon PSC. These impacts are considered to be insignificant overall, however, because they would not diminish protections afforded to Chinook salmon under the provisions of Amendment 91 in the current management of the groundfish fisheries and thus are not likely to jeopardize the sustainability of Chinook salmon.

Pollock stocks

Chapter 4 analyzes the impacts of the alternatives on pollock stocks. Analysis of Alternatives 2, 3 and 4 indicate that these alternatives could make it more difficult to catch the full TAC for Bering Sea pollock compared to Alternative 1. Catching less pollock than authorized under the TAC would reduce the total catch of pollock and reduce the impact of fishing on the pollock stock. However, these alternatives are likely to result in fishermen shifting where they fish for pollock to avoid chum salmon PSC. Changes in where pollock fishing occurs were shown to likely change the size and (by extension) age of target fish to younger smaller pollock, which would potentially impact future ABC limits established for the pollock stocks.

All hard caps under Alternative 2 show that all sectors would have forgone high levels of pollock catch at most cap levels. Whereas the impacts to the fishery can be evaluated (in particular for Alternative 4 triggered closures to RHS participants, either June-July or B-season) the assumption that the pollock TAC may be fully harvested depends on the availability of pollock outside of triggered closures. The data show that in some years, the catch rate is consistently higher outside of the trigger area whereas in other years it is consistently lower for at-sea processors and inshore CVs and for the fleet as whole. The impact to the fishery of a triggered area closure depends on when the closure occurs and the spatial characteristics of the pollock stock, which, based on this examination, appears to be highly variable between years. As with the evaluation of hard caps, under Alternatives 2 the same impacts under triggered closures (Alternative 4) would apply; it seems likely that the fleet would fish earlier in the summer season and would tend to fish in places farther away from the core fishing grounds north of Unimak Island (estimated average increased distance from port due to closures was about 8%). Both of these effects would result in catches of pollock consisting of considerably smaller and younger, less valuable age groups. This impact would, based on future assessments, likely result in smaller ABCs, since individual pollock sizes would be smaller from missing the benefits of the summer-season growth.

As noted, the above impacts are primarily evaluated in the context of the changes in the fishery in order to evaluate the relative impact on the pollock population. Shifts in the catch age distribution would be detected and accounted for in the annual assessment. Allowable catch levels would therefore be adjusted appropriately based upon the application of the procedures to set ABC using the most recent stock assessment which incorporates all of these data. In general, variability in environmental conditions likely affects stock productivity more than the timing and location of fishing activities and modifications in relative catch levels. Thus the alternatives considered would be expected to have an insignificant effect on the productivity of the pollock stock.

Comparison of chum and Chinook salmon saved and forgone pollock harvest

Selection of a preferred alternative involves explicit consideration of trade-offs between the potential salmon saved (both chum and Chinook) and the forgone pollock catch, and of ways to maximize the amount of salmon saved and minimize the amount of forgone pollock. Chinook and chum PSC occur at different times over the B-season in relation to the overall pollock catch. Thus any management approach which is designed to reduce chum PSC in the early part of the B-season (June/July) by constraining pollock catches will have the potential to increase Chinook later in the season if the fishing fleet must fish later in the year to catch their quota than they would have done absent these measures. Note that as above, this assumes the fleet would behave similarly to the recent past.

Analyses show that all alternatives that reduce only western Alaska chum salmon PSC from current levels do so by impacting pollock catch timing and location and in many cases, increasing Chinook salmon PSC (see table below). Thus any management approach selected will require balance between different objectives. Approaches which maximize the reduction of chum PSC may lead to higher Chinook catch or more forgone pollock, while approaches which prioritize Chinook PSC may have lower estimated levels of western AK chum PSC reduction. Results are therefore presented in a series of comparative tables and figures to evaluate which alternatives do better or worse for each of the three key characteristics of WAK chum, Chinook and forgone/diverted pollock catch in an attempt to best characterize the balance among these impacts.

In terms of cap and sector allocation options under Alternative 2, option 1a, the lowest forgone pollock catches result in expected reductions of coastal western Alaska chum salmon PSC of about 22% to 25%, depending on the sector allocation options and cap considered. For hard-cap scenarios that have the highest impact on forgone pollock catch levels, the sector allocations are estimated to have significant improvements on the proportion of chum salmon saved. Note that while these proportional reductions in western Alaska PSC can be considerable (~80%), the absolute value for the impact reduction to bycatch is still low relative to the number of chum returning to coastal western Alaska (<1%). For Alternative 2, option 1b, the Asian stocks have the least amount of chum salmon AEQ saved while the savings were better for coastal western Alaska. Both stock groupings were relatively insensitive to cap levels and sector splits. That is, should option 1b be considered then the higher cap might be preferred since it provides about the same level of salmon PSC savings with lower levels of forgone pollock.

Alternative 3 provides more flexibility in fishing opportunities than Alternative 2 or 4 as there are neither caps nor additional area closures imposed outside of those under the revised RHS. The revised RHS is also designed to reduce western AK chum while also prioritizing Chinook. It is therefore likely to be less effective at reducing overall chum PSC than other Alternatives (hard caps or area closures) due to the implicit balance inherent with prioritization of Chinook measures; however it does provide the explicit linkage between these two often contrasting PSC priorities absent in the current program (Alternative 1) or in Alternative 2. It is not clear if overall chum salmon PSC levels would be reduced in comparison with the status quo RHS program. However, unlike any of the other alternatives, including status quo, it is clear that chum PSC reduction measures would be explicitly designed to avoid increased Chinook PSC.

Under Alternative 4, options that require a greater proportion of pollock to be diverted elsewhere have diminishing benefits in terms of increased chum salmon savings but in general require less pollock diversion than Alternative 2. There are some cap options that provide savings of about 38% for chum salmon AEQ while only impacting the pollock fishery by diverting about 8% of the B-season pollock (e.g., option 1b for Upper Yukon). However, as with Alternative 2, any option that diverts pollock catch to earlier in the B season has the potential to increase Chinook PSC.

The implications of imposing Alternatives 2, 3, or 4 and the associated options indicate that reducing bycatch levels and impacts to Alaskan chum salmon runs can be achieved, but improvements would be relative to the current estimated impacts which are already low (typically less than 1%). It is clear that options which reduce chum salmon PSC the most do so at the expense of forgone pollock and increased Chinook salmon PSC (or reduced capabilities to avoid Chinook salmon PSC). Options that perform better by lowering the forgone pollock while still reducing western Alaska chum salmon AEQ mortality, may do poorer at savings of chum salmon originating from Asian regions. The extent that these measures, if enacted without a system like the current RHS program (analyzed under Alternative 1), would reduce chum PSC is less well understood. It is clear that chum PSC totals generally increase as run sizes increase. It is also clear that the effectiveness of triggered closure areas will vary from year to year due to the inherent variability and complexity of pollock and chum salmon seasonal and spatial distribution.

The following table attempts to summarize the impacts of the alternatives (in all cases allocation scenario 1 was used) between average (2004-2011) chum salmon AEQ, pollock forgone or diverted, and Chinook salmon PSC change. Values in parentheses for alternative 4 option 1b) and 2b) represent differences due to unknown behavioral responses by the fleet (i.e., whether they would postpone fishing or fish outside of proposed closures). The color scheme is meant to reflect trade-offs (red being "worse" and green being "best" within columns over alternatives and options (rows).

			Change in Chum salmon AEQ (numbers that would have returned to spawn)			**Pollock forgone or diverted**	**Chinook PSC change**
	Option	Cap	Western Alaska	Asian	Total chum	Pollock	Chinook
Alternative 2	**1a)**	50,000	30,279	99,013	167,610	322,620	17,304
		200,000	16,269	62,727	101,275	118,561	8,651
		353,000	6,799	34,118	51,093	53,073	5,349
	1b)	15,600	12,529	-8,587	11,416	126,796	-5,934
		62,400	10,300	-3,907	12,247	66,303	-3,373
		110,136	8,584	-1,199	12,339	40,388	-2,142
Alternative 4	**1a)**	25,000	19,529	54,252	97,071	129,898	7,805
		75,000	16,001	48,006	83,718	86,605	5,686
		200,000	8,804	35,604	57,043	39,090	3,652
	1b)	7,800	12,618 (12,194)	227 (16,986)	21,709 (40,790)	47,537 (139,473)	-3,682 (273)
		23,400	12,573 (11,858)	5,876 (16,001)	27,579 (38,608)	31,951 (116,395)	-2,537 (209)
		62,400	10,372 (9,576)	5,083 (12,575)	22,657 (30,478)	20,553 (86,571)	-1,702 (146)
	2a)	25,000	12,085	21,651	46,274	103,527	2,716
		75,000	10,063	20,716	41,647	65,454	2,185
		200,000	4,645	14,746	25,558	28,970	1,039
	2b)	7,800	9,918 (7,762)	1,958 (10,817)	19,059 (25,990)	29,588 (82,323)	-2,464 (84)
		23,400	10,019 (8,210)	7,321 (10,965)	25,013 (26,536)	17,179 (64,890)	-1,496 (57)
		62,400	8,311 (6,914)	6,486 (8,954)	20,947 (21,777)	9,620 (44,300)	-885 (31)

Other marine resources

The impacts of the alternative management measures on marine mammals, seabirds, habitat and the ecosystem are evaluated qualitatively based upon results of the quantitative analysis for chum, Chinook, pollock and economic considerations. Alternative 2, hard caps in either June-July or B-season total, is not likely to increase fishery interactions with any of these resources categories, and may result in fewer interactions compared to status quo since the pollock fishery is likely to be closed earlier in the B-season. Under the RHS only alternative (Alternative 3) or the RHS plus triggered area closures proposed under Alternative 4, any closure of an area where marine mammals and seabirds 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. Closures under Alternatives 3 and 4 would also minimize fishery interactions with the seafloor and benthic habitat in those areas. Increased fishing pressure outside of triggered closure could increase the potential for adverse impact on non-target fish species and interactions with seabirds and marine mammals but this interaction is unlikely to be significantly different from status quo given the low levels of incidental catch in this fishery and that the catch of non-targets is unlikely to substantially increase.

Economic Impacts of the Alternatives

The RIR utilizes the analysis of changes in chum salmon AEQ savings under the alternatives that are contained in Chapter 5 of this Environmental Assessment. The AEQ estimates represent the potential benefit in numbers of adult chum salmon that would have returned to aggregate regions as applicable in the years 2004 to 2011. These benefits would accrue within natal river systems of stock origin as returning adult fish that may return to spawn or be caught in subsistence, commercial, or sport fisheries. However, given that the average estimated run size for Coastal Western Alaska for this period is 4.9 million chum salmon, the ratio of mortality impact from the pollock fishery calculated in the analysis of Chapter 5, is about 0.5%. It is simply not possible to quantify how those fish would have been used, and the comparative levels of benefit that would accrue to users of the chum salmon resource under the action alternatives. Needless to say the RIR summarizes the chum and Chinook PSC saved under each alternative and option as an estimate of the relative benefits of the alternatives accruing to the rivers of origin.

The RIR also provides analysis of the estimated impacts of the alternatives on the directed pollock fishery. Some hard caps (Alternative 2) have the potential effect of fishery closure for the remainder of the season resulting in potentially forgone pollock fishery gross revenues. In contrast, the triggered closure (Alternative 4, Alternative 2, June-July closure option) do not directly create forgone earnings, but rather, they place revenue at risk of being forgone. When the closure is triggered, vessels must be relocated outside the closure areas where operators must attempt to catch their remaining allocation of pollock TAC or stand down during the closure. Thus, the revenue associated with any remaining allocation is placed at risk of not being earned, if the fishing outside the closure area is not sufficiently productive to offset any operational costs associated with relative harvesting inefficiencies outside the closure area.

Alternatives 1 and 3 were analyzed separately from Alternatives 2 and 4. A general summary of potential additional costs to participants in the RHS system is provided for qualitative comparison with direct or indirect costs under the other alternatives. In some cases vessels are forced to take longer trips as a result of RHS closures, resulting in additional travel costs. There is some evidence for a decline in CPUE in some years after the closures were enacted. However, vessels also slightly increase haul duration in the hauls following the closures, which appears to partially or totally mitigate any decline in CPUE. There is also the potential for economic losses when vessels are forced off of areas where higher value products are produced. While this is likely to be a more characteristic impact in the A-season fishery because of the high value of roe, product-specific targeting and the amount of roe caught in the B-season has increased so that there can be meaningful differences in the value of fishing in one area versus another beyond what is captured in CPUE. Additionally at times, travel costs may increase significantly with closures, especially for some catcher vessels and at time when it is difficult to locate pollock close to port.

With respect to Alternatives 2 and 4, generally the CV sector is most affected by the hard cap and triggered closure actions being considered and is estimated to potentially have a much higher percentage of gross revenue affected than the other sectors. Thus, the aggregated treatment results in lower potential impact percentages than occur specifically for the CV sector. A general summary of the greatest impacts under each alternative are indicated below, however complete treatment of potential effects to each sector is contained in the pollock impacts chapter of the RIR. This summary identifies examples of impacts at the lowest cap level and under allocation scenario 1 (see tables describing alternatives previously) which favors the CV sector and then discusses how much the impacts are estimated to change as the cap level is increased. The effect of moving to the example allocation scenarios 2 and 3 is to generally decrease the allocation to the CV sector (and hence increase constraints on that sector), while slightly increasing the allocation to the other sectors (and thus reducing constraints in those sectors). The overall effect of allocation scenarios 2 and 3 is to reduce total revenue impacts; however, caution must be taken to recognize that the CV sector will have greater impacts with the shift in allocation and will exclusively bear nearly all impacts under allocation scenario 3 and the highest cap levels.

The summarized potential impacts of Alternative 2, Option 1a, indicate the greatest adverse economic impacts, in terms of potentially forgone gross revenue, would have occurred in 2011 ($516 million) and in 2005 ($481 million) and under the most restrictive PSC cap of 50,000 non-Chinook salmon. As the hard cap level is increased to 353,000 fish the potentially forgone revenue estimates decline relative to the two lower caps and the impacts accrue mostly in the CV sector. For example, the 2005 gross revenue impact is estimated to decline from $481 million to $271 million and then to $202 million as the cap is increased. These impacts represent 78 percent of B season gross revenue, at the lowest cap level, and 33 percent at the highest cap level with annual proportion of gross revenue of about half of these B season proportions.
Similarly for Alternative 2, Option 1b, the greatest adverse economic impacts, in terms of gross revenue put at risk, would have occurred in 2011 ($311 million) and in 2005 ($201 million) and under the most restrictive PSC cap of 15,600 non-Chinook salmon. As the cap level is increased to 110,136 fish the potentially forgone gross revenue estimates decline. For example, the 2005 revenue impact is estimated to decline from $201million to $130 million and then to $67 million as the cap is increased. These impacts represent 33 percent of B season gross revenue, at the lowest cap level, and 11 percent at the highest cap level with annual proportion of gross revenue of about half of these B season proportions.

The summarized potential impacts of Alternative 4, Option 1a, show similar trends with the greatest revenue at risk, occurring in 2011 ($240 million) and in 2005 ($139 million) and under the most restrictive PSC cap of 25,000 non-Chinook salmon. As the trigger cap level is increased to 200,000 fish the potentially forgone revenue estimates decline relative to the two lower caps and the impacts are concentrated in the CV sector. For example, the 2005 revenue impact is estimated to decline from $139 million to $123 million and then to $104 million as the cap is increased. These impacts represent 22 percent of B season gross revenue, at the lowest cap level, and 17 percent at the highest cap level or 11 and 9 percent of annual gross revenue, respectively.

For Alternative 4, Option 1b, the greatest adverse economic impacts, in terms of gross revenue put at risk, would have occurred in 2011 ($88 million) and in 2005 ($85 million) and under the most restrictive PSC cap of 7,800 non-Chinook salmon. As the trigger cap level is increased to 62,400 fish, the potentially forgone revenue estimates decline relative to the two lower caps and the impacts accrue mostly in the CV sector. For example, the 2005 revenue impact is estimated to decline from $85million to $64 million and then to $50 million as the cap is increased. These impacts represent 14 percent of B season gross revenue, at the lowest cap level, and 8 percent at the highest cap level and 4 percent of annual gross revenue respectively.

The summarized potential impacts of Alternative 4, Option 2a, show the greatest adverse economic impacts, in terms of potentially forgone gross revenue, would have occurred in 2011 ($183 million) and in

2005 ($108 million) under the most restrictive PSC cap of 25,000 non-Chinook salmon. Note that 2004 potentially forgone gross revenue actually was slightly higher ($110 million) than in 2005; however, the 2004 values are considerably lower than the 2005 values as the caps are increased. Thus, 2005 is retained here as the example year. As the trigger cap level is increased to 200,000 fish the potentially forgone revenue estimates decline relative to the two lower caps and the impacts accrue mostly in the CV sector. For example, the 2005 revenue impact is estimated to decline from $108 million to $94 million and then to $78 million as the cap is increased. These impacts represent 17 percent of B season gross revenue, at the lowest cap level, and 13 percent at the highest cap level and 7% of annual gross revenue respectively.

Finally, the summarized potential impacts of Alternative 4, Option 2b, indicate that again the greatest adverse economic impacts, in terms of gross revenue put at risk, would have occurred in 2011 ($52 million) and in 2005 ($54 million) and under the most restrictive PSC cap of 7,800 non-Chinook salmon. As the trigger cap level is increased to 62,400 fish the potentially forgone revenue estimates decline relative to the two lower caps and the impacts accrue exclusively in the CV sector. For example, the 2005 revenue impact is estimated to decline from $54 million to $34 million and then to $25 million as the cap is increased. These impacts represent 9 percent of B season gross revenue, at the lowest cap level, and 4 percent at the highest cap level and 2% of gross revenue respectively.

Reporting requirements under alternatives

Currently, the industry has a set of annual reporting requirements to the Council on their measures towards bycatch minimization under the status quo RHS management program for chum PSC. These requirements were specified by the Council at final action for Amendment 84 and are in regulation in conjunction with the entire ICA contract which specifies the functionality of the program in addition to all matters regarding membership and contractual agreements. Specifying all of the RHS provisions in regulation was intended to provide assurance that the program would function as indicated in the analysis for Amendment 84. The reporting requirements themselves were also put into regulation to indicate the efficacy of the current RHS program. However, these may be too general for the Council to evaluate the efficacy of the program relative to their stated policy goals.

The degree to which a revised RHS must be specified is a matter of policy, and specifying all of the provisions of the program in regulation is not mandatory. Experience has shown a lack of responsiveness of the program when it is fully specified in regulation since the ability to change measures over time and within seasons is limited. Should the Council select a preferred alternative which incorporates an RHS program, the Council should consider what the goals and objectives are of specifying individual provisions of the program in regulation in order to ensure it meet the Council's intent.

In addition, in selecting a preferred management strategy, under any of the alternatives including status quo, the Council could choose to specify annual reporting requirements that are more explicit then those currently under Amendment 84 provisions. This is considered particularly important should the Council select either Alternatives 1, 3 or 4 which rely upon an industry-managed RHS program for bycatch management. Chapter 2 contains recommendations for some requirements that could be included in a proposed reporting requirement for the industry under a program which relies heavily on the RHS to maintain efficacy. Additional reporting requirements proposed for the program include information on the closures that are imposed within season according to SeaStates's management of the RHS program. Absent explicit Council request, this information may not be readily available to the Council and the public should a revised management program be selected as a preferred management approach. The industry-requested reporting requirements can be derived from data SeaState currently uses for their in-season program. Reporting this information annually (or in-season) is meant to provide the Council and the public with information on the management and efficacy of the program and will complement additional analyses by staff. No additional data collection is envisioned.

The Council may also wish to signal its intent to review an analysis of the data provided on a periodic basis by requesting that after a period of 1-3 years staff conduct an analysis of the program's efficacy. A list is provided in Chapter 2 of information and analyses which could be requested of staff (Agency or Council or otherwise) to further indicate what information could be provided annually or periodically in order to best evaluate the efficacy of the program. The purpose of providing this analysis is to inform the Council and the public as to the extent to which the program is meeting the objectives of the Council and to provide the Council with the opportunity to initiate a different management approach should information indicate otherwise. The Council has the ability to modify management programs (by initiating a plan amendment analysis) at any time. However, explicitly stating when the program would be reviewed will help ensure that adequate staff resources are available and show that monitoring the program performance is a priority.

Managing and Monitoring the Alternatives

The observer and monitoring requirements currently in place to account for Chinook salmon PSC under Amendment 91 also enable NMFS to monitor chum salmon PSC. Since the implementation of Amendment 91, NMFS has found several issues that affect the observers' ability to ensure all species of salmon are counted. Therefore, NMFS recommends changes to the Amendment 91 requirements under all alternatives including the no action alternative. Catch accounting would rely on the information described for Alternative 1 (status quo) in section 2.5.

The current census data collection program is highly responsive to management needs and provides timely data, especially considering the logistics of the sectors and variations in operation type. However, even with this highly responsive system, the June and July cap under Alternative 4 results in a very short time period for NMFS to monitor and insure a timely trigger area closure. NMFS would need to project chum salmon harvest during the week to publish a Federal Register notice. These projections may result in a trigger closure being made prior to or after the cap being reached.

If the Council allocates hard caps or trigger caps among sectors and cooperatives, NMFS recommends that any entities receiving allocations be the same as those used for Chinook salmon PSC allocations under Amendment 91. Consistent allocation categories for Chinook and non-Chinook salmon would greatly simplify administrative functions for NMFS and the industry. Existing contracts and application to NMFS establishing these entities could be modified to incorporate the responsibility for receiving and managing chum salmon PSC allocations.

Area closures could be managed in a number of different ways, depending on the combination of components and options selected. Under Alternative 3, participants in the RHS would be exempt from the regulatory closure system. Monitoring and enforcement of this alternative is similar to Alternative 1 in which ICA members are managed under the RHS and NMFS closes the trigger area for non-ICA members. Under both Alternative 1 and 3, NMFS would continue to require that the federal regulations contain sufficient detail to prevent later substantive revisions to the ICA that would reduce its effectiveness. In addition, NMFS has determined that federal regulations for the RHS may not include specific requirements for the enforcement provisions or penalties that the ICA would impose on its participants. Therefore, in the future, under either Alternative 1 or Alternative 3, the Council could recommend that federal regulations require the RHS contain a description of the enforcement provisions and penalties that the ICA participants agree to assess on themselves for violation of the ICA provisions. However, the regulations could not include specific penalties.

Under Alternative 4, all pollock vessels would be subject to a trigger closure regardless of whether or not they participate in a RHS. Since all vessels will be subject to a trigger closure, the RHS is not the primary management tool for minimizing bycatch as it is under Alternatives 1 and 3. Therefore, the implementing regulations would focus on the components of Alternative 4 detailed in Table 2-8. Under the option for Alternative 4, general objectives and goals for the RHS program would be in regulation, but the specific parameters of the RHS program would not be in regulation. This would be similar to the regulations implementing the IPA component of Amendment 91.

The fishing industry will continue to incur costs associated with the administration of the RHS ICA. However, NMFS has not identified significant costs to the agency for managing or monitoring these alternatives. NMFS Office of Law Enforcement will provide additional information about the costs of enforcing Amendment 91 and the potential costs of the chum salmon bycatch alternatives prior to Council final action.

In addition to concerns noted above, NMFS has several recommendations with respect to deckloading, as well as three housekeeping regulatory corrections to improve salmon bycatch monitoring. With respect to deckloading issues that were raised during the Council's deliberations in March 2012, NMFS recommends that the regulations be revised to meet the following objectives:

- Vessel operators would be required to securely contain all catch brought aboard the vessel.
- Catch could be stored in the RSW tanks, inside the codend, or a live tank.
- No loose fish would be allowed to remain on deck outside the codend.
- If fish are spilled from the codend, they must be transferred immediately to the RSW tanks.
- In order to ensure the observer can be present to observe the transfer of catch securely contained outside the RSW, the vessel operator would be required to notify the observer at least 15 minutes prior to the transfer.

Additional specific recommendations regarding regulatory corrections are contained in Chapter 2.

Summary of Impacts

The following table was prepared to briefly summarize the major environmental, social and economic impacts of the alternatives to minimize chum salmon PSC in the Bering Sea pollock fishery.

Summary of Impacts of the Alternatives.

	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Description of Alternative	Status quo. Chum Salmon Savings Area with RHS ICA exemption	Hard cap 50,000-353,000 with 10.7 % to CDQ ; no exemptions. Options for sector allocation, rollovers, & transfers.	Larger Chum Salmon Savings Area based on 80% PSC; closure triggers 25,000-200,000 with 10.7% to CDQ; revised RHS program; RHS participants exempt from closures.	Close areas where 60% or 80% of PSC occurred. Triggers 25,000-200,000 with 10.7% to CDQ; Revised RHS program; Options for RHS ICA participants - exemption, closure areas, triggers, sector allocation, rollovers & transfers.
Chum Salmon PSC				
Total chum salmon PSC reduction (in # of AEQ)		11,416 (*1b*) to 167,610 (*1a*)	Likely similar to status quo	19,059 (*2b*) to 97,071 (*1a*)
Western AK chum salmon PSC (AEQ) reduction		6,799 (*1a w/ 353 K cap*) to 30,279 (*1a w/50K cap*)	Likely similar to status quo	4,645 (*2a w/ 200 K trigger*) to 19,529 (*1a w/50K trigger*)
AK chum salmon population impacts (% of run size on ave)	Coastal west AK (0.49%), Upper Yukon (1.26%) Not expected to jeopardize the sustainability of chum salmon stocks	Coastal west AK (range in 0.09% to 0.40%) Upper Yukon (range in 0.42% to 1.10%). Not expected to jeopardize the sustainability of chum salmon stocks	Likely similar to status quo	Coastal west AK (range in 0.24% to 0.43%) Upper Yukon (range in 0.28% to 1.11 %). Not expected to jeopardize the sustainability of chum salmon stocks
Chinook Salmon PSC				
Chinook Salmon PSC reduction (# of fish)	Not expected to jeopardize the sustainability of Chinook salmon stocks	(-5,593) (*1b w/50K cap*) to 17,304 (*1a w/50K cap*). Insignificant impacts, not expected to jeopardize the sustainability of chum salmon stocks	Likely similar to status quo but with some increased potential for lower Chinook PSC	(-3,682) (*1b w/25K trigger*) to 7,805 (*1a w/50K trigger*). Insignificant impacts, not expected to jeopardize the sustainability of chum salmon stocks
Pollock				
Population impacts	Not expected to impact productivity of pollock resource	Reduced catch overall; fleet will catch smaller pollock.. Not expected to impact productivity of pollock resource	Similar to status quo. Not expected to impact productivity of pollock resource	Reduced catch overall; fleet will catch smaller pollock. Not expected to impact productivity of pollock resource
Catch reduction (t forgone)	none	40,388 (*1a w/353K cap*) to 322,620 (*1a w/50K cap*).	Similar to status quo-	9,620 (*2b w/200 K trigger*) to 129,898 (*1a w/ 25K trigger*)
CDQ Impacts	Status quo.	CDQ impacts: 10-30% of potential forgone revenue	Insignificant effects	CDQ impacts: less than 2% of annual revenue at risk
Potentially Forgone Revenue and Revenue at Risk	none	Potentially forgone revenue >$500 million or nearly 80% of total	None, provided full participation in RHS	Revenue at Risk of as much as $240 million or 34% of total revenue in worst case
Operational Costs	no additional costs	Potential increased cost due to effort relocation and PSC avoidance	Reduced costs due to fewer chum RHS closures	Potential increased cost due to effort relocation and PSC avoidance
Net Benefits to the Nation	Status quo.	Non-comparable costs and benefits: Small improvement in chum and Chinook PSC (*a option*), potential increase in Chinook PSC (*b option*) and potentially large forgone revenue	Improved over Status Quo via enhanced chum PSC avoidance and management of Chinook stocks via a threshold. Similar cost to participants as current RHS	Non-comparable costs and benefits: Small improvement in chum and Chinook PSC (*a option*), potential increase in Chinook PSC (*b option*) and smaller amount of revenue "at risk" than in Alt. 2.

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1 Introduction

This Environmental Assessment (EA) provides decision-makers and the public with an evaluation of the predicted environmental effects of alternative measures to minimize chum salmon (also known as "non-Chinook salmon" prohibited species catch (PSC) in the Bering Sea pollock fishery. Although salmon PSC can occur in any of the groundfish fisheries, the majority of chum salmon PSC occurs in the Bering Sea pollock fishery. The Regulatory Impact Review (RIR) provides decision-makers and the public with an evaluation of the social and economic effects of these alternatives to addresses the requirements of Executive Order 12866, Executive Order 12898, and other applicable federal law. The EA/RIR serves as the central decision-making document for the North Pacific Fishery Management Council (Council) to recommend to the Secretary of Commerce changes in management of chum salmon PSC through an amendment to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP). If the Council submits a proposed FMP amendment, the National Marine Fisheries Service (NMFS) will review the Council's rationale and the EA/RIR on behalf of the Secretary of Commerce and will approve, disapprove, or partially approve the proposed amendment. If the FMP amendment is approved or partially approved, NMFS will implement the amendment through revisions to federal regulations at 50 CFR part 679. This EA complies with the National Environmental Policy Act (NEPA). The RIR addresses the requirements of Executive Order 12866 and Executive Order 12898.

The Council developed the following problem statement for this analysis:

> *Magnuson-Stevens Act National Standards direct management Councils to balance achieving optimum yield with bycatch reduction as well as to minimize adverse impacts on fishery dependent communities. Non-Chinook salmon (primarily made up of chum salmon) prohibited species bycatch (PSC) in the Bering Sea pollock trawl fishery is of concern because chum salmon are an important stock for subsistence and commercial fisheries in Alaska. There is currently no limitation on the amount of non-Chinook PSC that can be taken in directed pollock trawl fisheries in the Bering Sea. The potential for high levels of chum salmon bycatch as well as long-term impacts of more moderate bycatch levels on conservation and abundance, may have adverse impacts on fishery dependent communities.*
>
> *Non-Chinook salmon PSC is managed under chum salmon savings areas and the voluntary Rolling Hotspot System (RHS). Hard caps, area closures, and possibly an enhanced RHS may be needed to ensure that non-Chinook PSC is limited and remains at a level that will minimize adverse impacts on fishery dependent communities. The Council should structure non-Chinook PSC management measures to provide incentive for the pollock trawl fleet to improve performance in avoiding non-Chinook salmon while achieving optimum yield from the directed fishery and objectives of the Amendment 91 Chinook salmon PSC management program. Non-Chinook salmon PSC reduction measures should focus, to the extent possible, on reducing impacts to Alaska chum salmon as a top priority.*

1.1 What is this Action?

The proposed action is to implement new management measures to minimize chum salmon bycatch in the Bering Sea pollock fishery. This EA analyzes alternative ways to manage chum salmon bycatch, including replacing current management measures with revised or new measures. Current management measures include a PSC limit or "cap" that triggers closure of the Chum Salmon Savings Area (SSA) and exemption to this closure for participants in the rolling hotspot system intercooperative agreement (RHS ICA). The alternatives represent a range of PSC management measures that include new or revised caps, closure areas, and RHS ICA components for analysis that assist the decision-makers and the public in determining the best alternative to meet the purpose and need for the action. The alternatives meet the purpose and need by presenting different ways to minimize chum salmon bycatch in the Bering Sea pollock fishery to the extent practicable while achieving optimum yield.

1.2 Purpose and Need for this Action

The purpose of chum salmon PSC management in the Bering Sea pollock fishery is to minimize chum salmon bycatch to the extent practicable, while achieving optimum yield. Minimizing chum salmon bycatch to the extent practicable while achieving optimum yield is necessary to maintain a healthy marine ecosystem, ensure long-term conservation and abundance of chum salmon, provide maximum benefit to fishermen and communities that depend on chum salmon and pollock resources, and comply with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and other applicable federal law. National Standard 9 of the Magnuson-Stevens Act requires that conservation and management measures shall, to the extent practicable, minimize bycatch.

National Standard 1 of the Magnuson-Stevens Act requires that conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry. Section 3(33) of the Magnuson-Stevens Act defines optimum yield to mean "the amount of fish which …(A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; [and] (B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor…" NMFS has established in regulations at 50 CFR 679.20(a)(1)(i) that the optimum yield for the Bering Sea and Aleutian Island Management area is a range from 1.4 to 2.0 million metric tons (t).[1]

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

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

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

Several management measures are currently used to minimize chum salmon bycatch in the Bering Sea pollock fishery. Chum salmon taken incidentally in groundfish fisheries are classified as prohibited species and, as such, must be either discarded or donated through the Prohibited Species Donation Program. In the mid 1990s, NMFS implemented regulations recommended by the Council to control the

[1] In addition, through the Consolidated Appropriations Act of 2004 (Pub. L. 108-199), Congress required that the optimum yield for groundfish in the BSAI shall not exceed 2 million metric tons.

bycatch of chum salmon taken in the Bering Sea pollock fishery. These regulations established the Chum SSA and mandated year-round accounting of chum salmon bycatch in the trawl fisheries.

The Chum SSA is a time-area closure designed to reduce overall non-Chinook salmon bycatch in the federal groundfish trawl fisheries. This time-area closure was adopted based on historically observed salmon bycatch rates and was designed to avoid areas and times of high non-Chinook salmon bycatch. The Chum SSA is closed to pollock fishing from August 1 through August 31 of each year. Additionally, if the PSC limit of 42,000 non-Chinook salmon are caught by vessels using trawl gear in the Catcher Vessel Operational Area during the period August 15 through October 14, the Chum SSA remains closed to directed fishing for pollock for the remainder of the period September 1 through October 14.

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

To address this problem, the Council examined other means that were more flexible and adaptive to minimize salmon bycatch. The fleet voluntarily started the RHS program in 2001 for chum salmon and in 2002 for Chinook salmon. The exemption to area closures for the RHS ICA was first implemented through an exempted fishing permit in 2006 and 2007 subsequently, in 2008, through Amendment 84 to the BSAI FMP. Under Amendment 84, the requirements for an RHS ICA were implemented in federal regulations and vessels, and CDQ groups participating in an RHS ICA approved by NMFS were exempted from closures of the Chinook and Chum Salmon Savings Areas. The RHS ICA was intended to increase the ability of pollock fishery participants to minimize salmon bycatch by giving them more flexibility to move fishing operations to avoid areas where they experience high rates of salmon bycatch. Additional information about Amendment 84 is in Section 2.1.

The Council took additional action to minimize Chinook salmon bycatch in the Bering Sea pollock fishery under Amendment 91 to the BSAI FMP. Amendment 91 was approved by the Council in 2009 and implemented by NMFS in January 2011. This management program implements sector and seasonal Chinook salmon PSC limits ("hard caps"), provisions for higher caps for participants in an approved incentive plan agreement, and a Chinook salmon bycatch "performance standard." Additional information about Amendment 91 and management and monitoring modifications as a result of this program are contained in Chapter 2.

The Council is now considering whether additional management measures are needed to minimize the bycatch of chum salmon in the Bering Sea pollock fishery.

1.3 The Action Area

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

Impacts of the action may also occur outside the action area in the freshwater origins of the chum salmon caught as bycatch and in the chum salmon migration routes between their streams of origin and the Bering Sea (Figure 1-1). Chum salmon caught as bycatch in the Bering Sea pollock fishery may originate from Asia, Alaska, Canada, or the western United States.

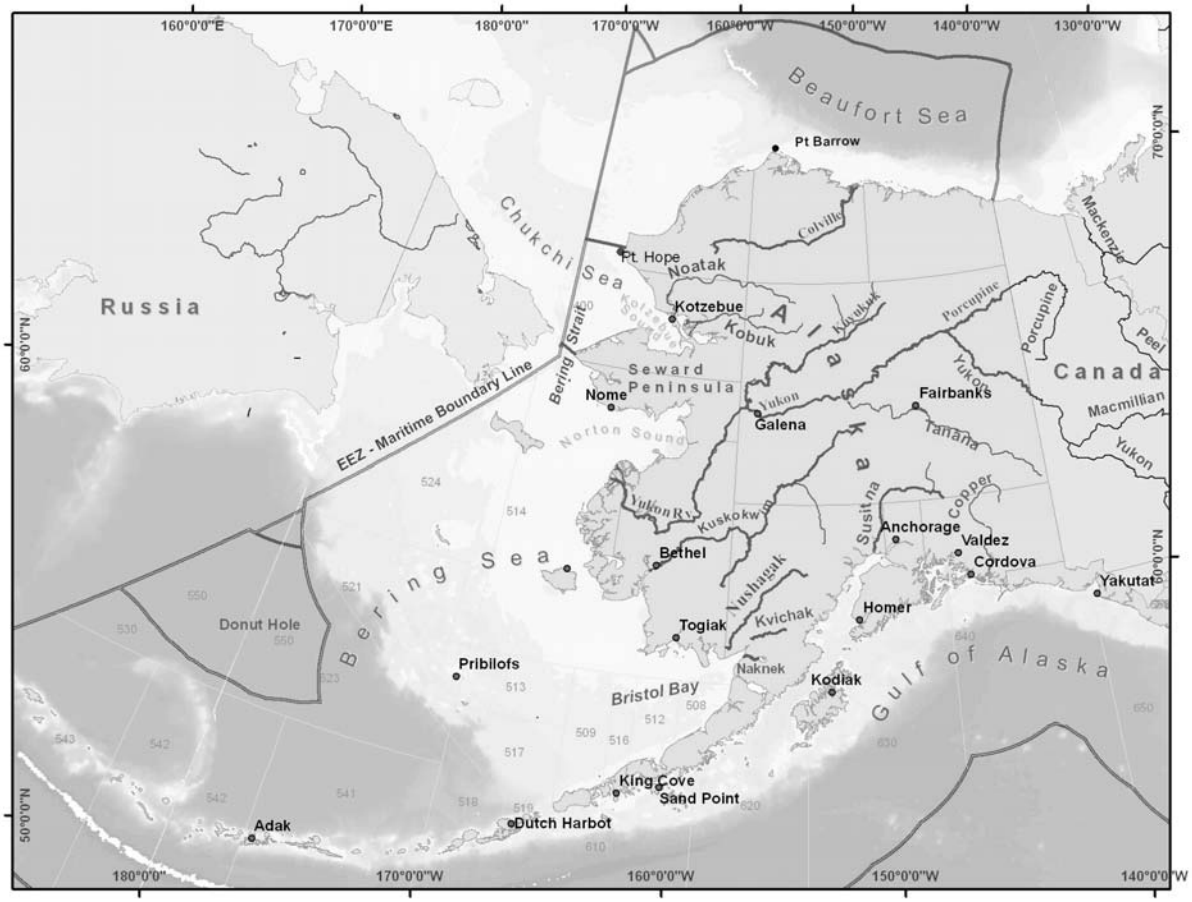


Figure 1-1 Map of the Bering Sea and major connected salmon producing rivers in Alaska and Northwest Canada

A comprehensive description of the action area is contained in previous environmental impact statements (EISs) prepared for North Pacific fishery management actions. The description of the affected environment is incorporated by reference from Chapter 3 of the Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries (NMFS 2004) and Chapter 3 of the Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska (NMFS 2005a). These documents contain extensive information on the fishery management areas, marine resources, habitat, ecosystem, social, and economic parameters of the pollock fishery. Both of these public documents are available on the NMFS Alaska Region website.[2]

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

A large body of information exists on the life histories and general distribution of salmon in Alaska. The locations of many freshwater habitats used by salmon are described in documents organized and maintained by the Alaska Department of Fish & Game (ADF&G). Alaska Statute 16.05.871 requires ADF&G to specify the various streams that are important for spawning, rearing, or migration of anadromous fishes. This is accomplished through the *Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes* (ADF&G 1998a) which lists water bodies documented to be used by anadromous fish, and the *Atlas to the Catalog of Waters Important for Spawning, Returning or Migration of Anadromous Fishes* (ADF&G 1998b), which shows locations of these waters and the species and life stages that use them. Additional information on salmon streams is available from the ADF&G website.[3]

1.4 The Bering Sea pollock fishery

Pollock is a commercially targeted species distributed in the North Pacific from Central California to the southern Sea of Japan. Currently, this species comprises a major portion of the BSAI finfish biomass and supports the largest single species fishery in the U.S. EEZ. The economic character of the fishery centers on the products produced from pollock: roe (eggs), surimi, and fillet products. In 2008, the total value of pollock increased to an estimated $1.415 billion but dropped by 2009 to $1.03 billion and for 2010 the estimate is $1.06 billion.

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

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

Sections 206(a) and (b) of the AFA establish the allocation of the Bering Sea pollock TAC among four AFA sectors. First, 10 percent of the Bering Sea pollock TAC is allocated to the CDQ Program. Then, NMFS reduces the remainder of the TAC by an amount of pollock that will be harvested as incidental catch in the non-pollock fisheries. In 2012, the incidental catch allowance for Bering Sea pollock is 32,400 mt. The remaining amount, after subtraction of the CDQ allocation and the incidental catch allowance, is called the directed fishing allowance. As required under the AFA, NMFS then allocates the directed fishing allowance among the three remaining AFA sectors (the "non-CDQ sectors"): 50 percent to the inshore catcher vessel (CV), 40 percent to the offshore catcher/processor (CP), and 10 percent to the mothership sector. Because the percentage of the TAC allocated to each of the four AFA sectors is specified in the AFA, transfer of pollock among the sectors is not allowed.

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

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

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

1.4.1 Community Development Quota Program

The CDQ Program was established by the Council in 1992 to improve the social and economic conditions in western Alaska communities by facilitating their economic participation in the BSAI fisheries. The CDQ Program was developed to redistribute some of the BSAI fisheries' economic benefits to communities adjacent to the Bering Sea and on the Aleutian Islands by allocating a portion of commercially important BSAI species including pollock to such communities. Their initial 7.5 percent allocation of pollock was expanded to 10 percent with the enactment of the AFA. These allocations are further allocated among the six CDQ groups: the Aleutian Pribilof Island Community Development Association (APICDA), the Bristol Bay Economic Development Corporation (BBEDC), the Central Bering Sea Fishermen's Association (CBSFA), the Coastal Villages Region Fund (CVRF), the Norton Sound Economic Development Corporation (NSEDC), and the Yukon Delta Fisheries Development Association (YDFDA). The percentage allocations of pollock among the six CDQ groups were approved by NMFS in 2005 based on recommendations from the State of Alaska. These percentage allocations are now the required allocations of pollock among the CDQ groups under section 305(i)(1)(B) of the Magnuson-Stevens Act. CDQ groups typically sell or lease their Bering Sea pollock allocations to various harvesting partners. The vessels harvesting CDQ pollock are the same vessels conducting AFA non-CDQ pollock harvesting. More detailed information on the CDQ Program is contained in the RIR.

1.4.2 Inshore catcher vessel sector

Each year, catcher vessels eligible to deliver pollock to the seven eligible AFA inshore processors may form cooperatives associated with a particular inshore processor. These catcher vessels are not required to join a cooperative and those that do not join a cooperative are managed by NMFS under the "inshore open access fishery." Usually, all inshore catcher vessels have joined one of seven inshore cooperatives. Annually, NMFS allocates the inshore sector's allocation of pollock among the inshore cooperatives and, if necessary, the inshore open access fishery. NMFS permits the inshore cooperatives, allocates pollock to them, and manages these allocations through a regulatory prohibition against an inshore cooperative exceeding its pollock allocation.

The inshore CV cooperatives are required to submit copies of their contracts to NMFS annually in their AFA inshore cooperative permit applications. These contracts must contain the information required in NMFS regulations, including information about the cooperative structure, vessels that are parties in the contract, and the primary inshore processor that will receive at least 90 percent of the pollock deliveries from these catcher vessels. Each catcher vessel in a cooperative must have an AFA permit with an inshore endorsement, a license limitation program permit authorizing the vessel to engage in trawl fishing for pollock in the Bering Sea, and no sanctions on the AFA or license limitation program permits. Although the contract requirements are governed by NMFS regulations, compliance with the provisions of the contract (primarily the 90 percent processor delivery requirements) are not enforced by NMFS, but are enforced through the private contractual arrangement of the cooperative.

Once an inshore cooperative's permit application is approved by NMFS, the cooperative receives an annual pollock allocation based on the catch history of vessels listed in a cooperative contract. The annual pollock allocation for the inshore CV sector is divided up by applying a formula in the regulations that allocates catch to a cooperative or the inshore open access fishery according to the specific sum of the catch history for the vessels in the cooperative or the "inshore open access" fishery. Under § 679.62(a)(1), the individual catch history of each vessel is equal to the sum of inshore pollock landings from the vessel's best 2 of the 3 years 1995 through 1997, and includes landings to catcher/processors for vessels that made landings of 500 mt or more to catcher/processors from 1995 through 1997. The percent of the inshore sector's allocation of pollock that is attributed to each CV based on this catch history is shown in Column D of Table 47c to 50 CFR part 679. Each year, fishing permits are issued to the inshore cooperative, with the permit application listing the CVs that are a member of each permitted cooperative.

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

1.4.3 Offshore catcher/processor cooperatives and mothership cooperative

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

Two fishery cooperatives are authorized by the AFA to form in the offshore CP sector and the offshore catcher vessel sector. A single cooperative may form that includes both CPs and named offshore catcher vessels delivering to CPs, or the CP and CV may form separate cooperatives and enter into an inter-cooperative agreement to govern fishing for pollock in the offshore CP sector. The offshore CP sector elected to form two cooperatives. The Pollock Conservation Cooperative (PCC) was formed in 1999 and is made up of 19 CPs that divide the sector's overall pollock allocation. The AFA listed 20 eligible CPs by name and also allowed eligibility for any other CP that had harvested more than 2,000 mt of pollock in 1997 and was eligible for the license limitation program. One CP, the *Ocean Peace*, met the requirements for an "unlisted catcher/processor" under the AFA and is part of the offshore CP sector. The *Ocean Peace* fished for pollock from 1999 through 2001 and again in 2008. Under the requirements of the AFA, unlisted CPs may harvest up to 0.5 percent of the offshore CP sector's allocation of pollock. The *Ocean Peace* is not part of the PCC.

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

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

1.4.4 Non-Chinook salmon bycatch in the Bering Sea pollock fishery

NMFS manages salmon PSC in two categories: Chinook salmon and "non-Chinook salmon," which includes four species of salmon (sockeye, coho, pink, and chum) and any salmon that are not identified to species. Table 1-1 shows that on average chum salmon comprised over 99.6 percent of the non-Chinook salmon from 2001 to 2012.

Table 1-1 Composition of non-Chinook salmon prohibited species catch by species from 2001 through 2012. **Source:** NMFS catch accounting, extrapolated from sampled hauls only.

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%
2008	17	9	100	11,646	11,772	98.9%
2009	37	17	238	29,432	29,724	99.0%
2010	13	7	122	10,620	10,762	98.7%
2011	28	445	667	154,771	155,911	99.3%
2012	91	184	13	20,678	20,966	98.6%

The majority of non-Chinook PSC in the Bering Sea occurs in the pollock fishery. As shown in Table 1-2, historically, the percent of the non-Chinook bycatch in the Bering Sea that has occurred in the Bering Sea pollock fishery has ranged from a low of 88 percent of all bycatch to a high of greater than 98.7 percent in 1993. Since 2002 bycatch of non-Chinook salmon in the Bering Sea pollock fishery has comprised over 95 percent of the total non-Chinook bycatch. Total catch of non-Chinook salmon in the pollock fishery reached an historic high in 2005 at 704,586 fish. Bycatch of non-Chinook salmon in this fishery occurs almost exclusively in the B season. Previously the historic high was 242,000 in 1993 (prompting previous Council action to enact the Chum SSA. In recent years bycatch levels for chum salmon have been much lower than levels seen between 2003 and 2006, and in 2010 bycatch was approximately 13,000 fish.

Table 1-2 Non-Chinook (chum) salmon mortality in BS pollock directed fisheries 1991 through 2010. **Source:** NMFS catch accounting, updated 1/20/12

Year	Annual with CDQ	Annual without CDQ	Annual CDQ only	A season with CDQ	B season with CDQ	A season without CDQ	B season without CDQ	A season CDQ only	B season CDQ only
1991	Na	28,951	na	na	na	2,850	26,101	na	na
1992	Na	40,274	na	na	na	1,951	38,324	na	na
1993	Na	242,191	na	na	na	1,594	240,597	na	na
1994	92,672	81,508	11,165	3,991	88,681	3,682	77,825	309	10,856
1995	19,264	18,678	585	1,708	17,556	1,578	17,100	130	456
1996	77,236	74,977	2,259	222	77,014	177	74,800	45	2,214
1997	65,988	61,759	4,229	2,083	63,904	1,991	59,767	92	4,137
1998	64,042	63,127	915	4,002	60,040	3,914	59,213	88	827
1999	45,172	44,610	562	362	44,810	349	44,261	13	549
2000	58,571	56,867	1,704	213	58,358	148	56,719	65	1,639
2001	57,007	53,904	3,103	2,386	54,621	2,213	51,691	173	2,930
2002	80,782	77,178	3,604	1,377	79,404	1,356	75,821	21	3,583
2003	189,185	180,783	8,402	3,834	185,351	3,597	177,186	237	8,165
2004	440,468	430,271	10,197	424	440,044	395	431,925	29	8,119
2005	704,552	696,859	7,693	578	703,974	546	693,806	32	10,168
2006	309,630	308,428	1,202	1,323	308,307	1,258	300,646	65	7,661
2007	93,783	87,303	6,480	8,510	85,273	7,354	84,136	1,156	1,137
2008	15,267	14,834	434	319	14,948	246	9,624	73	5,324
2009	46,127	45,178	950	48	46,080	48	45,719	0	361
2010	13,222	12,696	526	39	13,183	39	12,233	0	950
2011	191,445	187,676	3,769	122	191,323	111	190,797	11	526
2012	22,213	22,012	201	11	22,202	10	22,002	1	200

Non-CDQ data for 1991-2002 from bsahalx.dbf
Non-CDQ data for 2003-2010 from akfish_v_gg_pscnq_estimate
Non-CDQ data for 2011-2012 from akfish_v_gg_txn_primary_psc
CDQ data for 1992-1997 from bsahalx.dbf
CDQ data for 1998 from boatrate.dbf
CDQ data for 1999-2007 from akfish_v_cdq_catch_report_total_catch
CDQ data for 2008-2010 from akfish_v_gg_pscnq_estimate_cdq
CDQ data for 2011-2012 from akfish_v_gg_txn_primary_psc
Starting in 2011, the sampling method for salmon in BSAI pollock directed fisheries changed to census counts.
A season - January 1 to June 10
B season - June 11 to December 31

1.4.5 2009 through 2011 pollock catch and non-Chinook (chum) salmon bycatch by vessel category

Vessel-specific salmon bycatch information currently exists for catcher/processors, motherships, and observed catcher vessels in the inshore sector. However, vessels in the 30 percent observer coverage category are a significant component of the inshore sector; in 2011, per observer coverage changes implemented under Amendment 91, this sector is now covered at 100 percent. However through 2010, when these vessels were not observed, salmon bycatch rates from other observed vessels are used to estimate the salmon bycatch associated with the pollock catch by the unobserved vessels (as discussed in Section 3.1.5).

Table 1-3 shows the estimated pollock catch and salmon bycatch in the AFA pollock fisheries in the Bering Sea in 2009, by fishery sector and vessel length class. In 2009, 53of the vessels participating in the inshore sector were in the 30 percent observer coverage category. These vessels caught approximately 20 percent of the pollock catch and an estimated 49 percent of the non-Chinook (chum) salmon bycatch.

Table 1-3. Number of vessels that participated in the 2009 AFA pollock fisheries, pollock catch, and estimated non-Chinook salmon bycatch, by vessel category

Vessel category	Number of Vessels	Pollock (mt)	Percent of Pollock Catch	Number of non-Chinook salmon	Percent of non-Chinook Salmon
CDQ	13	81,478	10%	950	2%
Catcher/processor	15	281,603	36%	3,901	8%
Motherships	3	70,308	9%	1,733	4%
CV 60 ft.-125 ft.	53	152,649	20%	22,501	49%
CV ≥ 125 ft.	26	197,718	25%	17,043	37%
Total	97	783,756	100%	46,127	100%

Source: NMFS Alaska Catch Accounting System, 2/27/12

Table 1-4 shows the estimated pollock catch and salmon bycatch in the AFA pollock fisheries in the Bering Sea in 2010, by fishery sector and vessel length class. In 2010, 55of the vessels participating in the inshore sector were in the 30 percent observer coverage category. These vessels caught approximately 20 percent of the pollock catch and an estimated 42 percent of the non-Chinook (chum) salmon bycatch.

Table 1-5 and Table 1-6 show the estimated pollock catch and salmon bycatch in the AFA pollock fisheries in the Bering Sea in 2011 and 2012, by fishery sector and vessel length class. All vessels now have 100 percent observer coverage as a result of the implementation of the Amendment 91 Chinook bycatch management program.

Table 1-4. Number of vessels that participated in the 2010 AFA pollock fisheries, pollock catch, and estimated non-Chinook salmon bycatch, by vessel category

Vessel category	Number of Vessels	Pollock (mt)	Percent of Pollock Catch	Number of non-Chinook salmon	Percent of non-Chinook Salmon
CDQ	12	81,275	10%	526	4%
Catcher/processor Motherships*	15 2	353,326	45%	3,171	24%
CV 60 ft.-125 ft.	55	153,322	20%	5,584	42%
CV ≥ 125 ft.	26	198,362	25%	4,024	30%
Total	98	786,285	100%	13,222	100%

*CPs and mothership sector harvests are combined for confidentiality reasons.
Source: NMFS Alaska Catch Accounting System, 2/27/12

Table 1-5. Number of vessels that participated in the 2011 AFA pollock fisheries, pollock catch, and estimated non-Chinook salmon bycatch, by vessel category

Vessel category	Number of Vessels	Pollock (mt)	Percent of Pollock Catch	Number of non-Chinook salmon	Percent of non-Chinook Salmon
CDQ	15	116,978	10%	3,769	2%
Catcher/processor	15	423,680	36%	44,356	23%
Motherships*	3	109,856	9%	24,399	13%
CV 60 ft.-125 ft.	54	230,189	20%	59,292	31%
CV ≥ 125 ft.	26	288,904	25%	59,625	31%
Total	98	705,010	100%	191,441	100%

Source: NMFS Alaska Catch Accounting System, 2/27/12

Table 1-6 Number of vessels that participated in the 2012 AFA pollock fisheries, pollock catch, and estimated non-Chinook salmon bycatch, by vessel category

Vessel category	Number of Vessels	Pollock (mt)	Percent of Pollock Catch	Number of non-Chinook salmon	Percent of non-Chinook Salmon
CDQ	14	121,854	10%	201	1%
Catcher/processor	14	423,177	36%	1,934	9%
Motherships*	3	105,384	9%	978	4%
CV 60 ft.-125 ft.	54	224,984	19%	9,837	44%
CV ≥ 125 ft.	27	300,316	26%	9,263	42%
Total	98	1,175,714	100%	22,213	100%

Source: NMFS Alaska Catch Accounting System, 11/8/12

1.5 Public Participation

The EA and RIR are being developed with several opportunities for public participation. This section describes these avenues for public participation.

1.5.1 Scoping

Scoping is an early and open process for determining the scope of issues to be addressed in an EA or EIS and for identifying the significant issues related to the proposed action. A principal objective of scoping and public involvement process is to identify a range of reasonable management alternatives that will delineate critical issues and provide a clear basis for distinguishing among those alternatives and selecting a preferred alternative. Through the notice of intent, NMFS notified the public that a NEPA analysis and decision-making process for this proposed action has been initiated so that interested or affected people may participate and contribute to the final decision.

Scoping is the term used for involving the public in the NEPA process at its initial stages. Scoping 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 analysis. 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 January 8, 2009 (74 FR 798). Public comments were due to NMFS by March 23, 2009. 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. This scoping report summarizes issues and alternatives raised in public comments submitted during this scoping period.

Additionally, members of the public have the opportunity to comment during the Council process. The Council has noticed the public when it is scheduled to discuss non-Chinook salmon bycatch issues. The Council process, which involves regularly scheduled and noticed public Council meetings, ad-hoc industry meetings, and Council committee meetings, started before this formal scoping process and will continue after this formal scoping process is completed.

1.5.2 Summary of Alternatives and Issues Identified During Scoping

NMFS received four written comments from the public and interested parties.

1.5.2.1 Alternative management measures identified during scoping

The Council and NMFS will consider the alternatives identified during scoping in the analysis. The Council and NMFS will determine the range of alternatives to be analyzed that best accomplish the proposed action's purpose and need. The analysis describes the alternatives raised during scoping that were considered but not carried forward, and discuss the reasons for their elimination from further detailed study. Comments identified the following alternatives for consideration:

- Analyze a range of hard caps from 50,000 non-Chinook salmon to 400,000 non-Chinook salmon and their likely impacts to Western Alaska.
- The hard cap should be from 70,000 non-Chinook to 77,000 non-Chinook salmon.
- The hard cap should be less than or equal to 70,000 non-Chinook salmon because this amount appears to allow in-river escapement, subsistence harvest consistent with the Alaska National Interest Lands Conservation Act, and Canadian border passage goals to be achieved, while providing for traditional in-river commercial fishing opportunities.
- Any pollock fishery management actions aimed at reducing salmon bycatch by altering time, area, and/or fishing methods must be used in conjunction with a hard cap threshold beyond which additional bycatch is prohibited.
- Develop a research and monitoring plan to identify information needed to establish an optimal bycatch level based on improved genetic stock-specific information.

1.5.2.2 Issues identified during scoping

The comments received through the scoping process identified the following issues. To the extent practicable and appropriate, the analysis will take these issues into account.

- NEPA mandates the preparation of an EIS because the proposed chum salmon bycatch measures would be a significant action because they are likely to be controversial and to have substantial environmental, social, and economic impacts.
- The purpose of the proposed action should be to reduce BSAI salmon bycatch to levels which facilitate and provide for healthy returns of in-river fish both in Alaska and the Yukon River in Canada. Healthy returns mean adequate escapement and sufficient opportunity to meet subsistence harvest needs. Healthy returns also would allow for the taking of additional fish for historical non-subsistence harvest and would allow the United States to meet its international treaty obligations to Canada.
- Evaluate the impacts of anticipated climate change and how changes to ocean temperatures are impacting oceanic circulation and nutrient flow, and how these changes affect salmon diet, competition, predation, and migration.
- Identifying salmon bycatch stock of origin and age at maturity would assist significantly in understanding the impact of pollock fishery bycatch to in-river salmon returns not only in Alaska but for Pacific Northwest threatened and endangered salmon stocks as well. Collecting samples of salmon from the pollock fishery bycatch could inform non-Chinook salmon management decisions in both marine and in-river fisheries.
- Relying on inaccurate data could make NMFS think there are more fish in the sea than there actually are.

1.6 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 (E.O.) 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 (P.L. 108-199, 188 Stat. 452), as amended by Section 518 of the Consolidated Appropriations Act of 2005 (P.L. 108-447, 118 Stat. 3267). More information about E.O. 13175 is in section 1.10.11.

On January 16, 2009, as a first step in the consultation process, NMFS mailed letters to approximately 660 Alaska tribal governments, ANCSA corporations, and related organizations providing information about the proposed action and analysis and soliciting consultation and coordination with interested tribal governments and ANCSA corporations. NMFS received one comment from a tribal government, which was included in the scoping report. NMFS received a consultation request from the Native Village of St. Michael. A representative of St. Michael was contacted by NMFS by telephone, but no formal consultation meeting was scheduled. St. Michael participated in one of the 2011 consultation meetings described below.

On June 1, 2011, NMFS held a tribal consultation teleconference with representatives of six Norton Sound and Bering Strait tribal governments: Native Village of Elim/Elim IRA Council; Native Village of Gambell; Native Village of Savoonga; Native Village of Shishmaref/Shishmaref IRA Council; Native Village of Teller/Teller Traditional Council; and Mary's Igloo Traditional Council. Each of the tribes had submitted resolutions to NMFS requesting a consultation and requesting the Council adopt a hard cap of 30,000 chum salmon for the Bering Sea pollock fishery. These resolutions were in response to the continuing decline of regional salmon stocks, which the tribes reported has severely impacted their subsistence practices and traditions. A representative of Kawerak, Inc., also participated in the consultation. The consultation was scheduled to occur prior to the Council's meeting in Nome.

During the consultation, NMFS staff provided an overview of chum salmon bycatch management and then listened to the representatives' concerns. The representatives emphasized the cultural and nutritional significance of salmon, the importance of subsistence use of salmon, and concerns with the status of some chum salmon stocks. Several representatives requested information on the prohibited species donation program (PSD program) and expressed interest in participation in the program by western Alaska communities. Also discussed were environmental changes tribal members have observed in recent years, science and research needs in the area, interest in collaborative research and funding for tribes and regional non-profit corporations to conduct research, the cumulative impact of salmon interception in the False Pass salmon fisheries and salmon bycatch in the pollock fisheries, how NMFS and the Council collaborate to ensure that tribal concerns are addressed, how NMFS provides information and education about fisheries issues to the tribes, and the tribes' request that NMFS hire a tribal liaison. The issues and NMFS's responses are summarized in a report posted on the NMFS Alaska Region web site.[9]

On June 6, 2011, NMFS sent a letter to the Council summarizing the issues discussed in the tribal consultation. NMFS requested the Council address the tribes' recommendation for a 30,000 hard cap by either including it in the alternatives analyzed or providing an explanation why this cap does not meet the purpose and need for the action.

In mid June 2011, NMFS received consultation requests from the Native Village of Koyuk and the Native Village of St. Michael. Each submitted a resolution requesting the Council adopt a hard cap of 30,000 chum salmon for the Bering Sea pollock fishery. NMFS informed the tribal representatives that a consultation was conducted on this issue on June 1, and the representatives were asked to contact NMFS if they would like a separate consultation.

On August 18, 2011, the draft report of the consultation was sent to the participants, and comments on the draft were solicited. Included with the draft report were NMFS's preliminary summary letter to the

Council; the June 2011 Council action on Bering Sea chum salmon bycatch; the agenda for the September meeting of the Council's Rural Community Outreach Committee, which was scheduled to discuss future outreach on chum salmon bycatch; and information from the U.S. Food and Drug Administration on seafood safety following the March 2011 Japanese nuclear power plant incident. On September 9, 2011, the final report of the consultation was sent to the participants, the Native Village of Koyuk, the Native Village of St. Michael, the Council's Rural Community Outreach Committee, and other interested parties and posted on the NMFS Alaska Region web site.

In September 2011, NMFS invited 20 tribes in the Norton Sound and Bering Strait area, Kawerak, Inc., and other interested parties to participate in a teleconference following up on some of the issues raised during the June 1 tribal consultation. NMFS held the teleconference on October 6, 2011. Representatives of the following tribes participated in the teleconference: Native Village of Brevig Mission; Native Village of Savoonga; Native Village of St. Michael; and Nome Eskimo Community. Also participating were representatives from Kawerak, Inc., and staff from Senator Donald Olson's office, Representative Neal Foster's office, and the Council.

During the teleconference, NMFS staff summarized the June 1 tribal consultation and provided an overview of the PSD program. Council staff summarized the status of the Council's review of the proposed management measures to minimize non-Chinook salmon bycatch in the Bering Sea pollock fishery and noted that a public, statewide teleconference on these measures would be held in spring 2012. Issues raised by the tribal representatives included the significance of subsistence use of salmon, the quality of salmon distributed through the PSD program, clarification of some concerns addressed during the tribal consultation, and pollock fishery closures. A summary of these issues and NMFS's responses is posted on the NMFS Alaska Region web site and was distributed to the teleconference participants, the Council, and other interested parties.

At the April 2012 Council meeting, NMFS presented an overview of the tribal consultation meetings to the Council. NMFS asked the Council to address the request by some of the Norton Sound and Bering Strait tribes for a 30,000 chum salmon hard cap. The Council's response is described in 2.7.1.

1.7 Cooperating Agencies

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

1.8 Community Outreach

One of the Council's policy priorities is to improve communication with and participation by Alaska Native and rural communities in the federal fisheries management process. The Council developed an outreach plan to solicit and obtain input on the proposed action from Alaska Natives, communities, and other affected stakeholders. This outreach effort, specific to chum salmon bycatch management, dovetails with the Council's overall community and Native stakeholder participation policy.

The Council's Rural Community Outreach Committee identified this action as an important project for outreach efforts to rural communities. An outreach plan was developed in late 2009 and is continually refined.[4] The outreach plan includes attending several regional meetings in rural Alaska, as well as other

[4] http://www.alaskafisheries.noaa.gov/npfmc/current_issues/bycatch/ChumOutreach1010.pdf

meetings, in order to explain the proposed action, provide preliminary analysis, and receive direct feedback from rural communities prior to the final analysis. The majority of these meetings occured in early 2011. A summary of verbal comments received during outreach meetings is attached as Appendix 4 and was presented to the Council in June 2011.

1.9 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 BSAI FMP. 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.

1.10 Relationship of this Action to Federal Laws, Policies, and Treaties

While NEPA is the primary law directing the preparation of this EA, a variety of other federal laws and policies require environmental, economic, and socioeconomic analyses of proposed federal actions. This section addresses the CEQ regulations at 40 CFR 1502.2(d) that require an EA 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 EA and RIR contain the required analysis of the proposed federal action and its alternatives to ensure that the action complies with these additional federal laws and executive orders:

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

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

1.10.1 National Environmental Policy Act

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

NEPA has two principal purposes:

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

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

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

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

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

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

1.10.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act authorizes the United States to manage its fishery resources in the EEZ. The management of these marine resources is vested in the Secretary and in regional fishery management councils. In the Alaska Region, the Council is responsible for preparing FMPs for marine fishery resources requiring conservation and management. NMFS is charged with carrying out the federal mandates with regard to marine fish. The NMFS Alaska Region and Alaska Fisheries Science Center research, draft, and review the management actions recommended by the Council. The Magnuson-Stevens Act established the required and discretionary provisions of an FMP and created ten National Standards to ensure that any FMP or FMP amendment is consistent with the Act.

The Magnuson-Stevens Act emphasizes the need to protect fish habitat. Under the law, the Council has amended its FMPs to identify essential fish habitat (EFH). For any actions that may adversely impact EFH, the Magnuson-Stevens Act requires NMFS to provide recommendations to federal and state agencies for conserving and enhancing EFH. In line with NMFS policy of blending EFH assessments into existing environmental reviews, NMFS intends the analysis contained in Chapter 7of this EA to also serve as an EFH assessment.

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

1.10.3 Endangered Species Act (ESA)

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

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

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

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

Formal consultations, resulting in biological opinions, are conducted for federal actions that may have an adverse affect on the listed species. Through the biological opinion, a determination is made about whether the proposed action poses "jeopardy" or "no jeopardy" of extinction or adverse modification or destruction of designated critical habitat for the listed species. If the determination is that the proposed or on-going action will cause jeopardy or adverse modification of critical habitat, reasonable and prudent alternatives may be suggested which, if implemented, would modify the action to no longer pose the jeopardy of extinction or adverse modification to critical habitat for the listed species. These reasonable and prudent alternatives must be incorporated into the federal action if it is to proceed. A biological opinion with the conclusion of no jeopardy or adverse modification of critical habitat may contain conservation recommendations intended to further reduce the negative impacts to the listed species. These recommendations are advisory to the action agency (50 CFR 402.14(j)). If the likelihood exists of any take[5] occurring during promulgation of the action, an incidental take statement may be appended to a

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

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 EA contains pertinent information on the ESA-listed species that occur in the action area and that have been identified in previous consultations as potentially impacted by the Bering Sea pollock fishery. Analysis of the impacts of the alternatives is in the chapters addressing those resource components.

1.10.4 Marine Mammal Protection Act (MMPA)

Under the MMPA, NMFS has a responsibility to conserve marine mammals, specifically cetaceans and pinnipeds (other than walrus). The USFWS is responsible for sea otter, walrus, and polar bear. Congress found that certain species and stocks of marine mammals are or may be in danger of extinction or 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 EA analyzes the potential impacts of the pollock fishery and changes to the fishery under the alternatives on marine mammals.

1.10.5 Administrative Procedure Act (APA)

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

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

1.10.6 Regulatory Flexibility Act (RFA)

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

The RFA applies to any regulatory actions for which prior notice and comment is required under the APA. After an agency begins regulatory development and determines that the RFA applies, unless an agency can certify that an action subject to the RFA will not have a significant economic impact on a substantial number of small entities, the agency must prepare an initial regulatory flexibility analysis (IRFA) to accompany a proposed rule. Based upon the IRFA, and received public comment, assuming it is still not possible to certify, the agency must prepare a final regulatory flexibility analysis 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.

This analysis contains a draft IRFA that identifies the small entities directly regulated by the proposed action. The preamble to the proposed regulations that will be published in the *Federal Register* will contain the IRFA that evaluates the adverse impacts of this action on directly regulated small entities, in compliance with the RFA.

1.10.7 Information Quality Act (IQA)

The IQA directs the Office of Management and Budget (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.[6] Pursuant to the IQA and the NOAA guidelines, if the Council recommends an action alternative, this EA/RIR/IRFA will undergo a pre-dissemination review during NMFS's review of the Council's submission.

1.10.8 Alaska National Interest Lands Conservation Act (ANILCA)

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

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

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

Although ANILCA does not directly apply to the OCS region, NMFS aims to protect such uses pursuant to other laws, such as NEPA and the Magnuson-Stevens Act. The RIR evaluates the consequences of the

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

proposed actions on subsistence uses. Thus NMFS and the Council remain committed to ensuring that federal fishery management actions consider the importance of subsistence uses of salmon and protecting such uses from any adverse consequences. One of the reasons NMFS and the Council have proposed implementing salmon bycatch reduction measures is to protect the interests of salmon subsistence users.

1.10.9 American Fisheries Act (AFA)

The AFA established a cooperative management program for the Bering Sea pollock fishery. Among the purposes of the AFA was to tighten U.S. vessel ownership standards and to provide the pollock fleet the opportunity to conduct its fishery in a more economically rational manner while protecting non-AFA participants in other fisheries. Since the passage of the AFA, the Council has taken an active role in the development of management measures to implement the various provisions of the AFA. The AFA EIS was prepared to evaluate sweeping changes to the conservation and management program for the Bering Sea pollock fishery and to a lesser extent, the management programs for the other groundfish fisheries of the Gulf of Alaska and BSAI, the king and Tanner crab fisheries of the BSAI, and the scallop fishery off Alaska (NMFS 2002). Under the Magnuson-Stevens Act, the Council prepared Amendments 61/61/13/8 to implement the provisions of the AFA in the groundfish, crab, and scallop fisheries. Amendments 61/61/13/8 incorporated the relevant provisions of the AFA into the FMPs and established a comprehensive management program to implement the AFA. The EIS evaluated the environmental and economic effects of the management program that was implemented under these amendments, and developed scenarios of alternative management programs for comparative use. The AFA EIS is available on the NMFS Alaska Region website.[7]

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

1.10.10 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 an 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 EA and an IRFA in a single document that addresses the analytical requirements of NEPA, RFA, and Executive Order 12866. Criteria for determining "significance" for Executive Order 12866 purposes, however, are different than those for determining "significance" for NEPA or RFA purposes. A "significant" rule under Executive Order 12866 is one that is likely to:

- Have an annual effect on the economy (of the nation) of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;

[7] http://www.alaskafisheries.noaa.gov/sustainablefisheries/afa/eis2002.pdf

- Create serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in Executive Order 12866.

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

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

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

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

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

1.10.12 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.

1.10.13 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 United States 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 EA and RIR address the substantive issues involving the portion of chum salmon taken as bycatch in the Bering Sea pollock fishery that originated from the Yukon River as well as the impacts of salmon bycatch in the pollock fishery on returns of Chinook salmon to the Canadian portion of the Yukon River.

2 Description of Alternatives

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

Alternative 1: Status Quo (No Action)

Alternative 2: Hard cap

Alternative 3: Triggered closure with intercooperative exemption

Alternative 4: Triggered closure with intercooperative exemption and options for non-exempt closures

The alternatives analyzed in this environmental assessment and the Regulatory Impact Review (RIR) represent a complex suite of components, options, and suboptions. However, each of the alternatives involves a limit or "cap" on the number of non-Chinook salmon that may be caught in the Bering Sea pollock fishery and closure of all or a part of the Bering Sea to pollock fishing once the cap is reached. These closures would occur when a non-Chinook salmon bycatch cap was reached even if a portion of the pollock total allowable catch (TAC) has not yet been harvested. Alternative 2 components and options represent a change in management of the pollock fishery because if the non-Chinook salmon prohibited species catch (PSC) limits are reached before the full harvest of the pollock allocation, then directed fishing for pollock must stop either throughout the entire Bering Sea or for a specific time frame. Under Alternative 3, like Alternative 1, reaching the cap closes specific areas important to pollock fishing unless participants are parties in a rolling hot spot closure system approved by NMFS. Note that the alternatives are not mutually exclusive and mixing and matching of components of each may be done to create a combined management approach which would represent a new alternative.

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

This chapter also describes how management of the pollock fishery would change under each of the alternatives and how non-Chinook salmon bycatch would be monitored. Estimated costs and the impacts of these changes on the pollock fishery are discussed in the RIR.

2.1 Alternative 1: Status Quo (No Action)

Alternative 1 retains the current program of Chum Salmon Savings Area (SSA) closures in the Bering Sea triggered by separate non-Community Development Quota (non-CDQ) and CDQ non-Chinook salmon PSC limits, along with the exemption to these closures by pollock vessels participating in a Rolling Hot Spot intercooperative agreement (RHS ICA) approved by NMFS. The RHS ICA regulations were implemented in 2007 through Amendment 84 to the BSAI FMP. The regulations were revised in 2011 to remove those provisions of the ICA that were for Chinook bycatch management given the new program in place under Amendment 91. Closure of the Chum SSA is designed to reduce the total amount of chum incidentally caught by closing areas with historically high levels of salmon bycatch. The RHS ICA operates in lieu of regulatory closures of the Chum SSA and requires industry to identify and close areas of high salmon bycatch and move to other areas. Only vessels directed fishing for pollock are subject to the Chum SSA closure and ICA regulations. The ICA for 2011 and the list of vessels and CDQ groups participating in it are appended to this document (Appendix 2).

2.1.1 Chum Salmon Savings Area

Alternative 1 would keep the existing Chum SSA closures in effect (Figure 2-1). The Chum Salmon Savings Area was established in 1994 by emergency rule, and then formalized in the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP) in 1995 under Amendment 35 (ADF&G 1995) This area is closed to all trawling from August 1 through August 31. Additionally, if 42,000 non-Chinook salmon are caught in the Catcher Vessel Operational Area (CVOA) during the period August 15 through October 14, the area remains closed 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 PSC limit. (Figure 2-1).

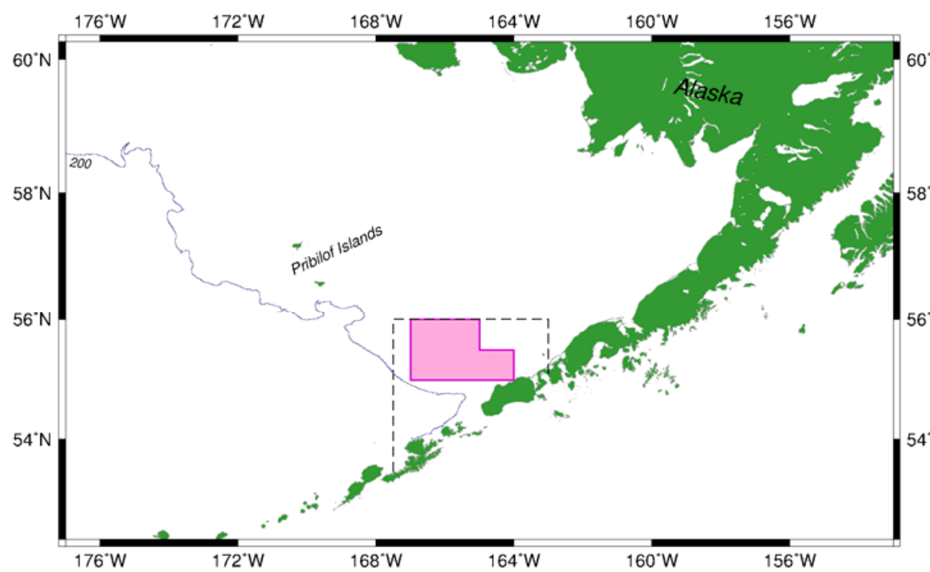


Figure 2-1 Chum Salmon Savings Area (CSSA), shaded and Catcher Vessel Operational Area (CVOA), dotted line.

2.1.2 PSC limits for the CDQ Program

Under the status quo, the CDQ Program receives an annual allocation of 10.7 percent of the Bering Sea non-Chinook salmon PSC limits as a prohibited species quota (PSQ) reserve. The non-Chinook PSQ reserve is 4,494 salmon annually and the remaining 37,506 non-Chinook salmon make up the PSC limit for the non-CDQ pollock fisheries. NMFS further allocates the PSQ reserves among the six CDQ groups based on percentage allocations approved by NMFS on August 8, 2005. More information about the CDQ allocations is in a *Federal Register* notice published on August 31, 2006 (71 FR 51804). For non-Chinook salmon, the percentage allocations of the PSQ reserve among the CDQ groups are as follows:

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

Unless exempted because of participation in the RHS ICA, a CDQ group is prohibited from directed fishing for pollock in the Chum SSA when that group's non-Chinook salmon PSQ is reached. NMFS does not issue fishery closures through rulemaking for the CDQ groups. All CDQ groups are participating in the RHS ICA approved in 2011, so they currently are exempt from closure of the Chum SSA.

2.1.3 Rolling Hotspot System Intercooperative Agreement

Regulations implemented under Amendment 84 to the BSAI FMP exempt vessels directed fishing for pollock from closures of both the Chum and Chinook Salmon Savings Areas if they participate in an RHS ICA approved by NMFS (NPFMC 2005). The fleet voluntarily started the RHS program in 2001 for chum salmon and in 2002 for Chinook salmon. The exemption to regulatory area closures for vessels that participated in the RHS was implemented in 2006 and 2007 through an exempted fishing permit. The North Pacific Fishery Management Council (Council) developed Amendment 84 to attempt to resolve the bycatch problem through the American Fisheries Act (AFA) pollock cooperatives. These regulations were implemented in late 2007 and the first RHS ICA approved by NMFS under these regulations was in effect starting in January 2008 (Appendix 2). The ICA was amended for the 2011 season to remove regulations related to the Chinook SSA (and all provisions under the ICA related to Chinook bycatch management) following implementation of Amendment 91.

See section 2.3.7.1 for further explanation of some issues the Council should consider if amending the current ICA regulations under either Alternative 1, 3 or 4.

The RHS provides real-time salmon bycatch information so that the fleet can avoid areas of high chum salmon bycatch rates. Using a system of base bycatch rate, the ICA assigns vessels to certain tiers, based on bycatch rates relative to the base rate, and implements area closures for vessels in certain tiers. Monitoring and enforcement are carried out through private contractual arrangements. Parties to the current RHS ICA include the AFA cooperatives and the CDQ groups. In addition, the ICA must identify a third-party salmon bycatch data manager (an "entity retained to facilitation vessel bycatch avoidance behavior and information sharing") and "at least one third party group," which could include "any organizations representing western Alaska who depend on non-Chinook salmon and have an interested in non-Chinook salmon bycatch regulation but do not directly fish in a groundfish fishery" (§ 679.21(g). All vessels and CDQ groups that are participating in the Bering Sea pollock fishery in 2012, except the *Ocean Peace*, participate in the currently approved RHS ICA. Under Amendment 84 and based on the structure of the voluntary RHS ICA in effect prior to Amendment 84, the ICA allows participation by only AFA cooperatives or CDQ groups. Although the regulations at § 679.21(g) do not specifically prohibit participation by individual vessel owners, the fact that the "participants" paragraph of the regulations specifically refer only to AFA cooperatives and CDQ groups implies that individual vessel owners may not be parties to an ICA. The fact that the *Ocean Peace* is not a member of an AFA cooperative may explain why it is not a party to the currently approved ICA.

Federal regulations require the ICA to describe measures that parties to the agreement will take to monitor salmon bycatch and redirect fishing effort away from areas in which salmon bycatch rates are relatively high. It also must include intra-cooperative enforcement measures and various other regulatory conditions. The ICA data manager monitors salmon bycatch in the pollock fisheries and announces area closures for areas with relatively high salmon bycatch rates. Federal regulations describe the process through which NMFS reviews a proposed ICA and approves those that contain the required provisions. However, once approved, NMFS does not independently monitor whether the industry operates under the provisions of its ICA. The efficacy of closures and bycatch reduction measures are reported to the Council annually and the Council, with input from the public, determines whether the RHS ICA is continuing to meet its goals for minimizing or reducing chum salmon bycatch.

Many modifications have been made to the ICAs for operation under the RHS program since it was initially approved for exemption to SSAs under Amendment 84. A description of the structure of the program is provided in Sections 2.1.2.1 through 2.1.2.5 below. Details within each section note where changes to the ICA have occurred since 2006 (the voluntary agreement in place prior to that in regulation under Amendment 84).

The ICA is structured based upon a cooperatives' bycatch rate as compared with a pre-determined "Base Rate." Once the Base Rate is determined (see Section 2.1.2.1), all provisions for fleet behavior, closures and enforcement are based upon the relation of the cooperative's rate to the Base Rate. Tier assignments (Section 2.1.2.2) are calculated from the cooperatives' proportional bycatch rate to the Base Rate with higher tiers corresponding to higher bycatch rates. These tiers then determine how access to specific areas will be determined following designation of "hot spot" closures. These areas are then to be avoided by cooperatives in higher tiers.

2.1.3.1 Base Rate: calculation

The structure of the ICA is based upon cooperatives' bycatch rates in comparison with a calculated Base Rate established prior to the start of the season. The Base Rate (BR) is initially established as 0.19 (from June 10th to July 1st) in chum/mt of pollock harvest. Prior to the 2006 ICA, the BR was a season fixed rate of 0.062. This was based upon a roughly 80 percent of the 2003 season average and was established such that no unnecessary closures would be enacted in periods of low abundance.[8] Beginning July 1st the chum BR is subject to a weekly in-season adjustment each Friday (announced on Thursday) based on a 3-week rolling average of the fleet's overall chum bycatch rate.

2.1.3.2 Tier assignment based upon Base Rate

Once the Base Rate is established, cooperatives are placed into "tiers" based upon their percentage performance with respect to the base rate. Tier status is determined by a coop's "rolling two week" average bycatch rate. Closures are determined by Sea State based upon spatial information on "hot spot" bycatch areas.

Tier Assignment rates

i. Tier 1 – cooperatives with bycatch rates less than 75% of Base Rate.
ii. Tier 2 – cooperatives with bycatch rates equal to or greater than 75% of the Base Rate and equal to or less than 125% of the Base Rate.
iii. Tier 3 – cooperatives with bycatch rates greater than 125% of the Base Rate.

2.1.3.3 Impacts of assignment to tier

Cooperatives are subject to savings closures based upon their tier assignments. Cooperatives assigned to Tier 1 are not constrained by savings closures. Cooperatives assigned to Tier 2 are subject to savings closures for 4 days: Friday at 6:00 pm to Tuesday at 6:00 pm. Cooperatives assigned to Tier 3 are subject to savings closures for 7 days: Friday at 6:00 pm to the following Friday at 6:00 pm.

Closure areas are rolling and are determined by Sea State based upon the bycatch rate within specified areas. For B season, closures are determined according to the following criteria:

1. Savings Closures are based on the chum salmon bycatch and pollock harvest for the 4- to 7-day period, depending on data quality, immediately preceding each closure announcement.

[8] A one-time inseason adjustment used to occur on September 1. This adjustment recalculated the Base Rate according to the average bycatch by members over the previous 3-week period (August 10 through 31).

2. Chum salmon bycatch in an area must exceed the chum salmon Base Rate in order for the area to be eligible for a Savings Closure.
3. Pollock harvest in a potential Savings Closure area must be a minimum of 2 percent of the total fleet pollock harvest for the same time period in order to be eligible as a Savings Closure.
4. Current Savings Closures are exempt from the 2 percent minimum harvest rule described in item 3, above, and may continue as a Savings Closure if surrounding bycatch conditions indicate there has likely been no change in bycatch conditions for the area.
5. The Bering Sea will be managed as two regions during the B season: a region east of 168° W. longitude (the Eastern Region) and a region west of 168° W. longitude (the Western Region).
6. Total Savings Closure area.
    i. Chum salmon
        a. The Eastern Region Savings Closures may cover up to 3,000 square miles. Note this was increased from 1,000 square miles prior to Amendment 84.
        b. The Western Region Savings Closures may cover up to 1,000 square miles.
7. There may be up to two Savings Closure areas at any one time within each region.
8. Closure areas will be described by a series of latitude and longitude coordinates and will be shaped as Sea State deems appropriate.
9. Sea State also provides additional non-binding hot-spot avoidance notices, outside of the savings closures, to the cooperatives as they occur throughout the season

One change from the previous ICA inclusive of Chinook bycatch management is the prioritization of Chinook closures over chum closures in the B season. Previously, within a single region Savings Closures must be either a chum closure or a Chinook closure, but not both. In the event Base Rates for both chum and Chinook are exceeded within a region during a week, the Savings Closure within that region was a Chinook closure. This was due to the elevated conservation concerns with respect to western Alaskan Chinook stocks. In those cases, Sea State issued a non-binding avoidance recommendation for the area of high chum bycatch. This prioritization was discontinued following implementation of Amendment 91 Chinook PSC management program thus is not part of the ICA from 2011 on.

2.1.3.4 "Vessel Performance Lists"

Another part of the ICA that has also been discontinued since 2011 is the "Vessel Performance Lists" (formerly called "Dirty Twenty Lists"). These vessel lists are published and made available to all members and include the 20 vessels with the highest chum (and previously Chinook) bycatch rates over the Base Rate. Prior to Amendment 84 this list reported the 20 vessels with the highest bycatch rate in excess of the Tier 1 rate. Lists are published by highest rate by week, highest rate for the past 2 weeks, and highest rates for the season-to-date. Only vessels with bycatch rates over the base rate appear on the list. Only vessels with more than 500 mt of groundfish catch are included in the season-to-date list. The season-to-date list was based on appearances on the weekly list. Accumulative points are assigned to vessels as they appear on the weekly list. Vessels in the number 1 slot on the weekly list receive 20 points, those in the number 2 slot receive 19 points and so on. The vessel's points are totaled each week, and the vessels with the 20 highest scores appear on the seasonal list. A vessel must have harvested over 500 mt of pollock before being eligible for the seasonal list. Previously this was calculated as the vessel's number of appearances on the weekly list divided by the number of weeks fished in the B season.

2.1.3.5 RHS ICA monitoring

Monitoring and enforcement of the bycatch agreement is done by Sea State using the Base Rate as a trigger for Savings Area closures and determining the Tier Assignment of the vessel. Prior to Amendment

84 there was no enforcement monitoring by Sea State and enforcement was left to the individual cooperatives. The Vessel Monitoring System (VMS) is the main tool for monitoring and enforcement. There are VMS requirements and fines for not complying. See section 5.f of the revised ICA for a more detailed description of the RHS ICA monitoring considerations.

Penalties for savings closure violations are placed in a bank account designed for holding funds which are then used to fund research at the discretion of the cooperatives. Penalty money collected under the agreement is intended to be used in salmon stock identification research. To date the violation funds have been used to fund the Geiger-Pella project on sampling protocol (Geiger and Pella, 2009). The violation fund put in $25,000 and Alaska Department of Fish & Game put in the remainder. In 2010, $47,602 was given to the University of Alaska (Tony Gharrett) as matching funds with Alaska Sustainable Salmon Fund money for a project entitled "Shared Chum Salmon Baseline Development Project." The remainder of the violation funds are awaiting an applicable project and have not yet been allocated.

A list of fines collected is contained in Table 2-1. The first violations occurred in 2005 before the exempted fishing permit seasons and the implementation of Amendment 84. At that time the penalty for the first violation by a vessel in a year was 50 percent of the ex-vessel value of the pollock caught in the violating tow. Beginning in 2006 (the EFP and Amendment 84 years), first violations in a year were set at $10,000, second violations were set at $15,000, and the third and subsequent violations in a year were set at $20,000. The *Northern Hawk* violation was a double-violation as the captain made two tows before he realized he was inside the closure area. There is currently a pending violation for the *Hazel Lorraine* from the 2010 B season. Additional information on 2011 B-season violations will be available in 2012 (J. Gruver, United Catcher Boats, pers. comm).

Table 2-1. Enforcement violation fines incurred under the Rolling Hot Spot/ICA from 2005 – 2009

Year	Coop.	Date	Vessel	Amount
2005.				
	Akutan	7/19/2005	Royal American	$1,700.00
	Northern Victor	7/18/2005	Storm Petrel	$2,094.30
			Annual Total	$3,794.30
2006				
	Akutan	10/20/2006	Golden Dawn	$10,000.00
	Akutan	9/30/2006	Royal American	$10,000.00
	Akutan	10/8/2006	Bristol Explorer	$10,000.00
	Akutan	10/18/2006	Arctic Explorer	$10,000.00
			Annual Total	$40,000.00
2007				
	Akutan	1/31/2007	Hazel Lorraine	$10,000.00
	Arctic	10/8/2007	Ocean Explorer	$10,000.00
	PCC	2/16/2007	Northern Hawk	$25,000.00
	UniSea	9/11/2007	Nordic Star	$10,000.00
	Westward	9/11/2007	Pacific Prince	$10,000.00
			Annual Total	$65,000.00
2009				
	Akutan	11/2/2009	Predator	$10,000.00
			Annual Total	$10,000.00
			Total Enforcement Fines:	**$118,794.30**

2.1.3.6 Comparison of Penalties under MSA and RHS ICA program

Per the Council's request in June 2011, a comparison was made between penalties imposed under a private contractual agreement such as the ICA and those imposed under the Magnuson Stevens Fishery Conservation and Management Act (MSA). The following was prepared by NOAA General Counsel to provide additional information to the Council on these differences.

Under the MSA, Civil Penalties and Permit Sanctions, 16 USC 1858, the Secretary of Commerce has the authority to impose penalties up to $140,000.[9] Generally, NOAA assesses penalties for violations of the MSA in accordance with NOAA's "Policy for the Assessment of Civil Administrative Penalties and Permit Sanctions" (Penalty Policy).[10] The Policy utilizes the statutory factors identified by the MSA and other statues commonly enforced by NOAA to create a system for determining appropriate penalties.[11] Those factors used are: the nature, circumstances, extent and gravity of the alleged violation; the alleged violator's degree of culpability; the alleged violator's history of prior offenses; and the alleged violator's ability to pay the penalty.[12] The Penalty Policy uses a matrix method to identify the initial base penalty, to which adjustments may be made depending on application of the adjustment factors: History of Compliance; Commercial vs. Recreational Activity; Activity after Violation/Cooperation; and Proceeds of the Unlawful Activity and Any additional Economic Benefit.[13]

Under the current Penalty Policy, the Magnuson-Stevens Act Schedule for Offense Level Guidance[14] closed area violations are classified as a Level III Offense under the penalty matrix for the Magnuson-Stevens Act (MSA)[15]. The second axis of the penalty matrix in the Penalty Policy focuses on the degree of mental culpability of the alleged violator and provides four levels of culpability: intentional, reckless, negligent, and unintentional. Thus, the matrix provides the following for a Level III first offense: [16]

Gravity Offense Level	Level of Culpability			
	Unintentional	Negligent	Reckless	Intentional
III	$5,000-$10,000	$10,000-$15,000	$15,000-$20,000	$20,000-$40,000

Generally, under the MSA penalty matrix, the initial base penalty for a closed area offense would be set at the midpoint of the penalty range in the appropriate matrix box corresponding with the culpability of the alleged violator.[17]

In addition to the monetary penalties authorized pursuant to the MSA, seizure and forfeiture of the ex-vessel value of all fish unlawfully harvested in the closed area is consistent with NOAA's enforcement

[9] Magnuson Stevens Fishery Conservation and Management Act, 16 USC 1858(a); For violations that occur after Dec. 11, 2008, the maximum civil penalty for each violation is $140,000. 73 Fed.Reg. 75321 (Dec. 11. 2008).
[10] The Penalty Policy is published at 76 Fed.Reg. 20959 (Apr. 14, 2011).
[11] See Penalty Policy, p. 3.
[12] Id. See, also, NOAA's civil procedure regulations at 15 CFR 904.108(a).
[13] See Penalty Policy, pp. 8-9.
[14] See Appendix 3 of the Penalty Policy.
[15] See Appendix 2 of the Penalty Policy.
[16] See Penalty Policy, p. 25
[17] See Penalty Policy, p. 7, Section V.

policy that forfeiture of the illegal catch "is considered in most cases as only the initial step in remedying a violation by removing the ill-gotten gains of the offense." See, 50 CFR 600.740(B).

When applying the Penalty Policy in a closed area violation case where the evidence shows, for example, that the violation arose out of the negligence of the operator, the initial base penalty amount would likely be $12,500 (mid-point of the box corresponding to negligent culpability), plus forfeiture of the value of the catch harvested unlawfully from the closed area. If the evidence showed that a violation was unintentional, the initial base penalty in accordance with the MSA penalty matrix would be $7,500. On the other hand, if the evidence showed that a violation was intentional, then the initial base penalty amount could rise to $30,000. In addition, as explained above, any adjustment(s) to the penalty based upon the alleged violator's cooperation or history of prior offenses would be made after establishing the initial base penalty.

It is important to note that if the Agency's assessed penalty is challenged in the course of an enforcement action, the administrative law judge hearing that matter is not bound by the penalty amount proposed by the Agency, and the administrative law judge may increase or decrease the amount in his or her penalty assessment. It is also important to note that the Agency has the authority to settle any particular case which could include some reduction in the penalty amount actually paid.[18]

John Gruver provided some data regarding Cooperative enforcement of the Rolling Hotspot program, including fines that have been assessed against vessels from 2005 through 2009. However, there are insufficient data to determine how the facts in any particular case would or could have been considered in an Agency closed area enforcement action. Nonetheless, from the information provided by Mr. Gruver, it appears that the current Cooperative policy of penalizing a first tow at $10,000, and a second tow at $15,000, appears to be different from NOAA's penalty policy in a number of ways:

A. the value of the fish unlawfully harvested in the closed area are not seized or otherwise included in the monetary penalty; and
B. the statutory factors required to be considered by the Secretary of Commerce for assessing a penalty are not considered in the Cooperative's internal enforcement action. This is particularly evident with regard to consideration of culpability, since the Cooperative imposes a flat penalty depending upon the number of tows in the closure area in a year;[19]

The Fine Summary (in section 2.1.3.5) also does not explain whether the Cooperative's penalties take into account prior offenses by the vessel owner or manager. Specifically, although no single vessel has apparently been subjected to penalties in two years, it appears that the cooperative Akutan Catcher Vessel Association has numerous instances where one of its vessels incurred a fine for fishing in a closure area. The fines against these vessels do not seem to be affected by their association with Akutan Catcher Vessel Association. This is different than in the context of an Agency enforcement action where the Agency has the discretion to hold the vessel owner, vessel manager, and the cooperative, jointly responsible for the actions of the operator of a vessel.

2.1.3.7 Annual Performance Review

The inter-cooperative produces an annual report to the Council which contains the following:

1. Number of salmon taken by species and season.
2. Estimate of number of salmon avoided as demonstrated by the movement of fishing effort away from salmon hot-spots.

[18] See 16 USC 1858(e).
[19] The fine amount for the first tow in a closure area in a year is $10,000, $15,000 for the second tow, and $20,000 for the third and each additional tows in the closure area.

3. A compliance/enforcement report which will include the results of an internal compliance audit and an external compliance audit if one has been done.
4. List of each vessel's number of appearances on the weekly vessel performance lists (note this is a requirement of the AFA coop reports).
5. Acknowledgement that the Agreement term has been extended for another year (maintaining the 3-year lifespan) and report of any changes to the Agreement that were made at the time of the renewal.

An annual third party audit is also conducted to ensure compliance (or report on non-compliance) with the provisions of the ICA. The third party audit is made available to the public and the Council in conjunction with the annual performance review.

2.1.4 Chinook Salmon Bycatch Management Measures under Amendment 91

The Council took final action on Amendment 91, Chinook salmon bycatch management measures in the Bering Sea pollock fishery in April 2009. NMFS approved regulations implementing Amendment 91 on August 30, 2010 (72 FR 53026), and the fishery has been operating under the requirements since January 2011. Amendment 91 established two Chinook salmon PSC limits (60,000 Chinook salmon and 47,591 Chinook salmon) for the Bering Sea pollock fishery. For each PSC limit, NMFS issues A season and B season Chinook salmon PSC allocations to the catcher/ processor sector, the mothership sector, the inshore cooperatives, and the CDQ groups. When a PSC allocation is reached, the affected sector, inshore cooperative, or CDQ group is required to stop fishing for pollock for the remainder of the season even if its pollock allocation had not been fully harvested.

NMFS issues transferable allocations of the 60,000 Chinook salmon PSC limit to those sectors that participate in an incentive plan agreement (IPA) and remain in compliance with the performance standard. Sector and cooperative allocations would be reduced if members of the sector or cooperative decided not to participate in an IPA. Vessels and CDQ groups that do not participate in an IPA fish under a restricted opt-out allocation of Chinook salmon. If a whole sector does not participate in an IPA, all members of that sector would fish under the opt-out allocation.

The IPA component is an innovative approach for fishery participants to design industry agreements with incentives for each vessel to avoid Chinook salmon bycatch at all times and thus reduce bycatch below the PSC limits. To ensure participants develop effective IPAs, the final rule required that participants submit annual reports to the Council that evaluate whether the IPA is effective at providing incentives for vessels to avoid Chinook salmon at all times while fishing for pollock. The sector-level performance standard ensures that the IPA is effective and that sectors cannot fully harvest the Chinook salmon PSC allocations under the 60,000 Chinook salmon PSC limit in most years. Each year, each sector is issued an annual threshold amount that represents that sector's portion of 47,591 Chinook salmon. For a sector to continue to receive Chinook salmon PSC allocations under the 60,000 Chinook salmon PSC limit, that sector must not exceed its annual threshold amount three times within 7 consecutive years. If a sector fails this performance standard, it will permanently be allocated a portion of the 47,591 Chinook salmon PSC limit. Under Amendment 91, NMFS would issue transferable allocations of the 47,591 Chinook salmon PSC limit to all sectors, cooperatives, and CDQ groups if no IPA is approved, or to the sectors that exceed the performance standard.

<u>Transferability:</u> Transferability of PSC allocations was included in Amendment 91 to mitigate the variation in the encounter rates of Chinook salmon bycatch among sectors, CDQ groups, and cooperatives in a given season by allowing eligible participants to obtain a larger portion of the PSC limit in order to harvest their pollock allocation or to transfer surplus allocation to other entities. Entities that receive transferable salmon bycatch allocations have to be created by a contract among the group of eligible AFA participants in that sector. Transferable allocations must be issued to an entity that represents all members

of the group eligible to receive the transferable allocation. The entity performs the following functions with NMFS:

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

The entities that are recognized by NMFS and receive transferable allocation of Chinook under Amendment 91 are:

- The seven inshore cooperatives that are entities recognized by NMFS through the pollock permitting process. They file contracts with NMFS and are issued permits for specific amounts of pollock. 50 CFR 679.7(k)(5)(ii) prohibits an inshore cooperative from exceeding its annual allocation of pollock. These entities also receive a transferable allocation of Chinook salmon.
- The six CDQ groups that are entities recognized by NMFS to receive groundfish, halibut, crab, and PSQ reserves. 50 CFR 679.7(d)(5) prohibits a CDQ group from exceeding its groundfish, crab, halibut PSC, and transferable Chinook salmon bycatch allocations.
- The CP Salmon Cooperative representing the AFA catcher/processor sector, which includes all members of the Pollock Conservation Cooperative (PCC), the seven catcher vessels named in the AFA, and the catcher/processor *Ocean Peace*.
- The Mothership Fleet Cooperative representing the AFA mothership sector, which includes the catcher vessels authorized under the AFA to deliver to the motherships named in the AFA (*Excellence*, *Ocean Phoenix*, and *Golden Alaska*).

Transferable allocations of Chinook salmon PSC were implemented under Amendment 91, and since the entities involved in the Chinook salmon PSC allocations are impacted by the current non-Chinook salmon actions a brief description is provided below. Further details of the Chinook salmon allocations are found in the Final Bering Sea Chinook Salmon Bycatch Management EIS/RIR.[20]

NMFS only issues transferable allocations of Chinook salmon PSC limit to those sectors that participate in an IPA and remain in compliance with the performance standard. Sector and cooperative allocations are reduced if members of the sector or cooperative decide not to participate in an IPA. Vessels and CDQ groups that do not participate in an IPA fish under a restricted opt-out allocation of Chinook salmon. If a whole sector does not participate in an IPA, all members of that sector fish under the opt-out allocation.

NMFS issues Chinook salmon PSC allocations to the catcher/processor sector, the mothership sector, the seven inshore cooperatives, and the six CDQ groups. Separate allocations are issued for the A season and the B season. Thus there are 15 different Chinook salmon bycatch accounts each season. Separate allocations are made for the A season and the B season for a total of up to 30 transferable bycatch allocation accounts.

Transfers are requests to NMFS from holders of Chinook salmon PSC allocations to move a specific amount of a Chinook salmon PSC from a transferor's (sender's) account to a transferee's (receiver's) account. NMFS's approval is required for any transfer. Chinook salmon remaining in an entity's account from the A season can be used in the B season (''rollover'') but an entity can only transfer PSC allocations to another entity within a season. An entity can also receive transfers of Chinook salmon bycatch to cover overages (''post-delivery transfers'').

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

Under Amendment 91, requests for transfers may be submitted either electronically or non-electronically through a form available on the NMFS Alaska Region Web site (http:// alaskafisheries.noaa.gov/). The catch accounting system is programmed with an online front-end application that reviews the transferor's catch account during a transfer request to ensure sufficient Chinook salmon is available to transfer and, if it is, to make that transfer effective immediately.

IPAs were submitted and approved for all sectors for the 2011 fishing year. Thus NMFS allocated sector and seasonal proportions of the 60,000 Chinook cap in 2011.

Chinook salmon allocations remaining from the A season can be used in the B season (''rollover''). Entities can transfer PSC allocations within a season and can also receive transfers of Chinook salmon PSC to cover overages (''post-delivery transfers'').

Increased observer coverage and monitoring requirements: The transferable hard caps implemented under Amendment 91 placed new constraints on the Bering Sea pollock fishery. Under this program, each entity (the catcher/processor sector, the mothership sector, each inshore cooperative, and each CDQ group)) that receives a transferable Chinook salmon bycatch allocation is prohibited from exceeding that allocation. Therefore, the Chinook bycatch limits, if reached, could prevent the full harvest of a pollock allocation to the AFA sectors, inshore cooperatives, or CDQ groups. Amendment 91 significantly increased the economic incentives to under report or misreport the amount of Chinook salmon bycatch or to discard or hide Chinook salmon before they can be counted by an observer. Thus, the monitoring requirements in the Bering Sea pollock fishery changed significantly in 2011 to enable Chinook salmon bycatch accounting.

While monitoring and enforcement provisions were put in place specifically to account for Chinook salmon, the methods are also applied to non-Chinook salmon. The monitoring of bycatch of all species of salmon is accomplished through: (1) requirements for 100 percent observer coverage for all vessels and processing plants; (2) salmon retention requirements; (3) specific areas to store and count all salmon, regardless of species; (4) video monitoring on at-sea processors; and (5) electronic reporting of salmon by species by haul (for catcher/processors) or delivery (for motherships and shoreside processors). Full retention of all salmon regardless of species is required because it is difficult to differentiate Chinook salmon from other species of salmon without direct identification by the observer. Therefore, although the monitoring was put into place to account for Chinook salmon, all species of salmon are counted using the same methods. Further details about the monitoring provisions implemented under Amendment 91 can be found in the Final Bering Sea Chinook Salmon Bycatch Management EIS/RIR.[21] Since the implementation of Amendment 91, NMFS has found several issues that effect the observers' ability to ensure all species of salmon are counted. Therefore, NMFS recommends changes to the Amendment 91 requirements under all alternatives including the no action alternative. The details of these changes are discussed later in this chapter at 2.5.

Catch Accounting: With the implementation of Amendment 91, the rate-based estimation procedure for salmon caught in the Bering Sea pollock fishery was replaced by a census of salmon. This census is used in the Catch Accounting System (CAS) to enumerate all species of salmon, including non-Chinook salmon species, caught by all sectors in the Bering Sea pollock fishery. The monitoring and observer requirements described in the previous section ensure that information about vessel-specific incidental salmon catch is always obtained and represents all salmon caught during a fishing trip.

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

Amendment 91 removed from regulations the 29,000 Chinook salmon PSC limit in the Bering Sea, the Chinook Salmon Savings Areas in the Bering Sea, exemption from Chinook Salmon Savings Area closures for participants in the RHS ICA, and Chinook salmon as a component of the RHS ICA. Amendment 91 did not change any regulations affecting the management of Chinook salmon in the Aleutian Islands or non-Chinook salmon in the BSAI.

Details of the Chinook Incentive Plan Agreements (IPAs) implemented in 2011 and 2012

All of the participants in the Bering Sea pollock fishery are subject to one of the IPA agreements. There are three IPA agreements currently in place:

- The Inshore Chinook Salmon Savings Incentive Plan Agreement
- The Mothership Salmon Savings Incentive Plan Agreement
- The Catcher Processor 'Chinook Salmon Bycatch Reduction Incentive Plan and Agreement.'

As well as generally adhering to the requirements of Amendment 91, the three agreements share a number of characteristics. The inshore and mothership sector are both based on the same general 'Salmon savings incentive plan' (SSIP) model, so they share additional features. Below the common features of the three plans are listed, then the features common to the mothership and inshore plans are described, and finally important specific features of each plan are noted.[22]

Features common to all current IPAs

In addition to generally adhering to the Amendment 91 requirements described above, all three agreements have the following characteristics:

- The Fixed A-Season Chinook Salmon Conservation Area (CSCA) continues from the closure first imposed in 2008.
- A rolling hotspot (RHS) program exists for each sector, although details vary. Closures are imposed in "core areas" where bycatch has traditionally occurred to avoid closing areas that are actually low-bycatch relative to historically fished areas. This feature is designed to avoid closing areas that the fleet may move to in order to avoid higher-bycatch areas.
- Large fees apply for any fishing violations inside of the RHS closure boundaries.
- The base rate of the RHS programs is 0.035 Chinook/MT pollock, though this adjusts during each season.
- VMS and observer data sharing are both required
- A small "buffer" is taken from each entity allocation and kept in reserve to ensure that the entity does not exceed its overall allocation.

Features common to the Inshore and Mothership Salmon Savings Incentive Plan Agreements

- Vessels can earn "salmon credits" in some years to use in higher bycatch years, subject to the 60,000 Chinook overall limit.
- Proportional pollock and share of salmon can be freely moved ("Paired transfers") but there are taxes and restrictions on other transfers. The tax declines as the sector's bycatch total approaches the cap.
- There is a "SSIP B" that would operate if the sector exceeds its share of the 47,591 standard in 2 of 6 years to prevent a third year above this standard.

Features unique to the Inshore Salmon Savings Incentive Plan Agreement

- Vessels earn one salmon credit for 3 saved – expire in 5 years.

[22] This description comes from the amended IPAs that can be found at http://fakr.noaa.gov/sustainablefisheries/bycatch/default.htm

- There is an insurance pool to cover possible vessel allocation overages, where vessels would pay back what's used plus a penalty if the vessel exceeds its holdings. If vessel was behaving conservatively, they are "qualified" users and pay a 50% assessment on top of repayment. If "unqualified," pay 200%.
- In periods of low salmon encounters (< 25% of the sector's share of the 47,591 Annual Threshold Amount), there's a rolling hotspot closure (RHC) program. When aggregate bycatch increases during a year, the closures ("Chinook Savings Areas") go away because the threat of the cap already provides an avoidance incentive. Other RHC program details include:
    - Base rate calculated weekly on 2-week moving average (note this was a correction in the amendment); beginning with Jan 20-29 period
    - Vessels > base rate are Tier 2, < base rate = Tier 1. Tier 2 vessels may not fish in the closures for 1 week, while there no restrictions on Tier 1
    - Weekly reports include each vessel's tier status and weekly 3-week rolling average bycatch rate
    - Up to 3 areas can be closed at a time, not to exceed 1000 square miles.
- Because inter-sector transfers do not change the annual threshold limit, there are strict controls on inter-sector transfers.
- "Mop-up" transfers allowed at end of season
- "Hardship transfers" allow salmon and pollock to be sent together without transfer taxes if a boat stops fishing for some reason.

<u>Features unique to the Mothership Salmon Savings Incentive Plan Agreement</u>

- Chinook account is done at the fleet level, but the rewards and punishments are returned to vessels at the end of the season.
- Special rules allow for how vessels may transfer their salmon to other fleets and sectors at the end of the season to provide opportunities to trade Chinook when this can occur without exceeding the annual use limit.
- Fleets earn one salmon credit for 2.29 salmon saved, and the credits expire in 3 years (first-in, first-out). Credits cannot be transferred between fleets or sectors.
- The rolling hotspot program is called a rolling hotspot closure (RHC) program and functions on a fleet level.
- The RHC program lasts throughout the season.
- Vessels must declare by January 15 to which fleet its pollock will be assigned and its Chinook will be assigned pro-rata.
- Transfers can be made to other fleets, the CP sector, or an inshore cooperative. They cannot use credits in years that they transfer.

<u>Features unique to the Catcher Processor 'Chinook Salmon Bycatch Reduction Incentive Plan and Agreement'</u>

- Three areas in the B season form the "Chinook conservation area" that is closed from October 15-31 if the Chinook base rate is above 0.015 Chinook/MT for September.
- There is full transferability within the sector, without transfer fees.
- There is the need and ability to decide collectively whether or not to exceed the sector's share of 47,591 for 2 of 7 years.
- There are limits on the size and number of RHS closures.
    - 500 sq mile & 2 areas W of 168W
    - 2 areas E of 168W
    - Max 4 areas total, 1500 sq miles total.

- RHS closures put in place for 1-week at the vessel's level compared to the base rate. Under some conditions, closures can be imposed on some vessels with a high aggregate bycatch rate for a second week.

2.2 Alternative 2: Hard Cap

Alternative 2 would establish separate chum salmon PSC caps for the pollock fishery in the B season. When the hard cap is reached, all directed fishing for pollock must cease for either the remainder of the year (Option 1a) or until August 1 (Option 1b). Only those non-Chinook salmon caught by vessels participating in the directed pollock fishery would accrue towards the cap. When the cap is reached, directed fishing for pollock would be prohibited during the applicable time frame.

Alternative 2 contains components, and options for each component, to determine (1) the total hard cap amount and time frame over which the cap is applied, (2) whether and how to allocate the cap to sectors, (3) whether and how salmon bycatch allocations can be transferred among sectors, and (4) whether and how the cap is allocated to and transferred among catcher vessel (CV) cooperatives.

If none of the options under Components 2 through 4 are selected, the Alternative 2 hard cap would apply at the fishery level and would be divided between the CDQ and non-CDQ fisheries. The CDQ Program would receive an allocation of 10.7 percent of a fishery level hard cap. The CDQ Program 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 chum salmon cap. This prohibition would require the CDQ group to stop directed fishing for pollock once its cap was reached because further directed fishing for pollock would likely result in exceeding the cap.

The remaining 89.3 percent of a fishery level hard cap would be apportioned to the non-CDQ sectors (inshore CV sector, offshore CP sector, and mothership sector) combined. The inshore CV sector contains up to seven cooperatives, each composed of multiple fishing vessels associated with a specific inshore processor. There also is a possibility than an inshore open access sector could form, if one or more catcher vessels do not join an inshore cooperative. All bycatch of non-Chinook salmon by any vessel in any of these three AFA sectors would accrue against the fishery level hard cap, and once the cap was reached, NMFS would simultaneously prohibit directed fishing for pollock by all three of these sectors.

Under Alternative 2, existing regulations related to the non-Chinook salmon PSC limit of 42,000 salmon and triggered closures of the Chum SSA in the Bering Sea would be removed from 50 CFR part 679.21.

Per Council direction (June 2010), the impact of implementing specific cap levels for Alternative 2 was analyzed based on a subset of the range of cap levels, as indicated in the tables under each component and option.

2.2.1 Component 1: Setting the Hard Cap

Component 1 would establish the annual hard cap based upon a range of numbers as shown below. Component 1 sets the overall cap; this could be either applied at the pollock fishery level to the CDQ and non-CDQ fisheries (not allocated by sector within the non-CDQ sectors), or may be subdivided by sector (Component 2) and the inshore sector allocation further allocated among the inshore cooperatives (Component 4).

2.2.1.1 Range of numbers for a hard cap

There are two options considered under the establishment of a non-Chinook PSC limit for vessels fishing in the directed pollock fishery. These options differ by whether the cap is established for the entire B season (Option 1a) or for June and July only (Option 1b).

Option 1a: Apply a non-Chinook PSC limit to vessels participating in the directed pollock fishery for the entire B season

Under this option the hard cap (non-Chinook PSC limit) would be established for vessels fishing in the directed pollock fishery according to the range of suboptions as shown below and would be applicable for the entire B season. Once reached, this cap would require all vessels affected by the cap to stop fishing for the remainder of the season.

The range of non-Chinook salmon PSC hard caps considered is shown below. As shown below, the CDQ Program would be allocated 10.7 percent of the fishery level cap with the remainder allocated to the combined non-CDQ fishery.

Range of suboptions for Option 1a cap for non-Chinook with allocations for CDQ Program (10.7%) and remainder for non-CDQ fishery (89.3%)

	Non-Chinook	CDQ	Non-CDQ
i)	**50,000**	5,350	44,650
ii)	75,000	8,025	66,975
iii)	125,000	13,375	111,625
iv)	**200,000**	21,400	178,600
v)	300,000	32,100	267,900
vi)	**353,000**	37,771	315,229

For analytical purposes only, a subset of the cap numbers included in the six suboptions will be used in the impact analysis to assess the impacts of operating under a given hard cap. This subset approximates the upper and lower endpoints of the suboption range, and a midpoint (in **bold** above).

Option 1b: Apply a non-Chinook PSC limit to vessels participating in the directed pollock fishery during June and July

Under this option the hard cap (non-Chinook PSC limit) would be established for vessels fishing in the directed pollock fishery during June and July. Once reached, this cap would require all vessels affected by the cap to stop fishing until August 1.

The range of cap suboptions under Option 1b are shown in the table below. They represent the proportion of non-Chinook PSC caught in June and July relative to the B season total during 2003 through 2011. **Bolded** suboptions represent the subset for the analysis.

Range of suboptions for Option 1b cap for non-Chinook with allocations for CDQ Program (10.7%) and remainder for non-CDQ fishery (89.3%)

	Non-Chinook	CDQ	Non-CDQ
1)	**15,600**	**1,669**	**13,931**
2)	23,400	2,504	20,896
3)	39,000	4,173	34,827
4)	**62,400**	**6,677**	**55,723**
5)	93,600	10,015	83,585
6)	**110,136**	**11,785**	**98,351**

The cap numbers initially represented a range of rounded historical averages over different 3-, 5- and 10-year time periods ranging from 1997 through 2006. The Council chose to modify these averages based both on more recent year averages as well as downward adjustments that the Council made in their December 2009 motion (for complete Council motions from December 2009 and June 2010 see Appendix 1 to Chapter 2). For comparison, Table 2-2 shows the resulting change in these time periods for historical averaging by using the most recent time frame as opposed to averaging only from time frames 2006 and earlier.

Table 2-2. Comparison of historical averages using previous time frame (1997-2006) time periods with more recent (1997-2009) 3-, 5-, and 10-yr averages

Period (current alternative set)	Average (# of salmon)	Period	Average (# of salmon)
2004-2006	484,895	2007-2009	51,629
2002-2006	344,898	2005-2009	233,820
1997-2006	201,195	2000-2009	199,489
1997-2001	57,493		

2.2.2 Component 2: Sector Allocation

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

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

For analytical purposes, a subset of the sector level cap options that provides the greatest contrast will be used for detailed analysis.

2.2.2.1 Option 1: Sector level caps 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 sector; 10% for the mothership sector; and 40% for the offshore CP sector. This results in sector level caps of 45% inshore CV, 9% mothership, and 36% offshore CP.

This option would set the sector level hard caps based on the percentage established for pollock allocations under the AFA. Application of these percentages results in the following range of sector level caps, based upon the range of caps in Component 1, Option 1 (Table 2-3).

2.2.2.2 Options 2-6: Historical average of non-Chinook salmon bycatch by sector and blended adjustment of pro-rata and historical

Under Option 2, sector level caps would be set for each sector based on a range of sector allocation percentages. Table 2-6 summarizes the range of sector allocations resulting from Options 1 through 6 and suboptions under each.

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

i. 3-year (2007-2009)
ii. 5-year (2005-2009)
iii. 10-year (2000-2009)
iv. 14-year (1997-2009)

Option 3) Allocation based on 75% pro-rata and 25% historical

i. 3-year (2007-2009)
ii. 5-year (2005-2009)
iii. 10-year (2000-2009)
iv. 14-year (1997-2009)

Option 4) Allocation based on 50% pro-rata and 50% historical

i. 3-year (2007-2009)
ii. 5-year (2005-2009)
iii. 10-year (2000-2009)
iv. 14-year (1997-2009)

Option 5) Allocation based on 25% pro-rata and 75% historical

i. 3-year (2007-2009)
ii. 5-year (2005-2009)
iii. 10-year (2000-2009)
iv. 14-year (1997-2009)

Option 6) Allocate 10.7% to CDQ, remainder divided 44.77% to Inshore CV, 8.77% to Mothership and 35.76% to Catcher Processors.

Table 2-3. Sector percentage allocations resulting from Options 1 through 6. The allocation included for analytical purposes are shown in **bold**.

Period for Average	Option	% historical: pro-rata	CDQ	Inshore CV	Mothership	Offshore CPs
NA (AFA)	1	0:100	10.0%	45.0%	9.0%	36.0%
2007-2009	2i	100:0	4.4%	75.6%	5.6%	14.4%
	3i	75:25	5.8%	67.9%	6.5%	19.8%
	4i	50:50	7.2%	60.3%	7.3%	25.2%
	5i	25:75	8.6%	52.6%	8.2%	30.6%
2005-2009	**2ii**	**100:0**	**3.4%**	**81.5%**	**4.0%**	**11.1%**
	3ii	75:25	5.0%	72.4%	5.3%	17.3%
	4ii	**50:50**	**6.7%**	**63.3%**	**6.5%**	**23.6%**
	5ii	25:75	8.3%	54.1%	7.8%	29.8%
2000-2009	2iii	100:0	4.4%	76.0%	6.2%	13.4%
	3iii	75:25	5.8%	68.3%	6.9%	19.1%
	4iii	50:50	7.2%	60.5%	7.6%	24.7%
	5iii	25:75	8.6%	52.8%	8.3%	30.4%
1997-2009	2iv	100:0	4.4%	74.2%	7.3%	14.1%
	3iv	75:25	5.8%	66.9%	7.8%	19.5%
	4iv	50:50	7.2%	59.6%	8.2%	25.0%
	5iv	25:75	8.6%	52.3%	8.6%	30.5%
Suboption (10.7% to CDQ)	**6**	**NA**	**10.7%**	**44.77%**	**8.77%**	**35.76%**

For analysis the following range of sector allocations will be examined:

Option	CDQ	Inshore CV	Mothership	CP
2ii (sector allocation 1)	3.4%	81.5%	4.0%	11.1%
4ii (sector allocation 2)	6.7%	63.3%	6.5%	23.6%
Suboption (sector allocation 3)	10.7%	44.77%	8.77%	35.76%

Based on the cap levels noted under Component 1 for analysis, the sector level caps under Component 2, and the cooperative provisions under Component 3 to be analyzed, the following shows the sector level caps to be evaluated in this analysis (Table 2-4). Note that cooperative level caps to the inshore CV sector will be analyzed qualitatively (see Section 2.2.4 for cooperative provisions and allocations).

Table 2-4. Alternative 2 non-Chinook salmon sector level caps for analysis (note sector level numbers refer to options as listed in Table 2-3 above)

Hard cap	Sector allocation	CDQ	CV	MS	CP
	1	1,700	40,750	2,000	5,550
50,000	2	3,350	31,650	3,250	11,800
	3	5,350	22,385	4,385	17,880
200,000	1	6,800	163,000	8,000	22,200
	2	13,400	126,600	13,000	47,200
	3	21,400	89,540	17,540	71,520
	1	12,002	287,695	14,120	39,183
353,000	2	23,651	223,449	22,945	83,308
	3	37,771	158,038	30,958	126,233

2.2.3 Component 3: Sector Transfer

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

If sector level caps under Component 2 are selected, but neither Option 1 (transfers) or Option 2 (reallocations) are selected under Component 3, the sector level cap would not change during the year and NMFS would close directed fishing for pollock through notice in the *Federal Register* once each sector reached its sector level cap. There could be no movement of salmon bycatch hard cap allocations between the catcher/processor, mothership, inshore, or CDQ sectors. The short delay associated with inseason closures would require NMFS to closely monitor pollock catch and salmon bycatch in order to project when a sector might reach its salmon bycatch hard cap. NMFS would use observer counts and the monitoring requirements put into place for Amendment 91 to determine the amount of salmon bycatch made by each sector.

Because the CDQ sector level cap would be allocated to the CDQ groups, the CDQ caps would continue to be managed as they are under status quo, with further allocation of the non-Chinook salmon bycatch cap among the six CDQ groups, transferable allocations within the CDQ Program, and a prohibition against a CDQ group exceeding is salmon bycatch allocation.

2.2.3.1 Option 1: Transferable salmon bycatch caps

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

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

Suboption: Limit transfers to the following: a) 50%, b) 70%, or c) 90% of available salmon bycatch cap.

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

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

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

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

More information about the entities necessary to receive transferable non-Chinook salmon bycatch caps is in Section 2.2.5.

Under Option 1, each CDQ group allocation may be transferred between CDQ groups as well as among other AFA entities. Once sector level salmon bycatch hard caps are allocated to an entity representing an AFA sector or to a CDQ group, each entity receiving a transferable cap would be prohibited from exceeding that cap. NMFS would report any overages of the cap to NOAA Office of Law Enforcement for enforcement action.

A non-Chinook salmon bycatch transfer between different entities in the pollock fishery would require NMFS approval before the transaction could be completed. Per existing agency practice with other fishery programs with transferrable allocations, NMFS would review the transferring entities catch record to ensure sufficient amounts of salmon bycatch hard cap allocation was available to transfer. NMFS has developed the internal processes that allow quota share and allocation holders in various Alaska fisheries to conduct transfers through the NMFS web site. Such a process would be extended to transferable non-Chinook salmon bycatch allocations. The transfer process would be conducted through an online web site that allows entities to log onto a secure NMFS web site and make a salmon bycatch allocation transfer.

2.2.3.2 Option 2: Reallocate unused salmon bycatch to other sectors

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

A "reallocation" is a management action taken by NMFS to move salmon bycatch caps that remain in a season after a sector had stopped directed fishing for pollock to another AFA sector, CDQ sector, or the inshore open access fishery through a notice in the *Federal Register*. Reallocations are an alternative to transferable caps that allow one sector to voluntarily transfer unused salmon bycatch cap amounts to another sector.[23]

Under this option, if a non-CDQ AFA sector has completed harvest of its pollock allocation without reaching its sector level bycatch cap, and sufficient salmon bycatch cap remains to be reallocated, NMFS would reallocate the unused amount of salmon bycatch cap to other AFA sectors, including CDQ groups. Any reallocation of salmon bycatch caps by NMFS would be based on the proportion each sector represented of the total amount of pollock remaining for harvest by all sectors through the end of the season. Successive reallocations would occur as each non-CDQ sector completes harvest of its pollock allocation.

For example, if the catcher/processor sector completed harvest of its pollock allocation, but still had some remaining salmon bycatch hard cap, and if the mothership sector, inshore sector, and CDQ sector had remaining pollock, NMFS would reallocate the catcher/processor sector's remaining non-Chinook salmon allocation to the other pollock sectors. This is portrayed in the following table, in which there is a 1,000 non-Chinook salmon bycatch hard cap allocation remaining in the catcher/processor sector level hard cap (Table 2-5).

Table 2-5. Example of a non-Chinook salmon bycatch sector level cap reallocation to remaining sectors from catcher/processor sector level hard cap

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

Reallocations of non-Chinook salmon bycatch hard caps among AFA sectors could include the CDQ sector as a recipient of reallocations. Any salmon bycatch hard cap reallocated to the CDQ sector during a year would be further allocated among the CDQ groups, based on each group's percentage allocation of salmon bycatch. However, reallocations from the CDQ sector to other AFA sectors are not practicable under the current allocation structure of the CDQ sector. A percentage of the current salmon PSC limits currently are allocated to the CDQ sector. These PSC allocations are then further allocated among the six CDQ groups as transferable salmon PSQ. Therefore, once allocated among the CDQ groups, NMFS could not reallocate salmon bycatch from one or more CDQ groups through a reallocation.

[23] NMFS uses the term "rollover" to mean when a seasonal allocation is underharvested and the remaining amount rolls over to the next season.

Regulatory guidelines would be needed to allow NMFS to reallocate salmon bycatch. For example, the following process could be used for reallocations:

> *If, during a fishing season, the Regional Administrator determines that a non-CDQ AFA sector has completed harvest of its pollock allocation without reaching its sector level hard cap and sufficient salmon bycatch hard cap remains to be reallocated, the Regional Administrator would reallocate the projected unused amount of salmon bycatch hard cap to other AFA sectors (including CDQ), through notification in the Federal Register. Any reallocation of salmon bycatch hard cap by the Regional Administrator would be based on the proportion each sector represents of the total amount of pollock remaining for harvest by all sectors through the end of the season. Successive reallocation actions would occur as each sector completes harvest of its pollock allocation.*

2.2.4 Component 4: Cooperative provisions

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

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

Each year, NMFS issues fishing permits to cooperatives based on the cooperative's permit application, which lists all cooperative member catcher vessels. Fishing in the inshore open access fishery is possible should a vessel leave a cooperative, and the inshore CV pollock allocation allows for an allocation to an inshore open access fishery under these circumstances.

The range of inshore cooperative level caps in this analysis is based on the 2010 pollock allocations, and the options for the range for the inshore CV sector is based on Alternative 2 caps for analysis. All inshore sector CVs have been part of a cooperative since 2005 except two vessels in 2010. However, if this component is selected, regulations would accommodate allocations of the non-Chinook salmon bycatch cap to the inshore open access fishery, if, in the future, a vessel or vessels did not join a cooperative.

Table 2-6. Alternative 2 inshore catcher vessel sector non-Chinook salmon bycatch limits by cooperative based on 2010 pollock allocations.

Hard cap	Sector Allocation	Akutan CV Assoc	Arctic Enterprise	Northern Victor Fleet	Peter Pan Fleet	Unalaska	Unisea Fleet	Westward Fleet	Open access AFA
2010 pollock allocation		32.02%	0.00%	9.38%	2.88%	10.49%	25.95%	18.49%	0.00%
50,000	1	13,050	0	3,822	1,172	4,276	10,576	7,534	0
	2	10,136	0	2,968	910	3,321	8,214	5,851	0
	3	7,169	0	2,099	644	2,349	5,810	4,139	0
200,000	1	52,199	0	15,286	4,688	17,104	42,305	30,135	0
	2	40,542	0	11,873	3,641	13,284	32,858	23,406	0
	3	28,674	0	8,397	2,575	9,395	23,239	16,554	0
353,000	1	92,131	0	26,980	8,274	30,188	74,668	53,189	0
	2	71,557	0	20,955	6,426	23,447	57,994	41,311	0
	3	50,610	0	14,821	4,545	16,583	41,017	29,218	0

While NMFS recognizes inshore cooperatives as entities, the sector as whole is not represented by an entity recognized by NMFS. If Component 4 is not selected, non-Chinook salmon bycatch allocations would not be issued to the inshore cooperatives, as Chinook salmon currently is allocated under Amendment 91. This would require the inshore cooperatives and any catcher vessels not in a cooperative would to create an umbrella entity that represented all participants in the inshore sector. As noted below, creating a new a different entity for allocations of non-Chinook salmon that does not exist for allocations of Chinook salmon would increase the complexity of the salmon bycatch management measures.

2.2.4.1 Cooperative transfer options

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

When a salmon inshore 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 cap amounts from other inshore cooperatives (industry initiated)

Suboption: Limit transfers to the following: a) 50%, b) 70%, or c) 90% of available salmon

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

Sections 206(a) and (b) of the AFA establish the allocation of the TAC of pollock among the different AFA sectors, including the CDQ Program. Section 213(c) allows the Council to supersede some provisions of the AFA under certain circumstances. However, section 213(c) specifically does not allow the Council to supersede the sector allocations of pollock in sections 206(a) and 206(b). Therefore, the

AFA's allocation requirements effectively preclude the transfer of pollock from *one sector to another*. However, the AFA would allow the transfer of pollock among the inshore cooperatives. Such transfers would be subject to the 90 percent processor delivery requirement in section 210(b), which requires that 90 percent of the pollock allocated to an inshore cooperative must be delivered to the inshore processor associated with that cooperative. The AFA specifically requires that this provision be included in the inshore cooperative contracts and NMFS regulations contain this contract requirement in the inshore cooperative permitting requirements at § 679.4(l)(6).

Although not prohibited by the AFA, NMFS regulations currently do not authorize the transfer of pollock among the inshore cooperatives. Thus far, regulations authorizing inter-cooperative transfers of pollock have not been recommended to NMFS by the Council. However, regulations could be amended to allow pollock transfers among inshore cooperatives, subject to the requirement that the inshore cooperative contracts continue to include the 90 percent processor delivery requirement. These regulatory amendments could be made without requiring the Council to supercede requirements of the AFA.

Full transferability of pollock among the inshore cooperatives by superseding the 90 percent processor delivery requirements of subsections 210(b)(1) and (b)(6), could be allowed as long as the findings required in section 213(c)(1) of the AFA are made. To supersede this requirement, the Council would have to provide a rationale that explained why the proposed action mitigated adverse effects on fishery cooperatives and how it took into account all factors affecting the fisheries, including rationale explaining that the action was imposed fairly and equitably, to the extent practicable, among and within the sectors in the pollock fishery.

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

Pollock transfers would require NMFS approval before the transaction could be completed. Upon receipt of a transfer application, NMFS would review a cooperative's catch to ensure its salmon cap was reached and that an adequate amount of pollock was available. The transfer process could be online or using a paper application process.

NMFS prefers online transfers because paper-based transfers increase staff burden, the time required to complete a transfer, and may only be completed during business hours. However online transfer require NMFS to dedicate programming staff (or contractor) to develop, implement, and support an online system. Online accounting of pollock is also dependent on the CAS structure, which is the primary repository for catch data. The online interface would need to allow harvesters and NMFS to check account balances, make and accept transfers of pollock, and allow account balances to be updated based on transferred pollock and inseason reallocations of pollock from the ICA and the Aleutian Islands, should such reallocations occur. The online system would not allow cooperatives to receive transfers of pollock if they do not have any remaining Chinook salmon bycatch allocation. Thus, pollock allocation amounts and associated CAS account structure is dependent on whether salmon bycatch is allocated to the cooperative level and transferability of salmon is allowed. Any changes to the CAS required for salmon allocation transfers would need to interface with pollock transfer accounting.

A summary of the components, options and suboptions of Alternative 2 is contained in Table 2-7.

Table 2-7. Summary of Alternative 2 components, options, and suboptions for analysis.

<table>
<tr><td rowspan="7">Setting the hard cap (Component 1)</td><td rowspan="4">Option 1a: Cap established for B season. Select cap from a range of numbers*</td><td>Non-Chinook total</td><td colspan="2">CDQ</td><td>Non-CDQ</td></tr>
<tr><td>50,000</td><td colspan="2">5,350</td><td>44,650</td></tr>
<tr><td>200,000</td><td colspan="2">21,400</td><td>178,600</td></tr>
<tr><td>353,000</td><td colspan="2">37,771</td><td>315,229</td></tr>
<tr><td rowspan="3">Option 1b: Cap established for June and July. Select cap from a range of numbers*</td><td>15,600</td><td colspan="2">1,669</td><td>13,931</td></tr>
<tr><td>62,400</td><td colspan="2">6,677</td><td>55,723</td></tr>
<tr><td>110,136</td><td colspan="2">11,785</td><td>98,351</td></tr>
<tr><td rowspan="4">Sector allocation (Component 2)*</td><td>Range of sector allocations*</td><td>CDQ</td><td>Inshore CV</td><td>Mothership</td><td>Offshore CP</td></tr>
<tr><td>Option 2ii</td><td>3.4%</td><td>81.5%</td><td>4.0%</td><td>11.1%</td></tr>
<tr><td>Option 4ii</td><td>6.7%</td><td>63.3%</td><td>6.5%</td><td>23.6%</td></tr>
<tr><td>Option 6</td><td>10.7%</td><td>44.77%</td><td>8.77%</td><td>35.76%</td></tr>
<tr><td rowspan="6">Sector transfers and rollovers (Component 3)</td><td colspan="5">No transfers (Component 3 not selected)</td></tr>
<tr><td rowspan="4">Option 1</td><td colspan="4">Caps are transferable among sectors and CDQ groups within a fishing season</td></tr>
<tr><td colspan="2" rowspan="3"><u>Suboption</u>: Maximum amount of transfer limited to:</td><td>a</td><td>50%</td></tr>
<tr><td>b</td><td>70%</td></tr>
<tr><td>c</td><td>90%</td></tr>
<tr><td>Option 2</td><td colspan="4">NMFS rolls over unused salmon PSC to sectors still fishing in a season, based on proportion of pollock remaining to be harvested.</td></tr>
<tr><td rowspan="7">Cooperative Allocation and transfers (Component 4)</td><td>No allocation</td><td colspan="4">Allocation managed at the inshore CV sector level. (Component 4 not selected)</td></tr>
<tr><td>Allocation</td><td colspan="4">Allocate cap to each cooperative based on that cooperative's proportion of pollock allocation.</td></tr>
<tr><td rowspan="5">Option: Cooperative Transfers</td><td>Option 1</td><td colspan="3">Lease pollock among cooperatives in a season or a year</td></tr>
<tr><td>Option 2</td><td colspan="3">Transfer salmon PSC (industry initiated)</td></tr>
<tr><td colspan="2" rowspan="3"><u>Suboption</u> Maximum amount of transfer limited to the following percentage of salmon remaining:</td><td>a</td><td>50%</td></tr>
<tr><td>b</td><td>70%</td></tr>
<tr><td>c</td><td>90%</td></tr>
</table>

*Table reflects subset of numbers for analysis.

2.2.5 Management and Monitoring Under Alternative 2

Alternative 2 would establish a hard cap to limit non-Chinook salmon bycatch in the pollock fishery. When the hard cap is reached all directed fishing for pollock must cease. Only those non-Chinook salmon caught by vessels participating in the directed fishery for pollock would accrue towards the cap, and fishery closures on reaching the hard 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 four AFA sectors including the CDQ sector receive a sector level hard cap with the CDQ sector level hard cap allocated to the individual CDQ groups); and at the cooperative level.

The observer and monitoring requirements currently in place to account for Chinook salmon bycatch under Amendment 91 also enable NMFS to monitor non-Chinook salmon bycatch under a hard cap.
Since the implementation of Amendment 91, NMFS has found several issues that effect the observers' ability to ensure all species of salmon are counted. Therefore, NMFS recommends changes to the Amendment 91 requirements under all alternatives including the no action alternative. The details of these changes are discussed later in this chapter at 2.6.. Catch accounting would rely on the information described for Alternative 1 (status quo) in section 2.1.

As described in the status quo, NMFS currently monitors allocations of Chinook salmon PSC that are allocated to 15 entities, each with two seasonal allocations. ***NMFS strongly recommends that if the Council includes sector and cooperative level allocations of non-Chinook salmon PSC under either Alternative 2 or 3 that those allocations are made to the same sector entities that have been created for allocations of Chinook salmon.*** In other words, the non-Chinook PSC allocations would be made to:

- to the entity representing the catcher/processor sector (currently the CP Salmon Corporation);
- the mothership sector (currently the Mothership Fleet Cooperative);
- the seven inshore cooperatives; and
- the six CDQ groups

Consistent allocation categories for Chinook and non-Chinook salmon would greatly simplify administrative functions for NMFS and the industry. Existing contracts and application to NMFS establishing these entities could be modified to incorporate the responsibility for receiving and managing non-Chinook salmon PSC allocations.

2.3 Alternative 3: Trigger closure with RHS exemption

Alternative 3 would create new boundaries for the Chum Salmon Savings Area. The existing Chum Salmon Savings Area and associated trigger cap would be removed from regulation. The new boundaries would encompass the area of the Bering Sea where historically 80 percent of non-Chinook prohibited species catch occurred from 2003 through 2011 B season (Figure 2-2). The trigger caps that would close this area are described below. The area closure would apply to pollock vessels that are not in an RHS system when total non-Chinook salmon PSC from all vessels (those in an RHS system and those not in an RHS system) reaches the trigger cap level. The trigger cap would be allocated between the CDQ and non-CDQ pollock fisheries, as currently is done under status quo.

Component 1 of this alternative sets the trigger PSC cap level for this large scale closure. PSC from all vessels will accrue towards the cap level selected. However if the cap level is reached, the triggered closure would not apply to participants in the RHS program.

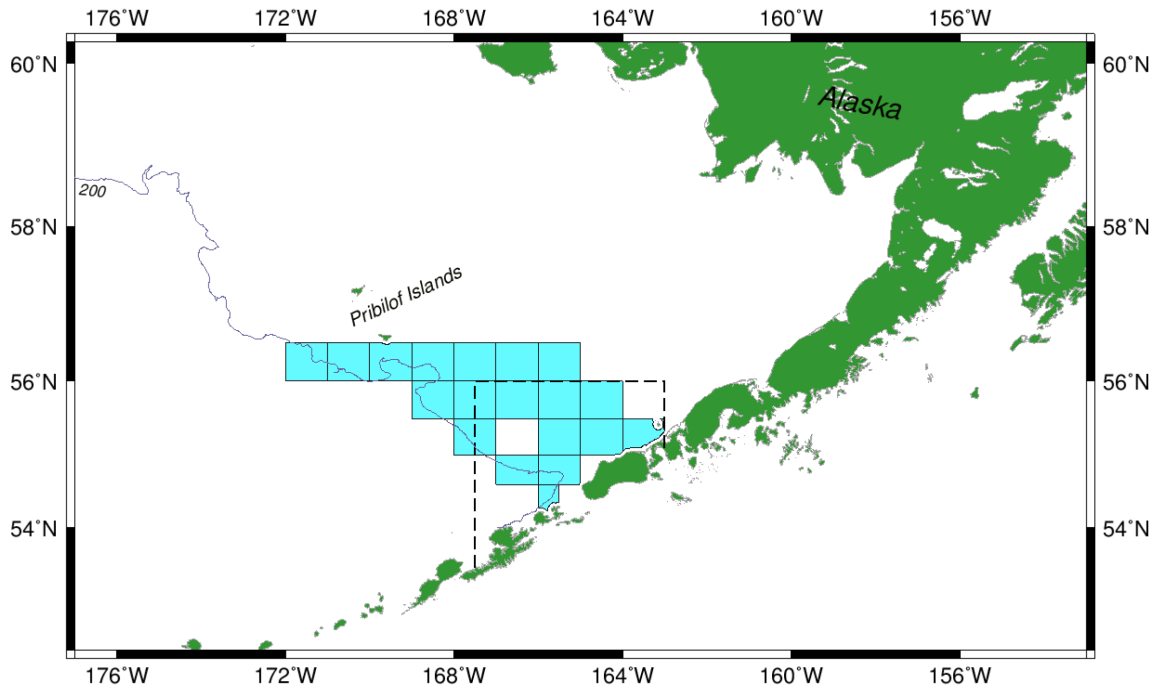


Figure 2-2. Selected area closures covering 80% of B season 2003 through 2011 chum bycatch.

2.3.1 Component 1: 80% Closure aggregate trigger PSC cap levels

The range of non-Chinook salmon PSC caps considered is shown below. As listed here, the CDQ sector allocation of the fishery level cap would be 10.7 percent, with the remainder apportioned to the combined non-CDQ fishery.

Range of suboptions for trigger PSC cap levels for non-Chinook with allocations for CDQ (10.7%) and remainder for non-CDQ fishery.

	Non-Chinook	CDQ	Non-CDQ
1)	**25,000**	**2,675**	**22,325**
2)	50,000	5,350	44,650
3)	**75,000**	**8,025**	**66,975**
4)	125,000	13,375	111,625
5)	**200,000**	**21,400**	**178,600**

For analytical purposes only, a subset of the cap levels included in the six suboptions were used in this document to assess the impacts of operating under a given hard cap. This subset approximates the upper and lower endpoints of the suboption range, and a midpoint (**bolded**).

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

Vessels participating in the RHS would operate under a different fishery level cap than any vessels not participating in the RHS. NMFS would continue to manage triggered area closures for vessels not participating in the ICA as described in status quo. Vessels participating in the RHS would be exempt from NMFS's area closures, and would instead be subject to the RHS closures.

The process currently used to monitor salmon bycatch and issue salmon savings area closures would continue for these closures. NMFS would have to determine whether a vessel was directed fishing for pollock and then match that vessel with its fishery component (CDQ or non-CDQ) or sector. NMFS currently uses a combination of VMS, industry reported catch information, and observer data to monitor vessel activities in special management areas, such as habitat conservation areas and species-specific savings areas (e.g., salmon savings area). These data sources are used by NMFS on a daily basis to monitor fishery limits. Information from VMS is useful for determining vessel location in relation to closure areas, but it may not conclusively indicate whether a vessel is fishing, transiting through a closed area, or targeting a particular species.

The observer and monitoring requirements currently in place to account for Chinook salmon bycatch under Amendment 91 also enable NMFS to monitor non-Chinook salmon bycatch under a trigger closure with RHS exemption. Since the implementation of Amendment 91, NMFS has found several issues that effect the observers' ability to ensure all species of salmon are counted. Therefore, NMFS recommends changes to the Amendment 91 requirements under all alternatives including the no action alternative. The details of these changes are discussed later in this chapter at 2.5. Catch accounting would rely on the information described for Alternative 1 (status quo).

2.3.2 Revised RHS program

Per Council request in April 2012, the RHS program under this alternative has a number of key differences from the current status quo program. Functionally the program operates largely similarly as described under Alternative 1 Section however a number of key changes have been proposed to address the Council's motion from April 2012.

The proposed program will operate on a vessel level. This means that the base rate and tier assignments are by vessels rather than by cooperative as with previous RHS program structure. Some aspects of the operation of the program have been modified to account for either suggested revisions by the Council or industry to streamline operations and/or address modification for efficiency or to better address WAK chum stocks and prioritize Chinook.

The primary revisions to the operation of the program are as follows (note that the full ICA agreement is appended to this document (Appendix 2).

Base Rate savings closure floor: Under this provision, when the Base Rate falls below 0.10 chum salmon/mt pollock there will be no closures for the week for which that Base Rate applies.

Base rate calculations and restrictions: As with the status quo RHS program, beginning June 10th the initial Base Rate for qualifying Savings Closure will be 0.19. Beginning with the second Thursday Announcement after June 10th and on each Thursday Announcement thereafter the Base Rate will be calculated as an accumulated average. Once 3 weeks of data becomes available Sea State will recalculate the Base Rate as the 3 week rolling average of the chum bycatch rate (chum salmon per metric ton of pollock harvest) by the Fishery. Regardless of the resulting recalculated Base Rate amount, weekly adjustments of the Base Rate shall not increase by more than 20% of the previous week's Base Rate.

Modification of enforcement provisions: Some modifications of the enforcement provisions under the status quo RHS have been made. A vessel must have more than one VMS point inside a Savings Closure Area during a tow before that tow may be considered for enforcement action. Once an enforcement action has been considered, the penalty structure has been modified for these violations. The current regulations at § 679.21(g) include a requirement for the ICA to include a provision for uniform penalties of $10,000.00 per violation; all violations in a year are for the same amount. The $10,000.00 uniform penalty amount is considered "liquidated damages" and satisfies all obligations related to a violation. NMFS has identified enforcement issues with a regulatory requirement for use of minimum uniform assessments of this type (see 2.4.7.1, pg 71), and recommends that these regulations be removed. The legal issues would not prevent the ICA from choosing to include privately enforced penalties.

Operationally in the program, there are specific measures in place in June and July when western Alaskan chum are determined to be more common on the grounds and different measures in place August through October when the Asian-origin fish are more prevalent. August to October measures are also intended to prioritize Chinook salmon over chum salmon given that catch rates for Chinook generally increase later in the B-season.

June to July measures:
More stringent closures mechanisms are in place in June and July to reflect the data indicating that western Alaskan chum are more prevalent on the fishing grounds in June and July as compared with later in the B season. All vessels are subject to any closures that are made during the month of June regardless of the vessel-specific bycatch rate. Following the first Friday after the 30th of June, qualified vessels and Mothership (MS) fleets will be assigned a Limited Test Fishing Privilege (LTFP). LTFP qualified vessels and MS fleets are allowed to fish in Savings Closure Areas during the first four days of a management week (10:00pm Friday to 10:00pm Tuesday).

In order to qualify for the LTFP vessels and MS fleets must have a rolling 2 week average bycatch rate below 75% of the current Base Rate. Vessels and MS fleets must also have landing data appearing in 2 management weeks before being considered for the LTFP. All other vessels will be prohibited from fishing in Savings Closure Areas during the month of July.

August to October measures:
Beginning with the first Thursday Announcement after July 31st, and with each Thursday Announcement for Friday Closure thereafter vessels and MS fleets will be assigned to one of three tiers based on their previous 2 weeks bycatch rate (chums per mt of pollock harvest). Tier assignments are based on the following criteria:

a. Vessels and MS fleets with a chum bycatch rate less than 75% of the Base Rate are assigned to "Tier 1".
b. Vessels and MS fleets with a chum bycatch rate equal to or greater than 75% of the Base Rate but equal to or less than 125% of the Base Rate are assigned to "Tier 2".
c. Vessels and MS fleets with a chum bycatch rate in excess of 125% the Bases Rate are assigned to "Tier 3".
d. Vessels and MS fleets assigned to Tier 1 may fish in Savings Closure Areas for the Management Week (10:00 pm Friday to 10:00 pm the following Friday), vessels and MS fleets assigned to Tier 2 may fish in Savings Closure Areas for the first 4 days of the Management Week (10:00 pm Friday to 10:00 pm Tuesday), and vessels and MS fleets assigned to Tier 3 are prohibited from fishing inside Savings Closure Areas for the entire Management Week.
e. There is no minimum data requirement per vessel or MS fleet for tier assignment.

These Tier assignments are similar to those under the status quo, however they are assigned on a vessel not cooperative basis.

Further modifications to the program in August through October include a reduction in the maximum closure areas as well as provisions for ceasing all closures once a Chinook threshold rate is met.
The criteria for establishing Savings Area closures during this time period are the following:

a. Maximum area available for Savings Closures in the East Region is reduced from 3,000 sq. mi. to 1,500 sq. mi.

b. Maximum area available for Savings Closures in the West Region is reduced from 1,000 sq. mi. to 500 sq. mi.

c. Savings Closures will be made on the basis of salmon bycatch rates, with ADFG stat areas that have the highest bycatch rates being closed first. However, Sea State will evaluate the uncertainty in the bycatch rate data by area, and, among areas whose bycatch rates are not found to differ significantly, Sea State will consider pollock catch rates and first close areas with low pollock catch rates, thus preserving pollock harvesting capabilities in these areas that do not differ statistically from other areas with nominally higher bycatch rates.

d. As genetic data are received that indicates times and/or areas characterized by a higher proportion of Western Alaskan salmon, the closure selection criteria will be modified to shift the focus of closures to those areas with the highest proportion of Western Alaska salmon.

In order to explicitly prioritize Chinook over chum for management purposes, a Chinook bycatch protection threshold is designated whereby all further chum closures would cease for the remainder of the season. Under this provision, once an ADF&G Statistical Area of the Bering Sea is determined to have a Chinook bycatch of .035 Chinook per metric ton of pollock harvest, and the associated pollock harvest is determined to be at a significant level (greater than 2% of the harvest that season), chum salmon Savings Closure Areas will be suspended for the remainder of the B Season.

Alternative 3 components and option

Component 1:Fleet PSC management with non-participant triggered closure	Area	Triggered closure encompassing 80% of historical PSC. Participants in RHS would be exempt from the regulatory closure if triggered.
	Option 1: cap	Select a cap from a range of numbers: 25,000 –200,000

2.3.3 Management and Monitoring under Alternative 3

Similar to status quo (rolling hot-spot [RHS] system in regulation), participants in the RHS would be exempt from the regulatory closure system. Monitoring and enforcement of this alternative is similar to status quo in which ICA members are managed under the RHS and NMFS closes the trigger area for non-ICA members. Monitoring and enforcement of the bycatch agreement under this alternative is done by Sea State using the Base Rate as a trigger for savings area closures and determining the tier assignment of the vessel. A description of management and monitoring by Sea State are contained under Alternative 1.

The current census data collection program is highly responsive to management needs and provides timely data, especially considering the logistics of the sectors and variation in operation type. The observer and monitoring requirements currently in place to account for Chinook salmon bycatch under Amendment 91 would be the same methods to account for non-Chinook salmon bycatch. Since the implementation of Amendment 91, NMFS has found several issues that affect the observers' ability to ensure all species of salmon are counted. Therefore, NMFS recommends changes to the Amendment 91 requirements under all alternatives including the no action alternative. The details of these changes are discussed later in this chapter in section 2.5. Catch accounting would rely on the information described for Alternative 1 (status quo) in section 2.1.

The U.S. Coast Guard has identified at-sea enforcement issues related to aerial surveillance for enforcing trawl closures. They note some issues in distinguishing between pelagic and non-pelagic trawl gear. This alternative would restrict only vessels using pelagic trawl gear from directed fishing for pollock within the area closures. All directed fishing for pollock in the Bering Sea uses pelagic trawl gear only.

Due to the size of the Alaska region and the number of enforcement assets available, one of the most effective means of surveillance is by aircraft. While an aircraft can be used to identify the type of vessel (e.g., long line, trawl, seine, pot), there is no way for people in an aircraft to readily identify whether a trawl vessel is using pelagic or non-pelagic trawl gear.

Because of these definitions, the only time people in an aircraft would be able to determine whether a vessel was using pelagic or non-pelagic trawl gear would be if they witnessed a haul back and noted chafing gear on the foot rope or roller gear. By definition, this vessel would be using non-pelagic trawl gear. All other definitions used to identify whether a vessel is using pelagic or non-pelagic trawl gear must be conducted by a boarding team on the vessel.

2.3.3.1 Recommended Revisions to the Current ICA Regulations

NMFS provides the following information and recommendations about current or future regulations should the Council include an ICA with a RHS system for the chum salmon PSC program at final action. The regulations implementing Amendment 84 contain detailed requirements for the contents of the RHS ICA, including information about the participants (those parties signing the ICA and agreeing to abide by its provisions), specific bycatch reduction measures, and monitoring and enforcement provisions. In contrast, requirements for the incentive plan agreements (IPAs) implemented under Amendment 91 contain only general requirements for NMFS approval of a proposed IPA. Under Amendment 84 there are two methods for controlling non-Chinook salmon PSC, the ICA and the Chum SSA. Vessels not participating in the ICA must comply with the Chum SSA closures. The detail in the current regulation for the chum salmon RHS ICA are valuable because when industry members participate in an ICA and are thus exempt from closure of the Chum SSA, the ICA is the primary chum salmon PSC management measure in effect. By contrast, under Amendment 91, the PSC limit is the primary regulatory tools for minimizing Chinook salmon PSC. The IPAs are important under Amendment 91, but no exemptions to the PSC limit are provided to participants in the IPA. In other words, Amendment 91 does not rely on the provisions of the IPA to minimize the PSC of Chinook salmon to the same degree as Amendment 84 relies on the RHS ICA to minimize chum salmon PSC.

In 2005, the Council recommended selecting the RHS ICA that was in effect at that time as its preferred alternative for Amendment 84. In approving Amendment 84 and its implementing regulations, NMFS determined that the RHS ICA was consistent with the National Standards, specifically that it minimized bycatch to the extent practicable. For NMFS to make that determination, it needed the assurance provided by detailed federal regulations that the ICA would remain in effect as it was described in the Council's preferred alternative. Without detailed regulations, NMFS would have limited ability to disapprove future proposed revisions to the ICA or to suspend the exemption from closures of the Chum SSA. Unfortunately, detailed contract provisions in federal regulation provide very little flexibility for the ICA participants to revise contract provisions to respond to new information or consider better methods on an annual basis to minimize bycatch without a regulatory amendment.

If the Council recommends a chum salmon PSC management program that provides exemptions to caps or area closures for participants in an approved ICA, NMFS may continue to require that the federal regulations contain sufficient detail to prevent later substantive revisions to the ICA that would reduce its effectiveness. It is difficult to define exactly where the line is between providing the necessary detail in the regulations to prevent weakening the ICA and providing flexibility to improve the ICA without first developing the details for the primary management program and comparing them with the current regulations. At the March/April 2012 Council meeting, NMFS highlighted the issue and recommended that the Council carefully review the current RHS ICA regulations and consider the level of detail that will be needed in future regulations to ensure that the chum salmon PSC management measures in effect under an ICA exemption are sufficient to support the required determinations of consistency with the National Standards.

The current non-Chinook salmon ICA regulations in § 679.21(g) are reproduced below with footnotes and additional comments:

(1) Requirements for the non-Chinook salmon bycatch reduction intercooperative agreement (ICA).

(i) *Application*. The ICA representative identified in paragraph (g)(2)(i)(B) of this section must submit a signed copy of the proposed non-Chinook salmon bycatch reduction ICA, or any proposed amendments to the ICA, to NMFS at the address in paragraph (b)(6) of this section.

(ii) Deadline. For any ICA participant to be exempt from closure of the Chum Salmon Savings Area as described at paragraph (e)(7)(ix) of this section and at § 679.22(a)(10), the ICA must be filed in compliance with the requirements of this section, and approved by NMFS. The proposed non-Chinook salmon bycatch reduction ICA or any amendments to an approved ICA must be postmarked or received by NMFS by December 1 of the year before the year in which the ICA is proposed to be effective. Exemptions from closure of the Chum Salmon Savings Area will expire upon termination of the initial ICA, expiration of the initial ICA, or if superseded by a NMFS-approved amended ICA.

(2) Information requirements. The ICA must include the following provisions:

(i) Participants.[24]

[24] Is participation in an RHS ICA limited to the AFA cooperatives and CDQ groups, and is it the Council's intent that owners of vessels not in an AFA cooperative may not participate in the ICA?

(A) The names of the AFA cooperatives and CDQ groups participating in the ICA. Collectively, these groups are known as parties to the ICA. Parties to the ICA must agree to comply with all provisions of the ICA.

(B) The name, business mailing address, business telephone number, business fax number, and business e-mail address of the ICA representative.

(C) The ICA also must identify one entity retained to facilitate vessel bycatch avoidance behavior and information sharing.

(D) The ICA must identify at least one third party group. Third party groups include any organizations representing western Alaskans who depend on non-Chinook salmon and have an interest in non-Chinook salmon bycatch reduction but do not directly fish in a groundfish fishery.

(ii) The names, Federal fisheries permit numbers, and USCG documentation numbers of vessels subject to the ICA.

(iii) Provisions that dictate non-Chinook salmon bycatch avoidance behaviors for vessel operators subject to the ICA, including:

(A) Initial base rate. The initial B season non-Chinook salmon base rate shall be 0.19 non-Chinook salmon per metric ton of pollock.

(B) Inseason adjustments to the non-Chinook base rate calculation. Beginning July 1 of each fishing year and on each Thursday during the B season, the B season non-Chinook base rate shall be recalculated. The recalculated non-Chinook base rate shall be the three week rolling average of the B season non-Chinook bycatch rate for the current year. The recalculated base rate shall be used to determine bycatch avoidance areas.

(C) ICA Chum Salmon Savings Area notices.[25] On each Thursday and Monday after June 10 of each year for the duration of the pollock B season, the entity identified under paragraph (g)(2)(i)(C) of this section must provide notice to the parties to the salmon bycatch reduction ICA and NMFS identifying one or more areas designated "ICA Chum Savings Areas" by a series of latitude and longitude coordinates. The Thursday notice must be effective from 6 p.m. A.l.t. the following Friday through 6 p.m. A.l.t. the following Tuesday. The Monday notice must be effective from 6 p.m. A.l.t. the following Tuesday through 6 p.m. A.l.t. the following Friday. For any ICA Salmon Savings Area notice, the maximum total area closed must be at least 3,000 square miles for ICA Chum Savings Area closures.

(D) Fishing restrictions for vessels assigned to tiers. For vessels in a cooperative assigned to Tier 3, the ICA Chum Salmon Savings Area closures announced on Thursdays must be closed to directed fishing for pollock, including pollock CDQ, for seven days. For vessels in a cooperative assigned to Tier 2, the ICA Chum Salmon Savings Area closures announced on Thursdays must be closed through 6 p.m. Alaska local time on the following Tuesday. Vessels in a cooperative assigned to Tier 1 may operate in any area designated as an ICA Chum Salmon Savings Area.

[25] See explanation below about comments received by NMFS from the United Catcher Boats on this paragraph.

(E) Cooperative tier assignments. Initial and subsequent base rate calculations must be based on each cooperative's pollock catch for the prior two weeks and the associated bycatch of non-Chinook salmon taken by its members. Base rate calculations shall include non-Chinook salmon bycatch and pollock caught in both the CDQ and non-CDQ pollock directed fisheries. Cooperatives with non-Chinook salmon bycatch rates of less than 75 percent of the base rate shall be assigned to Tier 1. Cooperatives with non-Chinook salmon bycatch rates of equal to or greater than 75 percent, but less than or equal to 125 percent of the base rate shall be assigned to Tier 2. Cooperatives with non-Chinook salmon bycatch rates of greater than 125 percent of the base rate shall be assigned to Tier 3.

(iv) Internal monitoring and enforcement provisions to ensure compliance of fishing activities with the provisions of the ICA. The ICA must include provisions allowing any party of the ICA to bring civil suit or initiate a binding arbitration action against another party for breach of the ICA. The ICA must include minimum annual uniform assessments for any violation of savings area closures of $10,000 for the first offense, $15,000 for the second offense, and $20,000 for each offense thereafter.[26]

(v) Provisions requiring the parties to conduct an annual compliance audit, and to cooperate fully in such audit, including providing information required by the auditor. The compliance audit must be conducted by a non-party entity, and each party must have an opportunity to participate in selecting the non-party entity. If the non-party entity hired to conduct a compliance audit discovers a previously undiscovered failure to comply with the terms of the ICA, the non-party entity must notify all parties to the ICA of the failure to comply and must simultaneously distribute to all parties of the ICA the information used to determine the failure to comply occurred and must include such notice(s) in the compliance report.

(vi) Provisions requiring data dissemination in certain circumstances. If the entity retained to facilitate vessel bycatch avoidance behavior and information sharing under paragraph (g)(2)(i)(C) of this section determines that an apparent violation of an ICA Chum Salmon Savings Area closure has occurred, that entity must promptly notify the Board of Directors of the cooperative to which the vessel involved belongs. If this Board of Directors fails to assess a minimum uniform assessment within 180 days of receiving the notice, the information used by the entity to determine if an apparent violation was committed must be disseminated to all parties to the ICA.

(3) NMFS review of the proposed ICA and amendments.

NMFS will approve the initial or an amended ICA if it meets all the requirements specified in paragraph (g) of this section. If NMFS disapproves a proposed ICA, the ICA representative may resubmit a revised ICA or file an administrative appeal as set forth under the administrative appeals procedures described at § 679.43.

(4) ICA Annual Report.

The ICA representative must submit a written annual report to the Council at the address specified in § 679.61(f). The Council will make the annual report available to the public.

[26] See explanation below about NMFS's recommendation that detailed penalty amounts should not be included in future ICA regulations.

(i) Submission deadline. The ICA annual report must be postmarked or received by the Council by April 1 of each year following the year in which the ICA is first effective.

(ii) Information requirements. The ICA annual report must contain the following information:

(A) An estimate of the number of non-Chinook salmon avoided as demonstrated by the movement of fishing effort away from Chum Salmon Savings Areas, and

(B) The results of the compliance audit required at § 679.21(g)(2)(v).

To assist with the Council's review and consideration of potential revisions to § 679.21(g), NMFS has highlighted selected regulatory text that may not be essential to support the alternatives, depending on the structure of the primary chum salmon PSC management program. Many factors may weigh into a decision of which regulations are essential or should be revised or removed, that would be most feasible to assess at final action. At the time the preferred alternative is selected for the chum salmon PSC, the elements of the final program recommended by the Council can be compared with the objectives stated in Council's motion, purpose and need statement, information provided in the public record, National Standards, program enforcement, and other variables.

The current regulations on the ICA and RHS at § 679.21(g) consist of several detailed components that are required to be reflected in the contract documents. They include: identification of the entities who are party to the ICA, the date that the ICA proposal must be submitted to NMFS, the base rates, tier levels, system of closures that are employed, the days that the closure notices apply, NMFS review of proposed ICA and amendments, and annual reporting requirements. Of these eight major elements, four stand out as likely to be essential to the operation of nearly any ICA program for reducing chum salmon PSC. For example, the submission, location, and deadlines for the proposed ICA under § 679.21(g)(2) would be a required element of any agreement that NMFS is expected to provide a formal determination regarding that the ICA is in place for a fishing season. The requirements included under § 679.21(g)(2) that identify the participants to the ICA would be essential information. NMFS review of the proposed ICA amendments at § 679.21(g)(3) and information for annual reporting at § 679.21(g)(4) are essential for establishing that NMFS is the governmental approving entity for the ICA, and that information to assess the efficacy of the program is available for the Council or others to verify.

Examples of Primary Management Programs: potential impact on regulatory detail.

Considering the range of alternatives presented in this EA, the Council may select any one of multiple approaches to a primary management program to minimize chum salmon PSC, and develop some corresponding record for recommending that the Secretary of Commerce approve the program. The range of possible primary management approaches is sufficient that it is impractical to assess the potential impacts on regulatory detail in more than very general terms. Examples of some general primary management concepts and possible impacts on regulatory detail are provided below.

The Council may select a primary management program similar to the present chum salmon PSC program implemented under Amendment 84. As previously noted, for those AFA cooperatives that are exempted from Chum SSA closures, Amendment 84 features a largely voluntary RHS bycatch control approach. This approach is supported by relative restrictive scheduled reporting of closure notices and use of established bycatch base rates for tracking of ICA milestones, as well as in-season and annual reporting to assist in evaluation of the effectiveness of the primary management program. As with the Amendment 84 program, the Council (or NMFS) could consider that these more restrictive and binding regulations are necessary to support the voluntary agreement, and the ability of NMFS to disapprove future proposed revisions to the ICA or to suspend the exemption from closures of the Chum SSA. In that event, the regulations at § 679.21 (g) may not require extensive revision.[27]

The Council may select a program with features similar to Amendment 91. A program analogous to Amendment 91 may emphasize an objective for chum salmon PSC measures to reduce chum salmon PSC beyond the reductions anticipated under the status quo, reducing the probability that PSC does not exceed the amounts observed during some historical period. If the Council chose chum salmon PSC management using performance standard(s) and allocation of transferable chum salmon PSC limits similar to Amendment 91,it may be feasible to reduce the amount of detail in certain sections of the regulations at § 679.21(g). Under Amendment 91, amendments to the IPA are submitted to NMFS for review, NMFS makes an administrative determination after assessing the consistency of the proposed amendment with the general regulatory provisions for the IPA, and the approved amendments are posted on NMFS's website for the public. The regulatory text at § 679.21(f) supporting the main requirements for the IPA program are general, though other aspects of regulations implementing Amendment 91, such as catch monitoring and observer requirements, are extensive.

The most effective approach for ensuring that each option the Council considers is addressed in regulation and contains the appropriate amount of detail would be for the Council to review each component of the existing regulations and compare each one with the Council's components at or prior to final action to determine if NMFS is to retain, revise, or remove each respective component. NMFS has included some discussion about streamlined regulations that may apply to some alternatives based on the minimum amount of specificity that could be considered in regulation, as well as discussion about a few elements of the RHS program that Council staff identified as potentailly benefiting from supporting regulation.

Regulatory revisions based on Public Comment on Amendment 91

In a letter of comment on Amendment 91 (dated May 7, 2010), the United Catcher Boats recommended revisions to § 679.21(g)(2)(iii)(C), which currently reads as follows:

> ICA Chum Salmon Savings Area notices. On each Thursday and Monday after June 10 of each year for the duration of the pollock B season, the entity identified under paragraph (g)(2)(i)(C) of this section must provide notice to the parties to the salmon bycatch reduction ICA and NMFS identifying one or more areas designated "ICA Chum Savings Areas" by a series of latitude and longitude coordinates. The Thursday notice must be effective from 6 p.m. A.l.t. the following Friday through 6 p.m. A.l.t. the following Tuesday. The Monday notice must be effective from 6 p.m. A.l.t. the following Tuesday through 6 p.m. A.l.t. the following Friday. For any ICA Salmon Savings Area notice, the maximum total area closed must be at least 3,000 square miles for ICA Chum Savings Area closures.

UCB's comment on this requirement was:

> This section should be re-written to more accurately describe the original intention of Amendment 84. While the twice weekly notices are required, ICA Chum Salmon Savings Area closures only occur if and when areas with bycatch in excess of the base rate, as described in paragraph (g)(2)(iii)(B), are identified. The sentence, "For any ICA Salmon Savings Area notice, the maximum total area closed must be at least 3,000 square miles for ICA Chum Salmon Area closures" is confusing and does not accurately reflect the original intention of the 3,000 square mile standard. The original intention was to assure that the ICA, not the notice, contain language

[27] Notwithstanding a few housekeeping and enforcement alternatives that NMFS recommends under all of the alternatives.

> that allows for the maximum areas available for a Chum Salmon Savings Area closure to be no less than 3,000 square miles. There was never an intention to require 3,000 square miles be closed by each notice as this sentence may be interpreted to mean.

NMFS was unable to address this comment in the final rule on Amendment 91 because it was outside of the scope of the analysis prepared for that action. In the response to comments, NMFS recommended that this issue be addressed during the Council's consideration of chum salmon PSC management measures. If the Council recommends that regulations at § 679.21 (g) should continue to require detail on the timing of the announcements for chum salmon closure areas, NMFS advises the clarification in regulation that the twice weekly notices are dependent on whether any closure(s) are being implemented. Revised paragraph § 679.21(g)(2)(iii)(C) may read as follows:

> ICA Chum Salmon Savings Area notices. On each Thursday and Monday after June 10 of each year for the duration of the pollock B season, the entity identified under paragraph (g)(2)(i)(C) of this section must provide notice to the parties to the salmon bycatch reduction ICA and NMFS identifying any areas designated as "ICA Chum Savings Areas" by a series of latitude and longitude coordinates. The Thursday notice must be effective from 6 p.m. A.l.t. the following Friday through 6 p.m. A.l.t. the following Tuesday. The Monday notice must be effective from 6 p.m. A.l.t. the following Tuesday through 6 p.m. A.l.t. the following Friday.
>
> The last sentence of § 679.21(g)(2)(iii)(C) may be revised to clarify the maximum size of the closure area and moving the sentence from (g)(2)(iii)(C) [Chum Salmon Savings Area Notice] to its own paragraph at (g)(2)(iii) to read as follows: For any ICA Salmon Savings Area notice, the total area closed must be no more than 3,000 square miles for any ICA Chum Savings Area closure.

A second letter from UCB to NMFS dated September 30, 2010, identifies errors in some vessel names and vessel IDs in Table 47 c to Part 679. Should the Council take action on any of the alternatives, NMFS proposes to revise this table to update the identifying information. The information in Table 47c is relevant to the management of AFA participants that would also be impacted by any of the alternatives.

Regulatory revisions to simplify in § 679.21(g)

This section addresses the Council's March/April 2012 motion which requests the EA to be updated with additional information on the ICA and RHS regulations at § 679.21(g). This section also summarizes potential regulatory revisions to § 679.21(g), recommended by the Enforcement Committee (see Enforcement Committee meeting minutes of March/April Council meeting).

In general, NMFS does not anticipate removing the primary management elements to support an ICA program – the submission, location, and deadlines for the proposed ICA, the participants to the ICA, NMFS review of the proposed ICA and amendments, and information for annual reporting.

NMFS has identified many regulatory provisions at § 679.21(g) that may be removed or simplified if the Council recommends modifying the ICA/RHS program. These begin at § 679.21(g)(2)(iii)(A) "Initial Base Rate" and continue through § 679.21(g)(2)(vi), "Provisions requiring data dissemination in certain circumstances."

Essential Elements in § 679.21(g)

Submission Location, and Deadlines for the proposed non-Chinook bycatch ICA: Regulations at § 679.21(g)(1) list the submission requirements and deadlines for the non-Chinook salmon ICA. These are essential elements to allow for NMFS to receive, review, and approve the ICA before the start of the fishing year.

Information Requirements (§ 679.21(g)(2)):

Participants to the ICA & Identifiers: Regulations at § 679.21(g)(2)(i) specify that the proposed ICA must identify the participants to the ICA and associated contact information for those participants. This information is an essential element to be retained in regulation, assuming the Council continues to use the ICA as a chum salmon PSC management tool. NMFS and the Council will always need to have a current list of all participants in the ICA and the representative for the ICA as contact information for insuring compliance under any set of ICA regulations.

At § 679.21 (g)(2)(i)(D), the ICA must also identify at least one third party group that includes any organizations representing western Alaskans who depend on chum salmon. Current regulations do not specify the function of this group. This regulation would depend on the specifics of the Council purpose and need and final motion. NMFS does not provide any advice at this time of whether it is a necessary element of the program. Guidance from the Council would assist in determining if this provision continues to be an important feature of the ICA and if it should remain in regulation.

NMFS review of the proposed ICA and amendments:
At 679.21 (g)(3), NMFS is identified as the government entity for approving the ICA, and establishing an approving entity would be a necessary element of any continuing ICA program. No change to this provision is recommended.

ICA Annual Report – Regulatory Detail: The ICA Annual Report at § 679.21(g)(4), as also referred to as the Salmon Avoidance report. This report is likely to be essential to evaluating the efficacy of the chum salmon PSC program. NMFS does not recommend that the report be removed. Additional considerations for annual reporting are discussed in the following section on "Consolidation of Annual Salmon Reports."

Non-Essential elements to current regulatory detail (contingent on primary management program)

Initial Base Rate, and Inseason adjustments to the non-Chinook base rate calculation: Under Amendment 84, the ICA Non-Chinook Salmon Savings Area closures apply to the B season only when such areas have chum salmon bycatch that is in excess of the base rate. The initial base rate for each year is set at a value of 0.19 in regulation at § 679.21(g)(2)(iii)(A). Following the establishment of the initial base rate, specific regulations for adjusting the base rate are at §679.21(g)(2)(iii)(B). These specific regulations list the start date for the recalculation of the base rate, and the days of the week that the recalculation must occur.

Under the model of less detailed regulations, any initial base rates and timing of the adjustments to the base rate may be proposed by the parties to the ICA. To inform NMFS and the public of how these rates would be calculated, NMFS could include very general regulatory text to have the proposed ICA provide its proposed procedure for any use of base rates as well as the ICA's approach for inseason adjustments to the base rate.

The proposed RHS of May 31, 2012 also introduces the need for a base rate floor in areas where base rates fall below 0.1 chum salmon/per mt of pollock (see 2.3.2, pg 49). The regulations could be revised to require that an ICA proposal include how any base rate floor or ceiling would be calculated, applied, and seasonally adjusted. Thus, with the ICA proposal discussion of of how the base rate is to be estimated, the regulatory detail specifying initial base rates and inseason adjustments could be removed.

Maximum or Minimum Chum Salmon Savings Area: The minimum chum salmon savings area is specified in regulation at § 679.21(g)(2)(iii)(D) under the requirements for chum salmon notice. The specific content of the notice for any chum Salmon savings areas could be proposed in the ICA or the requirement for a maximum area could be removed from regulation altogether. The participants to the ICA may find it useful to have some established limit to the area. In that event, it may be useful to retain or revise these regulations as previously described. To further the minimization of bycatch to the extent practicable, the Council may recommend that NMFS include general requirements for the proposed ICA to describe how it would establish minimum or maximum chum salmon savings areas.

ICA Chum Salmon Savings Area notices: The day of the week that notices must be sent to all participants in the ICA specifying the areas for ICA chum salmon saving areas are listed at § 679.21(g)(2)(iii)(D). However, ICA representatives have reported that information on chum salmon PSC can be received at any time, and fixed dates for notices may constrain the use of best available data to revise closures. These timing requirements could be left to the discretion of the ICA and removed from regulation.

Fishing restrictions for vessels assigned to tiers, and Cooperative tier assignments:
The regulation at § 679.21(g)(2)(iii)(E) controls the interval of time that an ICA chum salmon area closure applies to each tier and specifies the rate of chum salmon bycatch compared to the base rate that determines the tier to which each cooperative is assigned. These specific time intervals and tier assignments could be flexible and under the discretion of the ICA. Less detailed regulations would remove most of these specifications and require the proposed ICA to report on the methods used to assign closure areas based on a cooperative's recent Chum salmon PSC.

Annual Compliance Audit and Requirement for data dissemination: Under alternative 1, the proposed ICA must include specific provisions for an annual compliance audit at § 679.21(g)(2)(iv), and certain data must be disseminated to members of a cooperative on the results of any compliance issues at § 679.21(g)(2)(v). These requirements are intended to ensure independent review of the data used to track fishing activity in the closed areas and associated computations and to inform the ICA members of any issues identified during the audit. The Council may wish to consider if the compliance audit and data dissemination is currently achieving the objectives intended, is an effective tool for disseminating information, and would be likely to continue to be effective under the preferred alternative. NMFS does not have any specific recommendation regarding the need for continuing a compliance audit, though these two regulations contribute to the amount of regulatory detail at § 679.21(g).

New RHS data elements identified by Council staff: Regulatory Implications

In addition to the example at 2.4.7.1 for simplifying regulatory detail at 679.21(g) to support the RHS program, Alternative 3 includes a concept for expanding the amount and quality of information for evaluating the efficacy of the chum salmon bycatch under this option. Council staff requested that NMFS provide some additional input on three of these new data elements, to help address the feasibility of including these data elements in regulation (see pg 97). Three elements of the RHS program on page 97 are highlighted as portions of the program that could benefit from additional regulations are:

- *Closures*:
- *WAK chum*:
- *Chinook threshold*:

RHS Closures: NMFS is requested to address if regulations could be drafted "to ensure that the closure rules are followed. This could be provisions to ensure the number of closures per week, the rules for the closures or the rate-basis for the closures."

In alternative 3, closures under the RHS system are detailed for two time intervals: June through July, and August through October. In the current regulations (679.21(g)(2)(iii)(C), the notices for these closures must be announced on Thursday and Monday, and are implemented on Friday and Tuesday. Alternative 3 (page 49 description) appears to retain this basic schedule for June through July closures of two announcements and two implementation dates per week under the RHS program. The intent of the question to specify regulations for "the number of closures per week" may imply that existing regulatory detail on the specific days of each week be eliminated, but that no less than two separate announcements and implementation days be noticed every week. If this is the intent of the question, NMFS believes it would be possible to craft some regulation requiring the entity identified under paragraph (g)(2)(i)(C) to publish no less than two notices per week that apply to no less than two closures in the same week. The multiple closures notices may apply to identical or different areas of the Bering Sea.

NMFS is requested to consider possible regulatory forms for "rules or rate-basis for the closures." This is a somewhat general description, but as described in NMFS comments on the simplification of current regulations, much of the detail regarding the rules and chum salmon bycatch rates per ton of pollock, could be removed from regulation, and supplanted with regulatory text asking the ICA to submit the methodology for calculating bycatch rates in the ICA proposal. The text for that description could be fairly general and request the ICA to describe the "rules and rate-basis for the closures."

NMFS could not "ensure that the closures would be followed" for each vessel unless regulations allow for emergency closure requirements based on some clear and non-discretionary criteria. We do not believe that the Council intends to have NMFS engage in the emergency closure process to implement any portion of the RHS program. That objective of ensuring that closures would be followed is not likely to be something NMFS can accomplish through regulation.

WAK chum: The request for NMFS is to suggest, "some regulation to indicate that program is structured to prioritize closures for WAK chum over others." This is not a sufficient description of this element for NMFS to suggest potential regulations. The nature of the prioritization would need to be described in more detail. The Alternative 3 RHS closures for August to October (pg 50) includes an objective that may be structured to limit the severity of chum salmon closures during periods of suspected higher chum bycatch from Western Alaska sources. "As genetic data are received that indicates times and/or areas characterized by a higher proportion of Western Alaskan salmon, the closure selection criteria will be modified to shift the focus of closures to those areas with the highest proportion of Western Alaska salmon." The supply of any new genetic data is likely to require interpretation, and ICA-initiated closures based on that information would not be practical to constrain by regulation. NMFS would need more information to detail possible regulatory concepts to support the request.

Chinook threshold: The request for NMFS is to consider regulations: specifying both the threshold employed and the start date for it." The draft RHS agreement of May 31, 2012 proposes a threshold rate for Chinook salmon bycatch at which chum closures are suspended. Chinook bycatch of .035 Chinook per metric ton of pollock harvest, and the associated pollock harvest is determined to be at a significant level (greater than 2% of the harvest that season), chum salmon Savings Closure Areas will be suspended for the remainder of the B Season.

Our initial thoughts are that regulations should be possible to craft to define a fixed Chinook bycatch rate that would trigger cessation of all chum salmon closures under the RHS program. This would likely take the form of a requirement for the entity for the ICA to release a notice, informing all vessels party to the ICA that RHS closures had ceased. We would probably specify a time limit for them to release the notice, and might specify how the computation for the Chinook salmon bycatch rate must be calculated. NMFS could not necessarily enforce internal agreements imposed by a cooperative to continue to avoid areas with high chum salmon bycatch.

Remove detailed enforcement provisions from current RHS ICA regulations:
Current regulations at § 679.21(g)(2)(iv) require the RHS ICA to include the following:

> *Internal monitoring and enforcement provisions to ensure compliance of participants with the provisions of the ICA.* The ICA must include provisions allowing any party of the ICA to bring civil suit or initiate a binding arbitration action against another party for breach of the ICA. The ICA must include minimum annual uniform assessments for any violation of savings area closures of $10,000 for the first offense, $15,000 for the second offense, and $20,000 for each offense thereafter.

NMFS recommends that the regulations at § 679.21 (g)(2)(iv) be removed. If the Council recommends a program that requires the RHS ICA to contain a description of the enforcement provisions and penalties that the ICA participants agree to assess on themselves for violation of the ICA provisions, NMFS would not include these specific penalties in the implementing regulations. NMFS would include in regulation only the RHS ICA provisions that NMFS directly implements. Additionally, NMFS does not specify penalties for violations of the federal fishery regulations in federal regulation. Rather, the Secretary of Commerce retains discretion to assess penalties for violations of federal fishery regulations on a case-by-case basis.

Consolidation of Annual Reports: Salmon Bycatch Data

Annual reports are currently required for three programs that regulate the AFA pollock fishery: The AFA cooperative annual report at § 679.61 (f), Incentive Plan Agreement annual report (§ 679.21(f)), and the ICA Annual Report (§ 679.21(g)(4) (Table XX)). The ICA annual report is also referred to as the Salmon Avoidance report. In aggregate, these reports require industry representatives to submit information on groundfish catch, organization of cooperatives, cooperative decision making and performance of pollock cooperatives, as well as PSC species avoidance for Chinook salmon and chum salmon. General regulations, submission requirements, and features of each report are summarized in in Table 2-9.

Table 2-8. Annual Reports for AFA pollock fisheries

Name of report	**Regulatory Citation in 50 CFR 679**	**Who submitted to/from**	**When Submitted**	**Location**
AFA Coop Report	50 CFR §679.61 (f)	Submitted to the Council by AFA coops	April 1 of each year	On NMFS web site http://www.fakr.noaa.gov/sustainablefisheries/afa/afa_sf.htm
IPA report	50 CFR §679.21 (f)(12)(vii)	Submitted to the Council by IPA rep [a]	April 1 of each year	Not currently posted on NMFS web site. NMFS proposes to post on NMFS web site
ICA report – (Salmon Avoidance Rpt)	50 CFR §679.21 (g)(4)(i)	Submitted to the Council by ICA rep (behalf of AFA coops & CDQs)	April 1 of each year	On NMFS web site http://www.fakr.noaa.gov/sustainablefisheries/afa/afa_sf.htm
ICA compliance audit (report) –part of the ICA report	50 CFR §679.21 (g)(2)(v) and 679.21 (g)(4)(ii)(B)	Submitted to the Council as part of ICA report	April 1 of each year	Not currently posted on NMFS web site. NMFS proposes to post on NMFS web site.

[a] Entities eligible to participate in an IPA are qualifying AFA inshore cooperatives, catcher/processor sector, mothership sector, and CDQs

Regulations for Annual Reporting from Amendment 84 and to support chum salmon PSC.

The Council's motion for Amendment 84 requested the submission of industry data to evaluate the program. These data elements are included in regulations for the ICA (Salmon Avoidance Report), and the AFA cooperative annual report as follows:

1. *The number of salmon taken by species and season* is required in the AFA cooperative annual report regulations at § 679.61(f)(ii)(6);
2. *Estimate of the number of salmon avoided as demonstrated by the movement of effort away from salmon hot-spots* is required in the Salmon Avoidance Report regulations at § 679.21(g)(4)(ii)(A);
3. *A compliance/enforcement report which will include the results of an internal compliance audit and an external compliance audit if one has been done* is in the Salmon Avoidance Report at § 679.21(g)(4)(ii)(B);
4. *The List of each vessel's number of appearances on the weekly vessel performance lists* is required in the AFA cooperative annual report at § 679.61(f)(2)(vi);
5. *Acknowledgement that the agreement term has been extended for another year and any changes to the Agreement that were made at the time of the renewal* is required in the proposed ICA and addressed in regulations at § 679.21(g)(1)(ii); and
6. *The annual third party audit* is required as part of the compliance audit and is located in ICA regulations at § 679.21(g)(2)(v).

Regulations requiring submission of the IPA annual report (relevant to evaluating the effectiveness of chum salmon PSC)

The purpose and need in this EA emphasizes the importance of limiting potential, negative impacts to Chinook salmon PSC from implementation of the RHS closures. Data from the IPA annual reports may contribute to analyzing the interaction of RHS closures independently and in combination with the IPA to better understand how these programs impact chum and Chinook salmon PSC. Annual report regulations for the IPA are at § 679.21(f)(13)(ii)(A), (B), and (C), and require submission of:

1. a comprehensive explanation of incentive measures in effect during the previous year;
2. how incentive measures affected individual vessels; and
3. evaluation of whether incentive measures were effective in achieving salmon savings beyond levels that would have been achieved in absence of the measures.

NMFS does not have any specific recommendations for further reducing the amount of detail in existing regulations for the ICA annual report but encourages the Council to describe the specific data variables or information needed to monitor and assess the performance of the ICA/RHS program. In section 2.8.7.3, the Council staff have included a list of additional information that for evaluating the efficacy of the chum salmon PSC program. NMFS provides some additional comments regarding potential regulatory implications of the data for the Council to consider (see below heading: New Data and Annual Reporting).

The Council also may wish to consider if existing annual reporting to support evaluation of the ICA contains redundant information required in the IPA annual report or AFA cooperative annual report. It may be feasible to consolidate the annual reporting requirements of the ICA Salmon Avoidance Report, IPA annual report, and AFA cooperative annual report. This consolidation may assist participants in the Bering Sea pollock fishery who must submit similar data in multiple annual reports. However, the entities submitting each of these reports vary, based upon whether they are parties to an IPA, ICA or are in an AFA cooperative. Also, more than one AFA cooperative annual report and IPA annual report are submitted, while a single ICA Salmon Avoidance Report is submitted each year. So the amount of consolidation in these reports may be limited by the current scope and participants of these programs. It would be helpful for the Council to consider the tradeoffs for consolidating this information under any of the alternatives.

NMFS also encourages the Council to consider if it is useful to include an Economic Data Report (EDR) in the current program. EDRs have been developed for the Crab Rationalization, Amendment 80, and Amendment 91 programs. While NMFS has no specific recommendation on the need for an additional industry survey or expanded data to assess the effectiveness of the Chum salmon PSC measures, the recent implementation of the EDR for evaluating Amendment 91 raises questions about how amendments to the Chum salmon PSC program require less or different data.

Current regulations do not identify NMFS as the party responsible for posting the annual report on the NMFS website. Since that may be a method for making the report available to the public, the Council should provide guidance to staff on whether NMFS or the Council should post the annual report to its respective websites.

Finally, the current deadline for submitting the ICA report of April 1 is slightly prior to the annually scheduled Council March/April meeting. Regulations at § 679.21(g)(4) could require the ICA representative to submit the Annual Report on March 1 or March 15 of each year to coordinate the review of the IPA, ICA, and AFA cooperative reports. NMFS advises that regulatory text for the report due date be revised to an earlier date in March. Council direction is requested on the desired date for submission of each of these reports. Table 2-9 summarizes the reports, due dates, and method of dissemination to the public.

Regulatory and Paperwork Reduction Act Information from NMFS for New Data and Annual Reporting at 2.8.7.3

A list of twelve possible reporting requirements are drafted by Council staff at section 2.8.7.3. The list represents a first step in considering possible information for evaluating the program (and creating public transparency about data used for RHS closures). Additional background on each of the items in this list would be necessary for NMFS to transform these concepts into requirements in regulation and to fulfill the Paperwork Reduction Act (PRA) requirements to implement these concepts. The following pieces of information would assist NMFS in commenting and evaluating on these pieces of information.

1. For each of the 12 items, what is(are) the variable(s) that are included in the information request?
2. What is the primary data source for each variable. Would the data come from federal records, State of Alaska records, or private records? A number of the listed items seem to originate from NMFS records. If from private records, who is the primary ownership of data?
3. If the data is to be transferred to another party or to the public, identify who is the data flowing from and to? The description of entity providing or receiving the data needs to be very specific (such as an owner of an AFA catcher vessel or mothership, ICA entity, NMFS, etc.)
4. Is this a new information collection or an amendment of and existing information collection?
5. How often is the data to be recorded, or how often collected by government or submitted to the user or to the public?
6. If any of the data is for ICA decision making, why is the data required (if it is), and not already available to the ICA through internal contracts.
7. What is the format that the information is supposed to be submitted? Is it a table, a form, an electronic dataset, etc.
8. What are the potential or known confidentiality issues?

2.4 Alternative 4: Trigger closure with RHS exemption and options for non-exempt closures

As with Alternative 3, Alternative 4 would create new boundaries for the Chum Salmon Savings Area. The existing Chum Salmon Savings Area and associated trigger cap would be removed from regulation. The new boundaries would encompass the area of the Bering Sea where historically 80 percent of non-Chinook prohibited species catch occurred from 2003 through 2011 B season (Figure 2-3). The trigger caps that would close this area are described below. The area closure would apply to pollock vessels that are not in an RHS system when total non-Chinook salmon PSC from all vessels (those in an RHS system and those not in an RHS system) reaches the trigger cap level. The trigger cap would be allocated between the CDQ and non-CDQ pollock fisheries,as currently is done under status quo. The non-CDQ allocation of the trigger cap would not be further allocated among the AFA sectors or inshore cooperatives, unless options to do so were selected under Components 2 through 6.

Component 1 of this alternative sets the trigger PSC cap level for this large scale closure. PSC from all vessels will accrue towards the cap level selected. However if the cap level is reached, the triggered closure would not apply to participants in the RHS program. Under Component 2, however, in addition to the large closure for non-RHS participants, a select triggered area closure would apply to RHS participants. Four options of triggered closure areas and time frames are provided under Component 2. Component 3 then sets the trigger PSC cap level for the area selected under Component 2.

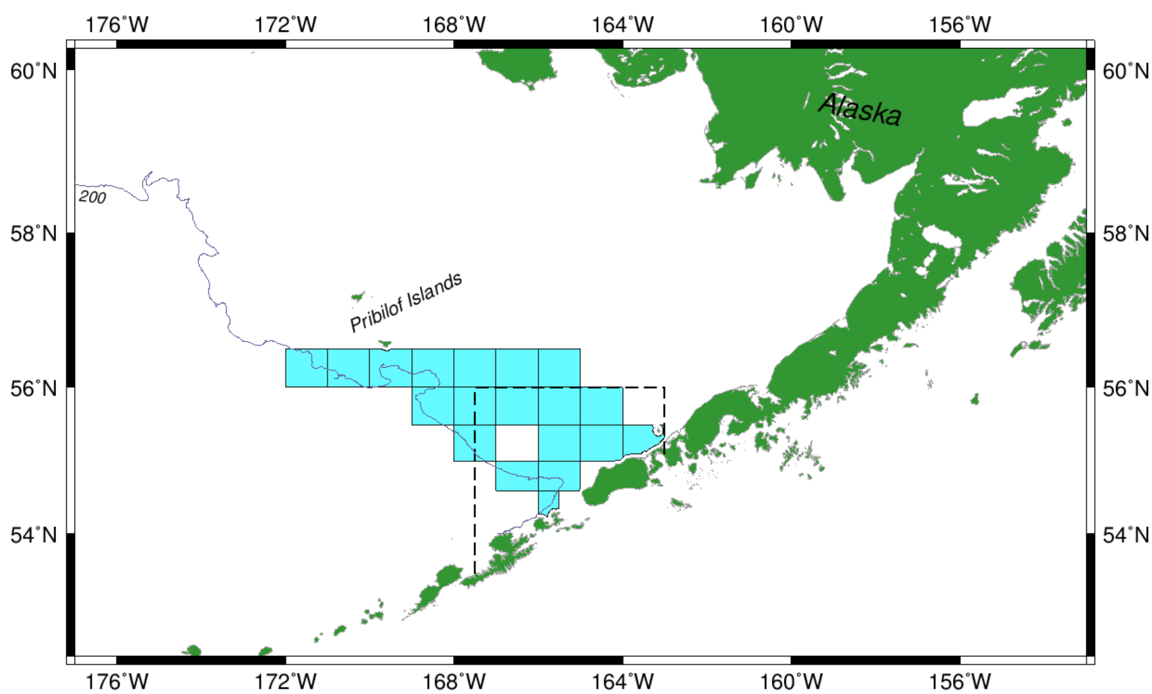


Figure 2-3. Selected area closures covering 80% of B season 2003 through 2011 chum bycatch.

2.4.1 Component 1: 80% Closure aggregate trigger PSC cap levels

The range of non-Chinook salmon PSC caps considered is shown below. As listed here, the CDQ sector allocation of the fishery level cap would be 10.7 percent, with the remainder apportioned to the combined non-CDQ fishery.

Range of suboptions for trigger PSC cap levels for non-Chinook with allocations for CDQ (10.7%) and remainder for non-CDQ fishery.

	Non-Chinook	CDQ	Non-CDQ
1)	**25,000**	**2,675**	**22,325**
2)	50,000	5,350	44,650
3)	**75,000**	**8,025**	**66,975**
4)	125,000	13,375	111,625
5)	**200,000**	**21,400**	**178,600**

For analytical purposes only, a subset of the cap levels included in the six suboptions were used in this document to assess the impacts of operating under a given hard cap. This subset approximates the upper and lower endpoints of the suboption range, and a midpoint (**bolded**).

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

The RHS program in operation under this alternative is the same as described under Alternative 3. Note this is a revised program from the one described under status quo.

Vessels participating in the RHS would operate under a different fishery level cap than any vessels not participating in the RHS. NMFS would continue to manage triggered area closures for vessels not participating in the ICA as described in status quo. Vessels participating in the RHS would be exempt from the large scale, and would instead be subject to the RHS closures.

The process currently used to monitor salmon bycatch and issue salmon savings area closures would continue for these closures. NMFS would have to determine whether a vessel was directed fishing for pollock and then match that vessel with its fishery component (CDQ or non-CDQ) or sector. NMFS currently uses a combination of VMS, industry reported catch information, and observer data to monitor vessel activities in special management areas, such as habitat conservation areas and species-specific savings areas (e.g., salmon savings area). These data sources are used by NMFS on a daily basis to monitor fishery limits. Information from VMS is useful for determining vessel location in relation to closure areas, but it may not conclusively indicate whether a vessel is fishing, transiting through a closed area, or targeting a particular species.

2.4.2 Component 2: Trigger closure areas and timing for RHS participants:

In addition to the RHS, vessels in the RHS system would be subject to:

Option 1: a trigger closure encompassing 80% of historical non-Chinook salmon PSC estimates.

Suboption 1a) Trigger closure would apply for the B season (June-October; Figure 2-3)

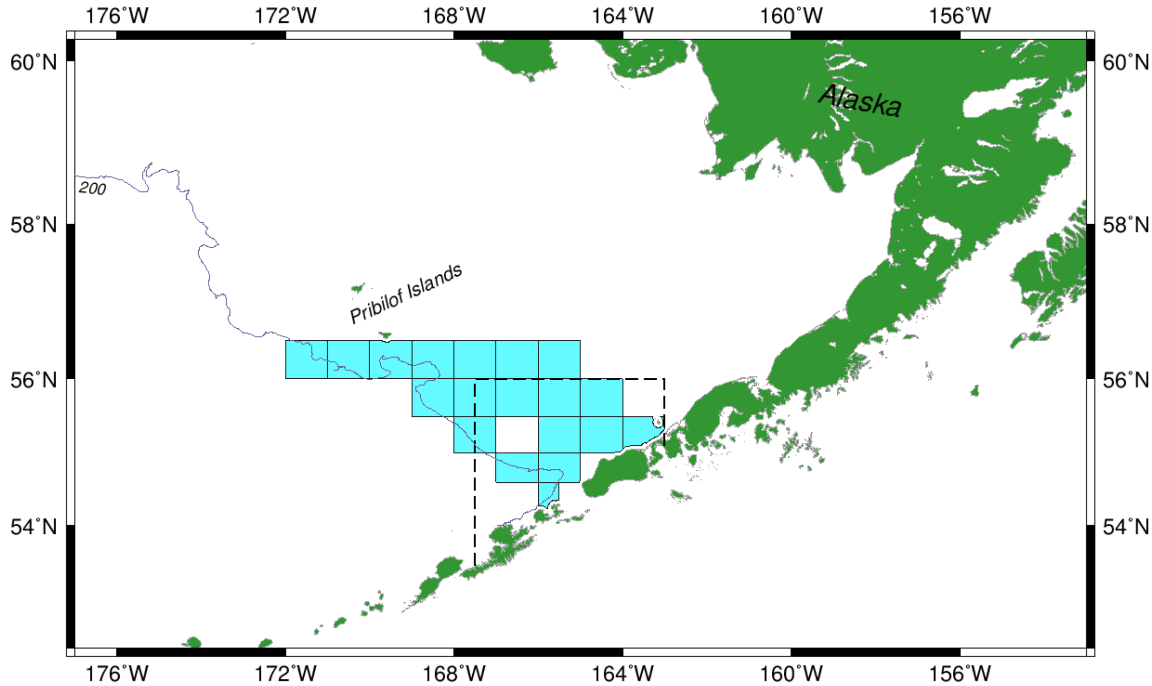


Figure 2-4. Selected area closures covering 80% of B season (option 1a) 2003-2011 chum bycatch.

Suboption 1b) Trigger closure would only apply in June and July (Figure 2-4).

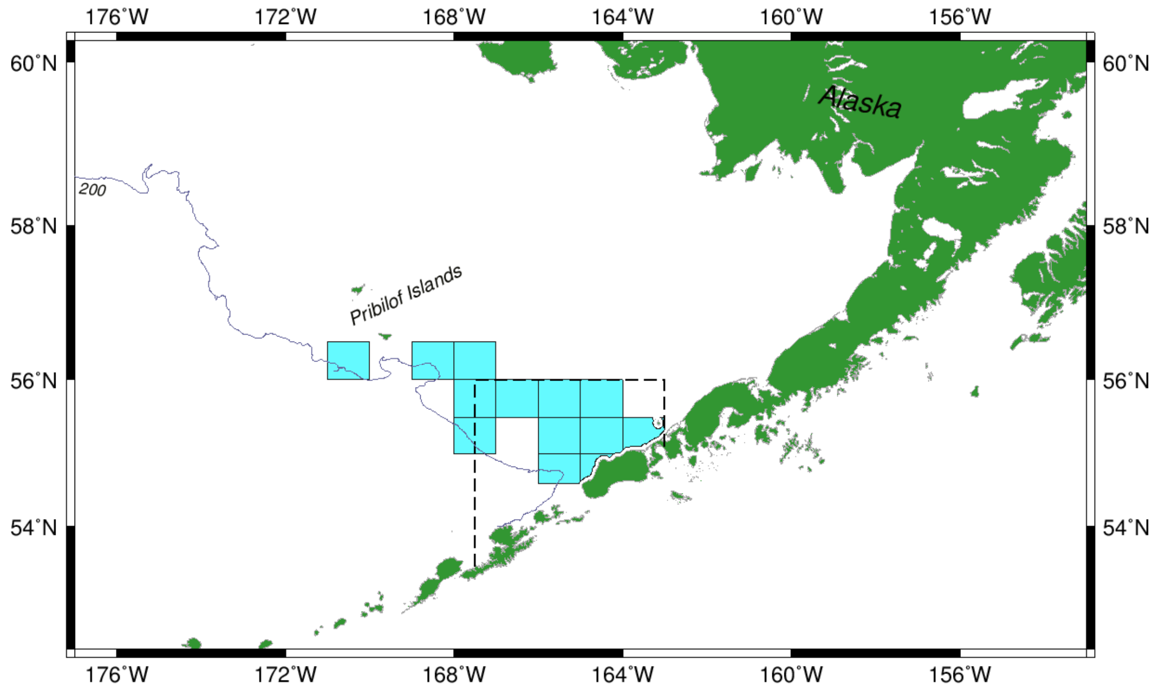


Figure 2-5. Selected area closures covering 80% of June-July 2003 (option 1b) through 2011 chum bycatch.

Option 2: a trigger closure encompassing 60% of historical non-Chinook salmon PSC estimates

Suboption 2a) Trigger closure would apply for the B season (June-October) (Figure 2-5).

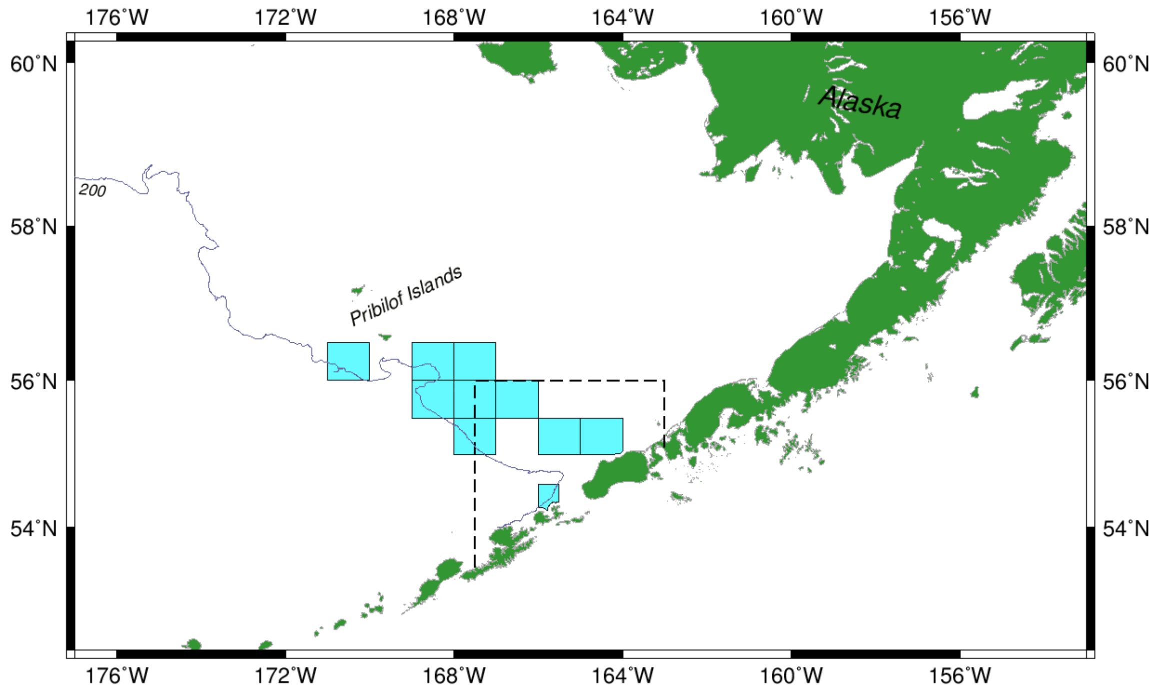


Figure 2-6. Selected area closures covering 60% of B season 2003 through 2011 chum bycatch.

Suboption 2b) Trigger closure would only apply in June and July (Figure 2-6).

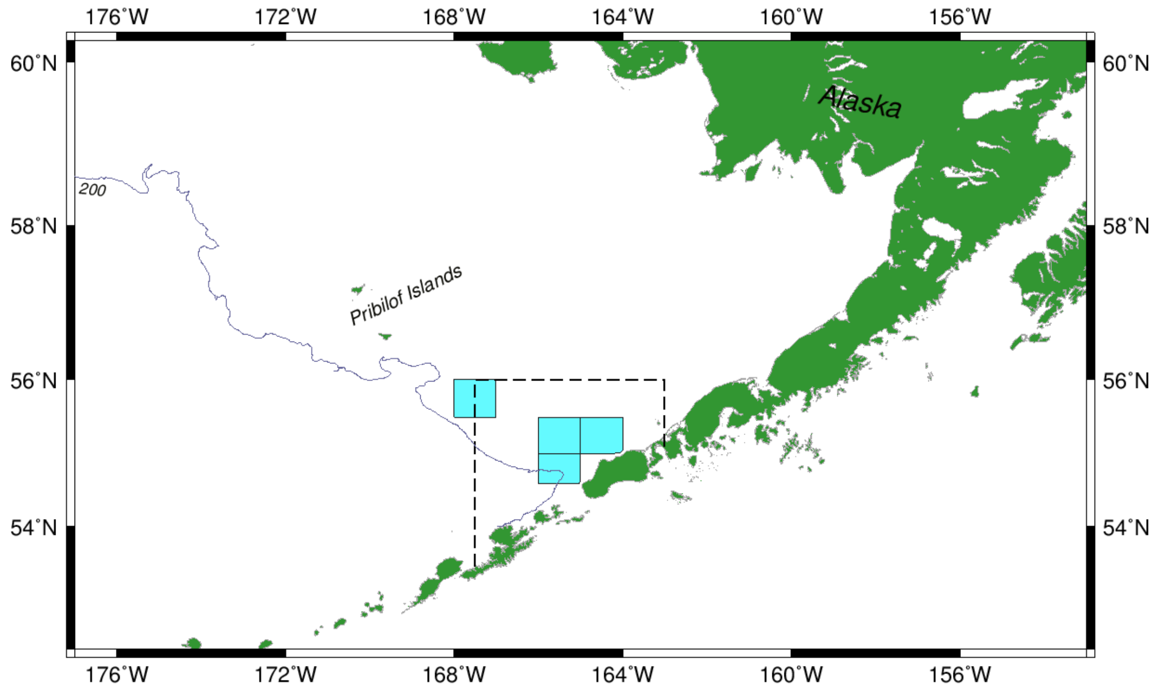


Figure 2-7. Selected area closures covering 60% of June-July 2003 through 2011 chum bycatch.

2.4.3 Component 3: PSC cap levels for trigger closures for RHS participants

PSC cap level options for a given closure selected under Component 2 are shown below. Note that caps for both Option 1 and Option 2 under Component 2 are shown. If Suboption 1b or 2b is selected, then the June-July cap would reflect the proportion of bycatch in June and July.

Range of suboptions for trigger PSC cap levels for non-Chinook with allocations for CDQ (10.7%) and remainder for non-CDQ fishery for RHS participants.

	Total Annual cap			June-July cap (Option 1b or 2b)		
	(Option 1a or 2a)	CDQ	Non-CDQ	Total June/July	CDQ	Non-CDQ
1)	25,000	2,675	22,325	7,800	835	6,965
2)	50,000	5,350	44,650	15,600	1,669	13,931
3)	75,000	8,025	66,975	23,400	2,504	20,896
4)	125,000	13,375	111,625	39,000	4,173	34,827
5)	200,000	21,400	178,600	62,400	6,677	55,723

2.4.4 Component 4: Sector allocation of trigger cap for RHS participants

The trigger cap selected along with the applicable trigger closure under Component 2 could be allocated to the sector level. Sector allocations are identical to the options as shown under Alternative 2 Component 2.

If this component is selected, the trigger cap would be apportioned at the sector level. This would result in separate sector level caps for the CDQ sector, the inshore catcher vessel sector (CV) sector, the mothership sector, and the offshore catcher/processor sector (CP) sector. The management of sector allocations would be the same as under Alternative 2. Allocating salmon caps to individual sectors would increase the complexity of NMFS's salmon bycatch monitoring efforts, as it would increase the number of salmon bycatch caps that NMFS would have to monitor.

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

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

If sector level caps under Component 4 are selected, but not selected are Option 1 (transfers) or Option 2 (reallocations) under Component 5, the sector level cap would not change during the year and NMFS would close directed fishing for pollock in the specified area once each sector reached its sector level cap. Because the CDQ sector level cap would be allocated to the CDQ groups, the CDQ allocations would continue to be managed as they are under status quo, with further allocation of the salmon bycatch trigger cap among the six CDQ groups, transferable allocations within the CDQ groups, and a prohibition against a CDQ group exceeding its salmon bycatch allocation.

2.4.5 Component 5: Sector level rollovers and transferability provisions

Rollover and transferability options by sector are the same as listed under Alternative 2, Component 3 (see section 2.2.3).

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 cap among the sectors and CDQ groups.

Suboption: Limit transfers to the following: a) 50%, b) 70%, or c) 90% of available salmon bycatch cap.

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

The two options under this component may be selected only if the trigger cap is apportioned among the sectors under Component 4. Options 1 and 2 are mutually exclusive, which means that either Option 1 to allow sector level transferable allocations or Option 2 to require NMFS to reallocate salmon bycatch from one sector to the other could be selected.

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

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

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

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

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

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

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

Option 2 would require NMFS to reallocate salmon bycatch from one sector to the other by publication of a reallocation in the *Federal Register*. Option 2 could apply if the non-CDQ trigger caps were allocated among the inshore, catcher/processor, and mothership sectors and the (1) management of the trigger caps was not allowed, (2) transferable trigger caps among the sectors were not allowed, or (3) the non-CDQ AFA sectors could not form the entity necessary to receive transferable salmon bycatch caps. Under Option 2, NMFS would reallocate the salmon bycatch trigger caps among the sectors. A reallocation of salmon bycatch would occur if a sector completed harvest of its pollock allocation and had some salmon bycatch trigger cap allocation remaining in a season. That remaining salmon bycatch trigger cap could be reallocated to other sectors still fishing based on the proportion of pollock remaining to be harvested by each sector.

2.4.6 Component 6: Cooperative allocation of trigger cap for inshore CV RHS participants

The trigger cap selected along with the applicable trigger closure under Components 2 and 3 could be further allocation within the inshore sector to the cooperatives level. Transferability options are the same as listed under Alternative 2, Component 4.

Option 1, would allow an inshore cooperative to transfer pollock to another inshore cooperative after the first cooperative's Chinook salmon allocation is reached. This option provides another means in addition to the transfer of the Chinook salmon bycatch allocations to match available pollock and available salmon bycatch for the inshore cooperatives. More information about this option is in section 2.2.4.1.

A summary of the components and options and suboptions for Alternative 4 is shown in Table 2-9.

Table 2-9 Summary of Alternative 4 components, options and suboptions

<table>
<tr><td rowspan="2">Component 1:Fleet PSC management with non-participant triggered closure</td><td>Area</td><td colspan="4">Triggered closure encompassing 80% of historical PSC. Participants in RHS would be exempt from the regulatory closure if triggered.</td></tr>
<tr><td>Option 1: cap</td><td colspan="4">Select a cap from a range of numbers: 25,000 –200,000</td></tr>
<tr><td rowspan="6">Component 2: Trigger Closure area and timing for RHS participants</td><td>Option 1: Area 80%</td><td colspan="4">Triggered closure encompassing 80% of historical PSC for all RHS participants</td></tr>
<tr><td>Suboption 1a): timing</td><td colspan="4">Applies to remainder of B season if triggered</td></tr>
<tr><td>Suboption 1b): Timing</td><td colspan="4">Applies in June and July if triggered</td></tr>
<tr><td>Option 2: Area 60%</td><td colspan="4">Triggered closure encompassing 60% of historical PSC for all RHS participants</td></tr>
<tr><td>Suboption 2a): timing</td><td colspan="4">Applies to remainder of B season if triggered</td></tr>
<tr><td>Suboption 2b): timing</td><td colspan="4">Applies in June and July if triggered</td></tr>
<tr><td rowspan="2">Component 3: PSC Cap levels for closure selected under Component 2 for RHS participants</td><td>Option 1a: PSC cap established for B season closure</td><td colspan="4">Select cap from range of numbers: 25,000 – 200,000</td></tr>
<tr><td>Option 1b: PSC cap established for June/July proportion</td><td colspan="4">Select cap from range of numbers: 7,800 – 62,400</td></tr>
<tr><td rowspan="4">Component 4: Allocating the trigger cap to sectors</td><td>Range of sector allocations:</td><td>CDQ</td><td>Inshore CV</td><td>Mothership</td><td>Offshore CP</td></tr>
<tr><td>Option 2ii</td><td>6.7%</td><td>63.3%</td><td>6.5%</td><td>23.6%</td></tr>
<tr><td>Option 4ii</td><td>10.7%</td><td>44.77%</td><td>8.77%</td><td>35.76%</td></tr>
<tr><td>Option 6</td><td>3.4%</td><td>81.5%</td><td>4.0%</td><td>11.1%</td></tr>
<tr><td rowspan="6">Component 5: Sector transfers and rollovers</td><td colspan="5">No transfers (Component 5 not selected)</td></tr>
<tr><td rowspan="4">Option 1</td><td colspan="4">Caps are transferable among sectors and CDQ groups within a fishing season</td></tr>
<tr><td colspan="2" rowspan="3"><u>Suboption</u>: Maximum amount of transfer limited to:</td><td>a</td><td>50%</td></tr>
<tr><td>b</td><td>70%</td></tr>
<tr><td>c</td><td>90%</td></tr>
<tr><td>Option 2</td><td colspan="4">NMFS reallocates unused salmon PSC to sectors still fishing in a season, based on proportion of pollock remaining to be harvested.</td></tr>
<tr><td rowspan="7">Component 6: Inshore Cooperative Allocation and transfers</td><td>No allocation</td><td colspan="4">Allocation managed at the inshore CV sector level. (Component 6 not selected)</td></tr>
<tr><td>Allocation</td><td colspan="4">Allocate cap to each inshore cooperative based on that cooperative’s proportion of pollock allocation.</td></tr>
<tr><td rowspan="5">Option: Cooperative Transfers</td><td>Option 1</td><td colspan="3">Lease pollock among cooperatives in a season or a year</td></tr>
<tr><td>Option 2</td><td colspan="3">Transfer salmon PSC (industry initiated)</td></tr>
<tr><td colspan="2" rowspan="3"><u>Suboption</u> Maximum amount of transfer limited to the following percentage of salmon remaining:</td><td>a</td><td>50%</td></tr>
<tr><td>b</td><td>70%</td></tr>
<tr><td>c</td><td>90%</td></tr>
</table>

2.4.7 Option for specifying general objectives and goals for the RHS program

This option relates to how the specification of a revised RHS program is contained in regulation. As noted under Alternative 1, the current RHS program is fully specified in regulation. Under this option, consideration is given to specifying the goals and objectives of such a program in regulation without explicitly including all provisions of the program itself in the implementing regulations. The intent would be to allow more flexibility in program operation than is currently available under status quo.

2.4.8 Management and Monitoring under Alternative 4

Under Alternative 4, the primary management tool to minimize chum salmon bycatch would be the trigger closures. NMFS could manage the trigger closures in a number of different ways, depending on the combination of components and options selected. Unlike Alternative 3, all pollock vessels would be subject to a trigger closure. Vessels could choose whether or not to participate in the RHS. For vessels participating in the RHS, trigger closures would require the sector or cooperative to stop pollock fishing in certain closure areas when its allocation of non-Chinook salmon PSC is reached. Depending on the selection of subsequent components in this alternative, salmon may be allocated at the fishery level (CDQ and non-CDQ), to each sector (inshore, mothership, catcher/processor, and CDQ), and, at the sector level, among the inshore cooperatives. A trigger closure would also apply to vessels that choose not to participate in the RHS.

The observer and monitoring requirements currently in place to account for Chinook salmon bycatch under Amendment 91 would be the same methods NMFS would use to account for salmon bycatch under Alternative 4. Since the implementation of Amendment 91, NMFS has found several issues that affect an observer's ability to ensure all species of salmon are counted. Therefore, NMFS recommends changes to the Amendment 91 regulation under all alternatives. The details of these changes are discussed in section 2.5. Catch accounting would rely on the information described for Alternative 1 (status quo) in section 2.1.4.

The current census data collection program is highly responsive to management needs and provides timely data, especially considering the logistics of the sectors and variations in operation type. However, even with this highly responsive system, a June and July cap results in a very short time period for NMFS to monitor and insure a timely trigger area closure. NMFS would need to project non-Chinook salmon harvest during the week to publish the Federal Register notice necessary to close an area. These projections may result in a trigger closure being made prior to or after the cap being reached.

2.4.8.1 Regulations

NMFS provides the following information and recommendations on potential regulations under Alternative 4. Since all vessels will be subject to a trigger closure, the RHS is not the primary management tool for minimizing bycatch as it is under Alternatives 1 and 3. Therefore, the implementing regulations would focus on the components detailed in Table 2-9. Under the option for Alternative 4, general objectives and goals for the RHS program would be in regulation, but the specific parameters of the RHS program would not be in regulation. This would be similar to the regulations implementing the IPA component of Amendment 91.

If the Council's goal is to achieve salmon savings below the trigger cap, similar to the Amendment 91 program, then the Council could develop general required elements for the RHS similar to those the Council developed for the Chinook salmon IPAs. NMFS would implement those required elements through regulations similar to the IPA regulations under Amendment 91 (75 FR 53026, August 30, 2012). The regulatory text at § 679.21(f) supporting the main requirements for the IPA program are general. With general required elements, NMFS could remove the detail in the regulations at § 679.21(g) implementing Amendment 84. This approach would provide for a more flexible RHS that can adapt and improve with new information while ensuring that the RHS remains effective in minimizing chum bycatch and achieving salmon savings below the trigger cap. Based on experience with Amendment 91, this is NMFS's recommended regulatory approach.

For this approach, Alternative 4 would need to specify (1) the general RHS required elements, (2) RHS membership criteria, (3) whether NMFS needed to approve the RHS, and (4) whether the RHS needs to submit an annual report or comply with any reporting requirements. These are the elements NMFS would implement through regulations. Under Amendment 91, the IPAs and amendments to the IPA are submitted to NMFS for review and approval. NMFS makes an administrative determination after assessing the consistency of the IPA or proposed amendment with the general regulatory provisions for the IPA, and the approved IPAs and amendments are posted on NMFS's website.

If the Council did not chose this option, then NMFS would include in regulation any required specific features for the RHS recommended by the Council. Under the current RHS description, it is not clear which RHS components the Council has determined must be in an RHS. The Alternative 4 description says that the RHS program in operation under this alternative is the same as described under Alternative 3. If the Council determines that all of the components in section 2.3.2 are required for the RHS under Alternative 4, in the detail provided, then these requirements would be in the regulations. However, given that the trigger closure is the primary management tool, NMFS would not require that any specific features be in the regulations unless it was part of the Council's action.

2.4.8.2 Enforcement

Alternative 4 would restrict only vessels using pelagic trawl gear (if their sector or cooperative level cap was reached) from directed fishing for pollock within the area closures. Due to the size of the Alaska region and the number of enforcement assets available, one of the most effective means of surveillance is by aircraft. The U.S. Coast Guard has identified at-sea enforcement issues related to aerial surveillance for enforcing trawl closures. While an aircraft can be used to identify the type of vessel (e.g., long line, trawl, seine, pot), there is no way for people in an aircraft to readily identify whether a trawl vessel is using pelagic or non-pelagic trawl gear. The only time people in an aircraft would be able to determine whether a vessel was using pelagic or non-pelagic trawl gear would be if they witnessed a haul back and noted chafing gear on the foot rope or roller gear. By definition, this vessel would be using non-pelagic trawl gear. All other definitions used to identify whether a vessel is using pelagic or non-pelagic trawl gear must be conducted by a boarding team on the vessel.

2.5 Improvements to Monitoring and Enforcement Provisions under all Alternatives

Amendment 91 monitoring measures have been in place since January 2011. These monitoring requirements are substantive; in order to support a program designed to provide a full census of chinook salmon bycatch in the BS pollock fishery. Generally, NMFS has noted good compliance with the monitoring requirements. Observer Program, Sustainable Fisheries, and NOAA OLE staff have worked closely with industry during the program implementation to provide outreach and support to ensure understanding and compliance with the monitoring requirements. Although non-Chinook species are not part of Amendment 91, it is difficult to differentiate salmon without having a specimen in hand. Therefore, the monitoring measures that have been in place for Chinook salmon were also required for non-Chinook salmon during Amendment 91.

The March 27, 2012 Enforcement Committee Minutes highlighted specific issues with the practice of "deckloads" under Amendment 91 and the developing Bering Sea non-Chinook salmon bycatch program. Put in place during Amendment 91, current regulations at 50 CFR 679.21 (c)(2) require all salmon be stored in an RSW tank prior to delivery to a processing plant. This regulation applies to catcher vessels delivering to stationary or inshore floating processors. The intent of this requirement is to reduce the potential for sorting of catch, to prevent unlawful discarding of salmon, and to make all salmon available to the observer for census and sampling at delivery.

Catcher vessel operators often set the final net of a trip to fill or exceed the capacity of their RSW tanks and this frequently results in having more fish in the codend than can be placed in the RSW tanks. A portion or the entire final haul may be placed on the deck of the vessel, either inside the codend or outside the codend and loose on deck.

NMFS recognizes deckloads have been a historic practice in the pollock fishery. However, deckloads have created a significant concern during the implementation of Amendment 91, and these concerns are expected to continue under any of the non-Chinook alternatives. Loose fish on deck which are not contained inside the codend creates numerous problems. Since these fish are accessible, sorting could occur that would otherwise not be possible were the fish contained securely in the RSW, live tank, or codend. As a result, NMFS cannot be assured that we have a complete and accurate census of the catch when an observer is unable to verify that they were able to census all the salmon in a haul or delivery. The occurrence of significant amounts of loose fish on the deck creates a situation where it is impossible for observers to assure that no salmon have been discarded at sea and no presorting has occurred. The potential for unobserved sorting of catch is high when catch is loose on deck.

During the first year, the agency worked with the fleet on a compromise procedure to address this problem. This approach involved a brief meeting between vessel personnel, plant personnel and observers to coordinate the dumping of any fish from the deck into the RSW tank where the catch would be pumped into the plant for sorting. As long as any fish that remained on deck and that could not be stored in the RSW tanks remained inside the codend and not loose on deck, NOAA considered the intent of the sampling program and regulations were being met. However, significant numbers of catcher vessel deliveries continue to arrive at the processors with large amounts of catch outside of a codend, and loose on deck.

The Enforcement Committee recommended that the analysis include a discussion of potential approaches to ensure all salmon taken as bycatch in catcher vessel trawl operations are delivered to a shoreside or stationary floating processor and that all salmon are available to be sampled by the observer at the shoreside or stationary floating processor.

The agency considered prohibiting deckloads completely. However, this may exacerbate pollock discard and wholesale dumping of unsorted codends which may contain salmon. Additionally it would likely be unworkable for some in industry. Finally, if deckloads were prohibited, some vessel operators may have difficulty predicting when the last haul exceeds RSW storage capacity.

An alternative approach that would meet NMFS' needs to ensure all salmon are accounted for and would allow vessel operators to continue the practice of deckloading has been developed. The regulations would be revised to meet the following objectives:

- Vessel operators would be required to securely contain all catch brought aboard the vessel.
- Catch could be stored in the RSW tanks, inside the codend, or a live tank.
- No loose fish would be allowed to remain on deck outside the codend.
- If fish are spilled from the codend, they must be transferred immediately to the RSW tanks.

In order to ensure the observer can be present to observe the transfer of catch securely contained outside the RSW(either inside the codend or a live tank), the vessel operator would be required to notify the observer at least 15 minutes prior to the transfer

This regulatory change would address many of concerns noted during the implementation of Amendment 91 while allowing vessel operators the ability to continue the practice of deckloading. This regulatory change would (1) eliminate the opportunity for sorting to occur prior to delivery, (2) reduce the occurrence of quantities of fish remaining on deck loose and unsupervised, (3) eliminate the use of totes, tarps, or checker bins to contain catch, and (4) provide the observer an opportunity to monitor the transfer of fish on the vessel during the offload.

In addition to the agency's concerns about deckloads, there are three housekeeping regulatory corrections that will improve the monitoring and enforcement of both Chinook and non-Chinook salmon bycatch.

View of Salmon in Storage Container

Regulations are §679.28(d)(7)(ii) require that all salmon stored in the container must remain in view of the observer at the observer sampling station at all times during the sorting of each haul. The intent of this regulation is to ensure that no salmon are removed from the salmon storage container. However, in instances where salmon are numerous or in cases where there is only one small salmon in a large salmon storage container, it can be difficult or impossible to see each individual fish in the container. To better meet the intent of this regulation, NMFS proposes to change the regulation at §679.28(d)(7)(ii) to ***require that the salmon storage container must remain in view of the observer at the observer sampling station at all times during the sorting of each haul***.

Removal of Salmon from Observer Sample Area at the End of a Haul or Delivery

Currently no regulations exist that require all salmon to be removed from the observer sampling area and the salmon storage location after the observer has completed their sampling and counting duties at the end of each haul or delivery for catcher processors or shoreside processing facilities. In order to avoid any confusion about which haul or delivery to attribute the salmon and to avoid double counting of salmon, the agency assumed the vessels and plants would remove the salmon from the observer's area and the storage container as soon as the observer had completed their salmon counting and sampling duties. However, we have received a challenge to this assumption and will need to incorporate a requirement in the regulations to ensure that ***once the observer has completed their sampling of the salmon for the haul or delivery that those salmon are promptly removed from the observer's area before the sorting of the next haul or delivery can begin.***

<u>Change in Directed Fishing for Pollock Requirement for Catcher Vesssels</u>

Current regulations require all catcher vessels directed fishing for pollock in the Bering Sea to follow the requirements for salmon handling, storage, and delivery to a shoreside processor. Difficulties have developed when catcher vessels use pelagic trawl gear and intend to directed fish for Pacific cod but also catch pollock. In this scenario any pollock caught is accrued to the AFA cooperative quota. However, depending on the total amount of each species that is caught at the time of delivery, the trip may be designated as either a Pacific cod or a pollock directed fishing target. Since the observer sampling and offload procedures at the shoreside processor are very different between Pacific cod and pollock fishing, salmon accounting data could be lost. Therefore, to meet the goal of the accounting for all salmon caught by AFA catcher vessels in the Bering Sea, the regulations regarding catcher vessels directed fishing for pollock in the Bering Sea will be changed to ***specify that the monitoring requirements apply when a catcher vessel named in the AFA is using pelagic gear in the Bering Sea.***

ATLAS Software aboard less than 125 ft AFA Catcher Vessels

Currently, all catcher vessels greater than 125 feet, catcher processors, and all shoreside and stationary floating processors required to have an observer present are required to maintain a computer and an electronic transmission system such as email for use by an observer. NMFS installs custom software on each of these computers, called ATLAS. Together the hardware and software allow observers to communicate with, and transmit data to NMFS. In the AFA shoreside pollock fleet about 26 of the 87 catcher vessels currently carry the ATLAS program. The rest of the vessels are not required to carry the ATLAS program because they are less the 125 feet in length. The observer data for these vessels is submitted via fax.

FMA Division staff ensures that data were collected following NMFS protocols and it is normal for there to be many data modifications during this “debriefing” and quality control process. If observers have access to the ATLAS software to enter data then the timeliness and quality of their data is increased. The ATLAS software contains business rules to perform many quality control and data validity checks which dramatically increase the quality of the preliminary data. When data is transmitted electronically, instead of submitted via fax, the time before the data are available for management decreases by 1-3 days. Additionally, observers onboard vessels with the ATLAS software have the ability to communicate directly with FMD Division staff in near real time to address questions regarding sampling as well as notify staff of potential compliance concerns. In these cases, NMFS OLE has been able to address these potential compliance issues with the vessels directly closer to the time when the incident occurred. This allows these vessels to come into compliance sooner and avoid more serious violations of the regulations. Better data quality checks of observer data and increased compliance by vessels both serve to improve NMFS’s ability to manage salmon bycatch. ***For these reasons, NMFS recommends that all alternatives include the requirement for ATLAS software on the AFA catcher vessels less than 125 feet in length and the ability for the observer to transmit their data directly from the vessel’s computer with the ATLAS software***.

2.6 Comparison of Alternatives

The following section provides an overview of the four broad alternatives under consideration and the over-arching management measures that would be imposed under each.

The table below compares the four alternatives, the relative time frame of the management measures being considered by alternative or multiple options within alternatives where applicable, and the action under consideration. Both Alternatives 2 and 4 have options for a management action enacted in June and July only or for the entire B season. Note that the alternatives are not mutually exclusive and thus measures for one alternative may be combined with those in another to form an additional alternative for consideration. For example, a June-July hard cap under Alternative 2 (Alternative 2, Component 1, Option 1b) could be combined with the B season closure to non-participants in the RHS system under Alternative 3 and 4 Component 1 to form a new management system that could be analyzed should the Council decide to mix and match amongst alternative components and options to tailor a specific program and objective for management.

Alternative	Timing	Management action		
1-Status quo	B-season	Exemption to regulatory closure of CSSA (Fig. 1) provided participation in RHS program		
2-Hard cap	B-season (Component 1, option 1a)	Fishery sectors close for the season when sector-specific cap level is reached		
	June /July (Component 1, option 1b)	Fishery sectors close until July 31 when sector-specific cap level is reached		
3-Closure area with RHS exemption	B-season (Component 1)	***Closure area applies to***	***Closure Area***	***Basis period***
		Non-participants of RHS program when **fishery-level** caps reached	80% of chum (Figure 2-2)	B season
4-Closure area with RHS exemption and options for non-exempt closures	B-season (Component 1)	***Closure area applies to***	***Closure Area***	***Basis period***
		Non-participants of RHS program when **fishery-level** cap[1] reached	80% of chum (Figure 2-3)	B season
	B season (Component 2, suboption 1a)	Participants of RHS program when **sector-level** cap reached	80% of chum (Figure 2-4)	B season
	June/July (Component 2, suboption 1b)	Participants of RHS program when **sector-level** cap reached	80% of chum (Figure 2-4)	June-July
	B season (Component 2, suboption 2a)	Participants of RHS program when **sector-level** cap reached	60% of chum (Figure 2-6)	B season
	June/July (Component 2, suboption 2b)	Participants of RHS program when **sector-level** cap reached	60% of chum (Figure 2-7)	June-July

[1]Note that under Alternative 4: Component 1 caps can be different than those of Component 3

2.6.1 Policy considerations of alternatives relative to chum and Chinook salmon and pollock

2.6.1.1 Trade offs

Selection of a preferred alternative involves explicit consideration of trade-offs between the potential salmon saved (both chum and Chinook) and potential forgone pollock catch, and of ways to maximize the amount of salmon saved and minimize the amount of forgone pollock.

As analyzed Chapters 4, 5 and 6, the impacts of the alternatives on total bycatch numbers of chum salmon and Chinook salmon and forgone pollock would vary by year. This is due to the annual variability in the rate of chum and Chinook salmon caught per ton of pollock and annual changes in chum salmon abundance and distribution in the Bering Sea. The RIR examines the relative cost of forgone pollock fishing under Alternative 2 and the revenue at risk under Alternative 3 as well as the potential benefits to subsistence, commercial, and recreational salmon fisheries.

As noted previously, Chinook and chum PSC occur at different times over the B-season in relation to the overall pollock catch (Figure 2-8). Thus any management approach which is designed to reduce chum PSC in the early part of the B-season (June/July) by constraining pollock catches will have the potential to increase Chinook later in the season if the fishing fleet must fish later in the year to catch their quota than they would have done absent these measures.

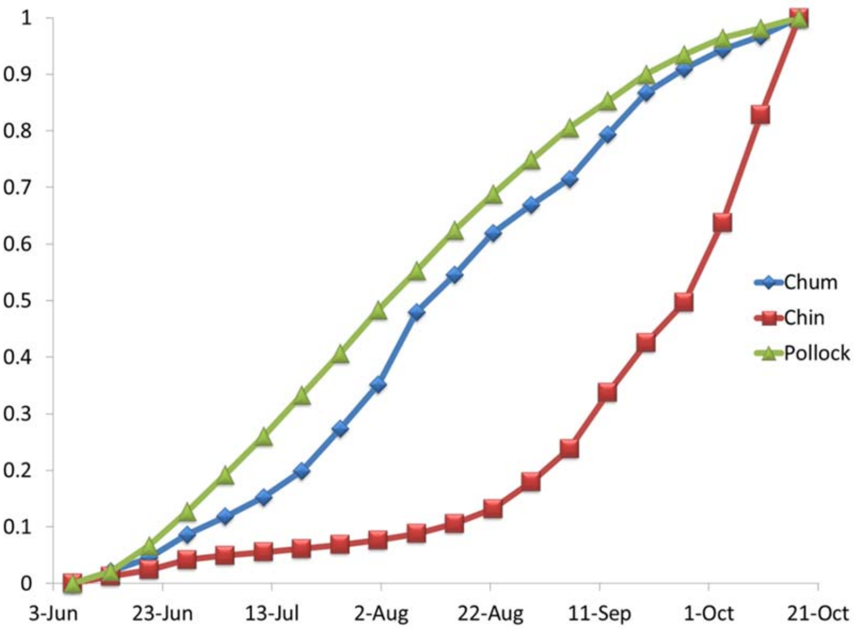


Figure 2-8 Mean relative values of pollock catch (triangles) compared with catch of chum (diamonds) and Chinook (squares) salmon species in the pollock fishery during the B-season.

It is important to recognize that the selection of a preferred management approach involves trading off different competing objectives in the Council's problem statement. In light of the best scientific information available, there is no single management alternative that can reduce western Alaska chum salmon PSC from current levels without diverting pollock catch, forgoing pollock catch and/or increasing Chinook salmon PSC. Thus any management approach selected will require balancing different objectives. Approaches which maximize the reduction of chum PSC may lead to higher Chinook catch or potentially more forgone pollock, while approaches which avoid increasing Chinook PSC may result in lower estimated levels of western AK chum PSC reduction. Results are therefore presented in a series of comparative tables and figures to evaluate which alternatives do better or worse for each of the three key characteristics of WAK chum, Chinook and forgone/diverted pollock catch in an attempt to best characterize the balance among these impacts.

In balancing the trade-offs among efficient pollock catch and Chinook and chum PSC reduction, vessel operators consider all of the incentives facing them. As well as economic incentives to maximize net revenue from pollock, vessels have strong incentives to avoid Chinook from Amendment 91. Slowing down pollock fishing leads to more fishing late in B season when Chinook are abundant on the grounds and even under Amendment 91 in 2011 vessels had increased Chinook PSC rates.

In terms of cap and sector allocation options under Alternative 2, option 1a, the lowest forgone pollock catches result in expected reductions of coastal western Alaska chum salmon PSC of about 22% to 25%, depending on the sector allocation options and cap considered (Figure 2-9). For hard-cap scenarios that have the highest impact on forgone pollock catch levels, the sector allocations are estimated to have significant improvements on the proportion of chum salmon saved (Figure 2-9). Note that while these proportional reductions in western Alaska PSC can be considerable (~80%), the absolute value for the impact reduction to bycatch is still low relative to the number of chum returning to coastal western Alaska (<1%). For Alternative 2, option 1b, the Asian stocks have the least amount of chum salmon AEQ saved and while the savings were better for coastal western Alaska, for both stock groupings were relatively insensitive to cap levels and sector splits. That is, should option 1b be considered then the higher cap might be preferred since it provides about the same level of salmon PSC savings with lower levels of forgone pollock.

Alternative 3 provides more flexibility in fishing opportunities than Alternative 2 or 4 as there are neither caps nor additional area closures imposed outside of those under the revised RHS. The revised RHS is also intended to reduce western AK chum while mitigating impacts on Chinook. As noted previously the estimated chum PSC is similar to status quo although the potential for more spatial and temporally targeted measures to reduce western Alaskan chum salmon is implicit to this revised program and may confer greater reductions than can be quantified at this time. However, unlike any of the other alternatives, including status quo, it is clear that chum PSC reduction measures would be explicitly designed to not exacerbate Chinook PSC. Alternative 3 also presents a range of additional tools that might be incorporated into a modified RHS program.

Under Alternative 4, options that require a greater proportion of pollock to be diverted elsewhere have diminishing benefits in terms of increased salmon savings but in general divert less pollock than Alternative 2 (Figure 2-10). There are some cap options that provide savings of about 20% for chum salmon AEQ while only impacting the pollock fishery by diverting about 8% of the B-season pollock.

In 2011 (the first year Amendment 91 was in effect) the cumulative seasonal pattern was different than average with shore-based vessels having a peak Chinook bycatch event at the end of the season whereas the chum bycatch occurred earlier than typical (Figure 2-11). For offshore catcher-processors the pattern for chum was similar to catcher boats but there was a lower increase in Chinook salmon bycatch at the end of the B season (Figure 2-12).

The implications of imposing Alternatives 2 or 4 and the associated options indicate that reducing bycatch levels and impacts to Alaskan chum salmon runs can be achieved, but improvements would be relative to the current estimated impacts which are already low (typically less than 1%). It is clear that options which reduce chum salmon bycatch the most do so at the expense of forgone pollock and increased Chinook salmon bycatch (or reduced capabilities to avoid Chinook salmon PSC; Figure 2-13). Options that perform better by lowering the forgone pollock while still reducing western Alaska chum salmon AEQ mortality, may do poorer at savings of chum salmon originating from Asian regions (Figure 2-13). The extent that these measures, if enacted without a system like the current RHS program (analyzed under Alternative 1), would reduce chum PSC are less well understood. It is clear that bycatch totals generally increase as run sizes increase. It is also clear that the effectiveness of triggered closure areas will vary from year to year due to the inherent variability and complexity of the pollock and chum salmon seasonal and spatial distribution.

The amount of pollock diverted (meaning the pollock would have to be taken outside of closure areas) was intermediate at about 110 thousand t to just over 160 thousand t. Another examination involved seeing if there were differences in the maximum values that could be attained in a given historical year (2003-2011). The results were similar in relative benefits over alternatives and options.

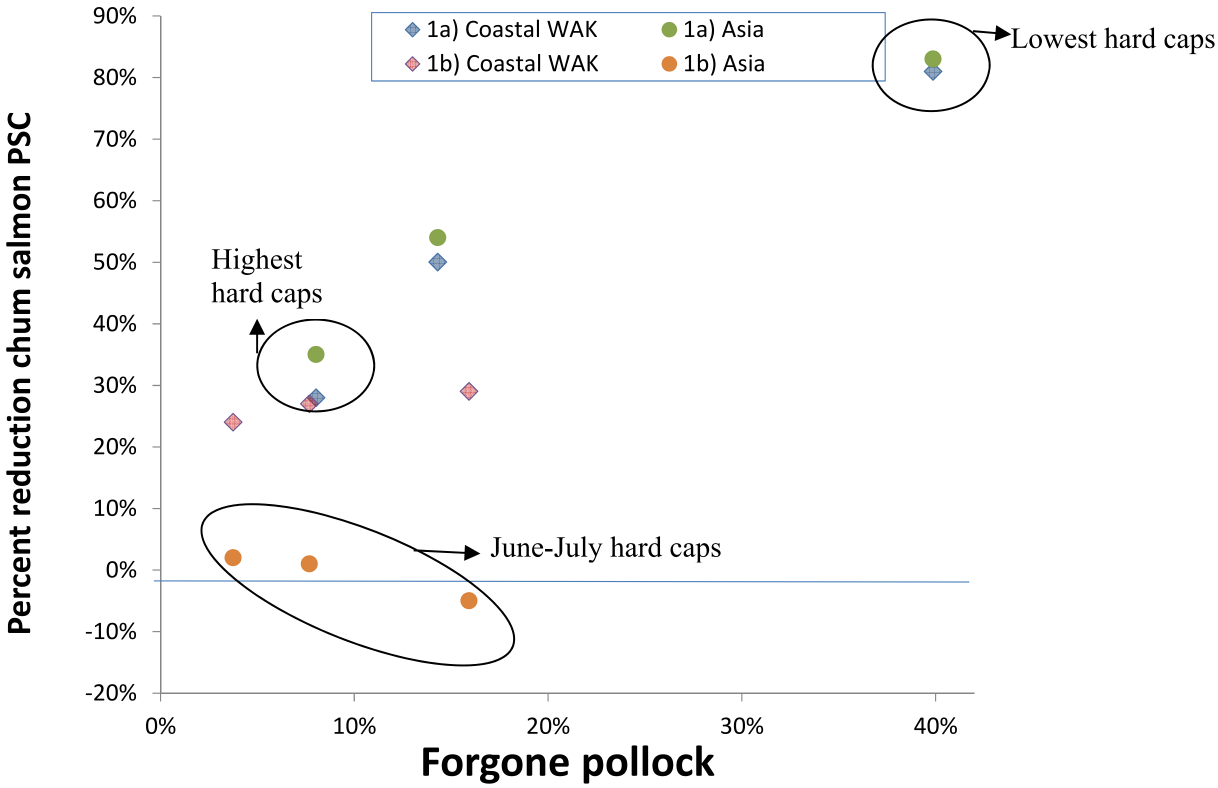


Figure 2-9. Relative reduction of chum salmon AEQ mortality (vertical axis) compared to relative amounts of pollock forgone (or diverted for 1b) by suboption for **Alternative 2**. Each point represents a different combination of sector allocation and cap level summed over 2003-2011.

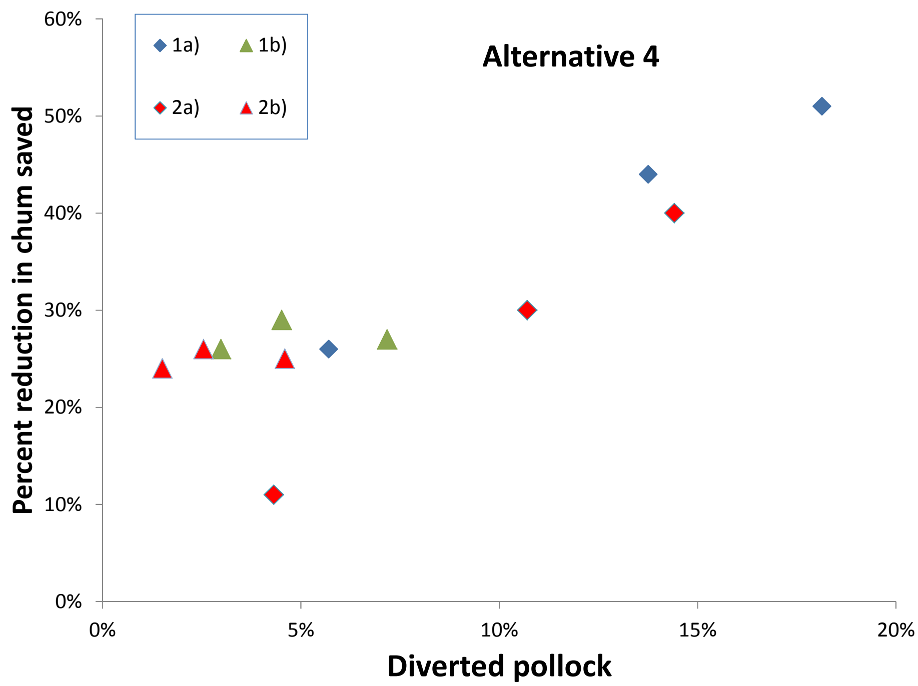


Figure 2-10. Relative reduction of chum salmon AEQ mortality (vertical axis) compared to relative amounts of pollock diverted by suboption for **Alternative 4**. Each point represents a different combination of sector allocation and cap level summed over 2003-2011.

Table 2-10. Summary over alternatives 2 and 4 using sector split of 2ii, λ=0 (λ=1 in parentheses) for different cap levels alternatives and their options. Chum AEQ are estimates of the adult equivalent annual **average** (2004-2011) improvements by alternative and option. Western Alaska is Upper Yukon combined with Coastal west Alaska, Asia include chum from Russia and Japan, the total adds these two groups and the remaining stocks. Chinook salmon saved are absolute reductions (or increases if negative) in bycatch and pollock are in tons. Italicized values signifying diverted catch due to closed areas and bold signifies foregone catch as **averaged** over 2003-2011.

			Change in Chum salmon AEQ (numbers that would have returned to spawn)			**Pollock forgone or diverted**	**Chinook PSC change**
	Option	Cap	Western Alaska	Asian	Total chum	Pollock	Chinook
Alternative 2	**1a)**	50,000	30,279	99,013	167,610	322,620	17,304
		200,000	16,269	62,727	101,275	118,561	8,651
		353,000	6,799	34,118	51,093	53,073	5,349
	1b)	15,600	12,529	-8,587	11,416	126,796	-5,934
		62,400	10,300	-3,907	12,247	66,303	-3,373
		110,136	8,584	-1,199	12,339	40,388	-2,142
Alternative 4	**1a)**	25,000	19,529	54,252	97,071	129,898	7,805
		75,000	16,001	48,006	83,718	86,605	5,686
		200,000	8,804	35,604	57,043	39,090	3,652
	1b)	7,800	12,618 (12,194)	227 (16,986)	21,709 (40,790)	47,537 (139,473)	-3,682 (273)
		23,400	12,573 (11,858)	5,876 (16,001)	27,579 (38,608)	31,951 (116,395)	-2,537 (209)
		62,400	10,372 (9,576)	5,083 (12,575)	22,657 (30,478)	20,553 (86,571)	-1,702 (146)
	2a)	25,000	12,085	21,651	46,274	103,527	2,716
		75,000	10,063	20,716	41,647	65,454	2,185
		200,000	4,645	14,746	25,558	28,970	1,039
	2b)	7,800	9,918 (7,762)	1,958 (10,817)	19,059 (25,990)	29,588 (82,323)	-2,464 (84)
		23,400	10,019 (8,210)	7,321 (10,965)	25,013 (26,536)	17,179 (64,890)	-1,496 (57)
		62,400	8,311 (6,914)	6,486 (8,954)	20,947 (21,777)	9,620 (44,300)	-885 (31)

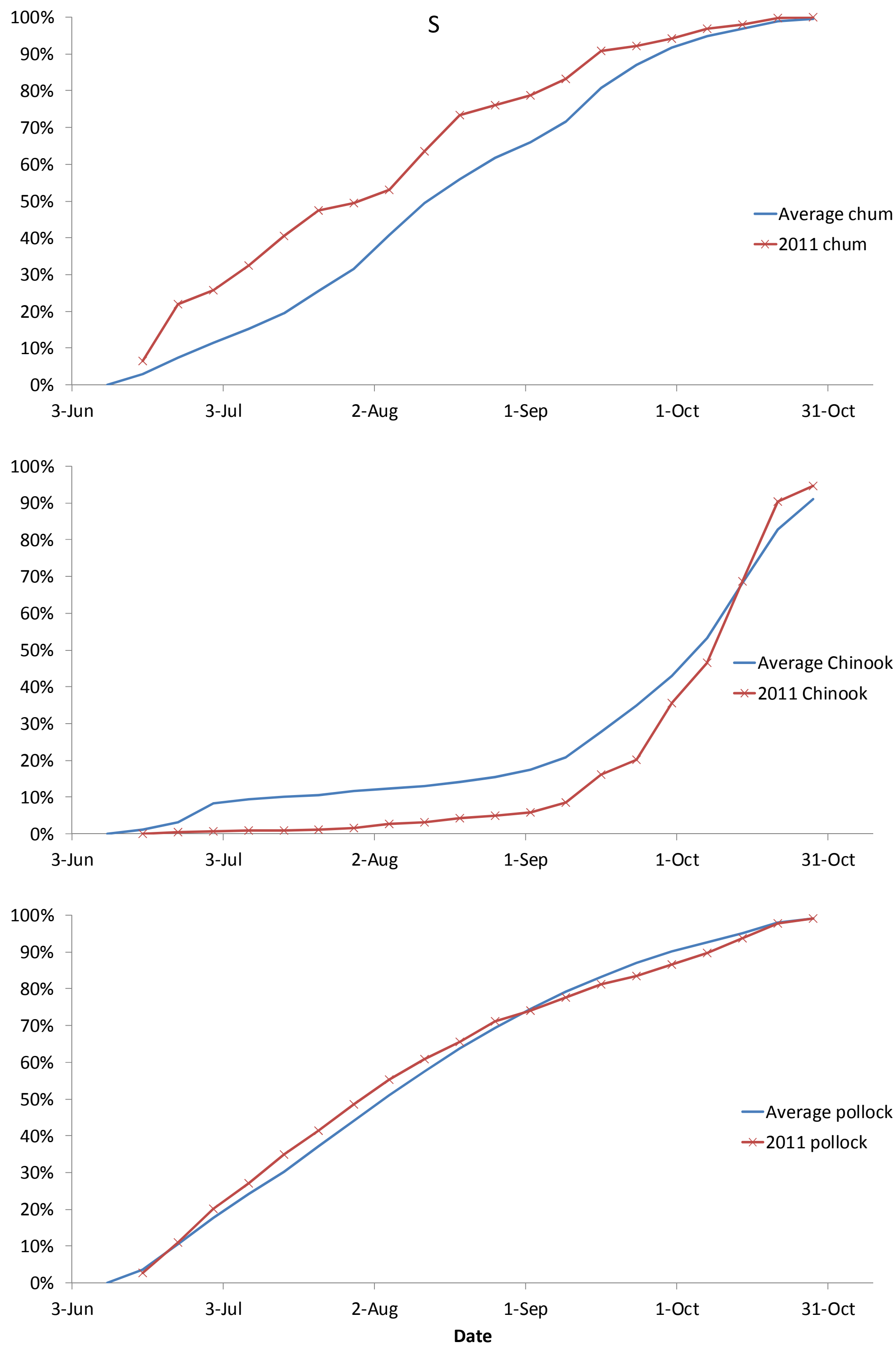


Figure 2-11. Shorebased catcher vessels' cumulative proportion of chum (top), Chinook (middle) and pollock (bottom) for 2011 compared to mean (2003-2011) values.

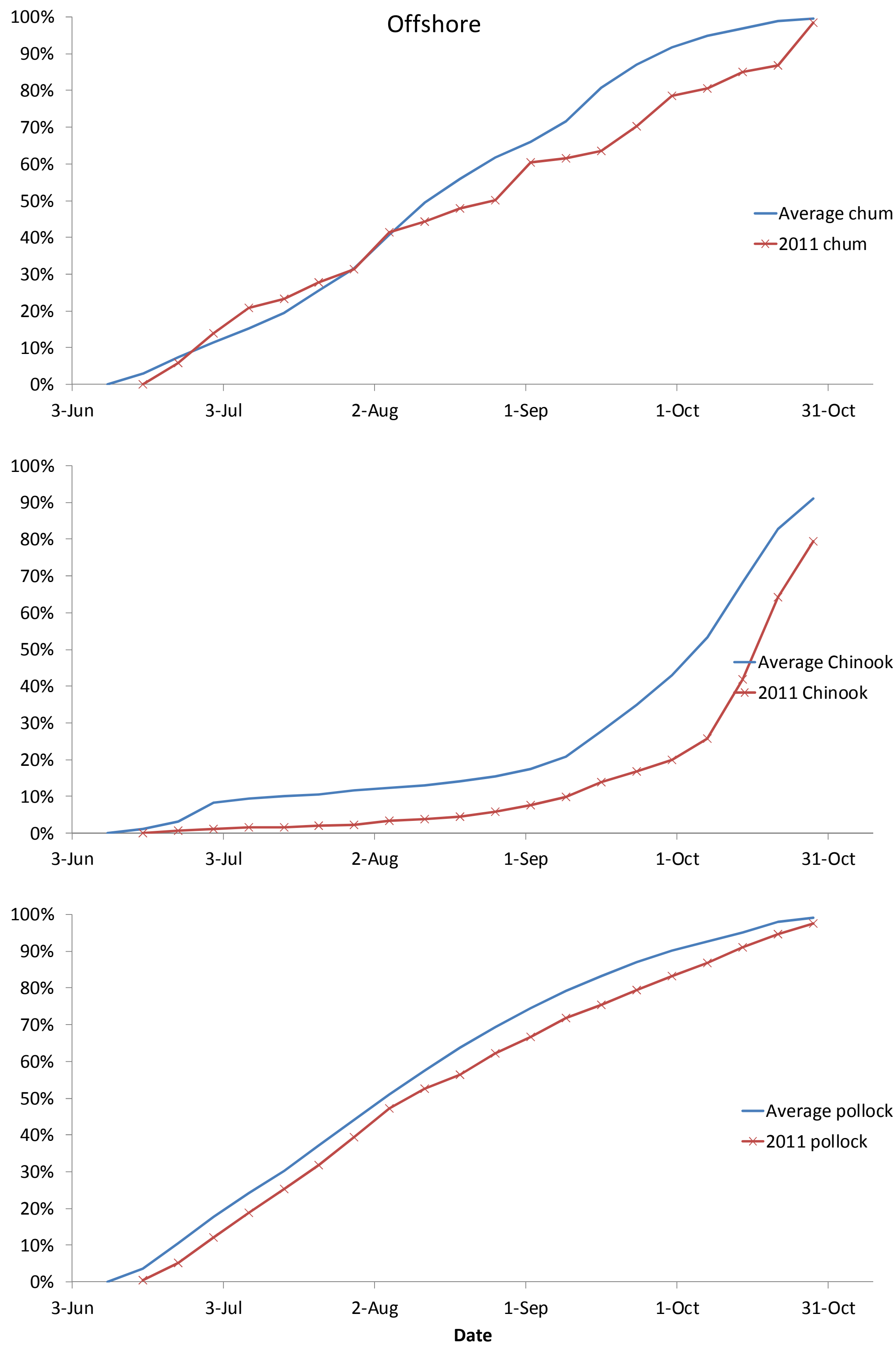


Figure 2-12. Offshore catcher processors' cumulative proportion of chum (top), Chinook (middle) and pollock (bottom) for 2011 compared to mean (2003-2011) values.

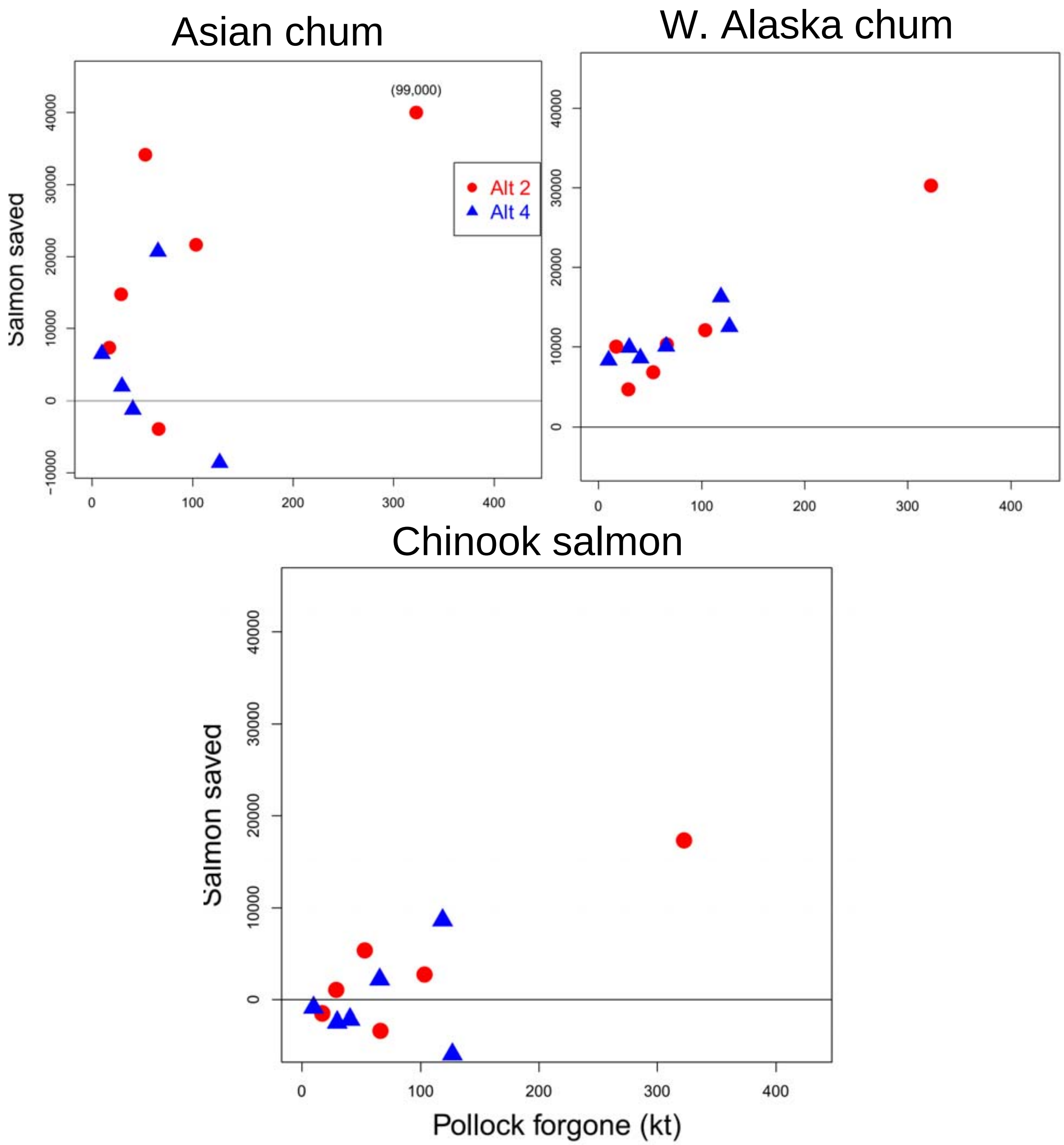


Figure 2-13. Mean expected reduction of salmon mortality (vertical axis) compared to relative amounts of pollock forgone or diverted (thousands of t) for different alternatives, caps and options. Western Alaska stocks include coastal W Alaska and Upper Yukon combined.

2.6.2 Council considerations for identifying a preferred management approach

This section provides some points of consideration for the Council when selecting a preferred alternative or identifying a preliminary preferred alternative. There are 4 alternatives under consideration. In selecting a preferred alternative the Council has several policy-level considerations including addressing the problem statement, the National Standards, and NEPA considerations. Furthermore the Council's selection of a preferred management approach is also centered on what is considered to be the primary management tool to ensure the efficacy of the measure as well as how the efficacy of an approach is to be assessed.

2.6.2.1 Selection of a management approach which addresses the Council's Problem Statement

The preferred alternative should address the problems and objectives that the Council identified in its problem statement for this action (page 1 of the EA and reproduced below). Therefore, the Council should review its problem statement to confirm that it still reflects the problems that led the Council to recommend new chum salmon PSC management measures and that it still reflects an accurate description of the objectives that the Council hopes to achieve with its preferred alternative.

> *Magnuson-Stevens Act National Standards direct management Councils to balance achieving optimum yield with bycatch reduction as well as to minimize adverse impacts on fishery dependent communities. Non-Chinook salmon (primarily made up of chum salmon) prohibited species bycatch (PSC) in the Bering Sea pollock trawl fishery is of concern because chum salmon are an important stock for subsistence and commercial fisheries in Alaska. There is currently no limitation on the amount of non-Chinook PSC that can be taken in directed pollock trawl fisheries in the Bering Sea. The potential for high levels of chum salmon bycatch as well as long-term impacts of more moderate bycatch levels on conservation and abundance, may have adverse impacts on fishery dependent communities.*
>
> *Non-Chinook salmon PSC is managed under chum salmon savings areas and the voluntary Rolling Hotspot System (RHS). Hard caps, area closures, and possibly an enhanced RHS may be needed to ensure that **non-Chinook PSC is limited** and remains at a level that will **minimize adverse impacts on fishery dependent communities**. The Council should structure non-Chinook PSC management measures **to provide incentive for the pollock trawl fleet to improve performance in avoiding non-Chinook salmon while achieving optimum yield from the directed fishery and objectives of the Amendment 91 Chinook salmon PSC management program**. Non-Chinook salmon PSC reduction measures should **focus, to the extent possible, on reducing impacts to Alaska chum salmon as a top priority**.*
>
> [emphasis added to identify what appear to be specific Council objectives for this action.]

The Council's specific objectives appear to be:

- balance national standard 1 to achieve optimum yield from the pollock fishery and national standard 9 to reduce bycatch to the extent practicable (recognizing that national standard 9 refers to *minimizing* bycatch to the extent practicable);
- reduce bycatch to address concerns for those who depend on salmon;
- develop a management approach which provides incentives to avoid salmon
- maintain the objectives of Chinook PSC program
- focus chum PSC measures on reducing impacts to western Alaska chum stock

In its rationale, the Council should address how the preferred alternative accomplishes the objectives identified in the problem statement for its action. If, as a result of information presented in the EA or provided to the Council through public comment, the problem statement no longer accurately describes the Council's objectives, the Council should modify the problem statement and clarify its objectives.

Because the Council's objectives focus specifically on limiting bycatch, it would be helpful for the Council to identify the level of chum salmon bycatch from which it hopes reductions to occur. Specifically identifying this benchmark would help the Council explain how its preferred alternative will accomplish its goal of reducing chum salmon bycatch.

Where possible and relevant, it would be helpful for the Council to identify specific information in the EA, the public comment, or the comment analysis report that it relied on to develop its preferred alternative.

If the Council chooses to create a preferred alternative, or a preliminary preferred alternative, the following series of considerations may be of assistance. Sections below review through the various components that are currently part of suite of alternatives. Each section also lists the options relative to that component that are included in these alternatives and lists the range that was analyzed in depth in the EA.

2.6.2.2 Consideration of the Magnuson-Stevens Act National Standards

Below are the 10 National Standards as contained in the Magnuson-Stevens Act, and a brief discussion of the consistency of the proposed alternatives with those National Standards, where applicable. The Council must consider the consistency with the National Standards in selecting their preferred management approach.

National Standard 1 — Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery

In terms of achieving "optimum yield" from the fishery, the Act defines "optimum", with respect to yield from the fishery, as the amount of fish which—

A. will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;
B. is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and
C. in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Most of the alternatives under consideration divert effort from time and areas but do not prevent the pollock fishery from achieving its total allowable catch (TAC) in most years. However, as noted in the analysis, some of the alternatives under consideration, particularly the most restrictive PSC limits under Alternative 2, would close the EBS pollock fishery prior to achieving its TAC in some years unless fishermen can adjust their fishing to avoid chum salmon PSC.

The pollock stock is not currently in danger of overfishing and is considered stable. The FMP establishes optimum yield for the BSAI groundfish fishery as falling within an established overall range for the BSAI groundfish fishery as a whole. This action is not expected to interfere with achievement of optimum yield within that range on a continuing basis despite the fact that in some years the EBS pollock TAC may not be achieved. The proposed action would likely reduce the PSC of chum salmon in years of high PSC either by closing the EBS pollock fishery early, by moving the fishery out of areas of high PSC or by encouraging fishermen to pursue ways to reduce chum PSC. A reduction in chum PSC may result in an increase in yield in the directed salmon fisheries although the relationship appears to be weak.

With the information that is available, the total 'value' of chum salmon savings cannot be estimated for the various user groups. The estimated annual savings of chum salmon may represent a cost to the pollock harvesters, processors and consumers that is realized in the amount of pollock that is harvested or additional costs to harvesters in diverted pollock for alternatives which increase fishing time and distance traveled due to time and area closures or may decrease the value of the fish harvested. To the extent possible, the value of these fish to the pollock harvesters and processors was described for each alternative and option in the RIR. Chum salmon PSC in the pollock target fishery also has value to the commercial harvesters of chum salmon, sport fishermen, subsistence users, and as prey for other species. A general description of each of these user groups was provided in the EA/RIR. However, we cannot estimate the change in the number of chum salmon that would accrue to each use as a result of this action. The EA does, however, estimate the adult salmon that would otherwise have survived to return to its spawning stream, however information is insufficient to partition each river of origin or further estimate the division of aggregate benefits amongst adult AEQ to stream of origin beyond that estimated in the EA.

Overall benefits to the Nation may be affected by the proposed action, though our ability to quantify those effects is quite limited. Overall net benefits to the Nation would not be expected to change to an identifiable degree between the alternatives under consideration.

National Standard 2 — Conservation and management measures shall be based upon the best scientific information available.

Information in this analysis represents the most current, comprehensive set of information available to the Council, recognizing that some information (such as operational costs) is unavailable. It represents the best scientific information available.

National Standard 3 — To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

NMFS conducts the stock assessments for EBS pollock and makes allowable biological catch recommendations to the Council. The Council sets the TAC for pollock based on the most recent stock assessment and survey information. EBS pollock will continue to be managed as a single stock under the alternatives in this analysis.

National Standard 4 — Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various U.S. fishermen, such allocation shall be (A) fair and equitable to all such fishermen, (B) reasonably calculated to promote conservation, and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

Nothing in the alternatives considers residency as a criterion for the Council's decision. Residents of various states, including Alaska and states of the Pacific Northwest, participate in the major sectors affected by these allocations. No discriminations are made among fishermen based on residency or any other criteria.

National Standard 5 — Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources, except that no such measure shall have economic allocation as its sole purpose.

The wording of this standard was changed in the recent Magnuson-Stevens Act authorization, to consider rather than promote efficiency. Efficiency in the context of this change refers to economic efficiency, and the reason for the change, essentially, is to de-emphasize to some degree the importance of economics relative to other considerations (Senate Report of the Committee on Commerce, Science, and Transportation on S. 39, the Sustainable Fisheries Act, 1996). The analysis presents information relative to these perspectives and provides information on the economic risks associated with the proposed PSC reduction methods.

National Standard 6 — Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

All of the alternatives under consideration in the proposed action appear to be consistent with this standard.

National Standard 7 — Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

All of the alternatives under consideration appear to be consistent with this standard.

National Standard 8 — Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

Many of the coastal communities in Alaska and the Pacific Northwest participate in the pollock fishery in one way or another such as homeport to participating vessels, the location of processing activities, the location of support businesses, the home of employees in the various sectors, or as the base of ownership or operations of various participating entities. A reduction of chum salmon PSC in the pollock fishery may be a benefit to fishing communities that depend on chum salmon. A summary of the level of fishery engagement and dependence in these communities of both pollock and salmon is provided in the RIR.

The sustained participation of these fishing communities is not put at risk by any of the alternatives being considered. Economic impacts to participating communities would not likely be noticeable at the community level, so consideration of efforts directed at a further minimization of adverse economic impacts to any given community is not relevant.

National Standard 9 — Conservation and management measures shall, to the extent practicable, (A) minimize bycatch, and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

The proposed action is specifically intended to reduce chum salmon PSC in the pollock fishery. The practicability of PSC reduction is discussed in the analysis of the impacts of the various alternatives and options.

National Standard 10 — Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

The alternatives under consideration appear to be consistent with this standard. None of the alternatives or options proposed would change safety requirements for fishing vessels. No safety issues have been identified relative to the proposed action.

2.6.3 Decide what the primary management program is: hard cap or RHS management of closures

The alternatives under consideration differ in scope of what the primary management tool employed to achieve the Council's objectives as described above. Two broad options are available in the suite of alternatives, a hard cap that explicitly limits the amount of chum bycatch under Alternative 2, or the RHS system under Alternatives 1, 3 and 4 which imposes closures on high-bycatch areas. These alternatives differ fundamentally in both the primary management tool as well as the benchmark against which the program is measured for evaluation of its efficacy. Once the Council selects the direction of the primary management tool then the decision points for each direction differ based on this decision.

2.6.4 Hard cap: Alternative 2

If the hard cap is to be the primary management tool then Alternative 2 contains the necessary decisions points for selecting and allocating PSC limits

.

A. Decide whether the cap is applied in June and July (only) or for the whole B-season. Select cap level.

Setting the hard cap (Component 1)		**Non-Chinook total**	**CDQ**	**Non-CDQ**
	Option 1a: Cap established for B season. Select cap from a range of numbers*	50,000	5,350	44,650
		200,000	21,400	178,600
		353,000	37,771	315,229
	Option 1b: Cap established for June and July. Select cap from a range of numbers*	15,600	1,669	13,931
		62,400	6,677	55,723
		110,136	11,785	98,351

Council needs to select one of these options:
- B season cap
- June/July cap

B. Decide whether the cap will be allocated to sectors

Sector allocation (Component 2)*	Range of sector allocations*	CDQ	Inshore CV	Mothership	Offshore CP
	Option 2ii	6.7%	63.3%	6.5%	23.6%
	Option 4ii	3%	70%	6%	21%
	Option 6	10.7%	44.77%	8.77%	35.76%

C. Are voluntary transfers allowed among sectors?

Sector transfers and rollovers (Component 3)	No transfers (Component 3 not selected)			
	Option 1	Caps are transferable among sectors and CDQ groups within a fishing season		
		Suboption: Maximum amount of transfer limited to:	a	50%
			b	70%
			c	90%
	Option 2	NMFS rolls over unused salmon PSC to sectors still fishing in a season, based on proportion of pollock remaining to be harvested.		

D. Should the inshore CV cap be subdivided among cooperatives

<table>
<tr><td rowspan="7">Cooperative Allocation and transfers (Component 4)</td><td>No allocation</td><td colspan="4">Allocation managed at the inshore CV sector level. (Component 4 not selected)</td></tr>
<tr><td>Allocation</td><td colspan="4">Allocate cap to each cooperative based on that cooperative's proportion of pollock allocation.</td></tr>
<tr><td rowspan="5">Option: Cooperative Transfers</td><td>Option 1</td><td colspan="3">Lease pollock among cooperatives in a season or a year</td></tr>
<tr><td>Option 2</td><td colspan="3">Transfer salmon PSC (industry initiated)</td></tr>
<tr><td colspan="2" rowspan="3"><u>Suboption</u> Maximum amount of transfer limited to the following percentage of salmon remaining:</td><td>a</td><td>50%</td></tr>
<tr><td>b</td><td>70%</td></tr>
<tr><td>c</td><td>90%</td></tr>
</table>

2.6.5 RHS program provisions

If a RHS program is to be included as a management tool then Alternatives 1, 3 and 4 contain provisions for including varying levels of the RHS as the primary management measures, either with a closure system to incentivize participation (Alternatives 1 and 3) or with additional triggered closures for RHS participants (Alternative 4).

2.6.5.1 Preference for a revised program with provisions for WAK chum and Chinook

If the revised RHS program is to be part of the Council's preferred approach then this would suggest either Alternative 3 or 4 as a preferred direction. Alternatives 3 and 4 contain the same revised program as listed under Component 1 "Fleet PSC management with non-participant closure", with the triggered closure for non-participants. The distinction between the two lies in whether or not the RHS program alone is sufficient to meet the Council's objectives (Alternative 3) or if additional layered triggered closures are needed to ensure that the objectives of the Council are met (Alternative 4)

Alternatives 3 and 4

<table>
<tr><td rowspan="2">Component 1:Fleet PSC management with non-participant triggered closure</td><td>Area</td><td>Triggered closure encompassing 80% of historical PSC. Participants in RHS would be exempt from the regulatory closure if triggered.</td></tr>
<tr><td>Option 1: cap</td><td>Select a cap from a range of numbers: 25,000 –200,000</td></tr>
</table>

2.6.5.2 Preference for layered closures in addition to the RHS program? Alternative 4

If additional federally-managed closures are desirable to meet the objectives of the Council's preferred management program then this would direct the Council towards Alternative 4. Several choices are necessary in selecting components of this alternative.

Component 2: Trigger Closure area and timing for RHS participants	**Option 1:** Area 80%	Triggered closure encompassing 80% of historical PSC for all R participants
	Suboption a: timing	Applies to remainder of B season if triggered
	Suboption b: Timing	Applies in June and July if triggered
	Option 2: Area 60%	Triggered closure encompassing 60% of historical PSC for all R participants
	Suboption a: timing	Applies to remainder of B season if triggered
	Suboption b: Timing	Applies in June and July if triggered

Council needs to select one of these options:

- Closure area
- Whether B season or June/July

Component 3: PSC Cap levels for closure selected under Component 2 for RHS participants	Option 1a: PSC cap established for B season closure	Select cap from range of numbers: 25,000 – 200,000
	Option 1b: PSC cap established for June/July proportion	Select cap from range of numbers: 7,800 – 62,400

Council needs to select cap for timing option

	Range of sector allocations*:	CDQ	Inshore CV	Mothership	Off
Component 4: Allocating the trigger cap to sectors	Option 1	10.0%	45.0%	9.0%	3
	Option 2ii	6.7%	63.3%	6.5%	2
	Option 4ii	10.7%	44.77%	8.77%	3
	Option 6	3.4%	81.5%	4.0%	1

Select if sector allocated

Component 5: Sector transfers and rollovers	No transfers (Component 5 not selected)			
	Option 1	Caps are transferable among sectors and CDQ groups within a fishing se		
		Suboption: Maximum amount of transfer limited to:	a	5
			b	7
			c	9
	Option 2	NMFS reallocates unused salmon PSC to sectors still fishing in a season, on proportion of pollock remaining to be harvested.		

Component 6: Inshore Cooperative Allocation and transfers	No allocation	Allocation managed at the inshore CV sector level. (Component 6 not sel		
	Allocation	Allocate cap to each inshore cooperative based on that cooperative's proportion of pollock allocation.		
	Option: Cooperative Transfers	Option 1	Lease pollock among cooperatives in a season or a ye	
		Option 2	Transfer salmon PSC (industry initiated)	
		Suboption Maximum amount of transfer limited to the following percentage of salmon remaining:	a	5
			b	7
			c	9

Select if sector transfers and cooperative provisions

2.6.5.3 Decide how the efficacy of the selected management program will be evaluated.

A consideration in selecting a preferred alternative is how the Council will ensure that the management approach is effective. The analysis provides the best estimate of how effective any of the alternative programs may be at achieving the Council's objectives. However, this does not ensure that the selected approach will result in the estimated impacts. NMFS drafts regulations according to the program selected by the Council to meet the intent of the management approach. Previously under amendment 84, all provisions of the ICA contractual agreement were put into regulation as a means of ensuring compliance with the program. However, as noted in Chapter 2 section 2.4.7.1, it is a policy decision as to what aspects of a given program must go into regulation to ensure its efficacy. Some provisions of the program are necessary in regulation in order to prevent substantive modifications to the ICA that would reduce its effectiveness. However putting the entire ICA into regulation does not ensure effectiveness and in fact can compromise the ability to make changes intended to improve the program's functionality and efficacy.

A summary of the essential and non-essential regulations in§ 679.21(g) is extracted from the section at 2.4.7.1 and included in Table 2-11. This summary table is based on the assumption that the primary management program would be consistent with the Council objectives for the program, National Standards, and other applicable statutes and regulations. The regulations that are identified as essential are intended to represent the minimum regulations required to support the current program, recognizing that the Council may wish to add additional detail in the regulations.

Table 2-11 Summary of essential and non-essential regulations in § 679.21(g) based on structure of primary management program: Non-essential regulations represent minimum potential regulations at discretion of the Council

Essential Regulations	**Non-Essential Regulations:**
Submission Location, and Deadlines for the proposed non-Chinook bycatch ICA:	Initial Base Rate, and Inseason adjustments to the non-Chinook base rate calculation: § 679.21(g)(2)(iii)(A)
Information Requirements: Participants to the ICA & Identifiers: (§ 679.21(g)(2)):	Maximum or Minimum Chum Salmon Savings Area: § 679.21(g)(2)(iii)(D)
Information Requirements; Third Party: § 679.21 (g)(2)(i)(D)	ICA Chum Salmon Savings Area notices: § 679.21(g)(2)(iii)(D)
NMFS review of the proposed ICA and amendments: 679.21 (g)(3)	Fishing restrictions for vessels assigned to tiers, and Cooperative tier assignments: § 679.21(g)(2)(iii)(E)
ICA Annual Report – Regulatory Detail: The ICA Annual Report at § 679.21(g)(4)	Annual Compliance Audit and Requirement for data dissemination: at § 679.21(g)(2)(iv)
If Regs on notice dates continued, clarify that twice weekly notices are dependent on whether any closure(s) are being implemented: § 679.21(g)(2)(iii)(C)	detailed enforcement provisions from current RHS ICA:§ 679.21(g)(2)(iv)

In addition to structural provisions of the program, some additional aspects of the revised RHS should be included in regulation to ensure that the aspects of the program which are explicitly structured to meet the Council's objectives are retained. These are the following:

- *Closures*: some information in the regulations to ensure that the closure rules are followed. This could be provisions to ensure the number of closures per week, the rules for the closures or the rate-basis for the closures.
- *WAK chum*: some regulation to indicate that program is structured to prioritize closures for WAK chum over others.

- *Chinook threshold*: This is a critical component of the revised RHS to explicitly tie it to the problem statement and council objective. Information in the regulations could consider specifying both the threshold employed and the start date for it.

Another measure of evaluating whether a program functions as the Council intends is to include annual reporting requirements in the alternative. Careful consideration of the reporting requirements could provide the information to the Council and the public that would both serve as a measure of the transparency of the ICA managed program as well as the efficacy of it. Reporting requirements would be in regulation, thus a report to the Council containing all the provisions noted would be mandated on an annual (or other periodic) basis. Both the timing and details of the requirements are critical to providing the basis for understanding to what extent the program is effective. One possibility for reducing the details of the ICA provisions in regulation is by requiring detailed reporting requirements that would provide the basis for determining both the efficacy and transparency of the program.

Using the revised RHS program as a candidate for a preferred alternative, some suggestions are put forward on explicit reporting requirements. These reporting requirements are listed in conjunction with additional information on the rationale for the requirement, and the details and frequency of reporting. Data listed for reporting often serve more than one purpose as a requirement. For example, the requirement (3) "Sea State summary of closure decision-making" would allow both for consideration of the efficacy of the closure by providing details on how and when the closure was enacted (which allows for analysis of its efficacy afterwards) as well as to provide a transparent overview for the public of what information was available at the time of the closure to identify that area. The transparency aspect is as important as the efficacy as it provides the Council and the public with information on management decisions being made under the ICA and the data upon which these decisions are made.

Currently the industry has a set of annual reporting requirements to the Council on their measures towards bycatch minimization under the status quo RHS management program for chum PSC. These requirements are that an annual report is submitted to the Council with the following:

1. *Number of salmon taken by species and season.*
2. *Estimate of number of salmon avoided as demonstrated by the movement of fishing effort away from salmon hot-spots.*
3. *A compliance/enforcement report which will include the results of an internal compliance audit and an external compliance audit if one has been done.*
4. *List of each vessel's number of appearances on the weekly vessel performance lists (note this is a requirement of the AFA coop reports).*
5. *Acknowledgement that the Agreement term has been extended for another year (maintaining the 3-year lifespan) and report of any changes to the Agreement that were made at the time of the renewal.*

In addition, an annual third party audit is also conducted to ensure compliance (or report on non-compliance) with the provisions of the ICA. The third party audit is made available to the public and the Council in conjunction with the annual performance review.

As discussed previously, while the status quo RHS program is specified in regulation, the degree to which a revised RHS must be specified is a matter of policy, and specifying the specifics of the program in regulation is not mandatory. The purpose of specifying in regulation previous was to ensure some manner of the program functionality being mandated by the regulations to implement it. However as experience has shown this does not ensure that the program functions as indicated and in fact in many ways this can impede the efficacy of the program by limiting the changes that can be made annually and within seasons to better improve program performance. Annual reporting requirements however, in conjunction with additional analyses conducted by staff on an annual or periodic basis if properly specified, could provide a transparent measure of program efficacy.

The following list (Table 2-12) summarizes ideas for annual reporting requirements under a revised RHS program that the Council could include with alternatives 3 or 4 in selecting a preliminary preferred alternative (or preferred alternative at final action). No specific reporting requirements are drafted for Alternative 2 as the hard cap would serve as the over-arching measure of the efficacy of the program, however the Council could specify more explicit reporting requirement for Alternative 2 as desirable. The main rationale for these specific reporting requirements is to provide transparency to the activities that actively affect fishing patterns and industry management of the RHS program. Following this, a list of additional information and analyses which could be requested of staff (Agency or Council or otherwise) is provided to further indicate what additional information could be provided annually or periodically in order to best evaluate the efficacy of the program. The industry-requested reporting requirements can be derived from data SeaState currently uses for their in-season program. Reporting this information annually (or in-season as noted in the table) is meant to provide the Council and the public with information on the management and efficacy of the program and will complement additional analyses by staff. No additional data collection is envisioned.

Table 2-12 Suggested reporting requirements in conjunction with selection of a RHS-based management program (Alts 1, 3, and 4). Requirements are for annual reporting unless indicated otherwise.

	Requirement	Rationale for requirement	Details and frequency
1	Dates and areas of Chinook closures under IPAs	Better understand relative constraints already imposed	As done by SeaState. Annual or in-season (see further explanation below)
2	Date and area Chinook threshold invoked and relative Chinook rates in other stat areas over time frame	To see whether threshold seems appropriate in when and why invoked based on relative rates in other stat areas	Detailed information on when the chum closures are suspended and based on what Chinook data
3	Sea State summary of closure decision-making	Provide transparency to why a particular area was closed	When closures are modified or extended during the B Season
4	Continue publication of any chum RHS reports sent to the pollock fleet	Continued transparency of reports and closed areas	Following A84, as issued.
5	Listing of advisory closure areas	Additional incentive provided by advisory areas	Need some measure of who fished in test fishing areas
6	Consolidate reporting requirements for both salmon species		To be developed further in conjunction with further action by the Council on this analysis. See below.

Further details on these numbered items are as follows:

1. Chinook closures under IPAs: This information is not required under the reporting requirements for Amendment 91. However, understanding the areas and frequency of closures for Chinook would allow for a better understanding of the constraints already imposed on the fleet outside of the measures proposed for chum salmon PSC management. This information is available through the IPA representatives but would require an agreement from each IPA to make this publicly available in conjunction with these reporting requirements. This information could be reported on an annual basis in the annual report to provide broader transparency of management, or in-season (as well) in order to better inform the fleet itself in-season as to high bycatch areas of

which they may not yet be aware. Not all closures under IPAs are shared between sectors currently.

2. Date and area Chinook threshold invoked: Detailed information on when the chum closures are suspended and based on what Chinook data (area, time period of calculation, etc.). This would be provided in the annual report. For greater transparency to the public it could be provided in-season.
3. Sea State summary of closure decision-making: collect data from SeaState that would provide additional information on why an area was closed and allow greater transparency about what information is being used which would also allow improved future analysis of when closures are most effective.
4. Continue publication of any chum RHS reports sent to the pollock fleet: when Amendment 91 was implemented, RHS agreements became private and NMFS, the Council, and the public no longer view when RHS were put in place. This requirement will ensure that chum RHS reports continued to be available at the time that closures are implemented.
5. Advisory closure listings: Often the RHS provides additional information to participants on areas which do not qualify as a closure based on criteria but are still potential hot spots that some participants may wish to avoid voluntarily. Currently there are no provisions for test fishing in RHS closures however the revised program under Alternatives 3 and 4 does provide a test-fishing provision associated with modified tier structure in June and July. Some measure of fishing in those closure areas as well as any information available from vessels fishing in advisory areas would be beneficial in examining the efficacy of these voluntary methods of bycatch avoidance.
6. This item was suggested by NMFS RO staff as a means to better consolidate reporting requirements for salmon PSC by the fleet. At this time staff have not have a chance to further develop what would be needed to move forward with this as an option in this analysis but should the Council express an interest in further development of consolidating reporting requirements for Chinook and chum PSC by the pollock fishery staff will develop this further for the public review draft.

Table 2-13. Additional information that could be compiled and analyzed by Agency or Council staff analysts in conjunction with Table 2-12 information provided by industry for evaluating the efficacy of the selected RHS-based management program

	Requirement	Rationale for requirement	Details and frequency
1	Cumulative catch statistics by ADFG area for pollock, chum and Chinook	Allows for comparison with historical data, greater transparency for effectiveness of closures	Data used weekly by SeaState to manage closures in-season
2	Relative ranking of bycatch rates for chum and Chinook by vessel	Measure of performance of incentives to reduce bycatch	Show distribution of rankings over vessels (no vessel identification)
3	CPUE, fuel cost, travel time	Measure of search time for fishing opportunities	Fuel costs from EDR in 2012, distance traveled from VMS
4	Index of salmon impact by species	Relative change in bycatch rates of affected vessels	*See below
5	Summary of % of pollock, chum, and Chinook in closure areas prior to Closure	The larger % of chum is in an area, the more likely the closure will be effective. This reveals whether the RHS closures are capturing much of the effort and salmon PSC	Ideally as part of each report, but if this is infeasible this information could be summarized post-season

Further descriptions of these numbered items are as follows:

1. Cumulative catch statistics by ADFG area for pollock, chum and Chinook: The rationale for this requirement is to provide the data that is currently used weekly by SeaState to manage in-season

closures in order to allow for transparent evaluation of the actions taken to delineate a closure and for comparison with similar data available historically. These data are easily available from the Observer Program thus requiring this of industry as opposed to tasking staff to compile annually is one negative to this requirement.

2. Relative ranking of bycatch rates for chum and Chinook by vessel: The rationale for this requirement is to give some vessel-level performance comparison under the new management regime to evaluate to what extent the incentives of fishing under the program are effective. The distribution of ranking of vessels within and across years would provide the Council with information in order to assess the performance of the program. Some of the difficulties that would need to be addressed in including this requirement would be issues related to not identifying vessels by name, for including a caveat that there are complications with evaluating vessel trends due to multiple changes in operator and ownership.
3. Data on CPUE, fuel cost, travel time: Providing data on these items will allow for an assessment of the fishing search time undergone in operation under the new management program. Fuel cost data will become available from the Chinook EDR starting in 2012 while estimates of distance traveled could be made available using VMS data and the Catch-in-Areas-database.
4. Index of salmon by species: Some method of accounting for salmon PSC reduction by virtue of the imposed RHS closures should be annually reported. There are multiple methods by which this calculation could be done, understanding that the variability between years may affect the reliability of this calculation. Examples of calculating this index are shown below:
   a. <u>Index of total salmon impact</u>
      i. Examines the degree to which there is a measurable average (and/or median) impact on bycatch rates in the period following closures compared to the period before the actual closures.
      ii. This follows the work done in the status quo analysis to estimate the observed savings from the closures.
      iii. Because there are periods of rising and declining bycatch during given years, this will be most informative over longer time-frames (annual or multi-year) rather than determining whether or not a particular closure is effective.
      iv. Other measures of annual impact will be researched and utilized as available.

   b. <u>Index of salmon reduction by species for affected vessels:</u>

   Use a simple formula which would provide a relative index of salmon savings. E.g., use the rate at the time of closure, the proportion of pollock that occurred in the closed area in that week (or specified time period), and use the "diverted pollock" to come up with an index that can be computed going forward and historically. E.g., let *C*

$$\hat{C}_{in} = p_{prior} C_{out}$$
$$\hat{S}_{in} = r_{in} \hat{C}_{in}$$
$$\hat{S}_{out} = r_{out} \hat{C}_{in}$$
$$S_{saved} = \hat{S}_{in} - \hat{S}_{out}$$

   where $\hat{C}_{in}$ is estimated pollock catch that would have occurred inside closed area given the proportion (p_{prior}) of the pollock that occurred inside the closure prior to the closure and $\hat{S}_{in}$ is the estimated salmon that would have been caught inside the closure given the observed rate r_{in} and estimated pollock) etc.

It's important to note that there are limitations to the method because it is not necessarily a causal relationship. If where and when bycatch occurs is random and areas of high bycatch are identified every period, vessels in the high-bycatch area before the closure will be average in the second (because bycatch is random), and this method would estimate a large salmon savings that would not actually be due the closures. However, bycatch is not completely random, and thus this may potentially provide a useful index from year to year, although the specific numbers should be viewed with caution.

5. Summary of % of pollock, chum, and Chinook in closure areas prior to Closure: similar to the information presented in the status quo analysis, a summary of pollock and PSC occurring in the area prior to the closure would be presented. If feasible, this information could be presented with all reports or alternatively at the end of the season. The following information could be included, reported by sector:
    a. % of pollock hauls and catch inside each closure
    b. % and number of chum and Chinook PSC occurring inside each closure.
    c. Number and % of vessels that fished in each closure.

The Council may wish to signal its intent to review an analysis of the data provided on a periodic basis by requesting that after a period of 1-3 years staff conduct an analysis of the program's efficacy. The purpose of providing this analysis is to inform the Council and the public as to what extent the program is meeting the objectives of the Council and to provide the Council with the opportunity to initiate a different management approach should information indicate otherwise. The Council has the ability to modify management programs (by initiating an amendment analysis) at any time. However, explicitly stating when the program would be reviewed will help ensure that adequate staff resources are available and show that monitoring the program performance is a priority.

2.7 Development of Alternatives

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 draft 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. These alternatives may still be modified by the Council in iterative reviews of this analysis. Currently the analysis is scheduled for initial review in April 2012. It is anticipated that some modification of the suite of alternatives may occur at initial review. The Council may select a preliminary preferred alternative at initial review in April 2012 and will select a preferred alternative at final action that may or may not comport with the preliminary preferred alternative.

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 that summarized the comments for the Council. Chapter 1 includes a detailed discussion of the issues raised in scoping, which is referenced but not repeated here.

This section discusses the Council's process for developing alternatives, while the following section describes those alternatives that were originally discussed at the Council level and through the Council's Salmon Bycatch Workgroup, but which, for the reasons noted below, were not analyzed in detail.

The Council, in February 2007, established a Salmon Bycatch Workgroup (SBW) committee, comprising members representing the interests of western Alaska (4 members) and of the pollock industry (4 members). This committee had two Chairs, one from each of the major interest groups represented in its membership. The Council later (June 2007) appointed an additional member from the Alaska Board of Fisheries. The Council requested that the SBW provide recommendations to the Council regarding appropriate salmon cap levels, by species (Chinook and chum or "other" salmon), to be considered for the pollock fishery, as well as to work with staff to provide additional review of and recommendations for the development of alternatives for analysis.

The SBW met five times: in March 2007, May 2007, August 2007, November 2007, and January 2009. These meetings were open to the public and noticed in the *Federal Register* accordingly. Following each meeting, a report was compiled representing the recommendations and discussions by the committee, and provided to the Council at its subsequent meeting (April 2007, June 2007, October 2007, December 2007, and February 2009). In the spring of 2009 the Council bifurcated the analyses of chum and Chinook management measures and prioritized the analysis of Chinook management measures. Final action on Chinook management measures was taken by the Council in April 2009 (Amendment 91). The fishery is operating under the Amendment 91 regulations, which began in January 2011.

The Council refined alternatives for chum salmon management measures in December 2009, June 2010, and June 2011 (see Council motions in Appendix 1 to this Chapter). Modifications included changing the range of numbers for cap considerations, adopting the area closure system previously proposed and then removing that system and refining the provisions under what is now Alternative 3. Further modification of alternatives may occur iteratively in the course of finalizing the analysis prior to final action.

The process for selecting areas for closure considerations under Alternative 3 was as follows:

1) Match official NMFS regional office data from 2003 through 2011 at the week, NMFS-area, and sector level with the observer database and expand the observer data to obtain estimates of total catch in areas by day and locations
2) Match these data spatially with the ADF&G 6-digit statistic areas
3) Compute proportion of bycatch and pollock for each ADF&G area over all years (B-season only)
4) Sort by the difference between chum and pollock proportions
5) Cumulate the proportion to obtain the ADF&G areas to select for closure areas

Separate compilations were done for the B season and for June-July (Table 2-14 and Table 2-15 and Figure 2-7). B-season areas for 80 percent and 60 percent closures are shown in Figure 2-3 and Figure 2-5 respectively whereas the areas for the June-July closures are shown in Figures 2-4 and Figure 2-6.

Table 2-14. **B season** proportions by ADF&G Statistical area from 2003 through 2011 expanded observer data and cumulative proportions to determine area closures. Horizontal line represents the cut-off point for the "60%" historical chum level whereas all data shown covers the 80% historical level.

	Proportion			Cumulative	
ADFG Area	Pollock	Chum	Chum-Poll	Pollock	Chum
675530	1.3%	14.1%	12.8%	1.3%	14.1%
675500	1.4%	8.0%	6.6%	2.6%	22.1%
645501	4.7%	8.9%	4.2%	7.3%	30.9%
685530	0.3%	4.3%	4.0%	7.6%	35.2%
685600	1.8%	5.1%	3.3%	9.4%	40.4%
675600	1.7%	4.5%	2.9%	11.1%	44.9%
665530	0.5%	2.8%	2.3%	11.6%	47.7%
705600	2.1%	4.0%	1.9%	13.7%	51.7%
655500	3.9%	5.1%	1.3%	17.6%	56.9%
655409	3.5%	4.5%	1.0%	21.1%	61.4%
655530	0.9%	1.9%	0.9%	22.0%	63.2%
695600	1.0%	1.8%	0.8%	23.0%	65.0%
655430	7.8%	8.5%	0.7%	30.8%	73.5%
665600	0.8%	1.4%	0.6%	31.6%	74.9%
645530	0.6%	1.2%	0.6%	32.3%	76.1%
655600	0.6%	1.1%	0.6%	32.8%	77.3%
665430	1.1%	1.5%	0.5%	33.9%	78.8%
715600	0.3%	0.8%	0.4%	34.2%	79.6%
635504	0.2%	0.6%	0.3%	34.4%	80.2%

Table 2-15 **June-July** proportions by ADF&G Statistical area from 2003 through 2011 expanded observer data and cumulative proportions to determine area closures. Horizontal line represents the cut-off point for the "60%" historical chum level whereas all data shown covers the 80% historical level.

	Proportion			Cumulative	
ADFG Area	Pollock	Chum	Chum-Poll	Pollock	Chum
675530	1.4%	16.9%	15.5%	1.4%	16.9%
645501	8.0%	22.1%	14.1%	9.4%	38.9%
655500	5.8%	12.2%	6.4%	15.2%	51.1%
655430	5.8%	9.4%	3.7%	20.9%	60.5%
675600	1.5%	3.3%	1.9%	22.4%	63.8%
685600	1.8%	3.6%	1.8%	24.2%	67.5%
705600	1.9%	3.2%	1.3%	26.1%	70.7%
665530	0.5%	1.8%	1.3%	26.6%	72.4%
655530	0.3%	1.5%	1.1%	26.9%	73.9%
635504	0.5%	1.5%	1.1%	27.4%	75.4%
645434	0.7%	1.6%	0.9%	28.0%	77.0%
645530	0.8%	1.7%	0.9%	28.8%	78.7%
675500	0.5%	1.0%	0.5%	29.3%	79.7%
635530	0.6%	0.8%	0.3%	29.9%	80.5%

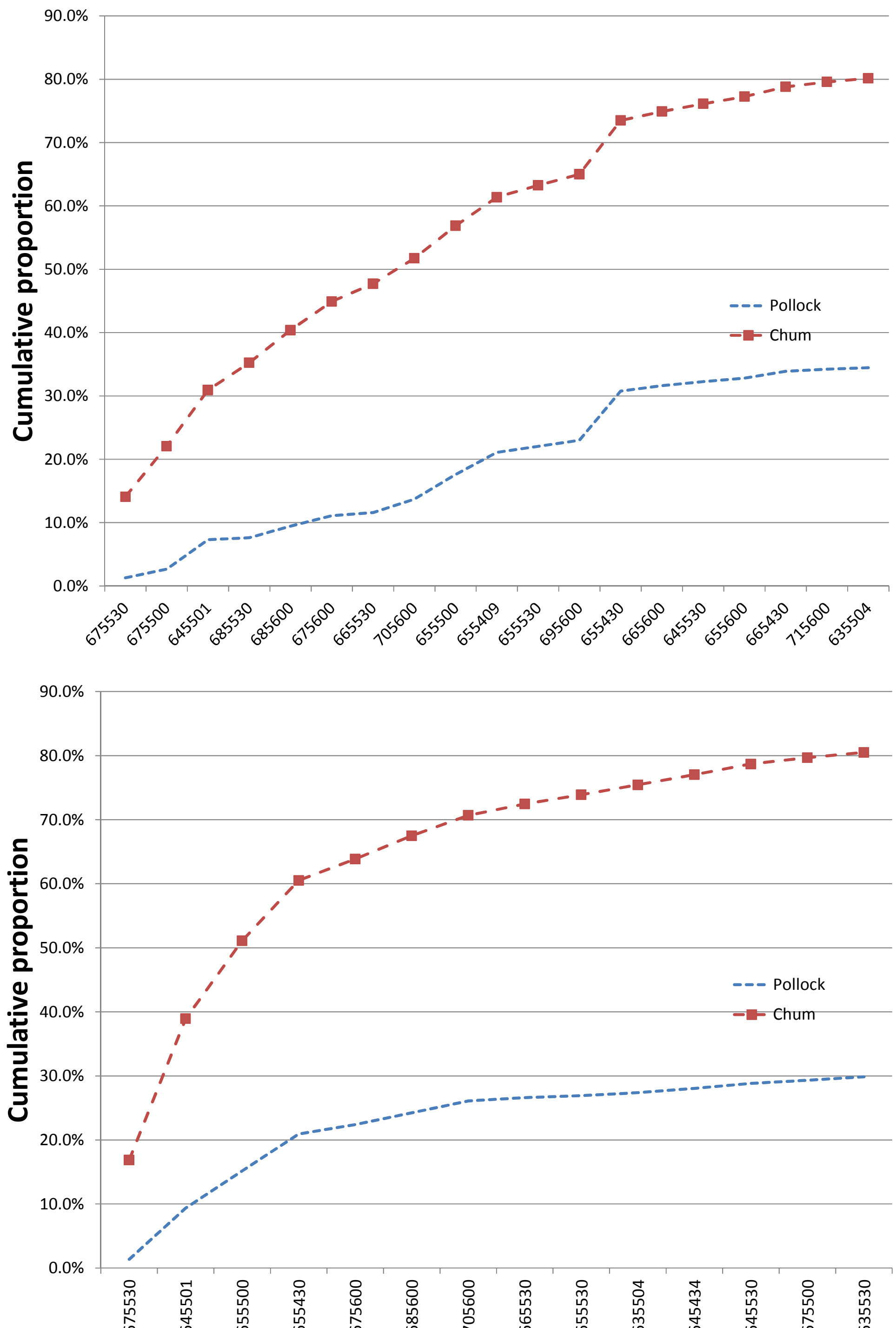


Figure 2-14 Cumulative proportion of chum and pollock catch for 2003 through 2011 for the B season (top panel) and for the June-July period (bottom) by ADFG statistical area.

2.7.1 Alternatives considered and eliminated from further analysis

Additional alternatives were considered by the Council over the time frame of the development of alternatives but were not carried forward for analysis. Modifications to the alternatives have focused on the range of hard caps and trigger caps under consideration, the years over which sector allocation percentages were considered and the area closures systems being considered. Modifications to these occurred iteratively, and the elimination of some of these from current consideration are described below.

The range of alternative hard caps for Alternative 2 were initially representative of the average bycatch over two extreme high and low time frames: 1997 through 2001 (representing the 5-year average prior to the approval of the Yukon River Agreement to the Pacific Salmon Treaty) and a high range of the 3-year average from 2004 through 2006. At that time the range under consideration was thus 58,176 to 488,045. At a subsequent Council meeting, the Council modified this range to round these numbers to 58,000 to 488,000 and then iteratively to modify this range to be 50,000 to 353,000. The Council likewise iteratively modified the years over which the historical sector allocation would be averaged to be more consistent with recent year history of bycatch by sector.

The suite of alternatives had previously included a separate alternative trigger closure system developed by staff at the request of the Council. This closure system was iteratively modified and most recently included in the initial review draft dated May 2011. At the June 2011 meeting, given indications that the proposed monthly closure system would limit the orderly conduct and efficient operation of this fishery and would be potentially less effective than other measures for minimizing bycatch to the extent practicable as stated in the purpose and need for this action, the Council moved to remove that alternative from further consideration. The Council did fold some of the concepts embodied in that system into the current Alternative 3 closure options. The previously considered closure system may be found in Chapter 2 of the May 2011 analysis.[33]

A hard cap of 30,000 chum salmon was requested by eight Norton Sound and Bering Strait tribal governments during consultations with NMFS under E.O. 13175. Each of the eight tribal governments submitted a resolution requesting the Council institute a hard cap of 30,000 chum salmon and that on reaching the hard cap the pollock fishery close with no sector allocations, no sector transfers, and no cooperative provisions. 1.6 describes the consultation meetings conducted by NMFS with these tribes. The Council considered this request at its June 2011 and April 2012 meetings, but did not include a 30,000 chum salmon hard cap as an additional alternative for analysis for the following reasons. At its June 2011 meeting, the Council responded to concerns from western Alaska by restructuring the analysis to include hard caps ranging from 15,500 to 109,430 chum salmon that would apply during June and July. Closures during June and July are targeted at protecting salmon stocks bound for western Alaska. The Council determined that a 30,000 chum salmon hard cap that closed the pollock fishery for the remainder of the year would be less effective than the management measures analyzed under the alternatives at achieving the purpose and need of this action to minimize bycatch to the extent practicable while achieving optimum yield. It would create a greater potential for pollock fishery closures, which would result in greater foregone gross revenues than the lowest cap, 50,000, included under Alternative 2, Option 1a. The Council stated that the 50,000 chum salmon cap provided a good representation of the impacts of a low cap. Additionally, because a 30,000 hard cap would add an additional significant constraint on the pollock fishery, the Council was concerned that a cap this low would hamper its goal of creating incentives for the pollock industry to reduce chum bycatch without reducing the effectiveness of the Chinook salmon PSC management program implemented under Amendment 91.

3 Methods for Impact Analysis

The following description of the methodology attempts to outline the scientific basis to aid decision-makers and the public. The chapter presents the approach used to evaluate the impacts of alternatives on pollock catch (Chapter 4), Chum salmon (Chapter 5), Chinook salmon (Chapter 6) and the economic impacts (RIR). For the remaining resource categories considered in this analysis, marine mammals, seabirds, other groundfish, EFH, ecosystem relationships, and environmental justice, impacts of the alternatives were evaluated largely qualitatively based on results and trends from the quantitative analysis. Emphasis was placed on carrying forward estimates of uncertainties and interpretation of different assumptions.

3.1 Estimating Chum salmon bycatch in the pollock fishery

This analysis relies on historical non-Chinook PSC that was estimated using observer information and CAS methodology. Data collection methods for vessels directed fishing for pollock changed for the 2011 fishing season due to implementation of Amendment 91. Most importantly, methodology moved away from a sample-based estimation procedure to a census for both Chinook and non-Chinook salmon species. An analysis of the monitoring changes implemented under Amendment 91 is found in the Final Bering Sea Chinook Salmon Bycatch Management EIS/RIR (http://www.fakr.noaa.gov/sustainablefisheries/bycatch/default.htm). Readers are directed to Chapters 2 and 6 and Cahalan et al. (2010) for a description of historical data collection methods and estimation procedures.

3.2 Estimating non-Chinook salmon saved and forgone pollock catch

The first step in the impact analysis was to estimate how Chum salmon bycatch (and pollock catch) might have changed in each year from 2003 to 2011 under the different alternatives. The years 2003 to 2011 were chosen as the analytical base years because that was the most recent 8 year time period reflective of recent fishing patterns at the time of initial Council action, with 2005 representing the highest historical bycatch of non-Chinook. Catch accounting changed beginning in the 2003 pollock fishery with the CAS. Since 2003, the CAS has enabled consistent sector-specific and spatially-explicit treatment of the non-Chinook salmon bycatch data for comparative purposes across years. Thus, starting the analysis in 2003 provides the most consistent and uniform data set that was available from NMFS on a sector-specific basis.

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

In some cases, the alternative and options would have closed the pollock fisheries earlier than actually occurred. When an alternative would have closed the pollock fishery earlier, an estimate is made of (1) the amount of pollock TAC that remained and (2) the reduction in the amount of chum salmon bycatch as a result of the closure. The unharvested or forgone pollock catch and the reduction in chum salmon bycatch is then used as the basis for assessing the impacts of the alternative. For some alternatives, the closures are spatial rather than complete and fishing can continue elsewhere. The components of the pollock fishery that are excluded from the closure areas are redistributed to outside areas and assumed to be able to continue fishing at the rate that boats within their sector caught pollock and prohibited species such as chum and Chinook salmon. This estimate of forgone or redistributed pollock catch and reduction in chum salmon bycatch also is used as a basis for estimating the economic impacts of the alternatives.

The analysis used actual catch of chum salmon in the Bering Sea pollock fishery, by season, first at the fleet level (CDQ and non-CDQ), and then at the sector-level (inshore CV (S), Mothership (M), offshore CP (P), and CDQ) for the years 2003-2011. Weekly data from the NMFS Alaska Region were used to approximate when the potential cap would have been reached. The day when the fishery trigger areas would have closed was approximated as mid-week. This date was then used to compute the bycatch rate for the remaining open areas (assuming that the same amount of pollock would have been harvested). The cost of moving from the closed areas was evaluated qualitatively in the RIR. For the shore-based catcher-vessel fleet, average distances to fishing grounds with and without closure scenarios were computed for 2003-2011 data. *In all cases the analysis was at the sector-level in terms of caps.* In practice, there can be cooperative level caps but data limitations prevent analysis at this resolution.

For transferability between sectors, for analysis this is just a special case removing any sector specific chum salmon allocation. This would result in higher bycatch and lower pollock diverted or foregone.

The following sections present the approaches used to break down chum salmon bycatch to account for the fact that only some of the bycatch would have returned to a river system or hatchery in the year it was caught in the pollock fishery and further that the bycatch originates from broadly different regions. The lagged impact of the bycatch is presented in section 3.2.1 below and the stock composition of the bycatch is in section 3.2.2.

3.2.1 Estimating Chum salmon adult equivalent bycatch

To understand impacts on chum populations, a method was developed to estimate how the different bycatch numbers would propagate to adult equivalent spawning salmon. Estimating the adult equivalent bycatch is necessary because not all salmon caught as bycatch in the pollock fishery would otherwise have survived to return to their spawning streams. This analysis relies on analyses of historical data using a stochastic “adult equivalence” model similar to that developed for Chinook salmon. This approach strives to account for sources of uncertainty. Details on the methodological approach and adult equivalent model are contained in Appendix 5.

Adult-equivalency (AEQ) of the bycatch was estimated to translate how different trigger cap scenarios may affect chum salmon stocks. Compared to the annual bycatch numbers recorded by observers each year for management purposes, the AEQ mortality considers the extensive observer data on chum salmon length frequencies. These length frequencies are used to estimate the ages of the salmon bycatch, appropriately accounting for the time of year that catch occurred. Coupled with information on the proportion of salmon that return to different river systems at various ages, the bycatch-at-age data is used to pro-rate, for any given year, how bycatch affects future potential spawning runs of salmon.

Evaluating impacts to specific stocks was done by applying available genetics studies from samples collected in 2005-2009 (see section 3.2.2). Even though sample collection issues exist, stock composition estimates appear to have consistencies depending on the time of year and location.

3.2.1.1 Estimating Chum salmon catch-at-age

In order to appropriately account for the impact of salmon bycatch in the groundfish fisheries, it is desirable to correct for the age composition of the bycatch. For example, the impact on salmon populations of a bycatch level of 10,000 adult mature salmon is likely greater than the impact of catching 10,000 juvenile salmon that have just emerged from rivers and only a portion of which are expected to return for spawning in several years’ time. Hence, estimation of the age composition of the bycatch (and the measure of uncertainty) is critical. The method follows an expanded version of Kimura (1989) and modified by Dorn (1992). Length at age data are used to construct age-length keys for each time-area stratum and sex. These keys are then applied to randomly sampled catch-at-length frequency data. The stratum-specific age composition estimates are then weighted by the catch within each stratum to arrive at an overall age composition for each year. The actual data and resultant age-length keys are extensive but can be provided on request to NMFS AFSC.

Length frequency data on chum salmon from NMFS observer database was used to estimate the overall length and age composition of the bycatch (Figure 3-1). The first step in conducting this analysis was to estimate the catch by area and period within the season because there is a clear within-season pattern in length frequency (Figure 3-2). Strata were considered as being EBS-wide for the early period and geographically stratified from the later period (Aug-October). This provided a compromise of samples and bycatch over the entire time series from which ages, lengths, and catch (Table 3-1) could be applied. Note that the stratification used here is independent from that used for the genetic stock composition estimation presented in the next section. The age data were used to construct annual stratified age-length keys when sample sizes were appropriate and stratified combined-year age-length keys for years where age samples were limited. To the extent possible, sex-specific age-length keys within each stratum were created and where cells were missing, a “global” sex-specific age-length key was used. The global key was computed over all strata within the same season. For years other than 2005-2009, a combined-year age-length key was used (based on data spanning all years).

Applying the available length frequencies with stratified catch and age data result in age composition estimates in the bycatch that are predominately age 4 (Table 3-2). Generally, it is inappropriate to use the same age-length key over multiple years because the proportions at age for given lengths can be influenced by variability in relative year-class strengths. Combining age data over all the years averages the year-class effects to some degree but may mask the actual variability in age compositions in individual years. To evaluate the sensitivity of our estimates to this problem we compared results by using the combined-year age-length key with results when annual keys were available. Results suggested that the differences associated with using the combined-year age-length key were relatively minor. For the purposes of this analysis, i.e., to provide improved estimates of the impact of bycatch on salmon returns, having age-specific bycatch estimates from these data is preferred. The estimates of uncertainty in the age composition due to sampling (via two-stage bootstrap application) were relatively minor.

The body size of chum salmon in the bycatch is generally larger during June and July than for the rest of the summer-fall season (Stram and Ianelli 2009). This pattern is also reflected by age as well with the average age of the bycatch older in the first stratum (June-July) compared to the other strata (Figure 3-3). Also apparent in these data are the differences in size frequency by sex with males consistently bigger than females (Stram and Ianelli 2009).

Table 3-1. Numbers and percentages of chum salmon caught by area and season strata (top section) used for converting length frequency data to age composition data. Also shown are estimates of pollock catch (bottom section). Note that these totals differ slightly from NMFS official values due to minor spatio-temporal mapping discrepancies.

Year	June-July	E Aug-Oct	W Aug-Oct	Total	June-July	E Aug-Oct	W Aug-Oct
				Chum (numbers)			
1991	4,817	19,801	2,796	27,414	18%	72%	10%
1992	8,781	30,330	34	39,145	22%	77%	0%
1993	4,550	229,180	7,142	240,872	2%	95%	3%
1994	5,971	75,239	7,930	89,140	7%	84%	9%
1995	122	18,329	418	18,870	1%	97%	2%
1996	893	45,707	31,058	77,659	1%	59%	40%
1997	319	31,503	32,452	64,274	0%	49%	50%
1998	102	44,895	2,217	47,214	0%	95%	5%
1999	470	44,438	874	45,783	1%	97%	2%
2000	10,229	44,502	2,286	57,017	18%	78%	4%
2001	6,371	36,578	10,105	53,055	12%	69%	19%
2002	3,712	71,096	2,067	76,875	5%	92%	3%
2003	14,843	142,319	18,986	176,147	8%	81%	11%
2004	48,540	345,507	44,780	438,827	11%	79%	10%
2005	238,338	304,078	128,740	671,156	36%	45%	19%
2006	177,663	90,507	34,898	303,068	59%	30%	12%
2007	13,352	31,901	39,841	85,094	16%	37%	47%
2008	5,544	6,513	2,514	14,571	38%	45%	17%
2009	23,890	16,879	4,576	45,346	53%	37%	10%
2010	8,284	2,869	1,946	13,099	63%	22%	15%
				Pollock (t)			
1991	480,617	146,566	258,332	885,515	54%	17%	29%
1992	481,266	225,503	23,639	730,407	66%	31%	3%
1993	16,780	583,778	111,519	712,077	2%	82%	16%
1994	33,303	516,557	154,842	704,703	5%	73%	22%
1995	9,359	558,420	87,949	655,728	1%	85%	13%
1996	12,139	513,922	103,967	630,028	2%	82%	17%
1997	2,736	257,394	301,282	561,412	0%	46%	54%
1998	1,748	441,128	133,283	576,159	0%	77%	23%
1999	15,518	359,934	190,750	566,203	3%	64%	34%
2000	68,868	351,649	244,314	664,831	10%	53%	37%
2001	184,100	439,385	203,622	827,107	22%	53%	25%
2002	268,146	478,689	132,809	879,644	30%	54%	15%
2003	349,518	313,814	208,151	871,483	40%	36%	24%
2004	360,000	245,770	249,329	855,099	42%	29%	29%
2005	372,508	133,659	354,905	861,072	43%	16%	41%
2006	347,953	105,202	409,078	862,234	40%	12%	47%
2007	327,698	136,438	309,729	773,865	42%	18%	40%
2008	277,689	48,327	245,132	571,147	49%	8%	43%
2009	279,731	28,013	158,797	466,540	60%	6%	34%
2010	298,925	39,816	133,066	471,808	63%	8%	28%

Table 3-2. Estimated number of chum salmon by age based on stratified, catch-corrected application of bycatch length frequencies, 1991-2010. Due to the limited availability of samples, a combined age-length key was used (italicized values) for all years except 2005-2009. Note that these totals differ slightly from NMFS official values due to minor spatio-temporal mapping discrepancies.

	Age							
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
1991	*63*	*564*	*7,552*	*15,641*	*3,315*	*204*	*24*	27,363
1992	*64*	*136*	*11,409*	*22,869*	*4,372*	*224*	*48*	39,122
1993	*201*	*912*	*70,305*	*141,809*	*25,939*	*1,258*	*302*	240,726
1994	*200*	*69*	*17,133*	*58,652*	*12,214*	*680*	*164*	89,112
1995	*15*	*66*	*3,430*	*12,311*	*2,809*	*172*	*53*	18,856
1996	*585*	*1,443*	*20,195*	*43,908*	*10,651*	*620*	*138*	77,540
1997	*600*	*953*	*17,683*	*34,726*	*9,374*	*681*	*107*	64,124
1998	*65*	*55*	*6,244*	*31,672*	*7,877*	*530*	*109*	46,552
1999	*37*	*153*	*7,952*	*30,313*	*6,792*	*374*	*102*	45,723
2000	*140*	*82*	*9,243*	*37,670*	*9,260*	*511*	*70*	56,976
2001	*252*	*425*	*9,771*	*33,582*	*8,490*	*455*	*58*	53,033
2002	*86*	*291*	*13,554*	*50,440*	*11,658*	*630*	*185*	76,844
2003	*454*	*1,943*	*37,379*	*109,221*	*25,249*	*1,520*	*311*	176,077
2004	*1,260*	*1,408*	*103,576*	*266,650*	*61,006*	*3,380*	*661*	437,941
2005	12,849	2,273	132,119	439,843	77,139	3,742	78	668,043
2006	0	0	47,852	155,360	93,930	3,997	70	301,209
2007	0	506	17,287	48,913	15,323	2,110	128	84,267
2008	4	7	1,848	9,471	3,022	141	23	14,516
2009	9	335	10,916	26,834	6,384	236	77	44,791
2010	*81*	*68*	*2,121*	*7,991*	*2,654*	*156*	*21*	13,093

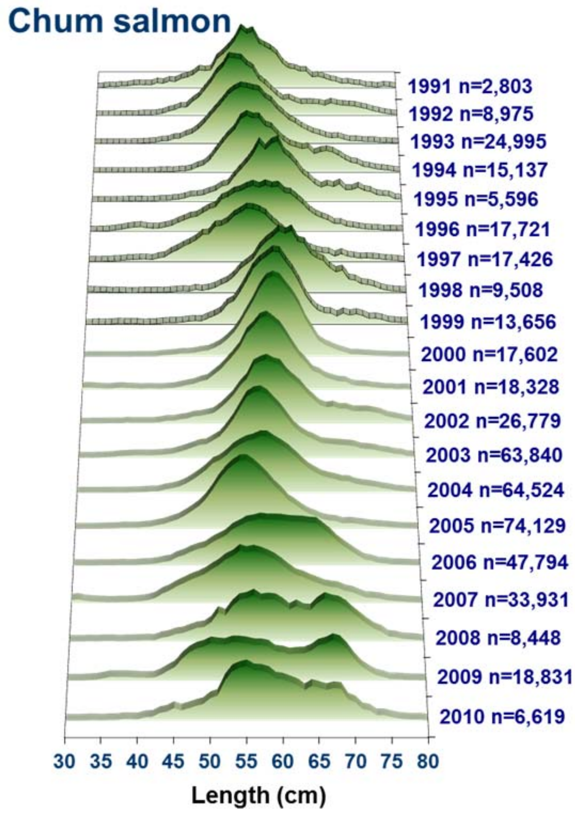


Figure 3-1. Chum salmon length frequency from the eastern Bering Sea pollock fishery, 1991-2010.

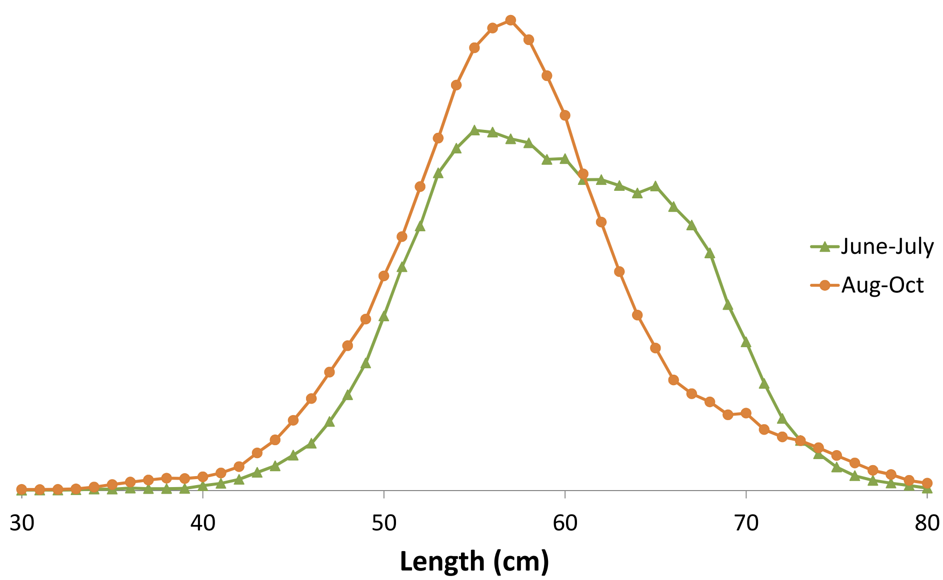


Figure 3-2. Aggregated chum length frequency from the eastern Bering Sea pollock fishery by period within the B-season, 1991-2010.

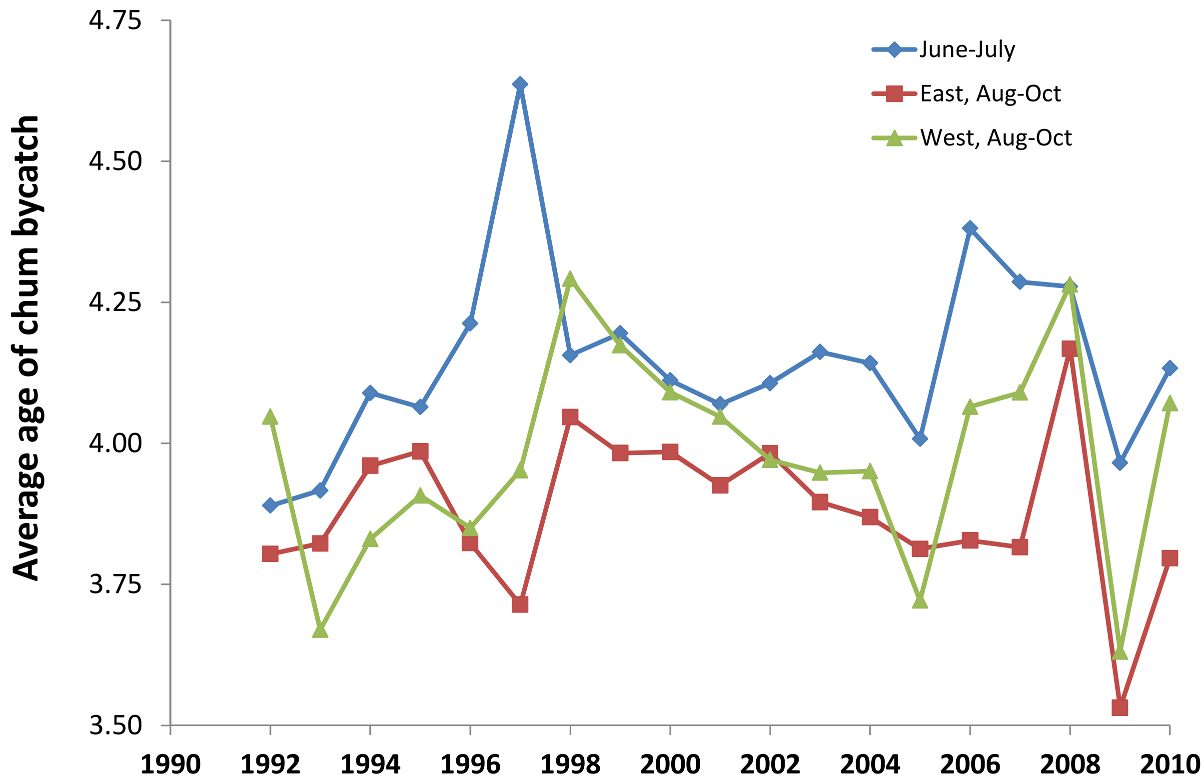


Figure 3-3. Stratified estimates of average age (years) of chum bycatch based on catch-at-age estimates from NMFS observer collected length frequencies and age determinations, 1991-2010.

3.2.1.2 Adult equivalence model

A simplified version of implementing Adult equivalence (AEQ) analysis to chum was possible because most of the bycatch occurred during the summer-fall fishery (only samples from this period are used for analysis). As with the Chinook model, given the age specific bycatch estimates by strata, oceanic natural mortality, and age composition of chum returning to spawn (for the AYK region), it is possible to estimate the AEQ for chum salmon. Alternative oceanic mortality rates can also evaluated because these are poorly known. Details on the model formulation are contained in Appendix 5.

The pattern of bycatch relative to AEQ is variable and relatively insensitive to mortality assumptions (Figure 3-4). For simplicity in presenting the analysis, subsequent values are based on the intermediate age-specific natural mortality (Scenario 2) which when evaluated with the stochastic components, revealed a fair amount of uncertainty in the AEQ estimates (Figure 3-5).

Notice that in some years, the bycatch records may be below the actual AEQ due to the lagged impact of previous years' catches (e.g., in 1994 and 2006; Table 3-3). A similar result would be predicted for AEQ model results in 2010 regardless of actual bycatch levels in this year due to the cumulative effect of bycatch prior to 2010.

Overall, the estimate of AEQ chum salmon mortality from 1994-2010 ranged from about 16,000 fish to just over 540,000 (Table 3-3). The application of these results to the genetic stock identification derived from sampling is presented in the next section.

Table 3-3 Estimated chum bycatch by year, their age-equivalent removals to mature returning salmon (AEQ, with upper and lower confidence intervals from simulations) and removals by chum salmon brood year (last two columns) using natural mortality scenario 2. Italicised values represent predictions from Eq. 7).

Bycatch year	Annual bycatch	Mean AEQ	AEQ 5th percentile	AEQ 95th percentile	Brood year	Estimated bycatch
1991	28,951	16,884	14,791	18,754	1988	56,008
1992	40,274	31,539	27,733	38,968	1989	160,433
1993	242,191	154,290	138,556	172,756	1990	119,973
1994	92,672	132,571	100,609	186,132	1991	38,624
1995	19,264	47,948	36,212	75,265	1992	55,596
1996	77,236	53,984	47,699	61,907	1993	62,179
1997	65,988	60,301	51,509	80,216	1994	64,948
1998	64,042	66,699	59,521	78,004	1995	46,863
1999	45,172	48,279	41,618	61,929	1996	54,118
2000	58,571	52,581	45,178	61,074	1997	57,182
2001	57,007	52,743	46,109	65,963	1998	90,286
2002	80,782	69,344	61,280	82,058	1999	190,325
2003	189,185	141,869	125,711	171,351	2000	376,947
2004	440,468	325,945	292,873	377,794	2001	631,926
2005	704,552	567,893	501,585	671,478	2002	285,480
2006	309,630	419,542	335,831	591,359	2003	97,814
2007	93,783	150,434	116,769	214,919	2004	37,342
2008	15,267	45,958	34,578	70,315	2005	31,239
2009	46,127	36,435	31,402	43,711	2006	16,959
2010	13,222	21,765	15,983	32,509		
2011	191,445	*119,162*				
2012		*62,950*				

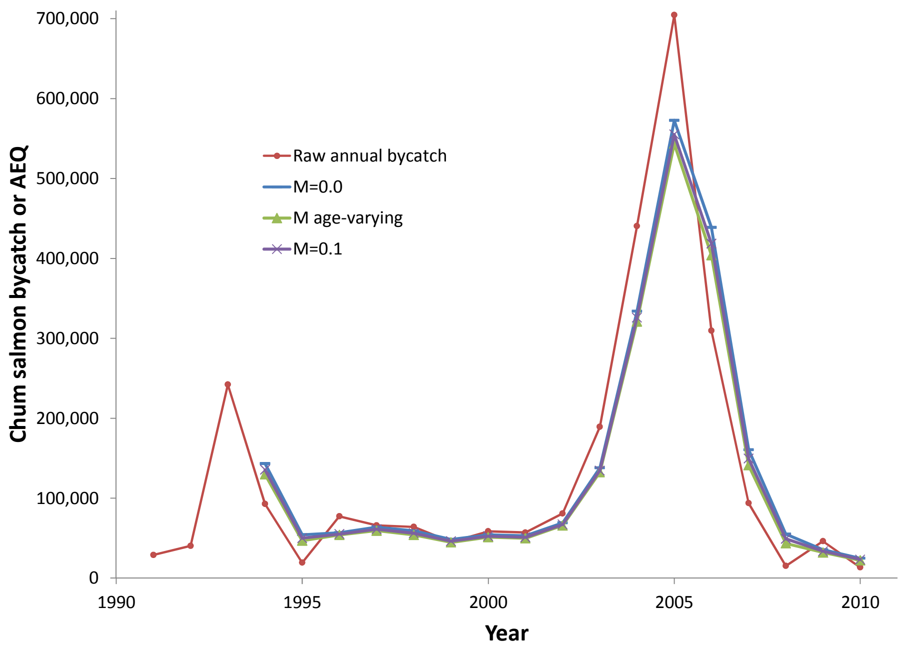


Figure 3-4. Estimated chum bycatch age-equivalent (AEQ) chum bycatch for three different assumptions about oceanic natural mortality rates compared to the annual tally.

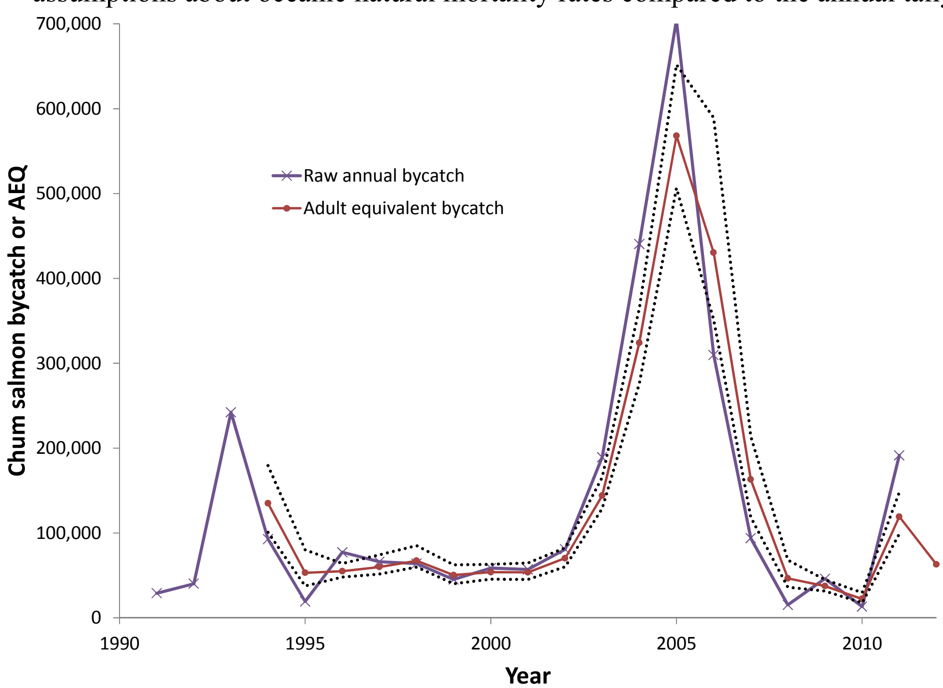


Figure 3-5. Estimated chum bycatch age-equivalent (AEQ) chum bycatch with stochastic (CV=0.4) age-specific oceanic natural mortality scenario 2 and rates compared to the annual tally. Dashed lines represent 5th and 95th percentiles based on 100 simulations. Note that values from 2011 and 2012 are based on predictions from equation 7.

3.2.2 Estimating the stock composition of chum salmon bycatch

This section provides an overview the available information used to determine the region or river of origin of the chum salmon caught as bycatch in the Bering Sea pollock fishery.

To determine the stock composition mixtures of the chum salmon bycatch samples collected from the Bering Sea pollock fishery, a number of genetics analyses have been completed and presented to the Council (i.e., Guyon et al. 2010, Marvin et al. 2010, Gray et al. 2010, and McCraney et al. 2010). The details of this work are provided in these reports and build from earlier studies (e.g., Wilmot et al. 1998, Seeb et al. 2004). These studies represent a large body of work on processing and analyzing the available genetic data and include comparisons of stock composition (of the bycatch samples) between the early period of the B-season and later as summarized in Gray et al. (2010). Based on the available datasets, they found a consistent pattern that later in the B-season the potential impact on Alaska stocks declines with bycatch samples dropping from about 28% Alaska origin down to about 13% after July 18^{th}. The proportions of bycatch from the SE Alaska-BC-Washington region also decreased later in the season while proportions from Russia and Japan increased later in the B-season. Given the available data, chum salmon bycatch origins appear to be affected by the relative amounts of bycatch that occur during the early and late periods within the B-season. The genetic analysis used here extends from the approaches reported earlier (e.g., Gray et al. 2010, Guyon et al. 2009) and spans the period 2005-2009. The main difference from these previous studies is that samples were temporally stratified to be from the period June-July or from August-October.

For this impact analysis, it is desirable to provide some estimates of AEQ specific to individual western Alaska river systems. On a gross scale, one approach would be to apply baseline average run-sizes for each system and apply these proportions to the "Western Alaska" group identified in the genetic analysis. An alternative approach might be to include the time series of run-size estimates so that a dynamic proportion for these sub-groups could be estimated. Neither approach is without problems but may help to provide some indication of the potential for specific in-river impacts due to bycatch. Because run size estimates are less reliable at fine regional scales results are presented at the level consistent with the genetics results (i.e., 6-regional breakouts; Figure 3-6). Individual populations from each region are identified in Table 3-4. To the extent possible assumptions of run sizes and maturity were used to provide qualitative results to individual western Alaskan river systems (See section 5.0).

Because mixing genetic samples with total bycatch levels and estimating bycatch proportions from stocks of interest (e.g., Western Alaska) requires careful consideration of variances, a model was developed from which a number of parameters of interest could easily be computed. It also provides a basis for more thorough evaluations on the significance of differences over years and areas. The integrated model approach which accounts for sampling error and imprecision due to genetics is described in the appendix.

The goal of this approach is to provide variance estimates for AEQ mortality to specific regions in different years. Analytical methods could be developed for these but would add complexity. The integrated model allows simple specification of variables such as year and strata factors that can be estimated simultaneously. Of particular interest for these data are whether seasonal differences in stock composition are significant and the degree to which stock composition estimates vary over years. Also, it may be possible to characterize the between year variability for the period that data are available and apply that variability to reconstruct historical bycatch patterns.

The average proportions of PSC chum salmon bycatch by six regions varies considerably by season with more from Japan and Russian during the latter part of the B season (Figure 3-7).

The SSC requested that year-effects on stock composition be tested to the extent possible. This was accomplished by estimating the mean June-July and August-October sub-season effect and computing the annual variability relative to these effects. The marginal distribution of the within-season effect indicates that western Alaska stocks comprise nearly 13% more in the June-July period compared to later in the season (Figure 3-8). However, there were some significant levels of between-year variability with lower proportions of western Alaska chum salmon evident in 2008 and 2009 samples during the June-July period (Figure 3-9). This indicates that year-effects are significant and would add to the uncertainty in extrapolating these results to an historical period. On the advice of the SSC, the stock composition estimates are focused on the period 2005-2009. However, for the earlier periods, the mean stratified stock composition estimates from this period could be used but with an added component of uncertainty equal to the estimated year-effect variability. This was accomplished by contrasting the within season mean estimates (and the variability associated with those) and adding the random-effects variance over different years. This is illustrated by comparing the proportion of stock composition that can be attributed to western Alaska stocks (coastal western AK plus Upper Yukon chum salmon) during the June-July period relative to the Aug-October period (Figure 3-10). Note that the variance due to the year effect is inflated and thus has the desired property of estimation “outside of sampled” years.

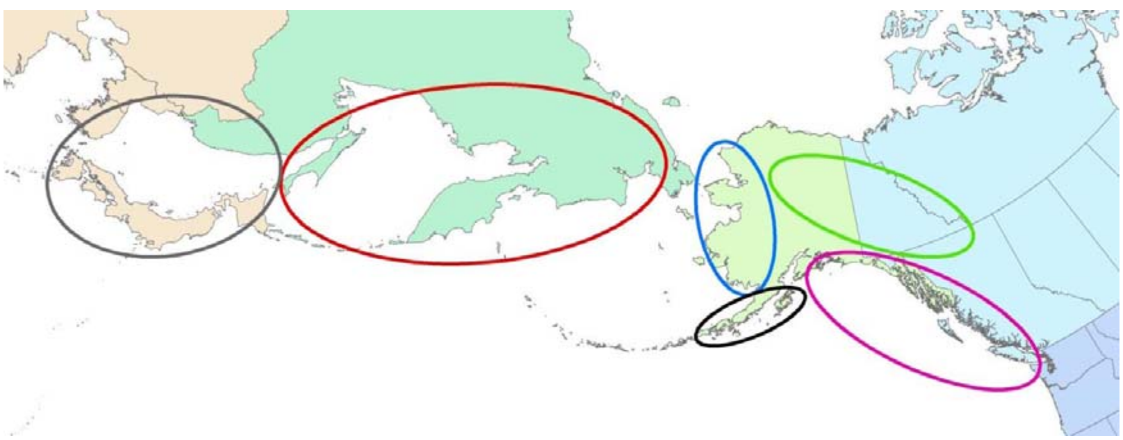


Figure 3-6. Six regional groupings of chum salmon populations used in the analysis including east Asia (grey), north Asia (red), coastal western Alaska (blue), upper/middle Yukon (green), southwest Alaska (black), and the Pacific Northwest (magenta). From Gray et al. 2010.

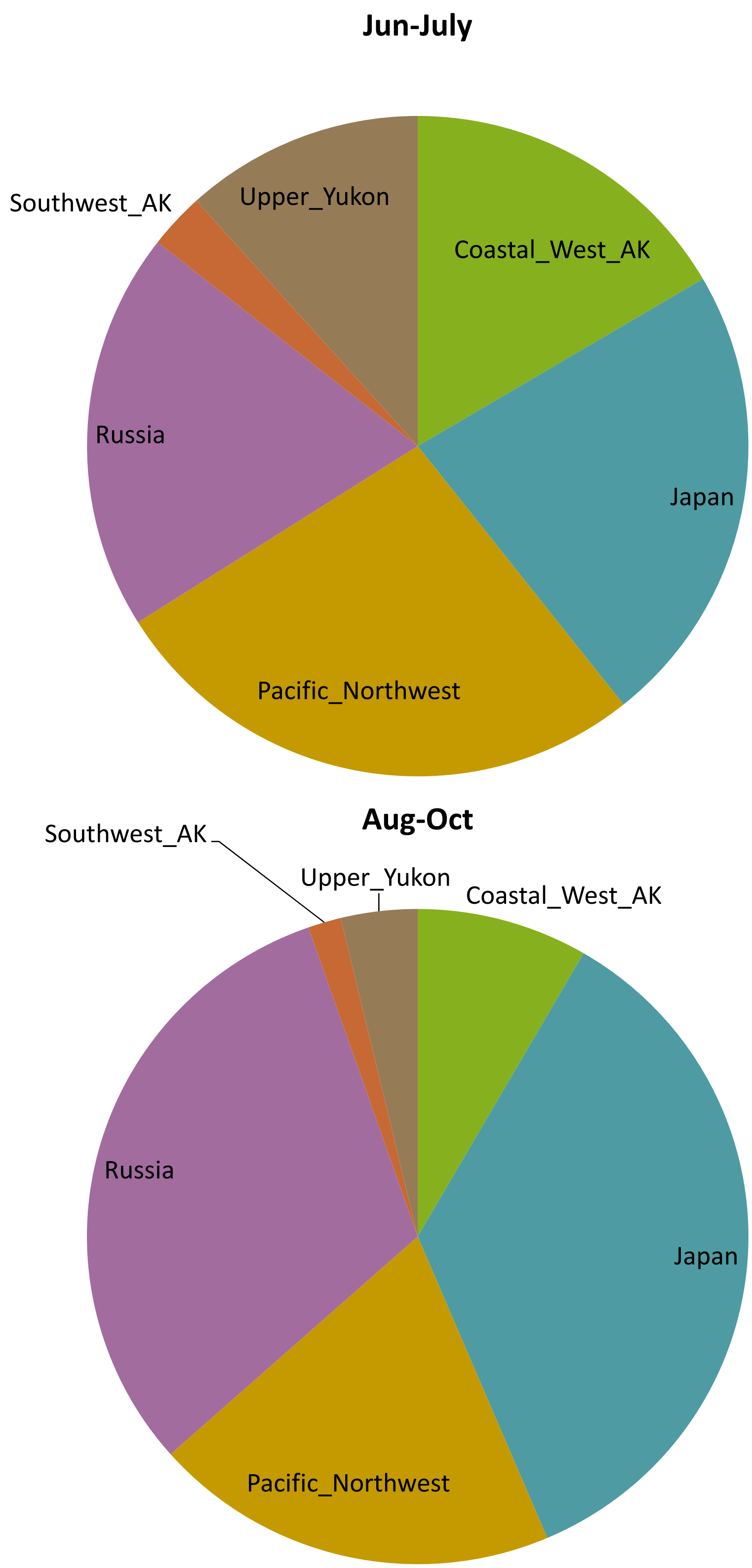


Figure 3-7. Average breakout of bycatch based on genetic analysis by early and late B-season strata, 2005-2009.

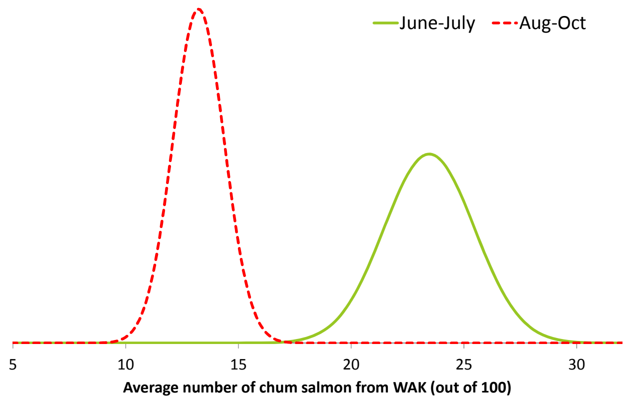


Figure 3-8. Genetic results showing the distribution of the mean WAK (coastal western Alaska and Upper Yukon combined) chum salmon in the bycatch for the early (June-July) compared to the late (Aug-Oct) B-season based on genetic data from 2005-2009.

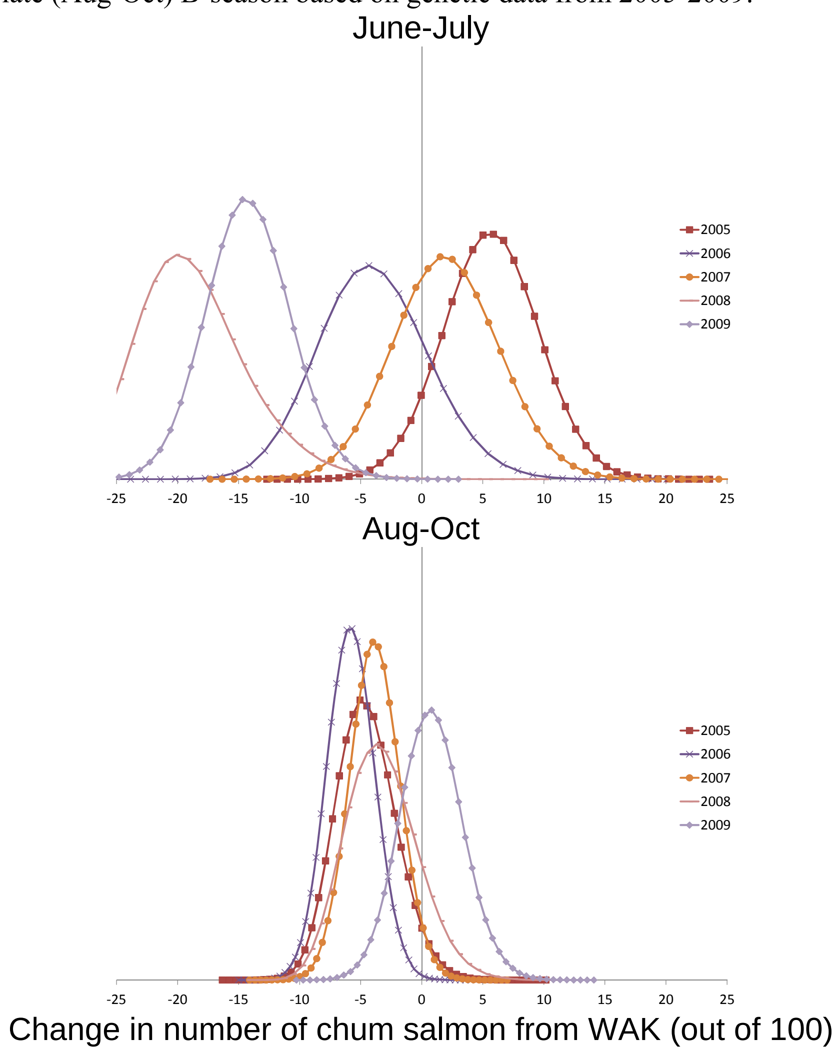


Figure 3-9. Genetics results showing the distribution of the mean WAK (coastal western Alaska and Upper Yukon combined) chum salmon in the bycatch for the early (June-July) compared to the late (Aug-Oct) B-season based on genetics data from 2005-2009.

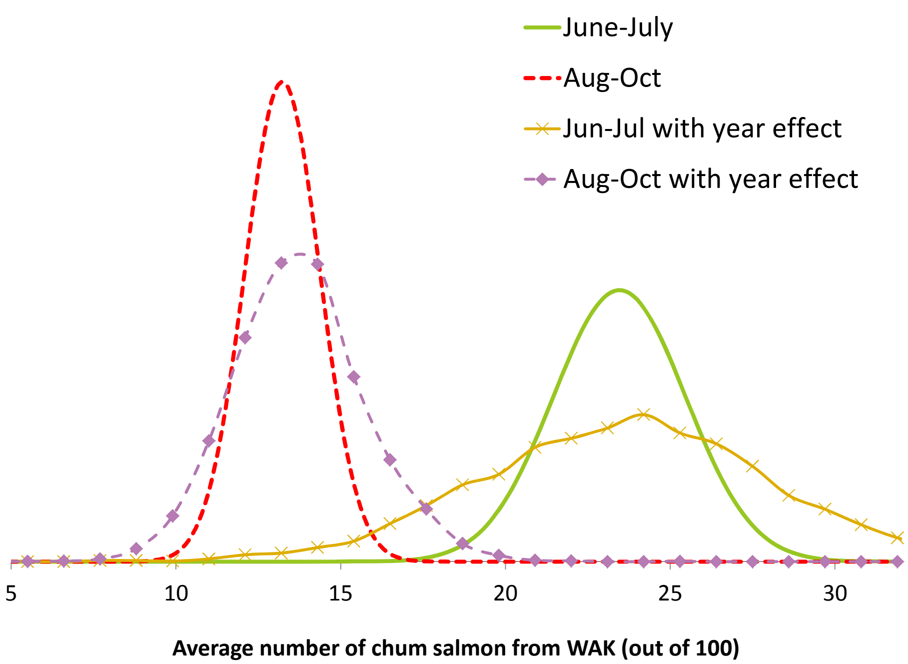


Figure 3-10. Comparison of the mean proportion of chum salmon bycatch originating from WAK (including upper Yukon) during early and late B-season and with the additional uncertainty due to year-effect variability.

Table 3-4. Chum salmon populations in the DFO microsatellite baseline with the regional designations used Gray et al, 2010.

DFO	Population	No.	DFO	Population	No.	DFO	Population	No.	DFO	Population	No.
41	Abashiri	1	230	Udarnitsa	2	439	Porcupine	4	107	Clatse_Creek	6
215	Avakumovka	1	290	Utka_River	2	83	Salcha	4	118	Clyak	6
40	Chitose	1	208	Vorovskaya	2	4	Sheenjek	4	62	Cold_Creek	6
315	Gakko_River	1	387	Zhypanova	2	1	Tatchun	4	77	Colonial	6
292	Hayatsuki	1	348	Agiapuk	3	9	Teslin	4	353	Constantine	6
44	Horonai	1	376	Alagnak	3	84	Toklat	4	168	Cooper_Inlet	6
252	Kawabukuro	1	3	Andreafsky	3	360	Alagoshak	5	197	County_Line	6
313	Koizumi_River	1	357	Aniak	3	333	American_River	5	12	Cowichan	6
300	Kushiro	1	301	Anvik	3	366	Big_River	5	414	Crag_Cr	6
37	Miomote	1	80	Chulinak	3	354	Coleman_Creek	5	161	Dak_	6
391	Namdae_R	1	347	Eldorado	3	355	Delta_Creek	5	259	Dana_Creek	6
231	Narva	1	358	George	3	359	Egegik	5	123	Date_Creek	6
298	Nishibetsu	1	307	Gisasa	3	332	Frosty_Creek	5	250	Dawson_Inlet	6
293	Ohkawa	1	371	Goodnews	3	365	Gertrude_Creek	5	91	Dean_River	6
297	Orikasa	1	288	Henshaw_Creek	3	370	Joshua_Green	5	261	Deena	6
214	Ryazanovka	1	339	Imnachuk	3	364	Meshik	5	170	Deer_Pass	6
312	Sakari_River	1	361	Kanektok	3	283	Moller_Bay	5	46	Demamiel	6
311	Shari_River	1	362	Kasigluk	3	369	Pumice_Creek	5	210	Dipac_Hatchery	6
36	Shibetsu	1	328	Kelly_Lake	3	367	Stepovak_Bay	5	319	Disappearance	6
299	Shikiu	1	340	Kobuk	3	335	Sturgeon	5	269	Dog-tag	6
253	Shiriuchi	1	343	Koyuk	3	350	Uganik	5	177	Draney	6
310	Shizunai	1	363	Kwethluk	3	334	Volcano_Bay	5	114	Duthie_Creek	6
217	Suifen	1	336	Kwiniuk_River	3	356	Westward_Creek	5	427	East_Arm	6
35	Teshio	1	303	Melozitna	3	239	Ahnuhati	6	266	Ecstall_River	6
39	Tokachi	1	373	Mulchatna	3	69	Ahta______	6	94	Elcho_Creek	6
38	Tokoro	1	372	Naknek	3	155	Ain_	6	193	Ellsworth_Cr	6
314	Tokushibetsu	1	330	Niukluk	3	183	Algard	6	203	Elwha	6
291	Toshibetsu	1	329	Noatak	3	58	Alouette	6	276	Ensheshese	6
296	Tsugaruishi	1	345	Nome	3	325	Alouette_North	6	263	Fairfax_Inlet	6
316	Uono_River	1	302	Nulato	3	270	Andesite_Cr	6	32	Fish_Creek	6
309	Yurappu	1	374	Nunsatuk	3	428	Arnoup_Cr	6	429	Flux_Cr	6
218	Amur	2	13	Peel_River	3	153	Ashlulm	6	102	Foch_Creek	6
207	Anadyr	2	322	Pikmiktalik	3	156	Awun	6	179	Frenchman	6
384	Apuka_River	2	331	Pilgrim_River	3	133	Bag_Harbour	6	227	Gambier	6
382	Bolshaya	2	346	Shaktoolik	3	164	Barnard	6	96	Gill_Creek	6
380	Dranka	2	341	Snake	3	16	Bella_Bell	6	166	Gilttoyee	6
223	Hairusova	2	368	Stuyahok_River	3	79	Bella_Coola	6	145	Glendale	6
378	Ivashka	2	375	Togiak	3	49	Big_Qual	6	135	Gold_Harbour	6
213	Kalininka	2	154	Tozitna	3	201	Big_Quilcene	6	11	Goldstream	6
225	Kamchatka	2	342	Unalakleet	3	281	Bish_Cr	6	66	Goodspeed_River	6
219	Kanchalan	2	344	Ungalik	3	198	Bitter_Creek	6	136	Government	6
379	Karaga	2	8	Big_Creek	4	103	Blackrock_Creek	6	205	Grant_Creek	6
294	Kikchik	2	89	Big_Salt	4	390	Blaney_Creek	6	100	Green_River	6
209	Kol_	2	86	Black_River	4	138	Botany_Creek	6	450	GreenRrHatchery	6
233	Magadan	2	87	Chandalar	4	264	Buck_Channel	6	237	Greens	6
211	Naiba	2	28	Chandindu	4	169	Bullock_Chann	6	141	Harrison	6
295	Nerpichi	2	82	Cheena	4	61	Campbell_River	6	438	Harrison_late	6
381	Okhota	2	81	Delta	4	323	Carroll	6	64	Hathaway_Creek	6
212	Oklan	2	7	Donjek	4	78	Cascade	6	234	Herman_Creek	6
222	Ola_	2	5	Fishing_Br	4	76	Cayeghle	6	17	Heydon_Cre	6
386	Olutorsky_Bay	2	88	Jim_River	4	42	Cheakamus	6	407	Hicks_Cr	6
228	Ossora	2	85	Kantishna	4	398	Cheenis_Lake	6	400	Homathko	6
224	Penzhina	2	2	Kluane	4	51	Chehalis	6	411	Honna	6
385	Plotnikova_R	2	59	Kluane_Lake	4	19	Chemainus	6	204	Hoodsport	6
221	Pymta	2	181	Koyukuk_late	4	47	Chilliwack	6	185	Hooknose	6
220	Tauy	2	90	Koyukuk_south	4	392	Chilqua_Creek	6	406	Hopedale_Cr	6
383	Tugur_River	2	10	Minto	4	117	Chuckwalla	6	412	Hutton_Head	6

Table 3-8. (continued) Chum salmon populations in the DFO microsatellite baseline (code) with the regional designations used in the analyses (column titled "No.";Gray et al. 2010).

DFO	Population	No.	DFO	Population	No.	DFO	Population	No.
			254	Mountain_Cr	6	265	Stanley	6
			111	Mussel_River	6	52	Stave	6
226	Tym_	2	157	Naden	6	396	Stawamus	6
6	Pelly	4	337	Nahmint_River	6	409	Steel_Cr	6
152	Inch_Creek	6	444	Nakut_Su	6	424	Stewart_Cr	6
146	Indian_River	6	14	Nanaimo	6	416	Stumaun_Cr	6
92	Jenny_Bay	6	122	Nangeese	6	327	Sugsaw	6
115	Kainet_River	6	422	Nass_River	6	324	Surprise	6
144	Kakweiken	6	399	Necleetsconnay	6	75	Taaltz	6
268	Kalum	6	113	Neekas_Creek	6	30	Taku	6
395	Kanaka_Cr	6	321	Neets_Bay_early	6	18	Takwahoni	6
402	Kano_Inlet_Cr	6	320	Neets_Bay_late	6	251	Tarundl_Creek	6
162	Kateen	6	173	Nekite	6	149	Theodosia	6
389	Kawkawa	6	104	Nias_Creek	6	22	Thorsen	6
95	Kemano	6	143	Nimpkish	6	129	Toon	6
192	Kennedy_Creek	6	53	Nitinat	6	279	Tseax	6
238	Kennell	6	191	Nooksack	6	202	Tulalip	6
351	Keta_Creek	6	186	Nooseseck	6	97	Turn_Creek	6
101	Khutze_River	6	318	NorrishWorth	6	430	Turtle_Cr	6
126	Khutzeymateen	6	159	North_Arm	6	247	Tuskwa	6
282	Kiltuish	6	377	Olsen_Creek	6	165	Tyler	6
93	Kimsquit	6	184	Orford	6	33	Tzoonie	6
187	Kimsquit_Bay	6	287	Pa-aat_River	6	124	Upper_Kitsumkal	6
419	Kincolith	6	260	Pacofi	6	140	Vedder	6
273	Kispiox	6	56	Pallant	6	70	Viner_Sound	6
106	Kitasoo	6	65	Pegattum_Creek	6	45	Wahleach	6
99	Kitimat_River	6	48	Puntledge	6	172	Walkum	6
275	Kitsault_Riv	6	98	Quaal_River	6	73	Waump	6
163	Kitwanga	6	147	Quap	6	232	Wells_Bridge	6
271	Kleanza_Cr	6	108	Quartcha_Creek	6	352	Wells_River	6
437	Klewnuggit_Cr	6	199	Quinault	6	105	West_Arm_Creek	6
21	Klinaklini	6	110	Roscoe_Creek	6	267	Whitebottom_Cr	6
418	Ksedin	6	397	Salmon_Bay	6	326	Widgeon_Slough	6
125	Kshwan	6	195	Salmon_Cr	6	277	Wilauks_Cr	6
423	Kumealon	6	134	Salmon_River	6	120	Wilson_Creek	6
112	Kwakusdis_River	6	200	Satsop	6	401	Worth_Creek	6
436	Kxngeal_Cr	6	236	Sawmill	6	60	Wortley_Creek	6
127	Lachmach	6	410	Seal_Inlet_Cr	6	248	Yellow_Bluff	6
262	Lagins	6	158	Security	6	434	Zymagotitz	6
131	Lagoon_Inlet	6	130	Sedgewick	6	139	Clapp_Basin	6
448	LagoonCr	6	393	Serpentine_R	6			
167	Lard	6	317	Shovelnose_Cr	6			
160	Little_Goose	6	249	Shustnini	6			
50	Little_Qua	6	206	Siberia_Creek	6			
413	Lizard_Cr	6	25	Silverdale	6			
119	Lockhart-Gordon	6	196	Skagit	6			
176	Lower_Lillooet	6	274	Skeena	6			
137	Mace_Creek	6	171	Skowquiltz	6			
242	Mackenzie_Sound	6	447	SkykomishRiv	6			
116	MacNair_Creek	6	132	Slatechuck_Cre	6			
55	Mamquam	6	43	Sliammon	6			
121	Markle_Inlet_Cr	6	15	Smith_Cree	6			
27	Martin_Riv	6	54	Snootli	6			
338	Mashiter_Creek	6	180	Southgate	6			
109	McLoughin_Creek	6	26	Squakum	6			
178	Milton	6	142	Squamish	6			
194	Minter_Cr	6	128	Stagoo	6			

Table 3-5. Sample sizes (numbers of B-season chum salmon) available for genetic stock-composition estimates (by sub-season stratified samples) compared to the number of hauls and the actual bycatch levels, 2005-2009. Note that bycatch totals may differ slightly from official totals due to minor differences encountered when matching spatially disaggregated data.

Year	2005	2006	2007	2008	2009
Number of chum used in genetics sampling					
Jun-Jul	480	356	240	192	635
Aug-Oct	542	974	1033	400	801
Total	1,022	1,330	1,273	592	1,436
Number of hauls from which samples were collected					
Jun-Jul	199	136	180	468	158
Aug-Oct	112	57	229	464	251
Total	311	193	409	932	409
Bycatch of non-Chinook salmon					
Jun-Jul	238,338	177,663	13,352	5,544	23,890
Aug-Oct	432,818	125,405	71,742	9,027	21,455
Total	671,156	303,068	85,094	14,571	45,346

Table 3-6. Summary results from genetic stock-composition estimates ($p_{i,k}$ for year *i* and sub-season stratum *k*) from the BAYES analysis. These data were used in conjunction with actual bycatch levels within sub-season strata. CV = coefficient of variation for $p_{i,k}$.

					Correlation					
Year	**Strata**	$p_{i,k}$	**CV**	**Region**	Japan	Russia	WAK	UppYuk	SW_AK	AKBCWA
2005	Jun-Jul	0.190	10%	Japan		-0.2493	-0.2588	-0.1796	-0.1020	-0.2535
2005	Jun-Jul	0.210	11%	Russia			-0.2751	-0.1909	-0.1085	-0.2694
2005	Jun-Jul	0.222	11%	WAK				-0.1982	-0.1126	-0.2796
2005	Jun-Jul	0.121	15%	UppYuk					-0.0781	-0.1941
2005	Jun-Jul	0.043	26%	SW_AK						-0.1103
2005	Jun-Jul	0.215	10%	AKBCWA						
2005	Aug-Oct	0.366	6%	Japan		-0.5038	-0.2374	-0.1374	-0.0928	-0.3629
2005	Aug-Oct	0.306	8%	Russia			-0.2074	-0.1200	-0.0810	-0.3170
2005	Aug-Oct	0.089	18%	WAK				-0.0566	-0.0382	-0.1494
2005	Aug-Oct	0.032	30%	UppYuk					-0.0221	-0.0865
2005	Aug-Oct	0.015	47%	SW_AK						-0.0584
2005	Aug-Oct	0.186	10%	AKBCWA						
2006	Jun-Jul	0.256	10%	Japan		-0.2810	-0.2339	-0.2108	-0.0676	-0.3773
2006	Jun-Jul	0.187	14%	Russia			-0.1910	-0.1721	-0.0552	-0.3081
2006	Jun-Jul	0.137	17%	WAK				-0.1433	-0.0459	-0.2565
2006	Jun-Jul	0.114	16%	UppYuk					-0.0414	-0.2312
2006	Jun-Jul	0.013	54%	SW_AK						-0.0741
2006	Jun-Jul	0.293	9%	AKBCWA						
2006	Aug-Oct	0.301	5%	Japan		-0.4304	-0.1687	-0.1444	-0.1000	-0.3952
2006	Aug-Oct	0.301	6%	Russia			-0.1686	-0.1444	-0.1000	-0.3951
2006	Aug-Oct	0.062	17%	WAK				-0.0566	-0.0392	-0.1548
2006	Aug-Oct	0.046	16%	UppYuk					-0.0335	-0.1326
2006	Aug-Oct	0.023	30%	SW_AK						-0.0918
2006	Aug-Oct	0.266	6%	AKBCWA						
2007	Jun-Jul	0.234	12%	Japan		-0.3074	-0.1873	-0.2774	-0.0667	-0.2816
2007	Jun-Jul	0.237	14%	Russia			-0.1890	-0.2799	-0.0673	-0.2842
2007	Jun-Jul	0.103	24%	WAK				-0.1706	-0.0410	-0.1732
2007	Jun-Jul	0.202	15%	UppYuk					-0.0608	-0.2565
2007	Jun-Jul	0.014	64%	SW_AK						-0.0617
2007	Jun-Jul	0.207	14%	AKBCWA						
2007	Aug-Oct	0.351	4%	Japan		-0.5292	-0.2292	-0.1478	-0.0736	-0.3267
2007	Aug-Oct	0.341	5%	Russia			-0.2242	-0.1446	-0.0719	-0.3196
2007	Aug-Oct	0.089	14%	WAK				-0.0626	-0.0312	-0.1384
2007	Aug-Oct	0.039	19%	UppYuk					-0.0201	-0.0892
2007	Aug-Oct	0.010	41%	SW_AK						-0.0444
2007	Aug-Oct	0.165	8%	AKBCWA						
2008	Jun-Jul	0.223	14%	Japan		-0.1942	-0.1207	-0.1487	-0.1124	-0.5353
2008	Jun-Jul	0.116	23%	Russia			-0.0815	-0.1004	-0.0759	-0.3613
2008	Jun-Jul	0.048	37%	WAK				-0.0624	-0.0472	-0.2246
2008	Jun-Jul	0.071	29%	UppYuk					-0.0581	-0.2767
2008	Jun-Jul	0.042	38%	SW_AK						-0.2092
2008	Jun-Jul	0.499	7%	AKBCWA						
2008	Aug-Oct	0.421	6%	Japan		-0.5371	-0.2504	-0.1992	-0.0971	-0.3564
2008	Aug-Oct	0.284	9%	Russia			-0.1848	-0.1470	-0.0717	-0.2631
2008	Aug-Oct	0.079	21%	WAK				-0.0685	-0.0334	-0.1226
2008	Aug-Oct	0.052	25%	UppYuk					-0.0266	-0.0975
2008	Aug-Oct	0.013	56%	SW_AK						-0.0476
2008	Aug-Oct	0.149	14%	AKBCWA						
2009	Jun-Jul	0.252	7%	Japan		-0.2742	-0.2094	-0.1136	-0.1394	-0.4301
2009	Jun-Jul	0.182	11%	Russia			-0.1703	-0.0925	-0.1134	-0.3499
2009	Jun-Jul	0.115	14%	WAK				-0.0706	-0.0866	-0.2672
2009	Jun-Jul	0.037	23%	UppYuk					-0.0470	-0.1450
2009	Jun-Jul	0.055	20%	SW_AK						-0.1778
2009	Jun-Jul	0.354	6%	AKBCWA						
2009	Aug-Oct	0.392	5%	Japan		-0.5557	-0.3244	-0.1413	-0.1415	-0.2248
2009	Aug-Oct	0.324	7%	Russia			-0.2793	-0.1216	-0.1218	-0.1935
2009	Aug-Oct	0.140	12%	WAK				-0.0710	-0.0711	-0.1130
2009	Aug-Oct	0.030	27%	UppYuk					-0.0310	-0.0492
2009	Aug-Oct	0.030	25%	SW_AK						-0.0493
2009	Aug-Oct	0.073	14%	AKBCWA						

Table 3-7. Time series of genetic stock-composition estimates of AEQ (percentages in top panel, total numbers in lower panel) based on B-season stratified samples. *Note—for 1994-2004 and 2010, mean stratified genetics data were applied to the bycatch levels.* ***All estimates include the lag-effect which accounts for the proportion of AEQ being caught in different calendar years.***

	AEQ	Coastal West AK	Japan	AKBCWA	Russia	SWAK	UppYukon
1994	132,571	9.4%	36.2%	17.5%	30.7%	1.9%	4.3%
1995	47,948	9.4%	36.3%	17.4%	30.8%	1.9%	4.3%
1996	53,984	9.3%	36.7%	17.0%	31.1%	1.8%	4.1%
1997	60,301	9.3%	36.7%	16.9%	31.2%	1.8%	4.0%
1998	66,699	9.3%	36.8%	16.9%	31.2%	1.8%	4.0%
1999	48,279	9.3%	36.8%	17.0%	31.2%	1.8%	4.0%
2000	52,581	9.7%	34.9%	18.9%	29.5%	2.0%	4.9%
2001	52,743	9.7%	35.0%	18.8%	29.6%	2.0%	4.9%
2002	69,344	9.5%	35.9%	17.8%	30.4%	1.9%	4.4%
2003	141,869	9.5%	35.7%	18.0%	30.3%	1.9%	4.5%
2004	325,945	9.6%	35.4%	18.4%	29.9%	2.0%	4.7%
2005	567,893	12.8%	31.6%	19.4%	27.9%	2.4%	6.0%
2006	419,542	11.9%	29.1%	24.2%	25.3%	2.0%	7.5%
2007	150,434	10.5%	30.5%	22.2%	27.9%	1.6%	7.3%
2008	45,958	9.6%	33.0%	22.4%	28.6%	1.7%	6.8%
2009	36,435	11.5%	31.5%	21.7%	24.8%	3.7%	3.8%
2010	21,765	12.1%	30.5%	23.9%	24.4%	3.6%	5.5%
2011	4,979	11.9%	29.8%	24.5%	24.0%	3.4%	6.4%
2012	464	11.5%	28.7%	25.5%	23.5%	3.0%	7.7%
1994	132,571	12,444	48,038	23,176	40,730	2,496	5,693
1995	47,948	4,492	17,407	8,346	14,761	899	2,042
1996	53,984	5,015	19,786	9,204	16,792	992	2,207
1997	60,301	5,587	22,153	10,218	18,805	1,102	2,435
1998	66,699	6,170	24,534	11,262	20,828	1,214	2,675
1999	48,279	4,478	17,753	8,190	15,070	883	1,952
2000	52,581	5,098	18,376	9,912	15,531	1,065	2,601
2001	52,743	5,100	18,458	9,891	15,603	1,063	2,586
2002	69,344	6,557	24,921	12,338	21,115	1,328	3,081
2003	141,869	13,484	50,713	25,540	42,947	2,749	6,444
2004	325,945	31,262	115,333	59,930	97,582	6,446	15,402
2005	567,893	72,605	179,225	110,351	158,205	13,400	34,093
2006	419,542	49,768	122,118	101,412	106,288	8,562	31,428
2007	150,434	15,814	45,875	33,427	41,974	2,366	11,039
2008	45,958	4,390	15,179	10,313	13,124	772	3,148
2009	36,435	4,203	11,481	7,890	9,046	1,353	1,392
2010	21,765	2,628	6,641	5,201	5,301	791	1,204
2011	4,979	593	1,482	1,221	1,197	169	317
2012	464	54	133	118	109	14	36

3.2.3 Combining genetic information with AEQ results

The AEQ model uses genetic estimates of chum salmon taken as bycatch in the Bering Sea pollock fishery to determine where the AEQ chum salmon would have returned. In order to align the AEQ estimates with the available genetics information the AEQ results need to split out by the years when the bycatch mortality occurred. For example, the AEQ bycatch mortality in 2008 (i.e., the impact on returning chum salmon in calendar year 2008) is a result of bycatch that occurred in earlier years in addition to the mature (returning) fish that were taken in 2008. This step is needed to apportion the AEQ results to stock of origin based on genetic samples which consist of mature and immature fish.. By splitting the AEQ estimates to relative contributions of bycatch from previous years, and applying GSI data from those years, they can then be realigned and renormalized to get proportions from systems by year (Table 3-7). The impact of the correction due to the lag is illustrated in Figure 3-11. Since data from 1991-2004 and

2010 were unavailable for this analysis, mean GSI (with year-effect variability added to the estimates of uncertainty) were used.

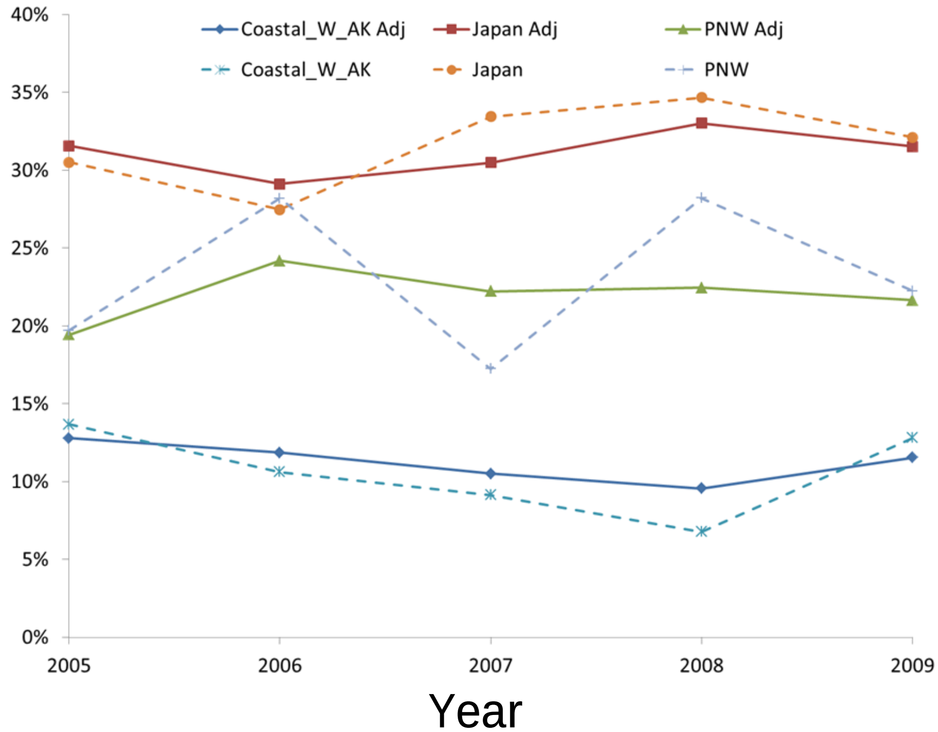


Figure 3-11. Comparison of the annual proportion of B-season chum salmon bycatch originating from different regions by year using the annual genetics results compared with the lag-corrected values (Adj).

3.3 Approach to evaluate Status Quo/RHS program

A separate analysis was completed estimating the efficacy of the RHS program for salmon bycatch reduction compared to what salmon bycatch would have been in the absence of that program. Details on the methodological approach are contained in Appendix 5.

Several different approaches were taken to evaluate the effectiveness of the RHS program. First, from 2003-2010, the average levels of bycatch reduction are examined before and after RHS closures are put in place. This enables an average salmon reduction or "treatment effect" of the closures to be estimated. However, because in some cases closures are left in place for several weeks and therefore no lasting impact of the closures is observed in data, a second method was utilized. For the period 1993-2000, the high-bycath areas were identified and hypothetical "closures" implemented. This allows for a better accounting of the longer-term benefits of the closures as well as exploration of how different elements of closures (e.g., size, frequency, the minimum rates used to close areas) impact their effectiveness.

3.4 Approach to evaluate Alternative 2, hard caps

Hard caps were evaluated similar to the methods for determining closures in the next section except that for each sector allocation and cap combination, rather than diverting effort to other areas, they were treated as if their season was over. At that point, the amount of salmon was compared with the total actual non-Chinook salmon bycatch to evaluate potential salmon savings that might have occurred had the hard cap been in place (ignoring the fact that the fleet would likely have taken measures to avoid reaching the cap). Likewise, their pollock catch at the point the cap was reached was compared with actual values for that year (within sectors). The cap levels evaluated for analysis were 50,000, 200,000, and 353,000 non-Chinook salmon with three selected sector-allocation schemes as outlined in section 2.

Additionally, an approach that acknowledges that the industry would react differently when a cap appeared eminent, we evaluated an "effective cap" situation in which the fleet would stand down when they approached 75% of the sector split cap. This was done as a sensitivity.

3.5 Evaluating Alternative 3

A separate analysis was completed estimating the efficacy of the revised RHS program proposed for Alternative 3 for salmon PSC reduction in comparison to estimates under Alternative . Details on the methodological approach are contained in Appendix 5.

3.6 Evaluating Alternative 4, trigger-cap scenarios

The methods for evaluating component 2 under alternative 4 require some notation and is included here rather than the methods section because of how diverted pollock fishing from a closed area by season requires extra consideration. Let $C_{i,j}$ be the bycatch of salmon (chum or Chinook) with index *i* be an indicator variable related to observations within the closure area (a value of 0 means outside, 1 means inside) and index *j* indicates period within a year: 0=before closure, 1=after closure but before Aug 1st, and 2=Aug 1st (or closure date if later than Aug 1st) to October 31st. Accounting for bycatch by these periods allows incorporation of genetics information which showed differences in chum stock compositions. Similarly, pollock catch ($P_{i,j}$) can be tallied from the observer data by the same indices.

The total bycatch for a given year C' is thus estimated as:

$$C' = C_{0,0} + C_{0,1} + P_{1,1}r_{0,1} + P_{1,2}r_{0,2} \text{ with } r_{0,j} = \frac{C_{0,j}}{P_{0,j}}$$

In words, this is simply the bycatch outside the closure area before and after a cap was reached plus the pollock caught inside the closure area after the cap was reached multiplied by the bycatch rate outside the area after the cap was reached.

An Alternative 4 option closes an area only in the June July period. This presents a challenge for analysis because the potential reaction by the fleet to such closures could vary. For example, vessels restricted by the closure in the June-July period may choose to fish outside the closure during that period or choose divert their pollock to fish after the end of July or some combination of these strategies. Consequently, we analyzed this type of closure by introducing a uniform 0,1 variable λ which when set to 1.0 assumes the pollock that was caught inside the closed area was diverted to outside the area for the remainder of the June-July period or if set to zero assumes the pollock that was caught inside the closed area was diverted to after the end of July. Intermediate values of λ allow some pollock to occur in both periods.

$$C' = C_{0,0} + C_{0,1} + \lambda P_{1,1}r_{0,1} + (1-\lambda)P_{1,1}r_{0.2}$$

where the 2nd index for $r_{0,2}$ value of 2 indicates that bycatch rates computation extends from August 1st through October 31st (with no closure area). An added complication is to monitor the chum salmon that comes from the different periods. For analysis, values selected for λ were 0.0, 0.5, and 1.0. The following describes the options and the closure area and period used for analysis:

Option	Closure area	Period/closure size basis
1a)	80%	B season
1b)	80%	June-July
2a)	60%	B season
2b)	60%	June-July

As with the results from Alternative 2, presentation over all combinations of caps (3), allocations (3), options (4), sectors (4), alternative λ values (3; for a subset of options), years (9), species and/or stocks of interest (8) would result in presenting nearly 30,000 values. Consequently, tables in chapter 5 are intended to highlight the different dimensions of the problem rather than show all results. As noted above, extra accounting is required to evaluate the within-B season impacts of the different components and alternative specifications. For this reason values are presented expanded to the genetics information on chum salmon (available for 2005-2009 and using seasonal average proportions in other years).

4 Walleye pollock

4.1 Overview of pollock biology and distribution

Overview information in this section is extracted from Ianelli et al. (2010). 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 2010).

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.

4.1.2 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 (Figure 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. In recent years, the proportion of catch taken west of 170°W has grown. The spatial distribution of the fishery is depicted in Figure 4-2 and the catch by each of the four sectors is shown in Table 4-1.

Table 4-1. Sector specific annual pollock catch (t) based on NMFS Regional Office data.

	CDQ	CP	M	CV	Total
2003	149,121	522,428	130,564	652,243	1,454,357
2004	149,173	519,570	129,222	637,971	1,435,936
2005	149,715	517,699	130,669	647,853	1,445,935
2006	150,482	528,009	131,404	645,614	1,455,508
2007	139,336	488,543	121,514	572,745	1,322,138
2008	99,964	347,233	85,359	427,759	960,314
2009	81,478	281,603	70,308	350,367	783,756
2010	81,275	282,750	70,576	351,684	786,285
2011	116,978	423,680	109,856	519,093	1,169,607
Total	1,117,522	3,911,514	979,471	4,805,328	10,813,836

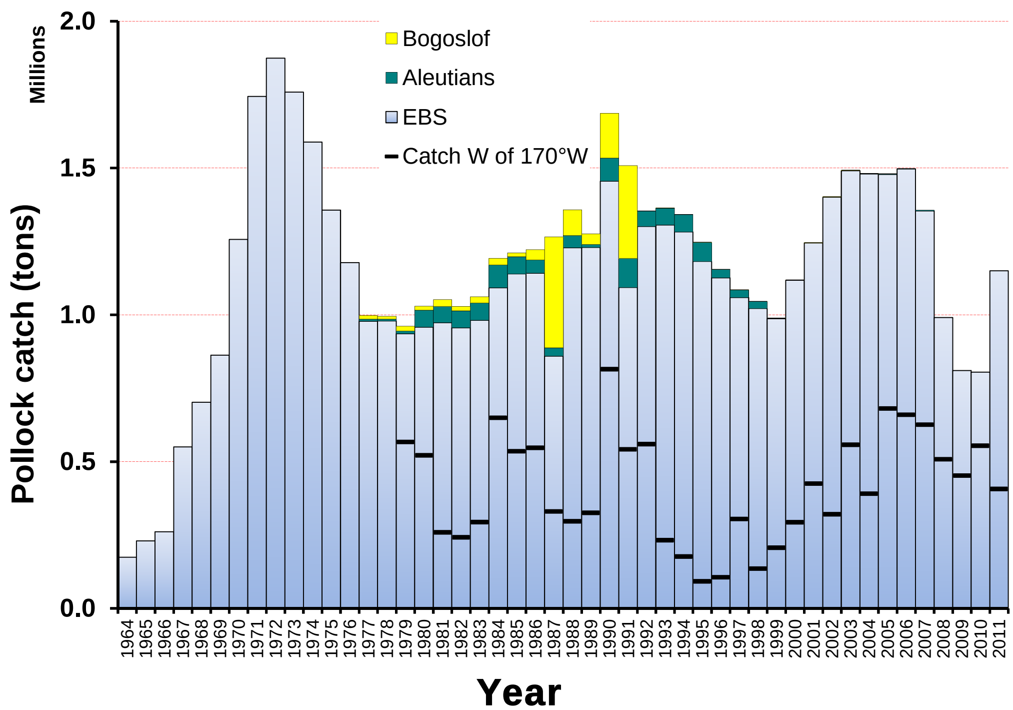


Figure 4-1. Alaska pollock catch estimates from the Eastern Bering Sea, Aleutian Islands, and Bogoslof Island regions, 1964-2011.

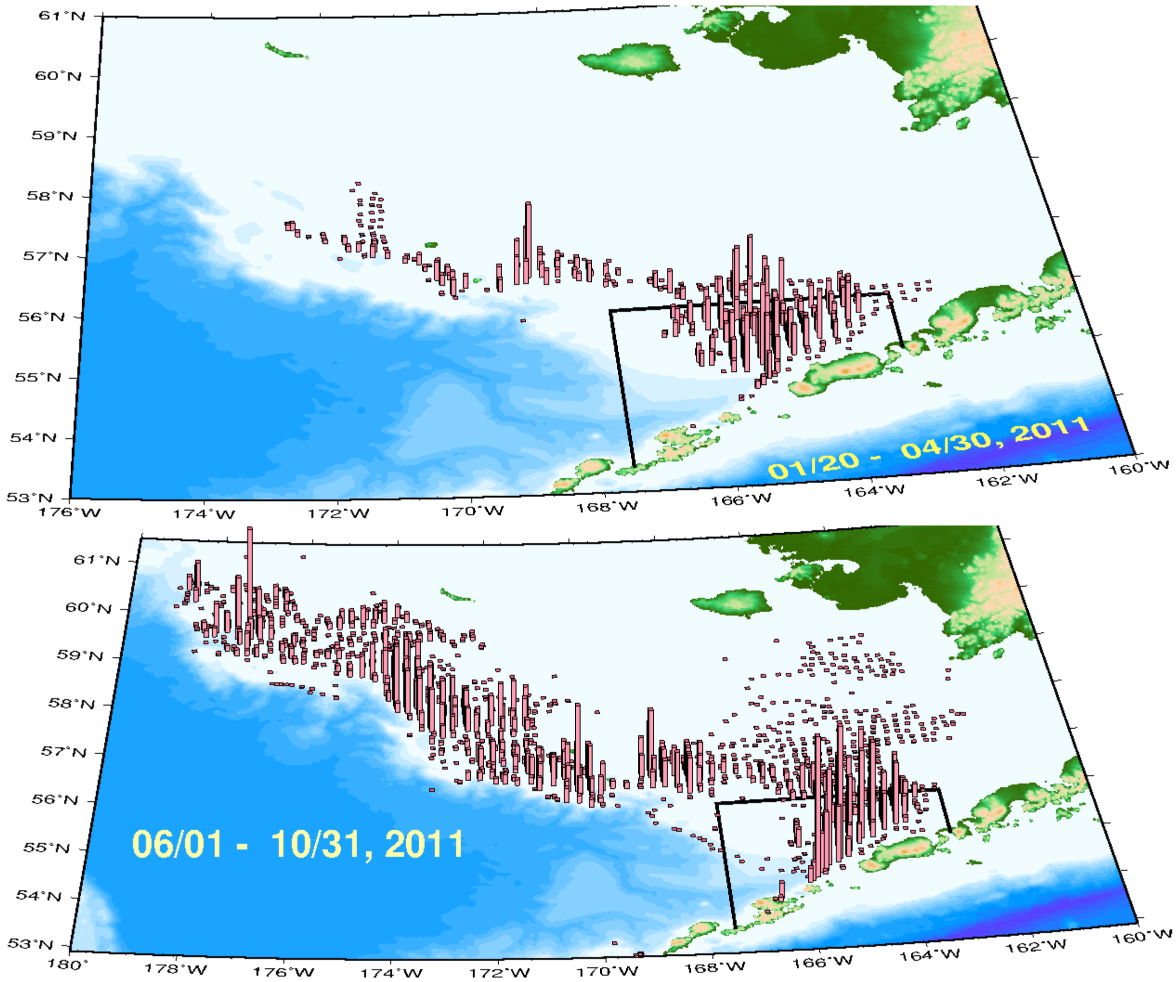


Figure 4-2. Alaska pollock 2011 catch distribution during the winter (top) and summer-fall (bottom).

4.1.3 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 (Figure 4-3).

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 due to a period of below-average recruitment which has subsequently improved since 2008 and is estimated to be above the target spawning level in 2011 (Ianelli et al. 2010). Due to the decline, catch was restricted to about 800 thousand tons in 2009 and 2010 whereas catch averaged 1.463 million tons from 2002-2005. The effect of these catches is 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. A summary of biomass and recruitment is shown in Figure 4-4.

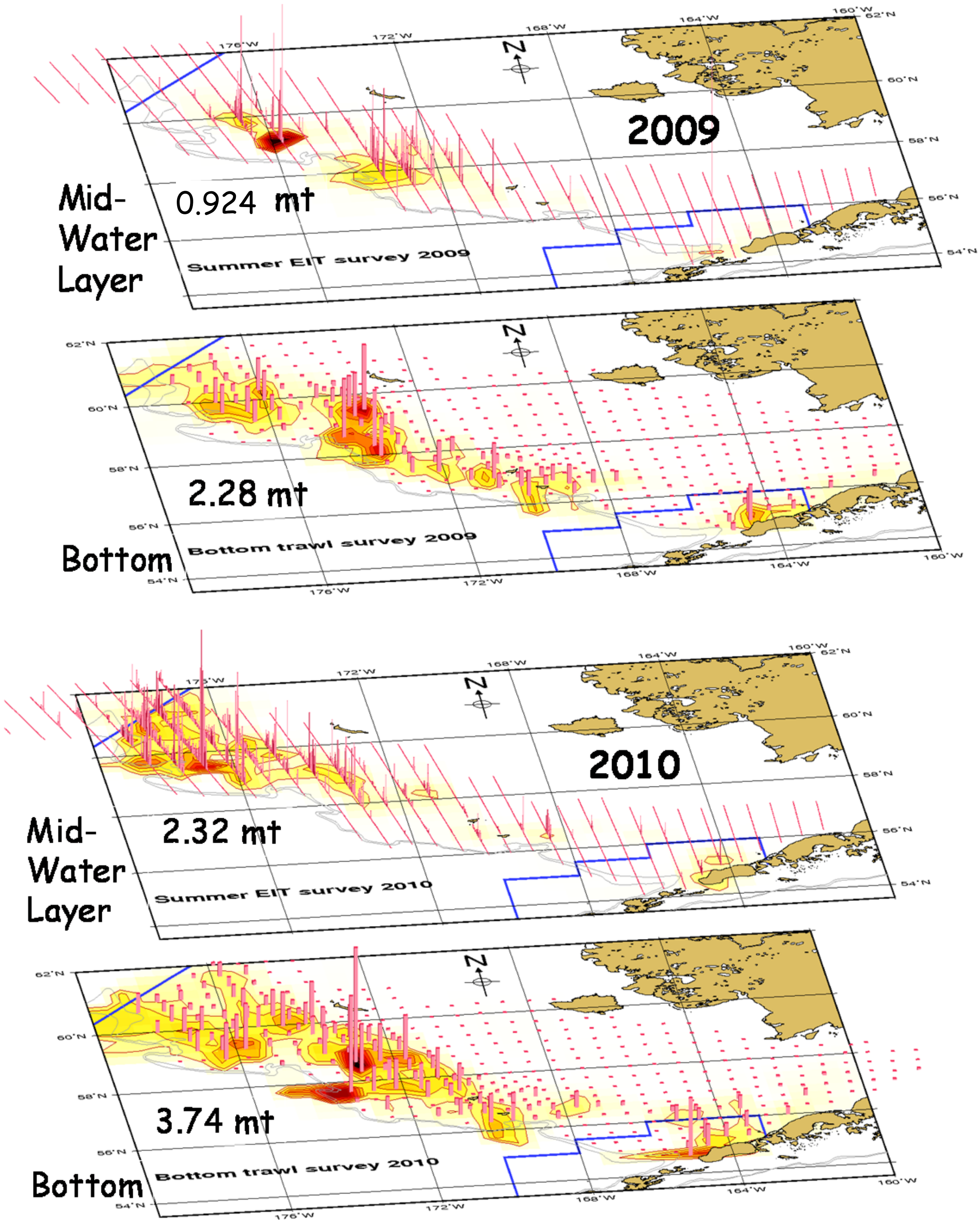


Figure 4-3. Echo-integration trawl and bottom trawl survey results for 2009 and 2010. Vertical lines represent biomass of pollock as observed in the different surveys.

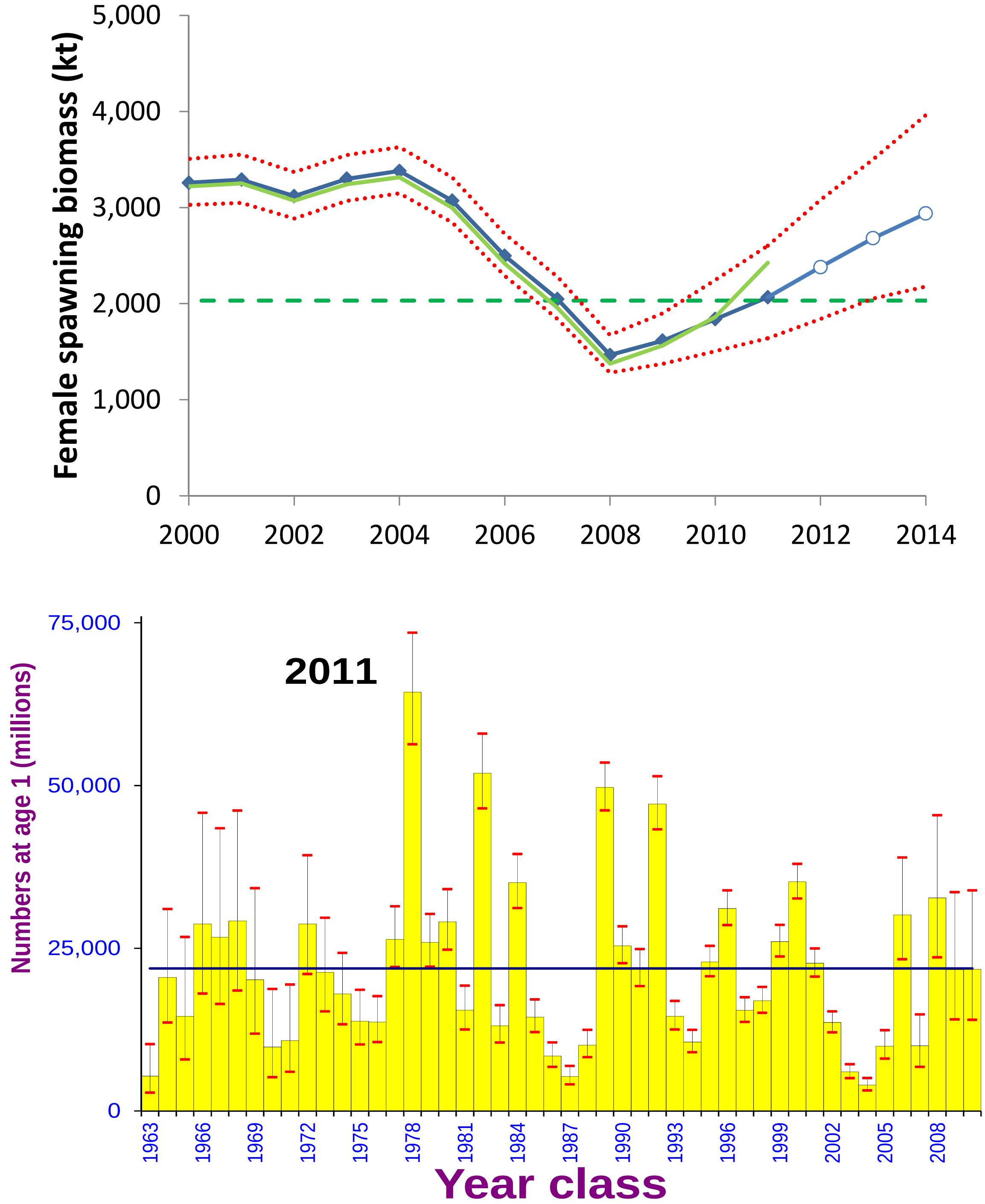


Figure 4-4. Estimated age female spawning EBS mid-year pollock biomass, 1978-2014 (top; with previous year's estimates) and age-1 year-class strengths (bottom panel). Approximate upper and lower 95% confidence limits are shown by shadings and error bars.

4.2 Impact of alternatives on the pollock stocks

The significance of the impacts of the alternative management measures on pollock stocks based on criteria adopted from HAPC EA 2006. Criteria used to determine significance of effects on target groundfish stocks are as follows:

Effect	Criteria			
	Significantly Negative	Insignificant	Significantly Positive	Unknown
Fishing mortality	Reasonably expected to jeopardize the capacity of the stock to yield sustainable biomass on a continuing basis.	Reasonably expected not to jeopardize the capacity of the stock to yield sustainable biomass on a continuing basis.	Action allows the stock to return to its unfished biomass.	Magnitude and/or direction of effects are unknown
Spatial or temporal distribution	Reasonably expected to adversely affect the distribution of harvested stocks either spatially or temporally such that it jeopardizes the ability of the stock to sustain itself.	Unlikely to affect the distribution of harvested stocks either spatially or temporally such that it has an effect on the ability of the stock to sustain itself.	Reasonably expected to positively affect the harvested stocks through spatial or temporal increases in abundance such that it enhances the ability of the stock to sustain itself.	Magnitude and/or direction of effects are unknown

4.2.1 Significance of Alternative 1 (status quo) on the pollock resource

Presently the pollock stock is managed based on science covering a wide variety of facets including the capacity of the stock to yield sustainable biomass on a continuing basis. Spatial and temporal distribution changes are closely monitored by scientifically trained at-sea observers. These changes are reflected in the annual stock assessments and in consideration of fishing conditions. Regular diet compositions and applications to multispecies ecosystem models are conducted to evaluate changes in predator-prey dynamics. In general, variability in environmental conditions likely affects stock productivity more than the timing and location of fishing activities. The present bycatch management system in place neither significantly affects the distribution of the stock spatially and temporally, nor is it reasonably expected to jeopardize the capacity of the stock productivity on a continuing basis. Thus Alternative 1 is expected to have an insignificant effect on the productivity of the pollock stock as evidenced by the capacity to yield sustainable biomass on a continuing basis and the ability of the stock to sustain itself regardless of any minor modifications in the stock distribution as a result of the fishery.

4.2.2 Alternative 2, hard caps

The amount of pollock catch that would have been forgone was compared with the total actual pollock to evaluate the impact of different sector-split hard caps. **This method ignores the fact that the fleet would likely have taken measures to avoid reaching a cap in any given year.** Nonetheless, all hard caps show that all sectors would have forgone high levels of pollock catch at most cap levels (Table 4-2 and Table 4-3). The sector most affected is the shore-based catcher vessels (CVs), particularly for the 50,000 chum salmon hard cap and the third sector allocation scheme evaluated (Table 4-2 and Table 4-3). For the first sector allocation scheme the impact on the at-sea catcher processors was highest, particularly in 2004. Since the impacts for hard caps are quite high (based on historical data in terms of tonnages of pollock), the effort required to avoid chum in such years would additionally increase the costs of fishing (Table 4-4). Summing hypothetical forgone pollock over sectors, the amount varies considerably between years ranging from no pollock forgone to over 79% for the low cap option in 2005 (Table 4-5). Also, the estimated week of closure in some years was quite early (Table 4-6 for options 1a and Table 4-7 for 1b).

Whereas these measures would directly affect the pollock fishery, the presentation of these consequences is necessary to evaluate the potential biological impacts on the pollock stock and is evaluated in section 4.2 below.

Table 4-2. Alternative 2 option 1a) estimated forgone pollock (in metric tons) by sector and year under 3 different allocation schemes and hard caps for 2003-2011 for the B season.

2ii (sector allocation 1)

Cap:	**50,000**				**200,000**				**353,000**			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2003	15,612	35,284	47,325	193,064			10,640					
2004	63,285	306,348	61,687	198,383	16,489	189,168	13,616	74,300		125,047		34,921
2005	23,497	288,830	68,135	300,100	5,683	107,182	20,909	250,591		72,399	4,420	210,633
2006		226,931		355,395				235,680				
2007	17,638	112,482	28,592	79,139								
2008												
2009												
2010												
2011	19,195	199,541	62,723	200,391		92,309	50,481			6,636	23,602	

4ii (sector allocation 2)

Cap:	**50,000**				**200,000**				**353,000**			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2003	5,080	15,264	30,702	210,408				26,230				
2004	36,053	286,156	50,440	199,782		125,047	1,743	79,627		7,439		59,794
2005	19,029	132,982	66,307	302,952		63,422	8,394	258,357				224,582
2006		97,410		359,614				290,939				199,143
2007	14,518	67,824	22,273	92,388								
2008												
2009				17,308								
2010												
2011	7,854	147,041	60,143	208,973			26,992				11,542	

6 (sector allocation 3)

Cap:	**50,000**				**200,000**				**353,000**			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2003	1,570		18,392	227,877				56,320				
2004	23,456	227,164	41,562	203,232		50,818		144,093				75,858
2005	13,858	119,198	63,631	307,984				266,864				251,805
2006				362,291				320,151				240,489
2007		52,986	16,760	117,810								
2008												
2009				61,679								
2010												
2011	2,361	131,761	57,181	260,447			17,161	67,318				

Table 4-3. Alternative 2 **option 1b)** estimated forgone pollock (in metric tons) by sector and year under 3 different allocation schemes and hard caps for 2003-2011 for the B season).

2ii (sector allocation 1)

Cap:	15,600				62,400				110,136			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2003		32,314	14,223	14,446								
2004		180,274	23,046	2,336		169,923	4,080			149,971		
2005		121,582	37,286	125,862		59,995	33,479	90,664			29,990	65,359
2006		79,842		127,429		5,873		104,099				83,230
2007		33,778	8,797									
2008												
2009			19,725	21,041								
2010			7,082									
2011	28,944	89,803	30,354	143,004		61,271	28,715	38,633		11,297	23,648	

4ii (sector allocation 2)

Cap:	15,600				62,400				110,136			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2003			10,952	29,551								
2004		176,110	20,883	17,527		137,567				48,040		
2005		113,144	37,082	130,616			30,932	99,153				80,374
2006		39,740		128,408				119,016				90,973
2007			3,145									
2008												
2009			10,025	36,745								
2010												
2011	10,056	80,769	30,158	145,669		10,477	24,370	71,438			20,800	

6 (sector allocation 3)

Cap:	15,600				62,400				110,136			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2003			6,737	52,157								
2004		173,619	18,641	38,611		56,439						
2005		110,585	35,826	136,603			19,383	103,115				91,973
2006		15,833		131,957				123,911				111,223
2007				10,223								
2008												
2009				54,561								
2010												
2011		67,731	30,046	149,130			21,856	103,838			10,528	40,098

Table 4-4. Alternative 2, option 1a) Estimated forgone pollock (relative to estimated catches) by sector and year under 3 different allocation schemes and hard caps for 2003-2011 for the B season.

2ii (sector allocation 1)

Cap:	50,000				200,000				353,000			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2003	10%	7%	36%	30%			8%					
2004	42%	59%	48%	31%	11%	36%	11%	12%		24%		5%
2005	16%	56%	52%	46%	4%	21%	16%	39%		14%	3%	33%
2006		43%		55%				37%				
2007	13%	23%	24%	14%								
2008												
2009												
2010												
2011	16%	47%	57%	39%		22%	46%			2%	21%	

4ii (sector allocation 2)

Cap:	50,000				200,000				353,000			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2003	3%	3%	24%	32%				4%				
2004	24%	55%	39%	31%		24%	1%	12%		1%		9%
2005	13%	26%	51%	47%		12%	6%	40%				35%
2006		18%		56%				45%				31%
2007	10%	14%	18%	16%								
2008												
2009				5%								
2010												
2011	7%	35%	55%	40%			25%				11%	

6 (sector allocation 3)

Cap:	50,000				200,000				353,000			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2003	1%		14%	35%				9%				
2004	16%	44%	32%	32%		10%		23%				12%
2005	9%	23%	49%	48%				41%				39%
2006				56%				50%				37%
2007		11%	14%	21%								
2008												
2009				18%								
2010												
2011	2%	31%	52%	50%			16%	13%				

Table 4-5. Alternative 2 summary of forgone (or diverted for 1b) pollock totaled over sectors under 3 different allocation schemes and hard caps for 2003-2011 for the B season. Bottom panels show in relative percentages. Caps for 1b options are shown in parentheses

	Actual pollock	50,000 (15,600)			200,000 (62,400)			353,000 (110,136)		
Year	catch (t)	2ii	4ii	6	2ii	4ii	6	2ii	4ii	6
		Option 1a)								
2003	874,471	291,284	261,454	247,839	10,640	26,230	56,320			
2004	855,557	629,704	572,430	495,415	293,574	206,417	194,911	159,968	67,233	75,858
2005	861,226	680,562	521,270	504,671	384,365	330,172	266,864	287,452	224,582	251,805
2006	862,021	582,326	457,024	362,291	235,680	290,939	320,151		199,143	240,489
2007	773,138	237,851	197,003	187,556						
2008	572,010									
2009	464,654		17,308	61,679						
2010	470,405									
2011	676,342	481,850	424,010	451,750	142,790	26,992	84,479	30,238	11,542	
Total	6,409,825	2,903,576	2,450,499	2,311,200	1,067,049	880,750	922,726	477,658	502,500	568,152
		Option 1b)								
2003	874,471	60,983	40,504	58,894						
2004	855,557	205,656	214,519	230,871	174,003	137,567	56,439	149,971	48,040	
2005	861,226	284,730	280,842	283,014	184,138	130,085	122,498	95,349	80,374	91,973
2006	862,021	207,271	168,148	147,790	109,972	119,016	123,911	83,230	90,973	111,223
2007	773,138	42,575	3,145	10,223						
2008	572,010									
2009	464,654	40,766	46,769	54,561						
2010	470,405	7,082								
2011	676,342	292,106	266,652	246,907	128,618	106,285	125,694	34,945	20,800	50,626
Total	6,409,825	1,141,168	1,020,579	1,032,259	596,731	492,953	428,543	363,495	240,188	253,822
		Option 1a)								
2003	874,471	33%	30%	28%	1%	3%	6%			
2004	855,557	74%	67%	58%	34%	24%	23%	19%	8%	9%
2005	861,226	79%	61%	59%	45%	38%	31%	33%	26%	29%
2006	862,021	68%	53%	42%	27%	34%	37%		23%	28%
2007	773,138	31%	25%	24%						
2008	572,010									
2009	464,654		4%	13%						
2010	470,405									
2011	676,342	71%	63%	67%	21%	4%	12%	4%	2%	
Total	6,409,825	45%	38%	36%	17%	14%	14%	7%	8%	9%
		Option 1b)								
2003	874,471	7%	5%	7%						
2004	855,557	24%	25%	27%	20%	16%	7%	18%	6%	
2005	861,226	33%	33%	33%	21%	15%	14%	11%	9%	11%
2006	862,021	24%	20%	17%	13%	14%	14%	10%	11%	13%
2007	773,138	6%	0%	1%						
2008	572,010									
2009	464,654	9%	10%	12%						
2010	470,405	2%								
2011	676,342	43%	39%	37%	19%	16%	19%	5%	3%	7%
Total	6,409,825	18%	16%	16%	9%	8%	7%	6%	4%	4%

Table 4-6. Estimated week of sector-specific pollock fishery closures due to hypothetical Alternative 2 (option 1a) hard caps (column sections) for three different allocation schemes (row sections) for the B season (2003-2011). A blank cell indicates that the fishery would have remained open.

2ii (sector	50,000				200,000				353,000			
allocation 1)	CDQ	CP	M	S	CDQ	CP	M	S	CDQ	CP	M	S
2003	30-Aug	9-Aug	2-Aug	9-Aug	20-Sep	4-Oct	20-Sep					
2004	15-Aug	13-Jun	11-Jul	1-Aug	12-Sep	4-Jul	26-Sep	5-Sep		1-Aug		26-Sep
2005	16-Aug	21-Jun	21-Jun	5-Jul	13-Sep	23-Aug	23-Aug	19-Jul		30-Aug	27-Sep	2-Aug
2006		19-Jul		14-Jun				26-Jul				
2007	9-Aug	28-Jun	9-Aug	6-Sep	11-Oct	6-Sep						
2008												
2009												
2010												
2011	16-Aug	28-Jun	21-Jun	12-Jul		23-Aug	12-Jul			18-Oct	30-Aug	

4ii (sector	50,000				200,000				353,000			
allocation 2)	CDQ	CP	M	S	CDQ	CP	M	S	CDQ	CP	M	S
2003	6-Sep	23-Aug	30-Aug	9-Aug				27-Sep				
2004	5-Sep	13-Jun	1-Aug	1-Aug		1-Aug	31-Oct	5-Sep				12-Sep
2005	16-Aug	16-Aug	28-Jun	5-Jul		30-Aug	20-Sep	19-Jul				26-Jul
2006		16-Aug		14-Jun				5-Jul				2-Aug
2007	23-Aug	16-Aug	23-Aug	30-Aug								
2008												
2009				30-Aug								
2010												
2011	18-Oct	26-Jul	21-Jun	5-Jul			16-Aug				11-Oct	

6 (sector	50,000				200,000				353,000			
allocation 3)	CDQ	CP	M	S	CDQ	CP	M	S	CDQ	CP	M	S
2003	20-Sep	20-Sep	6-Sep	2-Aug				13-Sep				
2004	12-Sep	20-Jun	22-Aug	1-Aug		5-Sep		22-Aug				5-Sep
2005	23-Aug	16-Aug	28-Jun	28-Jun				12-Jul				19-Jul
2006				7-Jun				21-Jun				26-Jul
2007	30-Aug	30-Aug	20-Sep	16-Aug								
2008												
2009				26-Jul								
2010												
2011		2-Aug	21-Jun	21-Jun			13-Sep	6-Sep				

Table 4-7. Estimated week of sector-specific pollock fishery closures due to hypothetical Alternative 2 (option 1b) hard caps (column sections) for three different allocation schemes (row sections) for the B season (2003-2011). A blank cell indicates that the fishery would have remained open.

2ii (sector	15,600				62,400				110,136			
allocation 1)	CDQ	CP	M	S	CDQ	CP	M	S	CDQ	CP	M	S
2003	19-Jul	7-Jun	19-Jul	26-Jul								
2004	11-Jul	6-Jun	4-Jul			13-Jun	25-Jul			20-Jun		
2005		14-Jun	21-Jun	28-Jun		12-Jul	21-Jun	5-Jul			28-Jun	12-Jul
2006		14-Jun	19-Jul	7-Jun		19-Jul		14-Jun				21-Jun
2007	7-Jun	7-Jun	12-Jul	26-Jul		12-Jul						
2008												
2009		26-Jul	5-Jul	26-Jul								
2010			19-Jul									
2011	5-Jul	21-Jun	14-Jun	14-Jun		5-Jul	21-Jun	19-Jul		26-Jul	21-Jun	
4ii (sector	15,600				62,400				110,136			
allocation 2)	CDQ	CP	M	S	CDQ	CP	M	S	CDQ	CP	M	S
2003		19-Jul	19-Jul	19-Jul								
2004		13-Jun	4-Jul	25-Jul		20-Jun				18-Jul		
2005		21-Jun	21-Jun	21-Jun			28-Jun	5-Jul				12-Jul
2006		28-Jun		7-Jun				14-Jun				21-Jun
2007	7-Jun	7-Jun	19-Jul	26-Jul								
2008												
2009			19-Jul	19-Jul								
2010												
2011	26-Jul	28-Jun	14-Jun	14-Jun		26-Jul	21-Jun	12-Jul			12-Jul	
6 (sector	15,600				62,400				110,136			
allocation 3)	CDQ	CP	M	S	CDQ	CP	M	S	CDQ	CP	M	S
2003			26-Jul	12-Jul								
2004		13-Jun	4-Jul	25-Jul		4-Jul						
2005		21-Jun	21-Jun	21-Jun			5-Jul	5-Jul				5-Jul
2006		19-Jul		7-Jun				7-Jun				14-Jun
2007		28-Jun	26-Jul	5-Jul								
2008												
2009				5-Jul								
2010												
2011		28-Jun	14-Jun	14-Jun			28-Jun	28-Jun			19-Jul	19-Jul

4.2.2.1 An evaluation of transferability of chum salmon among sectors

As noted in methods, the analysis assumes between cooperative transferability. Between sector transferability is evaluated here for Alternative 2, option 1a for illustrative purposes. This option assumes "perfect" transferability in that sectors would exchange allocated chum salmon PSC freely.

Actual transferability options would be initially from sector specific allocations (the analysis above was as if there were no sector allocations) and then in a given year, a "clean" sector could transfer their chum salmon PSC to a sector that requires more. Logically this poses challenges for analysis because the conditions for a transfer would have to be that the "clean" sector would know in advance that they have salmon to transfer to a sector needing more PSC salmon to extend their pollock fishing. Alternatively the clean sector could finish their pollock fishing earlier than the sector needing more PSC salmon and transfer at that time. Simulating either condition would require apriori knowledge about the interaction between sectors which are unknown. Additionally, such a system will add complexity to management and enforcement, and will obviously result in higher salmon bycatch (within a cap) and less foregone pollock.

To evaluate this option, one scenario for Alternative 2, option 1a) with a cap of 50,000 and sector allocation 6 was examined. In 2005 had this scenario been in place all sectors would have come up against their cap so there would be no transfers (with motherships and shorebased CV sectors hitting their cap on the 2nd and 4th of July, respectively). In 2006, shorebased boats would have hit their cap on June 14th, and remarkably all other sectors stay below their cap. Assuming somehow that the other sectors would know how much salmon they would catch at the end of the year, then the difference between the remaining salmon and the sum of their caps is 7,645 chum. That amount would not be enough for the shorebased sector to fish even one more day (their initial allocation is 22,385 salmon, on June 13th they went from 13,838 salmon to 30,390). In summary, the idea of transfers would be beneficial in principle; however, "what ifs" evaluations from historical data are limited to illustrate performance benefits.

4.2.3 Analysis of Alternative 3

Alternative 3 proposes a revised RHS system similar to the one in operation under Alternative 1. While there are key aspects to the program that differ from the status quo RHS system (as described further in Chapter 5 and Appendix 4) the estimated impacts on the fishery as it relates to pollock catch (and thus the pollock stock) are best approximated by the status quo. RHS closures will move the fishery around spatially and temporally and may do more of that under the Alternative 3 revised program in June and July, while ceasing to do so as Chinook PSC increases later in August into September. Under Alternative 3 (or any of the 4 alternatives) there are no proposed changes to the Chinook bycatch management program in place. As noted in Section 4.2.3, the pollock stock is managed based on science covering a wide variety of facets including the capacity of the stock to yield sustainable biomass on a continuing basis. Spatial and temporal distribution changes are closely monitored by scientifically trained at-sea observers. These changes are reflected in the annual stock assessments and in consideration of fishing conditions. Regular diet compositions and applications to multispecies ecosystem models are conducted to evaluate changes in predator-prey dynamics. In general, variability in environmental conditions likely affects stock productivity more than the timing and location of fishing activities. The present bycatch management system in place neither significantly affects the distribution of the stock spatially and temporally, nor is it reasonably expected to jeopardize the capacity of the stock productivity on a continuing basis. Thus Alternative 3 is expected to have an insignificant effect on the productivity of the pollock stock as evidenced by the capacity to yield sustainable biomass on a continuing basis and the ability of the stock to sustain itself regardless of any minor modifications in the stock distribution as a result of the fishery.

4.2.4 Analysis of Alternative 4

As presented in Chapter 2, the methods for evaluating accounted for bycatch for all options for the June-July and August-October periods to ensure proper application of stock identification results. The options under Alternative 3 are by size of area closure and period from which closures would take place:

Option	Closure area	Period/closure size basis
1a)	80%	B season
1b)	80%	June-July
2a)	60%	B season
2b)	60%	June-July

Options for maintaining efficiency in the amount that normal pollock grounds must be diverted (while still reducing bycatch) is a challenging problem and can vary considerably from year to year. For example there is a fair amount of variability between sectors for a given allocation scheme, cap, and trigger option (Table 4-8 through Table 4-11). Integrated results over years and sectors to compare the relative impact of the options on the pollock fishery show that the lower cap levels and sector allocation scheme 3 have the largest impact on the pollock fishery (Table 4-12). In terms of potential tons of pollock that would be diverted, Option 2a appears to have the lowest impact on pollock fishing among the other trigger closure options given cap and sector allocation scheme (Table 4-13).

The dates that closures would have occurred across options and sector allocations (and caps: Table 4-14 through Table 4-16).

Table 4-8. Alternative 4 estimated relative amount of pollock fishing (in percentages of pollock catch biomass) that would be diverted from historical fishing grounds by sector allocation (panels) and trigger cap levels for **Option 1a.**

	25,000				**75,000**				**200,000**			
	2ii (sector allocation 1)											
Option 1a)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003	6%	2%	16%	27%	3%	1%	12%	11%			6%	
2004	11%	12%	17%	21%	7%	12%	6%	17%	1%	5%	1%	6%
2005	0%	2%	7%	28%	0%	1%	4%	25%		1%		22%
2006		2%	0%	26%		0%		22%				14%
2007	1%	3%	0%	14%	1%	3%	0%					
2008												
2009	0%		0%	5%								
2010												
2011	8%	6%	28%	32%	6%	6%	26%	20%		5%	19%	
	3%	3%	8%	19%	2%	3%	6%	12%	0%	1%	3%	6%
	4ii (sector allocation 2)											
Option 1a)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003	5%	1%	13%	28%	1%		11%	19%				3%
2004	10%	12%	15%	21%	1%	8%	6%	20%		4%		7%
2005	0%	2%	5%	29%	0%	1%	1%	26%		1%		23%
2006		1%		26%				24%				17%
2007	1%	3%	0%	14%	0%	3%		9%				
2008												
2009			0%	6%								
2010												
2011	7%	6%	27%	32%	1%	5%	21%	24%			15%	
	3%	3%	8%	20%	0%	2%	5%	16%		1%	2%	7%
	6 (sector allocation 3)											
Option 1a)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003	3%	1%	13%	29%			8%	24%				6%
2004	6%	12%	11%	23%	0%	4%	1%	21%		2%		15%
2005	0%	1%	5%	31%		1%		27%				24%
2006		0%		26%				25%				21%
2007	1%	3%	0%	16%				12%				
2008				2%								
2009				6%				3%				
2010												
2011	5%	6%	27%	33%		4%	19%	25%			12%	11%
	2%	3%	7%	21%	0%	1%	3%	17%		0%	1%	10%

Table 4-9. Alternative 4 estimated relative amount of pollock fishing (in percentages of pollock catch biomass) that would be diverted from historical fishing grounds by sector allocation (panels) and trigger cap levels for **Option 1b.**

	7,800				**23,400**				**62,400**			
2ii (sector allocation 1)												
Option 1b)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003		0%	6%	4%			3%					
2004	2%	7%	13%	5%		7%	11%			6%	2%	
2005		1%	6%	17%		1%	6%	12%		0%	3%	10%
2006		1%		12%		1%		11%		0%		8%
2007		0%	0%	1%								
2008												
2009	0%	0%	2%	2%				0%				
2010			5%									
2011	0%	1%	9%	14%	0%	1%	9%	11%		1%	7%	3%
	0%	1%	5%	7%	0%	1%	4%	4%		1%	1%	3%
4ii (sector allocation 2)												
Option 1b)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003		0%	5%	5%			1%	0%				
2004		7%	13%	7%		6%	10%			5%		
2005		1%	6%	17%		0%	4%	14%			2%	11%
2006		1%		12%		0%		11%				10%
2007		0%	0%	1%								
2008												
2009			1%	2%				0%				
2010			0%	2%								
2011	0%	1%	9%	14%		1%	8%	11%		0%	3%	5%
	0%	1%	4%	8%		1%	3%	5%		1%	1%	3%
6 (sector allocation 3)												
Option 1b)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003			4%	8%				2%				
2004		7%	12%	9%		6%	5%	2%		0%		
2005		1%	6%	20%		0%	4%	16%				11%
2006		1%		12%				11%				11%
2007			0%	3%								
2008				2%								
2009			0%	5%				1%				
2010				5%								
2011	0%	1%	9%	14%		1%	8%	12%			2%	7%
	0%	1%	4%	9%		1%	2%	5%		0%	0%	4%

Table 4-10. Alternative 4 estimated relative amount of pollock fishing (in percentages of pollock catch biomass) that would be diverted from historical fishing grounds by sector allocation (panels) and trigger cap levels for **Option 2a.**

	25,000				**75,000**				**200,000**			
	2ii (sector allocation 1)											
Option 2a)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003	4%	2%	12%	22%	2%	1%	9%	6%			4%	
2004	10%	8%	14%	18%	6%	8%	6%	15%	1%	2%	1%	5%
2005	0%	1%	5%	22%	0%	0%	2%	20%		0%		17%
2006		1%	0%	22%		0%		18%				12%
2007	1%	3%	0%	11%	1%	3%	0%					
2008												
2009	0%		0%	5%								
2010												
2011	7%	4%	20%	25%	5%	4%	19%	14%		3%	13%	
	3%	2%	6%	16%	2%	2%	4%	9%	0%	1%	2%	4%
	4ii (sector allocation 2)											
Option 2a)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003	3%	1%	10%	22%	1%		8%	14%				1%
2004	9%	8%	13%	18%	1%	4%	5%	17%		2%		5%
2005	0%	1%	4%	23%	0%	0%	0%	20%		0%		18%
2006		0%		22%				20%				14%
2007	1%	3%	0%	11%		2%		7%				
2008												
2009			0%	5%								
2010												
2011	6%	4%	20%	25%	1%	3%	15%	18%			12%	
	2%	2%	6%	16%	0%	1%	3%	13%		0%	1%	5%
	6 (sector allocation 3)											
Option 2a)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003	2%	1%	10%	24%			5%	18%				2%
2004	5%	8%	10%	20%	0%	2%	1%	18%		1%		13%
2005	0%	0%	3%	25%		0%		21%				19%
2006		0%		22%				21%				17%
2007	1%	3%	0%	12%				10%				
2008				2%								
2009				6%				3%				
2010												
2011	5%	3%	19%	26%		3%	13%	20%			10%	10%
	2%	2%	5%	17%	0%	1%	2%	14%		0%	1%	8%

Table 4-11. Alternative 4 estimated relative amount of pollock fishing (in percentages of pollock catch biomass) that would be diverted from historical fishing grounds by sector allocation (panels) and trigger cap levels for **Option 2b.**

	7,800				**23,400**				**62,400**			
	2ii (sector allocation 1)											
Option 2b)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003			6%	3%			2%					
2004	2%	1%	6%	4%		1%	6%			1%	2%	
2005		0%	4%	11%		0%	3%	7%		0%	1%	5%
2006		0%		9%		0%		8%				5%
2007				0%								
2008												
2009			0%	1%				0%				
2010			4%									
2011	0%		6%	8%			6%	6%			5%	1%
	0%	0%	3%	5%		0%	2%	3%		0%	1%	1%
	4ii (sector allocation 2)											
Option 2b)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003			5%	5%			1%	0%				
2004		1%	6%	7%		1%	6%			1%		
2005		0%	3%	12%		0%	2%	8%			1%	6%
2006		0%		9%				8%				7%
2007				0%								
2008												
2009			0%	2%				0%				
2010			0%	0%								
2011	0%		6%	8%			5%	6%			2%	1%
	0%	0%	2%	5%		0%	2%	3%		0%	0%	2%
	6 (sector allocation 3)											
Option 2b)	CDQ	CP	MS	CV	CDQ	CP	MS	CV	CDQ	CP	MS	CV
2003			6%	3%			2%					
2004	2%	1%	6%	4%		1%	6%			1%	2%	
2005		0%	4%	11%		0%	3%	7%		0%	1%	5%
2006		0%		9%		0%		8%				5%
2007				0%								
2008												
2009			0%	1%				0%				
2010			4%									
2011	0%		6%	8%			6%	6%			5%	1%
	0%	0%	3%	5%		0%	2%	3%		0%	1%	1%

Table 4-12. Average proportion of pollock catch that would be estimated to be diverted from closed areas for different cap, sector allocations, and trigger options summarizing over years and sectors. The option 1(b) and 2(b) caps are shown in parentheses next to the B-season option 1(a) and 2(a) caps.

2ii (sector allocation 1)	25,000 (7,800)	75,000 (23,400)	200,000 (62,400)
Option 1a)	10.81%	7.21%	3.25%
Option 1b)	3.96%	2.66%	1.71%
Option 2a)	8.62%	5.45%	2.41%
Option 2b)	2.46%	1.43%	0.80%
4ii (sector allocation 2)	25,000 (7,800)	75,000 (23,400)	200,000 (62,400)
Option 1a)	10.75%	8.15%	3.38%
Option 1b)	4.25%	2.68%	1.77%
Option 2a)	8.54%	6.35%	2.56%
Option 2b)	2.72%	1.51%	0.89%
6 (sector allocation 3)	25,000 (7,800)	75,000 (23,400)	200,000 (62,400)
Option 1a)	11.10%	8.38%	4.71%
Option 1b)	4.90%	2.91%	1.67%
Option 2a)	8.87%	6.68%	3.66%
Option 2b)	3.17%	1.78%	0.95%

Table 4-13. Amount of pollock catch (thousands of t) that is estimated to be diverted from closed areas for different cap, sector allocations, and **trigger** options summing over years (2003-2011; nine years) and sectors for **Alternative 4**. The option 1(b) and 2(b) caps are shown in parentheses next to the B-season option 1(a) and 2(a) caps.

		Cap	
2ii (sector allocation 1)	25,000 (7,800)	75,000 (23,400)	200,000 (62,400)
Option 1a)	1,169	779	352
Option 1b)	428	288	185
Option 2a)	932	589	261
Option 2b)	266	155	87
4ii (sector allocation 2)	25,000	75,000	200,000
Option 1a)	1,162	882	366
Option 1b)	460	290	191
Option 2a)	924	686	277
Option 2b)	295	163	97
6 (sector allocation 3)	25,000	75,000	200,000
Option 1a)	1,200	906	510
Option 1b)	530	315	180
Option 2a)	959	722	396
Option 2b)	343	193	102

Table 4-14. Alternative 4 component 2 closure dates by sector and allocation scheme for each of the 4 options (1a, 1b, 2a, and 2b) for the **25,000 cap** level (options 1a and 2a) and **7,800 cap** level (options 1b and 2b).

		CDQ Allocation			CP Allocation			M Allocation			S Allocation		
Opt	Year	1	2	3	1	2	3	1	2	3	1	2	3
	2003	30-Aug	8-Sep	14-Sep	3-Aug	25-Aug	26-Aug	24-Jul	29-Jul	4-Aug	3-Aug	31-Jul	25-Jul
	2004	12-Aug	20-Aug	4-Sep	14-Jun	16-Jun	21-Jun	5-Jul	8-Jul	17-Jul	3-Aug	2-Aug	29-Jul
	2005	6-Aug	14-Aug	18-Aug	19-Jun	24-Jun	4-Aug	21-Jun	23-Jun	24-Jun	1-Jul	28-Jun	24-Jun
	2006	18-Sep			6-Jul	27-Jul	1-Aug	21-Aug	12-Sep		17-Jun	16-Jun	16-Jun
1a)	2007	21-Aug	26-Aug	27-Aug	15-Aug	22-Aug	29-Aug	28-Jul	14-Aug	21-Aug	25-Aug	20-Aug	6-Aug
	2008	25-Sep	25-Sep	25-Sep									29-Sep
	2009	30-Aug	29-Sep	29-Sep	12-Sep	5-Oct	5-Oct	19-Jul	3-Aug	17-Sep	29-Jul	28-Jul	16-Jul
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	4-Sep	6-Sep	6-Sep			
	2011	15-Jul	18-Aug	6-Sep	23-Jun	1-Jul	16-Jul	16-Jun	17-Jun	18-Jun	18-Jun	17-Jun	17-Jun
	2003				6-Jul	26-Jul		20-Jul	21-Jul	22-Jul	15-Jul	11-Jul	5-Jul
	2004	16-Jul			11-Jun	13-Jun	14-Jun	29-Jun	1-Jul	4-Jul	22-Jul	17-Jul	11-Jul
	2005	18-Jul			17-Jun	17-Jun	19-Jun	21-Jun	21-Jun	21-Jun	22-Jun	21-Jun	17-Jun
	2006	17-Jul			16-Jun	28-Jun	6-Jul	17-Jul	25-Jul		15-Jun	14-Jun	14-Jun
1b)	2007	7-Jul			3-Jul	20-Jul		5-Jul	6-Jul	19-Jul	27-Jul	13-Jul	4-Jul
	2008												15-Jul
	2009	24-Jun			21-Jul			20-Jun	4-Jul	7-Jul	8-Jul	5-Jul	30-Jun
	2010	26-Jun			17-Jul			9-Jul	21-Jul	27-Jul		25-Jul	20-Jul
	2011	27-Jun	1-Jul	14-Jul	19-Jun	22-Jun	23-Jun	16-Jun	16-Jun	16-Jun	13-Jun	13-Jun	13-Jun
	2003	30-Aug	8-Sep	14-Sep	3-Aug	25-Aug	26-Aug	24-Jul	29-Jul	4-Aug	3-Aug	31-Jul	25-Jul
	2004	12-Aug	20-Aug	4-Sep	14-Jun	16-Jun	21-Jun	5-Jul	8-Jul	17-Jul	3-Aug	2-Aug	29-Jul
	2005	6-Aug	14-Aug	18-Aug	19-Jun	24-Jun	4-Aug	21-Jun	23-Jun	24-Jun	1-Jul	28-Jun	24-Jun
	2006	18-Sep			6-Jul	27-Jul	1-Aug	21-Aug	12-Sep		17-Jun	16-Jun	16-Jun
2a)	2007	21-Aug	26-Aug	27-Aug	15-Aug	22-Aug	29-Aug	28-Jul	14-Aug	21-Aug	25-Aug	20-Aug	6-Aug
	2008	25-Sep	25-Sep	25-Sep									29-Sep
	2009	30-Aug	29-Sep	29-Sep	12-Sep	5-Oct	5-Oct	19-Jul	3-Aug	17-Sep	29-Jul	28-Jul	16-Jul
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	4-Sep	6-Sep	6-Sep			
	2011	15-Jul	18-Aug	6-Sep	23-Jun	1-Jul	16-Jul	16-Jun	17-Jun	18-Jun	18-Jun	17-Jun	17-Jun
	2003				6-Jul	26-Jul		20-Jul	21-Jul	22-Jul	15-Jul	11-Jul	5-Jul
	2004	16-Jul			11-Jun	13-Jun	14-Jun	29-Jun	1-Jul	4-Jul	22-Jul	17-Jul	11-Jul
	2005	18-Jul			17-Jun	17-Jun	19-Jun	21-Jun	21-Jun	21-Jun	22-Jun	21-Jun	17-Jun
	2006	17-Jul			16-Jun	28-Jun	6-Jul	17-Jul	25-Jul		15-Jun	14-Jun	14-Jun
2b)	2007	7-Jul			3-Jul	20-Jul		5-Jul	6-Jul	19-Jul	27-Jul	13-Jul	4-Jul
	2008												15-Jul
	2009	24-Jun			21-Jul			20-Jun	4-Jul	7-Jul	8-Jul	5-Jul	30-Jun
	2010	26-Jun			17-Jul			9-Jul	21-Jul	27-Jul		25-Jul	20-Jul
	2011	27-Jun	1-Jul	14-Jul	19-Jun	22-Jun	23-Jun	16-Jun	16-Jun	16-Jun	13-Jun	13-Jun	13-Jun

Table 4-15. Alternative 4 component 2 closure dates by sector and allocation scheme for each of the 4 options (1a, 1b, 2a, and 2b) for the **75,000 cap** level (options 1a and 2a) and **23,400 cap** level (options 1b and 2b).

		CDQ Allocation			CP Allocation			M Allocation			S Allocation		
Opt	Year	1	2	3	1	2	3	1	2	3	1	2	3
	2003	14-Sep	25-Sep	11-Oct	26-Aug	13-Oct	13-Oct	17-Aug	8-Sep	13-Sep	3-Sep	18-Aug	10-Aug
	2004	4-Sep	14-Sep	23-Sep	21-Jun	7-Jul	22-Jul	31-Jul	31-Aug	12-Sep	12-Aug	5-Aug	4-Aug
	2005	18-Aug	26-Aug	3-Oct	30-Jul	16-Aug	23-Aug	25-Jun	30-Jun	4-Aug	9-Jul	6-Jul	4-Jul
	2006				1-Aug						27-Jun	20-Jun	18-Jun
1a)	2007	27-Aug			27-Aug	12-Sep		29-Aug	27-Sep			27-Sep	9-Sep
	2008	25-Sep	25-Sep	25-Sep									
	2009	29-Sep	29-Sep	29-Sep	5-Oct	5-Oct	5-Oct	17-Sep	17-Sep	17-Sep	10-Oct	10-Oct	2-Sep
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	6-Sep	6-Sep	6-Sep			
	2011	22-Aug			12-Jul	30-Jul	4-Sep	19-Jun	24-Jun	30-Jun	4-Aug	17-Jul	7-Jul
	2003							24-Jul	29-Jul			29-Jul	24-Jul
	2004				13-Jun	16-Jun	21-Jun	5-Jul	6-Jul	15-Jul			28-Jul
	2005				19-Jun	23-Jun	31-Jul	21-Jun	23-Jun	24-Jun	30-Jun	26-Jun	24-Jun
	2006				5-Jul	26-Jul					17-Jun	16-Jun	16-Jun
1b)	2007							28-Jul					
	2008												
	2009							18-Jul			29-Jul	28-Jul	16-Jul
	2010												
	2011	11-Jul			23-Jun	1-Jul	13-Jul	16-Jun	17-Jun	18-Jun	18-Jun	17-Jun	16-Jun
	2003	14-Sep	25-Sep	11-Oct	26-Aug	13-Oct	13-Oct	17-Aug	8-Sep	13-Sep	3-Sep	18-Aug	10-Aug
	2004	4-Sep	14-Sep	23-Sep	21-Jun	7-Jul	22-Jul	31-Jul	31-Aug	12-Sep	12-Aug	5-Aug	4-Aug
	2005	18-Aug	26-Aug	3-Oct	30-Jul	16-Aug	23-Aug	25-Jun	30-Jun	4-Aug	9-Jul	6-Jul	4-Jul
	2006				1-Aug						27-Jun	20-Jun	18-Jun
2a)	2007	27-Aug			27-Aug	12-Sep		29-Aug	27-Sep			27-Sep	9-Sep
	2008	25-Sep	25-Sep	25-Sep									
	2009	29-Sep	29-Sep	29-Sep	5-Oct	5-Oct	5-Oct	17-Sep	17-Sep	17-Sep	10-Oct	10-Oct	2-Sep
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	6-Sep	6-Sep	6-Sep			
	2011	22-Aug			12-Jul	30-Jul	4-Sep	19-Jun	24-Jun	30-Jun	4-Aug	17-Jul	7-Jul
	2003							24-Jul	29-Jul			29-Jul	24-Jul
	2004				13-Jun	16-Jun	21-Jun	5-Jul	6-Jul	15-Jul			28-Jul
	2005				19-Jun	23-Jun	31-Jul	21-Jun	23-Jun	24-Jun	30-Jun	26-Jun	24-Jun
	2006				5-Jul	26-Jul					17-Jun	16-Jun	16-Jun
2b)	2007							28-Jul					
	2008												
	2009							18-Jul			29-Jul	28-Jul	16-Jul
	2010												
	2011	11-Jul			23-Jun	1-Jul	13-Jul	16-Jun	17-Jun	18-Jun	18-Jun	17-Jun	16-Jun

Table 4-16. Alternative 4 component 2 closure dates by sector and allocation scheme for each of the 4 options (1a, 1b, 2a, and 2b) for the **200,000 cap** level (options 1a and 2a) and **62,400 cap** level (options 1b and 2b)..

		CDQ Allocation			CP Allocation			M Allocation			S Allocation		
Opt	Year	1	2	3	1	2	3	1	2	3	1	2	3
	2003	11-Oct	11-Oct	11-Oct	13-Oct	13-Oct	13-Oct	19-Sep				29-Sep	16-Sep
	2004	19-Sep	12-Oct	12-Oct	19-Jul	4-Aug	23-Aug	24-Sep			7-Sep	6-Sep	21-Aug
	2005	15-Sep	3-Oct	3-Oct	22-Aug	2-Sep	6-Oct	18-Aug	20-Sep		18-Jul	16-Jul	14-Jul
	2006										1-Aug	13-Jul	1-Jul
1a)	2007												
	2008	25-Sep	25-Sep	25-Sep									
	2009	29-Sep	29-Sep	29-Sep	5-Oct	5-Oct	5-Oct	17-Sep	17-Sep	17-Sep	10-Oct	10-Oct	10-Oct
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	6-Sep	6-Sep	6-Sep			
	2011				22-Aug			11-Jul	15-Aug	15-Sep			2-Sep
	2003												
	2004				17-Jun	29-Jun	19-Jul	26-Jul					
	2005				11-Jul			24-Jun	27-Jun	10-Jul	8-Jul	5-Jul	2-Jul
	2006				29-Jul						23-Jun	19-Jun	17-Jun
1b)	2007												
	2008												
	2009												
	2010												
	2011				4-Jul	27-Jul		19-Jun	23-Jun	28-Jun	18-Jul	8-Jul	29-Jun
	2003	11-Oct	11-Oct	11-Oct	13-Oct	13-Oct	13-Oct	19-Sep				29-Sep	16-Sep
	2004	19-Sep	12-Oct	12-Oct	19-Jul	4-Aug	23-Aug	24-Sep			7-Sep	6-Sep	21-Aug
	2005	15-Sep	3-Oct	3-Oct	22-Aug	2-Sep	6-Oct	18-Aug	20-Sep		18-Jul	16-Jul	14-Jul
	2006										1-Aug	13-Jul	1-Jul
2a)	2007												
	2008	25-Sep	25-Sep	25-Sep									
	2009	29-Sep	29-Sep	29-Sep	5-Oct	5-Oct	5-Oct	17-Sep	17-Sep	17-Sep	10-Oct	10-Oct	10-Oct
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	6-Sep	6-Sep	6-Sep			
	2011				22-Aug			11-Jul	15-Aug	15-Sep			2-Sep
	2003												
	2004				17-Jun	29-Jun	19-Jul	26-Jul					
	2005				11-Jul			24-Jun	27-Jun	10-Jul	8-Jul	5-Jul	2-Jul
	2006				29-Jul						23-Jun	19-Jun	17-Jun
2b)	2007												
	2008												
	2009												
	2010												
	2011				4-Jul	27-Jul		19-Jun	23-Jun	28-Jun	18-Jul	8-Jul	29-Jun

4.2.4.1 Pollock fishery inside and outside of closure areas

Analysis of the 33 months from 2003-2010 B-season data, the trigger closure areas (at 50% level) resulted in 11 months having *worse* fishing outside of the areas (outside CPUE is 80% on average of CPUE inside) for **shore-based catcher vessels**. The other 22 months (two thirds of the data) fishing by this sector was *better* outside of the closure areas (outside closure areas was 143% better than inside). Note that this approach assumes homogeneity among vessels fishing inside and outside of closure areas since vessel effects were ignored.

For **at-sea catcher processors**, 22 months of 2003-2010 for B-season data were available for this comparison. Using the 50% trigger closure areas, only 4 of these months had *worse* fishing outside of the areas (outside CPUE is 66% on average of CPUE inside). The other 17 months (77% of the time) fishing was *better* outside of the closure areas (outside closure area was 184% better than inside).

Computing a mean distance (from a point about mid-way between Akutan and Dutch harbor (54°N 166.2°W) for all shore-based catcher-vessels can provide some insights on the potential effect of enacting the monthly closures using historical data. For example, the differences in distance due to closures indicate a 7% increase distance from "port" based on 2003-2010 data (Figure 4-6). By month, the apparent effect of closures becomes greater later in the B-season (Table 4-12). This suggests another intuitive impact on the pollock fishery (i.e., that area closures will likely result in increased fuel costs and travel times). Also, the spatial distribution of pollock is such that changes could change the age composition of the catch and have biological consequences but that these would be addressed in the stock assessment process (as with changes in the size composition of the age as noted in 4.2.4.2 below).

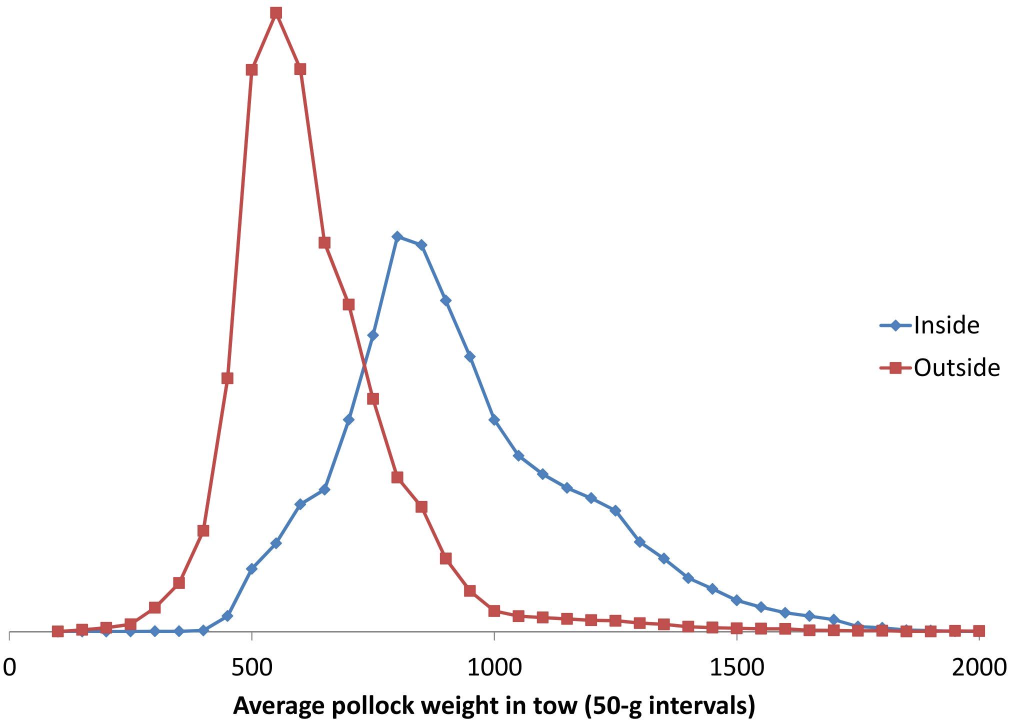
4.2.4.2 Effect of chum closures on size distribution of pollock

Under Alternatives 2 and 4, 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. NMFS at-sea observer length frequency data of pollock fishery was compiled inside of candidate chum closure areas (which vary by month based on the 50% closure scenario) and compared to length frequency outside of the areas based 1999-2010 for the months June-October (Table 4-11). The length frequency distribution for pollock found outside these areas is substantially smaller with a mean length of 45.7 cm outside compared to 49.4 cm inside area closures (Figure 4-5). The implication of this difference is that based on mean B-season fishery weights at length, inside the closure areas would require about 1,078 individual pollock to make up one ton of catch whereas outside the closure areas, 24% more pollock (or 1,334 pollock) would be required to make up one ton of pollock catch.

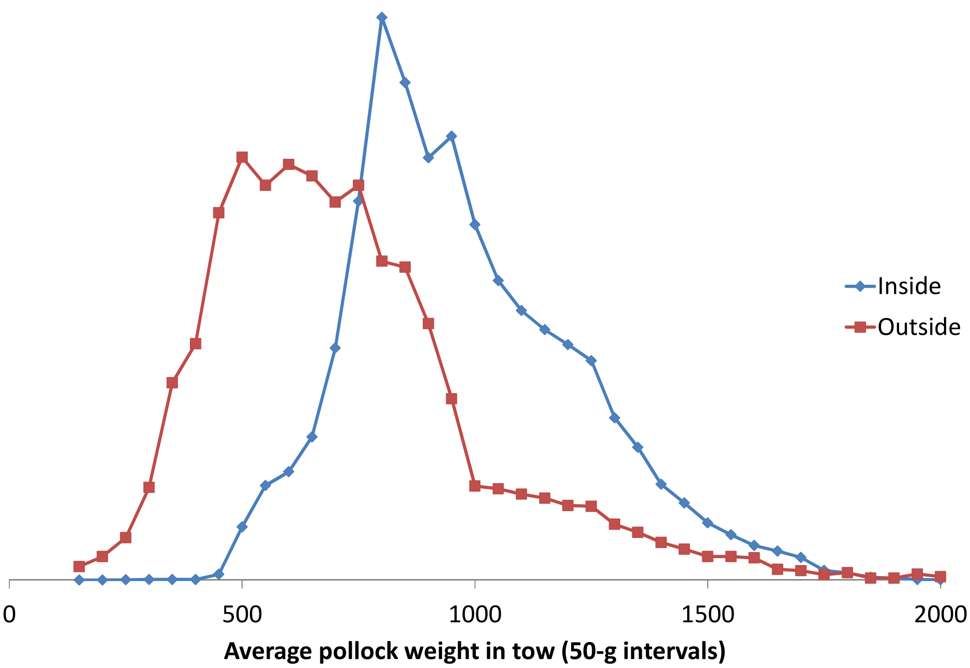
Because this fishery is extensively monitored, catch size and age information is available at fine spatial and temporal scales. These data are incorporated into the stock assessment which forms the basis for catch specification recommendations in the following year. An important part of this recommendation arises from the size composition of pollock caught each year. This affects the annually varying fishery "selectivity" which can subsequently affect the recommendation (ABC) going forward. Thus, if management measures for chum salmon result in a consistent catch of smaller fish this would shift the fishery selectivity estimates and the recommended ABC would change accordingly. Due to the nature of the ABC control rules applied for North Pacific groundfish stocks (which are based on conserving reproductive capacity) the implications of potentially catching smaller fish would not represent a potential population-level impact nor would the population sustainability be affected. Therefore, while this situation could result in minor changes in the future catches (indirectly through the stock assessment/ABC determination process), the actions would have an insignificant impact on the sustainability and viability of the pollock population.

4.2.5 Significance of Alternative 2, 3 and 4 on the pollock resource

Alternative 2 (hard cap) management measures are determined to be insignificant for fishing mortality, spatial distribution, and changes in prey availability because they all represent decreases in the amount of pollock catch. Alternatives 3 and 4 (RHS with or without additional area closures) management measures are also insignificant for fishing mortality, spatial distribution, and changes in prey availability as they represent either similar impacts as with status quo or decreases in the amount of pollock catch. For all of the alternatives, the stock is managed based on science covering a wide variety of facets including the capacity of the stock to yield sustainable biomass on a continuing basis. As noted under Alternative 1 impacts, spatial and temporal distribution changes in potential impacts are closely monitored by scientifically trained at-sea observers. Regular diet compositions and applications to multispecies ecosystem models are conducted to evaluate changes in predator-prey dynamics. As with Alternative 1 (Status quo), variability in environmental conditions likely affects stock productivity more than the timing and location of fishing activities while the impact of leaving additional pollock in the water under more restraining cap levels is not likely to contribute appreciably to the spawning stock in a measurable manner. While changes in size composition of the catch might be affected, this would be reflected within the stock assessment process and in future ABC recommendations to ensure continued pollock stock productivity. Thus regardless of any modifications in timing and location of fishing activities and/or catch levels under Alternative 2, 3 or 4 they are expected to have an insignificant effect on the productivity of the pollock stock.



a)



b)

Figure 4-5. Pollock fishery weight frequency inside of 80% chum closure area (for option 1a) for the entire fleet (top) and just the shore-based catcher boat sector (bottom) based on NMFS observer data from 2003-2011 for the months June-October.

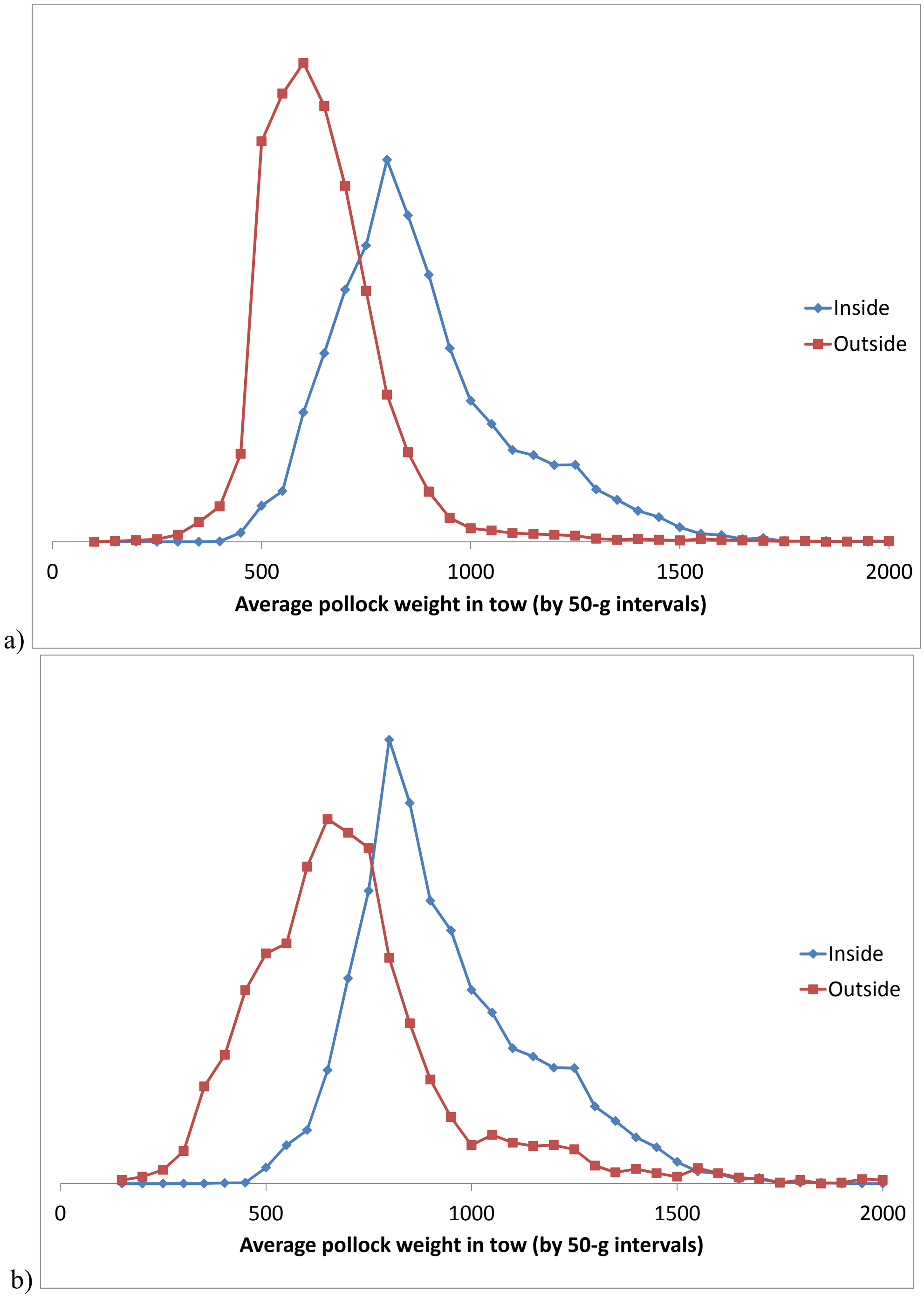


Figure 4-6. Pollock fishery weight frequency inside of 80% chum closure area (for option 1a) for the entire fleet (top) and just the shore-based catcher boat sector (bottom) based on NMFS observer data from 2003-2011 for the months June-July only.

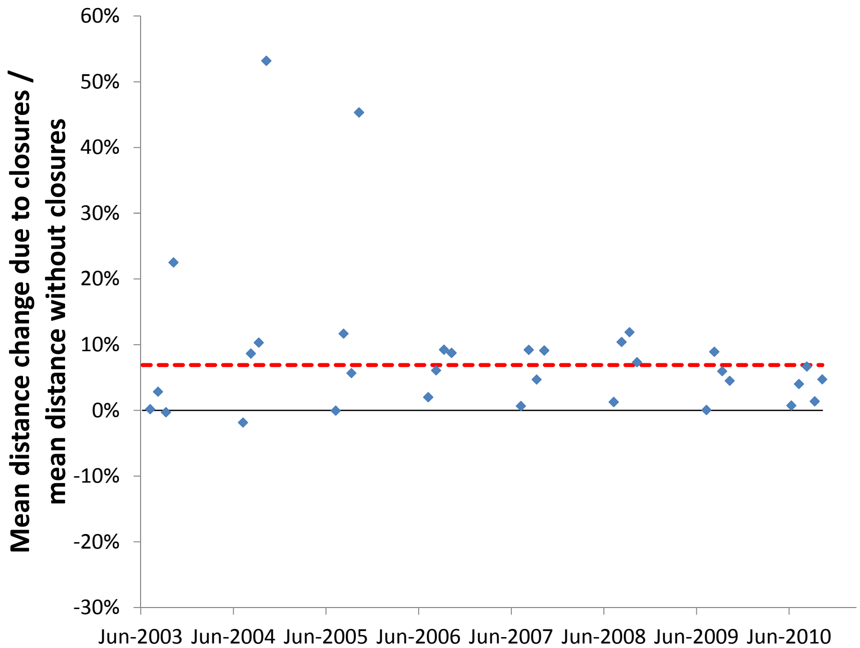


Figure 4-7. Mean distance of all shore-based catcher vessels from 54°N 166.2°W by B-season month expressed as a ratio of difference with closures divided by mean distance without closures, 2003-2010. Dashed line represents overall mean of 7% (i.e., closures result in average increased distance from port by about 7%.

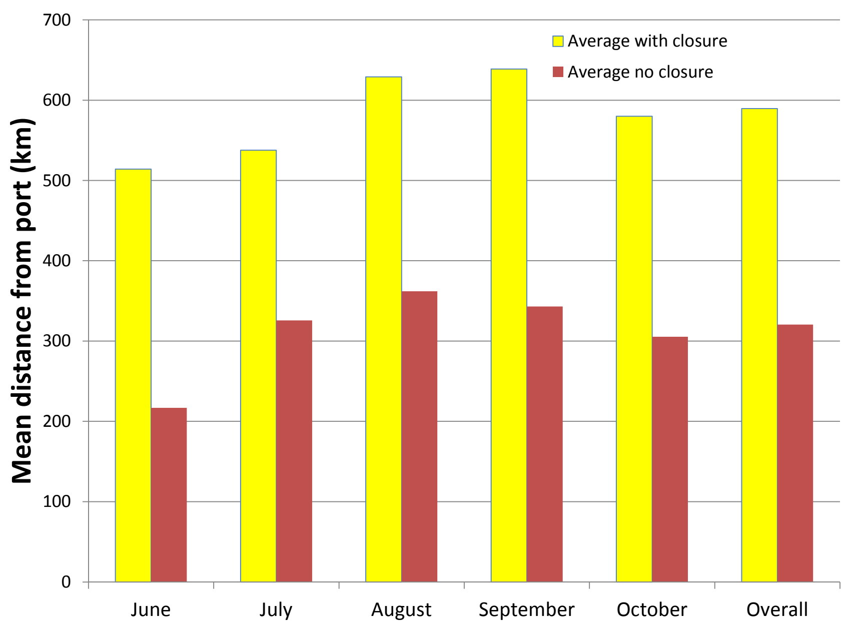


Figure 4-8. Mean distance of all shore-based catcher vessels from 54°N 166.2°W by B-season month, 2003-2011 for Alternative 3 80% large area closures XX (needs updating for 2011 data).

5 Chum Salmon

5.1 Overview of Chum salmon biology and distribution

Information on chum salmon may be found at the ADF&G website:
www.adfg.state.ak.us/pubs/notebook/fish/chum.php.

Chum salmon have the widest distribution of any of the Pacific salmon species. 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. These have the brightest color and possess the highest oil content of any chum salmon when they begin their upstream journey. Chum salmon spawning is typical of Pacific salmon with the eggs deposited in redds located primarily in upwelling spring areas of streams.

Chum salmon 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 two or more of the winters of their three to six year lives. In southeastern Alaska most chum salmon mature at four 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 salmon vary in size from four to over thirty pounds, but usually range from seven to eighteen pounds, with females generally smaller than males.

Chum salmon are the most abundant commercially harvested salmon species in arctic, northwestern, and Interior Alaska. They are known locally as 'dog salmon' and are an important year-round source of fresh and dried fish for subsistence and personal use purposes, but are of relatively less importance in other areas of the state. Sport fishermen generally capture chum salmon incidental to fishing for other Pacific salmon in either fresh or salt water. After entering fresh water, chums are most often prepared as smoked product. In the commercial fishery, most chum salmon are caught by purse seines and drift gillnets, but troll gear and set gillnets harvest a portion of the catch as well. In many areas they have been harvested incidental to the catch of pink salmon. The development of markets for ikura (roe) and fresh and frozen chum in Japan and northern Europe has increased their demand.

Because chum salmon are generally caught incidental to other species, catches may not be good indicators of abundance. In recent years chum salmon catch in many areas has been depressed by low prices. 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 appear to be cyclical or volatile; data suggests that most areas are improving following a major decline in the late 1990s and early 2000. Chum salmon in Northern Norton Sound continue to be managed as a stock of concern.

5.1.1 Food habits/ecological role

Chum salmon diet composition in summer is primarily euphausids and pteropods with some smaller amounts of amphipods, squid, fish, and gelatinous zooplankton. Chum from the shelf region contained a higher proportion of pteropods than the other regions while Aleutian Islands chum salmon contained higher proportions of euphausids and amphipods. Basin chum salmon samples had higher amounts of fish and gelatinous zooplankton. 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.

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).

Stomach sample analysis of ocean age .1 and .2 fish from basin and shelf area Chinook salmon indicated that their prey composition was more limited than chum salmon (Davis et al. 2004). This particular study did not collect many ocean age .3 or .4 Chinook, although those collected were located predominantly in the basin (Davis et al. 2004). Summer Chinook samples contained high volumes of euphausiids, squid and fish while fall stomach samples in the same area contained primarily squid and some fish (Davis et al. 2004). The composition of fish in salmon diets varied with area with prey species in the basin primarily northern lamp fish, rockfish, Atka mackerel, Pollock, sculpin and flatfish while shelf samples contained more herring, capelin, Pollock, rockfish and sablefish (Davis et al. 2004). Squid was an important prey species for ocean age .1, .2, and .3 Chinook in summer and fall (Davis et al. 2004). The proportion of fish was higher in summer than fall as was the relative proportion of euphausiids (Davis et al. 2004). The proportion of squid in Chinook stomach contents was larger during the summer in years (even numbered) when there was a scarcity of pink salmon in the basin (Davis et al. 2004).

Results from the Bering Sea shelf on diet overlap in 2002 indicated that the overlap between chum and Chinook salmon was moderate (30%), with fish constituting the largest prey category, results were similar in the basin (Davis et al. 2004). However notably on the shelf, both chum and Chinook consumed juvenile walleye pollock, with Chinook salmon consuming somewhat larger (60-190 mm SL) than those consumed by chum salmon (45-95 mm SL) (Davis et al. 2004). Other fish consumed by Chinook salmon included herring and capelin while chum salmon stomach contents also included sablefish and juvenile rockfish (Davis et al. 2004).

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

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

A paper in preparation (Farley and Murphy in prep.) describes one possible hypotehsis for high chum bycatch during the mid 2000's. Their analysis suggests that most of the immature chum salmon are distributed in the Bering Sea Basin; however, during 2004 to 2006 immature chum salmon migrated on to the southeastern Bering Sea shelf to feed on abundant age 0 walleye pollock that were distributed in surface waters during those years. They found a significant correlation with BASIS age 0 walleye pollock catch per unit effort (surface waters) and summer chum bycatch. They also found that the immature chum salmon captured on the southeaster Bering Sea shelf during the BASIS research cruises (2004 to 2006) were feeding exclusively on age 0 pollock. The authors hypothesize that more immature chum salmon migrate onto the southeastern Bering Sea shelf during years with high age 0 pollock abundance in surface waters and that the anomalously warm sea temperatures during those years appear to be associated with high abundance of age 0 pollock in surface waters (Farley and Murphy, in prep.).

5.1.2 Hatchery releases

5.1.2.1 Pacific Rim

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 2008; 2006; 2005); Canada (Cook and Irvine, 2007); USA (Josephson 2008; 2007; Eggers, 2006; 2005; Bartlett, 2008, 2007; 2006; 2005); Korea (SRT 2008, 2007, 2006, 2005). Chum salmon hatchery releases by country are shown below in Table 5-2 .

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 5-2).

Combined Asian hatchery releases in 2010 (Russia, Japan, Korea) account for 78% of the total releases while Alaskan chum releases account for 20% of the total releases. Chum enhancement projects in Alaska are not active in the AYK region.

Table 5-1 Hatchery releases of juvenile chum salmon in millions of fish.

Year	Russia	Japan	Korea	Canada	US	Total
1999	278.7	1,867.9	21.5	172.0	520.8	2,860.9
2000	326.1	1,817.4	19.0	124.1	546.5	2,833.1
2001	316.0	1,831.2	5.3	75.8	493.8	2,722.1
2002	306.8	1,851.6	10.5	155.3	507.2	2,831.4
2003	363.2	1,840.6	14.7	136.7	496.3	2,851.5
2004	363.1	1,817.0	12.9	105.2	630.2	2,928.4
2005	387.3	1,844.0	10.9	131.8	596.9	2,970.9
2006	344.3	1,858.0	7.3	107.1	578.8	2,895.5
2007	350.4	1,870.0	13.8	142.0	653.3	3,029.5
2008	508.0	1,888.0	16.6	82.0	604.0	3,098.6
2009	523.3	1,808.4	17.2	78.9	577.7	2,994.1
2010	595.7	1,851.6	20.9	64.3	645.9	3,178.4

Table 5-2 U.S. west coast hatchery releases of juvenile chum salmon in millions of fish.

Year	Alaska	Washington	Oregon	California	Idaho	Combined WA/OR/CA/ID	Total
1999	460.9	59.9	0	0	0		520.8
2000	507.7	38.8	0	0	0		546.5
2001	465.4	28.4	0	0	0		493.8
2002	450.8	56.4	0	0	0		507.2
2003	435.6	60.7	0	0	0		496.3
2004	578.5					51.7	630.2
2005	549.0					47.9	596.9
2006	541.2					37.6	578.8
2007	604.7	48.6	0	0	0	48.6	653.3
2008	567.5					36.0	603.5
2009	551.7					25.5	577
2010	609.2					36.7	645.9

A portion of hatchery fish have thermally marked otoliths (Table 5-3). In 2009 approximately 11% of the combined Asian (Japan, Korea, Russia) releases were thermally marked while for the USA, 79% were thermally marked. Of the USA hatchery released that are marked, over 99% of those are from Alaska with a very small proportion <1% from the combined states of Washington, Oregon, California and Idaho. Currently otoliths are not collected in the groundfish observer program for salmon species thus cataloguing the proportion of chum that are of hatchery origin in the bycatch is not possible at this time.

Table 5-3 Number of otolith marked chum salmon (numbers of fish) released from Pacific Rim hatcheries 2009-2010 (note 2010 data are preliminary). Source NPAFC.

Year	Russia	Japan	Korea	Canada	US	Total
2009	94,798,986	155,807,000	1,200,000	9,608,610	456,760,215	718,174,811
2010	288,120,000	152,865,000	6,500,000	8,300,000	591,077,800	1,046,862,800

5.1.2.2 Alaska

Hatchery-produced salmon are harvested in traditional common property fisheries, common property hatchery terminal area fisheries, and in private hatchery cost recovery fisheries. As enhanced fish enter terminal areas near hatchery release sites, fishery management is focused on the harvest of hatchery-produced surplus returns. In several locations terminal harvest areas (THAs) must be managed in cooperation with hatchery organizations to provide for broodstock needs and cost recovery harvests. Harvests in hatchery Special Harvest Areas (SHAs) are opened so hatchery operators can harvest returning fish to pay for operating costs and to reserve sufficient broodstock to provide for egg take goals. For some terminal locations only cost recovery harvest takes place; for some locations both common property and cost recovery harvests occur; at other locations only common property harvests occur.

Most hatchery fish harvested in terminal areas are segregated from wild stocks while common property fisheries harvest hatchery fish in mixed-stock fisheries during their migration to terminal areas. Hatchery operators are required to provide ADF&G with estimates of the total number of chum salmon harvested each year. The methods used to estimate harvests in mixed-stock fisheries vary from comprehensive thermal mark sampling to best estimates based on consultation with ADF&G management biologist and hatchery operators. Harvest estimates of wild chum salmon are based on estimates of the harvest of hatchery fish (i.e., subtracting the estimated contribution of hatchery fish to the common property fisheries from the total commercial harvest of chum salmon). More detail on local hatcheries is provided as a component in each of the regional management area sections below.

5.1.3 BASIS surveys

The Bering-Aleutian Salmon International Survey (BASIS) is an NPAFC-coordinated program of pelagic ecosystem research on salmon and forage fish in the Bering Sea. Shelf-wide surveys have been conducted beginning in 2006 on the eastern Bering Sea shelf (Helle et al 2007). A major goal of this program is to understand how changes in the ocean conditions affect the survival, growth, distribution, and migration of salmon in the Bering Sea. Research vessels from U.S. (F/V Sea Storm, F/V Northwest Explorer), Japan (R/V Kaiyo Maru, R/V Wakatake Maru), and Russia (R/V TINRO), have participated in synoptic BASIS research surveys in Bering Sea since in 2002 (NPAFC 2001).

The primary findings from the past 5 years (2002–2006) indicate that there are special variations in distribution among species: juvenile coho and Chinook salmon tend to be distributed nearshore and juvenile sockeye, chum, and pink salmon tended to be distributed further offshore. In general, juvenile salmon were largest during 2002 and 2003 and smallest during 2006, particularly in the northeast Bering Sea region. Fish, including age-0 pollock and Pacific sand lance were important components of the diets for all species of juvenile salmon in some years; however, annual comparisons of juvenile salmon diets indicated a shift in primary prey for many of the salmon species during 2006 in both the northeast and southeast Bering Sea regions. In addition, the average catch per unit effort of juvenile salmon fell sharply during 2006 in the southeast Bering Sea region. It is speculated that spring sea surface temperatures on the eastern Bering Sea shelf likely impact growth rate of juvenile western Alaska salmon through bottom-up control in the ecosystem. Cold spring SSTs lead to lower growth and marine survival rates for juvenile western Alaska salmon, while warm spring SSTs have the opposite effect (NPAFC 2001).

Figure 5-1 shows the relative abundance of juvenile salmon in the Northern Shelf Region of the Bering Sea as determined by the U.S. BASIS cruises from 2002 to 2007. The very low numbers of chum juveniles in 2004 may explain the relatively low chum salmon bycatch in the BSAI groundfish fishery in 2007. The numbers of juvenile chum salmon appear to be rebounding in 2006 and 2007 (Chris Kondzela, AFSC, personal communication).

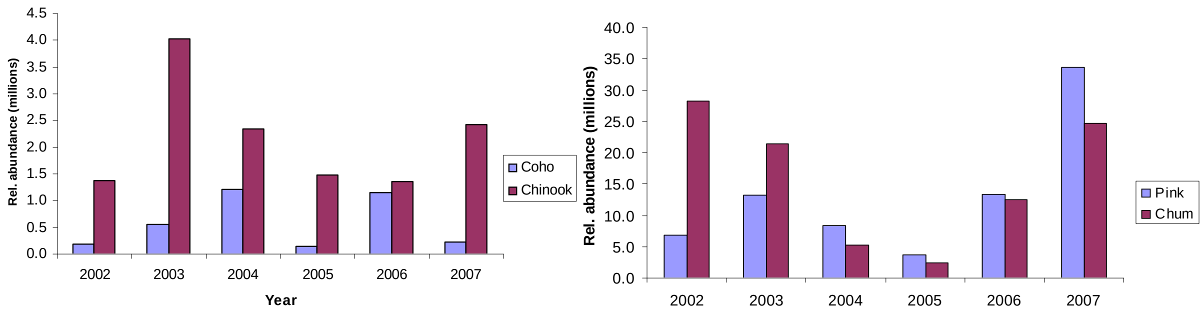


Figure 5-1 Relative abundance of juvenile salmon in the Northern Shelf Region (60°N-64°N latitude) of the U.S. BASIS survey, 2002-2007. Source: Chris Kondzela, NMFS AFSC.

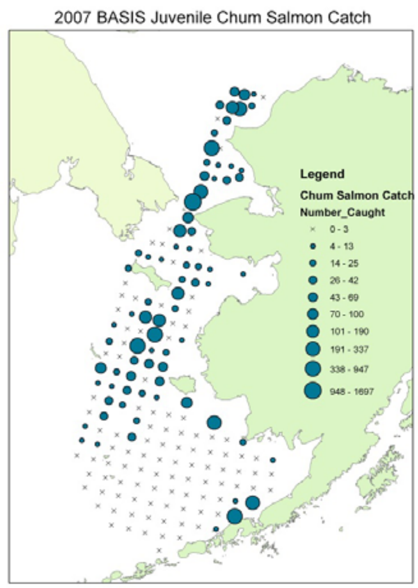


Figure 5-2 U .S. BASIS juvenile Chum salmon catches in 2007. Source: Chris Kondzela, AFSC

Stock mixtures of salmon from BASIS surveys in the Bering Sea have provided new information on oceanic migration and distribution of regional stock groups in the Bering Sea. Recent results from Japanese surveys indicate that 81% of the immature chum salmon in the Bering Sea basin were from Asian (Russia and Japan) populations during August-September in 2002. Results from U.S. surveys on the Bering Sea shelf and Aleutian chain indicate considerable spatial variation in stock mixtures; however, when pooled over location mixtures were very similar to mixtures present in the basin with 80% of the immature chum salmon from Asian populations. Immature chum salmon from western Alaska comprised 2% and 8% of immature chum salmon on the southern Bering Sea shelf and northern Bering Sea shelf, respectively. Stock mixtures of juvenile chum salmon have identified where migratory routes of western Alaska and Russian chum salmon stocks overlap and has helped identify the contribution of Russian stocks to the total biomass of juvenile chum salmon on the eastern Bering Sea shelf (JTC 2008).

During the June-July 2005 BASIS survey chum salmon was the most dominant fish species in upper epipelagic layer in the survey area (52 % from overall fish biomass estimates; NPAFC 2006). Chum salmon was a dominant Pacific salmon species in terms of its quantity (46% from overall Pacific salmon quantity). The rate of chum salmon occurrence in trawl catches was highest (92%) among all fish species (NPAFC 2006). During the survey period age 0.1 chum salmon has just started entering Bering Sea along the major pathway of Central Bering Sea Current. Age 0.2 chum salmon was distributed in the Aleutian and Commander Basins. This age group of chum salmon migrated into the Russian EEZ earlier than 0.1

along the major pathway of Central Bering Sea Current (NPAFC 2006). Near Navarin Cape and Kronotsky Capes age 0.2 chum was most proximate to the shore as compared with other areas (NPAFC 2006). Large-size (FL>53 cm) immature chum salmon was numerous in the northwestern Aleutian Basin and Navarin Shelf area (NPAFC 2006). Age 0.3 and higher was distributed almost throughout entire survey area (rate of occurrence in catches – 73%), except for inshore areas (NPAFC 2006). Maturing chum salmon individuals were noted in a high percentage of trawl catches (87 %). The overall biomass of chum salmon in the survey areas was estimated as 311.59 thousand tons (49% - immature and 51% - mature chum). Overall quantity estimates were 138.96 million individuals (57% - immature and 43% - mature chum salmon) (NPAFC 2006)

In 2007, the U.S. BASIS program sampled in the Bering Straits and the Chukchi Sea, and found water temperatures warmer than in the Bering Sea. Substantial numbers of juvenile pink and chum salmon were caught that were larger than those caught south of the Bering Straits. Juvenile chum salmon in this area and from the Chukchi Sea may also originate from the Yukon River (JTC 2008).

Genetic evaluations were recently completed on chum salmon samples from the 2006 and 2007 summer and fall BASIS cruises (McCraney et al. 2010; Figure 5-3 and Figure 5-4). Substantial differences were found in the stock composition of chum salmon between the continental slope and northern shelf environments compared with the southern continental shelf in the eastern Bering Sea, with more consistent stock composition in former and limited inter-annual variability while substantial inter-annual variability was found in the southern continental shelf region. The continental slope and northern shelf environments were dominated by Asian stocks while the southern continental shelf was dominated by North American stocks (McCraney et al. 2010).

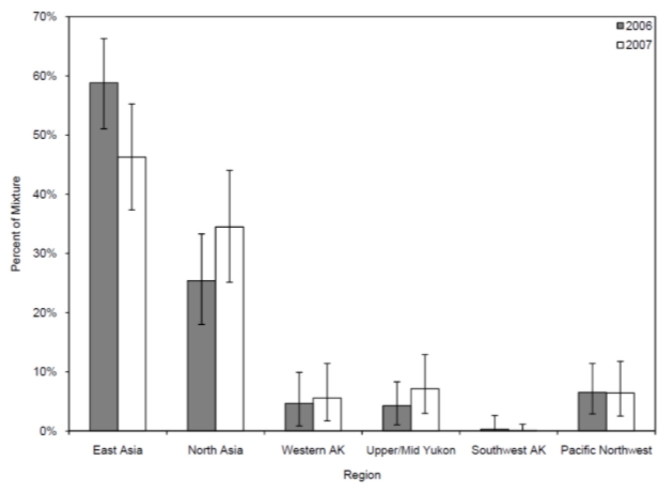


Figure 5-3 Stock composition of chum salmon in the north shelf habitat of the Bering Sea from 2006-07, as estimated by microsatellites. Error bars indicate 95% credible intervals. From McCraney et al. 2010.

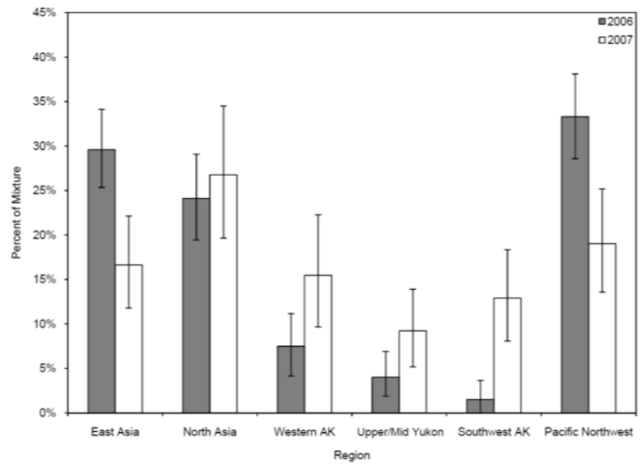


Figure 5-4 Stock composition of chum salmon in the south shelf habitat of the Bering Sea from 2006-07, as estimated by microsatellites. Error bars indicate 95% credible intervals. from McCraney et al. 2010.

The BASIS program is now moving into BASIS Phase II, building upon the work undergone in BASIS Phase I. Some of the main findings of Phase I included research indicating that the observed (2002-2006) shift in increased salmon returns to western Alaska was related to increased carrying capacity for juvenile salmon in the eastern and western Bering Sea (Farley and Moss in review; Farley and Trudel in review; Gritsenko et al. in review). Despite the increase in oceanic salmon abundance, salmon carrying capacity in offshore regions of the Bering Sea also appeared to be sufficient for the growth of immature salmon (Azumaya et al. 2008).

BASIS phase II is intended to be a 5-year (2009-2013) program of field, laboratory and computer modeling research combined with previous field efforts for better tracking of longer-lived salmon species (sockeye, chum and Chinook) through a complete Bering Sea production cycle (NPAFC 2009). This will ideally enable a clearer understanding of salmon carrying capacity in the Bering Sea (NPAFC 2009).

5.1.4 Migration corridors

BASIS surveys have established that the distribution and migration pathways of western Alaska juvenile salmon vary by species. Farley et al. (2006; Figure 5-5) 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.

Previous reports have studied seasonal migration patterns of Asian and North American chum salmon in the Bering Sea (Fredin et al. 1977). These show distinct differences in the Bering Sea based upon immature and maturing fish in migratory patterns between North American and Asian origin stocks (Figure 5-6), however data used to estimate these migration trends are dated (1950-1960s; Myers et al. 2006).

Migration routes of chum salmon from Japanese hatcheries were estimated based on genetic stock identification over several years (Figure 5-7). Urawa (2000, 2003) estimated that chum salmon from Japanese hatcheries begin to migrate into the Bering Sea in their second summer/fall, migrating south and east late in the fall to the Gulf of Alaska to spend their second winter. In subsequent years they migrate between feeding grounds in the Bering Sea and Gulf of Alaska in summer and fall prior to returning as maturing fish to Japan via the western Bering Sea (Urawa 2000; 2003).

High seas tagging experiments from 1954-2006 provide insights on the distribution, biology and ecology of immature and maturing AYK origin chum salmon migrating in the North Pacific Ocean and Bering Sea (Myers et al. 2009). In particular, their compilation shows that immature AYK chum salmon were primarily in the GOA with distribution shifting from spring to summer to west or northwest (Figure 5-8; Myers et al. 2009). They suggest that maturing AYK chum are distributed in the Northeast Pacific (GOA and south) in April and shift westward into the GOA by May and then the Bering Sea beginning in June (Myers et al. 2009). By July they indicate that maturing Yukon summer chum have already returned to coastal areas and spawning streams while Yukon Fall chum at that time were distributed across a broad front in the western GOA, Aleutians, and eastern and western Bering Sea (Myers et al. 2009).

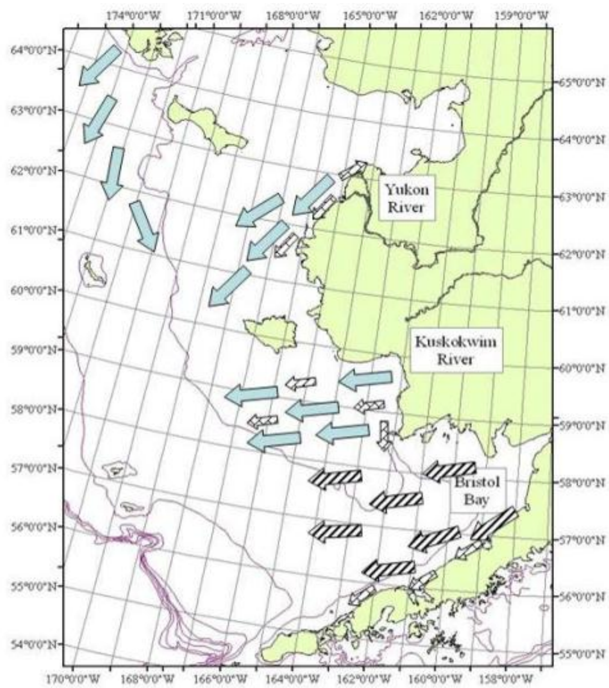


Figure 5-5. Seaward migration pathways for juvenile chum (solid arrow), sockeye (slashed line arrow), coho, and Chinook (boxed line arrow) salmon along the eastern Bering Sea shelf, August through October. Source: Farley et al 2007.

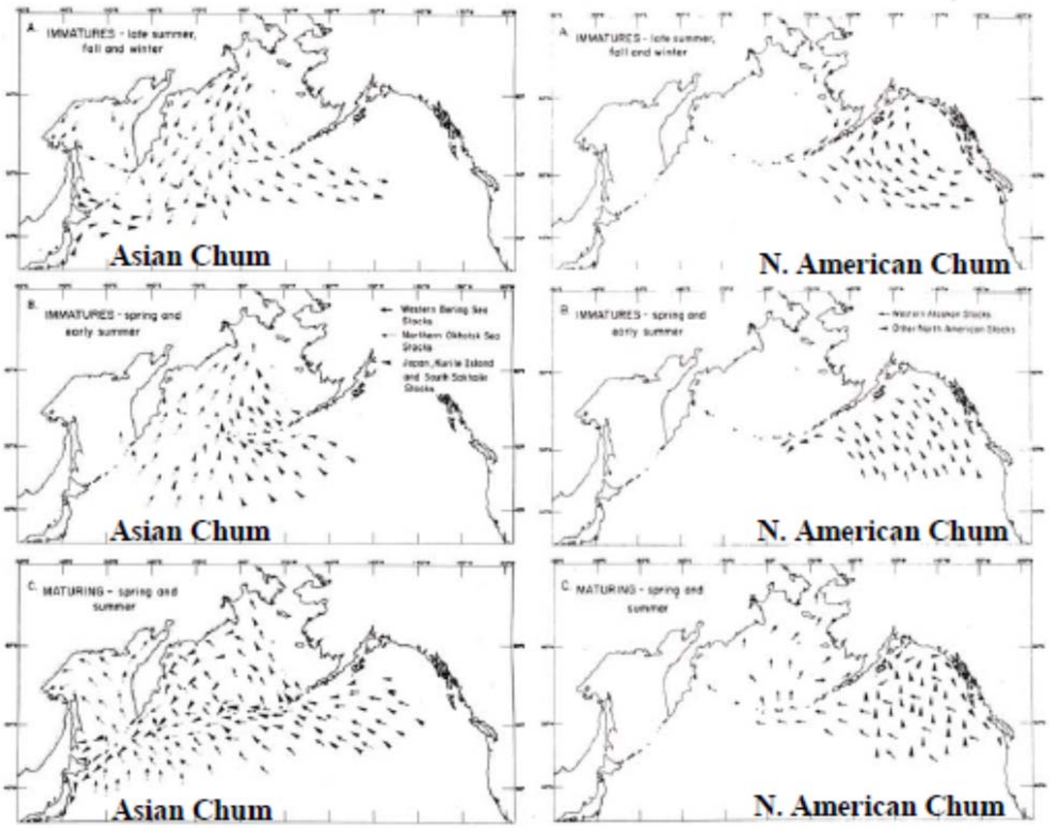


Figure 5-6. Models of seasonal ocean migration patterns of Asian and North American chum salmon. Arrows indicate direction of movement of immatures in later summer, fall and winter (top panels), immatures in spring and early summer (center panels), and maturing fish in spring and summer (bottom panels). Source: Fredin et al 1977.

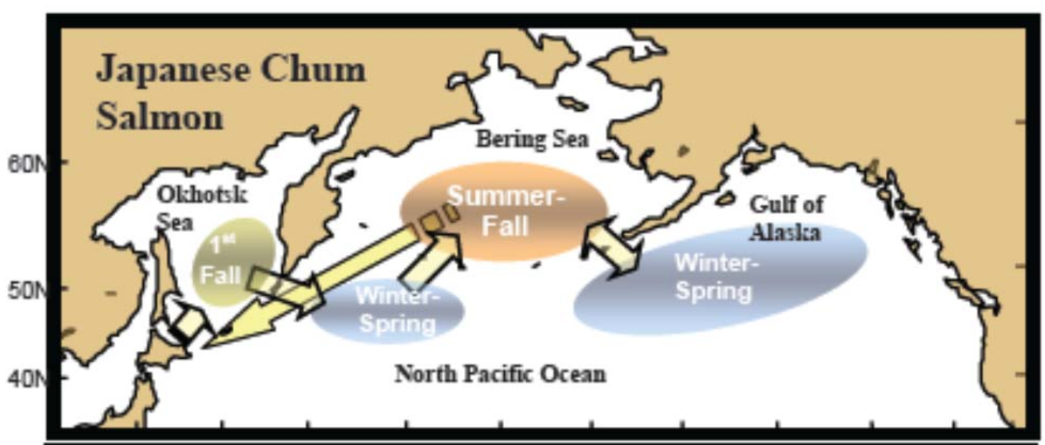


Figure 5-7. Model for Japanese hatchery chum salmon as estimated by genetic stock identification (Urawa 2000; 2003).

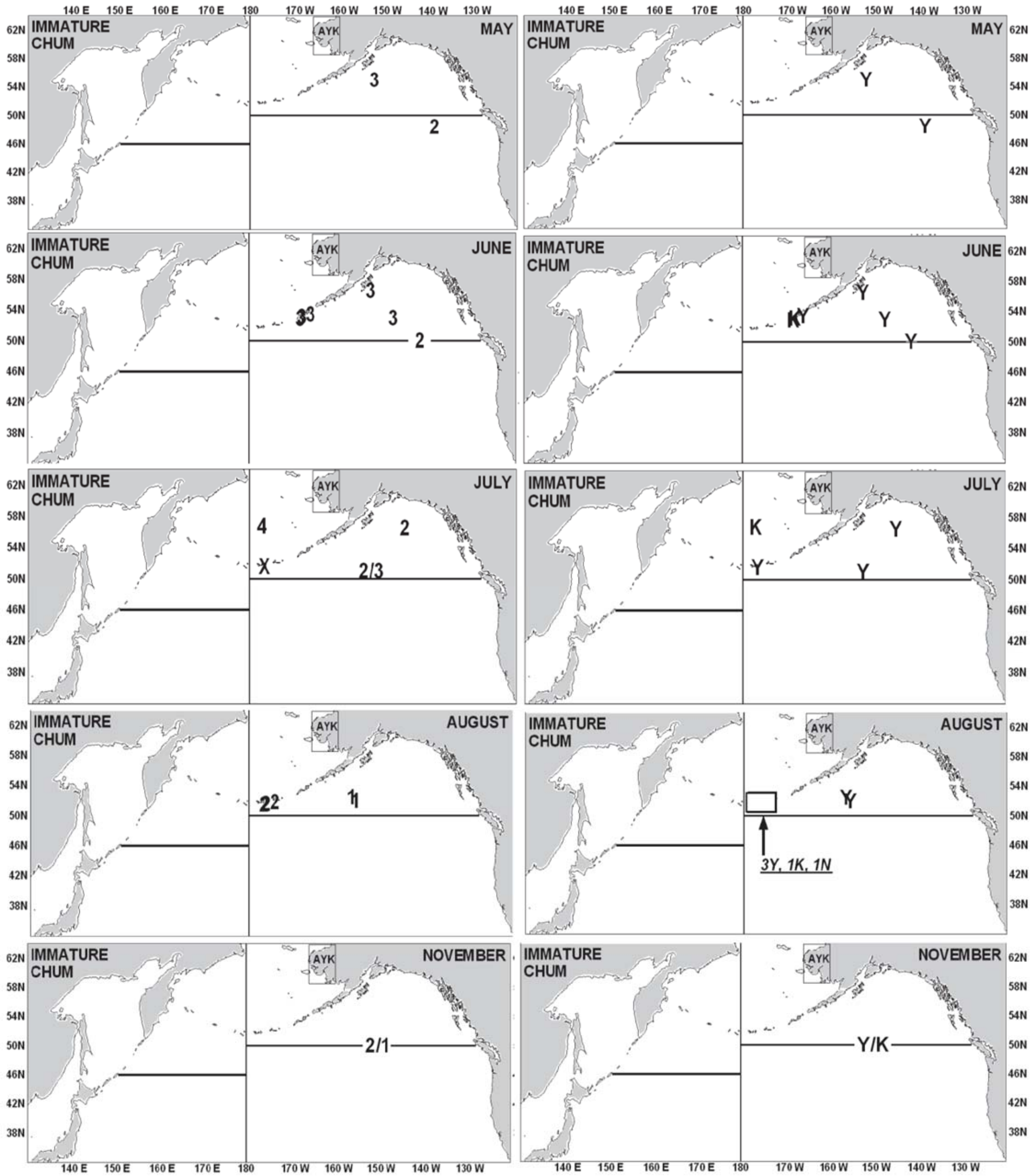


Figure 5-8. The known ocean distribution of immature Norton Sound (N), Yukon (Y), and Kuskokwim (K) chum salmon by month, ocean age-group (left panels), and stock (right panels), as indicated by high seas tag experiments 1954–2006. Numbers in left panels are ocean age at release; X = ocean age unknown; forward slash between two numbers indicates recoveries from two age groups released at or near the same ocean location. In August (right panel), labeled arrow (underline, italics) pointing at multiple recoveries (inside box) shows number of recoveries per stock. Number of recoveries by month of release: May = 2 fsh, June = 6, July = 5, August = 7, November = 2. Reported dates of recovery of adult fsh in the AYK region ranged from June 16 to September 24. From Myers et al. (2009).

5.1.1 Carrying capacity and run size overview for North Pacific

Hatchery releases of chum salmon are listed in Section 5.1.2. Chum salmon hatchery releases are the largest of all Pacific salmon species (Eggers 2009). Hatchery stocks of chum and pink salmon have been estimated to comprise 38% of the recent biomass of all salmon species in the North Pacific (Eggers 2010). Because of this, considerable research has focused on the carrying capacity of the North Pacific for salmon species and the impact of increased hatchery stocks on the growth and survival of wild salmon stocks (e.g., Kaeriyama et al. 2009).

Estimates of abundance trends vary but the most abundant salmon species caught in the North Pacific is pink salmon, followed by sockeye and chum salmon. One estimate of the relative abundance (1952-2005) indicated that pink salmon comprise on average 70% of the total abundance of the three while sockeye comprise 17% and chum 13% (Ruggerone et al. 2010). Catches have steadily increased in coastal Japan, Russia and central and southeast Alaska while catches in western Alaska have been decreasing in general after reaching a high in the mid-1990s (Kaeriyama et al. 2009). In British Columbia and the western United States (WA, OR, and CA) catches have been decreasing since the mid-1980s (Eggers 2004).

Ruggerone et al. estimated wild and hatchery salmon abundance across the Pacific Rim from 1990-2005. For chum salmon, wild abundance was highest in mainland Russia (32% of North Pacific total) followed by Kamchatka, western Alaska, Southeast Alaska, central Alaska and southern BC in roughly equal proportions (ranging from 10-16% of North Pacific total; Figure 5-9; Ruggerone et al. 2009).

Pacific-wide, hatchery releases of chum salmon have exceeded wild production since the mid-1980s (Figure 5-10; Ruggerone et al. 2009). Their study notes that Japan produced more than 83% of hatchery chum. Within Alaska, wild salmon runs north of southeast Alaska declined over this time period, especially in Prince William Sound where hatchery-origin chum now represent approximately 73% of total chum salmon abundance (Ruggerone et al. 2009). They raise the question whether large scale hatchery releases have influenced the growth and survival of wild chum salmon similar to arguments on the impact of pink salmon hatcheries in Prince William Sound (Hilborn and Eggers 2000, 2001; Werthheimer et al. 2001, 2004a, 2004b).

Wild chum salmon stocks across the North Pacific have had dramatic declines including those from Japan, South Korea, the Amur River (Russia and China), western Alaska, the Columbia River, and the summer-run chum salmon in Hood Canal, WA (Ruggerone et al 2009). This raises many questions about the potential density-dependence and possibility for chum salmon (and salmon species in general) competing in the North Pacific for a limited "common pool" of food resources in international waters (Ruggerone et al 2009). Current efforts are underway to estimate the overall carrying capacity of the North Pacific and to estimate the dependence of chum and other salmon species on prey and prey abundance and prey variability due to climate changes.

Kaeriyama et al (2009) estimated the run size and carrying capacity of Pacific salmon species in relation to long-term climate change and interactions between wild and hatchery salmon. Their work builds upon previous investigations by Kaeriyama and Edpalina (2004). They indicate that the combined catch of sockeye, chum and pink salmon comprise over 90% of the total catch of Pacific salmon, and that temporal changes has a 30 or 40 year periodicity corresponding to long-term climate change indications such as the Pacific Decal Oscillation (PDO) and regime shifts (Kaeriyama et al. 2009). Productions trends were similar for both North American and Asian populations. While catch and run sizes for Pacific Rim populations of chum salmon in general have been increasing since the 1970s, wild chum salmon populations have been decreasing, while hatchery chum salmon have increased substantively in Japan and southeast Alaska, comprising more than 80% of catch and 40% of run size (Kaeriyama et al. 2009). Estimated hatchery releases from 1990-2005 have apparently comprised 62% of chum salmon total abundance (wild and hatchery for pink, chum, and sockeye which combined comprise about 93% of oceanic salmon abundance; Ruggerone et al 2010).

Previous studies on Japanese chum salmon have shown that increases in run size may lead to a reduction in body size and an increase in average age at maturity that suggest a population density-dependent effect (Kaeriyama 1998). Sockeye salmon have also shown indications of density-dependent growth where greater marine growth contributed to higher survival rates and higher abundances (Ruggerone et al. 2007). Density-dependent growth from resulting from increases in hatchery salmon may affect wild chum populations (Kaeriyama et al. 2009). Significant correlations were observed between the estimated carrying capacity of three salmon species (sockeye, chum and pink) and the Aleutian Low Pressure Index (ALPI) indicating that these population trends may be synchronized with long-term trends in climate change (Kaeriyama et al. 2009). It has been suggested that carrying capacities for salmon have shifted downwards since the 1998/99 regime shift (Kaeriyama et al. 2009).

More recently a spatially explicit bioenergetics model was used to predict juvenile chum salmon growth rate potential (GRP) in the eastern Bering Sea during years of cold and warm sea surface temperatures (SST) as a means to understand the link between juvenile chum salmon prey demand and supply. Cold spring SSTs were generally correlated with higher juvenile growth rates and lower annual average GRP (Farley and Moss 2009). This may be related to cold spring temperature effects on the productivity of prey (Hunt and Stabeno 2002). Juvenile chum salmon were larger during years with SSTs in the northern region but not in the southern region (Farley and Moss 2009). Stock specific results for Kuskokwim and Yukon fall abundance in relation to SST suggest the possibility of increased size-selected predation on juvenile Kuskokwim chum salmon in cold years (Farley and Moss, 2009). This is hypothesized to be less of a factor on Yukon River chum salmon (Farley and Moss 2009).

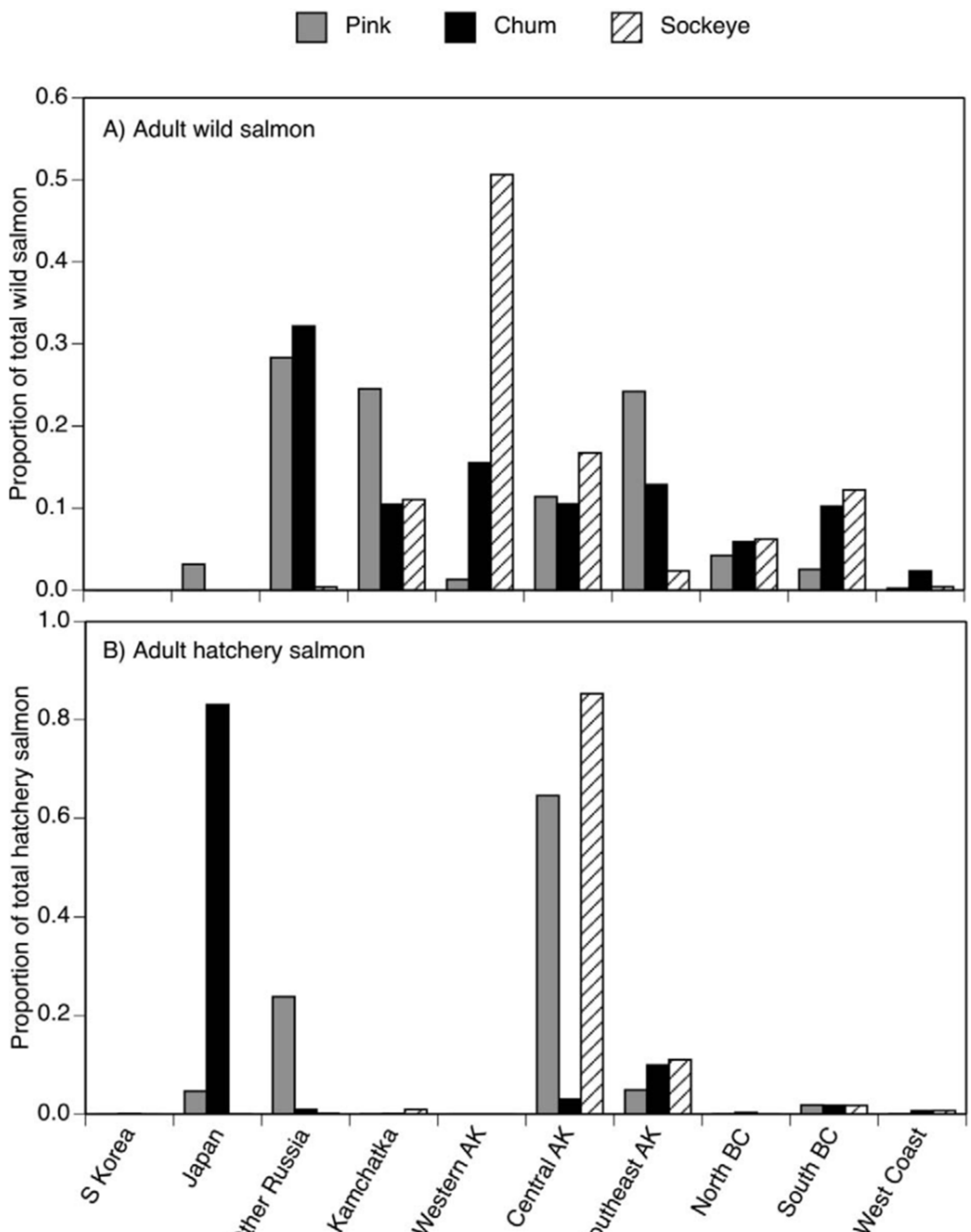


Figure 5-9. Relative contribution from each region to Pacific Rim production of adult (A) and hatchery (B) salmon during 1990-2005 (from Ruggerone et al. 2010).

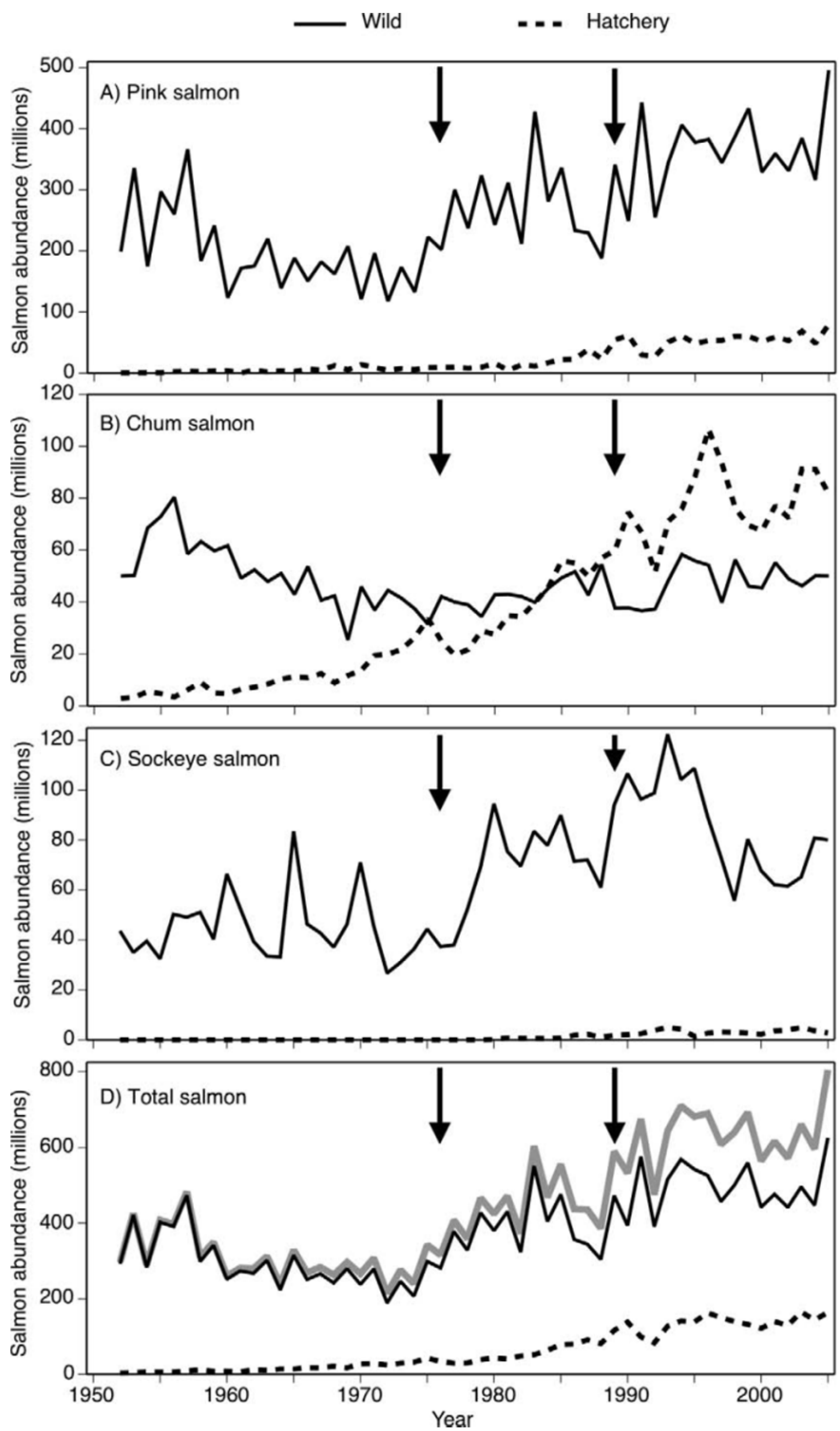


Figure 5-10. Annual adult abundance (catch plus number of spawners) of wild (solid lines) and hatchery (dashed lines) (A) pink salmon, (B) chum salmon and (c) sockeye salmon and (D) totals across species from 1952 to 2005 (from Ruggerone et al 2009).

5.2 Management of chum salmon stocks in Alaska

The Alaska State Constitution, Article VII, Section 4, states that "Fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial users." In 2000, the Alaska Board of Fisheries (board) adopted the Sustainable Salmon Fisheries Policy (SSFP) for Alaska, codified in 5 AAC 39.222. The SSFP defines sustained yield to mean an average annual yield that results from a level of salmon escapement that can be maintained on a continuing basis; a wide range of average annual yield levels is sustainable and a wide range of annual escapement levels can produce sustained yields (5 AAC 39.222(f)(38)).

The SSFP contains five fundamental principles for sustainable salmon management, each with criteria that are used by ADF&G and the board to evaluate the health of the state's salmon fisheries and address any conservation issues and problems as they arise. These principles are (5 AAC 39.222(c)(1-5):

- Wild salmon populations and their habitats must be protected to maintain resource productivity;
- Fisheries shall be managed to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning;
- Effective salmon management systems should be established and applied to regulate human activities that affect salmon;
- Public support and involvement for sustained use and protection of salmon resources must be maintained;
- In the face of uncertainty, salmon stocks, fisheries, artificial propagation, and essential habitats must be managed conservatively.

This policy requires that ADF&G describe the extent salmon fisheries and their habitats conform to explicit principles and criteria. In response to these reports the board must review fishery management plans or create new ones. If a salmon stock concern is identified in the course of review, the management plan will contain measures, including needed research, habitat improvements, or new regulations, to address the concern.

A healthy salmon stock is defined as a stock of salmon that has annual runs typically of a size to meet escapement goals and a potential harvestable surplus to support optimum or maximum yield. In contrast, a depleted salmon stock means a salmon stock for which there is a conservation concern. Further, a stock of concern is defined as a stock of salmon for which there is a yield, management, or conservation concern (5 AAC 39.222(f)(16)(7)(35)). Yield concerns arise from a chronic inability to maintain expected yields or harvestable surpluses above escapement needs. Management concerns are precipitated by a chronic failure to maintain escapements within the bounds, or above the lower bound of an established goal. A conservation concern may arise from a failure to maintain escapements above a sustained escapement threshold (defined below).

Escapement is defined as the annual estimated size of the spawning salmon stock. Quality of the escapement may be determined not only by numbers of spawners, but also by factors such as sex ratio, age composition, temporal entry into the system, and spatial distribution within salmon spawning habitat ((5 AAC 39.222(f)(10)). Scientifically defensible salmon escapement goals are a central tenet of fisheries management in Alaska. It is the responsibility of ADF&G to document, establish, and review escapement goals, prepare scientific analyses in support of goals, notify the public when goals are established or modified, and notify the board of allocative implications associated with escapement goals.

The key definitions contained in the SSFP with regard to scientifically defensible escapement goals and resulting management actions are: biological escapement goal, optimal escapement goal, sustainable escapement goal, and sustained escapement threshold. Biological escapement goal (BEG) means the escapement that provides the greatest potential for maximum sustained yield. BEG will be the primary management objective for the escapement unless an optimal escapement or inriver run goal has been adopted. BEG will be developed from the best available biological information and should be scientifically defensible on the basis of available biological information. BEG will be determined by ADF&G and will be expressed as a range based on factors such as salmon stock productivity and data uncertainty (5 AAC 39.222(f)(3)).

Sustainable escapement goal (SEG) means a level of escapement, indicated by an index or an escapement estimate, which is known to provide for sustained yield over a five to ten year period. An SEG is used in situations where a BEG cannot be estimated or managed for. The SEG is the primary management objective for the escapement, unless an optimal escapement or inriver run goal has been adopted by the board. The SEG will be developed from the best available biological information and should be scientifically defensible on the basis of that information. The SEG will be stated as a range (SEG Range) or a lower bound (Lower Bound SEG) that takes into account data uncertainty. The SEG will be determined by ADF&G and the department will seek to maintain escapements within the bounds of the SEG Range or above the level of a lower Bound SEG (5 AAC 39.222(f)(36)).

Sustained escapement threshold 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 also lower than the lower bound of the SEG. The SET is established by ADF&G in consultation with the board for salmon stocks of management or conservation concern (5 AAC 39.222(f)(39)).

Optimal escapement goal (OEG) means a specific management objective for salmon escapement that considers biological and allocative factors and may differ from the SEG or BEG. An OEG will be sustainable and may be expressed as a range with the lower bound above the level of SET (5 AAC 39.222(f)(25)).

The Policy for Statewide Salmon Escapement Goals is codified in 5 AAC 39.223. In this policy, the board recognizes ADF&G’s responsibility to document existing salmon escapement goals; to establish BEGs, SEGs, and SETs; to prepare scientific analyses with supporting data for new escapement goals or to modify existing ones; and to notify the public of its actions. The Policy for Statewide Salmon Escapement Goals further requires that BEGs be established for salmon stocks for which the department can reliably enumerate escapement levels, as well as total annual returns. Biological escapement goals, therefore, require accurate knowledge of catch and escapement by age class. Given such measures taken by ADF&G, the board will take regulatory actions as may be necessary to address allocation issues arising from new or modified escapement goals and determine the appropriateness of establishing an OEG. In conjunction with the SSFP, this policy recognizes that the establishment of salmon escapement goals is the responsibility of both the board and ADF&G.

The State of Alaska manages subsistence, sport/recreational (used interchangeably), commercial, and personal use harvest on lands and waters throughout Alaska. The Alaska Department of Fish and Game (ADF&G) is responsible for managing subsistence, commercial, sport, and personal use salmon fisheries. The first priority for management is to meet spawning escapement goals in order to sustain salmon resources for future generations. The highest priority use is for subsistence under both state and federal law. Salmon surplus above escapement needs and subsistence uses are made available for other uses. The Alaska Board of Fisheries (BOF) adopts regulations through a public process to conserve and allocate fisheries resources to various user groups. Subsistence fisheries management includes coordination with the Federal Subsistence Board and Office of Subsistence Management, which also manages subsistence uses by rural residents on federal lands and applicable waters under Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA). Yukon River salmon fisheries management includes obligations under an international treaty with Canada. Salmon fisheries management in southeast Alaska also includes international obligations under the Pacific Salmon Treaty.

5.2.1 State subsistence management

ADF&G, under the direction of the Alaska BOF, manages subsistence, personal use, sport, and commercial chum salmon harvests in waters within the State of Alaska out to the three mile limit. ADF&G also manages commercial and sport fisheries for salmon in the EEZ, in accordance with the Pacific Salmon Treaty and other Federal law, where management is either delegated to the State through the FMP or fisheries are not included in the FMP. The State has 82 local fish and game advisory committees that review, make recommendations, submit proposals, and testify to the Alaska BOF concerning subsistence and other uses in their areas.

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 byproducts 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[33]).

Under Alaska's subsistence statute, the BOF must identify fish stocks that support subsistence fisheries and, if there is a harvestable surplus of these stocks, determine the amount of the harvestable surplus that is reasonably necessary for subsistence uses, and adopt regulations that provide reasonable opportunities for these subsistence uses to take place. The Alaska BOF is required by the state subsistence statute to provide reasonable opportunities for subsistence uses; "reasonable opportunity" is defined in statute to mean an opportunity that allows a subsistence user to participate in a subsistence fishery that provides a normally diligent participant with a reasonable expectation of success of taking of fish (AS 16.05.258(f)). The BOF evaluates whether reasonable opportunities are provided by existing or proposed regulations by reviewing harvest estimates relative to the "amount reasonably necessary for subsistence use" (ANS) findings as well as subsistence fishing schedules, gear restrictions, and other management actions. Whenever it is necessary to restrict harvest, subsistence fisheries have a preference over other consumptive uses of the stock (AS 16.05.258). ADF&G, Division of Commercial Fisheries, manages subsistence fisheries in the area of potential effect. Subsistence and other uses may be restricted or closed to provide for sustainability based upon relevant adopted fishery management plans.

Alaska subsistence fishery regulations do not, in general, permit the sale of resources taken in a subsistence fishery. State law recognizes 'customary trade' as a legal subsistence use. 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 15.05.940(8)). This is applicable in certain regions of Alaska, including the customary trade in finfish (including salmon) within the Norton Sound-Port Clarence Area (5 AAC 01.188). Presently, the BOF has not received regulatory change proposals to allow customary trade in salmon resources under state subsistence regulations in other areas under consideration in this document.

ADF&G, Division of Commercial Fisheries, prepares annual fishery management reports (FMRs) for most fishery management areas in the state (Figure 5-11). Although FMRs focus primarily on commercial fisheries, most also routinely summarize basic data for programs that collect harvest information for subsistence fisheries. Detailed annual reports about subsistence fisheries harvest assessment programs are prepared for the Norton Sound/Kotzebue, Yukon River, and Kuskokwim areas; however, it is important to recognize the limitations associated with the effort to present a comprehensive annual report on Alaska's subsistence fisheries. Because of such limitations, harvest data may be a conservative estimate of the number of salmon being taken for subsistence uses in Alaska. These limitations include:

- Annual harvest assessment programs do not take place for all subsistence fisheries although programs are in place for most salmon fisheries such as the Yukon and Kuskokwim river drainages through post-season household surveys and for the Bristol Bay Area through subsistence salmon permits. There is no longer an annual subsistence harvest monitoring program for the Kotzebue Fisheries Management Area. Similarly, since 2004 annual harvest monitoring in the Norton Sound-Port Clarence Area has been limited to post-season household surveys in Shaktoolik and Unalakleet and through catch and gear information obtained from subsistence fishing permits in other parts of Norton Sound-Port Clarence Area.
- Annual subsistence harvest data are largely dominated by fish harvested under efficient gear types authorized by regulation, which, especially for salmon, generally means fish taken with gillnets, beach seines, or fish wheels. However, in portions of the Kotzebue Fisheries Management Area (5 AAC 01.120(b) &(f)), Norton Sound-Port Clarence Area (5 AAC 01.170(b) & (h)), and Yukon-Northern Area (5 AAC 01.220(a) & (k)), as well as the entire Kuskokwim Fisheries Management Area (5 AAC 01.270(a)), hook and line attached to a rod or pole (i.e. rod and reel) are recognized as legal subsistence gear under state subsistence fishing regulations. In these areas, significant numbers of households take salmon for subsistence uses with rod and reel or retain salmon from commercial harvests for home use. Where the BOF has recognized rod and reel gear as legal subsistence gear, annual harvest assessment programs or subsistence fishing permits also document salmon harvested with rod and reel. Federal subsistence management represents different subsistence gear regulations in some cases. For example, in Kotzebue Sound federally qualified users are authorized under federal subsistence regulations to harvest salmon by gillnet, beach seine, or rod and reel, but these harvests are not documented through either a state or federal harvest monitoring program and the numbers of salmon (largely chum salmon) harvested by gillnet or beach seine compared to rod and reel has not been documented since 2004.
- Annual harvest assessment programs are generally limited to post-season household surveys in communities located within a fisheries management area or through subsistence permits. Harvests by other Alaskans are not reflected in the annual harvest assessment programs that do not require permits, for example: in the Kotzebue Area, Kuskokwim river drainage or areas where permits are not required along the Yukon River drainage.
- Between management areas, and sometimes between districts within management areas, there are inconsistencies in the methods for collecting, analyzing, and reporting subsistence harvest data.
- In some areas there are no routine mechanisms for evaluating the quality of subsistence harvest data. For example, in some areas it is not known if all subsistence fishermen are obtaining permits and providing accurate harvest reports. This can result in an underestimation of harvests.
- There are few programs for contextualizing annual subsistence harvest data to interpret changes in harvests. However, in some cases, FMRs do contain discussions of data limitations and harvest trends.

For more information on state management of salmon subsistence fisheries, refer to the ADF&G website at www.adfg.alaska.gov/index.cfm?adfg=fishingSubsistence.main and the Alaska Subsistence Salmon Fisheries annual reports for 2008 (Fall et al. 2011) and 2009 (Fall et al. 2012).

5.2.2 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 opportunity for customary and traditional subsistence uses, among consumptive uses of fish and wildlife, on federal lands (16 U.S.C. 3114). In 1986, Alaska amended its subsistence law mandating a rural subsistence priority to bring it into compliance with ANILCA. However, in 1989, in the *McDowell* decision, the Alaska Supreme Court ruled that the priority in the state's subsistence law could not be exclusively based on location of residence under provisions of the Alaska Constitution. Other federal court cases regarding the state's administration of Title VIII of ANILCA ruled that the state would not be given deference in interpreting federal statute. Proposed amendments to ANILCA and the Alaska constitution were not adopted to rectify these conflicts, so the Secretaries of Interior and Agriculture implemented a parallel regulatory program to assure the rural subsistence priority is applied under ANILCA on federal lands. As a result, beginning in 1990, the state and federal governments both provide subsistence uses on federal public lands and waters in Alaska, which is about 230 million acres or 60% of the land within the state. In 1992, the secretaries of the Interior and Agriculture established the Federal Subsistence Board (FSB) and ten Regional Advisory Councils (RACs) to administer the responsibility. The FSB'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; and two additional public members representing rural subsistence users. See the figure below for the subsistence fisheries areas in Alaska.

Through the FSB, these agencies participate in development of regulations which establish the program structure, determine which Alaska residents are eligible to take specific species for subsistence uses, and establish seasons, harvest limits, and methods and means for subsistence take of species in specific federal areas. The RACs provide recommendations and information to the FSB; review proposed regulations, policies, and management plans; and provide a public forum for subsistence issues. Each RAC consists of residents representing subsistence, sport, and commercial fishing and hunting interests.

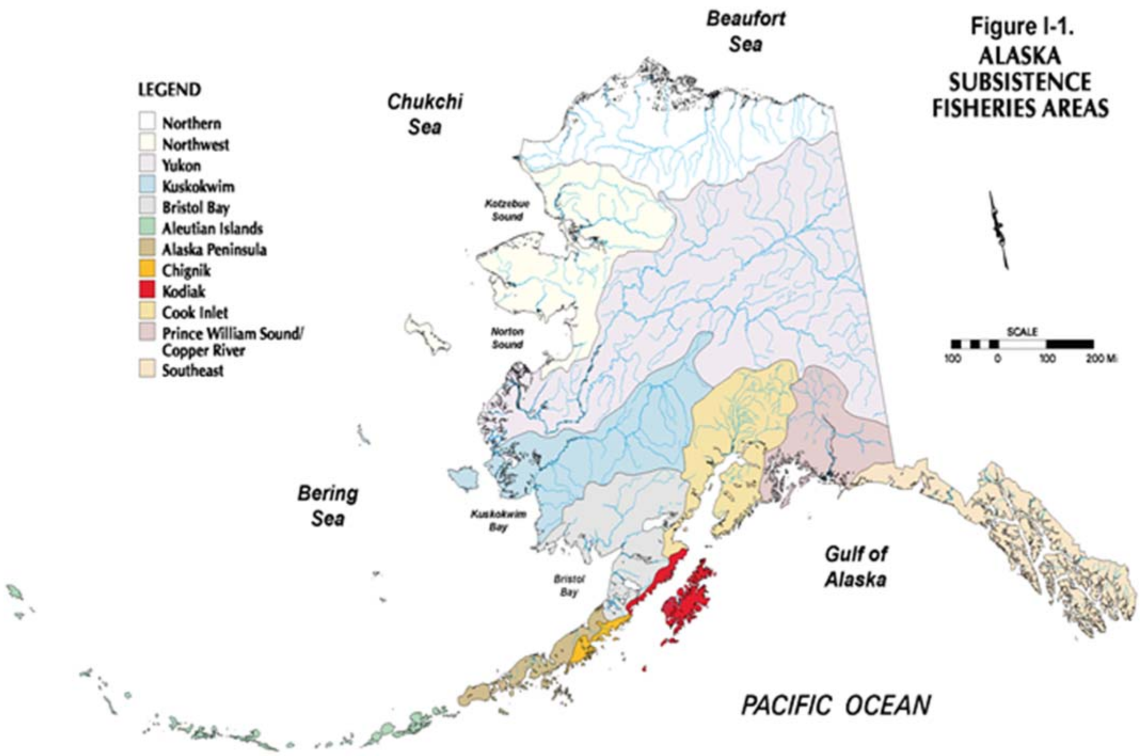


Figure 5-11 Alaska Subsistence Fisheries Areas.

While ANILCA creates a priority for subsistence uses over the taking of fish and wildlife for other purposes on public lands, it also imposes obligations on federal agencies with respect to decisions affecting the use of public lands, including a requirement that they analyze the effects of those decisions on subsistence uses and needs (16 U.S.C. 3120).

ANILCA defines "public lands" as lands situated "in Alaska" which, after December 2, 1980, are federal lands, except those lands selected by or granted to the State of Alaska, lands selected by an Alaska Native Corporation under the Alaska Native Claims Settlement Act (ANCSA), and lands referred to in section 19(b) of ANCSA (16 U.S.C. 3102(3)). The U.S. Supreme Court has ruled that ANILCA's use of "in Alaska" refers to the boundaries of the State of Alaska and concluded that ANILCA does not apply to the outer continental shelf (OCS) region (*Amoco Prod. Co. v. Village of Gambell*, 480 U.S. 531, 546-47 (1987)). The area for chum salmon PSC management is in the Bering Sea EEZ, which is in the OCS region.

Although ANILCA does not directly apply to the OCS region, NMFS aims to protect such uses pursuant to other laws, such as NEPA and the Magnuson-Stevens Act. The RIR evaluates the consequences of the proposed actions on subsistence uses. One of the reasons NMFS and the Council have proposed implementing salmon PSC reduction measures in the federal groundfish fisheries is to protect the interests of salmon subsistence users.

5.2.3 State management of personal use and sport salmon fisheries

The State of Alaska 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, longline, or other means defined by the BOF (AS 16.05.940(25)). Personal use fisheries are different from subsistence fisheries because they either do not meet the criteria established by the Joint Board of Fisheries and Game (Joint Board) for identifying customary and traditional fisheries (5 AAC 99.010) or because they occur within nonsubsistence areas.

The Joint Board is required to identify ‘nonsubsistence areas’, where ‘dependence upon subsistence is not a principal characteristic of the economy, culture, and way of life of the area or community’ (AS 16.05.258(c)). The BOF may not authorize subsistence fisheries in nonsubsistence areas. Personal use fisheries provide opportunities for harvesting fish with gear other than rod and reel in nonsubsistence areas. The Joint Board has identified Ketchikan, Juneau, Anchorage-Matsu-Kenai, Fairbanks, and Valdez as nonsubsistence areas (5 AAC 99.015). Persons may participate in personal use or recreational harvests for subsistence purposes within nonsubsistence use areas, but subsistence use does not have a preference in those areas.

Generally, fish may be taken for personal use purposes only under authority of a permit issued by ADF&G. Personal use fishing is primarily managed by ADF&G, Division of Sport Fish, but some regional or area fisheries for various species of fish are managed by the Division of Commercial Fisheries. For more information on state management of personal use fisheries, refer to the ADF&G website: www.adfg.alaska.gov/index.cfm?adfg=fishingPersonalUse.main.

The ADF&G Division of Sport Fish also manages the state’s recreational fisheries. Alaska statute defines sport fishing as the taking of or attempting to take for personal use, and not for sale or barter, any fresh water, marine, or anadromous fish by hook and line held in the hand, or by hook and line with the line attached to a pole or rod which is held in the hand or closely attended, or by other means defined by the BOF (AS 16.05.940(30)). By law, the division’s mission is to protect and improve the state’s recreational fisheries resources. For more information on state management of recreational fisheries, refer to the ADF&G website: http://www.adfg.alaska.gov/index.cfm?adfg=fishingSport.main.

Per Alaska statute (5 AAC 75.075(c)), the ADF&G, Division of Sport Fish is also responsible for overseeing the annual licensing of sport fish businesses and guides. A ‘sport fishing guide’ means a person who is licensed to provide sport fishing guide services to persons who are engaged in sport fishing (AS 16.40.299). ‘Sport fishing guide services’ means assistance, for compensation or with the intent to receive compensation, to a sport fisherman to take or to attempt to take fish by accompanying or physically directing the sport fisherman in sport fishing activities during any part of a sport fishing trip. Salmon is one of the primary species targeted in the states’ recreational fisheries. For further information, refer to the ADF&G website: http:///www.adfg.alaska.gov/index.cfm?adfg=prolicenses.sportfishguides. This site contains information important to the State of Alaska, Department of Fish and Game requirements for sport fish charter businesses, sport fish guides, and saltwater charter vessels.

5.2.4 State commercial salmon fishery management

Commercial fishing is defined by the State of Alaska as the taking of fish with the intent of disposing of them for profit, or by sale, barter, trade, or in commercial channels (AS 16.05.940 (5)). Commercial fisheries in Alaska fall under a mix of state and federal management jurisdictions. In general, the state has management authority for all salmon, herring, and shellfish fisheries, and for groundfish fisheries within three nautical miles of shore. Under the Magnuson-Stevens Act, the federal government has management authority for the majority of groundfish fisheries three to two hundred nautical miles offshore.

The state manages a large number of commercial salmon fisheries in waters from Southeast Alaska to Kotzebue Sound. Management of the commercial salmon fisheries is the responsibility of the ADF&G Division of Commercial Fisheries, under the direction of the BOF. The fisheries are managed under a limited entry system; participants must hold a limited entry permit for a fishery to fish and the number of permits for each fishery is limited. The state originally issued permits to persons with histories of participation in the various salmon fisheries. Permits can be bought and sold. Thus, since the original limitation program was implemented, new persons have entered into the commercial fishery by buying permits on the open market.

Alaska's commercial salmon fisheries are administered through the use of management areas throughout the state. The value of the commercial salmon harvest varies with the size of the runs, market conditions, and with foreign currency exchange rates. Because of the magnitude of commercial fisheries for salmon, state biologists collect extensive information and statistics to support management decisions. For information on commercial regulations refer to:
www.adfg.alaska.gov/index.cfm?adfg=CommercialByFisherySalmon.main.

5.3 Statewide summary for major Alaska stocks

Western Alaska includes the Alaska Peninsula, Bristol Bay, Kuskokwim, Yukon, Norton Sound, and Kotzebue Sound management areas. The Nushagak, Kuskokwim, Yukon, Unalakleet, and Kobuk rivers, along with Kuskokwim Bay and Norton Sound stocks, comprise the chum salmon index stocks for this region. Most Western Alaska chum salmon stocks declined sharply in the late 1990s through the early 2000s, rebuilt rapidly with record and near record runs in the mid 2000s, and abundance has been variable since 2007.

Chum salmon stocks in areas outside of western Alaska include those found in the Aleutian Islands, Kodiak, Chignik, Upper Cook Inlet, Lower Cook Inlet, Prince William Sound, and Southeast Alaska. Escapement goals are generally comprised of stock-aggregate goals from several individual index streams. There is no escapement goal or chum salmon escapement surveys in the Aleutian Islands area.

Table 5-4 provides a summary of stock status for chum salmon stocks across Alaska in 2011. Average to above average run sizes were seen in Kuskokwim, Yukon, Kotzebue rivers as well as in the GOA, Kodiak, Chignik and Cook Inlet rivers. In Norton Sound, the eastern and northern Norton Sound chum stocks saw above average run sizes in 2011, however Northern Norton Sound remains a Stock of Yield concern. Subsistence and commercial fisheries occurred in all river systems, however the summer chum run Yukon commercial fishery was limited by low returns of Chinook salmon. Sport fisheries were allowed on all chum stocks except chum salmon in the Nome subdistrict of Northern Norton Sound. Escapement goals were met in most river systems.

Table 5-4 Statewide summary of chum salmon stock status 2011.

Chum salmon stock	Total run size?	Escapement goals met?[1]	Subsistence fishery?	Commercial fishery?	Sport fishery?	Stock of concern?
Bristol Bay	Below average	1 of 1	Yes	Yes	Yes	No
Kuskokwim Bay	Average	1 of 1	Yes	Yes	Yes	No
Kuskokwim River	Above Average	2 of 2	Yes	Yes	Yes	No
Yukon River summer run	Above Average	2 of 2	Yes	Yes, but limited by low Chinook	Yes	No
Yukon River fall run	Above average	7 of 8	Yes	Yes	Yes	No
Eastern Norton Sound	Above average	1 of 1	Yes	Yes	Yes	No
Northern Norton Sound	Above average	7 of 7	Yes	Yes	Yes, except for Nome Subdistrict	Yield concern (since 2007)
Kotzebue	Above average	No surveys in 2011	Yes	Yes	Yes	No
North Peninsula	Below average	1 of 2	Yes	Yes	Yes	No
South Peninsula	Average	4 of 4	Yes	Yes	Yes	No
Aleutian Islands	n/a	n/a	Yes	Yes	Yes	No
Kodiak	Average	2 of 2	Yes	Yes	Yes	No
Chignik	Average	1 of 1	Yes	Yes	Yes	No
Upper Cook Inlet	Above average	1 of 1	Yes	Yes	Yes	No
Lower Cook Inlet	Average	9 of 12	Yes	Yes	Yes	No
Prince William Sound	Below Average	5 of 5	Yes	Yes	Yes	No
Southeast	Below average	7 of 8	Yes	Yes	Yes	No

[1] Some aerial survey-based escapement goals were not assessed due to inclement weather or poor survey conditions.

Table 5-5 show comparative information on chum stock status in 2010. In 2010, all stocks exhibited average to above average abundance except for the South Alaska Peninsula stocks and Yukon River fall chum salmon, which were below average. Subsistence restrictions were implemented on the Yukon River fall chum run and six of eight escapement goals were achieved. Two of the four escapement goals in the South Alaska Peninsula were not achieved and the area was closed to commercial fishing from August 4 through September 14 due to low escapements of both pink and chum salmon. Norton Sound 2010 chum salmon runs were some of the strongest on record. More southerly stocks in Kuskokwim Bay and Nushagak River showed above average runs from 2008–2010 and the most northerly stocks in Noatak and Kobuk rivers were also above average.

Commercial fisheries occurred in most areas of western Alaska in 2010. North Alaska Peninsula, Norton Sound, and Kuskokwim Bay had some of the largest chum salmon commercial harvests on record. Two Yukon River (summer run) and Kuskokwim River chum salmon harvests were more modest owing to potential for incidental harvest of weak Chinook salmon stocks and limited processing capacity in the Kuskokwim River. Generally, these were the largest commercial harvests since 1998 for most of western Alaska, and in Norton Sound, since 1986. Commercial fisheries targeting Yukon River fall chum salmon were limited to a late season terminal fishery in the Tanana River, as some restrictions were placed on subsistence fisheries and the sport fishery was closed.

In 2010, average escapement was achieved in Chignik, Prince William Sound, and Lower Cook Inlet areas. Below average escapement occurred in Kodiak and Southeast Alaska. There is only one chum salmon escapement goal in Upper Cook Inlet and the upper range of that goal was exceeded in 2010. Although spawning escapement goals were met in most of the Lower Cook Inlet streams, escapement into McNeil River failed to reach the lower goal for the sixteenth time in the past 21 years despite the continued ban on targeted commercial fishing.

Commercial fisheries occurred in all areas with above average harvests for chum salmon in Chignik, Upper Cook Inlet, Lower Cook Inlet, and Prince William Sound areas. Kodiak chum salmon harvests were below the most recent 10-year average.

Additional information on western Alaska stocks by region is contained in Appendix 6. This appendix contains detailed historical information on escapement, assessment methodology, stock of concern designations, in-river management and harvests (subsistence, commercial, sport and personal use) for Bristol Bay (A6.1.1), Kuskokwim Area (A6.1.2), Yukon River (A6.1.3) Norton Sound (A6.1.4), Kotzebue (A6.1.5), Port Clarence (A6.1.6), Alaska Peninsula/Area M(A6.1.7) and Aleutian Islands and Atka-Amlia Management area (A6.1.8). These stocks are included for detailed information as they are those represented by the two genetics groupings in this analysis of Coastal west Alaska and Alaska Peninsula.

Table 5-5 Over view of Alaskan chum salmon stock performance, 2010

Chum salmon stock	Total run size?	Escapement goals met?[1]	Subsistence fishery?	Commercial fishery?	Sport fishery?	Stock of concern?
Bristol Bay	Above average	1 of 1	Yes	Yes	Yes	No
Kuskokwim Bay	Above average	2 of 2	Yes	Yes	Yes	No
Kuskokwim River	Average	2 of 2	Yes	Yes	Yes	Yield concern discontinued 2007
Yukon River summer run	Average	2 of 2	Yes	Yes, but limited by low Chinook	Yes	Management concern discontinued 2007
Yukon River fall run	Below average	6 of 8	Restrictions	Limited season (Tanana River)	No	Yield concern discontinued 2007
Eastern Norton Sound	Above average	1 of 1	Yes	Yes	Yes	No
Northern Norton Sound	Above average	7 of 7	Yes	Yes	Yes, except for Nome Subdistrict	Yield concern (since 2000)
Kotzebue	Above average	6 of 6	Yes	Yes	Yes	No
North Peninsula	Average	2 of 2	Yes	Yes	Yes	No
South Peninsula	Below average	2 of 4	Yes	Yes	Yes	No
Aleutian Islands	n/a	n/a	Yes	Yes	Yes	No
Kodiak	Below average	2 of 2	Yes	Yes	Yes	No
Chignik	Average	1 of 1	Yes	Yes	Yes	No
Upper Cook Inlet	Above average	1 of 1	Yes	Yes	Yes	No
Lower Cook Inlet	Average	9 of 12	Yes	Yes	Yes	No
Prince William Sound	Average	5 of 5	Yes	Yes	Yes	No
Southeast	Below average	6 of 8	Yes	Yes	Yes	No

[1] Some aerial survey-based escapement goals were not assessed due to inclement weather or poor survey conditions.

5.4 Utilization of Alaska chum salmon

5.4.1 Importance of subsistence harvests

ADF&G, Division of Subsistence, estimates that approximately 38.3 million pounds of wild foods are harvested annually by residents of rural Alaska, representing on average 316 usable pounds per person. Communities throughout the various regions of rural Alaska rely upon various resources, based upon resource availability and customary and traditional resource use patterns (Wolfe 2004; Wolfe and Fall 2012). For example, Wolfe and Fall (2012) documented 92% to 100% of the rural households in Arctic, Interior, Western, and Southwestern Alaska use fish, while only 75% to 86% of households actually harvest fish, which testifies to the importance of sharing within subsistence-based economies. Similarly, based upon an analysis of comprehensive data on wild resource harvests from the 1980s 1990s, and 2000s, ADF&G found that on average, fish (mostly salmon) represent 55% of the total subsistence harvests by rural residents, followed by land mammals (22%), marine mammals (13%), wild plants (4%), birds (3%), and shellfish (93%).

Annual per capita subsistence harvest rates range from 436 pounds of wild foods per person in Arctic communities to 370 pounds per person in rural Interior Alaska communities, to 490 pounds per person among Yukon-Kuskokwim Delta communities. Average per capita harvests in Bristol Bay/Aleutians area is estimated at 212 pounds per person (Wolfe and Fall 2012).

The BOF has made ANS findings for salmon throughout the areas under discussion here (Table 5-6). These findings provide a perspective on the importance of salmon harvests to subsistence economies of rural Alaska. given that they were based upon historical harvest patterns within each fisheries management area (Figure 5-11).

The number of summer chum salmon harvested for subsistence from the Yukon River has fallen below the lower limit of the ANS five times between the years 1998 and 2010. Similarly, fall chum salmon harvests have fallen below the lower limit of the ANS ten times between 1998 and 2010. Yukon River coho salmon harvests have fallen below the lower limit of the ANS seven times between the years 1998 and 2010. Chinook salmon harvests from the Yukon River drainage have fallen below the lower limit of the ANS five times between the years 1998 and 2010 (refer to Appendix 6.1.3 for further discussion). Some of the reasons for not meeting an ANS threshold in a given year may include poor salmon abundance for that year, or a decline in commercial chum salmon harvest opportunity in an effort to preserve Chinook salmon numbers (personal communication, C. Brown, 2010). In years of poor salmon abundance, restrictions or closures to the subsistence fishery to achieve adequate escapements reduced harvest success and likely resulted in the lower bound of ANS ranges not being achieved. However, it should be noted that in some years when ANS was not achieved, total summer chum, fall chum, and coho salmon runs were adequate to provide for subsistence harvests and no additional restrictions were in place on the subsistence fishery, suggesting that in those years, factors other than salmon abundance or management were largely responsible for low subsistence harvests.

Table 5-6 Alaska Board of Fisheries Findings pertaining to non-Chinook salmon amounts reasonably necessary for subsistence findings

Fisheries Management Area	Year of ANS Finding	Chum Salmon	Summer Chum Salmon	Fall Chum Salmon	Sockeye Salmon	Coho Salmon	Salmon
Kotzebue	1993	-	-	-	-	-	43,500
Norton Sound-Port Clarence	1998	-	-	-	-	-	96,000-160,000
Nome Subdistrict	1999	3,430-5,716	-	-	-	-	-
Yukon River	2001	-	83,500-142,192	89,500-167,900	-	20,500-51,980	-
Kuskokwim River	2001	39,500-75,500	-	-	27,500-39,500	24,500-35,000	-
Remainder of Kuskokwim Area	2001	-	-	-	-	-	7,500-13,500
Bristol Bay	2001[28]	-	-	-	55,000-65,000[29]	-	157,000-172,171
Alaska Peninsula	1998	-	-	-	-	-	34,000-56,000

Generally, the total population and rural population in the fishery management areas discussed in this document have increased since 1980. Table 5-7 shows the populations reported for four U.S. Census periods (1980 – 2010) for each of the management areas at issue. Overall, the 2010 population of all the communities is about 61% higher than that reported in 1980. Note that the Yukon Area includes the city of Fairbanks, the second largest city in Alaska, as well as the Fairbanks Northstar Borough and portions of the Southeast Fairbanks Census Area and Denali Borough within the Fairbanks Nonsubsistence Area. The population of the Fairbanks Nonsubsistence Area represents 58% (1980) to 64% (2010) of the total population of all of the communities combined in each census year reported. The population of this nonsubsistence area grew 76% from 1980 to 2010. The population of the communities outside the Fairbanks Nonsubsistence Area, but within the five management areas under discussion, grew 28% from 1980 to 2010.

The recorded populations increased in each fishery management area with each new census, with one exception; the population of the combined communities in the Bristol Bay area decreased by about 5% from 2000 to 2010. The rate of increase, however, slowed, from a 33% increase from 1980 to 1990, to an 9% increase from 1990 to 2000 and an 11% increase from 2000 to 2010. For those communities outside the nonsubsistence area, the population grew about 22% from 1980 to 1990 and 13% from 1990 to 2000, but just over 1% from 2000 to 2010.

[28] The current ANS finding for Bristol Bay dates to 2001, with the embedded Kvichak sockeye ANS. The finding for all salmon for the entire area dates to 1993.
[29] The ANS finding for Bristol Bay sockeye salmon represents a nested ANS finding for the Kvichak river drainage, from the overall Bristol Bay area finding of 157,000-172,171 salmon (5 AAC 01.336(b)(1)).

Table 5-7 Population trends by fishery management area, 1980 – 2010

ADF&G Management Area	Number of Communities, 2010[a]	Population and percent of change between census years			
		2010	2000	1990	1980
Alaska Peninsula Area	6	2,216	2,103	1,994	1,566
% change		5.4%	5.5%	27.3%	
Arctic Area	29	17,015	16,404	14,401	11,368
% change		3.7%	13.9%	26.7%	
Bristol Bay	25	7,011	7,423	6,454	5,103
% change		-5.6%	15.0%	26.5%	
Kuskokwim Area	39	17,505	16,601	14,342	11,526
% change		5.4%	15.8%	24.4%	
Yukon Area	89	118,991	103,891	97,216	71,670
% change		14.5%	6.9%	35.6%	
Nonsubsistence areas	25	103,378	87,809	82,655	58,754
% change		17.7%	6.2%	40.7%	
Outside nonsubsistence areas	64	15,613	16,082	14,561	12,916
% change		-2.9%	10.4%	12.7%	
All Areas	188	162,738	146,422	134,407	101,233
% change		11.1%	8.9%	32.8%	
All areas outside nonsubsistence areas	163	59,360	58,613	51,752	42,479
% change		1.3%	13.3%	21.8%	

[a] Number of communities = number of census designated places and incorporated cities as listed by the U.S. Census Bureau in 2010 regardless of population size.
Sources: State of Alaska, Community Information Summaries, Alaska Dept of Commerce, Community and Economic Development, Division of Community and Regional Affairs; U.S. Census population data as summarized by the Alaska Dept of Labor and Workforce Development.

Note that different population trends occur within the communities of the regions reported. For example, the Yukon River drainage encompasses over 850,000 km^2 with dozens of tributaries and approximately 89 rural and urban communities (Loring and Gerlach, 2010). While the overall rural population has grown in the Yukon River drainage, downriver and upriver areas have displayed different population trends. Most recent growth has occurred in villages of the lower river (a five-fold increase from 1950 to 2008), while community populations of the middle and upper river have shown no growth after about 1980 (Wolfe, 2009). Refer to Appendix 6.1.3 for a map detailing the lower, middle, and upper sections of the Yukon River.

Despite the trend of decreasing harvests of salmon from the Yukon River drainage during the recent decade, ADF&G, Division of Subsistence, estimates for the time period 2000 - 2010 that 51% of the total subsistence harvests by rural Interior Alaska communities was salmon, followed by 32% land mammals, 13% other fish, 1% birds and eggs, and 2% wild plants. During this same time period, ADF&G estimates that rural Interior Alaska communities harvested on average 370 usable pounds of wild foods per person annually, which is lower than the estimate of 613 pounds per person derived from research conducted in the 1980s and 1990s (personal communication, James Fall, 2012).

In discussing the importance of subsistence salmon harvests to Alaska Native populations in rural communities, it is important to note that different Alaska Native groups live in different regions, and consequently most of the existing research and literature on salmon subsistence uses by Alaska Natives and communities is presented on a regional basis. The sections below address subsistence uses of salmon by the affected regions and the Alaska Native groups that live in those areas. For example, information about subsistence uses in the Norton Sound area and the Arctic pertains to Iñupiaq communities; information for the middle and upper Yukon pertains to Athabascan communities; and information for the Alaska Peninsula area pertains to Aleut communities (it is recognized that non-Alaska Native residents in these areas also participate in subsistence uses of salmon). The following information provides a general overview of the geographic scope and distribution of the Alaska Native groups that have established subsistence uses of salmon in the areas under discussion in the RIR. Further information can be found at: http://www.alaskanative.net/.

The Athabascan people traditionally live in Interior Alaska, an expansive geographic range that begins south of the Brooks Mountain Range and continues down to the Kenai Peninsula (Figure 5-12). Athabascans inhabit areas along five major river systems in this region: the Yukon, the Tanana, the Susitna, the Kuskokwim, and the Copper River drainages. There are eleven linguistic groups of Athabascans in Alaska.

Traditional Athabascans migrated seasonally, traveling in small groups to fish, hunt and trap. The Athabascans historically lived in small groups of 20 to 40 people that moved systematically through the resource territories. Annual summer fish camps for the entire family and winter villages served as base camps. In traditional and contemporary practices, Athabascans are taught respect for all living things. The most important part of Athabascan subsistence living is sharing. Hunters are part of a kin-based network in which they are expected to follow traditional customs for sharing in the community.

Figure 5-12 Traditional territory of the Alaska Athabascan people.

The southwest Alaska Natives are named after two main dialects of the Yupik language, known as Central Yup'ik and Cup'ik. Contemporary Yup’ik and Cup’ik people depend upon subsistence fishing, hunting and gathering for food.

Many of the villages within the area were ancient sites used as seasonal camps for subsistence resources. Historically, the Yup’ik and Cup’ik people were very mobile and organized their lives according to the animals and plants that they hunt and gather, often traveling with the migration of game, fish, and plants. The ancient settlements and seasonal camps contained small populations, with numerous settlements throughout the region consisting of extended families or small groups of families (Figure 5-13).

Figure 5-13 Traditional territory of the Central Yup'ik and Cup'ik people.

The Iñupiaq and the St. Lawrence Island Yupik people continue to operate as traditional hunting and gathering societies. They subsist on the land and sea of north and northwest Alaska (Figure 5-14). Their lives continue to revolve around the whale, walrus, seal, polar bear, caribou and fish. Traditional subsistence patterns depend upon the location and season of these resources:

- Whales and sea mammals are hunted in the coastal and island villages.
- Pink salmon and chum salmon, as well as cod, inconnu (sheefish) and whitefish are fished; herring, crab, and halibut are also caught.
- Birds and eggs form a continuous and important part of the diet.

Figure 5-14 Traditional territory of the Alaska Iñupiaq and St. Lawrence Island Yupik people.

The Unangax and Alutiiq (Sugpiaq) peoples are from south and southwest Alaska, obtaining most of their food and livelihood from the sea. Historically, villages were located at the mouths of streams to take advantage of fresh water and abundant salmon runs; this practice continues today. Besides nets, traps and weirs for fishing, people traditionally used wooden hooks and kelp or sinew lines. Today, salmon, halibut, octopus, shellfish, seal, sea lion, caribou (on the Alaska Peninsula), and deer (introduced to Kodiak Island and the Prince William Sound area in the 20th century) remain important components of the Unangax and Alutiiq (Sugpiaq) subsistence diet.

Figure 5-15 Traditional territory of the Unangax and Alutiiq (Sugpiaq) people.

Cultural context

In 2010, approximately 17 percent of Alaska's population, about 121,000 people, lived in rural areas. These people live in about 260 communities, most of which have fewer than 500 people and are not connected by road. About half of this rural population is made up of Alaska Native peoples (Wolfe and Fall 2012). In many smaller rural communities, Alaska Natives comprise more than 90% of the population.

For Alaska Natives and others throughout rural Alaska, harvesting and eating wild subsistence foods are essential to personal, social, and cultural identity. For purposes of this section, subsistence harvest by rural Alaskan communities is limited to the regions of western Alaska and includes: Norton Sound/Kotzebue (the Arctic Area); the Yukon River; the Kuskokwim Area; Bristol Bay; and the Alaska Peninsula (Figure 5-11). For example, rural economies of villages in the Yukon River drainage (as well as other regions in western Alaska) are characterized by a high production of wild foods for local use, exceedingly high costs of living, and low per capita monetary incomes. For example, in March 2012, costs of food in Napakiak, Napaskiak, and McGrath were 220% to 247% of that in Anchorage. The University of Alaska Cooperative Extension Service documents these costs through quarterly food cost surveys. See: http://www.uaf.edu/ces/hhfd/fcs/. Salmon is a substantial part of the mix of wild foods that supports rural communities. Specifically, in 2008, 40 villages of the Yukon River drainage depended upon annual harvests of salmon as dietary mainstays; this included 11,204 people, of which 89% were Alaska Native. Salmon harvests for subsistence use and commercial sale have been central to the economic and cultural well-being of this rural population (Wolfe, 2009).

Family Production and Fish Camps

Subsistence catches are directed primarily to meeting the food needs of local residents and sled dogs. Harvests tend to be self-limiting; families typically quit fishing when their family's food requirements or other social obligations are met. Unlike commercial fishing, subsistence fishing is primarily for local use, including sharing. Because of this, subsistence catch levels have displayed considerably more stability over time, while commercial participation and catches are determined more by run sizes, external markets, variable costs of operation, and income potential (Wolfe, 2009).

The production of salmon for subsistence uses typically occurs within family groups. Households commonly work together to catch and process salmon. These are most often households of children working with parents. Labor is typically unpaid for subsistence fishing; the finished product is divided and consumed among members of the participating family group. Family members from other communities sometimes visit during salmon fishing season, often to participate in fishing and processing and in bringing products back to their home communities (Wolfe, 2009; see also Ellanna and Sherrod 1984).

Some families use fish camps as bases for fishing and/or processing salmon. Fish camps are generally located near setnet sites, fish wheel sites, or drifting areas. Seasonal camps commonly have facilities such as cabins, wall tents, wood racks for drying fish, and smokehouses for curing salmon. In the past, fish camps commonly had yards for sled dogs, but these are found less often today (Wolfe, 2009).

In recent years fewer people have resided at fish camps along the Yukon River. More and more, people are living in their main community during the fishing season; however, fish camps still provide seasonal bases of operation for many people, though they may not reside or smoke fish there. Generally, more fish camps have fallen into disuse with fewer sled dogs, the loss of market for the commercial roe fishery, increased restrictions placed on subsistence fishing, and the press of monetary employment during the summer (these issues are discussed further in this section). Those who continue to use fish camps have done so for long tenures; aside from fishing, camps continue to be used because of the valued cultural activities attached to the camp (e.g., families enjoy camping and having the opportunity to share knowledge about living off the land) (Wolfe, 2009).

While consumption of traditional foods, including salmon, is typically widespread within rural communities, often there are certain particularly productive households in a community that procure far more foods than they themselves can consume. These households typically make up about 30 percent of a community's households, and yet they commonly produce about 70 percent or more of the community's traditional foods (Wolfe, 1987). In this way, the harvest of traditional foods is extremely important to kinship and social organization; food is shared and divided as a way of life (Wolfe, 1987; Wolfe et al. 2010). Similarly, customary barter and trade is a way for families to distribute subsistence harvests to people outside their usual sharing networks, in return for goods, services, or, under specific circumstances, cash. Like sharing, customary barter and trade provides traditional foods to individuals and families who are unable to harvest. Many of the exchanged foods (i.e. dried whitefish) are not available in commercial harvests. As noted further in this section, customary trade for cash is not expected to be conducted for profit, nor is it conducted in isolation from other subsistence activities (Moncrieff, 2007; see also e.g., Magdanz et al. 2007, and Krieg et al. 2007).

In a recent study of household patterns and trends in subsistence salmon harvests within 10 Norton Sound communities representing harvest data from 7,838 household surveys from 1994 - 2003, Magdanz et al. (2009:424) found a pattern similar to that described above where 21% of the households harvested 70% of the salmon by edible weight. During the study period, subsistence salmon harvests were estimated to have declined 5.8% annually. Most of the declines occurred during the first 5 years (1994 - 1998), when harvests trended lower by about 8% annually. During the latter years (1999 - 2003), harvests trended lower by about 1% annually across all communities. Household salmon harvests increased with the age of household heads, and households headed by couples reported higher average harvests than households headed by single persons, especially single men (Magdanz et al. 2009).

Dog Teams

Ethnographic and historic accounts from the 100-year period 1850 to 1950 show that dogs were traditionally used to support a variety of activities including trapping, exploration, commercial freighting, individual and family transportation, racing, and military application in interior Alaska. Throughout this period, fish, specifically dried salmon, was the standard diet for working dogs and became a commodity of trade and currency along the Yukon River and elsewhere. The first four decades of the 20th century encompasses the peak of the dog sled era in the Yukon River drainage. For individuals and families in rural Alaska, sled dogs were essential to the seasonal round of activities that provided food and cash income. Since the late 1960s, ADF&G has conducted annual post-season salmon harvest surveys in all

Yukon River salmon fishing communities. These surveys provide estimates of the total number of dogs in each survey community (Andersen, 1992).

Since their introduction in the 1960s and 1970s, snowmachines have become a dominant mode of winter transportation for most rural Alaska residents, but have not eliminated the use of dog teams. For individuals with access to wage employment, the speed and convenience of a snowmachine allows them to work a wage-earning job and engage in more efficient hunting and fishing activities during time off in order to provide their families with preferred wild foods. While the use and popularity of snowmachines has grown since the 1970s, dog populations declined but did not disappear. Dog teams continue to be maintained in most Yukon River drainage communities today to support activities such as general transportation, trapping, wood hauling, and racing. During the mid to late 1970s, an era of renewed interest in dog mushing began, largely sparked by highly publicized events such as the Iditarod Trail Race (Andersen, 1992).

In 1991, there were 95 mushing[30] households in seven study communities along the Yukon River. By 2008, the number of mushing households had dropped to 42, a decline of 56%. In 1991, the total number of sled dogs owned by the mushing households in the seven communities was estimated at 1,363 dogs. In 2008, the number of sled dogs owned by the mushing households was 671 dogs, a decline of 51% (Table 5-8) (Andersen and Scott, 2010). A complex set of economic and social changes in rural communities has eroded the ability and need of many rural dog mushers to maintain such a lifestyle. However, rural dog teams in 2008 remain highly reliant on locally caught fish, particularly chum salmon, for food.

Yukon River drainage salmon fed to dogs are viewed as a subset of the drainage-wide subsistence harvest of salmon (non-Chinook). Strategies related to fishing for dog food, timing of fishing activities, gear used, preservation methods, and the fish species targeted vary among mushers depending on geographic locations. From the lower to upper Yukon River drainage, the fish species utilized for dog food vary. In the lower part of the drainage, non-salmon species (e.g., eels/Artic lampreys, blackfish, pike) are more commonly fed to dogs than salmon. Along the middle Yukon, summer chum salmon is the most commonly harvested species of fish for use as dog food. Along the upper Yukon and Tanana rivers, fall chum salmon and coho salmon were the most commonly harvested fish species for dogs (Andersen, 1992).

The number of fish needed to maintain a working dog for a year varies depending upon the size of the dog, the work the dog is doing, the outside temperature, the species and condition of the fish when it was harvested, and the way the fish were preserved. As a general rule, however, there are approximately 200 feeding days for which dog food must be preserved. This is generally defined at the seven month period between mid-October when all salmon fishing ceases and mid-May when fishing activities start again. Along the upper Yukon, mushers generally allow for ½ to ¾ of a dried chum salmon or coho salmon in order to feed each dog each day during the winter. This is equivalent to approximately 100 to 150 salmon per dog for the winter feeding period. Along the middle Yukon, the availability of commercially-caught salmon carcasses from a summer chum commercial roe fishery greatly influences the number of fish used to feed dogs because the dried salmon used to feed dogs are a product of the commercial fishery and not a subset of the subsistence fishery. Along the lower Yukon, salmon comprise only a small part of the fish used to feed dogs (Andersen, 1992).

Data gathered in 2008 from mushers in the seven Yukon River study communities shows that 97% reported using fish to some extent to feed their dogs and 78% reported the fish comprised half or more of their dog's annual diet. In addition, 41% of mushers reported that locally caught fish made up 75% or

[30] In this context, dog musher is being used as a general term encompassing all users of dog and dog teams and not distinguishing amongst the specific various uses of sled dogs in rural villages.

more of their dog's diet. Overall, an estimated 492,465 pounds (round weight) of fish (all species) were harvested for dog food by mushers. Chum salmon, alone, contributed almost 65% (316,360 pounds) of this total (Table 5-8). For comparison, the total quantity of all fish species utilized for dog food in 1991 was estimated at 1,211,907 pounds (round weight), a decline of 59% (Andersen and Scott, 2010).

Table 5-8 Population, households, sled dogs, and chum salmon harvest in select Yukon River drainage communities, 1991 and 2008.

Community	Population		Number of Mushing Households		Number of Sled Dogs		Estimated Pounds of Chum Salmon Harvested for Dog Food, 2008
	1990	2008	1991	2008	1991	2008	
Fort Yukon	580	587	22	10	245	135	80,400
Huslia	207	227	11	5	153	83	42,000
Kaltag	240	188	11	0	113	0	0
Manley	96	77	9	8	234	114	41,952
Russian Mission	246	362	10	5	100	74	10,800
Saint Mary's	441	541	9	3	91	28	1,728
Tanana	345	252	23	11	427	237	139,480
Total	2,155	2,234	95	42	1,363	671	316,360

As important as fish are as a high-quality, low-cost food base for working sled dogs, all dog team owners supplement fish with purchased foods and non-fish food sources. The list of non-fish food items commonly fed to dogs includes rice and other bulk grains; commercially manufactured dry dog food; dog-grade chicken, beef, and lamb meat products; furbearer carcasses and wild game cutting scraps; and various fat, vitamin, and nutrient supplements (Andersen and Scott, 2010).

As previously mentioned, dog teams continue to play an important role in the mixed subsistence-cash economy of many rural communities despite the availability of snowmachines. Five reasons are most commonly cited by mushers as to why snowmachines have not completely replaced dog teams in their communities: 1) preference; 2) economy; 3) tradition; 4) sport and entertainment; and 5) social health. Mushers agree that the major advantages of snowmachines include speed; the fact that they do not need to be fed or maintained when not in use; they are ideal for short trips, breaking or setting trail in deep snow conditions, and hauling heavy loads on level trails; and are an easier mode of transportation for the elderly. However, the advantages of dogs center on their reliability and dependability, especially in extremely cold temperatures. There are specific areas, terrain, and/or snow conditions in which snowmachines cannot be operated and only accessed by dog teams. In addition, dogs can be acquired without a large cash outlay and can be operated without the use of costly gasoline and oil. In harsh conditions, snowmachines have a reported useful life of only two or three years. Dog teams are used to guard camps from bears, minimize waste by eating scraps, can generate income when raced or sold, and provide companionship. Dog mushing provides social benefits to individuals and communities; raising, training, caring for, and fishing for dogs is likened to a full time job, which keeps participants involved in a culturally relevant, useful, and healthy past-time on a year-round basis (Andersen, 1992).

In responding to years of low salmon runs, dog mushers outlined several strategies for maintaining the ability to feed and care for their dog teams. Overall, the option of buying more commercial food is the strategy most often employed for dealing with low salmon runs. Increasing the use of other fish species, as well as fishing longer and harder to obtain appropriate salmon quantities, is also a common compensation strategy. Mushers are reluctant to decrease the number of dogs owned as they already maintain the minimum number of dogs needed for the ways in which in the dogs are used (Andersen and Scott, 2010).

Diet and Nutrition

Alaska Natives' diet traditionally has consisted of foods obtained by hunting, fishing, trapping, and gathering. These include fish, land and marine mammals, birds and eggs, plants and berries and are referred to as Native, customary and traditional, or subsistence foods. The present-day diet of Alaska Native people also includes available store-bought foods tied to the mixed subsistence-cash economy that characterizes most rural Alaskan communities (e.g., Wolfe 1983; Wolfe 1991; Wolfe et al., 1984).

Consumption of traditional foods is greater in rural Alaska than anywhere else in the United States. About 38.3 million pounds of traditional foods are taken each year. This amounts to a per capita consumption of 316 pounds or just under one pound a day. In comparison, according to the U.S. Census Bureauthe average American uses about 218 pounds of store-bought meat, fish, and poultry annually. For 2009, the per capita consumption of red meat was 106 pounds; 97 pounds of poultry; and 16 pounds of fish http://www.census.gov/compendia/statab/cats/health_nutrition/food_consumption_and_nutrition.html.

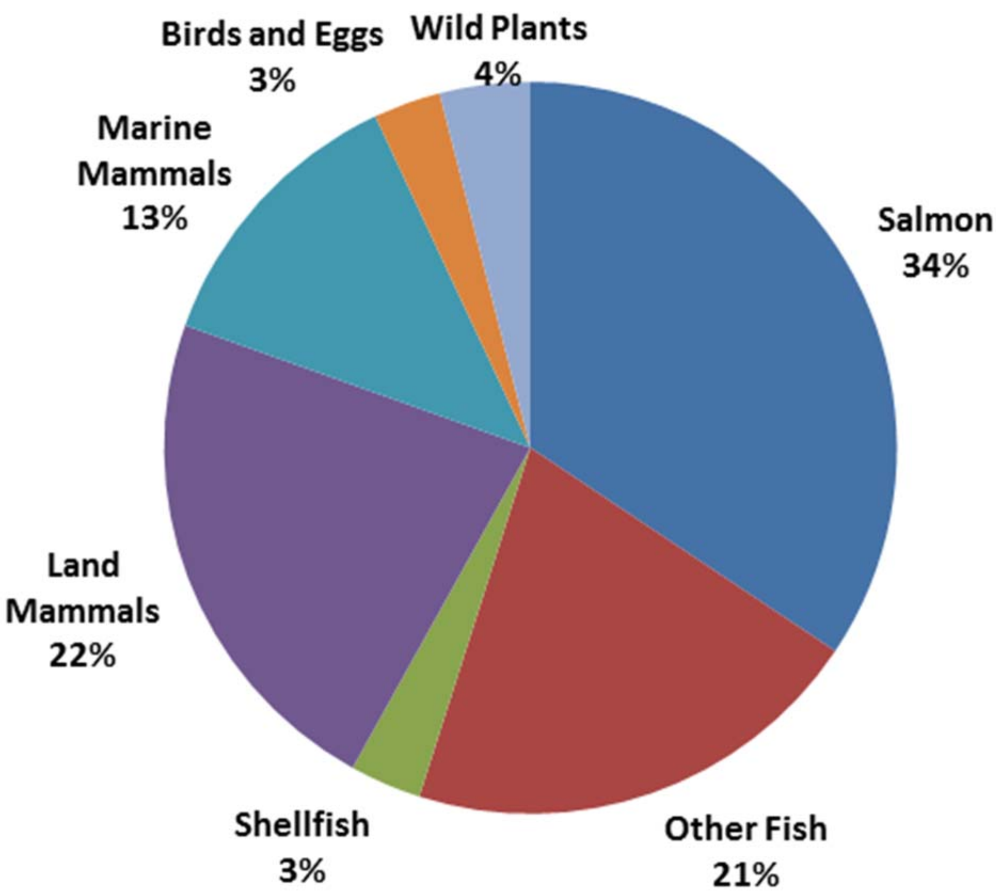


Figure 5-16. Composition of subsistence harvest by rural Alaska residents.

Native foods are especially nutritious, rich in protein, iron, vitamin B12, polyunsaturated fats, monounsaturated fats, and omega-3 fatty acids. ADF&G, Division of Subsistence, estimates that the annual rural harvest of 316 pounds per person contains 185% of the protein requirements of the rural population, containing about 94 grams of protein per person per day. The subsistence harvest contains 31% of the caloric requirements of the rural population (Wolfe and Fall 2012). In addition, they are low in saturated fat, added sugar, and salt. Native meats are generally lean and berries and greens are high in water content and micronutrients and low in empty calories. Hunting, gathering, harvesting, and preserving Native foods are energy intensive, providing physical activity. Furthermore, Native foods are highly valued and contribute to the spiritual, cultural, and social well-being of Alaska Native people as well as to the health of individuals, families, and communities. There is a trend, however, towards a greater dependency on store-bought foods and less on traditional foods (Johnson et al., 2009). This shift to increased reliance on imported store-bought foods is referred to as dietary westernization, which is defined as "the diffusion and adoption of western food culture" (Bersamin et al., 2007).

As a part of a traditional diet, fish and seafood especially contribute to energy, protein, mono- and polyunsaturated fatty acids, selenium, magnesium, and vitamins D and E. A decrease in traditional foods has important health implications. Higher intakes of omega-3 fatty acids may afford a greater degree of protection against coronary heart disease. Prior to the availability of store-bought foods, there were few carbohydrate sources in the diet. Much of the current carbohydrate consumption comes from foods rich in simple sugars. The relationship between increasing consumption of fructose and sucrose and the increases in type-2 diabetes and obesity in the U.S. is under active discussion. Increased consumption of added sugars can result in decreased intakes of certain micronutrients as well. Additionally, the low intake of calcium, dietary fiber, fruits, and vegetables could be contributing to the increased incidence of cancers of the digestive system (Johnson et al., 2009).

Populations in developing countries and minority and disadvantaged populations in industrialized countries are at the greatest risk for type 2 diabetes. Between 1990 and 1997, the number of Native Americans and Alaska Natives of all ages with diagnosed diabetes increased from 43,262 to 64,474 individuals. Throughout 1990 - 1997, the number of Native Americans and Alaska Natives with diabetes was greatest among individuals aged 45-64 years and the prevalence of diabetes and the number of diabetic cases was higher among Native American and Alaskan Native women than men. Although the Alaska region had the lowest age-adjusted prevalence of diabetes throughout the period, it had the highest relative increase (76%) in prevalence (Burrows et al., 2000).

National health surveys used to monitor diabetes in the U.S. population are not useful for monitoring diabetes prevalence among Native Americans and Alaska natives because of small sample sizes. The prevalence of diagnosed diabetes among Native Americans and Alaska Natives served by health facilities may not be representative of the total Native American and Alaskan population. Information on diabetes prevalence is currently lacking for approximately 40% of the Native American and Alaskan Native population (Burrows et al., 2000).

In a 2004 study conducted by the Alaska Native Health Board and the Alaska Native Epidemiology Center, researchers sought to measure the usual intake of a wide variety of foods, both subsistence and purchased, over the period of one year. The Alaska Traditional Diet Project (ATDP) had participants from villages located in the following Regional Health Corporations: 1) Norton Sound Health Corporation; 2) Tanana Chiefs Conference; 3) Yukon-Kuskokwim Health Corporation; 4) Bristol Bay Health Corporation; and 5) Southeast Alaska Regional Health Consortium.[31]

Prior to the ATDP study, there were few published data on the dietary intakes of Alaska Natives; however, some general trends can be identified. First, there is substantial regional and seasonal variation in food intake patterns among Alaska natives. Second, there has been an increasing use of store foods and

[31] Data from the Southeast Alaska Regional Health Consortium are not included here since this area falls outside the focus on western Alaska.

particularly in the consumption of sugared beverages over many years. Third, the intakes of some nutrients are reported to be low, including fiber, vitamin A, B vitamins, vitamin C, folate, iron, and calcium. Fourth, many important nutrients in the diets of Alaska natives come from subsistence foods, notably vitamin A, vitamin B12, omega-3 fatty acids, iron, and protein (Ballew et al., 2004).

Food and beverage data from responses of all participants in each region of the ATDP were ranked (top 50) by total amount consumed and by the estimated contribution of particular foods to nutrient intakes. In terms of total amounts of food consumed, sugared beverages (e.g., powdered drink mixes, soda pop) were in the top four items in all regions. White rice, white bread, and pilot bread were a staple in nearly all regions; however, the finding of eight species of fish in the Norton Sound and Yukon-Kuskokwim regions, seven species of fish in the Bristol Bay region, and two species of fish in the Tanana Chiefs region indicates the importance of fish in the diet of Alaska natives. Table 5-9 below outlines the importance of salmon in the diet of participants of the ATDP study (Ballew et al., 2004).

Table 5-9 Total consumption (in pounds) of salmon species consumed by participants in each of the Regional Health Corporations.

	Chum Salmon		King Salmon		Coho Salmon		Sockeye Salmon		Pink Salmon	
	Total Con. (lbs)	Percent Part.	Total Con. (lbs)	Percent Part.	Total Con. (lbs)	Percent Part.	Total Con. (lbs)	Percent Part.	Total Con. (lbs)	Percent Part.
Norton Sound	2,729 (26)	85% (25)	1,384 (42)	94% (7)	3,875 (18)	88% (17)	4,162 (16)	~	3,206 (23)	69% (48)
Yukon-Kuskokwim	8,296 (12)	84% (29)	15,722 (5)	98% (2)	5,968 (16)	~	~	~	~	~
Bristol Bay	2,532 (29)	~	5,076 (12)	93% (9)	3,486 (17)	86% (33)	6,354 (10)	93% (12)	2,261 (31)	~
Tanana Chiefs Conference	~	~	583 (16)	97% (1)	243 (26)	79% (24)	~	~	~	~

Note: 'Total Con.' = Total consumption in lbs.
Note: 'Percent Part.' = Percent participants. This indicates the number of people (out of those surveyed) who reported eating the salmon species. Numbers in parenthesis indicate where that species of salmon ranked among the top 50 foods consumed.

The most common reason given by ATDP participants for eating less subsistence foods ws a reduction in the availability or quality of fish and animals. The most common concerns expressed about subsistence foods were observations of fish and animals with parasites, diseases, or lesions; reduced numbers of fish and animals; and the possible presence of contaminants in fish and animals. Other reasons for lower subsistence uses included not having anyone to hunt for the family, working at a job or not having time to hunt and gather, living away from the village, lack of transportation to hunt and gather, and not having the traditional knowledge to hunt and gather (Ballew et al., 2004).

Mixed Economy

In the 20th century, most rural Alaska Native communities transitioned from predominantly local, subsistence-based economies to mixed economies, in which residents relied a combination of local subsistence harvests, on wage labor, and on transfer payments like the Alaska Permanent Fund Dividend (Goldsmith 2007 *Remote Rural Economy of Alaska*). In the latter half of the 20th century, rural Alaska experienced dramatic improvements in infrastructure – transportation, utilities, communications, education, health care – funded by state revenue from oil development, by expanded federal programs, and by successful Alaska Native regional corporations. As a result, employment, personal income, and mobility increased substantially. Rural living standards improved substantially in the latter 20th century. For the first time, many rural Alaska residents had means to travel to, and in some cases, relocate in regional centers and urban areas of the state.

Nonetheless, rural Alaska still presents an economic environment distinctly different from other states in the U.S. The majority of the population is Alaska Native, living in small, isolated villages. There are few road connections between villages and the primary transportation connection with the state's cities is by air. This region has a large subsistence economy in which residents provide a significant share of their real income through hunting, fishing, and harvesting local wild products (Huskey et al., 2004). Rural hub communities of Dillingham, Bethel, Nome, Kotzebue, and Barrow are the locus of many wage jobs and are regional service centers for health services, retail stores, government agencies, and transportation. They have regular service from scheduled aircraft and receive shipments of goods and equipment by barge during summer months (Caulfield, 2002; see also Fall et al., 1986; Magdanz and Olanna 1986; Wolfe et al., 1986).

For most families, making a living on the Yukon River requires integration of subsistence activities with wage employment, commercial fishing, or other types of money-making activities (e.g., furbearer trapping). At a household level, these two components of the mixed economy are often combined by family members. Income produced by family members typically pays for the equipment and fuel used in the production of wild foods (Wolfe, 2009). Cash enables household members to purchase boats, outboard motors, rifles, and fishnets. With these, people living in rural Alaska are able to procure and consume traditional foods (Caulfield, 2002). Cash may also be used to pay for housing, utilities, transportation, and a variety of other goods and services.

In a mixed economy, people often move to improve their employment opportunities. Improving job opportunities and the chance of finding work were the reason most frequently cited for moving among inter-community migrants on Alaska's North Slope and for Native migration within and into the Canadian Northwest Territories (Huskey et al., 2004). A study conducted by the Institute of Social and Economic Research also found that the pursuit of economic and educational opportunities appears to be the predominant cause of migration. Rural Alaska (all communities state-wide) net migration shows an increase in net out-migration from about 1,200 per year during the period 2002 - 2005 to about 2,700 per year in 2006 and 2007 (Martin et al., 2008).

Place amenities, such as public and environmental goods, influence patterns of migration. The subsistence economy in rural North Alaska provides a good example of the interaction of culturally defined preferences and place amenities in migration. Subsistence activities, such as hunting, fishing, and gathering, add substantially to the real income of rural Natives. Subsistence may limit the effect of relative market opportunities on Native migration (Huskey et al., 2004).

In Alaska, conventional economic opportunities (employment, growth, education) are concentrated in Anchorage and Fairbanks. Many rural Alaskans have moved to cities to take advantage of these opportunities. Yet most rural people are heavily invested in rural subsistence economies by virtue of their local knowledge and social capital. For those who stay in rural Alaska, these investments provide significant non-cash returns that improve the quality of their lives. For those who move to unfamiliar urban environments, these local investments provide no return whatsoever and will gradiually atrophy, making it increasingly difficult to return home (see Huskey et al., 2004).

Migration between village and town (dual residencies) and seasonal moves for employment and subsistence fishing has become a well-established pattern for some villages along the Yukon River. Poor prospects for local employment pushes families away from a village, while traditional pursuits like subsistence fishing tend to pull them back. Low salmon runs and restricted subsistence fishing time are contributing factors to increased mobility and migration in order to be more economically productive. In the past people could make a living along the Yukon River (Wolfe, 2009). When villages become too small, maintaining a local public school and other facilities becomes problematic.

The cash sector appears to be the weaker of the two economic sectors. As a general rule, households struggle to find ways to make enough money to enable them to live in rural communities where costs of living are already high. Wage-paying jobs tended to be scarce, seasonal, and intermittent and finding employment in the private sector is difficult. In villages along the Yukon River, the percentage of adults who earn some money through employment ranges from 50% to 80%. Mean household income (earned and unearned sources) in 2007 ranged from $27,286 to $38,936. On a per capita basis, total incomes from earned and unearned sources ranged from $6,357 per person to $14,807 per person. This is substantially lower than the per capita incomes in Alaska's urban areas at $24,525 per person in Fairbanks and $20,166 per person in Anchorage (based upon 2000 U.S. Census) (Wolfe, 2009).

Food Budgets

ADF&G, Division of Subsistence, estimates that approximately 38.3 million pounds of wild foods are harvested annually by residents of rural Alaska, representing on average 316 usable pounds per person. Regarding the economic value of traditional foods to the economies of rural Alaska, the estimated replacement cost of traditional foods in rural Alaska, if assumed to be $3.50 per pound, equates to over $134 million for all of rural Alaska. If a replacement value of $7 per pound is used, still likely a low figure, the estimated wild food replacement value for rural Alaska is estimated to be more than $268 million annually (Wolfe and Fall 2010). In a study by Wolfe and Walker (1987) that developed a predictive model of rural community subsistence harvests, a $100 decrease in mean taxable income per income tax return resulted in an estimated one pound increase in community subsistence harvests per person per year.

Food security

Food security is defined as having access to sufficient, safe, healthful, and culturally preferred foods. Food security is a condition and a constantly unfolding process, one through which people try to align short-term needs and long-term goals of health and sustainability. Numerous circumstances and drivers of change may limit the ability of rural and urban Alaskans to reliably procure traditional foods including vulnerabilities to regional environmental change, external market shifts in the price or availability of imported fuel and supplies, environmental contamination, and land use changes such as oil, natural gas, and minerals development. According to the USDA's 2008 report on household food security in the United States, approximately 11.6 percent of Alaskan households are food insecure; at some time during the year these households had difficulty providing enough food for all members of their household. This measure captures a portion of those of in Alaska coping with food insecurity. While little data are available regarding food insecurity in rural communities, other indicators of food insecurity are present in rural areas of the state including trends for various diet- and lifestyle-related health issues (e.g. type 2 diabetes and obesity) (Loring and Gerlach, 2010).

ADF&G, Division of Subsistence, began including questions related to food security in comprehensive wild resource research in two Kotzebue Sound communities in 2007. Using a modified national food security data collection protocol, 88% of surveyed Kivalina households and 82% of Noatak households reported high or marginal levels of food security, compared with 89% in the United States. Subsistence harvests clearly contributed to that food security, and when food insecurities were reported they were twice as likely to be related to store-bought foods as to subsistence foods (Magdanz et al. 2010:69).

In Alaska, 90% of the rural population, which represents 20% of the state's total population and 49% of the Alaska Native population, rely on locally procured fish for at least part of the year (Loring and Gerlach, 2010). Five factors are found to be significantly related to household salmon production: fishing fuel (gallons); equipment holdings; number of harvesters; number of households eating salmon; and the number of people eating salmon. The amount of fuel expended by households while fishing was the factor most strongly associated with household subsistence salmon productivity. The strong correlation of fuel expenditures and salmon output is consistent with concerns about the rising monetary costs of subsistence fishing. To be successful fishing, a household had to expend money in boat fuel to reach fishing sites, to check setnets, to drift gillnets, and to transport fish. Difficulties are encountered given the higher costs of fuel coupled with poor salmon runs; households cannot afford to travel to set and check nets that are catching only small numbers of fish. As such, a lack of money may limit the extent of fishing, and by extension, the amount of salmon harvested (Wolfe, 2009).

While there has been a recent dramatic increase in fuel prices throughout Alaska, total utility costs, including heat, electricity, water, and sewer, paid by residents of remote Alaska communities increased from a median value of 6.6% of total income to 9.9% of total income from 2000 to 2006. By comparison, the median amount spent by urban Anchorage households increased from 2.6% to 3.1% of household income during the same period from 2000 to 2006. It is estimated that in rural Alaska, the overall consumption of diesel fuel and gasoline for all end uses equates to about 1,000 gallons of fuel per person. Increasing fuel costs equate to an additional economic burden of several thousand dollars per household in rural Alaska; however, fuel cost alone is not a definitive driver of migration through 2007. Because migration is related to earnings (see previous section), the people most impacted by high fuel costs may be least able to afford to move and unable to afford as much fuel to hunt and fish (Martin et al., 2008).

Salmon Shortages and Species Substitution

Salmon is part of a mix of wild foods that supports communities in rural Alaska. Since the late 1990s, depressed salmon runs have been associated with substantial changes in salmon fisheries of the Yukon River drainage. Commercial salmon fishing has been restricted or closed on the lower and middle river. Incomes to village residents from commercial fishing have fallen. Subsistence fishing times have been shortened and staggered to achieve salmon escapements and provide for U.S. and Canadian harvest allocations. Catching a mix of wild foods helps to buffer against shortfalls due to annual variability in the abundance of particular species. Low harvests in one type of salmon might be replaced by higher harvest of other types of fish or wildlife; however, taking into account the level of subsistence dependence on salmon, it is also possible that other wild foods do not compensate for low subsistence salmon harvests during a poor year. Some households may buy more store foods to compensate, if they have the income. Persons in other households may leave the village in search of employment because of such difficult economic circumstances (Wolfe, 2009).

Specifically, in Alakanuk (coastal district of the lower Yukon drainage) and Stevens Village (upper Yukon drainage, District Y-5), between-year comparisons of wild food harvest suggest that the low harvests of salmon may not be made up by increased harvests of other types of wild resources. Comparing 1980 with 2007, food production was lower across all major species groups in Alakanuk, including marine mammals (-48.8%) and fish (-81.4%). There was no evidence of increased production in other wild foods to make up for low subsistence salmon catches. Comparing 1985 with 2007 in Stevens Village, harvests were up for land mammals (+45.2%), but down for fish (-71.4%). The depressed local economy at Stevens Village has resulted in a significant out-migration of families from the community and a loss of population. In general, harvests of other wild food species in 2007 had not increased in order to compensate for the greater costs of catching salmon in any village (Wolfe, 2009).

Fishing Regulations

Fishing regulations determine access to salmon stocks throughout western Alaska. Custom guides the activities of extended families at the local level, including conventions regarding harvest areas, harvest methods, and disposition of catch. Alongside these local customs, subsistence fishing is regulated by state and federal entities, and by an international agreement between the U.S. and Canada under the Pacific Salmon Treaty.

Among the various agencies responsible for management of Yukon River salmon fisheries, ADF&G has the lead role in managing fisheries within the U.S. portion of the drainage and is the lead agency in negotiations between the U.S. and Canada for trans-boundary salmon stocks. The priorities of management are to first ensure adequate escapement to sustain future runs; second, provide reasonable opportunity for subsistence fishermen to meet their needs; and third, provide opportunity to commercial, sport, and personal use fishermen to harvest fish in excess of escapement and subsistence needs. ADF&G uses an adaptive management process to achieve these priorities that starts with development of management strategies based on pre-season forecasts, then transitions into evaluation of run strength in season and adjusting management strategy implementation based on in-season performance of annual salmon runs. Pre-season forecasts and management strategies are developed based on guidelines and directives as outlined in state and federal management plans and regulations, and in cooperation with federal subsistence managers, fishermen, tribal council representatives, and other stakeholders within guidelines (personal communication, J. Linderman, 2010).

While forecasts and pre-season management strategies are made each year, these are frequently revised based on in-season run assessments. For example, the structure and implementation of fishing windows may be adjusted in-season by Emergency Order based on run strength and run timing estimates derived from in-season run assessment programs. By default, subsistence fishing is open on the river and is closed by regulatory Emergency Orders; while commercial fisheries are closed by default and must be opened by Emergency Order. Management decisions often need to be made before fish have reached the areas, districts, or communities affected. Managers use test fisheries, sonar projects, genetic stock identification and age-sex-length composition, and in-season harvest reports to assess and project salmon run timing and run strength in-season to inform management decisions (personal communication, J. Linderman, 2010).

In the Yukon River Management Area, the core projects and associated platforms collecting run assessment information in-season are (in chronological order moving upstream) a nearshore marine test fishery operated near Dall Point south of the mouth of the Yukon River, inriver drift and set net test fisheries operated out of Emmonak near the mouth of the river, a drift test net fishery near the community of Mountain Village, Pilot Station Sonar operated approximately 123 miles from the mouth, test fish wheels operated at the Rapids approximately 731 mile from the mouth, and Eagle Sonar operated near the Canadian border near the community of Eagle approximately 1,200 miles from the mouth. Additional projects are operated in Yukon River tributaries spread throughout the drainage, which are primarily designed to assess escapements and assess results of management actions. The combined in-season information provided by these programs allows managers to identify trigger points that when reached prompt actions (i.e. restrictions or closures on subsistence fisheries or openings for commercial fisheries) in the various Yukon River management districts. The information provided by these projects also assists managers in determining the level of management action required, such as the duration of time warranted for commercial periods to ensure subsistence opportunity is not impacted and adequate escapements are achieved, or any reduction in subsistence fishing time needed to ensure adequate escapements (personal communication, J. Linderman, 2010).

Among the primary concerns often expressed by subsistence fishers are limitations on fishing times (open and closed seasons and periods), limitations on gear (mesh size and net depth), and the lack of effective regulations on high-seas bycatch (Wolfe, 2009). Other concerns amongst subsistence users in rural communities includes: impacts of closures on food security, economic security, and on ecosystems; observations of ecological change including fish abundance, fish size, fish health, and spawning grounds; and problems in existing management priorities/approaches including the inefficacy of radar[32] and the role of at-sea bycatch by the commercial groundfish fishery (Loring and Gerlach, 2010).

[32]While the term radar is often used by subsistence stakeholders when expressing various concerns, it is assumed by area management biologists that they are referring to the use of sonar for monitoring fish passage along the Yukon River (personal communication, John Linderman, 2010).

Families along the lower Yukon River often prefer to put up subsistence Chinook salmon soon after river breakup. With the bulk of Chinook salmon subsistence catch drying, families with commercial permits could then fish for sale during commercial openings. Families catch additional fish for subsistence uses between commercial periods, as needed. When schedules and locations allow, subsistence fishing would get an initial week or so jump on commercial fishing (Wolfe, 2009). Directed summer chum salmon commercial openings are initiated and managed also based upon the timing of Chinook runs. When Chinook salmon runs are weak, a directed commercial fishery is typically not prosecuted. In weak Chinook salmon years, a commercial fishery is directed at summer chum salmon in mid to late June and is initiated and managed based on the strength of the chum salmon run in consideration of the impacts on Chinook salmon from incidental harvest.

While communities along the entire Yukon River focus on Chinook salmon, there is considerable variation in the patterns of summer and fall chum salmon harvest and use throughout the river area. These differences result from a range of issues including species distribution and quality throughout the river drainage and cultural patterns of use (e.g., more dog teams along the upper river). The state and federal management strategy has sought to take fishing pressure off the earliest pulses of Chinook salmon runs in order to get fish upriver to meet escapement goals, achieve Canadian border passage obligations under the Yukon River Salmon Agreement, and provide for subsistence uses in upriver districts. At the mouth of the Yukon River, when there has been uncertainty regarding the strength of Chinook and summer chum salmon runs, managers have not scheduled openings until the runs have developed and uncertainty over sonar count and test fishery information is reduced. In addition, in years of strong summer chum salmon runs, but weak Chinook runs, fishing times tend to be restricted in the lower river commercial chum fishery to avoid incidental catch of Chinook salmon (Wolfe, 2009 and personal communications, Caroline Brown and John Linderman, 2010).

Subsistence fishing is open seven days a week until the first large pulse of Chinook salmon appears in each district, which then triggers implementation of the regulatory subsistence fishing schedule in each district in the lower river. In some mainstream upper river districts (i.e. Coastal District and Subdistricts 5D), the regulatory subsistence fishing schedule remains seven days per week unless additional conservation measures are warranted. The general management strategy is to reduce fishing pressure on the earliest portions of Chinook runs while providing for subsistence fishing, and secondarily, for commercial fishing. This strategy is employed to spread subsistence harvest over the entire run to provide for escapements by reducing the potential for differential harvest of specific spawning stocks, provide for subsistence harvest throughout the drainage, and provide for Canadian border passage obligations (Canadian escapement and harvest allocation combined). As a consequence, subsistence fishing periods can have negative effects on subsistence salmon processing; fish harvested in widely-spaced batches of salmon create difficulties for successfully drying and smoking salmon. There is risk involved in drying fish in smaller batches, rather than a larger, single batch because the different quality of fish drying at different rates can result in over-drying and excessively hard fish. In addition, subsistence openings may occur during bad weather creating problems with drying and processing because of an increased potential for spoilage. Without a regulatory fishing schedule, fishermen would have more flexibility in choosing appropriate weather to catch and process subsistence fish (Wolfe, 2009 and personal communication, John Linderman, 2010) but at the potential sacrifice of Yukon River treaty obligations with Canada, overall escapement, and upriver subsistence harvest needs. In extreme circumstances (i.e., scheduled fishing periods coupled with high fuel prices), individual fishermen may feel forced to fish outside regulations in order to meet their family’s food needs (Wolfe, 2009). This could come at the potential cost of international treaty obligations, the overall health of Yukon River salmon populations, and upriver subsistence users.

Under the Alaska subsistence law, the BOF has made separate customary and traditional use findings for Yukon River Chinook salmon, summer chum salmon, fall chum salmon, and coho salmon, and has established separate ANS findings for each (see Table 5-6). Harvests of one species that consistently fall below the lower limit of the ANS may suggest that a reasonable opportunity for subsistence uses can no longer be provided, or may suggest that the need for that level of harvest has decreased and no longer applies (i.e., with the decrease in the presence and use of dog teams, the need for historical levels of chum salmon harvest for dog food has also decreased). If it is determined that a reasonable opportunity can no longer be provided because of resource limitations, state statute would require that non-subsistence uses be eliminated (AS 16.05.258). Under such circumstances, like that which occurred with Nome Subdistrict chum salmon through the late 1990s and early 2000s, subsistence fishing participation would be limited through a tiered management scenario where individual Alaskans would be ranked against one another according to their customary and traditional dependence upon the fish stock in question, to determine who would be provided an opportunity to fish for subsistence uses. Therefore, those Alaskans who do not qualify for a tiered subsistence fishery where there is insufficient harvestable surplus to provide a reasonable opportunity for all subsistence uses generally would shift to other salmon stocks or other resources to ensure sufficient wild resources are obtained to support household economies (Wolfe, 2009 and personal communications, John Linderman and Jim Simon, 2010). In such cases, harvest and use of another species may then increase such that the amount necessary for subsistence for the replacement species may need to be adjusted by the BOF.

5.4.2 Overview of subsistence harvests

Of the total number of pounds of wild foods harvested annually for subsistence purposes in rural Alaska communities, subsistence fisheries contribute about 55% from finfish and 3% from shellfish. Although producing a major portion of the food supply, subsistence harvests represent just a small part of the annual harvest of all wild resources in Alaska, approximately 1.1%. Commercial fisheries take 98.3% of the wild resource harvest, and sport fisheries and hunts take about 0.6% (Wolfe and Fall 2012).

The estimated total subsistence harvest of salmon throughout Alaska in 2010, based on annual harvest assessment programs, was 983,559 fish. The estimated statewide harvest of chum salmon was 235,473 fish (24%) (Figure 5-17). In 2010, fisheries in the management areas encompassing western Alaska accounted for the following portions of the total estimated statewide subsistence salmon (all species) harvest: the Yukon Area (223,573 salmon; 23% of the statewide total); the Kuskokwim Area (193,006 salmon; 20%); the Bristol Bay Management Area (113,238 salmon; 11%); and Arctic Alaska (77,928 salmon; 8%)[33] (Figure 5-18). In 2010, as in other recent years, three areas dominated the subsistence chum salmon estimated harvest: the Yukon Area (160,546 salmon; 68% of the statewide harvest), the Kuskokwim Area (47,885 salmon; 20%), and Arctic Alaska (19,139 salmon; 8%) (Table 5-10 and Figure 5-19). Table 5-11 provides trend data on the number or households in Alaska that use subsistence salmon. Statewide eligibility criteria require individuals to be Alaskan residents for the preceding 12 months before harvesting salmon for subsistence uses (Fall et al., 2011).

[33] Subsistence harvest estimates for Arctic Alaska for 2003 and 2004 do not include the regional center of Kotzebue, which had been included in the harvest assessment program since 1994. No subsistence fisheries harvest data were collected in the Kotzebue area for 2005 through 2010; therefore, the estimated harvest totals for Northwest Alaska as reported since 2003 are incomplete.

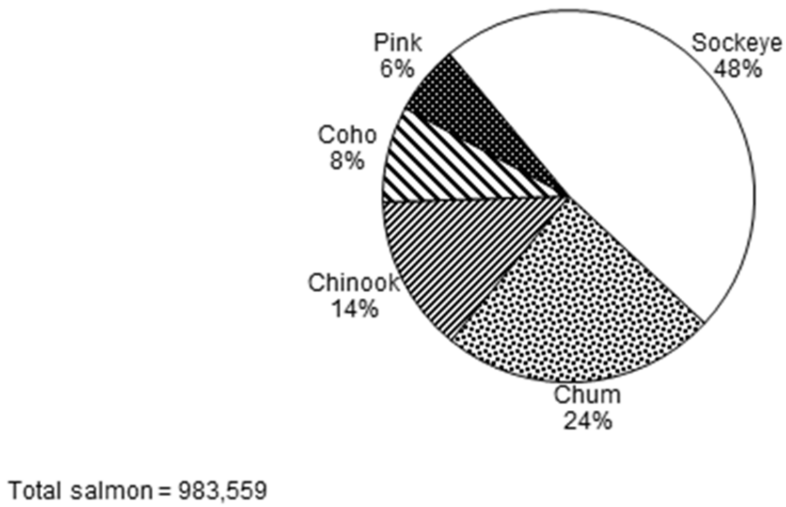


Figure 5-17 Alaska subsistence salmon harvest by species, 2010. (Source: Fall et al., 2012)

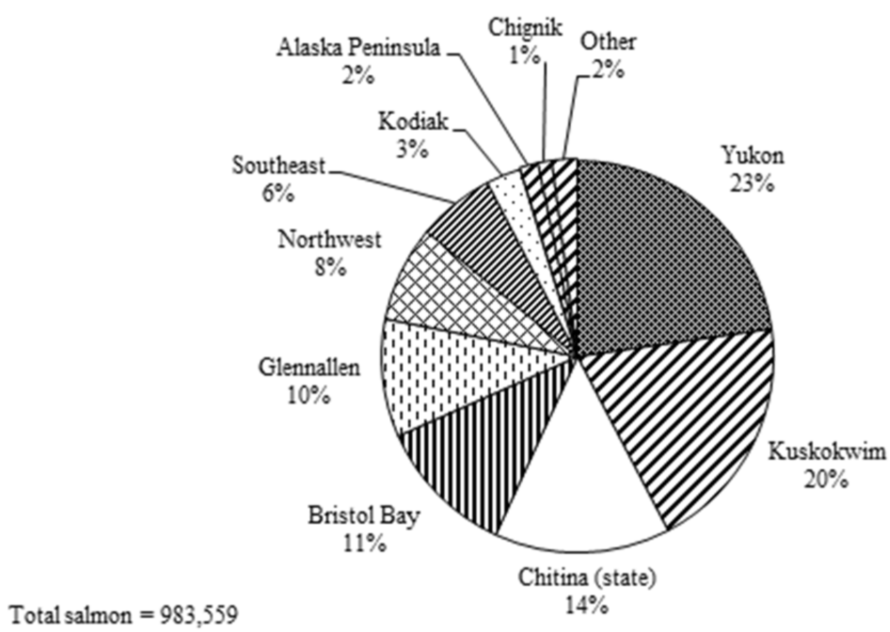


Figure 5-18 Alaska subsistence salmon harvest by area, 2010. (Source: Fall et al., 2012)

Table 5-10 Alaska subsistence salmon harvests, 2010

	Households or Permits		Estimated Salmon Harvest					
Fishery[a]	Total[b]	Surveyed or returned	Chinook	Sockeye	Coho	Chum	Pink	Total
Adak District	2	1	0	25	0	0	0	25
Alaska Peninsula Management Area	183	138	338	9,464	2,898	1,274	985	14,959
Batzulnetas Fishery	3	3	0	106	0	0	0	106
Bristol Bay Management Area	1,082	979	10,852	90,444	4,623	4,692	2,627	113,238
Chignik Management Area	124	90	188	8,148	1,820	222	656	11,034
Chitina Subdistrict: State[c]	9,308	7,757	700	140,089	1,892	0	0	142,680
Chitina Subdistrict: Federal	92	38	36	5,352	88	0	0	5,476
Copper River Flats	326	320	281	2,034	27	22	0	2,365
Glennallen Subdistrict	1,587	1,331	2,653	92,632	422	0	0	95,706
Kenai and Kasilof Rivers: Federal	169	151	0	943	0	0	0	943
Kodiak Management Area	1,890	1,890	158	22,170	4,200	273	1,266	28,067
Kuskokwim Management Area	4,215	2,247	69,242	41,042	34,169	47,885	668	193,006
Northwest Alaska[d]	1,106	1,043	2,079	1,368	11,945	19,139	43,397	77,928
Port Graham & Koyuktolik Subdistricts	35	35	30	1,630	1,448	308	1,054	4,470
Prince William Sound (General)	1	1	0	0	0	0	0	0
PWS Eastern District (Tatitlek)	8	5	0	165	142	10	50	367
PWS Southwestern District (Chenega Bay)	9	5	0	55	0	87	6	148
Seldovia Fishery	16	12	3	133	41	47	88	312
Southeast Region	2,217	1,829	1,828	52,258	3,885	878	3,721	62,571
Tyonek Fishery	105	77	843	212	167	2	2	1,226
Unalaska District	216	170	1	3,883	319	71	336	4,611
Upper Yentna Fishery	32	32	0	642	50	18	38	748
Yukon Management Area	3,066	1,659	44,721	0	14,107	160,546	4,199	223,573
Total	25,792	19,813	133,953	472,796	82,244	235,473	59,093	983,559

Source ADF&G Division of Subsistence, ASFDB 2010 (ADF&G 2010).

a. Estimates for the Yukon and Southeast fisheries include both subsistence and personal use harvests.
b. Because the numbers of permits issued for the Kodiak and Port Graham/Koyuktolik fisheries are unknown, the numbers of permits returned are used in place of these values.
c. Reclassified as a personal use fishery in 2003. It is still included in this table due to its historical classification as a subsistence fishery.
d. Does not include the Kotzebue Area.

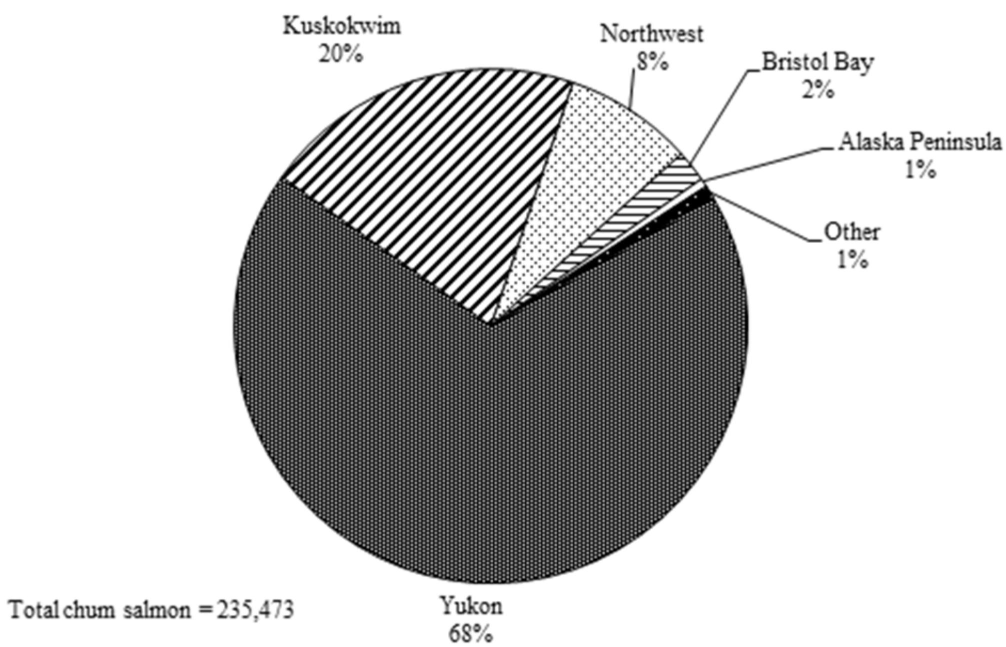


Figure 5-19 Subsistence chum salmon harvest by area, 2010 (Source: Fall et al., 2012).

Table 5-11 Historical Alaska subsistence and personal use salmon harvests, 1994–2010

	Households or Permits		Estimated Salmon Harvest					
Year	Total	Surveyed or returned	Chinook	Sockeye	Coho	Chum	Pink	Total
1994	22,553	16,492	188,134	445,109	138,101	417,199	94,469	1,283,012
1995	22,358	15,770	186,422	386,034	125,909	499,992	54,908	1,253,264
1996	23,708	18,751	161,976	416,467	124,786	498,525	80,928	1,282,682
1997	26,754	21,782	182,174	525,417	99,043	347,808	41,543	1,195,985
1998	27,774	22,264	177,017	466,386	95,211	302,037	74,216	1,114,867
1999	27,854	22,993	161,333	511,044	91,896	339,242	33,253	1,136,768
2000	25,365	20,983	134,270	422,002	103,212	248,598	52,710	960,791
2001	28,641	21,907	165,039	487,570	101,291	242,035	44,501	1,040,436
2002	24,497	19,189	144,777	398,134	94,365	229,922	86,754	953,952
2003	25,018	19,096	166,593	420,579	109,172	239,648	67,929	1,003,920
2004	27,046	20,923	176,416	453,201	103,772	241,022	92,281	1,066,692
2005	25,060	18,513	155,658	461,804	100,095	257,977	77,031	1,052,564
2006	25,881	18,558	142,658	452,477	96,024	291,971	74,320	1,057,451
2007	25,736	17,851	157,813	459,372	80,685	273,951	34,787	1,006,608
2008	25,920	18,762	176,158	406,621	116,105	270,688	86,337	1,055,909
2009	25,657	19,225	141,563	396,504	88,307	214,145	38,666	879,185
2010	25,792	19,813	133,953	472,796	82,244	235,473	59,093	983,559
5-year average (2005-2009)	25,651	18,582	154,770	435,356	96,243	261,746	62,228	1,010,343
10-year average (2000-2009)	25,882	19,501	156,095	435,826	99,303	250,996	65,532	1,007,751
Historical average (1994-2009)	25,614	19,566	163,625	444,295	104,248	307,173	64,665	1,084,005

Source: ADF&G, Division of Subsistence, ASFDB 2010 (ADF&G 2010).

5.5 Impacts on chum salmon

The following criteria are used to evaluate the impact of alternative management measures on Chum salmon PSC in comparison to the status quo management.

Criteria used to estimate the significance of impacts on incidental catch of PSC and other non-target species

Insignificant impact	The impact is not expected to jeopardize the sustainability of chum salmon.
Adverse impact	There are substantially increased incidental takes of chum salmon
Beneficial impact	Natural at-sea mortality of chum salmon would be reduced – perhaps by the harvest of a predator or by the harvest of a species that competes for prey.
Significantly adverse impact	A significantly adverse impact would be reasonably expected to jeopardize the sustainability of chum salmon
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the Bering Sea pollock fishery on chum salmon, and significantly beneficial impacts are not defined for these species.
Unknown impact	Not applicable

Note these criteria were modified from those employed in the 2006-2007 groundfish harvest specifications environmental assessment/final regulatory flexibility analysis (EA/FRFA).

5.5.1 Pollock fishery bycatch of Chum salmon under Alternative 1

The majority of non-Chinook bycatch in the Bering Sea occurs in the pollock 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 2005 the pollock fishery contribution to the total non-Chinook bycatch has ranged from 88% in 2010 to 99.3% in 2005. Total catch of non-Chinook salmon in the pollock fishery reached an historic high in 2005 at 704,552 fish (Table 5-12). Bycatch of non-Chinook salmon in this fishery occurs almost exclusively in the B season.

Table 5-12. Non-Chinook (chum) salmon mortality in BSAI pollock directed fisheries 1991-2012. Updated 1/14/2012.

Year	Annual with CDQ	Annual without CDQ	Annual CDQ only	A season with CDQ	B season with CDQ	A season without CDQ	B season without CDQ	A season CDQ only	B season CDQ only
1991	Na	28,951	na	na	na	2,850	26,101	na	na
1992	Na	40,274	na	na	na	1,951	38,324	na	na
1993	Na	242,191	na	na	na	1,594	240,597	na	na
1994	92,672	81,508	11,165	3,991	88,681	3,682	77,825	309	10,856
1995	19,264	18,678	585	1,708	17,556	1,578	17,100	130	456
1996	77,236	74,977	2,259	222	77,014	177	74,800	45	2,214
1997	65,988	61,759	4,229	2,083	63,904	1,991	59,767	92	4,137
1998	64,042	63,127	915	4,002	60,040	3,914	59,213	88	827
1999	45,172	44,610	562	362	44,810	349	44,261	13	549
2000	58,571	56,867	1,704	213	58,358	148	56,719	65	1,639
2001	57,007	53,904	3,103	2,386	54,621	2,213	51,691	173	2,930
2002	80,782	77,178	3,604	1,377	79,404	1,356	75,821	21	3,583
2003	189,185	180,783	8,402	3,834	185,351	3,597	177,186	237	8,165
2004	440,468	430,271	10,197	424	440,044	395	431,925	29	8,119
2005	704,552	696,859	7,693	578	703,974	546	693,806	32	10,168
2006	309,630	308,428	1,202	1,323	308,307	1,258	300,646	65	7,661
2007	93,783	87,303	6,480	8,510	85,273	7,354	84,136	1,156	1,137
2008	15,267	14,834	434	319	14,948	246	9,624	73	5,324
2009	46,127	45,178	950	48	46,080	48	45,719	0	361
2010	13,222	12,696	526	39	13,183	39	12,233	0	950
2011	191,445	187,676	3,769	122	191,323	111	190,797	11	526
2012	22,213	22,012	201	11	22,202	10	22,002	1	200

Non-CDQ data for 1991-2002 from bsahalx.dbf
Non-CDQ data for 2003-2010 from akfish_v_gg_pscnq_estimate
Non-CDQ data for 2011-2012 from akfish_v_gg_txn_primary_psc
CDQ data for 1992-1997 from bsahalx.dbf
CDQ data for 1998 from boatrate.dbf
CDQ data for 1999-2007 from akfish_v_cdq_catch_report_total_catch
CDQ data for 2008-2010 from akfish_v_gg_pscnq_estimate_cdq
CDQ data for 2011-2012 from akfish_v_gg_txn_primary_psc
Starting in 2011, the sampling method for salmon in BSAI pollock directed fisheries changed to census counts.
A season - January 1 to June 10
B season - June 11 to December 31

The spatial distribution of bycatch rates for chum salmon (chum salmon/t of pollock) from 1991-2010 shows the impact of the high bycatch year (2005) particularly the different pattern in the early part of the summer compared to the period after July (Figure 5-20). Currently the Chum Salmon Savings Area is invoked for the month of August annually and in September when triggered. However, starting in 2006, the fleet has been exempt from these closures because of their participation in the salmon bycatch reduction intercooperative agreement, which was implemented in 2006 (under an exempted fishing permit) and in regulation in 2007 under Amendment 84.

Bycatch by sector from 1997-2012 is summarized in Table 5-13. Annual percentage contribution to the total amount by year and sector (non-CDQ) from 1997-2012 is summarized in Table 5-14.

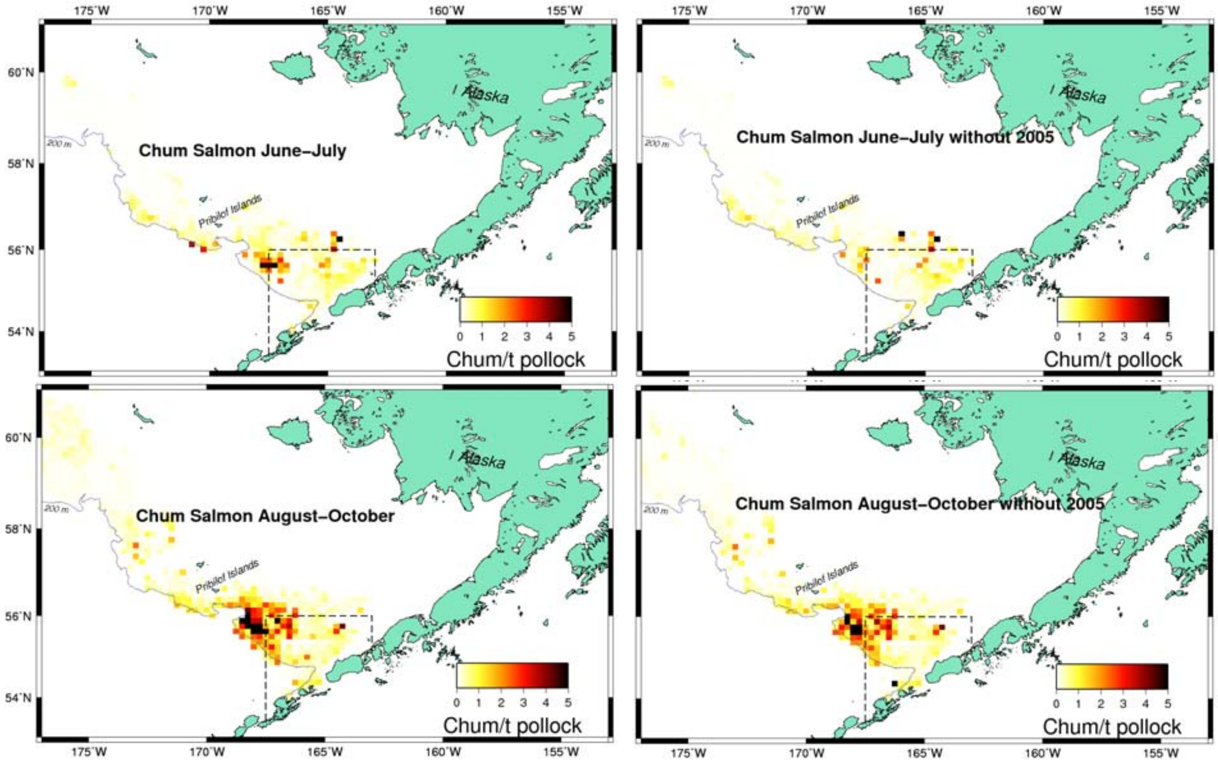


Figure 5-20. Chum salmon bycatch rates (numbers per t of pollock) for 2003-2010 data (left panels) and with the 2005 data omitted (right panels) by months within the B-season. Catcher Vessel Operational Area (CVOA) is represented by dashed line.

Table 5-13. Non-Chinook bycatch in the EBS pollock trawl fishery 1997-2012 by sector. CP = catcher processor, M= Mothership, S = Shoreside catcher vessel fleet. CDQ = community development quota (note this does not represent the sector which caught the fish in this listing). For confidentiality reasons CDQ catch by sector since 2008 cannot be listed separately. Data through 01/14/2012 Source NMFS catch accounting

Year	CP	M	S	CDQ (total)	Total
1997	23,131	15,018	23,610	4,229	65,988
1998	8,119	6,750	49,173	0	64,042
1999	2,312	212	42,087	661	45,271
2000	4,930	509	51,428	1,704	58,571
2001	20,356	8,495	25,052	3,103	57,007
2002	9,303	13,873	54,002	3,474	80,652
2003	22,785	11,894	146,104	8,356	189,138
2004	76,134	13,330	340,807	10,197	440,468
2005	62,963	15,312	618,584	7,693	704,552
2006	18,066	2,010	288,352	1,202	309,630
2007	27,198	5,424	54,680	6,480	93,783
2008	1,562	641	12,631	434	15,267
2009	3,901	1,733	39,544	950	46,127
2010	2,101	1,070	9,525	526	13,222
2011	44,356	24,399	118,921	3,769	191,445
2012	1,934	978	19,100	201	22,213

Table 5-14. Percent of total annual non-Chinook salmon catch by sector by year 1997-2012 (CDQ not included in sector totals) CP = catcher processor, M= Mothership, S = Shoreside catcher vessel fleet.

Year	CP	M	S
1997	35%	23%	36%
1998	13%	11%	77%
1999	5%	0%	93%
2000	8%	1%	88%
2001	36%	15%	44%
2002	12%	17%	67%
2003	12%	6%	77%
2004	17%	3%	77%
2005	9%	2%	88%
2006	6%	1%	93%
2007	29%	6%	58%
2008	10%	4%	83%
2009	8%	4%	86%
2010	16%	8%	72%
2011	23%	13%	62%
2012	9%	4%	86%

5.5.1.1 Bycatch under RHS/Inter-cooperative Agreement

An analysis has been prepared which evaluates the efficacy of the current RHS program at reducing bycatch. A summary of the findings are provided here as well as further explained in conjunction with Alternative 3. This analysis provides an evaluation of the status quo chum PSC reduction measures. Identifying the means to evaluate the efficacy of the rolling hotspot program helps in defining the current status quo conditions of the fishery whereby bycatch is being reduced by the RHS compared with having no management measures in place for chum. These results are also provided in order to provide a comparison of PSC reduction measures under the other 3 alternatives and in particular to compare estimated bycatch reduction of the current RHS program (Alternative 1) with the revised program being proposed (Alternative 3). The full evaluation of the RHS program components 2003-2011 and a discussion of historical evaluations from the pre-RHS time frame 1993-2000 is contained in Appendix 7.

Since 2001, there has been an inter-cooperative agreement (ICA) among pollock cooperatives to impose short-term “hot spot” closures designed to limit chum salmon PSC in the Bering Sea pollock fishery. A description of the current ICA including modifications made to it since 2005 is contained in Appendix 2. Sea State, Inc. is hired by the pollock industry to analyze the National Marine Fisheries Service (NMFS) Observer Program data, vessel monitoring system (VMS) data, and other real-time data to relay information to the fleet and to implement hotspot closures. Since August 2006, following approval of Amendment 84 by the Council[34], these rolling hotspot (RHS) closures have been the only chum-related PSC restrictions on the pollock fishery.

The three panes of Figure 5-21 show the locations of RHS closures in the Bering Sea at different points in the B Season from 2003-2011 (left panel), in the high-chum year of 2005 (middle), and the low-chum year of 2009 (right). The closures have been imposed on much of the pollock fishing grounds at different points during the period of analysis.

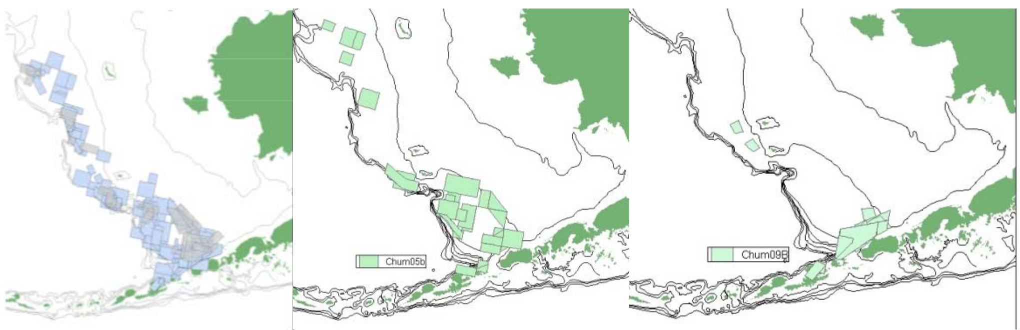


Figure 5-21. RHS B Season Closures 2003-2011 (left), 2005B (center) and 2009B (right)

As described in section 2.1.3, the rolling hotspot program serves both informational and regulatory functions. If vessels perceive a strong enough incentive to avoid chum PSC, there would be little necessity for the *regulatory* function of hotspot closures, because vessels would avoid fishing in locations where they would expect to have high PSC.

Under the existing system, the direct costs of high chum PSC – and the benefits of avoiding chum PSC – are not born by the individual vessels or companies and some vessels have had much higher chum PSC rates than others, in part due to their choices to fish in areas where there have recently been high PSC hauls. As well as informing vessels about where PSC rates are high, the hotspot system restricts vessels from fishing in what have recently been the highest PSC areas, thus providing a dynamic means to regulate chum PSC in the fishery.

This analysis attempts to address the following questions. Has chum salmon been reduced by the RHS system, and if so, how much chum salmon has been avoided beyond what would have occurred without the system?

[34] Note that the exemption was implemented via an EFP in the B season of 2006 and was implemented by regulation following Secretarial approval of Amendment 84 in January 2007.

In order to evaluate these questions, the mechanisms though which the RHS hotspot system could lead to salmon PSC reduction had to be identified. The primary mechanisms include:

1. Closing an area causes vessels in an area to move to other areas, hopefully with lower PSC.
2. The awareness by vessel operators that an area may be closed could lead to a reduction in fishing effort in the soon-to-be closed area immediately prior to the closure.
3. Preventing additional fishing from occurring in the area during closure periods by other vessels after the closure is put in place.

The mapping and information sharing that is part of the system (as described in Section 2.1.2) also facilitates more informed decision-making, though how this affects behavior is difficult to measure.

The estimated amount of salmon saved or avoided due to the status quo is equal to the PSC that would have resulted if vessel operators had fished in a closed area minus what actually occurred when the vessels fished outside the closures. It's important to note that this measure is the impact on the fleet as a whole – not just the vessels that were in the area prior to it being closed. Many of the vessels in an area prior to a closure would not have returned and other vessels could have visited the area had it been open.

Some RHS closures are extended multiple times, for periods of up to several weeks. A challenging part of this analysis is the estimation of how much salmon would have been caught if fishing had occurred inside of the closed areas when closures were in place for longer time periods. An additional challenge is that because this method of analysis examines changes relative to when closures are implemented, it's possible that as a result of closures, high PSC never occurred so there's no change to pick up in a statistical analysis. However, an examination of historical PSC patterns suggests that the magnitude of this type of PSC reduction is unlikely to be very large.

Importantly, there may be disproportionate gains in just a few of the highest PSC periods that are not well-measured by the examination of all of the closure areas via averaging. However, there are also other times when these methods may over-estimate PSC that would have occurred, either because PSC rates or fishing activity in an area would have declined even without the closure. Similarly, as with fixed closures, hotspot closures may, at times, cause vessels to choose to fish in areas that have higher PSC than if they had remained in the closure.

To evaluate the effectiveness of the hotspot system, we estimate the change in the overall PSC rate for the entire fishery at the time that closures are implemented relative to the period immediately prior to the closures being implemented, controlling for the fact that different vessels were in the closures at different time periods. This analysis draws upon a literature in economics and statistics called regression discontinuity design that focuses on evaluating the effectiveness of different programs (e.g., Thistlewaite and Campbell (1960), Davis (2008), and Lee and Lemieux (2009)). There is an extensive and active literature in economics, statistics, and other fields that is still expanding this methodology, but the basic idea is that even in the presence of highly dynamic processes such as PSC, we can focus upon the change near to a management action to isolate the effect of a policy measure, in this case the imposition of the hostspot closure areas. By examining the PSC rates in the days right before and right after closures have been implemented, we are able to focus on the impact of the closures in changing the PSC rates.

In considering what methodology is most appropriate, a key consideration is the fact that while only some vessels were in a closure area before a closure, *the closures potentially have an impact on the whole fleet because they also prevent vessels from entering.* All vessels would have had some probability of fishing in the closed area after the closure. To answer the question of how effective the RHS program is, we want to know the average impact on the fleet, which is what is assessed here.

There are some limitations to this approach. First, attributing the effectiveness of the RHS system to the overall change in PSC rate may not always account for seasonality, short-term trends in the fishery, or potentially high-PSC areas that have been avoided. In periods of increasing PSC, a hotspot closure might dramatically reduce PSC relative to what would have occurred; however, due to the movement of chum salmon the rate after a given closure might nonetheless be higher than prior to the closure. If we focus on period right around closures, we can still measure the change in chum PSC that occurs when closures are implemented. This is a better measure of overall effectiveness than the impact of any particular closure which will be more swayed by random high-PSC episodes.

If the RHS closures are effective, there should on average be some visible impact on chum PSC when we compare the PSC rates immediately before and after the closures are implemented. Controlling for variation in PSC levels and the vessels participating at different points, the magnitude of this effect can be statistically tested.

An obvious challenge of this analysis is that fishing inside closures is not observed. In order to gain insight into what would have happened inside of closures had they not been closed, this analysis also examines the pre-RHS (1993-2000) period, so that the dynamics of high-PSC areas can be observed in periods when closures were not in place.

The changes in chum PSC that resulted after B-season closures are estimated by use of PSC data before and after all of the closure periods.[35] These changes are estimated for each closure *period* rather than each closure area to minimize double-counting. If two closures are in place at the same time, the salmon and pollock inside either closure are totaled and considered to be inside the closure area and the salmon and pollock caught outside of the areas are considered outside.

Chinook closures were given a priority later in the year, so that while chum closures were sometimes in place late in the year, these closure periods were not very focused on chum. Therefore, we consider the effectiveness of chum RHS closures for two, overlapping periods:

- June – August (early season), and
- B-season (All B-season).

Before carefully modeling the impact of the closures, controlling for vessel and annual variation, the average changes from before to after the closures are examined. There is, on average, a small drop in PSC rate in the days immediately following the implementation of RHS chum closures.

Figure 5-22 displays the average chum PSC rates for the three days before and after chum closures are implemented. In the figure, the larger drop is visible in the right hand panel. The pre-RHS analysis, below, provides a means to estimating the total salmon saved. Details on this method are discussed below.

[35] Additionally, we limit the analysis to all closure periods in which there was a least one chum bycatch closure in place (i.e., not periods with only Chinook closures).

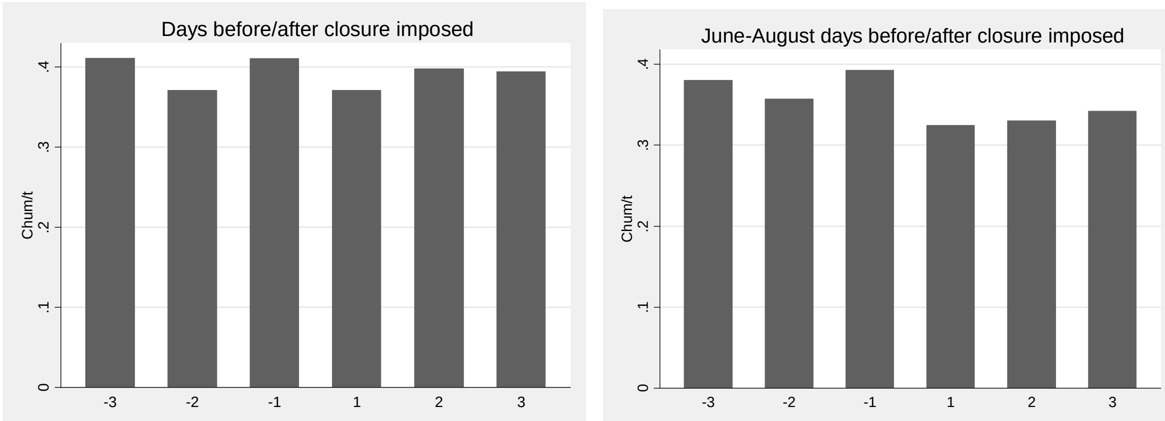


Figure 5-22. Chum PSC / MT Before & After Closures Implementation 2003-2011.

Table 5-15 shows the most dramatic reductions observed after RHS closures appear to be in 2004 and 2006. However, the table also displays that there is no reduction on average in the days following closures for several days. Because there is on average 1/9 as much data at the annual level as in the aggregate comparison, several large increases in PSC after a closure have a larger impact on the annual results than the aggregate. Additionally, in early low chum PSC years there are fewer closure periods so the impacts of any extreme event would be magnified in this table.

Table 5-15. Average chum PSC rate for the 3 days before and after Chum RHS closure periods, Individual Years, 2003-2011

Day Relative to	Year									
Closure	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Total**
-3	0.239	0.486	0.862	0.497	0.141	0.03	0.103	0.058	0.41	0.411
-2	0.253	0.386	0.782	0.529	0.128	0.059	0.095	0.056	0.331	0.371
-1	0.285	0.465	0.841	0.544	0.176	0.053	0.127	0.054	0.352	0.411
1	0.39	0.311	0.712	0.35	0.147	0.066	0.192	0.035	0.435	0.371
2	0.227	0.385	0.753	0.423	0.133	0.027	0.204	0.119	0.493	0.398
3	0.242	0.418	0.821	0.473	0.199	0.033	0.142	0.033	0.396	0.395
Total	0.273	0.408	0.795	0.467	0.154	0.045	0.144	0.059	0.404	0.393

Table 5-16. Average chum PSC rate for the 3 days before and after Chum RHS closure periods beginning in June-August, Individual Years, 2003-2011

	Year									
Days Before/ After VRHS	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
-3	0.15	0.379	0.89	0.536	0.096	0.025	0.104	0.057	0.39	0.38
-2	0.176	0.359	0.794	0.57	0.107	0.036	0.094	0.055	0.34	0.357
-1	0.12	0.48	0.832	0.575	0.167	0.04	0.122	0.053	0.358	0.393
1	0.093	0.275	0.695	0.369	0.113	0.06	0.188	0.032	0.425	0.325
2	0.095	0.312	0.676	0.461	0.08	0.018	0.199	0.038	0.38	0.33
3	0.139	0.322	0.811	0.527	0.107	0.021	0.122	0.03	0.306	0.342
Total	0.128	0.353	0.782	0.504	0.112	0.033	0.138	0.044	0.368	0.354

This analysis displays the mean change, but in estimating the effect of the closures, it does not account for several conflating factors. First, there are differences in the vessels fishing before and after the closures, so the mean may be influenced by whether vessels that commonly fish in higher PSC areas are before or after closures. Second, there are very different absolute levels across years and periods of the year. We thus control for closure-level variation. In alternative models, we also included year and month controls which provided comparable results but with less explanatory power. Figure 5-23 displays the estimated reduction in PSC resulting from the RHS closures for the days following the closures compared to the days before the closure, based on a negative binomial or glm regression. For the entire B-season, the average of these periods is 9 percent; for June-August, the average is 15 percent. The annual model is significant at the 90 percent level when comparing the day before to the day after closures, while all of the other regression results are significant at the 99 percent level; additional details of the analysis are provided in Appendix 7.

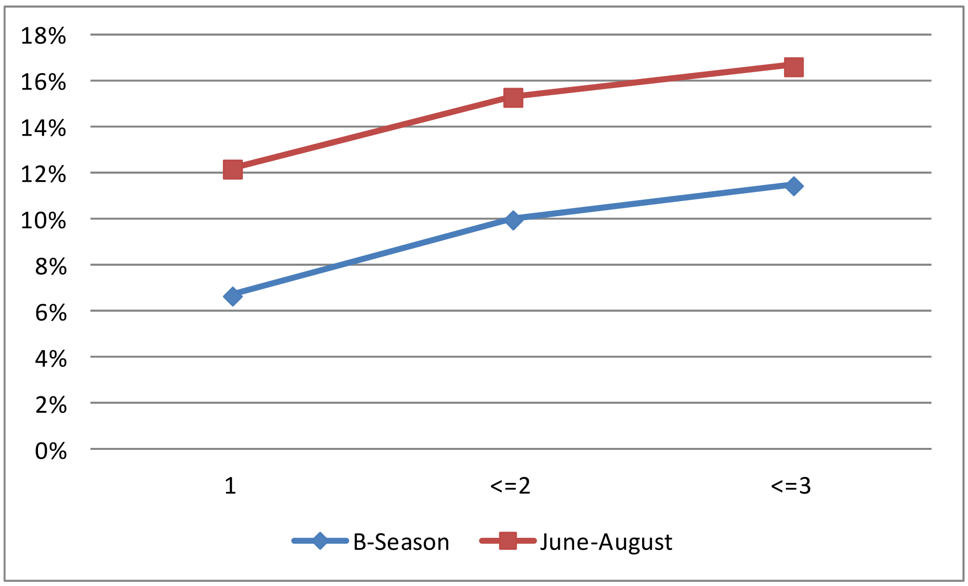


Figure 5-23. Estimated mean reduction in chum PSC for the days following RHS closures versus before, with period and vessel controls, 2003-2011.

The results of this section suggest that RHS Program has led chum PSC reduction in the periods from before to after the closures. A major challenge of this evaluation is, of course, that it is unclear what levels of chum PSC would have occurred if there had been no RHS closures in place. From 2001-2011, one can observe how rates change around closures but it's impossible to observe how PSC would have occurred without closures.

Therefore, to better understand chum PSC without closures the years from 1993-2000 are examined, prior to implementation of any voluntary closures. The advantage of using data from this period is that they are unaffected by closures. This complements the information gained from examining the current RHS system because reactions to actual closures were observed and a statistically significant reduction in chum PSC following the closures were apparent. Analysis of the earlier pre-RHS system allows estimation of season-long impacts of hypothetical RHS-like closures. So as to limit confusion with the existing RHS system, the model of the RHS closure applied to the earlier data will be referred to as the PRHS system (for pre-RHS system).

For the wide range of closure variables presented here, the net impact of almost any combination of closures is some average reduction in chum PSC. The annual and total average reduction in chum PSC resulting from the high, baseline, and low impact models are displayed in Table 5-17. The baseline model estimates 14.5 percent of chum would have been avoided with a RHS-like system in place from 1993-2000. The annual variation in average benefits is 4-28 percent, though in some PRHS configurations, the annual benefits may be close to zero or larger than the averages. Results indicate that the hypothetical PRHS system would have reduced chum PSC.

Table 5-17. Percent chum reduced per year with different with different PRHS configurations, 1993-2000.

	Baseline		High-end		Low-end	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1993	0.147	0.062	0.237	0.028	0.087	0.04
1994	0.132	0.053	0.206	0.044	0.104	0.044
1995	0.044	0.025	0.048	0.025	0.043	0.035
1996	0.147	0.116	0.238	0.049	0.076	0.052
1997	0.133	0.049	0.172	0.024	0.085	0.027
1998	0.123	0.071	0.198	0.032	0.069	0.045
1999	0.159	0.06	0.245	0.063	0.077	0.056
2000	0.277	0.098	0.404	0.045	0.167	0.091
Total	14.5%	0.093	21.9%	0.101	8.9%	0.062

Table 5-18 displays the average amount of pollock relocated per year under the three different models. Under the different models, 4-10 percent of pollock would have been relocated in the historical RHS simulation.

Table 5-18. Percent pollock reallocated per year with different with different PRHS configurations, 1993-2000

	Baseline		High-end		Low-end	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1993	0.081	0.034	0.122	0.013	0.054	0.02
1994	0.088	0.046	0.128	0.02	0.065	0.039
1995	0.039	0.02	0.043	0.019	0.035	0.027
1996	0.066	0.029	0.095	0.009	0.04	0.013
1997	0.087	0.043	0.127	0.018	0.048	0.021
1998	0.063	0.026	0.081	0.017	0.039	0.016
1999	0.038	0.022	0.058	0.025	0.013	0.006
2000	0.09	0.04	0.124	0.04	0.048	0.022
Total	6.9%	0.039	9.7%	0.038	4.3%	0.026

For the baseline PRHS configuration, more chum PSC are avoided with larger closures (Table 5-19 and Figure 5-24). However, as the number of closures exceeds three statistical areas, the benefits diminish while the amount of pollock relocated continues to increase. Also, with large closure areas uncertainty on how vessel operators will react increases.

Table 5-19. Estimated annual chum PSC reduction from different size hotspot closures under the baseline PRHS system, 1993-2000.

Avg. % Chum reduced per year

	Maximum number of area(s) closed						
Year	1	2	3	4	5	6	7
1993	0.105	0.188	0.249	0.279	0.303	0.32	0.328
1994	0.089	0.162	0.215	0.226	0.24	0.255	0.259
1995	0.037	0.053	0.069	0.076	0.082	0.084	0.088
1996	0.098	0.281	0.379	0.442	0.472	0.49	0.494
1997	0.047	0.139	0.199	0.228	0.263	0.296	0.315
1998	0.075	0.152	0.187	0.202	0.21	0.217	0.22
1999	0.134	0.182	0.219	0.241	0.25	0.252	0.252
2000	0.246	0.308	0.33	0.349	0.356	0.357	0.358
Total	10%	18%	23%	26%	27%	28%	29%

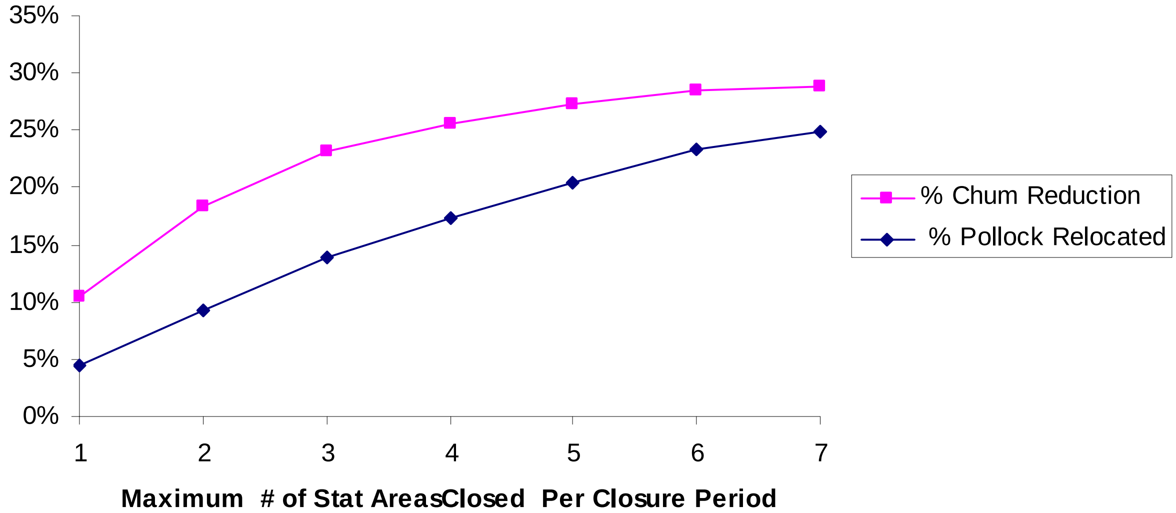


Figure 5-24. Percentage reduction in Chum PSC and pollock reallocated with different sized closures.

Several issues are worth noting about factors that potentially influence the estimated salmon reduction upwards, downwards, or in an unknown direction.

Features that have an unknown impact on the reduction estimates:

- *The smaller, targeted nature of the RHS closures.* On the one hand, the smaller closures can target hotspots that cross multiple statistical areas, but smaller areas are also closed in the current RHS system, leaving more area open.
- *AFA.* While this period was primarily before the American Fisheries Act (AFA), the daily PSC variation in the fishery does not appear to have changed significantly. The RHS was only possible with intercooperative agreements (ICAs) after the AFA, but the impact on fishing behavior is unclear. The AFA allows vessels to travel further in search of more valuable fishing without losing a share of the total catch, but this has the potential to influence closure effectiveness in either direction.
- *The Steller Sea Lion Conservation Area (SCA Emergency Closure in 2000).* The highest reduction in the analysis occurred in this year, which catcher vessel effort was reallocated for much of this year.

- *Average Chinook and Chum PSC levels were much higher from 2003-2011* than in the previous decade.

Features that could lead to an understatement of estimates of hotspot reductions:

- Sea State balances available information, historical experience, and predictions about how salmon are likely to move to implement closures, while these historical PRHS-like closures uses a window of information in recent days to design closures.
- Unmeasured PSC may occur because vessels may plan to start fishing outside of a RHS closure after it is announced, which is not accounted for in the historical PRHS simulations.

Features that could lead to an overstatement of estimates of hotspot reductions:

- PSC rates are assumed to be the daily average rate for the sector on each day of relocation. Examining the PSC rates from 2003-2011 of vessels that are moved out of RHS closures, they have higher than average rates. However, for CVs, an unknown portion of this increase is due to how salmon from a trip that starts and ends after a closure are divided between all hauls of a trip, so some portion of this different may be due to accounting.
- The areas closed by the simulation can be much larger at times than the actual RHS closures, especially when two high PSC areas are closed in core catcher vessels fishing areas. The "low-end" estimate only closes one area to attempt to account for this.

How do 2003-2010 Chinook and chum PSC closures interact?

The pre-RHS historical simulation analysis suggests that targeting Chinook and chum reduction is in general complementary. Here we focus upon 2003-2010 and discuss the interaction of some of the Amendment 91 and chum PSC measures below.

In choosing where to implement RHS closures for Chinook and chum PSC reduction, SeaState recognizes that there are periods when trade-offs between and Chinook and chum PSC occur, which is occasionally noted in SeaState reports to the fleet. For example, the following description is from the 8/27/07 SeaState report to the fleet: "*The Chinook bycatch is 30% less than we had last year by this time (despite having taken 25,000 mt more pollock this season to date) and the chum bycatch is only 14% of what it was last year at this point. Unfortunately, we don't get to relax. We are not changing the Chinook closures to the north as they seem to have done a good job of reducing Chinook catches. I'm afraid that if we shifted the closures around to slow down the chum bycatch we might then see boats back in the current closures and catching more Chinook.*"

On the other hand, there are times when there are areas that have elevated levels of both species in the same locations, so closing an area is expected to reduce both chum and Chinook. For example, in mid-August 2006, a closure was put in place for 4 days as a Chinook closure but was later extended as a chum closure.

To provide some additional insight into whether or not chum and Chinook RHS closures complement one another, we examine the correlation between the PSC rate in and out of each closure period for each species. The correlation for all B-season closure periods from 2003-2009 is found to be 0.57. If it were consistently necessary to trade-off chum and Chinook PSC when creating hotspot closures, we would expect to see a negative correlation between these ratios. While more extensive analysis could reveal more information about when there are conflicts between reducing chum and Chinook PSC, the positive correlation suggests that chum and Chinook PSC reduction through existing RHS closures is, in general, complementary. The limits of this relationship are discussed below.

Examination of 100 percent impact on 2011 PSC rates

A number of elements of the fishery changed in 2011 with Amendment 91 protections being imposed to reduce Chinook PSC. One significant change in the fishery is that all vessels have 100-percent observer coverage. An examination of the expanded coverage is provided in Appendix 7. <u>The analysis indicates that this was not a significant factor in 2011 being a relatively high PSC year.</u>

What is the likely interaction of status quo measures with Amendment 91 measures?

The new Amendment 91 measures provide additional incentives to the pollock fishery to avoid Chinook salmon PSC. Amendment 91 has two principal components for Chinook avoidance: a hard cap on the number of Chinook that can be caught each year, and incentive plan agreements (IPA) that provide additional incentives for Chinook PSC avoidance at all PSC levels including those well below the hard cap level.

The IPAs are different for each sector but all provide a mandate that vessels stay below the sector-specific hard cap. In addition to other measures, a Rolling Hotspot Program (RHS) for Chinook PSC is part of the IPAs for all sectors. Thus there may be closures in place for Chinook PSC reduction as well as any fixed or rolling closures intended for chum PSC reduction.

As well as changing Chinook-avoidance incentives, Amendment 91 also changes the incentive to avoid Chinook *relative* to chum – vessels do not pay an individual cost of chum, but do for Chinook – therefore vessels will be likely to choose to fish in high chum grounds with zero Chinook over low chum grounds with any Chinook in them.

How will A91 measures interact with current or potential future chum PSC avoidance measures? The presence of the Amendment 91 measures mean that fixed or hotspot chum closures have the *potential* to be more expensive for the fleet and lead to higher Chinook PSC. Similarly, the Chinook PSC measures could make it more costly and/or difficult for vessels to avoid high chum PSC area. If a vessel exceeds its available Chinook salmon PSC and is unable to obtain access to additional PSC, then it will be unable to continue to fish for pollock in a given year. Similarly, there is the potential that vessels would be forced by chum area closures to fish in high Chinook areas if low Chinook PSC fishing grounds are closed by chum closures. However, as discussed above, Chinook and chum PSC are significantly positively correlated from 2003-2010 and the pre-RHS analysis also suggests that on average targeting low PSC of one species is likely to reduce PSC of the other species.

With Amendment 91, the Chinook RHS program was taken out of regulation. However, as part of the IPAs that have been implemented in all three sectors (with 100% of vessels), a Chinook RHS system is in place. These closures applied to different vessels depending on their PSC performance compared to the "base rate" for the sector. The mothership closures that were implemented applied to one platform, the CP closures were closed to one vessel, and the shoreside closure applied to 12 vessels. Additional "advisory areas" were also distributed to the fleets. Figure 5-25 displays the Chinook RHS closures that were in place for the different sectors during 2011, which are in addition to the hard cap and other IPA components that are discussed in Chapter 2 of the EA.

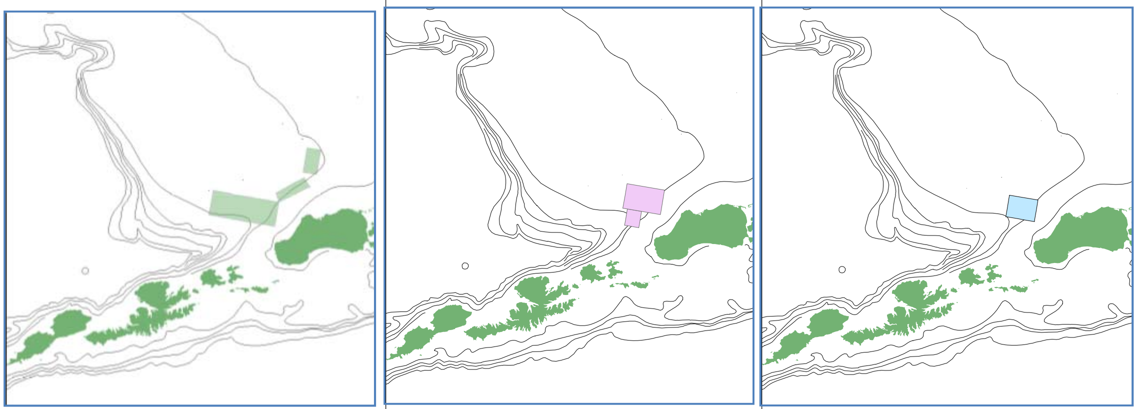


Figure 5-25: Chinook Rolling Hotspot Closures, 2011 B-Season for the Mothership Sector (Left Panel), Catcher Processor sector (Middle) and Catcher vessel sector (Right). Additional high-Chinook advisory areas were also communicated to the fleet.

Sea State carefully weighs the need to reduce PSC of both species in its decision making. Any type of fixed closure system would eliminate this flexibility, which is also the case with the Chum Salmon Savings Area. As discussed above, in general high chum and Chinook PSC areas that become RHS closures tend to be correlated.

A brief analysis of the potential impact of the B-Season Chinook Conservation Area (BCCA) is presented in Appendix 7. These results suggest that there is little evidence to suggest the BCCA is likely to have a significant impact on chum PSC. For the two years where fishing occurred in the BCCA, there was considerably higher PSC in the area in 2004 but only for 8 hauls. In 2007, there was slightly lower PSC in the area. Most years there was no fishing in this area during the closure period.

Additional Flexibilities of RHS System

While the RHS system's primary purposes are to identify high PSC areas, convey PSC information to the fleet, and to close those areas with the highest rates, reading the SeaState reports reveals that SeaState attempts to use all available information to most effectively implement closures. Here are several examples that illustrate the type of information that is utilized in closure designation and how the information is interpreted.

The 8/2/07 SeaState report illustrates how near real-time VMS data is used to supplement observer data: "East of 168 we have elevated rates in 655600 and a couple of reports of high-bycatch tows from that area as well. None of this is showing up in observer data, so we are stuck with making the closure based on VMS coverage of the vessels involved."

The 8/27/07 report shows the nuance of trying to separate low-PSC fishing from higher PSC areas: "*Finally, I think boats that visited 675500 and 675530 might have picked up some chums there as well, but again they fished in multiple areas and reports from the grounds are conflicting. The amount of pollock taken in those areas is so low that the areas don't even reach the "2% of pollock catch" threshold to be included in our bycatch rates tables. However, if you do try those areas you might want to wary because fishing is almost never clean out near edge in those stat areas. It can be OK in a bit from the edge (in, say, 70 – 75 fm), and that's where the fishing took place, but the boundary between areas of high and low bycatch can be pretty abrupt.*"

Figure 5-26 below, shows the overlapping closures that were put in place from mid-August to early-October, 2009. This was a low-PSC period but the closures were repeatedly moved to close areas with the highest PSC at the time.

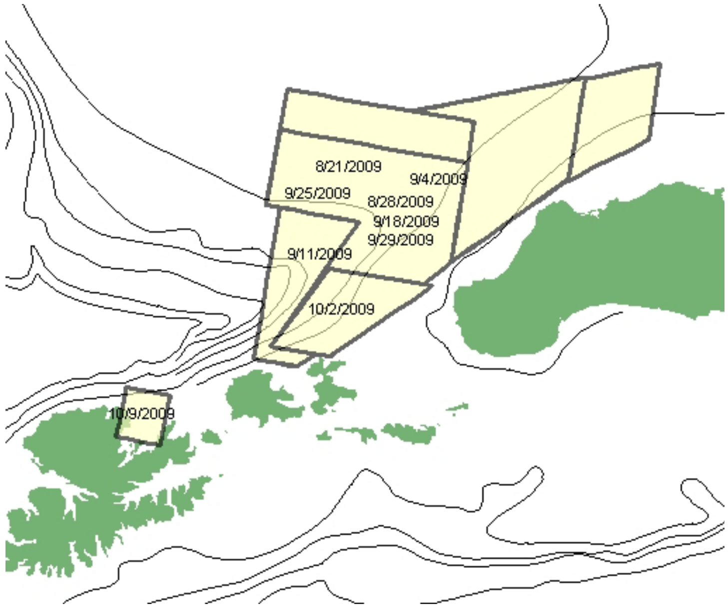


Figure 5-26. Shifts in late summer 2009 Closures illustrate SeaState efforts and ability to adjust to changing PSC hotspots

Summary of Findings on Status Quo Chum PSC-reduction measures

Collectively, the Chinook and chum salmon PSC measures implemented through the RHS system and Amendment 91 arguably represent the most extensive PSC reduction efforts that have been undertaken. In this analysis, we concentrate on the RHS components of the chum PSC reduction measures. A number of relevant findings are summarized below.

Key findings of the status quo current-period and historical analysis include:

- Chum PSC has been reduced by the chum RHS program. Looking at the change in rates following the RHS closures, the reduction is several percent, but this number is larger after controlling for vessel and closure-specific effects. The reduction in chum PSC is also larger in the June-August period than in the B-season as a whole. However, in 2011, there was not an observable average chum PSC reduction from the RHS program.
- From 2003-2011, chum PSC rates for the entire B-season in the 1-3 days following RHS closures are approximately 9 percent lower than in the 1-3 days before, after controlling for vessel- and closure-specific variation. For June-August, this average PSC reduction was 15 percent.
- Evaluating the 1993-2000 period, an RHS-like system would have reduced chum PSC by an estimated 9-22 percent on average with about 4-10% percent of pollock fishing have been relocated to other areas.
- The current period RHS analysis provides an estimate of the impact soon after the closures, but it does not account for some reduction that may occur when closures are left in place for a long period of time. However, closures are typically left in for long periods in times of relatively low chum PSC, so the majority of chum typically occurs in periods when closures are moved to address new hotspots. Further, the reduction farther away from the closures is likely to be less substantial, as the closures will usually have less impact on fishing choices as the fleet readjusts. So it is reasonable in light of these analyses, including the historical simulations, to estimate that the total chum PSC reduction to be in the range of 10-15 percent.
- Annual average share of chum PSC *caught in the* closures in the 5-days before closures were imposed from 2003-2011 ranged from 11-36 percent for CVs and from 2-32 percent for other sectors, with the majority of years being in the upper end of this range for CVs. The average

percentage of pollock range caught in the closures areas during this period ranged from 7-21 percent for CVs and was 6 percent or less for the other sectors.

- The pre-RHS analysis suggest that often 'what's good for chum is good for Chinook' with the range of Chinook PSC savings as 6-14 percent per year when areas are closed because of high chum rates only.
- Based on 1993-2000 data, increasing the number of closures always reduces salmon PSC more, but at the cost of reallocating additional pollock effort per unit of PSC avoided.
- Closures based on the most recent information possible lead to larger average reductions and moderately small base rates appear on average to be more effective. At a very low PSC level, closures do not appear to be effective.
- The current "tier system" of the RHS program allows cooperatives with low PSC relative to the base rate to fish inside closed areas. This could provide some incentive for cooperatives to have lower chum PSC rates in order to be able to fish in closed areas, though these vessels often choose to fish elsewhere regardless of tier status. *During closure periods, 4.6 percent of CV pollock and 0.3 percent of pollock by the other sectors was taken inside the closure areas.* Thus there is little evidence that the incentives within the current tier system are likely to provide strong motivation for chum PSC reduction.
- An examination of the chum PSC rates in the chum Salmon Savings Area (SSA) indicates that in over 90 percent of months from 2003-2010, chum PSC rates were *lower* in the Chum SSA than outside of it, suggesting that a trigger closure of this area could be actually increase chum PSC.
- An evaluation of the B-season Chinook Conservation Area (BCCA) which is imposed by the CP/MS/CDQ incentive plan agreement (IPA) suggests that there is little evidence to suggest the BCCA is likely to have a significant impact on chum PSC rates.
- In 2011, chum RHS closures were in place throughout the B season, whereas in previous years Chinook closures were explicitly given regulatory priority. Additionally, in 2011 all vessels had 100 percent coverage and salmon was censused in the plant. This did not appear to affect chum reduction.
- As well as changing Chinook-avoidance incentives, Amendment 91 also changes the incentive to avoid Chinook *relative* to chum – vessels do not pay an individual cost of chum, but do for Chinook – therefore vessels will be likely to choose to fish in high chum grounds with zero Chinook over low chum grounds with any Chinook in them.

Compared to alternative spatial management systems, the RHS system has advantages and limitations. Key advantages of the hotspot system relative to fixed closures include:

- Sea State has shown the ability to make trade-offs between chum and Chinook PSC and to consider how vessels will respond.
- Adjustments to what areas will be closed can be made regularly in response to the substantial inter-annual variability in the quantity and concentration of PSC. This prevents the possibility that fixed closures would consistently force vessels from low-PSC areas, which is a possibility with any system that cannot adjust.
- Anecdotal information from vessel operators and plant managers can be combined with observer data, VMS data, and knowledge of how seasonal PSC conditions evolve to make well-informed predictions of where salmon PSC will occur in the near-term. For example, from the 8/27/07 SeaState report – "It would be particularly useful to know if there is a temperature front associated with higher or lower PSC, as there was further up on the shelf."
- In balancing the chum and Chinook PSC, the RHS system has demonstrated the ability to carefully balance the trade-offs in a manner that could not be done with fixed closures.

5.5.1.2 AEQ and region of origin impacts under Alternative 1

Applying the AEQ results to the available genetics data requires careful consideration of time and area of genetics sampling relative to actual bycatch. For example, should genetics sampling under-represent an area of high bycatch, then the appropriate ratios must be applied to obtain an unbiased representation of the bycatch by stock of origin. The methods used to estimate stock composition and attempt to correct for potential biases are presented in section 3.2.2.

Results indicate that on average (2005-2009 data) 11% of the AEQ came from coastal western Alaska systems and about 6% of the total bycatch mortality is attributed to the Upper Yukon fall run of chum salmon (Table 3-13). Applying these proportions to conservative run size estimates (compiled from section 5 and omitting systems which were missing run-size information; Table 5-20) indicates that the highest impact rate (chum salmon mortality due to the pollock fishery divided by run-size estimates) was less than 1.7% for the combined western Alaska stocks (Table 5-21). In only three out of 16 years was the impact rate estimated to be higher than 0.7% (Table 5-21). For the Upper Yukon stock, the estimate of the impact is higher with a peak rate of 2.73% estimated on the run that returned in 2006 (with upper 95% confidence bound at 3.70%; Table 5-21 and Figure 5-27). For the SW Alaska region (taken to be from Area M) the estimate of impact rate is the lowest for any of the Alaska sub-regions. The average impact rate (2004-2011) by region (with ranges over this period):

Coastal west Alaska	0.49%	(0.07% - 1.23%)
Upper Yukon	1.26%	(0.17% - 2.73%)
Combined WAK	0.63%	(0.08% - 1.31%)
Southwest Alaska	0.40%	(0.07% - 1.03%)

These impact rates would be the de facto values that might be applicable to sub-regions (or individual rivers). The historical information on stock identification at finer scales is limiting due both to the sampling and to the resolution of the genetic methods used. Overall, comparing AEQ mortality due to bycatch of chum salmon to run sizes and suggests a variable relationship (Figure 5-28). These results indicate even with uncertainties considered, that bycatch of western Alaska chum salmon is likely most affected by the magnitude of returns (Figure 5-29). Sensitivity of impact-rate uncertainty to alternative assumptions about underlying variability indicates that assumed run-size CV has a large impact followed by the precision of genetic analysis whereas uncertainty in AEQ survival rate had a relatively minor effect (Figure 5-30).

For comparison purposes, any of the alternatives which would reduce non-Chinook salmon bycatch would be affecting the impact rates to Alaska systems shown above.

Table 5-20. Estimates of chum salmon run sizes by broad regions, 1991-2011. WAK includes coastal western Alaska and Upper Yukon (Fall run). These values only include regions where estimates were available and may be considered conservative. See section 5 for details and derivation on stocks from these regions. For impact rates and uncertainty, a coefficient of variation of 10% was assumed for these estimates.

	WAK run size	Coastal WAK	Upper Yukon	SW Alaska (escapement only)
1991	3,994,425	2,964,197	1,030,228	1,029,576
1992	3,284,895	2,811,796	473,099	877,674
1993	2,317,635	1,873,932	443,703	955,646
1994	4,821,985	3,882,840	939,145	1,170,604
1995	7,859,471	6,434,764	1,424,707	1,735,854
1996	5,059,317	4,010,706	1,048,611	1,433,400
1997	3,070,893	2,419,498	651,395	1,197,250
1998	3,133,865	2,811,832	322,033	2,771,735
1999	2,623,213	2,208,252	414,961	1,391,480
2000	1,379,043	1,139,744	239,299	1,110,175
2001	2,789,785	2,408,374	381,411	1,557,147
2002	3,545,500	3,121,188	424,312	1,304,489
2003	3,976,035	3,202,539	773,496	958,277
2004	3,937,242	3,324,602	612,640	1,173,828
2005	8,172,150	5,891,716	2,280,434	1,300,567
2006	8,889,338	7,738,349	1,150,989	1,380,181
2007	6,320,768	5,204,218	1,116,550	1,401,451
2008	5,283,734	4,378,634	905,100	997,037
2009	4,651,320	4,075,589	575,730	750,821
2010	4,693,153	4,086,792	606,360	
2011	5,739,776	4,533,335	1,206,441	
Median	3,994,425	3,324,602	651,395	1,197,250

Table 5-21. Estimated median impact of the pollock fishery (based on regional AEQ estimates from Table 3-13) on chum salmon assuming run size estimates presented in Table 5-20 (with an assumed 10% CV) by broad regions, 1994-2009. WAK includes coastal western Alaska and Upper Yukon (Fall run). Italicized values are extrapolated from 2005-2009 stratum-specific mean bycatch stock composition estimates and as such have higher levels of uncertainty. They do account for the amount of bycatch that occurred within each stratum and the estimates of total run strength. Values in parentheses are the 5th and 95th percentile from the integrated combined AEQ-Genetic-run-size uncertainty model.

	Coastal WAK	Upper Yukon	WAK (coastal + Upper Yukon)	SW Alaska[1]
1994	*0.32% (0.22%, 0.45%)*	*0.61% (0.39%, 0.93%)*	*0.38% (0.27%, 0.5%)*	*0.11% (0.00%, 0.27%)*
1995	*0.07% (0.05%, 0.1%)*	*0.14% (0.08%, 0.23%)*	*0.08% (0.06%, 0.12%)*	*0.03% (0.00%, 0.07%)*
1996	*0.12% (0.09%, 0.17%)*	*0.2% (0.12%, 0.31%)*	*0.14% (0.1%, 0.19%)*	*0.04% (0.00%, 0.09%)*
1997	*0.23% (0.16%, 0.32%)*	*0.36% (0.21%, 0.57%)*	*0.26% (0.19%, 0.34%)*	*0.05% (0.00%, 0.13%)*
1998	*0.21% (0.15%, 0.3%)*	*0.81% (0.48%, 1.28%)*	*0.28% (0.2%, 0.37%)*	*0.02% (0.00%, 0.06%)*
1999	*0.2% (0.14%, 0.28%)*	*0.46% (0.27%, 0.72%)*	*0.24% (0.17%, 0.33%)*	*0.04% (0.00%, 0.08%)*
2000	*0.44% (0.31%, 0.59%)*	*1.05% (0.7%, 1.53%)*	*0.55% (0.42%, 0.71%)*	*0.04% (0.00%, 0.10%)*
2001	*0.21% (0.14%, 0.29%)*	*0.67% (0.43%, 0.96%)*	*0.27% (0.21%, 0.35%)*	*0.03% (0.00%, 0.07%)*
2002	*0.21% (0.15%, 0.29%)*	*0.7% (0.45%, 1.05%)*	*0.27% (0.2%, 0.35%)*	*0.05% (0.00%, 0.12%)*
2003	*0.42% (0.3%, 0.56%)*	*0.8% (0.52%, 1.2%)*	*0.5% (0.38%, 0.65%)*	*0.14% (0.00%, 0.34%)*
2004	*0.92% (0.66%, 1.25%)*	*2.41% (1.59%, 3.43%)*	*1.16% (0.87%, 1.51%)*	*0.25% (0.00%, 0.62%)*
2005	**1.23% (0.93%, 1.6%)**	**1.42% (0.98%, 2.04%)**	**1.28% (1.01%, 1.63%)**	**0.81% (0.39%, 1.47%)**
2006	**0.64% (0.47%, 0.86%)**	**2.63% (1.86%, 3.65%)**	**0.9% (0.7%, 1.16%)**	**0.45% (0.25%, 0.75%)**
2007	**0.31% (0.23%, 0.41%)**	**0.99% (0.71%, 1.37%)**	**0.43% (0.33%, 0.56%)**	**0.09% (0.05%, 0.17%)**
2008	**0.09% (0.07%, 0.13%)**	**0.35% (0.25%, 0.49%)**	**0.13% (0.1%, 0.18%)**	**0.02% (0.01%, 0.07%)**
2009	**0.1% (0.08%, 0.14%)**	**0.23% (0.15%, 0.35%)**	**0.12% (0.1%, 0.16%)**	**0.18% (0.10%, 0.29%)**

[1]SWAK uses escapement only as a proxy for total run size.

Table 5-22. Estimated historical adult equivalent mortality (AEQ) under Alternative 1 (status quo) due to pollock fishery bycatch by river system with upper 95% confidence value shown in parenthesis. Italicized values preliminary based on projections from equation 7 (chapter 3).

	Coastal WAK		Upper Yukon		WAK (coastal WAK + Upper Yukon)		SW Alaska	
1994	12,543	(16,781)	5,903	(8,533)	18,446	(23,556)	2,542	(3,062)
1995	4,502	(6,327)	2,063	(3,137)	6,566	(8,827)	904	(1,164)
1996	5,014	(6,582)	2,206	(3,258)	7,220	(9,042)	992	(1,297)
1997	5,587	(7,430)	2,435	(3,625)	8,022	(10,219)	1,102	(1,463)
1998	6,171	(8,192)	2,676	(3,993)	8,847	(11,215)	1,215	(1,628)
1999	4,473	(5,945)	1,950	(2,917)	6,424	(8,122)	882	(1,187)
2000	5,100	(6,513)	2,604	(3,542)	7,704	(9,321)	1,066	(1,114)
2001	5,104	(6,551)	2,589	(3,551)	7,693	(9,391)	1,064	(1,121)
2002	6,558	(8,551)	3,081	(4,363)	9,639	(11,975)	1,328	(1,598)
2003	13,483	(17,424)	6,443	(9,056)	19,926	(24,398)	2,748	(3,185)
2004	31,261	(40,162)	15,401	(21,263)	46,663	(56,804)	6,446	(7,116)
2005	72,610	(90,760)	34,095	(46,314)	106,700	(127,475)	13,401	(18,805)
2006	49,776	(63,817)	31,440	(41,961)	81,216	(98,710)	8,562	(10,148)
2007	15,815	(20,688)	11,056	(14,803)	26,871	(33,648)	2,362	(2,334)
2008	4,048	(5,401)	3,104	(4,291)	7,152	(9,311)	708	(708)
2009	4,332	(5,442)	1,429	(1,990)	5,761	(7,000)	1,396	(2,133)
2010	*2,748*		*1,024*		*3,772*		*6,132*	
2011	*13,059*		*9,173*		*22,232*		*29,245*	
Mean	14,566		7,704		22,270		4,561	

	AK-BC-WA		Japan		Russia		Total	
1994	24,165	(30,615)	48,440	(57,492)	40,967	(48,726)	133,219	(152,151)
1995	8,561	(11,587)	17,696	(22,271)	14,973	(18,880)	48,344	(59,264)
1996	9,341	(11,770)	20,019	(22,697)	16,966	(19,226)	54,095	(56,750)
1997	10,349	(13,243)	22,390	(25,839)	18,983	(22,068)	60,389	(65,922)
1998	11,424	(14,610)	24,851	(28,604)	21,096	(24,223)	66,880	(72,697)
1999	8,268	(10,641)	17,934	(20,963)	15,218	(17,802)	48,382	(53,725)
2000	10,233	(12,418)	18,610	(21,088)	15,726	(17,786)	52,723	(56,157)
2001	10,217	(12,501)	18,737	(21,357)	15,794	(18,119)	52,932	(57,173)
2002	12,619	(15,616)	25,249	(28,649)	21,373	(24,273)	69,493	(73,947)
2003	26,174	(32,180)	51,308	(57,835)	43,424	(48,861)	142,273	(148,123)
2004	61,564	(75,071)	116,730	(131,388)	98,520	(111,321)	326,777	(340,222)
2005	111,183	(132,586)	180,100	(206,071)	159,038	(185,105)	569,091	(602,556)
2006	102,437	(119,942)	122,723	(145,114)	106,237	(126,746)	419,286	(469,973)
2007	33,814	(41,702)	46,217	(55,548)	42,483	(50,542)	150,676	(177,152)
2008	10,507	(13,133)	15,332	(18,819)	13,105	(16,472)	46,493	(56,519)
2009	8,109	(9,526)	12,012	(13,732)	9,325	(10,871)	36,520	(39,747)
2010	*4,734*		*811*		*7,608*		*23,058*	
2011	*29,342*		*3,131*		*35,125*		*119,075*	
Mean	27,391		42,349		38,665		134,428	

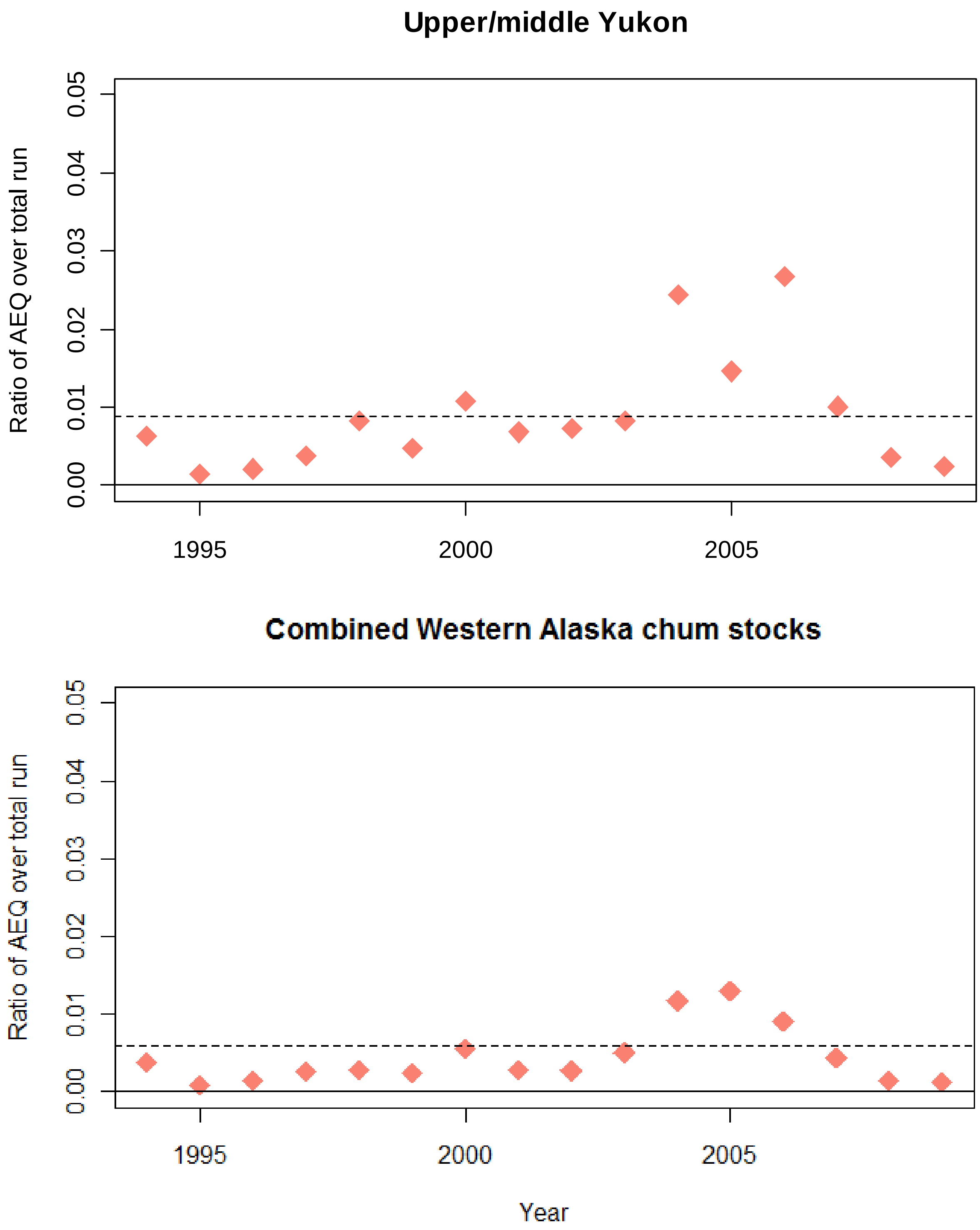


Figure 5-27. Estimated impact rates due to pollock fishery bycatch of chum salmon run sizes for Upper Yukon (top) and for western Alaska stocks (coastal west Alaska stocks plus Upper Yukon combined; bottom).

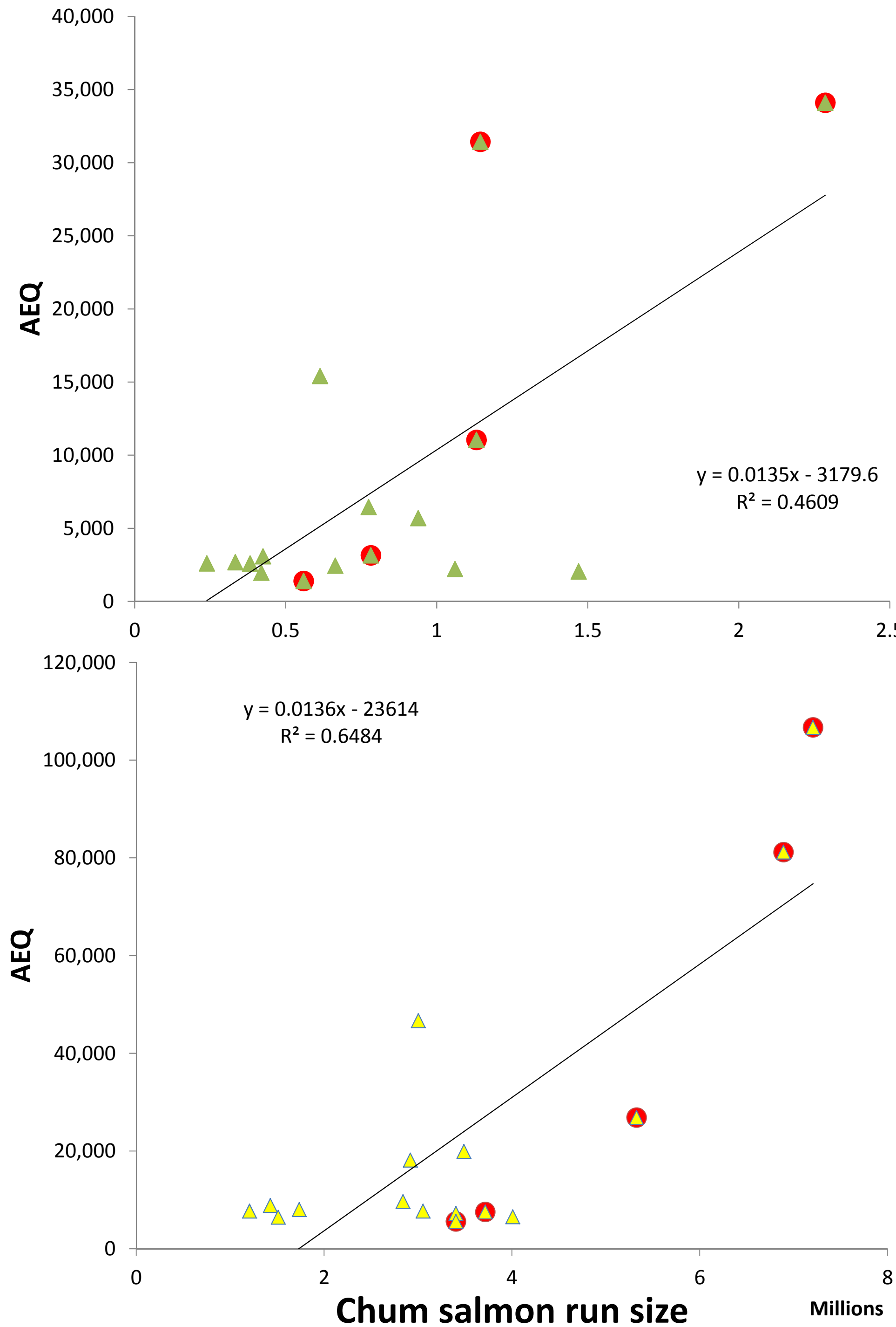


Figure 5-28. AEQ results compared to chum salmon run sizes for Upper Yukon (top) and for western Alaska stocks (coastal west Alaska stocks plus Upper Yukon combined; bottom). Filled circles represent data from years where genetics data were available and applied directly. Other points are based on mean bycatch stock composition proportions within strata and are thus more uncertain.

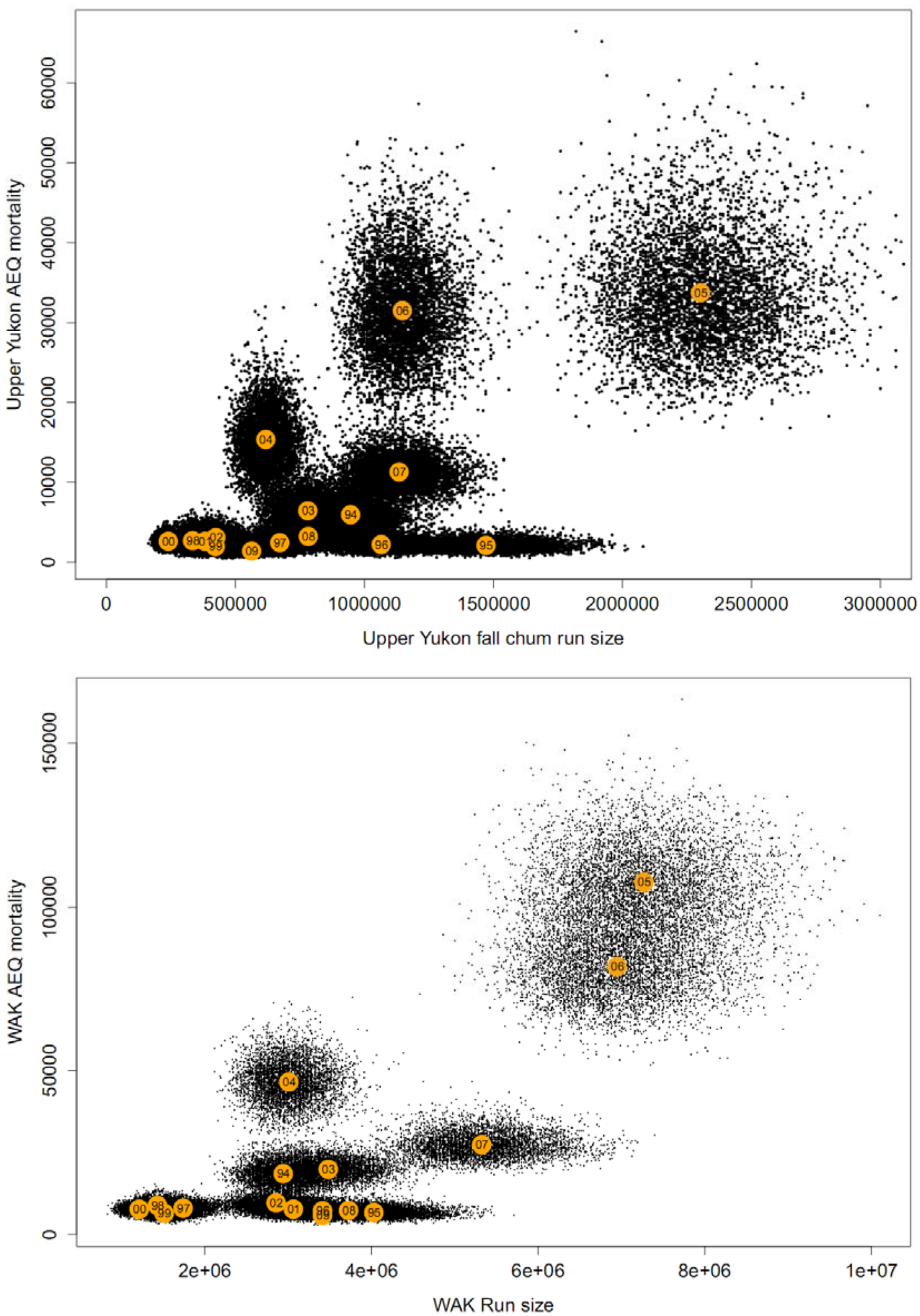


Figure 5-29. Estimated AEQ results compared to chum salmon run sizes for Upper Yukon (top) and for western Alaska stocks (coastal west Alaska stocks plus Upper Yukon combined; bottom). Circles represent mean estimates by year and concentrations of points represent relative density (probability) from the MCMC integration over uncertainty in run strength (10% CV), AEQ mortality, sampling, and genetic classification errors.

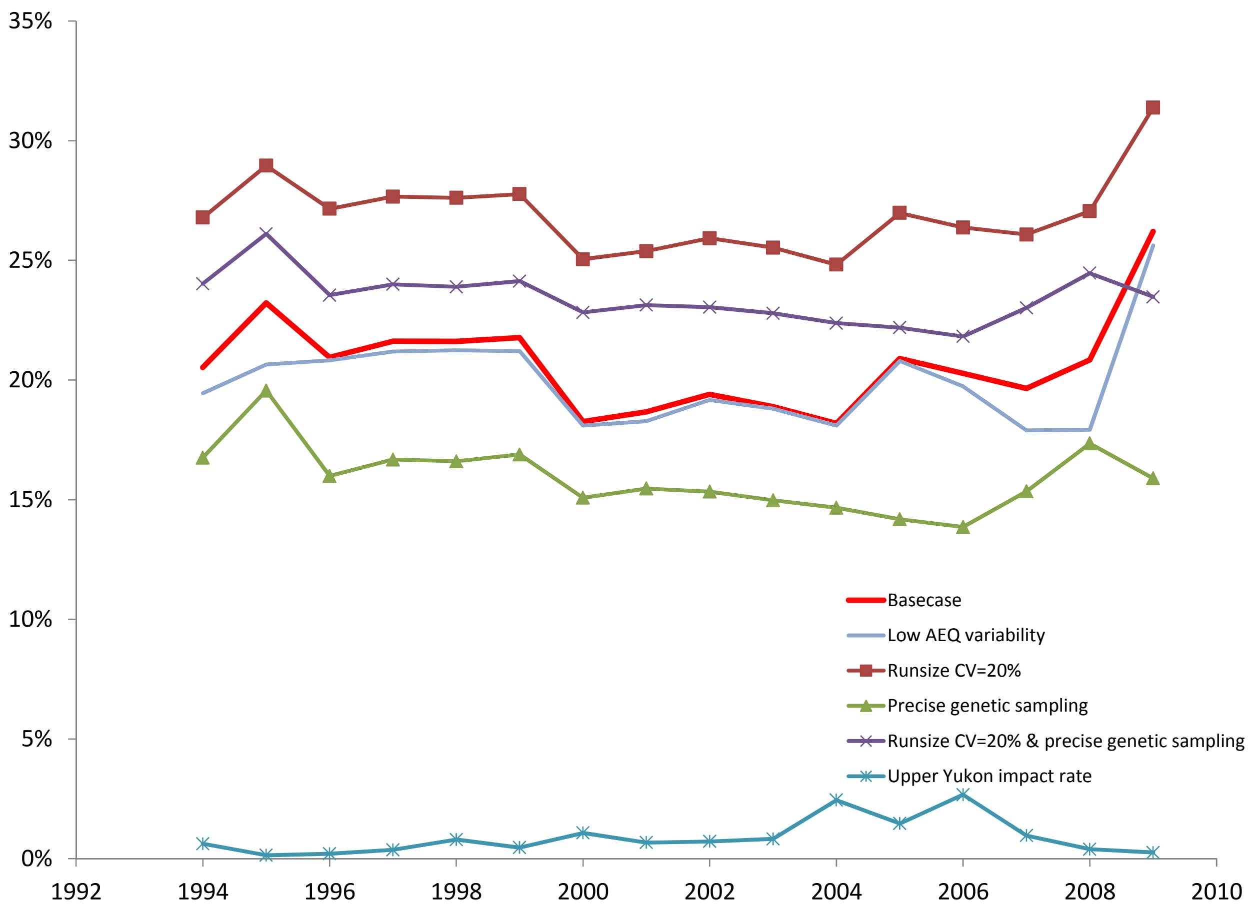


Figure 5-30 Example sensitivity analysis of impact rate uncertainty (CV of Upper Yukon impact rate—AEQ mortality divided by total run size estimate) to AEQ survival rate, run-size, and genetic sampling variability. Note for the basecase scenario AEQ survival was assigned a 20% CV and a 10% CV was assumed for run size estimates.

5.5.2 Alternative 2, hard caps

Under the analyzed options for the hard caps and sector allocations, the numbers of salmon saved is quite high for some years and varies by sector, especially for suboption 1b (Table 5-23). In percentage terms the low cap had the biggest chum salmon savings for most stocks (~80% but lowest savings for the SW Alaska components (Table 5-24). This table also shows that different sector allocations had relatively minor impact on savings except for the highest hard cap level which tended to save the most salmon under sector allocation 6. The previous section presented the dates when sector specific closures would have occurred (Table 4-3).

For suboption 1b) the numbers of salmon saved was much lower but there was considerable contrast between stocks (Table 5-25). For example, the lowest cap under 1b) reduced the impact on the Upper Yukon on average by 42% but the same option actually increased the estimated AEQ impact on Asian chum salmon (Table 5-26). Scrutiny of results summed over years 2004-2011 indicate 1b) is apparently less sensitive to sector allocations than for suboption 1a (Table 5-27). For the Upper Yukon different cap levels vary by suboption with 1a at low levels saving more chum whilst at higher cap levels, the savings for 1b is higher (Figure 5-31). Table 5-29 and Table 5-30 provides contrast of results over cap levels and options by year for sector allocation 2ii. Table 5-31 and Table 5-32 provide a summary of the caps and options and sector splits summed over years (both in absolute and relative levels of chum salmon saved.

Relative impacts to individual river systems depend on where and when the bycatch occurs. This can add to the inter-annual variability in results for the same caps, closures, and allocations between sectors. On average (based on 2005-2009 data) approximately 12% of the AEQ chum salmon mortality from the pollock fishery is attributed to the coastal western Alaskan regional grouping while ~7% is attributed to the Upper Yukon (Fall chum). For the Southwest Alaska Peninsula stocks, the average AEQ over this period comprises about 2%, of all AEQ while for the combined PNW (including regions from Prince William Sound all the way to WA/OR), the average is 22%. Combined, the estimated Asian contribution is ~58% on average (for Russian stocks and Japanese stocks). Yearly estimates presented in Chapter 3 indicate that the AEQ has ranged 23,000-570,000 chum salmon in aggregate (1994-2011).

Genetic information is sufficient to isolate some broad regions of origin across the Pacific Rim, and allows for some differentiation in relative impacts to those regions. For those systems where run size information is available, this impact analysis can be taken one step further to derive an impact rate of the removals due to the pollock fishery on the run size. The average impact rate for Coastal west Alaska (0.49%), Upper Yukon (1.26%), and Southwest Alaska (0.40%) is very low. According to ADF&G managers such low rates are unlikely to have had an impact on management considerations for these regions. Furthermore, the comparison of AEQ mortality due to chum salmon PSC with run sizes suggests that this relationship is correlated indicating that the PSC is likely related to magnitude of returns. For these reasons, the overall impact of the status quo on chum salmon stocks is considered to be insignificant as it is unlikely to jeopardize the sustainability of these stocks. Nonetheless alternatives are evaluated to estimate potential means to minimize the adverse impacts of the overall incidental catch levels, and regional AEQ estimates by reducing PSC catch of chum through different management strategies under Alternatives 2, 3 and 4.

For Alternative 2 nearly every option under consideration result in reductions of chum PSC and consequently provide increased returns of adult salmon to their regions of origin. The largest reduction is estimated to occur under a hard cap of 50,000 chum, option 1a for a B-season cap which would have provided an average Coastal western Alaska increased return of 20.3 thousand chum (compared to an average AEQ mortality estimated at 24.2 thousand chum). Given that the average estimated run size for this region for this period is 4.9 million, the ratio of mortality impact is about 0.5% under Alternative 1 as compared to a range of relative impacts over all caps and options is 0.09 – 0.35%, it seems unlikely that in-river management would have been modified further for this amount of returning fish aggregated over all rivers systems in coastal west Alaska given the intricacies of in-season, in-river management. However, bycatch in some options (e.g., option 1b) result in slightly higher or negligible reductions for Asian chum salmon. The options under Alternative 2 which increase the PSC reduction are likely to confer a beneficial impact as the mortality of chum salmon would be reduced. None of the options would be estimated to increase the western Alaskan chum PSC in the pollock fishery although some options have a differential impact on increased proportion of Asian stocks while reducing the impact to western Alaskan stocks. Nevertheless, overall impacts of Alternative 2 are likely to be insignificant because would not be reasonably expected to jeopardize the sustainability of chum salmon stocks.

It was noted that the fleet behavior faced with a hard cap would be to stand down when bycatch levels approached the cap (i.e., they would take extra measures to avoid hitting the cap). To provide some idea of this impact the analysis was conducted assuming the “effective” cap was 75% of the actual regulatory level. Results from this indicated that the improvement on salmon impacts (relative to Table 5-27) ranged widely between sector splits, options, and cap levels (Table 5-33).

Table 5-23. A subset of estimated chum salmon saved (AEQ in #s of fish) by region and year under 3 different allocation schemes and hard caps for Alternative 2, component 2 **option 1a)**, 2004-2011. UPDATED!!

		Estimated	50,000			200,000			353,000		
	Year	AEQ	2ii	4ii	6	2ii	4ii	6	2ii	4ii	6
Coastal WAK	2004	31,261	25,854	25,673	25,534	13,558	14,634	15,665	5,134	6,120	9,640
	2005	72,610	67,937	68,260	69,045	44,934	48,603	53,072	22,462	30,200	41,244
	2006	49,776	45,482	46,125	47,294	25,002	29,645	35,191	10,772	16,893	24,440
	2007	15,815	10,011	10,221	10,610	2,417	3,987	5,668		1,192	2,590
	2008	4,048	1,017	1,008	1,014						
	2009	4,332		546	1,318						
	2010	2,748		299	723						
	2011	13,059	7,886	7,832	7,923	2,100	657	1,263	736	111	
	Total	193,649	158,186	159,965	163,460	88,011	97,525	110,859	39,105	54,516	77,914
Upper Yukon	2004	15,401	12,289	11,965	11,707	6,304	6,429	6,882	2,256	2,689	4,235
	2005	34,095	32,478	32,581	32,985	20,347	22,424	25,038	8,648	13,048	18,858
	2006	31,440	26,650	27,160	28,053	12,623	16,144	20,147	4,064	7,997	12,670
	2007	11,056	7,424	7,613	7,941	1,836	3,140	4,542		905	1,976
	2008	3,104	451	447	450						
	2009	1,429		122	295						
	2010	1,024		67	162						
	2011	9,173	4,759	4,751	4,862	1,033	289	555	323	49	
	Total	106,722	84,050	84,706	86,454	42,142	48,426	57,165	15,291	24,689	37,738
SWAK	2004	6,446	5,248	5,173	5,113	2,729	2,885	3,089	1,012	1,207	1,901
	2005	13401	12,507	12,556	12,701	8,063	8,791	9,676	3,748	5,274	7,399
	2006	8562	8,260	8,300	8,409	5,234	5,904	6,688	1,751	3,332	5,169
	2007	2362	1,724	1,717	1,724	892	1,057	1,217		440	923
	2008	708	116	115	116						
	2009	1396		120	289						
	2010	6132		66	158						
	2011	29245	1,764	1,756	1,786	432	130	249	145	22	
	Total	68,252	29,619	29,803	30,296	17,351	18,767	20,919	6,656	10,274	15,392
SEAK-BC-WA	2004	61,564	49,054	48,345	47,785	25,509	26,955	28,855	9,458	11,273	17,756
	2005	111,183	98,704	98,432	98,510	70,580	72,392	75,657	43,130	49,682	62,060
	2006	102,437	83,992	84,550	85,792	50,245	57,295	65,680	20,804	33,300	48,731
	2007	33,814	26,768	27,009	27,588	10,503	13,969	17,555		5,181	10,989
	2008	10,507	1,888	1,871	1,882						
	2009	8,109		294	710						
	2010	4,734		161	390						
	2011	29,342	16,518	16,443	16,720	4,038	1,210	2,327	1,356	205	
	Total	361,690	276,923	277,105	279,377	160,875	171,821	190,073	74,748	99,641	139,536
Asia	2004	215,250	183,706	184,695	185,557	97,675	109,024	116,709	38,253	45,598	71,819
	2005	339,138	298,774	298,544	298,203	227,261	228,562	230,980	155,468	165,047	195,819
	2006	228,960	197,042	196,800	197,287	138,629	146,492	157,929	73,740	98,071	130,579
	2007	88,700	58,319	58,297	58,865	23,660	29,072	34,494		11,671	24,566
	2008	28,437	7,912	7,843	7,890						
	2009	21,337		2,906	7,015						
	2010	8,419		1,593	3,846						
	2011	38,256	46,346	45,800	45,786	14,592	4,894	9,411	5,484	828	
	Total	968,497	792,100	796,476	804,450	501,818	518,044	549,523	272,946	321,214	422,784

Table 5-24. A subset of estimated relative chum salmon saved (proportional change in AEQ) by region and year under 3 different allocation schemes and hard caps for Alternative 2, component 2 **option 1a)**, 2004-2011. UPDATED!!

		Estimated	50,000			200,000			353,000		
	Year	AEQ	2ii	4ii	6	2ii	4ii	6	2ii	4ii	6
	2004	31,261	83%	82%	82%	43%	47%	50%	16%	20%	31%
	2005	72,610	94%	94%	95%	62%	67%	73%	31%	42%	57%
	2006	49,776	91%	93%	95%	50%	60%	71%	22%	34%	49%
	2007	15,815	63%	65%	67%	15%	25%	36%		8%	16%
Coastal WAK	2008	4,048	25%	25%	25%						
	2009	4,332		13%	30%						
	2010	2,748		11%	26%						
	2011	13,059	60%	60%	61%	16%	5%	10%	6%	1%	
	Total	193,649	82%	83%	84%	45%	50%	57%	20%	28%	40%
	2004	15,401	80%	78%	76%	41%	42%	45%	15%	17%	27%
	2005	34,095	95%	96%	97%	60%	66%	73%	25%	38%	55%
	2006	31,440	85%	86%	89%	40%	51%	64%	13%	25%	40%
	2007	11,056	67%	69%	72%	17%	28%	41%		8%	18%
Upper Yukon	2008	3,104	15%	14%	14%						
	2009	1,429		9%	21%						
	2010	1,024		7%	16%						
	2011	9,173	52%	52%	53%	11%	3%	6%	4%	1%	
	Total	106,722	79%	79%	81%	39%	45%	54%	14%	23%	35%
	2004	6,446	81%	80%	79%	42%	45%	48%	16%	19%	29%
	2005	13401	93%	94%	95%	60%	66%	72%	28%	39%	55%
	2006	8562	96%	97%	98%	61%	69%	78%	20%	39%	60%
	2007	2362	73%	73%	73%	38%	45%	52%		19%	39%
SWAK	2008	708	16%	16%	16%						
	2009	1396		9%	21%						
	2010	6132		1%	3%						
	2011	29245	6%	6%	6%	1%	0%	1%	0%	0%	
	Total	68,252	43%	44%	44%	25%	27%	31%	10%	15%	23%
	2004	61,564	80%	79%	78%	41%	44%	47%	15%	18%	29%
	2005	111,183	89%	89%	89%	63%	65%	68%	39%	45%	56%
	2006	102,437	82%	83%	84%	49%	56%	64%	20%	33%	48%
	2007	33,814	79%	80%	82%	31%	41%	52%		15%	32%
SEAK-BC-WA	2008	10,507	18%	18%	18%						
	2009	8,109		4%	9%						
	2010	4,734		3%	8%						
	2011	29,342	56%	56%	57%	14%	4%	8%	5%	1%	
	Total	361,690	77%	77%	77%	44%	48%	53%	21%	28%	39%
	2004	215,250	85%	86%	86%	45%	51%	54%	18%	21%	33%
	2005	339,138	88%	88%	88%	67%	67%	68%	46%	49%	58%
	2006	228,960	86%	86%	86%	61%	64%	69%	32%	43%	57%
	2007	88,700	66%	66%	66%	27%	33%	39%		13%	28%
Asia	2008	28,437	28%	28%	28%						
	2009	21,337		14%	33%						
	2010	8,419		19%	46%						
	2011	38,256	121%	120%	120%	38%	13%	25%	14%	2%	
	Total	968,497	82%	82%	83%	52%	53%	57%	28%	33%	44%

Table 5-25. A subset of estimated chum salmon saved (AEQ in #s fish) by region and year under 3 different allocation schemes and hard caps for Alternative 2, component 2 **option 1b)**, 2004-2011. UPDATED!!

		Estimated	15,600			62,400			110,136		
	Year	AEQ	2ii	4ii	6	2ii	4ii	6	2ii	4ii	6
Coastal WAK	2004	31,261	-1,931	-3,034	-4,880	-1,696	-1,596	-409	-1,676	-507	
	2005	72,610	26,783	26,018	24,728	24,647	26,236	27,968	22,786	24,409	26,443
	2006	49,776	25,208	25,280	25,087	21,049	22,560	23,989	17,220	19,276	21,546
	2007	15,815	5,327	5,585	5,557	3,852	4,219	4,678	2,315	3,147	3,864
	2008	4,048	-89	4	-19						
	2009	4,332	141	27	-111						
	2010	2,748	79	15	-61						
	2011	13,059	842	1,032	1,266	51	119	167	316	-147	-193
	Total	193,649	56,360	54,927	51,567	47,903	51,538	56,393	40,962	46,178	51,660
Upper Yukon	2004	15,401	384	-49	-795	122	-111	168	-65	5	
	2005	34,095	17,676	17,377	16,858	15,632	16,273	17,044	13,932	14,653	15,781
	2006	31,440	18,113	18,220	18,168	14,540	15,541	16,585	11,297	12,948	14,686
	2007	11,056	4,732	4,791	4,886	3,293	3,611	3,997	1,995	2,695	3,308
	2008	3,104	28	21	65						
	2009	1,429	109	100	89						
	2010	1,024	65	55	49						
	2011	9,173	2,765	2,824	2,954	912	993	1,243	550	71	276
	Total	106,722	43,872	43,338	42,272	34,499	36,306	39,037	27,709	30,372	34,052
SWAK	2004	6,446	-181	-390	-744	-194	-219	-24	-222	-63	
	2005	13401	5,630	5,490	5,253	5,071	5,340	5,658	4,598	4,899	5,299
	2006	8562	3,386	3,403	3,364	2,965	3,109	3,279	2,558	2,779	2,999
	2007	2362	122	157	151	69	63	93	-17	41	51
	2008	708	-9	1	-1						
	2009	1396	221	238	255						
	2010	6132	122	130	140						
	2011	29245	554	587	638	154	176	222	129	-7	20
	Total	68,252	9,844	9,615	9,055	8,065	8,468	9,228	7,046	7,648	8,370
SEAK-BC-WA	2004	61,564	-1,660	-3,613	-6,912	-1,788	-2,032	-217	-2,054	-584	
	2005	111,183	12,384	10,871	8,405	14,315	16,046	17,916	15,688	16,592	17,604
	2006	102,437	22,885	23,118	22,659	18,970	20,817	22,878	14,726	17,691	20,006
	2007	33,814	8,307	8,866	8,798	5,803	6,255	7,122	3,019	4,616	5,677
	2008	10,507	-159	9	-29						
	2009	8,109	1,905	2,249	2,629						
	2010	4,734	1,055	1,233	1,442						
	2011	29,342	5,238	5,550	6,022	1,462	1,668	2,108	1,215	-62	200
	Total	361,690	49,954	48,284	43,013	38,762	42,755	49,806	32,593	38,252	43,487
Asia	2004	215,250	-26,197	-34,902	-49,279	-20,946	-17,545	-6,379	-18,913	-5,960	
	2005	339,138	-34,787	-41,029	-50,868	-15,062	-8,449	-1,275	137	4,537	5,682
	2006	228,960	3,460	3,428	1,649	7,636	10,607	13,273	8,992	11,439	11,963
	2007	88,700	6,932	8,926	8,331	5,262	5,464	6,609	1,772	3,926	4,851
	2008	28,437	-843	-11	-314						
	2009	21,337	-354	-1,206	-2,213						
	2010	8,419	-226	-661	-1,213						
	2011	38,256	-16,685	-15,030	-13,550	-8,146	-8,129	-9,968	-1,584	-2,402	-4,898
	Total	968,497	-68,699	-80,486	-107,458	-31,255	-18,053	2,260	-9,596	11,540	17,598

Table 5-26. A subset of estimated chum salmon saved (proportional change in AEQ) by region and year under 3 different allocation schemes and hard caps for Alternative 2, component 2 **option 1b)**, 2004-2011. UPDATED!!

		Estimated	15,600			62,400			110,136		
	Year	AEQ	2ii	4ii	6	2ii	4ii	6	2ii	4ii	6
Coastal WAK	2004	31,261	-6%	-10%	-16%	-5%	-5%	-1%	-5%	-2%	
	2005	72,610	37%	36%	34%	34%	36%	39%	31%	34%	36%
	2006	49,776	51%	51%	50%	42%	45%	48%	35%	39%	43%
	2007	15,815	34%	35%	35%	24%	27%	30%	15%	20%	24%
	2008	4,048	-2%	0%	0%						
	2009	4,332	3%	1%	-3%						
	2010	2,748	3%	1%	-2%						
	2011	13,059	6%	8%	10%	0%	1%	1%	2%	-1%	-1%
	Total	193,649	29%	28%	27%	25%	27%	29%	21%	24%	27%
Upper Yukon	2004	15,401	2%	0%	-5%	1%	-1%	1%	0%	0%	
	2005	34,095	52%	51%	49%	46%	48%	50%	41%	43%	46%
	2006	31,440	58%	58%	58%	46%	49%	53%	36%	41%	47%
	2007	11,056	43%	43%	44%	30%	33%	36%	18%	24%	30%
	2008	3,104	1%	1%	2%						
	2009	1,429	8%	7%	6%						
	2010	1,024	6%	5%	5%						
	2011	9,173	30%	31%	32%	10%	11%	14%	6%	1%	3%
	Total	106,722	41%	41%	40%	32%	34%	37%	26%	28%	32%
SWAK	2004	6,446	-3%	-6%	-12%	-3%	-3%	0%	-3%	-1%	
	2005	13401	42%	41%	39%	38%	40%	42%	34%	37%	40%
	2006	8562	40%	40%	39%	35%	36%	38%	30%	32%	35%
	2007	2362	5%	7%	6%	3%	3%	4%	-1%	2%	2%
	2008	708	-1%	0%	0%						
	2009	1396	16%	17%	18%						
	2010	6132	2%	2%	2%						
	2011	29245	2%	2%	2%	1%	1%	1%	0%	0%	0%
	Total	68,252	14%	14%	13%	12%	12%	14%	10%	11%	12%
SEAK-BC-WA	2004	61,564	-3%	-6%	-11%	-3%	-3%	0%	-3%	-1%	
	2005	111,183	11%	10%	8%	13%	14%	16%	14%	15%	16%
	2006	102,437	22%	23%	22%	19%	20%	22%	14%	17%	20%
	2007	33,814	25%	26%	26%	17%	18%	21%	9%	14%	17%
	2008	10,507	-2%	0%	0%						
	2009	8,109	23%	28%	32%						
	2010	4,734	22%	26%	30%						
	2011	29,342	18%	19%	21%	5%	6%	7%	4%	0%	1%
	Total	361,690	14%	13%	12%	11%	12%	14%	9%	11%	12%
Asia	2004	215,250	-12%	-16%	-23%	-10%	-8%	-3%	-9%	-3%	
	2005	339,138	-10%	-12%	-15%	-4%	-2%	0%	0%	1%	2%
	2006	228,960	2%	1%	1%	3%	5%	6%	4%	5%	5%
	2007	88,700	8%	10%	9%	6%	6%	7%	2%	4%	5%
	2008	28,437	-3%	0%	-1%						
	2009	21,337	-2%	-6%	-10%						
	2010	8,419	-3%	-8%	-14%						
	2011	38,256	-44%	-39%	-35%	-21%	-21%	-26%	-4%	-6%	-13%
	Total	968,497	-7%	-8%	-11%	-3%	-2%	0%	-1%	1%	2%

Table 5-27. Estimated chum salmon AEQ saved by region, and cap, Alternative 2 options for all years combined (summed over 2004-2011) under 3 different allocation configurations. Run estimates are from Table 5-22. Caps in parentheses represent the (b) options (June/July only)UPDATED!!

Region	Run Estimate	Estimated AEQ	Cap	Option	Allocation configuration 2ii	4ii	6
Coastal WAK	39,233,000	193,649	50,000	1a)	158,186	159,965	163,460
			(15,600)	1b)	56,360	54,927	51,567
			200,000	1a)	88,011	97,525	110,859
			(62,400)	1b)	47,903	51,538	56,393
			353,000	1a)	39,105	54,516	77,914
			(110,136)	1b)	40,962	46,178	51,660
Upper Yukon	8,454,000	106,722	50,000	1a)	84,050	84,706	86,454
			(15,600)	1b)	43,872	43,338	42,272
			200,000	1a)	42,142	48,426	57,165
			(62,400)	1b)	34,499	36,306	39,037
			353,000	1a)	15,291	24,689	37,738
			(110,136)	1b)	27,709	30,372	34,052
SW AK			50,000	1a)	29,619	29,803	30,296
			(15,600)	1b)	9,844	9,615	9,055
			200,000	1a)	17,351	18,767	20,919
			(62,400)	1b)	8,065	8,468	9,228
			353,000	1a)	6,656	10,274	15,392
			(110,136)	1b)	7,046	7,648	8,370
SEAK-BC-WA			50,000	1a)	276,923	277,105	279,377
			(15,600)	1b)	49,954	48,284	43,013
			200,000	1a)	160,875	171,821	190,073
			(62,400)	1b)	38,762	42,755	49,806
			353,000	1a)	74,748	99,641	139,536
			(110,136)	1b)	32,593	38,252	43,487
Asia			50,000	1a)	792,100	796,476	804,450
			(15,600)	1b)	-68,699	-80,486	-107,458
			200,000	1a)	501,818	518,044	549,523
			(62,400)	1b)	-31,255	-18,053	2,260
			353,000	1a)	272,946	321,214	422,784
			(110,136)	1b)	-9,596	11,540	17,598

Table 5-28 Comparison of relative impact rates by cap and option for Alternative 2 based on run size estimates presented in Table 5-20) for Coastal western Alaska and Upper Yukon stock breakouts. Caps in parentheses represent the (b) options.

		50,000 (15,600)		200,000 (62,400)		353,000 (110,136)	
Coastal WAK	Alt 1	1a)	1b)	1a)	1b)	1a)	1b)
2004	0.94%	0.15%	0.96%	0.48%	0.95%	0.79%	0.96%
2005	1.23%	0.13%	0.83%	0.51%	0.85%	0.88%	0.87%
2006	0.64%	0.05%	0.31%	0.33%	0.36%	0.52%	0.38%
2007	0.30%	0.09%	0.18%	0.25%	0.20%	0.30%	0.22%
2008	0.09%	0.07%	0.10%	0.09%	0.09%	0.09%	0.09%
2009	0.11%	0.11%	0.09%	0.11%	0.11%	0.11%	0.11%
2010	0.07%	0.07%	0.06%	0.07%	0.07%	0.07%	0.07%
2011	0.29%	0.12%	0.26%	0.24%	0.29%	0.27%	0.28%
Average	0.49%	0.09%	0.35%	0.27%	0.37%	0.40%	0.38%
		50,000 (15,600)		200,000 (62,400)		353,000 (110,136)	
Upper Yukon	Alt 1	1a)	1b)	1a)	1b)	1a)	1b)
2004	2.51%	0.44%	2.33%	1.35%	2.39%	2.15%	2.44%
2005	1.50%	0.14%	0.80%	0.67%	0.86%	1.16%	0.91%
2006	2.73%	0.36%	1.07%	1.66%	1.37%	2.43%	1.51%
2007	0.99%	0.24%	0.46%	0.79%	0.60%	0.99%	0.65%
2008	0.34%	0.29%	0.34%	0.34%	0.34%	0.34%	0.34%
2009	0.25%	0.25%	0.21%	0.25%	0.25%	0.25%	0.25%
2010	0.17%	0.17%	0.15%	0.17%	0.17%	0.17%	0.17%
2011	0.76%	0.39%	0.52%	0.67%	0.68%	0.73%	0.71%
Average	1.26%	0.42%	0.73%	0.77%	0.83%	1.10%	0.88%

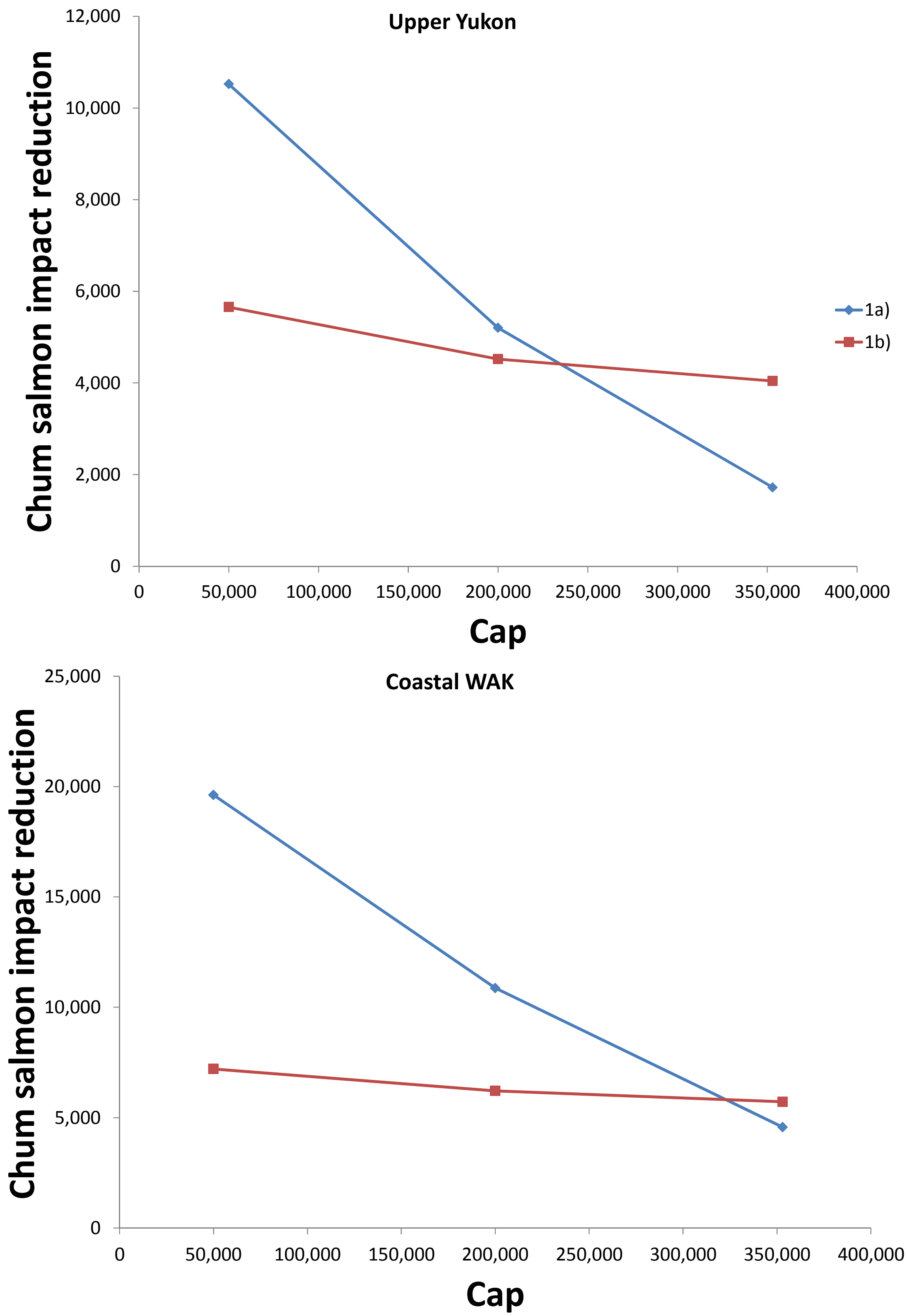


Figure 5-31. Average chum salmon impact reduction (AEQ) by suboption for Alternative 2, sector allocation 2ii, for years 2004-2011 for Upper Yukon (top) and Coastal WAK (bottom).

Table 5-29. Estimated annual chum salmon saved in AEQ terms under alternative 2 by hard cap and option for 2004-2011 for the B season with allocation configuration 1 (2ii). The third column lists the run-size estimates from Table 5-20 whereas the 4th column is from Table 5-22. Caps in parentheses represent the (b) options.

	Year	Run size (if avail.)	Estimated AEQ	50,000 (15,600) 1a)	1b)	200,000 (62,400) 1a)	1b)	353,000 (110,136) 1a)	1b)
Coastal WAK	2004	3,324,602	31,261	26,313	-556	15,150	-404	5,089	-688
	2005	5,891,716	72,610	65,047	23,849	42,504	22,807	20,696	21,478
	2006	7,738,349	49,776	45,763	25,749	24,159	22,027	9,818	20,112
	2007	5,204,218	15,815	11,202	6,658	2,927	5,154		4,457
	2008	4,378,634	4,048	1,095	-136				
	2009	4,075,589	4,332		558				
	2010	4,086,792	2,748		310				
	2011	4,533,335	13,059	7,533	1,216	2,210	134	944	370
	Total		193,649	156,952	57,649	86,950	49,718	36,547	45,730
Upper Yukon	2004	612,640	15,401	12,684	1,128	7,111	780	2,236	474
	2005	2,280,434	34,095	30,799	15,901	18,776	14,416	7,610	13,393
	2006	1,150,989	31,440	27,313	19,077	12,363	15,651	3,500	14,109
	2007	1,116,550	11,056	8,399	5,916	2,289	4,376		3,788
	2008	905,100	3,104	485	28				
	2009	575,730	1,429		207				
	2010	606,360	1,024		119				
	2011	1,206,441	9,173	4,504	2,870	1,085	938	415	592
	Total		106,722	71,501	45,245	41,623	36,162	13,760	32,355
SWAK	2004		6,446	5,370	113	3,061	75	1,003	-10
	2005		13401	11,937	5,057	7,574	4,699	3,396	4,390
	2006		8562	7,862	3,216	4,771	2,924	1,560	2,711
	2007		2362	1,703	242	836	203		165
	2008		708	125	-14				
	2009		1396		324				
	2010		6132		179				
	2011		29245	1,678	618	454	169	186	142
	Total		68,252	28,675	9,733	16,695	8,070	6,146	7,399
SEAK-BC-WA	2004		61,564	50,196	1,088	28,606	730	9,374	-73
	2005		111,183	97,312	11,189	70,304	14,320	41,861	13,989
	2006		102,437	85,121	26,806	49,666	23,430	20,134	21,198
	2007		33,814	28,166	11,125	10,740	8,662		7,405
	2008		10,507	2,032	-244				
	2009		8,109		2,241				
	2010		4,734		1,242				
	2011		29,342	15,713	5,836	4,246	1,601	1,739	1,342
	Total		361,690	228,345	59,284	163,562	48,741	73,107	43,862
Asia	2004		215,250	185,271	-17,296	108,513	-12,194	37,915	-12,564
	2005		339,138	299,162	-31,577	233,591	-9,128	154,570	-4,918
	2006		228,960	197,658	10,349	137,531	16,355	73,350	15,920
	2007		88,700	59,536	10,605	22,781	9,701		8,136
	2008		28,437	8,519	-1,254				
	2009		21,337		1,801				
	2010		8,419		974				
	2011		38,256	44,675	-13,327	15,375	-7,424	7,033	-1,353
	Total		968,497	609,549	-39,725	517,792	-2,690	272,868	5,222

Table 5-30. Estimated annual relative chum salmon saved in AEQ terms under alternative 2 by hard cap and option for 2004-2011 for the B season with allocation configuration 1 (2ii). Caps in parentheses represent the (b) options.

		Estimated	50,000 (15,600)		200,000 (62,400)		353,000 (110,136)	
	Year	AEQ	1a)	1b)	1a)	1b)	1a)	1b)
Coastal WAK	2004	31,261	84%	-2%	48%	-1%	16%	-2%
	2005	72,610	90%	33%	59%	31%	29%	30%
	2006	49,776	92%	52%	49%	44%	20%	40%
	2007	15,815	71%	42%	19%	33%		28%
	2008	4,048	27%	-3%				
	2009	4,332		13%				
	2010	2,748		11%				
	2011	13,059	58%	9%	17%	1%	7%	3%
	Total	193,649	81%	30%	45%	26%	19%	24%
Upper Yukon	2004	15,401	82%	7%	46%	5%	15%	3%
	2005	34,095	90%	47%	55%	42%	22%	39%
	2006	31,440	87%	61%	39%	50%	11%	45%
	2007	11,056	76%	54%	21%	40%		34%
	2008	3,104	16%	1%				
	2009	1,429		14%				
	2010	1,024		12%				
	2011	9,173	49%	31%	12%	10%	5%	6%
	Total	106,722	67%	42%	39%	34%	13%	30%
SWAK	2004	6,446	83%	2%	47%	1%	16%	0%
	2005	13401	89%	38%	57%	35%	25%	33%
	2006	8562	92%	38%	56%	34%	18%	32%
	2007	2362	72%	10%	35%	9%		7%
	2008	708	18%	-2%				
	2009	1396		23%				
	2010	6132		3%				
	2011	29245	6%	2%	2%	1%	1%	0%
	Total	68,252	42%	14%	24%	12%	9%	11%
SEAK-BC-WA	2004	61,564	82%	2%	46%	1%	15%	0%
	2005	111,183	88%	10%	63%	13%	38%	13%
	2006	102,437	83%	26%	48%	23%	20%	21%
	2007	33,814	83%	33%	32%	26%		22%
	2008	10,507	19%	-2%				
	2009	8,109		28%				
	2010	4,734		26%				
	2011	29,342	54%	20%	14%	5%	6%	5%
	Total	361,690	63%	16%	45%	13%	20%	12%
Asia	2004	215,250	86%	-8%	50%	-6%	18%	-6%
	2005	339,138	88%	-9%	69%	-3%	46%	-1%
	2006	228,960	86%	5%	60%	7%	32%	7%
	2007	88,700	67%	12%	26%	11%		9%
	2008	28,437	30%	-4%				
	2009	21,337		8%				
	2010	8,419		12%				
	2011	38,256	117%	-35%	40%	-19%	18%	-4%
	Total	968,497	63%	-4%	53%	0%	28%	1%

Table 5-31. Estimated total Alaska chum salmon saved summed over 2004-2011 for different **hard caps** and sector allocations by year under Alternative 2. Caps in parentheses represent the (b) options. Total AEQ mortality estimate is provided in the bottom row of each regional breakout.

	Sector allocation	Estimated AEQ	50,000 (15,600) 1a)	1b)	200,000 (62,400) 1a)	1b)	353,000 (110,136) 1a)	1b)
Coastal WAK	2ii		156,952	57,649	86,950	49,718	36,547	45,730
	4ii		157,656	56,047	96,573	52,703	54,828	46,462
	6		162,426	53,399	116,258	56,201	77,167	50,086
		193,649						
Upper Yukon	2ii		84,184	45,245	41,623	36,162	13,760	32,355
	4ii		83,901	44,629	48,256	37,703	24,446	31,577
	6		86,734	44,322	61,318	40,425	37,431	33,863
	Total	106,722						
SWAK	2ii		28,675	9,733	16,695	8,070	6,146	7,399
	4ii		28,810	9,536	17,998	8,303	10,311	7,359
	6		29,396	9,256	21,084	8,611	14,688	7,799
	Total	68,252						
SEAK-BC-WA	2ii		278,541	59,284	163,562	48,741	73,107	43,862
	4ii		277,571	56,476	172,737	52,293	103,226	44,083
	6		283,102	53,269	200,362	56,692	142,135	47,398
	Total	361,690						
Asia	2ii		794,820	-39,725	517,792	-2,690	272,868	5,222
	4ii		800,621	-51,593	522,931	8,722	339,216	22,437
	6		814,930	-75,994	568,806	13,322	438,591	27,492
	Total	968,497						

Table 5-32. Estimated proportion of Alaska chum salmon saved relative to AEQ mortality for the period 2004-2011 under different **hard caps** and sector allocations by year for Alternative 2. Caps in parentheses represent the (b) options.

	Sector allocation	Estimated AEQ	50,000 (15,600) 1a)	1b)	200,000 (62,400) 1a)	1b)	353,000 (110,136) 1a)	1b)
Coastal WAK	2ii		81%	30%	45%	26%	19%	24%
	4ii		81%	29%	50%	27%	28%	24%
	6		84%	28%	60%	29%	40%	26%
		193,649						
Upper Yukon	2ii		79%	42%	39%	34%	13%	30%
	4ii		79%	42%	45%	35%	23%	30%
	6		81%	42%	57%	38%	35%	32%
		106,722						
SWAK	2ii		42%	14%	24%	12%	9%	11%
	4ii		42%	14%	26%	12%	15%	11%
	6		43%	14%	31%	13%	22%	11%
		68,252						
SEAK-BC-WA	2ii		77%	16%	45%	13%	20%	12%
	4ii		77%	16%	48%	14%	29%	12%
	6		78%	15%	55%	16%	39%	13%
		361,690						
Asia	2ii		82%	-4%	53%	0%	28%	1%
	4ii		83%	-5%	54%	1%	35%	2%
	6		84%	-8%	59%	1%	45%	3%
		968,497						

Table 5-33. Estimated improvement in chum salmon AEQ saved by region, and cap, Alternative 2 options for all years combined (summed over 2004-2011) under 3 different allocation configurations. Proportions represent the anticipated increase in relative salmon saved reported in Table 5-27 due to the tendency for the fleet to stand down (assumed to be 75% of the cap) instead of reaching the cap. Caps in parentheses represent the (b) options.UPDATED!!

			Allocation configuration		
Region	Cap	Option	2ii	4ii	6
Coastal WAK	50,000	1a)	5%	5%	4%
	(15,600)	1b)	-4%	-4%	0%
	200,000	1a)	23%	17%	12%
	(62,400)	1b)	6%	6%	2%
	353,000	1a)	71%	40%	22%
	(110,136)	1b)	11%	8%	6%
Upper Yukon	50,000	1a)	6%	6%	4%
	(15,600)	1b)	0%	0%	2%
	200,000	1a)	29%	20%	13%
	(62,400)	1b)	9%	7%	4%
	353,000	1a)	98%	47%	27%
	(110,136)	1b)	14%	11%	9%
SW AK	50,000	1a)	5%	5%	5%
	(15,600)	1b)	-3%	-4%	1%
	200,000	1a)	20%	15%	11%
	(62,400)	1b)	6%	7%	3%
	353,000	1a)	90%	46%	18%
	(110,136)	1b)	9%	7%	7%
SEAK-BC-WA	50,000	1a)	5%	5%	5%
	(15,600)	1b)	-6%	-7%	0%
	200,000	1a)	20%	16%	11%
	(62,400)	1b)	6%	11%	3%
	353,000	1a)	64%	38%	18%
	(110,136)	1b)	16%	10%	10%
Asia	50,000	1a)	5%	5%	4%
	(15,600)	1b)	39%	32%	11%
	200,000	1a)	16%	14%	12%
	(62,400)	1b)	44%	3%	-558%
	353,000	1a)	48%	32%	14%
	(110,136)	1b)	40%	-88%	-30%

5.5.2.1 An evaluation of transferability of chum salmon among sectors

As noted in methods, the analysis assumes between cooperative transferability. Between sector transferability can be evaluated assuming “perfect” transferability in that sectors would exchange allocated chum salmon PSC freely. This was shown to reduce the saving of chum salmon and the PSC under this system would be higher for all stocks (including Chinook salmon; compared to Alternative 2 option 1a).

The actual intended transferability options would be initially from sector-specific allocations and then in a given year, a "clean" sector could transfer their chum salmon PSC to a sector that requires more. Logically this poses challenges for analysis because the conditions for a transfer would have to be that the "clean" sector would know in advance that they have salmon to transfer to a sector needing more PSC salmon to extend their pollock fishing. Alternatively the clean sector could finish their pollock fishing earlier than the sector needing more PSC salmon and transfer at that time or would anticipate their surplus and trade it. Simulating these conditions would require strong assumptions about the interaction between sectors. Additionally, such a system will add complexity to management and enforcement, and for any given cap will allow higher chum PSC (within a cap) and cause less foregone pollock.

Nonetheless we examined one scenario to for Alternative 2, option 1a) with a cap of 50,000 and sector allocation 6. In 2005 had this scenario been in place all sectors would have come up against their cap so there would be no transfers (with motherships and shorebased CV sectors hitting their cap on the 2nd and 4th of July, respectively). In 2006, shorebased boats would have hit their cap on June 14th, and remarkably all other sectors stay below their cap. Assuming somehow that the other sectors would know how much salmon they would catch at the end of the year, then the difference between the remaining salmon and the sum of their caps is 7,645 chum. That amount would not be enough for the shorebased sector to fish even one more day (their initial allocation is 22,385 salmon, on June 13th they went from 13,838 salmon to 30,390). In summary, the idea of transfers would be beneficial in principle; however, "what ifs" evaluations from historical data are limited to illustrate performance benefits.

5.5.3 Alternative 3 – Revised Rolling Hotspot (RHS) Exemption

Alternative 3 proposes a revised RHS program which has been modified to address iterative requests by the Council. The revisions to the RHS program affect the trade-offs inherent to salmon PSC management in the Bering Sea pollock fishery. They allow for more targeted attention on Western AK chum and Chinook.

The major modifications to the existing RHS program are discussed below with an estimation of the efficacy these measures may have on the program's functionality and PSC reduction. Analysis of this alternative draws upon the historical simulations and the current-period analysis and information examined under Alternative 1 (Section 5.5.1). The full industry proposal for the revised program is included as appendix 1 to this document.

The new proposed industry RHS program makes a number of modifications to existing program. The new proposal achieves several changes that are likely to be improvements that help meet the Council's goals of targeting Western Alaska chum and Chinook reduction:

- Ability to incorporate new genetic information as available,
- Change of closures to operate at vessel- or platform-level rather than coop-level, and
- A decrease in closure areas and a suspension of chum closure program late in the year when Chinook PSC rates are higher.

Other measures in the program will facilitate more efficient pollock harvest, which in some years is likely to reduce fishing in October, thus likely reducing Chinook PSC. These measures include:

- Including a floor on the base rate so that closures are not unnecessarily implemented when they are not expected to be effective.
- A change of the start-time of closures from 6pm to 10pm.A change the Tier 2 component to the program to allow fishing in the first 4 days after a closure is implemented, rather than prohibiting it during this period.

It should be noted that the "vessel performance list" is not included in the revised RHS program. The Council should explicitly note that it wishes to preserve this aspect of the RHS program if it does indeed wish to do so.

5.5.3.1 Targeted measures for reducing western Alaska chum PSC

Given genetic information (as discussed in Chapter 3) indicating that western Alaskan chum are more predominant in the bycatch in June and July, this proposal provides for more targeted June-July chum closures with provisions to accommodate Chinook beginning after August 1. The Tier structure under this alternative is modified for June and July as follows: In June there are no tier differences and closures apply to all vessels; in July a special Tier called a Limited Test Fishing Privilege (LTFP) for qualified vessels and MS fleets is created whereby vessels with a 2-week rolling average below 75% of the current Base Rate may fish in designated closures for the first 4 days of a management week, and then must leave the area; in August and beyond, the three Tier system is in place as follows:

1. Tier 1: Vessels and MS fleets with a chum bycatch rate less than 75% of the Base Rate
2. Tier 2: Vessels and MS fleets with a chum bycatch rate ≥ 75% ≤ 125% of the Base Rate
3. Tier 3: Vessels and MS fleets with a chum bycatch rate > 125% the Bases Rate are assigned to "Tier 3".

Vessels and MS fleets assigned to Tier 1 may fish in Savings Closure Areas for the Management Week (10:00 pm Friday to 10:00 pm the following Friday), vessels and MS fleets assigned to Tier 2 may fish in Savings Closure Areas for the first 4 days of the Management Week (10:00 pm Friday to 10:00 pm Tuesday), and vessels and MS fleets assigned to Tier 3 are prohibited from fishing inside Savings Closure Areas for the entire Management Week.

A significant change in the revised system is that closures for vessels in Tier 2 applies not for the first 4 days of the management week, but for the second three days of the management week. This will make more vessels able to remain in the closed areas if they choose to do so.

Closure announcements will begin the second Thursday after June 10th. Thus, the first closure will be in place 8-15 days after the start of the season, depending on the day of the week that June 10 falls. As shown in
Table 5-34, over the 2003-2011 period closures have been in place for a significant number of days in June in 2005, 2006, and 2011. Few or no closures were implemented in June in other years because chum PSC rates were very low – for 2008-2010, for example, below 0.03 chum / MT. The historical status analysis suggests that implementing closures at such low PSC rate levels would be unlikely to reduce PSC.

Table 5-34. Days per Month with Chum or Chinook Closures in Place, 2003-2011.

Year	June	July	Aug	Sept	Oct	Nov
2001	2	13	15	30	31	
2002		13	31	30	31	1
2003		21	25	27	24	
2004		30	31	15		
2005	7	31	29	25	25	
2006	11	31	31	30	31	
2007		23	31	28	31	2
2008		28	29	27	29	1
2009	2	28	31	28	13	
2010	2	29	22	24	20	1
2011	14	31	31	30	29	1

In order to analyze the potential impact of these revisions, historical fishing patterns inside and outside the closures were examined. Under the proposed program, June closures are mandatory and therefore apply to all vessels. However, historically little fishing occurred in June inside closures in most years (Table 5-35). If any incentive effect exists now through which the tier system would motivate vessels to avoid chum PSC, this incentive would be lost under the new, tier-less June closures.

Table 5-35. Fishing inside RHS closures that began in June during the 5 days after closures were implemented, 2003-2011.

Year	CV	% Hauls In	# Hauls In	# Hauls Out	% Chum In	Chum In VRHS	Chum Out VRHS	Chum Rate In	Chum Rate Out	% Pollock In	Pollock In (MT)	Pollock Out (MT)	Chum PSC Rate Ratio In/Out
2005	CV	15.5%	26	142	9.9%	273	2,476	0.133	0.204	14.4%	2,048	12,150	0.65
2006	CV	0.7%	2	265	2.2%	620	27,984	2.929	1.326	1.0%	212	21,102	2.21
2011	CV	6.0%	37	579	5.3%	772	13,868	0.200	0.349	8.9%	3,859	39,695	0.57
2005	CP/MS /CDQ	0.3%	1	378	0.2%	6	2,889	0.141	0.091	0.1%	42	31,595	1.55
2006	CP/MS /CDQ	0.0%	0	395	0.0%	-	632		0.022	0.0%	-	28,453	*
2011	CP/MS /CDQ	7.6%	46	560	23.7%	2,423	7,786	0.746	0.183	7.1%	3,249	42,620	4.08
2003-11	CV	6.2%	65	986	3.6%	1,665	44,328	0.272	0.647	7.7%	6,119	72,947	0.42
Avg/ Total	CP/MS /CDQ	3.4%	47	1,333	17.7%	2,429	11,307	0.738	0.086	3.1%	3,292	102,668	8.57

As noted, little fishing has occurred inside the closures in most years so the change in Tier structure is unlikely to have a significant impact on the efficacy of the closures. However, in June if the fishing that occurred were moved out of the closures and occurred at the average rate outside of the closures, it would have resulted in a very small amount of chum savings, as reflected below (Table 5-36). Additinonal information is contained at the end of Appendix 7. Note that while under the new tier system it is possible that a small amount of additional savings could occur in July under the revised program, the vast majority of fishing in the period after closures was by Tier 1 vessels so in July there will be little change in access to the closures (because under the status quo Tier 2 vessels are prohibited from fishing in the closure for the first 4 days after the closures are in place and in the revised program only vessels with relatively low PSC are allowed to fish in closures during the four days after they are in place).

Table 5-36. Estimated potential additional chum PSC reduction from vessels being prohibited from fishing in RHS closures that began in June, 2003-2011.

Year	Potential June Chum Reduction	% of June chum PSC	% Annual chum avoided
2005	(142)	-0.6%	-0.02%
2006	339	0.3%	0.11%
2011	1,253	2.9%	0.65%

In July, closures have been in place for the majority of the time for most years from 2003-2011. Fishing that occurred inside July RHS closures is shown in Table 5-37.

Table 5-37. Fishing inside RHS closures that began in <u>July</u> during the 5 days after closures were implemented, 2003-2011.

Year	CV	% Hauls In	# Hauls In	# Hauls Out	% Chum In	Chum In VRHS	Chum Out VRHS	Chum Rate In	Chum Rate Out	% Pollock In	Pollock In (MT)	Pollock Out (MT)	Chum PSC Rate Ratio In/Out
2003	CV	8.1%	35	397	5.1%	200	3,726	0.056	0.091	8.1%	3,589	40,892	0.61
2004	CV	0.9%	6	661	7.5%	274	3,385	0.520	0.050	0.8%	527	67,849	10.42
2005	CV	1.9%	16	823	2.2%	4,137	183,268	2.905	2.518	1.9%	1,424	72,791	1.15
2006	CV	1.0%	7	700	1.7%	712	41,340	2.949	0.748	0.4%	241	55,250	3.94
2008	CV	8.9%	63	641	31.7%	379	815	0.198	0.018	4.0%	1,915	45,532	11.05
2009	CV	7.9%	53	616	8.4%	835	9,118	0.351	0.223	5.5%	2,381	40,866	1.57
2010	CV	1.0%	6	619	5.4%	147	2,572	0.687	0.048	0.4%	214	53,597	14.31
2011	CV	4.6%	66	1,361	8.9%	2,498	25,522	0.917	0.276	2.9%	2,725	92,489	3.32
2003	CP/MS/CDQ	3.0%	39	1,270	10.7%	290	2,431	0.133	0.023	2.0%	2,177	105,329	5.77
Other yrs	CP/MS/CDQ	0.1%	3	4,950	1.3%	316	23,132	2.3	0.057	0.0%	140	407,321	*
2007	CP/MS/CDQ	0.8%	10	1,185	0.9%	18	2,055	0.024	0.021	0.8%	761	96,226	1.11
2009	CP/MS/CDQ	0.5%	6	1,196	0.4%	6	1,419	0.029	0.018	0.3%	208	80,922	1.64
2011	CP/MS/CDQ	0.2%	3	1,524	0.0%	3	17,108	0.012	0.146	0.2%	270	117,177	0.08
2003-11	CV	4.2%	252	5,818	3.3%	9,182	269,746	0.705	0.647	2.7%	13,017	469,266	1.09
Avg/Total	CP/MS/CDQ	0.6%	61	10,125	1.4%	633	46,145	0.178	0.086	0.4%	3,555	806,974	2.07

Note: For confidentiality, information on hauls in closures for 2004-2006, 2008, and 2010 are combined.

5.5.3.2 Measures to reduce overall chum and Chinook PSC

A vessel's PSC rate compared to the base rate determines how the vessel's tier is determined. In the current RHS system, there is an initial base rate and then a process by which the base rate adjusts during the season that impacts whether or not hotspot closures are imposed and into what tier vessels fall from week to week. At the beginning of the B season, the chum base rate is established at 0.19 salmon/t. Beginning on July 1, the rate is re-adjusted every week to a three-week moving average of the fishery's PSC rate. Under the revised program, the date when a rolling average begins is the second Thursday Announcement after June10th. On each Thursday Announcement thereafter, the Base Rate will be calculated as an accumulated average. As with the status quo RHS program, the initial base rate is 0.19.

Additional changes were proposed to the Base Rate under the revised program. In order to best evaluate the impact of these modifications we use historical simulations on how the Base Rate modifications would have been estimates to impact closures (from the pre-RHS analysis employed under Alternative 1 and with further analysis in Appendix 7) and then compare with the proposed changes to the Base Rate under the revised RHS.

The baseline pre-RHS analysis uses base rates of 0.06 and 0.19 chum/t but the model setup allows examining how average PSC changes under different base rates (Table 5-38**)**. Under the larger of the base rates examined, it is less likely that a closure would be in place when large PSC events occur.[36] Interestingly though, low base rates can at times cause more chum to be caught, as is shown for 1996 (Table 5-38). The lower reduction in this case occurs because closures are put in place that end up diverting vessels away from relatively low-PSC fishing. A very low base rate also adds costs through unnecessary reallocation of pollock effort.

Table 5-38. Average simulated chum PSC reductions for different base rates, for the baseline PRHS configuration, 1993-2000. Note that the base rate displayed is for the 2-5 day reference period of the model (not the 3-week window or the fixed annual level that has been features of the Sea State model).

	Base Rate (short-term)						
Year	0.01	0.02	0.06	0.12	0.19	0.3	0.4
1993	0.147	0.147	0.147	0.146	0.146	0.136	0.135
1994	0.13	0.132	0.124	0.128	0.128	0.128	0.125
1995	0.087	0.069	0.051	0.044	0.029	0.027	0.017
1996	0.034	0.022	0.165	0.16	0.156	0.144	0.111
1997	0.104	0.104	0.104	0.103	0.099	0.095	0.085
1998	0.116	0.116	0.114	0.114	0.104	0.083	0.077
1999	0.198	0.197	0.168	0.157	0.143	0.128	0.124
2000	0.304	0.304	0.296	0.28	0.258	0.214	0.176
Total	0.140	0.136	0.146	0.141	0.133	0.119	0.106

The modifications to the Base Rate under the proposed program here in Alternative 3 are 1) imposing a floor on the base rate and 2) adding a provision to the limit the ability to increase the base rate.

A floor of 0.10 on the base rate is included in the revised RHS. This would mean that when no areas have a three-week moving average bycatch rate greater than 0.10, no closures are put in place. There is also a provision to limit the increases to 20% of the current base rate. By restricting the speed that the rate is able to change, it makes it less reactive to large rapid changes in bycatch rates.

As noted in the analysis of Alternative 1, a floor on the base rate proved to be useful in minimizing the costs of the system. At very low PSC rates, the historical simulation showed that imposing closures can at times slightly increase bycatch. Thus absent a floor on the base rate, imposing closures at such low levels moves vessels around unnecessarily at extra cost with little expected benefit.

One concern with the floor as written in the draft revised industry RHS proposal is that it is possible that the base rate will not rise quickly enough. Thus if bycatch was near zero for two weeks and 0.25 the third week, the 3-week average base rate would be below the 0.10 floor. Basing the floor on a shorter time window (e.g., one week) would solve this problem.

The periods when the 3-week moving average of chum PSC was less than <0.10 were separately evaluated to assess the impact of this measure. The exact arrival of data for the closures is uncertain because of delays between when chum PSC are caught and when that information is relayed to Sea State,

[36] One caveat to note about the base rates here is that they are base on the recent window of data considered (which varies from 2-5 days), rather than the 3 weeks before.

but the rates for 2-23 days before the closures were imposed were used to identify closures that would likely have been subject to the floor. On average, there was no observed reduction in chum PSC from the closures when comparing the chum PSC rates in the days before and after the closures (as shown in Appendix 7, there is an insignificant increase).

Table 5-39. Observed chum PSC rates for the 3 days before and after chum RHS closures when the 3-week moving average <0.10 chum/t of pollock (only occurred in low-PSC years)

Rate period	2008	2009	2010	Total
1-3 days before	0.017	0.078	0.041	0.041
1-3 days after	0.045	0.133	0.055	0.080

This is true even in percentage terms – even if there were slight savings in percentage terms, the total benefit would be very small. All of the closures that would fall below the floor were imposed in 2008-2010 and the mean chum PSC rate in the 3 days after the closures actually rose to 0.08 chum/MT pollock compared to 0.04 chum/MT in the 3 days before the closures, though this was not a significant difference. Interestingly (perhaps by chance), there was significant savings in the closures when the 3-week moving average was between 0.1 and 0.2, suggesting that raising the floor to a higher level would reduce chum effectiveness.

The 3-week moving average in-season adjustments of the base rate allow the system to adjust and still be relevant to the current fishing conditions. If the base rate is very high and the actual PSC rate is very low, then there are no closures or they do not apply to anyone. If the base rate is very low relative to the PSC rate, then closures apply to all cooperatives (so exclude people but do not provide an incentive to be in one tier versus another).

At low chum-encounter periods, an area may have the highest PSC, but closing it will not have much expected benefit in terms of salmon PSC reduction and may lead to good, relatively low-PSC areas being closed, potentially forcing the fleet to fish in areas that actually have higher PSC. The absolute reduction in PSC at low encounter levels is also likely to be low.

The historical analysis suggests that lowering the base rate from 0.19 chum/t would not have a significant impact on RHS effectiveness. Raising the rate to 0.4 would lead to slightly greater PSC levels in the historical simulations, but this was at lower average annual levels than the 2011 rate, for example, when chum closures were in effect for virtually all of the B season. As noted above, closures have been effective when the observed rates were between 0.1 and 0.2 chum/t.

It would be useful for the Council to request that the intent of 20% limitation on the increase in the base rate increase be clarified. If the goal is to ensure that the tier system is always functioning, it could be based on recent information so that the rate (when above a floor) would always place vessels in different tiers. Another potential issue with the slow re-adjustment (i.e., the 3-week moving average) is that if the base rate were very low for two weeks, (0.01, for example) then the base rate has the potential to not move above the "floor" with the rising bycatch. Similarly, as overall bycatch rates come down, the base rate will not come down quickly and all vessels may be in the "good" tier.

Under the proposed revised RHS program, beginning in August, when an ADF&G statistical area has 2 percent of pollock effort and a Chinook bycatch rate greater than 0.035, chum bycatch closures will be suspended for the remainder of the season. To analyze the impact of this provision, the approximate dates when the chum closures would have been suspended from 2003-2011 (for the entire Bering Sea Region) are calculated (Table 5-40). The exact date would depend on what information was available on a particular day.

Table 5-40. Date of Chum Program RHS Closure Suspension East and West of 168° west Longitude

Year	W of 168	E of 168	Combined
2003	8/27/2003	9/17/2003	9/10/2003
2004	8/19/2004	9/2/2004	9/2/2004
2005	8/20/2005	8/13/2005	8/27/2005
2006	9/24/2006	8/27/2006	9/17/2006
2007	8/27/2007	8/13/2007	8/27/2007
2008	10/14/2008	9/23/2008	9/23/2008
2009	NA	9/3/2009	9/24/2009
2010	10/1/2010	9/17/2010	9/17/2010
2011	11/5/2011	9/10/2011	9/10/2011

After largely being focused on chum from 2001-2005, the RHS program placed a priority on Chinook through 2010. When the Amendment 91 regulations were implemented in 2011, the regulations which explicitly prioritized Chinook closures ceased as all RHS provisions for Chinook were removed from regulation.

Thus 2011 was the first year where chum closures continued throughout the B-season regardless of Chinook PSC rates by area and thus provides an indication of how these chum closures have affected Chinook PSC. Beginning in 2011, we examine the Chinook rates inside and outside the chum RHS closures to determine whether or not they appear likely to be raising Chinook PSC. The following process was utilized:

- The pollock catch and PSC for all of the hauls that occurred inside and outside of the area that would be closed by the RHS closures for the 5-days before the closures were examined and compared.
- The amount of pollock catch inside the area that would be closed is multiplied by the difference in Chinook rates (Chinook PSC rate outside – Chinook PSC rate inside) to make a coarse estimate of the impact on Chinook of the chum RHS closures.

As can be seen in Table 5-40 below, because there is little difference in the Chinook PSC rates in and out of the closures late in the year in 2011, there is no evidence that there will be a significant impact on Chinook PSC from moving vessels out of the closed areas. Note this estimate does not account for uncertainty, and actual Chinook PSC could be higher or lower.

Table 5-41. Estimated reduction in Chinook PSC as a result chum RHS closures

Month	Possible Chinook Reduction	Total Chinook in Period	% in-period Chinook Reduction
August	19	351	5.3%
September	-28	4,980	-0.6%
October	5	8,278	0.1%

Whether or not the provision of the revised program to suspend Chinook closures is important depends on both the rates in the closures (discussed immediately above) and whether the chum RHS closures slow fishing so that more Chinook are caught at the end of the B season. As has been noted in the status quo analysis and in public comment in past Council meetings, slowing down fishing substantially early in the season has the potential to increase the time required for vessels to catch their share of the pollock TAC. How large is this increase likely to be and what is the potential magnitude of this impact?

To provide some insight into the potential impact of a significant slowing down of fishing, below we display the PSC from the last trip of the year of all shoreside catcher vessels In the future, there are Amendment 91 incentives to avoid Chinook so this is unlikely to be completely representative, but it does provide some information about how high Chinook PSC has been at the end of the season. This represents a large change in the number of trips per year (6-15 percent), much larger than any impacts from current closures. But it does display the trade-off between additional measures that might slow pollock fishing to protect chum and the amount of fishing that is likely to occur in high-Chinook times of the year.

Table 5-42 Chinook, Chum, and Pollock in the last trip of all observed shoreside catcher vessels, 2003-2011

year	Chinook	Chum	Poll MT	% Chinook	% chum	% poll	% trips
2003	3,038	11,081	19,190	43%	12%	7%	10%
2004	3,728	15,638	14,327	21%	6%	6%	10%
2005	8,505	16,743	15,424	32%	4%	6%	9%
2006	3,249	4,345	15,398	20%	2%	6%	9%
2007	7,067	1,725	13,059	26%	5%	6%	9%
2008	1,327	818	13,612	38%	11%	8%	12%
2009	413	2,324	15,027	22%	11%	10%	15%
2010	2,034	454	15,398	39%	9%	11%	15%
2011	3,360	8,412	14,067	24%	7%	5%	6%

A related question is whether or not additional effort could be taken to start fishing earlier. In August 2011, there was an unusually steep decline in pollock catch per unit effort (CPUE), which fell abruptly, leading to more fishing occurring in October than otherwise would have happened. Table 5-43 displays the count and percentage of hauls by month for the catcher processor and mothership sectors, indicating a larger than average amount of fishing in October in 2011, driven apparently by poor pollock fishing conditions in the middle of the summer. Table 5-44 displays the number and percentage of hauls by the shoreside catcher-vessel sector. There was much less effort in October from 2008-2010 than in previous years, which was impacted by low TAC and by the greater number and proportion of hauls that have occurred by CVs in June since 2007.

Table 5-43. Count and Percentage of CP and MS Hauls per Month, B-Season 2003-2011[37]

	Hauls per month by year, CP, MS, and CDQ Sectors								
month	2003	2004	2005	2006	2007	2008	2009	2010	2011
June	648	679	658	510	417	309	401	578	609
July	1,416	1,519	1,435	1,374	1,375	1,135	1,012	948	1,156
Aug	1,347	1,369	1,353	1,475	1,376	1,038	809	749	924
Sept	944	864	848	895	784	852	461	161	862
Oct	143	56	42	360	579	237	16	18	754
	% of total Hauls by year, CP, MS, and CDQ Sectors								
month	2003	2004	2005	2006	2007	2008	2009	2010	2011
June	14%	15%	15%	11%	9%	9%	15%	24%	14%
July	31%	34%	33%	30%	30%	32%	37%	39%	27%
Aug	30%	31%	31%	32%	30%	29%	30%	31%	21%
Sept	21%	19%	20%	19%	17%	24%	17%	7%	20%
Oct	3%	1%	1%	8%	13%	7%	1%	1%	17%

Table 5-44. Percentage of CV Hauls per Month, B-Season, 2003-2011[38]

	Hauls per month CV Sectors								
month	2003	2004	2005	2006	2007	2008	2009	2010	2011
June	190	232	419	432	469	575	542	428	923
July	653	694	839	707	728	805	753	691	1,429
Aug	923	938	833	907	763	816	456	500	1,417
Sept	724	802	604	827	756	618	236	247	893
Oct	395	495	586	722	861	233	94	169	724
	% of total Hauls by CV Sector								
mon	2003	2004	2005	2006	2007	2008	2009	2010	2011
June	7%	7%	13%	12%	13%	19%	26%	21%	17%
July	23%	22%	26%	20%	20%	26%	36%	34%	27%
Aug	32%	30%	25%	25%	21%	27%	22%	25%	26%
Sept	25%	25%	18%	23%	21%	20%	11%	12%	17%
Oct	14%	16%	18%	20%	24%	8%	5%	8%	13%

An additional question is whether or not requiring sequential weeks to be above the 0.035 Chinook/t level is more likely to indicate that Chinook have arrived. There has been significant variation in the timing of the arrival of Chinook on the pollock grounds among years. Requiring a longer period of time or a larger number of areas to be above a Chinook threshold would make it more likely that the removal of chum

[37] The total number of hauls changes based on TAC and catch rates, but the numbers indicate that there was relatively intense effort early in the season.
[38] Because of the implementation of 100-percent observer coverage in 2011, shoreside delivery counts for 2011 are not comparable to previous years. Percentages adjust with the total TAC as a shorter period is typically required to catch a lower TAC.

closures is not premature, but would also make the system slower to react to the arrival of Chinook on the grounds.

Table 5-45. Summary of Alternative 3 RHS modifications and impacts

Program Feature	2011 Status quo	Alternative 3, proposed revision	Discussion of Impact
Initial base rate	0.19	0.19	
Adjusted base rate (3-week moving average)		Minimum rate of 0.10 required for closures.	Little impact on chum; possible improvement in pollock fishing.
Max area	Max of 3,000 sq. mi. East of 168, 1,000 sq. mi. West of 168	Max of 3,000 sq. mi. East of 168, 1,000 sq. mi. West of 168	No change
Number of areas	Max 2 East of 168, 1 west of 168	No maximum	Ability to implement more small closures, though this is optional
Level of Tier status	Vessel/MS platform level	Cooperative-level	Potential for improvement in chum PSC reduction, though magnitude uncertain & unlikely to be large with same sized closures as status quo
Tier system	No closures for Tier 1 coops <0.75 of base rate; 4-day closures for Tier 2 coops with 75-125% of base rate; 7-day closures for Tier 3, >125% of base rate	June: no tier system, closures for all; July: <75% can stay in closure for 4-days, then leave; other vessels 7-day closures; August until end or Chinook suspension: same tiers as status quo, but Tier 2 vessels can fish for 4-days and then must leave instead of being excluded for 4 days	On average, minimal impact expected from these changes, although at times there could be stronger or weaker incentives to avoid areas. Less than 6 % of fishing during the 5-days after closures occurred in areas. For example, in June there is no tier system so therefore no link to individual or coop behavior. The change in Tier 2 status will allow more fishing in the closures in August and beyond.
Chum closures suspended after Chinook exceeds threshold		Chum closures removed in late August or September	Increased flexibility late in the season that could slightly increase chum bycatch, reduce Chinook, and better achieve TAC.
New Flexibility added		Potential focus on areas with more AK chum; flexibility to leave better pollock areas open when catch rates are similar	More likely and less costly to achieve TAC; potential slight reduction in Chinook because faster pollock fishing means less pollock caught in high Chinook bycatch period in October

The amount of area closed is similar to the current program (less in August and September with the intent to prevent larger areas from interfering with chum avoidance). In the revised program there are not different closures that are implemented in higher-PSC periods so it is are likely that the revised RHS program would be comparably effective at reducing chum PSC in high-bycatch years like 2005 or 2011. However, the closures of this proposed revised system can be better targeted to focus on Western Alaska chum and to reduce the likelihood that chum PSC reduction will lead to greater Chinook PSC, a feature about which the Council has expressed concern. If in the future more information is known about where AK chum PSC are most likely to be encountered, this change could provide additional conservation benefits.

There are no features in the revised RHS program that indicate it will have a significant impact in reducing chum PSC over the status quo although the revised RHS program allows greater flexibility in achieving catching the pollock TAC and potentially in protecting Chinook salmon. Because the RHS program was focused on Chinook in late in the B season of most years before 2011, removing RHS closures is unlikely to have a significant impact on chum. In sum, the performance of Alternative 3 is likely to be similar to Alternative 1 in terms of estimated chum PSC, although the proposed changes increase the ability of the fishery to avoid Chinook compared with the current program.

5.5.3.3 Alternative modifications to proposed RHS system (not currently included in RHS proposal)

Following the analysis of Alternative 3, some suggestions are made about potential additional modifications that could be made in a revised RHS program to improve its efficacy. A general discussion of how measures might provide additional chum PSC conservation is provided, followed by more specific list of features.

Vessels choose to fish in different locations, trading off the expected costs and benefits of fishing in different locations. Vessels in the fishery communicate about the pollock and salmon PSC conditions on the grounds. When only pollock is involved, vessels consider necessary catch rates, the value of different sized fish, and the costs (in time and fuel) of going to different locations. Different sizes and configurations of vessels, different port locations, fisher experiences and other factors lead to different choices. With Chinook involved, vessels also must avoid Chinook to stay under their personal share of the hard cap and best respond to the incentives in the IPAs. If vessels ignore Chinook bycatch, they could quickly be shut out of the fishery. Because Chinook conditions are highest (and volatile) at the end of the B-season, vessels must conserve throughout the season to ensure that they have enough Chinook to catch all of their pollock.

In contrast, with chum PSC, vessels that ignore it face a closure of a small portion of the pollock fishing grounds, but pay the all of the lost revenue and increased costs of avoiding chum. Before Amendment 91, Chinook was caught in a similar vein. Now under Amendment 91, as noted in the status quo analysis, the Council has significantly changed the priority placed on Chinook relative to chum. When vessels are faced with whether to fish in an area with high chum or Chinook PSC, they trade off the large potential financial risk of catching Chinook and being shut of the pollock fishery versus if they catch a high quantity of chum PSC their personal action might close an area that they might or might not fish in the following week. Vessels also pay the cost of moving but realize few benefits. It is not surprising to see vessels place a much higher priority on Chinook.

If the Council chooses to increase the incentive to avoid chum PSC, this puts additional financial burden on the pollock fleet, though to what degree is uncertain because there is considerable variation in the costs of avoiding chum at different times and for different vessels. But the Amendment 91 incentives to avoid Chinook will remain. With any change in the chum PSC program, vessels will still trade-off how efficiently they catch pollock with how well they avoid Chinook, but they will make this trade-off with additional consideration of chum.

There are two primary means through which the existing RHS system may reduce PSC:

- The “closure effect’ – prohibiting vessels from fishing during the next period in current high-PSC areas and
- The “incentive effect” – the tier system and the threat of the closures may provide some incentive to have a lower PSC rate before areas are closed to avoid being subject to the closure in subsequent periods.

There are trade-offs in the development of any system between the 1) how much effort and costs are spent avoiding chum and Chinook PSC and 2) the amount of PSC avoided as a result. The relationship between chum and Chinook PSC avoidance is more complicated. At times, as is shown in the status quo analysis, chum and Chinook occur in the same locations, so avoiding one can lead to avoiding the other. However, any action that slows fishing early in the year will lead to more fishing in the high-Chinook portion of the B season.

If the Council wishes to modify the RHS program to place greater emphasis on chum PSC avoidance, the ideal system will have a stronger incentive effect to encourage creative vessels to actively avoid chum. 1. Ideally the system will not have more closures that are actually implemented, but the system may need to link stronger consequences to behavior in order to induce greater PSC avoidance.

The current tier system allows some vessels to fish inside of the RHS closures to provide an incentive for vessels to avoid high PSC, because the closures do not apply to lower-PSC vessels. However, the small amount of fishing that Tier 1 and 2 vessels do inside of current closures suggests that this incentive is not very strong, as most vessels choose to fish elsewhere during the closure period. It is reasonable to conclude that a larger carrot or stronger stick must be at play if vessels are going to change their behavior markedly.

Vessel captains make several important decisions that impact their PSC rates, including:

- When to start the season
- What general area to fish in
- How to fish – how deep, when to fish, and whether to use excluders (when possible)
- Whether to stay in an area when fishing conditions change or they gain knowledge of improved fishing conditions elsewhere.

Concern about Chinook as well as uncertainty about pollock fishing conditions and whether vessels will be able to catch their share of TAC has pushed most vessels to start fishing earlier in the B-season. Excluder technology for Chinook avoidance has reportedly increased, although excluder use is not tracked by NMFS. Thus RHS incentives can affect several choices:

- Where to go
- How to fish while there,
- Whether to leave when high PSC is encountered.

The closure effect of the RHS program impacts some vessels, but the incentive effect does not appear to be large enough to regularly induce vessels to either avoid high PSC grounds or to leave when they encounter high PSC. This is not to say that there is no effect, just that vessels can be seen choosing to fish in or returning to recent chum PSC “hotspots” that are not (or not yet) subject to closures.

In a general sense, the Council has several means to alter the RHS program to further incentivize changes in behavior:

- Require stronger incentives (such as larger closures) that would expand to close more hotspots when they exist.
- Require the RHS program to achieve performance goals. The Council can require that industry develop a plan that it can demonstrate will prohibit vessels from fishing in high-PSC areas (at a threshold set by the Council). In other words, the Council may make a policy change from requiring a mechanism to requiring an observed outcome.

In all cases, actions should be tied to individual behavior so that vessels have incentives to reduce PSC where practicable to avoid being subject to closures or negative actions.

There are many ways that the tier system could be adjusted to provide stronger incentives to have lower chum PSC rates. For example, the new CP sector Chinook IPA makes high-PSC vessels potentially subject to longer closures (2 weeks) when their aggregate PSC level is high, relative to other vessels. A similar mechanism could be implemented for chum. Or at the extreme, a vessel that has persistently very high PSC rates could be forced by an alternative tier system to “stand down” for a period of time (or this could be interpreted as the vessel being subject to a Bering Sea – wide closure). An expanded RHS program could also:

- Close more areas in high-PSC times. Anytime weekly bycatch for an area is above a threshold, the area could be closed to vessels with high chum PSC.
- Make whether vessels are subject to closures contingent on recent behavior (e.g., since the last closure), so that vessels are rewarded with open grounds for low PSC and pay a consequence for extremely high-PSC rates.
- Create more tiers, so that there incentives for vessels regardless of their PSC levels
- Shorten the approximately 24-hour delay between when closures are announced and implemented. This would have costs to the fishery, but would make more effective closures and discourage vessels from being in high-PSC areas that might be immediately subject to closures.
- If a more a stringent chum RHS is developed, vessels could be receive an exemption from some of the chum closures if they have relatively low *Chinook* PSC, further increasing the incentive to avoid Chinook PSC as well.
- The late-season Chinook closure exemption could be made to only apply to vessels with low chum-PSC in June and July.

The tier system in the current and proposed RHS systems is tied to spatial closures, but it could be tied to any incentive. Many options exist for the types of incentives that can be tied to a tier system, but the range of possible incentives that could be incorporated includes:

- Larger or longer-term closures for high-PSC vessels (as discussed above)
- Periods of no fishing
- Fines or fees, that could pay for RHS monitoring or could fund research
- Areas could be placed in a ‘warning list’ so that vessels fishing in areas that were known to be high-PSC would make vessels subject to larger or longer-term spatial closures or other penalties.

It should be noted that the draft Chinook “Financial Incentive Plan” (FIP) developed by the members of the catcher-processor sector as part of the Amendment 91 analysis would also share many of the characteristics of an expanded tier system. In a manner similar to the FIP, vessels could contribute money to a pool that would be returned to the fleet in proportion to PSC performance to provide an incentive for vessels to avoid chum without using spatial closures.

There is an additional modification of the proposed revised RHS program that could be useful for the future evaluation of the program. Chum hotspots or "advisory areas" could be designated but not closed after the Chinook threshold leads to the suspension of the chum RHS closures. This would allow fishing inside the "closures" actually to be observed (since the closures are not really applied). Of course, the incentives for SeaState in this case would be different than when designating actual RHS closures because such an advisory hotspot does not actually lead to vessels potentially being forced onto grounds with lower pollock CPUE or high Chinook PSC rates. Nevertheless, it provides an interesting experimental opportunity.

5.5.4 Alternative 4, Triggered closure with RHS exemption

Note that the analysis and discussion of Alternative 4 component 1 is represented by the discussion of Alternative 3. Discussion under that alternative centers on the revisions to the RHS program in contrast to the status quo RHS program. The same revised RHS program is in operation under Alternative 4. Thus all components include the revised program but build upon it (after component 1) by imposing broad-scale triggered area closures.

The methodology for evaluating the impact of the additional triggered closures is similar to the other approaches in that results are based on superimposing proposed rules on data from 2003-2011 and assuming that fishery behaviors would be unchanged. For the areas that get closed the pollock that was caught inside the region is diverted to outside and salmon bycatch accrues at the rate observed outside the area. For example, if a closure occurred on a specific data and the historical data indicated that 1,000 t of pollock was caught inside the closure after that day, then that 1,000 t would be caught in proportion to areas and times outside of that area and the added salmon bycatch would be $x \bullet 1{,}000$ where x is the number of salmon caught per ton of pollock outside the closure area and after the closure occurred (accounting is done by sector). If the bycatch rate x is higher than the actual rate *inside* the closure that the total bycatch in that year will be higher than the observed.

5.5.4.1 Alternative 4, Component 1

Component 1 of alternative 4 imposes a large-scale triggered closure to which participants in the RHS program are exempt. This component is examined in two ways: 1-as a separate alternative whereby this is the only component selected and thus the RHS program provides the primary management tool while the large-scale area closure provides the incentive to participate in the RHS, and 2-as the first layer in a series of measures including components 2 through 6 as desirable to provide additional protection to minimize chum PSC.

As a first pass for Alternative 4 it was assumed that the fishery-wide bycatch level (with the trigger cap allocated only between CDQ and non-CDQ vessels) was evaluated against season-wide caps (no further sector allocations) to determine when closures would occur. This entailed simply accruing the annual bycatch by these two groups and when a group-level (CDQ or non-CDQ) cap was reached, the 80% area would be closed to that group. Results for chum salmon saved indicate approximate dates closures would have occurred in different years are shown in Table 5-46. Since this is a measure intended to provide incentives for participation, this component is not evaluated as a primary management tool, but rather it gives some idea of the magnitude of the constraint as a means to providing an incentive to participate in the RHS program.

Selection of a cap level of under this component will interact with choices made elsewhere. For example, additional closure and cap configurations may result in complexity where participation may become less desirable.

Table 5-46. Approximate week the large area closure would occur.

	25,000		75,000		200,000	
	CDQ	**Non-CDQ**	**CDQ**	**Non-CDQ**	**CDQ**	**Non-CDQ**
2003	6-Sep	2-Aug	27-Sep	23-Aug		
2004	29-Aug	27-Jun	19-Sep	1-Aug		29-Aug
2005		28-Jun		5-Jul		19-Jul
2006		7-Jun		21-Jun		26-Jul
2007	6-Sep	16-Aug		6-Sep		
2008						
2009		26-Jul				
2010						
2011	4-Oct	21-Jun		19-Jul		

Given that the current program has 100% participation, it is likely that if this component alone were selected, and with the relative constraints estimated on the CDQ and non-CDQ fishery as shown in Table 5-46, participation would remain at 100%. Thus the impacts of this component (alone with no other components selected) are best characterized by status quo, assuming no other changes to the RHS program prior to implementation.

5.5.4.2 Alternative 4, Components 2-6

Under Components 2-6, additional layered management is placed on the participants of the RHS program by virtue of triggered closure areas[39]. Here whatever cap level is selected under Component 1 does not need to be equivalent to one selected under these components. Once these components are selected, a specified trigger area, cap and time frame are imposed on the fleet (either by CDQ and non-CDQ fleet or by individual sector) *in addition* to closures imposed by virtue of participation in the RHS program. Since RHS closures were already imposed on the fleet over the analytical time frame used here, it is assumed that imposing additional triggered closures by sector would best approximate this alternative, however it should be noted that no changes in fleet behavior as a result of the threat of the additional closures are included for analysis but it is assumed that some modification in fleet behavior would be likely to occur. Thus this analysis represents a worst-case scenario for constraints by sector as fleets would likely make behavioral changes to try to avoid reaching specified cap levels.

[39] Note that as discussed in Chapter 2, component 6, cooperative provisions are treated qualitatively and all analysis quantitatively is focused on the sector-level allocations only.

An Alternative 4 option closes an area only in the June July period. This presents a challenge for analysis because the potential reaction by the fleet to such closures could vary. For example, vessels restricted by the closure in the June-July period may choose to fish outside the closure during that period or choose divert their pollock to fish after the end of July or some combination of these strategies. Consequently, we analyzed this type of closure by introducing a uniform 0,1 variable λ which when set to 1.0 assumes the pollock that was caught inside the closed area was diverted to outside the area for the remainder of the June-July period or if set to zero assumes the pollock that was caught inside the closed area was diverted to after the end of July. Intermediate values of λ allow some pollock to occur in both periods. For analysis, values selected for λ were 0.0, 0.5, and 1.0. The following describes the options and the closure area and period used for analysis:

Option	Closure area	Period/closure size basis
1a)	80%	B season
1b)	80%	June-July
2a)	60%	B season
2b)	60%	June-July

As with the results from Alternative 2, presentation over all combinations of caps (3), allocations (3), options (4), sectors (4), alternative λ values (3; for a subset of options), years (9), species and/or stocks of interest (8) would result in presenting nearly 30,000 values. Consequently, tables below are intended to highlight the different dimensions of the problem rather than show all results. As noted above, extra accounting is required to evaluate the within-B season impacts of the different components and alternative specifications. For this reason values are presented expanded to the genetics information on chum salmon (available for 2005-2009 and using seasonal average proportions in other years).

For an appreciation of the inter-annual variability over options there is a broad range of results. For example, the chum salmon saved for a cap of 25,000 and sector split 2ii, option 1b) outperforms the other options in all years except for in 2007 (where it is estimated to have a slightly negative impact, i.e., more bycatch; Table 5-47). It should be noted that in 2007 the overall chum bycatch was quite low and such fine scale differences are minor. As expected, higher cap levels result in reduced overall chum salmon savings (Table 5-47 through Table 5-49). Imposing closures in June-July has definite consequences for Asian AEQ chum bycatch (much lower savings) compared 1a) or 2a) and varied by sector split (Table 5-50). The dates of closures across options and sector allocations and caps indicate that higher cap levels result in closures that occur later in the season (for options 1a) and 2a) and for the June-July period, generally occur near the end of July (Table 5-52-Table 5-54).

The impact of different λ values on closures across caps and for an intermediate sector allocation (4ii) shows that for coastal west-Alaska stocks the best option for saving chum salmon is when it's value is zero (indicating that pollock diverted due to closures in June-July be taken later on in the year when there are no closures; Figure 5-32). This figure also reveals that this comes at the expense of worse Chinook salmon bycatch (i.e., negative Chinook salmon savings due to increased fishing activity later in the year when Chinook bycatch rates generally increase).

Over all options and sector splits for Alternative 4, component 2, the sector split configurations had the least contrast (except for the 200,000 cap and option 2a); Table 5-50). These results also indicate that the most effective option for saving chum is indicated by option 1b) and the lowest cap level (25,000). Note however that this option generally increases the date of closure (compared to 1a) and would likely result in higher Chinook salmon bycatch (see below). Dates of closures by option are shown in Table 5-52-Table 5-54 for each cap level and indicate that closures occur sooner for lower caps.

Table 5-47. Estimated annual chum salmon AEQ saved for years 2004-2011 for **Alternative 4 with cap set at 25,000 (options 1a, 2a) and 7,800 options 1b and 2b) and sector split 2ii (allocation 1)** with values of λ at 0 (stand down till Aug 1st) and 1 (fish outside closure areas in June July) by region (apportioned by sector and where appropriate in option 1b) and 2b) by June-July) and allocations. UPDATED!!

		Option					
Cap=25,000 (7,800)	Year	1a)	1b) λ=0	1b) λ=1	2a)	2b) λ=0	2b) λ=1
Coastal WAK	2004	11,322	-2,704	-305	-1,211	-2,287	-206
	2005	43,153	27,141	26,482	29,538	22,009	17,061
	2006	34,049	25,700	24,313	25,508	20,494	15,484
	2007	7,035	5,530	5,326	4,765	4,260	3,300
	2008	-290	12	20	-165	-2	-2
	2009	810	884	1,007	780	729	793
	2010	444	498	563	428	414	448
	2011	3,648	1,966	2,680	813	1,384	1,520
	Total	100,171	59,028	60,085	60,457	47,001	38,397
Upper Yukon	2004	5,005	-615	-265	-575	-699	-179
	2005	21,277	16,850	14,330	15,558	13,315	9,225
	2006	21,387	17,932	16,028	16,081	14,092	10,173
	2007	5,920	4,770	4,480	3,981	3,598	2,748
	2008	-129	64	38	-73	0	-4
	2009	196	307	333	190	251	263
	2010	108	182	192	104	151	155
	2011	2,297	2,426	2,330	957	1,639	1,321
	Total	51,056	41,918	37,466	36,223	32,346	23,701
SWAK	2004	2,237	-440	-81	-246	-401	-55
	2005	8,024	5,516	5,048	5,559	4,412	3,250
	2006	6,066	3,707	3,727	4,681	2,990	2,385
	2007	1,222	307	510	852	247	315
	2008	-33	2	3	-19	0	0
	2009	215	464	487	209	376	384
	2010	118	259	270	114	210	214
	2011	832	640	715	257	440	405
	Total	18,681	10,455	10,678	11,409	8,275	6,899
SEAK-BC-WA	2004	20,901	-4,099	-764	-2,297	-3,742	-516
	2005	56,291	15,711	25,233	31,359	14,059	16,222
	2006	62,272	27,977	34,780	42,996	23,061	22,011
	2007	19,685	9,999	11,358	13,502	7,802	7,040
	2008	-538	28	39	-306	-4	-4
	2009	801	3,084	3,111	785	2,479	2,452
	2010	439	1,728	1,733	430	1,398	1,376
	2011	7,788	6,026	6,711	2,422	4,136	3,805
	Total	146,737	60,455	82,202	88,891	49,189	52,386
Asia	2004	84,057	-25,633	-1,015	-8,606	-19,964	-685
	2005	160,128	-12,334	47,234	67,968	-1,488	30,395
	2006	131,498	22,929	57,503	85,078	22,698	36,451
	2007	33,725	12,353	17,228	23,656	9,905	10,641
	2008	-2,256	-37	89	-1,281	-17	-9
	2009	4,090	3,131	3,808	3,934	2,620	3,001
	2010	2,242	1,743	2,124	2,157	1,471	1,688
	2011	20,531	-334	8,918	303	436	5,057

	Total	349,958	1,818	135,890	173,210	15,662	86,539

Table 5-48. Annual chum salmon saved for years 2003-2011 for **Alternative 4 with cap set at 75,000 (options 1a and 2a) and 23,400 (options 1b and 2b) and sector split 2ii (allocation 1)** with values of λ at 0 (stand down till Aug 1st) and 1 (fish outside closure areas in June July) by region (apportioned by sector and where appropriate in option 1b) and 2b) by June-July) and allocations. UPDATED!!

		Option					
Cap=75,000 (23,400)	Year	1a)	1b) λ=0	1b) λ=1	2a)	2b) λ=0	2b) λ=1
Coastal WAK	2004	10,441	-371	-100	1,341	-120	-38
	2005	36,673	28,953	27,728	25,225	23,731	19,967
	2006	27,752	25,102	23,990	20,827	19,996	16,395
	2007	5,872	4,997	4,798	4,009	3,809	2,979
	2008	-6			-28		
	2009		241	251		240	250
	2010		132	138		132	137
	2011	2,015	1,225	1,794	-614	919	1,099
	Total	82,745	60,280	58,599	50,761	48,706	40,789
Upper Yukon	2004	4,637	75	-87	562	-1	-33
	2005	17,826	17,149	15,072	13,130	13,633	10,860
	2006	17,076	17,084	15,592	13,006	13,341	10,497
	2007	4,750	4,222	4,001	3,255	3,215	2,484
	2008	-3			-12		
	2009		81	83		81	83
	2010		44	46		44	45
	2011	977	1,648	1,560	-196	1,132	955
	Total	40,626	40,303	36,267	29,745	31,444	24,892
SWAK	2004	2,067	-35	-27	260	-15	-10
	2005	6,783	5,774	5,301	4,741	4,663	3,819
	2006	5,142	3,678	3,752	3,949	2,968	2,616
	2007	1,114	275	458	778	223	284
	2008	-1			-3		
	2009		119	122		119	121
	2010		66	67		65	66
	2011	412	421	479	-109	299	293
	Total	15,516	10,297	10,151	9,616	8,321	7,190
SEAK-BC-WA	2004	19,308	-318	-251	2,428	-142	-96
	2005	49,531	20,873	26,739	27,970	19,004	19,287
	2006	52,496	28,006	33,422	36,226	23,213	22,202
	2007	17,001	9,023	10,237	11,764	6,988	6,355
	2008	-12			-51		
	2009		772	777		769	773
	2010		423	426		421	424
	2011	3,852	3,964	4,492	-1,017	2,814	2,751
	Total	122,868	62,744	75,842	77,321	53,067	51,697
Asia	2004	77,308	-5,044	-333	10,254	-1,391	-128
	2005	145,027	12,186	49,773	65,042	21,408	35,875
	2006	115,476	28,720	55,643	73,741	28,386	37,245
	2007	32,154	11,262	15,479	22,191	8,910	9,609
	2008	-50			-215		
	2009		896	951		892	947
	2010		491	522		489	519
	2011	14,131	-1,501	5,970	-5,284	-131	3,656

	Total	306,738	47,012	128,004	165,731	58,564	87,723

Table 5-49. Annual chum salmon saved for years 2003-2011 for **Alternative 4 with cap set at 200,000 (option 1a and 2a) and 62,400 (option 1b and 2b) and sector split 2ii (allocation 1)** with values of λ at 0 (stand down till Aug 1st) and 1 (fish outside closure areas in June July) by region (apportioned by sector and where appropriate in option 1b) and 2b) by June-July) and allocations. UPDATED!!

		Option					
Cap=200,000 (62,400)	Year	1a)	1b) λ=0	1b) λ=1	2a)	2b) λ=0	2b) λ=1
Coastal WAK	2004	8,858	-330	-20	1,986	-81	-23
	2005	22,337	25,723	24,035	11,993	21,243	18,047
	2006	13,116	20,934	19,609	8,461	16,715	14,018
	2007	1,930	3,691	3,523	1,363	2,765	2,257
	2008						
	2009						
	2010						
	2011	1,119	262	494	467	226	270
	Total	47,361	50,279	47,641	24,269	40,868	34,569
Upper Yukon	2004	3,954	21	-17	875	2	-20
	2005	10,116	15,125	13,080	5,909	12,118	9,820
	2006	7,036	13,974	12,534	4,863	10,896	8,822
	2007	1,465	3,118	2,937	1,035	2,331	1,882
	2008						
	2009						
	2010						
	2011	499	454	429	213	271	234
	Total	19,116	32,693	28,964	12,894	25,617	20,739
SWAK	2004	1,757	-38	-5	392	-10	-6
	2005	4,037	5,111	4,598	2,214	4,159	3,452
	2006	2,987	3,183	3,136	2,013	2,592	2,288
	2007	712	202	336	503	169	216
	2008						
	2009						
	2010						
	2011	222	107	132	93	72	72
	Total	9,715	8,564	8,198	5,215	6,983	6,022
SEAK-BC-WA	2004	16,413	-352	-49	3,661	-91	-57
	2005	34,950	19,043	23,250	15,481	17,510	17,451
	2006	29,543	22,698	26,470	18,181	18,990	18,367
	2007	8,384	6,662	7,516	5,921	5,133	4,815
	2008						
	2009						
	2010						
	2011	2,072	1,005	1,236	872	679	675
	Total	74,950	49,056	58,423	44,115	42,221	41,252
Asia	2004	65,400	-4,055	-65	14,775	-964	-76
	2005	114,582	13,777	43,217	43,009	21,800	32,443
	2006	77,704	23,932	44,442	43,443	24,366	31,091
	2007	18,886	8,311	11,365	13,338	6,647	7,281
	2008						
	2009						
	2010						
	2011	8,263	-1,298	1,642	3,407	37	897

Total	219,435	40,666	100,601	117,971	51,886	71,636

Table 5-50. Combined chum salmon saved (AEQ) over years 2004-2011 for **Alternative 4**, by region for different cap levels (apportioned by sector and where appropriate in option 1b) and 2b) by June-July with λ=0) and allocations. The second column lists the run-size estimates summed from Table 5-20 whereas the 3rd column is from Table 5-22. Caps in parentheses are (b) options.UPDATED!!

Region	Run Estimate	Estimated AEQ	Cap	Option	Allocation configuration 2ii	4ii	6
Coastal WAK	39,233,000	193,649	25,000 (7,800)	1a)	100,171	100,498	100,762
				1b)	59,028	57,023	54,215
				2a)	60,457	60,946	60,623
				2b)	47,001	45,105	43,083
			75,000 (23,400)	1a)	82,745	87,180	90,908
				1b)	60,280	60,379	60,027
				2a)	50,761	53,641	54,766
				2b)	48,706	48,808	48,421
			200,000 (62,400)	1a)	47,361	57,316	66,178
				1b)	50,279	53,332	56,929
				2a)	24,269	33,746	39,051
				2b)	40,868	43,105	45,701
Upper Yukon	8,454,000	106,722	25,000 (7,800)	1a)	56,061	56,383	56,476
				1b)	41,918	41,302	40,664
				2a)	36,223	36,545	36,371
				2b)	32,346	31,738	31,315
			75,000 (23,400)	1a)	45,263	48,233	50,630
				1b)	40,303	40,665	41,072
				2a)	29,745	31,857	32,875
				2b)	31,444	31,741	32,224
			200,000 (62,400)	1a)	23,071	29,273	35,597
				1b)	32,693	34,834	37,204
				2a)	12,894	18,537	22,607
				2b)	25,617	27,262	29,058
SW AK			25,000 (7,800)	1a)	18,681	18,871	18,959
				1b)	10,455	10,118	9,683
				2a)	11,409	11,604	11,587
				2b)	8,275	7,941	7,627
			75,000 (23,400)	1a)	15,516	16,272	16,893
				1b)	10,297	10,446	10,517
				2a)	9,616	10,076	10,241
				2b)	8,321	8,440	8,440
			200,000 (62,400)	1a)	9,715	11,305	12,580
				1b)	8,564	8,992	9,539
				2a)	5,215	6,833	7,621
				2b)	6,983	7,265	7,686
SEAK-BC-WA			25,000 (7,800)	1a)	167,638	170,261	172,013
				1b)	60,455	56,832	51,981
				2a)	88,891	90,825	91,679
				2b)	49,189	45,691	42,030
			75,000 (23,400)	1a)	142,176	147,257	152,558
				1b)	62,744	63,121	62,641
				2a)	77,321	79,349	80,689
				2b)	53,067	53,032	52,216
			200,000 (62,400)	1a)	91,363	106,738	117,951
				1b)	49,056	52,564	57,471
				2a)	44,115	58,440	60,991

	2b)	42,221	45,120	48,350

Table 5-50 (continued) Combined chum salmon saved over years 2003-2011 for **Alternative 4**, by region for different cap levels (apportioned by sector and where appropriate in option 1a) and 2a) by June-July) and allocations.

Region	Cap	Option	Allocation 2ii	4ii	6
Asia	25,000 (7,800)	1a)	434,015	437,649	441,545
		1b)	1,818	-16,689	-41,332
		2a)	173,210	175,536	176,542
		2b)	15,662	-1,956	-20,004
	75,000 (23,400)	1a)	384,046	387,983	397,471
		1b)	47,012	42,015	29,258
		2a)	165,731	159,775	157,013
		2b)	58,564	53,295	40,011
	200,000 (62,400)	1a)	284,835	318,627	325,773
		1b)	40,666	44,379	53,291
		2a)	117,971	151,965	132,400
		2b)	51,886	54,919	58,647

Table 5-51 Annual chum salmon saved for years 2003-2011 for **Alternative 4 with cap set at 25,000, 75,000, and 200,000 (panels) and sector split 2ii (allocation 1)** with values of λ of 1 (fish outside closure areas in June July) by region (apportioned by sector and where appropriate in option 1b) and 2b) by June-July) and allocations. Caps in parentheses are for (b) options. UPDATED!!

Cap=25,000 (7,800)	Year	Status quo	Option 1a)	1b) λ=1	2a)	2b) λ=1
Coastal WAK	2004	0.94%	0.60%	0.95%	0.98%	0.95%
	2005	1.23%	0.50%	0.78%	0.73%	0.94%
	2006	0.64%	0.20%	0.33%	0.31%	0.44%
	2007	0.30%	0.17%	0.20%	0.21%	0.24%
	2008	0.09%	0.10%	0.09%	0.10%	0.09%
	2009	0.11%	0.09%	0.08%	0.09%	0.09%
	2010	0.07%	0.06%	0.05%	0.06%	0.06%
	2011	0.29%	0.21%	0.23%	0.27%	0.25%
	Average	0.49%	0.24%	0.34%	0.34%	0.40%
Upper Yukon	2004	2.51%	1.70%	2.56%	2.61%	2.54%
	2005	1.50%	0.56%	0.87%	0.81%	1.09%
	2006	2.73%	0.87%	1.34%	1.33%	1.85%
	2007	0.99%	0.46%	0.59%	0.63%	0.74%
	2008	0.34%	0.36%	0.34%	0.35%	0.34%
	2009	0.25%	0.21%	0.19%	0.22%	0.20%
	2010	0.17%	0.15%	0.14%	0.15%	0.14%
	2011	0.76%	0.57%	0.57%	0.68%	0.65%
	Average	1.26%	0.66%	0.82%	0.83%	0.98%

Cap=75,000 (23,400)	Year	Status quo	Option 1a)	1b) λ=1	2a)	2b) λ=1
Coastal WAK	2004	0.94%	0.63%	0.94%	0.90%	0.94%
	2005	1.23%	0.61%	0.76%	0.80%	0.89%
	2006	0.64%	0.28%	0.33%	0.37%	0.43%
	2007	0.30%	0.19%	0.21%	0.23%	0.25%
	2008	0.09%	0.09%	0.09%	0.09%	0.09%
	2009	0.11%	0.11%	0.10%	0.11%	0.10%
	2010	0.07%	0.07%	0.06%	0.07%	0.06%
	2011	0.29%	0.24%	0.25%	0.30%	0.26%
	Average	0.49%	0.28%	0.34%	0.36%	0.39%
Upper Yukon	2004	2.51%	1.76%	2.53%	2.42%	2.52%
	2005	1.50%	0.71%	0.83%	0.92%	1.02%
	2006	2.73%	1.25%	1.38%	1.60%	1.82%
	2007	0.99%	0.56%	0.63%	0.70%	0.77%
	2008	0.34%	0.34%	0.34%	0.34%	0.34%
	2009	0.25%	0.25%	0.23%	0.25%	0.23%
	2010	0.17%	0.17%	0.16%	0.17%	0.16%
	2011	0.76%	0.68%	0.63%	0.78%	0.68%
	Average	1.26%	0.78%	0.83%	0.91%	0.97%

Cap=200,000 (62,400)	Year	Status quo	Option 1a)	1b) λ=1	2a)	2b) λ=1
Coastal WAK	2004	0.94%	0.67%	0.94%	0.88%	0.94%
	2005	1.23%	0.85%	0.82%	1.03%	0.93%
	2006	0.64%	0.47%	0.39%	0.53%	0.46%
	2007	0.30%	0.27%	0.24%	0.28%	0.26%
	2008	0.09%	0.09%	0.09%	0.09%	0.09%
	2009	0.11%	0.11%	0.11%	0.11%	0.11%
	2010	0.07%	0.07%	0.07%	0.07%	0.07%
	2011	0.29%	0.26%	0.28%	0.28%	0.28%
	Average	0.49%	0.37%	0.37%	0.43%	0.41%
Upper Yukon	2004	2.51%	1.87%	2.52%	2.37%	2.52%
	2005	1.50%	1.05%	0.92%	1.24%	1.06%
	2006	2.73%	2.12%	1.64%	2.31%	1.97%
	2007	0.99%	0.86%	0.73%	0.90%	0.82%
	2008	0.34%	0.34%	0.34%	0.34%	0.34%
	2009	0.25%	0.25%	0.25%	0.25%	0.25%
	2010	0.17%	0.17%	0.17%	0.17%	0.17%
	2011	0.76%	0.72%	0.72%	0.74%	0.74%
	Average	1.26%	1.04%	0.92%	1.11%	1.02%

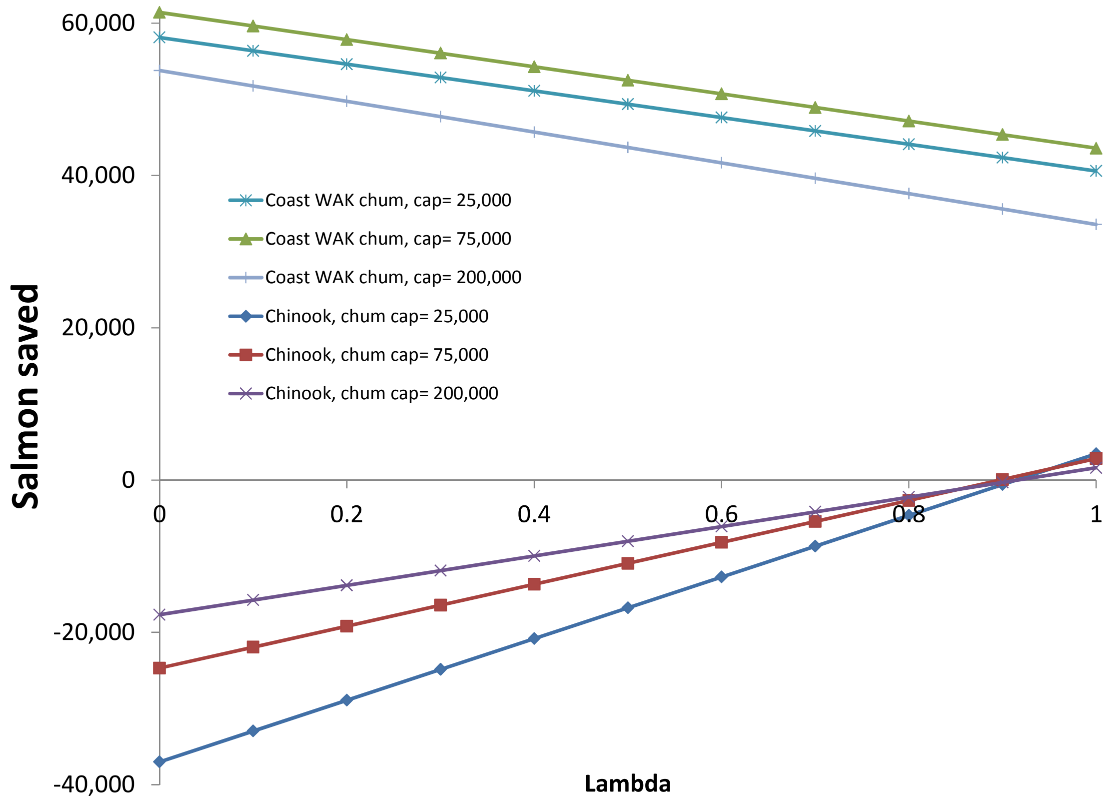


Figure 5-32. Contrast in salmon saved for different values of Lambda (λ) for option 1b (2b yielded similar patterns) for different cap levels. Values represent the sum over 9 years of data as if Alternative 4, component 2, options 1b had been applied. A value of λ= 1 simply implies that the pollock excluded from closures in June-July would be caught outside the closure in that period whereas a value of λ=0 means that the pollock diverted would be caught *after* July 31st in all areas (under this option there are no closure areas after July 31st).

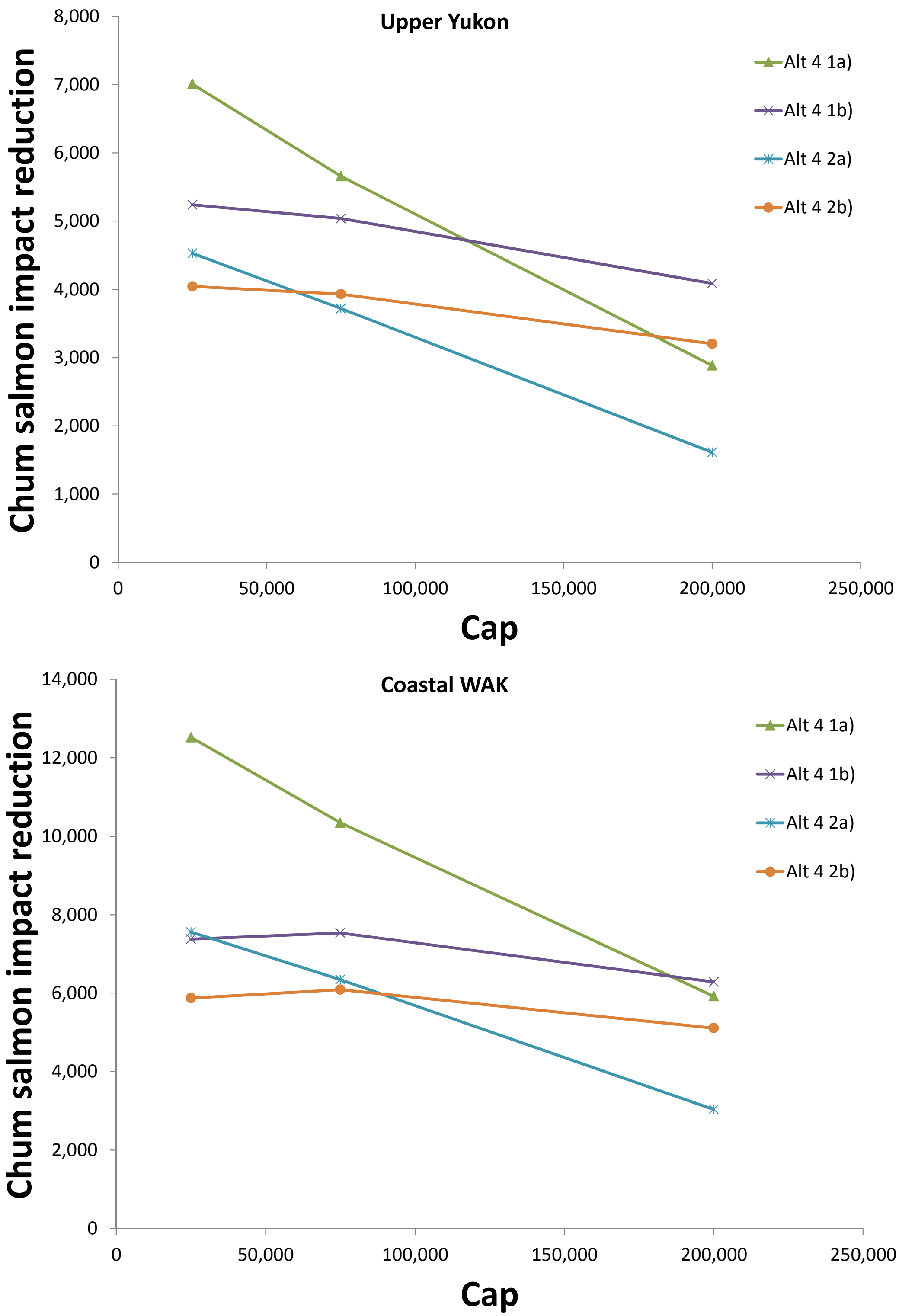


Figure 5-33. Average chum salmon impact reduction (AEQ) by suboption for Alternative 4, sector allocation 2ii, for years 2004-2011 for Upper Yukon (top) and Coastal WAK (bottom).

Table 5-52. Alternative 4 component 2 closure dates by sector and allocation scheme for each of the 4 options (1a, 1b, 2a, and 2b) for the **25,000 cap (options 1a and 2a) and 7,800 cap (options 1b and 2b)** level. UPDATED!!

		CDQ Allocation			CP Allocation			M Allocation			S Allocation		
Opt	Year	1	2	3	1	2	3	1	2	3	1	2	3
	2003	30-Aug	8-Sep	14-Sep	3-Aug	25-Aug	26-Aug	24-Jul	29-Jul	4-Aug	3-Aug	31-Jul	25-Jul
	2004	12-Aug	20-Aug	4-Sep	14-Jun	16-Jun	21-Jun	5-Jul	8-Jul	17-Jul	3-Aug	2-Aug	29-Jul
	2005	6-Aug	14-Aug	18-Aug	19-Jun	24-Jun	4-Aug	21-Jun	23-Jun	24-Jun	1-Jul	28-Jun	24-Jun
	2006	18-Sep			6-Jul	27-Jul	1-Aug	21-Aug	12-Sep		17-Jun	16-Jun	16-Jun
1a)	2007	21-Aug	26-Aug	27-Aug	15-Aug	22-Aug	29-Aug	28-Jul	14-Aug	21-Aug	25-Aug	20-Aug	6-Aug
	2008	25-Sep	25-Sep	25-Sep									29-Sep
	2009	30-Aug	29-Sep	29-Sep	12-Sep	5-Oct	5-Oct	19-Jul	3-Aug	17-Sep	29-Jul	28-Jul	16-Jul
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	4-Sep	6-Sep	6-Sep			
	2011	15-Jul	18-Aug	6-Sep	23-Jun	1-Jul	16-Jul	16-Jun	17-Jun	18-Jun	18-Jun	17-Jun	17-Jun
	2003				6-Jul	26-Jul		20-Jul	21-Jul	22-Jul	15-Jul	11-Jul	5-Jul
	2004	16-Jul			11-Jun	13-Jun	14-Jun	29-Jun	1-Jul	4-Jul	22-Jul	17-Jul	11-Jul
	2005	18-Jul			17-Jun	17-Jun	19-Jun	21-Jun	21-Jun	21-Jun	22-Jun	21-Jun	17-Jun
	2006	17-Jul			16-Jun	28-Jun	6-Jul	17-Jul	25-Jul		15-Jun	14-Jun	14-Jun
1b)	2007	7-Jul			3-Jul	20-Jul		5-Jul	6-Jul	19-Jul	27-Jul	13-Jul	4-Jul
	2008												15-Jul
	2009	24-Jun			21-Jul			20-Jun	4-Jul	7-Jul	8-Jul	5-Jul	30-Jun
	2010	26-Jun			17-Jul			9-Jul	21-Jul	27-Jul		25-Jul	20-Jul
	2011	27-Jun	1-Jul	14-Jul	19-Jun	22-Jun	23-Jun	16-Jun	16-Jun	16-Jun	13-Jun	13-Jun	13-Jun
	2003	30-Aug	8-Sep	14-Sep	3-Aug	25-Aug	26-Aug	24-Jul	29-Jul	4-Aug	3-Aug	31-Jul	25-Jul
	2004	12-Aug	20-Aug	4-Sep	14-Jun	16-Jun	21-Jun	5-Jul	8-Jul	17-Jul	3-Aug	2-Aug	29-Jul
	2005	6-Aug	14-Aug	18-Aug	19-Jun	24-Jun	4-Aug	21-Jun	23-Jun	24-Jun	1-Jul	28-Jun	24-Jun
	2006	18-Sep			6-Jul	27-Jul	1-Aug	21-Aug	12-Sep		17-Jun	16-Jun	16-Jun
2a)	2007	21-Aug	26-Aug	27-Aug	15-Aug	22-Aug	29-Aug	28-Jul	14-Aug	21-Aug	25-Aug	20-Aug	6-Aug
	2008	25-Sep	25-Sep	25-Sep									29-Sep
	2009	30-Aug	29-Sep	29-Sep	12-Sep	5-Oct	5-Oct	19-Jul	3-Aug	17-Sep	29-Jul	28-Jul	16-Jul
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	4-Sep	6-Sep	6-Sep			
	2011	15-Jul	18-Aug	6-Sep	23-Jun	1-Jul	16-Jul	16-Jun	17-Jun	18-Jun	18-Jun	17-Jun	17-Jun
	2003				6-Jul	26-Jul		20-Jul	21-Jul	22-Jul	15-Jul	11-Jul	5-Jul
	2004	16-Jul			11-Jun	13-Jun	14-Jun	29-Jun	1-Jul	4-Jul	22-Jul	17-Jul	11-Jul
	2005	18-Jul			17-Jun	17-Jun	19-Jun	21-Jun	21-Jun	21-Jun	22-Jun	21-Jun	17-Jun
	2006	17-Jul			16-Jun	28-Jun	6-Jul	17-Jul	25-Jul		15-Jun	14-Jun	14-Jun
2b)	2007	7-Jul			3-Jul	20-Jul		5-Jul	6-Jul	19-Jul	27-Jul	13-Jul	4-Jul
	2008												15-Jul
	2009	24-Jun			21-Jul			20-Jun	4-Jul	7-Jul	8-Jul	5-Jul	30-Jun
	2010	26-Jun			17-Jul			9-Jul	21-Jul	27-Jul		25-Jul	20-Jul
	2011	27-Jun	1-Jul	14-Jul	19-Jun	22-Jun	23-Jun	16-Jun	16-Jun	16-Jun	13-Jun	13-Jun	13-Jun

Table 5-53. Alternative 4 component 2 closure dates by sector and allocation scheme for each of the 4 options (1a, 1b, 2a, and 2b) for the **75,000 cap (options 1a and 2a) and 23,400 cap (options 1b and 2b)** level. UPDATED!!

		CDQ Allocation			CP Allocation			M Allocation			S Allocation		
Opt	Year	1	2	3	1	2	3	1	2	3	1	2	3
	2003	14-Sep	25-Sep	11-Oct	26-Aug	13-Oct	13-Oct	17-Aug	8-Sep	13-Sep	3-Sep	18-Aug	10-Aug
	2004	4-Sep	14-Sep	23-Sep	21-Jun	7-Jul	22-Jul	31-Jul	31-Aug	12-Sep	12-Aug	5-Aug	4-Aug
	2005	18-Aug	26-Aug	3-Oct	30-Jul	16-Aug	23-Aug	25-Jun	30-Jun	4-Aug	9-Jul	6-Jul	4-Jul
	2006				1-Aug						27-Jun	20-Jun	18-Jun
1a)	2007	27-Aug			27-Aug	12-Sep		29-Aug	27-Sep			27-Sep	9-Sep
	2008	25-Sep	25-Sep	25-Sep									
	2009	29-Sep	29-Sep	29-Sep	5-Oct	5-Oct	5-Oct	17-Sep	17-Sep	17-Sep	10-Oct	10-Oct	2-Sep
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	6-Sep	6-Sep	6-Sep			
	2011	22-Aug			12-Jul	30-Jul	4-Sep	19-Jun	24-Jun	30-Jun	4-Aug	17-Jul	7-Jul
	2003							24-Jul	29-Jul			29-Jul	24-Jul
	2004				13-Jun	16-Jun	21-Jun	5-Jul	6-Jul	15-Jul			28-Jul
	2005				19-Jun	23-Jun	31-Jul	21-Jun	23-Jun	24-Jun	30-Jun	26-Jun	24-Jun
	2006				5-Jul	26-Jul					17-Jun	16-Jun	16-Jun
1b)	2007							28-Jul					
	2008												
	2009							18-Jul			29-Jul	28-Jul	16-Jul
	2010												
	2011	11-Jul			23-Jun	1-Jul	13-Jul	16-Jun	17-Jun	18-Jun	18-Jun	17-Jun	16-Jun
	2003	14-Sep	25-Sep	11-Oct	26-Aug	13-Oct	13-Oct	17-Aug	8-Sep	13-Sep	3-Sep	18-Aug	10-Aug
	2004	4-Sep	14-Sep	23-Sep	21-Jun	7-Jul	22-Jul	31-Jul	31-Aug	12-Sep	12-Aug	5-Aug	4-Aug
	2005	18-Aug	26-Aug	3-Oct	30-Jul	16-Aug	23-Aug	25-Jun	30-Jun	4-Aug	9-Jul	6-Jul	4-Jul
	2006				1-Aug						27-Jun	20-Jun	18-Jun
2a)	2007	27-Aug			27-Aug	12-Sep		29-Aug	27-Sep			27-Sep	9-Sep
	2008	25-Sep	25-Sep	25-Sep									
	2009	29-Sep	29-Sep	29-Sep	5-Oct	5-Oct	5-Oct	17-Sep	17-Sep	17-Sep	10-Oct	10-Oct	2-Sep
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	6-Sep	6-Sep	6-Sep			
	2011	22-Aug			12-Jul	30-Jul	4-Sep	19-Jun	24-Jun	30-Jun	4-Aug	17-Jul	7-Jul
	2003							24-Jul	29-Jul			29-Jul	24-Jul
	2004				13-Jun	16-Jun	21-Jun	5-Jul	6-Jul	15-Jul			28-Jul
	2005				19-Jun	23-Jun	31-Jul	21-Jun	23-Jun	24-Jun	30-Jun	26-Jun	24-Jun
	2006				5-Jul	26-Jul					17-Jun	16-Jun	16-Jun
2b)	2007							28-Jul					
	2008												
	2009							18-Jul			29-Jul	28-Jul	16-Jul
	2010												
	2011	11-Jul			23-Jun	1-Jul	13-Jul	16-Jun	17-Jun	18-Jun	18-Jun	17-Jun	16-Jun

Table 5-54. Alternative 4 component 2 closure dates by sector and allocation scheme for each of the 4 options (1a, 1b, 2a, and 2b) for the **200,000 cap (options 1a and 2a) and 62,400 cap (options 1b and 2b)** level. UPDATED!!

		CDQ Allocation			CP Allocation			M Allocation			S Allocation		
Opt	Year	1	2	3	1	2	3	1	2	3	1	2	3
	2003	11-Oct	11-Oct	11-Oct	13-Oct	13-Oct	13-Oct	19-Sep				29-Sep	16-Sep
	2004	19-Sep	12-Oct	12-Oct	19-Jul	4-Aug	23-Aug	24-Sep			7-Sep	6-Sep	21-Aug
	2005	15-Sep	3-Oct	3-Oct	22-Aug	2-Sep	6-Oct	18-Aug	20-Sep		18-Jul	16-Jul	14-Jul
	2006										1-Aug	13-Jul	1-Jul
c1a)	2007												
	2008	25-Sep	25-Sep	25-Sep									
	2009	29-Sep	29-Sep	29-Sep	5-Oct	5-Oct	5-Oct	17-Sep	17-Sep	17-Sep	10-Oct	10-Oct	10-Oct
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	6-Sep	6-Sep	6-Sep			
	2011				22-Aug			11-Jul	15-Aug	15-Sep			2-Sep
	2003												
	2004				17-Jun	29-Jun	19-Jul	26-Jul					
	2005				11-Jul			24-Jun	27-Jun	10-Jul	8-Jul	5-Jul	2-Jul
	2006				29-Jul						23-Jun	19-Jun	17-Jun
1b)	2007												
	2008												
	2009												
	2010												
	2011				4-Jul	27-Jul		19-Jun	23-Jun	28-Jun	18-Jul	8-Jul	29-Jun
	2003	11-Oct	11-Oct	11-Oct	13-Oct	13-Oct	13-Oct	19-Sep				29-Sep	16-Sep
	2004	19-Sep	12-Oct	12-Oct	19-Jul	4-Aug	23-Aug	24-Sep			7-Sep	6-Sep	21-Aug
	2005	15-Sep	3-Oct	3-Oct	22-Aug	2-Sep	6-Oct	18-Aug	20-Sep		18-Jul	16-Jul	14-Jul
	2006										1-Aug	13-Jul	1-Jul
2a)	2007												
	2008	25-Sep	25-Sep	25-Sep									
	2009	29-Sep	29-Sep	29-Sep	5-Oct	5-Oct	5-Oct	17-Sep	17-Sep	17-Sep	10-Oct	10-Oct	10-Oct
	2010	26-Aug	26-Aug	26-Aug	4-Oct	4-Oct	4-Oct	6-Sep	6-Sep	6-Sep			
	2011				22-Aug			11-Jul	15-Aug	15-Sep			2-Sep
	2003												
	2004				17-Jun	29-Jun	19-Jul	26-Jul					
	2005				11-Jul			24-Jun	27-Jun	10-Jul	8-Jul	5-Jul	2-Jul
	2006				29-Jul						23-Jun	19-Jun	17-Jun
2b)	2007												
	2008												
	2009												
	2010												
	2011				4-Jul	27-Jul		19-Jun	23-Jun	28-Jun	18-Jul	8-Jul	29-Jun

5.5.4.3 Impacts of pollock fishery on chum salmon for Alternative 4

Based on the analysis of Alternative 4 and the assumptions inherent in evaluating the relative participation in the RHS program and constraints imposed by area closures (and thus the amount of chum salmon 'saved' under various closures and PSC cap levels), there are incidental takes of chum salmon PSC at generally reduced levels from status quo. For some suboptions and combinations, this management alternative will likely decrease the bycatch of chum salmon for Alaska stocks. These suboptions and combinations would thus minimize the impacts of the status quo management. However, bycatch in some options (e.g., option 1b) results in slightly higher or neglible reductions for Asian chum salmon. Given that revised management measures would not diminish protections afforded to chum salmon in the current management of the groundfish fisheries and are estimated to reduce the current PSC, the impact of this alternative is determined to be insignificant.

Component 1 would impose a revised CSSA on non-participants of the RHS system. Taken on it's own with no other components selected, the impacts of component 1 are best characterized by status quo given the current level (100%) of participation in the RHS program. Some considerations by the Council in conjunction with Component 1 may modify parameters of the current RHS program. While it is difficult to examined the potential impacts of these modifications quantitatively, qualitative discussion of the merits of modifying individual parameters was summarized to provide an overview of the likely impacts. It is likely that modification of some of the RHS parameters has the potential to improve the performance of this system in minimizing the adverse impacts of status quo on chum salmon and possibly Chinook salmon as well.

Components 2-6 would impose additional constraints on the RHS participants in addition to the area closures imposed under the RHS system itself. Based on the analysis of the triggered closures, caps and allocations, some options in some years may be very constraining on the pollock fleet. While this analysis focusses on the amount of chum salmon potentially saved by virtue of the constraints applied by additional area closures, it is important to note that if participation in the RHS program itself becomes increasingly constraining and complicated by layered triggered closures on top of the RHS program, the incentive to participate in the program itself may be undermined. The intent of Component 1 is to provide a strong enough incentive to encourage participation in the RHS program. Under this alternative this is done by imposing a large-scale triggered area closure at a range of cap levels. The magnitude of the incentive to participate in the RHS program will depend upon the level of constraint of the cap level selected in conjunction with this provision, particularly if additional components are selected to layer constraints on the participants. If participation in the program becomes equally or nearly as constraining as the risk of non-participation, then the assumptions inherent in this evaluation (of 100% participation) will be invalid.

5.5.5 Summary of the impacts of the alternatives on Chum

Estimates of historical bycatch represent actual numbers of chum salmon taken and include benefits of existing management measures. The status quo analysis estimates are provided to understand the effectiveness of the current system relative to one which lacked any salmon bycatch avoidance program. The reduction due to this program is estimated to range from 4-28% based on estimation of imposing the system in years prior to its operation. Comparing alternatives against status quo requires understanding that the relative benefits are in addition to the current status quo measures.

There is clearly some amount of impact on chum salmon of the chum PSC taken in the status quo pollock fishery. The measure of that impact is evaluated in multiple ways, first the overall amount of chum PSC removed by the fishery in each year is provided which has ranged from15,000-700,000 (Table 5-12). Then, given that those numbers alone are insufficient to indicate the true impact of the fishery on chum salmon stocks, and that excellent information exists on the age and maturity of chum salmon taken as bycatch in the pollock fishery, we estimate the adult equivalence of those bycatch to better estimate the impact on spawning stocks. This has ranged overall from 23,000-570,000 in aggregate (1994-2011; Table 5-22).

While this estimate is a better approximation of the relative impact in any one year or on average on spawning stocks, it represents nonetheless an aggregate AEQ for the entire Pacific Rim population of chum salmon stocks stretching from the west coast of the continental USA to Russia and Japan. This comprises thousands of regions and individual streams of origin (Table 3-4), many of which (e.g. Japan) have a high number of hatchery releases per year and thus have varying dependencies on the wild spawning stocks (Table 5-1). A better approximation of regional impacts then, is to segregate the AEQ to genetic rivers of origin in order to approximate the AEQ to those specific regions with their different spawning stocks and stock status. As discussed in 3.2.2, genetic information is sufficient to isolate some broad regions of origin across the Pacific Rim, and allows for some differentiation in relative impacts to those regions. Estimated historical AEQ by regions are found in Table 5-22.

For those systems where run size information is available, this impact analysis can be taken one step further to derive an impact rate of the removals due to the pollock fishery on the run size (Table 5-21). The average impact rate for Coastal west Alaska (0.49%), Upper Yukon (1.26%), and Southwest Alaska

(0.40%) is very low (Section 5.5.1.2) the relative impact rates in most years of the status quo incidental catch levels on aggregate run sizes, is very low and according to ADF&G managers unlikely to have had an impact on management considerations for these regions. Furthermore, the comparison of AEQ mortality due to chum salmon PSC with run sizes suggests that this relationship is variable (Figure 5-28- Figure 5-29). Together these results indicate that the bycatch is likely related to magnitude of returns. For these reasons collectively, the overall impact of the status quo on chum salmon stocks is considered to be insignificant to chum salmon at a population level as it is unlikely to be reasonably expected to jeopardize the sustainability of these stocks. Nonetheless alternatives are evaluated to estimate potential means to minimize the adverse impacts of the overall incidental catch levels, and regional AEQ estimates by reducing PSC catch of chum through different management strategies under Alternatives 2, 3 and 4. Moving forward to evaluation of the other alternatives, comparison is made regarding minimizing impacts by a reduction in incidental catch of chum PSC or increasing adverse impacts on chum PSC if the given alternative would result in an increase of incidental catch of chum PSC as compared with status quo.

Under Alternative 2, the hard cap options, estimates indicate a tradeoff between chum salmon saved (in AEQ terms) and foregone pollock under option 1a which performed the best for western Alaska stocks but also had the highest cost in terms of averaging a closure that would have foregone over 300 thousand t (Table 5-55). This table also shows that an intermediate result which saved an additional 15-19 thousand chum salmon to western Alaska (but also conserved relatively about three times as many Asian chum salmon) are Alternative 4, option 1a) at cap levels of 25,000 or 75,000. Another examination involved seeing if there were differences in the maximum values that could be attained in a given historical year (2003-2011). The results were similar in relative benefits over alternatives and options.

Under the options and suboptions for Alternative 2, this management alternative will likely decrease the bycatch of chum salmon for Alaska stocks. These suboptions and combinations would thus minimize any impact of the status quo management. However, bycatch in some options (e.g., option 1b) result in slightly higher or neglible reductions for Asian chum salmon.

For Alternative 2 nearly every option under consideration result in reductions of chum PSC and consequently provide increased returns of adult salmon to their regions of origin. The largest reduction is estimated to occur under a hard cap of 50,000 chum, option 1a for a B-season cap which would have provided an average Coastal western Alaska increased return of 20.3 thousand chum (compared to an average AEQ mortality estimated at 24.2 thousand chum). Nearly every option under consideration result in reductions of chum PSC and consequently provide increased returns of adult salmon to their regions of origin. The largest reduction is estimated to occur under a hard cap of 50,000 chum, option 1a for a B-season cap which would have provided an average Coastal western Alaska increased return of 20.3 thousand chum (compared to an average AEQ mortality estimated at 24.2 thousand chum). Given that the average estimated run size for this region for this period is 4.9 million, the ratio of mortality impact is about 0.5% under Alternative 1 as compared to a range of relative impacts over all caps and options is 0.09 – 0.35%, it seems unlikely that in-river management would have been modified further for this amount of returning fish aggregated over all rivers systems in coastal west Alaska given the intricacies of in-season, in-river management. The options under Alternative 2 which increase the PSC reduction are likely to confer a beneficial impact as the mortality of chum salmon would be reduced. None of the options would be estimated to increase the western Alaskan chum PSC in the pollock fishery although some options have a differential impact on increased proportion of Asian stocks while reducing the impact to western Alaskan stocks. Nevertheless, overall impacts of Alternative 2 are likely to be insignificant on chum salmon at a population level because would not be reasonably expected to jeopardize the sustainability of chum salmon stocks.

Estimated impacts of Alternative 3 are similar to those under Alternative 1. While the best estimate of impacts on PSC reduction under the revised RHS program is similar to the estimated reductions currently accruing by use of this program currently, the revised program does allow for provisions to better protect western Alaska chum salmon. These provisions allow for increased closures in June as well as spatially-explicit closures (Section 2.3.2) when and where genetic information indicates that a higher proportion of the bycatch originates from western Alaskan stocks (Section 3.2.2, Figure 3-7). While analysis of this alternative is not refined sufficiently to delineate which proportion of the estimated PSC reduction from closures would accrue from western Alaskan stocks, the program is designed to allow for increased flexibility to reduce these impacts explicitly. Any reduction from status quo estimated impacts would be a beneficial impact on western Alaskan stocks. Alternative 3 is estimated to have a similar chum PSC impact as with status quo and thus an insignificant impact on chum salmon at a population level as it is not be reasonably expected to jeopardize the sustainability of chum salmon stocks. However, behavioral changes in the future as a result of these explicit modifications to the program may result in greater western Alaska chum PSC reductions (and thus confer a beneficial impact over status quo) then the analysis indicates.

Nearly every option under Alternative 4 confers a PSC reduction from status quo (Table 5-55) and thus increased returns of salmon to spawning streams. The magnitude of this reduction varies with the components and options selected. As with Alternative 2, options to apply management measures in June and July only are included to address increased proportion of western Alaskan chum on the grounds. While these options (options 1b and 2b) lead to generally less overall chum PSC reduction then B-season wide measures(options 1a and 2a), they lead to a greater proportion of the chum PSC savings accruing from western Alaska. Overall results in terms of relative impact rates to coastal western Alaska range from 0.24% – 0.41% across all caps and options. Overall impacts of Alternative 4 are likely to be insignificant on chum salmon at a population level because would not be reasonably expected to jeopardize the sustainability of chum salmon stocks.

Table 5-55. Summary over alternatives using sector split of 2ii, λ =0 (λ =1 in parentheses) for different cap levels alternatives and their options. Chum AEQ are estimates of the adult equivalent annual **average** (2004-2011) improvements by alternative and option. Western Alaska is Upper Yukon combined with Coastal west Alaska, Asia include chum from Russia and Japan, the total adds these two groups and the remaining stocks. UPDATED!!

			Change in Chum salmon AEQ (numbers that would have returned to spawn)			**Pollock forgone or diverted**	**Chinook PSC change**
	Option	Cap	Western Alaska	Asian	Total chum	Pollock	Chinook
Alternative 2	**1a)**	50,000	30,279	99,013	167,610	322,620	17,304
		200,000	16,269	62,727	101,275	118,561	8,651
		353,000	6,799	34,118	51,093	53,073	5,349
	1b)	15,600	12,529	-8,587	11,416	126,796	-5,934
		62,400	10,300	-3,907	12,247	66,303	-3,373
		110,136	8,584	-1,199	12,339	40,388	-2,142
Alternative 4	**1a)**	25,000	19,529	54,252	97,071	129,898	7,805
		75,000	16,001	48,006	83,718	86,605	5,686
		200,000	8,804	35,604	57,043	39,090	3,652
	1b)	7,800	12,618 (12,194)	227 (16,986)	21,709 (40,790)	47,537 (139,473)	-3,682 (273)
		23,400	12,573 (11,858)	5,876 (16,001)	27,579 (38,608)	31,951 (116,395)	-2,537 (209)
		62,400	10,372 (9,576)	5,083 (12,575)	22,657 (30,478)	20,553 (86,571)	-1,702 (146)
	2a)	25,000	12,085	21,651	46,274	103,527	2,716
		75,000	10,063	20,716	41,647	65,454	2,185
		200,000	4,645	14,746	25,558	28,970	1,039
	2b)	7,800	9,918 (7,762)	1,958 (10,817)	19,059 (25,990)	29,588 (82,323)	-2,464 (84)
		23,400	10,019 (8,210)	7,321 (10,965)	25,013 (26,536)	17,179 (64,890)	-1,496 (57)
		62,400	8,311 (6,914)	6,486 (8,954)	20,947 (21,777)	9,620 (44,300)	-885 (31)

6 Chinook salmon

Seasonal bycatch totals are presented in Table 6-7 and by pollock fishing sector in Table 6-8.

6.1 Overview of Chinook salmon biology and distribution

Overview information in this section is extracted from Delaney (1994). Other information on Chinook salmon may be found at the ADF&G website, http://www.cf.adfg.state.ak.us/geninfo/finfish/salmon/salmhome.php.

The Chinook salmon (*Oncorhynchus tshawytscha*) is the largest of all Pacific salmon, with weights of individual fish commonly exceeding 30 pounds. In North America, Chinook salmon range from the Monterey Bay area of California to the Chukchi Sea area of Alaska. In Alaska, it is abundant from the southeastern panhandle to the Yukon River. Major populations return to the Yukon, Kuskokwim, Nushagak, Susitna, Kenai, Copper, Alsek, Taku, and Stikine rivers. Important runs also occur in many smaller streams.

Like all species of Pacific salmon, Chinook salmon are anadromous. They hatch in fresh water, spend part of their life in the ocean, and then spawn in fresh water. All Chinooks die after spawning. Chinook salmon may become sexually mature from their second through seventh year, and as a result, fish in any spawning run may vary greatly in size. For example, a mature 3-year-old will probably weigh less than 4 pounds, while a mature 7-year-old may exceed 50 pounds. Females tend to be older than males at maturity. In many spawning runs, males outnumber females in all but the 6- and 7-year age groups. Small Chinooks that mature after spending only one winter in the ocean are commonly referred to as "jacks" and are usually males. Alaska streams normally receive a single run of Chinook salmon in the period from May through July.

Chinook salmon migrate through coastal areas as juveniles and returning adults; however, immature Chinook salmon undergo extensive migrations and can be found inshore and offshore throughout the North Pacific and Bering Sea. In summer, Chinook salmon concentrate around the Aleutian Islands and in the western Gulf of Alaska (Eggers 2004).

Juvenile Chinook salmon in freshwater feed on plankton and then later eat insects. In the ocean, they eat a variety of organisms including herring, pilchard, sand lance, squid, and crustaceans. Salmon grow rapidly in the ocean and often double their weight during a single summer season.

North Pacific Chinook salmon are the subject of commercial, subsistence, personal use, and sport fisheries, as discussed in more detail in Chapters 9 and 10. The majority of the Alaska commercial catch is made in Southeast Alaska, Bristol Bay, and the Arctic-Yukon-Kuskokwim areas. Fish taken commercially average about 18 pounds. The majority of the catch is made with troll gear and gillnets. Approximately 90 percent of the subsistence harvest is taken in the Yukon and Kuskokwim rivers.

The Chinook salmon is perhaps the most highly prized sport fish in Alaska and is extensively fished by anglers in the Southeast and Cook Inlet areas. The sport fishing harvest of Chinook salmon is over 76,000 annually, with Cook Inlet and adjacent watersheds contributing over half of the catch.

Unlike “other salmon” species, Chinook salmon rear in inshore marine waters and are, therefore, available to commercial and sport fishermen all year.

6.1.1 Food habits/ecological role

Western Alaskan salmon runs experienced dramatic declines from 1998 through 2002 with a record low in stocks in 2000. Weak runs during this time period have been attributed to reduced productivity in the marine environment rather than an indication of low levels of parent year escapements (Bue and Lingnau 2005). Recent Bering-Aleutian Salmon International Survey (BASIS) evaluations have examined the food habits from Pacific salmon in the Bering Sea in an attempt to evaluate potential interactions between salmon species as well as their dependence upon oceanographic conditions for survival.

Ocean salmon feeding ecology is highlighted by the BASIS program given the evidence that salmon are food limited during their offshore migrations in the North Pacific and Bering Sea (Rogers 1980; Rogers and Ruggerone 1993; Aydin et al. 2000, Kaeriyama et al. 2000). Increases in salmon abundance in North America and Asian stocks have been correlated to decreases in body size of adult salmon which may indicate a limit to the carrying capacity of salmon in the ocean (Kaeriyama 1989; Ishida et al. 1993; Helle and Hoffman 1995; Bigler et al. 1996; Ruggerone et al. 2003). International high seas research results suggest that inter and intra-specific competition for food and density-dependant growth effects occur primarily among older age groups of salmon particularly when stocks from different geographic regions in the Pacific Rim mix and feed in offshore waters (Ishida et al. 1993; Ishida et al 1995; Tadokoro et al. 1996; Walker et al. 1998; Azumaya and Ishida 2000; Bugaev et al. 2001; Davis 2003; Ruggerone et al. 2003).

Results of a fall study to evaluate food habits data in 2002 indicated Chinook salmon consumed predominantly small nekton and did not overlap their diets with sockeye and chum (Davis et al. 2004). Shifts in prey composition of salmon species between seasons, habitats and among salmon age groups were attributed to changes in prey availability (Davis et al. 2004).

Stomach sample analysis of ocean age .1 and .2 fish from basin and shelf area Chinook salmon indicated that their prey composition was more limited than chum salmon (Davis et al. 2004). This particular study did not collect many ocean age .3 or .4 Chinook, although those collected were located predominantly in the basin (Davis et al. 2004). Summer Chinook samples contained high volumes of euphausiids, squid and fish while fall stomach samples in the same area contained primarily squid and some fish (Davis et al. 2004). The composition of fish in salmon diets varied with area with prey species in the basin primarily northern lamp fish, rockfish, Atka mackerel, Pollock, sculpin and flatfish while shelf samples contained more herring, capelin, Pollock, rockfish and sablefish (Davis et al. 2004). Squid was an important prey species for ocean age .1, .2, and .3 Chinook in summer and fall (Davis et al. 2004). The proportion of fish was higher in summer than fall as was the relative proportion of euphausiids (Davis et al. 2004). The proportion of squid in Chinook stomach contents was larger during the summer in years (even numbered) when there was a scarcity of pink salmon in the basin (Davis et al. 2004).

Results from the Bering Sea shelf on diet overlap in 2002 indicated that the overlap between chum and Chinook salmon was moderate (30%), with fish constituting the largest prey category, results were similar in the basin (Davis et al. 2004). However notably on the shelf, both chum and Chinook consumed juvenile walleye pollock, with Chinook salmon consuming somewhat larger (60-190 mm SL) than those consumed by chum salmon (45-95 mm SL) (Davis et al. 2004). Other fish consumed by Chinook salmon included herring and capelin while chum salmon stomach contents also included sablefish and juvenile rockfish (Davis et al. 2004).

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

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

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

Chinook salmon hatchery releases by country are shown below in Table 6-1. There are no hatchery releases of Chinook salmon in Japan and Korea and only a limited number in Russia.

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

Year	Russia	Japan	Korea	Canada	USA	TOTAL
1999	0.6	-	-	54.4	208.1	263.1
2000	0.5	-	-	53.0	209.5	263.0
2001	0.5	-	-	45.5	212.1	258.1
2002	0.3	-	-	52.8	222.1	275.2
2003	0.7	-	-	50.2	210.6	261.5
2004	1.17	-	-	49.8	173.6	224.6
2005	0.84	-	-	43.5	184.0	228.3
2006	0.78	-	-	40.9	181.2	223.7
2007	0.78	-	-	44.6	182.2	227.6
2008	1.0			38.0	201.4	240.4
2009	0.78	-	-	41.6	201.0	243.4
2010	0.88	-	-	44.1	201.9	246.9

For Chinook salmon fry, the United States has the highest number of annual releases (80% of total in 2007), followed by Canada (~20%). In Canada, enhancement projects have been on-going since 1977 with approximately 300 different projects for all salmon species (Cook and Irvine 2007). Maximum production for Chinook releases was reached in 1991 with 66 million fish in that year (Cook and Irvine 2007). Releases of Chinook in 2006 occurred in the following regions: Yukon and Transboundary River, Skeena River, North Coast, Central Coast, West Coast and Vancouver Island, Johnstone Strait, Straits of Georgia, and the Lower and Upper Fraser rivers. Of these the highest numbers were released in the West Coast Straits of Georgia (20 million fish) followed by Vancouver Island area (12.4 million fish) the Lower Fraser River (3.3 million fish) (Cook and Irvine 2007).

Of the US releases however, a breakout by area shows that the highest numbers are coming from the State of Washington (63% in 2007), followed by California (19% in 2007), and then Oregon (7% in 2007) (Table 6-2). 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 6-2. USA west coast hatchery releases of juvenile Chinook salmon, in millions of fish.

Year	Alaska	Washington	Oregon	California	Idaho	WA/OR/CA/ID (combined)	TOTAL
1999	8.0	114.5	30.5	45.4	9.7		208.1
2000	9.2	117.4	32.3	43.8	6.8		209.5
2001	9.9	123.5	28.4	45.0	5.4		212.1
2002	8.4					213.6	222.0
2003	9.3					201.3	210.6
2004	9.35	118.2	17.0	27.4	1.7	164.2	173.6
2005	9.46	117.7	19.2	28.8	8.7	174.5	184.0
2006	10.2	110.5	19.2	29.4	12.0	171.0	181.2
2007	10.5	114.5	13.2	34.8	9.2	171.7	182.2
2008	11.4					201.4	212.4
2009	10.5					201.0	211.5
2010	11.0					201.9	212.9

6.1.3 Chinook salmon stock of origin

Chinook salmon stock of origin has been extensively summarized in the FEIS for Amendment 91 (NMFS, 2009). A brief overview of that information is provided here as well as an update on recent genetic information from bycatch samples taken in the 2010 Bering Sea trawl fisheries.

Table 6-3 shows a comparison of historical stock composition estimates for three studies on Chinook bycatch samples taken from trawl fisheries in the Bering Sea. These studies were similar in general findings of the preponderance of western Alaskan stocks in the bycatch. The Seeb et al. (2008) results were employed in the Chinook EIS analysis (NMFS 2009) in order to estimate bycatch stock composition historically to best evaluate the impacts to western Alaskan river systems of different management alternatives under consideration. In order to do so, the stock composition results on the samples were corrected for when and where the bycatch occurred by season.

Table 6-4 shows the mean values of catch-weighted stratified proportions of stock composition used in the Chinook EIS analysis based on genetic sampling by season, and region (SE=east of 170°W, NW=west of 170°W). These results indicate the change in stock composition by area in the B season with increased proportions of some stocks (e.g. Upper Yukon in the NW portion of the Bering Sea and PNW in the SE). This shows the potential for increasing the proportion of one stock of origin over another in the bycatch as the fishery moves to the NW in some years.

Table 6-3. Comparison of stock composition estimates for three different studies on Chinook bycatch samples taken from trawl fisheries in the eastern Bering Sea.

Study		Myers and Rogers (1988)			Myers et al (2003)			Seeb et al. 2008		
Years sampled		1979-1982			1997-1999			2005-2007[1]		
Stocks and estimated aggregate % composition in bycatch	Western AK	60%			56%					
		Yukon	Bristol Bay	Kusko-kwim	Yukon	Bristol Bay	Kusko-kwim			
		17%	29%	24%	40%	34%	26%			
Smaller scale breakouts (where available) listed to the right (with associated % contrib. of aggregate below)	Coastal WAK (also includes Norton Sound)							48%		
								Lower Yukon	Kusko-kwim	Bristol Bay
								Na	Na	Na
	Middle Yukon							3%		
	Upper Yukon							3%		
	NAK Penin							13%		
	Cook Inlet	17%			31%			4%		
	SEAK/Can	9%			8%					
	TBR							2%		
	PNW[2]							23%		
	Russia	14%			5%			2%		
	Other[3]							3%		

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

[2]PNW is an aggregate of 54 stocks from British Columbia, Washington, Oregon and California. For a full list of stocks included see FEIS.

[3]'other' is comprised of minor components after aggregation to major river systems as described in FEIS.

Table 6-4. 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 FEIS 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)

New genetics results are available for 2010 BSAI trawl fishery (ref for Tech memo). These results indicate that for the A season approximately 94% of the samples taken in the fishery originate from Alaskan rivers draining into the Bering Sea. Further details on the relative proportion by stock or origin and season for these samples are as follows:

A season: 41% Coastal WAK, 24% Upper Yukon, 16% North Alaska Peninsula, 12% Middle Yukon
B season: 47% from Bering Sea rivers, with the majority (42%) from Coastal WAK.

Both the overall level of bycatch as well as the sample sizes were low in 2010. The total bycatch in all BSAI groundfish fisheries in 2011 was 26,672 of this 95.6% was from the pollock fishery. The 2010 genetics report analyzes additional fisheries bycatch of Chinook as well as the pollock fishery but does not differentiate between these. Direct comparison of this study with previous estimates is not possible at this time absent correcting the samples to when and where the bycatch was occurring in that year as with the analysis done on the genetics from 2006-2007 for the EIS (NMFS 2009). Furthermore, sampling differed in 2010 from previous years. Previously bycatch was opportunistically sampled for genetics. In 2010 a more systematic protocol was employed but because new salmon census sampling had not yet been instituted, this sampling design is different from 2011 when the new systematic sampling in conjunction with the census of salmon occurred. Genetic results from 2011 are unavailable as of Feb 29, 2012.

6.2 Chinook salmon assessment overview by river system or region

This section provides a brief overview of the status of western Alaskan Chinook salmon stocks. Western Alaska includes the Bristol Bay, Kuskokwim, Yukon, and Norton Sound management areas. Nushagak, Goodnews, Kanektok, Kuskokwim, Yukon, and Unalakleet rivers comprise the Chinook salmon index stocks for this region. Comprehensive information by region can be found in the environmental impact statement prepared for the Bering Sea Chinook Salmon Bycatch Management action by the Council (NPFMC/NOAA 2009) and is incorporated by reference. The EIS can be downloaded online at: http://www.fakr.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/feis/eis_1209.pdf

The Alaska Board of Fisheries (board) designated the Yukon and Kuskokwim river stocks as a "Yield Concern" in September 2000 based on a chronic inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above each stock's escapement needs (Table 6-3). In January 2004, the board also designated Chinook salmon in Subdistricts 5 (Shaktoolik) and 6 (Unalakleet) of Norton Sound as a "Yield Concern". Based on improved abundance, that designation was lifted for Kuskokwim River stocks in January 2007, but remained for the Yukon River and Subdistricts 5 (Shaktoolik) and 6 (Unalakleet) of Norton Sound. The Alaska Department of Fish and Game (department) recommended and the board concurred in continuing these designations at the 2010 board meeting.

In general, these western Alaska Chinook salmon stocks declined sharply in 2007 and remained low in 2008–2010. For the more northerly of these stocks, the 2008 Chinook salmon run was one of the poorest on record. On the heels of the below average 2007–2009 Chinook salmon runs in western Alaska, management of the 2010 fisheries was conservative. All of the Chinook salmon runs to western Alaska started late and most were four to six days late in run timing. The late run combined with inclement weather in early June resulted in a delayed start to most fisheries. No directed Chinook salmon commercial fisheries occurred in the Yukon River, Kuskokwim River, or in Norton Sound in 2011, and only small commercial fisheries occurred in the Nushagak and Kuskokwim Bay (Table 6-3). Sport fisheries were restricted or closed in the Nushagak River, Yukon (Chena River), Kuskokwim (Kwethluk and Tuluksak rivers), and Unalakleet and Shaktoolik rivers of Norton Sound Area. More significantly, subsistence fisheries in tributaries of the Kuskokwim River (Kwethluk and Tuluksak rivers; USFWS federal closure), and Norton Sound (Unalakleet and Shaktoolik rivers) were restricted or closed. In spite of conservative management strategies, which in some cases were at great cost to the people who rely on these resources for food and income, only some escapement goals were achieved in western Alaska.

An overview of Chinook stock performance across the State including regions outside of western Alaska is shown in Table 6-5. For comparison with 2010, stock performance information is presented for that year in Table 6-6. Detailed information on how Chinook stocks are assessed and managed by region and historical stock performance is available in the Chinook Salmon FEIS (NMFS/NPFMC 2009).

Table 6-5. Overview of Alaskan Chinook salmon stock performance, 2011.

Chinook salmon stock	Total run size?	Escapement goals met?[a]	Subsistence fishery?	Commercial fishery?	Sport fishery?	Stock of concern?
Bristol Bay	Poor	1 of 1[b] (4 not surveyed)	Yes	Limited in Nushagak District	Restricted on Nushagak	No
Kuskokwim	Poor	3 of 9	Yes, 3 tributaries closed, restrictions in mainstem District 1	None on Kuskokwim River, limited in Bay	3 tributaries closed	No
Yukon	Poor	4 of 5	Yes, restricted fishing schedule	No directed, small incidental take with chum but not sold	Bag limit reduced to 1 all tributaries, no retention mainstem and Tanana R., no bait allowed Tanana R. tributaries	Yield
Norton Sound	Poor	0 of 4	Yes, with restrictions	No	No	Yield
Alaska Peninsula	Below average	0 of 1	Yes	Yes	Yes	No
Kodiak	Below average	2 of 2	Yes	Restricted, nonretention in Karluk and Ayakulik areas	Restricted, nonretention in Karluk, reduced bag and annual limits in Ayakulik	Management (Karluk)
Chignik	Average	1 of 1	Yes	Yes	Yes	No
Upper Cook Inlet	Below average	8 of 21[c]	Yes	Restricted in Northern District	Various restrictions including complete closure	6 stocks of concern
Lower Cook Inlet	Below average	2 of 3	Yes	Yes	Restricted; closed Anchor river	No
Prince William Sound	Below average	1 of 1	Yes	Yes	Yes	No
Southeast	Average	9 of 11	Yes	Yes	Yes	No

[a] Some aerial survey-based escapement goals were not assessed due to inclement weather or poor survey conditions, therefore we do not know if the escapement goals were met for these systems.

[b] The Chinook salmon escapement goal of 40,000 – 80,000 was met on the Nushagak River in 2011. However, the inriver goal of 75,000 was not met on the Nushagak River in 2011.

Table 6-6 Overview of Alaskan Chinook salmon stock performance, 2010.

Chinook salmon stock	Total run size?	Escapement goals met?[a]	Subsistence fishery?	Commercial fishery?	Sport fishery?	Stock of concern?
Bristol Bay	Poor	0 of 1[b] (4 not surveyed)	Restricted on Nushagak	Limited in Nushagak District	Restricted, closed on Nushagak	No
Kuskokwim	Poor	3 of 7 (7 not surveyed)	Yes, 2 tributaries closed	None on Kuskokwim River, limited in Bay	2 tributaries closed	No
Yukon	Poor	3 of 7	Yes	No directed, some incidental take with chum	1 Tributary closed	Yield
Norton Sound	Poor	1 of 3 (2 not surveyed)	Yes, with restrictions	No	No	Yield
Alaska Peninsula	Below average	1 of 1	Yes	Yes	Yes	No
Kodiak	Below average	1 of 2	Karluk closed	Restricted in Karluk and Ayakulik areas	Karluk closed	Management
Chignik	Average	1 of 1	Yes	Yes	Yes	No
Upper Cook Inlet	Below average	4 of 19 (2 not surveyed)	Yes	Restricted in Northern District	Various restrictions	6 stocks of concern
Lower Cook Inlet	Below average	2 of 3	Yes	Yes	Yes	No
Prince William Sound	Below average	0 of 1	Yes	Yes	Yes	No
Southeast	Average	9 of 11	Yes	Yes	Yes	No

[a] Some aerial survey-based escapement goals were not assessed due to inclement weather or poor survey conditions, therefore we do not know if the escapement goals were met for these systems.
[b] The Chinook salmon escapement goal was not met on the Nushagak River in 2010.

6.3 Impacts of alternatives on Chinook salmon

The following criteria are used to evaluate the impact of alternative management measures on Chinook salmon in comparison to the status quo management.

Criteria used to estimate the significance of impacts on Chinook salmon

Insignificant impact	The impact is not expected to jeopardize the sustainability of Chinook salmon.
Adverse impact	There are substantially increased incidental takes of Chinook salmon
Beneficial impact	Natural at-sea mortality of Chinook salmon would be reduced – perhaps by the harvest of a predator or by the harvest of a species that competes for prey.
Significantly adverse impact	A significantly adverse impact would be reasonably expected to jeopardize the sustainability of Chinook salmon
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the Bering Sea pollock fishery on Chinook salmon, and significantly beneficial impacts are not defined for these species.
Unknown impact	Not applicable

Seasonal bycatch totals are presented in Table 6-7 and by pollock fishing sector in Table 6-8.

Table 6-7. Chinook salmon bycatch from the pollock fishery, 1991-2012 by season.

Year	A-season	B-Season	Total
1991	38,791	2,114	40,906
1992	25,691	10,259	35,950
1993	17,264	21,252	38,516
1994	28,451	4,686	33,136
1995	10,579	4,405	14,984
1996	36,068	19,554	55,623
1997	10,935	33,973	44,909
1998	15,193	36,130	51,322
1999	6,352	5,627	11,978
2000	3,422	1,539	4,961
2001	18,484	14,961	33,444
2002	21,794	12,701	34,495
2003	32,609	12,977	45,586
2004	23,104	28,595	51,699
2005	27,285	40,050	67,335
2006	58,287	24,306	82,592
2007	69,139	52,350	121,488
2008	16,574	4,842	21,415
2009	9,683	2,718	12,401
2010	7,624	2,067	9,692
2011	7,136	18,363	25,499
2012	7,773	3,577	11,350

Table 6-8. Chinook bycatch by sector for the Bering Sea pollock fleet, 1991-2012.

	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, 38	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	2,881	14,361	15,367	32,609	1,940	4,039	6,998	12,977	45,586
2004	2,076	9,453	11,576	23,104	2,076	4,288	22,231	28,595	51,699
2005	2,106	11,382	13,797	27,285	888	4,336	34,826	40,050	67,335
2006	5,395	17,253	35,638	58,287	200	1,532	22,573	24,306	82,592
2007	5,859	27,889	35,390	69,139	3,543	7,137	41,670	52,350	121,488
2008	1,270	4,551	10,752	16,574	175	413	4,254	4,842	21,415
2009	601	3,042	6,040	9,683	152	333	2,233	2,718	12,401
2010	493	3,401	3,730	7,624	84	51	1,932	2,067	9,692
2011	459	2,236	4,441	7,136	2,426	1,986	13,951	18,363	25,499
2012	312	2,836	4,625	7,773	49	97	3,431	3,577	11,350

Based on analyses presented in the FEIS (NPFMC/NOAA 2009) the adult equivalent mortality for Chinook salmon are variable with the impact on run sizes (due to bycatch) showing a lagged effect (Fig. 6-1). Chinook salmon ages in the bycatch are more variable than for chum (generally 3-7 years old) and the lagged effect on AEQ is higher. The FEIS (NPFMC/NOAA 2009) also estimated the relative impact due to bycatch (AEQ) for coastal western Alaska Chinook stocks which ranged from below 10,000 to about 45,000 Chinook salmon during 1993-2007.

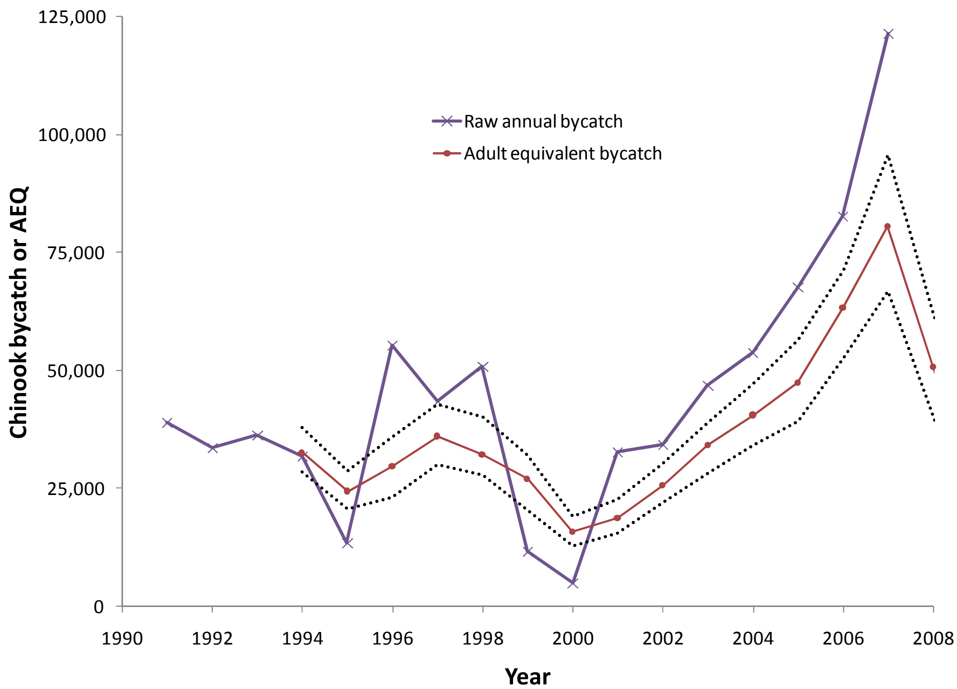


Fig. 6-1 Time series of Chinook actual and adult equivalent bycatch from the pollock fishery, 1991-2007 (2008 raw annual bycatch also indicated separately). The dotted lines represent the uncertainty of the AEQ estimate, due to the combined variability of ocean mortality, maturation rate, and age composition of bycatch estimates (NPFMC/NOAA 2009).

6.3.1 Summary of impacts of pollock fishery on Chinook salmon for Alternative 1

The current Chinook bycatch management program was evaluated in the FEIS (NPFMC/NMFS 2009) and was found to not adversely impact Chinook salmon stocks. Thus results for status quo are considered to be insignificant. Alternatives are evaluated against the status quo incidental catch to estimate potential means to minimize the impacts of chum PSC and in doing so these alternatives may either minimize the impacts on Chinook PSC or increase the impacts on Chinook by increasing the incidental catch above that realized under status quo.

6.3.2 Impacts on Chinook salmon under Alternative 2

The annual impact of chum salmon options of alternative 2 indicate that Chinook salmon bycatch will decreased in many years under option 1a, especially for the lower cap levels (Table 6-9). However, under option 1b (which would close the fishery only within the June-July period) resulted in increased bycatch of Chinook salmon because of pollock that would be diverted later in the year (Table 6-10). All sectors are estimated to have a similar pattern between options (Table 6-11).

Table 6-9. Estimated annual reduction in Chinook salmon bycatch by year for chum management measures under Alternative 2 by cap, suboption, and sector allocation, 2003-2011. Note that caps in parentheses represent (b) options UPDATED!!

Cap	Suboption 1a			Suboption 1b		
50,000 (15,600)	2ii	4ii	6	2ii	4ii	6
2003	11,263	10,209	8,732	-1,611	-1,247	-1,754
2004	24,462	23,798	23,226	-2,974	-4,132	-5,848
2005	36,543	35,912	35,732	-20,609	-21,167	-21,977
2006	21,748	21,634	20,664	-9,165	-9,006	-9,130
2007	45,017	46,808	44,872	-1,540	-122	-2,139
2008						
2009		890	1,112	-362	-620	-898
2010				-1		
2011	16,701	16,531	16,427	-17,140	-17,046	-17,107
Total	155,734	155,783	150,765	-53,402	-53,341	-58,854
Cap	Suboption 1a			Suboption 1b		
200,000 (62,400)	2ii	4ii	6	2ii	4ii	6
2003	1,411	4,158	6,089			
2004	18,578	17,321	18,803	-2,069	-1,657	-684
2005	34,823	33,583	31,541	-14,509	-14,641	-15,070
2006	19,225	19,537	19,961	-7,442	-8,411	-8,694
2007						
2008						
2009						
2010						
2011	3,819	2,351	14,233	-6,336	-8,625	-11,454
Total	77,855	76,950	90,628	-30,357	-33,335	-35,902
Cap	Suboption 1a			Suboption 1b		
353,000 (110,136)	2ii	4ii	6	2ii	4ii	6
2003						
2004	12,044	13,725	14,685	-1,790	-576	
2005	33,253	31,174	31,365	-9,681	-11,475	-13,216
2006		18,948	19,246	-6,042	-6,534	-7,953
2007						
2008						
2009						
2010						
2011	2,846	2,284		-1,761	-1,447	-4,543
Total	48,143	66,130	65,296	-19,274	-20,032	-25,713

Table 6-10. Estimated total reduction in Chinook salmon bycatch for chum management measures under Alternative 2 by cap, suboption, and sector allocation, 2003-2011. Note that caps in parentheses represent (b) options UPDATED!!

		Allocation configuration		
Cap	Option	2ii	4ii	6
50,000 (15,600)	1a)	155,734	155,783	150,765
	1b)	-53,402	-53,341	-58,854
200,000 (62,400)	1a)	77,855	76,950	90,628
	1b)	-30,357	-33,335	-35,902
353,000 (110,136)	1a)	48,143	66,130	65,296
	1b)	-19,274	-20,032	-25,713

Table 6-11. Estimated total reduction in Chinook salmon bycatch by sector for chum management measures under Alternative 2 by cap, suboption, and sector allocation, 2003-2011. Note that caps in parentheses represent (b) options UPDATED!!

Cap	Option	Allocation	CDQ	CP	M	S
50,000 (15,600)	1a)	2ii	5,184	17,267	8,362	124,921
		4ii	4,241	14,424	8,150	128,967
		6	1,270	11,469	7,649	130,378
	1b)	2ii	-357	-7,369	-4,144	-41,531
		4ii	-124	-5,010	-3,728	-44,479
		6		-4,771	-3,370	-50,712
200,000 (62,400)	1a)	2ii	777	6,511	5,469	65,099
		4ii		4,018	2,921	70,010
		6		1373.77	2,307	86,947
	1b)	2ii		-3,685	-2,561	-24,112
		4ii		-1,765	-2,112	-29,458
		6		-684	-1,800	-33,419
353,000 (110,136)	1a)	2ii		4,681	2,420	41,042
		4ii		426	2,284	63,420
		6				65,296
	1b)	2ii		-1,907	-2,050	-15,317
		4ii		-576	-1,447	-18,009
		6			-728	-24,985

6.3.3 Impacts on Chinook salmon under Alternative 3

As is discussed in Section 5.5.3 under the Alternative 3 analysis, Chinook PSC could potentially be reduced from current levels given the modifications to the RHS programs which explicitly link the cessation of chum measures to a Chinook threshold. Under the status quo RHS program, the regulations require that chum closures are called whenever chum rates exceed a base rate threshold. Prior to the modifications of the RHS regulations following Amendment 91, the RHS was designed for both Chinook and chum closures. Under that program, Chinook closures were given priority over chum closures to ensure the conservation of Chinook PSC. When Chinook provisions were removed from the regulations due to the Amendment 91 Chinook PSC management program implementation in 2011, there was no longer any recognition in the now chum-only RHS program of the priority on Chinook. As a result, under status quo, chum closures continue to move the fleet around and at times into areas of higher Chinook well into September and October when Chinook rates tend to be higher. Under the revised RHS, the Chinook threshold provides a benchmark whereby chum closures cease once the threshold for the Chinook rate (0.035 Chinook/mt pollock) is reached. This will avoid any exacerbation of Chinook PSC due to area closures for chum. Analysis of this threshold indicates that it is reached in every year 2003-2011 between the dates of August 25 and September 15 (depending upon the individual year). Analysis of 2011 (only) indicated that the rates inside and outside of the chum closures were similar for Chinook, thus these closures may not in fact be exacerbating Chinook PSC levels (Table 5-41). Thus while the potential exists for this flexibility in the RHS program to reduce Chinook PSC, currently available data are insufficient to detect a significant reduction and Chinook PSC levels are assumed to approximately status quo.

6.3.4 Impacts on Chinook salmon under Alternative 4

Similar to Alternative 2, Alternative 4 contains options that divert pollock into later in the season result which can result in worse Chinook salmon PSC (Table 6-12 and Table 6-13). The variability is somewhat greater which likely reflects changes in the spatio-temporal patterns of Chinook salmon bycatch between years.

Table 6-12. Estimated annual reduction in Chinook salmon bycatch by year for chum management measures under Alternative 4 by cap, suboption, and sector allocation equal to 2ii (option 1) 2003-2011. Note that caps in parentheses represent (b) options UPDATED!!

		Option			
Cap	Year	1a)	1b)	2a)	2b)
25,000 (7,800)	2003	3,766	-1,012	-5,138	-933
	2004	-2,266	-3,569	-4,685	-2,782
	2005	19,210	-15,519	-993	-10,350
	2006	11,914	-4,763	10,442	-3,399
	2007	21,971	-760	9,129	-78
	2008				
	2009	802	-73	771	-43
	2010		-2		-2
	2011	14,847	-7,440	14,923	-4,590
		70,243	-33,138	24,448	-22,177
75,000 (23,400)	2003	4,914	-121	-545	-107
	2004	-1,000	-811	-4,626	-309
	2005	18,982	-11,440	-1,164	-6,464
	2006	11,397	-4,443	10,092	-3,109
	2007	2,123		1,032	
	2008				
	2009		-9		-9
	2010				
	2011	14,757	-6,011	14,872	-3,464
		51,172	-22,835	19,661	-13,462
200,000 (62,400)	2003	406		-122	
	2004	930	-401	-817	-146
	2005	18,475	-9,399	-1,628	-5,037
	2006	10,475	-3,423	9,459	-2,186
	2007				
	2008				
	2009				
	2010				
	2011	2,584	-2,098	2,463	-598
		32,871	-15,322	9,355	-7,966

Table 6-13. Estimated total reduction in Chinook salmon bycatch by year for chum management measures under Alternative 4 by cap, suboption, and sector allocation equal to 2ii (option 1), 2003-2011. Note that caps in parentheses represent (b) options UPDATED!!

		Allocation		
Cap	Option	2ii	4ii	6
	1a)	70,243	71,673	76,001
25,000	1b)	-33,138	-36,394	-41,744
(7,800)	2a)	24,448	26,216	31,892
	2b)	-22,177	-24,524	-28,263
	1a)	51,172	45,376	55,696
75,000	1b)	-22,835	-24,393	-27,137
(23,400)	2a)	19,661	1,866	8,961
	2b)	-13,462	-14,848	-17,517
	1a)	32,871	32,096	42,438
200,000	1b)	-15,322	-17,136	-18,340
(62,400)	2a)	9,355	8,330	15,887
	2b)	-7,966	-8,947	-10,220

6.3.5 Summary of the impacts of the alternatives on Chinook salmon

Under all four of the alternatives under consideration, there are incidental take of Chinook PSC. The impact of Chinook PSC on Chinook salmon was analyzed previously (NOAA/NPFMC 2009). Alternatives here are analyzed against whether they incur any change from status quo, understanding that management measures for Chinook (Amendment 91) remain unchanged by the management measures under consideration for chum. Some of the alternatives, notably Alternative 2 option 1B and Alternative 3 option 1B would increase fishing pressure to later in the B-season and likely increase the catch of Chinook and thus increase the adverse impact on Chinook PSC. Other alternatives such as Alternative 2, option 1a would close the fishery earlier in the B season and thus likely minimize the adverse impact on Chinook PSC.

Under Alternative 2, option 1b and suboptions as described above, this management alternative will likely increase the bycatch of Chinook salmon due to increased fishing pressure later in the B season when Chinook rates tend to be higher. These alternatives and options would increase the adverse impact on Chinook. For options 1a and suboptions, as indicated previously, fishing would likely close earlier in the B season which would reduce the bycatch of Chinook and thus minimize any adverse impact. Alternative 3 would encourage participation in the RHS program and would explicitly monitor Chinook PSC rates in a manner that would ensure (after Aug 1st) that chum measures did not interfere with Chinook closures and management measures.

Under Alternative 4 option 1b and suboptions as described above, this management alternative may also increase the bycatch of Chinook salmon due to increased fishing pressure diverted to later in the B season when Chinook rates tend to be higher. These alternatives and options would increase the adverse impact on Chinook. For options 1a and suboptions, as indicated previously, fishing would be less likely to be diverted early in the B season.

The estimated impacts under Alternatives 2, 3, and 4 are believed to be insignificant in either case because they would not diminish protections afforded to Chinook salmon under the provisions of Amendment 91 in the current management of the groundfish fisheries as the pollock fishery is still subject to the Chinook salmon PSC limit established under that amendment. Thus these alternatives for chum PSC management are not expected to jeopardize the sustainability of Chinook salmon stocks.

7 Other Marine Resources

The Bering Sea pollock fishery, and potential changes to the prosecution of the pollock fishery to reduce salmon bycatch under the alternatives, impacts other fish species, marine mammals, seabirds, and essential fish habitat. This chapter analyses the impacts to these other marine resources.

7.1 Other fish species

Vessels participating in the directed pollock fishery catch other groundfish species incidentally while also incidentally caught in the fishery in lesser amounts.

Table 7-1 Bycatch estimates (t) of non-target species caught in the BSAI directed pollock fishery, 1997-2002 based on observer data, 2003-2010 based on observer data as processed through the catch accounting system (NMFS Regional Office, Juneau, Alaska).

Group	1997	1998	1999	2000	2001	2002
Jellyfish	6,632	6,129	6,176	9,361	3,095	1,530
Squid	1,487	1,210	474	379	1,776	1,708
Skates	348	406	376	598	628	870
Misc Fish	207	134	156	236	156	134
Sculpins	109	188	67	185	199	199
Sleeper shark	105	74	77	104	206	149
Smelts	19.5	30.2	38.7	48.7	72.5	15.3
Grenadiers	19.7	34.9	79.4	33.2	11.6	6.5
Salmon shark	6.6	15.2	24.7	19.5	22.5	27.5
Starfish	6.5	57.7	6.8	6.2	12.8	17.4
Shark	15.6	45.4	10.3	0.1	2.3	2.3
Benthic inverts.	2.5	26.3	7.4	1.7	0.6	2.1
Sponges	0.8	21	2.4	0.2	2.1	0.3
Octopus	1	4.7	0.4	0.8	4.8	8.1
Crabs	1	8.2	0.8	0.5	1.8	1.5
Anemone	2.6	1.8	0.3	5.8	0.1	0.6
Tunicate	0.1	1.5	1.5	0.4	3.7	3.8
Unident. inverts	0.2	2.9	0.1	4.4	0.1	0.2
Echinoderms	0.8	2.6	0.1	0	0.2	0.1
Sea pen/whip	0.1	0.2	0.5	0.9	1.5	2.1
Other	0.8	2.9	1.1	0.8	1.2	3.7

Table 7-1 Bycatch estimates (t) of non-target species caught in the BSAI directed pollock fishery, 1997-2002 based on observer data, 2003-2010 based on observer data as processed through the catch accounting system (NMFS Regional Office, Juneau, Alaska). (Continued)

Group	2003	2004	2005	2006	2007	2008	2009	2010
Jellyfish	5,592	6,495	5,084	2,657	2,156	3,722	3,731	2,174
Skates	462	829	693	1,258	1,182	2,301	1,635	1,076
Squid	952	717	699	893	962	374	119	77
Sharks	191	186	163	506	214	114	92	24
Sculpins	92	141	140	171	161	254	153	157
Eulachon	2	19	9	87	101	2	2	1
Eelpouts	1	1	1	21	119	7	2	0
Sea stars	89	7	10	11	5	7	5	5
Grenadier	20	10	9	9	11	4	1	1
Other osmerids	7	2	3	5	37	2	0	0
Octopus	9	3	1	2	4	3	4	1
Lanternfish	0	0	0	10	6	1	0	0
Sea pens, whips	1	1	2	2	4	1	2	2
Birds	0	0	2	0	1	0	0	0
Capelin	0	0	0	2	1	0	0	0
Other fish	98	88	147	140	198	102	59	134
Other invertebrates	2	2	11	5	6	7	2	2

Table 7-2 Bycatch estimates (t) of other target species caught in the BSAI directed pollock fishery, 1997-2010 based on then NMFS Alaska Regional Office reports from observers (*2010 data are preliminary*).

	Pacific Cod	Flathead Sole	Rock Sole	Yellowfin Sole	Arrowtooth Flounder	Pacific Ocean Perch	Atka Mackerel	Sablefish	Greenland Turbot	Alaska Plaice	All other	Total
1997	8,262	2,350	1,522	606	985	428	83	2	123	1	879	15,241
1998	6,559	2,118	779	1,762	1,762	682	91	2	178	14	805	14,751
1999	3,220	1,885	1,058	350	273	121	161	7	30	3	249	7,357
2000	3,432	2,510	2,688	1,466	979	22	2	12	52	147	306	11,615
2001	3,878	2,199	1,673	594	529	574	41	21	68	14	505	10,098
2002	5,925	1,843	1,885	768	606	544	221	34	70	50	267	12,214
2003	5,968	1,740	1,419	210	618	935	762	48	40	7	67	11,814
2004	6,437	2,105	2,554	841	557	393	1,051	17	18	8	120	14,100
2005	7,413	2,352	1,125	63	651	652	677	11	31	45	125	13,145
2006	7,285	2,861	1,361	256	1,088	737	789	9	65	11	152	14,612
2007	5,627	4,228	510	86	2,794	624	315	12	107	3	188	14,494
2008	6,761	4,209	1,964	405	1,364	336	15	2	82	30	39	15,205
2009	7,876	4,652	7,534	269	2,143	114	25	2	44	176	25	22,861
2010	6,902	4,333	2,220	1,017	1,414	230	55	2	23	109	22	16,326
Average	6,110	2,813	2,021	621	1,126	457	306	13	67	44	268	13,845

7.1.1 Effects on other Fish Species

7.1.1.1 Significance Criteria for Other Fish Species

The following criteri, modified from the 2006-2007 groundfish harvest specifications environmental assessment/final regulatory flexibility analysis (EA/FRFA) is used to evaluate the impact of the alternatives on non-target fish species (Table 7-3).

Table 7-3. Criteria used to determine significance of effects on other fish species.

Insignificant impact	No substantial change in incidental take of the non-target species in question.
Adverse impact	There are substantially increased incidental takes of the non-target species in question
Beneficial impact	Natural at-sea mortality of the nontarget species in question would be reduced – perhaps by the harvest of a predator or by the harvest of a species that competes for prey.
Significantly adverse impact	The Bering Sea pollock fishery is subject to operational constraints under PSC management measures. Operation of the Bering Sea pollock fishery in a manner that substantially increases the take of nontarget species would be a significantly adverse effect on nontarget species.
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the Bering Sea pollock fishery on the nontarget species, and significantly beneficial impacts are not defined for these species.
Unknown impact	Not applicable

The effects of the EBS pollock fishery on fish species that are caught incidentally has most recently been analyzed in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007) as well as analyzed in the Chinook Salmon Bycatch Measures EIS (NPFMC/NMFS 2009). The harvest specifications analysis concludes that under the status quo, the neither the level of mortality nor the spatial and temporal impacts of fishing are likely to jeopardize the sustainability of the target and nontarget fish populations while the Chinook EIS concluded that none of the proposed alternative measures, neither hard caps nor area closures (similar to ones examined here) would jeopardize the sustainability of target and nontarget fish populations either.

Alternative 2 would establish a hard cap that limits bycatch of chum salmon in the EBS pollock fishery either in June and July or for the remainder of the B-season when triggered. A lower hard cap may result in the pollock fishery closing before the TAC is reached, which may reduce impacts of this fishery on incidental catch species. A higher hard cap may allow for pollock fishing at current levels, and impacts would likely be similar to the status quo fishery. Some incidental catch of non-target species occurs in the pollock fishery. Fishing pressure is unlikely to increased (and more likely to decrease) under alternative 1, and options and suboptions would thus decrease this incidental catch and minimize the adverse impact on non-target species. This alternative is not likely to result in significant adverse impacts given the small amount of incidental catch under status quo and the likelihood that alternative management measures would minimize this catch.

The Alternative 2 hard caps, to the extent that they prevent the pollock fleet from harvesting the pollock TAC and therefore reduce pollock fishing effort, would reduce the pollock fisheries impacts on forage fish from Alternative 1. 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. This would increase the adverse impact under this alternative but this is not likely to be significantly adverse given the low levels of incidental catch in this fishery and catch of non-targets is unlikely to substantially increase.

Alternative 3 proposes a large-scale fixed or triggered closure as a back-stop mechanism to encourage participation in the RHS program for bycatch reduction. Given that there is 100% participation by the fleet in the current RHS program it is reasonable to assume that under this alternative the incentive to remain in the program would be strong enough to continue to maintain 100% participation. Thus the impacts of this alternative on incidental catch of other fish species would be similar to status quo.

Alternative 4, components 2-6 propose additional triggered closures on the RHS participants which would close identified areas for June and July or the remainder of the B-season when a specific cap level is reached by fishery or sector. The area closure would reduce the pollock fisheries impacts to ecosystem component species 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 or 4, it is reasonable to conclude that the overall impacts on ecosystem component species and incidental catch of other fish species 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. This would increase the adverse impact under this alternative but this is not likely to be significantly adverse given the low levels of incidental catch in this fishery and catch of non-targets is unlikely to substantially increase.

7.2 Marine Mammals

7.2.1 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, sea ice, shores and rocks, and nearshore waters (Lowry et al. 1982). The PSEIS (NMFS 2004) describes the range, habitat, diet, abundance, and population status for marine mammals.

The most recent marine mammal stock assessment reports (SARs) for strategic BSAI marine mammals stocks (Steller sea lions, northern fur seals, harbor porpoise, North Pacific right whales, humpback whales, sperm whales, fin whales and bowhead whales) were completed in 2011 based on a review of data available through 2010 (Allen and Angliss 2011). Polar bears, Pacific walrus, and northern sea otters are under U.S. Fish and Wildlife Service juriscition. Polar bears and Pacific walrus status were updated in 2010, northern sea otters were updated in 2008 (Allen and Algliss 2011). The SARs provide population estimates, population trends, and estimates of the potential biological removal (PBR) levels for each stock. The SARs also identify potential causes of mortality and whether the stock is considered a strategic stock under the MMPA. The SARs are available on the Protected Resources Division web site at http://www.nmfs.noaa.gov/pr/sars/region.htm.

Amendment 91 to the BSAI Groundfish FMP analyzed the impacts of the pollock fishery on marine mammals. The preferred alternative in that analysis, ultimately selected, established the status quo alternative for this analysis. That analysis also provided a detailed description of the status marine mammals in the Bering Sea, which is incorporated here by reference. Tables 7-4 and 7-5 provide a summary of the status of pinnipeds and cetacean stocks potentially affected by the Bering Sea pollock fishery.

Table 7-4 Status of Pinniped stocks potentially affected by the Bering Sea pollock fishery

Pinnipedia species and stock	***Status under the ESA***	***Status under the MMPA***	***Population Trends***	***Distribution in action area***
Steller sea lion - Western and Eastern Distinct Population Segment (DPS)	Endangered (W) Threatened (E)	Depleted, strategic	For the western DPS, regional increases in counts in trend sites of some areas have been offset by decreased counts in other areas so that the overall population of the western DPS appears stable (Fritz et al. 2008). The eastern DPS is steadily increasing and is being considered for delisting (NMFS 2010).	Western DPS inhabits Alaska waters from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters. Eastern DPS inhabit waters east of Prince Williams Sound to California. Occur throughout AK waters, terrestrial haulouts and rookeries on Pribilof Is., Aleutian Is., St. Lawrence Is. And off mainland. Use marine areas for foraging. Critical habitat designated around major rookeries and haulouts and foraging areas.
Northern fur seal – Eastern Pacific	None	Depleted, strategic	Recent pup counts show a continuing decline in productivity in the Pribilof Islands. During 1998-2006, pup production declined 6.1% annually on St. Paul Island and 3.4% annually on St. George Island. Despite near exponential growth on Bogoslof Island, the overall abundance estimate continues to decline in the Bering Sea.	Fur seals occur throughout Alaska waters, but their main rookeries are located in the Bering Sea on Bogoslof Island and the Pribilof Islands. Approximately 55% of the worldwide abundance of fur seals is found on the Pribilof Islands (NMFS 2007b). Forages in the pelagic area of the Bering Sea during summer breeding season, but most leave the Bering Sea in the fall to spend winter and spring in the N. Pacific.
Harbor seal – Gulf of Alaska Bering Sea	None	None	Moderate to large population declines have occurred in the Bering Sea and Gulf of Alaska stocks.	GOA stock found primarily in the coastal waters and may cross over into the Bering Sea coastal waters between islands. Bering Sea stock found primarily around the inner continental shelf between Nunivak Island and Bristol Bay and near the Pribilof Islands.
Ringed seal – Alaska	Status under review	None	Reliable data on population trends are unavailable.	Found in the northern Bering Sea from Bristol Bay to north of St. George Island and occupy ice (Figure 7-3).
Bearded seal – Alaska	Status under review	None	Reliable data on population trends are unavailable.	Found in the northern Bering Sea from Bristol Bay to north of St. George Island and inhabit areas of water less than 200 m that are seasonally ice covered (Figure 7-3).
Ribbon seal – Alaska	None	None	Reliable data on population trends are unavailable.	Found throughout the offshore Bering Sea waters (Figure 7-3).
Spotted seal - Alaska	Status under review	None	Reliable data on population trends are unavailable.	Found throughout the Bering Sea waters (Figure 7-3).
Pacific Walrus	Status under review	Strategic	Population trends are unknown. Population size estimated from a 2006 ice survey is 15,164 animals, but this is considered a low estimate. Further analysis is being conducted on the 2006 survey to refine the population estimate.	Occur primarily is shelf waters of the Bering Sea. Primarily males stay in the Bering Sea in the summer. Major haulout sites are in Round Island in Bristol Bay and on Cape Seniavin on the north side of the Alaska Peninsula.

Source: Allen and Angliss 2011 and List of Fisheries for 2011 (75 FR 68468).
Northern fur seal pup data available from http://www.fakr.noaa.gov/newsreleases/2007/fursealpups020207.htm.

Table 7-5 Status of Cetacea stocks potentially affected by the Bering Sea pollock fishery

Cetacea species and stock	***Status under the ESA***	***Status under the MMPA***	***Population Trends***	***Distribution in action area***
Killer whale – AT1 Transient; Eastern North Pacific GOA, AI, and BS transient; West Coast transient; and Eastern North Pacific Alaska Resident	None	AT1 Transient Depleted, strategic	AT1 group is estimated at 7 animals. Unknown abundance for the eastern North Pacific Alaska resident; West Coast transient; and Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea transient stocks. Minimum abundance estimates for the Eastern North Pacific Alaska Resident and West coast transient stocks are likely underestimated because new whales recently found in the Alaskan waters.	Transient-type killer whales from the Aleutian Islands and Bering Sea are considered to be part of a single population that includes Gulf of Alaska transients. Killer whales are seen in the northern Bering Sea and Beaufort Sea, but little is known about these whales.
Dall's porpoise – Alaska	None	None	Reliable data on population trends are unavailable.	Found offshore waters from coastal western Alaska to Bering Sea.
Humpback whale- Western North Pacific Central North Pacific	Endangered	Depleted, strategic	Reliable data on population trends are unavailable for the western North Pacific stock. Central North Pacific stock thought to be increasing. The status of the stocks in relation to optimal sustainable population (OSP) is unknown.	W. Pacific and C. North Pacific stocks occur in Alaskan waters and may mingle in the North Pacific feeding area shown in Figure 7-2. Humpback whales in the Bering Sea identity to western or Central North Pacific stocks, or to a separate, unnamed is stock difficult.
North Pacific right whale Eastern North Pacific	Endangered	Depleted, strategic	Abundance not known, stock is considered to represent only a small fraction of its pre-commercial whaling abundance.	See Figure 7-4 for distribution and designated critical habitat.
Fin whale – Northeast Pacific	Endangered	Depleted, strategic	Abundance may be increasing but surveys only provide information for portions of the stock in the central-eastern and southeastern Bering and coastal waters of the Aleutian Islands and the Alaska Peninsula, and much of the North Pacific range has not been surveyed.	Found in the Bering Sea and coastal waters of the Aleutian Islands and Alaska Peninsula. Most sightings in the central-eastern Bering Sea occur in a high productivity zone on the shelf break (Figure 7-1).
Minke whale - Alaska	None	None	Considered common but abundance not known and uncertainty exists regarding the stock structure.	Common in the Bering and Chukchi Seas and in the inshore waters of the GOA.
Sperm Whale – North Pacific	Endangered	Depleted, strategic	Abundance and population trends in Alaska waters are unknown.	Inhabit waters 600 m or more depth, south of 62°N lat. Males inhabit Bering Sea in summer.
Gray Whale – Easter North Pacific	None	None	Minimum population estimate is 17,752 animals. Increasing populations in the 1990's but below carrying capacity.	Most spend summers in the shallow waters of the northern Bering Sea and Arctic Ocean. Winters spent along the Pacific coast near Baja California.
. Source: Allen and Angliss 2011 and List of Fisheries for 2011 (72 FR 68468). North Pacific right whale included based on NMFS 2006 and Salveson 2008 www.nmfs.noaa.gov/pr/species/mammals/cetaceans/spermwhale.htm				

7.2.2 ESA Consultations for Marine Mammals

For Bering Sea marine mammals, ESA Section 7 consultations have been completed for all ESA-listed marine mammals (NMFS 2000, NMFS 2001, NMFS 2010). The Amendment 91 EIS provides a detailed description of the ESA section 7 consultations through December, 2009, and is incorporated here by reference. This section provides information on Section 7 consultations that have taken place since that document was published.

7.2.2.1 Steller Sea Lions

In 2006, NMFS reinitiated a FMP-level Section 7 consultation on the effects of the groundfish fisheries on Steller sea lions, humpback whales, and sperm whales to consider new information on these species and their interactions with the fisheries (NMFS 2006a). A final Biological Opinion (BiOp) was published in November, 2010 and found that the effects of the groundfish fisheries were likely to jeopardize the continued existence of Steller sea lions and adversely modify designated critical habitat (JAM). As a result, a Reasonable and Prudent Alternative (RPA) was developed that removed the likelihood of causing JAM to Steller sea lions by restricting fisheries in the western and central Aleutians.. The BiOp also found that the groundfish fisheries were not likely to jeopardize the continued existence of humpback or sperm whales. NMFS implemented the Steller sea lion protection measures in the RPA on January 1, 2011 (NMFS 2010b) by interim final rule (75 FR 77535, December 13, 2010, corrected 75 FR 81921, December 29, 2010). The RPA did not change the Steller sea lion protection measures in the EBS. Incidental take statements for Steller sea lions, humpback whales, fin whales, and sperm whales were completed on February 10, 2011 (Balsiger 2011). The results of that BiOp (JAM for Steller sea lions) was challenged in court by the State of Alaska and several industry groups. Although the court rejected the scientific complaints of the plaintiffs, the court ordered NMFS to prepare an EIS to evaluate alternatives to avoid JAM in order to provide the public with greater input to the process. That EIS is scheduled for completion in 2014. The BiOp was also reviewed by a panel commissioned by the States of Alaska and Washington (Bernard et al. 2011) and the Center for Independent Experts in 2012. Those reviews resulted in four separate reports, each of which was critical of the findings of the BiOp, particularly the conclusion of jeopardy as a result of nutritional stress.

A detailed discussion of Steller sea lion population trends in the WDPS is included in the most recent Biological Opinion (NMFS 2010b) new information is summarized here. Land-based and aerial surveys of Steller sea lions in the western Aleutian Islands were conducted by the Alaska Ecosystem Program (AEP) of the National Marine Mammal Laboraotry (NMML), Alaska Fisheries Science Center (AFSC) in June 2012 (DeMaster 2012). However, persistent fog and low ceilings in the Aleutian Islands precluded flights during most of the aerial survey period and no sites east of 177°E were surveyd from the air in 2012. The summary of SSL population in NMFS (2010b) remains the most complete and up to date.

7.2.2.2 Ice Seals

In 2008, the Center for Biological Diversity (CBD) petitioned NMFS to list ringed, bearded, and spotted seals under the ESA due to threats to the species from (1) global warming, (2) high harvest levels allowed by the Russian Federation, (3) oil and gas exploration and development, (4) rising contaminant levels in the Arctic, and (5) bycatch mortality and competition for prey resources from commercial fisheries (CBD 2008a). Pursuant to a court settlement, NMFS completed the status review and issued a 12-month finding on October 15, 2009 for the spotted seal (74 FR 53683). NMFS published the 12-month finding on December 10, 2012 proposing the list the ringed seal and two distinct population segments (DPSs) of the bearded seal. NMFS published a six-month extension for final ruling on December 13, 2011, which extended the deadline for final rule to June 2012. In September, 2012 CBD again sued NMFS for failing to issue a final rule. As of October, 2012 the final rule for ringed and bearded seals has not yet been published.

7.2.2.3 North Pacific Right Whale

North Pacific right whales are arguably the most endangered stock of large whales in the world (Allen and Anglis 2011), with a minimum population estimate of 17 individuals. Critical habitat for North Pacific right whales consists of an area in the southeast Bering Sea and a small area southeast of Kodiak Island (Fig. 7-4), although most North Pacific right whale sightings have occurred within critical habitat in the Bering Sea. In April 2012 NMFS published a Notice of Intent to prepare a recovery plan for the North Pacific right whale.

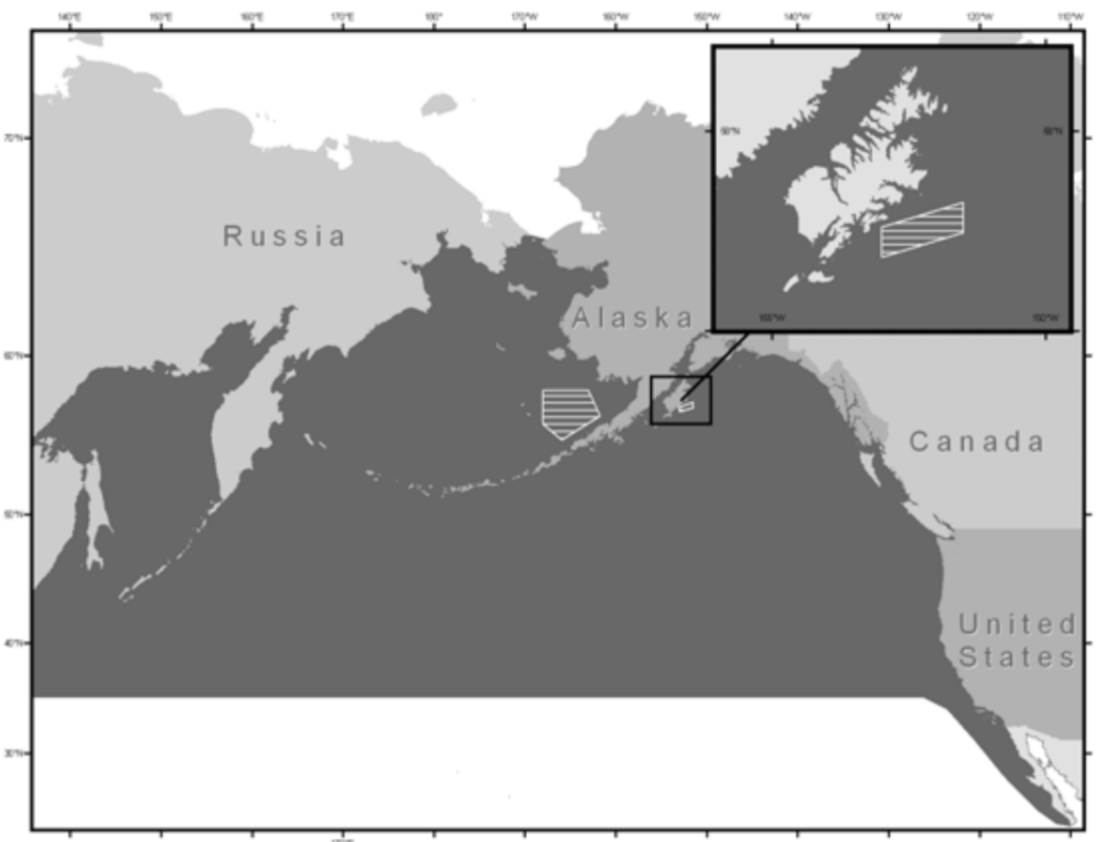


Figure 7-1. North Pacific right whale distribution and critical habitat shown in lined boxes. (Angliss and Outlaw 2008)

7.2.2.4 Pacific Walrus

Pacific walrus (*Odobenus rosmarus divergens*) are managed by the U.S. Fish and Wildlife Service (FWS). They occur throughout the shallow, continental shelf waters of the Bering and Chukchi Seas, occasionally moving into the East Siberian Sea and the Beaufort Sea. During the summer months, most of the population migrates into the Chukchi Sea, but several thousand animals, primarily adult males, aggregate at coastal haulouts in the Bering Straits region, Gulf of Anadyr, and Bristol Bay. The size of the Pacific walrus population has never been known with any certainty, and recent population estimates have provided unsatisfactory results because of differences in survey methods that produced large variances and unknown biases. The most recent population estimation (Speckman et al. 2011) is 129,000 with 95% confidence limits of 55,000 to 507,000.

On February 7, 2008, the Center for Biological Diversity petitioned the USFWS to list Pacific walrus under the ESA because of the impact of global warming in the sea ice habitat (CBD 2008). On February 10, 2011, the USFWS released its 12-month finding and concluded that listing the Pacific walrus as threatened or endangered is warranted but precluded at this time by higher priority actions under the ESA. Therefore, the agency has added Pacific walrus to the candidate species list. As priorities allow, the USFWS will develop a proposed rule to list the Pacific walrus.

7.2.3 Existing Management Measures to Mitigate Fishing Impacts on Marine Mammals

In the BS, extensive closures are in place for Steller sea lions including no transit zones and closures of critical habitat around rookeries and haulouts and some offshore foraging areas. These closures affect commercial harvests of pollock, Pacific cod, and Atka mackerel, which are important components of the Steller sea lion diet. The Bering Sea subarea has several pollock fishery closures in place for Steller sea lion protection including no transit zones, closures around rookeries and haulouts, the Bogoslof foraging area closure, and the Steller Sea Lion Conservation Area (Figure 7-5). The Amendment 91 analysis (NMFS 2009) concluded that the BSAI pollock fishery, as regulated by these closures, was not likely to result in significantly adverse impacts to Steller sea lions or their critical habitat. On January 1, 2011, the Interim Final Rule resulting from the 2010 BSAI and GOA FMP-level Biological Opinion went into effect. This Interim Final Rule provides additional protection to Steller sea lions by restricting fishing for Atka mackerel and Pacific cod in vast areas of the western and central Aleutian Islands (Fig. 7-5).

Figure 7-5 also shows the other areas closed to pollock fishing. The Nearshore Bristol Bay Trawl Closure prohibits pollock vessels from fishing in Bristol Bay. The Pribilof Island Area Habitat Conservation Zone prevents pollock trawling at all times in the area around the Pribilof Islands. The walrus protection areas around Round Island and The Twins, are closed from April 1 through September 30 to pollock vessels.

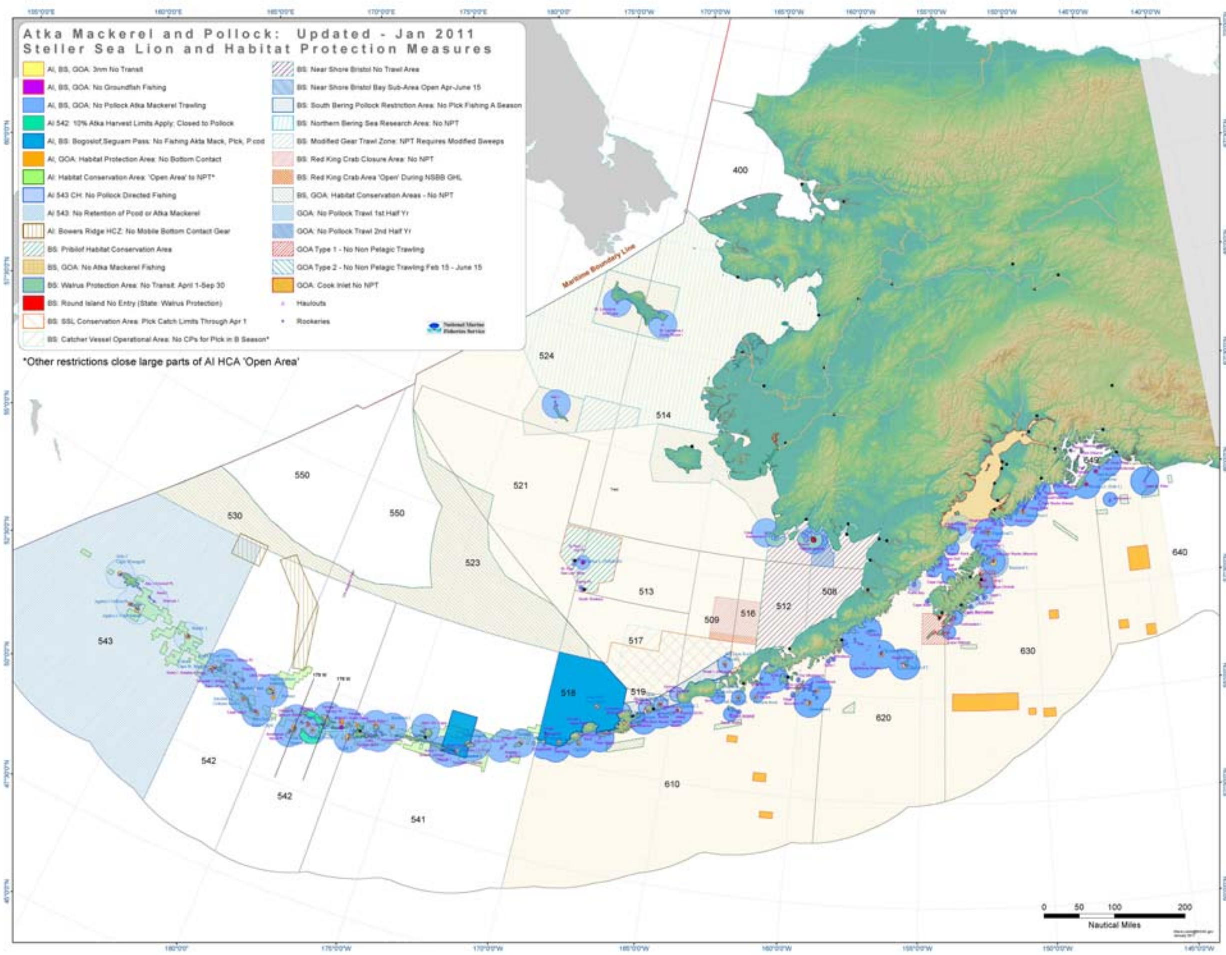


Figure 7-2. Pollock Fishery Restrictions Including Steller Sea Lion Protection Areas. (Details of these closures are available through the NMFS Alaska Region website at http://www.fakr.noaa.gov/sustainablefisheries/sslpm/).

7.2.4 Effects on Marine Mammals

7.2.4.1 Significance Criteria for Marine Mammals

Criteria to assess the impacts of the action on marine mammals are listed below. These criteria are adopted from the 2006-2007groundfish harvest specifications environmental assessment/final regulatory flexibility analysis (EA/FRFA). The Status Quo alternative is the pollock fishery as prosecuted under Amendment 91 to the BSAI Groundfish FMP, and as such is not considered to cause significantly adverse impacts to marine mammals in the Bering Sea. The other alternatives being considered constitute a change from status quo, and impacts are assessed as a change from status quo. Although impacts from commercial fisheries cannot be considered beneficial (incidental take, reduced prey availability, and increased disturbance are all adverse impacts), it is possible that an alternative considered in this analysis could reduce the harmful effects of commercial fisheries on marine mammals and seabirds, if it can be demonstrated that they reduce incidental take, competition for prey, or disturbance.

Table 7-6. Criteria for determining significance of impacts to marine mammals.

	Incidental take and entanglement	Prey availability	Disturbance
Adverse impact	Mammals are taken incidentally to fishing operations or become entangled in marine debris.	Fisheries reduce the availability of marine mammal prey.	Fishing operations disturb marine mammals.
Beneficial impact	There is no beneficial impact.	There is no beneficial impact.	There is no beneficial impact.
Insignificant impact	No substantial change in incidental take by fishing operations, or in entanglement in marine debris	No substantial change in competition for key marine mammal prey species by the fishery.	No substantial change in disturbance of mammals.
Significantly adverse impact	Incidental take is more than PBR or is considered major in relation to estimated population when PBR is undefined.	Competition for key prey species likely to constrain foraging success of marine mammal species causing population decline.	Disturbance of mammal is such that population is likely to decrease.
Significantly beneficial impact	Not applicable	Not applicable	Not applicable
Unknown impact	Insufficient information available on take rates.	Insufficient information as to what constitutes a key area, prey species, or important time of year.	Insufficient information as to what constitutes disturbance.

7.2.5 Incidental Take Effects

The Alaska Groundfish Harvest Specifications EIS contains a detailed description of the effects of the groundfish fisheries on marine mammals (Chapter 8 of NMFS 2007a) and is incorporated by reference. The Amendment 91 EIS contains a description fo the effects of the pollock fishery on marine mammals in the Bering Sea (Ch 8 in NMFS 2009) and is also incorporated by reference The BSIA pollock fishery is listed as a Category II fishery in the 2011 List of Fisheries, meaning incidental take of marine mammals ranges from 1% to 50% of Potential Biological Removal (PBR). Potential take in the pollock fishery is below the PBR for all marine mammals for which PBR has been determined. Table 7-7 provides more detail on the levels of take based on the most recent SAR (Allen and Angliss 2011). Overall, very few marine mammals are reported taken in the Bering Sea pollock fishery.

Table 7-7. Estimated mean annual mortality of marine mammals from observed BSAI pollock fishery and potential biological removal. Mean annual mortality is expressed in number of animals and includes both incidental takes and entanglements. The averages are from the most recent 5 years of data since the last SAR update, which may vary by stock. Groundfish fisheries mortality calculated based on Allen and Angliss (2011).

Marine Mammal Species and Stock	Years used to calculate mean annual mortality from BSIA pollock fishery	Mean annual mortality, from BSAI pollock fishery	Potential Biological Removal (PBR)
*Steller sea lions (western)	2002-2006	3.83	254
Northern fur seal	2002-2006	0.21	13,809
Harbor seal (BS)	2002-2006	0.29	603
Harbor seal (AI)	2000-2004	0	1334
Spotted seal	N/A	N/A	Undetermined
Ringed seal	N/A	N/A	Undetermined
Ribbon seal	N/A	N/A	Undetermined
Killer whale Eastern North Pacific AK resident	N/Z	N/Z	20.8
Killer whale, GOA, BSAI transient	2002-2006	0.41	5.5
Dall’s porpoise	2002-2006	1.09	Undetermined
*Humpback whale, Western North Pacific	N/A	N/A	2.6
*Humpback whale, Central North Pacific	N/A	N/A	61.2
Minke whale, Alaska	N/A	N/A	Undetermined
*Fin whale, Northeast Pacific	2002-2006	0.23	11.4
Pacific walrus	N/A	N/A	2,580

* ESA-listed stock

Table 7-8 shows the months and locations when incidental takes of marine mammals occurred in 2003, 2004, 2005, and 2006. It is not possible to determine any seasonality to the incidental takes of killer whales, fur seals, or fin whales since only one occurrence for each is reported during this time period. It appears that Dall’s porpoise may be more likely taken in July and bearded seals may be more likely taken in September and October. Steller sea lions appear to be taken in the A and B pollock fishing seasons, mostly in January through March and in September. Based on the very limited data in Table 7-8, bearded seals were primarily taken in the northern portion of the eastern Bering Sea. Killer whale, Dall’s porpoise, and fin whale appear to be taken in the area along the shelf break. Steller sea lions appear to be taken primarily in the southern portion of the eastern Bering Sea and northwest of the Pribilof Islands.

Table 7-8. Marine Mammals taken in the pollock fishery 2007 - 2011. Locations correspond to the areas depicted in Figure 7-5 (Sources: National Marine Mammal Laboratory and the North Pacific Groundfish Observer Program)

Species	Date	Location
Steller sea lion	2007-03-13	517
Northern fur seal	2007-08-07	513
Northern fur seal	2007-08-21	517
Bearded seal	2007-09-11	521
Northern fur seal	2007-09-26	521
Steller sea lion	2007-10-09	521
Steller sea lion	2008-01-21	509
Steller sea lion	2008-01-30	509
Steller sea lion	2008-01-30	509
Harbor seal	2008-01-31	517
Steller sea lion	2008-03-02	517
Steller sea lion	2008-03-03	517
Steller sea lion	2008-07-04	521
Steller sea lion	2008-07-06	521
Bearded seal	2008-07-08	517
Ringed seal	2008-07-16	521
Ribbon seal	2008-08-04	521
Bearded seal	2008-08-17	521
Steller sea lion	2008-08-25	521
Ribbon seal	2008-09-05	517
Bearded seal	2008-09-05	524
Northern fur seal	2008-09-09	521
Bearded seal	2008-09-21	524
Steller sea lion	2009-01-27	509
Steller sea lion	2009-02-14	513
Steller sea lion (2)	2009-02-16	509
Steller sea lion	2009-02-17	509
Dall's porpoise	2009-02-23	509
Steller sea lion	2009-03-18	513
Ribbon seal	2009-07-19	521
Bearded seal	2009-07-30	509
Ringed seal	2009-08-06	521
Steller sea lion	2010-02-23	509
Steller sea lion	2010-03-03	521
Steller sea lion	2010-03-06	521
Spotted seal	2010-03-20	521
Steller sea lion	2010-04-06	521
Bearded seal	2010-07-06	509
Humpback whale	2010-07-19	517
Northern fur seal	2010-08-04	517
Northern fur seal	2010-08-10	521
Steller sea lion	2010-08-12	517
Steller sea lion	2011-01-30	509
Steller sea lion	2011-02-24	509
Steller sea lion	2011-02-26	513
Ringed seal	2011-04-01	521

Steller sea lion	2011-06-24	517
Steller sea lion	2011-06-27	521
Steller sea lion	2011-08-04	519
Ringed seal	2011-08-07	521
Ringed seal	2011-08-11	524
Steller sea lion	2011-08-23	517
Steller sea lion	2011-08-31	519

7.2.5.1 Incidental Take Effects under Alternative 1: Status Quo

Pollock fishery on the incidental takes of marine mammals are analyzed in the Amendment 91 Chinook Salmon Bycatch Management Measures EIS (NPFMC/NMFS 2009). That analysis concluded that the BSAI pollock fishery was not likely to have significant adverse impacts to marine mammals in the Bering Sea and no changes are expected under status quo. No changes in incidental take and entanglement are expected under Status Quo, therefore, impacts from Alternative 1 are considered insignificant.

7.2.5.2 Incidental Take Effects under Alternative 2: Hard Cap

Imposing hard caps on the pollock fishery and the impact this could have on fishing pressures on marine mammals was also examined in the Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009). The range of hard caps under Alternative 2 may result in different potential for incidental takes of marine mammals. Lower hard caps may stop the pollock fishery in the Bering Sea earlier, which could reduce the potential for incidental takes in fishing areas where marine mammals interact with pollock fishing vessels. However, any change in incidental take or entanglement is not expected to be substantial, and impacts are likely to be insignificant.

The options for sector allocations and transfers, and cooperative provisions affect the management and distribution of the cap across the sectors. These options are not likely to have any effect on pollock fishing in a manner that would change the potential for incidental takes of marine mammals since the overall quantity of pollock fishing and potential for interaction with marine mammals is not changed by the allocations, transfers, and cooperative provisions.

7.2.5.3 Incidental Take Effects under Alternative 3 and Alternative 4: Triggered Closures

Component 1 of Alternatives 3 and 4, proposes a large-scale fixed or triggered closure as a back-stop mechanism to encourage participation in the RHS program for bycatch reduction. Given that there is 100% participation by the fleet in the current RHS program it is reasonable to assume that under this alternative the incentive to remain in the program would be strong enough to continue to maintain 100% participation. Thus the impacts of this alternative on incidental catch of marine mammals would be similar to status quo, and is considered insignificant.

Additional components of Alternative 4 propose additional triggered area closure for RHS participants. 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 7-7). Fishing under any of the alternatives and options would require vessels to comply with Steller sea lion protection measures and the Pribilof Island Area Habitat Conservation Zone, reducing the potential for interaction with Steller sea lions and northern fur seals in these areas. A large portion of the closures are located in the southern part of the Bering Sea where Steller sea lions are more likely to be encountered. These closures for salmon also may reduce the potential for incidental takes of

Steller sea lions in the closure locations. However, any changes are not likely to be substantial, and impacts are likely to be incremental and insignificant.

7.2.6 Prey Availability Effects

The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009), identified the marine mammals in the Bering Sea that may be impacted bythe pollock fishery, and their major prey items. That summary is incorporated here by reference.

The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009) 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 2009). The exceptions to this are northern fur seals and Steller sea lions which potentially compete for principal prey with the groundfish fisheries (NMFS 2001, 2007b).

7.2.6.1 Prey Availability Effects under Alternative 1: Status Quo

7.2.6.1.1 Northern fur seals

The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009) summarized the potential impacts of Bering Sea pollock fishing on Northern fur seals, and concluded that the fishery was not likely to cause significant adverse impacts to the population of Northern fur seals in the Bering Sea. No changes are expected under Status Quo alternative and no changes in prey availability are expected under Status Quo.

7.2.6.1.2 Steller sea lions

The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009) summarized the potential impacts of Bering Sea pollock fishing on Steller sea lions, and concluded that the fishery was not likely to cause significant adverse impacts to the population of Steller sea lions in the Bering Sea. No changes are expected under Status Quo alternative and no changes in prey availability are expected under Status Quo.

7.2.6.1.3 Other direct impacts on marine mammal prey

The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009) summarized other potential direct impacts of the Bering Sea pollock fishery on marine mammal prey, and that summary is included here by reference. Under the status quo alternative, no substantial changes are expected in the direct take or potential competition for resources of other marine mammals species species. Therefore, any impacts from Alternative 1 are considered insignificant.

7.2.6.2 Prey Availability Effects under Alternative 2: Hard Caps

A hard cap on the amount of salmon taken in the pollock fishery could benefit Steller sea lions, resident killer whales, spotted seals, ribbon seals, and northern fur seals if the cap prevents harvest of salmon and pollock that these species prey upon. If the hard cap results in additional fishing effort in less productive pollock areas with less salmon bycatch, the shifting of the fleet may allow for additional pollock being available as prey in those areas where salmon is concentrated, if these areas are also used by Steller sea lions, spotted seals, ribbon seals, and northern fur seals for foraging. The higher hard cap would be less constraining on the fishery and would likely result in effects on prey availability similar to the status quo. Lower hard caps would be more constraining on the fishery, making more salmon available for prey for Steller sea lions, northern fur seals, spotted seals, and resident killer whales, and may allow for more pollock prey if the fishery is closed before reaching its pollock TAC.

The more restrictive caps may result in smaller pollock being taken by the pollock fishery, as described in Chapter 4. It is not clear how much smaller the pollock might be. Since 2003, the pollock fishery has tended to harvest pollock that are less than 60 cm and greater than 30 cm in the Bering Sea (NPFMC 2007). Steller sea lions and northern fur seals tend to prey on whatever size of pollock is most abundant at the time of foraging (Fritz et al. 1995). In years with one or more large recently spawned year classes, Steller sea lions and fur seals consume primarily juvenile pollock (Pitcher 1981, Calkins 1998, Zeppelin et al. 2004, and Sinclair et al. 1994). As large year classes of pollock age and grow, they will continue to be targeted by sea lions and fur seals particularly if the size of subsequent year classes is small. As a consequence, overlap between fisheries (that generally take large pollock) and pinnipeds in the size of pollock consumed will change depending on the age structure of pollock. Juvenile Steller sea lions are more likely to successfully forage on smaller rather than larger pollock. Taking smaller pollock may increase the potential for the fishery to compete with juvenile Steller sea lions for pollock, and may increase the estimated overlap between the fishery and juvenile Steller sea lions for pollock prey size. Whether competition would occur depends on the abundance of the size of prey targeted by the sea lions. Steller sea lions tend to prey more on juvenile pollock in the summer on haulouts than in the winter or in the summer on rookeries (Zeppelin et al. 2004). For the year of data analyzed, the overlap between the size of pollock taken in the fishery and those used as prey by Steller sea lions in the winter and summer is 56% and 61%, respectively (Zeppelin et al. 2004). Harvesting smaller pollock in the early B season may have more of a potential for competition for juvenile Steller sea lions using haulouts in the summer compared to animals at rookeries and in the winter.

All pollock recovered from scat samples from spotted and ribbon seals in 2006 and 2007 were well below 20 cm in length (range 5-22.7 cm) (Ziel et al. 2008). It is not clear if this size of pollock was eaten because it was the size that could easily be captured or it was the most abundant size. It is not likely the shifting of the pollock fishery to smaller fish would result in fish less than 20 cm in length being taken and therefore, competition with ribbon and spotted seals is not likely if they are targeting these smaller fish, regardless of abundance.

The options for sector allocations, sector transfers, and cooperative provisions affect the management and distribution of the cap across the sectors and are not likely to have any overall effect on pollock fishing that would change the potential competition for prey species between the pollock fishery and marine mammals. Options that allocate more chum salmon bycatch to the CV sector compared to the offshore sector would result in more harvest of pollock in the southern part of the Bering Sea where more Steller sea lions are located compared to the northern Bering Sea where northern fur seals and spotted seals may be foraging. This may result in more potential for competition for salmon and pollock prey for Steller sea lions than for northern fur seals or spotted seals. The Steller sea lion protection measures were designed to mitigate competition between the fisheries and Steller sea lions. This may reduce any potential for increased competition for prey if allocating higher portions of the salmon caps to the CV sector would result in more fishing in the southern Bering Sea.

Any impacts from establishment of hard caps are likely to be incremental and no substantial change in competition for key marine mammal prey species is likely. Therefore, any impacts from Alternative 2 are expected to be insignificant.

7.2.6.3 Prey Availability Effects under Alternative 3 and Alternative 4: Triggered Closures

Component 1 of alternatives 3 and 4 , proposes a large-scale fixed or triggered closure as a back-stop mechanism to encourage participation in the RHS program for bycatch reduction. Given that there is 100% participation by the fleet in the current RHS program it is reasonable to assume that under this alternative the incentive to remain in the program would be strong enough to continue to maintain 100% participation. Thus the impacts of this alternative on competition for key marine mammal prey species would be not substantially different to status quo and are expected to be insignificant.

Additional components of Alternative 4 propose additional triggered area closure for RHS participants. A pollock fishery closure of an area where Steller sea lions, humpback whales, spotted seals, or northern fur seals are likely to compete with pollock fishing vessels would likely reduce the potential for competition for prey resources (pollock and salmon). Occurrences of fin and minke whales are more widespread in the Bering Sea and therefore, they are less likely to be affected by the triggered closures. The potential reduction in competition would depend on the foraging locations and prey species for Steller sea lions, humpback whales, spotted seals, and northern fur seals and on the timing of the foraging activity and fishing.

Based on stomach samples collected in the 1980s, Steller sea lions may not depend on salmon as prey in the areas of the Pribilof Islands and northern Bering Sea (NMFS 2008). No salmon was detected in stomach samples from these areas. Steller sea lions appear to use salmon resources in the southern portion of the Bering Sea based on scat sampling near Akutan and Bogoslof Island (Figure 3 in Trites et al. 2007). Salmon area closures in the northern portion of the Bering Sea are not likely to have any effect on salmon prey resources for Steller sea lions and spotted seals, because there is no evidence of the sea lions or spotted seals eating salmon in the northern portion of the Bering Sea.

For fur seals, spotted seals, and Steller sea lions, closing the salmon areas in the northern portion of the Bering Sea may only provide a localized benefit for reducing competition for pollock in the closure area. The overall availability of pollock as prey is not likely to change given the existing closure areas and the pollock fleet's likely ability to still harvest its TAC.

Any impacts from the establishment of triggered closures on competition for key marine mammal prey species are not expected to be substantially different from status quo. Therefore, any impacts from Alternatives 3 or 4 are expected to be insignificant.

7.2.7 Disturbance Effects

7.2.7.1 Disturbance Effects under Alternative 1: Status Quo

The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009), summarized the likely disturbance effects of the BSAI pollock fishery and concluded that the pollock fishery is not likely to result in significantly adverse impacts to marine mammals. That summary is incorporated here by reference. No changes are expected under the Status Quo alternative, and no substantial change in the disturbance of marine mammals is likely. Therefore, impacts of the Status Quo alternative are expected to be insignificant.

7.2.7.2 Disturbance Effects under 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 hard caps reduce pollock fishing, then the potential for disturbance of marine mammals is reduced. If hard caps increase the duration of the fishing season as vessels move to areas of lower pollock concentration to avoid areas of high salmon bycatch, the potential for disturbance of marine mammals increases if those mammals are present in the areas to which the fleet moves. The higher hard caps are less likely to constrain the BS pollock fishery, and impacts of the higher caps are likely to be similar to status quo. The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009), concluded that the BSAI pollock fishery are unlikely to cause significantly adverse disturbance impacts to marine mammals. Because there is not likely to be any substantial change in the disturbance of marine mammals as a result of Alternative 2, impacts of Alternative 2 are expected to be insignificant.

7.2.7.3 Disturbance Effects under Alternatives 3 and 4: Triggered Closures

Component 1 of Alternatives 3 and 4 proposes a large-scale fixed or triggered closure as a back-stop mechanism to encourage participation in the RHS program for bycatch reduction. Given that there is 100% participation by the fleet in the current RHS program it is reasonable to assume that under this alternative the incentive to remain in the program would be strong enough to continue to maintain 100% participation. Thus the impacts of this alternative on incidental catch of marine mammals would be similar to status quo.

Additional components of Alternative 4 propose additional triggered area closure for RHS participants. As has been discussed above, disturbance effects are most likely for Steller sea lions, northern fur seals, spotted seals, and humpback whales. Other mammal species considered in this analysis are unlikely to be disturbed by the BS pollock fishery, and any impacts from Alternatives 3 or 4 on them is considered insignificant. Humpback whales are highly mobile, and likely to transit through any proposed closure areas. Therefore, any impact to them would be incremental and not substantially different from Status Quo, and is considered insignificant.

For Steller sea lions, northern fur seals, spotted seals, and humpback whales, the potential for impact from Alternatives 3 and 4 is limited to the extent that closures occur in the area where those species are present, and at the time that those species are present. Closures would occur south of the Pribilof Islands, and north of the Alaska Peninsula. Closures of these waters to pollock fishing could reduce the potential for disturbance to Steller sea lions, northern fur seals, and spotted seals in the area, at the time of the closure. However impacts from these closures would be incremental and not substantially different from Status Quo, and are considered insignificant.

7.3 Seabirds

7.3.1 Seabird Resources in the Bering Sea

Thirty-eight species of seabirds breed in Alaska. Breeding populations are estimated to contain 36 million individual birds in Alaska, 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.

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.

More information on seabirds in Alaska's EEZ may be found in several NMFS, Council, and USFWS documents:

- The URL for the USFWS Migratory Bird Management program is at: http://alaska.fws.gov/mbsp/mbm/index.htm
- Section 3.7 of the PSEIS (NMFS 2004a) provides background on seabirds in the action area and their interactions with the fisheries. This may be accessed at http://www.fakr.noaa.gov/sustainablefisheries/seis/final062004/Chaps/chpt_3/chpt_3_7.pdf
- The annual Ecosystems Considerations chapter of the SAFE reports has a chapter on seabirds. Back issues of the Ecosystem SAFE reports may be accessed at http://www.afsc.noaa.gov/REFM/REEM/Assess/Default.htm.
- The Seabird Fishery Interaction Research webpage of the Alaska Fisheries Science Center http://www.afsc.noaa.gov/refm/reem/Seabirds/Default.htm
- The NMFS Alaska Region's Seabird Incidental Take Reduction webpage: http://www.fakr.noaa.gov/protectedresources/seabirds.html
- The BSAI and GOA Groundfish FMPs each contain an "Appendix I" dealing with marine mammal and seabird populations that interact with the fisheries. The FMPs may be accessed from the Council's home page at http://www.fakr.noaa.gov/npfmc/default.htm
- Washington Sea Grant has several publications on seabird takes, and technologies and practices for reducing them: http://www.wsg.washington.edu/publications/online/index.html
- The seabird component of the environment affected by the groundfish FMPs is described in detail in Section 3.7 of the PSEIS (NMFS 2004a).
- Seabirds and fishery impacts are also described in Chapter 9 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007a).

Table 7-9. Seabird species in the BSAI (NMFS 2004).

Type	Common name	Status	Type	Common name	Status
Albatrosses	Black-footed				
	Short-tailed	Endangered	Guillemots	Black	
	Laysan			Pigeon	
Fulmars	Northern fulmar				
Shearwaters	Short-tailed		Eiders	Common	
	Sooty			King	
Storm petrels	Leach's			Spectacled	Threatened
	Fork-tailed			Steller's	Threatened
Cormorants	Pelagic		Murrelets	Marbled	
	Red-faced			Kittlitz's	Candidate
	Double-crested			Ancient	
Gulls	Glaucous-winged		Kittiwakes	Black-legged	
	Glaucous			Red-legged	
	Herring		Auklets	Cassin's	
	Mew			Parakeet	
	Bonaparte's			Least	
	Sabine			Whiskered	
	Ivory			Crested	
Murres	Common			Rhinoceros	
	Thick-billed		Terns	Arctic	
Jaegers	Long-tailed			Aleutian	
	Parasitic		Puffins	Horned	
	Pomarine			Tufted	

7.3.2 ESA-Listed Seabirds in the Bering Sea

Several species of conservation concern occur in the EBS. Short-tailed albatross is listed as endangered under the ESA, and Steller's eider and spectacled eider are listed as threatened. Kittlitz's Murrelet is a candidate species for listing under the ESA. The red-legged kittiwake is a species of conservation concern due to recent population declines. The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009), analyzed the potential impacts of the Bering Sea pollock fishery on seabirds and concluded that Short-tailed albatross are the only seabird that could potentially interact with the pollock fishery. Although other seabirds are present, they are not likely to interact with the pollock fishery. Because of the low likelihood of potential impacts for other species, this analysis will only consider potential impacts to Short-tailed albatross.

7.3.2.1 Short-tailed albatross

Short-tailed albatross (*Phoebastria albatrus*) is currently listed as endangered under the ESA. Short-tailed albatross 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. In recent years, the population has recovered at a 7% to 8% annual rate. The world population of short-tailed albatross in 2009 was estimated at 3,000 birds. The majority of nesting occurs on Torishima Island in Japan, where an active volcano threatens the colony. No critical habitat has been designated for the short-tailed albatross in the United States, because the population growth rate does not appear to be limited by marine habitat loss (NMFS 2004b). Short-tailed albatross feeding grounds are continental shelf breaks and areas of upwelling and high productivity. Short-tailed albatross are surface feeders, foraging on squid and forage fish.

7.3.3 Status of ESA Consultations on Groundfish and Halibut Fisheries

USFWS has primary responsibility for managing seabirds and has evaluated effects of the BSAI and GOA FMPs and the harvest specifications process on currently listed species in two Biological Opinions (USFWS 2003a and 2003b). Both Biological Opinions concluded that the groundfish fisheries off Alaska, including the EBS pollock fishery, are unlikely to jeopardize populations of listed species or adversely modify or destroy critical habitat for listed species. 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)) and in the Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009).

In 1997, NMFS initiated a Section 7 consultation with USFWS on the effects of the Pacific halibut fishery off Alaska on the short-tailed albatross. USFWS issued a Biological Opinion in 1998 that concluded that the Pacific halibut fishery off Alaska was not likely to jeopardize the continued existence of the short-tailed albatross. USFWS issued an Incidental Take Statement of two short-tailed albatross in a 2-year period (e.g., 1998/1999, 2000/2001, 2002/2003), reflecting what the agency anticipated the incidental take could be from the fishery action. Under the authority of ESA, USFWS identified non-discretionary reasonable and prudent measures that NMFS must implement to minimize the impacts of any incidental take.

Two updated USFWS biological opinions were published in 2003:

- Section 7 Consultation - Biological Opinion on the Effects of the Total Allowable Catch-Setting Process for the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries to the Endangered Short-tailed Albatross (*Phoebastria albatrus*) and Threatened Steller's Eider (*Polysticta stelleri*) (USFWS 2003b).
- Section 7 Consultation - Programmatic Biological Opinion on the Effects of the Fishery Management Plans for the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries on the Endangered Short-tailed Albatross (*Phoebastria albatrus*) and Threatened Steller's Eider (*Polysticta stelleri*) (USFWS 2003a).

Although USFWS has determined that the short-tailed albatross is adversely affected by hook-and-line Pacific halibut and groundfish fisheries off Alaska, both USFWS opinions concurred with NMFS and concluded that the Gulf of Alaska (GOA) and Bering Sea and Aleutian Islands Management Area (BSAI) fishery actions are not likely to jeopardize the continued existence of the short-tailed albatross. The Biological Opinion on the TAC-setting process updated incidental take limits to—

- four short-tailed albatross taken every 2 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 biological opinion is in effect (approximately 5 years).

The 2003 Biological Opinion on the TAC-setting process also included mandatory terms and conditions that NMFS must follow in order to be in compliance with the ESA. These include implementation of seabird deterrent measures, outreach and training of fishing crews on proper deterrence techniques, training observers in seabird identification, and 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.

USFWS also released a short-tailed albatross recovery plan in September 2008 (USFWS 2008). This recovery plan describes 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. Translocation of chicks to new colonies has begun. USFWS estimates that short-tailed albatross may be delisted in the year 2030, if new colony establishment is successful.

7.3.4 Short-tailed albatross distribution and interactions with Alaska fisheries

7.3.4.1 *Satellite Tracking of Short-tailed Albatross*

USFWS and Oregon State University placed 52 satellite tags on Laysan, black-footed, and short-tailed albatrosses in the central Aleutian Islands to study movement patterns of the birds in relation to commercial fishing activity and other environmental variables. From 2002 to 2006, 21 individual short-tailed albatrosses (representing about 1% of the entire population) were tagged, including adults, sub-adults, and hatch-year birds. During the non-breeding season, short-tailed albatross ranged along the Pacific Rim from southern Japan through Alaska and Russia to northern California, primarily along continental shelf margins (Suryan et al. 2006).

Sufficient data existed for 11 of the 14 birds to analyze movements within Alaska. Within Alaska, albatrosses spent varying amounts of time among NMFS reporting areas, with six of the areas (521, 524, 541, 542, 543, 610) being the most frequently used (Suryan et al. 2006). Non-breeding 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. The Aleutian Islands, in particular, were a primary foraging destination for short-tailed albatrosses.

7.3.4.2 *Short-tailed Albatross Takes in Alaska Fisheries*

Table 6-2 lists the short-tailed albatrosses reported taken in Alaska fisheries since 1983. With the exception of one take in the Western GOA, all takes occurred along the shelf break in the Bering Sea. The Western GOA take was in the hook-and-line halibut fishery. No takes were reported from 1999 through 2009. No takes with trawl gear have been reported. While the incidental take statement take limits for short-tailed albatross have never been met or exceeded, three short-tailed albatrosses were taken in the BSAI hook-and-line Pacific cod fishery in 2010 (Table 6-2 and Figure 6-3). NMFS is working closely with industry and the observer program to understand the specific circumstances of these incidents.

Table 7-10. Reported takes of short-tailed albatross in Alaska fisheries.

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 (5 yrs)
21 Sept 98	BS	Pacific cod hook-and-line	adult (8 yrs)
28 Sept 98	BS	Pacific cod hook-and-line	sub-adult
27 Aug 2010	BS	Pacific cod hook-and-line	Sub-adult (7 yrs 10 mos)
14 Sept 2010	BS	Pacific cod hook-and-line	Sub-adult (3 yrs 10 mos)
25 Oct 2010	BS	Pacific cod hook-and-line	Sub-adult (less than 2 years)

Source: AFSC.

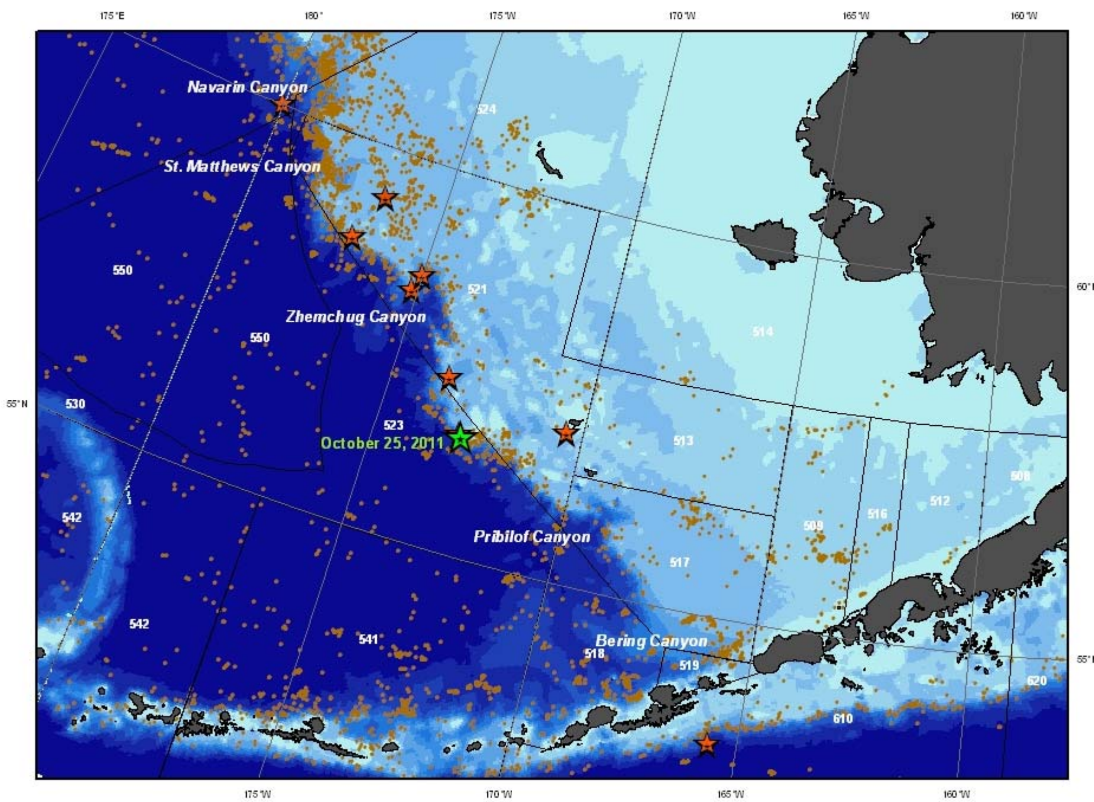


Figure 7-3. Locations (brown dots) of all Short-tailed albatross locations during September to November 2001-2010, and locations of all STAL takes in Alaska fisheries (red stars) from 1983 to 2010, and location of the most recent STAL take (green star). Credits: Yamashita Institute for Ornithology, Oregon State University, U.S. Fish and Wildlife Service, and Ministry of Environment, Japan. Reprinted from http://alaskafisheries.noaa.gov/index/infobulletins/bulletin.asp?BulletinID=7771.

7.3.5 Effects on Seabirds

7.3.5.1 Significance Criteria for Seabirds

Criteria for analyzing the potential impacts of these alternatives are identified below. These criteria are adopted form the 2006-2007 groundfish harvest specifications environmental assessment/final regulatory flexibility analysis (EA/FRFA). The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009), analyzed the Bering Sea and Aleutian Islands pollock fishery as it is currently prosecuted, and concluded that the fishery is not likely to result in significantly adverse impacts to seabirds. Alternative 1 is Status Quo, and under that alternative no changes are expected, and no significantly adverse impacts are expected for any seabirds. As with marine mammals, potential impacts from other alternatives are assessed as a change from status quo.

Table 7-11. Criteria used to determine significance of impacts to seabirds.

	Incidental take	Prey availability	Benthic habitat
Insignificant	No substantive change in bycatch of seabirds during the operation of fishing gear.	No substantive change in forage available to seabird populations.	No substantive change in gear impact on benthic habitat used by seabirds for foraging.
Adverse impact	Non-zero take of seabirds by fishing gear.	Reduction in forage fish populations, or the availability of forage fish, to seabird populations.	Gear contact with benthic habitat used by benthic feeding seabirds reduces amount or availability of prey.
Beneficial impact	No beneficial impact can be identified.	Availability of offal from fishing operations or plants may provide additional, readily accessible, sources of food.	No beneficial impact can be identified.
Significantly adverse impact	Trawl take levels increase substantially from the baseline level, or level of take is likely to have population level impact on species.	Food availability decreased substantially from baseline such that seabird population level survival or reproduction success is likely to decrease.	Impact to benthic habitat decreases seabird prey base substantially from baseline such that seabird population level, survival, or reproductive success is likely to decrease. (ESA-listed eider impacts may be evaluated at the population level).
Significantly beneficial impact	No threshold can be identified.	Food availability increased substantially from baseline such that seabird population level survival or reproduction success is likely to increase.	No threshold can be identified.
Unknown impacts	Insufficient information available on take rates or population levels.	Insufficient information available on abundance of key prey species or the scope of fishery impacts on prey.	Insufficient information available on the scope or mechanism of benthic habitat impacts on food web.

7.3.6 Seabird Interactions with Alaska Groundfish Trawl Fisheries

The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009) summarized seabird interactions with the BSAI pollock trawl fishery and is included here by reference.

7.3.6.1 Incidental Take Effects under Alternative 1 Status Quo

The effects of the status quo BSAI pollock trawl fisheries on incidental takes of seabirds are detailed in the Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009). That analysis concluded that Short-tailed albatross are the only seabird species potentially affected by the BSAI pollock fishery, but determined that the fishery as now prosecuted is unlikely to result in significantly adverse impacts to the species. Recent modeling suggests that even if there were to be large increases in the number of short-tailed albatross taken in the BSAI pollock trawl fishery, the impacts on the short-tailed albatross population would have negligible effects on the recovery of the species. Therefore, because no change is expected under the Status Quo Alternative, any potential impacts are insignificant.

7.3.6.2 Incidental Take Effects under Alternative 2 Hard Cap

The range of hard caps under Alternative 2 offer a range of potential for incidental takes of seabirds. If hard caps constrain the pollock fishery, then the potential for takes of seabirds is reduced. If hard caps do not constrain the fishery, then impacts from Alternative 2 would be similar to the status quo alternative. Under either scenario, any change from status quo is likely to be insubstantial and the impacts would be insignificant .

7.3.6.3 Incidental Take Effects under Alternatives 3 and 4 Triggered Closures

Alternative 3, Component 1 of Alternatives 3 and 4 proposes a large-scale fixed or triggered closure as a back-stop mechanism to encourage participation in the RHS program for bycatch reduction. Given that there is 100% participation by the fleet in the current RHS program it is reasonable to assume that under this alternative the incentive to remain in the program would be strong enough to continue to maintain 100% participation. Thus the impacts of this alternative on incidental catch of seabird species would be similar to status quo.

Alternative 3, components 2 through 6Additional components of Alternative 4 propose additional triggered closures on RHS participants. The potential effects of the trigger closures depend on the presence of seabirds in the closure areas and the timing of the closures. If Alternatives 3 or 4 result in the closure of areas where interactions between pollock trawl vessels and seabirds are more likely to occur, it would reduce the potential for incidental takes of seabirds. As with Alternative 2, the likely change in seabird interaction would be insubstantial, and the impacts are likely to be insignificant.

7.4 Essential Fish Habitat

This section addresses the mandatory requirements for an essential fish habitat (EFH) assessment enumerated in the final rule (67 FR 2343, January 17, 2002) implementing the EFH provisions of the Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). Importantly, an EFH assessment is required for any federal action that may adversely affect EFH. The mandatory requirements for an EFH assessment are:

- a description of the action;
- an analysis of the potential adverse effects of the action on EFH and the managed species;

- the Federal agency's conclusions regarding the effects of the action on EFH; and
- proposed mitigation, if applicable.

An EFH assessment may incorporate by reference other relevant environmental assessment documents, such as a Biological Assessment, a NEPA document, or another EFH assessment prepared for a similar action.

The Magnuson-Stevens Act defines EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." For the purpose of interpreting the definition of EFH, the EFH regulations at 50 CFR 600.10 specify that "waters" include aquatic areas that are used by fish and their associated physical, chemical, and biological properties, and may include areas historically used by fish where appropriate; "substrate" includes sediments, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' entire life cycle.

The criterion for analyzing effects on habitat is derived from the requirement at 50 CFR 600.815(a)(2)(ii) that NMFS must determine whether fishing adversely affects EFH in a manner that is "more than minimal and not temporary in nature." This standard determines whether actions are required to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable.

The final rule for EFH (67 FR 2343; January 17, 2002) does not define minimal and temporary, although the preamble to the rule states, "Temporary impacts are those that are limited in duration and that allow the particular environment to recover without measurable impact. Minimal impacts are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions" (67 FR 2354).

In 2005, NMFS and the Council completed the EIS for EFH Identification and Conservation in Alaska (EFH EIS; NMFS 2005). The EFH EIS provided a thorough analysis of alternatives and environmental consequences for amending the Council's FMPs to include EFH information pursuant to Section 303(a)(7) of the Magnuson-Stevens Act and 50 CFR 600.815(a). Specifically, the EFH EIS examined three actions: (1) describing and identifying EFH for Council managed fisheries, (2) adopting an approach to identify HAPC within EFH, and (3) minimizing to the extent practicable the adverse effects of Council-managed fishing on EFH. The EFH EIS evaluates the long term effects of fishing on benthic habitat features, as well as the likely consequences of those habitat changes for each managed stock based on the best available scientific information.

In this analysis, the effects of fishing on EFH are analyzed for alternative salmon bycatch reduction measures, using the best available scientific information. Analysis included the review of the EFH Descriptions (EFH EIS Appendix D.3), the effects of fishing analysis (EFH EIS Appendix B.2), and associated Habitat Assessment Reports (EFH EIS Appendix F) to conclude whether or not an adverse effect on EFH will occur. A complete evaluation of effects would require detailed information on the distribution and abundance of habitat types, the life history of living habitat, habitat recovery rates, and natural disturbance regimes. Although more habitat data become available from various research projects each fishing year, much is still unknown about EFH in the EEZ off Alaska.

7.4.1 Description of the Action

The actions considered in this EFH assessment are the alternatives described in detail in Chapter 2. The important components of these alternatives for the EFH assessment are the gear used, the fishing effort, and the location of the fishery. This information for the pollock fishery is presented in the EFH EIS, and is incorporated here by reference. Appendix B of the EFH EIS contains an evaluation of the potential adverse effects of fishing activities on EFH, including the effects of pelagic trawl gear. Summaries and assessments of habitat information for all federally managed species in the BSAI are provided in Appendix F of the EFH EIS. The EFH EIS describes an overall fishery impact for each fishery based on the relative impacts of the gear used (which is related to physical and ecological effects), the type of habitat fished (which is related to recovery time), and the proportion of that bottom type utilized by the fishery. Under the alternative salmon bycatch reduction measures, pollock fishing effort may change and the location of the fisheries may change to avoid salmon bycatch or because specified areas may be closed to pollock fishing. However, the fishing seasons and the gear used in the fisheries are not likely to change under the alternatives. Changes to the prosecution of the pollock fishery are described in Chapter 4.

7.4.2 Impacts on EFH

Fishing operations change the abundance or availability of certain habitat features (e.g., prey availability or the presence of living or non-living habitat structure) used by managed fish species to spawn, breed, feed, and grow to maturity. These changes can reduce or alter the abundance, distribution, or productivity of that species, which in turn can affect the species' ability to support a sustainable fishery and the managed species' contribution to a healthy ecosystem (50 CFR 600.10). The outcome of this chain of effects depends on characteristics of the fishing activities, the habitat, fish use of the habitat, and fish population dynamics. The duration and degree of fishing's effects on habitat features depend on the intensity of fishing, the distribution of fishing with different gears across habitats, and the sensitivity and recovery rates of habitat features.

The Bering Sea pollock fishery harvests pollock with pelagic trawl gear in pelagic habitat. Pelagic habitat is identified as EFH for marine juvenile and maturing salmon. Amendments 7 and 8 defined salmon EFH in the FMP for the Salmon Fisheries in the EEZ off the Coast of Alaska. The EFH EIS, in Section 3.2.1.5 and Appendix F, provides habitat descriptions for the five salmon species managed under the FMP. Briefly, marine salmon stocks school in pelagic waters and utilize ocean conditions to grow and mature before returning to nearshore and freshwater adult spawning areas. Salmon are known to associate with ocean ledges and features, such as ridges and seamounts. Salmon utilize these features because the features attract and concentrate prey.

Appendix B to the EFH EIS describes how pelagic trawl gear impacts pelagic habitat (NMFS 2005). The EFH EIS concluded that pelagic effects from fisheries are minimal because no information was found indicating significant effects of fishing on features of pelagic waters serving a habitat function for managed species. The Bering Sea pollock fishery only interacts with salmon habitat in the ocean, and the concerns about these interactions center on effects on bycatch of prey and prey availability. Salmon prey (copepods, squid, herring, and other forage fish) are subject to only a few targeted fisheries outside of the EEZ, such as the State of Alaska herring fisheries and international squid fishery. However, the pollock fishery does catch salmon prey species, including squid, capelin, eulachon, and herring. Currently, the catch of these prey species is very small relative to overall population size of these species, thus fishing activities are considered to have minimal and temporary effects on prey availability for salmon. Chapter 7 provides more information on the impacts of the Bering Sea pollock fishery on these prey species.

Appendix B to the EFH EIS also describes how pelagic trawl gear impacts benthic species and habitat (NMFS 2005). The EFH EIS notes that “pelagic trawls may be fished in contact with the seafloor, and there are times and places where there may be strong incentives to do so, for example, the EBS shelf during the summer” (NMFS 2005). Trawl performance standards for the directed pollock fishery at 50 CFR 679.7(a)(14) reduce the likelihood of pelagic trawl gear use on the bottom. However, concern exists about the contact of pelagic trawl gear on the bottom and the current standards used to limit bottom contact (from June 2006 minutes of the SSC and AP, available at: http://www.fakr.noaa.gov/npfmc/minutes/minutes.htm). Flatfish and crab bycatch in the pollock fishery also shows that pelagic gear contacts the bottom. The description of impacts by pelagic trawl gear on habitat in this document is based on the best available science, but may be considered controversial with some believing the impact may be more than described.

The results of the EFH EIS analysis of the effects of fishing on benthic habitat features determined the long-term effect index (LEI) to represent the proportion of feature abundances (relative to an unfished state) that would be lost if recent fishing patterns were continued indefinitely. The LEI was 10.9% for the biological structure of sand/mud and slope habitats of the eastern Bering Sea where fishing effort is concentrated, and recovery rates are moderately low. The analysis also calculated the proportion of each LEI attributable to each fishery. The pollock pelagic trawl fishery was the largest single component (4.6%) of the total effects on living structure in the eastern Bering Sea sand/mud habitat. The combined effects of the bottom trawl fisheries made up all of the remaining 6.3%. Nearly all (7.2%) of the LEI for living structure on the eastern Bering Sea slope was due to the pollock pelagic fishery. Based on this analysis, the EFH EIS determined that the fishing effects are not limited in duration and therefore not temporary. However, the EFH EIS considered LEIs of less than 11% as small.

The EFH EIS also evaluated the effects on managed species to determine whether stock condition indicates that the fisheries affect EFH in a way that is more than minimal. To conduct this evaluation, the analysts first reviewed the LEI from the fishing effects model to assess overlap with the distribution of each stock. The analysts then focused on habitat impacts relative to the three life-history processes of spawning/breeding, feeding, and growth to maturity. Finally, the analysts assessed whether available information on the stock status and trends indicated any potential influence of habitat disturbance due to fishing. Based on the available information, the EFH EIS analysis found no indication that continued fishing at the current rate and intensity would affect the capacity of EFH to support life history processes of any species. In other words, the effects of fishing of EFH would not be more than minimal.

Due to the nature of this action, the Bering Sea pollock fishery as modified by the proposed action is not predicted to have additional impacts beyond those identified in the EFH EIS. Based on the analysis presented in the EFH EIS and summarized above, NMFS concludes that Alternative 1 would impact EFH for managed species, but that the available information does not identify effects of fishing that are more than minimal. In other words, effects may occur but they would not exceed the minimal and temporary limits established by 50 CFR 600.815(a)(2).

The Alternatives 2 caps would, to the extent that they prevent the pollock fleet from harvesting the pollock TAC and therefore reduce pollock fishing effort, reduce the pollock fisheries impacts on EFH from status quo. The RIR provides a discussion of the ability of the pollock fleet to harvest the TAC under Alternative 2.

Alternative 3, component 1, proposes a large-scale fixed or triggered closure as a back-stop mechanism to encourage participation in the revised RHS program for bycatch reduction. Given that there is 100% participation by the fleet in the current RHS program it is reasonable to assume that under this alternative the incentive to remain in the program would be strong enough to continue to maintain 100% participation. Analysis of Alternative 3 indicates that the impacts are likely to be best represented by status quo. Thus the overall impacts on EFH would be similar to Alternative 1.

Alternative 4, propose additional triggered closures on RHS participants. These trigger closures would close large areas either for June and July or for the remainder of the B-season when triggered. The area closures 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.

7.4.3 Mitigation

Currently, pelagic trawl gear is subject to a number of area closures to protect habitat and marine species: the Steller Sea lion closure areas, the Nearshore Bristol Bay closure, the Pribilof Islands Habitat Conservation Zone. If new information emerges to indicate that the Bering Sea pollock trawl fishery is having more than a minimal impact on EFH, the Council may consider additional habitat conservation measures.

7.4.4 Conclusions

All alternatives would have impacts on EFH similar to those found in the EFH EIS. NMFS concludes that all of the alternatives would affect EFH for managed species. However, best available information does not identify any effects of fishing as significantly adverse. In other words, effects may occur from fishing, however these effects do not exceed the minimal and temporary limits established by 50 CFR 600.815(a)(2). Alternative 2 to the extent that the cap level would close the pollock fishery before the TAC is harvested, could have less of an impact on EFH. Alternative 4 may have less of an impact because it would close, if triggered 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.

7.5 Ecosystem

Ecosystems consist of communities of organisms interacting with their physical environment. Within marine ecosystems, competition, predation, and environmental disturbance cause natural variation in recruitment, survivorship, and growth of fish stocks. Human activities, including commercial fishing, can also influence the structure and function of marine ecosystems. Fishing may change predator-prey relationships and community structure, introduce foreign species, affect trophic diversity, alter genetic diversity, alter habitat, and damage benthic habitats.

The EBS pollock fishery potentially impacts the EBS ecosystem by relieving predation pressure on shared prey species (i.e., species which are prey for both pollock and other species), reducing prey availability for predators of pollock, altering habitat, imposing bycatch mortality, or by ghost fishing caused by lost fishing gear. Ecosystem considerations for the EBS groundfish fisheries are summarized annually in the Ecosystem Considerations chapter of the EBS Stock Assessment and Fishery Evaluation report (Zador 2011). These considerations are summarized according to the ecosystem effects on the groundfish fisheries as well as the potential fishery effects on the ecosystem.

7.5.1 Effects of the Alternatives

An evaluation of the effects of the EBS pollock fisheries on the ecosystem is discussed annually in the Ecosystem Considerations section of the pollock chapter of the SAFE report (Ianelli et al 2010), and was evaluated in the Harvest Specifications EIS (NMFS 2007). This analysis concluded that the current EBS pollock fisheries do not produce population-level impacts to marine species or change ecosystem-level attributes beyond the range of natural variation. Consequently, Alternative 1 is not expected to have a significant impact on the ecosystem.

Alternatives 2, 3 and 4 will either maintain or reduce the overall level of pollock harvest from the status quo. The level of fishing effort by pollock vessels is not expected to change, except in years where the fishery is closed early due to the attainment of the chum salmon c under Alternative 2 cap. At an ecosystem level, the effects of reducing fishing to this extent are not expected to be significant. While the location and timing of fishing activities may show some localized changes due to the fleet’s efforts to find areas with low chum salmon bycatch rates outside of area closures, overall the fleet is not likely to have a significant impact on the ecosystem under any of the alternatives.

8 Cumulative Effects

This section analyzes the cumulative effects of the actions considered in this environmental assessment. A cumulative effects analysis includes the effects of past, present, and reasonably foreseeable future action (RFFA). The past and present actions are described most recently in the Bering Sea Chinook Bycatch Management Measures FEIS (2009) and are incorporated by reference. This analysis provides a brief review of the RFFA that may affect environmental quality and result in cumulative effects. Future effects include harvest of federally managed fish species and current habitat protection from federal fishery management measures, harvests from state managed fisheries and their associated protection measures, efforts to protect endangered species by other federal agencies, and other non-fishing activities and natural events.

The most recent analysis of RFFAs for the Bering Sea pollock fishery is in the Bering Sea Chinook Bycatch Management Measures FEIS (2009). Any additional RFFAs since that analysis are summarized below for this proposed action. The RFFAs are described in the Bering Sea Chinook Bycatch Management Measures FEIS (2009) , are applicable for this analysis, and are incorporated by reference. A summary table of these RFFAs is provided below (Table 8-1). The table summarizes the RFFAs identified applicable to 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). 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. Identification of actions likely to impact a resource component within this action's area and time frame will allow the public and Council to make a reasoned choice among alternatives.

The reasonably foreseeable future actions that may affect resource components and that also may be affected by the alternatives in this analysis are listed below and in Table 8-1. 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 analysis. 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 8-1 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.

Table 8-1. 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 chum salmon • Sport harvest of chum salmon • Increasing levels of economic activity in Alaska's waters and coastal zone

8.1.1 Ecosystem-sensitive management[40]

8.1.2 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

[40] The term "ecosystem-sensitive management" is used in this analysis 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.

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 provided in Chapter 5 and is available at the AFSC website at: http://www.afsc.noaa.gov/ABL/occ/ablocc_basis.htm.

In 2008, North Pacific Research Board (NPRB) and National Science Foundation (NSF) began a project for understanding ecosystem processes in the Bering Sea called the Bering Sea Integrated Ecosystem Research Program (BSIERP). Approximately 90 federal, state and university scientists will provide coverage of the entire Bering Sea ecosystem. Scientists conducted three years of field research on the eastern Bering Sea Shelf, from St. Lawrence Island to the Aleutians, and are currently conducting two more years for analysis and reporting. The study covers a range of issues, including atmospheric forcing, physical oceanography, and the economic and social impacts on humans and communities of a changing ecosystem. More information on this research project is available on the NPRB web site at: http://bsierp.nprb.org/index.htm.

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

8.1.3 Increasing protection of ESA-listed and other non-target species

Pollock fishing may impact a wide range of other resources, such as seabirds, marine mammals, and non-target species, such as salmon and halibut. Recent Council and NMFS actions suggest that the Council and NMFS may consider measures for protection for ESA-listed and other non-target species.

Changes in the status of species listed under the ESA, the addition of new listed species, designation of critical habitat, and results of future Section 7 consultations may require modifications to pollock fishing practices to reduce the impacts of this fishery on listed species and critical habitat.

We are not aware of any changes to the ESA-listed salmon status or designated critical habitat that may affect the future pollock fishery. The impacts of the pollock fishery on ESA-listed salmon are currently limited to the Upper Willamette and Lower Columbia River stocks. The tracking of coded-wire tagged surrogate salmon for ESA-listed stocks may result in additional ESA-listed salmon stocks being identified as potentially impacted by the pollock fisheries. The possible take of any additional ESA-listed salmon stocks would trigger ESA consultation and may result in additional management measures for the pollock fishery depending on the result of the consultation.

Washington State's Sea Grant program is currently working with catcher-processors in the Bering Sea pollock fishery to study the sources of seabird strikes in their operations and to look for ways fishermen can reduce the rate of strikes (Melvin et al. 2004). Other studies are investigating the potential for use of video monitoring of seabird interactions with trawl and longline gear (McElderry et al. 2004; Ames et al. 2005). This research is especially important because action area has very high seabird densities and potential aggregations of ESA-listed short tailed albatross (NMFS 2007b).

Information on listed marine mammals and potential for impacts from this action are contained in Chapter 7.

8.1.3.1 Increasing integration of ecosystems considerations into fisheries management

Ecosystem assessments evaluate the state of the environment, including monitoring climate–ocean indices and species that indicate ecosystem changes. Ecosystem-based fisheries management reflects the incorporation of ecosystem assessments into single species assessments when making management decisions, and explicitly accounts for ecosystem processes when formulating management actions. Ecosystem-based fisheries management may still encompass traditional management tools, such as TACs, but these tools will likely yield different quantitative results.

To integrate such factors into fisheries management, NMFS and the Council will need to develop policies that explicitly specify decision rules and actions to be taken in response to preliminary indications that a regime shift has occurred. These decision rules need to be included in long-range policies and plans. Management actions should consider the life history of the species of interest and can encompass varying response times, depending on the species' lifespan and rate of production. Stock assessment advice needs to explicitly indicate the likely consequences of alternate harvest strategies to stock viability under various recruitment assumptions.

Management strategy evaluations (MSEs) can help in this process. MSEs use simulation models of a fishery to test the success of different management strategies under different sets of fishery conditions, such as shifts in ecosystem regimes. The AFSC is actively involved in conducting MSEs for several groundfish fisheries, including for several flatfish species in the BS, and for pollock in the GOA.

Both the Pew Commission report and the Oceans Commission report point to the need for changes in the organization of fisheries and oceans management to institutionalize ecosystem considerations in policy making (Pew 2003; U.S. Commission on Ocean Policy 2004). The Oceans Commission, for example, points to the need to develop new management boundaries corresponding to large marine ecosystems, and to align decision-making with these boundaries (U.S. Commission on Ocean Policy 2004).

Since the publication of the Oceans Commission report, the President has established a cabinet-level Committee on Ocean Policy by executive order. The Committee is to explore ways to structure government to implement ecosystem-based ocean management (Evans and Wilson 2005). Congress reauthorized the Magnuson-Stevens Act in December 2006 to addresses ecosystem-based management.

NMFS and the Council are continuing to develop their ecosystem management measures for the fisheries in the EEZ off Alaska. NMFS is currently developing national Fishery Ecosystem Plan guidelines. It is unclear at this time whether these will be issued as guidelines, or as formal provisions for inclusion in the Magnuson-Stevens Act.

The Council has created a committee to research ecosystem developments and to assist in formulating positions with respect to ecosystem-based management. The Council completed a fishery ecosystem plan for the Aleutian Islands ecosystem (NPFMC 2007). An interagency Alaska Marine Ecosystem Forum (AMEF) is improving inter-agency communication on marine ecosystem issues. The Council has signed a Memorandum of Understanding with 10 Federal agencies and 4 State agencies, to create the AMEF. The AMEF seeks to improve communication between the agencies on issues of shared responsibilities related to the marine ecosystems off Alaska's coast. The initial focus of the AMEF will be on the Aleutian Islands marine ecosystem. The SSC holds annual ecosystem scientific meetings at the February Council meetings.

In addition to these efforts to explore how to develop its ecosystem management efforts, the Council and NMFS continue to initiate efforts to take account of ecosystem impacts of fishing activity. The Council has recommended habitat protection measures for the eastern Bering Sea (73 FR 12357, March 7, 2008). These measures include the Northern Bering Sea Research Area to address potential impacts of shifts in fishing activity to the north.

The Council's Ecosystem Committee discusses ecosystem initiatives and advise the Council on the following issues: (1) defining ecosystem-based management; (2) identifying the structure and Council role in potential regional ecosystem councils; (3) assessing the implications of NOAA strategic planning; (4) drafting guidelines for ecosystem-based approaches to management; (5) drafting Magnuson-Stevens Act requirements relative to ecosystem-based management; and (6) coordinating with NOAA and other initiatives regarding ecosystem-based management. More details are available in the Council's website at http://www.fakr.noaa.gov/npfmc/current_issues/ecosystem/Ecosystem.htm.

The Council established Federal fisheries management in the Arctic Management Area. The Council developed, and NMFS approved, an Arctic Fishery Management Plan that (1) closes the Arctic to commercial fishing until information improves so that fishing can be conducted sustainably and with due concern to other ecosystem components, (2) determines the fishery management authorities in the Arctic and provide the Council with a vehicle for addressing future management issues, and (3) implements an ecosystem based management policy that recognizes the unique issues in the Alaskan Arctic. No significant fisheries exist in the Arctic Management Area, either historically or currently. However, the warming of the Arctic and seasonal shrinkage of the sea ice may be associated with increased opportunities for fishing in this region. The action is necessary to prevent commercial fisheries from developing in the Arctic without the required management framework and scientific information on the fish stocks, their characteristics, and the implications of fishing for the stocks and related components of the ecosystem.

8.1.3.2 Fishery management responses to the effects of climate change

While climate warming trends are being studied and increasingly understood at a global scale (IPCC 2007), the ability for fishery managers to forecast biological responses to changing climate continues to be difficult. The Bering Sea is subject to periodic climatic and ecological "regime shifts." These shifts change the values of key parameters of ecosystem relationships, and can lead to changes in the relative success of different species.

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

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

8.1.4 Traditional management tools

8.1.4.1 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 analysis: 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.

In 2010 the BSAI groundfish FMP was amended to 'break out' other species into individual categories for management purposes thus separate specification are now established for squid, sharks, octopus and skates (NPFMC 2010).. The number of TAC categories with low values for ABC/OFL is increasing which tends to increase the likelihood that NMFS will close directed fisheries to prevent overfishing. Managers closely watch species with fairly close amounts between the OFL and ABCs during the fishing year and the fleet will adjust behavior to prevent incurring management actions. While managing the species with separate ABCs and OFLs reduces the potential for overfishing the individual species, the effect of creating more species categories can increase the potential for incurring management measures to prevent overfishing.

8.1.4.2 Development of the salmon excluder device

Gear modifications are one way to reduce salmon bycatch in the pollock fisheries. NMFS has issued exempted fishing permits for the purpose of testing a salmon excluder device in the pollock trawl fishery of the Bering Sea from 2004 to 2006 and for fall 2008 through spring 2011. 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. The excluder has been successful in reducing Chinook salmon bycatch and modifications are being tested to improve its effectiveness for reducing chum salmon bycatch.

8.1.5 Actions by Other Federal, State, and International Agencies

8.1.5.1 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. Stock assessment overviews by region for Chum stocks and a description of state management by area are contained in Chapter 5. The Alaska Board of Fisheries (BOF) adopts regulations through a public process to conserve fisheries resources and to allocate fisheries resources to the various users. Yukon River salmon fisheries management includes obligations under an international treaty with Canada. Subsistence fisheries management includes coordination with U.S. Federal government agencies where federal rules apply under ANILCA. Subsistence salmon fisheries are 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.

8.1.5.1.1 Area M chum harvests

The Area M fishery in the Alaska Peninsula is managed by the State of Alaska. Area M is further divided into two management areas, the North Alaska management area and the South Alaska management area. Stock status of this region and direct impacts of the action on the Area M stocks are contained in Chapter 5 of this analysis. Combined harvests in the fishery in 2010 totaled more than 1.7 million fish.

Overview of Area M chum harvests: Salmon fisheries in the South Alaska Peninsula Management Area (Area M) are prosecuted in 2 seasons, a June commercial fishery and a post-June fishery occurring after July 1. Legal fishing gear types in South Peninsula waters include purse seine, drift gillnet and set gillnet (Potter et al, 2011). All five species of salmon are commercially harvested in this management area. Information on stock assessment in Area M is contained in Chapter 5.

A separate management plan exists for the June fishery, the *South Unimak and Shumagin Islands June Fisheries Management Plan* (5 AAC 09.365). The BOF modified this plan in 2004 to establish set fishing schedules during the June fishery (Poetter et al, 2011). In 2010 the BOF discussed proposed modifications to the plan but made no changes. However, during that meeting a significant amount of time was spent on the topic of the chum salmon harvest in June. A number of amendments were put before the BOF that included closing down the June fishery, reinstating the historical chum salmon cap, and establishing a ratio-based management system (Poetter et al., 2011). Due to these concerns in 2010 and 2011 the purse seine fleet voluntarily stodd down during the initial fishing period (3 days).

Harvests in the June fishery through 2010 comprise a significant proportion of the annual chum harvest. Table 8-2 below shows the harvest of chum since 2003 (to be consistent with the time frame in this analysis, additional years of harvest data are available at Poetter et al., 2011). in this fishery in conjunction with the total harvest of chum annually (i.e. including the post July 1 fishery). The proportion of harvest from the June fishery of the annual total over this time frame has ranged from as low as 25% in 2006 to 64% in 2012. The numbers of chum harvested in the June fishery over this time frame has ranged from 271,700 in 2010 to a high of 696,775 in 2009. It seems reasonably foreseeable that this fishery will continue in the future.

Table 8-2. South Alaska Peninsula (Area M) chum harvests (in number of fish) from 2003-2011 in the June fishery compared with the annual total chum harvest for Area M and the proportion of the harvest from the June fishery. Harvest data taken from Poetter et al., 2011. And Murphy et al. 2012

Year	June harvest	Annual total harvest	Proportion of annual total from June harvest
2003	282,438	637,305	0.44
2004	482,309	790,108	0.61
2005	427,830	739,460	0.58
2006	299,827	1,175,843	0.25
2007	297,539	679,787	0.44
2008	410,932	814,123	0.50
2009	696,775	1,684,583	0.41
2010	271,700	792,369	0.34
2011	423,335	979,187	0.43
2012	392,305	610,004	0.64

Stock of origin of Area M chum harvests: Per Council request for additional information regarding the stock of origin of chum salmon caught in the combined Area M chum salmon fisheries, the following information was excerpted from a report presented by ADF&G to the BOF in February 2010 entitled “Summary of Studies Addressing Stock Composition in the South Unimak and Shumagin Islands Fishery” (ADF&G, 2010). The origin of chum salmon stocks harvested in the South Unimak and Shumagin Islands June fishery has been a source of concern among fishermen throughout Western Alaska for several decades. Many studies have been conducted to ascertain origins of harvested stocks and their relative proportions in fisheries during the past 88 years with the most recent study currently undergoing analysis (Western Alaska Salmon Stock Identification Project; WASSIP). The two most current completed analyses of stock composition in the June fishery are known as the "1987 Tagging Study" (Eggers et al. 1988; Eggers et al. 1991; ADF&G BOF Report 1992) and "Genetic analysis of chum salmon harvested in the South Unimak and Shumagin Islands June Fisheries, 1993-1996" (Seeb et al. 1997). Another genetic study called "Genetic analysis of chum salmon harvested in the South Peninsula Post June Fishery, 1996-1997" (Crane and Seeb 2000) was conducted along the South Peninsula during July and August of 1996 and 1997.

Regarding the first study, there were many caveats noted in the BOF report with respect to tagging methodology and analysis but in general, the most recent analysis of data from the 1987 tagging study (ADF&G BOF Report 1992) attempted to model the possible range of stock compositions in the fishery. All modeled cases showed an overwhelming representation (83%-90%) of Western Alaska summer chum complex (Kotzebue, Norton Sound, Yukon, Kuskokwim, Bristol Bay) and Asian stocks, with stocks from North Peninsula, South Peninsula, and Central Alaska present in much smaller proportions. Early tag releases tended to be from Norton Sound, Yukon and Kuskokwim stocks while later releases were mainly from Bristol Bay, North or South Alaska Peninsula, and Central Alaska stocks. This study provided insight into the broad composition of stocks in the June fishery, which was valuable in determining appropriate baseline representation for subsequent genetic analyses.

Regarding the second study, chum salmon were sampled for genetic (allozyme) analysis during the June fisheries in 1993 through 1996 at South Unimak and 1994 through 1996 in the Shumagin Islands. The purpose was to estimate stock proportions in samples (Seeb et al. 1997). Results of this study were broadly similar to those of the 1987 tagging study, in that NW Alaska summer and Asian chum stocks represented the majority of stock groups present. Northwest Alaska summer chum was the largest component of the South Unimak and Shumagin Islands June fishery in every year sampled and was a larger component of the South Unimak fishery than the Shumagin Islands fishery in two of the three years.

Finally with respect to studies of stock composition from this fishery, during July and early August of 1996 and 1997, chum salmon were sampled for genetic stock identification on the South Alaska Peninsula (Crane and Seeb 2000). Fish were sampled from the department test fishery as well as from commercial harvests. The commercial fishery was divided into two geographical areas (the Shumagin Islands area consisting of the Shumagin Island Section of the Southeastern District and the Mainland Area consisting of the Southeastern District Mainland and the Unimak, Southwestern, and South Central districts) and into three time periods. Stock group proportions were estimated using allozymes and chum salmon were assigned to the same ten reporting groups as identified in the June genetics study. Over the time period analyzed in this study, little change in stock composition was observed. The majority of stocks came from the Alaska Peninsula/Kodiak group. In contrast to the pattern of stock contributions in the June fishery, proportions of NW Alaska summer and Fall Yukon in the post-June fishery were very low.

The Western Alaska Salmon Stock Identification Project (WASSIP) was initiated in 2006 and has comprehensively sampled commercial and subsistence fisheries for chum and sockeye salmon throughout Western Alaska, from Chignik to Kotzebue over a four year period. Mixed stock analyses to estimate relative stock contributions to catches will be accomplished using the single nucleotide polymorphism (SNP) baseline for chum salmon. The chum salmon baseline has been greatly expanded in recent years, and consists of greater than 32,000 individuals from 310 populations throughout the Pacific Rim. Analyses will be conducted using 96 SNP markers, many of which were developed to differentiate among chum salmon populations spawning within western Alaska and Alaska Peninsula drainages. With addition of more baseline populations, development of additional genetic markers and incorporation of methods designed to more precisely estimate small stock proportions in samples, WASSIP will be the most comprehensive stock identification project to date, including more than 75,000 chum salmon individuals from harvest samples. When WASSIP results are released, stock proportions for chum salmon catches will be reported to six broad scale groups in Western Alaska. These include four reporting groups from the Alaska Peninsula (Chignik, South Peninsula, Northwestern District, Northern District), a Kotzebue area reporting group, and a single combined reporting group for the broad coastal region encompassing Bristol Bay, Kuskokwim River, Yukon River, and Norton Sound. WASSIP results will not be released until mid-November (after this document is released) and additional information will be provided as a supplemental to this document available for the December 2012 Council meeting.

While specific aspects of overall State of Alaska 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.

8.1.5.2 Hatchery releases of salmon

Hatcheries produce salmon fry and release these small salmon into the ocean to grow and mature before returning as adults to the hatchery or local rivers and streams for harvest or breading. Hatchery production increases the numbers of salmon in the ocean beyond what is produced by the natural system. A number of hatcheries produce salmon in Korea, Japan, Russia, the US, and Canada. The North Pacific Anadromous Fish Commission summarizes information on hatchery releases, by country and by area, where available. Chapter 5, Chum salmon, and Chapter 6, Chinook salmon, provide more information on current and past hatchery releases. It is reasonably foreseeable the hatchery production will continue at a similar level into the future.

8.1.5.3 Future exploration and development of offshore mineral resources

The Minerals Management Service (MMS) expects that reasonably foreseeable future activities include numerous discoveries that oil companies may begin to develop in the next 15-20 years in federal waters off Alaska. Potential environmental risks from the development of offshore drilling include the impacts of increased vessel offshore oil spills, drilling discharges, offshore construction activities, and seismic surveys. In an EIS prepared for sales in the OCS Leasing Program, the MMS has assessed the cumulative impacts of such activities on fisheries and finds only small incremental increases in impacts for oil and gas development, which are unlikely to significantly impact fisheries and essential fish habitat (MMS 2003).

8.1.6 Private actions

8.1.6.1 Commercial pollock and salmon fishing

Fishermen will continue to fish for pollock, as authorized by NMFS, and salmon, as authorized by the State. Fishing constitutes the most important class of reasonably foreseeable future private actions and will take place indefinitely into the future. Chapter 4 and the RIR, provide more information on the Bering Sea pollock fishery.

Commercial salmon fisheries exist throughout Alaska, in marine waters, bays, and rivers. Chapter 5 Chum Salmon, Chapter 6 Chinook Salmon, and the RIR provide more information on the commercial salmon fisheries.

8.1.6.2 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 are organized under 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. In 2009, the six CDQ groups generated nearly $180 million in revenue with operating expenses of $161 million, resulting in an increase in net assets of nearly $18 million. Operating expenses include all program costs, investments, and general and administrative expenses.[41]

One of the most tangible direct benefits of the CDQ Program has been employment opportunities for western Alaska village residents. Jobs generated by the CDQ Program included work aboard a wide range of fishing vessels, internships with the business partners or government agencies, employment at processing plants, and administrative positions. Many of the jobs generated by the CDQ Program are associated with shoreside fisheries development projects in CDQ communities. This includes a wide range of projects, including those directly related to commercial fishing. Examples of such projects include building or improving seafood processing facilities, purchasing ice machines, purchasing and building fishing vessel, gear improvements, and construction of docks or other fish handling infrastructure.

CDQ groups also have invested in peripheral projects that directly or indirectly support commercial fishing for halibut, salmon, and other nearshore species. This includes seafood branding and marketing, quality control training, safety and survival training, construction and staffing of maintenance and repair facilities that are used by both fishermen and other community residents, and assistance with bulk fuel procurement and distribution. Several CDQ groups are actively involved in salmon assessment or enhancement projects, either independently or in collaboration with ADF&G. Salmon fishing is a key component of western Alaska fishing activities, both commercially and for subsistence. The CDQ Program provides a means to support and sustain both such activities.

8.1.6.3 Subsistence harvest of salmon

Communities in western and Interior Alaska depend on salmon from the Bering Sea for subsistence and the associated cultural and spiritual needs. Chum and Chinook salmon

[41] 2009 CDQ Sector report, WACDA, p. 16. http://www.wacda.org/media/pdf/SMR_2009.pdf

consumption can be an important part of regional diets, and 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. The RIR provides more information on subsistence harvests.

8.1.6.4 Sport fishing for salmon

Regional residents may harvest chum and Chinook salmon for sport, using a State sport fishing license, and then use these salmon for essentially subsistence purposes. Regional sport fisheries, including 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 salmon will continue indefinitely into the future.

8.1.7 Summary of cumulative impacts

Reasonably foreseeable future actions that may affect target and prohibited species are shown in Table 8-1. Ecosystem management, rationalization, and traditional management tools are likely to improve the protection and management of target and prohibited species, including pollock and chum salmon and are not likely to result in significant effects when combined with the direct and indirect effects of Alternatives 2 and 3. Ongoing research efforts are likely to improve our understanding of the interactions between the harvest of pollock and salmon. NMFS is conducting or participating in several research projects to improve understanding of the ecosystems, fisheries interactions, and gear modifications to reduce salmon bycatch.

The State of Alaska manages the commercial salmon fisheries off Alaska. The State's first priority for management is to meet spawning escapement goals to sustain salmon resources for future generations. Subsistence use is the highest priority use under both State and Federal law. Surplus fish beyond escapement needs and subsistence use are made available for other uses, such as commercial and sport harvests. The State carefully monitors the status of salmon stocks returning to Alaska streams and controls fishing pressure on these stocks.

Other government actions and private actions may increase pressure on the sustainability of target and prohibited fish stocks either through extraction or changes in the habitat or may decrease the market through aquaculture competition, but it is not clear that these would result in significant cumulative effects. Any increase in extraction of target species would likely be offset by federal management. These are further discussed in Sections 4.1.3 and 7.3 of the Harvest Specifications EIS (NMFS 2007).

Reasonably foreseeable future actions for non-specified and forage species include ecosystem-sensitive management, traditional management tools, and private actions. Impacts of ecosystem-sensitive management and traditional management tools are likely to be beneficial as more attention is brought to the taking of non-specified species in the fisheries and accounting for such takes.

Reasonably foreseeable future actions for marine mammals and seabirds include ecosystem-sensitive management; rationalization; traditional management tools; actions by other federal, state, and international agencies; and private actions, as described in Sections 8.4 and 9.3 of the Harvest Specifications EIS (NMFS 2007a). Ecosystem-sensitive management, rationalization, and traditional management tools are likely to increase protection to marine mammals and seabirds by considering these species more in management decisions, and by improving the management of the pollock fishery through the restructured observer program, catch accounting, seabird avoidance measures, and vessel monitoring systems (VMS). Research into marine mammal and seabird interactions with the pollock fisheries are likely to lead to an improved understanding leading to trawling methods that reduce adverse impacts of the fisheries. 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. Any change in protection measures for marine mammals 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 continued existence or adverse modification or destruction of designated critical habitat. 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.

Any action by other entities that may impact marine mammals and seabirds will likely be offset by additional protective measures for the federal fisheries to ensure ESA-listed mammals and seabirds are not likely to experience jeopardy or adverse modification of critical habitat. Direct mortality by subsistence harvest is likely to continue, but these harvests are tracked and considered in the assessment of marine mammals and seabirds. The cumulative effect of these impacts in combination with measures proposed under Alternatives 2 and 3 is not likely to be significantly adverse.

Reasonably foreseeable future actions for habitat and the ecosystem include ecosystem-sensitive management; rationalization; traditional management tools; actions by other federal, state, and international agencies; and private actions, as detailed in Sections 10.3 and 11.3 of the Harvest Specifications EIS (NMFS 2007). Ecosystem-sensitive management, rationalization, and traditional management tools are likely to increase protection to ecosystems and habitat by considering ecosystems and habitat more in management decisions and by improving the management of the fisheries through the observer program, catch accounting, seabird and marine mammal protection, gear restrictions, and VMS. Continued fishing under the harvest specifications is likely the most important cumulative effect on EFH but the EFH EIS (NMFS 2005) has determined that this effect is minimal. The Council is also considering improving the management of non-specified species incidental takes in the fisheries to provide more protection to this component of the ecosystem. Any shift of fishing activities from federal waters into state waters would likely result in a reduction in potential impacts to EFH because state regulations prohibit the use of trawl gear in much of state waters. Nearshore impacts of coastal development and the management of the Alaska Water Quality Standards may have an impact on EFH, depending on the nature of the action and the level of protection the standards may afford. Development in the coastal zone is likely to continue, but Alaska overall is lightly developed compared to coastal areas elsewhere and therefore overall impact to EFH are not likely to be great. The EBS pollock fishery has been independently certified to the Marine Stewardship Council environmental standard for sustainable fishing. Overall, the cumulative effects on habitat and ecosystems are under Alternatives 2 and 3 are not likely to be significantly adverse.

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable future actions listed above, the cumulative impacts of the proposed action are determined to be not significant.

9 NEPA Summary

One of the purposes of an environmental assessment is to provide the evidence and analysis necessary to decide whether an agency must prepare an environmental impact statement (EIS). The Finding of No Significant Impact (FONSI) is the decision maker's determination that the action will not result in significant impacts to the human environment, and therefore, further analysis in an EIS is not needed. The Council on Environmental Quality regulations at 40 CFR 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." An action must be evaluated at different spatial scales and settings to determine the context of the action. Intensity is evaluated with respect to the nature of impacts and the resources or environmental components affected by the action. NOAA Administrative Order (NAO) 216-6 provides guidance on the National Environmental Policy Act (NEPA) specifically to line agencies within NOAA. It specifies the definition of significance in the fishery management context by listing criteria that should be used to test the significance of fishery management actions (NAO 216-6 §§ 6.01 and 6.02). These factors form the basis of the analysis presented in this Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis. The results of that analysis are summarized here for those criteria.

Context: For this action, the setting is the eastern Bering Sea (EBS) pollock fishery. Any effects of this action are limited to this regulatory area. The effects of this action on society are on individuals directly and indirectly participating in that fishery and on those who use the ocean resources. Because this action concerns the use of a present and future resource, this action may have impacts on society as a whole or regionally.

Intensity: Considerations to determine intensity of the impacts are set forth in 40 CFR 1508.27(b) and in the NAO 216-6, Section 6. Each consideration is addressed below in order as it appears in the NMFS Instruction 30-124-1 dated July 22, 2005, Guidelines for Preparation of a FONSI. The sections of the EA that address the considerations are identified.

1) *Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?*

No. No significant adverse impacts on target species were identified for the alternatives. Under the Alternative 2 PSC limits, the implementation of a lower PSC limit may result in the pollock fishery closing before the TAC is reached, while a higher PSC limit would allow for pollock fishing at current levels with no change from the status quo. Alternative 3 would impose closures according to the revised RHS program. Alternative 4 would impose area closures either in June/July or for the remainder of the B-season in addition to the revised RHS system closures. Presently the stock is managed based on science covering a wide variety of facets including the capacity of the stock to yield sustainable biomass on a continuing basis. Spatial and temporal distribution changes in potential impacts are closely monitored by scientifically trained at-sea observers and any changes in size or age of target species would be detected at a fine scale by catch monitoring and addressed in the annual stock assessment. Regular diet compositions and applications to multispecies ecosystem models are conducted to evaluate changes in predator-prey dynamics. In general, variability in environmental conditions seems to affect stock productivity. However, the modifications under this alternative would have an insignificant effect on the ability to sustainably manage the pollock resource. While changes in size composition of the catch might be affected, this would be reflected within the stock assessment process and in future ABC recommendations to ensure continued pollock stock productivity. Thus regardless of any modifications in timing and location of fishing activities and/or catch levels under the alternatives they are expected to have an insignificant effect on the productivity of the pollock stock. Target species are managed under harvest specifications that prevent overfishing. Therefore, no impacts on the sustainability of any target species are expected (EA Section 4.2).

2) *Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?*

No. The alternatives under consideration would either implement PSC limits for chum salmon which would close the pollock fishery or trigger an area closure. To the extent that chum salmon prohibited species catch is controlled or reduced as a result of this action, it will likely have beneficial impacts on chum salmon stocks relative to the status quo. Effects cannot be measured at the individual stock level because data are not available at this scale, however the relative impact rates in most years of the status quo incidental catch levels on aggregate run sizes, is very low and according to ADF&G managers unlikely to have had an impact on management considerations for these regions. Furthermore, the comparison of AEQ mortality due to chum salmon PSC with run sizes suggests that this relationship is variable. Together these results indicate that the bycatch is likely related to magnitude of returns. For these reasons collectively, the overall impact of the status quo on chum salmon stocks is considered to be insignificant to chum salmon at a population level as it is unlikely to be reasonably expected to jeopardize the sustainability of these stocks. Potential effects of the alternatives on other non-target and prohibited species are expected to be insignificant and similar to status quo, as fishing pressure is unlikely to increase. The alternatives are not expected to jeopardize the sustainability of any ecosystem component, other non-target or prohibited species (EA Sections 5.3, 6.3, and 7.11).

3) *Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in the fishery management plans (FMPs)?*

No. No significant adverse impacts were identified for the alternatives on ocean or coastal habitats or EFH. The EBS pollock fishery is a pelagic trawl fishery under the status quo and has minimal effect on benthic habitat. Substantial damage to ocean or coastal habitat or EFH under the alternatives is not expected (EA Section 7.4.2).

4) *Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?*

No. Public health and safety will not be affected in any way not evaluated under previous actions or disproportionately as a result of the proposed action. The action under the alternatives will not change fishing methods (including gear types), nor will it substantially change timing of fishing (EA Section 4.2, RIR Section XXX).

5) *Can the proposed action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?*

The analysis in the EA shows that the impacts of the alternatives on ESA-listed species (marine mammals, seabirds, and salmon), designated critical habitat, or marine mammals are likely insignificant. The only critical habitat designated for an ESA-listed species is for Steller sea lions and Cook Inlet beluga whale. Several seabird species of conservation concern occur in the EBS. Short-tailed albatross is listed as endangered under the ESA, and Steller's eider and spectacled eider are listed as threatened. Kittlitz's Murrelet is a candidate species for listing under the ESA. The red-legged kittiwake is a species of conservation concern due to recent population declines. The alterantives under consideration would not change the Steller sea lion protection measures, ensuring the action is not likely to result in adverse effects not already considered under previous

ESA consultations for Steller sea lions and their critical habitat. The fisheries are not being changed under either alternative that would result in effects beyond those already analyzed in the 2010 Biological Opinion for the authorization of the Alaska groundfish fisheries. This consultation covered all ESA-listed marine mammals occurring in the action area except Cook Inlet Beluga Whales and Southern Resident Killer whales. ESA consultations are being conducted with the Protected Resources Divisions, Alaska Region and Northwest Region, on the potential effects of the GOA PSC limit action on Chinook salmon in the WGOA and CGOA regions on Cook Inlet beluga whales, Southern Resident killer whales, and ESA-listed Chinook salmon. NMFS Sustainable Fisheries Division Alaska Region has determined that the groundfish fisheries as managed under this action may affect these species and their designated critical habitat, but these effects are likely not measurable or *de minimus*; and therefore, this action is not likely to adversely affect ESA listed species or their designated critical habitat. This action also would limit the amount of chum salmon taken in the pollock fishery which would reduce the likelihood of affecting prey for Cook Inlet Beluga whales, Southern Resident Killer whales and of affecting the primary constituent elements of designated critical habitat (EA Section 7.2.4, 7.2.5, 7.2.6, 7.2.7, and 7.3.5.1).

6) Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

No significant adverse impacts on biodiversity or ecosystem function were identified for the alternatives. No significant effects are expected on biodiversity, the ecosystem, marine mammals, or seabirds, as overall the EBS pollock fleet is constrained in the location and timing of the fishery by Steller sea lion protection measures (EA Section 7.4).

7) Are significant social or economic impacts interrelated with natural or physical environmental effects?

Socioeconomic impacts of this action result from the potential that the pollock fishery will be closed before the TAC is achieved, or additional costs associated with efforts of the fleet to avoid areas with high prohibited species catch rates under the RHS or the regulatory area closures. These impacts are a direct result of the action of imposing PSC limits and associated area closures on the fishery. These impacts are independent of the natural or physical effects of imposing PSC limits on the fisheries and are not expected to be significant. The greatest adverse economic impact on the pollock fishery would have occurred in the highest PSC years (2005 and 2011) and under the most restrictive PSC cap of 50,000 chum salmon where Alternative 2 Option 1a is estimated to result in approximately $482 million and $519 million in potentially forgone gross revenue in 2005 and 2011, respectively. Beneficial but insignificant social impacts may occur for those who depend on directed fisheries for chum salmon, however there is insufficient information to determine how specific chum stocks will be impacted by this proposed action (RIR Section XXX).

8) Are the effects on the quality of the human environment likely to be highly controversial?

This action directly affects the pollock fishery in the Bering Sea, which is a fishery of value to the groundfish fleet. There is uncertainty associated with the origin of specific chum stocks caught as prohibited species catch in the fishery. However, development of the proposed action has involved participants from the scientific and fishing communities and the potential impacts on the human environment are understood; therefore, this action is considered high-interest but not highly controversial as far as understanding the impacts of this action on the human environment (EA Section1, 2, 3, RIR Section XX).

9) *Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?*

No. This action would not affect any categories of areas on shore. This action takes place in the geographic area of the eastern Bering Sea. The land adjacent to this marine area may contain archeological sites. This action would occur in adjacent marine waters so no impacts on these cultural sites are expected. The marine waters where the fisheries occur contain ecologically critical areas. Effects on the unique characteristics of these areas are not anticipated to occur with this action because the amount of fish removed by vessels are within the specified TAC harvest levels and the alternatives provide protection to EFH and ecologically critical nearshore areas (EA Section 7.4).

10) *Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?*

No. The potential effects of the action are understood because of the fish species, harvest methods involved, and area of the activity. For marine mammals and seabirds, enough research has been conducted to know about the animals' abundance, distribution, and feeding behavior to determine that this action is not likely to result in population effects (EA Sections 7.2.4 and 7.3.5). The potential impacts of different gear types on habitat also are well understood, as described in the EFH EIS (NMFS 2005) (EA Section 7.4). The effects of the action will reduce salmon PSC but effects cannot be measured at the individual stock level because data are not available at this scale.

11) *Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?*

No. Beyond the cumulative impact analyses in the 2006 and 2007 harvest specifications EA, and the Groundfish Harvest Specifications EIS, and other on-going actions such as the development of salmon excluder devices, the prosecution of the western Alaska and Alaska Peninsula state salmon fisheries, hatchery releases of chum salmon across the Pacific Rim, no other additional past or present cumulative impact issues were identified. The combination of effects from the cumulative effects of past, present, and reasonably foreseeable future actions and this proposed action are not likely to result in significant effects for any of the environmental component analyzed and are therefore not significant (EA Section 8).

12) *Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources?*

No. This action will have no effect on districts, sites, highways, structures, or objects listed or eligible for listing in the National Register of Historic Places, nor cause loss or destruction of significant scientific, cultural, or historical resources (EA Section 2).

13) *Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?*

No. This action poses no risk of the introduction or spread of nonindigenous species into the Bering Sea beyond those previously identified because it does not change fishing, processing, or shipping practices that may lead to the introduction of nonindigenous species (EA Section 2).

14) Is the proposed action likely to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?

No. This action would control the risk of high chum salmon prohibited species catch occurring in the EBS pollock fishery. This action does not establish a precedent for future action because prohibited species catch control measures have been frequently used as a management tool for the protection of marine resources in the Alaska groundfish fisheries. Pursuant to NEPA, for all future actions, appropriate environmental analysis documents (EA or EIS) will be prepared to inform the decision makers of potential impacts to the human environment and to implement mitigation measures to avoid significant adverse impacts.

15) Can the proposed action reasonably be expected to threaten a violation of federal, state, or local law or requirements imposed for the protection of the environment?

No. This action poses no known risk of violation of federal, state, or local laws or requirements for the protection of the environment.

16) Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

No. The effects on target and non-targeted species from the alternatives are not significantly adverse as the overall harvest of these species will not be affected. No cumulative effects were identified that, added to the direct and indirect effects on target and non-targeted species, would result in significant effects (EA Sections 5.3, 6.3, 7.2, 7.3, and 8).

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Appendix 1: Industry proposal for Non-Chinook Salmon Revised RHS Program – For Council Analysis (Submitted to Council Staff May 31, 2012.)

The following is unedited text of the revised proposed non-Chinook RHS Program.

General Agreement Provisions.

1. Membership. Signed parties to this Agreement are limited to all AFA Cooperatives, all CDQ Groups, Sea State, and UCB.

2. Recitals. 1) Reduce the bycatch of Western Alaska origin chum salmon; 2) promote the harvest of EBS pollock during times of low Western Alaska origin chum salmon abundance; and 3) manage chum salmon protection measures in a manner that does not result in higher Chinook salmon bycatch.

3. Purpose of this Agreement. To implement a private, contractual inter-cooperative program to reduce the bycatch of Western Alaska origin chum salmon in the Bering Sea directed pollock fisheries, including both the CDQ and AFA pollock fisheries (the "Fishery").

4. Monitoring and Management. The Coops shall retain Sea State as the program Monitor and United Catcher Boats as the ICA Representative and program Manager. (Details per current agreement.)

5. Bycatch Management. Because non-Chinook salmon bycatch is typically low in the A season, the management of non-Chinook (chum) bycatch by this Agreement will occur in the Fishery B season. Using a Base Rate as a trigger to identify Savings Closure Areas which are areas closed to pollock fishing to all vessels in June, allow limited test fishing in Savings Closures by qualified vessels in July, and as a basis for determining Savings Closure Areas and each vessel's tier status beginning in August and until Chinook bycatch protection is required.

   Base Rate calculations, identification of test fishing vessels, sector pollock harvest and chum bycatch to date, and vessel tier assignments (when applicable) will occur on a weekly basis ("Management Week") and are announced to the Coops each Thursday (the "Thursday Announcement") for implementation at 10:00 pm the next day, the "Friday Closure". Savings Closures will be included in each Thursday Announcement for Friday Closure and may be updated each Monday (the "Monday Announcement") for implementation at 10:00 pm the next day, the "Tuesday Closure".

   Non-Chinook bycatch will be management in 2 regions of the Bering Sea. An East Region, east of 168° west longitude, and a West Region, west of 168° west longitude. For the months of June and July up to 3,000 sq. miles may be closed at any one time in the Eastern Region and up to 1,000 sq. miles may be closed at any one time in the Western Region. Beginning in August the Eastern Region closure area limit is reduced to 1,500 sq. miles and the Western Region closure area limit is reduced to 500 sq. miles. The number of individual Savings Closure Areas in each region at any one time is up to the discretion of the RHS program Monitor and/or Manager provided the sum of all Savings Closure Areas in a Region does not exceed the Region's area limit.

6. Savings Closure Area Corrections. Upon recognizing a recently implemented Savings Closure Area may not maximize chum bycatch reduction as intended the program Manager and Monitor may, at their discretion, announce a Saving Closure Area Correction Notice. Saving Closure Area Corrections may not exceed the maximum area allowed for Savings Closures in each Region and must provide a minimum of 24 hours notice to the Coops before implementation. Savings Closure Area Corrections begin at the first 10:00 pm time slot after the 24 hour notice requirement has been met.

7. Initial Chum Salmon Base Rate. Beginning June 10th the initial Base Rate for qualifying Savings Closure will be 0.19.

8. Subsequent Base Rate Calculations. Beginning with the second Thursday Announcement after June 10th and on each Thursday Announcement thereafter the Base Rate will be calculated as an accumulated average. Once 3 weeks of data becomes available Sea State will recalculate the Base Rate as the 3 week rolling average of the chum bycatch rate (chum salmon per metric ton of pollock harvest) by the Fishery. Regardless of the resulting recalculated Base Rate amount, weekly adjustments of the Base Rate shall not increase by more than 20% of the previous week's Base Rate.

9. Sea State Notification Methods - Sea State will provide each coop with each Savings Area Closure Announcement by email, text message, and, when possible, access to a webpage information source. Sea State will make its best effort to provide information directly to vessels, but only as a convenience to the fleet. The responsibility of providing vessels with closure information, tier status, etc. falls upon both the coop and the individual vessels themselves.

10. Savings Closure Area Designation Criteria. Use the language as found in the current RHS Agreement as follows:

> To qualify as a Chum Salmon Savings Area, (a) an amount of pollock that Sea State in its sole discretion determines to be substantial must have been taken in the Savings Area during the period on which its designation as a Savings Area is based, or the area must have been designated a Savings Area for the prior notification period and there must be evidence satisfactory to Sea State in its sole discretion that suggests that non-Chinook salmon bycatch rates in the area are not likely to have changed, and (b) the salmon bycatch rate in the area for the period on which its definition as a Chum Salmon Savings Area is based must exceed the Base Rate. For purposes of (a), above, Sea State shall consider a pollock harvest of two percent (2%) of the total amount of pollock harvested in the Fishery during the period on which a Chum Salmon Savings Area designation is based to be indicative of, but not dispositive of, whether a substantial amount of pollock has been harvested in an area.

11. Base Rate Savings Closure Area Floor. Whenever the Base Rate falls below 0.10 chum salmon per metric ton of pollock harvest there will be no Savings Closures for the week for which that Base Rate applies.

12. Inshore CV Bycatch Estimates. The current RHS Agreement at Section 4.a. requests inshore coop vessels to make at sea a "best estimate" report to Sea State for each tow. This " best

estimate" information has not proven to be useful for management of the RHS program and will be dropped in the revised Agreement. The eliminated language reads as follows:

> The Inshore Coops shall arrange for their vessels to report the crew's best estimate of the amount of pollock and the number of non-Chinook salmon in the tow when reporting its location. Each Inshore Coop shall develop its own methods and means to accurately calculate (when feasible) or estimate the amount of pollock and the number of salmon contained in each tow by its members' vessels, and to rapidly and accurately report that information to Sea State.

It will be replaced with language stating the inshore coops will agree to make their landing report data available to Sea State in as timely a manner as possible.

13. Savings Closure Area Enforcement Provisions.
    a. Apparent Savings Closure Area notices by a vessel are sent to their coop board for determination, and when applicable, the board is responsible for collecting the assessment. (same as current Agreement)
    b. Use definition of "fishing" as stated in the current agreement.
    c. A vessel must have more than one VMS point inside a Savings Closure Area during a tow before that tow may be considered for enforcement action.
    d. Upon receiving notice of an apparent violation from Sea State, a coop board has 180 days to respond with a report of the action taken along with a record of the record supporting that decision (as per current agreement).
    e. If no response from a coop board is received by the end of the 180 day period, all other coops, CDQ Groups, and named third parties will be notified of the failure to report and have standing to pursue Savings Closure enforcement with the same rights.
    f. Upon receiving a coop board's report within the 180 day period, the report will be forwarded to all other coops, CDQ Groups, and named third parties for review. Objections to the coop's decision must be submitted to the Manager and/or Monitor within 30 days.
    g. Uniform penalties of $10,000.00 per violation; all violations in a year are for the same amount. The $10,000.00 uniform penalty amount is considered "liquidated damages" and satisfies all obligations related to a violation.
    h. Assessments collected are use for supporting research concerning salmon taken incidentally in the Fishery (same as current Agreement).
    i. Evidence for violation determinations stays the same as current RHS Agreement.
    j. Members must maintain an operational VMS approved by Sea State, and provide their VMS tracking data to Sea State. Penalty of $1,000.00 a day for every day over 30 days a vessel fails to meet this provision while in the Fishery (same as current Agreement).

14. Hold Sea State and UCB "Hold Harmless" Provision. As stated in the current RHS Agreement.

15. Coop Membership Provisions. To be determined in draft ICA, but consistent with current agreement.

16. Term. Same as current Agreement. Auto rollover with a September 15th drop out notification deadline for the upcoming year.

17. Breach and Termination of Exemption. As stated in the current RHS Agreement

18. Annual Compliance Audit. As stated in the current RHS Agreement.

19. Miscellaneous. As stated in the current RHS Agreement.

Components Specific to June and July.

1. June Savings Closure Area Management. All vessels are prohibited from fishing inside the Savings Closure Areas from the start of the B Season (June 10) until the first Friday after June 30th.

2. July Savings Closure Area Management. Beginning with the first Thursday Announcement after June 30th and continuing weekly until the first Thursday Announcement after July 31st, qualified vessels and Mothership (MS) fleets will be assigned a Limited Test Fishing Privilege (LTFP). LTFP qualified vessels and MS fleets are allowed to fish in Savings Closure Areas during the first four days of a Management Week (10:00 pm Friday to 10:00 pm Tuesday). To qualify for the LTFP vessels and MS fleets must have a rolling 2 week average bycatch rate below 75% of the current Base Rate. Vessels and MS fleets must have landing data appearing in 2 Management Weeks before being considered for the LTFP.

Components Specific for August through October

1. Tier Assignments.

   Beginning with the first Thursday Announcement after July 31st, and with each Thursday Announcement for Friday Closure thereafter vessels and MS fleets will be assigned to one of three tiers based on their previous 2 weeks bycatch rate (chums per mt of pollock harvest). Tier assignments are based on the following criteria:

   a. Vessels and MS fleets with a chum bycatch rate less than 75% of the Base Rate are assigned to "Tier 1".
   b. Vessels and MS fleets with a chum bycatch rate equal to or greater than 75% of the Base Rate but equal to or less than 125% of the Base Rate are assigned to "Tier 2".
   c. Vessels and MS fleets with a chum bycatch rate in excess of 125% the Bases Rate are assigned to "Tier 3".
   d. Vessels and MS fleets assigned to Tier 1 may fish in Savings Closure Areas for the Management Week (10:00 pm Friday to 10:00 pm the following Friday), vessels and MS fleets assigned to Tier 2 may fish in Savings Closure Areas for the first 4 days of the Management Week (10:00 pm Friday to 10:00 pm Tuesday), and vessels and MS fleets assigned to Tier 3 are prohibited from fishing inside Savings Closure Areas for the entire Management Week.
   e. There is no minimum data requirement per vessel or MS fleet for tier assignment.

2. Savings Closure Criteria.

Beginning with the first Thursday Announcement after July 31st, and with each Thursday Announcement for Friday Closure thereafter Savings Closure Areas are determined on the following criteria:

a. Maximum area available for Savings Closures in the East Region is reduced from 3,000 sq. mi. to 1,500 sq. mi.
b. Maximum area available for Savings Closures in the West Region is reduced from 1,000 sq. mi. to 500 sq. mi.
c. Savings Closures will be made on the basis of salmon bycatch rates, with ADFG stat areas that have the highest bycatch rates being closed first. However, Sea State will evaluate the uncertainty in the bycatch rate data by area, and, among areas whose bycatch rates are not found to differ significantly, Sea State will consider pollock catch rates and first close areas with low pollock catch rates, thus preserving pollock harvesting capabilities in these areas that do not differ statistically from other areas with nominally higher bycatch rates.
d. As genetic data are received that indicates times and/or areas characterized by a higher proportion of Western Alaskan salmon, the closure selection criteria will be modified to shift the focus of closures to those areas with the highest proportion of Western Alaska salmon.

3. Chinook Bycatch Protection Threshold. Once an ADF&G Statistical Area of the Bering Sea is determined to have a Chinook bycatch of .035 Chinook per metric ton of pollock harvest, and the associated pollock harvest is determined to be at a significant level as described in the above item #10, Savings Closure Area Designation Criteria, chum salmon Savings Closure Areas will be suspended for the remainder of the B Season.

Appendix 2: Non-Chinook ICA agreement for 2011

AMENDED AND RESTATED
BERING SEA POLLOCK FISHERY ROLLING HOT SPOT CLOSURE
NON-CHINOOK SALMON BYCATCH MANAGEMENT AGREEMENT

This AMENDED AND RESTATED BERING SEA POLLOCK FISHERY ROLLING HOT SPOT CLOSURE NON-CHINOOK SALMON BYCATCH MANAGEMENT AGREEMENT is entered into by and among POLLOCK CONSERVATION COOPERATIVE ("PCC"), the HIGH SEAS CATCHERS COOPERATIVE ("High Seas"), MOTHERSHIP FLEET COOPERATIVE ("MFC"), the "Inshore Coops", i.e., AKUTAN CATCHER VESSEL ASSOCIATION, NORTHERN VICTOR FLEET COOPERATIVE, PETER PAN FLEET COOPERATIVE, UNALASKA FLEET COOPERATIVE, UNISEA FLEET COOPERATIVE and WESTWARD FLEET COOPERATIVE, and the "CDQ Groups", i.e., ALEUTIAN PRIBILOF ISLAND COMMUNITY DEVELOPMENT ASSOCIATION, BRISTOL BAY ECONOMIC DEVELOPMENT CORPORATION, CENTRAL BERING SEA FISHERMEN'S ASSOCIATION, COASTAL VILLAGES REGION FUND, NORTON SOUND ECONOMIC DEVELOPMENT CORPORATION and YUKON DELTA FISHERIES DEVELOPMENT ASSOCIATION, and SEA STATE, INC. ("Sea State") and UNITED CATCHER BOATS ASSOCIATION ("UCB") as of ___________, 2010. PCC, High Seas, MFC, and the Inshore Coops are hereafter collectively referred to as the "Coops".

This Agreement is entered into with respect to the following facts:

RECITALS

Western Alaskans have expressed conservation and allocation concerns regarding the incidental catch of non-Chinook salmon in the Bering Sea pollock fishery. While such bycatch is regulated by the North Pacific Fishery Management Council (the "Council") and the National Marine Fisheries Service ("NMFS"), the Coops desire to address this issue by inter-cooperative agreement, out of respect for the concerns of Western Alaskans, to avoid unnecessary incidental catch of non-Chinook salmon and to obviate the need for regulatory salmon savings areas.

Now, therefore, for good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties agree as follows:

AGREEMENT

1. Purpose of Agreement. This Amended and Restated Non-Chinook Salmon Bycatch Management Agreement amends and supersedes that certain Salmon Bycatch Management Agreement entered into among the parties set forth above as of December 1, 2007. The purpose of this Agreement is to implement a private, contractual inter-cooperative program to reduce non-Chinook salmon bycatch in the Bering Sea directed pollock fishery, inclusive of both the Community Development Quota ("CDQ") and non-CDQ allocations (the "Fishery"). Each party to this Agreement agrees exercise all commercially reasonable efforts to achieve that purpose.

2. Monitoring and Management. The Coops shall retain Sea State to facilitate vessel bycatch avoidance behavior, information sharing, data gathering, analysis, and fleet monitoring necessary to implement the bycatch management program contemplated under this Agreement. The Coops shall retain United Catcher Boats (UCB) as the ICA representative. UCB will provide day-to-day management of inter- cooperative matters related to the performance of this Agreement.

3. Bycatch Management. The parties agree that because the bycatch of non-Chinook salmon is typically very low during the Fishery "A" season, the bycatch management of non-Chinook salmon by this Agreement will occur during the Fishery "B" season. Therefore, non-Chinook salmon bycatch in the Fishery "B" season shall be managed on an inter-cooperative basis as follows. Sea State shall use a bycatch rate (the "Base Rate") as a trigger for identifying areas to be closed to pollock fishing by certain Coops ("Chum Salmon Savings Areas"), and as a basis for determining each Coop's tier status, which in turn shall govern whether, and if so, when, each Coop's members may harvest pollock inside of a Savings Area. During "B" seasons, Sea State shall monitor non-Chinook salmon bycatch, and may announce Chum Salmon Savings Areas for non-Chinook salmon, and Sea State shall assign each Coop a bycatch tier status. In addition, Sea State shall have the authority to declare up to two Chum Salmon Savings Areas in the Bering Sea region east of 168 degrees West longitude (the "East Region") and up to two Chum Salmon Savings Areas in the Bering Sea/Aleutian Islands region west of 168 degrees West longitude (the "West Region"). The non-Chinook salmon Base Rate shall be adjusted during each "B" season in response to non-Chinook bycatch rates, to take into account fluctuations in non-Chinook salmon encounters.

a. Initial non-Chinook Base Rate. The initial "B" season non-Chinook salmon Base Rate shall be 0.19 non-Chinook salmon per metric ton of pollock.

b. Non-Chinook Base Rate In-Season Adjustment. Commencing on July 1 of each year that this Agreement is in effect, and on each Thursday through the duration of each "B" season thereafter, Sea State shall recalculate the "B" season non-Chinook salmon Base Rate. The recalculated Base Rate shall be the three week rolling average of the Fishery "B" season non-Chinook bycatch rate for the then-current year. The recalculated Base Rate shall be the governing non-Chinook salmon Base Rate for purposes of each “Thursday Announcement” of a “Friday Closure” (as defined below) following recalculation.

c. Implementation of Salmon Savings Measures. Sea State shall use Fishery “B” season bycatch data from fishing activity after June 10 of each year to provide Coops with preliminary information regarding the location and concentration of non-Chinook salmon, and to determine initial Chum Salmon Savings Area closures and Coop Tier assignments (as defined below). Sea State shall implement Chum Salmon Savings Area closures as appropriate upon non-Chinook bycatch rates exceeding the Base Rate, and thereafter through the balance of each Fishery “B” season.

d. Cooperative Tier Assignments. Rate calculations for purposes of tier assignments shall be based on each Coop’s pollock catch in the Fishery for the prior two weeks (the denominator) and the aggregate amount of associated bycatch of non-Chinook salmon taken by its members (the numerator). For purposes of this Section, a Coop’s non-Chinook salmon bycatch amount shall be based on observer data.

- Coops with non-Chinook salmon bycatch rates of less than 75% of the applicable Base Rate shall be assigned to “Tier 1.
- Coops with non-Chinook salmon bycatch rates equal to or greater than 75% of the applicable Base Rate but equal to or less than 125% of the Base Rate shall be assigned to “Tier 2”.
- Coops with non-Chinook salmon bycatch rates greater than 125% of the applicable Base Rate shall be assigned to “Tier 3”.

e. Bycatch Hot Zone Identification. When the Fishery “B” season is open to any of the inshore, catcher/processor or mothership components, on an ongoing basis Sea State shall calculate the non-Chinook bycatch rates for each Alaska Department of Fish and Game (“ADF&G”) statistical area for which Sea State receives a non-Chinook salmon bycatch report, and when feasible, for each lateral half of each such statistical area. Bycatch rates shall be recalculated and updated every four (4) or seven (7) days during the season, immediately proceeding the closure announcements described in Section 4.g., below, as Sea State determines appropriate given the quality of data available for the area. The non-Chinook bycatch rates shall be calculated on the basis of reports Sea State determines to be adequately accurate, including reliable tow-by-tow estimates from the fishing grounds. In every case, rates calculated on the basis of the actual number of salmon observed per tow shall be given priority over rates based on sampling and extrapolation.

f. Chum Salmon Savings Areas. On each Thursday and on each Monday following June 10, for the duration of the Fishery “B” season, Sea State shall, subject to the criteria set forth below, provide notice to the Coops identifying one or more areas designated as “Chum Salmon Savings Areas”, within which pollock fishing shall be restricted on the basis of each Coop’s Tier status.

(i) Savings Area Designation Criteria. To qualify as a Chum Salmon Savings Area, (a) an amount of pollock that Sea State in its sole discretion determines to be substantial must have been taken in the Savings Area during the period on which its designation as a Savings Area is based, or the area must have been designated a Savings Area for the prior notification period and there must be evidence satisfactory to Sea State in its sole discretion that suggests that non-Chinook salmon bycatch rates in the area are not likely to have changed, and (b) the salmon bycatch rate in the area for the period on which its definition as a Chum Salmon Savings Area is based must exceed the Base Rate. For purposes of (a), above, Sea State shall consider a pollock harvest of two percent (2%) of the total amount of pollock harvested in the Fishery during the period on which a Chum Salmon Savings Area designation is based to be indicative of, but not dispositive of, whether a substantial amount of pollock has been harvested in an area.

(ii) Savings Area Boundaries and Limitations. Subject to the limits set forth in this Section, Savings Areas shall be defined by a series of latitude/longitude coordinates as Sea State determines appropriate to address salmon bycatch. Notwithstanding the foregoing, the following limits shall apply to designations of “B” season Savings Areas: (i) Chum Salmon Savings Area closures in the East Region may not exceed three thousand (3,000) square miles in total area during any single closure period; (ii) Chum Salmon Savings Areas in the West Region may not exceed one thousand (1,000) square miles in total area during any single closure period; (iii) there may be up to two (2) Savings Areas per Region per closure period.

g. Savings Area Closure Announcements. Fishery “B” season Savings Area closures announced on Thursdays (the “Thursday Announcement” of the “Friday Closures”) shall be effective from 6:00 pm the following Friday through 6:00 pm the following Tuesday, and Savings Area closures announced on Mondays (the “Monday Announcement” of “Tuesday Closures”) shall be effective from 6:00 pm the following Tuesday through 6:00 pm the following Friday. Upon a Chum Salmon Savings Area closure taking effect, fishing by Coop vessels participating in the Fishery shall be restricted pursuant to Subsection 4.i., below. Each Thursday Announcement shall include the following information: (i) season update on pollock harvest and non-Chinook salmon bycatch by pollock fishery sector and in total; (ii) each Coop’s updated rolling two week non-Chinook salmon bycatch rate, associated Tier status, and Savings Area closure dates, times and days; (iii) the coordinates describing each Chum Salmon Savings Area, and a map of the Area; (iv) non-Chinook salmon bycatch rates for each Alaska Department of Fish and Game statistical area in which there was directed pollock fishing during the previous week; and (v) updated vessel performance lists, as defined in 4.j., below. Each Monday Announcement shall include the information described in clauses (i), (iii), (iv), and a reminder to each Coop of its chum bycatch Tier status.

h. Savings Area Implementation. During the Fishery "B" seasons, Savings Area closures shall apply to Coop member vessels as follows. Chum Salmon Savings Areas announced as Friday Closures and as updated by Tuesday Closures shall be closed to fishing by Tier 3 Coop vessels for seven days. Chum Salmon Savings Areas announced as Friday Closures shall be closed to fishing by Tier 2 Coop vessels through 6:00 pm the following Tuesday. Tier 1 Coop vessels may fish in Chum Salmon Savings Areas closed to the Tier 2 and Tier 3 Coop vessels.

i. Vessel Performance Lists. On a weekly basis, Sea State shall provide salmon bycatch performance lists to the Coops calculated on the basis of non-Chinook bycatch.

i. A list of the 20 vessels with the highest non-Chinook bycatch rates for the previous 2 weeks in excess of the Base Rate.

ii. A list of the 20 vessels with the highest non-Chinook bycatch rates for the previous week in excess of the Base Rate.

j. Throughout the Fishery "B" season, Sea State shall provide salmon "hot spot" advisory notices concerning areas of high non-Chinook salmon bycatch that do not fall within Savings Area closures.

4. Data Gathering and Reporting. The Coops acknowledge that the effectiveness of the bycatch management program being implemented under this Agreement depends on rapidly gathering, analyzing and disseminating accurate data concerning non-Chinook salmon bycatch in the Fishery. The Coops therefore agree as follows.

a. Each Coop shall require its members to take all actions necessary to release their vessels' NMFS observer reports and official landing records to Sea State as soon as commercially practicable after such documents are completed. Each Coop shall request its members' vessels to exercise commercially reasonable efforts to report to Sea State within 24 hours the location of, estimated pollock tonnage of and estimated number of non-Chinook salmon in each trawl tow. PCC may satisfy its obligation under this section 6.a. by arranging to have its members' vessels' observer reports concerning non-Chinook salmon bycatch transmitted to Sea State. MFC and High Seas may satisfy their obligations under this Section by arranging to have the pollock amounts and non-Chinook salmon counts for their members' vessels reported to Sea State by the observers on the processing vessels to which their members' vessels deliver. The Inshore Coops shall arrange for their vessels to report the crew's best estimate of the amount of pollock and the number of non-Chinook salmon in the tow when reporting its location. Each Inshore Coop shall develop its own methods and means to accurately calculate (when feasible) or estimate the amount of pollock and the number of salmon contained in each tow by its members' vessels, and to rapidly and accurately report that information to Sea State.

b. Sea State shall from time to time announce a non-Chinook bycatch rate that shall trigger an incident reporting requirement. Each Coop shall require its members' vessels to notify their coop manager (if applicable), the intercooperative manager and, if feasible, Sea State as soon as possible of any tow with a non-Chinook salmon bycatch rate that the crew estimates to be equal to or greater than the incident reporting rate threshold.

5. Savings Area Closure Enforcement. Upon a Coop receiving a Savings Area closure notice which has the effect of closing one or more Savings Areas to fishing by its members' vessels under this Agreement, the Coop shall timely notify its members. Each Coop agrees to take enforcement action with respect to any violation of a Savings Area closure notice, and to collect the assessments set forth below in cases where a vessel is found to have violated a closure.

a. Sea State shall monitor the fishing activities of all Coops' members' vessels, and shall promptly report all apparent Savings Area violations to all Coops. For purposes of this Agreement, "fishing" shall mean all activity of a vessel between the time of initial gear deployment and final gear retrieval. For purposes of this Section 5.a., "gear deployment" and "gear retrieval" shall have the meanings given them in 50 C.F.R. 679.2 or its successor, as the same may be amended from time to time. Initial gear deployment shall mean setting trawl gear with an empty codend, and final gear retrieval shall mean retrieving trawl gear to either pull a codend aboard the vessel or to deliver the codend to another vessel.

b. Upon receiving notice of an apparent violation from Sea State, the Board of Directors of the Coop to which the vessel belongs shall have one hundred and eighty (180) days to take action in connection with the apparent violation, and to provide a report of the action taken and a copy of the record supporting that action to all other Coops. When the Board of Directors to which the vessel belongs provides its report, or if the Coop Board of Directors fails to provide its report within such 180 day period, then Sea State and/or UCB shall provide each other Coop, the CDQ Groups, the Association of Village Council Presidents ("AVCP"), Bering Sea Fishermen's Association ("BSFA"), Tanana Chiefs' Conference ("TCC") and Yukon River Drainage Fishermen's Association ("YRDFA") with the Coop's report (if provided) and the record developed by Sea State in connection with the apparent violation, and each of such parties shall have standing to pursue Savings Area closure enforcement actions equivalent to such Coop's own rights with respect to its members.

c. The Coops hereby adopt a uniform assessment for a skipper's first annual violation of a Savings Area closure of Ten Thousand Dollars ($10,000.00), a uniform assessment for a skipper's second annual violation of a Savings Area closure of Fifteen Thousand Dollars ($15,000.00), and a uniform assessment of Twenty Thousand Dollars ($20,000.00) for a skipper's third and subsequent violations in a year. The Coops acknowledge that the damages resulting from violating a Savings Area closure are difficult to estimate, and that the foregoing assessment amounts are therefore intended to be a substitute in all cases for direct, indirect and consequential damages. Therefore, the Coops agree that the assessment amounts established under this Subsection 5.c are liquidated damages, the payment of which (together with reasonable costs of collection) shall satisfy a Coop's and its members' obligations related to a Savings Area closure violation. The Coops hereby waive any and all claims to direct, indirect or consequential damages related to such violation.

d. The Coops agree that any funds collected in connection with a violation of this agreement, in excess of those necessary to reimburse the prevailing party for its costs and attorneys fees, shall be used to support research concerning salmon taken incidentally in the Fishery. The Coops agree to consult with the CDQ Groups, AVCP, BSFA, TCC and YRDFA regarding the most appropriate use of such funds.

e. For purposes of this Section 5, State and Federal landing reports, observer data, VMS tracking data, vessel log books and plotter data and Coop catch data produced by the Sea State in conformance with NMFS catch accounting and bycatch estimation procedures shall be presumed accurate and sufficient for determining whether a vessel violated a Savings Area closure, absent a clear and compelling demonstration of manifest error. The Coops agree to take all actions and execute all documents necessary to give effect to this provision.

f. The Coops agree to require their members to obtain and maintain an operational VMS unit approved by Sea State on their vessels, provided that such units are available on a commercially reasonable basis. The Coops agree to cause their members to release their VMS tracking data to Sea State. Sea State agrees not to disclose any such information, other than as specifically authorized under this Agreement, as necessary to fulfill the intents and purposes of this Agreement, or with prior consent from the affected vessel owner. The Coops agree that the damages resulting from vessels operating in non-compliance with this subsection are difficult to estimate, and the Coops therefore hereby adopt a uniform assessment of One Thousand Dollars ($1,000.00) per day for each consecutive day over thirty (30) consecutive days that a Coop member's vessel is employed in the Fishery without an operational VMS unit approved by Sea State, provided such unit is available on a commercially reasonable basis.

6. Release and Waiver of All Claims Against SeaState and United Catcher Boats; Indemnification and Hold Harmless. The parties acknowledge that the effectiveness of this Agreement depends to a significant extent on Sea State's and UCB's discretion and judgment in designating and defining Savings Areas, determining each Coop's Tier status, monitoring compliance with Savings Area closures, and initiating and supporting enforcement actions under circumstances where a Coop member appears to have violated this Agreement. The parties further acknowledge that if Sea State or UCB were potentially liable for simple negligence in connection with such actions, it would be necessary for Sea State and UCB to charge a substantially larger fee for the services they provide in connection with this Agreement, to offset that potential liability. It is therefore in the parties' interest to reduce Sea State's and UCB's potential liability under this Agreement. Therefore, the Coops and the CDQ Groups hereby waive and release any and all claims against Sea State and UCB arising out of or relating to Sea State's or UCB's services in connection with this Agreement, other than those arising out of gross negligence or willful misconduct by Sea State or UCB. Further, the Coops jointly and severally agree to indemnify, defend and hold Sea State and UCB harmless against any third party claims asserted against Sea State or UCB arising out of or relating to Sea State's or UCB's services in connection with this Agreement, other than those arising out of gross negligence or willful misconduct by Sea State or UCB.

7. ICA Representative contact information:

United Catcher Boats
4005 20th Ave. West, Suite 116
Seattle, WA 98199
Phone: 206-282-2599
Fax: 206-282-2414
E-mail: penguin@ucba.org

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8. Coop Membership Agreement Amendments. To give effect to this Agreement, the Coops agree to cause each of their Membership Agreements to include the following provisions.

a. Each member shall acknowledge that its vessel's operations are governed by this Agreement, and shall agree to comply with its terms.

b. Each member shall authorize its Coop's Board of Directors to take all actions and execute all documents necessary to give effect to this Agreement.

c. Each member shall authorize its Coop Board of Directors to enforce this Agreement, and if the Board fails to do so within one hundred eighty (180) days of receiving notice from Sea State that a cooperative member may have failed to comply with the Agreement, each member shall authorize each other Coop, each of the CDQ groups, AVCP, BSFA, TCC and YRDFA to individually or collectively enforce this Agreement.

d. Each member shall agree to maintain an operational VMS unit approved by Sea State on its vessel at all times that its vessel is participating in the Fishery, provided such VMS unit is available on a commercially reasonable basis, and shall agree to cause its vessel's VMS tracking data to be released to Sea State on a basis that permits Sea State to determine whether the member's vessel has operated in compliance with this Agreement. Each Coop member shall release to Sea State its State and Federal landing reports, observer data, VMS tracking data, and vessel log books and plotter data for purposes of determining its compliance with this Agreement, and agrees that in the event Sea State concludes that its vessel may have violated a hot spot closure, Sea State may release such data as Sea State in its sole discretion determines appropriate to facilitate enforcement of this Agreement.

e. Each member shall agree that the information contained in the records identified in d., above, shall be presumed accurate absent a clear and compelling demonstration of manifest error, and shall be presumed sufficient to determine its compliance with this Agreement.

f. Each member shall agree that the damages resulting from violating a Savings Area closure are difficult to estimate, and that the assessment amounts provided under this Agreement are therefore intended to be a substitute in all cases for direct, indirect and consequential damages. Each member shall agree that its Coop Board of Directors may modify Savings Area violation assessment amounts from time to time, as necessary to maintain an effective deterrent to Savings Area violations. Each member shall agree that each trawl tow during which the member's vessel fishes in a Savings Area in violation of this Agreement shall constitute a separate violation for purposes of assessment calculation. Each member shall agree that damages for violating this Agreement shall apply on a strict liability basis, regardless of a member's lack of knowledge of the violation or intent to violate the agreement. Each member shall agree that actual damages for violating this Agreement would be difficult to calculate, and shall therefore agree to pay the assessment amounts established under this Agreement, as amended from time to time, as liquidated damages. Each member agrees to modify its skipper contracts to make its skipper(s) fully responsible for the assessments levied in connection with a breach of the agreement. Further, each member agrees that in the event a skipper fails to assume such assignment of liability, or in the event such assumption of liability is deemed invalid, the member shall be liable for the full amount of such assessment, and all related costs and attorneys' fees.

g. Each member shall agree that in connection with any action taken to enforce this Agreement, the prevailing party shall be entitled to the costs and fees it incurs in connection with such action, including attorneys' fees.

h. Each member shall agree that in addition to legal remedies, the Board of Directors of each cooperative, each of the CDQ groups, BSFA and YRDFA shall be entitled to injunctive relief in connection with the second and subsequent violations of this Agreement.

i. Each member shall agree to waive and release any and all claims against Sea State and UCB arising out of or relating to Sea State's or UCB's services in connection with this Agreement, other than those arising out of gross negligence or willful misconduct by Sea State or UCB.

j. Each member shall acknowledge that, notwithstanding the definition of "fishing" used in this Agreement (which is the consistent with the definition used by NMFS for logbook entries and observer reporting purposes), it is the Coops' policy that no member's vessel will be present in a Savings Area that is closed to fishing by such Coops' members' vessels unless and until such vessel's trawl doors have been fully retrieved or stored. Further, each member shall agree that, absent extenuating circumstances, such member exercise its best efforts to comply with this policy.

9. Term. This Agreement shall take effect as of November 30, 2010. The initial term of this Agreement shall extend through November 1, 2013. The term of this Agreement shall be automatically extended for an additional year as of September 15 each year it remains in effect, i.e., as of September 15, 2011, the new expiration date of this Agreement shall be November 1, 2014, and so on. A party to this Agreement may terminate its status as a party by providing written notice to all other parties to this Agreement to that effect, provided that the effective date of such party's termination shall be the expiration date of this Agreement in effect at the time the termination notice is delivered. For example, if a Coop provides termination notice on August 15, 2011, its termination shall not be effective until November 1, 2013. If a Coop provides termination notice on October 1, 2011, its termination shall not be effective until November 1, 2014. Notwithstanding any party's termination of its participation in this Agreement or the expiration of its term, the enforcement provisions of Section 7, above, shall survive with full force and effect.

10. Breach and Termination of Exemption. Each Coop acknowledges that, as of the opening of the 2011 "B" season Fishery, NMFS is expected to issue an annual exemption to the regulatory salmon savings closures (the "Exemptions") to each Coop that is a party to and complies with this Agreement. Further, each Coop acknowledges that a Coop's material breach of this Agreement that is not timely cured shall result in forfeiture of such Coop's right to retain its Exemption. The following shall constitute material breaches of this Agreement:

(i) a Coop failing to take enforcement action within one hundred eighty (180) days of being notified by Sea State of an apparent violation of a Savings Area closure by one or more of its members, as provided in Section 5.b, above;

(ii) a Coop failing to collect and/or disburse an assessment in compliance with this Agreement within one hundred eighty (180) days of a determination that its member(s) violated a Savings Area closure, as provided in Sections 5.c and 5.d, above;

(iii) a Coop failing to collect and/or disburse an assessment in compliance with this Agreement within one hundred eighty (180) days of a determination that a member of the Coop failed to maintain an available, operational VMS unit approved by Sea State on its vessel as provided in Section 5.f of this Agreement and/or failed to cause such vessel(s) to release their VMS tracking data to Sea State as provided in Section 5.f of this Agreement.

In the event of a material breach of this Agreement by a Coop that is not cured within thirty (30) days of such Coop's authorized representative receiving written notice of such breach from one or more other Coop(s), a CDQ Group, AVCP, BSFA, TCC or YRDFA, any one of such parties may demand that the breaching Coop tender its Exemption to NMFS, and such Coop shall do so within ten (10) days. If a Coop fails to timely tender its Exemption, any of such parties may seek injunctive relief requiring such Coop to tender its Exemption.

11. Annual Compliance Audit. The Coops shall annually retain an entity that is not a party to this Agreement (the "Compliance Auditor") to review and prepare a report concerning Sea State's performance of its monitoring and notification obligations under this Agreement and actions taken by the Coops in response to all notifications from Sea State to the Coops regarding potential violations of this Agreement. All parties to this Agreement will be provided an opportunity to participate in selecting the non-party Compliance Auditor. Sea State and the Coops shall cooperate fully with the Compliance Auditor, and shall provide any information the Compliance Auditor requires to complete its review and report. If the Compliance Auditor identifies a failure to comply with this Agreement as part of its review, the Compliance Auditor shall notify all parties to this Agreement of the failure to comply, shall distribute to all parties to this Agreement the information used to identify the failure to comply, and shall provide notice of any such failures in the Compliance Auditor's final report.

12. Miscellaneous.

a. No amendment to this Agreement shall be effective against a party hereto unless in writing and duly executed by such party. The parties agree to amend this Agreement as reasonably necessary to conform with changes in law or circumstances.

b. This Agreement shall be governed by and construed in accordance with applicable federal law and the laws of the State of Washington.

c. This Agreement may be executed in counterparts which, when taken together, shall have the same effect as a fully executed original. Delivery of a signed copy of this Agreement by telefacsimile shall have the same effect as delivering a signed original.

d. The parties agree to execute any documents necessary or convenient to give effect to the intents and purposes of this Agreement.

e. All notices required to be given under this Agreement shall be deemed given five (5) days following deposit in certified first class U.S. mail, postage prepaid, with the correct address, or upon the first business day following confirmed telefacsimile or e-mail transmission to the recipient. Each party to this Agreement agrees to provide the name, postal address, telefacsimile number and e-mail address of its duly authorized representative(s) for purposes of receiving notices under this Agreement within three (3) days of executing this Agreement.

f. In the event that any provision of this Agreement is held to be invalid or unenforceable, such provision shall be deemed to be severed from this Agreement, and such holding shall not affect in any respect whatsoever the validity of the remainder of this Agreement.

g. Each Coop agrees to use its best efforts to resolve any disputes arising under this Agreement through direct negotiations. Breaches of this Agreement for which a party seeks a remedy other than injunctive relief that are not resolved through direct negotiation shall be submitted to arbitration in Seattle, Washington upon the request of any party to this Agreement. The party's written request will include the name of the arbitrator selected by the party requesting arbitration. The other party will have ten (10) days to provide written notice of the name of the arbitrator it has selected, if any. If the other party timely selects a second arbitrator, the two arbitrators will select a third arbitrator within ten (10) days. If the other party does not timely select the second arbitrator, there shall be only the one arbitrator. The single arbitrator or the three (3) arbitrators so selected will schedule the arbitration hearing as soon as possible thereafter. Every arbitrator, however chosen, must have no material ties to any Coop or Coop member. The decision of the arbitrator (or in the case of a three (3) arbitrator panel, the decision of the majority) will be final and binding. The arbitration will be conducted under the rules of (but not by) the American Arbitration Association. The parties will be entitled to limited discovery as determined by the arbitrator(s) in its or their sole discretion. The arbitrator(s) will also determine the "prevailing party" and that party will be entitled to its reasonable costs, fees and expenses, including attorneys' and arbitrator fees, incurred in the action by said party. In no event will arbitration be available pursuant to this paragraph after the date when commencement of such legal or equitable proceedings based on such claim, dispute, or other matter in question would be barred by the applicable statute of limitations.

Entered into as of the date first set forth above.

Pollock Conservation Cooperative

By ________________________________
Its ________________________________

High Seas Catchers Cooperative

By ________________________________
Its ________________________________

Mothership Fleet Cooperative

By ________________________________
Its ________________________________

Akutan Catcher Vessel Association

By ________________________________
Its ________________________________

Northern Victor Fleet Cooperative

By ________________________________
Its ________________________________

Peter Pan Fleet Cooperative

By ________________________________
Its ________________________________

Unalaska Fleet Cooperative

By ________________________________
Its ________________________________

Unisea Fleet Cooperative

By ________________________________
Its ________________________________

Westward Fleet Cooperative

By ________________________________
Its ________________________________

Aleutian Pribilof Island Community Development

By ________________________________
Its ________________________________

Bristol Bay Economic Development Corporation

By ________________________________
Its ________________________________

Central Bering Sea Fishermen's Association

By ________________________________
Its ________________________________

Coastal Villages Region Fund

By ________________________________
Its ________________________________

Norton Sound Economic Development Corporation

By ________________________________
Its ________________________________

Yukon Delta Fisheries Development Association

By ________________________________
Its ________________________________

Sea State Inc.

By ________________________________
Its ________________________________

United Catcher Boats Association

By ________________________________
Its ________________________________

Appendix 3: RHS B-Season Closure Periods 2003-2009

The following table, Table A3-1, provides detailed information on chum and Chinook bycatch during periods that RHS closures were implemented for 2003-2009. The table provides detailed information on the pollock fishing and bycatch for 1) the 5-day period before each closure – *inside the closure*, 2) the 5-day period before each closure – *outside the closure*, and 3) the 5-day period *after* each closure – in all locations.

We present this information for informational purposes. In the analyses above, the changes ranging from 1-3 days before and after each closure are examined most thoroughly.

For each of the three 5-days groups, the following information is listed:

- Date the closure began
- Type of closure – chum or Chinook
- Number of hauls occurring
- Chum, Chinook, and pollock – the numbers are extrapolated to the Region's total as done elsewhere in this EA.
- Proportions of (extrapolated) chum, Chinook, and pollock occurring in the closure area prior to the closure

Several caveats should be noted when examining the table:

- As noted in the data description section, when a closure is extended, it is reported as one closure period and the length of the closure is reported.
- Double counting occurs for several reasons:
    - o With simultaneous closures, because fishing that occurs outside of all of the closures in place at any one time listed for each closure. The fishing that occurs in the other closure(s) in place at the same time also is noted in for each closure.
    - o Hauls may occur within 5 days of simultaneous closures.
- As noted above, the 2003-2005 closures are designated here as 'Chum*' but some of these closures may be re-designated as Chinook in future analyses.

Table A3-1. Comparison of pollock and bycatch activity in and out of RHS Closures Before implementation and After Closures in All Locations

			Information for 5 days before RHS closure -- Inside the Closure									
Start date	Days closed	Closure type	Hauls	Chum	Chinook	Pollock	Proportion Chum	Proportion Chinook	Proportion Pollock	Chum rate	Chinook rate	Duration (hours)
07/11/03	7	Chum*	5	3	0	118	0.00	0.00	0.00	0.026	0.000	5
07/11/03	7	Chum*	25	262	2	4459	0.20	0.05	0.12	0.059	0.000	46
07/18/03	7	Chum*										
07/18/03	7	Chum*	32	313	4	5412	0.18	0.36	0.18	0.058	0.001	185
07/25/03	7	Chum*	31	146	0	1788	0.09	0.00	0.07	0.081	0.000	76
08/08/03	7	Chum*	83	6018	9	12414	0.59	0.10	0.35	0.485	0.001	519
08/15/03	7	Chum*	94	9937	8	12175	0.74	0.11	0.39	0.816	0.001	648
08/15/03	7	Chum*	13	394	17	936	0.03	0.23	0.03	0.421	0.018	24
08/22/03	7	Chum*	41	1953	4	6261	0.22	0.03	0.17	0.312	0.001	178
08/22/03	7	Chum*	3	555	3	250	0.06	0.02	0.01	2.223	0.013	8
08/29/03	7	Chum*	36	3750	28	3565	0.58	0.12	0.10	1.052	0.008	124
09/09/03	3	Chum*	5	97	29	459	0.02	0.09	0.01	0.211	0.063	22
09/12/03	7	Chum*	15	704	57	2092	0.09	0.11	0.06	0.336	0.027	72
09/12/03	7	Chum*	11	147	14	1027	0.02	0.03	0.03	0.143	0.014	55
09/26/03	7	Chum*	52	4322	124	4554	0.21	0.22	0.18	0.949	0.027	371
10/03/03	7	Chum*										
10/10/03	7	Chum*	31	287	137	1144	0.05	0.07	0.10	0.251	0.120	181
10/17/03	7	Chum*	14	1583	233	1301	0.46	0.28	0.14	1.217	0.179	109
07/02/04	7	Chum*	4	247	0	445	0.08	0.00	0.01	0.555	0.000	8
07/02/04	7	Chum*	14	124	2	2303	0.04	0.03	0.08	0.054	0.001	67
07/09/04	7	Chum*	22	325	11	1909	0.11	0.06	0.04	0.170	0.006	78
07/16/04	7	Chum*	8	334	6	435	0.13	0.06	0.01	0.769	0.015	28
07/23/04	7	Chum*	9	958	3	1039	0.18	0.03	0.03	0.922	0.002	18
07/23/04	7	Chum*	15	978	4	1324	0.19	0.05	0.04	0.739	0.003	62
07/30/04	7	Chum*	16	1432	16	1050	0.33	0.23	0.03	1.363	0.015	36
08/06/04	7	Chum*										
08/06/04	4	Chum*	27	4468	16	4345	0.12	0.07	0.19	1.028	0.004	128
08/10/04	3	Chum*	32	16069	25	3261	0.53	0.12	0.11	4.928	0.008	128
08/13/04	7	Chum*	14	6311	23	2624	0.42	0.10	0.07	2.405	0.009	115
08/17/04	14	Chum*	52	6591	106	5592	0.60	0.43	0.17	1.179	0.019	443
08/17/04	14	Chum*										
08/24/04	7	Chum*	50	23968	210	4160	0.67	0.20	0.15	5.761	0.051	350
08/27/04	4	Chum*										
08/31/04	7	Chum*	6	183	13	628	0.02	0.02	0.02	0.291	0.021	57
08/31/04	3	Chum*										
09/03/04	4	Chum*	3	800	17	190	0.06	0.01	0.00	4.213	0.087	26
09/10/04	7	Chum*	36	23655	103	3948	0.36	0.10	0.11	5.992	0.026	315

	Information for 5 days before RHS closure -- Outside the Closure							Information for 5 days after RHS closure -- Outside the Closure						
Start date	Hauls	Chum	Chinook	Pollock	Duration (hours)	Chum rate	Chinook rate	Hauls	Chum	Chinook	Pollock	Duration (hours)	Chum rate	Chinook rate
07/11/03	312	1309	42	35809	819	0.037	0.001	395	2193	30	43220	1279	0.051	0.001
07/11/03	292	1050	40	31467	778	0.033	0.001	395	2193	30	43220	1279	0.051	0.001
07/18/03	231	1735	10	29496	807	0.059	0.000	375	2668	33	34410	1421	0.078	0.001
07/18/03	199	1422	7	24085	622	0.059	0.000	375	2668	33	34410	1421	0.078	0.001
07/25/03	243	1566	10	25123	1159	0.062	0.000	522	2494	95	54600	1369	0.046	0.002
08/08/03	221	4187	83	22609	728	0.185	0.004	433	9702	95	44038	1853	0.220	0.002
08/15/03	186	3534	66	19068	738	0.185	0.003	396	6920	176	41064	1416	0.169	0.004
08/15/03	265	13034	57	29990	1336	0.435	0.002	396	6920	176	41064	1416	0.169	0.004
08/22/03	329	6986	149	31128	1356	0.224	0.005	516	8521	280	46155	1832	0.185	0.006
08/22/03	367	8384	150	37139	1526	0.226	0.004	516	8521	280	46155	1832	0.185	0.006
08/29/03	327	2685	197	30395	1180	0.088	0.006	441	6951	836	44559	1274	0.156	0.019
09/09/03	304	4871	282	32159	1278	0.151	0.009	367	9916	719	36421	1835	0.272	0.020
09/12/03	291	6808	446	31486	1413	0.216	0.014	364	10175	557	34311	1955	0.297	0.016
09/12/03	295	7365	489	32551	1430	0.226	0.015	364	10175	557	34311	1955	0.297	0.016
09/26/03	227	16476	433	20871	1208	0.789	0.021	262	3914	876	20458	1793	0.191	0.043
10/03/03	278	8704	1197	17105	1897	0.509	0.070	220	10073	2431	14769	1329	0.682	0.165
10/10/03	159	5788	1893	10164	950	0.569	0.186	132	7113	1661	11060	875	0.643	0.150
10/17/03	76	1891	603	8054	415	0.235	0.075	42	273	184	3280	225	0.083	0.056
07/02/04	262	3011	61	29996	969	0.100	0.002	424	2355	119	39596	1677	0.059	0.003
07/02/04	252	3134	59	28139	911	0.111	0.002	424	2355	119	39596	1677	0.059	0.003
07/09/04	432	2549	168	42864	1637	0.059	0.004	454	3220	153	43224	1482	0.075	0.004
07/16/04	411	2244	96	41141	1396	0.055	0.002	443	6133	87	42550	1708	0.144	0.002
07/23/04	327	4227	77	36322	1329	0.116	0.002	424	4154	88	46738	1567	0.089	0.002
07/23/04	321	4207	75	36038	1285	0.117	0.002	424	4154	88	46738	1567	0.089	0.002
07/30/04	268	2892	53	31591	1201	0.092	0.002	378	16554	127	36849	1442	0.449	0.003
08/06/04	170	38307	240	23112	929	1.657	0.010	495	18075	207	48471	1923	0.373	0.004
08/06/04	143	33839	224	18767	801	1.803	0.012	495	18075	207	48471	1923	0.373	0.004
08/10/04	229	14237	188	26961	1067	0.528	0.007	501	13935	278	48525	2192	0.287	0.006
08/13/04	335	8574	212	35374	1525	0.242	0.006	434	9343	291	38801	1969	0.241	0.007

08/17/04	302	4311	143	27939	1341	0.154	0.005	374	27992	629	32423	1911	0.863	0.019
08/17/04	351	10796	243	33289	1751	0.324	0.007	374	27992	629	32423	1911	0.863	0.019
08/24/04	286	11891	828	24093	1437	0.494	0.034	485	13996	758	40813	2535	0.343	0.019
08/27/04	313	18964	991	27234	1895	0.696	0.036	453	10419	951	46210	1959	0.225	0.021
08/31/04	331	9895	673	31479	1780	0.314	0.021	466	14354	1463	50451	1678	0.285	0.029
08/31/04	337	10078	686	32108	1838	0.314	0.021	466	14354	1463	50451	1678	0.285	0.029
09/03/04	366	12128	1150	42824	1357	0.283	0.027	440	54622	1300	40024	2152	1.365	0.032
09/10/04	344	42675	949	30857	1843	1.383	0.031	487	54211	2732	35393	2610	1.532	0.077

			Information for 5 days before RHS closure -- Inside the Closure									
Start date	Days closed	Closure type	Hauls	Chum	Chinook	Pollock	Proportion Chum	Proportion Chinook	Proportion Pollock	Chum rate	Chinook rate	Duration (hours)
06/24/05	7	Chum	63	6470	167	11605	0.47	0.41	0.29	0.557	0.014	306
06/24/05	4	Chum	22	251	1	1221	0.02	0.00	0.03	0.205	0.001	84
06/28/05	3	Chum	18	713	6	906	0.09	0.02	0.03	0.787	0.007	96
06/28/05	3	Chum	9	145	7	1118	0.02	0.02	0.03	0.129	0.006	33
07/01/05	4	Chum	14	180	9	423	0.04	0.03	0.01	0.425	0.022	101
07/01/05	4	Chum	25	472	4	904	0.12	0.01	0.03	0.522	0.005	124
07/05/05	3	Chum	48	3756	59	6292	0.26	0.31	0.22	0.597	0.009	369
07/05/05	3	Chum	116	9120	128	13849	0.63	0.67	0.49	0.659	0.009	780
07/08/05	4	Chum	7	11872	0	1812	0.35	0.00	0.06	6.552	0.000	64
07/08/05	4	Chum	8	1081	8	779	0.04	0.04	0.03	1.388	0.010	60
07/12/05	3	Chum	34	15608	28	3005	0.73	0.40	0.12	5.193	0.009	163
07/15/05	4	Chum	4	2466	4	459	0.23	0.03	0.02	5.371	0.008	22
07/19/05	3	Chum	7	2138	6	397	0.04	0.04	0.01	5.383	0.016	65
07/22/05	4	Chum	20	17932	12	2916	0.22	0.07	0.08	6.150	0.004	96
07/29/05	7	Chum	15	3841	7	339	0.10	0.04	0.02	11.338	0.019	107
08/05/05	4	Chum	25	30676	47	4275	0.28	0.24	0.15	7.176	0.011	199
08/09/05	7	Chum										
08/09/05	3	Chum										
08/12/05	4	Chinook	4	2141	17	330	0.11	0.03	0.01	6.481	0.052	61
08/16/05	3	Chum	26	8523	35	2598	0.26	0.06	0.11	3.281	0.013	159
08/19/05	4	Chum	43	20944	128	4166	0.30	0.22	0.14	5.027	0.031	321
08/19/05	4	Chum	50	3083	46	5088	0.05	0.08	0.18	0.606	0.009	148
08/23/05	3	Chum	4	1269	4	227	0.08	0.00	0.01	5.591	0.016	25
08/26/05	3	Chum	12	2142	38	2361	0.15	0.03	0.11	0.907	0.016	39
09/06/05	3	Chum	28	9623	10	2948	0.48	0.02	0.13	3.265	0.003	104
09/09/05	4	Chum	11	1208	29	760	0.19	0.04	0.03	1.589	0.038	71
09/13/05	3	Chum										
09/16/05	7	Chum	46	4460	97	6552	0.47	0.09	0.31	0.681	0.015	260
09/27/05	3	Chum	3	373	106	174	0.03	0.06	0.01	2.145	0.611	25
09/27/05	3	Chum	25	3434	733	2290	0.29	0.45	0.17	1.500	0.320	267
09/30/05	4	Chum	8	3153	88	454	0.32	0.05	0.04	6.938	0.194	70
10/07/05	4	Chum	30	5808	2313	3110	0.43	0.53	0.28	1.867	0.744	354
10/11/05	10	Chum	4	936	284	480	0.06	0.08	0.06	1.949	0.592	58
10/14/05	7	Chum	35	4190	1528	1249	0.27	0.30	0.13	3.354	1.223	200
10/21/05	4	Chum										

	Information for 5 days before RHS closure -- Outside the Closure							Information for 5 days after RHS closure -- Outside the Closure						
Start date	Hauls	Chum	Chinook	Pollock	Duration (hours)	Chum rate	Chinook rate	Hauls	Chum	Chinook	Pollock	Duration (hours)	Chum rate	Chinook rate
06/24/05	325	7153	240	27967	1108	0.256	0.009	441	5760	322	34547	1928	0.167	0.009
06/24/05	362	12225	392	37046	1299	0.330	0.011	441	5760	322	34547	1928	0.167	0.009
06/28/05	398	7416	282	32963	1713	0.225	0.009	360	7563	269	38418	1841	0.197	0.007
06/28/05	407	7984	282	32751	1776	0.244	0.009	360	7563	269	38418	1841	0.197	0.007
07/01/05	363	3888	286	33825	1699	0.115	0.008	352	19242	220	33046	1422	0.582	0.007
07/01/05	352	3596	291	33344	1677	0.108	0.009	352	19242	220	33046	1422	0.582	0.007
07/05/05	226	10640	133	21983	1073	0.484	0.006	523	30458	158	42152	1551	0.723	0.004
07/05/05	158	5276	64	14427	662	0.366	0.004	523	30458	158	42152	1551	0.723	0.004
07/08/05	311	22502	192	28519	962	0.789	0.007	504	12701	88	40228	1609	0.316	0.002
07/08/05	308	27398	184	28766	940	0.952	0.006	504	12701	88	40228	1609	0.316	0.002
07/12/05	307	5668	41	22325	965	0.254	0.002	469	32926	168	46781	1573	0.704	0.004
07/15/05	276	8333	110	27529	1005	0.303	0.004	494	81010	177	48009	1731	1.687	0.004
07/19/05	254	48520	155	28954	959	1.676	0.005	444	66011	196	50532	1646	1.306	0.004
07/22/05	303	63750	172	34922	1065	1.826	0.005	376	38089	173	41640	1641	0.915	0.004
07/29/05	177	35200	170	20813	901	1.691	0.008	466	82224	224	41832	1792	1.966	0.005
08/05/05	249	80370	150	23579	993	3.408	0.006	438	44220	523	42408	1884	1.043	0.012
08/09/05	326	49822	417	29869	1607	1.668	0.014	492	13309	655	43900	1667	0.303	0.015
08/09/05	326	49822	417	29869	1607	1.668	0.014	492	13309	655	43900	1667	0.303	0.015
08/12/05	258	17019	491	26379	1113	0.645	0.019	485	55344	625	42829	1737	1.292	0.015
08/16/05	257	24811	511	21629	1160	1.147	0.024	312	51813	827	40910	1363	1.267	0.020
08/19/05	225	47823	444	24610	999	1.943	0.018	308	22518	987	36664	1312	0.614	0.027
08/19/05	216	65037	520	23530	1157	2.764	0.022	308	22518	987	36664	1312	0.614	0.027
08/23/05	195	13771	770	26105	989	0.528	0.029	431	19349	1519	39358	1680	0.492	0.039
08/26/05	203	11873	1132	19987	1018	0.594	0.057	435	19196	1269	40161	1767	0.478	0.032
09/06/05	221	10616	593	20017	915	0.530	0.030	321	7397	1327	34207	1298	0.216	0.039
09/09/05	249	5303	766	23050	855	0.230	0.033	268	8873	1313	30898	1245	0.287	0.042
09/13/05	134	3034	553	11210	555	0.271	0.049	341	14458	1267	33920	1894	0.426	0.037
09/16/05	116	5051	947	14835	671	0.341	0.064	321	8458	1110	23664	1795	0.357	0.047
09/27/05	169	11588	1530	13076	956	0.886	0.117	224	12675	2601	23419	1342	0.541	0.111
09/27/05	147	8527	903	10960	714	0.778	0.082	224	12675	2601	23419	1342	0.541	0.111
09/30/05	139	6691	1638	12410	674	0.539	0.132	189	11019	3173	17985	1356	0.613	0.176
10/07/05	110	7808	2048	7913	745	0.987	0.259	201	16939	4155	10510	1319	1.612	0.395
10/11/05	147	14697	3488	7499	1064	1.960	0.465	143	17005	4387	12557	983	1.354	0.349
10/14/05	104	11564	3574	8434	771	1.371	0.424	101	8744	1637	7657	778	1.142	0.214
10/21/05	85	5482	1469	5904	669	0.929	0.249	56	4419	1169	4101	414	1.078	0.285

			Information for 5 days before RHS closure -- Inside the Closure									
Start date	Days closed	Closure type	Hauls	Chum	Chinook	Pollock	Proportion Chum	Proportion Chinook	Proportion Pollock	Chum rate	Chinook rate	Duration (hours)
06/20/06	7	Chinook	48	6911	82	3016	0.35	0.32	0.17	2.292	0.027	427
06/20/06	7	Chum	24	133	2	1145	0.01	0.01	0.06	0.116	0.002	111
06/27/06	7	Chum	56	3575	43	2147	0.37	0.41	0.16	1.665	0.020	605
07/04/06	3	Chum	26	3112	74	2021	0.16	0.37	0.08	1.540	0.037	150
07/07/06	4	Chinook	6	505	16	377	0.04	0.12	0.02	1.339	0.043	51
07/07/06	4	Chum	26	699	0	1102	0.05	0.00	0.05	0.634	0.000	108
07/11/06	3	Chum	5	0	0	0	0.00	0.00	0.00			21
07/11/06	3	Chum	38	2047	22	1522	0.21	0.22	0.07	1.345	0.015	327
07/14/06	4	Chum	23	2812	9	1192	0.25	0.11	0.06	2.358	0.008	209
07/14/06	4	Chum	11	538	8	305	0.05	0.09	0.02	1.763	0.026	105
07/18/06	3	Chum	8	125	1	126	0.04	0.02	0.01	0.993	0.007	42
07/21/06	4	Chum	4	723	4	175	0.13	0.02	0.01	4.140	0.022	10
07/25/06	3	Chum	3	68	0	111	0.01	0.00	0.00	0.614	0.000	13
07/28/06	4	Chum	7	3467	8	355	0.22	0.08	0.01	9.755	0.023	40
08/01/06	3	Chum	9	5411	7	468	0.26	0.07	0.03	11.549	0.016	71
08/04/06	4	Chum	30	6332	25	2188	0.22	0.18	0.09	2.893	0.012	161
08/08/06	3	Chum	4	136	1	169	0.00	0.00	0.01	0.804	0.005	24
08/11/06	4	Chinook	14	15617	87	1658	0.59	0.66	0.08	9.421	0.053	95
08/15/06	7	Chum	26	3580	24	1302	0.21	0.15	0.06	2.750	0.018	188
08/22/06	10	Chum	46	1208	18	1556	0.32	0.08	0.07	0.777	0.011	297
08/25/06	7	Chum	3	434	7	224	0.09	0.02	0.01	1.935	0.032	27
09/01/06	7	Chinook	4	133	27	283	0.06	0.09	0.01	0.470	0.097	48
09/08/06	7	Chum	26	234	39	1539	0.14	0.20	0.18	0.152	0.025	163
09/15/06	4	Chinook	54	1450	1093	4004	0.32	0.52	0.25	0.362	0.273	526
09/22/06	7	Chinook	15	755	708	1273	0.30	0.29	0.04	0.594	0.556	115
09/29/06	7	Chinook	19	563	403	1494	0.34	0.48	0.08	0.377	0.270	204
10/06/06	7	Chinook	33	2097	1058	3094	0.51	0.46	0.15	0.678	0.342	218
10/10/06	3	Chum										
10/13/06	4	Chinook	7	103	772	717	0.13	0.25	0.08	0.143	1.077	74
10/17/06	7	Chinook	56	687	1673	6124	0.44	0.55	0.39	0.112	0.273	432
10/24/06	7	Chinook	18	120	529	1297	0.21	0.35	0.22	0.092	0.408	233

Start date	Hauls	Chum	Chinook	Pollock	Duration (hours)	Chum rate	Chinook rate	Hauls	Chum	Chinook	Pollock	Duration (hours)	Chum rate	Chinook rate
06/20/06	131	12750	174	15197	795	0.839	0.011	287	7676	122	28066	1842	0.274	0.004
06/20/06	155	19529	255	17068	1111	1.144	0.015	287	7676	122	28066	1842	0.274	0.004
06/27/06	146	6192	63	11640	972	0.532	0.005	413	43731	409	42243	2216	1.035	0.010
07/04/06	278	15952	128	22761	1601	0.701	0.006	427	8495	96	29758	1980	0.285	0.003
07/07/06	297	13326	113	22098	1649	0.603	0.005	408	11302	115	31358	2019	0.360	0.004
07/07/06	277	13132	129	21373	1592	0.614	0.006	408	11302	115	31358	2019	0.360	0.004
07/11/06	310	9725	101	20595	1603	0.472	0.005	433	7620	61	39639	1970	0.192	0.002
07/11/06	279	7684	79	19083	1304	0.403	0.004	433	7620	61	39639	1970	0.192	0.002
07/14/06	182	8355	76	17400	991	0.480	0.004	402	4703	158	41801	1641	0.113	0.004
07/14/06	194	10629	77	18287	1095	0.581	0.004	402	4703	158	41801	1641	0.113	0.004
07/18/06	124	3321	58	11560	638	0.287	0.005	349	8658	204	38738	1318	0.224	0.005
07/21/06	212	4733	190	26274	847	0.180	0.007	407	17157	135	38496	1556	0.446	0.004
07/25/06	297	11213	111	27894	1101	0.402	0.004	442	15866	106	38648	1858	0.411	0.003
07/28/06	297	12079	94	25731	1223	0.469	0.004	482	27830	155	44826	1847	0.621	0.003
08/01/06	180	15295	100	16390	813	0.933	0.006	467	31027	167	41280	1895	0.752	0.004
08/04/06	219	22155	113	21807	843	1.016	0.005	424	32527	171	41132	1872	0.791	0.004
08/08/06	252	32329	167	27042	1153	1.196	0.006	483	23210	93	45685	2088	0.508	0.002
08/11/06	203	11058	45	19169	1019	0.577	0.002	423	24400	187	38496	1873	0.634	0.005
08/15/06	217	13250	129	20041	1016	0.661	0.006	478	8190	144	42389	1965	0.193	0.003
08/22/06	212	2574	197	20158	892	0.128	0.010	507	5230	401	37051	2197	0.141	0.011
08/25/06	207	4434	299	15701	1090	0.282	0.019	433	3413	410	35821	2219	0.095	0.011
09/01/06	331	2218	287	19135	1693	0.116	0.015	423	2381	337	25796	2132	0.092	0.013
09/08/06	135	1451	159	7061	750	0.205	0.022	307	5428	2483	32006	1765	0.170	0.078
09/15/06	115	3061	1001	12177	540	0.251	0.082	351	2598	2038	35179	1750	0.074	0.058
09/22/06	266	1726	1692	28552	1252	0.060	0.059	350	2184	1029	29964	1562	0.073	0.034
09/29/06	174	1087	431	16145	825	0.067	0.027	253	4208	1954	27455	1476	0.153	0.071
10/06/06	174	2038	1262	16987	1105	0.120	0.074	222	1167	2437	13633	1465	0.086	0.179
10/10/06	145	1245	1023	10658	1078	0.117	0.096	281	1176	4063	14653	1786	0.080	0.277
10/13/06	158	668	2279	7968	967	0.084	0.286	228	1389	2525	16321	1564	0.085	0.155
10/17/06	151	868	1356	9399	1016	0.092	0.144	222	1121	2648	13724	2025	0.082	0.193
10/24/06	78	449	992	4726	763	0.095	0.210	110	185	984	4125	827	0.045	0.239

			Information for 5 days before RHS closure -- Inside the Closure									
Start date	Days closed	Closure type	Hauls	Chum	Chinook	Pollock	Proportion Chum	Proportion Chinook	Proportion Pollock	Chum rate	Chinook rate	Duration (hours)
07/06/07	7	Chum	26	401	13	1785	0.18	0.18	0.07	0.225	0.007	113
07/10/07	3	Chinook										
07/17/07	3	Chum	9	73	3	621	0.12	0.06	0.03	0.118	0.004	44
07/20/07	11	Chum										
07/24/07	7	Chum	22	97	0	1908	0.07	0.00	0.10	0.051	0.000	70
07/31/07	7	Chum	28	363	0	1648	0.16	0.00	0.09	0.220	0.000	92
08/03/07	4	Chum	10	352	13	648	0.11	0.14	0.04	0.543	0.019	94
08/07/07	3	Chum	9	240	5	418	0.11	0.12	0.06	0.575	0.013	59
08/10/07	7	Chum	36	455	4	1402	0.23	0.07	0.16	0.324	0.003	276
08/21/07	3	Chum	30	1024	28	3161	0.11	0.07	0.11	0.324	0.009	237
08/17/07	7	Chum	66	1385	216	6850	0.42	0.47	0.20	0.202	0.032	215
08/21/07	3	Chum	7	2884	33	367	0.31	0.09	0.01	7.860	0.089	36
08/21/07	7	Chum	20	1727	45	1314	0.18	0.12	0.05	1.314	0.034	85
08/21/07	7	Chum	11	4349	54	641	0.46	0.14	0.02	6.782	0.084	52
08/17/07	4	Chum	52	571	0	4468	0.17	0.00	0.13	0.128	0.000	416
08/28/07	3	Chinook	13	662	49	844	0.09	0.08	0.04	0.784	0.058	115
08/31/07	4	Chinook	9	209	22	400	0.04	0.03	0.02	0.522	0.055	72
08/31/07	4	Chum	10	379	23	970	0.07	0.03	0.06	0.391	0.023	57
09/04/07	3	Chinook	48	1100	334	3797	0.18	0.29	0.22	0.290	0.088	201
09/04/07	7	Chum	5	76	17	95	0.01	0.01	0.01	0.799	0.176	33
09/11/07	7	Chum	14	57	37	504	0.01	0.02	0.03	0.114	0.074	114
09/11/07	3	Chinook	16	1241	701	1628	0.19	0.45	0.10	0.762	0.430	137
09/14/07	4	Chinook	7	26	76	581	0.00	0.02	0.04	0.045	0.131	28
09/21/07	7	Chinook	51	789	817	2808	0.59	0.66	0.53	0.281	0.291	512
09/25/07	10	Chinook	16	163	229	559	0.14	0.21	0.05	0.291	0.409	177
09/25/07	10	Chinook	28	117	57	753	0.10	0.05	0.07	0.155	0.076	149
10/05/07	4	Chinook	8	13	68	384	0.02	0.01	0.02	0.034	0.176	55
10/09/07	3	Chinook	3	21	163	177	0.03	0.05	0.02	0.116	0.917	20
10/09/07	3	Chinook										
10/12/07	7	Chinook	51	131	3121	3446	0.20	0.44	0.26	0.038	0.906	581
10/12/07	7	Chinook	11	75	170	810	0.11	0.02	0.06	0.093	0.210	108
10/19/07	14	Chinook	23	38	1260	1545	0.04	0.23	0.07	0.024	0.816	198
10/23/07	3	Chinook	58	82	542	2501	0.14	0.10	0.13	0.033	0.217	285

	Information for 5 days before RHS closure -- Outside the Closure							Information for 5 days after RHS closure -- Outside the Closure						
Start date	Hauls	Chum	Chinook	Pollock	Duration (hours)	Chum rate	Chinook rate	Hauls	Chum	Chinook	Pollock	Duration (hours)	Chum rate	Chinook rate
07/06/07	285	1834	56	24991	1123	0.073	0.002	396	411	28	38600	1553	0.011	0.001
07/10/07	208	568	32	18975	827	0.030	0.002	364	469	61	37935	1751	0.012	0.002
07/17/07	174	541	48	18029	794	0.030	0.003	394	1887	58	35330	1622	0.053	0.002
07/20/07	278	1634	48	24033	1093	0.068	0.002	401	1230	43	32956	1752	0.037	0.001
07/24/07	226	1246	35	16925	925	0.074	0.002	364	1530	36	28596	1834	0.054	0.001
07/31/07	268	1908	46	17281	1618	0.110	0.003	492	3078	60	49116	2300	0.063	0.001
08/03/07	223	2965	74	14379	1453	0.206	0.005	452	2480	39	33520	1965	0.074	0.001
08/07/07	128	2025	39	6132	821	0.330	0.006	394	1692	93	30932	2079	0.055	0.003
08/10/07	93	1491	51	7617	531	0.196	0.007	457	3315	422	42462	2238	0.078	0.010
08/21/07	280	8412	351	24660	1163	0.341	0.014	428	10263	692	38057	2277	0.270	0.018
08/17/07	278	1901	244	28162	1379	0.068	0.009	347	10538	405	33476	1484	0.315	0.012
08/21/07	303	6552	346	27454	1364	0.239	0.013	428	10263	692	38057	2277	0.270	0.018
08/21/07	290	7709	334	26507	1315	0.291	0.013	428	10263	692	38057	2277	0.270	0.018
08/21/07	299	5087	325	27179	1348	0.187	0.012	428	10263	692	38057	2277	0.270	0.018
08/17/07	292	2715	460	30545	1178	0.089	0.015	347	10538	405	33476	1484	0.315	0.012
08/28/07	221	6469	529	18454	1171	0.351	0.029	402	9677	1351	27311	2506	0.354	0.049
08/31/07	212	4880	671	15667	1234	0.312	0.043	409	9288	1398	29406	2534	0.316	0.048
08/31/07	211	4710	671	15098	1248	0.312	0.044	409	9288	1398	29406	2534	0.316	0.048
09/04/07	196	5054	824	13086	1299	0.386	0.063	416	9276	1380	27112	2562	0.342	0.051
09/04/07	239	6079	1141	16788	1468	0.362	0.068	416	9276	1380	27112	2562	0.342	0.051
09/11/07	256	6358	1522	16329	1893	0.389	0.093	370	8302	4461	22891	2597	0.363	0.195
09/11/07	254	5174	858	15205	1870	0.340	0.056	370	8302	4461	22891	2597	0.363	0.195
09/14/07	206	8485	3930	13274	1666	0.639	0.296	308	2520	1823	17011	2147	0.148	0.107
09/21/07	70	543	414	2513	482	0.216	0.165	336	1394	1068	13775	2599	0.101	0.077
09/25/07	257	985	845	9801	1979	0.101	0.086	229	2228	1999	10029	1890	0.222	0.199
09/25/07	245	1031	1017	9608	2007	0.107	0.106	229	2228	1999	10029	1890	0.222	0.199
10/05/07	161	783	4777	15239	1300	0.051	0.313	294	829	4739	14211	2384	0.058	0.333
10/09/07	187	574	3336	10274	1490	0.056	0.325	301	828	7019	15844	2893	0.052	0.443
10/09/07	190	594	3499	10451	1510	0.057	0.335	301	828	7019	15844	2893	0.052	0.443
10/12/07	187	530	4014	9803	1761	0.054	0.409	303	922	4416	17448	2535	0.053	0.253
10/12/07	227	586	6965	12439	2233	0.047	0.560	303	922	4416	17448	2535	0.053	0.253
10/19/07	264	869	4105	19952	2054	0.044	0.206	294	581	6119	16945	2144	0.034	0.361
10/23/07	248	515	5150	16134	1940	0.032	0.319	263	327	4903	11733	2003	0.028	0.418

			Information for 5 days before RHS closure -- Inside the Closure									
Start date	Days closed	Closure type	Hauls	Chum	Chinook	Pollock	Proportion Chum	Proportion Chinook	Proportion Pollock	Chum rate	Chinook rate	Duration (hours)
07/04/08	14	Chum										
07/11/08	7	Chum	20	314	3	1665	0.48	0.23	0.14	0.188	0.002	114
07/18/08	14	Chum	26	614	11	2350	0.72	0.77	0.30	0.261	0.005	194
08/01/08	11	Chum	3	216	0	188	0.45	0.00	0.05	1.152	0.000	22
08/15/08	7	Chum	3	4	0	218	0.01	0.00	0.01	0.019	0.000	14
08/29/08	7	Chum	14	419	7	636	0.47	0.12	0.05	0.658	0.011	102
09/09/08	7	Chum	6	40	5	151	0.03	0.02	0.02	0.268	0.034	56
09/16/08	10	Chinook	75	294	105	1323	0.50	0.51	0.27	0.222	0.079	696
09/26/08	4	Chinook										
10/03/08	7	Chum	15	21	21	372	0.05	0.07	0.12	0.056	0.055	191
10/10/08	7	Chinook	8	28	92	397	0.16	0.35	0.18	0.071	0.231	73
10/17/08	7	Chinook	57	80	925	4811	0.67	0.80	0.85	0.017	0.192	654
10/24/08	8	Chinook	7	4	174	181	1.00	1.00	0.98	0.025	0.962	107
06/29/09	4	Chum	36	274	6	2613	0.14	0.01	0.11	0.105	0.002	204
07/03/09	4	Chum	85	1053	46	5872	0.68	0.57	0.26	0.179	0.008	632
07/03/09	7	Chum	5	8	1	279	0.01	0.01	0.01	0.029	0.003	33
07/07/09	3	Chum	16	248	27	1166	0.10	0.33	0.05	0.212	0.023	72
07/10/09	4	Chum	10	605	5	547	0.20	0.12	0.03	1.105	0.010	73
07/14/09	7	Chum	40	1235	7	2059	0.61	0.30	0.10	0.600	0.004	417
07/28/09	7	Chum	13	2361	48	946	0.61	0.57	0.04	2.495	0.051	126
08/14/09	21	Chum	4	0	0	523	0.00	0.00	0.06	0.000	0.000	33
08/21/09	7	Chum	4	359	5	178	0.26	0.15	0.01	2.018	0.027	28
08/28/09	7	Chum	25	1065	22	2072	0.33	0.17	0.17	0.514	0.011	140
09/04/09	7	Chum	7	0	0	0	0.00	0.00	0.00			58
09/08/09	7	Chinook	22	11	67	1412	0.00	0.25	0.18	0.008	0.047	117
09/11/09	4	Chinook	21	2632	97	1756	0.92	0.70	0.31	1.499	0.055	204
09/18/09	7	Chinook	20	941	129	1830	0.81	0.54	0.48	0.514	0.071	180
09/25/09	4	Chinook										
09/29/09	3	Chinook										
10/02/09	7	Chinook										
10/09/09	4	Chinook	3	0	0	945	0.00	0.00	0.37	0.000	0.000	28

	Information for 5 days before RHS closure -- Outside the Closure							Information for 5 days after RHS closure -- Outside the Closure						
Start date	Hauls	Chum	Chinook	Pollock	Duration (hours)	Chum rate	Chinook rate	Hauls	Chum	Chinook	Pollock	Duration (hours)	Chum rate	Chinook rate
07/04/08	191	81	3	14325	861	0.006	0.000	384	337	8	26233	2105	0.013	0.000
07/11/08	157	346	9	10089	924	0.034	0.001	306	592	18	25356	1644	0.023	0.001
07/18/08	89	243	3	5569	491	0.044	0.001	367	404	133	32274	2065	0.013	0.004
08/01/08	58	260	6	3401	357	0.076	0.002	335	304	27	24908	2026	0.012	0.001
08/15/08	236	577	13	16663	1388	0.035	0.001	444	895	46	28833	2741	0.031	0.002
08/29/08	200	467	50	11196	1441	0.042	0.004	379	757	83	23884	2870	0.032	0.003
09/09/08	158	1392	283	7516	1379	0.185	0.038	306	1055	275	12746	2438	0.083	0.022
09/16/08	91	289	99	3664	643	0.079	0.027	354	291	49	27380	1750	0.011	0.002
09/26/08	43	396	168	2839	332	0.139	0.059	176	285	166	7085	1529	0.040	0.023
10/03/08	75	398	285	2797	793	0.142	0.102	190	329	344	6781	1595	0.048	0.051
10/10/08	87	144	169	1843	640	0.078	0.092	130	150	763	5853	1231	0.026	0.130
10/17/08	43	40	225	881	281	0.045	0.255	121	30	508	5126	1132	0.006	0.099
10/24/08	6	0	0	3	29	0.000	0.000	41	5	155	1784	346	0.003	0.087
06/29/09	253	1725	670	21258	1559	0.081	0.032	407	1671	90	27203	2367	0.061	0.003
07/03/09	230	484	35	16410	1286	0.030	0.002	321	2758	63	21093	1765	0.131	0.003
07/03/09	310	1529	80	22002	1885	0.069	0.004	321	2758	63	21093	1765	0.131	0.003
07/07/09	296	2120	54	20285	1626	0.105	0.003	394	2991	50	23259	2353	0.129	0.002
07/10/09	284	2353	39	17514	1694	0.134	0.002	384	1949	21	27826	2154	0.070	0.001
07/14/09	232	800	18	17704	1192	0.045	0.001	343	987	17	29253	1883	0.034	0.001
07/28/09	238	1514	37	24621	974	0.061	0.001	337	9552	33	32140	1548	0.297	0.001
08/14/09	118	986	10	8751	706	0.113	0.001	227	2129	43	21344	1150	0.100	0.002
08/21/09	130	1035	26	12112	712	0.085	0.002	246	4088	124	19717	1324	0.207	0.006
08/28/09	130	2134	111	9881	730	0.216	0.011	176	781	61	11243	975	0.069	0.005
09/04/09	75	773	77	5068	482	0.153	0.015	174	4621	249	11321	1023	0.408	0.022
09/08/09	100	4696	195	6618	660	0.710	0.030	147	676	116	9704	832	0.070	0.012
09/11/09	61	227	41	3840	354	0.059	0.011	137	928	193	9366	813	0.099	0.021
09/18/09	35	218	109	1982	244	0.110	0.055	105	1718	203	9546	653	0.180	0.021
09/25/09	65	1172	63	5501	399	0.213	0.011	89	426	169	3949	442	0.108	0.043
09/29/09	57	289	159	2613	302	0.111	0.061	120	288	51	2928	573	0.098	0.017
f10/02/09	103	417	142	1909	505	0.219	0.075	58	34	33	3078	302	0.011	0.011
10/09/09	22	18	37	1604	130	0.011	0.023	1	*	*	*	*	*	*

Appendix A4 Rural Outreach Report

Summary of outreach on proposed action to limit non-Chinook (chum) salmon bycatch in the Bering Sea pollock fishery

June 2011

Genesis for outreach plan

As a result of one of the North Pacific Fishery Management Council's (Council) policy priorities, it is focusing on improving outreach and communications with rural stakeholders and developing a method for systematic documentation of Alaska Native and community participation in the development of fishery management actions.[42] Upon review of several suggestions to expand both ongoing communication and outreach specific to particular projects,[43] the Council initiated a small workgroup to further review potential approaches and provide recommendations. Upon review of the workgroup report in February 2009, the Council approved the workgroup's primary recommendation to initiate a standing committee (the Rural Community Outreach Committee) to provide input to the Council on ways to improve outreach to communities and Alaska Native entities. The committee has three primary tasks: 1) to advise the Council on how to provide opportunities for better understanding and participation from Native Alaska and rural communities; 2) to provide feedback on community impacts sections of specific analyses; and 3) to provide recommendations regarding which proposed Council actions need a specific outreach plan and prioritize multiple actions when necessary. The committee was initiated in June 2009.

In addition to the stated Council policy priority, the need to improve the stakeholder participation process was highlighted during development of the Chinook salmon bycatch analysis. The Council made efforts to solicit and obtain input on the proposed action from Alaska Natives, rural communities, and other affected stakeholders. This outreach effort, specific to Chinook salmon bycatch management, dovetailed with the Council's overall community and Alaska Native stakeholder participation policy.

The Council's Rural Community Outreach Committee met in August 2009 and recommended that the non-Chinook (chum)[44] salmon bycatch issue be a priority for rural outreach. The Council agreed with this recommendation, to undertake an outreach effort with affected community and Native stakeholders prior to and during the development of the draft EA/RIR/IRFA (analysis), prior to final Council action. The committee met again in November 2009, with the primary purpose of helping to develop an outreach plan for this issue, given that the Council was scheduled to review the chum bycatch alternatives at its December 2009 meeting. Note that in October, the Council's Salmon Bycatch Workgroup also recommended that outreach begin prior to approval of the final alternatives. Both the workgroup and November committee report are on the Council website. The Rural Community Outreach Committee met again in February 2010, in part to review and finalize the outreach plan.

The outreach plan for chum salmon bycatch management was developed by Council staff with input from NMFS, the Council, the Rural Community Outreach Committee, and affected stakeholders. It is intended to improve the Council's decision-making processes on the proposed action, as well as enable the Council to maintain ongoing and proactive relations with Alaska Native and rural communities. Another of the objectives of the plan is to coordinate with NMFS' tribal consultation activities, to prevent a duplication of efforts between the Council and NMFS, which includes not confusing the public with divergent

[42]This policy priority is identified in the Council's workplan resulting from the Programmatic SEIS.
[43]http://www.fakr.noaa.gov/npfmc/Tasking/community_stakeholder.pdf
[44]While the proposed action would regulate all non-Chinook salmon bycatch, including sockeye, coho, pink, and chum salmon, chum salmon comprises over 99.6% of the total catch in this category. Thus, the proposed action is commonly referred to as the chum salmon bycatch issue.

processes or providing inconsistent information. The entire outreach plan is provided here: http://www.fakr.noaa.gov/npfmc/current_issues/bycatch/ChumOutreach1210.pdf.

This report will be included, in part or in whole, in the analysis submitted to the Council prior to its final recommendation. A broad overview of the primary steps of and results from the chum salmon bycatch outreach plan follows.

Outreach components

The following sections outline the general components of the outreach plan for the proposed action on chum salmon bycatch in the Bering Sea pollock fisheries**.** These include: direct mailings to stakeholders; community outreach meetings; additional outreach (statewide teleconference, radio/newspaper, press releases); and documentation of rural outreach meeting results.

Note also that NMFS undertook scoping for the alternatives in late March 2009, and the scoping report was provided to the Council in June 2009. Through the notice of intent, NMFS notified the public that a NEPA analysis and decision-making process for the proposed action has been initiated so that interested or affected people may participate and contribute to the final decision. 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 January 8, 2009 (74 FR 798). Public comments were due to NMFS by March 23, 2009. 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.

The scoping report summarizes the comments received during the January 8, 2009 to March 23, 2009, scoping period, and summarizes the issues associated with the proposed action and describes alternative management measures raised in public comment during the scoping process. The purpose of the report is to inform the Council and the public of the results of scoping and to assist in the development of the range alternatives and analysis. NMFS received four written comments from the public and interested parties. (Appendix 1 to the Scoping Report contains copies of the comments.) The NMFS Alaska Region web site contains the notice of intent, the scoping report, and related additional information.[45]

Direct mailings to stakeholders

On September 18, 2009, the Council provided a mailing to over 600 stakeholders, including community governments, regional and village Native corporations, regional non-profit Native corporations, tribal entities, Federal Subsistence Regional Advisory Council coordinators, Community Development Quota corporations, ADF&G Regional Coordinators, and other community or Native entities. The mailing was also sent to previous contacts or individuals that have contacted the Council on salmon bycatch issues, and State legislature and Congressional representatives.

The mailing included a two-page flyer for potential posting in communities. It provided a brief summary of the issue, including bycatch trends, and solicited input from stakeholders identified as being potentially affected by the proposed action. It also provided a summary of the Council's schedule on this issue, methods of contacting the Council, and a website reference to the current suite of alternatives and options. The flyer was intended to inform individuals and communities as to the current stage of the process that the Council was undertaking in December 2009 (i.e., refining alternatives and options and establishing a timeline for analysis). In addition, the flyer noted that pending Council direction in December, it is likely that an outreach plan will be developed for the proposed action, which would likely include regional

[45] http://www.fakr.noaa.gov/sustainablefisheries/bycatch/salmon/non_chinook/default.htm.

outreach meetings in rural Alaska, in order to explain the proposed action, provide preliminary analysis, and receive feedback from rural communities.

The Council sent a letter and another mailing to the same group of stakeholders March 31, 2010, to notify the public of the May 4 Statewide teleconference and the scheduled action for the June 2010 Council meeting. The Council was scheduled to conduct a final review and possible revision of the proposed alternatives and options for analysis at the June meeting. The intent of the mailing was to ensure awareness of the current Council schedule, the suite of proposed alternatives, the statewide teleconference, and to solicit feedback on the alternatives and options to be analyzed.

Finally, the Council sent a third mailing in May 2011 to the same group of stakeholders prior to the Council meeting at which initial review is scheduled (June 2011, in Nome). The intent of this mailing was to ensure awareness of the suite of alternatives, the range of impacts analyzed, the schedule for final action, and to solicit input on the selection of a preliminary preferred alternative, should one be selected.

In addition, the draft analysis (EA/RIR/IRFA), associated documents, outreach materials, and powerpoint presentations, are posted on the Council website as available, and prior to the Council's scheduled meeting for final action. In addition, the Council newsletter reports upon progress and relevant meetings. The public is also able to listen to all Council meetings real-time via the internet if they cannot attend in person. The Council will also consider a follow-up mailing to potentially affected entities as to the results of the Council's final recommendation for chum salmon bycatch reduction measures to the Secretary of Commerce, if, at that point, the website and Council newsletter are not considered sufficient means to reach potentially affected stakeholders.

Statewide teleconference (May 2010)

In order to get feedback prior to the Council's suite of alternatives, staff conducted a statewide teleconference on May 4, 2010. The primary purpose was an orientation for the public, such that people understand the basics of the alternatives proposed and ways to provide formal input to the Council (e.g., written and oral testimony), prior to the June 2010 Council meeting. A secondary purpose of the call is to document public input on the suite of alternatives, which was provided to the Council in June 2010. A short presentation was provided on the proposed action and Council process, and using most of the time for questions and concerns from the public.

Other guidance that staff followed, as suggested by the Rural Community Outreach Committee, included:

- Limit the call to 2 - 3 hours.
- Clearly articulate the purpose of the call.
- Provide a 2 or 3 minute time limit for questions.
- Provide a mailing/flyer to the list of community and Native contacts that includes: the suite of alternatives; the schedule for action, including community outreach meetings; information on the teleconference; and notice that those who RSVP with the Council that they will attend the teleconference will have the first priority for asking questions.
- In addition to the RSVP list, attempt to take questions from a broad geographic range.
- Work with regional organizations to provide hub sites, where many community members could call in together. Examples provided: Kawerak in Nome, Northwest Arctic Borough in Kotzebue, AVCP in Bethel, Unalakleet.
- Make the powerpoint presentation available on the Council website prior to the call.
- Use a phone line without a limit on the number of callers that can participate.
- Close the call with a reminder of how to participate in the Council process, and the opportunity to provide formal input to the Council in late May/June.

The presentation provided by Council staff during the teleconference is posted here: http://www.fakr.noaa.gov/npfmc/current_issues/bycatch/chumPPT410.pdf. The audio recording of the teleconference is provided here: http://www.box.net/shared/j37fjfq8i1. The report on the teleconference is attached as **Appendix 1**, which includes the public comments provided, staff presentation, call log, and the public notice for the teleconference.

Community outreach meetings (late 2010 – early 2011)

An important component of the outreach plan was to conduct outreach on the issue in remote villages that depend heavily on salmon for subsistence. Transportation and access to Council meetings by residents of communities in western and interior Alaska is costly and difficult. The outreach plan intended to schedule outreach in various villages, regional hubs and otherwise, in order to promote two-way communication between Council members, staff, and subsistence, recreational, and commercial salmon users. The outreach was intended to help the Council understand the concerns and needs of these communities, facilitate revision of the analysis in accordance with new information, and provide information to residents on the proposed action and Council process such that they may comment and participate in a meaningful way.

Upon informal consultation with community and Native coordinators, as well as the Rural Community Outreach Committee, staff determined that the most effective approach to community outreach meetings is to work with established community representatives and Native entities within the affected regions and attend annual or recurring regional meetings, in order to reach a broad group of stakeholders in the affected areas. Working with established entities which have regular in-region meetings tends to reach more stakeholders than if the Council hosted its own outreach meeting in the community. It was determined that Council staff would convene individual outreach meetings only as necessary and appropriate, if a regional or Council meeting was not scheduled in a particular area during a timeframe in which Council staff and/or members could attend sufficiently prior to final action.

Staff scheduled outreach in rural Alaska in order to correspond with regularly scheduled regional meetings and the release of a preliminary analysis, but prior to the release and Council review of the first formal initial review draft impact analysis (June 2011) and selection of a preferred alternative. The intent was to allow the public time to review and provide comments early in the process, such that changes can be made prior to completion of the final analysis, and allow the Council to receive community input prior to its selection of a preferred alternative.

With regard to outreach meetings, Council staff consulted with the coordinators of five of the Federal Subsistence Regional Advisory Councils (RACs), the Association of Village Council Presidents (AVCP), the Tanana Chiefs Conference (TCC), the Yukon River Drainage Fisheries Association (YRDFA), Kawerak, Inc., and the Yukon River Panel, in order to evaluate the potential for time on the agendas of their annual or biannual regional meetings. There was a recognized conflict between the AVCP annual meeting October 5 – 7, 2010, in Bethel, and the Council meeting October 4 – 12, in Anchorage, so staff and Council members were unable to attend the October AVCP meeting.[46] A schedule conflict with another outreach meeting also prevented staff from attending the Seward Peninsula RAC meeting in Nome (February 15 – 16). However, the June 2011 Council meeting is scheduled in Nome, which will provide ample agenda time for this issue and public comment. In addition, NMFS staff attended the Bering Strait regional conference in Nome in February and provided the Council presentation; Council staff did not attend due to weather.

[46]The AVCP represents 56 tribes in the Yukon-Kuskokwim Delta.

In sum, the outreach schedule included attending seven regional meetings, and at least two meetings with the Yukon River Panel in Anchorage. Through coordination with the meeting sponsors, Council staff was allocated agenda time to discuss the chum salmon bycatch proposed action at each of the following public meetings.

Yukon River Panel	April and Dec 6 – 9, 2010; Anchorage
Yukon River Drainage Fisheries Assn annual meeting	Feb 14 – 17, 2011; Mountain Village
Bering Strait Regional Conference	Feb 22 – 24, 2011; Nome
Yukon-Kuskokwim Delta Regional Advisory Council	Feb 23 – 24, 2011; Mountain Village
Western Interior Regional Advisory Council	March 1 – 2, 2011; Galena
Eastern Interior Regional Advisory Council	March 3 – 4, 2011; Fairbanks
Bristol Bay Regional Advisory Council	March 9 – 10, 2011; Naknek
Tanana Chiefs Conference annual meeting	Mar 15 – 19, 2011; Fairbanks

Each of the above organizations represents an area that encompasses several member villages and/or tribes. While it is recognized that there is some overlap in representation between the various entities, the participants that attend the meetings may be very different. However, all of the groups represent rural communities, most of which are small in population and removed from the road system. Kawerak, Inc., organizes the Bering Strait Regional Conference, and is a regional consortium of tribal governments organized as a nonprofit corporation with headquarters in Nome, Alaska. Kawerak provides services to 20 Native villages located on or near the Bering Straits. The Yukon-Kuskokwim Delta RAC represents 42 villages in its management area. The Eastern Interior RAC represents 13 villages along the Yukon or Tanana Rivers and an additional 17 villages within the region. The Western Interior RAC represents 27 villages along the Yukon and Kuskokwim Rivers. The Bristol Bay RAC represents 31 Bristol Bay subsistence communities. The Tanana Chiefs Conference is a tribal consortium of 42 villages in interior Alaska, along the Yukon, Tanana, and Kuskokwim Rivers. Please refer to the maps provided in **Appendix 2** to see the geographic representation of these entities.

Two Council members and two Council staff analysts attended a portion of each regional meeting, with the exception of the Bering Straits Regional Conference, to which weather prevented attendance. NMFS staff also attended the Bering Straits Regional Conference and the Tanana Chiefs Conference annual meeting. At each meeting, Council staff provided a 30 to 45 minute presentation on the Council process, outreach efforts, a review of the Council's previous action on Bering Sea Chinook salmon bycatch, and the proposed action on chum salmon bycatch reduction measures. Council members and staff were then available to answer questions.

In addition, Council staff provided a presentation of the proposed action at the Yukon River Panel meeting in April 2010, and again in December 2010 in Anchorage. The Yukon River Panel is an international advisory body established under the Yukon River Salmon Agreement[47] for the conservation, management, restoration, and harvest sharing of Canadian-origin salmon between the U.S. and Canada. Three Council staff members attended the December meeting and responded to questions on both the Bering Sea chum salmon bycatch action and the proposed action on Chinook salmon bycatch reduction measures in the GOA pollock fishery.

Documenting Results

This summary report was prepared to document the outreach process and results of the regional meetings and statewide teleconference. This report will be presented to the Council, in conjunction with the initial review draft analysis, in June 2011, when the Council is scheduled to review that analysis and could select a preliminary preferred alternative if desired. As stated previously, this report will also be included

[47] This agreement constitutes Chapter 8 of the Pacific Salmon Treaty: www.psc.org/pubs/treaty.pdf.

in the final analysis submitted to the Secretary of Commerce after the Council selects a final preferred alternative.

Council staff documented comments provided at the regional meetings, including public testimony.[48] A short summary of each meeting is provided below, as a brief reference. Note that the dates provided below refer to the date on which the Council presentation and comments occurred, recognizing that each meeting was typically two to three days. Resolutions or motions on the issue resulting from these meetings are provided as **Appendix 3**.

Yukon River Drainage Fisheries Association annual meeting; February 15, 2011, Mountain Village

The YRDFA Board of Directors is comprised of 30 members from Yukon River communities that represent the various fishing districts, including: Alakanuk, Kotlik, Mountain Village, St. Mary's, Holy Cross, Galena, Kaltag, Tanana, Minto, Nenana, Huslia, Eagle, Scammon Bay, Marshall, Anvik, Nulato, Allakaket, Fort Yukon, Whitehorse, and Haines Junction. The Board is representative of subsistence, commercial, and sportfish salmon users, and processors, and YRDFA has members along the entire Yukon River drainage, which encompasses more than 50 communities. In addition to YRDFA Board members and staff,

The YRDFA Board was concerned with the very limited recent Yukon River fall chum salmon runs. Members emphasized that there seems to be a correlation between high bycatch and the number of salmon returning to the rivers; but that when a species natural productivity is low, even low bycatch years can exacerbate the problem. Thus, there needs to be an effort and incentives to reduce bycatch in both high and low years.

Similar to other regions, the Board was concerned with the 'waste' associated with salmon bycatch, and the need to retain chum and Chinook bycatch as food. The Board pressed for efforts to figure out how to retain more salmon bycatch of a food-grade quality for distribution to village residents in western Alaska. Others related the difficulty in maintaining subsistence fishing, given the high price of gas and the limited fishing windows (e.g., burning 25 gallons per 24-hour window, and harvesting much fewer, smaller, salmon). Members emphasized that this type of information, and the cultural importance and dependence on salmon as the mainstay of the village diet, should be included in the impact analysis.

Members were concerned with subsistence users, both western Alaska residents and tribal members, not being heard in the Council process. Several members noted that tribes and tribal members have their own questions and concerns that need to be addressed, and that there should be a priority to start and continue a dialogue between the tribes and the Council. A direct, consistent relationship, and the ability to have this type of one-on-one communication, is essential. One member stated that the hope is that the salmon stocks will start increasing, and that the Council and YRDFA need to show each other that they are engaged in meaningful efforts to facilitate a rebound. Mandatory, year-round closure areas were mentioned by multiple members as an approach the Council should take.

The Board also had many specific questions about the way the pollock fishery operates, the seasons, the number of vessels in the various sectors, the status of salmon excluder devices, observer coverage, monitoring and enforcement of the provision of Amendment 91, and the differences between the timing of Chinook and chum bycatch in the Bering Sea. They also wanted a summary of the effectiveness of the current voluntary rolling hotspot closure system, as many residents along the river have varying perspectives and have heard conflicting information.

[48] In addition, all of the Federal Subsistence RAC meetings are recorded and transcribed.

Public comment was also taken – two people testified on the importance of chum salmon to the communities in the region and Alaska Native culture.

Bering Strait Regional Conference; February 23, 2011; Nome

This conference was organized by Kawerak, Inc. and brought together residents of 20 villages in the Norton Sound region to discuss education, health care, and natural resource issues. Due to weather, Council staff was unable to get to Nome, so NMFS (Sally Bibb, AKR) participated in the panel discussion on resource issues in their place, and presented an overview of the Council process, the chum salmon bycatch analysis, and the Northern Bering Sea Research Plan to approximately 75 people. Conference participants made the following comments: (1) Norton Sound is one of the areas hit hardest by poor chum salmon returns and is the only area of the state that has Tier II management for subsistence fishing for chum salmon, (2) the hard cap for Chinook salmon implemented under BSAI Amendment 91 is too high and represents a level of bycatch that is above the actual bycatch levels of most of the last 20 years, (3) the Seward Peninsula Federal Subsistence Regional Advisory Council recommended a hard cap of 30,000 chum salmon for the Bering Sea pollock fishery, which is a cap level that currently is not included in the Council's range of alternatives, and (4) trawling should not be allowed in the Northern Bering Sea Research Area because of the sensitivity of the shallow bottom and the importance of the resources in this area to the people of Norton Sound.

NMFS AKR also manned a table at the conference with Protected Resources, Alaska Fisheries Science Center, and US Fish and Wildlife Service staff to have one-on-one conversations with conference attendees and to answer questions about protected resources and fisheries management issues. Most people stopping by the table were interested in marine mammal issues, specifically walrus and ice seals, although several people reiterated the comments that they made relevant to the panel presentation.

Yukon-Kuskokwim Delta Subsistence Regional Advisory Council; February 23, 2011, Mountain Village

The Yukon-Kuskokwim Delta RAC is comprised of 12 members, from the communities of Kalskag, Kwethluk, Tuluksak, Eek, Tuntutuliak, Bethel, Alakanuk, Pilot Station, Kotlik, Hooper Bay, and Mountain Village. Approximately 40 people attended, including State and Federal agency staff and local residents. The discussion included both Chinook and chum salmon bycatch. The majority of the discussion on chum salmon was about accounting reliability, salmon discards and retention requirements, and the potential to use more chum bycatch for food through the food bank system. The RAC requested further information on the Sea Share program and the percentage of salmon bycatch that is retained for food through that program. The RAC was very concerned with whether discards of salmon were occurring, and the general reliability of the observer and catch accounting information.

Western Interior Subsistence Regional Advisory Council; March 2, 2011, Galena

The Western Interior RAC meeting attendees included RAC members, State and Federal agency staff, YRDFA staff, and community members (estimate of 60 total participants). The region the RAC represents encompasses 27 villages along the Yukon and Kuskokwim rivers, and the 10 RAC members are from McGrath, Ruby, Aniak, Galena, Wiseman, Allakaket, Holy Cross, Anvik, and Huslia.

The RAC asked how a hard cap system is different from an allocation of salmon bycatch, and asked what types of incentives are in place to keep the pollock fleet from fishing up to the cap every year. It was later discussed that the Council should focus on disincentives to catching salmon as bycatch, as opposed to incentives. One disincentive could be requiring the retention, freezing, and distribution of salmon bycatch to Western Alaska communities and tribal councils, for both genetic sampling and food. The RAC conveyed that there needs to be strong disincentives to reduce the destruction and waste of such an important food source. Members also discussed the substitutability of salmon species: if subsistence users must give up Chinook salmon to bycatch or other factors, (fall) chum salmon becomes increasingly important to mid – to upper Yukon River communities. At the same time, it was noted that additional salmon in the food bank provides limited benefits; it does not help meet annual or long-term escapement goals. Members emphasized the vulnerability of the salmon stocks; in a year that escapement goals are not met, it lowers the productivity of the river for many years.

The RAC also wanted an explanation of how the Council balances the national standards of minimizing bycatch (e.g., of salmon) and achieving optimum yield (e.g., in the pollock fishery). There were questions about how flexible each Council may be in interpreting the national standards, and whether any priority system or guidance is formalized. The RAC also questioned the need to maximize pollock catch, and whether there is an inherent problem with not meeting optimum yield.

The RAC strongly recommended that additional funding for new genetics data be provided for salmon stocks of concern, in order to better delineate stock of origin. Specific stocks mentioned were the Norton Sound and Chukchi chum salmon stocks. This spurred discussion of the current state of the genetics data and how refined the analysis will be in terms of breaking out (bycatch) stocks by river system.

In terms of alternatives, RAC members stated that a shorter pollock season is a feasible alternative that should be included for consideration, since the fleet is on the water for 9+ months of the year. While bycatch in the pollock fishery is not the only contributing factor to lower salmon returns, the Council should consider a management strategy to reduce the fishing pressure for a period during the year, since salmon spend so much of their life cycle in marine waters. A similar alternative was recommended by the RAC for consideration under the Chinook salmon bycatch reduction measures, but was not included by the Council for analysis.

Ethics issues and appointments were also discussed, as RAC members asked about the current composition of the Council and the perception that it is skewed toward the trawl industry. Staff reviewed the representation of the currently appointed members of the Council and reiterated the appointment process and terms. The RAC was interested in who to contact regarding having a seat on the Council that represents subsistence and tribal issues.

The agenda item closed with a resolution to work with YRDFA, tribes, and communities to develop a position on the chum salmon bycatch issue prior to or during the June 2011 Council meeting. In addition, the RAC approved sending a member to attend the June 2011 Council meeting.

Eastern Interior Subsistence Regional Advisory Council; March 3, 2011, Fairbanks

The Eastern Interior RAC is comprised of 12 members, from the communities of Eagle, Tok, Tanana, Fort Yukon, Central, Manley Hot Springs, North Pole, and Venetie. The Eastern Interior RAC meeting was comprised primarily of RAC members and State and Federal agency staff, with a few community members and non-profit groups represented (estimate of 60 total participants). The Eastern Interior RAC represents thirteen villages along the Yukon or Tanana rivers and an additional seventeen villages within the region.
Overall, the RAC emphasized the severe dependence in the Upper Yukon on chum salmon, both to provide food for local residents and to support dog teams for transportation.

The Eastern Interior RAC was very concerned with the level and preciseness of genetics data, and asked for further explanation of the new 'census approach' to sampling under BSAI Amendment 91, compared to the previous system of sub-sampling of catch. There were detailed questions about how the sampling is done, and whether otoliths are used for genetic sampling, to determine the level of hatchery salmon in the bycatch. Staff committed to researching and responding to this question after the meeting.[49]

The RAC also questioned whether the Bering Sea pollock fleet is generally able to catch the entire pollock TAC; discussion ensued about this being the first year of implementation for Amendment 91 and that the fleet stood-down for about the first 10 days of the A season in an effort to avoid Chinook salmon. Members were concerned with the significant increase in the pollock TAC in 2011 and possible ramifications relative to bycatch. They questioned whether they should assume a higher TAC means that the fleet will be fishing longer. The response and discussion centered on the concept that a higher TAC does not necessarily mean higher bycatch or bycatch rates. The pollock TAC is higher as a result of increased pollock abundance resulting from the annual stock assessment; in effect, it may reduce the need to prospect for pollock, and allow the pollock fleet an opportunity to look for better, cleaner fishing grounds. The pollock seasons would not be affected, and it is uncertain whether the duration of the fishery would change. The RAC also asked for an update on the research and use of salmon excluder devices.

At the close of the agenda item, the RAC related concerns with the length of time it takes to have a management action implemented. From the time a problem is identified (such as salmon bycatch) to a solution being implemented, it can take 3 to 4 years. Members asked whether the Council has discussed the possibility of reducing the Federal requirements associated with its analytical process (i.e., NEPA) and made recommendations to that end to the Federal government. The RAC stated appreciation for the face-to-face dialogue with Council members and staff, and reiterated the need to continue to strengthen a working relationship.

Bristol Bay Subsistence Regional Advisory Council; March 9, 2011, Naknek

The Bristol Bay RAC is comprised of 10 members, from the communities of Togiak, Naknek, King Salmon, Chignik Lake, Dillingham, Manokotak, and Iliamna. The Bristol Bay RAC meeting was comprised primarily of RAC members and Federal agency staff, with a few public participants and one ADF&G staff person (estimate of 25 total participants). The Bristol Bay RAC represents 31 Bristol Bay subsistence communities and rural residents.

Regarding Chinook salmon measures, the RAC emphasized the importance of Chinook salmon as a subsistence food and noted lower returns (and smaller fish) in their region. They asked on what the existing (performance) cap of 47,591 Chinook salmon was based under Amendment 91. For chum salmon, one RAC member noted that hard caps should be targeted (more restrictive) during the months in which the data indicate that a higher proportion of the bycatch is salmon originating from western Alaska river systems (e.g., under Alternative 3).

The RAC also supported requiring that bycaught salmon is received, stored, and donated in a condition fit for human consumption, and wanted the industry to make progress on providing the infrastructure for distribution to rural Alaska residents in areas that are experiencing very low salmon returns. One member noted that salmon not fit for human consumption could still be used to feed dog teams. The requirement to count and then discard salmon is counter-intuitive to the concept of not wasting salmon under any abundance conditions. Like the Western Interior RAC, the Bristol Bay RAC emphasized the need for disincentives to encounter salmon (i.e., the cost of retaining, freezing, storing, and distributing to food banks) as opposed to incentives for cleaner fishing. Like other RACs, the Bristol Bay RAC requested the specific amount and percentage of salmon bycatch that is currently processed and distributed to food banks.

[49] The response was provided from Diana Stram, Council staff, to KJ Mushovic, coordinator for the EI RAC, USFWS, via email on April 20, 2011.

The RAC was also interested in the areas identified for closure under Alternative 3, specifically, what years were used to identify those areas (2003 – 2010), and whether a more restrictive trigger cap could be established for specific months to avoid more western Alaska bound chum salmon. They also asked whether it is typically the majority of the fleet that operates in those high bycatch areas or just a few vessels, and whether the closures identified for each month represent a 40%, 50%, or 60% reduction in historical bycatch for each month, across the entire B season, or both.

The RAC emphasized that the Council and analysis should recognize that while the genetic data limit the analysis to impacts on river systems on an aggregate basis (e.g., western Alaska; upper and middle Yukon River), there are some very small, vulnerable streams whose relatively small runs are crucial to various subsistence communities. The example provided was the Naknek River: the entire Chinook run may be 5,000 fish, but this is a very important food source to many tribes and communities in the Bristol Bay region. A similar situation exists for chum salmon. The RAC was interested in how impacts on subsistence users would be addressed in the analysis, and whether other potential pollock trawl impacts, such as on marine mammal species and habitat, would be addressed.

Public testimony was taken; one person (WWF) testified that the RAC should recommend a hard cap on chum salmon bycatch in the Bering Sea pollock fisheries. This testimony also provided notice of a roundtable discussion with tribal leaders being scheduled for June 2011 in Nome, during the Council meeting, in order to increase tribal consultation and participation in the Federal fisheries management process. This notice was also distributed at the other RAC meetings attended by Council staff.

Tanana Chiefs Conference annual convention; March 14, 2011, Fairbanks

The Tanana Chiefs Conference is a tribal consortium of 42 villages in interior Alaska, along the Yukon, Tanana, and Kuskokwim Rivers. Their annual delegate and board of directors meeting was March 14 – 17, in Fairbanks, and the Council presentation was provided under the 'subsistence issues' agenda item. About 250 people attended, including the 42 delegates from each of the member villages. After the presentation, a question and answer period was provided for an hour for all attendees.

Overall, participants at the TCC convention emphasized the need to be treated fairly and to participate in the development of fisheries management plans and policies. This participation must be based on meaningful consultation and communication between Federal agencies, the TCC, and Alaska Native villages. One member noted that it is also important to talk to people and conduct outreach in their own villages, as they may be hesitant to speak at the convention.

Members were frustrated by current State management of the commercial and subsistence salmon fisheries that create conflict between upper and lower river salmon users, while at the same time, the Bering Sea pollock fishery is allowed an unlimited amount of salmon bycatch. Yukon River fishermen and communities have been conserving and sacrificing, but the pollock industry could do much more than they have been. Members were frustrated by the level of Chinook bycatch, the waste it represents, believed that there is a direct correlation between high bycatch years and low returns to the river in subsequent years, and reiterated that the current cap is too high. All testifiers implored the Council to recognize that there is a long cultural, spiritual, and dietary dependence on salmon and the ability to subsistence harvest salmon. Residents of remote villages do not have access to substitute foods, and they also need salmon to feed their dogs through the winter.

One testifier stated that the advisory status Alaska Natives are afforded in the Federal and State fisheries management processes in Alaska lead to frustrated attempts to getting the real issues on the table; by contrast, participation by tribes in the Pacific Northwest appears result in more meaningful dialogue and positive outcomes. The discussion included mention that there is not a designated tribal seat on the North Pacific Council, as there is on the Pacific Council, and there needs to be more Alaska Native representation on the current Council. In addition, the North Pacific salmon recovery fund sponsors participation by OR and WA tribes in the management process; the new budget, when passed, amends the provisions of this fund such that Alaska tribes will also have access to these monies.

Another member noted that the 10 year average for Chinook bycatch is decreasing, specifically the years since 2007. They support a lower cap on chum (and Chinook, recognizing the Council has already taken action) and want to encourage a meaningful dialogue to debate the issue prior to a decision. The goal is to pass the right to fish for salmon (both subsistence and commercially) to future generations. A meeting was mentioned in April for salmon users to discuss reducing their take on the lower river to allow salmon to get to the spawning grounds. One member questioned whether ANILCA applies to Council decisions.

Appendices A5-7: Link for additional appendices.

The following appendices are available on the Council's website at:
http://www.alaskafisheries.noaa.gov/npfmc/PDFdocuments/bycatch/ChumPSC_Appendix5-7_1112.pdf

Paper copies are also available by request of the Council office at (907) 271-2809

Appendix 5: Additional information on methodology for impact analyses

This appendix contains detailed supplemental information to Chapter 3 of the EA regarding the methodology for impact analyses for the EA, in particular information in deriving the AEQ estimates employed in this document. Some of this information is repeated and/or summarized in Chapter 3 of the EA.

Appendix A6: Alaskan salmon stock status overviews by river system

This appendix contains detailed stock status and harvest information on Alaskan river systems with a particular focus on western Alaskan and Alaskan Peninsula stocks. A snapshot of this information is summarized in Chapter 5 of the EA and Chapter 7 of the RIR.

Appendix A7: Additional RHS analyses: Alternatives 1 and 3

This appendix contains detailed analyses of the current RHS system (under the status quo, Alternative 1) as well as the revised RHS program (under Alternative 3). Some of these analyses are summarized in Chapters 5 and 6 of the EA as well as Chapter 6 of the RIR while this appendix contains all analyses conducted for informing this EA.