FINAL

Environmental Assessment/ Regulatory Impact Review

for Proposed Amendment 110 to the
Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area

Bering Sea Chinook salmon and Chum salmon bycatch management measures

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Abstract: This Environmental Assessment/Regulatory Impact Review analyzes proposed management measures to address bycatch of Chinook salmon and chum salmon in the Bering Sea pollock fishery. The measures under consideration include modifying chum salmon bycatch management within existing industry incentive plan agreements, adding more incentives to avoid Chinook salmon, modifying season lengths for the summer pollock fishery, and reducing the prohibited species catch limit and/or performance standard threshold implemented in the existing Chinook salmon bycatch management program. All of the alternatives were designed to improve the current management for chum salmon and Chinook salmon bycatch by providing pollock fishery participants opportunities for increased flexibility to respond to changing conditions and greater incentives to minimize bycatch of both salmon species, to the extent practicable.

List of Acronyms and Abbreviations

‘	feet
Am	Amendment (for FMP)
AAC	Alaska Administrative Code
ABC	acceptable biological catch
ADF&G	Alaska Department of Fish and Game
AEQ	adult equivalent
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center
AGDB	Alaska Groundfish Data Bank
AKFIN	Alaska Fisheries Information Network
ANILCA	Alaska National Interest Lands Conservation Act
BASIS	Bering Sea-Aleutian Salmon International Survey
BEG	biological escapement goal
BOF	Alaska Board of Fisheries
BSAI	Bering Sea and Aleutian Islands
CAS	Catch Accounting System
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
COAR	Commercial Operators Annual Report
Council	North Pacific Fishery Management Council
CP	catcher/processor
CV	catcher vessel
CWT	coded-wire tag
DPS	distinct population segment
E	East
E.O.	Executive Order
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	endangered species unit
FMA	Fisheries Monitoring and Analysis
FMP	fishery management plan
FONSI	Finding of No Significant Impact
FR	Federal Register
FRFA	Final Regulatory Flexibility Analysis
ft	foot or feet
GHL	guideline harvest level
GOA	Gulf of Alaska
ID	Identification
IRFA	Initial Regulatory Flexibility Analysis
IPA	Incentive Plan Agreement
IQF	individually quick frozen
JAM	jeopardy or adverse modification
lb(s)	pound(s)
LEI	long-term effect index
LLP	license limitation program
LOA	length overall
m	meter or meters
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MMPA	Marine Mammal Protection Act
MSST	minimum stock size threshold
mt	metric ton
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
NMFS	National Marine Fishery Service
NOAA	National Oceanic and Atmospheric Administration
NPAFC	North Pacific Anadromous Fish Commission
NPFMC	North Pacific Fishery Management Council
NPPSD	North Pacific Pelagic Seabird Database
Observer Program	North Pacific Groundfish and Halibut Observer Program
OEG	optimal escapement goal
OMB	Office of Management and Budget
PBR	potential biological removal
PSC	prohibited species catch
PPA	Preliminary preferred alternative
PRA	Paperwork Reduction Act
PSEIS	Programmatic Supplemental Environmental Impact Statement
PWS	Prince William Sound
RFA	Regulatory Flexibility Act
RFFA	reasonably foreseeable future action
RIR	Regulatory Impact Review
RPA	reasonable and prudent alternative
RSW	refrigerated seawater
SAFE	Stock Assessment and Fishery Evaluation
SAR	stock assessment report
SBA	Small Business Act
Secretary	Secretary of Commerce
SEG	sustainable escapement goal
SET	sustainable escapement threshold
SNP	single nucleotide polymorphism
SPLASH	Structure of Populations, Levels of Abundance, and Status of Humpbacks
SRKW	Southern Resident killer whales
SSFP	Sustainable Salmon Fisheries Policy
SW	southwest
TAC	total allowable catch
U.S.	United States
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VMS	vessel monitoring system
W	West

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Executive Summary

This document analyzes proposed management measures that would address Chinook salmon and chum salmon[1] prohibited species catch (PSC) management and apply exclusively to the directed pollock fishery in the eastern Bering Sea (BS). The measures under consideration include: requiring incorporation of chum salmon PSC management into existing Chinook salmon incentive plan agreements (IPA), modifying IPA requirements to add provisions and more stringent restrictions for Chinook salmon PSC management, modifying the existing pollock season dates and seasonal pollock allocations, and adding a lower Chinook salmon PSC limit and/or performance standard that would be employed in years of low Chinook salmon abundance.

Under the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP), salmon have a specific status as a prohibited species. The BSAI FMP requires that groundfish fishermen avoid bycatch of prohibited species. Additionally, any salmon PSC must either be donated to the Prohibited Species Donation (PSD) Program, or returned to sea as soon as practicable, with minimum injury, after an observer has determined the number of salmon and collected any scientific data or biological samples. Throughout this analysis Chinook and chum salmon that are caught in the pollock fishery are noted as salmon 'PSC' but are also referred to by the Magnuson-Stevens Act definition of bycatch when discussing overall purpose and need, objectives, and terminology within the industry IPAs.

Purpose and Need

The purpose of this proposed action to minimize Chinook salmon and chum salmon bycatch in the Bering Sea Pollock fishery to the extent practicable. This action is need to make Chinook salmon and chum salmon bycatch management more effective, comprehensive, and efficient. The current chum salmon bycatch reduction program under Amendment 84 does not meet the North Pacific Fishery Management Council's (Council) objectives to prioritize Chinook salmon bycatch avoidance, while preventing high chum salmon bycatch and focusing on avoidance of Alaska chum salmon stocks; and allow flexibility to harvest pollock in times and places that best support those goals. Incorporating chum salmon avoidance through the IPAs should more effectively meet those objectives by allowing for the establishment of chum measures through a program that is sufficiently flexible to quickly adapt to changing conditions.

Chinook salmon are an extremely important resource to Alaskans who depend on local fisheries for their sustenance and livelihood. Multiple years of historically low Chinook salmon abundance have resulted in significant restrictions for subsistence users in western Alaska, and failure to achieve State of Alaska conservation objectives. The current Chinook salmon bycatch reduction program under Amendment 91 was designed to minimize bycatch to the extent practicable in all years, under all conditions of salmon and pollock abundance. While Chinook salmon bycatch impact rates have been low under the program, there is evidence, illustrated in section 3.5.3 of this EA, that improvements could be made to ensure the program is minimizing Chinook salmon bycatch at low levels of salmon abundance. This could include measures to avoid salmon late in the year and to strengthen incentives across both seasons, either through revisions to the IPAs or regulations.

Alternatives

This analysis considers five alternative management strategies in addition to the status quo management. Each of the five alternatives was designed to improve upon the current management of chum and Chinook

[1] This action is specific to Chinook salmon and chum salmon bycatch in the BS pollock fishery. FMP provisions and regulations regarding other salmon remain unchanged; however, industry efforts to reduce Chinook salmon and chum salmon bycatch have the potential to also reduce bycatch of the other salmon species.

salmon bycatch by providing opportunities for increased flexibility to respond to changing conditions and greater incentives to reduce bycatch of both salmon species. These alternatives are not mutually exclusive. Below is a brief description of the alternatives under consideration in this analysis including the status quo. Additional information regarding each of the alternatives is included in Chapter 2.

Alternative 1: No Action. Current management measures are in place for both Chinook salmon PSC and chum salmon PSC.

Chinook salmon PSC is managed under Amendment 91, a complex management system which sets overall PSC limits to close fishing, by sector and season, while providing flexibility through the inclusion of a performance standard and the creation of industry-proposed IPAs to further reduce bycatch below the performance standard. The IPAs, as reviewed by the Council, are designed to increase incentives for vessels to lower bycatch rates even in years when salmon encounters were low. The mothership and catcher/processor IPAs were both modified for 2015 to include requirements for salmon excluders and several additional provisions.

Chum salmon PSC is managed under Amendment 84. The pollock fleet is exempt to a large-scale closure (Chum Salmon Savings Area) in the Bering Sea for participating in an inter-cooperative agreement with a rolling hot spot (RHS) program which uses real-time data from the fleet to move the fleet away from areas of highest bycatch by week. The entire fleet participated in this program, which is governed by a contractual agreement and managed by third-party contractor Sea State that assimilates fleet data and closes areas of the fishing grounds to cooperatives that have the highest bycatch rates in that week. The provisions of the contractual agreement for the RHS program are in regulation.

Alternative 2: Move Chum salmon PSC into IPAs. This alternative addresses chum salmon PSC management measures only. An annual exemption from the Chum Salmon Savings Area is contingent upon participation in an IPA that includes the provisions for addressing chum salmon PSC within the existing IPA. General requirements for chum salmon PSC management in the IPAs would be included in regulation. IPAs would likely run a fleet-level RHS program similar to status quo, but with improved flexibility to avoid Chinook salmon PSC in the latter portion of the summer fishing season. Provisions of the Amendment 84 RHS would be removed from regulation, but the non-Chinook salmon PSC limit and Chum Salmon Savings Area would remain in the FMP and in regulation, and vessels which do not participate in an IPA will be subject to the closure when enacted.

Alternative 3: Additional IPA provisions for Chinook salmon. This alternative addresses Chinook salmon management measures only. Under this alternative, the IPAs would need to modify their programs to include additional provisions and restrictions intended to increase incentives to avoid Chinook salmon PSC. These modifications include the following: restrictions or penalties for vessels which have consistently high Chinook PSC rates, require use of salmon excluders, require that a RHS program for Chinook operate throughout both A and B seasons, modify the longevity of a savings credit under savings-credit-based IPA programs (for inshore and mothership IPAs only), and restrictions or performance criteria to ensure that bycatch rates in October are not higher than the preceding months. The latitude to address these provisions would be left to the individual IPAs, but the new requirements would be added to the regulations.

Alternative 4: Revise the Bering Sea pollock fishery season dates and seasonal allocation of pollock. This alternative addresses both Chinook and chum salmon PSC and would modify the seasonal allocation of pollock and/or the existing B-season start and end dates for the pollock fishery. Two season date options are considered: to begin the season on June 1st instead of June 10th and to end the season on September 15th, October 1st, or October 15th. The third option provides for a shift in the seasonal allocation of pollock to increase A-season allocation by 5% to 10%. These options are not mutually exclusive. This alternative is intended to shift the fishing effort earlier in the B season, when Chinook salmon bycatch rates have historically been lower.

<u>Alternative 5</u>: Lower the PSC limit and/or the performance standard threshold in years of low Chinook salmon abundance. Under this alternative the overall PSC limit (60,000) and/or the performance standard (47,591 annually; divided by sector and season) would be lowered in years when western Alaska Chinook salmon stocks are projected to be low. Each fall, ADF&G would notify NMFS whether 'low Chinook abundance' has occurred based on an assessment of the indexed run strength of the combined run sizes of the Unalakleet, Upper Yukon, and Kuskokwim river systems. NMFS would set the annual PSC limit and/or performance standard's annual threshold amount based on ADF&G's assessment of Chinook salmon abundance in the annual harvest specifications. As with status quo, sectors that exceed the applicable performance standard threshold, in 3 out of 7 years, would be held to their proportion of the 47,591 Chinook PSC limit every year thereafter. All other provisions of the current Chinook salmon PSC management program under status quo would remain in place. Options for reducing the PSC limit and/or performance standard threshold range from 25% to 60% reduction from current limits. For the PSC limit, this is a range of 24,000 to 45,000, while for the performance standard threshold; this is a range of 19,036 to 35,693. The performance standard threshold is the level to which IPAs are structured in the incentives to remain below. Reduced PSC limits would only be applicable in years of low western Alaska Chinook salmon abundance, as described above.

<u>Alternative 6 (Preferred Alternative)</u>: Alternative 6 combines measures included in Alternatives 2, 3, 4, and 5. This alternative was selected by the Council as its preferred alternative (PA) in April 2015. This combined management approach includes: all provisions of Alternative 2 (moving chum salmon bycatch management into the IPAs); all of Alternative 3 (options to revise IPA requirements for Chinook bycatch); incorporates a reallocation of an additional 5% of annual pollock quota from the B-season to the A-season from Alternative 4; and reduces the PSC limit (from 60,000 to 45,000) and performance standard threshold (from 47,591 to 33,318) in years of low abundance (as defined under Alternative 5). All other provisions of Amendment 91 remain in place. This results in a combined management approach that provides additional specificity and provisions to the IPA requirements, additional reporting requirements to address these changes, provides for some additional flexibility to catch pollock at times of lower Chinook encounters, by a quota reallocation, and provides for more stringent measures in times of low western Chinook abundance in Alaskan rivers. The Council also adopted into Alternative 6 the NMFS recommendations for management and enforcement improvements identified in Section 2.7, and analyzed in Section 4.8 below.

Environmental Assessment

This section focuses on the relative impacts to pollock stocks, Chinook salmon, and chum salmon under the different alternatives. The analysis also considered the impact of the alternatives on other groundfish stocks, marine mammals, and the ecosystem. Of these, the alternatives were not estimated to have any change from status quo (not significant) impacts.

Pollock

The Bering Sea walleye pollock (*Gadus chalcogrammus*) fishery is one of the largest in the world. The fishery is divided between a seasonal winter fishery ("A" season, January 20 through June 10) and a summer fishery ("B" season, June 10 through November 1). The Bering Sea pollock stock is not overfished nor approaching an overfished condition. Presently the pollock stock is managed based on science to account for a variety of factors, including the capacity of the stock to yield sustainable biomass on a continuing basis. Catch levels are conservatively managed, with total allowable catch (TAC) levels set well below the Acceptable Biological Catch (ABC) levels. 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 stock's productivity on a continuing basis.

Alternatives 2 through 6 are not estimated to result in any significant changes to the pollock stock. Alternative 2 would result in a revised RHS system, similar to the one in operation under Alternative 1. As such, the estimated impacts on the fishery as it relates to pollock catch (and, thus, the pollock stock) are best approximated by the status quo. Alternatives 3 through 6 may result in fishing earlier in the B-season (or additional effort in the A season), with effort concentrated in areas away from core fishing grounds and/or result in some of the pollock quota being unharvested in some years. There is evidence that the average pollock size and recovery rate (finished product relative to whole fish weight) increases later in the B-season, and that this change in timing could adversely affect the pollock fishery to some degree. However, the extent that these impacts affect resource management (for stock conservation purposes) is mitigated by the resulting data incorporated into the annual stock assessment process. That is, such changes are accounted for in catch specification recommendations for subsequent years. Therefore, while impacts of alternative management strategies could result in minor changes in future catches (indirectly through the stock assessment/ABC determination process), the actions would not have a significant impact on the sustainability and viability of the pollock population.

Chinook salmon and chum salmon

Western Alaska Chinook salmon stocks are in a period of extremely low abundance, and further reductions of all sources of mortality are being considered. The Bering Sea pollock fishery catches substantial numbers of Chinook salmon in both A and B seasons in some years, although recent levels are much lower than historical bycatch levels. Genetic information indicates that the majority (~65%) of the Chinook salmon caught in the Bering Sea pollock fishery originate from a single geographic region encompassing several western Alaskan rivers, including a genetically distinct group from the Canadian portion of the Yukon River.

Chum salmon stocks in Alaska are generally at higher abundance than historical periods with some stocks in Norton Sound still in decline. The pollock fishery catches chum salmon predominantly in the B-season. Genetic information indicates that the majority of the chum salmon caught in the pollock fishery are of Asian –origin (~60%), while over one-fifth (~21%) originate from aggregate streams in western Alaska. The pollock fishery has caught large numbers of chum PSC historically (~700,000 in 2005), with levels in recent years quite variable. Catch in 2014 was ~200,000, with approximately 40,000 of Western Alaska origin.

In order to understand the impacts of bycatch on Chinook salmon populations, it is necessary to estimate how different bycatch numbers would propagate to adult equivalent (AEQ) 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. Because the Chinook salmon caught in the pollock fishery range in ages from 3 to 7 year olds, the impacts of bycatch in any one year may be lagged by several years. Thus, a high bycatch year (such as in 2007 for Chinook) may have impacts lower than the number of PSC recorded as mortality in that year, but will continue to impact returns to rivers for several years into the future. Similarly, a low bycatch year may indicate low mortality in that year, but the true impacts are influenced by the bycatch that has occurred in previous years. Therefore, AEQ is a more accurate representation of the true impact to spawning salmon than the mortality in numbers of fish recorded in any one year.

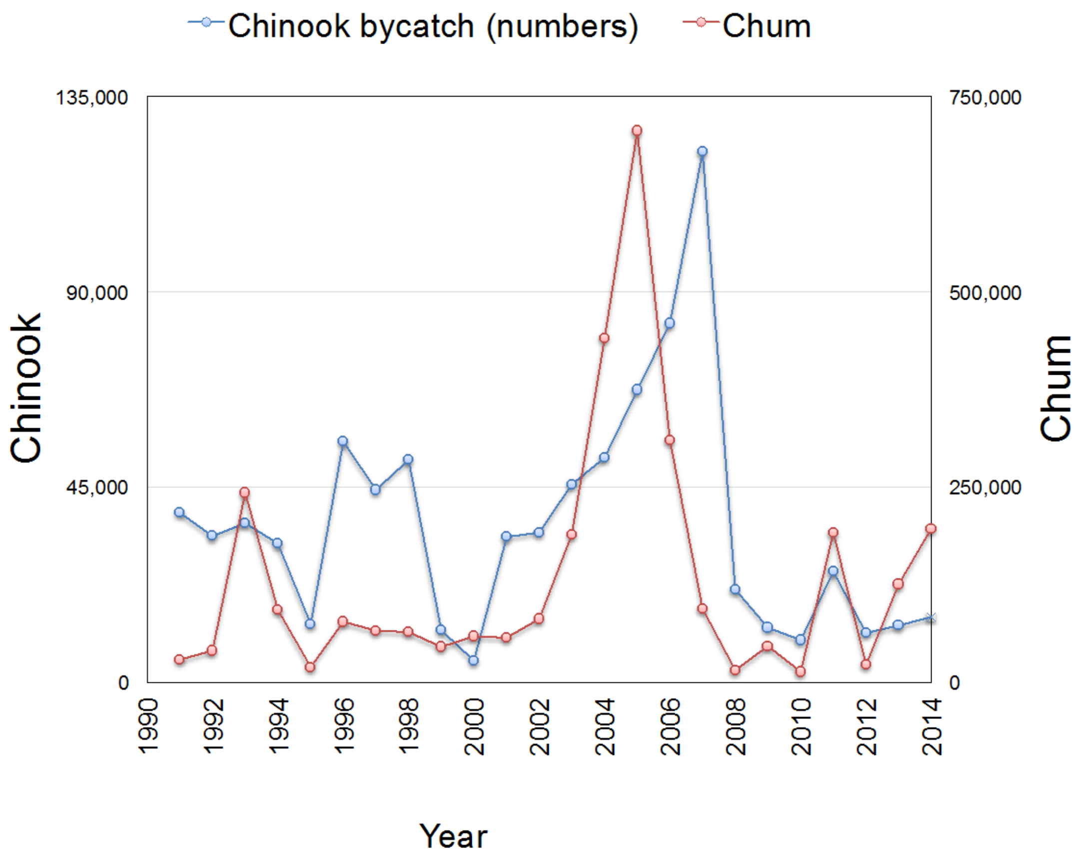

Figure 1. Time series of Chinook and chum salmon bycatch in the pollock fishery, 1991-2014.

The overall impact rate (salmon bycatch/run size) was estimated for the historical levels of chum and Chinook PSC from the pollock fishery to best estimate impacts at the population level. Some key western Alaska river systems can be differentiated from the available genetic data and that, coupled with available run size data, allows for the calculation of the pollock fishery impact rate. For Chinook salmon, the peak impact to the aggregate Coastal western Alaska stocks (rivers in western Alaska from Norton Sound to Bristol Bay, excluding the Upper Yukon) was 7.50% in 2008 (one year after the historically high bycatch in the fishery), while the impact rate in 2012 was estimated at 1.98%. For the Upper Yukon, the peak was also in 2008 at 4.00%, with 2012 estimated at 1.35%. Since Chinook PSC has remained low, most likely these 2012 impact rates are representative of impacts in 2013 and 2014. For chum, the average impact rate (2004 through 2011) for Coastal west Alaska was 0.46% with the Upper Yukon (fall chum) at 1.16%.

Analysis of Alternative 1 since implementation of Amendment 91 in 2011 has shown that, under status quo, the rates have declined for all sectors in recent years. Similarly, bycatch rates by week pre- and post-Amendment 91 show declines in each week, and indicate that the fleet is focusing on fishing earlier in the B-season to avoid high summer bycatch rates in September and October. However, a substantial increase in bycatch occurred in 2011, compared to 2008 through 2010, largely driven by increased bycatch in the B-season as compared with the B-season trends in 2008 through 2010. A recent study evaluating vessel-based behaviour since 2011 suggested that not all vessels in the fleet had modified behaviour in conjunction with the new management measures, and that room for improved vessel behaviour appeared to be related to fishing activities in the B-season.

Alternatives 2 through 6 provide additional measures for increased reduction of Chinook and chum PSC. Information is insufficient to compare estimated impacts in terms of AEQ or impact rates, thus, alternatives are compared in conjunction with whether or not bycatch is estimated to increase or decrease from status quo for each species under the proposed alternative. Alternative 2 focuses only on chum salmon measures, however it does provide some increased flexibility for the fleet to avoid Chinook, as bycatch rates increase in the B season. Alternative 2 is likely to result in similar impacts to chum salmon as with status quo measures, although there is the potential for some increased chum salmon savings over status quo, given some operational modifications to the proposed RHS system. There is also the potential for increased chum removals when chum closures are suspended. While it is not possible to directly quantify these benefits, any reduction of Chinook and chum salmon bycatch will reduce adverse impacts on salmon stocks. Therefore, this alternative is estimated to have some (likely small) reduced adverse impact as compared with status quo for salmon stocks.

Alternative 3 proposes additional provisions within IPAs to explicitly increase the incentive to avoid Chinook salmon PSC. It is not possible to quantify the impacts of all of the measures within IPAs to these additional restrictions nor to estimate the relative reductions in salmon bycatch that would result from IPAs implementing these provisions. Nevertheless, this alternative is estimated to be similar to status quo in impacts under these options with the possibility of a reduced adverse impact to Chinook salmon, depending upon the severity of the penalties imposed by the IPAs or if fishing is reallocated earlier based on late-season incentives. The impacts to chum salmon under this alternative are assumed to be the same as with status quo.

Alternative 4 modifies the season opening and closing dates for the B season, and contains an option to shift the pollock quota 5% to10% to the A season. The purpose of these modifications is to provide additional opportunities and incentives for fishing earlier in the year (in both A and early B season) in order to avoid fishing when Chinook bycatch rates are historically high. Under the options to close the fishery in September and October, while it is unclear whether all of the pollock quota could be caught prior to these ending dates, some additional effort would likely be shifted earlier in the season. Analysis of this alternative indicates that with fishing occurring earlier in the B season under both season-date options, there is likely to be reduced Chinook bycatch by shifting effort away from September and October, the months historically with the highest rates. However, under the option to shift pollock quota between seasons, results are varied regarding the impact on overall Chinook bycatch. In general, this option is estimated to reduce adverse impacts to Chinook salmon, although this reduction is entirely dependent on vessels avoiding high-bycatch at the end of the B season, either through mandate, choices by vessels to fish earlier, or sufficiently strong IPA measures. It is also contingent on vessel behavior and bycatch rates in the A season, when the additional quota is harvested. As shown in a C-4 addendum, there are likely to be increased economic benefits to moving quota to the A season. Shifting effort earlier into the B season may result in slightly higher adverse impact to chum salmon PSC compared with status quo, but these impacts are expected to be negligible.

Alternative 5 would modify the existing PSC limit and/or performance standard threshold under the Chinook Salmon Bycatch Management Program (Amendment 91) in years of low Chinook abundance. An index of the combined run sizes from three river system ('3 System Index') using the following river systems Unalakleet, Upper Yukon, and Kuskokwim in-river run reconstructions is proposed for use in determination of 'low abundance". Low abundance is to be defined as an annual combined 3-system run size of ≤250,000 Chinook salmon. A range of proportional reductions to the PSC limit and/or performance standard threshold are considered annually. Based on data on run reconstructions, the low threshold would have been reached in 2000, and again from 2010 through 2014. Estimated impacts of lowering the performance standard threshold in 2011 through 2013 (data are insufficient to estimate impacts from 2001), indicates that the only threshold that might have had a constraining impact (and, thus, estimated salmon savings) would be the 60% annual reduction in the year 2011. However, it is difficult to predict backwards in time how vessels and the parties to the IPAs would have operated in 2011 to address the potential implications of a lower performance threshold. Under these conditions, vessels would have faced a lower performance standard threshold from the beginning of the year and, in all recent years, would have had an incentive to avoid Chinook throughout the year to avoid exceeding the performance standard. It is possible that a large gap between the performance standard threshold and PSC limit would encourage IPAs to risk exceeding the lower level in those years and, if so, to revise the IPA for the resulting PSC limit of their portion of the 47,591 (or whichever performance standard threshold is applicable in that year), and/or respond slowly to the need to operate under the lower performance standard threshold, as the lower PSC limit would not be imposed until the third of 7 years. Nevertheless, this alternative is assumed to reduce adverse impacts as compared with status quo, understanding that actual impacts are highly contingent on IPAs continuing to reduce bycatch at low levels of encounters below specific PSC limit.

The intent of reducing PSC limits under this alternative is to reduce the risk to western Alaska Chinook salmon stocks when they are at critically low levels of abundance. Chinook salmon stocks in western Alaska continue to fail to meet escapement goals, and consequently all fishery sources of mortality must be reduced.

Regulatory Impact Review

The analysis of costs and benefits of the alternatives contained in the Regulatory Impact Review (RIR) provides an impacts discussion on salmon, and provides a qualitative treatment of potential effects on pollock fishery operations, both of which are based almost entirely on the analysis presented in the EA. The RIR also provides background information regarding the status quo conditions in both the pollock fishery and potentially affected salmon fisheries. The RIR provides a largely qualitative treatment of the potential effects of the alternatives on the pollock fishery.

Alternatives 1 and 2
Section 3.3.1 provides an assessment of the effects of the alternatives on pollock. That assessment has determined that Alternatives 2 through 5 are estimated to result in no significant changes to the pollock stock, relative to Alternative 1. As such, the estimated impacts on the fishery as it relates to pollock catch are best approximated by the status quo. Alternative 2 proposes a revised RHS system similar to the one in operation under Alternative 1. RHS closures will move the fishery around spatially and temporally, while ceasing to do so as Chinook PSC increases later in August into September.

Alternative 3
Overall, the options analyzed under Alternative 3 are all intended to increase the incentives to reduce Chinook bycatch within the IPAs. Any incentive at the vessel level that translates into increased savings of Chinook salmon results in reduced salmon bycatch overall. It is not possible to quantify the compliance of vessels within IPAs to these additional restrictions. Alternative 3 modifies some of the provisions within the IPAs to better address vessel-specific behavior and, thus, may increase some of the constraints on individual vessels, but Alternative 3 is not likely to result in forgone pollock harvest. Similarly, it is not possible to quantify the potential operational costs that may be incurred in further avoidance of Chinook.

Alternative 4
Alternative 4 modifies the start and end dates of the pollock season to begin earlier (option 1) and end earlier (option 2 with suboptions) and includes a separate option to shift 5% to 10% of the annual pollock quota to the A-season. Shifting the B-season opening date sooner (to June 1) would likely reduce Chinook salmon bycatch assuming some vessels choose to start fishing earlier, although this may conflict

with other opportunities (e.g., such as using pollock vessels to tender other non-pollock fishing operations, such as directed herring and salmon).

Section 3 contains an analysis of the option to close fishing earlier (Sept 15th, Oct 1st, and Oct 15th). That analysis assumes that all pollock catch was achieved in the time frame leading up to the closure. For contrast, Table 46 provides actual values of the pollock that would have been forgone after the closure dates. This information is an approximation of the worst-case scenario for pollock; however, it is expected that additional effort would be shifted to earlier in the season in order to catch all available quota, albeit with potentially greater operational costs. However, it is not expected that pollock TAC, and thereby gross revenue, would actually be forgone.

Alternative 4, Option 3 would change the allocation of pollock to have 5% and 10% more of the annual TAC be taken in the A-season. Vessels typically come very close to their A-season allocation in virtually every year, suggesting that the 40 percent cap does constrain the fishery and that additional flexibility would likely lead to more fishing in the A season.

The analysis shows that a 5 percent shift of pollock catches to the A season would result in more than $15 million in increased Value per Caught Weight. The 10 percent shift doubles this estimate to more than $30 million. This estimate assumes that the A-season product value premiums will be fully earned; however, that is not likely to be the case. What this TAC shift is more likely to do is to extend the A season fishing activity into later March and April for different vessels when these premiums are not likely to be as high.

The A-season TAC shift may provide considerable secondary economic benefit to fishery dependent communities. These benefits would accrue through greater earnings for shore-based processing plants, due to higher A-season product values. There may also be greater earnings by vessel crew, with associated increases in expenditures when in port. The magnitude of such benefits cannot be quantified; however, we note that they are likely to accrue, all else equal. Thus, is it is expected that there will be some economic gains from fishing in the A-season versus the B-season, but the degree of this benefit will depend on market conditions for different products, fish size caught in the fishery, the product recovery rate of fish caught, the value and quantity of roe, and how much of the fish that is transferred comes from the end of the B-season. Considerable variation is likely among future years. **In sum, given more recent values and the range of estimates, a 5 to10 percent gain in gross revenue per ton of pollock product appears plausible.** Note that because costs are expected to be relatively similar, the change may represent a larger percentage change in net benefits, all else equal.

Alternative 5

Alternative 5 would modify the existing PSC limit and/or performance standard threshold under Amendment 91 in years of low Chinook abundance. An index of the combined run sizes from three river system (‘3 System Index’) using the following river systems Unalakleet, Upper Yukon, and Kuskokwim in-river run reconstructions are proposed for use in determination of low abundance (See Section 2.5 for more details on the justification for these river systems). Low abundance would be defined as an annual combined 3-system run size of ≤250,000 Chinook salmon. A range of proportional reductions to the PSC limit and/or performance standard threshold is evaluated annually (25% and 60%).

There are two options included in the time frame over which this estimation of ‘low abundance’ would be assessed, (1) to apply based on a one-year determination, or (2) as an average of two years. The 3-run index of run reconstruction estimates shown in Table 6 show that the years in which the ‘low abundance’ threshold would have been reached, based on a one-year determination, would have occurred in 2000, and 2010 through 2013. The two-year average would have applied to just 2010 through 2013. Given the timing of the specifications process and the status determination from the preliminary run reconstruction from the 3-system index (as noted in section 2.5), a determination in one year (or a two-year average) would enact a lower performance standard threshold (or lower PSC limit and performance standard threshold) the following year. Thus, for example, in 2000 a determination of a low abundance threshold would have been made and resulting lower PSC limits put into place for 2001 fishing year. In 2001, the run reconstruction showed that the total run estimate for the index was above the threshold, so the relative constraint would have only been in place for one year and then reverted to the original performance standard. Had this program been in place in that year, the one-year switch to a lower performance threshold (without the knowledge that it was a one-year-only determination) would likely have caused the fleet to stand down from traditional areas and also would likely have affected incentive behavior controls under the IPAs.

It should be noted that vessels would have faced a lower PSC limit and/or performance standard threshold from the beginning of the year, and in all recent years would have had an incentive to avoid Chinook throughout the year to avoid reaching the limits. Analysis of this alternative was limited to considering historical catch, and employing cut off dates based on a new B season threshold only as a worst-case scenario evaluation. This evaluation, however, is limited by an inability to quantitatively estimate what behavioral changes would occur by industry when revising the IPAs to accommodate these potential restrictions and improve incentives accordingly. It is unknown whether the gap between the performance standard threshold and PSC limit would encourage IPAs to be more likely to risk exceeding the lower level in those years and, if so, revise the IPA for the resulting PSC limit of their portion of the 47,591, and/or respond slowly to the need to operate under the lower performance standard, as the PSC limit would not be imposed until the third of seven years. In addition, it is uncertain whether sectors, cooperatives, CDQ groups, or individual vessels would opt-out of the IPA (e.g., a sector chooses not to submit an IPA, or a cooperative, CDQ group, or vessel chooses not to participate in an IPA), and instead be subject to the opt-out allocation, which is the sum of each opt-out vessel's portion of the opt-out cap of 28,496 or the performance standard threshold, whichever is less. Sectors, cooperatives, or CDQ groups that opt-out would not receive any direct allocation of Chinook salmon. As the opt-out cap is approached, NMFS will close the pollock fishery to opt-out vessels to prevent exceeding the opt-out allocation.

Alternative 6

Alternative 6, the Council's preferred alternative (PA), is a combination of elements of Alternatives 2, 3, 4 and 5. Alternative 6 is expected to decrease the amount of pollock caught in B season by up to 5 percent. How this will affect the timing of fishing by individual vessels is unknown, but it will enable vessels to complete their pollock fishing and should reduce Chinook bycatch as a result of any reduction that occurs later in the season. Because of this and current efforts by industry to reduce Chinook bycatch, the net reduction in Chinook from the options added to the IPA requirements could be reduced because there is likely to be less fishing in October. This means, for example, operating excluder devices or the rolling hotspot program late in the year may not affect as many vessels or trips.

The combination of measures from Alternatives 4 and 5 (pollock reapportionment and cap reductions) is likely to make it easier for vessels to stay below their allocations under a reduced performance standard threshold and PSC limit because it is less likely that vessels will need to fish in the high Chinook bycatch period late in the B-season to catch their pollock allocation.

Because under Alternative 6 the gap between the performance standard threshold and the PSC limit has increased from 26 to 35 percent of the performance standard threshold relative to the current gap, the incentive to participate in an IPA does not appear to be diminished. The reduced duration of credits for inshore vessels makes it more likely that credits earned in a year will be useful in the future, although it is apparent from public testimony that vessels and companies are striving not to need to use the credits at any point.

Fishery Dependent Communities
The RIR also considers potential effects on Fishery Dependent Communities. The effects of the alternatives on the pollock fishery do not include any significant impacts to the pollock stock, no direct changes to the pollock TAC, and do not directly affect fishing communities. Several of the alternatives do have the potential to add constraints to vessel operations and possibly to increase operational costs for things such as fuel, crew food, and gear; however, assuming acquisitions were made in communities adjacent to the fishing ground, expenditures in port for such items would provide economic benefits to fishery dependent communities. Further, permitting a seasonal shift in pollock catch could result in a net increase in product value for both the at-sea and shoreside sectors. Such an increase in shoreside product value would also be an economic benefit to fishing communities. Because vessels typically catch all of their A season pollock allocations when they could choose to "roll over" pollock to the B season, indications are that for economic reasons at least some portion of vessels will choose to catch additional pollock in the A season. In sum, adverse effects on fisheries dependent communities are not evident for any of the alternatives.

Improvements to monitoring, enforcement, and administrative provisions
Finally, section 4.8.4 in the RIR provides an estimate of projected costs and benefits of NMFS's recommended improvements monitoring, enforcement, and administrative provisions under all alternatives. As described in Section 2.7, NMFS proposes to (1) clarify the requirement that all catcher vessels in the BS pollock fishery must retain all salmon and deliver them to the processor; (2) remove the requirement that all salmon be stored in an refrigerated seawater tank; (3) require that, after observer sampling, data collection, and crew sorting is completed, any loose fish on deck would be made unavailable for sorting and discard; and (4) require that the vessel operator notify the observer at least 15 minutes before transfer, sorting, handling, or discard of any catch prior to delivery of catch to the processor.

Whether the benefits of securing loose fish on deck outweigh the costs depends on how much the current situation is undermining the salmon PSC census. The degree of incentive to discard salmon depends on the number of salmon allocated to a particular vessel from its cooperative, the salmon PSC counted thus far in the season or year, and the consequences of additional salmon PSC by the vessel. Any amount of salmon PSC is of concern to most vessel operators, however, some vessels have relatively small amounts of Chinook salmon PSC allocated from their cooperatives. Salmon PSC rates vary, and it is difficult to predict the number of salmon in the loose fish on the deck of a vessel. Many hauls have little or no salmon, but some hauls may contain a large number of salmon. Under some circumstances there may be sufficient salmon in the loose fish on deck, and sufficient opportunity, to create the incentive necessary for vessel crew to discard salmon without detection by the observer. NMFS recommends securing loose fish on deck to reduce the opportunity for discard.

As described in Section 2.7, NMFS also recommends extending the requirement to provide a computer with ATLAS software installed on it to vessels less than 125 ft LOA while participating in the BS pollock fishery. However, NMFS is not proposing to require the at-sea transmission of the data from these vessels.

Based on recent participation information, expanding ATLAS requirements would affect 55 catcher vessels less than 125 ft LOA. Five of these 55 vessels have voluntarily provided ATLAS to the assigned observer, another 13 of the 55 vessels participate in the rockfish program fishery which requires the vessel provide a computer and the ATLAS program to the observer. Of the 13 vessels that participate in the Rockfish Program, 5 have installed ATLAS on a computer that remains on board the vessel throughout the entire year, the remaining 8 share one or more laptops and provide the computer and ATLAS program to the observer only when required. This is possible because not all 8 vessels conduct fishing activity at the same time, so they can move the laptop from one vessel to another as they enter or exit the rockfish program fishery. This will not be the case for vessels participating in the AFA fishery because largely, the vessels are all out fishing at the same time and each vessel will need to provide the computer and ATLAS program simultaneously.

Most vessels required to install ATLAS on a computer onboard the vessel comply with this requirement by allowing NMFS to install ATLAS on an existing computer on the vessel. When this occurs, the cost of providing the computer is minimal. Some vessels may elect to purchase a laptop separate from the vessel's existing computer and have ATLAS installed on that laptop. In the case a vessel does not already have an existing computer that supports the ATLAS program; a new computer would need to be purchased. NMFS has estimated the cost of a computer that would meet the regulatory requirements at approximately $600. If all 55 vessels affected by the proposed requirement select this option, the fleet-wide cost of providing a laptop computer would be approximately $33,000 (55 x $600), since 10 vessels already have ATLAS installed onboard the vessel, the maximum fleet-wide cost would be approximately $27,000 (45 x $600). Most, if not all, of the vessels already have a computer that meets the minimum requirements and they would only incur costs if they choose to purchase an additional computer. Therefore, the mandatory costs of providing a computer would be much less than $33,000 and may even be zero.

Requiring vessels to provide a computer installed with observer data entry software will allow observers to electronically enter data in the field, saving NMFS the costs of hand keying observer data. Observers currently assigned to AFA catcher vessels <125' LOA document data on paper forms onboard the vessel and transmit data to NMFS at the end of each fishing trip using a fax machine provided by the processor receiving the vessel's AFA catch. NMFS estimates that it takes 3 hours of staff time per delivery to enter observer data received by fax. Data entry staff time costs $50/hour. Therefore, the estimated cost to NMFS of entering faxed data is $150 per delivery. Based on the number of trips by catcher vessels less than 125 feet LOA in the BS pollock fishery, NMFS estimates that the average cost of entering faxed data is about $145,000 per year. This cost would be eliminated or significantly reduced if all observer data were transmitted electronically to NMFS.

NMFS made several other recommendations, all of which were adopted by the Council in it selection of the preferred alternative. These include a proposed revision of the regulatory language to clarify that *the salmon storage container* on catcher/processors and motherships (and not each individual salmon in the container) must remain in view of the observer at the observer sampling station at all times during the sorting of each haul. In addition, all salmon must be removed from the salmon storage container and adjacent area at the end of each haul or delivery. Further, Table 47 to part 679 will be removed from the regulations. These revisions should not impose any additional costs on industry.

Finally, the deadline for three annual reports associated with the BS pollock fishery will be revised to reduce the time available to prepare the reports. Depending on the availability of information for the reports and the people and resources to complete the reports, this earlier deadline may impose some costs on industry.

Comparison of Alternatives for Decision-making

Table 1 provides an overview of the major similarities and differences amongst the alternatives, while Table 2 provides a summary of the major potential benefits, key concerns and policy-level trade-offs amongst them.

Table 1. Summary and comparison of alternatives.

Alt	Chinook PSC limit	Non-Chinook PSC limit	IPA requirements	Pollock seasons
1	60,000 PSC limit 47,591 performance standard Divided by sector and season.	PSC limit closes Chum salmon savings area (August 1-31 by regulation). Pollock fishery exempt if in RHS program	To allow for allocation of the 60,000 PSC limit and 47,591 performance standard: Chinook IPA must meet requirements. IPAs approved by NMFS.	A season: January 20-June 9th B season: June 10-Nov 1
2	Same as Alt 1	Status quo PSC limit and closure for any vessels not participating in an IPA which includes chum bycatch management	Requirements for IPA would be modified to include chum bycatch management. Focus on avoidance of western AK chum and not increasing Chinook bycatch	Same as Alt 1
3	Same as Alt 1	Same as Alt 1	Modify IPA requirements for Chinook to include: • Restrictions/penalties on high bycatch rate vessels • Salmon excluder devices • RHS continuously in A and B seasons • Modify duration of salmon savings credit • Restrictions/performance criteria for bycatch rates in October	Same as Alt 1
4	Same as Alt 1	Same as Alt 1	Same as Alt 1	**A season:** Jan 20th-May 31st (or Jun 9th) **B season:** Open: Jun 1- (or Jun 10th) Close: Sept 15th or Oct 1st or Oct 15th Pollock **A:B allocation** (with rollover): 1) 45:55 or 2) 50:50
5	Reduce performance standard by 25% or 60% Reduce PSC limit by 25% or 60%	Same as Alt 1	Same as Alt 1. However IPAs will need to adjust their programs to accommodate a lower performance standard (and PSC limit) in low Chinook salmon abundance years	Same as Alt 1
6	45,000 PSC limit 33,318 Performance standard in years of low abundance. Divided by sector and season.	Status quo PSC limit and closure for any vessels not participating in an IPA which includes chum bycatch management	Modify IPA requirements for Chinook to include: • Restrictions/penalties on high bycatch rate vessels • Salmon excluder devices • RHS continuously in A and B seasons • Modify duration of salmon savings credits • Restrictions/performance criteria for bycatch rates in October	Pollock **A:B allocation** (with rollover): 45:55

Table 2. Summary major policy-level issues and trade-offs among alternatives.

Alt	Policy-level trade-offs
1	**Status quo issues**: • Chum salmon PSC management intended as an interim measure while better approaches are developed. • Regulations limit flexibility in RHS program. • Chinook PSC management effective at keeping bycatch below limits but could improve on objective to affect vessel behavior under conditions of low salmon encounters. • Need to account for both salmon species with regard to objectives.
2	**Potential benefits** • Likely to provide greater flexibility to modify RHS program to best suit goals and objectives to focus upon protections for WAK chum stocks while continuing to avoid Chinook. **Key concerns** • Potential for increased chum bycatch when RHS closures are lifted or modified to avoid Chinook salmon. • Assumes that Chinook opt-out provisions and CSSA exemption provide sufficient incentive to participate in an IPA.
3	**Potential benefits** • Likely to provide incremental improvement in Chinook bycatch incentives over status quo, although larger potential penalties would provide stronger incentives for vessels to avoid Chinook. • More flexible and adaptive means of increasing IPA incentives for bycatch reduction than mandating explicit measures by regulation; however, actual impact will depend upon how the IPAs respond to additional requirements. • October bycatch performance incentives can bring down Chinook PSC but still maintain pollock fishery flexibility. **Key concerns** • Depending on IPA response, most of the items in this alternative likely to result in only minor changes relative to Alt 1. • Management measures are outside of regulation and it may be difficult to monitor in terms of incentives and effectiveness. Sectors can dramatically change the form of the IPAs in response to adjustments here.
4	**Potential benefits** • Options to curtail season earlier likely to provide the greatest reduction in Chinook salmon PSC over other alternatives. • Option to open B-season 9 days earlier likely to encourage additional earlier fishing effort in B season and reduce Chinook bycatch. • Options to reallocate additional pollock quota to A-season may provide additional tools to encourage less fishing at end of B season **Key concerns** • Risk that pollock may be forgone in B season depending upon season length options. • Differential impacts by sectors as some sectors have historically completed fishing by proposed end dates. • High potential to increase chum bycatch by increased fishing pressure earlier in B season. • Seasonal quota reallocation may provide tool to encourage fishing earlier but lacks restrictions on fishing at the end of B-season—this change alone could increase rates in some years. Some vessels currently choose to pursue other activities outside of the pollock fishery early in the B season and may continue to do so without new incentives or restrictions. • Presumes IPA structure combined with A91 limits and seasonal allocation sufficient to keep A-season PSC from increasing • Some form of Steller sea lion consultation would need to be pursued.
5	**Potential benefits** • Threshold for more restrictive management is an index of low abundance. In a year or years of low Chinook abundance (2010-2014) then application of different management measure to reduce risk of reaching PSC limits. **Key concerns** • Some relationship of PSC to run size but at low threshold, significant additional reductions may be difficult to realize. • In some individual years (e.g., 2000) the threshold may be met but run sizes could rebound quickly (e.g., in 2001). Such a sequence may significantly increase the costs of Chinook avoidance to the pollock fishery, including that some vessels might not harvest their pollock allocations. • Impacts will be contingent on how IPAs adapt to lower performance standard threshold or lower PSC limit in applicable years. Allocations to individual vessels under lowest performance standard may be very constraining and result in modification to the IPAs within sectors. • Potential that reducing performance standard threshold while retaining higher PSC limit in applicable years will provide perverse response to PS under current IPA structures based upon an evaluation that the Chinook stock will be above the threshold in subsequent years and that it could provide increased incentive to exceed the performance standard threshold. • While vessels often have the ability to move or avoid areas or change when they fish to reduce Chinook bycatch, we do not know how difficult it will be for vessels to avoid Chinook in the future.

Alt	Policy-level trade-offs
6	**Potential benefits** • Likely to provide greater flexibility to focus upon protections for WAK chum stocks while continuing to avoid Chinook. • Likely to provide incremental improvement in Chinook bycatch incentives, although larger potential penalties would provide stronger incentives for vessels to avoid Chinook. • More flexible and adaptive means of increasing IPA incentives for bycatch reduction; however, actual impact will depend upon how the IPAs respond to additional requirements. • October bycatch performance incentives can bring down Chinook PSC but still maintain pollock fishery flexibility. • Reallocating additional pollock quota to A-season may provide additional tools to encourage less fishing at end of B season. • Threshold for more restrictive management is an index of low abundance. In a year or years of low Chinook abundance (2010-2014) then application of different management measure to reduce risk of reaching PSC limits. **Key concerns** • Depending on the economic choices of different vessels and the strength of IPA incentives to have low bycatch in October, it is uncertain how much fishing will be reduced late in the B season in all years which would reduce Chinook bycatch to the greatest degree. • The reduction in the PSC limit and performance threshold level will require some changes in the inshore and mothership IPA programs; how these changes will impact the strength of incentives is unclear. • The reduction in allocations at the vessel/platform level increases the likelihood that vessels will increase costs and reduce product value in efforts to further reduce Chinook bycatch.

Selection of the preferred alternative

As noted previously, the alternatives under consideration, while analyzed individually, are not mutually exclusive. In selecting the preferred alternative (PA), and in particular with combining aspects across alternatives, the Council considered policy objectives associated with each and the potential downstream impacts of pulling some aspects forward and not others. Over-arching policy goals in the suite of alternatives include providing greater flexibility to the pollock fleet to avoid bycatch, with provisions to prohibit bad behavior at times of higher Chinook bycatch. Some options within alternatives are redundant or in conflict with other options, however. Table 3 is provided to summarize which options can be combined, as well as how options meet the range of objectives in the Council's purpose and need. Table 4 contains an estimate of impacts within options across categories of Chinook and chum bycatch and pollock harvest. Note this does not include mixing across alternatives and the related impacts of doing so.

At final action the Council selected a PA which is a combination of options in all of the action alternatives. In doing so, the Council seeks to balance the goals and objective in the purpose and need statement (Section 1.1), the ten National Standards (Section 5.1), concerns with balancing competing conflicts, interests, and management programs, as well as input from the public in selecting a PA.

Table 3. Summary of alternatives and options relative to Council intent, management tools and ability to combine across alternatives in constructing a preferred alternative.

Alt /Option	Management tools considered under alternatives	Potential to combine with other tools
	Tools to reduce fishing during times of high Chinook encounters	
4.1	• Modify B-season opening	Yes all Alts
4.2	• Shorten B-season	For all but Alt 3.5
3.5	• Penalties within IPAs for Oct PSC	For all but Alt 4.2
4.3	• Shift quota to A-season	Yes for all alts
	Tools to help increase incentives to reduce Chinook PSC	
5.1 and 5.2	• Reduced performance standard	Yes all alts
5.1 and 5.2	• Reduced PSC limit and performance standard	Yes all alts
3.5	• IPA penalties on high PSC vessels	Yes all alts
3.2	• Mandate excluders within IPAs	Yes all alts
3.5	• IPA penalties for high PSC in Oct	For all but 4.2
3.4	• Revise credit system for CVSSIP	Yes all alts
3.3	• Retain RHS all season	Yes all alts
	Avoid high bycatch of chum	
2	• Incorporate chum into IPAs	Yes all alts

Table 4. Summary of alternatives and options in relation to Council management objectives and whether options can be combined in selecting a preferred alternative. The symbols ↑, ↔, and ↓, reflect improvements, relative neutrality, and potential negative effect (all relative to status quo), respectively.

Alt/Opt	Measure	Chinook PSC	Chum PSC	Pollock Fishing Flexibility
4.1	Modify B-season opening	↑	↑	↔
4.2	Shorten B-season	↑	↔	↓
3.5	Penalties within IPAs for Oct PSC	↑	↔	↓
4.3	Shift quota to A-season	↔↑	↑	↑
5.1, 5.2	Reduced performance standard	↔↑	↔	↓
5.1, 5.2	Reduced PSC limit and performance standard	↑	↔	↓
3.5	IPA penalties on high PSC vessels	↔↑	↑↔	↔
3.2	Mandate excluders within IPAs	↑	↑	↓
3.5	IPA penalties for high PSC in Oct	↔↑	↑↔	↔↓
3.4	Revise credit system for CVSSIP	↑	↔	↓
3.3	Retain RHS all season (CVs)	↑	↔	↓
2	Incorporate chum into IPAs	↔	↔↑	↑
	Add rule to only allow fishing late if also fished early	↑↔	-	↑

1 Introduction

This document analyzes proposed management measures that would address Chinook salmon and chum salmon prohibited species catch (PSC) management and apply exclusively to the directed pollock fishery in the eastern Bering Sea (BS). Pollock is harvested with fishing vessels using trawl gear, which are large nets towed through the water by the vessel. Pollock can occur in the same locations as Chinook salmon and chum salmon. Consequently, Chinook salmon and chum salmon are accidently caught in the nets as fishermen target pollock. The measures under consideration include: requiring incorporation of chum salmon PSC management into existing Chinook salmon incentive plan agreements (IPA), modifying IPA requirements to add provisions and more stringent restrictions for Chinook salmon PSC management, modifying the existing pollock season dates and seasonal pollock allocations, and adding a lower Chinook salmon PSC limit and/or performance standard that would be employed in years of low Chinook salmon abundance.

The Magnuson-Stevens Act defines bycatch as fish that are harvested in a fishery, which are not sold or kept for personal use. Therefore, Chinook salmon and chum salmon caught in the pollock fishery are considered bycatch under the Magnuson-Stevens Act, the FMP, and NMFS regulations at 50 CFR part 679. Bycatch of any species, including discard or other mortality caused by fishing, is a concern of the Council and NMFS. National Standard 9 of the Magnuson-Stevens Act requires the Council to select, and NMFS to implement, conservation and management measures that, to the extent practicable, minimize bycatch and bycatch mortality.

The bycatch of culturally and economically valuable species like Chinook salmon and chum salmon, which are fully allocated and, in some cases, facing conservation concerns, are categorized as prohibited species under the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP) and are the most regulated and closely managed category of bycatch. The FMP requires that groundfish fishermen avoid bycatch of prohibited species. Pacific salmon, steelhead trout, Pacific halibut, king crab, Tanner crab, and Pacific herring are classified as prohibited species in the groundfish fisheries off Alaska.

As a prohibited species, fishermen must avoid salmon bycatch and any salmon caught must either be donated to the Prohibited Species Donation (PSD) Program, or returned to Federal waters as soon as practicable, with a minimum of injury, after an observer has determined the number of salmon and collected any scientific data or biological samples. The PSD Program was initiated to reduce the amount of edible protein discarded under PSC regulatory requirements. One reason for requiring the discard of prohibited species is that some of the fish may live if they are returned to the sea with a minimum of injury and delay. However, salmon caught incidentally in trawl nets always die as a result of that capture. The PSD Program allows enrolled seafood processors to retain salmon bycatch for distribution to economically disadvantaged individuals through tax-exempt hunger relief organizations.

Throughout this analysis Chinook salmon and chum salmon that are bycaught in the pollock fishery are noted as salmon 'PSC', but are also referred to by the Magnuson-Stevens Act definition of bycatch when discussing overall purpose and need, objectives, and terminology within the industry IPAs.

This document is an Environmental Assessment/Regulatory Impact Review (EA/RIR). An EA/RIR provides assessments of the environmental impacts of an action and its reasonable alternatives (the EA) and the economic benefits and costs of the action alternatives, as well as their distribution (the RIR). This EA/RIR addresses the statutory requirements of the Magnuson-Stevens Fishery Conservation and Management Act, the National Environmental Policy Act, Presidential Executive Order 12866, and the Regulatory Flexibility Act. An EA/RIR is a standard document produced by the Council and the National

Marine Fisheries Service (NMFS) Alaska Region to provide the analytical background for informed decision-making.

1.1 Purpose and Need

The purpose of this proposed action to minimize Chinook salmon and chum salmon bycatch in the Bering Sea Pollock fishery to the extent practicable. This action is needed to make Chinook salmon and chum salmon bycatch management more effective, comprehensive, and efficient.

The Council adopted the following purpose and need statement in June 2014:

> *The current chum salmon bycatch reduction program under Am 84 does not meet the Council's objectives to prioritize Chinook salmon bycatch avoidance, while preventing high chum salmon bycatch and focusing on avoidance of Alaska chum salmon stocks; and allow flexibility to harvest pollock in times and places that best support those goals. Incorporating chum salmon avoidance through the Incentive Plan Agreements (IPAs) should more effectively meet those objectives by allowing for the establishment of chum measures through a program that is sufficiently flexible to adapt to changing conditions quickly.*
>
> *Chinook salmon are an extremely important resource to Alaskans who depend on local fisheries for their sustenance and livelihood. Multiple years of historically low Chinook salmon abundance have resulted in significant restrictions for subsistence users in western Alaska and failure to achieve conservation objectives. The current Chinook salmon bycatch reduction program under Am 91 was designed to minimize bycatch to the extent practicable in all years, under all conditions of salmon and pollock abundance. While Chinook salmon bycatch impact rates have been low under the program, there is evidence that improvements could be made to ensure the program is reducing Chinook salmon bycatch at low levels of salmon abundance. This could include measures to avoid salmon late in the year and to strengthen incentives across both seasons, either through revisions to the IPAs or regulations.*

1.2 History of this Action

The Council has been actively addressing Chinook and chum salmon PSC measures since the mid-1990s. Previously triggered time and area closures (Salmon Savings Areas (SSA)) have been used to manage chum and Chinook in the Bering Sea. These closures were designed based on analyses of groundfish observer data collected from 1990 through 1995. However, the efficacy of these closures was called into question when the fleet began observing that salmon bycatch rates were higher outside of the closures when triggered than inside of the closures. The industry began voluntarily participating in an Inter-cooperative Agreement (ICA) for salmon bycatch in which a private contractual agreement between fleet participants established a rolling hot spot (RHS) program through which the fleet would agree to adhere to short-term (4-day to 7-day) closures in discrete areas of the Bering Sea when observed salmon bycatch was high. The RHS program was initially developed to reduce bycatch of Chinook and 'other' salmon (primarily chum) in order to avoid triggering the closures themselves; however, eventually it became clear that the SSAs were exacerbating salmon bycatch by inadvertently inducing the fleet to move into areas of higher rates (NPFMC, 2005). Numerous requests from the pollock industry led to Amendment 84, which exempts the fleet from the SSAs, provided they participated in the ICA. Detailed regulations specified all of the provisions in the RHS program from the contractual agreement. This exemption was always intended to be an interim measure while the Council explored alternative salmon bycatch management measures.

In response to heightened concerns over all sources of Chinook salmon mortality, and due to high salmon bycatch in several years (Figure 2), the Council took action to reduce Chinook salmon bycatch in the pollock fishery by imposing Amendment 91 to the BSAI FMP in 2011 (NMFS 2010). Previous restrictions for Chinook salmon bycatch had been addressed through the time and area closures noted above (Stram and Ianelli 2009), but these measures did not serve to minimize consistently Chinook salmon bycatch each year. Consequently, new measures were developed that imposed limits on the Chinook salmon bycatch by fishery sector and season. The measures set limits to close fishing by sector and season, but also include some flexibility through creation of industry IPAs to further reduce salmon bycatch below the established performance standard. The IPAs are designed to increase incentives for vessels to lower salmon bycatch rates, even in years when salmon encounters were low.

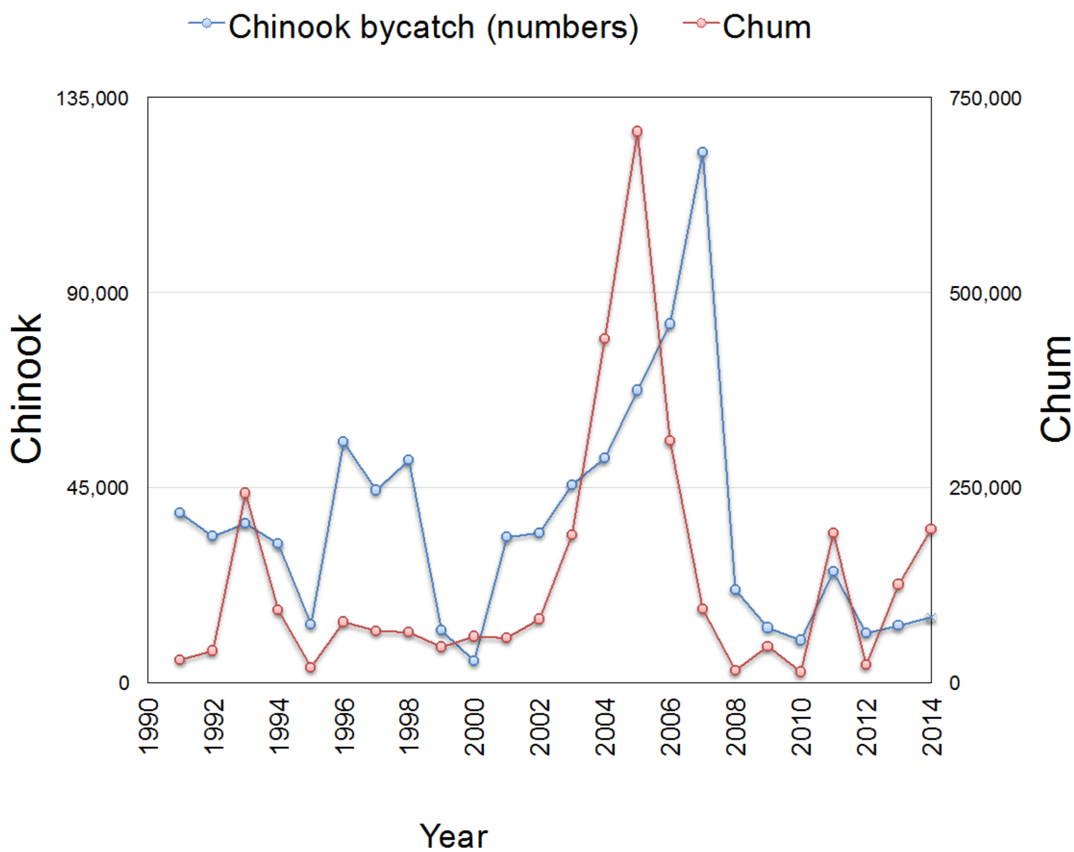

Figure 2. **Time series of Chinook and chum salmon bycatch in the pollock fishery, 1991-2014.**

Following action on Amendment 91, the Council considered separate management measures for Chum salmon PSC. After an iterative process of developing and modifying alternatives over multiple years and several analyses, all of the alternatives considered were found to exacerbate Chinook bycatch. Thus, in December 2012, the Council moved to consider chum salmon PSC in conjunction with consideration of Chinook salmon PSC management changes in order to comprehensively address the management of both species.

Due to continued concerns with extremely low returns to western Alaska Chinook stocks, and the genetic information regarding high proportions of the salmon bycatch consisting of these stocks (Guthrie et al., 2014; Guthrie et al., 2013; Guthrie et al., 2012; Guthrie and Wilmot, 2004; Myers et al., 2004) , the Council reviewed a discussion paper in October 2013 that provided updated Adult Equivalent (AEQ) analysis of the salmon bycatch estimates to aggregate rivers of origin, impact rates of the salmon bycatch to these aggregate river systems, as well as an analysis of fishery and salmon bycatch performance in the first three years of the management program (Ianelli and Stram, 2014; Stram and Ianelli, 2014). The

Council also requested a proposal from the pollock industry of how chum salmon bycatch could be incorporated into the existing Chinook salmon IPAs.

Following review in October 2013, the Council moved to request a discussion paper to evaluate several aspects of salmon PSC management in the Bering Sea in order to provide information necessary to initiate modifications to the current management program. Information on two broad topics was requested: 1) evaluation of the regulatory changes needed to incorporate Bering Sea chum salmon PSC management into the Chinook salmon IPAs; and 2) evaluation of possible measures to refine the current Chinook salmon bycatch management program either by regulatory measures or through incorporation of additional provisions in the IPAs. In June 2014, the Council moved to initiate an analysis of a combined Chinook and chum PSC management program and revised these alternatives following initial review in December 2014. Revised alternatives are described in Chapter 2.

1.3 Description of Action Area

The Bering Sea sub-area of the BSAI management area is the area in which this action occurs (Figure 3). This action is solely addressing management of the Bering Sea pollock fishery and does not affect the pollock fishery in the Aleutian Island subarea.

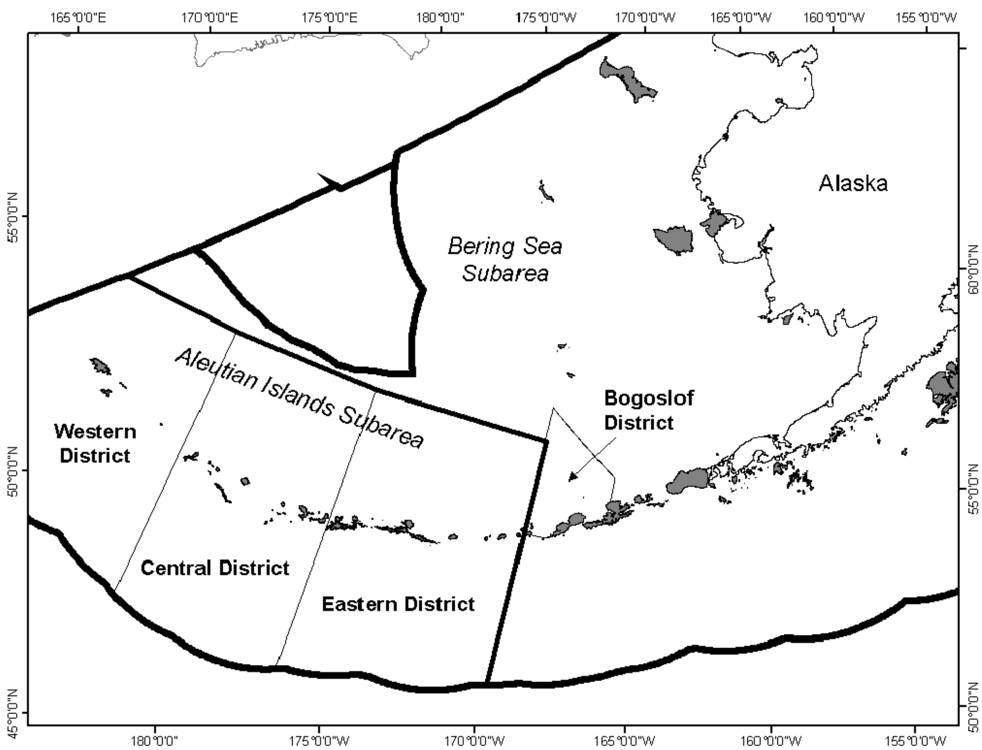

Figure 3. Bering Sea sub-areas for management

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

A variety of Federal laws and policies require environmental, economic, and socioeconomic analyses of proposed Federal actions. This EA/RIR contains the required analysis of the proposed Federal action and its alternatives to ensure that the action complies with Federal laws and executive orders. Some that are more pertinent to this particular action are described in more detail below (those in italics are incorporated by reference to NMFS/NPFMC 2009, but are not described herein):

1. National Environmental Policy Act (NEPA)
2. Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act)
3. Endangered Species Act (ESA)
4. Marine Mammal Protection Act (MMPA)
5. *Administrative Procedure Act (APA)*
6. Regulatory Flexibility Act (RFA)
7. *Information Quality Act (IQA)*
8. *Coastal Zone Management Act (CZMA)*
9. Alaska National Interest Lands Conservation Act (ANILCA)
10. American Fisheries Act (AFA)
11. Executive Order 12866: Regulatory planning and review
12. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments
13. *Executive Order 12898: Environmental Justice*
14. 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 will violate Federal, State, or local law or related regulations.

1.4.1 National Environmental Policy Act

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

NEPA has two principal purposes:

1. To require Federal agencies to evaluate the potential environmental effects of any major planned Federal action, ensuring that public officials make well-informed decisions about the potential impacts.
2. To promote public awareness of potential impacts at the earliest planning stages of major Federal actions by requiring Federal agencies to prepare a detailed environmental evaluation for any major Federal action significantly affecting the quality of the human environment.

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

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

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

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

1.4.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act authorizes the U.S. to manage its fishery resources in the EEZ. The management of these marine resources is vested in the Secretary and in regional fishery management councils. In the Alaska Region, the Council is responsible for preparing FMPs for marine fishery resources requiring conservation and management. NMFS is charged with carrying out the Federal mandates with regard to marine fish (among other living marine resources). 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 actions under examination in this EA/RIR are Chinook salmon and 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 United States fishing industry. An analysis of the alternatives relative to the National Standards is provided in Chapter 6.

1.4.3 Endangered Species Act (ESA)

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

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

Currently, with the listing of a species under the ESA, the critical habitat of the species must be designated to the maximum extent prudent and determinable (16 U.S.C. 1533(b)(6)(C)), simultaneously with the listing. The ESA defines critical habitat as those specific areas that contain the essential features necessary to the conservation of a listed species, and that may be in need of special consideration. Federal agencies are prohibited from undertaking, authorizing, or funding 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 consulting agency (NMFS or USFWS). Informal consultations are conducted for Federal actions that are believed to have no adverse effects on the listed species, nor destroy or adversely modify its designated critical habitat. The action agency can prepare a biological assessment to determine if the proposed action would adversely impact the listed species or adversely 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 effect 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 that, if implemented, would modify the action to no longer pose the jeopardy of extinction or adverse modification to critical habitat for the listed species. These reasonable and prudent alternatives must be incorporated into the Federal action, if it is to proceed. A biological opinion with the conclusion of no jeopardy or adverse modification of critical habitat may contain conservation recommendations intended to further reduce the negative impacts to the listed species. These recommendations are advisory to the action agency (50 CFR 402.14(j)). If the likelihood exists of any take[2] occurring during promulgation of the action, an incidental take statement may be appended to a biological opinion to provide for the amount of take that is expected to occur from normal promulgation of the action. An incidental take statement is not the equivalent of a permit to take a listed species.

This EA incorporates 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 by reference from the Chinook salmon bycatch management EIS (NMFS/NPFMC 2009); however, for those ESA-listed marine mammals species potentially affected by the current proposed action, analysis of the impacts of the alternatives is in Section 3.7.

1.4.4 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 in Section 3.7.

1.4.5 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

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

jurisdictions. The Small Business Administration has established size criteria for all major industry sectors in the United States, including fish harvesting and fish processing businesses.

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

1.4.6 Alaska National Interest Lands Conservation Act (ANILCA)

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

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

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

Although ANILCA does not directly apply to the OCS region, NMFS aims to protect such uses pursuant to other laws, such as NEPA and the Magnuson-Stevens Act. 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. Appendix A-4 provides a detailed discussion of the subsistence uses of salmon.

1.4.7 American Fisheries Act (AFA)

The AFA established a cooperative management program for the Bering Sea pollock fisheries. Among the purposes of the AFA was to tighten U.S. vessel ownership standards and to provide the pollock fleet the opportunity to conduct its fishery in a more economically rational manner, while protecting non-AFA participants in other fisheries. Since the passage of the AFA, the Council has taken an active role in the development of management measures to implement the various provisions of the AFA. The AFA EIS was prepared to evaluate sweeping changes to the conservation and management program for the Bering Sea pollock fishery and, to a lesser extent, the management programs for the other groundfish fisheries of the GOA and BSAI, the king and Tanner crab fisheries of the BSAI, and the scallop fishery off Alaska (NMFS 2002). Under the Magnuson-Stevens Act, the Council prepared Amendments 61/61/13/8 to implement the provisions of the AFA in the groundfish, crab, and scallop fisheries, respectively. 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 AFA 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.[3]

NMFS published the final rule implementing the AFA on December 30, 2002 (67 FR 79692). The structure and provisions of the AFA constrain the types of measures that can be implemented to reduce salmon bycatch in the pollock fishery. The RIR, in Chapter 4, contains a detailed discussion of the pollock fishery under the AFA, and the relationship between the Chinook salmon and chum salmon bycatch management and the AFA.

1.4.8 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. Chapter 4 contains the RIR analysis in compliance with E.O. 12866.

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 adverse economic impact on a substantial number of directly regulated 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:

1. 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;
2. Create serious inconsistency or otherwise interfere with an action taken or planned by another agency;
3. Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
4. Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in Executive Order 12866.

The Secretary of Commerce with the Office of Management and Budget (OMB), makes the final determination of significance under this Executive Order. An action determined to be significant is subject to OMB review and clearance before its publication and implementation.

1.4.9 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

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

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.

The consultation process for this action started during the Council process when the Council started developing Amendment 110. A number of tribal representatives and tribal organizations provided written public comments and oral public testimony to the Council during Council outreach meetings on Amendment 110 and at the numerous Council meetings at which Amendment 110 was discussed.

NMFS conducted two tribal consultations, one in December 2014 and one in April 2015, with representatives from the Tanana Chiefs Conference; Association of Village Council Presidents; Yukon River Drainage Fisheries Association; Kawerak, Inc.; and Bering Sea Fishermen's Association. These organizations requested these consultations to discuss the salmon bycatch management measures under consideration by the Council. These organizations also prepared letters for the Council on these issues. NMFS posted reports from these consultations on the NMFS Alaska Region Web site at *http://alaskafisheries.noaa.gov/tc/*.

NMFS will continue the consultation process by sending a letter to all Alaska Native representatives when the Notice of Availability for Amendment 110 and the proposed rule are published in the Federal Register notifying them of the opportunity to comment.

1.4.10 Pacific Salmon Treaty and the Yukon River Agreement

In 2002, the United States and Canada signed the Yukon River Agreement to the Pacific Salmon Treaty. The Yukon River Agreement states that the "Parties shall maintain efforts to increase the in-river run of Yukon River origin salmon by reducing marine catches and by-catches of Yukon River salmon. They shall further identify, quantify and undertake efforts to reduce these catches and by-catches" (Art. XV, Annex IV, Ch. 8, Cl. 12). The Yukon River Agreement also established the Yukon River Panel as an international advisory body to address the conservation, management, and harvest sharing of Canadian-origin salmon between the U.S. and Canada. This proposed action is an element of the Council's efforts to continue to reduce bycatch of salmon in the pollock fishery and ensure compliance with the Agreement. Additionally, in developing Amendment 91, as well as the current alternatives under consideration in this action, NMFS and the Council have considered the recommendations of the Yukon River Panel. This EA/RIR addresses the substantive issues involving the portion of Chinook salmon taken as bycatch in the Bering Sea pollock fishery that originated from the Yukon River and the impacts of salmon bycatch in the pollock fishery on returns of Chinook salmon to the Canadian portion of the Yukon River.

2 Description of Alternatives

NEPA requires that an EA analyze a reasonable range of alternatives consistent with the purpose and need for the proposed action. The alternatives in this section were designed to accomplish the stated purpose and need for the action. All of the alternatives were designed to improve upon the current management for chum and Chinook salmon PSC by providing opportunities for increased flexibility to respond to changing conditions and greater incentives to reduce bycatch of both salmon species.

The Council adopted the following revised alternatives for analysis in December 2014.

2.1 Alternative 1, No Action

The status quo alternative includes both the current management of chum salmon PSC under Amendment 84 regulations (50 CFR 679.21(g)) and Chinook salmon PSC under Amendment 91 regulations (50 CFR 679.21(f)).

2.1.1 Chum salmon PSC measures under status quo

Alternative 1 retains the current program of Chum Salmon Savings Area (CSSA) 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 inter-cooperative agreement (RHS ICA) approved by NMFS. The RHS ICA regulations were implemented in 2007, through Amendment 84 (Am 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 (Am 91). Closure of the CSSA is designed to reduce the total amount of chum PSC by closing areas with historically high levels of chum salmon bycatch. The RHS ICA operates in lieu of a fixed area closure (the CSSA) and requires industry to identify and close areas of high salmon bycatch and move to other areas. Only vessels directed fishing for Bering Sea pollock are subject to the Chum SSA closure and ICA regulations.

The CSSA (Figure 4) was established in 1994, by emergency rule, and then formalized in 1995 under Amendment 35 to the BSAI FMP (60 FR 34904, July 5, 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) at any point in time during the period August 15 through October 14, the area closes and 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 this PSC limit (Figure 4).

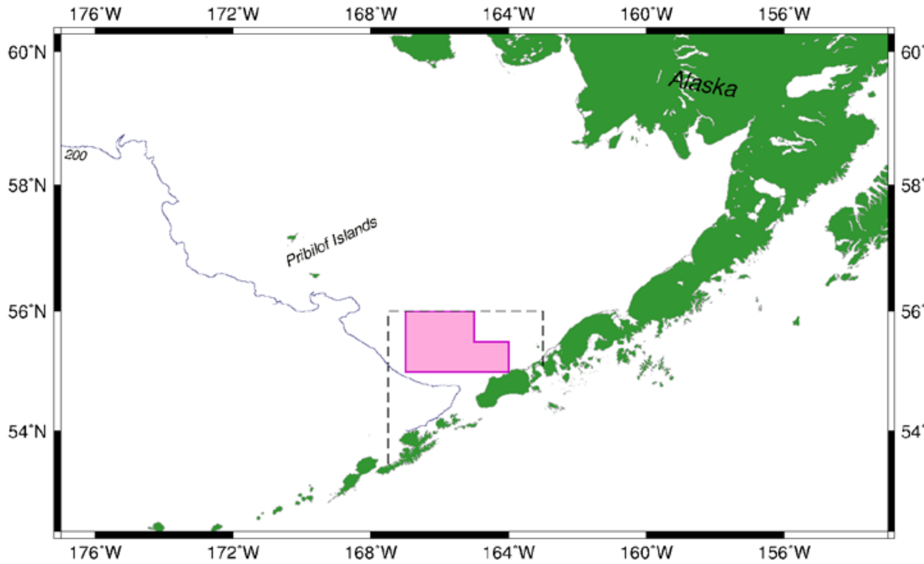

Figure 4. **Chum Salmon Savings Area (CSSA), shaded and Catcher Vessel Operational Area (CVOA), dotted line.**

2.1.1.1 Rolling Hotspot System Inter-cooperative Agreement

Regulations implemented under Amendment 84 to the BSAI FMP exempted vessels directed fishing for pollock from closures of both the CSSA 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 Council developed Amendment 84 to attempt to minimize salmon bycatch to the extent practicable while giving the industry some flexibility. 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). For the 2011 season, the ICA and regulations covering Amendment 84 were amended to account for the adoption of Amendment 91 and its approach to managing Chinook salmon bycatch.

The RHS continues to provide real-time salmon bycatch information so that the fleet can avoid areas of high chum salmon bycatch rates. Using a system of base salmon bycatch rate, the ICA assigns vessels to certain tiers, based on salmon bycatch rates relative to the base rate, and implements area closures for vessels in certain tiers. Monitoring and enforcement are carried out through private contractual arrangements. The ICA operates fleet-wide and the provisions apply at the cooperative level; 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 salmon 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 interest in non-Chinook salmon bycatch regulation, but do not directly fish in a groundfish fishery" (§ 679.21(g)(2)(i)(D)).

Except the *Ocean Peace*, all vessels and CDQ groups that participate in the Bering Sea pollock fishery 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 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 below. Details within each section note where changes to the ICA have occurred since 2006.

The ICA is structured based upon a cooperatives' salmon bycatch rate as compared with a pre-determined "Base Rate." Once the Base Rate is determined (see Section 2.1.1.2), 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 2.1.1.3) are calculated from the cooperatives' proportional salmon bycatch rate to the Base Rate with higher tiers corresponding to higher rates. These tiers then determine how access to specific areas will be determined following designation of "hot spot" closures. These areas are then closed to cooperatives in higher tiers.

2.1.1.2 Base Rate calculation

The structure of the ICA is based upon cooperatives' salmon 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. 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.

2.1.1.3 Base Rate Tier assignment

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 cooperative's "rolling two week" average chum bycatch rate. Closures are determined by Sea State, Inc., based upon spatial information on "hot spot" salmon bycatch areas.

Tier Assignment rates

i. Tier 1 – cooperatives with chum bycatch rates less than 75% of Base Rate.
ii. Tier 2 – cooperatives with chum 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 chum bycatch rates greater than 125% of the Base Rate.

2.1.1.4 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 on the salmon bycatch rate within specified areas. For the 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-day to 7-day period, depending on data quality, immediately preceding each closure announcement.
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 chum bycatch conditions indicate there has likely been no change in salmon 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 salmon 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.

2.1.1.5 Vessel Performance Lists

These vessel performance 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 salmon 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 chum 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. Cumulative 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 vessels' 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.

2.1.1.6 RHS ICA monitoring

Monitoring and enforcement of the chum 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.

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.

2.1.1.7 Annual Performance Review

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

- Number of salmon taken, by species and season.
- Estimate of number of salmon avoided[4], as demonstrated by the movement of fishing effort away from salmon hot-spots.
- A compliance/enforcement report which will include the results of an internal compliance audit and an external compliance audit if one has been done.
- List of each vessel's number of appearances on the weekly vessel performance lists (note this is a requirement of the AFA co-op reports).
- 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.

2.1.2 Chinook salmon PSC management under status quo

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 removed from regulations the Chinook Salmon Savings Area and trigger limit in the Bering Sea, the 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.

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,

[4] Regulations at 50 CFR 679.21(g)(4)(ii)(A) say "An estimate of the number of non-Chinook salmon avoided as demonstrated by the movement of fishing effort away from Chum Salmon Savings Areas."

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 IPA and remain in compliance with the performance standard.[5] Sector and cooperative allocations would be reduced if members of the sector or cooperative decided not to participate in an IPA. Vessels, cooperatives, and CDQ groups that do not participate in an IPA would 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. If a vessel, cooperative, CDQ group, or sector opts-out of an IPA, NMFS would allocate that entity's portion of the 28,496 opt-out cap to the opt-out allocation for that fishing year and the entity would fish under that opt-out allocation. NMFS would manage the opt-out allocation as an open access PSC limit and close the pollock fishery to opt-out vessels when the Chinook bycatch by those vessels approaches 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, maintain Chinook bycatch at minimum levels. To ensure participants develop effective IPAs the final rule required that participants submit annual reports to the Council that evaluate whether the IPA was 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 can only exceed its annual threshold amount 2 times within any 7 consecutive years. Under the current program, if a sector fails this performance standard, it will be allocated a portion of the 47,591 Chinook salmon PSC limit each subsequent year. 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.

2.1.2.1 PSC Allocations

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 PSC accounts each season. Separate allocations are made for the A season and the B season for a total of up to 30 transferable PSC allocations.

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)

[5] Note the definition of the performance standard is as follows (from 50 CFR 679.21(f)(6)): "Chinook salmon bycatch performance standard. If the total annual Chinook salmon bycatch by the members of a sector participating in an approved IPA is greater than that sector's annual threshold amount of Chinook salmon in any three of seven consecutive years, that sector will receive an allocation of Chinook salmon under the 47,591 PSC limit in all future years. (i) Annual threshold amount. Prior to each year, NMFS will calculate each sector's annual threshold amount. NMFS will post the annual threshold amount for each sector on the NMFS Alaska Region Web site (http:// alaskafisheries.noaa.gov/). At the end of each year, NMFS will evaluate the Chinook salmon bycatch by all IPA participants in each sector against that sector's annual threshold amount. (ii) Calculation of the annual threshold amount. A sector's annual threshold amount is the annual number of Chinook salmon that would be allocated to that sector under the 47,591 Chinook salmon PSC limit, as shown in the table in paragraph (f)(3)(iii)(B) of this section. If any vessels in a sector do not participate in an approved IPA, NMFS will reduce that sector's annual threshold amount by the number of Chinook salmon associated with each vessel not participating in an approved IPA."

account. NMFS's approval is required for any transfer. Chinook salmon PSC 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 PSC to cover overages ("post-delivery transfers").

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 PSC allocations have to be created by a contract among the group of eligible AFA participants in that sector. Transferable PSC 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 PSC on behalf of all members of the entity;
- Is authorized to transfer all or a portion of the entity's PSC 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 PSC 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 PSC 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.
- 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 PSC 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*).

2.1.2.2 Observer coverage, monitoring requirements, and catch accounting

Amendment 91 placed new constraints on the Bering Sea pollock fishery. Under this program, each entity that receives a transferable Chinook salmon PSC allocation is prohibited from exceeding that allocation. Therefore, the Chinook PSC limits, if reached, could prevent the full harvest of a pollock allocation to the AFA sectors, inshore cooperatives, or CDQ groups. Amendment 91 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 all salmon. The monitoring of bycatch of all species of salmon in the BS pollock fisheries 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.[6] 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 is recommending changes to the monitoring requirements under Amendment 91 under all alternatives including the no action alternative. The details of these changes are discussed in section 2.5.

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. The monitoring and observer requirements described in the previous section ensure that information about vessel-specific salmon PSC is always obtained and represents all salmon caught during a fishing trip.

2.1.2.3 Incentive Plan Agreements

This section provides details of the Chinook IPAs implemented in 2011 through 2015. All of the participants in the Bering Sea pollock fishery are currently subject to IPA agreements. NMFS has allocated sector and seasonal proportions of the 60,000 PSC limit since 2011.

There are three IPA agreements currently in place: [7]

- 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.'

The IPAs can be revised by submitting amendments to NMFS for approval at any time; however, participants in an IPA must be specified by December 1, prior to the following fishing year. Thus, the specific features of the IPAs can change at any point.

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.[8]

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 RHS program exists for each sector, although details vary. Closures are imposed in "core areas" where salmon bycatch has traditionally occurred, to avoid closing areas that are actually

[6] http://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm
[7] IPAs and amendments can be accessed here: https://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/ipa/ipas.htm.
[8] This description is condensed from the amended IPAs that can be found at http://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm

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 salmon 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 kept in reserve from each entity's allocation 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 salmon 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 salmon bycatch total approaches the PSC limit.

Features unique to the Inshore Salmon Savings Incentive Plan Agreement
- Vessels earn one salmon credit for 3 saved – credits expire in 5 years.
- 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," they 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 salmon bycatch increases during a year, the closures ("Chinook Savings Areas") go away, because the threat of the PSC limit 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 through 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 are no restrictions on Tier 1.
    - Weekly reports include each vessel's tier status and weekly 3-week rolling average salmon bycatch rate.
    - Up to 3 areas can be closed at a time, not to exceed 1,000 square miles.
- Because inter-sectoral transfers do not change the annual threshold limit, there are strict controls on inter-sectoral transfers.
- Transfers are allowed at end of season.
- "Hardship transfers" allow salmon and pollock to be sent together, without transfer taxes, if a boat stops fishing due to a hardship such as mechanical failure.

Features unique to the Mothership Salmon Savings Incentive Plan Agreement
- Inseason Chinook accounting and RHS closures are done at the fleet level, but the rewards and punishments are applied 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.
- 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 Catcher Processor 'Chinook Salmon Bycatch Reduction Incentive Plan and Agreement'

- Three areas in the B season form the "Chinook conservation area", and are closed from October 15 through 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 and 2 areas west of 168W
    - areas east of 168W
    - Max 4 areas total, 1,500 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 salmon bycatch rate for a second week.

New features to the Mothership IPA and the CP IPA for the 2015 fishing year are summarized below.

MSSIP New IPA Features: Since the B-season of 2014, the mothership sector has been operating under new "Best Management Practices" that have been incorporated in the Sector's IPA that was approved by NMFS and is in effect in 2015. Key features of the Best Management Practices include: 1) a requirement for a test tow by a single vessel when entering new areas, 2) attention to codend size and its relation to salmon bycatch, 3) requirement to minimize tow duration where possible, 4) required use of excluders whenever possible and reporting of any non-use, and 5) extensive and rapid communication of pollock catch and salmon bycatch information. Additionally, there is a requirement to review the effectiveness of these and other potential practices and update the practices on an annual basis.

CP New IPA Features: The CP/CDQ IPA was modified for 2015, adding two new features. First, the use of a salmon excluder is now mandatory for fishing in January through March, and beginning September 1. Second, the outlier penalty previously proposed by the sector in June 2014, and discussed under Alternative 3, has been included in the IPA. The provision will make any vessels with 3 consecutive seasons with seasonal salmon bycatch above the mean, subject to hotspot closures throughout the following season, as well as subject to a fixed B-season closure if the next season is a B-season.

2.1.2.4 Annual reporting requirements for Amendment 91

Annual reports are required of each IPA entity and provided to the Council at the April Council meeting (requirements are for submission no later than April 1 each year). 50 CFR 679.21(f)(13) stipulates that IPA entities report annually on the following:

- Incentive measures in effect in the previous year;
- How incentive measures affected individual vessels;
- How incentive measures affected salmon savings beyond current levels;
- IPA amendments approved by NMFS since the last annual report and the reasons for amendments;

- Sub-allocation to each participating vessel;
- Number of Chinook PSC and amount of pollock (mt) at the start of each fishing season;
- Number of Chinook PSC and amount of pollock (mt) caught at the end of each season;
- In-season transfers among entities of Chinook salmon PSC or pollock among AFA cooperatives;
- Transfers among IPA vessels; and amount of pollock (mt) transferred.

Additionally, an economic data report (EDR) is required to be submitted annually. The Amendment 91 EDR program is managed primarily by the Alaska Fisheries Science Center (AFSC), with support from NMFS Alaska Region, and is administered in collaboration with Pacific States Marine Fisheries Commission (PSMFC). The EDR is a mandatory reporting requirement under 50 CFR 679.65 for all entities participating in the AFA pollock fishery, including vessel masters and businesses that own or lease[9] one or more AFA-permitted vessels active in fishing or processing BS pollock, CDQ groups receiving allocations of BS pollock, and representatives of sector entities receiving allocations of Chinook salmon PSC from NMFS. The EDR program is comprised of three separate survey forms[10]:

- Chinook salmon PSC Allocation Compensated Transfer Report (CTR)
- Vessel Fuel Survey
- Vessel Master Survey

Distinct conditions that require an entity to submit one or more of the respective forms are discussed in more detail below. In addition to the EDR program, the data collection measures developed by the Council also specified modification of the Daily Fishing Logbook (DFL) for BSAI pollock trawl CVs and CPs (implemented in for the 2012 fishing year) to add a “checkbox” to the tow-level logbook record, requiring vessel operators to indicate instances when a vessel fishing pollock in the BSAI changed fishing locations, prior to each tow, for the primary purpose of avoiding Chinook salmon PSC. For AFA CPs, this information is recorded in the Trawl CP Electronic Logbook (ELB) and submitted to NMFS via the eLandings system. The DFL for trawl CVs is not submitted to NMFS in a form that permits electronic data capture, so vessel movement data for pollock CVs remains unavailable pending implementation of an electronic logbook for trawl CVs or the digitization of logbook data.

The Vessel Fuel Survey and Vessel Master Survey have been successfully implemented to collect data from all active AFA vessels and have yielded substantial new information that will be useful for analysis of Amendment 91. However, to date, very little information has been collected through the logbook checkboxes or the CTR form.

2.2 Alternative 2, Manage chum salmon PSC in the IPAs

Alternative 2 would remove BSAI Am 84 regulations and incorporate chum salmon avoidance into the Amendment 91 IPAs. An annual exemption from the Chum Salmon Savings Area is contingent upon participation in an IPA that includes the provisions below. Under Alternative 2, NMFS would revise regulations at 50 CFR 679.21(f)(13) to include associated reporting requirements for chum salmon and regulations at 50 CFR 679.21(f)(12)(iii)(B)(3) would be revised to include chum salmon bycatch avoidance.

Proposed revisions to the IPA requirements are as follows:

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[9] For the sake of clearer exposition, "vessel owners or leaseholders" as a group are referred to collectively as "vessel owners" hereafter in this report, except where a relevant distinction pertains.

[10] Amendment 91 EDR forms can be accessed online at http://www.alaskafisheries.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/edr/default.htm.

Description of the incentive plan.
The IPA must contain a written description of the following:

- The incentive(s) that will be implemented under the IPA for the operator of each vessel participating in the IPA to avoid Chinook salmon and chum salmon bycatch under any condition of pollock and Chinook salmon abundance in all years;
- The incentive(s) to avoid chum salmon should not increase Chinook salmon bycatch;
- The rewards for avoiding Chinook salmon, penalties for failure to avoid Chinook salmon at the vessel level, or both;
- How the incentive measures in the IPA are expected to promote reductions in a vessel's Chinook salmon and chum salmon bycatch rates relative to what would have occurred in absence of the incentive program;
- How the incentive measures in the IPA promote Chinook salmon savings and chum salmon savings in any condition of pollock abundance or Chinook salmon abundance in a manner that is expected to influence operational decisions by vessel operators to avoid Chinook salmon and chum salmon; and
- How the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's Chinook salmon bycatch to keep total bycatch below the performance standard described in paragraph (f)(6) of this section for the sector in which the vessel participates.; and
- How the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's chum salmon bycatch to avoid areas and times where the chum salmon are likely to return to Western Alaska.
- The rolling hot spot program for chum salmon bycatch avoidance and an agreement to provide notifications of closure areas and any violations of the rolling hot spot program to at least one third party organization representing western Alaskans who depend on salmon and do not directly fish in a groundfish fishery.

Alternative 2 addresses only chum salmon provisions, except for (viii) which would also apply to the Chinook salmon rolling hot spot program. Under this alternative, regulatory provisions of Amendment 84 would be removed. Regulations for conferring the exemption to the CSSA would refer only to participation in an IPA that contains the provisions listed above. Additional reporting requirements would be mandated to address the goals and objectives in the IPA provisions related to chum salmon. Outside of the CSSA backstop measure for non-IPA participants, no additional chum bycatch measures would be in regulation or under the FMP.

2.3 Alternative 3, Add new IPA provisions for Chinook salmon

Alternative 3 considers additional requirements for the IPAs to include in their individual programs to improve overall as well as vessel-level incentives for bycatch reduction. The specific requirements under consideration are to revise Federal regulations to require that IPAs include the following provisions:

Option 1. Restrictions or penalties targeted at vessels that consistently have significantly higher Chinook salmon PSC rates relative to other vessels fishing at the same time. Include a requirement to enter a fishery-wide in-season PSC data sharing agreement.

Option 2. Required use of salmon excluder devices, with recognition of contingencies.
Suboption: Required use of salmon excluder devices, with recognition of contingencies, from Jan 20 – March 31, and Sept 1 until the end of the B season.

Option 3. A rolling hotspot program that operates throughout the entire A and B seasons and an agreement to provide notifications of closure areas and any violations of the rolling hot spot program to at least one third party organization representing western Alaskans who depend on Chinook salmon and do not directly fish in a groundfish fishery.

Option 4. Limit salmon savings credits to a maximum of three years for savings credit based IPAs.

Option 5. Restrictions or performance criteria used to ensure that Chinook salmon PSC rates in the month of October are not significantly higher than those achieved in the preceding months.

These provisions may be met by individual IPAs in a variety of ways and the explicit manner in which they are addressed within IPAs is not specified. Rather, as with current IPA requirements, the IPA application submitted to NMFS for approval must include a description of how these provisions are included in the IPA.

Option 1 would apply equally to all three IPAs as none currently has provisions to address outlier vessels with significantly higher rates than other vessels fishing at the same time. A fishery-wide PSC data-sharing agreement could be done through SeaState, similar to the manner in which all chum salmon PSC data are made available to SeaState.

Option 2 would also apply equally to all three IPAs. An accounting mechanism would need to be created within each IPA to ensure this requirement is met, and reporting requirements associated with this alternative could include a summary of compliance and contingencies with adhering to this requirement.

For Option 3, the requirement to maintain a RHS is primarily associated with the CVSSIP program as that program includes a threshold provision (25%) after which the RHS program no longer operates in that season (see section 3.4.8.4 for additional description of this threshold). Under this option, that provision would need to be eliminated such that the RHS program would continue to operate throughout the entire season regardless. Adding the agreement to provide notifications of closure areas and any violations of the rolling hot spot program to at least one third party organization representing western Alaskans who depend on Chinook salmon and do not directly fish in a groundfish fishery would make the Chinook salmon RHS consistent with the chum salmon RHS.

Option 4 also applies only to the CVSSIP IPA as the MSSIP program already includes this provision and the CP IPA is not based upon a salmon savings credit system. Here the CVSSIP savings structure would need to be revised such that credits expire after 3 years instead of the current structure where they last for five years. See section 3.4.8.4 for additional information on the CVSSIP salmon savings credit structure.

Option 5 applies to all sectors. Here the IPAs have the latitude to develop some form of restriction or penalty to ensure that rates in October do not reach levels higher than the previous months.

2.4 Alternative 4, Revise the Bering Sea pollock fishery seasons and pollock allocations

Alternative 4 would change the pollock fishery seasons.

Option 1. Change the start date of the Bering Sea pollock B season to June 1.
Option 2. Shorten the Bering Sea pollock fishery to end on:
[suboptions: September 15, October 1, or October 15].
Option 3. Reallocate pollock A and B season apportionments to:
Suboption: 45% (A) and 55% (B), with A to B season rollovers
Suboption: 50% (A) and 50% (B), with A to B season rollovers

Under Alternative 4 (Options 1 and 2) the pollock season dates would be modified to start earlier (option 1) and/or to shorten the season to mid-September, early October, or mid-October (option 2). These options are not mutually exclusive.
Under Option 1 the regulations under 50 CFR 679.23(e)(2)(i) may be revised as follows:
679.23(e)(2)
(i) A season. From 1200 hours, A.l.t., January 20 through 1200 hours, A.l.t. ***May 30****~~June 10~~; and*

(ii) B season. From 1200 hours, A.l.t., June 1~~0~~ through 1200 hours, A.l.t., November 1.

Under Option 2 the regulations under 50 CFR 679.23(e)(2)(i) may be revised as follows:
679.23(e)(2)

Suboption 1: *(ii) B season. From 1200 hours, A.l.t., June 10 through 1200 hours, A.l.t., ~~November 1~~* ***September 15****.*

Suboption 2: *(ii) B season. From 1200 hours, A.l.t., June 10 through 1200 hours, A.l.t., ~~November 1~~* ***October 1****.*

Suboption 3: *(ii) B season. From 1200 hours, A.l.t., June 10 through 1200 hours, A.l.t., ~~November 1~~* ***October 15****.*

The regulatory changes under options 1 and 2 could be combined given that the options are not mutually exclusive. All directed fishing for pollock would end by the season end dates as listed under the suboptions for option 2.

Option 3 provides for a change in the allocation of the seasonal apportionment of pollock to increase the A season quota by 5% or 10%. The regulations at 679.20(5)(i)(B) would be modified to provide for 45% or 50% of the quota taken in the A season.[11] As with the current regulatory requirements, any unused pollock quota in the A season would be rolled over to the B season. Options 1 through 3 under Alternative 4 are not mutually exclusive.

2.5 Alternative 5, Lower performance standard and/or PSC limit in years of low Chinook abundance

Alternative 5 would lower the existing performance standard[12] and the PSC limit under Amendment 91 in years of low Chinook abundance. In a year in which an index of river systems has not met a specified threshold for run size (post-season ADF&G data provided annually), the performance standard and overall PSC limit would be reduced the following year per the options and suboption below. Under this alternative, a threshold determination may be based on either one year of compiled run-size data or an average of two years of run size data. The suboption can be dropped altogether; however, if the suboption is included it must be selected with one of the options (or a level of reduction within the bounds of the options) and cannot be selected as a stand-alone action. See section 2.6.4.4 for a comprehensive

[11] From 50 CFR 679.20(5)(i)(B): "(1) Inshore, catcher/processor, mothership, and CDQ components. The portions of the BS subarea pollock directed fishing allowances allocated to each component under Sections 206(a) and 206(b) of the AFA and the CDQ allowance in the BSAI will be divided into two seasonal allowances corresponding to the two fishing seasons set out at 50 CFR 679.23(e)(2), as follows: A Season, 40 percent; B Season, 60 percent. (2) In-season adjustments. Within any fishing year, the Regional Administrator may add or subtract any under harvest or over harvest of a seasonal allowance for a component to the subsequent seasonal allowance for the component through notification published in the Federal Register."

[12] Note that as specified under Alternative 1, the 'performance standard' is the provision for a sector to not exceed its annual threshold amount in more than 3 out of 7 years.

discussion of the inclusion of this part of Alternative 5 in the Council's selection of Alternative 6, the preferred alternative.

Option 1. 25% reduction (35,693)
Option 2. 60% reduction (19,036)

Suboption: Reduce the 60,000 PSC limit in years of low Chinook salmon abundance by the same proportion as the performance standard.

Alternative 5 also specifies that sectors that exceed the applicable performance standard, a third time out of a rolling 7 years, would then be held to their proportion of the annual applicable performance standard every year thereafter. Alternative 5 also specifies that if an option is selected that establishes a performance standard lower than the opt-out cap currently in regulation, then in a year in which the lowered performance standard is in place, the opt-out cap would be equal to the lower performance standard. In a year in which the lowered performance standard is in place and there are no approved IPAs, the PSC limit allocated to sectors would equal the lower performance standard.

The remainder of this section focuses on the index of river systems applicable under Alternative 5.

Each year, ADF&G would provide data by which to evaluate whether the index met the threshold for 'low Chinook abundance' based on an assessment of the indexed run strength each fall. NMFS would set the performance standard's annual threshold amount, and if selected, the overall PSC limit, based on whether the index met the threshold for low abundance in the annual harvest specifications. To implement this alternative, several modifications would need to be made to regulatory language under § 679.21(f)(6) to indicate the annual threshold amount (and potentially, PSC limit) and the portion of each that sectors would receive following the determination of a 'low Chinook abundance' year. In those years, the performance standard and PSC limit modification would be included in the annual specifications process as outlined below. Note that for ease of terminology, the analysis uses the terms 'low' or 'not low', but the threshold for all indices considered, including the index in the current Council motion, actually represents historically very poor salmon abundance years. These are years characterized by escapement goals not being met, severe restrictions on subsistence fisheries, or total closure of those fisheries, and in some years, Federal fishery disaster declarations.

Alternative 5 specifies using post-season run size estimates for the index. These run size estimates will be made available to NMFS by ADF&G by October 1, in time to coincide with the Council's October meeting where preliminary groundfish harvest specifications (including PSC limits) are set. ADF&G would provide written notification to NMFS, which will inform the Council and the public of the combined post-season run size estimate for the index stocks and, thus, whether or not it is below the threshold designation specified in the Council motion for a 'low Chinook abundance' year. Following Council action in October, NMFS would publish a proposed rule for the preliminary groundfish harvest specifications in the BSAI, including the adjusted Chinook PSC annual threshold amount (and under the suboption, the adjusted PSC limit), resulting from the determination of stock status. The annual threshold and PSC limit amounts would also be included in the final rule to implement the final groundfish harvest specifications following December Council action.

A proposed timeline for the notification of compiled run data to indicate a low abundance threshold year with timing for proposed and final rulemaking for specifications and IPA submission timing is included below (Table 5). Because the final specifications are not usually formally effective until February or March, NMFS would issue an adjustment for the following year if the threshold changes from what was in the previous years' harvest specifications upon which the fishery opens in January. No change in harvest specifications would be required in years that meet or exceed the threshold as PSC limits are included in regulation.

Table 5. Proposed timeline for harvest specifications process and determination of 'low Chinook threshold.'

Date	Action
October 1	ADF&G provides written notification and compiled data on post-season run size estimates from index systems to NMFS
October 1	New IPAs from industry submitted to NMFS (entities can amend IPAs at any time)
October Council meeting	Proposed harvest specifications including adjusted PSC limit and/or performance standard threshold in low abundance years (Council/NMFS)
December 1	Amendments to the list of IPA participants (vessels included, etc.) submitted to NMFS
December Council meeting	Final harvest specifications including adjusted PSC limit and/or performance standard in low abundance years

Under Alternative 5, an index of the combined run sizes of the Unalakleet, Upper Yukon, and Kuskokwim in-river run reconstructions is proposed for use in determination of low abundance ('3 System Index'). Low abundance is defined in Alternative 5 as an annual combined 3 system run size of ≤250,000 Chinook salmon; the reasons for which are described in this section. This index and threshold was approved at the December 2014 Council meeting and differs from the Council's June 2014 motion.[13] After the June Council meeting, ADF&G scientists evaluated the index in the June motion and other alternative indices to propose an approach using the best available scientific information to meet several inherent objectives. This new 3 System Index was described in the December 2014 initial review draft analysis for Council consideration, and the Council modified the motion to adopt this index at that meeting.

2.6 Alternative 6, Combine bycatch management for Chinook salmon and chum salmon (Preferred Alternative)

Alternative 6 combines the measures included in Alternatives 2, 3, 4 and 5. This alternative was selected by the Council as its preferred alternative (PA) in April 2015. This combined management approach includes all provisions of Alternative 2 (moving chum salmon bycatch management into the IPAs), all of Alternative 3 (options to revise IPA requirements for Chinook bycatch), incorporates a reallocation of an additional 5% of pollock quota to the A-season from Alternative 4, and reduces the PSC limit and performance standard in years of low abundance (Alternative 5). This results in a combined management approach which provides additional specificity and provisions to the IPA requirements, additional reporting requirements to address these changes, provides for some additional flexibility to catch pollock at times of lower Chinook salmon encounters by a quota reallocation and provides for more stringent measures in times of low Chinook abundance in western Alaskan rivers. These provisions are grouped by category and described further below. The Council also adopted into Alternative 6 the NMFS

[13] The June 2014 motion included the following direction for an index: *Revise Federal regulations to lower the performance standard under Am 91 in years of low Chinook salmon abundance per the options below. Low abundance is defined as ≤500,000 Chinook salmon, based on the total Chinook salmon run size index of the coastal WAK aggregate stock grouping in a [option: year or average of two years].*

recommendations for management and enforcement improvements identified in Section 2.7, and analyzed in Section 4.8 below.

2.6.1 IPA revisions

An annual exemption from the Chum Salmon Savings Area is contingent upon participation in an IPA that includes the chum salmon provisions below. Additional provisions address Chinook bycatch management under the IPAs.

Description of the incentive plan. The IPA must contain a written description of the following:

- The incentive(s) that will be implemented under the IPA for the operator of each vessel participating in the IPA to avoid Chinook salmon and chum salmon bycatch under any condition of pollock and Chinook salmon abundance in all years.
- The incentive(s) to avoid chum salmon should not increase Chinook salmon bycatch.
- The rewards for avoiding Chinook salmon, penalties for failure to avoid Chinook salmon at the vessel level, or both.
- How the incentive measures in the IPA are expected to promote reductions in a vessel's Chinook salmon and chum salmon bycatch rates relative to what would have occurred in absence of the incentive program.
- How the incentive measures in the IPA promote Chinook salmon savings and chum salmon savings in any condition of pollock abundance or Chinook salmon abundance in a manner that is expected to influence operational decisions by vessel operators to avoid Chinook salmon and chum salmon.
- How the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's Chinook salmon bycatch to keep total bycatch below the performance standard described for the sector in which the vessel participates.
- How the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's chum salmon bycatch to avoid areas and times where the chum salmon are likely to return to Western Alaska.
- The rolling hot spot program for salmon bycatch avoidance that operates throughout the entire A and B seasons and an agreement to provide notifications of closure areas and any violations of the rolling hot spot program to at least one third party organization representing western Alaskans who depend on salmon and do not directly fish in a groundfish fishery.
- Restrictions or penalties targeted at vessels that consistently have significantly higher Chinook salmon PSC rates relative to other vessels fishing at the same time. Include a requirement to enter a fishery-wide in-season PSC data sharing agreement.
- Required use of salmon excluder devices, with recognition of contingencies, from Jan 20 – March 31, and Sept 1 until the end of the B season.
- Salmon savings credits last for a maximum of three years for savings credit based IPAs.
- Restrictions or performance criteria used to ensure that Chinook salmon PSC rates in the month of October are not significantly higher than those achieved in the preceding months.

2.6.2 Pollock quota reallocation

Seasonal allocation of pollock will be set at 45% in the A-season, and 55% in the B-season. As with current pollock management any unused quota will be rolled over into the B-season.

2.6.3 Revised PSC limit and performance standard in years of low Chinook abundance

A revised PSC limit (45,000 fish) and performance standard (33,318 fish) will be in place in years defined as low Chinook abundance. The performance standard and PSC limit would be lowered in the year following the year in which the index was ≤250,000 Chinook salmon. Low abundance is defined as ≤250,000 Chinook salmon, based on the post-season in-river Chinook salmon run size index of the Unalakleet, Upper Yukon, and Kuskokwim aggregate stock grouping. Sectors that exceed the applicable performance standard, in 3 out of 7 years, would be held to their proportion of the annual applicable performance standard in future years (for example, either 47,591 or the 33,318, whichever is in place that year). In a year in which the lowered performance standard is in place and there are no approved IPAs, the PSC limit allocated among sectors would equal the lower performance standard.

The specification process and timing are as described under Alternative 5. The Council, ADF&G, and NMFS will establish a transparent process for annual review of ADF&G's 3 System Index, the data and assumptions used to generate the index, and any changes ADF&G proposes to make to the methods used to generate the index. This process will ensure that the index benefits from Council and public review and represents the best available scientific information.

2.6.4 Index of low Chinook salmon abundance

The 3 system index under Alternative 6 composed of the Unalakleet, Upper Yukon, and Kuskokwim River in-river run reconstructions appears to best meet the data and index objectives consistent with the Council's intent. The natural break in the data, to distinguish between historically low years and other years, is about 250,000 Chinook salmon for the combined systems in the index. Thus, the threshold under Alternative 6 is appropriately set at ≤250,000. Several advantages to such an index, described in this section, are summarized below:

- A broad index using Chinook salmon run size is an appropriate metric for moving toward abundance-based PSC caps. Run size is the most reliable indicator of overall abundance of returning fish, because other potential metrics based on only on catches or escapements are influenced by management actions taken in-river to achieve escapement goals. Run size is also strongly related to total AEQ bycatch for the coastal western Alaska stock grouping.
- Combining multiple river systems improves the index's ability to separate particularly low abundance years, and better delineates the natural break used in defining a threshold.
- Among all combinations of systems in relation to AEQ the natural break is best defined with the 3 System Index. This index provides the clearest signal to identify years in which runs were truly, historically low, which is consistent with Council intent. Years where run size is below this break (2000 and 2010 through 2014) include those with geographically broad failures to meet escapement goals, which required significant restrictions to subsistence harvests, and/or resulted in Federal fisheries disaster declarations.
- The index includes a broad regional representation of indicator stocks in coastal western Alaska with significant Chinook salmon subsistence fisheries.

The following sections describe the index proposed in the June 2014 motion, the considerations in developing an alternative index that better meets Council objectives, and the proposed 3 System Index.

The June 2014 Council motion related a lower performance standard to low Coastal Western Alaska (CWAK) Chinook salmon run abundance, defining low abundance using the whole CWAK reporting group as an index. This index was initially selected as it demonstrates a positive linear relationship between Chinook salmon bycatch AEQ for the CWAK group and total CWAK run abundance, with the exception of outlier years 2006–2009 that had particularly high bycatch relative to the run abundance (Figure 5). A natural break in these data occurs at annual run sizes of approximately 500,000 CWAK Chinook salmon, which was the threshold for low abundance in the June Council motion. Years where total run size (in-river run size plus AEQ) is below this break (2000 and 2010-2012) are those with widespread failures to meet escapement goals, restrictions to subsistence harvests, and Federal fisheries disaster declarations.

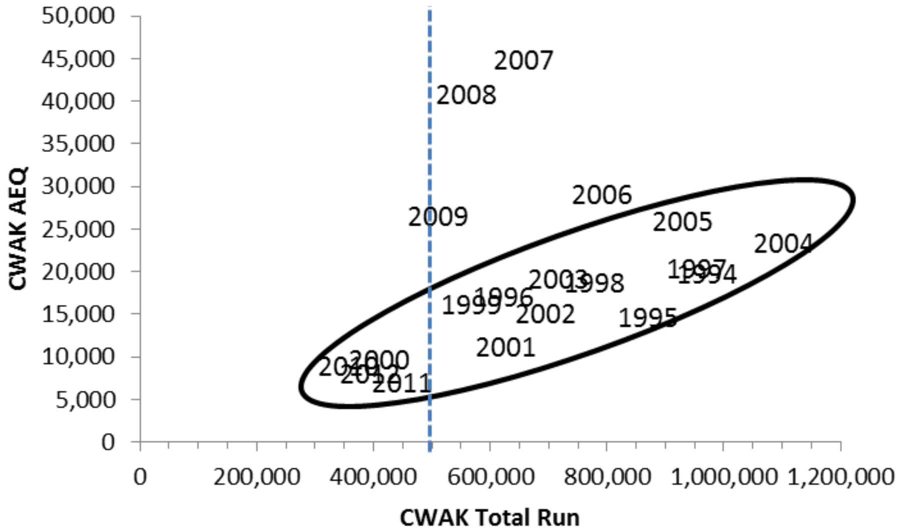


Figure 5. Relationship between the CWAK total run index estimate and bycatch AEQ for the CWAK reporting group. Those years showing a linear trend and not considered outliers are included in the ellipse (Y=0.0227x, R^2 = 0.6739). The proposed threshold identified by the natural break in the data is shown by the vertical dotted line.

The CWAK total run index estimate was developed in 2013 specifically for the purpose of AEQ analysis developed by Council and NOAA staff for previous Council analyses and is heavily dominated by Kuskokwim and Nushagak river information. It does not represent abundance trends in the Middle and Upper Yukon Chinook salmon, which have also experienced declines and are critically important subsistence systems. Moreover, the availability of reconstructed total run data for all CWAK stocks that contribute to this grouping on an annual basis is later than for those stocks for which regular in-river run reconstructions are annually produced. This could serve to delay an abundance-based management action in the BS pollock fishery and put intended management measures out-of-step with trends in Chinook salmon run abundance in Western Alaska.

2.6.4.1 Objectives used to evaluate possible indices and indices considered

After the June 2014 Council meeting, ADF&G fisheries scientists reviewed data that could best be used to index annual run abundance. Best available data were considered to meet the following objectives: (1) high data quality, (2) transparency and accessibility to stakeholders, (3) timeliness of estimates to be used for Federal regulatory processes, and (4) likelihood that necessary data will continue to be collected by ADF&G on an annual basis (i.e., data are of high management importance to ADF&G). Through this evaluation it became apparent that the use of index stocks for which in-river run reconstructions are already produced on an annual basis would best satisfy these data objectives.

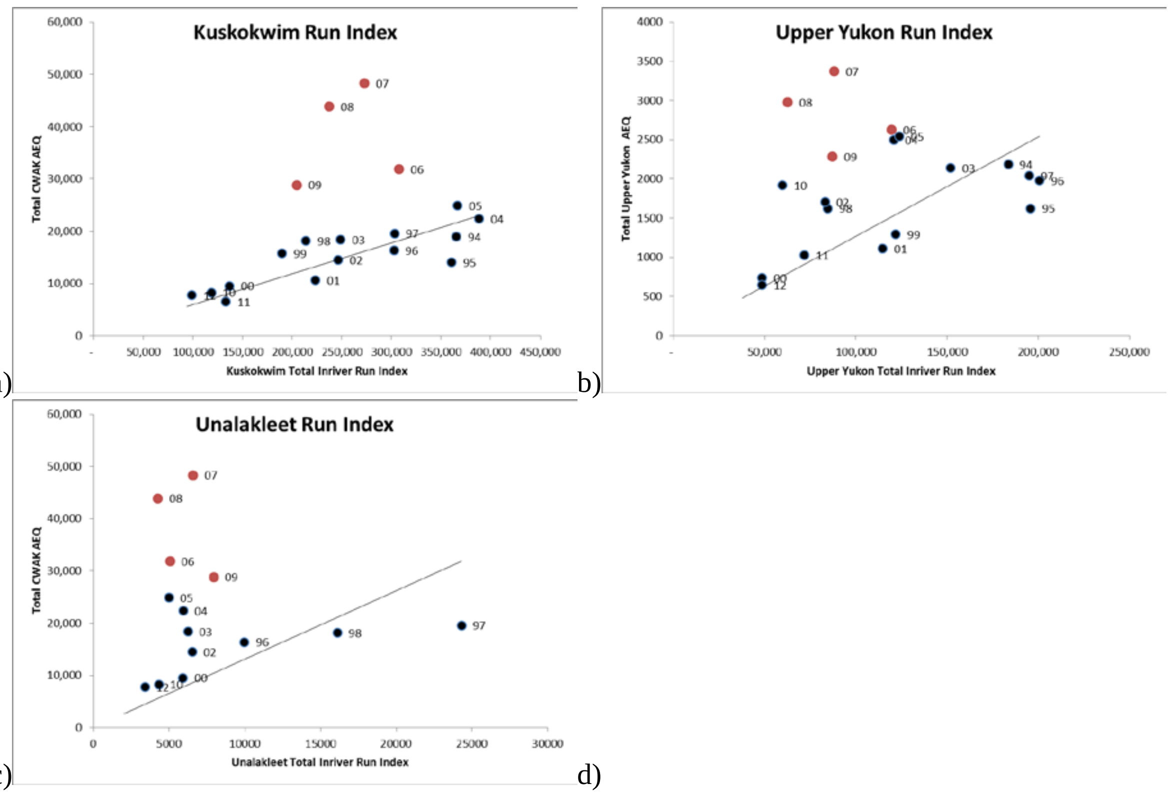
ADF&G develops and publishes in-river Chinook salmon run reconstructions for four significant systems in Western Alaska on an annual basis: Unalakleet River in Norton Sound, the Upper Yukon River, Kuskokwim River, and Nushagak River (Figure 2). In-river run reconstructions represent an estimate of all fish harvested in the river and respective coastal areas plus escapement; in effect, all returning salmon; they do not include AEQ estimates of fish bycaught as PSC. The inclusion of AEQ for a total run estimate would present further delays since genetic analyses of bycatch necessary for AEQ development are not immediately available. Each of these run reconstructions are of highest priority for in-river management of Chinook salmon and constitute some of the most robust datasets in the region. In addition to well-developed annual harvest estimates, each of the Unalakleet, Kuskokwim, and Upper Yukon river run reconstructions use multiple assessment projects and are consequently less vulnerable to individual project deficiencies in a given year due to unforeseen circumstances (e.g. flooding event). Based on these best available scientific data, alternative indices to the CWAK index were evaluated with respect to the following index objectives: (1) broad regional representation of stocks, and (2) robustness of approach to accurately classify “low” or “not low” Western Alaska Chinook salmon run abundance. **Combinations of run reconstructions considered for inclusion in an index were**: a 4 System Index (all four run reconstructions for the systems identified above); a 3 System Index (Unalakleet, Upper Yukon and Kuskokwim River run reconstructions); a 2 System Index (Kuskokwim and Nushagak run reconstructions); a Standardized 3 System Index; a Standardized 4 System Index; and individual systems.

Figure 6. In-river run abundance for Chinook salmon for Nushagak, Kuskokwim, Upper Yukon, and Unalakleet rivers. In 1982, 1983, 1998, 2012, 2013 the in-river run abundance for Nushagak River exceeds the combined run abundances of the other systems, increasing the likelihood that Nushagak River would be particularly influential to an index.

2.6.4.2 Consideration of multiple systems and the Nushagak in an index

Each of the four available systems can be plotted relative to appropriate AEQ components (Figure 7) as was done for the initial CWAK analysis (Figure 5). In all instances, 2006–2009 are treated as outliers, similar to the CWAK index. Combining multiple systems improves the index’s ability to separate particularly low abundance years, and better delineates the natural break used in defining a threshold in the Council motion (Figure 8 and Figure 9; Table 6). While the relationship between the index and AEQ tends to improve when more of the systems that produce large components of the CWAK AEQ are incorporated (Kuskokwim and Nushagak rivers combined; Figure 9), among all combinations of systems in relation to AEQ the natural break is best defined with the 3 System Index comprised of the combined run abundance estimates of Kuskokwim, Upper Yukon, and Unalakleet rivers (Figure 8).

Moreover, when Kuskokwim and Nushagak run size estimates are combined in an index, the index solely represents these systems and is unrelated to more northerly stocks. Further analysis suggests that inclusion of the Nushagak River in the index may be highly influential and while similar trends have been realized in the Nushagak River compared to the Kuskokwim River, inclusion of the Nushagak could potentially mask low run abundance in the other western Alaska systems or could trigger a "low" abundance designation if this one stock alone experienced a poor run year (Figure 2). During the time period evaluated (1994 – 2013); however, the same years meet a 'low' designation under either the 3 System Index or 4 System Index in which the Nushagak is included. For the reasons specified above, and because the Kuskokwim River supports the largest Chinook salmon subsistence fishery in Alaska, the 3 System Index including Kuskokwim River, but excluding Nushagak River, was proposed as the best index and is currently included in the Council motion. The Nushagak supports a small subsistence fishery that is not a major component of the harvest of Chinook salmon on this stock.



a) b) c) d)

Figure 7. Individual river system run indices in association to AEQ components.

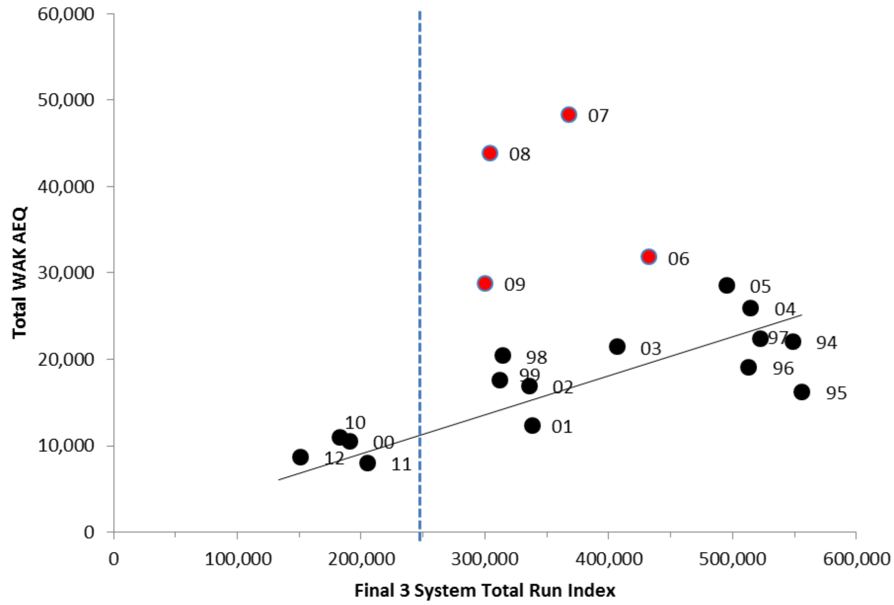


Figure 8. **Relationship between final in-river run abundance of the 3 System In-river Run Index and the bycatch AEQ attributed to all Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon) (Y=0.0451x, R^2 = 0.570). The 250,000 Chinook salmon reference point is indicated by the vertical line.**

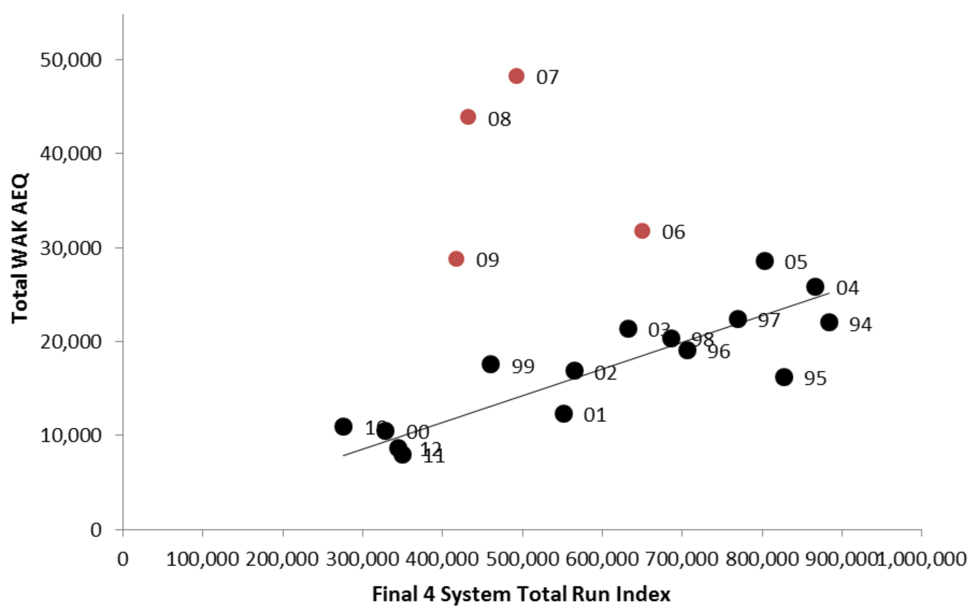


Figure 9. **Relationship between final in-river run abundance of the 4 System In-river Run Index (Kuskokwim, Upper Yukon, Unalakleet and Nushagak river systems) and the bycatch of AEQ attributed to Western Alaska stocks (Y=0.0285x, R^2 = 0.712).**

2.6.4.3 Consideration of a standardized index

One proposed solution to the potential influence of the Nushagak River system on an index, as suggested by the SSC in December, is to standardize the run abundance estimates so that each system provides an equal contribution to the index. ADF&G scientists evaluated the effect of a standardized index and found that, even when standardized, the resulting distribution of data is similar to unstandardized indices (Figure 8, Figure 9 and Figure 10). Both the 3 System Index and 4 System Index show the same years clustering below a natural break (Figure 10, a and b). However, standardization does not appear to result in any improvement in the ability to distinguish between ‘low’ and ‘not low’ for the purpose of the index; the natural break is still most clear in the unstandardized indices. The results also indicate that the unstandardized approach is reasonable in that it does not overly weight one abundance pattern over another among stocks. Either approach provides an acceptable index with similar results, but the unstandardized approach is indexed in numbers of fish, which is a more intuitive metric.

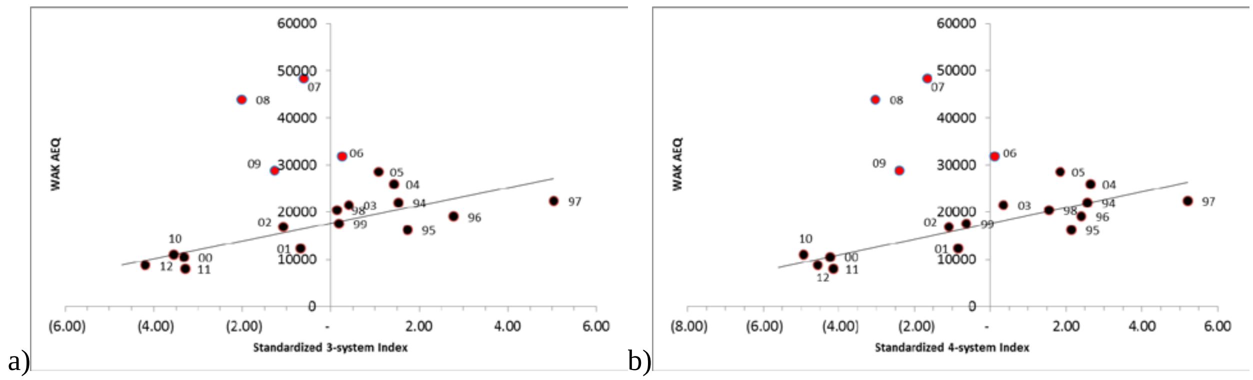


Figure 10. Standardized 3 System Index (a) and 4 System Index (b) in relation to total Western Alaska AEQ

2.6.4.4 Recommendation for the 3 System Index and threshold

Regardless of method or combination of systems, the same years cluster together as being particularly poor and below a natural break in the data. In the 3 System Index, this natural break occurs at about 250,000 Chinook salmon (Figure 11). This cluster of years represents only those years that exhibited particularly poor runs across all systems. It should be noted that entry or exit from a low productivity regime may be evident in different systems at different times. For example, more northerly Western Alaska stocks appear to have been the first to experience low run abundance, later followed by stocks of more southerly origin. It is only those years when both northerly and southerly Western Alaska stocks concurrently experience low run abundance (2000, 2010 through 2014) that would fall below the threshold. In some years the indexed abundance is above this natural break; abundance was poor in one or more, but not all systems (e.g., 2009, 2008, 2007, etc.), and severe subsistence fishing restrictions and inabilities to meet escapement objectives were experienced in some but not all systems. These years would **not** be classified as “low” abundance years using the natural break as a metric.

Based on analyses related to the objectives above, analysts recommended and the Council approved the ‘3 System Index’ composed of Unalakleet, Upper Yukon, and Kuskokwim River in-river run reconstructions, with low abundance defined as an annual run size of ≤250,000 Chinook salmon. The years clustering below the natural break in the 3 System Index (Figure 8) are the same years (2000 and 2010 through 2012) as those in the CWAK index (Figure 5), an index that includes the Nushagak (Figure 9), and an index that standardizes the run abundance estimates using either the three or four systems (Figure 10). These years are easily categorized as low run abundance years for all three systems due to failures to meet escapement goals and restrictions on subsistence harvests, in addition to Federal fisheries disaster declarations. Note that 2013 and 2014 data are not shown in the figure below because AEQ has not yet been estimated for those years; however, 2013 and 2014 would also fall below the proposed threshold to designate a ‘low’ run abundance year (2013 was 143,396; 2014 was 212,750).

2.6.4.5 Timeliness of the index

As noted previously, ADF&G will use post-season run size estimates for the index, and make those available to NMFS by October 1. Whereas post-season estimates would be available in an adequate timeframe, the timeliness of finalized run reconstructions may not be ideal to implement further bycatch reduction measures in times of low Chinook salmon abundance. Finalized run reconstructions are available the spring following the salmon run, meaning the data would be available to the public and the Council in the spring of the following year. For example, for the 2014 salmon season, finalized run reconstructions for all systems would be available by spring 2015 (approximately March) and not published until late 2015 or later. In effect, potential action to change the performance standard would not occur until the second year following a particular Chinook salmon season. The preference is to implement action as close as possible to realized abundance trends. In contrast, for example, the 2014 post-season run size estimate for the 3 System Index is available as of October 1, 2014 (212,750), which indicates Western Alaska Chinook salmon abundance below the proposed threshold of 250,000 Chinook salmon. Consequently, the timeliness of this information could allow for a change in the caps for the subsequent groundfish fishing season (2015).

In post-season run size estimates, escapement and any commercial and recreational harvest are available and known, and subsistence harvest is estimated by ADF&G because subsistence harvest survey data are not yet available. Thus, the difference between post-season and final run size data is that the estimate of subsistence harvest is based on managers' expectations of subsistence harvest rather than an estimate based on survey data, respectively. Given the nature of subsistence use, Chinook salmon subsistence harvest estimates for Upper Yukon, Kuskokwim, and Unalakleet rivers are generally stable in years of adequate run size and no fishery restrictions. In years of restrictions, subsistence harvest can be expected to be somewhat lower than typical harvest, depending on the severity of the restrictions. Because the majority of the run in low run abundance years is realized as escapement, post-season estimates are a very good surrogate for finalized run estimates (Table 6, Figure 12).

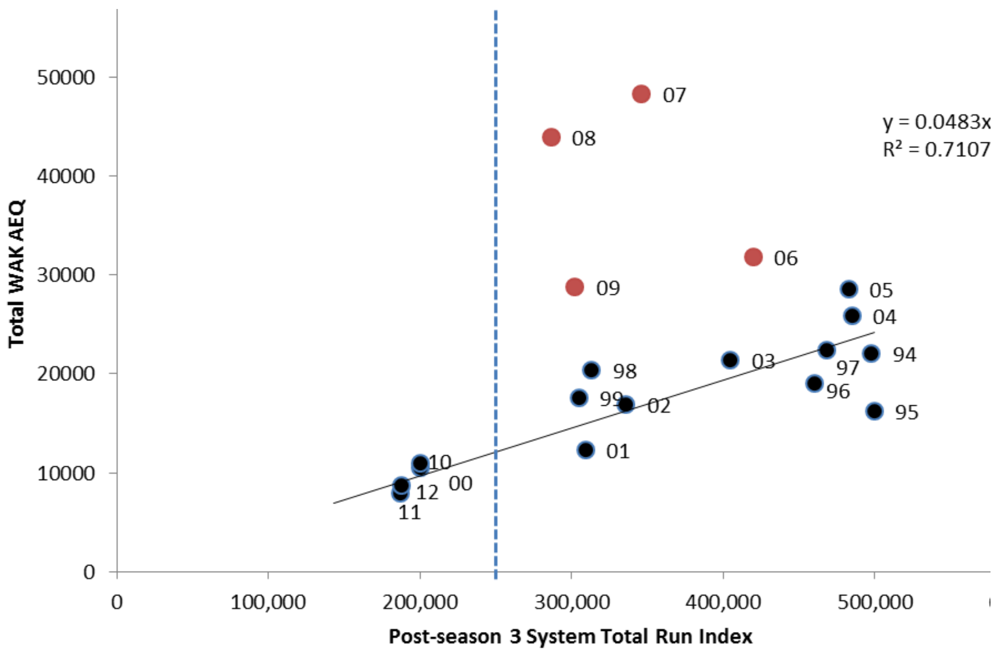


Figure 11. Relationship between post-season in-river run abundance of the 3 System Index and the bycatch AEQ attributed to all Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon). The 250,000 Chinook salmon reference point is indicated by the vertical line.

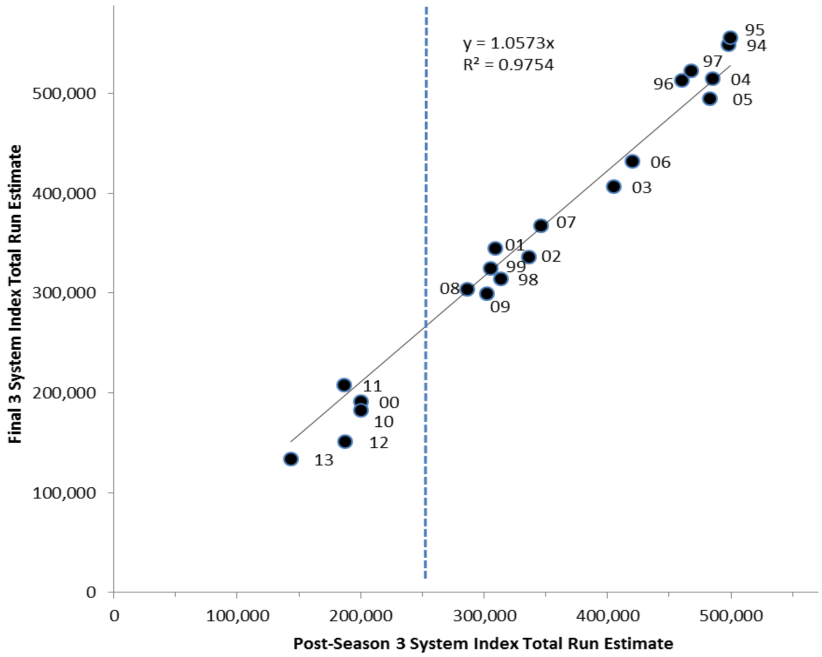


Figure 12. Relationship of post-season 3 System Index and final 3 System Index. The 250,000 Chinook salmon reference point is indicated by the vertical line.

ADF&G staff assessed the robustness of post-season estimates of the 3 System Index as an indicator of low Chinook salmon abundance, which is one of the primary objectives. Within the historical timeframe used for these analyses, there are no years in which an aggregate post-season in-river run estimate for the 3 System Index would yield a categorization of "low" or "not low" abundance different from that categorization yielded by the final estimate ((Table 6). It should be noted that the post-season run index tends to slightly overestimate abundance in low run abundance years and therefore reduces the risk of a lower performance standard being triggered that would not be supported by the final in-river run index.

The sensitivity of "low" or "not low" run abundance categorization of the post-season estimates of the 3 System Index to different assumptions of subsistence harvest was also tested. If one assumes higher subsistence harvest than would reasonably be predicted to occur in restricted years (i.e., no effect of management restrictions), the same years would classify as "low" and "not low" as would be expected in the final run estimates. Conversely, if we assume a greater impact of management actions than would reasonably be expected to occur due to restrictions (i.e. zero subsistence harvest in restricted years), the same years would classify as "low" and "not low" as would be expected in the final run estimates. The post-season 3 System Index appears to be robust to false positives and false negatives (Table 7).

Note that using the 3 System Index also provides more transparency than the CWAK index described in the current June motion and includes a broad regional representation of stocks in western Alaska. ADF&G is responsible for producing these run reconstructions annually, and stakeholders can access the finalized data in the publications produced by the department annually, and available through the ADF&G website:

- **Kuskokwim River** is available in annual Fishery Management Reports. A document reporting the methodology for developing the run reconstruction can be found at: http://www.adfg.alaska.gov/FedAidPDFs/FDS12-49.pdf

- While not identified in its own publication, the total run size of **Upper Yukon River** is reconstructed by ADF&G by using the number of spawners identified in Appendix A9 of the annual Joint Technical Committee to the Yukon River Panel Reports (example: http://yukonriverpanel.com/salmon/wp-content/uploads/2009/03/rir3a201302.pdf) and adding the total harvest of Upper Yukon Chinook salmon in Table 5 of the annual ADF&G publication, Origins of Chinook Salmon in Yukon River Fisheries (example: http://www.adfg.alaska.gov/FedAidPDFs/FDS13-53.pdf).

- **Unalakleet River** is currently published in the triennial BOF Report but will also be made available in annual Fishery Management Reports, an example: http://www.adfg.alaska.gov/FedAidPDFs/SP12-28.pdf

Escapement information, the primary component of the post-season run index, can be accessed and monitored throughout the salmon season through a variety of outlets, including the ADF&G website.

Table 6 Post-season and final individual run reconstruction estimates for Unalakleet, Upper Yukon, and Kuskokwim rivers, and in-river run index from the aggregate. Shaded cells are those years that would fall below a 250,000 Chinook salmon threshold.

	POST-SEASON INRIVER RUN ESTIMATE					FINAL INRIVER RUN ESTIMATE			
YEAR	Unalakleet	Upper Yukon	Kuskokwim	3 System Index Total		Unalakleet	Upper Yukon	Kuskokwim	3 System Index Total
1994	7,400	146,633	343,827	497,860			183,585	365,246	548,832
1995	10,617	147,836	341,441	499,894			195,777	360,513	556,291
1996	9,564	161,214	289,511	460,288		9,971	200,704	302,603	513,278
1997	22,274	139,079	306,688	468,042		24,307	195,103	303,189	522,599
1998	14,535	82,814	215,986	313,335		16,114	84,569	213,873	314,556
1999	8,925	94,226	201,787	304,938		13,277	121,894	189,939	325,110
2000	6,133	53,728	140,624	200,486		5,907	48,466	136,618	190,991
2001	6,377	77,564	225,322	309,263		6,437	114,754	223,707	344,898
2002	6,624	79,591	249,707	335,922		6,535	83,054	246,296	335,884
2003	6,051	133,062	265,845	404,958		6,233	151,988	248,789	407,011
2004	5,244	105,326	374,483	485,053		5,929	120,697	388,136	514,761
2005	5,577	112,153	365,382	483,112		4,986	123,779	366,601	495,366
2006	4,721	113,618	301,781	420,120		5,051	119,454	307,662	432,168
2007	6,264	80,014	260,122	346,400		6,577	88,052	273,060	367,690
2008	3,767	60,082	222,843	286,692		4,249	62,587	237,074	303,910
2009	7,317	84,871	210,142	302,330		7,944	87,225	204,747	299,915
2010	4,687	58,914	136,804	200,405		4,297	59,800	118,507	182,604
2011	3,731	61,017	122,143	186,891		3,256	71,874	133,059	208,189
2012	4,086	47,512	136,088	187,686		3,394	48,496	99,143	151,033
2013	2,507	33,573	107,316	143,396		1,975	37,835	94,000	133,810

Table 7. Sensitivity of the post-season in-river run reconstruction estimates for Unalakleet, Upper Yukon, and Kuskokwim rivers, and the 3 System Index under various subsistence harvest estimate assumptions: (1) subsistence harvest estimation scaled on severity of management action and prior information of effects of those actions, (2) subsistence harvest estimation assuming zero subsistence harvest during years of harvest restrictions (overestimation of subsistence harvest reduction), (3) subsistence harvest estimation assuming full subsistence harvest in all years despite specific management actions to restrict subsistence harvest (underestimation of subsistence harvest reduction). Shaded cells are those years that would fall below a 250,000 Chinook salmon threshold.

	POST-SEASON INRIVER RUN ESTIMATE				POST-SEASON INRIVER RUN ESTIMATE ASSUMING NO HARVEST IN RESTRICTED YEARS (ZERO SUBSISTENCE HARVEST)				POST-SEASON INRIVER RUN ESTIMATE ASSUMING NO MANAGEMENT EFFECT IN RESTRICTED YEARS (FULL SUBSISTENCE HARVEST)			
YEAR	Unalakleet	Upper Yukon	Kuskokwim	3 System Index Total	Unalakleet	Upper Yukon	Kuskokwim	3 System Index Total	Unalakleet	Upper Yukon	Kuskokwim	3 System Index Total
1994	7,400	146,633	343,827	497,860	7,400	146,633	343,827	497,860	7,400	146,633	343,827	497,860
1995	10,617	147,836	341,441	499,894	10,617	147,836	341,441	499,894	10,617	147,836	341,441	499,894
1996	9,564	161,214	289,511	460,288	9,564	161,214	289,511	460,288	9,564	161,214	289,511	460,288
1997	22,274	139,079	306,688	468,042	22,274	139,079	306,688	468,042	22,274	139,079	306,688	468,042
1998	14,535	82,814	215,986	313,335	14,535	82,814	215,986	313,335	14,535	82,814	215,986	313,335
1999	8,925	94,226	201,787	304,938	8,925	94,226	201,787	304,938	8,925	94,226	201,787	304,938
2000	6,133	53,728	140,624	200,486	6,133	28,728	65,624	100,486	6,133	58,728	150,624	215,486
2001	6,377	77,564	225,322	309,263	6,377	52,564	225,322	284,263	6,377	82,564	230,322	319,263
2002	6,624	79,591	249,707	335,922	6,624	79,591	249,707	335,922	6,624	79,591	249,707	335,922
2003	6,051	133,062	265,845	404,958	3,551	133,062	265,845	402,458	6,551	133,062	265,845	405,458
2004	5,244	105,326	374,483	485,053	2,744	105,326	374,483	482,553	5,744	105,326	374,483	485,553
2005	5,577	112,153	365,382	483,112	2,577	112,153	365,382	480,112	5,577	112,153	365,382	483,112
2006	4,721	113,618	301,781	420,120	2,221	113,618	301,781	417,620	5,221	113,618	301,781	420,620
2007	6,264	80,014	260,122	346,400	4,764	80,014	260,122	344,900	7,764	80,014	260,122	347,900
2008	3,767	60,082	222,843	286,692	2,267	35,082	222,843	260,192	5,267	65,082	222,843	293,192
2009	7,317	84,871	210,142	302,330	5,817	64,871	210,142	280,830	8,817	94,871	210,142	313,830
2010	4,687	58,914	136,804	200,405	3,187	33,914	136,804	173,905	6,187	63,914	136,804	206,905
2011	3,731	61,017	122,143	186,891	2,231	46,017	72,143	120,391	5,231	76,017	157,143	238,391
2012	4,086	47,512	136,088	187,686	2,586	32,512	76,088	111,186	5,586	62,512	161,088	229,186
2013	2,507	33,573	107,316	143,396	1,507	28,573	47,316	77,396	4,507	58,573	132,316	195,396

2.7 Improvements to Monitoring and Enforcement Provisions under all Alternatives

Amendment 91 monitoring measures have been in place since January 2011. These monitoring requirements include observer coverage requirements and equipment and operational requirements designed to provide a full census of salmon bycatch in the BS pollock fishery. Generally, NMFS has noted good compliance with the monitoring requirements. Observer Program, Sustainable Fisheries, and NOAA OLE staffs have worked closely with industry during the program implementation to provide outreach and support to ensure understanding and compliance with the monitoring requirements. NMFS has identified the following four recommendations for revisions to the monitoring regulations implemented under Amendment 91 and two recommendations related administrative issues (removing Table 47 from the regulations and changing the deadline for AFA annual reports).

At final action, the Council recommended these regulatory amendments as part of the preferred alternative.

2.7.1 Salmon Retention and Handling on Catcher Vessels

Shortly after implementation of Amendment 91 on January 1, 2011, NMFS staff identified an inconsistency between the regulations for the retention and storage of salmon PSC and the longstanding practice of “deckloading” on some trawl catcher vessels. Regulations at § 679.21 (c)(2) state:

> (ii) Operators of vessels delivering to shoreside processors or stationary floating processors must:

(A) Store in a refrigerated saltwater [RSW] tank all salmon taken as bycatch in trawl operations.
(B) Deliver all salmon to the processor receiving the vessel's BS pollock catch.

The intent of this requirement was to reduce the potential for unlawful discard of salmon, and to make all salmon available to an observer for census and sampling. NMFS intended to accomplish this by imposing strict retention and storage rules in all sectors. However, the requirement to store all salmon in an RSW tank is difficult to enforce, because a catcher vessel operator will often set the final net of a trip to fill or exceed the capacity of their RSW tanks and this can result in having more fish in the codend than can be placed in the tanks. As a result, a portion of the final haul is stored on the deck of the vessel, either contained or loose on the deck.

NMFS recognizes deckloads are a historical and ongoing practice in the pollock fishery. NMFS began monitoring the occurrences of deliveries accompanied by a deckload in 2011. Twenty-eight percent of BS pollock deliveries in 2012 were accompanied by a deckload of fish (either contained in a codend or loose on deck). About five percent of those deliveries included some amount of loose catch on the deck of the vessel. NMFS has continued to monitor deckload deliveries in 2013 and 2014. As described in more detail in Section 4.8.4, in 2013 and 2014 between 7 percent and 9 percent of the pollock deliveries had loose fish on deck. The total estimated weight of the loose fish on deck in all deliveries was 428 mt in 2013 and 684 mt in 2014. Most deliveries involved less than 10 mt (22,050 lbs.) of loose fish on deck. The maximum estimated weight of loose fish on deck in a delivery was about 25 mt (55,125 lbs.).

Loose fish on deck which is not contained inside a codend or some other inaccessible area creates numerous problems. Since these fish are accessible, sorting and potential discard of salmon could occur that would otherwise not be possible were the entire catch secured until delivery. As a result, when loose catch accompanies a delivery, NMFS cannot be assured that all salmon caught are delivered to a processor and that a complete and accurate census of all incidental salmon catch is accomplished. Considering the high priority the Council has placed on obtaining a complete census of salmon PSC in the BS pollock fishery, NMFS highlights this practice and recommends some regulatory amendments that could reduce the potential for salmon to be discarded before they are counted and included in the census.

During the first year of Amendment 91 implementation, NMFS worked with the fleet on a compromise procedure to address deckload deliveries. This approach is detailed in each processor’s Catch Monitoring and Control Plan (CMCP). It involves a brief meeting between vessel personnel, plant personnel and observers to coordinate the transfer of any catch from the deck into the RSW tank where the catch would be pumped into the plant for sorting. As long as any catch that remained on deck and not 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, this was an interim solution to try to reconcile industry practices with the requirement that all salmon be placed in an RSW tank. Despite the focus on this issue, the proportion of deliveries with loose fish on deck increased in 2014.

The Council’s Enforcement Committee addressed this issue at its March 27, 2012, meeting. The 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 counted and sampled by the observer at the processor.

Several alternatives have been discussed to address NMFS’s concerns about monitoring salmon retention on vessels that store fish on deck rather than in fish holds. One option is to prohibit deckloading. However, these catcher vessels are required to retain all pollock, so prohibiting deckloading may create conflicting regulatory requirements when more pollock are brought onboard a vessel than can be contained in holds. The prohibition on deckloading also could encourage wholesale dumping of unsorted codends which may contain salmon.

Another option is to require only that all salmon prohibited species catch by catcher vessels in the BS pollock fishery be retained onboard the vessel and delivered to the processor taking delivery of the vessel's pollock catch. The requirement to store salmon in an RSW tank would be removed. This option would not specify how catch must be stored or handled onboard the vessel, only the required outcome of no discard of salmon. However, this option does not directly address NMFS's concern that loose fish on deck provide too much of an opportunity for salmon to be sorted from the catch and discarded. In addition, all other vessels and processors in the BS pollock fishery, except catcher vessels delivering unsorted codends, are subject to requirements about the handling, sorting, and storage of salmon to ensure proper accounting. Therefore, NMFS recommends the following revisions to the regulations governing the retention and handling of salmon on catcher vessels that bring catch onboard the vessel:

- Clarify the requirement that all catcher vessels in the BS pollock fishery must retain all salmon and deliver them to the processor receiving the vessel's BS pollock catch.
- Remove the requirement that all salmon be stored in an RSW tank (this requirement is too specific).
- Require that after the observer has completed sampling and data collection and the crew has completed sorting the catch and discarding any catch that is allowed to be discarded, all salmon and any other catch retained onboard the vessel must be made unavailable for sorting or discard until the catch is delivered to the processor. Methods to make salmon or retained catch unavailable for sorting or discard include, but are not limited to, placing the catch in an enclosed container either above or below deck, securing the catch in an enclosed codend, or completely and securely covering the fish on deck. This requirement would mean that no loose fish would be allowed to be on deck after observer sampling and data collection and crew sorting was completed.
- Require that the vessel operator notify the observer at least 15 minutes before transfer of fish from one location to another on the vessel or any sorting, handling, or discard of catch prior to delivery of catch to the processor receiving the vessel's BS pollock catch. This requirement would provide the observer the opportunity to monitor the movement or sorting of catch after it is brought onboard the vessel to ensure that no salmon are discarded, and to monitor the re-securing of loose fish on deck.

These requirements would address many concerns noted during the implementation of Amendment 91 while allowing vessel operators to continue the practice of deckloading. Specifically, these revisions would (1) reduce the opportunity for illegal discard of salmon prior to delivery, (2) reduce the occurrence of and quantities of fish remaining loose on deck, (3) provide the observer the opportunity to monitor all handling or transfer of catch on the vessel and during the delivery.

Additional information about the projected costs and benefits of this proposed regulatory amendment is in Section 4.8.4.

2.7.2 ATLAS Software Aboard Catcher vessels less than 125 ft LOA

Currently, all catcher vessels greater than or equal to 125 ft LOA, all processor vessels, and all shoreside processors and stationary processors that are 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. The only exception to these requirements is for vessels using pot gear. NMFS installs custom software called ATLAS on each of these computers. ATLAS is used by observers to enter data collected on the vessel or in the plant. Together the hardware and software allow observers to communicate with, and transmit data to NMFS.

In the AFA shoreside pollock fleet 26 of the 86 CVs that fished in either 2013 or 2014 currently carry a computer with ATLAS software and provide data transmission capabilities for observers. The rest of the vessels are not required to provide a computer with ATLAS installed because they are less the 125 ft LOA or they are delivering unsorted codends to motherships and not required to carry an observer. The observer data for the vessels less than 125 ft LOA required to carry observers are submitted via fax upon returning to port after each trip.

NMFS reviews observer information to ensure that data were collected following proper protocols and it is normal for data to be modified during the "debriefing" and quality control process. The ATLAS software contains business rules that perform many of these quality control and data validation checks automatically, which dramatically increase the quality of the preliminary data. If observers have access to the ATLAS software to enter data and transmission capabilities to send this information then the number of corrections that must be made during the debriefing process is reduced and the timeliness and quality of data is increased. Also, data that is transmitted electronically arrives in a more timely manner to managers. If data are faxed this increases the time for the data to be received, keypunched, and available to managers by a week or more. Additionally, observers onboard vessels with the ATLAS software and transmission capabilities have the ability to communicate directly with Observer Program staff in near real time to address questions regarding sampling as well as to notify staff of potential compliance concerns. In these cases, NOAA OLE has been able to identify compliance trends and violations early to better engage industry with outreach and minimize the need for enforcement actions. This allows 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, in previous drafts of this analysis NMFS recommended extending the requirement to provide a computer with the ATLAS software and the ability for observers to transmit their data from AFA CVs, including those less than 125 ft LOA.

During the December 2012 Council meeting and a public workshop (held in Seattle on May 16, 2013), NMFS received testimony from AFA CVs regarding the potential new computer and data transmission requirements. Most fishery participants were concerned with the cost required to transmit data while at sea and questioned the need for increased timeliness of the at-sea observer data, since salmon PSC accounting on AFA CVs is conducted at the shoreside plant. An alternative was proposed that would require vessels to provide a computer with ATLAS, but not require the ability for observers to transmit their data while at sea. Subsequently, AFA CVs greater than 125 ft LOA have requested that NMFS also consider removing their requirement to provide data transmission capabilities so that all AFA CVs would have the same requirements.

It is possible to develop regulations requiring vessels to provide a computer where an observer can use ATLAS, without the requirement to transmit the data while at sea. This approach was implemented for CVs participating in the Central Gulf of Alaska Rockfish Program. In development of the Rockfish Program, NMFS determined that vessels made short duration trips and that the cost of requiring communication equipment would outweigh the benefits of increased timeliness of data transmission. Under this approach, observers enter all their data into the ATLAS software that is installed on a computer provided by the vessel. Once the vessel returns to port to offload catch, the observer downloads their data to a memory stick and transmits the data from a shore-based computer with internet access. If wireless internet access was available on the boat when the vessel is in port then potentially an observer could also transmit the data directly from the computer on the boat. At the time of data transmission, the observer is able to send questions and download any error messages or instructions from a NMFS in-season advisor.

There are several tradeoffs when considering ATLAS without transmission capabilities. On one hand, this approach reduces costs for the vessels. NMFS gains the benefit of data being entered into ATLAS instead of receiving faxed copies of data sheets that require keypunching which significantly adds to the delay in managers having access to the data. On the other hand, data transmission from the vessel while at sea provides the fastest access to the information for management. There may also be a few vessels that deliver to locations without reliable internet access and this needs to be considered under the approach of ATLAS without transmission capability for AFA CVs. Finally, without transmission capabilities observers do not have the ability to directly communicate with a NMFS in-season advisor in near real time to discuss problems encountered on the vessels or address sampling problems. The observer has to submit the question or concern after a trip and wait for a response at the completion of the next trip, which could be up to a week or longer.

In consideration of these tradeoffs, NMFS recommends:

- leaving the regulations in place for CVs greater than 125 ft LOA to maintain a computer and an electronic transmission system for use by an observer; and
- adding new regulations requiring that AFA CVs less than 125 ft LOA provide the observer access to computer and that the computer has installed the most recent release of ATLAS provided NMFS, but no data transmission requirements.

Additional information about the projected costs and benefits of this proposed regulatory amendment is in Section 4.8.4.

2.7.3 Additional regulation changes

1. View of Salmon in Storage Container

Regulations at §679.28(d)(7)(ii) require that *all salmon* stored in the salmon storage container on a catcher/processor or mothership 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 for an observer to see each individual fish in the container. NMFS proposes to correct the wording of this regulation to better reflect the intent that *the salmon storage container* (and not each individual salmon in the container) must remain in view of the observer at the observer sampling station at all times during the sorting of each haul.

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

Currently regulations do not require all salmon to be removed from the observer sampling area and the salmon storage location at the end of each haul by a catcher/processor or mothership or each delivery in a processing plant. To avoid any confusion about which haul or delivery to attribute the salmon and to avoid double counting of salmon, NMFS assumed that vessel and plant personnel 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, NMFS received a challenge to this assumption from an industry participant. Therefore, NMFS proposes to add a new sentence to regulations that would require all salmon be removed from the salmon storage container and adjacent area at the end of each haul or delivery, after the observer has completed his or her data collection duties and in the presence of the observer.

3. Remove Table 47, 50 CFR part 679 from regulations

NMFS proposes to remove Tables 47a, b, c, and d from the regulations and would instead maintain these tables on the NMFS Alaska Region Web site. NMFS added Tables 47a, b, c, and d to part 679 with the final rule to implement Amendment 91 to the FMP. At that time, Tables 47a, b, c, and d were the most efficient way to be transparent about the values NMFS uses in making the necessary calculations under the Amendment 91 Program: the percent of the each sector's pollock allocation, numbers of Chinook salmon associated with each vessel in the sector used to calculate the opt-out allocation and annual threshold amounts, and the percent of the pollock allocation associated with each vessel that NMFS uses to calculate minimum participation in the IPAs.

Since these tables were published in August 2010, catcher vessels have changed names and consolidated pollock allocations and Chinook salmon PSC limits. In June 2014, NMFS recalculated the pollock allocations and Chinook salmon limits for catcher vessels that had changes to their allocation and limits since 2010. NMFS revised Table 47c to show the original and revised information and published the revised table on the NMFS Alaska Region's Web site at *http://alaskafisheries.noaa.gov/rr/tables/tabl47c_2014.pdf*. However, a regulatory amendment is required to change these tables in the regulations. Changes to the information in these tables may become more frequent with the ability to replace AFA vessels under Amendment 106 to the FMP (79 FR 54590, September 12, 2014).

4. Revision to the deadline for annual reports

Participants in the BS pollock fishery are required to submit the following three annual reports to the Council by April 1 of each year:

- <u>AFA cooperative annual report</u>. Since 2002, the AFA cooperatives have been required to submit an annual AFA cooperative report to the Council that provides information their allocations and fishing activity.
- <u>Chinook salmon IPA annual report</u>. Described in Section 2.1.2.2.
- <u>Non-Chinook salmon inter-cooperative agreement (ICA) annual report</u>. Described in Section 2.1.1.6.

Table 8 provides a list of the information requirements for each of the three currently required annual reports.

Under Amendment 91, the deadline for all of these annual reports was standardized at April 1 and presentation of the annual reports has been done at the April Council meeting each year. In the first few years of implementation, the April 1 deadline created a difficulty because it did not provide enough time for Council staff to receive and copy the reports and make them available to the Council and public prior to the Council meeting. With the transition to electronic copies of Council documents, the burden associated with photocopying these reports for the Council meeting may be reduced. However, the question of providing a copy of the annual reports to the Council and public in an appropriate amount of time prior to the Council meeting remains a question. Therefore, the Council may wish to consider revising the deadline for these reports to March 15 or another appropriate date. An economic data report (EDR) also must be submitted to NMFS each June 1.

In addition to establishing the appropriate deadline for these annual reports, under some of the alternatives, the Council considered consolidating or revising some of the information requirements in the annual reports.

Table 8. Mandatory and voluntary annual reporting requirements for the AFA cooperatives and participants in the Bering Sea pollock fishery.[14]

AFA cooperative annual report (§ 679.61(f))	IPA annual report (§ 679.21(f)(13))	ICA annual report (§ 679.21(g)(4))
The cooperative's allocated catch of pollock and sideboard species, and any sub-allocations of pollock and sideboard species made by the cooperative to individual vessels on a vessel-by-vessel basis.	A comprehensive description of the incentive measures in effect in the previous year.	An estimate of the number of non-Chinook salmon avoided as demonstrated by the movement of fishing effort away from Chum Salmon Savings Areas.
The cooperative's actual retained and discarded catch of pollock, sideboard species, and PSC on an area-by-area and vessel-by-vessel basis.	A description of how these incentive measures affected individual vessels.	The results of the compliance audit.
A description of the method used by the cooperative to monitor fisheries in which cooperative vessels participated.	An evaluation of whether incentive measures were effective in achieving salmon savings beyond levels that would have been achieved in absence of the measures.	
A description of any actions taken by the cooperative in response to any vessels that exceed their allowed catch and bycatch in pollock and all sideboard fisheries.	A description of any amendments to the terms of the IPA that were approved by NMFS since the last annual report and the reasons that the amendments to the IPA were made.	
The total weight of pollock landed outside the State of Alaska on a vessel-by-vessel basis.	Sub-allocation to each participating vessel of the number of Chinook salmon PSC and amount of pollock (mt) at the start of each fishing season, and number of Chinook salmon PSC and amount of pollock (mt) caught at the end of each season.	
The number of salmon taken by species and season, and list each vessel's number of appearances on the weekly "dirty 20" lists for non-Chinook salmon. *Council requested (voluntary) additional information*: [1] AFA exempt vessel activity in the GOA and inter-temporal harvest information	In-season transfers. For in-season transfer of Chinook salmon PSC or pollock among AFA cooperatives, entities eligible to receive Chinook salmon PSC allocations, or CDQ groups, provide the following information: date of transfer, name of transferor, name of transferee, number of Chinook salmon PSC transferred, and amount of pollock (mt) transferred. For transfers among vessels participating in the IPA provide the following information: date of transfer, name of transferor, name of transferee, number of Chinook salmon PSC transferred, and amount of pollock transferred.	

[14] From Table 1 in "Review of Cooperative Reporting Requirements" Discussion Paper. North Pacific Fishery Management Council, December 2013.

2.8 Comparison of alternatives and selection of a preferred alternative

Table 9 provides an overview of the major similarities and differences amongst the alternatives while Table 10 provides a summary of the major potential benefits, key concerns and policy-level trade-offs amongst them.

Table 9. Summary and comparison of alternatives.

Alt	Chinook PSC limit	Non-Chinook PSC limit	IPA requirements	Pollock seasons
1	60,000 PSC limit 47,591performance standard PSC limits and performance standard divided by sector and season.	PSC limit closes Chum salmon savings area (August 1-31 by regulation). Pollock fishery exempt if in RHS program.	To allow for allocation of the 60,000 PSC limit and 47,591 performance standard: Chinook IPA must meet requirements in regulation. Annual approval process by NMFS.	A season: January 20-June 9th B season: June 10-Nov 1
2	Same as Alt 1	Status quo PSC limit and closure for any vessels not participating in an IPA with includes chum bycatch management	Requirements for IPA in regulation would be modified to include chum bycatch management. Focus on avoidance of western AK chum and provisions for not increasing Chinook bycatch	Same as Alt 1
3	Same as Alt 1	Same as Alt 1	Modified IPA requirements for Chinook to include options for: • Restrictions/penalties on high bycatch rate vessels • Require use of salmon excluder devices • RHS continuously in A and B seasons • Modify duration of salmon savings credit • Restrictions/performance criteria for bycatch rates in October	Same as Alt 1
4	Same as Alt 1	Same as Alt 1	Same as Alt 1	**A season:** Jan 20th-May 31st (or Jun 9th) **B season:** Open: Jun 1- (or Jun 10th) Close: Sept 15th or Oct 1st or Oct 15th Pollock **A:B allocation** (with rollover): 1) 45:55 or 2) 50:50
5	Performance standard reduced: Option 1: 25% Option 2: 60% Suboption to also reduce PSC limit by same % (25% and 60%).	Same as Alt 1	Same as Alt 1. However IPAs will need to adjust their programs to accommodate a lower performance standard (and PSC limit) in applicable years	Same as Alt 1

Alt	Chinook PSC limit	Non-Chinook PSC limit	IPA requirements	Pollock seasons
6	45,000 PSC limit 33,318 Performance standard in years of low abundance. PSC limits and performance standard divided by sector and season.	Status quo PSC limit and closure for any vessels not participating in an IPA that includes chum bycatch management	Modified IPA requirements for Chinook to include options for: • Restrictions/penalties on high bycatch rate vessels • Require use of salmon excluder devices • RHS continuously in A and B seasons • Modify duration of salmon savings credits • Restrictions/performance criteria for bycatch rates in October	Pollock **A:B allocation** (with rollover): 45:55

Table 10. Summary major policy-level issues and trade-offs among alternatives.

Alt	Policy-level trade-offs
1	**Status quo issues**: • Chum salmon PSC management intended as an interim measure while better approaches were developed. • Regulations limit flexibility in RHS program. • Chinook PSC management effective at keeping bycatch below limits but could improve on objective to affect vessel behavior under conditions of low salmon abundance. • Need to account for both salmon species with respect to objectives.
2	**Potential benefits** • Likely to provide greater flexibility to modify RHS program to best suit goals and objectives to focus upon protections for WAK chum stocks while continuing to avoid Chinook. **Key concerns** • Potential for increased chum bycatch when RHS closures are lifted or modified to avoid Chinook salmon. • Assumes that Chinook opt-out provisions and CSSA exemption provide sufficient incentive to participate in an IPA.
3	**Potential benefits** • Likely to provide incremental improvement in Chinook bycatch incentives over status quo, although larger potential penalties would provide stronger incentives for vessels to avoid Chinook. • More flexible and adaptive means of increasing IPA incentives for bycatch reduction than mandating explicit measures by regulation; however, actual impact will depend upon how the IPAs respond to additional requirements. • October bycatch performance incentives can bring down Chinook PSC but still maintain pollock fishery flexibility. **Key concerns** • Depending on IPA response, most of the items in this alternative likely to result in only minor changes relative to Alt 1. • Management measures are outside of regulation and it may be difficult to monitor in terms of incentives and effectiveness. Sectors can dramatically change the form of the IPAs in response to adjustments here.
4	**Potential benefits** • Options to curtail season earlier likely to provide the greatest reduction in Chinook salmon PSC over other alternatives. • Option to open B-season 9 days earlier likely to encourage additional earlier fishing effort in B season and reduce Chinook bycatch. • Options to reallocate additional pollock quota to A-season may provide additional tools to encourage less fishing at end of B season **Key concerns** • Risk that pollock may be forgone in B season depending upon season length options. • Differential impacts by sectors as some sectors have historically completed fishing by proposed end dates. • High potential to increase chum bycatch by increased fishing pressure earlier in B season. • Seasonal quota reallocation may provide tool to encourage fishing earlier but lacks restrictions on fishing at the end of B-season—this change alone could increase rates in some years. Some vessels currently choose to pursue other activities outside of the pollock fishery early in the B season and may continue to do so without new incentives or restrictions. • Presumes IPA structure combined with A91 limits and seasonal allocation sufficient to keep A-season PSC from increasing • Some form of Steller sea lion consultation would need to be pursued
5	**Potential benefits** • Threshold for more restrictive management is an index of low abundance. In a year or years of low Chinook abundance (2010-2014) then application of different management measure to reduce risk of reaching PSC limits. **Key concerns** • Some relationship of PSC to run size but at low threshold, significant additional reductions may be difficult to realize. • In some individual years (e.g., 2000) the threshold may be met but run sizes could rebound quickly (e.g., in 2001). Such a sequence may significantly increase the costs of Chinook avoidance to the pollock fishery, including that some vessels might not harvest their pollock allocations. • Impacts will be contingent on how IPAs adapt to lower performance standard threshold or lower PSC limit in applicable years. Allocations to individual vessels under lowest performance standard may be very constraining and result in modification to the IPAs within sectors. • Potential that reducing performance standard threshold while retaining higher PSC limit in applicable years will provide perverse response to PS under current IPA structures based upon an evaluation that the Chinook stock will be above the threshold in subsequent years and that it could provide increased incentive to exceed the performance standard threshold. • While vessels often have the ability to move or avoid areas or change when they fish to reduce Chinook bycatch, we do not know how difficult it will be for vessels to avoid Chinook in the future

Alt	Policy-level trade-offs
6	**Potential benefits** • Likely to provide greater flexibility to focus upon protections for WAK chum stocks while continuing to avoid Chinook. • Likely to provide incremental improvement in Chinook bycatch incentives, although larger potential penalties would provide stronger incentives for vessels to avoid Chinook. • More flexible and adaptive means of increasing IPA incentives for bycatch reduction; however, actual impact will depend upon how the IPAs respond to additional requirements. • October bycatch performance incentives can bring down Chinook PSC but still maintain pollock fishery flexibility. • Reallocating additional pollock quota to A-season may provide additional tools to encourage less fishing at end of B season. • Threshold for more restrictive management is an index of low abundance. In a year or years of low Chinook abundance (2010-2014) then application of different management measure to reduce risk of reaching PSC limits. **Key concerns** • Depending on the economic choices of different vessels and the strength of IPA incentives to have low bycatch in October, it is uncertain how much fishing will be reduced late in the B season in all years which would reduce Chinook bycatch to the greatest degree. • The reduction in the PSC limit and performance threshold level will require some changes in the inshore and mothership IPA programs; how these changes will impact the strength of incentives is unclear. • The reduction in allocations at the vessel/platform level increases the likelihood that vessels will increase costs and reduce product value in efforts to further reduce Chinook bycatch.

2.8.1 Selection of the preferred alternative

As noted previously, the alternatives under consideration, while analyzed individually, are not mutually exclusive. In selecting the preferred alternative (PA), and in particular with combining aspects across alternatives, the Council has considered policy objectives associated with each and the potential downstream impacts of pulling some aspects forward and not others. Over-arching policy goals in the suite of alternatives include provisions to provide greater flexibility to the pollock fleet to avoid bycatch with provisions to prohibit bad behavior at times of higher Chinook bycatch. Some options within alternatives are redundant or in conflict with other options however. Table 11 is provided to summarize which options can be combined as well as how options meet the range of objectives in the Council's purpose and need. At final action the Council selected a PA which is a combination of the alternatives. In doing so, the Council balanced the goals and objective in the Purpose and Need statement (Section 1.1), the ten National Standards (Section 5.1), concerns with balancing competing conflicts, interests and management programs as well as input from the public in selecting a PA.

Table 11. Summary of alternatives and options relative to Council intent, management tools and ability to combines across alternatives in constructing a preferred alternative.

Alt /Option	**Council Intent** and Management tools considered under alternatives	Potential to combine with other tools
	Tools to reduce fishing during times of high Chinook encounters	
4.1	• Modify B-season opening	Yes all Alts
4.2	• Shorten B-season	For all but Alt 3.5
3.5	• Penalties within IPAs for Oct PSC	For all but Alt 4.2
4.3	• Shift quota to A-season	Yes for all alts
	Tools to help increase incentives to reduce Chinook PSC	
5.1 and 5.2	• Reduced performance standard	Yes all alts
5.1 and 5.2	• Reduced PSC limit and Performance Standard	Yes all alts
3.5	• IPA penalties on high PSC vessels	Yes all alts
3.2	• Mandate excluders within IPAs	Yes all alts
3.5	• IPA penalties for high PSC in Oct	For all but 4.2
3.4	• Revise credit system for CVSSIP	Yes all alts
3.3	• Retain RHS all season	Yes all alts
	Avoid high bycatch of chum	
2	• Incorporate chum into IPAs	Yes all alts

Table 12. Summary of alternatives and options in relation to Council management objectives. The symbols ↑, ↔, and ↓, reflect improvements, relative neutrality, and potential negative effect (all relative to status quo), respectively.

Alt/Opt	**Measure**	**Chinook PSC**	**Chum PSC**	**Pollock Fishing Flexibility**
4.1	Modify B-season opening	↑	↑	↔
4.2	Shorten B-season	↑	↔	↓
3.5	Penalties within IPAs for Oct PSC	↑	↔	↓
4.3	Shift quota to A-season	↔↑	↑	↑
5.1, 5.2	Reduced performance standard	↔↑	↔	↓
5.1, 5.2	Reduced PSC limit and performance standard	↑	↔	↓
3.5	IPA penalties on high PSC vessels	↔↑	↑↔	↔
3.2	Mandate excluders within IPAs	↑	↑	↓
3.5	IPA penalties for high PSC in Oct	↔↑	↑↔	↔↓
3.4	Revise credit system for CVSSIP	↑	↔	↓
3.3	Retain RHS all season (CVs)	↑	↔	↓
2	Incorporate chum into IPAs	↔	↔↑	↑
	Add rule to only allow fishing late if also fished early	↑↔	-	↑

The impacts of many of the alternatives/options above depend on whether they are implemented alone or in conjunction with other measures. Some examples are provided below of the types of mixing and matching considered by the Council and the estimated impact of combining measures into example packages (Table 11 and Table 12).

For example, Alternative 2 for chum bycatch management under the IPAs can be combined with any of the alternatives without, in and of itself, being a factor decreasing the flexibility of management in the IPAs. As noted in Section 2.8 no other alternative for chum management considered in past iterative analyses provided flexibility to address chum bycatch without a high potential for consequences on avoiding Chinook.

Under Alternative 4, several tools are considered which may provide opportunity to catch pollock quota at times of lower Chinook bycatch. These tools include:

- Modify B-season opening date
- Modify quota proportions between A and B seasons.

These two measures could be combined to increase flexibility understanding that not all vessels will be able to take advantage of the opportunity to fish earlier due to a variety of reasons (operational constraints, other fishing on-going, travel time from other regions, time frame for regular vessel maintenance and safety considerations etc.; see Section 3.5.4 for more information). Selection of a combination of these measures may allow *some* vessels to take advantage of the increased flexibility and potentially provide them the ability to catch their quota in times of lower Chinook bycatch which provides for incrementally lower bycatch overall. Note that while these measures may, as intended, provide some vessels the ability to fish earlier it does not, absent additional layering, prohibit any vessels from fishing later in the B-season. To do so the Council considered adding additional provisions from other options and alternatives such as measures under Alternative 4 to close the fishing season earlier, or provisions under alternatives to fold additional restrictions, penalties or performance criteria into the IPAs. In considering these options the Council is relying on the structure of the IPAs as well as the Amendment 91 caps and seasonal allocations to prevent increased bycatch in the A season should sectors fish additional quota in the A season (and possibly earlier and/or harder through the season).

Alternative 5 addresses lower PSC limits in years of low abundance of western Alaskan Chinook. This alternative can be combined with other alternative measures, such as under Alternative 4 (option to open season earlier, options to adjust proportion of seasonal pollock quota) to provide increased flexibility to the fleet under potentially more restrictive PSC limit. PSC limit provisions under Alternative 5 for the overall PSC limit and the performance standard threshold could also be combined over the range of percentages considered to best increase or retain incentives to remain below the performance standard.

In selecting a PA the Council considered a combination of a variety of measures across all the alternatives under consideration. Table 13 provides a worksheet that assisted the Council in designing a PA. The PA includes a combination across multiple alternatives and options. This worksheet is organized according to the broad goals and objectives as identified in the Council’s purpose and need statement (Section 1.1).

Table 13. Worksheet for construction a preferred alternative (PA) across all of the management measures (Alternatives/Options or 'Alt/Opt') considered

	Measure	Alt/Opt	PA
Status Quo	Current Chum management under Am84; Chinook management under Am91	1	
Late season action	Penalties within IPAs for Oct PSC	3.5	
	Rule to allow fishing late B-season only if fished early	New/3.5	
	Close B-season earlier	4.2	
Seasonal TAC shift	Shift quota to A-season	4.3	
PSC limit adjustment	Reduced performance standard threshold	5.1, 5.2	
	Reduced PSC limit and performance standard	5.1, 5.2	
Chum	Incorporate chum into IPAs	2	
Mandate IPA details	Mandate excluders within IPAs	3.2	
	Retain RHS all season	3.3	
	Revise credit system for CVSSIP	3.4	
	IPA penalties on high PSC vessels	3.5	
June 1 open	Earlier B-season opening	4.1	

In order to assist the Council and the public with understanding the implications of a variety of combinations of management measures, Table 14 shows some broad combinations of alternative components (indicated by dark grey) grouped, as with Table 13, according to meeting Council goals and objectives. Note that alternatives/options that are shaded in light grey are ones that would not be in conflict with other measures, have limited negative trade-offs, and might be considered regardless of other measures. Estimated direction of impacts to Chinook, chum and pollock of the combinations of alternatives (shown as 'Packages") are shown at the bottom of the table and described in more detail in Table 15.

Table 14. Example alternative and option combinations—"Packages"—as shown in dark gray shading intended to show which components may best be combined together and how they likely complement or substitute one another. The symbols ↑, ↔, and ↓, reflect improvements, relative neutrality, and potential negative impact (all relative to status quo), respectively.

Type of measure - chose 1 of each | **Package**

	Measure	**Alt/Opt**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Late season action	Penalties within IPAs for Oct PSC	3.5							
	Rule to allow fishing late B-season only if fished early	New/3.5							
	Close B-season earlier	4.2							
Seasonal TAC shift	Shift quota to A-season	4.3							
PSC limit adjustment	Reduced performance standard threshold	5.1, 5.2							
	Reduced PSC limit and performance standard	5.1, 5.2							
Items below can be chosen independently:									
Chum	*Incorporate chum into IPAs*	2							
Mandate IPA details	*Mandate excluders within IPAs*	3.2							
	Retain RHS all season	3.3							
	Revise credit system for CVSSIP	3.4							
	IPA penalties on high PSC vessels	3.5							
June 1 open	*Earlier B-season opening*	4.1							
	Chinook		↑	↔	↑	↑	↑↔	↑↑	↑
	Chum		↔↓	↑	↓	↔	↔	↓	↔
	Pollock		↓	↑	↓	↔	↔	↓	↔↓

Table 15. Overall description of impacts of each example 'Package' combination in Table 14 on Chinook salmon, chum salmon, and pollock.

Alternative/ Option Package	Chinook impact description	Chum impact description	Pollock impact description
1	Less or zero fishing late B-season will reduce Chinook bycatch.	More effort in early B season could increase chum bycatch.	Lower product value and reduced alternative opportunities for the pollock fishery due to more harvest earlier in the B season.
2	Ambiguous impact on Chinook depending on when pollock effort is reduced in B season	Less B season fishing will reduce chum	More flexibility in timing and higher gross revenue in A season
3	Reduced PSC limit can be expected to reduce Chinook bycatch.	Vessels are likely to fish more in early B season to avoid high-bycatch late which could increase chum bycatch.	Greater avoidance costs and reduced product value from moving off fish, avoiding areas, and fishing less in late B season
4	Increase in A season Chinook likely countered by reduction in late B season	Neutral impacts	Higher gross revenue/MT in shift to A season but reduced gross revenue at end of B season; definitely tool for some vessels that only fish early in B season now.
5	Increase in A season Chinook likely countered by increased avoidance and less effort in late B season	Neutral impacts	Higher gross revenue/MT in shift to A season but reduced revenue but some additional avoidance costs
6	More avoidance throughout the year and less bycatch in late B season	Vessels are likely to fish more in early B season to avoid high-bycatch late that could increase chum bycatch.	Greater avoidance costs and reduced product value from moving off fish, avoiding areas, and fishing less in late B season
7	More avoidance throughout the year and less bycatch in late B season but more effort in A season	Neutral impacts	Higher gross revenue/MT in shift to A season but additional avoidance and gross revenue lost with early B season closure

2.8.2 Rationale for the Council's Preferred Alternative

The intent of the PA is to create a comprehensive program that more effectively minimizes Chinook salmon and chum salmon bycatch in the Bering Sea pollock fishery. In considering this combined management approach, the Council considered a broad suite of measures that are all estimated to result in some level of behavior change to further avoid salmon bycatch, which is the primary objective of this action. Experience has shown that PSC avoidance requires flexibility and the ability of vessels to adjust to real-time information and fishery conditions. The recommended changes in the PA are adjustments to the existing program to make it more effective. In particular the Council expressed that it remains extremely important to ensure that the program is working as intended and to evaluate whether the incentives are strong in times of historically low Chinook abundance.

Incorporating chum salmon into the IPAs provides measures to prevent high chum salmon bycatch, while allowing for flexibility to target avoidance of Alaska chum stocks by avoiding times when the composition of the chum bycatch contains chum salmon of Alaska origin and to adapt to changing conditions on the water quickly. In doing so, this action for chum bycatch strikes an appropriate balance between regulatory requirements and adaptive management. Genetic information indicates that the majority of the chum salmon caught in the pollock fishery are of Asian origin (approximately 60 percent) while a smaller percentage (approximately 21 percent) originate from aggregate streams in western Alaska. Chum salmon from elsewhere in Alaska, the Pacific Northwest, and Canada comprise the remaining percentage of the bycatch (approximately 19 percent). While the genetics cannot differentiate hatchery-origin fish from wild Asian chum salmon, given the high proportion of Pacific Rim hatchery-released chum from Japan, much of the Asian origin chum observed in the bycatch is likely to be of Asian hatchery-origin. The Council's action is designed to consider the importance of continued production of critical chum salmon runs in western Alaska by focusing on bycatch avoidance of Alaskan chum salmon runs. These runs have indicated a history of volatility in run sizes and an historic importance in the subsistence lifestyle of Alaskans. Additional protections to other chum stocks outside of Alaska are embedded in the Council's objective to avoid the high bycatch of chum salmon overall, recognizing that most non-Alaska chum salmon are likely from Asian hatcheries.

Further modifications to IPA requirements increase the incentives to reduce Chinook salmon bycatch within the IPAs. The IPA system is based on being flexible, responsive, and able to be tailored by each sector to fit its operational needs. Incorporating additional provisions was noted by the Council as intended to provide an opportunity for IPAs to increase their responsiveness and improve upon an individual vessel level in some sectors. This is intended to reduce the potential for outlier behavior as has been noted in the analysis. The action would require an excluder during almost the entire A season and the last two months of the B season, the times in which the fleet encounters Chinook. The mandate that the IPAs require all vessels to use an excluder without the need to detail what type of excluder design to use in Federal regulations provides the best approach.

The inclusion of a lower PSC limit and performance standard threshold is based on the need for additional incentives to reduce bycatch when these Chinook stocks are critically low in order to minimize the impact of the pollock fishery. Any additional fish returning to those rivers improves the ability to meet the escapement goals, which is necessary for long-term sustainability of the stock and the people reliant on this fishery. This action only reduces both PSC limits, in years of very low salmon abundance. The performance standard is truly the operational PSC limit, however reducing the PSC limit is also appropriate given the potential for decreased bycatch reduction incentives should the performance standard threshold be exceeded with a large gap before the PSC limit itself is reached. Specifically, vessels may choose not to incur the extra costs associated with bycatch avoidance once a performance standard has been exceeded, unless there's a lower PSC limit in place. In years of low abundance, reducing this risk is critical thus the Council selected to reduce both the PSC limit and the performance standard threshold

Integral to the Council's decision on the level of the limit reduction is the fact that the current bycatch levels are much lower than the caps. This is likely due to low salmon abundance as well as to the incentive programs working. Thus all of the combined measures included in the PA are focused upon retaining the incentives to reduce bycatch at all levels of abundance as intended by the Council's original action under Amendment 91.

2.9 Consideration of Reporting Requirements

The Council requested consideration of additional reporting requirements to be discussed in conjunction with selection of a PA at final action. Some information is provided below regarding additional reporting requirements that could be considered in conjunction with various alternatives and options. At final action, the Council recommended reporting requirements as necessary to implement the Council's preferred alternative, the removal of the chum ICA annual report, and the consolidation of chum and Chinook salmon IPA reporting.

As noted under Alternative 2, additional reporting requirements would be required should the IPAs be modified to include chum bycatch avoidance. The following list (Table 16) summarizes ideas for additional annual reporting requirements under any program which includes a revised RHS program. 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 RHS program on a periodic basis. 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 16. Suggested reporting requirements in conjunction with selection of a RHS-based management program. 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 a clause in 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 stakeholders about the evolving Chinook salmon mitigation measures. Not all closures under IPAs are shared between sectors currently. Note this would also be an important requirement should the Council move forward with Alternative 3, option 3 to mandate that RHS programs under the IPAs operate throughout the entire A and B season as these programs, while in operation, are not part of the IPA requirements.

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.

   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. .
5. This item was suggested by NMFS RO staff as a means to better consolidate reporting requirements for salmon PSC by the fleet. Some additional items that could be considered in conjunction with Alternatives and options under consideration for Chinook bycatch management modifications are listed below:
6. Detailed description of all incentives applied in an IPA. For example, for the RHS: where, when, the vessels that had fished in the area before the closures and information on how the closures were identified.
7. For outlier incentives or incentives to reduce fishing at the end of the B-season, data used to determine if and how incentives apply.
8. Excluder usage by vessels.

Table 17. Additional information that could be compiled and analyzed by Agency or Council staff analysts in conjunction with Table 16 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	Catch Per Unit Effort, 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 is available from the Chinook EDR since 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 is 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 decide 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.

2.10 Alternatives Considered but not Analyzed Further

The Council has been considering various measures for chum salmon bycatch management since final action was taken in 2009 on Amendment 91 for Chinook. A lengthy iterative process of developing alternative measures for Chum salmon PSC occurred from 2009 to 2012. Measures under consideration included PSC limits, revised area closure systems and a triggered closure with an exemption similar to status quo. The analysis of these however was complicated by issues related to the differential timing in the B-season of chum PSC compared with Chinook PSC. While chum PSC tends to be caught in higher amounts beginning in late July to early August, Chinook levels ramp up in September to October when Chum salmon PSC tends to be lower. Thus any efforts to reduce chum bycatch earlier in the summer can lead to additional fishing pressure later in the B-season, which would have the potential to exacerbate Chinook PSC. As a result of this, in December 2012, at the third initial review of iterative Chum salmon bycatch management measures analyses, the Council elected to take the following motion:

> *The Council is concerned that the current suite of alternatives does not provide a solution to the competing objectives outlined in the problem statement and purpose and need, recognizing the overall objective to minimize salmon bycatch in the Bering Sea pollock fishery to the extent practicable, while providing for the ability to achieve optimum yield in the pollock fishery. It is clear from the analysis thus far that measures considered to reduce bycatch of Alaska origin*

chum have a high likelihood of undermining the Council's previous actions to protect Chinook salmon.

The Council requested that each sector provide a proposal that would detail how they would incorporate a western Alaska chum salmon avoidance program, with vessel level accountability, within their existing Chinook IPA for Council review. Upon review and public input, the Council then determined an approach to best meet the multiple objectives outlined in the problem statement.

A combined proposal for incorporating chum into the IPAs was presented to the Council in October 2013 in conjunction with the staff discussion paper. At that time the Council made a number of requests for analysts to consider in a discussion paper for June 2014 review by the Council. These requests were primarily related to Chinook bycatch management measures, but information was requested on current regulatory requirements for Chum salmon bycatch measures and changes that would be needed to manage both salmon species together under a combined bycatch management program.

The Council requested consideration of a modification in the PSC accounting period. The current PSC accounting period used for the groundfish fisheries (to accrue against current Chinook and chum PSC limits) is on the calendar year January-December. Options requested for consideration by the Council include the following: Start of the pollock B-season (June 10) through the end of the A-season (June 9), September 1 through August 31st, October 1 through September 30th.

Previously this was considered in conjunction with the development of alternatives for the Chinook salmon bycatch management measures action which eventually led to Amendment 91. The intention of this option initially was that it more closely tracks the salmon biological year whereby juvenile salmon (those primarily taken as bycatch) likely enter the Bering Sea in the fall to feed and remain on the grounds throughout the winter. This group then migrates to other locations during the summer months prior to beginning their return to their natal streams (those that are of spawning age) in the summer. Thus, the same cohort of salmon that are being caught in the B season remain on the grounds in the A season and any closure potentially triggered by high B season Chinook catch would protect the same age class of salmon from additional impacts in the A season. There could therefore be additional conservation benefits conferred on the same cohort of salmon by the same PSC limit when applied in this manner versus the identical PSC limit over the course of the calendar year.

At the time of initial consideration (April 2008 staff discussion paper), seasonal allocation of annual caps was not considered in conjunction with the PSC limits. Post-season analysis of this option indicated that under many PSC limits there was a high likelihood of the fleet being closed out of fishing in as early as the first few weeks of the A season. As the A season is the more lucrative roe-bearing fishing season, the Council searched for different solutions that might allow for incentives to reduce bycatch in both A and B season, and provide a limit seasonally to protect individual cohorts of salmon within and across years, while still allowing the opportunity to achieve optimum yield in the pollock fishery. As a result the Council removed the PSC accounting period option from the analysis and instead replaced it with a range of options for seasonal allocation from A to B season and the option to rollover unused bycatch from A to B season. The range considered (% A season: % B season) was 70:30, 58:42, 55:45, 50:50. The preferred alternative implemented under Amendment 91 has a seasonal allocation of 70:30 A:B season with an unrestricted rollover of unused salmon from the A to B season.

Under Amendment 91, with caps divided by season, sector and within IPAs to vessels, it is highly unlikely that modifying the PSC accounting period would result in the previously estimated A-season constraints and thus additional salmon conservation on the same cohort. Instead it is far more likely that while there would be a higher incentive to conserve B-season salmon than under present conditions, the first option (to begin June 10 and continue through to the end of the A-season quota) would likely result in a relaxation of any constraint in the A-season. The A-season is the more lucrative season and as vessel-based rankings across sectors and within season have shown rates are far more uniform in the A-season (Stram and Ianelli, 2014) suggesting both more limited fishing opportunities (due to ice cover) and a uniform intent to balance the necessity of salmon bycatch usage to obtain higher value fish. If the A-season was prosecuted under a full rollover from any B-season allocation, there would be limited, if any, incentive to conserve salmon outside of not reaching the individual limit itself while pursuing more valuable roe-bearing fish. Thus it is highly unlikely this option, under the current allocation and IPA programs would achieve any additional conservation benefits from the status quo PSC accounting. Significant modification in the PSC limit structure, seasonal allocations and rollover provisions would be necessary to best structure the PSC limit to retain any incentive measures currently in place. This change could provide additional economic benefits to the pollock fishery which would be able to pursue high-value roe without fear of being shut out of the B-season pollock fishery. As noted, however, this would occur at the expense of greater Chinook PSC. The Council as a result of these considerations did not move this option forward for analysis.

The Council considered modifications to the IPAs (as in Alternative 3) through regulatory means rather than within the IPA structure alone. At this time the Council has forwarded only the modifications to the IPA structure that would be accomplished within the IPA proposals themselves as alternatives for analysis.

Finally as discussed in section 2.4.6, the Council initially considered an index run for Alternative 5 based upon the CWAK combined stocks, including the Nushagak, and a standardized index. For the reasons outlined in section 2.4.6, the Council elected to use the 3 System index instead.

3 Environmental Assessment

There are four required components for an environmental assessment. The purpose and need for the proposal is described in Chapter 1, and the alternatives in Chapter 2. This section (Chapter 3) addresses the probable environmental impacts of the proposed action and alternatives. A list of preparers and agencies and persons consulted is included in Chapter 7.

This section evaluates the impacts of the alternatives and options on the various environmental components. The social and economic impacts of this action are described in detail in the RIR (Chapter 4).

Recent and relevant information, necessary to understand the affected environment for each resource component, is summarized in the relevant subsection. For each resource component, the analysis identifies the potential impacts of each alternative, and uses criteria to evaluate the significance of these impacts. If significant impacts are likely to occur, preparation of an EIS is required. Although an EIS should evaluate economic and socioeconomic impacts that are interrelated with natural and physical environmental effects, economic and social impacts by themselves are not sufficient to require the preparation of an EIS (see 40 CFR 1508.14).

The National Environmental Policy Act (NEPA) also requires an analysis of the potential cumulative effects of a proposed action and its alternatives. An environmental assessment or environmental impact statement must consider cumulative effects when determining whether an action significantly affects environmental quality. The Council on Environmental Quality (CEQ) regulations for implementing NEPA define cumulative effects as:

> *"the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7*).

The discussion of past and present cumulative effects is addressed with the analysis of direct and indirect impacts for each resource component below. The cumulative impact of reasonably foreseeable future actions is addressed in Section 3.8.

3.1 Documents incorporated by reference in this analysis

This EA relies heavily on the information and evaluation contained in previous environmental analyses, and these documents are incorporated by reference. The documents listed below contain information about the fishery management areas, fisheries, marine resources, ecosystem, social, and economic elements of the groundfish fisheries. They also include comprehensive analysis of the effects of the fisheries on the human environment, and are referenced in the analysis of impacts throughout this section.

3.1.1 Bering Sea Chinook Salmon Bycatch Management Final Environmental Impact Statement/Regulatory Impact Review.

The Bering Sea Chinook Salmon Bycatch Management Final Environmental Impact Statement/Regulatory Impact Review (Chinook EIS/RIR, NPFMC/NMFS 2009) provides decision makers and the public with an evaluation of the environmental, social, and economic effects of alternative management measures for Chinook salmon bycatch in the Bering Sea and Aleutian Islands management areas and is referenced here for an understanding of the impacts on Chinook salmon of bycatch management in the Bering Sea pollock fishery. The EIS examines a range of different PSC limits for

Chinook salmon in the pollock fishery. The EIS evaluates the effects of different alternatives on target species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. This document is available from: http://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/feis/.

3.1.2 Stock Assessment and Fishery Evaluation (SAFE) Report for the Groundfish Resources of the BSAI.

Annual SAFE reports review recent research and provide estimates of the biomass of each species and other biological parameters. The SAFE report includes the acceptable biological catch (ABC) specifications used by NMFS in the annual harvest specifications. The SAFE report also summarizes available information on the ecosystems and the economic condition of the groundfish fisheries off Alaska. This document is available from: http://www.afsc.noaa.gov/refm/stocks/assessments.htm.

3.1.3 Final Programmatic Supplemental Environmental Impact Statement (PSEIS) on the Alaska Groundfish Fisheries.

The PSEIS evaluates the Alaska groundfish fisheries management program as a whole, and includes analysis of alternative management strategies for the GOA and BSAI groundfish fisheries (NMFS 2004). The EIS is a comprehensive evaluation of the status of the environmental components and the effects of these components on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. This document is available from: http://alaskafisheries.noaa.gov/sustainablefisheries/seis/intro.htm.

3.2 Analytical method

The approach to modify existing measures for Chinook and chum salmon PSC in the BS pollock fishery is limited in scope and will not likely affect all environmental components of the Bering Sea. Table 18 summarizes the impact findings on potentially affected components: pollock, Chinook and chum salmon, other groundfish, and marine mammals. The effects of the alternatives on the resource components would be caused by potential changes in the timing and amount of harvest of pollock, changes in bycatch of Chinook and chum salmon, incidental catch of groundfish, modified season length in the summer season and a reallocation of Pollock between the A and B seasons. A change in pollock harvest may affect bycatch rates for salmon species and the socioeconomic environment. The socioeconomic environment may be affected through any changes in groundfish harvest, which would modify total gross revenue.

Table 18 shows the components of the human environment and whether the alternatives have the potential to impact that component and require further analysis. Extensive analysis on all environmental components is not needed in this document because the proposed action or its alternatives are not anticipated to have environmental impacts on all environmental components. Analysis is included only for pollock, Chinook salmon, chum salmon, other groundfish, and marine mammals, the only environmental components which the proposed action and alternative may impact. No effects from the alternatives are expected on seabirds, habitat, or the ecosystem components of the environment. The effects of the pollock fishery on habitat, seabirds, and the ecosystem were previously analyzed in the Chinook EIS/RIR and conclusions of that document are incorporated by reference (NPFMC/NMFS 2009). There is no anticipated modification in spatial/temporal intensity of the fishery that would be estimated to modify the conclusions of those documents. Under any of the alternatives, the pollock fishery would have no effects on these components beyond those described in the Chinook EIS/RIR (NPFMC/NMFS 2009). The affected resource components in relation to each alternative are discussed in detail below.

Table 18. Resources components potentially affected by the alternatives and impact summary.

	Potentially affected resource component						
Alternatives	Pollock	Chinook	Chum	Other groundfish	Marine Mammals	Habitat	Ecosystem
Alt 1	N	N	N	N	N	N	N
Alt 2	Y	Y	Y	Y	Y	N	N
Alt 3	Y	Y	Y	Y	Y	N	N
Alt 4	Y	Y	Y	Y	Y	N	N
Alt 5	Y	Y	Y	Y	Y	N	N

N = no impact beyond status quo anticipated by the alternative on the component.
Y = an impact beyond status quo is possible if the alternative is implemented.

3.3 Pollock

Walleye pollock (*Gadus chalcogrammus;* hereafter referred to as pollock) are broadly distributed throughout the North Pacific with the largest concentrations found in the Eastern Bering Sea. Also marketed under the name Alaska pollock, this species continues to represent over 40% of the global whitefish production with the market disposition split fairly evenly between fillets, whole (headed and gutted), and surimi (Fissel et al. 2012). An important component of the commercial production is the sale of roe from pre-spawning pollock. Pollock are considered to be a relatively fast growing and short-lived species and play an important role in the ecosystem.

Pre-spawning aggregations of pollock are the focus of the winter fishery, the "A-season", which opens on January 20th and extends into early-mid April. During this season the fishery produces highly valued roe which can comprise over 4% of the catch in weight (Ianelli et al., 2013). The summer fishery, or "B-season", opens on June 10th and extends through late October. Since the closure of the Bogoslof management district (INPFC area 518) to directed pollock fishing in 1992, the A-season pollock fishery on the EBS shelf has been concentrated primarily north and west of Unimak Island (Ianelli *et al.* 2007). Depending on ice conditions and fish distribution, there has also been effort along the 100 m contour (and deeper) between Unimak Island and the Pribilof Islands (Ianelli et al., 2013).

Data analyzed on 19 years of egg and larval distribution in the eastern Bering Sea suggested that pollock spawn in two pulses spanning 4-6 weeks in late February then again in mid-late April (Bacheler et al., 2010). Their data also suggest three unique areas of egg concentrations with the region north of Unimak Island and the Alaska Peninsula being the most concentrated (Bacheler et al., 2010).

3.3.1 Effects of the alternatives on pollock

The effect of the BS pollock fishery on the pollock stock is assessed annually in the BSAI Groundfish SAFE report (e.g., Ianelli et al., 2014). The effect of the pollock fishery under Alternative 1 was analyzed in the Chinook EIS/RIR (NPFMC/NMFS 2009). This section provides recent and relevant information necessary to understand the effects of the proposed action and its alternatives on pollock. Table 19 describes the criteria used to determine whether the impacts on pollock are likely to be significant. The pollock stock is neither overfished nor subject to overfishing, and biomass is projected to remain above the target biomass level through 2015. It is estimated that the BS pollock fishery under the status quo is sustainable for pollock stocks.

Table 19. Criteria used to determine significance of effects on pollock.

Effect	Criteria			
	Significantly Negative	**Insignificant**	**Significantly Positive**	**Unknown**
Stock Biomass: potential for increasing or reducing stock size	Changes in fishing mortality are expected to jeopardize the ability of the stock to sustain itself at or above its MSST (minimum stock size threshold)	Changes in fishing mortality are expected to maintain the stock's ability to sustain itself above MSST	Changes in fishing mortality are expected to enhance the stock's ability to sustain itself at or above its MSST	Magnitude and/or direction of effects are 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
Change in prey availability	Evidence that the action may lead to changed prey availability such that it jeopardizes the ability of the stock to sustain itself.	Evidence that the action will not lead to a change in prey availability such that it jeopardizes the ability of the stock to sustain itself.	Evidence that the action may result in a change in prey availability such that it enhances the ability of the stock to sustain itself.	Magnitude and/or direction of effects are unknown

Alternative 1 maintains the current management of Bering Sea pollock stocks. Presently the pollock stock is managed based on science covering a wide variety of factors including the capacity of the stock to yield sustainable biomass on a continuing basis. Catch levels are conservative managed; with TAC levels are set well below the Acceptable Biological Catch (ABC) levels (Table 20). The present salmon 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. Fishing during the A-season has suffered in recent years due to the low roe recovery from pollock. This might be due in part to colder conditions, slower maturing pollock given their age/size (which may also be related to colder condtions), and changes in the fishery distribution (e.g., in areas outside of the industry's Chinook salmon conservation area; further to the north than has been typical; Ianelli et al., 2014).

The spatial pattern of fishing in 2013 winter was unusual compared to previous years with most fishing activity further north and away from the Unimak Island region (Ianelli et al, 2013). This was apparently in part due to industry-based measures to reduce the potential for salmon bycatch. 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. Thus Alternative 1 has no significant 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.

Alternatives 2 through 5 are estimated to result in no significant changes to the pollock stock relative to Alternative 1. Alternative 2 proposes a revised RHS system similar to the one in operation under Alternative 1. As such, 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 while ceasing to do so as Chinook PSC increases later in August into September. Alternative 3 modifies some of the provisions within the IPAs to better address vessel-specific behavior and thus may increase some of the constraints on individual vessels but is neither estimated to result in forgone pollock. Strong outlier incentives or incentives that would dramatically reduce October Chinook PSC could change fleet-wide spatial/temporal fishing practices.

Alternative 4 would modify the season length in the summer B season by either opening or closing the fishery earlier as well as options to shift seasonal allocation of pollock quota to provide additional quota availability in the A-season (note these are not mutually exclusive). This could affect the spatial or temporal distribution of the pollock stock and hence the size composition of the catch (e.g., see Figure 13 for changes in mean body weight within season). Under these options, it seems likely that the fleet would fish earlier in the summer season and this would likely move fishing to places further away from the core fishing grounds north of Unimak Island. Both of these effects would appear to result in catches of pollock that were smaller in mean sizes-at-age (e.g., small pollock generally caught earlier in B-season; Figure 13). 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 result in a consistent catch of smaller fish in the B-season this would shift the fishery selectivity estimates and the recommended ABC would change accordingly. This also holds for increased fishing during the spawning season (option 3 of this alternative). 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), Alternative 4 would have no significant impact on the sustainability and viability of the pollock population, because it is unlikely to affect the distribution of pollock such that it has an effect on the ability of the stock to sustain itself.

Alternative 5 would impose a lower PSC limit and/or performance standard threshold in years of estimated low western Alaska Chinook abundance (See Section 2.5 for a description of the 3-system index to trigger a lower performance threshold). This low Chinook abundance indication (low index of Chinook salmon abundance) would have been reached in 2010 with estimated run strengths remaining below that level through 2014 under current conditions of Chinook salmon stock estimates. As such the lower PSC limit and/or performance standard threshold would have been in place from 2011-2013. As discussed further in section 3.5.5, the fishery would have had to lower bycatch or would have reached the performance standard threshold under the most restrictive of the options under consideration in one year (2011). Here it would be estimated that 25,000 t of pollock could potentially go unharvested (assuming no change in behavior by the fleet to harvest the pollock earlier). This is a small amount as compared to the overall biomass of the pollock stock and would be unlikely to have any impact on the stock productivity. It is also highly likely the fleet would fish earlier in order to harvest their quota prior to any constraining limit from Chinook bycatch measures. Thus, as with Alternative 4, effort is likely to shift earlier in the season with similar results in higher proportion of smaller pollock caught in the earlier part of the B season (Figure 13). Similar to the discussion above with Alternative 4, these data are incorporated into the stock assessment which forms the basis for catch specification recommendations in the following year. Therefore, while this situation could result in minor changes in the future catches (indirectly through the stock assessment/ABC determination process), Alternative 5 would not have a significant impact on the sustainability and viability of the pollock population.

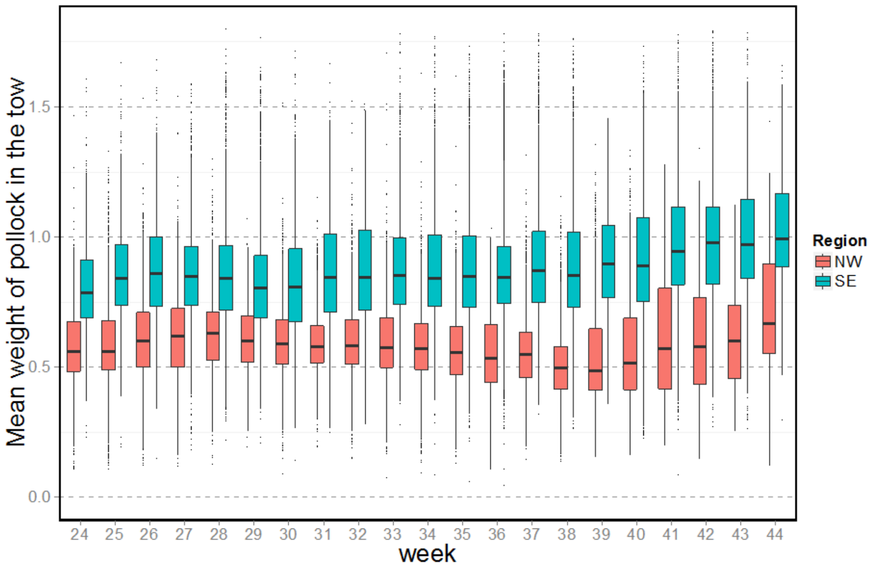


Figure 13. **Mean body weight of pollock in the tow (kg) based on NMFS observer data for the B season by week and region.**

Table 20. **Time series of 1964-1976 catch (left) and ABC, TAC, and catch for BS pollock, 1977-2014 in t. Source: compiled from NMFS Regional office web site and various NPFMC reports.**

Year	Catch	Year	ABC	TAC	Catch
1964	174,792	1977	950,000	950,000	978,370
1965	230,551	1978	950,000	950,000	979,431
1966	261,678	1979	1,100,000	950,000	935,714
1967	550,362	1980	1,300,000	1,000,000	958,280
1968	702,181	1981	1,300,000	1,000,000	973,502
1969	862,789	1982	1,300,000	1,000,000	955,964
1970	1,256,565	1983	1,300,000	1,000,000	981,450
1971	1,743,763	1984	1,300,000	1,200,000	1,092,055
1972	1,874,534	1985	1,300,000	1,200,000	1,139,676
1973	1,758,919	1986	1,300,000	1,200,000	1,141,993
1974	1,588,390	1987	1,300,000	1,200,000	859,416
1975	1,356,736	1988	1,500,000	1,300,000	1,228,721
1976	1,177,822	1989	1,340,000	1,340,000	1,229,600
		1990	1,450,000	1,280,000	1,455,193
		1991	1,676,000	1,300,000	1,195,664
		1992	1,490,000	1,300,000	1,390,309
		1993	1,340,000	1,300,000	1,326,609
		1994	1,330,000	1,330,000	1,329,352
		1995	1,250,000	1,250,000	1,264,247
		1996	1,190,000	1,190,000	1,192,781
		1997	1,130,000	1,130,000	1,124,433
		1998	1,110,000	1,110,000	1,019,082
		1999	992,000	992,000	989,680
		2000	1,139,000	1,139,000	1,132,710
		2001	1,842,000	1,400,000	1,387,197
		2002	2,110,000	1,485,000	1,480,776
		2003	2,330,000	1,491,760	1,490,879
		2004	2,560,000	1,492,000	1,480,543
		2005	1,960,000	1,478,500	1,483,022
		2006	1,930,000	1,485,000	1,487,651
		2007	1,394,000	1,394,000	1,354,501
		2008	1,000,000	1,000,000	990,583
		2009	815,000	815,000	810,784
		2010	813,000	813,000	810,215

Year	Catch	Year	ABC	TAC	Catch
		2011	1,270,000	1,252,000	1,199,070
		2012	1,220,000	1,200,000	1,205,197
		2013	1,375,000	1,247,000	1,270,745
		2014	1,369,000	1,267,000	1,298,593
		1977-2014 average	1,376,974	1,195,559	1,174,324

3.4 Chinook and chum salmon stocks

3.4.1 Overview of Chinook biology and distribution

Overview information on Chinook salmon can be found at:
http://www.adfg.alaska.gov/index.cfm?adfg=chinook.main.

The Chinook salmon (*Oncorhynchus tshawytscha*) is the largest of all Pacific salmon species, 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. On the Asian coast, Chinook salmon occur from the Anadyr River area of Siberia southward to Hokkaido, Japan. In Alaska, they are abundant from the southeastern panhandle to the Yukon River. Chinook salmon typically have relatively small spawning populations and the largest river systems tend to have the largest populations. Major populations of Chinook salmon return to the Yukon, Kuskokwim, Nushagak, Susitna, Kenai, Copper, Alsek, Taku, and Stikine rivers with important runs also occurring in many smaller streams.

Like all species of Pacific salmon, Chinook salmon are anadromous. They hatch in fresh water and rear in main-channel river areas for one year, typically. The following spring, Chinook salmon turn into smolt and migrate to the salt water estuary. They spend anywhere from one to five years feeding in the ocean, then return to spawn in fresh water. All Chinook salmon 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. 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 often make extensive freshwater spawning migrations to reach their home streams on some of the larger river systems. Yukon River spawners bound for the headwaters in Yukon Territory, Canada will travel more than 2,000 river miles during a 60-day period. Chinook salmon do not feed during the freshwater spawning migration, so their condition deteriorates gradually during the spawning run as they use stored body materials for energy and gonad development.

Each female deposits between 3,000 and 14,000 eggs in several gravel nests, or redds, which she excavates in relatively deep, fast moving water. In Alaska, the eggs usually hatch in the late winter or early spring, depending on time of spawning and water temperature. The newly hatched fish, called alevins, live in the gravel for several weeks until they gradually absorb the food in the attached yolk sac. These juveniles, called fry, wiggle up through the gravel by early spring. In Alaska, most juvenile Chinook salmon remain in fresh water until the following spring when they migrate to the ocean as smolt in their second year.

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.

3.4.2 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 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 year or more 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. 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 yield concern.

3.4.3 Western Alaska Chinook and chum salmon stock status

The following sections contain information relating to Alaskan Chinook and chum salmon stock status including whether stocks are classified as ”stocks of concern”, whether escapement goals are established and met, and whether or not catch restrictions were in place in 2013 and 2014. This information has been provided by staff at ADF&G per Council request to provide context for the discussion of Chinook salmon PSC in the Bering Sea pollock fishery. A discussion of the State’s Sustainable Salmon Fisheries Policy (SSFP) and definitions for different escapement goals and objectives are provided, in addition to updated information on individual stock status.

3.4.3.1 Stocks of Concern

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 (BOF) 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 BOF 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 to which salmon fisheries and their habitats conform to explicit principles and criteria. In response to these reports the BOF 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 sustained 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). The current and historical Chinook and chum salmon stocks of concern are shown in Table 21 and Table 22. There are currently 10 Chinook salmon stocks of concern and two chum salmon stocks of concern. The status of all Alaska salmon stocks are reviewed every three years during the normal BOF cycle.

Table 21. Historical and current Chinook salmon stocks of concern in Alaska [Source ADF&G]

Region	Area	Stock	Level of Concern	Year Initiated	Year Removed
Central	Cook Inlet	Anchor River	Management	2001	2004
	Cook Inlet	Alexander River	Management	2011	ongoing
	Cook Inlet	Theodore River	Management	2011	ongoing
	Cook Inlet	Lewis River	Management	2011	ongoing
	Cook Inlet	Chuitna River	Management	2011	ongoing
	Cook Inlet	Willow Creek	Yield	2011	ongoing
	Cook Inlet	Goose Creek	Yield	2011	2013
	Cook Inlet	Goose Creek	Management	2013	ongoing
	Cook Inlet	Sheep Creek	Management	2013	ongoing
AYK	Kuskokwim	Kuskokwim River	Yield	2001	2007
	Yukon	Yukon River	Yield	2001	ongoing
	Norton Sound	Norton Sound SD 5/6	Yield	2004	ongoing
Westward	Kodiak	Karluk River	Management	2011	ongoing

Table 22. Historical and current chum salmon stocks of concern in Alaska [Source ADF&G]

Region	Area	Stock	Level of Concern	Year Initiated	Year Removed
AYK	Kuskokwim	Kuskokwim River	Yield	2001	2007
	Yukon	Toklat River fall chum	Management	2001	2004
	Yukon	Fishing Branch fall chum	Management	2001	2004
	Yukon	Yukon River summer chum	Management	2001	2007
	Yukon	Yukon River fall chum	Yield	2001	2007
	Norton Sound	Norton Sound SD 1	Management	2001	2007
	Norton Sound	Norton Sound SD 1	Yield	2007	ongoing
	Norton Sound	Norton Sound SD 2/3	Yield	2001	ongoing

The State of Alaska manages subsistence, sport/recreational (used interchangeably), commercial, and personal use harvest on lands and waters throughout Alaska. 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 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.

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, fish size, 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 BOF 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 in-river 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 in-river run goal has been adopted by the BOF. 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 (SET) means a threshold level of escapement, below which the ability of the salmon stock to sustain itself is jeopardized. In practice, SET can be estimated based on lower ranges of historical escapement levels, for which the salmon stock has consistently demonstrated the ability to sustain itself. The SET is lower than the lower bound of the BEG and also lower than the lower bound of the SEG. The SET is established by ADF&G in consultation with the BOF 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 BOF 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 BOF 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 BOF and ADF&G. A listing of escapement goals by river system and escapements 2004-2013 is included in Sections 1. Additional information summarizing whether or not management goals were met and whether catch restrictions were recently imposed (in 2013 and 2014 only) is shown in Table 23, Table 24, Table 25, 4, and Section 10 (Appendix A-3).

3.4.4 Chinook salmon

In Alaska, there are hundreds of individual Chinook salmon stocks ranging from southeast to as far north as Norton Sound. Western Alaska includes the Bristol Bay, Kuskokwim, Yukon, Norton Sound management areas. The Nushagak, Kuskokwim, Yukon, and Unalakleet rivers, along with Kuskokwim

Bay and Norton Sound stocks, comprise the major Chinook salmon index stocks for this region. Chinook salmon stocks in areas outside of western Alaska include those found in the Alaska Peninsula, Kodiak, Upper Cook Inlet, Lower Cook Inlet, Prince William Sound, and Southeast Alaska.

3.4.4.1 Chinook Salmon Abundance and Productivity

Recent declines in Chinook salmon productivity and abundance are widespread and persistent throughout Alaska. Available run abundance data for Chinook salmon in Alaska indicate significant declines were first fully detected in 2007 from a persistent decline in productivity that began with returns from brood year 2001. Run abundance data available from 21 stocks in Alaska show substantial variability and moderate to no coherence among stocks prior to 2004 (Figure 14). Run abundance data isolating 7 stocks in western Alaska are shown in Figure 15. This was followed by declines in run abundance across the state from 2007 to present. This is consistent with a downward trend in productivity.

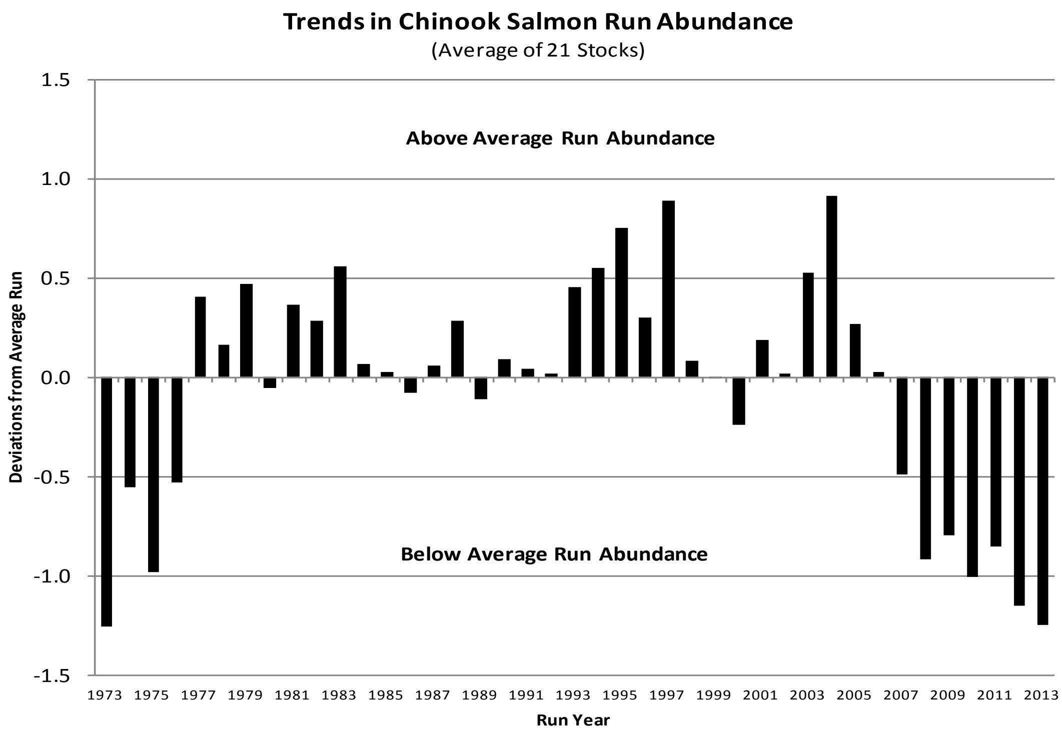


Figure 14. Average of standardized deviations from average run abundance for 21 stocks of Chinook salmon in Alaska (the Unalakleet, Nushagak, Goodnews and Kuskokwim in western Alaska; the Chena and Salcha on the Yukon River; the Canadian Yukon, the Chignik and Nelson on the Alaska Peninsula; the Karluk and Ayakulik on Kodiak Island; the Deshka, Anchor and late run Kenai in Cook Inlet, the Copper in the northeastern Gulf of Alaska, and the Situk, Alsek, Chilkat, Taku, Stikine, and Unuk in Southeastern Alaska). [Source ADF&G]

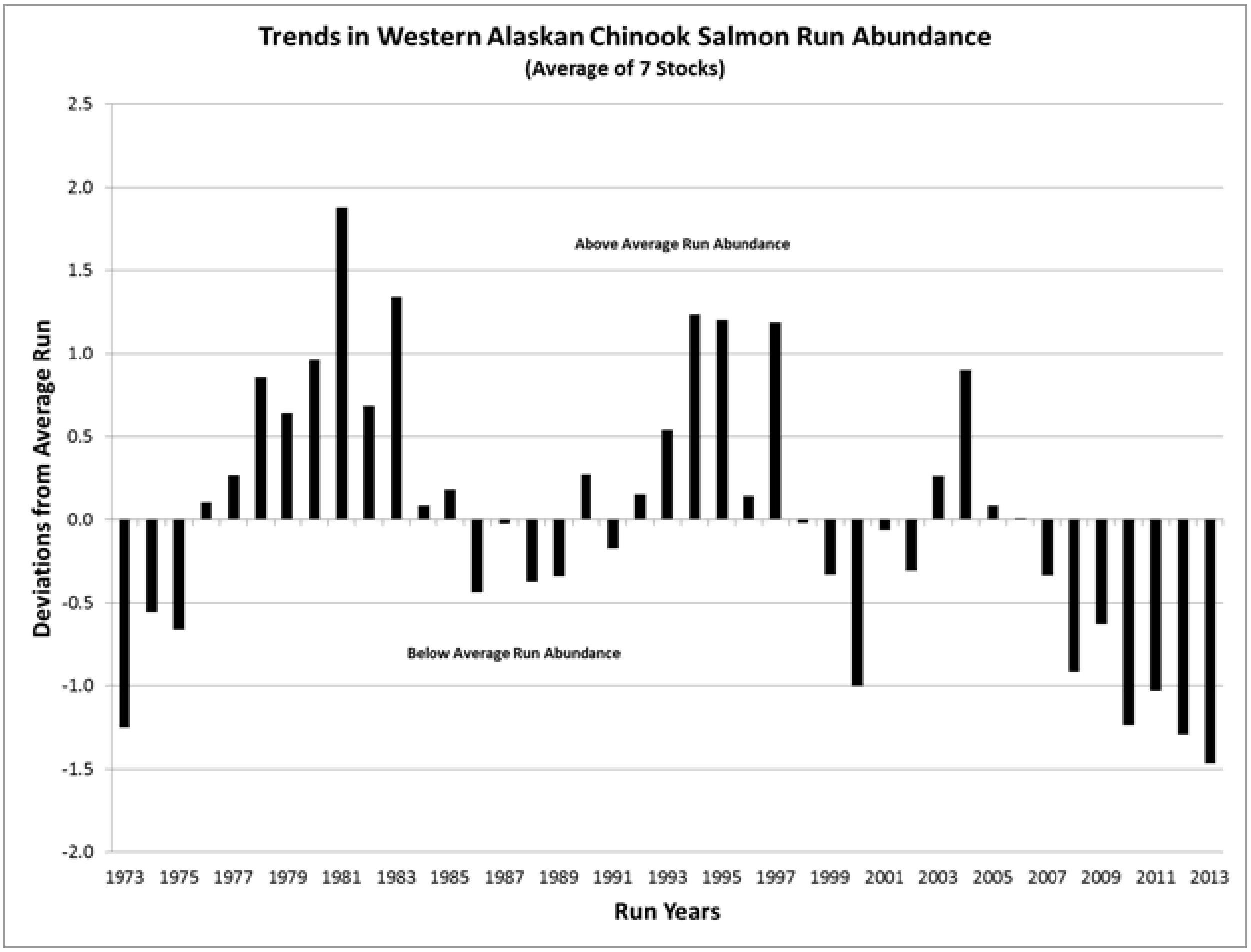


Figure 15. **Average of standardized deviations from average run abundance for 7 stocks of Chinook salmon in western Alaska (the Unalakleet, Nushagak, Goodnews and Kuskokwim; the Chena and Salcha on the Yukon River; the Canadian Yukon). [Source ADF&G]**

Below average run sizes were observed across the state in 2013 with few exceptions. In 2013, 61 stocks with escapement goals were assessed; escapements were within the goal range for 28 stocks, above the range or SMSY point estimate for 2 stocks, and below the goal for 31 stocks (Figure 16). The percentage of stocks statewide that met or exceeded goal was 49%. Of the 31 stocks below goal, six stocks (Chilkat and Taku (Southeast), Theodore River (Cook Inlet), East Fork Andreafsky and Anvik (Yukon), and Chignik) were within 15% of the target goal. Twenty-five stocks were more than 15% below goal.

In western Alaska, only six Chinook salmon stocks of the 23 assessed (26%) met or exceeded escapement goals in 2013. Despite the use of aggressive fishery management measures, the Kuskokwim Area met 17% of its assessed escapement goals, the Yukon River met 43%, and Norton Sound met none. From 2004 to 2013, the percentage of western Alaska stocks that met or exceeded escapement goals or goal ranges has ranged from a high of 92% in 2004 to a low of 26% in 2013 (Figure 17).

From 2004 to 2013, the percentage of stocks that met or exceeded escapement goals or goal ranges has varied from 43% in 2012 to 93% in 2004. The escapement goals and 2004 to 2013 escapements for all monitored stocks with escapement goals are listed in Section 1 (Appendix A-1).

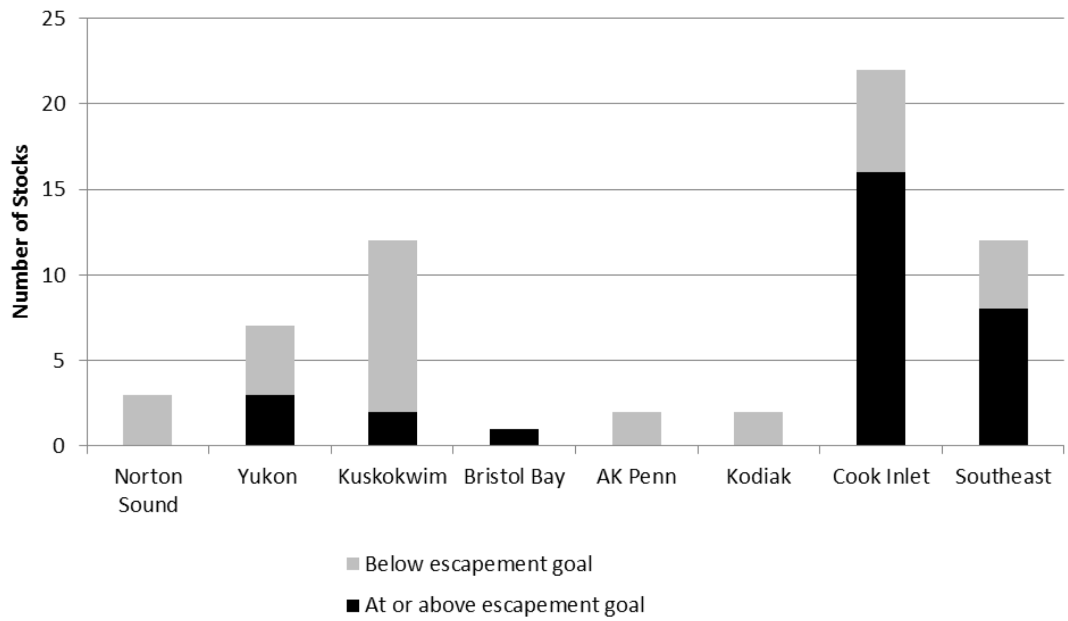


Figure 16. Number and status of monitored Chinook salmon stocks with escapement goals, 2013 [Source ADF&G]

Though escapement data for 2014 are preliminary, below average run sizes have been reported statewide. In western Alaska, Chinook salmon runs in 2014 were a little better than in 2013 in Norton Sound, Yukon River, and Kuskokwim River. Conversely, runs were below average in Kuskokwim Bay (Goodnews and Kanektok rivers) where escapement goals were not met and in the Nushagak River which had one of the poorest runs on record. A majority of the escapement goals that were met statewide is attributable to very conservative management that included fishing closures and severe restrictions.

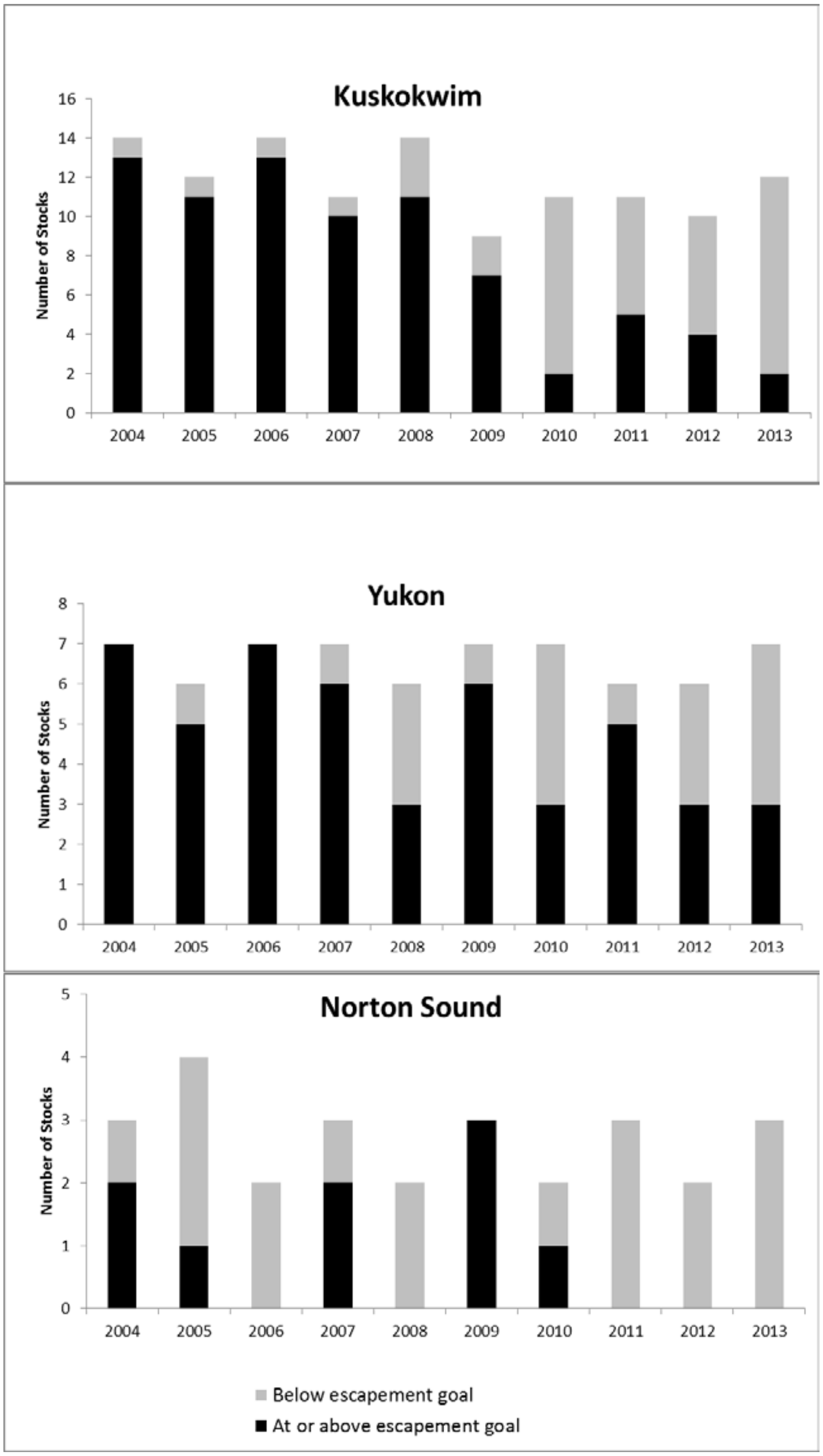


Figure 17 Number and status of monitored Chinook salmon stocks with escapement goals for the AYK Region (Kuskokwim, Yukon, and Norton Sound), 2004–2013 [Source ADF&G]

3.4.4.2 Chinook Salmon Management

This information has been provided by staff at ADF&G per Council request to provide context for the discussion of Chinook salmon PSC in the Bering Sea pollock fishery. Fishery management has been responsive to lower run abundances in an attempt to achieve escapement goals. Statewide, and particularly in the AYK region, Kodiak, and Cook Inlet, significant catch restrictions and closures have been enacted for Chinook salmon in recent years in an effort to meet escapement objectives and ensure sustained yield. Chinook salmon fisheries have been curtailed and fisheries for other more abundant salmon species have been limited in areas where their harvest could affect weak Chinook runs. Stock status and catch restrictions are in Table 23 for 2013 and Table 24 for 2014. Appendix A-3 provides a summary of Chinook salmon fishery management actions by region for 2011 to 2013.

In western Alaska, severe restrictions were implemented in both 2013 and 2014 to reduce catches of Chinook salmon in an effort to improve escapements. In 2013, Norton Sound subsistence fishing was restricted, the commercial fishery was closed, and sport fishery restrictions were implemented (Table 23). In the Yukon River there were subsistence schedule restrictions, no directed commercial fisheries, and restrictions and bag limits in the sport fisheries. In the Kuskokwim Area, several tributaries had subsistence restrictions and closures, no commercial fishing in Kuskokwim River, limited fishing in Kuskokwim Bay, and multiple tributaries closed to sport fishing. No actions were taken in the Nushagak River in 2013. In 2014, commercial and sport fisheries were closed in western Alaska, with a couple of minor exceptions. Subsistence fishing for Chinook salmon was closed or restricted by reduced fishing time and/or gear restrictions from Kuskokwim Bay to northern Norton Sound. This was the first year of gear restrictions in Northern Norton Sound. Eastern Norton Sound and the Yukon River were closed to subsistence fishing, Kuskokwim River had a long closure and then gear restrictions, and Kuskokwim Bay had reduced fishing time or gear restrictions. Coastal marine waters from Kuskokwim Bay to Norton Sound had fishing gear restrictions for the first time ever. Fishing gear restrictions primarily consisted of reductions in gillnet mesh size to 6 inches. Subsistence harvests are expected to be the lowest or near lowest on record. In the Nushagak River, sport fishing bag limits were reduced in 2014.

In the Alaska Peninsula, time and area restrictions were implemented for the commercial, sport, and subsistence fisheries to reduce harvest of Chignik River Chinook salmon. Similarly in Kodiak, time and area restrictions were implemented in both 2013 and 2014 for commercial, sport, and subsistence fisheries to increase escapement to the Karluk River.

In Upper Cook Inlet, emergency orders were issued for 2013 and 2014 restricting and closing sport fisheries for Chinook salmon in both fresh and salt waters. Commercial set gillnetting was restricted and closed for part of the season in the Kenai Kasilof, and East Foreland sections of the Upper Subdistrict. In the Northern District, the commercial set gillnet fishery was restricted and in river sport fisheries were tightly constrained to conserve Chinook salmon. In Lower Cook Inlet, escapement goals have generally been met, but only with restrictions and/or closures to sport fisheries in both years.

In Prince William Sound, additional inside closures were implemented beyond what was required in regulation in 2013 (2 additional) and 2014 (9 additional). Further, in 2013 the commercial fishery was closed completely for 13 days to increase Copper River escapement for both sockeye and Chinook.

In Southeast Alaska, management actions included discretionary mesh restrictions in District 111 and 115 to reduce harvest of Taku and Chilkat River stocks; area restrictions in District 115 to reduce harvest of Chilkat River Chinook salmon, and closure of the Situk-Ahrnklin Inlet subsistence fishery and area restrictions for the commercial fishery in Situk-Ahrnklin Inlet to increase escapement to the Situk River. Additionally, time and area restrictions were implemented for the troll fishery to reduce harvest of Unuk River Chinook salmon in 2014.

Table 23. Overview of Alaskan Chinook salmon stock performance, 2013. [Source ADF&G]

Area	Total run size?	Escapement goals met or exceeded?[1]	Subsistence fishery?	Commercial fishery?	Sport fishery?	Stock of concern?
Northern Norton Sound	Below Average	0 of 2	Yes with restrictions	No	Yes with restrictions	No
Eastern Norton Sound	Below Average	0 of 1	Yes with restrictions	No	Yes with restrictions	Yield concern since 2004
Yukon River	Below Average	3 of 7	No	No	No	Yield concern since 2001
Kuskokwim River	Below Average	2 of 10	Yes with restrictions	No	Yes with restrictions	Yield concern 2001-2007
Kuskokwim Bay	Below Average	0 of 2	Yes	Yes with restrictions	Yes with restrictions	No
Bristol Bay	Below Average	1 of 1	Yes	Yes	Yes with restrictions	No
North AK Peninsula	Below Average	0 of 1	Yes	Yes	Yes	No
Kodiak	Below Average	0 of 2	Yes with restrictions	Yes with restrictions	Yes with restrictions	Karluk River management concern since 2011
Chignik	Below Average	0 of 1	Yes with restrictions	Yes with restrictions	Yes with restrictions	No
Upper Cook Inlet	Below Average	13 of 19	Yes	Yes with restrictions	Yes with restrictions	7 current SOCs (see Table 1)
Lower Cook Inlet	Below Average	3 of 3	Yes	Yes	Yes with restrictions	No
Prince William Sound	Below Average	1 of 1	Yes with restrictions	Yes with restrictions	Yes	No
Southeast	Below average	8 of 12	Yes with restrictions	Yes troll fishery No gillnet fishery	Yes with restrictions	No

[1]Some escapement goals were not assessed; numbers are expressed as escapement goals met or exceeded out of the total number of stocks assessed.

Table 24. Overview of Alaskan Chinook salmon stock performance, 2014 [Source ADF&G]

Area	Total run size?	Escapement goals met or exceeded?[1]	Subsistence fishery?	Commercial fishery?	Sport fishery?	Stock of concern?
Northern Norton Sound	Below Average	2 of 2	Yes with restrictions	No	Yes with restrictions	No
Eastern Norton Sound	Below Average	2 of 2	Yes very limited; with restrictions	No	Yes with restrictions	Yield concern since 2004
Yukon River	Below Average	5 of 5	No	No	No	Yield concern since 2001
Kuskokwim River	Below Average	2 of 11	Yes with restrictions	No	Yes with restrictions	Yield concern 2001-2007
Kuskokwim Bay	Below Average	0 of 3	Yes	Yes with restrictions	Yes with restrictions	No
Bristol Bay	Below Average	1 of 1	Yes	Yes	Yes with restrictions	No
North AK Peninsula	Below Average	1 of 1	Yes	Yes	Yes	No
Kodiak	Below Average	0 of 2	Yes with restrictions	Yes with restrictions	Yes with restrictions	Karluk River mgt concern since 2011
Chignik	Below Average	1 of 1	Yes with restrictions	Yes with restrictions	Yes with restrictions	No
Upper Cook Inlet	Below Average	13 of 21	Yes	Yes with restrictions	Yes with restrictions	7 current SOCs (Table 1)
Lower Cook Inlet	Below Average	2 of 3	Yes	Yes	Yes with restrictions	No
Prince William Sound	Below Average	Not available	Yes with restrictions	Yes with restrictions	Yes	No
Southeast	Below average	6 of 12	Yes with restrictions	Yes troll. No gillnet.	Yes with restrictions	No

[1]Some escapement goals were not assessed; numbers are expressed as escapement goals met or exceeded out of the total number of stocks assessed.

3.4.5 Chum salmon

Western Alaska includes the 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. Chum salmon stocks in areas outside of western Alaska include those found in the Aleutian Islands, Kodiak, Chignik, Cook Inlet, Prince William Sound, and Southeast Alaska.

3.4.5.1 Chum Salmon Abundance and Productivity

In 2013, average to above average run sizes were observed in Kuskokwim, Yukon, Kotzebue rivers as well as in the GOA, Kodiak, Chignik and Cook Inlet rivers. Eastern Norton Sound chum stocks were approximately average run size in 2013; however, Northern Norton Sound chum salmon in Subdistricts 2 and 3 had poor runs and remain a Stock of Yield concern. There are no escapement goals or escapement surveys for chum salmon in the Aleutian Islands area.

In 2013, 53 stocks with escapement goals were assessed; escapements were within the goal range for 10 stocks, above the range or S_{MSY} point estimate for 33 stocks, and below the goal for 10 stocks (Figure 18 and Table 25). The percentage of monitored stocks that met or exceeded goal was 81%. Of the 10 stocks below goal, 3 stocks were from Southeast Alaska, 1 stock was from Prince William Sound, 4 stocks were from Cook Inlet, 1 was from the Yukon River (Fishing Branch fall chum), and 1 stock was from Norton Sound (Kwiniuk River). The escapement goals and 2004 to 2013 escapements for all monitored stocks with escapement goals are listed in Section 9 (Appendix A-2).

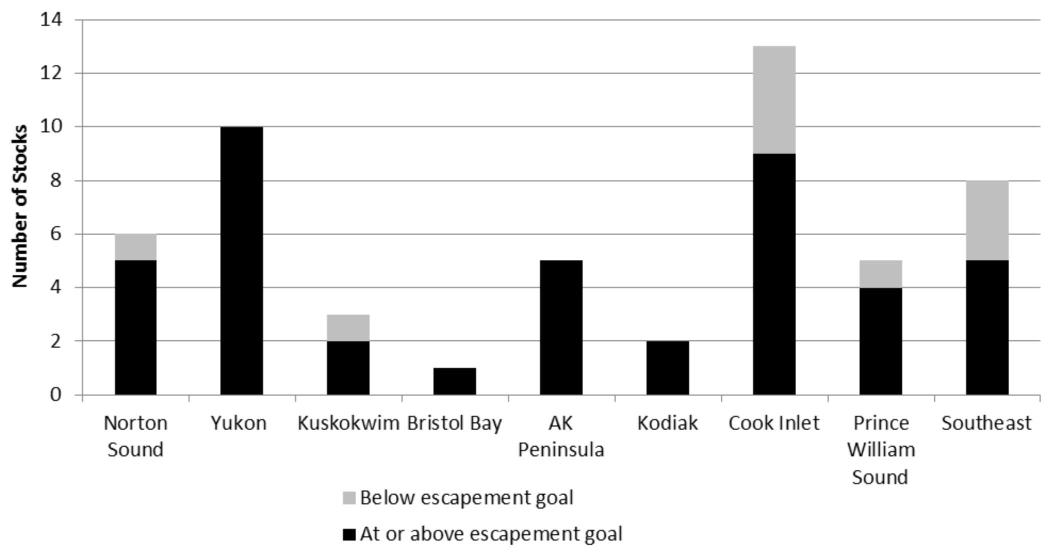


Figure 18 Number and status of monitored chum salmon stocks with escapement goals, 2013 [Source ADF&G]

Escapement data for 2014 are not currently available as the runs are still occurring. Preliminary data suggest that chum salmon runs to western Alaska were above average, with the exception of Kuskokwim River and Bay which had run sizes below the recent 10-year average. Kotzebue had one of the largest runs on record.

3.4.5.2 Chum Salmon Management

This information has been provided by staff at ADF&G per Council request to provide context for the discussion of chum salmon PSC in the Bering Sea pollock fishery. Subsistence and commercial fisheries occurred in all river systems in 2013, however the Yukon River summer chum commercial fishery was limited by low returns of co-migrating Chinook salmon, and very limited fishing occurred in Northern Norton Sound because of low abundance (Table 25). Sport fisheries were allowed on all chum stocks except in the Penny and Cripple rivers of the Nome subdistrict of Northern Norton Sound which are closed by regulation. In January 2013, the BOF adopted a proposal that opened the sport fishery for chum salmon in the Nome subdistrict with the exception of these two rivers.

Table 25. Statewide summary of chum salmon stock status, 2013 [Source ADF&G]

Chum salmon stock	Total run size?	Escapement goals met or exceeded[1]	Subsistence fishery?	Commercial fishery?	Sport fishery?	Stock of concern?
Kotzebue	Above Average	No surveys in 2013	Yes	Yes	Yes	No
Northern Norton Sound	Below Average	4 of 5	Yes	Yes, but limited	Yes, except Nome Subdistrict	Yield concern (since 2007)
Eastern Norton Sound	Average	1 of 1	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	8 of 8	Yes	Yes	Yes	No
Kuskokwim River	Average	1 of 1	Yes	Yes	Yes	No
Kuskokwim Bay	Average	1 of 1	Yes	Yes	Yes	No
Bristol Bay	Below Average	1 of 1	Yes	Yes	Yes	No
North Peninsula	Below average	2 of 2	Yes	Yes	Yes	No
South Peninsula	Average	3 of 3	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	8 of 12	Yes	Yes	Yes	No
Prince William Sound	Below average	4 of 5	Yes	Yes	Yes	No
Southeast	Average	5 of 8	Yes	Yes	Yes	No

[1]Some escapement goals were not assessed; numbers are expressed as escapement goals met or exceeded out of the total number of stocks assessed.

In 2014, subsistence and commercial fisheries occurred across the state; however the Yukon River summer chum commercial fishery was limited by low returns of Chinook salmon. In the AYK region, Kotzebue had the second largest commercial harvest on record. Commercial fishing was allowed in all Norton Sound subdistricts. The Yukon summer chum salmon commercial harvest was second largest since 1989. Dip net gear was used in the Yukon River commercial fishery for the second consecutive year to allow release of Chinook salmon alive while targeting summer chum salmon. Kuskokwim Area chum salmon returns were below average in 2014. Subsistence fishing opportunity in the Kuskokwim River was restricted due to Chinook salmon conservation measures. Chum salmon directed commercial fisheries occurred on the Kuskowkwim River, though the opportunities were limited to the tail end of the run. Commercial harvest of chum salmon in Kuskokwim Bay Districts was incidental to directed sockeye salmon commercial fisheries. No special actions were implemented for chum salmon sport fisheries in western Alaska in 2014.

3.4.6 Genetic stock of origin of Chinook and chum stocks in pollock fishery bycatch

Genetic information indicates that the majority (~65%) of the Chinook salmon caught in the Bering Sea pollock fishery originate from a single geographic region encompassing several western Alaskan rivers, including a genetically distinct group from the Canadian portion of the Yukon River (Myers and Rogers, 1983, 1988; Guthrie and Wilmot, 2004; Myers *et al.*, 2004; Guyon and Guthrie, 2010; Guthrie *et al.*, 2012, 2013, 2014). Recent results from the 2012 pollock fishery are consistent with these findings with the aggregate Coastal Western Alaska stocks dominating the sample set (63%) with smaller contributions from North Alaska Peninsula (11%), British Columbia (10%), and West Coast U.S. (OR/CA/WA) (7%) stocks (Guthrie et al., 2014). For chum salmon, the pollock fishery bycatch stock of origin is dominated by Asian-origin stocks (~60%) based upon 2012 results; see Vulstek et al, 2014) with smaller contributions from the Eastern Gulf of Alaska/Pacific Northwest group (18%), western Alaska (14%), Upper/middle Yukon (7%) and Southwest Alaska (2%). While the genetics cannot differentiate hatchery-origin fish from wild Asian chum salmon, given the high proportion of Pacific Rim hatchery-released chum from Japan (with hatchery releases form Asian comprising over 78% of total Pacific Rim releases in 2010; NPAFC), much of the Asian origin chum observed in the bycatch is likely to be of Asian hatchery-origin.

Reports showing the genetic results and regions of origin of the Chinook and chum salmon from the Bering Sea pollock fishery are presented annually to the Council including comparative discussions of how sampling rates, locations and results change from one year to the next. The most recent reports are from the 2013 pollock fishery and are available at: *http://legistar2.granicus.com/npfmc/meetings/2015/4/923_A_North_Pacific_Council_15-04-06_Meeting_Agenda.pdf*. Genetic results are incorporated into the AEQ analysis of status quo and are discussed further under the analysis of alternatives.

3.4.7 Subsistence utilization of Alaska Chinook and chum salmon

This information has been provided by staff at ADF&G per Council request to provide context for the discussion of Chinook salmon and chum salmon PSC in the Bering Sea pollock fishery. Additional detailed information on subsistence utilization of Alaska Chinook and chum salmon is provided in Appendix A-4.

3.4.7.1 Importance of subsistence harvests

This section describes of the importance of subsistence fishing and hunting to Alaska Natives and other rural Alaska residents. As discussed in Section 3.4.6, analysis of the stock composition of Chinook and chum salmon incidentally caught in the Bering Sea pollock fishery has shown that the stock structure is dominated by western Alaska stocks—stocks that have historically been harvested at high levels for subsistence. Therefore, this section focuses on the importance of subsistence to people who live in western and interior Alaska.

The population of the Arctic-Yukon-Kuskokwim (AYK) region outside nonsubsistence areas as defined by the Joint Board of Fisheries and Game included approximately 120 communities with 16,318 households and 59,098 residents in 2010. In addition, many of the 102,017 residents of the Fairbanks North Star Borough and the portions of the Denali Borough and the Southeast Fairbanks Census Area within nonsubsistence areas use AYK salmon stocks. In Bristol Bay, 18 communities with a population of 7,120 in 2,404 households (in 2010) also harvest Chinook, chum, and other salmon from local stocks for subsistence.

The ADF&G, Division of Subsistence, estimated in 2012 that approximately 36.9 million pounds of wild foods were harvested annually by residents of rural Alaska, representing on average 295 usable pounds per person. ADF&G found that on average, fish represent 53 percent of the total subsistence harvests by rural residents (with salmon providing 32 percent and other fish 21 percent), followed by land mammals (23 percent), marine mammals (14 percent), wild plants (4 percent), birds and eggs (3 percent), and shellfish (3 percent) (Fall et al. 2014:2).

Annual per capita subsistence harvest rates range from 320 pounds per person in rural Interior Alaska communities, to 425 pounds per person among Yukon-Kuskokwim Delta communities and 438 pounds of wild foods per person in Arctic communities. Average per capita harvests in Bristol Bay/Aleutians area is estimated at 204 pounds per person (Fall et al. 2014).

Regarding the value of traditional foods to the economies of rural Alaska, the estimated replacement cost of traditional foods in rural Alaska, if assumed to be $4 per pound, equates to over $147 million. If a replacement value of $8 per pound is used, still likely a low figure, the estimated wild food replacement value is more than $295 million annually (Fall et al. 2014).

Fish and wildlife are especially nutritious, rich in protein, iron, vitamin B12, polyunsaturated fats, monounsaturated fats, and omega-3 fatty acids. In addition, they are low in saturated fat, added sugar, and salt. ADF&G estimates that the annual rural harvest of 295 pounds per person contains 189 percent of the protein requirements of the rural population, containing about 87 grams of protein per person per day. The subsistence harvest contains 26 percent of the caloric requirements of the rural population (Fall et al. 2014). Harvesting and preserving wild foods are energy intensive, providing physical activity. Furthermore, these foods are highly valued and contribute to spiritual, cultural, and social well-being 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).

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. The relationship between increasing consumption of fructose and sucrose and the increases in type-2 diabetes and obesity 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).

3.4.7.2 Food Security

Food security is defined as having access to sufficient, safe, healthful, and culturally preferred foods. Numerous circumstances and drivers of change may limit the ability of 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 mineral 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. The Division of Subsistence has investigated food security through its comprehensive household surveys in northern and western Alaska communities (e.g. Magdanz et al. 2010, Brown et al. 2012, Brown et al. 2013, Ikuta et al. 2014, Brown et al. 2014, Braem et al. 2014).

3.4.7.3 Contemporary Cultural Context of Subsistence Salmon Fishing

In the 20th century, most rural Alaska communities transitioned from predominantly local, subsistence-based economies to mixed economies, in which residents relied on a combination of local subsistence harvests, wage labor, and transfer payments like the Alaska Permanent Fund Dividend (Goldsmith 2007). Today, subsistence harvests remain a prominent part of the local, mixed economy of rural Alaska, and the mainstay of social welfare of the people (Wolfe and Walker 1987). In ‘mixed’ economies, small to moderate amounts of cash are provided at different times of the year by limited employment opportunities. This limited cash sector supports subsistence harvests (e.g., making money to buy gear then used in subsistence practices). The more reliable subsistence sector provides the material basis that allows these mixed subsistence and market-based economies to continue. Subsistence activities also provide a context within which traditional elements of these cultures can persist. Salmon is a substantial part of the mix of wild foods that supports rural communities (Wolfe et al. 2010:1).

During the development of Amendment 91, many individuals wrote public comment letters to NMFS and testified to the Council on the importance of subsistence harvest to their livelihoods, families, tribes, cultures, and communities. Public comments explained that salmon are especially significant to the cultural, spiritual, and nutritional needs of Alaska Natives and that analysis of impacts on subsistence users and subsistence resources must reflect the values obtained from a broad range of uses, not simply the commercial value or monetary replacement costs of these fish. Comments emphasized that strong returns of healthy salmon are critical to the future human and wildlife uses of those fish and to the continuation of the subsistence way of life.

Subsistence activities commonly involve an entire community. According to Wolfe (2007), “in the AYK region, salmon is harvested primarily within family groups…commonly men harvest and women process salmon for subsistence food, consumed within extended families and shared with others in the community.” With reduced subsistence opportunities come fewer opportunities for young people to learn cultural subsistence practices and techniques, and this knowledge may be lost to them in the future. Subsistence hunting and fishing are specialized activities in rural Alaska, with a relatively small percentage of households being extremely productive, harvesting most of their community’s annual supplies and distributing them to less productive families (Wolfe 1987, Wolfe et al. 2010). Based upon research in Yukon River communities, Wolfe et al. (2010) found five factors 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 result from the higher costs of fuel coupled with poor salmon runs; households cannot afford to travel more often 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 et al. 2010).

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 are not available in commercial harvests. By law, 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).

Given the significance of the subsistence harvest in rural Alaska, subsistence use should also be viewed as having substantial economic value. However, this economic role is often “hidden,” “unmeasured in the state’s indices of economic growth or social welfare and neglected in the state’s economic development policy” (Wolfe and Walker 1987:56).

3.4.7.4 Rural migration

In Alaska, conventional economic opportunities are concentrated in Anchorage and Fairbanks. Improving job opportunities was the reason most frequently cited for moving among inter-community migrants on Alaska's North Slope (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 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 Alaska provides a good example of the interaction of culturally defined preferences and the characteristics of place amenities in shaping decisions about migration. Subsistence activities, such as hunting, fishing, and gathering, add substantially to the real income of rural Natives. Thus, subsistence opportunities may limit the effect of relatively limited market opportunities on Native migration (Huskey et al. 2004; Huskey 2009).

3.4.7.5 Family Production and Fish Camps

The production of salmon for subsistence uses typically occurs within family groups. Households work together to catch and process salmon. 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 visit during salmon fishing season, often to participate in fishing and processing and bring products back to their communities (Wolfe et al. 2010; 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. Camps commonly have facilities such as cabins, wall tents, wood racks for drying fish, and smokehouses for curing salmon (Wolfe et al. 2010).

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 markets for the commercial roe fishery, increased restrictions placed on subsistence fishing, and the press of monetary employment during the summer. 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 (Wolfe et al. 2010).

3.4.7.6 Dog Teams

Ethnographic and historic accounts from 1850 to 1950 show that dogs were traditionally used to support trapping, exploration, commercial freighting, individual and family transportation, racing, and military application in interior Alaska. 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.

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 dog teams. 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. Rural dog teams in the early 21st century remain highly reliant on locally caught fish, particularly chum salmon, for food (Andersen and Scott, 2010).

In responding to years of low salmon runs, dog mushers use 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 adequate 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).

3.4.7.7 Salmon Shortages and Species Substitution

Since the late 1990s, depressed salmon runs have been associated with substantial changes in salmon fisheries of the Yukon and Kuskokwim river drainages. 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 treaty-defined U.S. and Canadian harvest allocations. Catching a mix of wild foods helps 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 and Spaeder, 2009).

3.4.7.8 Overview of subsistence salmon harvests

The estimated total subsistence harvest of salmon in Alaska in 2012, based on annual harvest assessment programs, was 935,470 fish. The estimated statewide harvest of chum salmon was 367,692 fish (39 percent) and the estimated harvest of Chinook salmon was 74,381 fish (8 percent) (Figure 22). Please refer to Section 1 (Appendix A-4) for further information.

In 2012, as in other recent years, four areas dominated the subsistence chum salmon harvest: the Yukon Area (227,032 salmon; 62 percent of the statewide harvest), the Kuskokwim Area (81,912 salmon; 22 percent), the Kotzebue District (26,694; 7 percent) Area and the Norton Sound-Port Clarence Area (24,049 salmon; 7 percent) (Figure 20).

Figure 21 reports subsistence Chinook harvests in 2012 by general harvest area. The largest estimated subsistence harvests of Chinook salmon in 2012 occurred in the Yukon area (30,486 salmon; 41 percent), followed by the Kuskokwim (25,336 salmon; 34 percent), Bristol Bay (12,136 salmon; 16 percent), the Glennallen Subdistrict of the Prince William Sound Area (2,649; 4 percent), and the Norton Sound-Port Clarence Area (1,335 salmon; 2 percent).

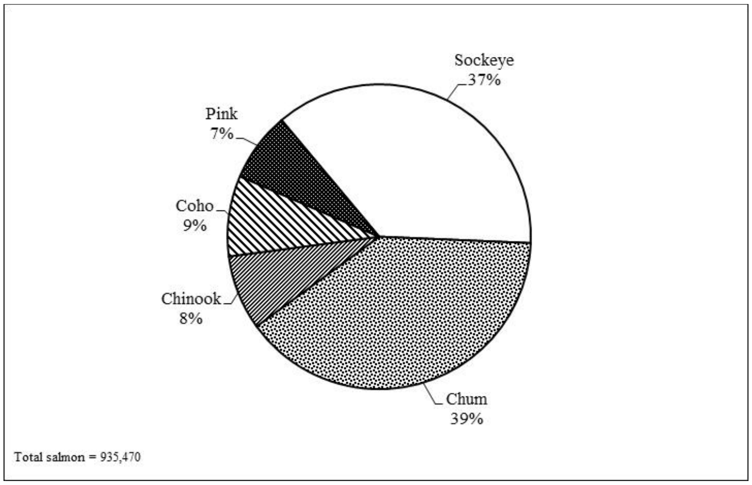


Figure 19. Alaska subsistence salmon harvest by species, 2012 (Source: Fall et al., 2014)

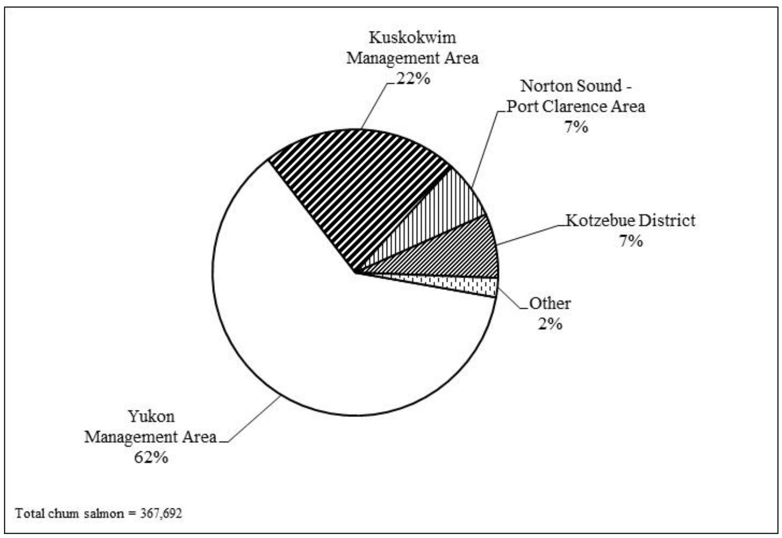


Figure 20. Subsistence chum salmon harvest by area, 2012 (Source: Fall et al., 2014).

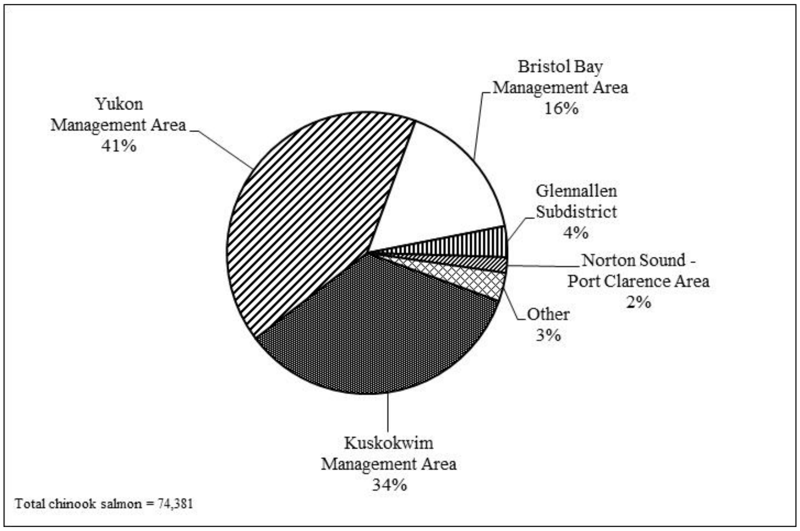


Figure 21. Estimated subsistence Chinook salmon harvest by area, 2012 (Source: Fall et al. 2014).

3.4.7.9 Overview of Regional Subsistence Harvests

Figure 22 summarizes historical estimates of subsistence harvest of Chinook, chum, and other salmon, by harvest area for the years in which relatively comprehensive data are available. The data provided are through 2012. See Section 3.4.3 for stock status information. Some primary points regarding regional patterns and trends include:

- Chinook salmon are the first salmon to arrive each year, which is key to their importance for subsistence throughout their range.
- Chinook salmon are a preferred food throughout their range, including in communities and areas where they are harvested in relatively small numbers.
- Chinook salmon make up a relatively small portion of the subsistence harvests west of Shaktoolik, in Kotzebue Sound, and on Alaska's North Slope. Chinook salmon also is a relatively small portion of the subsistence harvests in the Alaska Peninsula and Aleutian Islands management areas. Chinook comprised less than 1 percent of subsistence harvests in the Kotzebue District between 1994 and 2004, about 2 percent in the Alaska Peninsula Area between 2002 and 2011, and less than 0.2 percent in the Aleutian Islands Area in the same period (Fall et al. 2014).

In the Norton Sound Area, subsistence salmon harvests are dominated by pink and chum salmon, which made up 49 percent and 23 percent, respectively, of the total subsistence salmon harvest in the area from 1994 through 2012. For the area as a whole, Chinook accounted for about 5 percent of the subsistence salmon harvested between 1994 and 2012 (Fall et al. 2014). Despite being a relatively small portion of the overall harvest, Chinook salmon are a preferred subsistence food in the Norton Sound Area.

Chinook salmon are clearly a critical species on the Yukon River. More summer and fall chum salmon are harvested (about 71 percent of the annual average for 2003-2012); during the same period Chinook accounted for 19 percent of the number of salmon harvested (Fall et al. 2014). However, the relative total harvest of each type of salmon does not account for other important considerations, including the relative size, flavor, drying qualities, use as human food versus dog food, and social and cultural significance.

The subsistence salmon fisheries in the Kuskokwim Area are some of the largest in Alaska in terms of the number of residents who participate and the number of salmon harvested (Fall et al. 2014). Since 1994, when ADF&G began acquiring reasonably complete statewide coverage of subsistence salmon harvest data, over 50 percent of Chinook salmon harvested under subsistence regulations have been taken in the

Kuskokwim Area. Between 2010 and 2013 (study years 2009–2012), the Division of Subsistence conducted comprehensive subsistence harvest surveys in 18 Kuskokwim River communities. The results indicate that on average, salmon contributes 42 percent of the total wild resource harvest (in edible pounds) in the Lower Kuskokwim communities, 65 percent in the Central Kuskokwim communities, and 25 percent in the Upper Kuskokwim communities (Brown et al. 2012, 2013; Ikuta et al. 2014).

Chinook salmon are important in the Bristol Bay region, although they represent a lower percentage of the total salmon harvest in the area because such a large portion of the subsistence harvest is sockeye salmon. In districts where both sockeye and Chinook are available in relatively high numbers (Togiak, Naknek, and Nushagak), Chinook comprise a higher percentage of the total, but Chinook are also a favored subsistence food in the other Bristol Bay districts with relatively small Chinook runs. In the Bristol Bay Area from 2003 through 2012, Chinook harvests ranged between 10 percent and 16 percent of total subsistence salmon harvests; from 1983 to 1992, they ranged between 5 percent and 9 percent (Fall et al. 2014).

3.4.7.10 Achievement of Amount Necessary for Subsistence: Yukon Area

As required by AS 16.05.258 (b), the BOF has made findings regarding the “amount reasonably necessary for subsistence” (called an “ANS finding”) for salmon in the areas under discussion. These findings provide a perspective on the importance of salmon harvests to subsistence economies of rural Alaska given that they are based upon historical harvest patterns within each fisheries management area.

Since 1998, the harvests of all species have been within their respective ANS ranges for the Yukon Area for only 2 years: 2005 and 2007 (Table 26). As a result of the necessary restrictions to subsistence, Chinook salmon harvests have fallen below the lower end of the ANS range every year since 2008 (Figure 23). In contrast, the harvests of summer chum and fall chum, which are more abundant, have been increasing, likely due to fishermen replacing their lost Chinook salmon harvests with chum salmon.

Reasons for not meeting an ANS threshold in a given year may include poor salmon abundance or restrictions in subsistence summer chum salmon harvest opportunity in an effort to protect the co-migrating Chinook salmon run (personal communication, C. Brown, 2010). In years of poor Chinook 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.

With continued low abundance and the risk of not meeting the border passage obligations of the Yukon Salmon Treaty, 2013 and 2014 proved extremely restrictive years in terms of subsistence harvests for Chinook salmon. The border passage goal was met in 2014, but not in 2013. Consistent with the new regulation requiring the protection of the first pulse of Chinook salmon in the lower river, windowed openings were closed on the first pulse chronologically upriver. As the 2013 run progressed, in-season projections indicated a poor to below average run and subsistence fishing closures were implemented on each of the three pulses. Very limited opportunity with 6 inch mesh or smaller was provided in between pulses to allow the harvest of other salmon species and nonsalmon species (JTC report 2014:7-8). As a result of these restrictions, harvest estimates were the lowest on record for Chinook salmon: approximately 12,500 fish. Other salmon harvests included 92,000 summer chum, 112,900 fall chum, and 14,100 coho salmon (JTC report 2014:13-14). In 2014, the preseason outlook projected little to no harvestable surplus of Chinook salmon. As a result, managers in the US portion of the river closed all subsistence fishing for Chinook salmon until the bulk of the run was past, prohibiting the use of any gill nets larger than 4 inch mesh and instead limiting fishermen to the use of non-lethal methods such as dip nets, beach seines, and manned fishwheels where Chinook salmon are immediately released to the water alive.

3.4.7.11 Achievement of ANS: Kuskokwim Area

Chinook salmon abundance in the Kuskokwim River drainage has substantially decreased since 2007. In 2012, sharp declines in Chinook salmon abundance caused severe hardship for fishery-dependent communities in the Kuskokwim Area. Subsistence fishers were affected by the 12-day rolling closures of all subsistence salmon fishing in the Kuskokwim River and its tributaries. A poor Chinook salmon run and 35 days of management restrictions resulted in low harvests of Chinook salmon that were approximately 70 percent below the recent 10-year average (Shelden et al. 2014). This was the lowest subsistence harvest ever recorded for the Kuskokwim River. As a result, the U.S. Department of Commerce declared a resource disaster for the Kuskokwim River Chinook salmon fishery on September 13, 2012.

The 2013 fishing season was the first year of the new Kuskokwim River Salmon Management Plan (5 AAC 07.365). This plan included a new drainagewide Chinook salmon escapement goal of 65,000–120,000 fish. Due to consecutive years of low Chinook salmon runs to the Kuskokwim River, a preseason management action was taken to close subsistence salmon fishing in major tributaries from Aniak downstream to Bethel. On June 28, from the mouth of the Kuskokwim to Tuluksak, subsistence salmon gillnet mesh size was restricted to 6-inch or less to conserve Chinook salmon and provide harvest opportunity on more abundant sockeye and chum salmon. These restrictions were then rolled upriver to the village of Chuathbaluk. July 14 was the last day these restrictions were in place. The 2013 subsistence harvest was 47% below the historical in-river harvest of Chinook salmon, and was the second lowest recorded. The new drainagewide Chinook salmon escapement goal was not achieved in 2013, with an estimated 47,315 Chinook salmon escapement. This was the lowest escapement on record for the Kuskokwim River drainage.

ADF&G, USFWS, and the Kuskokwim River Salmon Management Working Group agreed to take a very conservative management approach entering the 2014 fishing season. On April 17, the Federal Subsistence Board adopted a Special Action to close the Kuskokwim Chinook salmon fishery to non-Federally qualified users within the boundary of the Yukon Delta National Wildlife Refuge (Aniak downstream to the mouth). Subsistence fishing for salmon began to close on May 20th downstream of Tuluksak, and then rolled upriver as run timing dictated. As chum and sockeye salmon abundance started to exceed Chinook salmon abundance, limited subsistence fishing opportunity with 6-inch mesh gillnet gear was provided. The first 6-inch mesh fishing period was on June 20, with additional opportunity provided sequentially upstream as run timing dictated. 2014 subsistence harvest of Chinook salmon is expected to be one of the lowest recorded.

Subsistence harvests of Chinook salmon have failed to achieve the lower bound of the ANS range since 2011 (Figure 24). Subsistence harvesters have been targeting more abundant species in years of lower Chinook salmon abundance, and they are tied to both voluntary and involuntary changes in gear usage.

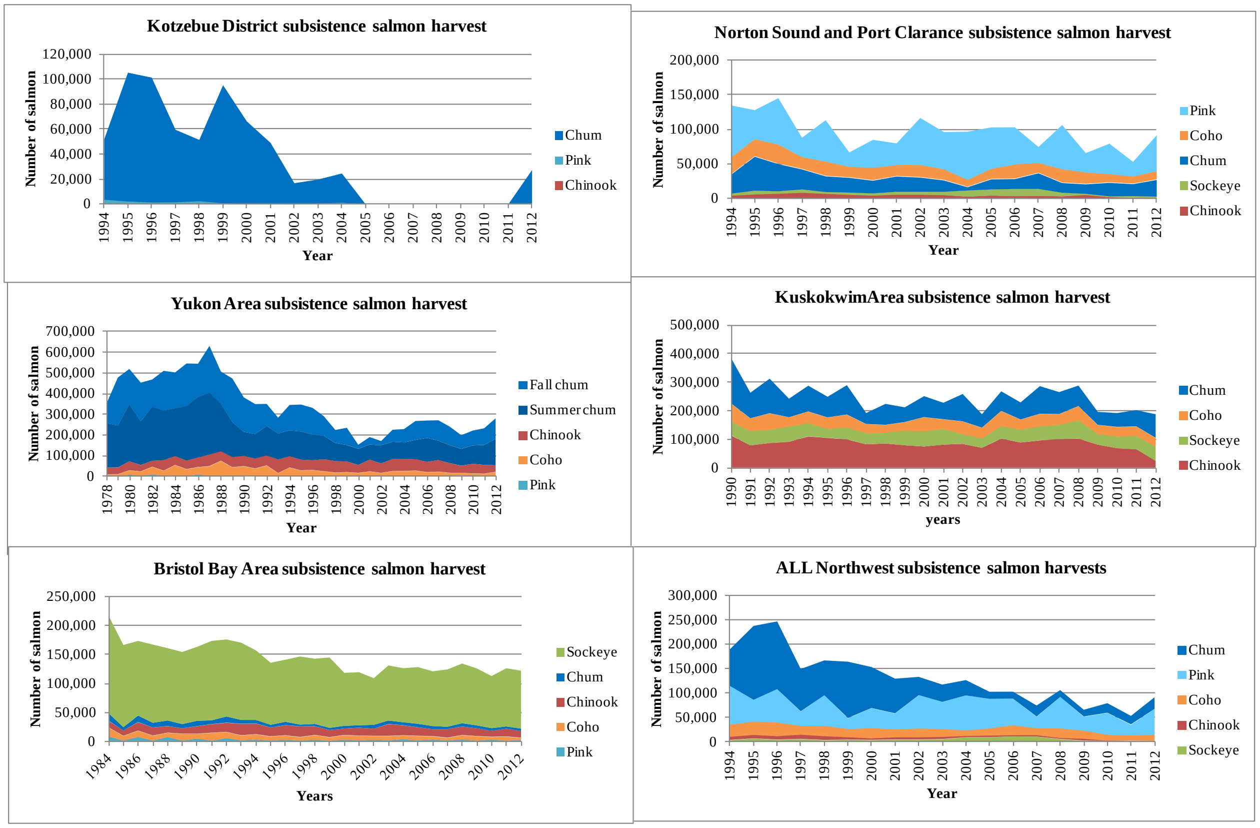


Figure 22. **Estimated subsistence harvests of Chinook, chum, and other salmon, by key management areas (Source: Fall et al. 2014)**

Table 26. Comparison of amounts necessary for subsistence (ANS) and estimated subsistence salmon harvests, Yukon Area, 1998–2012

ANS range	Chinook 45,500–66,704	Coho 20,500–51,980	Summer chum 83,500–142,192	Fall chum 89,500–167,900
Year	Estimated number of subsistence salmon harvested			
1998[b]	52,910	**<u>16,606</u>**	**<u>81,858</u>**	**<u>59,603</u>**
1999[b]	50,711	**<u>20,122</u>**	**<u>79,348</u>**	**<u>84,203</u>**
2000[b]	**<u>33,896</u>**	**<u>11,853</u>**	**<u>72,807</u>**	**<u>15,152</u>**
2001	53,462	21,977	**<u>68,544</u>**	**<u>32,135</u>**
2002	**<u>42,117</u>**	**<u>15,619</u>**	**<u>79,066</u>**	**<u>17,908</u>**
2003	55,221	22,838	**<u>78,664</u>**	**<u>53,829</u>**
2004	55,102	24,190	**<u>74,532</u>**	**<u>61,895</u>**
2005	53,409	27,250	93,259	91,534
2006	48,593	**<u>19,706</u>**	115,093	**<u>83,987</u>**
2007	55,156	21,878	92,891	98,947
2008	**<u>45,186</u>**	**<u>16,855</u>**	86,514	**<u>89,357</u>**
2009	**<u>33,805</u>**	**<u>16,006</u>**	**<u>80,539</u>**	**<u>66,119</u>**
2010	**<u>44,559</u>**	**<u>13,045</u>**	88,373	**<u>68,645</u>**
2011	**<u>40,980</u>**	**<u>12,344</u>**	96,020	**<u>80,202</u>**
2012	**<u>30,415</u>**	21,533	126,992	99,309

Source Jallen et al. (*In prep*)

a. Estimates for 1998–2004 do not include personal use harvests, ADF&G test fishery distributions, or salmon removed from commercial harvests. Estimates for 2005–2012 include test fishery distributions because the ANS are based on harvests from 1990–1999 and included test fishery distribution. **<u>Bold underlined</u>** cells indicate harvest amounts are below the minimum ANS.

b. Species-specific ANS ranges do not apply before 2001.

Table Source: Alaska Subsistence Salmon Fisheries 2012 Annual Report (Fall et al. 2014)

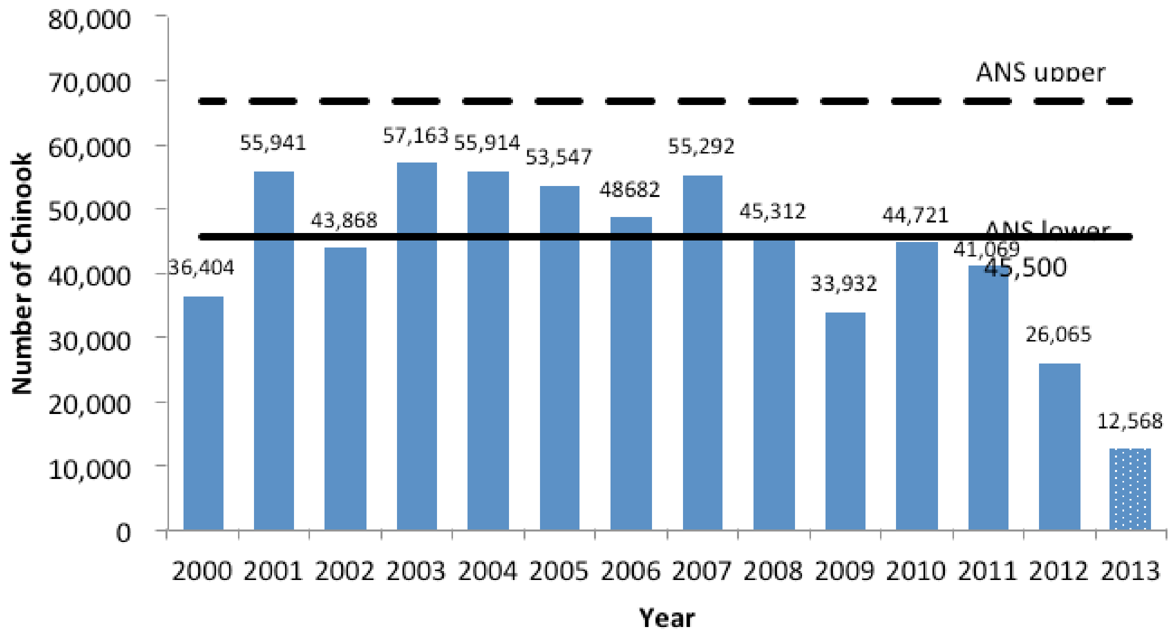


Figure 23. Yukon River Chinook salmon amounts necessary for subsistence (ANS) and estimated subsistence harvest, 2000–2013. Data for 2013 are preliminary. [Source: ADF&G]

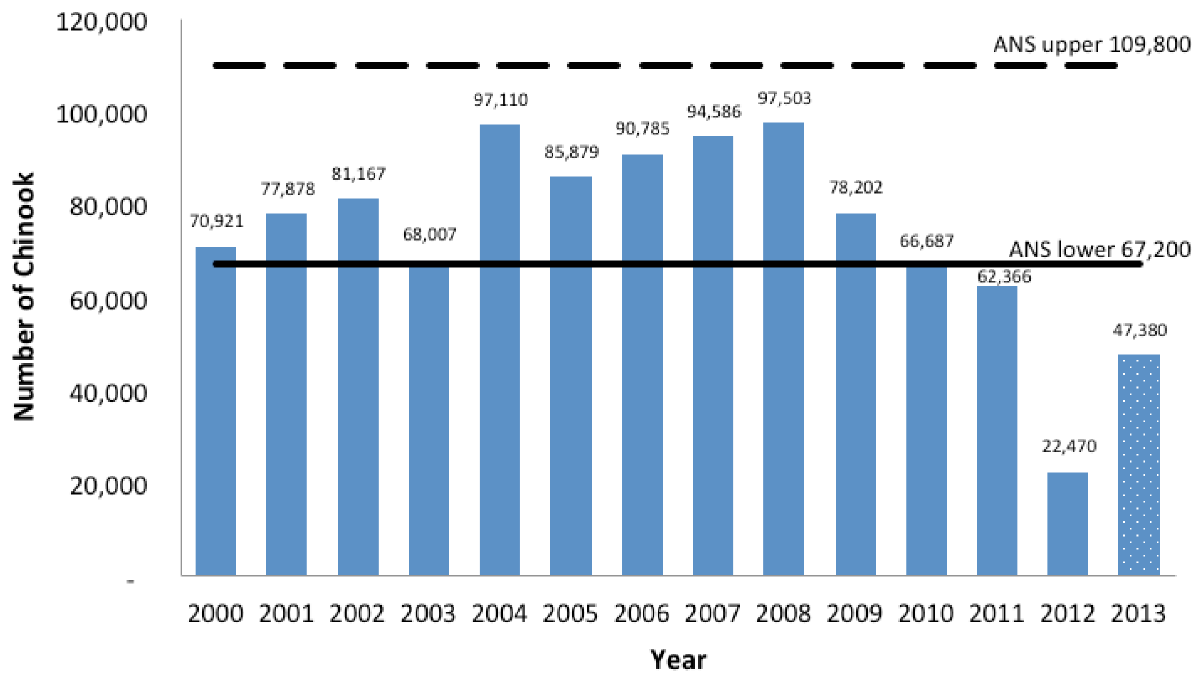


Figure 24. Kuskokwim River Chinook salmon amounts necessary for subsistence (ANS) and estimated subsistence harvest, 2000–2013. Data for 2013 are preliminary. [Source: ADF&G]

3.5 Effects of the alternatives on Chinook salmon and chum salmon

Table 27 describes the criteria used to determine whether the impacts on Chinook and chum salmon stocks are likely to be significant.

Table 27. Criteria used to estimate the significance of impacts on incidental catch of Chinook and chum salmon.

No impact	No incidental takes of Chinook salmon or chum salmon.
Adverse impact	There are incidental takes of Chinook salmon or chum salmon
Beneficial impact	Natural at-sea mortality of Chinook salmon or chum salmon would be reduced
Significantly adverse impact	An action that diminishes protections to Chinook salmon or chum salmon in the pollock fishery to the extent that there is a population level impact.
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the pollock fishery on Chinook salmon or chum salmon, and significantly beneficial impacts are not defined.
Unknown impact	Not applicable.

The impact analysis for Alternatives 2 through 6 is based upon comparison with current Chinook and chum bycatch (annually, seasonally, and by sector) under Alternative 1. For this reason comparative analysis of alternatives is framed in relative levels of Chinook and chum salmon PSC "saved" (reduced bycatch) or in the case of alternatives estimated to increase bycatch the characterization is in negative losses (increased bycatch). All of these estimated impacts are in comparison to status quo levels in Table 29. Any impact to Chinook salmon under the alternatives then is estimated by whether it is likely to represent either no change from status quo, an increase in the adverse impact from status quo levels or a reduced adverse impact should PSC levels be estimated to be reduced under the alternative. To the extent possible AEQ is discussed in relative terms where alternatives may modify the current proportions by stock of origin due to differential seasonal fishing patterns or estimated change in PSC levels from current levels.

3.5.1 Alternative 1

Alternative 1 retains the current Chinook salmon and chum bycatch management programs. For Chinook salmon this entails management under the Amendment 91 program implemented in 2011 while for chum management is under the program implemented in 2007 under Amendment 84 which is described further in Section 2. For more details on Amendment 91 and the changes instituted in 2011 see Section 2.1.2. Here we report on current trends in bycatch of both species annually, by sector, by season and the annual AEQs by stock composition region.

Chinook and chum salmon bycatch mortality occurs in BSAI groundfish fisheries, primarily in the Bering Sea pollock fishery (Figure 26 and Figure 25). For Chinook salmon, the BS pollock fishery comprises between 64% to 96% percent of the overall Chinook bycatch since 1991, with the most recent complete year, 2013, comprising 81% of the overall BSAI Chinook bycatch. Other BSAI groundfish fisheries comprise on average 3,000 Chinook salmon annually. In recent years this comprises a higher proportion of the overall bycatch as annual bycatch has been substantially lower in recent years than the historical high amounts from 2004 through 2007. Thus, for example, in 2010 other groundfish fisheries comprised 22% of overall Chinook bycatch while in 2011 they comprised a low of 4% of the overall Chinook bycatch in that year (for comparison in 2013 19% of the total Chinook bycatch in the BSAI was comprised of bycatch from other groundfish fisheries). For chum salmon bycatch, the pollock fishery comprises over 92% (since is 1996) consistently with many years greater than 98-99% from the pollock fishery. As this management action is focused solely on the pollock fishery all further data and tables relate solely to the mortality by sector and season in that fishery. Bycatch levels for Chinook overall declined sharply following the historically high levels from 2004 to 2007. While substantially lower than the highest years, current bycatch levels have been observed historically, particularly in the mid- and late-1990s. Chum bycatch levels have varied substantially since the early 1990s; however recent levels are considerably less than the historical high in 2005. While lower than the historical high in 2005, chum salmon PSC in 2014 is amongst the higher levels over the 2003-2014 period (219,092 chum salmon as of October 24, 2014).

By sector, overall Chinook salmon bycatch levels have declined since 2007 (Table 29). However, a substantial increase occurred in 2011 compared to 2008-2010, largely driven by increased bycatch in the B-season as compared with the B-season trends in 2008-2010. The inshore CV sector continues to comprise the majority of the bycatch by sector (Table 29).

Amendment 91 was implemented in 2011. Since that time a number of changes have been noted in terms of bycatch levels, rates and vessel behavior. Under status quo the rates have declined for all sectors in recent years (Figure 27). Comparing bycatch rates by week pre and post Amendment 91 also shows significant declines in each week and also shows that the fleet is focusing on fishing earlier in the B-season (Figure 28). This confirms the findings of Stram and Ianelli (2014) that revised management regulations appear to have resulted in reduced bycatch of salmon overall. Also, lower bycatch rates seem to reflect changing behaviour in response to new management measures. Their study also suggested that since Amendment 91 performance at the individual vessel level improved and that the poorer performing vessels (in terms of having high PSC) improved (e.g., Figure 29). However the study also suggested that not all vessels in the fleet had modified behaviour in conjunction with new management measures, and that room for improved vessel behaviour appeared to be related to fishing activities in the B-season (Stram and Ianelli, 2014).

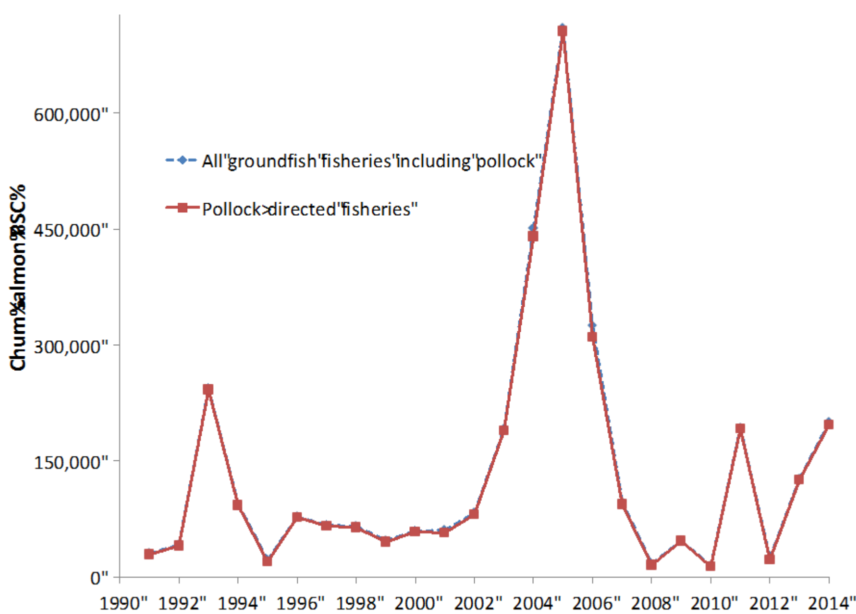


Figure 25. Chum salmon PSC by all groundfish fisheries and directed pollock fishery in the BSAI region, 1991-2014 (through Oct 25th 2014).

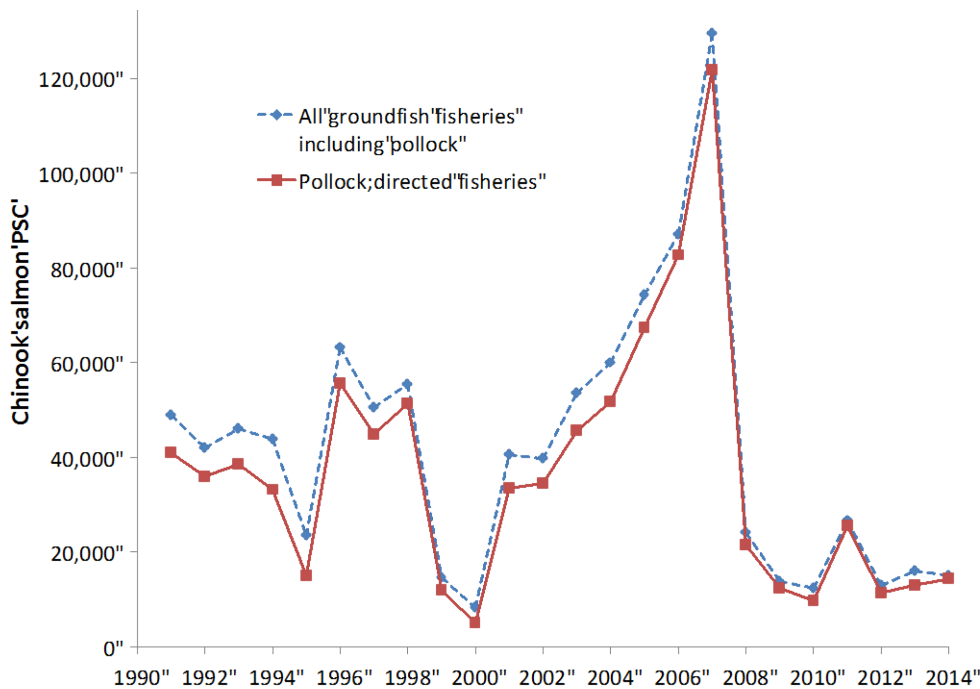


Figure 26. **Chinook salmon PSC by all groundfish fisheries and directed pollock fishery in the BSAI region, 1991-2014 (through Oct 25th 2014).**

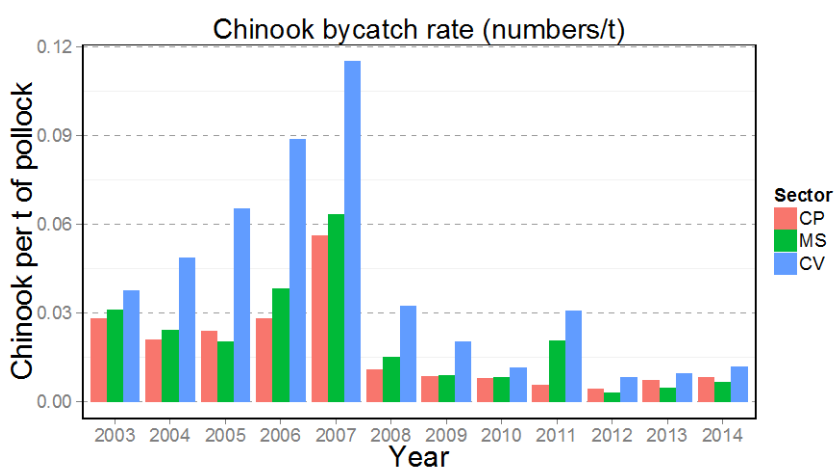


Figure 27. **Sector-specific Chinook salmon PSC / t of pollock rates, 2003-2014.**

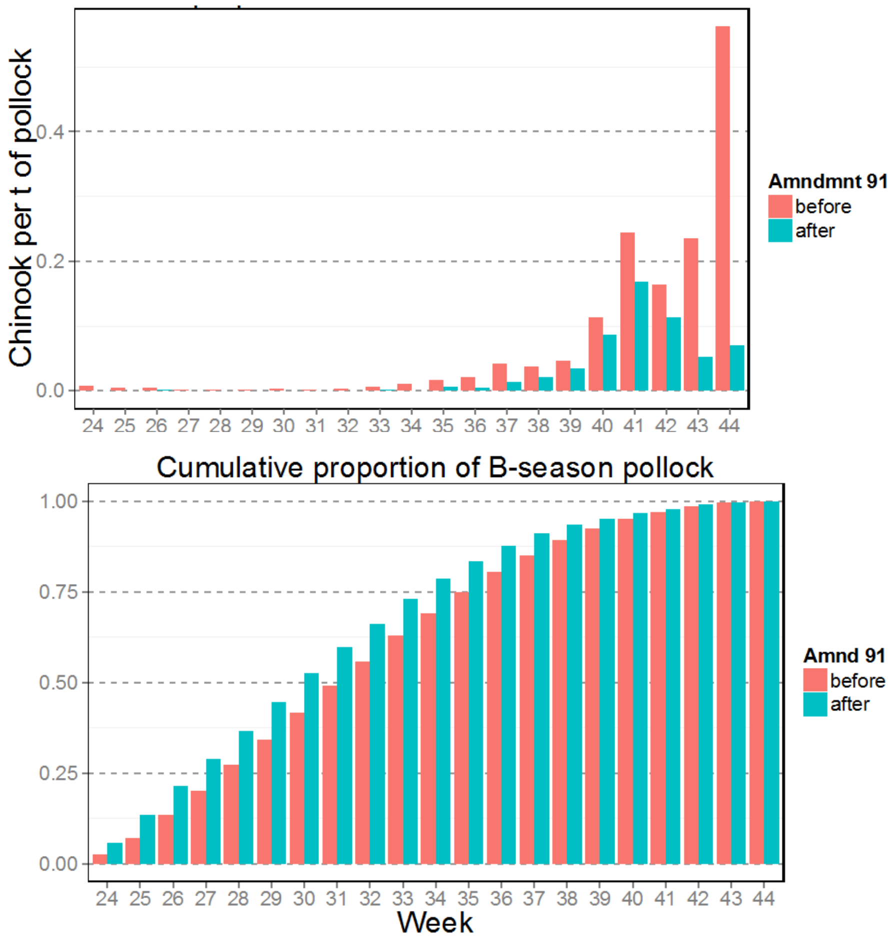


Figure 28. **Weekly Chinook salmon PSC rates in B-season (top) and cumulative Chinook salmon PSC as a proportion of the B-season total (bottom) for 2003-2010 (before Amendment 91) and 2011-2014 (after Amendment 91).**

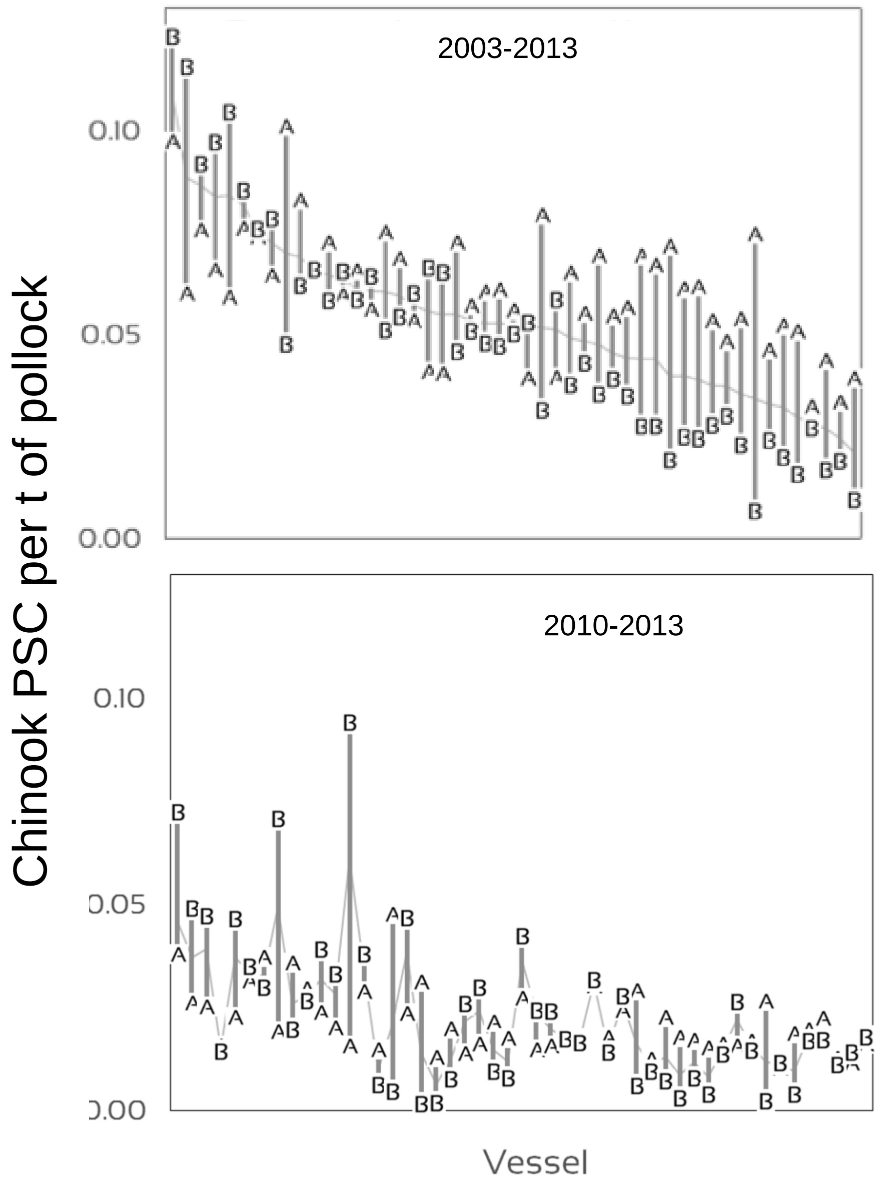


Figure 29. Aggregate annual (line) and "A" and "B" season bycatch rate over all years (2003-2013; top) compared to recent period for each of the 46 selected "shore-based" fishing vessels. Horizontal axis is the same in both and based on the relative rankings for the period 2003-2013. Modified from Stram and Ianelli (2014).

Table 28. Chinook salmon bycatch in the pollock fishery by season (A and B), area (NW=east of 170°W; SE=west of 170°W), and sector (CV=shorebased catcher vessels, MS=mothership operations, CP=catcher-processors, CDQ = community development quota). Note that CDQ prior to 2003 were included in the other sectors and for the purpose of this study, are added to the CP fleet for impact estimates. ***Source: NMFS Alaska Regional Office, Juneau as of Aug 23, 2013.***

Season	A	A	A	A	B	B	B	B	B	B	B	B	
Area	All	All	All	All	NW	NW	NW	NW	SE	SE	SE	SE	
Sector	CV	MS	CP	CDQ	CV	MS	CP	CDQ	CV	MS	CP	CDQ	Total
1991	10,192	9,001	17,645		0	48	318		1,667	103	79		39,054
1992	6,725	4,057	12,631		0	26	187		1,604	1,739	6,702		33,672
1993	3,017	3,529	8,869		29	157	7,158		2,585	6,500	4,775		36,619
1994	8,346	1,790	17,149		0	121	771		1,206	452	2055		31,890
1995	2,040	971	5971		0	35	77		781	632	2896		13,403
1996	15,228	5,481	15,276		0	113	908		9,944	6,208	2,315		55,472
1997	4,954	1,561	3,832		43	2,143	4,172		22,508	3,559	1,549		44,320
1998	4,334	4,284	6,500		0	309	511		27,218	6,052	2,037		51,244
1999	3,103	554	2694		13	12	1,284		2,649	362	1306		11,978
2000	878	19	2525		4	230	286		714	23	282		4,961
2001	8,555	1,664	8,264		0	162	5,346		3,779	1,157	4,517		33,444
2002	10,336	1,976	9,481		0	38	211		9,560	1,717	1,175		34,495
2003	15,367	2,567	12,982	1,693	712	858	2,461	504	6,286	971	817	368	45,586
2004	11,576	1,830	8,559	1,140	2,310	1,375	1,824	1,217	19,921	494	845	609	51,699
2005	13,797	1,864	10,328	1,299	8,870	546	3,792	555	25,956	144	105	62	67,319
2006	35,638	4,864	16,204	1,585	961	148	1,251	130	21,687	11	165	26	82,671
2007	36,463	4,816	25,841	3,113	1,637	1,825	4,558	2,023	39,701	20	1,748	506	122,252
2008	10,692	1,127	4,091	605	251	175	339	31	3,994	0	38	5	21,347
2009	6,241	547	2,738	358	115	70	310	89	2,092	16	0	0	12,576
2010	3,735	493	3,066	335	73	20	50	0	1,859	64	1	0	9,695
2011	4,441	459	1,806	430	142	69	1,244	76	13,809	2,357	408	258	25,499
2012	4,624	312	2,484	344	75	7	52	2	3,358	42	40	3	11,343
2013	3,640	557	3,563	472	13	7	34	6	697	18	32	2	9,041

Table 29. Total PSC for Chinook and chum salmon and pollock catch (in t) by sector and season, 2003-2014 as of October 25th 2014.

	Shore-based CVs			CVs to Motherships			CPs			CDQ			
	A	B	Subtot	A	B	Subtot	A	B	Subtot	A	B	Subtot	Total
Chinook salmon													
2003	15,367	6,998	22,365	2,567	1,829	4,395	12,982	3,278	16,261	1,693	872	2,565	45,586
2004	11,576	22,231	33,807	1,830	1,869	3,699	8,559	2,669	11,227	1,140	1,826	2,966	51,699
2005	13,474	34,794	48,268	1,810	690	2,500	9,903	3,896	13,798	1,273	637	1,910	66,477
2006	34,966	22,581	57,547	4,664	159	4,823	15,485	1,416	16,902	1,580	157	1,737	81,009
2007	35,212	41,085	76,296	4,757	1,845	6,602	25,680	6,306	31,986	3,091	2,529	5,620	120,505
2008	10,692	4,229	14,921	1,127	175	1,302	4,091	377	4,467	605	36	641	21,331
2009	6,242	2,212	8,454	547	86	633	2,738	310	3,048	358	89	447	12,582
2010	3,264	1,914	5,178	493	84	577	2,949	51	3,000	335	0	335	9,090
2011	4,415	13,940	18,355	444	2,426	2,870	1,795	1,651	3,446	426	334	760	25,431
2012	4,580	3,433	8,013	308	49	357	2,457	92	2,549	342	5	347	11,266
2013	3,640	4,254	7,894	557	48	605	3,565	448	4,013	472	48	520	13,032
2014	6,420	2,702	9,122	463	180	643	3,961	566	4,527	692	36	728	15,020
Chum salmon													
2003	1,389	144,715	146,104	260	11,634	11,894	1,948	20,837	22,785	237	8,119	8,356	189,139
2004	156	340,651	340,807	54	13,276	13,330	185	75,949	76,134	29	10,168	10,197	440,468
2005	221	617,647	617,868	45	15,267	15,312	271	62,204	62,475	32	7,661	7,693	703,348
2006	498	283,213	283,711	85	1,925	2,010	668	17,251	17,919	65	1,137	1,202	304,842
2007	2,303	51,785	54,088	81	5,343	5,424	4,923	22,272	27,195	1,156	5,324	6,480	93,188
2008	23	12,743	12,766	6	635	641	218	1,344	1,562	73	361	434	15,402
2009	42	39,752	39,794	0	1,733	1,733	6	3,895	3,901	0	950	950	46,378
2010	22	9,428	9,449	0	1,070	1,070	18	2,079	2,097	0	526	526	13,142
2011	60	115,725	115,785	0	24,399	24,399	51	44,292	44,343	11	3,758	3,769	188,296
2012	3	19,160	19,163	1	977	978	6	1,928	1,934	1	200	201	22,276
2013	62	110,496	110,558	23	3,835	3,858	102	10,229	10,331	15	554	569	125,316
2014	350	145,035	145,385	17	8,091	8,108	162	63,004	63,166	27	2406	2,433	219,092
Pollock (t)													
2003	258,299	393,943	652,242	51,778	78,786	130,564	207,158	315,263	522,422	59,528	89,594	149,121	1,454,348
2004	259,674	378,295	637,969	51,889	77,333	129,222	207,573	311,997	519,571	59,739	89,434	149,173	1,435,934
2005	245,412	386,289	631,701	47,974	79,271	127,244	193,892	310,215	504,107	56,081	90,646	146,727	1,409,779
2006	253,739	384,284	638,023	49,930	79,735	129,665	200,757	319,000	519,757	60,170	90,312	150,482	1,437,927
2007	238,381	328,512	566,893	47,569	72,775	120,344	191,966	293,518	485,484	55,674	83,608	139,282	1,312,003
2008	173,570	254,188	427,758	34,712	50,647	85,359	138,843	208,391	347,234	39,949	60,015	99,964	960,314
2009	140,685	209,799	350,484	28,162	42,146	70,308	112,523	169,077	281,600	32,523	48,956	81,478	783,870
2010	137,950	202,628	340,578	28,027	42,549	70,576	109,029	169,557	278,586	32,061	48,285	80,346	770,086
2011	217,744	291,046	508,790	43,581	65,731	109,311	171,508	247,949	419,457	49,240	66,167	115,407	1,152,965
2012	204,220	315,155	519,375	41,691	63,424	105,115	167,254	253,877	421,131	47,988	73,126	121,114	1,166,736
2013	218,463	330,297	548,760	43,287	66,710	109,997	175,583	264,928	440,511	50,598	75,940	126,538	1,225,806
2014	*271,078*	*299,218*	*570,296*	*54,469*	*62,998*	*117,467*	*218,148*	*241,917*	*460,065*	*63,159*	*87,014*	*150,173*	*1,298,000*

An adult equivalency (AEQ) model was developed for use in the Chinook EIS/RIR (NPFMC/NMFS 2009). This was done to understand the impacts of bycatch on Chinook salmon populations, and required the development of a method to estimate how the different bycatch numbers would propagate to adult equivalent spawning salmon. This is distinguished from the annual bycatch numbers that are recorded by observers each year for management purposes. An AEQ model was also employed in previous analyses of chum salmon bycatch management reviewed by the Council in 2012 with results summarized below.

The AEQ bycatch applies the extensive observer datasets on the length frequencies of Chinook and chum salmon taken as bycatch and converts these to the ages of the bycaught salmon, appropriately accounting for the time of year that catch occurred. Coupled with information on the proportion of salmon that return to different river systems at various ages, the bycatch-at-age data is used to pro-rate, for any given year, how bycatch affects future potential spawning runs of salmon.

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. Because the Chinook salmon caught in the pollock fishery range in ages from 3-7 year olds, the impacts of bycatch in any one year may be lagged by several years. Thus a high bycatch year (such as in 2007 for Chinook) may have impacts lower than the number of PSC recorded as mortality in that year but will continue to impact returns to rivers for several years into the future. Similarly a low bycatch year may indicate low mortality in that year but the true impacts are influenced by the bycatch that has occurred in previous years. Therefore AEQ is a more accurate representation of the true impact to spawning salmon than the mortality in numbers of fish recorded in any one year (Figure 30).

Since the Council's action in 2009 some additional work has been done to augment and update the Chinook AEQ analysis (Ianelli and Stram, 2014). This includes refinement of the model framework and analysis, comparative information with the model employed in the 2009 analysis and use of run reconstruction data to estimate impact rates of the pollock fishery bycatch by regional stock grouping based upon the genetics (Ianelli and Stram, 2014).

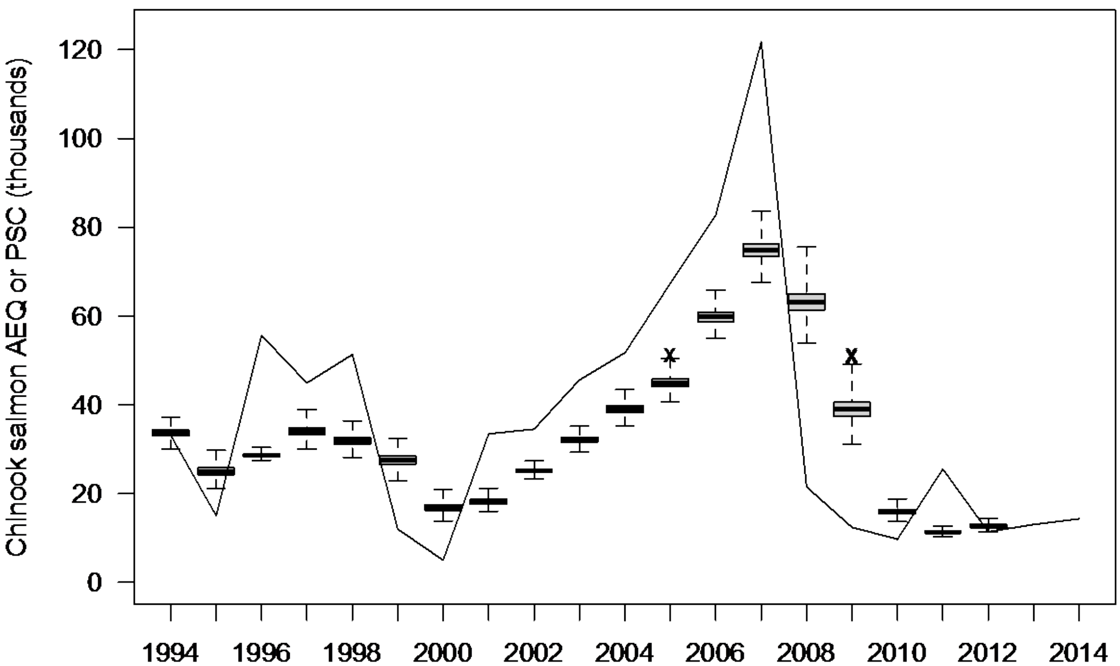


Figure 30. Estimated annual total adult equivalent (AEQ) mortality of Chinook salmon from the BS pollock fishery, 1994-2012 (boxplots) and PSC (1994-2014). Units are numbers of salmon and height of boxes represent the uncertainty (inter-quartile ranges) due to oceanic survival and other factors that vary within the model. Horizontal lines within the boxes represent the medians of the posterior distribution. (From Ianelli and Stram 2014).

Using the genetic information as described in Section 3.4.6 for Chinook, nine stock groups were identified for estimating aggregate results to region of origin. These groups are the following: British Columbia-Washington-Oregon, Coastal western Alaska, Cook Inlet, Middle Yukon, North Alaska Peninsula, Russia, Southeast Alaska, Upper Yukon and an aggregate 'other' grouping. For a list of rivers comprised by each grouping see Guthrie et al, 2014. Using these groupings, the estimated regional annual AEQ are shown in Table 30. Also shown in this table is the estimate of the uncertainty in total AEQ and the proportion by regional stock group of the AEQ that occurred during the "A" season.

The largest bycatch is from the coastal western Alaska stock grouping. Here the coastal western Alaska RSG includes all major river systems in western Alaska from the Kotzebue region in the north to the Bristol Bay region in the south excluding the middle and Upper Yukon River (note that for purposes of estimating impact rates the middle Yukon is included with the Coastal western Alaska grouping to form a larger aggregate group of all but the Upper Yukon western Alaskan river systems). Interesting patterns are seen by season for the different stock groupings particularly as compared to when and where the majority of the bycatch is taken (Table 30). For example, on average 76% of the Upper Yukon Chinook salmon bycatch is taken during the winter fishery, whereas the A-season bycatch represents only about 55% of the overall Chinook salmon AEQ mortality. Conversely, the vast majority of Cook Inlet Chinook salmon bycatch (87%) is taken during the summer pollock fisheries, although the total AEQ is fairly small.

Table 30. Chinook salmon AEQ estimates by regional stock group for the years 1994-2012 (top panel) and the proportion of AEQ for each stock group that occurred during the A season (bottom panel). Last column of the upper panel represents the coefficient of variation (CV) of the estimated total AEQ (From Ianelli and Stram, 2014).

	BC-WA-OR	Coast W AK	Cook Inlet	Middle Yukon	N AK Penin	Other	Russia	SEAK	Upper Yukon	Total	CV
1994	4,157	19,192	570	916	5,667	181	376	472	2,068	33,644	2.8%
1995	3,166	14,154	418	649	4,310	127	268	343	1,543	25,017	4.6%
1996	3,365	16,111	411	744	5,300	130	294	378	1,868	28,629	1.4%
1997	4,942	19,398	718	849	5,144	203	384	486	1,862	34,029	3.4%
1998	5,578	18,291	880	725	3,809	226	379	479	1,407	31,818	3.3%
1999	5,219	15,841	847	600	2,872	212	335	424	1,079	27,485	5.0%
2000	3,416	9,654	552	334	1,666	132	201	257	610	16,839	6.2%
2001	2,324	10,582	372	544	2,588	122	231	281	1,021	18,066	4.3%
2002	2,878	14,351	386	711	4,387	130	281	353	1,612	25,115	2.3%
2003	3,822	18,405	526	901	5,470	172	364	454	2,012	32,160	2.5%
2004	4,926	22,340	702	1,072	6,324	220	447	558	2,340	38,979	3.1%
2005	6,802	25,202	947	1,278	6,578	297	582	681	2,479	44,891	2.8%
2006	12,135	28,685	1,121	1,471	11,681	371	748	953	2,535	59,788	2.7%
2007	12,528	42,180	1,352	1,717	11,646	433	874	1,086	3,024	74,931	2.8%
2008	8,071	38,950	1,216	1,360	8,946	362	704	853	2,565	63,172	4.3%
2009	3,706	24,984	775	909	5,263	230	446	508	2,050	38,917	6.0%
2010	1,705	8,228	262	711	2,610	81	187	203	1,862	15,884	4.8%
2011	1,358	6,312	208	414	1,608	64	122	168	1,033	11,296	3.0%
2012	1,589	7,697	275	300	1,691	81	131	191	675	12,645	3.8%

	BC-WA-OR	Coast W AK	Cook Inlet	Middle Yukon	N AK Penin	Other	Russia	SEAK	Upper Yukon	Total
1994	44%	66%	15%	76%	89%	24%	39%	63%	83%	67%
1995	44%	68%	16%	84%	89%	24%	43%	65%	85%	68%
1996	50%	74%	20%	91%	92%	29%	52%	71%	89%	75%
1997	32%	55%	10%	74%	83%	16%	30%	52%	76%	56%
1998	19%	39%	5%	61%	72%	9%	18%	36%	63%	40%
1999	14%	30%	4%	53%	64%	6%	13%	28%	54%	31%
2000	12%	28%	3%	56%	61%	5%	12%	25%	52%	28%
2001	32%	50%	9%	52%	82%	16%	24%	48%	70%	52%
2002	47%	68%	16%	75%	90%	26%	41%	66%	84%	69%
2003	45%	66%	15%	74%	89%	25%	39%	64%	83%	67%
2004	40%	61%	13%	71%	87%	21%	34%	58%	80%	62%
2005	25%	54%	10%	63%	80%	19%	24%	54%	77%	53%
2006	47%	60%	13%	71%	87%	33%	32%	69%	76%	62%
2007	50%	63%	15%	63%	86%	50%	38%	71%	71%	64%
2008	51%	58%	14%	53%	87%	55%	41%	65%	64%	61%
2009	55%	51%	15%	46%	87%	58%	48%	58%	68%	57%
2010	32%	63%	25%	79%	91%	35%	66%	50%	91%	68%
2011	36%	53%	16%	82%	90%	27%	59%	51%	94%	60%
2012	34%	46%	11%	76%	87%	19%	45%	46%	91%	52%
Avg.	37%	55%	13%	68%	84%	26%	37%	55%	76%	57%

Run-size information has been assembled for two regional stock groupings (aggregate Coastal western Alaska including the middle Yukon and the Upper Yukon, Canadian-origin fish) in order to allow estimation of the impact rates of the pollock fishery bycatch on these aggregate stock groupings. Table 31 shows the estimated impact rates of the pollock fishery bycatch for these two regional stock groupings. The peak estimated impact for both these regions occurred in 2008 and was estimated at 7.9% and 4.0% of their potential total returns, respectively (Table 31; Figure 31).

Table 31. Results of the Chinook salmon AEQ analysis combined with the available genetic data for the years 1994-2012 impact as the ratio of AEQ to estimated ADFG run size. Note that middle Yukon is added to the coastal west Alaska group. (From Ianelli and Stram 2014)

Year	CWAK	Upper Yukon	Year	CWAK	Upper Yukon
1994	2.01%	1.11%	2004	2.07%	1.72%
1995	1.65%	0.79%	2005	2.78%	2.00%
1996	2.66%	0.94%	2006	3.76%	2.13%
1997	2.08%	1.00%	2007	6.88%	3.46%
1998	2.41%	1.51%	2008	7.49%	4.03%
1999	2.87%	0.94%	2009	5.14%	2.37%
2000	2.41%	1.16%	2010	2.36%	3.11%
2001	1.71%	1.04%	2011	1.43%	1.44%
2002	2.11%	1.69%	2012	1.98%	1.35%
2003	2.64%	1.25%			

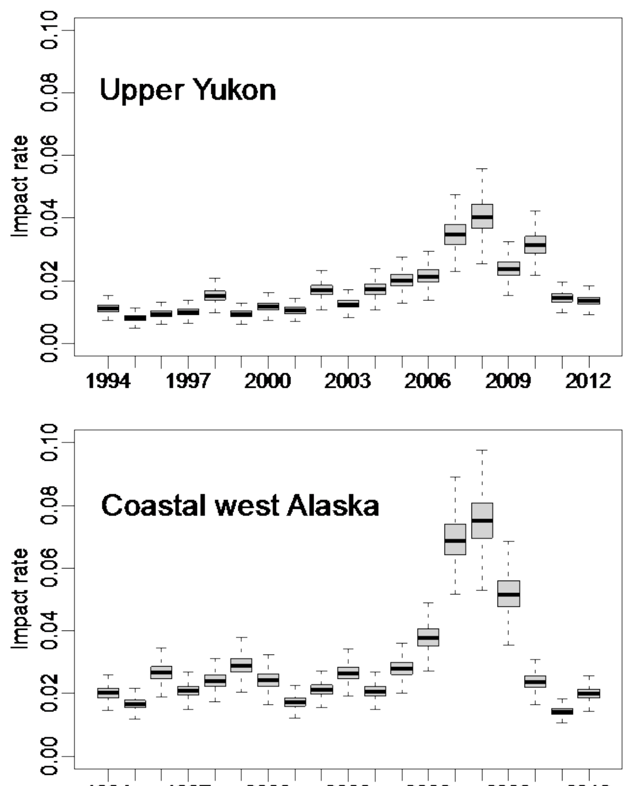


Figure 31. Estimated impact of the BS pollock fishery on the Upper Yukon stock (top) and coastal west Alaska (which includes the "middle Yukon"; bottom), 1994-2012. Vertical axis is the ratio of AEQ over the point estimates of total run sizes.

The genetics and age composition data for updating the full AEQ model was unavailable for 2013 and 2014. However, the PSC totals for Chinook salmon remain less than 15,000 fish in 2013 and 2014 and the relative stability of the genetic stock ID patterns historically (and given reports of the composition in 2013), the fishery impact to the regional stock groups is unlikely to have increased above the values observed in 2011 and 2012.

Without conducting the full AEQ model, a simple multiple regression can be used to relate AEQ estimates and the stock ID information to the largest single factor: the amount of Chinook salmon PSC. Linear coefficients for PSC from A season lagged 0, 1, and 2 years plus coefficients related to current-year PSC in the region west of 170º W, and lagged one year for PSC from east of 170º W provides reasonable historical fits to AEQ and a means to estimate AEQ given seasonal and regional PSC values (Figure 32). From these relationships, it is possible to estimate relative impacts (assuming the genetic stock composition of the bycatch remains consistent—cross validation using this approach has indicated that it has in the past). In particular, using updated run strengths in 2013 and 2014 (for the main systems where information was available; others were assumed equal to the 2012 values) and given regression model estimates of about 7,400 Chinook salmon AEQ for those years, the impact rate would be about 2.3%:

~AEQ ÷ CWAK run size = Impact rate

For 2013:

7,400 ÷ 318,149 = 0.023.

For 2014:

7,400 ÷ 318,856 = 0.023.

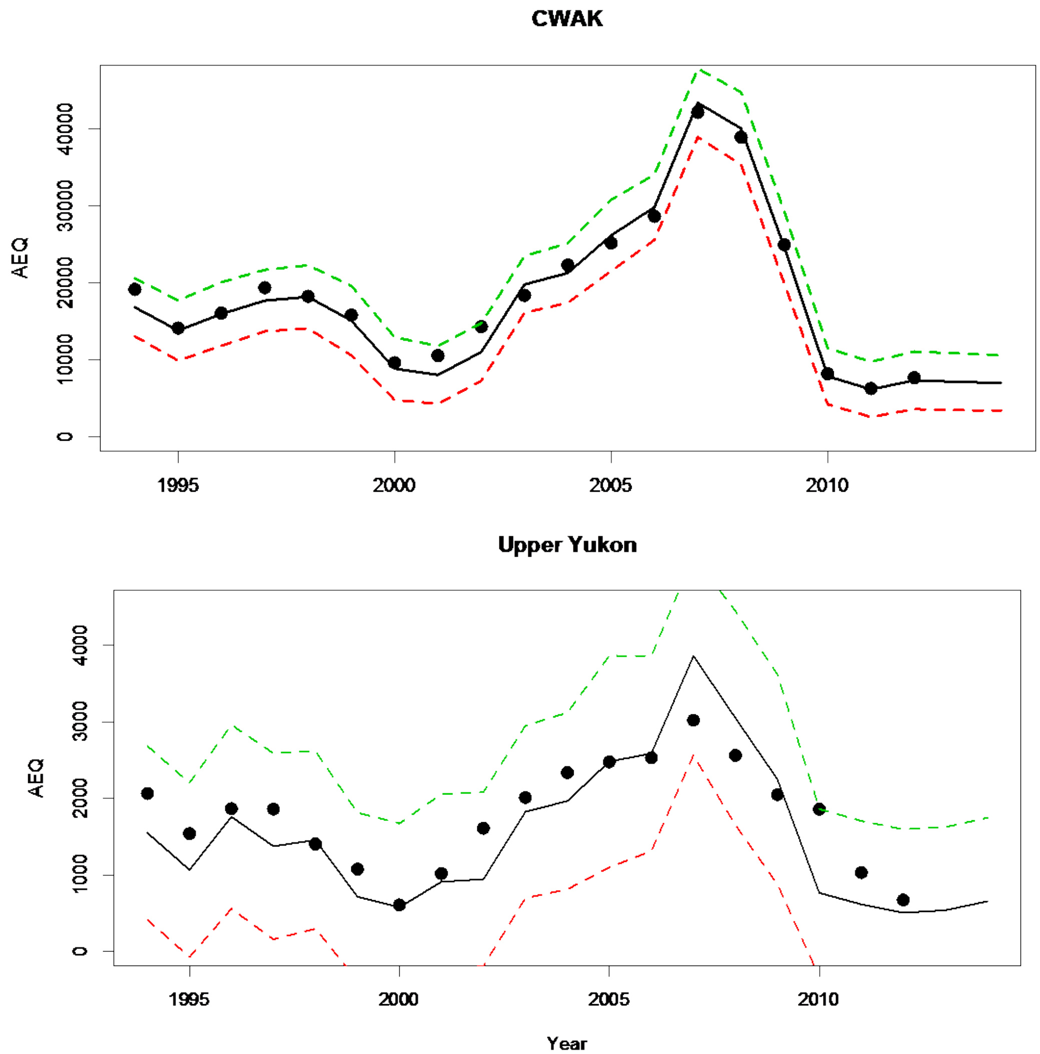


Figure 32. Predicted Chinook salmon AEQ based on lagged PSC levels by region for the Coastal west Alaska region (top) and Upper Yukon (bottom). Specifically, coefficients estimated for PSC for A season lagged 0, 1, and 2 years plus coefficients related to current-year PSC in the region west of 170º W, and lagged one year for PSC from east of 170º W. Approximate 90% confidence bands shown by dashed lines.

For chum salmon bycatch a similar, albeit simplified, analysis was completed (from NPFMC, 2012). Impacts rates (chum salmon bycatch/run size) were estimated based on available genetic break-outs in Gray et al, 2010. Here, based upon the available genetic stock groupings identified in Gray et al, 2010 as well as availability of aggregate run size data, three systems were identified for estimating impact rates: Coastal western Alaska, Upper Yukon (Canadian-origin fall-run chum), and Southwest Alaska (which includes river systems from the Alaska Peninsula). A fourth group which is designated ‘Combined WAK’ is shown which combined the coastal WAK grouping with the Upper Yukon to show relative impacts to aggregate western Alaska chum stocks. Based on this analysis, on average (using 2005-2009 data) 11% of the AEQ came from coastal western Alaska systems and about 6% of the total AEQ bycatch originated from the Upper Yukon fall run of chum salmon. Using conservative run size estimates from ADF&G (river systems with missing run-size information were omitted) indicated 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 32). In only three out of 16 years was the impact rate estimated to be higher than 0.7%. For the Upper Yukon stock, the estimate of the impact is higher with a peak rate of 2.7% estimated on the run that returned in 2006 (with upper 95% confidence bound at 3.7%). For the SW Alaska region the estimate of impact rate is the lowest for any of the Alaska sub-regions. The average impact rate (2005-2009) by region:

Coastal west Alaska	0.47%
Upper Yukon	1.12%
Combined WAK	0.57%
Southwest Alaska	0.31%

Table 32. Estimated median impact of the pollock fishery as reported on in NPFMC (2009) for chum salmon assuming run size estimates presented in (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.

The AEQ, overall and to regional stock groups, and impact rate estimates for Chinook and chum salmon provide useful baseline information for the relative impact of overall bycatch levels by the pollock fishery on Chinook and chum salmon stocks, particularly in reference to stocks in western Alaska. AEQ analysis and results are presented for background information on the relative proportional estimates to regions of origin, however information is insufficient to support carrying these calculations through to estimation of impacts to regions of origin under various alternatives. Table 29 shows the Chinook and chum PSC in the pollock fishery by sector and season as well as the associated pollock catches from 2003-2014. The pollock fishery is a known Chinook and chum salmon mortality, as represented by annual trends in Table 29, therefore the status quo pollock fishery has an adverse impact on Chinook and chum salmon. However given the rates of impact (salmon PSC/aggregate run size) for chum and Chinook stocks in western Alaska, it is likely that bycatch at current levels does not represent a significantly adverse impact because Alternative 1 maintains protections afforded to Chinook and chum salmon in the groundfish fisheries.

3.5.2 Alternative 2

Alternative 2 addresses chum salmon PSC management only. In October, 2013 the three IPAs presented a collaborative proposal to the Council on how chum salmon bycatch could be incorporated into the existing IPAs. The proposal focuses upon the use of the current RHS program for chum salmon bycatch management operating in all sectors with closures applying at the cooperative level (as with status quo) with some modifications based upon the intent to improve chum salmon bycatch avoidance during times of higher chum bycatch rates while balancing Chinook salmon bycatch avoidance and opportunities for pollock harvests in the latter portion of the B season.[15] The general changes suggested in the proposal presented to the Council in October 2013 form the basis for estimating how chum would be incorporated into IPAs in order to estimate the impacts of this Alternative for purposes of this analysis.

Some of the features that are included in the proposal are more stringent Base Rate definition, using a 2-week rolling average as suggested by previous analyses of RHS efficacy. Provisions are also proposed to avoid rapidly climbing Base Rates (which can serve to undermine the cooperatives impacted by closures by pushing most cooperatives into Tier 1 to which closures do not apply) and ineffective closures in periods of low chum salmon encounters (having little impact on bycatch but slowing down fishing and therefore increasing fishing later in the B-season when Chinook bycatch rates rise). These measures are all considered improvements over the current chum RHS program and would likely improve program efficacy.

One important element in the proposal, which is likely to be included in any revised IPA proposal, is the explicit prioritization of Chinook protection when Chinook rates begin to increase. A “Chinook Protection Trigger” is proposed such that when a rate of $\geq$ 0.035 Chinook per t of pollock is encountered in any ADF&G statistical area within a Region (Section 2.2) then chum closures within that Region would cease and instead the applicable Chinook PSC limit and other measures within each IPA would be the primary bycatch management measures. The rationale for this dates back to the original RHS program under the regulations for Amendment 84 which operated as a combined Chinook and chum salmon bycatch management program and chum closures shifted to Chinook closures when that threshold was reached in a statistical area. As such there was an explicit prioritization of Chinook measures if both salmon species were present. Regulations to implement Amendment 91 removed this prioritization, leaving chum RHS closures in effect late in the B-season, which can force the fleet into areas of lower pollock harvest rates and slow down the fishery. As seen in previous chum salmon bycatch management measures under consideration, anything that slows down the fishery in the B-season has the potential to exacerbate Chinook salmon bycatch later in the season.

The degree to which this provision actually would reduce the number of vessels that fish in the closures when they are in place is unknown, as many vessels are in RHS program tiers that allow them to fish in the closures, however these vessels may nonetheless avoid fishing in the closed areas because these areas are identified as recent hotspots. December 2012 Council analysis of chum RHS closures discussed the limited amount of fishing that occurred in RHS closures and some vessel masters have mentioned in Amendment 91 skipper surveys that they always avoided the RHS closures. From 2003-2011, during RHS closure periods, 4.6 percent of catcher vessel pollock and 0.3 percent of pollock by the other sectors was taken inside the closure areas.

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[15] The initial proposal also contained an objective pertaining to a higher level of bycatch reduction for mature chum salmon during the months of June and July based on previous reports to the Council on the higher proportion of western Alaska chum salmon in the bycatch during those periods. However the value of prioritizing these months is inconclusive based on more recently presented chum salmon bycatch genetics reports (Guthrie et al, 2014). Nevertheless some of those proposed measures, absent the specific timing considerations, may be considered in the future.

This alternative is likely to result in similar impacts to chum salmon as with status quo, although there is the potential for some increased chum salmon savings over status quo given proposed modifications to the RHS system. The increased flexibility of management under the IPA structure and specifically the inclusion of the Chinook Protection Trigger are likely to increase Chinook savings over status quo management as more potentially low-Chinook areas will be available for pollock harvests during times of increased rates of Chinook bycatch. While it is not possible to directly quantify these benefits, any reduction of Chinook and chum salmon bycatch will provide some improvement over the status quo impact on salmon stocks. **Therefore this alternative is estimated to have some (likely small) reduced adverse impact compared to Alternative 1.**

The reduced adverse impacts to Chinook and chum salmon under this alternative assume that there remains 100% fleet-wide participation in the RHS program as there is under the status quo (Amendment 84) chum salmon ICA. Should measures under Alternative 2 decrease the incentive to remain in an IPA, then adverse impacts to chum salmon and Chinook salmon under this alternative could increase.

3.5.3 Alternative 3

Alternative 3 increases the provisions to reduce Chinook bycatch under the IPAs with a variety of options. These options are discussed in order below with the resulting impact analysis on Chinook stocks. It should also be noted that the revised IPA agreements include several of these provisions for the 2015 fishing year.

The options analyzed under Alternative 3 are all intended to increase the incentives to reduce Chinook bycatch within the IPAs. Any incentive at the vessel level that translates into increased savings of Chinook salmon results in reduced salmon bycatch overall. It is not possible to quantify the compliance of vessels within IPAs to these additional restrictions nor to estimate the relative reductions in salmon bycatch that would result from IPAs implementing these provisions. Nevertheless, this alternative is estimated to be similar to Alternative 1 in impacts under these options with the likelihood of a reduced adverse impact to Chinook salmon relative to Alternative 1 depending upon the strength of incentives or penalties imposed. The impacts to chum salmon under this alternative are estimated to be similar to Alternative 1.

3.5.3.1 Alternative 3, option 1, restrictions or penalties for vessels with higher PSC rates

Alternative 3, option 1 would impose **"Restrictions or penalties targeted at vessels that consistently have significantly higher Chinook salmon PSC rates relative to other vessels fishing at the same time. Include a requirement to enter a fishery-wide in-season PSC data sharing agreement."** The two elements in this option are combined because of the Council's concern that creating incentives or penalties that would reward or punish a vessel for its bycatch performance relative to others would discourage information sharing and cooperation. To reduce the potential for a vessel to consistently maintain higher rates of Chinook salmon PSC than other vessels fishing at the same time (i.e., an outlier), this option would incorporate additional restrictions or penalties targeted at individual vessels that consistently have significantly higher PSC rates as a way for IPAs to increase their responsiveness and improve an individual vessel's performance. Restrictions or penalties targeted at the outliers have the potential to induce changes in fishing behaviors. Strong incentives will induce vessel operators to change where they fish to avoid Chinook salmon bycatch. Changes in fishing patterns can involve several different behaviors: avoiding an area that has historically or recently had high bycatch; using and sharing more information on high-bycatch areas; and moving immediately once high bycatch has been observed.

First, the provision to impose fishing restrictions or penalties is addressed followed by a discussion of the fleet-wide information sharing provision. Vessels have repeatedly demonstrated that there are trade offs among the costs and benefits of fishing in different locations and at different periods (e.g., Eales and Wilen 1986, Haynie and Layton 2010, van Putten et al. 2012). For example, if the catch rate in an area increases, unsurprisingly vessels are more likely to visit that area, all other factors being equal. When fuel prices increase and make travel more expensive, vessels on average choose to take shorter trips, all other factors being equal. Any incentive that significantly increases the cost of catching PSC would reduce the likelihood that vessels would choose to fish in high-bycatch areas and/or at the highest bycatch time periods. Abbott, Haynie, and Reimer (2015) have shown how vessels in the Amendment 80 fishery have changed various aspects of their fishing behavior to reduce halibut bycatch when given individual-level allocations.

In evaluating different potential incentives, the question is whether the measures provide enough of an incentive to alter vessel behavior and if so, to what degree. Because these changes may be costly, the Council may also wish to consider whether additional avoidance and the fuel, time, and lost product value that may result are justified by the reductions achieved in Chinook PSC. For example, punishing a vessel for catching a small number of Chinook that cannot be avoided even in extremely low-abundance conditions would reduce fishery benefits without conservation gains.

There are two ways in which restrictions or penalties might reduce Chinook salmon PSC. The first means is that vessels with high bycatch rates would be restricted from fishing at high-bycatch periods or locations in some manner that would directly lead to lower Chinook PSC. For example, penalized vessels might be prohibited from fishing in high-bycatch areas or times of the year.

The second is that the potential penalty would serve as a deterrent to some or all vessels that may have high Chinook PSC levels, thus reducing Chinook PSC for many vessels over a longer period of time while perhaps never being actually imposed on any vessels.

Vessel operators make a number of choices about when, where, and how to fish including:

- Selecting periods that avoid high bycatch
- Fishing in areas with lower bycatch
- Using an excluder or other technology that reduces bycatch
- Use advanced information such as test tows or information from other vessels when moving operations to new areas.

When there is a threat of reaching the PSC limit, vessels have an incentive to do all of these. However, at levels well below the PSC limit, the incentives to take these actions are lower. An incentive has the potential to induce changes in all of the above behaviors. If a vessel is fishing on a certain day (with or without an excluder), strong incentives will induce vessels to change where they fish. This change in fishing location can involve several different behaviors:

- Avoiding an area which has historically or recently had high bycatch
- Using and sharing more information on high-bycatch areas (if this is possible, given the existing high amount of communication)
- Moving immediately upon observing high bycatch.

As well as longer-term incentives, penalties could be specifically targeted to discourage returning to high-bycatch areas.

The optimal period for assigning a potential penalty is not clear. Shorter periods could unduly penalize vessels for random, unlucky events. However, it could also lead to vessels being very careful to avoid bycatch or to developing additional technological innovations. Penalties could be imposed based on behavior over different periods, e.g., trip-level, weekly, bi-weekly, monthly, seasonal, or annual time.

The process involves two steps: one in which a judgment is made whether to apply a penalty and the other, the length of the period for which the penalty would apply. The period selected for judging the penalty interacts with the length of the penalty period. For example, a short "judging" period applied to a longer penalty period may increase incentives to avoid a given penalty.

In documents submitted by IPA representatives for the June 2014 Council meeting and incorporated into the 2015 CP/CDQ IPA, proposed penalties were based on 3 years or 3 seasons of vessels having high rates (1 – 1.5 standard deviations above the seasonal/annual average).[16] Based upon the proposed definition of an outlier, one vessel in the CP sector would have exceeded this threshold by rates higher than 1.5 SD of the seasonal mean in three consecutive seasons. Basing penalties on multiple periods (such as 3 years or 3 seasons) of high bycatch would mean that the penalties would not be enforced in many situations when vessels had high bycatch for sustained periods of time. Vessels could adjust their behavior in the third year/ season and ignore the penalty in other periods. Specifically, vessels could have two high-bycatch seasons and then be within 1 or 1.5 standard deviations of the mean and then would not be subject to penalties.

The revised proposed inshore SSIP provides outlier provisions for both the A and B seasons. The A-season outlier provision would make any vessels with 2 consecutive A season bycatch rates greater than 1 standard deviation above the mean seasonal bycatch rate subject to an expanded Chinook fixed area closure in the following A-season. The B season outlier provision is combined with Option 5 and focuses on reducing October bycatch and is described below under Alternative 5. Vessels with a rolling October Chinook bycatch rate > 0.2 Chinook/MT will be required to stop fishing for the season. Vessels with a rolling trip-level bycatch rate for October fishing > 0.1 Chinook/MT will be required in the following trip to reduce their October rate below 0.1 Chinook/MT or to stop fishing for the remainder of the season.

An analysis of 2011-2014 A season vessel Chinook bycatch rates indicates that the A season outlier threshold would have been applied 7 times over the 76 catcher vessels operating in this period, including one case where one vessel was above one standard deviation above the seasonal mean three years in a row (considered as two of the seven occasions when the penalty would have been imposed). 22 vessels were also above the threshold for a single year and 3 vessels were above the threshold for 2 non-consecutive years, and thus 25 vessels had fishing seasons where they would have faced the penalty the following year if they had again exceeded the threshold.

This penalty occurs frequently enough that it has the potential to incentivize vessels to further reduce their Chinook PSC. The degree to which this would occur will depend on the strength of the penalty -- how important access to the expanded A season closed area is to the vessels and whether the closure itself would have led to a further reduction in Chinook PSC if the vessels did not reduce their bycatch sufficiently enough to avoid the penalty and had to fish outside of the closure.

The definition of an "outlier" – how far above average a vessel can be without suffering a penalty – can be defined by the Council. The more focused the penalty is on extreme outliers, the less likely it will impact the behavior of people who are more "normal."

[16] IPA proposals for June 2014 Council meeting available at npfmc.org.

Punishing vessels for a single trip would only conceivably make sense if vessels had information ahead of time that suggested that they should have avoided where they actually fished. Industry could potentially design a rule that would define what is reasonable, though this is by nature very subjective.

The strength of the incentives for PSC reduction could vary widely and the vessels that would need to pay attention to the potential penalties could be wide-ranging. To have an impact, the potential penalty needs to be sufficient to make vessels adjust their behavior to avoid bycatch. If traveling to avoid Chinook will cost $1000 but the potential penalty is $500, the penalty itself would be unlikely to induce the behavior change. The stronger the potential penalties and likelihood that the penalty could apply to a particular vessel, the more effort will be spent avoiding salmon.

The best penalty would combine a deterrent with penalty that achieves additional bycatch reduction, rather than just being punitive. To provide one example among many possible, a vessel that has high bycatch this October could be restricted from fishing next October or after September 15.

This penalty on high-bycatch vessels could also function as an individual rolling hotspot program, where vessels would be prohibited from fishing in a larger number of high-bycatch areas based on recently available data.

In the West Coast Whiting Mothership Cooperative (WMC), one feature of the cooperative agreement is "Sanctions against vessels that have exceeded a bycatch rate within a seasonal pool."[17] If a vessel exceeds their pro-rata share of cumulative bycatch by 25 percent, they will be prohibited from fishing the following season. No vessels were prohibited in 2013. Thus some members of industry have experience designing in-season penalty systems.

As has been noted in many contexts including the development of Amendment 91, there is the potential for members of the same company or cooperative to "game" the system to avoid penalties if the penalties are relative to other vessels. For example, if a penalty were based on some relation to a current-year average, a company with one vessel close to the "penalty line" might strategically catch more salmon with its low-bycatch vessels to avoid the penalty being imposed on its high-bycatch vessel. If the Council chooses to pursue implementing penalties relative to some average level of performance, additional consideration should be given to reduce the likelihood that the system would generate this type of perverse incentive. If the incentives are only based on a single high-stakes threshold (e.g., only the top 3 vessels are punished) it may prove challenging to eliminate the threat of collusion to game the system. If all vessels are rewarded or penalized on their relative performance rather than only the outliers, the benefits of gaming the system will greatly decline.[18] Part of IPA approval could be demonstrating that the system would be difficult to game.

[17] http://www.pcouncil.org/wp-content/uploads/INFO_SUP_RPT_3_Co_opAnnualRept_2013_preliminary_MS_NOV2013BB.pdf, p.5, accessed 9/6/2015.

[18] http://www.npfmc.org/wp-content/PDFdocuments/bycatch/SalmonAvoidProposal209.pdf discusses how vessel might try to game any system based on relative performance, but also indicates how challenging this would be to successfully do given many players and uncertainty involved.

The following list is merely a **broad range of options** that might be applied, depending on the Council's desired intensity of potential penalties or incentives.

- Prohibit September outlier vessels from fishing in October
- Prohibit early October outlier vessels from fishing in late October.
- Prohibit vessels with the highest October bycatch this year from fishing the following October.
- Prohibit vessels with the highest A-season bycatch from fishing in October (or after September 15).
- Restrict fishing locations for vessels that have the highest bycatch. Prohibit the vessels from fishing in the statistical areas where they fished in their high-bycatch period.
- Provide monetary penalties for vessels with the highest bycatch. Money could be used for research or shared within the fleet by vessels with the lowest bycatch rates.

If Alternative 5, option 2 were chosen which created a large buffer between the performance standard limit and the PSC limit, an outlier incentive could be required in IPAs to discourage individual vessels that exceed the performance standard limit from approaching the PSC limit. However, concerns about collusion would exist for the mothership sector because of its small number of participants.

The second part of Alternative 3, option 1, addresses a requirement for fleet-wide data-sharing. Information sharing is a core component of the IPA agreements for all sectors. For vessels to join an IPA, they are required to provide their observer data to the third party observer, which is currently Sea State. Vessels also communicate directly with Sea State when they have high bycatch. Formal and informal information sharing is an integral part of the pollock industry's Chinook and chum salmon PSC management programs. The Sea State website was substantially improved over the last few years to allow vessels to gain additional information on other vessels' bycatch, as well as the average bycatch rates in different statistical areas.[19]

If there were strong incentives that rewarded/punished people based on their relative performance, it is unlikely but conceivable that communication about bycatch could be withheld or distorted. However, it is not clear this would occur as vessels would also have even stronger incentives to obtain information to avoid having high bycatch. Sharing information with others in the fleet is the currency to gain that information from others in the future.

The observer program cannot accurately observe and report haul-level bycatch information on catcher vessels[20], so any requirement to report catcher vessel haul-level information would continue to fall to the vessel master rather than an observer. However, when vessels have larger numbers of observed Chinook bycatch in their deliveries without giving notice to the fleet, this behavior could be penalized if the haul-level notices were recorded. The details of this information-sharing process appear likely to be more effectively managed within an IPA agreement than by NMFS.

One example of more extensive industry-mandated data sharing comes from the West Coast. The West Coast Mothership Cooperative (WMC) requires extensive information sharing through reports which are distributed daily to the fleet, as described in the WMC's report on the 2013 whiting season. [21]

[19] John Gruver, United Catcher Boats, pers. comm.
[20] Martin Loefflad, pers. comm.
[21] http://www.pcouncil.org/wp-content/uploads/D2b_SUP_WMC_PPT_APR2013BB.pdf. Accessed September 4, 2014.

"*The WMC provided Sea State, Inc. with a harvest schedule of each MS/CVs share of whiting and pro-rata portion of the allocated bycatch species. Sea State, Inc. queries the NORPAC observer database to obtain the Mothership observer reports on a daily basis. Sea State, Inc. uses this data to produce daily reports which are distributed by email to all WMC members, the Coop manager, and to the Mothership processors.*

The Sea State, Inc. report shows several tables of information, including:

- *daily catch and bycatch amounts for the fleet as a whole for most recent 10 days*
- *overall YTD rates and percent of whiting quota and bycatch harvested*
- *for the fleet in aggregate*
- *YTD bycatch rates for each Mothership's fleet*
- *YTD bycatch rates and amounts for each vessel*
- *percent and amounts of whiting quota and bycatch allocations*
- *harvested by each seasonal pool*
- *the balance of whiting available in each seasonal pool by vessel.*"

In order to reduce the possibility, requiring information sharing would seem prudent, although this is very likely to be a requirement imposed as part of IPAs. If the Council does not elect to require information sharing, t**he Council should require that all information sharing processes be clearly described annually in the IPA reports to ensure that this type of within industry sharing continues.**

In summary, any penalties imposed would occur in the context of the existing PSC limit and IPA agreements (although the IPAs could be adjusted in response to Council action). The Council has a lot of flexibility in developing potential penalties, but not a clear roadmap over what are the preferred penalties, if any are desired.

3.5.3.2 Alternative 3, option 2, salmon excluder devices

Alternative 3, option 2 addresses a requirement for the IPAs to require the use of salmon excluder devices year-round or as a sub-option, during specific times of the A- and B-season (see Section 2.3 description of alternatives). The challenge of successfully mandating excluder use is that any change to a trawl net (e.g., adding a plastic bag) could be considered an excluder, so mandating simply "an excluder" would not be meaningful. In contrast, being extremely specific by requiring a certain excluder design could stifle innovation by prohibiting experimentation that might lead to the development of new and better excluders.

The Council requested in October 2013 an informal assessment of the use of salmon excluders by sector. Voluntary reporting by sector representatives indicated a widespread (and increasing) use across all sectors. One of the Council's requests was consideration of mandating the usage within IPAs themselves (or in regulation).

In the mothership sector, salmon excluders are already employed nearly 100% (with exceptions only for rare occasions such as torn nets, establishment of properly functioning nets, etc.[22]) with a revision to MSSIP contract formalizing 100% usage (with exceptions as noted) in 2015. In June 2014, the CP IPA feedback document proposed mandatory usage from January 20th to March 31st and again from September 1 to the end of the B season and this requirement was included in the sector's 2015 IPA. Reporting

[22] Letter to C. Oliver from J. Bersch, Mothership Fleet Cooperative (October 2013). Summary included in staff discussion paper: http://www.npfmc.org/wp-content/PDFdocuments/bycatch/BSAIChinookDiscPaper913.pdf.

requirements for usage were also proposed by the Inshore SSIP in June 2014, but mandating usage was not proposed under that sector's revised IPA. In the 2013 usage survey, on average approximately 75 percent of catcher vessels reported using an excluder "all the time" or "almost all the time" between the 2011A season and 2013A season for which the survey applied. Thus requiring excluders would impact only a portion of the fleet.

If the new inshore IPA proposal is implemented, with limited exceptions, an excluder will be mandatory from January-March and in September and October.

In June 2014, all three IPA's feedback documents expressed concern regarding how requirements on excluder usage are imposed so as to not stifle innovation in design or penalize vessels for some instances where mandatory usage is not feasible (e.g., a torn net). Many of these concerns were also noted in the June 2014 Chinook salmon bycatch discussion paper under regulatory issues with mandating excluder use.

Excluders can reduce target catch as well as bycatch. This means that it may take more time fishing, which could push more fishing effort into September and October when Chinook bycatch is higher. Recent experimental fishing permit (EFP) results have shown a Chinook reduction of 38 percent, combined with a chum reduction of 7 percent and less than one percent pollock loss.[23] However, it is unknown how much these results can be generalized, and whether this percentage of bycatch reduction or pollock loss will occur under both high and low bycatch and pollock fishing conditions.

The June 2014 CP IPA comments note: "*During times of year when salmon are not present on the pollock fishing grounds in substantial numbers, using salmon excluders is more likely to reduce pollock CPUE and prolong pollock fishing into times of higher salmon abundance, which increases the risk of catching more salmon than can be saved due to the excluder. Therefore, mandating their use at these times did not appear effective.*"

A hypothetical example makes the tradeoff of using an excluder in a low-bycatch situation clearer. Assume there were 100 days of low-Chinook fishing that are in question to use an excluder for, with a bycatch rate of 1 Chinook per day. Using the excluder during that period would reduce bycatch by 38 percent and save a total of 38 Chinook during this 100 day period. According to EFP results, pollock fishing would also be slowed by approximately 1 percent which would lead to 1 more day of fishing at the end of the season. If the bycatch rate for that end-of-season day were 100 times as high, or 100 Chinook per day, then assuming the excluder was used on that end-of-season day, PSC would have been reduced by 38 percent and 62 Chinook would have been caught, for a net increase of 24 Chinook from using the excluder in the low-bycatch period. However, if the bycatch at the end of the season were only 50 times as high, after using the excluder, 31 Chinook would have caught on that end-of-season day, and using the excluder would have saved a net of 7 Chinook (38 Chinook avoided in the low-bycatch period minus the additional bycatch at the end of the season).

Across years there are periods when the relative rates between the start and end of the B season are on either side of this ratio, so it is unclear how frequently bycatch would be lower when vessels do not use excluders.

Another possible variant of this requirement would be to require that vessels in the top 25 percent of bycatch rates (or another threshold) would be required to use excluders at all times. Because we do not

[23] http://www.npfrf.org/uploads/2/3/4/2/23426280/salmon_excluder_efp_11-01_final_report-1.pdf. Accessed September 7, 2014.

know which vessels have used excluders, we do not know how frequently high-bycatch vessels have used excluders, but this would ensure that they are not in this group for lack of using the right equipment.

The times when a vessel should use an excluder increase as the excluder becomes more efficient at avoiding bycatch. If it avoids more Chinook, the vessel should use it more frequently. Similarly, the less pollock catch rates are reduced, the more the excluder should be used in lower-Chinook times because the less that using it will slow pollock fishing and lead to more fishing at the end of the season.

Requiring excluders seems most practical under IPAs and not in regulation; however increased reporting requirements (regulatory or through IPAs) would provide additional data on the estimated usage on a haul-by-haul basis. Explicit consideration should be given to how these reporting requirements are structured. One option would be to require tracking for each haul or trip of whether an excluder is being used. Vessels could apply to not use an excluder, providing a brief justification of why they are not using the excluder. Industry could report on non-excluder justifications as well as usage and performance.

The suboption to require excluder use on the high-Chinook periods of the year would focus the requirement on discrete times of year and reduce the likelihood that the requirement would increase Chinook PSC by reducing pollock catch rates at low-PSC periods. Challenges of determining what constitutes special cases when it will not be useful to use an excluder will still exist under this suboption. This requirement would also ensure that all vessels purchase an excluder so would overcome the fixed cost required to have an excluder available, although at the cost of installing the excluder.

3.5.3.3 Alternative 3, option 3, rolling hotspot program

Alternative 3, option 3 addresses mandating that a RHS program operate throughout the entire A and B seasons and an agreement to provide notifications of closure areas and any violations of the rolling hot spot program to at least one third party organization representing western Alaskans who depend on Chinook salmon and do not directly fish in a groundfish fishery. The Chinook RHS programs that are components of the CP and Mothership IPA programs are in place in some form through throughout the year. Currently the Inshore IPA program has a provision that suspends the Chinook RHS closure program when the share of the seasonal base cap exceeds 25% of the total allocation. The requirement for notifications to a third party organization would be new for each IPA.

Mandating that a RHS program operate throughout the entire A and B would thus apply to only the inshore RHS program, unless the Council elected to recommend additional changes to the CP and mothership RHS programs that would make the RHS programs in those sectors applicable in very low Chinook PSC situations. There are times under all three RHS programs where closures are not in place because of *low* Chinook PSC rather than high-PSC conditions. Table 33 shows in 4 of the 8 seasons from 2011-2014, the Chinook RHS program was suspended for participants in the inshore SSIP.[24]

Table 33. Chinook RHS suspension dates for the inshore SSIP

	2011	2012	2013	2014
A-season Chinook RHS suspension date	no suspension	Mar 8	no suspension	Mar 27
B-season Chinook RHS suspension date	Sept 15	Oct 11	no suspension	no suspension

[24] J. Gruver, pers. comm.

Industry representatives have stated that the reasoning behind the inshore RHS program suspension provision was that the RHS system was designed to provide avoidance incentives when Chinook PSC is well below the performance standard threshold and PSC limit. At higher Chinook PSC levels, there is a significant threat to vessels of being closed out of pollock fishing by reaching the PSC limit, and thus a strong incentive to avoid Chinook. An additional reason for suspending the closures is that it prevents "mistakes," where a RHS closure actually ends up being in place in areas with relatively lower bycatch and high pollock catch rates, leading to higher Chinook bycatch. While on average the RHS closures are placed in high-bycatch areas and analysis of the chum RHS program indicates that it reduces bycatch, there are times when closures may not keep up with quickly changing bycatch hotspots and there is the potential that closures could be costly to the fleet (or a portion of the fleet) and potentially increase Chinook and/or chum bycatch.

While there have been formal suspensions of the inshore RHS program in some years, in the CP and mothership sectors, the number of Chinook RHS closures actually applied – and the number of vessels impacted – has been quite limited since Amendment 91 went into place in 2011. For example, both the mothership and the CP sector had no RHS closures in 2012, due to extremely low Chinook PSC concentrations on the fishing grounds. In the B-season of 2011 when the Inshore Chinook RHS program was suspended on September 15, there were no RHS closures in the CP sector due to low Chinook PSC for the sector, while there were 4 closure announcements for the mothership sector.

This proposed change would have an impact later in the season in higher-PSC seasons. Given the rules in the current inshore RHS system, the closures would not apply to all vessels, but to those vessels with relatively high bycatch.

It is difficult to know how effective this requirement would be, for several reasons. First, advisories are still sometimes given during closure periods, so that some of the benefits would have been achieved without the closures. Members of industry have noted that the primary impact of the RHS system is the information communicated about where bycatch is high. However, if based on previous analysis of the chum RHS program,[25] we estimate the savings from the RHS closures at approximately 10 percent, the following savings would have been achieved during the suspension periods (described above):

Year	Chinook caught after suspension	Chinook reduction at 10% effectiveness
2011	11,585	1,159
2012	1,904	190
2014	2,043	204

Because we do not know how many vessels would actually be subject to the RHS closures, there is uncertainty about this estimate, but it is a reasonable and informed estimate given that vessels often avoid RHS closures even when they are not required to do so, which was also noted in the November 2012 Chum EA.

If the new inshore IPA proposal is implemented, a Chinook rolling hotspot program will be in place throughout the year.

[25] Chum EA, November 2012, http://www.npfmc.org/wp-content/PDFdocuments/bycatch/ChumPSC_EA1112.pdf.

3.5.3.4 Alternative 3, option 4, salmon savings credits

Option 4 addresses specific provisions of the time required in the Inshore and Mothership Salmon Savings Incentive Programs (SSIPs) to accrue and save salmon credits. This option does not apply to the CP sector as its IPA is not based on salmon credits. The Inshore and Mothership SSIPs allow vessels to earn credits by avoiding salmon in one year, which they can use in the future to fish above the vessel or mothership platform's share of the performance standard for a limited number of years. Under this option the credits would be allowed to last for a maximum of three years.

As well as the duration of earned salmon credits, the rate at which vessels earn salmon credits is important. The Mothership program earns each platform one credit per 2.29 salmon avoided below the performance standard and credits last for 3 years. The inshore IPA enables vessels to earn 1 savings credit for each 3 salmon that they avoided below the performance standard, but credits last for 5 years.

The 2013 Inshore IPA report states that the 5-year window was necessary to fulfill the Council's requirements for an IPA. "*The SSIP proposed to the Council ahead of the final motion in April of 2009 included a Savings Credit lifespan of 3 years. However, once the Council included the 2 out of 7 year limitation on exceeding the Performance Standard for vessels in an IPA the SSIP, in order to keep the main incentive of the program in place (earning Savings Credits) the lifespan had to be extended to 5 years. Without the additional 2 years the SSIP may not have qualified as an Incentive Plan in all years. For example, if the inshore sector exceeded its Performance Standard 2 years in a row, and had continued with the 3-year life span, there would be no incentive by vessels to earn Savings Credits in either of the following 2 years*."[26] To ensure that incentives are always in place, the Mothership sector IPA creates a second element to its SSIP program where credits would have to be earned for vessels to fish to their sector's share of 47,591 in the event that the performance standard was exceeded in any 2 of 7 years.

A system that allows vessels to earn credits will be more effective if it is more likely that the credits will be useful. Given the low PSC totals in recent years, vessels have large quota balances. With a full "credit account", the likelihood that additional credits earned in a particular year would be useful is quite low.

Table 34 displays salmon savings that would be earned under the current salmon credit earnings rates of the Mothership and Inshore SSIP programs under different annual bycatch conditions. For example, if bycatch were 10,000 per year, under the inshore SSIP program, 1 credit would be earned for each 3 salmon caught below the performance standard level of 47,591. For the Mothership SSIP, 1 credit would be earned for each 2.29 salmon caught below the performance standard level of 47,591. [Note: in actuality, this would apply to each sector's share of the performance standard threshold, but here we use the total cap values for illustration.]

It takes roughly 4 years for inshore vessels to earn the credit balances that mothership platforms acquired in 3 years for the same bycatch levels. Until the 4th year, vessels would have larger amounts of total credits in the mothership program because of faster earnings rates, but then the total credits earned in the mothership program would stay constant because the 4-year-old credits would expire. Thus the total Chinook that could be caught under each program would vary depending on how Chinook PSC conditions varied from year to year. For example, if vessels/platforms alternated between high and low PSC, the total bycatch could be higher for the mothership sector, while after 4 years of very low bycatch, the inshore SSIP has the potential to have a longer period of "spending" credits rather than earning them because of the 5-year duration of credits. Although it should be noted that in general the highest average

[26] http://alaskafisheries.noaa.gov/sustainablefisheries/afa/coopreports/2013/inshoreipa.pdf. Accessed September 5, 2014.

bycatch would occur for vessels that fished close to the performance standard threshold every year rather than being well below and then above it. Thus far, this has not occurred at all, as most vessels have stayed well below the performance standard threshold.

Table 34. Hypothetical comparison of the credits earned under the Mothership and Inshore SSIP programs

Credit earning rate of the inshore SSIP		3				
		Credit balance after Year number …				
Total bycatch/ year	Credits earned per year	1	2	3	4	5
10,000	12,530	12,530	25,061	37,591	50,121	62,652
20,000	9,197	9,197	18,394	27,591	36,788	45,985
30,000	5,864	5,864	11,727	17,591	23,455	29,318
40,000	2,530	2,530	5,061	7,591	10,121	12,652

Credit earning rate of the mothership SSIP		2.29				
		Credit balance after Year number …				
Total bycatch/ year	Credits earned per year	1	2	3	4	5
10,000	16,415	16,415	32,831	49,246	49,246	49,246
20,000	12,048	12,048	24,097	36,145	36,145	36,145
30,000	7,682	7,682	15,363	23,045	23,045	23,045
40,000	3,315	3,315	6,630	9,945	9,945	9,945

There is a trade-off implicit in how long salmon credits can be saved. Having salmon savings credits endure for a longer periods makes them more valuable to earn, but it also means that vessels will often have more credits "in the bank" so the value of earning additional credits declines. There's a tradeoff between credits being too hard to earn so it is not worth the effort and so easy to earn that the credits are not worth very much. After several years of low Chinook bycatch rates, Chinook bycatch conditions would have to change greatly to make more credits likely to be very valuable.

As discussed above, the credits available under the two SSIP programs are a function of the earning rates (2.29 versus 3 salmon must be avoided to acquire a savings credit), the duration of credits, and the likelihood that credits will be needed, which is partially a function of the gap between the performance standard threshold and the PSC limit. If a vessel has credits (or a base allocation) which will expire if they do not use them, vessels do not have a clear reason for conservation.

In order to strengthen the incentive to earn credits, several additional steps could be taken.

- Shorten the duration of credit duration
- Decrease the credit earning rate
- Ensure that credits or quota are never "use it or lose it."

Decreasing the duration of credits to 3 years would thus be likely to increase the incentive to earn credits for the inshore sector, but increasing the credit earning requirement from 2.29 to 3 for the mothership sector would also increase the incentive to reduce Chinook PSC. The inshore SSIP could increase its earning rate if only the duration of credits is specified.

If the new inshore IPA proposal is implemented, a Chinook rolling hotspot program will be in place throughout the year.

3.5.3.5 Alternative 3, option 5, avoid bycatch in October

Alternative 3, Option 5 considers ways that the fishery would be allowed to stay open in October, contingent on vessels meeting Chinook PSC rates that are deemed acceptable by the Council. If criteria are designed to ensure that vessels do not have “excessive” bycatch late in the season, this alternative would provide greater flexibility to vessels and ensure to catch their pollock quota or pursue other fishing opportunities (e.g., tendering or fishing on the West Coast) while not catching excessively high bycatch. While high Chinook PSC has occurred late in the season, many vessels have also been able to fish in this period without excessive bycatch.

There are several potential **time periods upon which to base potential performance criteria**. For example, fishing in October could only be allowed for vessels that had:

- Bycatch rates prior to October less than the average rate for the vessel’s sector
- October bycatch rates the previous year less than the average October rate for the sector, or
- Rates both earlier in the B season AND the previous October less than the average rate for the vessel’s sector.

An alternative rate higher or lower than the sector average could also be chosen as the threshold**. This level, or the definition of “significant” in this option, is something the Council can choose to define**.

For the mothership sector, this average rate comparison would be more complicated, especially with two platforms owned by the same company.

The above performance criteria would not ensure that the rates are lower than in previous months, but would both provide an incentive to reduce earlier bycatch and prohibit high bycatch vessels from fishing in October during the subsequent year.

Implementing October prohibitions based on trip-level performance would be very challenging. A catcher vessel could have one bad trip that would lead to it being prohibited from continuing to fish. Alternatively, a catcher processor or mothership might start a two-week trip at the start of October and they would have fished extensively in October before any restriction could apply. In this case, the restriction could also be based on a shorter period than the trip (e.g., 3 days or one week), but this would have larger economic impacts if the vessel had to return to port without harvesting its pollock.

In the Pacific whiting fishery, the West Coast Mothership Cooperative has Sea State implement closer to real-time measures to monitor hotspots:

“*Each fleet’s performance relative to the Base Rates constitutes a trigger requiring the fleet to relocate if they encounter a bycatch “hotspot”. Relocation is required in the event of any of the following situations:*

If a fleet’s three day rolling average rate of exceeds the Base Rate for any bycatch species, and that Fleet’s cumulative year to date bycatch rate exceeds half of the Base Rate for that species,
If a fleet’s three day rolling average rate of exceeds 125% of the Base Rate for a bycatch species
If a fleet’s bycatch rate during any single day exceeds twice the Base Rate for a bycatch species,

This real time mechanism for response to bycatch encounters coupled with a requirement for test tows upon entering a new area, has served to avoid using up bycatch allocations.”

A similarly fast rolling hotspot program could be utilized to ensure that vessels do not fish in high bycatch areas in October, the highest bycatch period of the year.

Several other options are explored below in more detail.

1. Require that vessels fishing in October were active in the fishery throughout the B-season. This would ensure that vessels that fish in October only do so because they had to do so to harvest their pollock quota, rather than they chose to delay fishing.

   The definition of "throughout the season" can vary depending on how willing the Council is to restrict other fishing activities (e.g., tendering or fishing for whiting) to ensure that fishing does not occur in the high-Chinook portion of the season. The definition could focus on proportion, requiring that at least 75 percent of catch occurs prior to October, for example, or require that the vessel has been active in the fishery each of the previous months.

2. Any bycatch by a vessel in October (or after September 15) above the June – September 14 average sector rate would be penalized in the following A season by proportionally reducing the vessel's Chinook allocation. This feature would provide a strong direct incentive for vessels avoid Chinook at the end of the season.

   In this case, the IPA representatives would calculate the average rate for fishing through September 14 and deduct available quota the following A-season. If the early-season average rate would estimate that a vessel would catch 5 Chinook but the vessel catches 15 Chinook, they would have 10 less Chinook allocated to them the following A-season.

3. To fish in October, vessels have to be below average for the rest of the year.

   IPA representatives would calculate the sector average rate for the entire year through September 14 and only vessels that are below the rate would be allowed to fish after October. This incentive would also provide a strong incentive to vessels to reduce their bycatch throughout the year. Vessels that did not achieve the standard would be forced to sell their pollock and salmon to other vessels. In this sense, fishing in October would be a privilege only available to vessels with the lowest Chinook PSC. Implementing this would be challenging for the mothership sector because of the small number of companies participating in the sector.

All of the incentives in this option would provide Chinook savings while providing more flexibility to the pollock fishery than a late-season closure. These incentives would also provide additional flexibility in the future if Chinook runs improve considerably and the Council becomes more concerned about the relative importance of reducing chum bycatch.

The B-season outlier provision that is included in the December 2014 inshore SSIP proposal is a combination of Options 1 and 5 and focuses on reducing October Chinook bycatch. Vessels with a rolling October Chinook bycatch rate > 0.2 Chinook/MT will be required to stop fishing for the season. Vessels with a rolling trip-level bycatch rate for October fishing > 0.1 Chinook/MT will be required in the following trip to reduce their October rate below 0.1 Chinook/MT or to stop fishing for the remainder of the season.

Using the October landings data for 2011-2014, we can see that this mechanism would have applied to many vessels each year, and would have necessarily significantly altered October fishing. There was no fishing in October in 2014 so there would have been no direct impact.

Exactly how much this would impact October fishing is not clear, but there are several means through which Chinook PSC is likely to be reduced. Is likely that this incentive would encourage vessels to fish earlier in future years because it is very risky for a vessel to fish in October knowing that a high-bycatch rate on a trip could end a vessel's season. Vessels are also more likely in October to avoid high-bycatch areas even when they have large amount of Chinook PSC otherwise available to them. If vessels are stopped for the season, some quota is likely to move to other vessels and the Chinook bycatch rates of these vessels are unknown. While the vessels continuing to fish will often be vessels already fishing at a low rate, it is possible that other vessels not previously fishing in October would fish the quota of a vessel restricted from fishing. In summary, it appears likely that this would be an effective incentive to reduce October bycatch.

Table 35. Cumulative October Chinook bycatch rate by inshore catcher vessel trip for 2011

ID	1	2	3	4	5	6	7	8	9	10
1	0.12	0.17								
2	0.01	0.02	0.02	0.05						
3	0.43	0.44	0.33	0.28	0.31					
4	0.10	0.14								
5	0.14	0.15								
6	0.05	0.05	0.16	0.14	0.14	0.14	0.13	0.12		
7	0.15	0.20	0.26							
8	0.32	0.78	0.69							
9	0.02	0.03	0.09	0.10	0.10	0.09	0.09			
10	0.06	0.13	0.36	0.32	0.30	0.31	0.30	0.30		
11	0.06	0.16	0.13	0.14	0.15	0.17	0.19			
12	0.12	0.25	0.24	0.24	0.25	0.26				
13	0.22	0.23	0.35	0.32	0.28					
14	0.10	0.16	0.29	0.31	0.27	0.27	0.28	0.28		
15	0.16	0.23	0.22	0.22	0.21	0.21				
16	0.10									
18	0.05	0.26	0.42							
19	0.10	0.21	0.16	0.19	0.23	0.24				
20	0.22	0.16	0.20	0.22						
22	0.10	0.07	0.09	0.09	0.10	0.10	0.12			
23	0.16	0.22	0.38							
24	0.11	0.19	0.28							
25	0.10	0.18	0.24							
26	0.04	0.08	0.07	0.11	0.11					
27	0.23	0.25								
28	0.04	0.24	0.32							
29	0.27	0.28	0.37							
30	0.03	0.03	0.07	0.09	0.11	0.15				
31	0.05	0.15		0.97	0.33	0.37	0.40			
32	0.17	0.38	0.43							
33	0.17	0.15	0.24							
35	0.09	0.18	0.21							
36	0.11	0.12	0.17	0.16	0.20	0.26	0.27	0.25		
37	0.25									
38	0.13	0.39								
39	0.24	0.52								

Table 36. Cumulative October Chinook bycatch rate by inshore catcher vessel trip for 2012

ID	1	2	3	4	5	6	7	8	9	10
1	0.03	0.05	0.41	0.27						
2	0.06	0.04	0.04	0.12						
3	0.08	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.08	
4										
5	0.06	0.11	0.08							
6	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	
7	-									
9	0.02	0.01	0.04	0.04	0.03					
10	0.07	0.08	0.05	0.05	0.04	0.08				
11	0.09	0.08	0.08	0.08						
12	0.16	0.07	0.06	0.05	0.06	0.07	0.18	0.17		
14	0.04	0.04	0.04	0.05	0.04	0.07	0.09	0.09		
15	0.04	0.03	0.03	0.04	0.03	0.03	0.04	0.03	0.04	
16	0.02		0.21	0.03	0.04					
17	0.13	0.14	0.15	0.10	0.12	0.11	0.13			
18										
19	0.15	0.08	0.09	0.07	0.07	0.08	0.08			
22	0.03	0.02	0.02	0.02	0.02	0.04	0.04	0.04		
23										
27	0.07	0.06	0.49	0.32						
29										
30	0.02	0.02	0.06	0.05	0.04	0.03	0.04	0.04	0.04	0.04
31	0.03	0.02	0.05	0.09	0.07	0.10	0.09	0.10		
34	0.09	0.05	0.14							
35										
36	0.12	0.08	0.23	0.15	0.13	0.13	0.12	0.16		

Table 37. Cumulative October Chinook bycatch rate by inshore catcher vessel trip for 2013

ID	1	2	3	4	5	6	7	8	9	10
2	0.01	0.01								
3	0.35	0.28	0.56	0.50	0.38	0.32				
6	0.07	0.20			0.02					
9	0.26	0.28	0.18	0.13	0.11	0.11				
10	0.39	0.21	0.15	0.12						
11	0.35	0.77	0.77	0.46	0.37	0.35				
12	0.01	0.01	0.03							
15	0.07	0.07								
19	0.02	0.01								
21	0.08	0.16	0.27	0.30		0.01	0.07			
22	0.00	0.03								
30	0.11	0.04								
31	0.10	0.28		0.00						
36	0.39	0.34								

Notes on tables: the ID is a random vessel ID. Squares highlighted in red indicate the vessel's rolling Chinook bycatch rate > 0.2 Chinook/MT. Squares highlighted in yellow indicate the vessel's rolling Chinook bycatch rate > 0.1 Chinook/MT. The vessel must stop if the square is red or on the second adjacent yellow square.

3.5.4 Alternative 4

Alternative 4 modifies the start and end dates of the pollock season to begin earlier (option 1) and end earlier (option 2 with suboptions) as well as to shift 5% or 10% of the pollock quota from the B season to the A season (option 3). While these options are not mutually exclusive, this analysis treats them individually but in section 2.8 considers the overlay within and across alternatives.

3.5.4.1 Evaluating seasonal date changes, options 1 and 2

In the analysis for Option 1 of Alternative 4, opening fishing on June 1st, we assumed that the average bycatch rate per ton of pollock, and the catch per day of pollock observed (within sectors and years) from June 10th-30th would apply for June 1-9th period. We then assumed that this amount of pollock (9 days times the average pollock per day from June 10-30) would be subtracted from the end of the pollock season. For example, for a given sector and year, if the average catch per day from June 10-30th was 100 t per day, and there were 10 vessels in that sector, then an additional 9,000 t from that sector would be taken in June. This 9,000 t would then affect when that sector's season finished. If this sector had the same average catch rate per day in October, then fishing would be finished 9 days earlier. This accounts for how fishing days were shifted. The differences in salmon bycatch occurs based on the comparative rates (salmon per t of pollock) for those 9 days in early June that have been swapped with the bycatch rates at the end of the season (which in this example were the last 9 days of fishing by that sector). The analysis of the option to close fishing earlier (Sept 15th, Oct 1st and Oct 15th) simply rolled the amount of pollock that had been caught (in each year by sector) after those closures into the period prior to those closures.

Option 1 (open the pollock fishery on June 1st) suggests that shifting the B-season opening date sooner would likely help reduce Chinook salmon bycatch assuming some vessels choose to start fishing earlier, although this may conflict with other opportunities (e.g., such as using pollock vessels to tender other non-pollock fishing operations such as directed herring and salmon, or vessels participating in fisheries outside of the Bering Sea such as the whiting fishery). Table 38 shows the seasonal bycatch rate for Chinook by month and Table 39 shows the pattern for chum salmon PSC. The amount of Chinook salmon PSC taken in each year and sector indicates that significant amounts are taken after mid-September (Table 40). In contrast, proportionately few chum salmon are taken after this period (Table 41).

Depending on the year, the amount of Chinook salmon PSC savings from shifting the B-season opening sooner varies but is generally positive (Table 42). This contrasts with the result for chum salmon which shows that generally moving pollock fishing earlier in the summer (i.e., starting on June 1st) will have a variable but negligible effect on further reductions occurring for chum salmon PSC (Table 43).

The analysis of the option to close fishing earlier (Sept 15th, Oct 1st and Oct 15th) is presented in Table 44 showing the amount of salmon PSC saved for both Chinook salmon and chum salmon. As expected, closing on Sept 15th had a larger effect on Chinook salmon PSC reductions whereas for chum salmon in several years the change in closure date made the PSC levels higher (as indicated by negative values in the table). These numbers assume that all pollock catch was achieved in the time frame leading up to the closure. For contrast, actual values in those years (including the pollock that would have been forgone after that date and the catch of Chinook and chum following each week-ending date) are shown in Table 45 through Table 47. Note that here the actual week-ending dates obtained through the Catch Accounting System are used (not an extrapolation to the actual dates of the suboptions). These tables give an approximation of the 'worst-case scenario" for pollock obtained and resulting Chinook and chum PSC saved. It is expected that results under this option would differ and is shown as a bookend only. While it is not possible to determine whether all of the pollock quota could be achieved prior to these ending dates clearly some additional effort would be shifted earlier in the season.

Analysis of these options of this alternative overall indicates that with fishing occurring earlier in the B season, or reduced fishing in the B season due to the shift to the A season, there is likely to be reduced Chinook bycatch by shifting effort away from the highest rates in September and October. **This therefore suggests a reduced adverse impact to Chinook salmon relative to Alternative 1. Given that chum salmon bycatch rates are typically highest in August (with some indication that western Alaska chum are proportionally more common in the bycatch in June and July), shifting effort earlier into the B season may result in slightly higher impact to chum salmon PSC compared with status quo. However these increased adverse impacts are not estimated to be significantly adverse.** While data presented here is intended to provide an estimate of the relative rates likely to be encountered by the fleet based upon historical rates, this does not take into account the potentially increased efficacy of fleet reporting on higher chum bycatch rates that may be encountered earlier in the B season and resulting fleet movement away from these regions. Therefore the magnitude of the adverse impact to chum PSC may be over-estimated by use of historical rates.

Table 38. Annual and monthly pattern of Chinook salmon bycatch in the pollock fishery (number per t of pollock). Shading represents higher bycatch rates. Note negligible pollock fishing occurs in April, and May and November and December are closed to directed fishing.

	Month	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Catcher processors	J	0.046	0.030	0.035	0.057	0.137	0.018	0.070	0.042	0.013	0.019	0.030	0.027
	F	0.092	0.030	0.054	0.057	0.141	0.036	0.014	0.028	0.012	0.011	0.023	0.016
	M	0.027	0.049	0.034	0.083	0.072	0.016	0.017	0.021	0.008	0.014	0.014	0.023
	J	0.001	0.008	0.006	0.002	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.000
	J	0.001	0.003	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
	A	0.006	0.008	0.012	0.001	0.005	0.001	0.001	0.000	0.002	0.000	0.001	0.001
	S	0.024	0.025	0.027	0.007	0.035	0.002	0.004	0.001	0.011	0.001	0.005	
	O	0.064	0.049	0.025	0.014	0.120	0.010	0.004	0.004	0.023	0.000	0.014	
Annual CP		*0.028*	*0.021*	*0.024*	*0.028*	*0.056*	*0.011*	*0.009*	*0.008*	*0.006*	*0.005*	*0.007*	*0.009*
Mothership	J	0.072	0.015	0.035	0.085	0.210	0.110	0.050	0.000	0.022	0.047	0.027	0.011
	F	0.053	0.037	0.040	0.097	0.099	0.025	0.020	0.017	0.012	0.006	0.015	0.013
	M	0.038	0.046	0.031	0.088	0.049	0.029	0.012	0.018	0.009	0.004	0.010	0.009
	J	0.001	0.007	0.010	0.000	0.003		0.002	0.009	0.001	0.001	0.001	0.001
	J	0.001	0.004	0.002	0.000	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001
	A	0.005	0.006	0.007	0.001	0.006	0.001	0.003	0.001	0.002	0.000	0.000	0.001
	S	0.019	0.023	0.022	0.005	0.037	0.005	0.012	0.001	0.008	0.001	0.005	
	O	0.144	0.077	0.018	0.002	0.183	0.009			0.176			
Annual MS		*0.031*	*0.024*	*0.020*	*0.038*	*0.064*	*0.015*	*0.009*	*0.008*	*0.021*	*0.003*	*0.005*	*0.007*
Shore-based CVs	J	0.052	0.040	0.039	0.115	0.409	0.117	0.322	0.148	0.012	0.019	0.025	0.024
	F	0.065	0.036	0.072	0.192	0.160	0.072	0.030	0.051	0.024	0.030	0.007	0.041
	M	0.055	0.059	0.034	0.059	0.044	0.023	0.014	0.010	0.019	0.017	0.025	0.023
	J	0.001	0.003	0.011	0.032	0.009	0.003	0.013	0.009	0.001	0.002	0.003	0.002
	J	0.001	0.002	0.009	0.010	0.003	0.004	0.004	0.001	0.002	0.001	0.001	0.001
	A	0.001	0.019	0.033	0.009	0.009	0.002	0.003	0.002	0.006	0.002	0.005	0.002
	S	0.018	0.064	0.069	0.072	0.143	0.034	0.052	0.029	0.099	0.020	0.048	
	O	0.135	0.349	0.435	0.200	0.446	0.218	0.046	0.197	0.238	0.084	0.131	
Annual CV		*0.038*	*0.049*	*0.065*	*0.089*	*0.115*	*0.032*	*0.020*	*0.012*	*0.031*	*0.008*	*0.010*	*0.012*
All sectors		*0.032*	*0.031*	*0.038*	*0.051*	*0.077*	*0.019*	*0.013*	*0.009*	*0.018*	*0.006*	*0.008*	*0.010*

Table 39. **Annual and monthly pattern of chum salmon bycatch in the pollock fishery (number per t of pollock). Shading represents higher bycatch rates. Note negligible pollock fishing occurs in April, and May and November and December are closed to directed fishing.**

	Month	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Catcher processors	J	0.007	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
	F	0.013	0.001	0.001	0.004	0.047	0.002	0.000	0.000	0.000	0.000	0.000	0.000
	M	0.005	0.001	0.002	0.002	0.007	0.001	0.000	0.000	0.001	0.000	0.001	0.001
	J	0.015	0.397	0.199	0.063	0.025	0.006	0.025	0.018	0.091	0.003	0.027	0.100
	J	0.011	0.129	0.015	0.049	0.016	0.002	0.009	0.008	0.138	0.009	0.023	0.078
	A	0.066	0.288	0.228	0.038	0.057	0.007	0.019	0.013	0.151	0.003	0.040	0.190
	S	0.138	0.198	0.354	0.055	0.208	0.010	0.033	0.014	0.099	0.015	0.032	
	O	0.260	0.093	0.153	0.022	0.028	0.010	0.037	0.014	0.292	0.004	0.064	
Mothership	J	0.003	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	F	0.008	0.001	0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	M	0.002	0.001	0.003	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.001	0.000
	J	0.017	0.069	0.332	0.001	0.017		0.034	0.008	0.615	0.008	0.010	0.015
	J	0.044	0.120	0.095	0.021	0.063	0.009	0.041	0.033	0.257	0.025	0.067	0.096
	A	0.068	0.121	0.307	0.030	0.115	0.012	0.056	0.011	0.263	0.011	0.079	0.106
	S	0.372	0.142	0.321	0.034	0.171	0.014	0.130	0.039	0.878	0.009	0.040	
	O	0.237	0.407	0.140	0.006	0.054	0.015			0.177			
Shore-based CVs	J	0.007	0.001	0.000	0.000	0.001	0.000	0.003	0.002	0.000	0.000	0.000	0.000
	F	0.008	0.001	0.001	0.003	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	M	0.002	0.000	0.002	0.001	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.001
	J	0.033	0.045	0.234	1.240	0.043	0.044	0.031	0.018	0.483	0.020	0.092	0.060
	J	0.094	0.079	2.343	1.078	0.060	0.029	0.167	0.058	0.297	0.026	0.319	0.345
	A	0.325	0.933	2.259	1.180	0.206	0.039	0.264	0.028	0.569	0.053	0.428	0.922
	S	0.651	2.051	0.551	0.153	0.410	0.127	0.568	0.096	0.506	0.200	0.637	
	O	0.701	1.425	1.370	0.151	0.059	0.078	0.116	0.090	0.189	0.048	0.107	

Table 40. Chinook salmon bycatch remaining by different dates (representing the week of closure), years, and sectors. The bottom panel is summed over all sectors.

Chinook salmon CPs	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1-Sep	1,797	2,048	1,379	1,099	5,288	239	76	15	1,478	6	329
8-Sep	1,487	1,603	664	654	4,902	224	31	15	1,336	3	250
15-Sep	1,183	908	392	604	4,598	175	25	8	1,192	1	184
22-Sep	990	613	24	462	4,193	153	13	3	1,098	0	151
29-Sep	504	133	0	294	3,292	153	0	0	934	0	79
6-Oct	79	3	0	205	2,682	118	0	0	773	0	17
13-Oct	0	0	0	15	1,804	10	0	0	599	0	0
20-Oct	0	0	0	0	338	4	0	0	34	0	0
27-Oct	0	0	0	0	0	0	0	0	0	0	0
MS											
1-Sep	1,592	1,421	271	109	2,895	120	36	0	2,362	0	8
8-Sep	1,560	1,298	221	101	2,764	106	36	0	2,332	0	3
15-Sep	1,414	1,190	143	60	2,713	100	4	0	2,300	0	0
22-Sep	1,332	977	119	48	2,474	90	0	0	2,288	0	0
29-Sep	1,039	748	95	45	2,275	42	0	0	1,858	0	0
6-Oct	327	722	8	27	1,691	26	0	0	1,385	0	0
13-Oct	96	580	0	24	868	4	0	0	417	0	0
20-Oct	0	421	0	24	158	4	0	0	3	0	0
27-Oct	0	0	0	0	0	0	0	0	0	0	0
Shore-based catcher vessel											
1-Sep	6,627	18,832	28,379	18,658	38,163	3,349	827	1,230	12,247	2,912	2,731
8-Sep	6,192	16,917	27,297	16,280	34,382	2,931	670	1,117	11,207	2,623	2,610
15-Sep	5,569	15,241	25,216	14,000	31,980	2,695	325	846	9,584	2,285	2,546
22-Sep	4,911	14,275	22,205	12,372	30,528	2,517	167	832	8,423	2,069	1,381
29-Sep	3,044	12,053	15,563	10,288	25,603	2,129	47	558	5,742	1,787	634
6-Oct	980	9,484	9,286	7,086	19,037	1,888	0	471	2,286	1,284	252
13-Oct	23	6,173	7,899	3,479	14,022	582	0	175	783	934	149
20-Oct	0	4,283	0	263	7,789	153	0	0	0	268	0
27-Oct	0	0	0	0	0	0	0	0	0	0	0
Combined											
1-Sep	10,016	22,301	30,029	19,867	46,346	3,707	939	1,245	16,087	2,918	3,068
8-Sep	9,239	19,818	28,182	17,036	42,048	3,261	737	1,132	14,875	2,626	2,863
15-Sep	8,166	17,339	25,751	14,664	39,291	2,970	354	855	13,076	2,286	2,730
22-Sep	7,233	15,865	22,348	12,882	37,195	2,760	180	835	11,809	2,069	1,532
29-Sep	4,587	12,934	15,658	10,627	31,170	2,324	47	558	8,534	1,787	713
6-Oct	1,386	10,209	9,294	7,318	23,410	2,032	0	471	4,444	1,284	269
13-Oct	119	6,753	7,899	3,518	16,694	596	0	175	1,799	934	149
20-Oct	0	4,704	0	287	8,285	161	0	0	37	268	0
27-Oct	0	0	0	0	0	0	0	0	0	0	0
Chinook salmon PSC Total	45,586	51,295	66,510	81,056	120,505	21,331	12,582	9,143	25,372	11,267	13,021

Table 41. Chum salmon bycatch remaining by different dates (representing the week of closure), years, and sectors. The bottom panel is summed over all sectors.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
non-Chinook salmon											
1-Sep	12,236	11,932	10,574	4,140	5,816	680	996	146	17,624	522	1,959
8-Sep	9,417	7,783	4,658	1,634	2,448	550	748	37	16,554	118	1,511
15-Sep	7,586	3,964	2,351	1,101	1,921	220	482	27	14,938	14	1,038
22-Sep	3,990	1,169	302	736	953	153	120	7	13,219	10	685
29-Sep	892	298	0	249	538	137	3	0	10,672	2	159
6-Oct	40	12	0	171	264	69	0	0	9,985	0	55
13-Oct	0	0	0	18	137	1	0	0	4,157	0	0
20-Oct	0	0	0	0	66	1	0	0	18	0	0
27-Oct	0	0	0	0	0	0	0	0	0	0	0
MS											
1-Sep	9,736	8,862	4,962	511	1,915	285	257	0	8,752	28	76
8-Sep	8,484	7,886	2,502	278	1,619	259	215	0	5,176	7	34
15-Sep	6,079	6,431	1,084	149	1,479	163	64	0	2,315	0	0
22-Sep	2,189	5,154	722	63	767	138	0	0	2,033	0	0
29-Sep	1,291	4,250	592	48	675	56	0	0	1,267	0	0
6-Oct	371	4,203	116	18	444	36	0	0	690	0	0
13-Oct	79	2,350	0	6	190	8	0	0	132	0	0
20-Oct	0	1,070	0	6	84	2	0	0	6	0	0
27-Oct	0	0	0	0	0	0	0	0	0	0	0
Shore-based catcher vessel											
1-Sep	81,970	224,423	102,189	18,750	17,145	3,500	4,772	1,422	12,997	9,059	22,765
8-Sep	72,296	140,915	92,388	14,785	7,773	1,779	2,940	942	9,341	4,739	5,744
15-Sep	51,250	73,951	79,326	11,858	4,691	1,372	1,506	387	7,609	2,300	4,663
22-Sep	25,582	58,315	65,247	9,126	3,361	849	418	368	5,527	1,134	1,125
29-Sep	12,500	42,793	42,413	4,604	2,417	302	33	71	3,026	776	386
6-Oct	4,696	37,994	21,511	2,819	1,845	141	0	58	786	457	152
13-Oct	54	10,479	15,933	1,008	817	20	0	16	101	295	24
20-Oct	0	4,638	0	7	333	3	0	0	0	115	0
27-Oct	0	0	0	0	0	0	0	0	0	0	0
Combined											
1-Sep	103,942	245,218	117,725	23,402	24,876	4,465	6,025	1,568	39,373	9,609	24,800
8-Sep	90,197	156,584	99,548	16,697	11,840	2,588	3,903	978	31,071	4,864	7,289
15-Sep	64,915	84,346	82,761	13,108	8,091	1,754	2,052	413	24,862	2,314	5,701
22-Sep	31,761	64,638	66,271	9,926	5,081	1,140	538	375	20,779	1,144	1,810
29-Sep	14,683	47,341	43,005	4,901	3,631	495	36	71	14,965	778	545
6-Oct	5,107	42,209	21,627	3,008	2,553	246	0	58	11,461	457	207
13-Oct	133	12,829	15,933	1,032	1,144	29	0	16	4,390	295	24
20-Oct	0	5,708	0	13	483	6	0	0	24	115	0
27-Oct	0	0	0	0	0	0	0	0	0	0	0
Total non-Chinook Salmon PSC (all year)	189,138	440,058	704,544	306,025	93,188	15,402	46,378	13,269	191,441	22,276	125,316

Table 42. Amount of Chinook salmon PSC saved by year and sector for Alternative 4, opening the B-season on June 1st instead of June 10th. See text for details of how computations were conducted. Figures in parentheses represent negative savings (i.e., increased PSC catch given assumptions).

	Shore-based CVs	CVs to Motherships	CPs	CDQ	Total
2003	1,214	139	1,886	8	3,247
2004	3,802	59	695	19	4,575
2005	12,337	52	329	249	12,968
2006	3,631	11	165	16	3,823
2007	12,737	74	874	990	14,675
2008	4,229	-	34	(1)	4,262
2009	1,136	(12)	7	84	1,215
2010	1,914	(26)	50	-	1,938
2011	7,282	778	427	113	8,601
2012	2,270	(8)	(8)	(0)	2,254
2013	4,254	(3)	196	48	4,495
2014	741	144	500	(2)	1,384
					63,436

Table 43. Amount of chum salmon PSC saved by year and sector for Alternative 4, opening the B-season on June 1st instead of June 10th. See text for details of how computations were conducted. Figures in parentheses represent negative savings (i.e., increased PSC catch given assumptions).

	Shore-based CVs	CVs to Motherships	CPs	CDQ	Total
2003	10,882	476	9,411	151	20,920
2004	17,753	251	(3,117)	72	14,959
2005	29,345	(1,443)	85	1,071	29,058
2006	(36,219)	13	(467)	3	(36,671)
2007	797	39	61	365	1,263
2008	1,306	-	15	(8)	1,313
2009	5,969	(163)	102	802	6,710
2010	1,895	(103)	(70)	(155)	1,567
2011	(7,195)	(2,096)	3,986	382	(4,923)
2012	1,735	(56)	0	46	1,725
2013	6,497	(69)	387	535	7,351
2014	109	1,893	2,888	(216)	4,674
					47,942

Table 44. Amount of Chinook salmon (top panel) and chum salmon (bottom panel) PSC saved by year and sector for Alternative 4, opening the B-season on June 1st instead of June 10th. Suboptions 1, 2, and 3 close the fishery on Sept 15th, October 1st and October 15th respectively. See text for details of how computations were conducted. Figures in parentheses represent negative savings (i.e., increased PSC catch given assumptions).

Chinook salmon	Alt. 4 (option 1)	Alt4 Option 2 sub-option 1 (close 9/15)	Alt4 Option 2 sub-option 2 (close 10/1)	Alt4 Option 2 sub-option 3 (close 10/15)
2003	3,247	9,105	7,572	4,245
2004	4,575	20,707	16,055	12,299
2005	12,968	27,437	23,832	14,032
2006	3,823	17,715	12,071	9,036
2007	14,675	44,590	36,566	28,237
2008	4,262	3,509	2,823	2,218
2009	1,215	796	285	33
2010	1,938	1,200	831	546
2011	8,601	15,480	12,187	7,763
2012	2,254	2,811	2,165	1,686
2013	4,495	2,845	2,630	613
2014	1,384	1,052	158	0

Chum salmon	Alt. 4 (Option 1)	Alt4 Option 2 sub-option 1 (close 9/15)	Alt4 Option 2 sub-option 2 (close 10/1)	Alt4 Option 2 sub-option 3 (close 10/15)
2003	20,920	75,641	46,430	5,497
2004	14,959	194,045	34,570	18,761
2005	29,058	(55,517)	(16,538)	(5,396)
2006	(36,671)	(115,784)	(66,656)	(30,591)
2007	1,263	5,432	(7,988)	(7,237)
2008	1,313	2,771	744	(92)
2009	6,710	3,048	803	(225)
2010	1,567	1,004	194	(12)
2011	(4,923)	(2,085)	(4,579)	55
2012	1,725	7,540	526	(358)
2013	7,351	12,010	(8)	(2,476)
2014	4,674	6,246	(270)	-

Table 45. Chinook salmon bycatch remaining by different dates (representing the week of closure), years, and sectors. The bottom panel is summed over all sectors.

Chinook salmon

CP	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
5Sep	1,474	2,054	2,231	1,096	5,281	239	145	23	1,631	6	404
12Sep	1,214	1,608	1,331	652	4,896	224	100	15	1,444	3	325
19Sep	1,007	911	631	603	4,591	175	94	15	1,302	1	259
26Sep	897	613	362	461	4,192	153	82	8	1,158	0	226
3Oct	447	131	24	294	3,292	153	69	3	1,064	0	154
10Oct	79	3	0	205	2,682	118	69	0	900	0	17
17Oct	0	0	0	15	1,804	10	0	0	739	0	0
24Oct	0	0	0	0	338	4	0	0	565	0	0
31Oct	0	0	0	0	0	0	0	0	0	0	0
MS											
5Sep	1,487	1,423	486	104	2,871	120	36	0	2,364	0	8
12Sep	1,455	1,300	271	96	2,758	106	36	0	2,359	0	3
19Sep	1,403	1,190	221	60	2,714	100	4	0	2,329	0	0
26Sep	1,330	977	143	48	2,474	90	0	0	2,297	0	0
3Oct	1,039	748	119	45	2,275	42	0	0	2,285	0	0
10Oct	327	722	95	27	1,689	26	0	0	1,855	0	0
17Oct	96	580	8	24	867	4	0	0	1,382	0	0
24Oct	0	421	0	24	157	4	0	0	414	0	0
31Oct	0	0	0	0	0	0	0	0	0	0	0
Shorebased catcher vessel											
5Sep	6,627	18,832	29,081	18,605	38,409	3,366	824	1,253	12,804	2,912	2,731
12Sep	6,192	16,917	28,379	16,303	34,639	2,948	665	1,194	12,247	2,623	2,610
19Sep	5,569	15,241	27,297	14,023	32,217	2,712	320	1,088	11,207	2,285	2,546
26Sep	4,911	14,275	25,216	12,450	30,781	2,534	162	817	9,584	2,069	1,381
3Oct	3,044	12,053	22,205	10,308	25,949	2,146	47	802	8,423	1,787	634
10Oct	980	9,484	15,563	7,109	19,249	1,888	0	544	5,742	1,284	252
17Oct	23	6,173	9,286	3,520	14,399	582	0	451	2,286	934	149
24Oct	0	4,283	7,899	345	7,514	153	0	175	783	268	0
31Oct	0	0	0	0	0	0	0	0	0	0	0
Combined											
5Sep	9,588	22,309	31,798	19,805	46,561	3,725	1,005	1,276	16,799	2,918	3,143
12Sep	8,861	19,825	29,981	17,051	42,293	3,278	801	1,209	16,050	2,626	2,938
19Sep	7,979	17,342	28,149	14,686	39,522	2,987	418	1,103	14,838	2,286	2,805
26Sep	7,138	15,865	25,721	12,959	37,447	2,777	244	825	13,039	2,069	1,607
3Oct	4,530	12,932	22,348	10,647	31,516	2,341	116	805	11,772	1,787	788
10Oct	1,386	10,209	15,658	7,341	23,620	2,032	69	544	8,497	1,284	269
17Oct	119	6,753	9,294	3,559	17,070	596	0	451	4,407	934	149
24Oct	0	4,704	7,899	369	8,009	161	0	175	1,762	268	0
31Oct	0	0	0	0	0	0	0	0	0	0	0
Total Chinook Salmon PSC (all year)	**45,586**	**51,696**	**67,362**	**82,695**	**121,770**	**21,480**	**12,369**	**9,697**	**25,499**	**11,344**	**13,033**

Table 46. Pollock catch remaining by different dates (representing the week of closure), years, and sectors. The bottom panel is summed over all sectors. Units are metric tons.

Pollock											
CP	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
5Sep	72,795	65,720	72,714	87,075	68,550	61,288	29,101	11,748	89,894	19,382	39,009
12Sep	50,049	43,705	50,817	68,715	54,850	51,439	19,577	6,208	76,477	12,319	28,735
19Sep	29,714	24,773	28,522	49,198	44,945	29,563	9,615	3,430	63,874	3,524	18,107
26Sep	15,578	12,602	15,472	33,580	37,257	16,656	3,551	2,398	52,258	2,731	11,692
3Oct	4,414	2,393	2,827	17,170	28,429	8,411	786	813	39,669	1,029	5,681
10Oct	151	601	0	8,205	21,859	5,703	242	86	27,039	137	1,953
17Oct	0	0	0	989	12,909	4,058	0	57	16,211	127	166
24Oct	0	0	0	0	4,297	1,950	0	34	7,000	0	139
31Oct	0	0	0	0	0	0	0	0	0	0	0
M											
5Sep	23,369	36,062	22,054	24,992	27,243	21,546	2,589	1,426	19,672	1,691	2,162
12Sep	18,586	27,294	16,310	20,822	23,979	18,758	1,020	0	19,044	231	954
19Sep	14,009	20,029	13,107	15,413	20,845	12,208	242	0	16,469	0	0
26Sep	9,289	12,686	7,763	11,299	15,950	9,983	0	0	13,296	0	0
3Oct	5,644	3,889	6,133	8,816	12,772	6,855	0	0	11,871	0	0
10Oct	2,296	3,449	5,381	5,576	10,177	5,239	0	0	7,886	0	0
17Oct	984	3,025	2,068	3,379	6,504	2,181	0	0	5,472	0	0
24Oct	0	2,422	0	1,189	3,258	296	0	0	2,840	0	0
31Oct	0	0	0	0	0	0	0	0	0	0	0
S											
5Sep	108,331	96,303	109,995	129,959	90,420	29,297	13,563	16,934	69,204	51,927	38,974
12Sep	82,154	71,544	93,432	111,346	76,291	21,386	9,990	12,482	58,420	40,206	24,466
19Sep	56,152	54,533	75,999	86,061	64,543	15,085	5,736	8,205	51,562	30,643	15,819
26Sep	36,870	41,218	58,668	62,460	58,865	11,280	3,705	4,399	41,258	24,451	10,713
3Oct	22,765	32,727	43,896	42,848	45,824	9,177	1,323	4,277	31,733	18,776	8,578
10Oct	12,088	24,557	29,775	27,100	34,297	6,925	0	1,814	20,008	15,144	7,671
17Oct	731	9,875	16,307	13,482	19,039	822	0	1,015	7,692	8,235	1,926
24Oct	0	5,644	12,211	739	6,324	56	0	341	2,738	2,534	0
31Oct	0	0	0	0	0	0	0	0	0	0	0
Combined											
5Sep	204,495	198,085	204,763	242,026	186,213	112,131	45,253	30,108	178,770	73,000	80,145
12Sep	150,789	142,543	160,559	200,883	155,120	91,583	30,587	18,690	153,941	52,756	54,155
19Sep	99,875	99,335	117,628	150,672	130,333	56,856	15,593	11,635	131,905	34,167	33,926
26Sep	61,737	66,506	81,903	107,339	112,072	37,919	7,256	6,797	106,812	27,182	22,405
3Oct	32,823	39,009	52,856	68,834	87,025	24,443	2,109	5,090	83,273	19,805	14,259
10Oct	14,535	28,607	35,156	40,881	66,333	17,867	242	1,900	54,933	15,281	9,624
17Oct	1,715	12,900	18,375	17,850	38,452	7,061	0	1,072	29,375	8,362	2,092
24Oct	0	8,066	12,211	1,928	13,879	2,302	0	375	12,578	2,534	139
31Oct	0	0	0	0	0	0	0	0	0	0	0

Table 47. Chinook salmon bycatch number per t of pollock by week and sector (and combined over the whole fleet), 2003-2013.

CP	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
5 Sep	0.031	0.020	0.012	0.002	0.038	0.001	0.008	0.000	0.006	0.001	0.001
12 Sep	0.011	0.020	0.041	0.024	0.028	0.001	0.005	0.001	0.014	0.000	0.008
19 Sep	0.010	0.037	0.031	0.002	0.031	0.002	0.001	0.000	0.011	0.000	0.006
26 Sep	0.008	0.024	0.021	0.009	0.052	0.002	0.002	0.006	0.012	0.001	0.005
3 Oct	0.040	0.047	0.027	0.010	0.102	0.000	0.005	0.003	0.007	0.000	0.012
10 Oct	0.086	0.071	0.008	0.010	0.093	0.013	0.000	0.004	0.013	0.000	0.037
17 Oct	0.524	0.005		0.026	0.098	0.066	0.285	0.000	0.015	0.000	0.010
24 Oct				0.015	0.170	0.003		0.000	0.019	0.000	0.000
31 Oct					0.079	0.002		0.000	0.081		0.000
Mothership operations											
5 Sep	0.020	0.036	0.018	0.012	0.046	0.014	0.000	0.002	0.002	0.006	0.006
12 Sep	0.007	0.014	0.037	0.002	0.035	0.005	0.000	0.000	0.008	0.000	0.004
19 Sep	0.011	0.015	0.016	0.007	0.014	0.001	0.041		0.012	0.000	0.003
26 Sep	0.015	0.029	0.015	0.003	0.049	0.005	0.017		0.010		
3 Oct	0.080	0.026	0.015	0.001	0.063	0.015			0.008		
10 Oct	0.213	0.059	0.032	0.006	0.226	0.010			0.108		
17 Oct	0.176	0.335	0.026	0.001	0.224	0.007			0.196		
24 Oct	0.098	0.264	0.004	0.000	0.219	0.000			0.368		
31 Oct		0.174		0.020	0.048	0.013			0.146		
Shorebased catcher vessels											
5 Sep	0.004	0.032	0.052	0.036	0.053	0.016	0.027	0.005	0.045	0.006	0.048
12 Sep	0.017	0.077	0.042	0.124	0.267	0.053	0.045	0.013	0.052	0.025	0.008
19 Sep	0.024	0.099	0.062	0.090	0.206	0.037	0.081	0.025	0.152	0.035	0.007
26 Sep	0.034	0.073	0.120	0.067	0.253	0.047	0.078	0.071	0.158	0.035	0.228
3 Oct	0.132	0.262	0.204	0.109	0.371	0.185	0.048	0.120	0.122	0.050	0.350
10 Oct	0.193	0.314	0.470	0.203	0.581	0.115	0.036	0.105	0.229	0.138	0.421
17 Oct	0.084	0.226	0.466	0.264	0.318	0.214		0.116	0.281	0.051	0.018
24 Oct	0.031	0.447	0.339	0.249	0.542	0.561		0.409	0.303	0.117	0.077
31 Oct		0.759	0.647	0.467	1.188	2.709		0.514	0.286	0.106	
Combined											
5 Sep	0.017	0.028	0.028	0.013	0.045	0.008	0.015	0.001	0.019	0.003	0.020
12 Sep	0.014	0.045	0.041	0.067	0.137	0.022	0.014	0.006	0.030	0.014	0.008
19 Sep	0.017	0.057	0.043	0.047	0.112	0.008	0.026	0.015	0.055	0.018	0.007
26 Sep	0.022	0.045	0.068	0.040	0.114	0.011	0.021	0.057	0.072	0.031	0.104
3 Oct	0.090	0.107	0.116	0.060	0.237	0.032	0.025	0.012	0.054	0.038	0.101
10 Oct	0.172	0.262	0.378	0.118	0.382	0.047	0.025	0.082	0.116	0.111	0.112
17 Oct	0.099	0.220	0.379	0.164	0.235	0.133	0.285	0.112	0.160	0.051	0.016
24 Oct	0.069	0.424	0.226	0.200	0.369	0.092		0.396	0.157	0.114	0.076
31 Oct		0.583	0.647	0.191	0.577	0.070		0.467	0.140	0.106	0.000

Table 48. Chum salmon bycatch number per t of pollock by week and sector (and combined over the whole fleet), 2003-2013.

CP	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
5 Sep	0.125	0.189	0.267	0.137	0.249	0.013	0.026	0.046	0.087	0.058	0.046
12 Sep	0.091	0.203	0.178	0.028	0.054	0.015	0.028	0.040	0.142	0.012	0.045
19 Sep	0.260	0.230	0.163	0.024	0.129	0.005	0.062	0.015	0.139	0.005	0.059
26 Sep	0.282	0.086	0.108	0.030	0.048	0.002	0.043	0.012	0.207	0.005	0.092
3 Oct	0.202	0.161		0.009	0.043	0.024	0.006		0.066	0.002	0.031
10 Oct	0.267	0.020		0.021	0.015	0.046			0.648		0.034
17 Oct				0.018	0.009	0.000			0.605		
24 Oct					0.016	0.001			0.008		
31 Oct											
Mothership operations											
5 Sep	0.262	0.111	0.774	0.056	0.091	0.010	0.027		1.404	0.014	0.035
12 Sep	0.527	0.201	0.267	0.024	0.045	0.017	0.197		0.915	0.031	0.036
19 Sep	0.827	0.174	0.223	0.021	0.147	0.013	0.265		0.202		
26 Sep	0.249	0.103	0.173	0.006	0.029	0.029			0.195		
3 Oct	0.275	0.107	0.144	0.009	0.090	0.014			0.242		
10 Oct	0.227	4.418	0.056	0.005	0.070	0.009			0.216		
17 Oct	0.081	2.125		0.000	0.033	0.003			0.045		
24 Oct		0.443		0.005	0.026	0.007			0.104		
31 Oct		0.595									
Shorebased catcher vessels											
5 Sep	0.371	3.385	0.572	0.202	0.673	0.224	0.527	0.115	0.546	0.372	1.179
12 Sep	0.815	3.954	0.762	0.116	0.275	0.067	0.344	0.150	0.171	0.259	0.126
19 Sep	1.342	1.177	0.960	0.114	0.236	0.142	0.545	0.160	0.224	0.190	0.709
26 Sep	0.948	1.833	1.644	0.242	0.075	0.272	0.167	0.124	0.218	0.065	0.354
3 Oct	0.734	0.590	1.569	0.113	0.053	0.073	0.025	0.018	0.186	0.089	0.262
10 Oct	0.410	1.896	1.380	0.133	0.067	0.021		0.057	0.143	0.024	0.023
17 Oct	0.074	1.395	1.327	0.081	0.040	0.023		0.050	0.038	0.033	0.013
24 Oct		0.825		0.015	0.054	0.054				0.047	
31 Oct		0.606									
Combined											
5 Sep	0.258	1.601	0.428	0.159	0.425	0.093	0.147	0.090	0.384	0.237	0.691
12 Sep	0.501	1.680	0.474	0.072	0.155	0.024	0.127	0.143	0.252	0.139	0.080
19 Sep	0.880	0.602	0.571	0.073	0.167	0.033	0.186	0.026	0.177	0.169	0.355
26 Sep	0.601	0.631	1.333	0.134	0.059	0.049	0.100	0.102	0.210	0.050	0.162
3 Oct	0.526	0.496	1.286	0.068	0.055	0.039	0.019	0.018	0.141	0.073	0.079
10 Oct	0.390	1.892	0.932	0.086	0.051	0.021		0.057	0.432	0.024	0.025
17 Oct	0.078	1.487	1.327	0.065	0.028	0.005		0.050	0.355	0.033	0.013
24 Oct		0.710		0.008	0.036	0.003			0.010	0.047	
31 Oct		0.599									

3.5.4.2 Evaluating seasonal pollock re-allocation, option 3

Two analytical approaches to evaluating shifts to the A season were completed. In one, trips within sectors were used as the main metric for extending seasons (either to start earlier or to go later). In the other, fishing operation dates were used as a way to evaluate shifting allocation of B-season pollock into A-season. Both methods require assumptions that are unrealistic. However, their intent is to help characterize the nature of the options before the Council rather than be precisely predictive and these approaches present some idea of the complexity involved in coming up with a complete analytical evaluation. These are referred to as "Trip-based" and "Date-based" respectively and are summarized in a subsequent section below.

Trip-based Evaluation. This approach involves evaluating the extent that "trips" might be the natural way to respond to alternative fishing opportunities. For example, an individual vessel might choose to add trips to the end (or beginning, in some cases) to their A-season fishing and drop "trips" from later in the B-season so as to avoid salmon bycatch. The available data indicate that from 2011-2014, the average "trip" by vessels within sectors provides a reasonably stable proportion of the annual catch. It turns out that for this period, one "trip" for catcher-processors represents about 5% of their annual quota. For shore-based CVs and mother-ship operations, one trip represents about 10% and 3.33% of their annual totals, respectively. Therefore, applying these values to observed trip pollock catches and PSC rates (e.g., for first and second trips) within seasons can provide a reasonable means to evaluate how reallocation may affect PSC rates.

In practice, the TAC might be reallocated from the B-season to the A season by adding trips earlier in the season, at the end, or some combination. Alternatively, fewer vessels might fish in the B season, so that fishing would occur at the same time but with a reduction in catch. It will also depend on the level of the TAC, fishing conditions, how many vessels are involved in salmon tendering, and other factors.

For all vessels, Chinook salmon caught with the first and last three catcher vessel trips and first and last 2 catcher processor trips for each season from 2011-2014 were applied. Because vessels start and end at different times and have very different levels of bycatch, this process adds a trip before or after each vessels' "normal" operating plans.

Three scenarios for how catch is re-allocated *to* the A season:

- The additional TAC is caught all the start of each vessel's A-season fishing
- The additional TAC is caught after the end of each vessel's A-season fishing
- The TAC is evenly distributed between the start and end of each vessel's A-season fishing.

Chinook PSC in A season is increased by the amount that comes with this additional effort and the associated rates. We explore three scenarios for how catch is re-allocated *from* the B-season:

- The TAC is caught all the start of each vessel's B-season fishing.
- The TAC is caught after the end of each season's
- The TAC evenly distributed between the start and end of the season.

In this approach, the Chinook salmon PSC is reduced by the amount associated with the number of trips that were necessary in each year to catch that amount of pollock. This process leads to an increase in A-season PSC and a reduction in B-season PSC. The degree to which this leads to a net benefit for Chinook depends on the period from which fishing effort in the B-season is moved and the period to which it occurs in A-season. The following tables show the impacts for the different sectors of this change.

Table 49. Increase in A-Season PSC from 5% increase in TAC, Reduction in B-Season from corresponding decrease in catch, by sector.

Impact of shift **to** A season

	CV				CP				MS		
Year	to start	mixed	end	Year	to start	mixed	end	Year	to start	mixed	end
2011	541	605	668	2011	278	253	228	2011	87	59	32
2012	431	290	150	2012	355	427	499	2012	57	39	20
2013	690	724	758	2013	580	523	466	2013	96	83	70
2014	1,047	857	668	2014	532	632	732	2014	68	48	29
avg	**677**	**619**	**561**	**avg**	**436**	**459**	**481**	**avg**	**77**	**57**	**38**

Impact of shift **from** B season

	CV				CP				MS		
Year	From start	mixed	end	Year	From start	mixed	end	Year	From start	mixed	end
2011	-57	-3,323	-5,680	2011	-24	-470	-944	2011	-6	-436	-927
2012	-84	-540	-1018	2012	-18	-13	-9	2012	-6	-7	-3
2013	-82	-320	-466	2013	-17	-83	-153	2013	-5	-7	-5
2014	-78	-386	-730	2014	-6	-78	-156	2014	-5	-29	-32
avg	-75	-1,142	-1973	avg	-16	-161	-315	avg	-5	-120	-242

Similarly, for 10% transfer of TAC from B-season to A-season, there is a larger increase in A-season Chinook PSC and a larger decrease in B-season PSC. Because this process uses the bycatch associated with the number of B-season trips required to catch the change in TAC, this is not just a doubling of the 5% numbers.

Table 50. Increase in A-Season Chinook salmon PSC for the 10% re-allocation of pollock TAC into the A-season. , Reduction in B-Season from corresponding decrease in catch, by sector.

Impact of shift **to** A season

	CV				CP				MS		
Year	to start	mixed	end	Year	to start	mixed	end	Year	to start	mixed	end
2011	1,081	1,209	1,337	2011	555	506	456	2011	174	93	12
2012	862	581	300	2012	709	854	999	2012	115	63	12
2013	1,380	1,448	1,515	2013	1,161	1,046	932	2013	193	102	11
2014	2,093	1,714	1,336	2014	1,063	1,264	1,465	2014	135	72	9
avg	**1,354**	**1,238**	**1,122**	**avg**	**872**	**918**	**963**	**avg**	**154**	**83**	**11**

Impact of shift from B season

	CV				CP				MS		
Year	From start	mixed	end	Year	From start	mixed	end	Year	From start	mixed	end
2011	-125	-4,561	-8,996	2011	-73	-644	-1,214	2011	-12	-888	-1,765
2012	-140	-931	-1,721	2012	-39	-28	-18	2012	-12	-9	-7
2013	-196	-651	-1,106	2013	-30	-157	-283	2013	-11	-10	-10
2014	-146	-724	-1,302	2014	-12	-147	-283	2014	-9	-36	-64
avg	-152	-1,717	-3,281	avg	-38	-244	-450	avg	-11	-236	-461

In order to evaluate the net impact of these shifts, it is possible to consider the worst, medium and best combinations of fishing periods that shift from B season and to the A season. For example, in a 'worst' scenario A-season fishing period would be at the highest Chinook salmon PSC rate and shifted from a B-season period that had the lowest rate. The "best" scenario would be where B-season trips that moved to the A-season would be from the highest rate (in B) to the lowest (in A; Table 51). Over the range of trip selection strategies evaluated, most lead to an increase in Chinook salmon PSC but is variable between years. For example, if the B-season TAC reductions had occurred at the end of 2011 and 2012, PSC would have been much lower for 2011 and slightly lower for 2012, all other things being equal. It is also apparent that the timing of when increased fishing in A-season would occur has far less impact than assuming when fishing would be curtailed during the B season.

Table 51. Outcomes under the "trip-based" method of evaluating change in re-allocating Chinook salmon PSC from the B-season to A. Units are numbers of Chinook salmon PSC

	5% change in TAC NET increase or decrease in salmon				10 % change in TAC NET increase or decrease in salmon		
	Worst	Median	Best		Worst	Median	Best
2011	946	-3,279	-6,687	2011	1,856	-4221	-10,298
2012	892	197	-519	2012	1,810	530	-750
2013	1,329	922	601	2013	2,633	1,778	923
2014	1,758	1,044	311	2014	3,527	2,143	759
avg	**1,231**	**-279**	**-1,573**	**avg**	**2,456**	**57**	**-2,342**

Date-based Evaluation. For this approach, a change in PSC allocation assumed that additional pollock shifting to A-season would have been taken only in the period March 15-April. Additionally, the pollock catch that "moved" from the B-season and re-allocated to the A-season was assumed to shift from the pollock taken in late September and all of October (and hence uses the PSC rate for this period). Should the catch that's shifted to the A-season exceed the actual pollock catch in that mid-September to October period, the remaining amount is "moved" from June – mid-September proportionately (and the Chinook PSC rate would be based on rates from that period). The calculations for this approach are detailed in an appendix. Simply speaking, total Chinook salmon expected given the current seasonal allocation and bycatch rates (number / t of pollock) were re-allocated from the B season with rates corresponding to date ranges as shown in Table 52.

The PSC rates vary depending on year-ranges used. However, moving late-season pollock to other parts of the year would result in lower bycatch (assuming the data in aggregate are representative across sectors; Table 52). For example, the late B-season PSC rate is over three times the rate observed during the A-season for 2011-2014. Note that these rates are based on available observer data individual tows and the rates will differ from the final tallies provided by the NMFS regional office, especially for years prior to 2011 when vessels less than 125' had observer coverage of less than 100%.

Using the 2015 seasonal allocation (as an example) the AFA A-season allocation of 505,136 t would increase by 63,142 t for the 45% A-season TAC option and by twice that amount for the 50% A-season TAC option. When these amounts are applied the change in the reduction can be substantial, but varies considerably depending on which historical period is used (Table 53). These results, given the assumptions about rates and implied fishing behavior, indicate that Chinook salmon PSC would decrease by about 2% to 27% depending on the option and year range applied (Table 53).

Table 52. **PSC rates (Chinook salmon per t of pollock) by season and sub-season (sectors combined) for different sets of years based on raw NMFS tow-by-tow observer data.**

Year range	A season	Mar 15th-Apr 30th	B-season	Jun-Sep 14	Sep 15-Oct 31st
2003-2007	0.071	0.054	0.026	0.010	0.110
2008-2010	0.028	0.014	0.004	0.002	0.023
2011-2014	0.014	0.021	0.008	0.002	0.071

Table 53. **Relative change in Chinook salmon PSC for different sets of years based on NMFS observer data.**

	Change in Chinook PSC	
Year range	45% pollock in A season	50% pollock in A season
2002-2007	-9%	-17%
2008-2010	-5%	-2%
2011-2014	-27%	-21%

The trip-based approach suggested there was on average a slight decrease in annual Chinook bycatch with a 5 percent shift in TAC and a negligible increase with a 10 percent increase. There is little difference in net bycatch between adding additional trips at the beginning or the end of the A-season. The date-based approach of using late-A season bycatch rate for pollock transferred from the B-season may be unrealistic for CPs and MS since most observations come from the CV sector and those are taken to be indicative for this period. Results show sensitivity to the years being averaged as expected since different management measures were in place and conditions (such as temperature and relative Chinook salmon run strengths) varied. How the sectors, coops, and vessels will respond to these types of changes is difficult to predict and the approaches examined here are intended to describe the difficulty. Nonetheless, it is clear that measures which help reduce fishing in October generally result in lower Chinook salmon PSC annually.

Another way to evaluate the impact of seasonal re-allocation would be to assume that the catch increases (and decreases) occur proportionally within each season (i.e., using rates in Table 52). While this may prove impractical given that numbers of participants are relatively constant, it is included as another "average" view of how the re-allocation may impact Chinook salmon PSC. Over different year ranges (e.g., 2003-2007, 2008-2010, and 2011-2014) the "average" bycatch rate in the B-season is lower than that of the A season so any re-allocation of pollock from the B to the A will result in higher Chinook salmon PSC.

As noted from genetics data (e.g., Guthrie et al. 2015; Figure 33) the stock composition between A and B season varies considerably. This will modify the effective reduction in lower bycatch due to shifts of pollock allocation from B to A-seasons. For illustration consider the following hypothetical example. Under status quo, assume that the PSC was 10,000 Chinook salmon. Then imagine instead that under Option 3, pollock allocation was shifted into the A-season from the B and this resulted in an overall decrease in PSC of 2,000 Chinook salmon (a 20% reduction) relative to status quo. In this hypothetical scenario, assume also that the reduction from the B-season PSC was 2,500 Chinook salmon and the added fishing in the A-season resulted in 500 more salmon compared to the status quo A-season situation (the net decrease in PSC is still 2,000). However, because the A-season PSC in some years may have a higher proportion of western Alaska Chinook salmon, the apparent reduction is lower but still results in a net reduction of 10% to western Alaska Chinook salmon stocks (in terms of AEQ). Should a similar bycatch scenario lead to no reduction in overall PSC (i.e., the additional bycatch that would accrue in the A-season matches the reduction in bycatch in the B-season), then the expectation is that this would result in a 7% *increase* in the impact of the pollock fishery on western Alaskan stock due to the pattern of stock composition of A-season bycatch compared to that of the B-season. This type of effect compounds the uncertainty about predicting impacts on PSC of re-allocating seasonal pollock apportionments.

Analysis of option 3 under this alternative overall indicates that should fishing occur earlier in the B season, or reduced fishing in the B season due to the shift to the A season, there is likely to be reduced Chinook bycatch by shifting effort away from the highest rates in September and October. However, there is some evidence suggesting that conditions could arise that would result in higher bycatch. Therefore, **this alternative suggests a mixed impact to Chinook salmon PSC relative to Alternative 1. Here, mixed impact indicates that under some assumptions there may be a reduced adverse impact to Chinook compared to status quo, or alternatively under other assumptions a negligible increase over status quo but not significantly adverse.** While data presented here is intended to provide an estimate of the relative rates likely to be encountered by the fleet based on historical rates, this does not take into account the potentially increased efficacy of fleet reporting on higher Chinook bycatch rates that may be encountered earlier in the B season and resulting fleet movement away from these regions. Therefore the magnitude of the adverse impact to Chinook PSC may be over-estimated by use of historical rates.

Relative to changing the allocation of pollock to have 5% and 10% more of the annual TAC be taken in the A-season (option 3), the “date-based” analysis (presented in the next section) applied to chum salmon rates confers savings of about 15% and 32% more chum salmon (based on 2011-2014 data). The reason for this is due to the assumption that the higher bycatch rates of (predominantly Asian hatchery) chum during the latter part of the season coupled with the low chum-salmon bycatch rates in the A season (Figure 34).

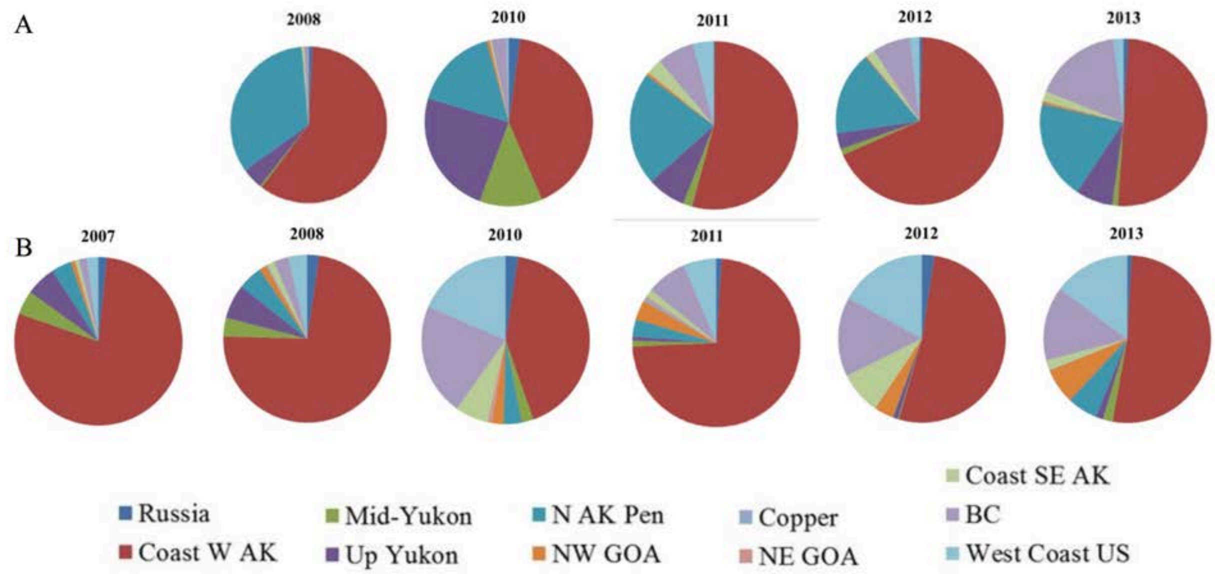

Figure 33. **Comparison of "A" season genetic stock composition estimates for 2008 and 2010-13 from the BSAI Chinook salmon bycatch. Comparison of "B" season genetic stock composition estimates for 2007, 2008, and 2010-13 stock composition estimates from the BSAI "B" season Chinook salmon bycatch. Estimates from 2011-13 are overall bycatch estimates whereas earlier compositions are of available sample sets. The same genetic baseline and regional groupings were used in all analyses (From Guthrie et al. 2015).**

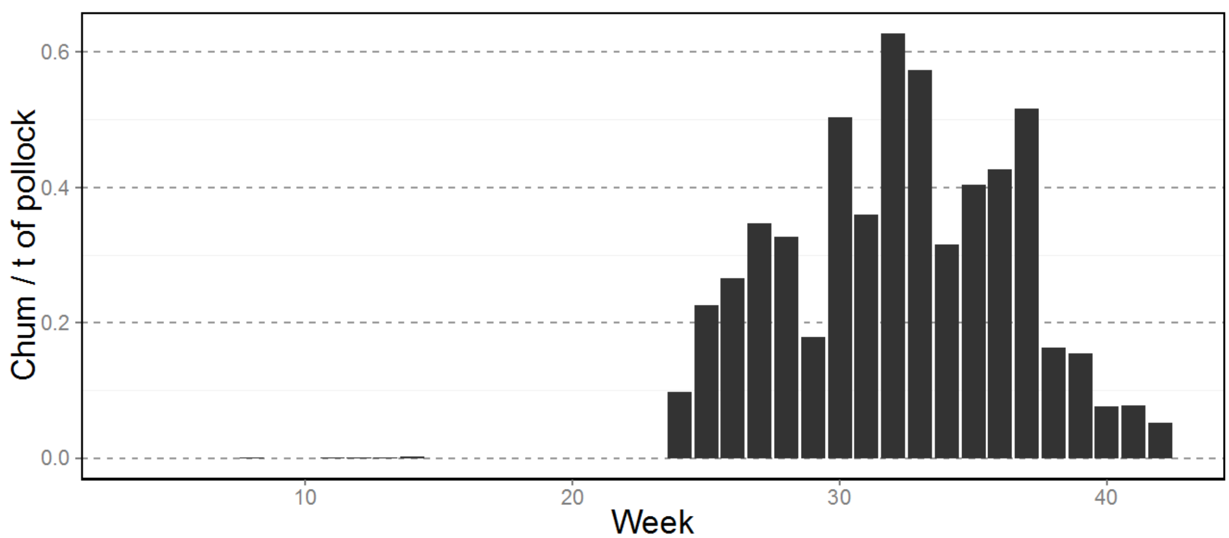

Figure 34. **Chum salmon bycatch rates by week based on 2011-2014 NMFS observer data.**

3.5.5 Alternative 5

Alternative 5 would modify the existing PSC limit and/or performance standard threshold under Amendment 91 in years of low Chinook abundance. An index of the combined run sizes from three river system ('3 System Index') using the following river systems Unalakleet, Upper Yukon, and Kuskokwim in-river run reconstructions are proposed for use in determination of 'low abundance"(See Section 2.6.4 for more details on the justification for these river systems). If adopted by the Council, low abundance would be defined as an annual combined 3-system run size of ≤250,000 Chinook salmon. A range of proportional reductions to the PSC limit and/or performance standard threshold is evaluated annually (25% and 60%). Table 54 shows the current PSC caps and performance standard thresholds under Am 91 as well as proposed reductions annually, seasonally and to sector under Alternative 5.

Table 54. Current PSC limits and annual performance standard threshold under Status Quo (alternative 1) and options under Alternative 5. Note that while the PSC limit in regulation is sector and seasonally allocated (actual limits shown in bold) the performance standard threshold is not seasonally allocated but is shown for management purposes with sector and seasonal allocations.

Status Quo		A Seas.	B Seas.	CV-A	CV-B	MS A	MS B	C/P A	C/P B	CDQ A	CDQ B
	Cap	70.0%	30.0%	49.8%	69.3%	8.0%	7.3%	32.9%	17.9%	9.3%	5.5%
PSC limit	60,000	42,000	18,000	20,916	12,474	3,360	1,314	13,818	3,222	3,906	990
Perf. Std. threshold	47,591	33,314	14,277	16,590	9,894	2,665	1,042	10,960	2,556	3,098	785
Opt-out cap	28,496	19,947	8,549	9,934	5,924	1,596	624	6,563	1,530	1,855	470
Reduced Performance Standard threshold											
25%	35,693	24,985	10,708	12,443	7,421	1,999	782	8,220	1,917	2,324	589
60%	19,036	13,325	5,711	6,636	3,958	1,066	417	4,384	1,022	1,239	314
Reduced PSC limit											
25%	45,000	31,500	13,500	15,687	9,356	2,520	986	10,364	2,417	2,930	743
60%	24,000	16,800	7,200	8,366	4,990	1,344	526	5,527	1,289	1,562	396

There are two options included in the time frame over which this estimation of 'low abundance' would be assessed, to apply based on a one-year determination or as an average of two years. The 3-run index of run reconstruction estimates shown in Table 6 show that the years in which the 'low abundance' threshold would have been reached based on a one-year determination would have occurred in 2000, and 2010-2013. The two-year average would have applied to just 2010-2013. Given the timing of the specifications process and the status determination from the preliminary run reconstruction from the 3-system index (as noted in section 2.5), a determination in one year (or a two-year average) would enact a lower performance standard threshold (or lower PSC limit and performance standard threshold) the following year. Thus, in 2000, a determination of a 'low Chinook salmon abundance" would have been made and resulting lower PSC limits put into place for 2001 fishing year. In 2001 the run reconstruction showed that the total run estimate for the index was above the threshold so the relative constraint would have only been in place for one year and then reverted to the original performance standard. Had this program been in place in that year, the one-year switch to a lower performance threshold (without the knowledge that it was a one-year-only determination) would likely have caused the fleet to stand down from traditional areas and also would likely have affected incentive behavior controls under the IPAs.

The 'low abundance' period beginning in 2010 would have triggered a lower PSC limit and/or performance standard limit beginning in 2011-2014. For comparisons, tables of catch by sector and week were constructed from 2003-2014 and bycatch rates before and after a putative closure in 2011-2014 were made. Total bycatch and pollock catch by sector and season is shown in Table 29. These data were broken into weekly totals to evaluate when closures would have occurred. Here it is important to recall that any remaining salmon PSC allocation that is unused by sector in the A-season rolls over to the B-season which impacts the magnitude of relative constraints. Rollover amounts of Chinook salmon from the A-season into B-season were substantial. Cumulative totals were tracked for the three species (Chinook salmon, chum salmon, and pollock) by week, sector, season, and year over each of the options and sub-options. Results show that only in 2011 for the 60% reductions in annual PSC limits were there appreciable direct effects for the years 2011-2014 (Table 55). Results for non-constraints are omitted. Only for the option to reduce the annual performance standard by 60% (option 2) was there any reduction in PSC and even still only in 2011 for the inshore CV sector (by 7,127 Chinook salmon or 32% of the 2011 total).

It should be noted that vessels would have faced a lower PSC limit and/or performance standard threshold from the beginning of the year and in all recent years would have had an incentive to avoid Chinook throughout the year to avoid reaching the limits. Analysis of this alternative was limited to considering historical catch and employing cut off dates based on a new B season threshold only as a worst-case scenario evaluation. This evaluation however is limited by an inability to quantitatively estimate what behavior changes would occur by industry revising the IPAs to accommodate these potential restrictions and improve incentives accordingly. It is unknown whether the gap between the performance standard threshold and PSC limit would encourage IPAs to be more likely to risk exceeding the lower level in those years and if so revise the IPA for the resulting PSC limit of their portion of the 47,591, and/or respond slowly to the need to operate under the lower performance standard as the PSC limit would not be imposed until the third of 7 years. In addition, it is uncertain whether sectors, cooperatives, CDQ groups, or individual vessels would opt-out of the IPA (e.g., a sector chooses not to submit an IPA, or a cooperative, CDQ group or vessel chooses not to participate in an IPA), and instead be subject to the opt-out allocation, which is the sum of each opt-out vessel's portion of the opt-out cap of 28,496 or the performance standard threshold, whichever is less. Sectors, cooperatives, or CDQ groups that opt-out would not receive any direct allocation of Chinook salmon. As the opt-out cap is approached, NMFS will close the pollock fishery to opt-out vessels to prevent exceeding the opt-out allocation.

Impacts to Chinook and chum under Alternative 5 are estimated to be reduced from Alternative 1 contingent upon the IPA response to lower cap and threshold levels. Exceeding the performance standard and being allocated the PSC limit appears to be more likely under Option 2 with a low performance standard cap and high PSC limit IPAs will choose between a very low performance standard and a PSC limit 3 times as high. Alternative 5 is the only alternative under consideration that provides an explicit mechanism to increase bycatch reduction measures in times of low western Alaska Chinook abundance. The intent of reducing PSC limits under this alternative is to reduce the risk to western Alaska Chinook salmon stocks when they are at critically low levels of abundance. Chinook salmon stocks in western Alaska continue to fail to meet escapement goals, and consequently all sources of mortality must be reduced.

3.5.5.1 Time lag considerations for specifications versus biological predictive capacities

The Council specifically requested in June 2014 that: "Analysts should also describe potential methods for addressing the time lag between the population's vulnerability to marine fishery bycatch and the population statistics in the trigger." A qualitative evaluation to address this follows.

Bycatch occurs on salmon runs prior to when information is available to trigger the lower performance standards. That is, only part of the bycatch will occur on the runs in the first year when a trigger occurs to lower the performance standard (some will have occurred in the years prior to the trigger due to factors related to the AEQ). Some components of the salmon returns are vulnerable to bycatch before the run strengths can be evaluated. The situation that would be most problematic (and least effective) is if the trigger was reached in solitary years and subsequent years the run-strengths index returned to higher levels. In this scenario, the additional constraints on fisheries would likely be less effective since a significant part of the impact may have been due to previous year's bycatch due to the fact that not all bycatch would have returned in the year it was caught. In practice, a significant component of the lagged effect is from the previous year (and also the current year). A scenario where the measure would be more effective is if the index of run strengths were correlated through time--i.e., when salmon returns were below the trigger, it would stay poor for a few years before recovering. This is the scenario that is evident historically with Chinook salmon runs.

For illustration, imagine a scenario of 4 consecutive years of below-trigger run-strength index values followed by a 5th year in which run strengths improve to above the index threshold. In the first year the added constraint on the pollock fishery would have had beneficial consequences for the salmon that were maturing in that year, but the immature salmon in previous years would have had less benefit. However, in the 2nd year and 3rd year, the beneficial aspects for lower relative incidental takes of salmon would be greater (since the constraints would have covered more of the AEQ fish). In the 4th year, the constraints would be effective for fish returning that year but less effective for the immature bycatch in that year (since they are from a more abundant cohort as will be deemed in this example in years 5 and 6). So on balance, the potential effectiveness of such an additional triggered measure will be less effective if the runs are characterized as having irregular, 1-year triggers and more effective if there are periods of poor salmon runs spanning a few years. The latter scenario is more typical for salmon runs, as the previous year is a good predictor of the following year. In this scenario, measures will be less effective in the first year beginning of the period (due to the lag effect between age of the bycatch and expected maturation) and overly cautious in the last year at the end of the period (due again to the lagged effect and the fact that the measures apply to a portion of the salmon population where it is less important).

Table 55. Numbers of PSC salmon that would have been saved (or t of pollock forgone) and the week of the year that the sector specific Chinook salmon PSC limit would have been attained if Alternative 5 Options 1 and 2 would have been in place without behavioral change.

Option 1, 25% reduction in Sector allocations of Chinook salmon PSC

	Shore-based CVs			CVs to Motherships			CPs			CDQ			
	A	B	Subtot	A	B	Subtot	A	B	Subtot	A	B	Subtot	Total
Chinook salmon after limit reached													
2011					3	3							3
2012													
2013													
2014													
Pollock (t) after limit reached													
2011					58	58							58
2012													
2013													
2014													
Non-Chinook after limit reached													
2011					6	6							6
2012													
2013													
2014													
Week limit reached													
2011					Oct 10								
2012													
2013													
2014													

Option 2, 60% reduction in Sector allocations of Chinook salmon PSC

	Shore-based CVs			CVs to Motherships			CPs			CDQ			
	A	B	Subtot	A	B	Subtot	A	B	Subtot	A	B	Subtot	Total
Chinook salmon after limit reached													
2011		5,742	5,742		1,385	1,385							7,127
2012													
2013													
2014													
Pollock (t) after limit reached													
2011		19,533	19,533		5,414	5,414							24,946
2012													
2013													
2014													
Non-Chinook after limit reached													
2011		3,026	3,026		690	690							3,716
2012													
2013													
2014													
Week limit reached													
2011		Sep 19			Sep 26								
2012													
2013													
2014													

3.5.5.2 Effect of alternative caps or performance standards

Comparing threshold reference points (for run-strength) with the options for PSC limit reductions are shown in Figure 35. Note that the “outlier” years were omitted in evaluating a relationship between bycatch and run strengths since this was prior to IPAs being in place. A goal in the design of Amendment

91 (status quo) was to try to provide incentives to avoid bycatch at all run-sizes. That is, the impact rate (effect of the pollock fishery on the Chinook salmon stocks) is shown by the slope of lines through the origin in Figure 35 (and presented annually in Figure 31). As noted above, it appears that the impact rate since 2011 has remained low and projections for 2013 and 2014 indicate that the value continues to be just under 2%. Whereas there are too few years under Amendment 91 from which to make comparisons, presently indications are that the impact rate has remained at historically low levels, even given low Chinook salmon stock conditions in western Alaska. The current performance standard threshold and combination of allocating vessel bycatch and IPA activities contribute to these low impact rates. However, if for some reason the current performance standard PSC had been attained (which is highly improbable given how vessels are behaving under the current Chinook conditions), the impact is much higher than when compared to scenarios if either the Options 1 or 2 limits were reached during 2011-2014 (Figure 36). It is worth noting that under the existing Amendment 91 provisions, the impact rate was lower than it would have been had any of the proposed limits been reached. However, the intent of this alternative is that reducing the overall limits would not encourage the fleet to reach them but to increase incentives further to remain well below them, particularly at low stock sizes.

In many fisheries management settings, when stocks are deemed in need of rebuilding (as Chinook salmon in many of the western Alaska systems are), fishing mortality rates are adjusted downwards to promote rebuilding (e.g., for the NPFMC groundfish management plans under Amendment 56). Whereas it is unlikely that the PSC from the pollock fishery is the cause of the current depleted state of the Chinook salmon stocks, the limits imposed are intended to provide parallel constraints on PSC catch rates and contribute to reduced Chinook mortality from all sources. Reduced caps at low Chinook salmon run sizes are intended to be a proxy mechanism to reduce impact rates. Such an “idealized” rate to promote rebuilding may be difficult to achieve with step-changes in caps in which the cap returned to a higher level after being reduced by the 3-river index. For example, as the run size decreases, the relative impact rate if bycatch was at the PSC limit could increase (Figure 37). This is caused by the step-change in the threshold amount rather than a proportional decrease in the performance standard threshold related directly to salmon abundance. It also assumes that the PSC limit would be attained while the purpose of decreasing PSC limits is to continue to increase the incentive to remain below these levels particularly at extremely poor Chinook run sizes.

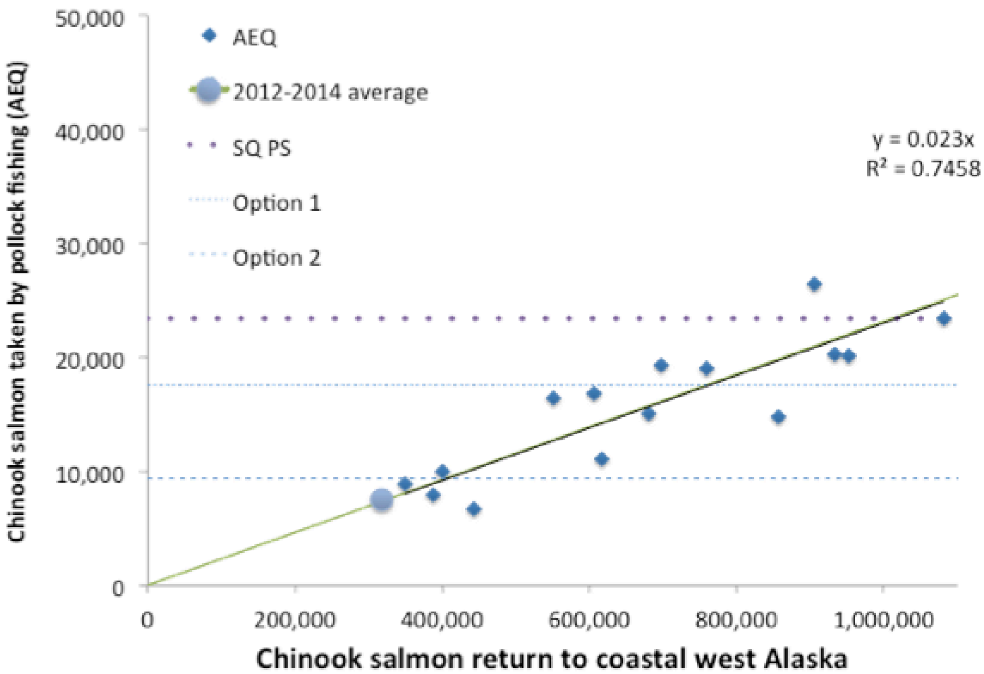

Figure 35. Relationship between in-river run abundance for coastal west Alaska and the bycatch AEQ values. Horizontal dotted lines represent the AEQ mapping of PSC for status quo performance standard (23,448 Chinook salmon in AEQ terms) and Alternative 5, options 1 and 2 (17,586 and 9,379 Chinook salmon in AEQ terms, respectively). The thick diagonal green line is the estimated impact post Amendment 91 (~2%).

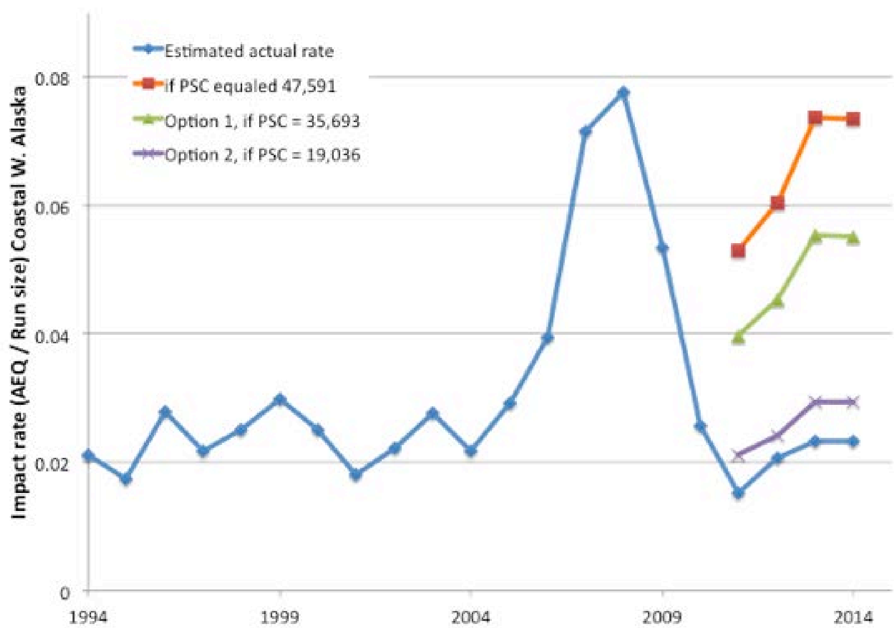

Figure 36. Estimated impact rate by year to coastal west Alaskan Chinook salmon runs (vertical scale) and projected "what-ifs" had the PSC equaled different levels. Note that run-size for 2013 and 2014 was assumed to equal that of 2012.

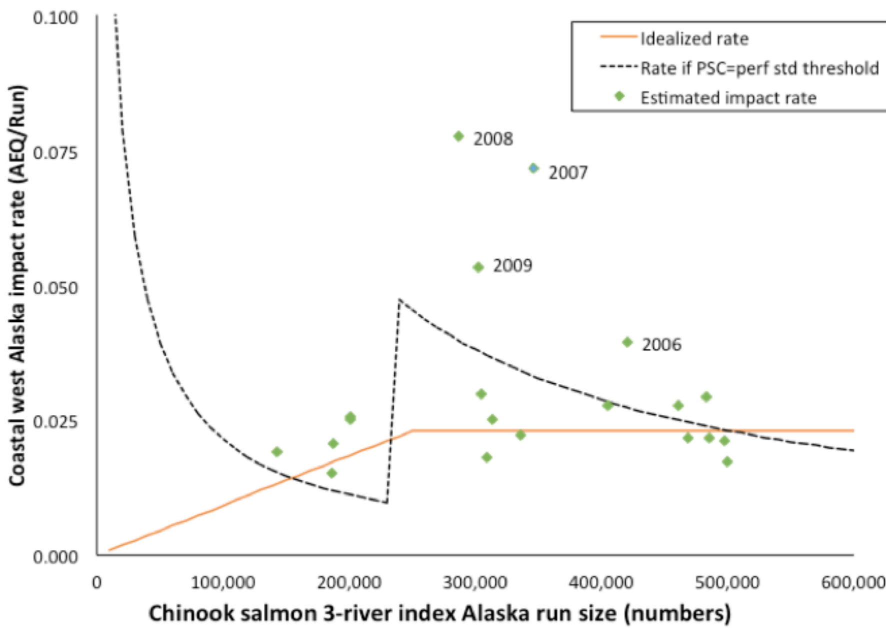

Figure 37. Estimated impact rate to coastal west Alaska stocks versus historical 3-river run index (points) compared with an "idealized" rate which decreased at low stock sizes (solid line) and an example of what the rate would look like if the performance standard threshold was reached (dashed line).

3.5.5.3 Biological implications of returning fish

Under Alternative 5, the PSC limit structure is explicitly established to be reduced in times of low Chinook abundance (as defined by the threshold as described in section 2.6.4). While Am 91 is structured with the IPAs to reduce bycatch at all levels of abundance, analyses have shown that additional measures could be taken to reduce bycatch below current levels (see Section 3.5). Hence this alternative structure is based on the need for additional provisions to reduce bycatch when these stocks are critically low. As described previously, the impact rate of the pollock fishery on western Alaskan Chinook stocks is less than 2% in recent years. Additional measures to constrain the fishery and/or provide incentives to reduce bycatch further will further reduce the impact of the fishery. Whereas as shown above, the magnitude of additional fish due to added bycatch measures may be low, their importance to ensure stock recovery is important to articulate.

Escapement goals for salmon stocks represent the estimated number of spawning fish required to maintain the stock at levels which provide for sustained yields. Index run sizes identified as falling below a threshold under Alternative 5 are those that are broadly insufficient to meet multiple escapement goals, despite dramatic harvest reductions (including closures) to in-river fisheries. The State of Alaska, under the policy for the management of sustainable salmon fisheries, mandates "salmon fisheries shall be managed to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning." Therefore, escapement goals established by ADF&G are representative of reproductive spawning abundance that is deemed necessary for long term viability of the population and maintenance of sustained yields. Consistent failure to achieve escapement goals is detrimental to the long-term productive capacity of these stocks. Any additional fish returning to those rivers improves the ability to meet the escapement goals (e.g., a level of spawning abundance).

Additionally, for the Upper Yukon, escapement and harvest sharing goals of transboundary stocks are identified management objectives agreed to by U.S. and Canadian governments under the Yukon River Agreement of the Pacific Salmon Treaty (see section 1.4.10 for more information). Therefore treaty considerations are also important in considering the sustainability of this stock, and considering what additional management measures could be pursued in order to improve the ability to come closer to meeting established escapement goals.

3.5.5.4 Considerations for PSC limit reductions

Would vessels have been impacted by lower caps without changes in behavior?
It is unclear to what extent the current structure of the IPAs would remain under reduced PSC limit. Some features of the current IPAs that are structured for the specific vessel-level provisions of the IPA intent may need to be modified to be effective under this Alternative. Some concerns noted by industry participants by sector include the following[27]:

> *The current rules of salmon savings programs could be adjusted with respect to the number of salmon and rules within the IPA for treatment, but there will always be a non-linear behavioral response to catching salmon. Lowering the hard cap may be more likely to enact behavioral change but under any scenario there is always likely to be some form of 'breaking point' whereby additional pressure by a cap level will no longer result in additional bycatch reduction. For some sectors there was an impression that salmon allocations are treated as a budget to be managed not a limit to be avoided based upon initial allocation[28].*
>
> *It is likely that as the cap levels are decreased, the vessel-level restrictions under the IPAs will become more liberal to allow for additional flexibility under more constraining caps and that the likelihood of reaching the performance threshold limit in a given year at low cap levels increases. IPAs might consider removing the current practice of establishing buffer levels (prior to allocating salmon to vessel level). Trading and transferability is could be utilized more under lower cap levels, but vessels may not be willing to trade because they have so little Chinook allocated. Risk-sharing may become more likely than conservation measures.*

To demonstrate some of the difficulties of applying current IPA structure to reduced PSC limits, the current individual vessel allocations in the CP and CV IPAs were reduced to the proposed PSC limits to best evaluate what number of salmon would be allocated by vessels under this alternative, absent any changes to the current IPA structure in these sectors. For CPs this allocation was compared against actual bycatch 2001 through 2014 to evaluate the number of vessels, absent other behavioral changes, that would have reached their allocation in a given year and been forced to either lease pollock, transfer salmon or stand down fishing.

For catcher processors, from 2011 through 2014 PSC of Chinook salmon was less than the allocation would have been under option 1 for all vessels. However, under Option 2 vessels would have reached their allocation 9 times in those four years. Under that option (60% reduction in PSC performance standard threshold) two vessels reached their allocation in 3 out of those 4 years and two other vessels also would have reached their annual allocation. These vessels would have had to make decisions regarding either purchasing salmon or leasing out their pollock for the fleet to catch its pollock quota.

For shore-based catcher vessels, there are many (~45) individual boats that are operating with less than 200 Chinook salmon (annually) allocated under the status quo performance standard threshold and

[27] Based upon personal communication obtained from members of the pollock industry in conjunction with the February 2015 Council meeting.
[28] See section 3.5.7 for additional information on original Amendment 91 allocation percentages and usage under status quo.

reductions being considered will likely result in greater difficulty for individual vessels under current operational and allocative procedures (Figure 38). However, it is not necessarily the case that these vessels will be the most impacted; they have smaller Chinook allocations because they have less pollock and therefore have more flexibility about when to catch it. The SSIP may consider modifying how allocations are done at the vessel-level or consider operating on a cooperative rather than explicitly vessel-based allocative level.

Additionally the concept of combining across all alternatives to provide additional bycatch reduction and fishing flexibility would not necessarily be equivalent across or within sectors. For example, participants in the Hake fishery and the Whiting fishery would be less likely to be able to take advantage of earlier seasonal openings under Alternative 5 than other participants, and combining both earlier seasonal openings with increased quota in A-season has the potential to disrupt maintenance schedules for vessels and cause these to be rescheduled at other times of the year. Additionally shortening the B-season in combination with other alternatives also compresses the shipyard maintenance schedule prior to the B-season start time. The vessels which are most likely to take advantage of tools for flexibility such as additional quota in the A-season are the ones which have more flexibility to begin with.

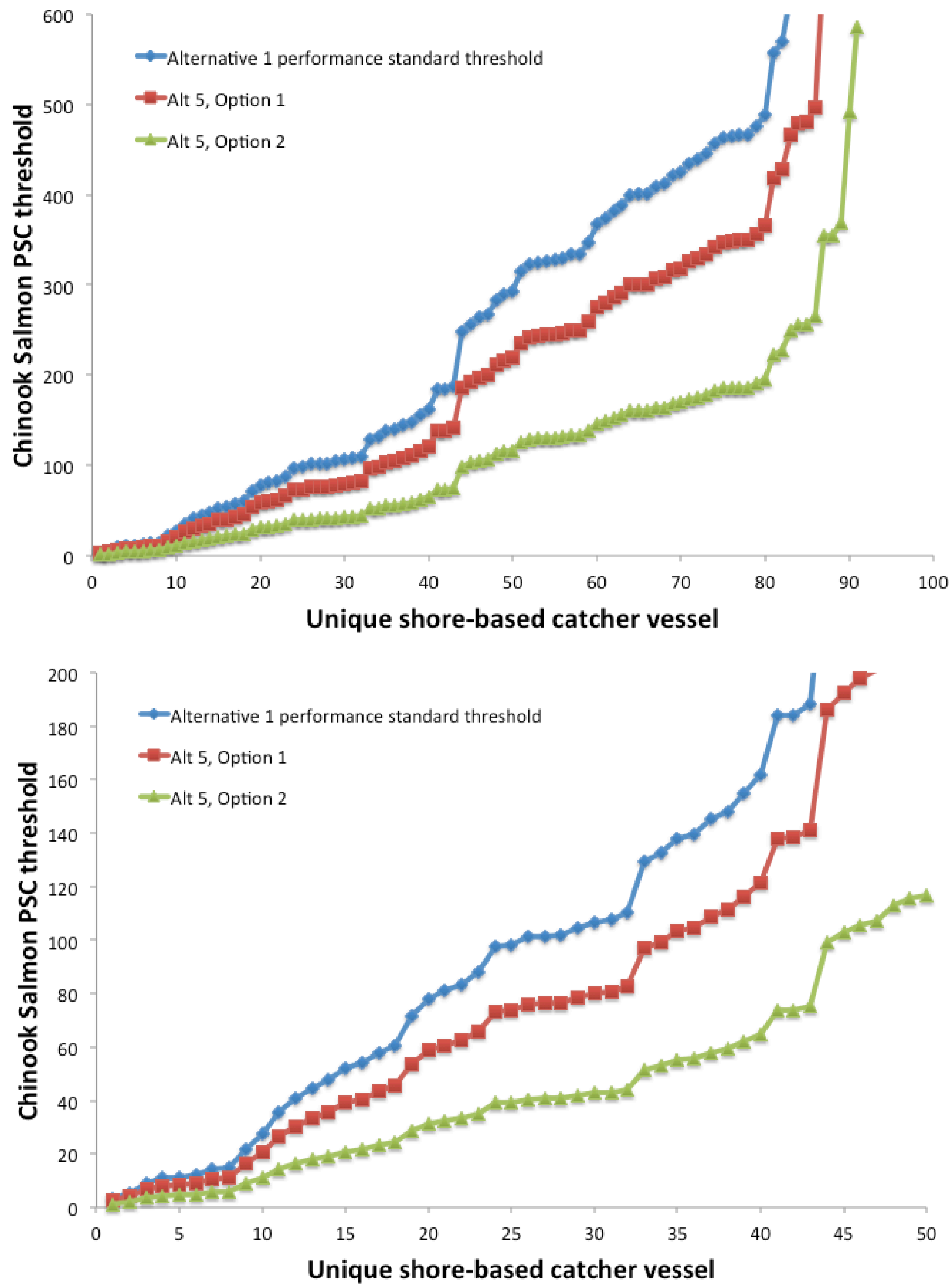

Figure 38. Individual vessel allocations under status quo and likely allocations under options 1 and 2 of Alternative 5 (bottom panel shows the same data but at finer scale for the 50 boats with the lowest Chinook salmon PSC allocation).

Under this alternative, the Council is considering if the PSC limit and/or performance standard threshold should be adjusted in times of low in-river salmon abundance. The relationship between the PSC limit, the performance standard, and the parallel or differential reduction of both, needs to be considered in designing a system that ideally promotes the best incentive to stay below the performance standard.

Likely vessel behavior under reduced caps[29]

At the start of any year vessel operators lack knowledge whether it will be a low or high-PSC year, so they have reasons to be conservative. Even if it were desirable for the vessels, it would be challenging for them to "fish to the cap." The incentives to avoid doing this under the Inshore SSIP and MSSIP are even stronger to because these programs have substantially restricted the ability of individual vessels to purchase Chinook allocations from other vessels if they exceed their share of the PSC limit. Because there are significant, dense concentrations of Chinook on the fishing grounds that have been caught historically, skippers and vessel owners face the constant fear and risk that a bad day could expend all of a vessel's salmon allocation. The fleet has been able to avoid this outcome to date, but this is not an unreasonable fear.

An additional reduction in the PSC limit would force vessels to move even more quickly away from high-bycatch locations, even when this is expensive. It would likely induce changes in timing that would lead to more fishing earlier in the B-season. However, if salmon return quickly to the grounds, it is very difficult to predict the difficulty that vessels have to avoid high-bycatch areas.

Presumably new information sharing implemented through Sea State is already making it easier to learn about the bycatch conditions in different locations and this process can be expected to continue to improve. A lower PSC limit would provide an additional incentive for further excluder improvement.

The gap between the performance standard limit and the PSC limit under a lower performance standard threshold and PSC limit

The gap between the PSC limit and the annual threshold provides a potential incentive for vessels to conserve in years where they do not need to approach the PSC limit.

Lowering the performance standard threshold, while keeping the PSC limit at its current level, would provide an incentive in many years for vessels to stay below the performance standard threshold. This would be expected under most conditions, because operators would not know if next year would have higher bycatch. The larger gap between the annual threshold and the PSC limit, as in Option 2, would provide an insurance policy that will protect the pollock industry in the event of a rapid return to higher Chinook conditions. One concern, however, a vessel or sector might approach or exceed their share of the annual threshold early in the year and be faced with the choice to either have to very aggressively avoid Chinook or accept this as one of the years above the annual threshold with a very large increase in their Chinook allocation.

The different options and sub-options proposed under Alternative 5 propose different combinations of reductions in the performance standard threshold and the PSC limit. The Council can choose the levels that it wants for the performance standard threshold and the PSC limit, but there are likely to be different design changes in the IPAs and behavior by vessels within the different options and sub-options.

Amendment 91 does not mandate the strength of incentives that must be part of the IPAs. As discussed elsewhere in this analysis, it requires that basic requirements be established for approval, but the IPAs do not have to meet any thresholds of effectiveness. There are observable differences is behavior post-A91, but we cannot clearly distinguish the impacts of the PSC limit versus the incentive measures under the IPAs. This is not to suggest that Amendment 91 is not having an impact; if Amendment 91 had been in

[29] It should be noted that we do not know the upper limit of how much Chinook could appear on the grounds. Here we analyze the likely impacts of the vessels and IPA managers to changing PSC limits, but this is not to disregard the possibility that abundant Chinook salmon could appear on the fishing grounds in the future.

effect in 2007, bycatch would have been reduced by at least 50 percent. The goal of Amendment 91 with the IPA system is to provide incentives at all levels of salmon abundance, recognizing that these levels may vary across years.

If there were only one annually allocated PSC limit, there would be limited incentive to avoid Chinook in years when Chinook encounters are well below the cap level. Because salmon allocations can be sold among vessels, the incentive to avoid salmon would increase as PSC levels approach the PSC limit because a vessel could sell salmon allocations that it does not need. Because there is uncertainty about bycatch rates for all vessels, however, vessels may be reluctant to sell their salmon to other vessels early in the year.

The gap between the performance standard threshold and the PSC limit can potentially be used to induce lower bycatch in an IPA system, but because of the large degree of flexibility that IPA designers have in deciding how strong incentives will be, there is no direct relationship between the size of the gap and the strength of incentives in the programs. For any given performance standard threshold, a larger PSC limit will definitely help to ensure that vessels in the pollock fishery can catch their pollock and target and produce higher value products.

Focusing on a comparison of a change of the status quo to option 1 and sub-option 1 is useful for focusing on the effect of the gap between the PSC limit and the performance standard threshold.

Moving to option 1, reducing the performance standard threshold but not the cap, would have several impacts on the IPAs functioning:

- Each year the base Chinook allocation within the IPAs would be reduced under all the programs.
- Under the SSIP and MSSIP, vessels would stop earning credits and start using previously acquired credits earlier.
- Under the CP/CDQ IPA, some vessels will be more likely to be in the position of needing to adjust their behavior or obtain additional Chinook allocation.
- For the same amount of Chinook on the fishing grounds, it is more likely that the performance standard threshold will be exceeded, although vessels are likely to make adjustments in the timing, location, and potentially excluder usage to further lower their bycatch.
- Comparing Option 1 to sub-option 1, with a higher PSC limit and the same performance standard threshold, the advantages of exceeding the threshold are greater if the gap is larger (under Option 1). If the IPA makes a year one of its 2 of 7 years, it will get access to more Chinook PSC as a result than in other years.
- This is a temporary change in the cap level, so it is reasonable to have a larger buffer to allow vessels to use the buffer if Chinook encounter amounts increase dramatically, hopefully indicating near-future increases in in-river returns. However, at the individual level, vessels could be in the position that they would be over the performance standard threshold and therefore have no incentive to not use their stored credits under the SSIP and MSSIP.

Figure 39. Status quo and options under consideration for alternatives showing performance standard threshold and PSC limit.

Changes of the performance standard threshold and PSC limit under the inshore and mothership SSIP

By sectors, there are different implications of the spread between the performance standard threshold and the PSC limit. Under both SSIP programs, previously earned credits allow vessels to go over the performance standard threshold (See Section 3.4.8.6 for extensive discussion on how CV and MS vessels earn credits). In current form, the decision to go over the performance standard threshold is at the individual level. But if a number of vessels exceed the cap, under the performance standard, this can make the year one of the 2 of 7 years when the IPA as a whole exceeds the performance standard threshold. The SSIP participants might choose revise the program to better ensure that they do not go slightly over the performance standard threshold for a year because just a few vessels significantly exceeded the threshold. Without Council stipulation, the IPAs may also choose to adjust the persistence of credits or the earning rate as well in any manner than they choose with the changes in the performance standard threshold.

Under the SSIP, anytime a vessel goes above their threshold, they begin consuming earned credits and have no individual incentive to retain the saved units that will expire that year. Under the inshore SSIP program, vessels decide if they will use credits and once they exceed the performance standard threshold and begin using credits they will have a supply of credits from 3 years before for MSSIP and 5 years before that will expire this year if they do not use them. This could also mean that a vessel would save diligently for several years but never have any opportunity to use the credits because other vessels used their credits causing the IPA as a whole to exceed performance standard threshold for 2 years, forcing adherence to the performance standard threshold in subsequent years.

The SSIP programs will be challenging because individuals can decide to go over the annual threshold without it collectively being one of the 7 years. It seems that the larger the gap between the annual and PSC limit, the more likely that this feature would have to be adjusted through an IPA amendment to prevent vessels from assuming that other vessels are likely to exceed the cap and therefore they should as well.

To summarize the potential impacts under Alternative 5 on the SSIP:

- The inshore SSIP and MSSIP will have to address how existing credits apply at the lower performance standard. Most vessels have many credits already and therefore could go to the PSC limit level if they chose to.
- The programs are likely to make changes that will prevent a small number of vessels from causing an IPA to exceed the performance standard threshold even when many vessels are well below it.
- In the current form, members of the IPA can chose to make the incentives for additional reduction as strong as they like, so the amount of savings that will be gained below the performance standard threshold is unknown.

Possible changes under the current CP/CDQ Program

Beyond the PSC limit, the incentives for avoiding Chinook under the CP/CDQ IPA are that if a vessel has high bycatch, it may be closed out of an area through the RHS program. If fleet bycatch rates are high enough, fixed late-season area closures can also apply. Additionally, the IPA has an early-season fixed closure.

Under the current CP/CDQ IPA, there is no potential additional incentive generated by the larger spread between the performance standard threshold and PSC limit. The members decide whether to have a year be one of the years that the cap is exceeded and if so the vessels allocate Chinook up to the PSC limit amount.

The members of the IPA could decide to abandon the IPA and adopt the lower hard-cap in perpetuity. The Council would need to decide whether the gains from having a lower PSC limit are justified. The Council could set an even lower PSC limit in response, which would potentially impose additional costs on the fishery if Chinook salmon return to the fishing grounds.

Members of the CP sector developed and proposed an IPA before Amendment 91 was implemented but the Council adjusted the PSC limit downwards during final action and the IPA participants chose adopt a less stringent IPA.[30] So it is possible that the sector could remove the fixed closures if the Council further reduces the performance standard threshold and/or the PSC limit, but the vessels have an incentive to avoid the areas anyway, especially under lower caps.

In summary, to summarize the potential impacts under Alternative 5 on the CP/CDQ program:

- We cannot say how much the current IPA is reducing Chinook below the performance standard or whether the IPA will be changed if Alternative 5 is chosen.
- More of a gap between the performance standard threshold and the PSC limit will make reduce the likelihood the fishery will be greatly harmed by increasing Chinook on the grounds. It will not provide a greater incentive for Chinook reduction under the current IPA.

Challenges of the performance standard

During final action of Amendment 91, the Council chose to implement the performance standard, which presented several operational difficulties to implementing IPAs. Rather than allowing individual vessels to exceed the annual threshold after years of being below it, everyone in the IPA was linked together so that a fleet could only exceed the performance standard in a year. The ratio between the PSC limit and the annual threshold amount was not based on designing the perfect mechanism, but different levels that

[30] Industry proposal available at: http://www.npfmc.org/wp-content/PDFdocuments/bycatch/salmonICA409.pdf; SSC analysis presentation is available at: http://www.npfmc.org/wp-content/PDFdocuments/bycatch/HaynieICA309.pdf.

the Council considered when designing the program and the Council's comfort at the time with different levels of Chinook bycatch.

There are limitations with the performance standard as it currently is in place. The systems as they are currently set up have "use it or lose it" points that result from the fact that an IPA as a whole – not an individual vessels – use one of their years above the performance standard threshold without being forced to adhere to the lower threshold in perpetuity. This makes the IPAs less effective than they could be if they had more continuous incentives for avoidance.

In its current form, the performance standard could be adapted so that instead of having 3 of 7 years to collectively exceed the performance standard threshold, vessels would be faced with the ability to go to the higher cap independently and only proportional to the degree to which members of the IPA were below the performance standard threshold the previous year. Additionally, there could be the requirement that any excess in a year would have to be met with a proportional reduction the following year.

The SSC analysis of the proposed plans in 2009 demonstrated how different systems where vessels have to maintain an average level would achieve Chinook reduction below the performance standard threshold level. This would provide continuous incentives for vessels to avoid Chinook in all years.

Because there can be a lag between bycatch rates and in-river run strength, it is very difficult to smoothly choose the "correct" cap level that will make vessels avoid Chinook under all conditions but also make it unlikely that the pollock fleet will be unnecessarily restricted.

3.5.6 Alternative 6 (preferred alternative)

Alternative 6, the Council's PA, is a combination of elements of Alternatives 2, 3, 4 and 5. As such the analysis of the impacts of this alternative are best reflected in the sections as noted below. Further discussion of the implications of combining these alternatives and likely implications are summarized below.

Table 56. Alternative 6 table of impacts to Chinook and Chum salmon

Management Provision (and Alternative/Option)	Section Reference Where Impacts to Chinook and Chum Salmon Characterized
Move Chum bycatch into IPAs (Alt 2)	Section 3.5.2
Additional Chinook Provisions within IPAs (Alt 3 options 1-5)	Section 3.5.3
Reallocation of pollock quota 5% to A-season (Alt 4, option 3, suboption 45%(A)/50%(B)	Section 3.5.4.2; Table 46, Table 48, Table 49, Table 50
Reduced PSC limit and performance standard threshold in years of low Chinook abundance	Section 3.5.5
Combination of all elements	Section 2.8; Tables 14, 15

Discussion of combined approach

As with each of the other alternatives, the **impacts to Chinook and chum under this alternative are estimated to be reduced from Alternative 1.** Specifically the combination of increased incentives, flexibility in catching pollock at times where chum and Chinook bycatch may be reduced and provisions for an explicit cap level reduction during times of low abundance are considered to be complementary measures to further reduce bycatch of both salmon species and provide for improved management as compared with status quo.

Moving chum into the IPAs (Alt 2) is considered to have a similar impact to Alternative 1 on Chinook bycatch. The other elements of Alternative 6 interact to reduce Chinook salmon bycatch. Exactly how this will occur is uncertain because Amendment 91 provides significant flexibility to the pollock industry to develop IPAs.

Because the Mothership and Catcher Processor / CDQ IPAs have already incorporated several of the features of Alternative 3 into their IPAs in 2015, the sectors affected by each option of Alternative 3 are expected to be as follows:

Table 57. Sector adjustments of Alternative 3 Options.

	Sectors that will have to adjust to each option		
Alternative 3 options	**Catcher vessel**	**Mothership**	**Catcher Processor**
1. Outlier incentives	X	X	
2. Excluder usage	X		
3. 3-year credit duration	X		
4. Hotspot system throughout year	X		
5. October rate similar to earlier	X	X	X

Alternative 6 is expected to decrease the amount of pollock caught in B season by up to 5 percent. How this will affect the timing of fishing by individual vessels is unknown, but it will enable vessels to complete their pollock fishing and should reduce Chinook bycatch as a result of any reduction that occurs later in the season. Because of this and current efforts by industry to reduce Chinook bycatch, the net reduction in Chinook from the options added to the IPA requirements could be reduced because there is likely to be less fishing in October. This means, for example, operating excluders or the rolling hotspot program late in the year may not affect as many vessels or trips.

The combination of measures from Alternatives 4 and 5 (pollock reapportionment and cap reductions) is likely to make it easier for vessels to stay below their allocations under a reduced performance standard threshold and PSC limit because it is less likely that vessels will need to fish in the high Chinook bycatch period late in the B-season to catch their pollock allocation.

Because under Alternative 6 the gap between the performance standard threshold and the PSC limit has increased from 26 to 35 percent of the performance standard threshold relative to the current gap, the incentive to participate in an IPA does not appear to be diminished. The reduced duration of credits for inshore vessels makes it more likely that credits earned in a year will be useful in the future, although it is apparent from public testimony that vessels and companies are striving not to need to use the credits at any point.

3.5.7 Data and considerations for differential approaches by sector

In conjunction with the Council's June 2014 motion, a request was made that "Analysts should provide data and considerations to inform an approach to differentially apply the seasonal adjustments under Alternative 4 and the reduction in the performance standard among the CV, CP and MS sectors under Alternative 5".

Under Alternative 4, data are provided for considering a differential application of the seasonal adjustments across sectors in Table 40 and Table 41 (interpolated for actual closure dates for Chinook and chum salmon PSC remaining after that date) and Table 45 and Table 46 (for actual week-ending dates historically and Chinook salmon PSC and pollock catch remaining after those dates). While impact analysis results overall for Alternative 4 are characterized by summing the salmon saved or pollock forgone across all sectors, data are provided to assess differential impacts to each sector by the closing dates considered in Alternative 4 (September 15, October 1, October 15). Thus the relative impacts to each sector by differential dates can be taken from the tables provided in Section 3.5.4.

For Alternative 5, consideration of a differential reduction in the performance standard across sectors requires consideration of the original allocation formula for Amendment 91, and usage by sector in conjunction with allocation since 2011. Recall that the allocations considered under Amendment 91 ranged from percentage allocations to sectors based upon AFA pollock allocations, allocations to sectors based upon historical usage over a range of years and time frames from 1997-2006, and weighted averages combining historical percentages with AFA pollock-based allocations. The resulting allocation scheme that was selected and implemented was the following: A blended estimate of the5-year (2002-2006) historical average of the annual proportion of Chinook salmon by sector within each season, adjusted by blending the reported bycatch for CDQ and non-CDQ partner sectors. This was then weighted by the AFA pollock allocation for each sector. In each season, the proportional allocation by sector is comprised of 0.75 multiplied by the adjusted 5-year historical average bycatch by sector and 0.25 multiplied by the AFA pollock allocation by sector. The resulting seasonal allocations by sector are the following:

A season: CDQ 9.3%; inshore CV fleet 49.8%; mothership fleet 8.0%; offshore CP fleet 32.9%
B season: CDQ 5.5%; inshore CV fleet 69.3%; mothership fleet 7.3%; offshore CP fleet 17.9%

In order to address the Council's request, a comparison was made using the performance standard of 47,591, allocated seasonally (70:30) and by sector under Amendment 91 with the actual proportional usage by sector since 2011 (Table 58, upper panel). Similarly, the 60% reduction in the performance standard (Alternative 5, option 2 for annual 60% reduction) was then likewise compared against historical usage since 2011 (Table 58, lower panel). No adjustment was made to account for the actual rollover that occurs (100% remainder from A to B season) as the purpose was simply to compare against the allocation percentages as currently structured. It should be noted that despite the appearance of 'overages' by sectors seasonally with the rollover from the A season no sector has exceeded its seasonal or annual proportion of the performance standard.

Table 58. Comparison of Sector-specific allocation of the performance standard (top panel) in numbers and % of total by year 2011-2014 with actual proportion of PSC used (by season). Lower panel shows similar information using Alternative 5, option 2 (60% annual reduction) for comparative purposes. 'Sector total' refers to the annual total proportion of the performance standard by sector while 'fleet total' refers to the annual proportion of the total performance standard by all sectors combined.

	Shore-based CVs			CVs to Motherships			CPs			CDQ			
	A	B	Annual Sector total	A	B	Annual Sector total	A	B	Annual Sector total	A	B	Sector total	**Annual Fleet total**
Percentage Seasonal Allocation	49.8%	69.3%	55.6%	8.0%	7.3%	7.8%	32.9%	17.9%	28.4%	9.3%	5.5%	8.2%	**100%**
47,591 performance standard (Alt 1, Status Quo)													
PSC Allocation (#)	16,591	9,894	26,485	2,665	1,042	3,707	10,960	2,556	13,516	3,098	785	3,883	**47,591**
2011	27%	141%	69%	17%	233%	77%	16%	65%	25%	14%	43%	20%	**53%**
2012	28%	35%	30%	12%	5%	10%	22%	4%	19%	11%	1%	9%	**24%**
2013	22%	43%	30%	21%	5%	16%	33%	18%	30%	15%	6%	13%	**27%**
2014	39%	27%	34%	17%	17%	17%	36%	22%	33%	22%	5%	19%	**32%**
19,036 performance standard (Alt 5, option 2)													
PSC Allocation (#)	6,636	3,958	10,594	1,066	417	1,483	4,384	1,022	5,406	1,239	314	1,553	**19,036**
2011	67%	352%	173%	42%	582%	194%	41%	161%	64%	34%	106%	49%	**134%**
2012	69%	87%	76%	29%	12%	24%	56%	9%	47%	28%	2%	22%	**59%**
2013	55%	107%	75%	52%	12%	41%	81%	44%	74%	38%	15%	33%	**68%**
2014	97%	68%	86%	43%	43%	43%	90%	55%	84%	56%	11%	47%	**79%**

Note that unlike other groundfish fisheries' percentage allocations to the CDQ, the percentage of the PSC cap in the pollock fishery is not tied to a default percentage and was purposefully changed (from a default 7.5% previously) as a decision-point in Amendment 91. The Council continues to have the flexibility to estimate the appropriate Chinook PSC cap for the CDQ fleet as it deems appropriate.

3.5.8 Comparison of impacts on salmon across alternatives

The overall impact rate (salmon bycatch/run size) under the status quo (**Alternative 1**) was estimated for the historical levels of chum and Chinook PSC from the pollock fishery to best estimate impacts at the population level. Some key western Alaskan river systems can be differentiated from the available genetic data and that coupled with available run size data allows for the calculation of the pollock fishery impact rate. For Chinook salmon, the peak impact to the aggregate Coastal western Alaska stocks (rivers in western Alaska from Norton Sound to Bristol Bay excluding the Upper Yukon) was 7.50% in 2008 (one year after the historically high bycatch in the fishery) while impact levels in 2012 were estimates at 1.98%. For the Upper Yukon the peak was also in 2008 at 4.00% with 2012 estimated at 1.35%. For chum the average impact rate (2004-2011) for Coastal west Alaska was 0.46% with the Upper Yukon (fall chum) at 1.16%. Since Chinook PSC levels have remained low, most likely these 2012 impact rates are representative of impacts in 2013 and 2014.

Alternatives 2 through 5 provide additional measures for increased avoidance of Chinook and chum PSC. Information is insufficient to compare estimated impacts in terms of AEQ or impact rates thus alternatives are compared in conjunction with whether or not bycatch is estimated to increase or decrease from status quo for each species under the proposed management.

Table **59** provides a summary of the impacts of the alternatives on Chum and Chinook salmon compared to status quo according to the significance criteria as shown in Table 27.

Alternative 2 focuses only on chum salmon measures, however, it does provide some increased flexibility for the fleet to avoid Chinook as bycatch rates increase in the B season. Alternative 2 is likely to result in similar impacts to chum salmon as with status quo PSC levels, although there is the potential for some increased chum salmon savings over status quo given some operational modifications to the proposed RHS system as well as potential for increased adverse impacts for chum if closures are ceased for Chinook. While it is not possible to directly quantify these benefits, any reduction of Chinook and chum salmon bycatch will reduce the adverse impact on salmon stocks. Therefore this alternative is estimated to have some (likely small) reduced adverse impacts as compared with status quo for salmon stocks.

Alternative 3 proposes additional provisions within the IPAs to explicitly increase the incentive for vessels to avoid Chinook salmon PSC. Any increased incentive at the vessel level that translates into increased avoidance of Chinook salmon results in reduced salmon bycatch overall. It is not possible to quantify the compliance of vessels within IPAs to these additional restrictions nor to estimate the relative reductions in salmon bycatch that would result from IPAs implementing these provisions. Option 3 to mandate excluder usage at specified times seems to provide both flexibility to the fleet in times of low salmon encounters while allowing for potentially substantial bycatch reduction in times of high encounters. Option 5 to impose penalties on the fleet seems to provide some explicit mechanism to avoid bycatch in September/October with suggestions provided as to how these may be specified. Nevertheless, this alternative is estimated to be similar to status quo in impacts under these options with the possibility of a reduced adverse impact to Chinook salmon depending upon the strength of incentives developed. The impacts to chum salmon under this alternative are estimated to be the same as with status quo.

Alternative 4 modifies the season opening and closing dates for the B season as well as the seasonal allocation of pollock. The purpose of these modifications is to provide additional tools and flexibility in opportunities and incentives for fishing earlier in the B season in order to avoid fishing late in the season when Chinook bycatch rates are historically highest. Analysis of this alternative indicates that with fishing occurring earlier in the B season under both seasonal change options, there will very likely be reduced Chinook bycatch by shifting effort away from the highest rates in September and October. The benefits in reduced Chinook bycatch by the option to modify the pollock allocations between A and B season is entirely dependent on the industry's response in the fishing behavior and the express intent to avoid the latter part of the B season. This option in and of itself does not prohibit fishing later in the B-season. Options under Alternative 4 overall are estimated to confer a reduced adverse impact to Chinook salmon. However, given that chum salmon bycatch rates are typically highest in August (with some indication that western Alaska chum are proportionally more common in the bycatch in June and July), shifting effort earlier into the B season may result in slightly higher adverse impact to chum salmon PSC compared with status quo.

Alternative 5 would modify the existing performance standard and possibly the overall PSC cap under Amendment 91 in years of low Chinook abundance. An index of the combined run sizes from three river system ('3 System Index') using the following river systems Unalakleet, Upper Yukon, and Kuskokwim in-river run reconstructions are proposed for use in determination of 'low abundance". Using this index, low abundance would be defined as an annual combined 3-system run size of ≤250,000 Chinook salmon. A range of proportional reductions to the performance standard and PSC cap are considered annually (25%; 60%) Based on data on run reconstructions the low threshold would have been reached historically in 2000 (under the one year option only) and again from 2010-2014. Estimated impacts of lowering the performance standard in 2011-2013 (data is insufficient to estimate impacts from 2001) indicates that the only threshold that might have had a constraining impact (and thus estimates salmon savings) would be the 60% annual reduction in the year 2011, based on historical activity. However, what is difficult to predict is how the pollock vessels and sectors would respond to a lower performance standard in the development of or revisions to the incentive structures in their IPAs. Current IPA structures may need to be modified to address lower cap provisions, specifically for those IPAs that allocate salmon to the individual vessel. Salmon conditions in the future are unknown and the costs and difficulty of Chinook avoidance is uncertain. Under these conditions, vessels would face a lower annual threshold from the beginning of the year and in all recent years would have an incentive to avoid Chinook throughout the year to avoid exceeding the (lowered) annual threshold. An increased gap between the performance standard and PSC limit would encourage vessels to be more likely to risk exceeding the lower level in those years and if so revise the IPA for the resulting PSC limit of their portion of the 47,591, and/or respond slowly to the need to operate under the lower performance standard as the PSC limit would not be imposed until the third of 7 years. In addition, it is uncertain whether sectors, cooperatives, CDQ groups, or individual vessels would opt-out of the IPA (e.g., a sector chooses not to submit an IPA, or a cooperative, CDQ group or vessel chooses not to participate in an IPA), and instead be subject to the opt-out allocation, which is the sum of each opt-out vessel's portion of the opt-out cap of 28,496 or if the performance standard is lower than the opt out, the opt out is equivalent to the performance standard. Sectors, cooperatives, or CDQ groups that opt-out would not receive any direct allocation of Chinook salmon. As the opt-out cap is approached, NMFS will close the pollock fishery to opt-out vessels to prevent exceeding the opt-out allocation.

Alternative 6 (combined management approach) provides an explicit mechanism to increase bycatch reduction measures in times of low western Alaska Chinook abundance. The intent of reducing cap levels under this alternative is to reduce the risk to western Alaska Chinook salmon stocks when they are at critically low levels of abundance. Chinook salmon stocks in western Alaska continue to fail to meet escapement goals, and consequently all sources of mortality must be reduced. This is similar to reducing all known sources of mortality when a fish or crab stock under Federal management is declared overfished and subject to a rebuilding plan.

How much decreasing cap levels will provide for increased incentives to reduce bycatch below the PSC cap and performance standard will depend largely on the incentive structure within IPAs under these scenarios, the distance between the PSC limit and the performance standard and the overall level of PSC limit reduction. The combination of options amongst alternatives as described under Alternative 6 provides for both increased incentives for bycatch reduction with tools to provide the flexibility to the pollock fishery to accommodate these additional constraints.

Table 59 Summary of impacts to chum and Chinook salmon in reference to the significance criteria in Table 27

	Chinook salmon	Chum salmon
Alternative 1	Adverse, not significant	Adverse, not significant
Alternative 2	Same as Alternative 1	May reduce adverse impacts compared to Alternative 1, also has the potential to increase adverse impacts relative to Alternative 1 but still not significant
Alternative 3	May reduce adverse impacts compared to Alternative 1	Same as Alternative 1
Alternative 4	May reduce adverse impacts compared to Alternative 1	May increase adverse impacts compared to Alternative 1
Alternative 5	Option 1: Same as Alternative 1 Option 2: May reduce adverse impacts compared to Alternative 1	Option 1: Same as Alternative 1 Option 2: May reduce adverse impacts compared to Alternative 1
Alternative 6	May reduce adverse impacts compared to Alternative 1	May reduce adverse impacts compared to Alternative 1

3.6 Effects on other groundfish

Vessels participating in the directed pollock fishery in the Bering Sea catch incidentally while targeting pollock. Bycatch estimates of non-target species and incidental catch of target species in the directed pollock fishery are reported annually in the pollock stock assessment (Ianelli et al., 2013). Incidental catch levels are very low, less than 1% of the total pollock catch on average (Ianelli et al, 2013).

The effects of the Bering Sea pollock fishery on fish species that are caught incidentally has more recently been analyzed in the Chinook EIS/RIR (NPFMC, NMFS 2009). The analysis concludes that under status quo, bycatch of other groundfish species in the pollock fishery will not significantly impact those stocks because incidental catch in the pollock fishery accrues towards each species or species group OFL, and NMFS closes all fisheries in which a species is caught before its OFL is reached. Therefore, the pollock fishery would be closed prior to contributing to significant impacts to other groundfish stocks. Alternatives 2 through 5 may modify the temporal nature of the fishery in the B-season but not the overall catch of pollock (and thus incidentally caught target and non-target species). Catch quotas are established for target species caught incidentally (such as pacific cod, flatfish species, skates, squid) which are designed to ensure stock sustainability. In general the catch levels of these species represent a small proportion of their overall fishing mortality from BSAI groundfish fisheries. Using the date-based formulation for evaluating bycatch rates of Chinook salmon, a number of other species were examined for shifting catch into the A-season under Alternative 4. The patterns for these species are as expected with some increases (in relative terms) in the flatfish and decreases in the Pacific ocean perch with Pacific cod and flathead sole showing only modest changes (Table 61).

Table 60. Bycatch estimates (t) of other target species caught in the BSAI directed pollock fishery, 1997-2012 based on then NMFS Alaska Regional Office reports from observers (*2014 data are preliminary*).

	Pacific Cod	Flathead Sole	Rock Sole	Yellowfin Sole	Arrowtooth Flounder	Pacific Ocean Perch	Atka Mackerel	Sablefish	Greenland Turbot	Alaska Plaice	Skates	Squid	Sharks	Sculpin	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	1,706	1,419	210	618	935	762	48	40	7	571	1,226	294	81	327	14,213
2004	6,437	2,009	2,554	841	557	394	1,053	17	18	8	841	977	187	150	436	16,477
2005	7,413	2,319	1,125	63	651	653	678	11	31	45	732	1,150	169	131	490	15,661
2006	7,291	2,837	1,361	256	1,089	736	789	9	65	11	1,308	1,399	512	169	620	18,450
2007	5,630	4,203	510	86	2,795	625	315	12	107	3	1,287	1,169	245	190	726	17,902
2008	6,965	4,288	2,123	516	1,711	336	15	5	85	49	2,756	1,452	144	281	438	21,164
2009	7,878	4,602	7,602	271	2,203	114	25	3	44	176	3,856	209	100	292	305	27,682
2010	6,987	4,309	2,330	1,057	1,502	231	57	2	26	126	1,886	277	26	258	375	19,448
2011	9,998	4,846	8,463	1,095	1,599	660	894	1	29	74	2,342	178	65	315	590	31,150
2012	10,047	3,957	6,819	1,452	735	713	263	1	53	129	2,017	495	55	286	512	27,534
2013	8,944	3,142	6,360	2,072	958	611	70	0	21	147	1,756	117	43	221	242	24,703
2014	5,193	2,537	4,380	1,927	756	1,295	117	1	41	322	811	1,478	75	189	495	19,617

Table 61. Other species taken incidentally to the pollock fishery and how they would change based on 2011-2014 data only. All units are kg / t of pollock

	A season allocation		All of A season	Mar 15th- Apr 30th	All of B Season	Jun - Sep 14	Sep 15 – Oct 31st
	45%	50%					
Flathead sole	0%	3%	4.050	3.011	0.816	0.663	2.439
Pacific cod	-4%	-4%	9.075	6.996	3.987	3.622	7.872
Yellowfin sole	3%	7%	0.900	0.261	0.004	0.004	0.006
Northern rock sole	8%	16%	5.219	3.576	0.042	0.034	0.127
P. ocean perch	-11%	-25%	0.093	0.096	0.540	0.556	0.370

Alternatives 2 through 6 will not affect the annual assessment process, and in-season management of catch quotas; therefore the effect of these alternatives on stock biomass or fishing mortality is not significant. Because the fishery is still prosecuted on the same fishing grounds under all of the alternatives, there is no anticipated change in the composition of the incidentally caught species or the availability of their prey. To the extent that some of the alternatives close the fishery earlier in the season and may result in not achieving the full pollock quota, and/or more constraining PSC caps close sectors of the fishery prior to reaching their quota, the impacts on incidental catch species may be reduced.

As seen in Table 61, alternatives under consideration may modify the amount of incidental catch taken in the pollock fishery by a very small amount. These increases or decreases in incidental catch are minor and not anticipated to affect the overall stock productivity of these groundfish stocks nor disrupt fishing activities. However in years where incidental catch levels are higher than average (for example for squid in 2014) with small quotas from incidental catch species such as squid, this could impact the available fishing areas to the pollock fleet and further complicate effective management measures to minimize salmon bycatch. This is discussed further under cumulative effects.

3.7 Marine Mammals

Alaska supports one of the richest assemblages of marine mammals in the world. Twenty-two species are present from the orders Pinnipedia (seals and sea lions), Carnivora (sea otters), and Cetacea (whales, dolphins, and porpoises). Some marine mammal species are resident throughout the year, while others migrate into or out of Alaska fisheries management areas. Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, and the continental shelf (Lowry et al. 1982).

A number of concerns may be related to marine mammals and potential impacts of fishing. For individual species, these concerns include—

- listing as endangered or threatened under the ESA;
- protection under the MMPA;
- announcement as candidate or being considered as candidates for ESA listings;
- declining populations in a manner of concern to State or Federal agencies; or being vulnerable to direct or indirect adverse effects from some fishing activities.

Marine mammals have been given various levels of protection under the current fishery management plans of the Council, and are the subjects of continuing research and monitoring to further define the nature and extent of fishery impacts on these species. The Alaska groundfish harvest specifications environmental impact statement (NMFS 2007) provides information regarding fisheries interactions with marine mammals. The most recent status information is available in the 2013 Marine Mammal Stock Assessment Reports (SARs) (Allen and Angliss, 2014).

Marine mammals, including those currently listed as endangered or threatened under the ESA, that may be present in the action area are listed in Table 62. All of these species are managed by NMFS, with the exception of Pacific walrus, polar bears, and Northern sea otters, which are managed by USFWS. ESA Section 7 consultations with respect to the actions of the Federal groundfish fisheries have been completed for all of the ESA-listed species, either individually or in groups. Of the species listed under the ESA and present in the action area, several species may be adversely affected by commercial groundfish fishing. These include Steller sea lions, Arctic ringed seals, bearded seals, humpback whales, fin whales, and sperm whales (NMFS 2010a; NMFS 2014a).

Table 62. Marine mammals likely to occur in the Bering Sea subarea.

Common Name	Scientific Name	ESA Status
Northern Right Whale	*Balaena glacialis*	Endangered
Bowhead Whale	*Balaena mysticetus*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Blue Whale	*Balaenoptera musculus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Steller Sea Lion[1]	*Eumetopias jubatus*	Endangered
Beluga Whale	*Delphinapterus leucas*	None
Minke Whale	*Balaenoptera acutorostrata*	None
Killer Whale	*Orcinus orca*	None
Dall's Porpoise	*Phocoenoides dalli*	None
Harbor Porpoise	*Phocoena*	None
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	None
Beaked Whales	*Berardius bairdii and Mesoplodon spp.*	None
Northern Fur Seal	*Callorhinus ursinus*	None
Pacific Harbor Seal	*Phoca vitulina*	None
Pacific Walrus[2]	*Odobenus rosmarus divergens*	Precluded
Northern Sea Otter[2]	*Enhydra lutis*	Threatened
Bearded Seal	*Erignathus barbatus*	Threatened[2]
Spotted Seal	*Phoca largha*	Threatened
Ringed Seal	*Phoca hispida*	Threatened
Ribbon Seal	*Phoca fasciata*	None
Polar Bear[3]	*Ursus maritimus*	Threatened

[1] Steller sea lions born west of Cape Suckling, 144° W longitude, are listed as endangered.
[2] On July 25, 2014, the US District Court for the District of Alaska issued a memorandum decision in a lawsuit challenging the listing of bearded seals under the ESA (Alaska Oil and Gas Association v. Pritzker, Case NO. 4:13-cv-00018-RPB). The decision vacated NMFS's listing of the Beringia DPS of bearded seals as a threatened species. NMFS is currently appealing that decision.
[3] Pacific walrus, Northern sea otters, and polar bears are under the jurisdiction of the USFWS. A walrus ESA listing is warranted but precluded (76 FR 7634, February 10, 2011), and scheduled for 2017.

The PSEIS (NMFS 2004) provides descriptions of the range, habitat, diet, abundance, and population status for marine mammals. Marine mammal stock assessment reports (SARs) are prepared annually for the strategic marine mammal stocks (Steller sea lions, northern fur seals, harbor porpoise, North Pacific right whales, humpback whales, sperm whales, and fin whales)[31]. 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 information from the PSEIS and the SARs is incorporated by reference.

The Chinook EIS/RIR provides information on the effects of the pollock fishery on marine mammals and is incorporated by reference. This section provides relevant and recent information since that EIS/RIR. 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.

[31] The SARs are available on the NMFS Protected Resources Division website at http://www.nmfs.noaa.gov/pr/sars/region.htm.

Table 64 and Table 63 provide a summary of the status of pinnipeds and cetacean stocks potentially affected by the Bering Sea pollock fishery. Direct and indirect interactions between marine mammals and the pollock fishery may occur due to overlap in the size and species harvested in the fishery that are also important marine mammal prey, and due to temporal and spatial overlap in marine mammal occurrence and commercial fishing activities. This discussion focuses on marine mammals that may interact-with or be-affected by the BS pollock fishery**.**

3.7.1 Effects on Marine Mammals

Criteria to assess the impacts of the action on marine mammals are listed below. These criteria are adopted from the 2006-2007 groundfish 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 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.

3.7.2 Incidental Take Effects

The Amendment 91 EIS contains a description of the effects of the pollock fishery on marine mammals in the Bering Sea (Chapter 8 in NPFMC/NMFS 2009) and is also incorporated by reference. The BS 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 66 provides more detail on the levels of take based on the most recent SAR (Allen and Angliss 2014). Overall, very few marine mammals are reported taken in the Bering Sea pollock fishery.

Table 67 shows the months and locations when incidental takes of marine mammals occurred from 2007 through 2011.

Table 63. Status of Pinniped stocks potentially affected by the Bering Sea pollock fishery

Pinnipedia species and stock	*ESA Status*	*MMPA Status*	*Population Trends*	*Distribution in action area*
Steller sea lion - Western Distinct Population Segment (DPS)	Endangered	Depleted & a strategic stock	Strong evidence suggests that overall, western DPS Steller sea lion abundance increased from 2000 through 2012. Abundance trends varied by region across the western DPS, with strong evidence of increases in three or four regions east of Samalga Pass and evidence of declines west of Samalga Pass (Fritz et al. 2013).	The western DPS inhabits Alaska waters from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters. Sea lions forage throughout the waters off Alaska and use the following terrestrial haulout and rookery sites in the Bering Sea: Hall Is., Cape Newenham, Walrus Is., St. George Is., St. Paul, and St. Lawrence Is. Critical habitat is designated around major rookeries, haulouts and foraging areas.
Northern fur seal – Eastern Pacific	None	Depleted & a strategic stock	Pup production has declined on St. Paul Is. since the mid-1990s. From 1998-2010, pup production declined 5.42% per year ($P < 0.01$) on St. Paul Is. and 2.09% per year ($P = 0.03$) on St. George Is. Production at Bogoslof Is. has grown exponentially since the 1990s. Between 2005 and 2011, pup production at Bogoslof Island increased 9.9% per year. Yet, overall population abundance is driven by the decline on St. Paul.	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 – Aleutian Is. stock, Pribilof Is. stock, and Bristol Bay stock	None	None	Aleutian Is. stock abundance estimate is 3,570 (se = 329) based on 2004 survey; current population trend is unknown though estimated to have decreased by 67% from 1982 through 1999. Pribilof Is. stock abundance estimate is 232 based on 2010 survey; current population trend is unknown. Bristol Bay stock abundance estimate is 18,577 (se = 1,080) based on 2005 survey; aerial survey data show an increasing trend.	Harbor seals are not migratory. The Aleutian Is. stock is distributed along the Aleutian Chain from Ugamak Is. to Cape Wrangell. The Pribilof Is. stock is distributed in an area south of St. George Is. and north of St. Paul Is. in the Bering Sea. The Bristol Bay stock is distributed east of an arc between Nunivak Is. and Unimak Is. in Bristol Bay.
Ringed seal – Alaska	Threatened	Depleted & a strategic stock	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
Bearded seal – Alaska	Threatened*	Depleted & a strategic stock*	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
Ribbon seal, AK	None	None	Reliable data on population trends are unavailable.	Found throughout the offshore Bering Sea waters
Spotted seal, AK	None	None	Reliable data on population trends are unavailable.	Found throughout the Bering Sea waters
Pacific Walrus	Listing warranted but precluded	Strategic	Population trends unknown. Population size estimated from a 2006 ice survey is 129,000 animals (95% CI 55,000 – 507,000) and this estimate is considered to be an underestimate given the limited area surveyed.	Occur primarily is shelf waters of the Bering Sea. Primarily males stay in the Bering Sea in the summer. Major haulout sites are in Round Island in Bristol Bay and on Cape Seniavan on the north side of the Alaska Peninsula.

Source: Allen and Angliss 2014 and List of Fisheries for 2015 (79 FR 77926).
* On July 25, 2014, the US District Court for the District of Alaska issued a memorandum decision in a lawsuit challenging the listing of bearded seals under the ESA (Alaska Oil and Gas Association v. Pritzker, Case NO. 4:13-cv-00018-RPB). The decision vacated NMFS's listing of the Beringia DPS of bearded seals as a threatened species. NMFS is currently appealing that decision. Pacific Walrus information available from http://www.fws.gov/alaska/fisheries/mmm/stock/Revised_April_2014_Pacific_Walrus_SAR.pdf

Table 64 Status of Cetacea stocks potentially affected by the Bering Sea pollock fishery.

Cetacea species and stock	*ESA Status*	*MMPA Status*	*Population Trends*	*Distribution in action area*
Killer whale – AT1 Transient; Eastern North Pacific GOA, AI, and BS transient; West Coast transient; and Eastern North Pacific Alaska Resident	None	AT1 Transient – Depleted & a strategic stock	Only 7 AT1 group whales are estimated to remain. There has been no recruitment to this population since 1984. A total of 136 transients have been identified in the Gulf of Alaska and a combined total of 451 individual whales have been identified in the Aleutian Islands and Bering Sea. The minimum abundance estimate for the West coast transient stock was 243 in 2006. A minimum abundance estimate for the Alaska Resident portion of the Eastern North Pacific stock is 2,347. Because these population estimates are based on photo identification of individuals and considered minimum estimates, no reliable estimate of trend is available for these stocks.	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.	Offshore waters from coastal western Alaska to Bering Sea.
Humpback whale- Western North Pacific Central North Pacific	Endangered	Depleted & a strategic stock	Reliable data on population trends are unavailable for the western North Pacific stock. Central North Pacific stock thought to be increasing. The status of the stocks in relation to optimal sustainable population (OSP) is unknown.	W. Pacific and C. North Pacific stocks occur in Alaskan waters and may mingle in North Pacific feeding area. Humpback whales in Bering Sea (Moore et al. 2002) inconclusively identified as belonging to the western or Central North Pacific stocks, or to a separate, unnamed stock.
North Pacific right whale Eastern North Pacific	Endangered	Depleted strategic stock	Photographic and genotype data through 2008 were used to calculate the first mark-recapture estimates of abundance for right whales in the Bering Sea and Aleutian Islands, resulting in estimates of 31 (95% CL 23-54, CV=0.22) and 28 (95% CL 24-42), respectively (Wade et al. 2011). This stock is considered to represent only a small fraction of its precommercial whaling abundance and is arguably the most endangered stock of large whales in the world.	See NPFMC/NMFS 2009 Chapter 8 for distribution and designated critical habitat.
Fin whale – Northeast Pacific	Endangered	Depleted & a strategic stock	Abundance may be increasing but surveys only provide abundance information for portions of the stock in the central-eastern and southeastern Bering and coastal waters of the Aleutian Islands and the Alaska Peninsula, and much of the North Pacific range has not been surveyed.	Found in the Bering Sea and coastal waters of the Aleutian Islands and Alaska Peninsula. Most sightings in the central-eastern Bering Sea occur in a high productivity zone on the shelf break (See NPFMC/NMFS 2009 Chapter 8).
Minke whale - Alaska	None	None	Considered common but abundance not known and uncertainty exists regarding population trend and stock structure.	Common in the Bering and Chukchi Seas and in the inshore waters of the GOA.
Sperm Whale – North Pacific	Endangered	Depleted and 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 18,017 animals. Population appears to be increasing at an annual rate of 3.2% (se = 0.5%) though below carrying capacity.	Most spend summers in the shallow waters of the northern Bering Sea and Arctic Ocean. Winters spent along the Pacific coast near Baja California.
Beluga Whale – Bristol Bay, Eastern Bering Sea, Cook Inlet, and eastern Chukchi Sea	None for all stocks except Cook Inlet, which are endangered	Cook Inlet – Strategic; rest - none	Abundance estimated at 3,710 animals trend not declining for the eastern Chuckchi Sea stock. Minimum population estimate for the eastern Bering Sea stock is 28,406 animals, but considered an unreliable estimate and trend unknown. Bristol Bay stock is minimum estimate at 2,467 animals and 65% population increase from 1993 -2005. For Cook Inlet Belugas, estimated annual decline of 1.2% from 1994 - 2005 with minimum abundance estimate of 280 whales.	Summer in the Arctic Ocean and Bering Sea coastal waters, and winter in the Bering Sea in offshore waters associated with pack ice. Cook Inlet belugas remain in Cook Inlet year round, but eat salmon that occur in the Bering Sea and are taken as bycatch.
Source: Allen and Angliss 2014 and List of Fisheries for 2015 (77 FR 77926).				

Table 65. 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.

Table 66. Estimated mean annual mortality of marine mammals from observed BS 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 (2014).

Marine Mammal Species and Stock	Years used to calculate mean annual mortality from BSIA pollock fishery	Mean annual mortality, from BS pollock fishery	Potential Biological Removal (PBR)
*Steller sea lions (western)	2007-2011	7.36	274
Northern fur seal	2007-2011	3.52	11,638
Harbor seal	2007-2010	0.30	1,167
Spotted seal	N/A	N/A	Undetermined
Ringed seal	2007-2011	1.0	Undetermined
Ribbon seal	N/A	N/A	Undetermined
Bearded seal	2007-2011	1.4	Undetermined
Killer whale Eastern North Pacific, AK resident	N/A	N/A	1.96
Killer whale, GOA, BSAI transient	N/A	N/A	23.4
Dall's porpoise	2007-2010	0.31	Undetermined
*Humpback whale, Western North Pacific	2007-2011	0.20	2.6
*Humpback whale, Central North Pacific	2007-2011	0.20	7.9
Minke whale, Alaska	N/A	N/A	Undetermined
*Fin whale, NE Pacific	2007-2011	0.00	Undetermined
Pacific walrus	N/A	N/A	2,580

Table 67. Marine Mammals taken in the pollock fishery 2007 - 2011. Locations correspond to NMFS reporting area locations (Sources: National Marine Mammal Laboratory and the North Pacific Groundfish Observer Program)

Species	Date	Location	Species	Date	Location
Steller sea lion	2007-03-13	517	Steller sea lion	2009-03-18	513
Northern fur seal	2007-08-07	513	Ribbon seal	2009-07-19	521
Northern fur seal	2007-08-21	517	Bearded seal	2009-07-30	509
Bearded seal	2007-09-11	521	Ringed seal	2009-08-06	521
Northern fur seal	2007-09-26	521	Steller sea lion	2010-02-23	509
Steller sea lion	2007-10-09	521	Steller sea lion	2010-03-03	521
Steller sea lion	2008-01-21	509	Steller sea lion	2010-03-06	521
Steller sea lion	2008-01-30	509	Spotted seal	2010-03-20	521
Steller sea lion	2008-01-30	509	Steller sea lion	2010-04-06	521
Harbor seal	2008-01-31	517	Bearded seal	2010-07-06	509
Steller sea lion	2008-03-02	517	Humpback whale	2010-07-19	517
Steller sea lion	2008-03-03	517	Northern fur seal	2010-08-04	517
Steller sea lion	2008-07-04	521	Northern fur seal	2010-08-10	521
Steller sea lion	2008-07-06	521	Steller sea lion	2010-08-12	517
Bearded seal	2008-07-08	517	Steller sea lion	2011-01-30	509
Ringed seal	2008-07-16	521	Steller sea lion	2011-02-24	509
Ribbon seal	2008-08-04	521	Steller sea lion	2011-02-26	513
Bearded seal	2008-08-17	521	Ringed seal	2011-04-01	521
Steller sea lion	2008-08-25	521	Steller sea lion	2011-06-24	517
Ribbon seal	2008-09-05	517	Steller sea lion	2011-06-27	521
Bearded seal	2008-09-05	524	Steller sea lion	2011-08-04	519
Northern fur seal	2008-09-09	521	Ringed seal	2011-08-07	521
Bearded seal	2008-09-21	524	Ringed seal	2011-08-11	524
Steller sea lion	2009-01-27	509	Steller sea lion	2011-08-23	517
Steller sea lion	2009-02-14	513	Steller sea lion	2011-08-31	519
Steller sea lion (2)	2009-02-16	509			
Steller sea lion	2009-02-17	509			
Dall's porpoise	2009-02-23	509			

Incidental Take Effects under Alternative 1: Status Quo

Incidental take of marine mammals in the BS pollock fishery is analyzed in the Chinook Salmon EIS (NPFMC/NMFS 2009). That analysis concluded that the BS pollock fishery was not likely to have significant adverse impacts to marine mammals. No changes in incidental take and entanglement are expected under Status Quo, therefore, impacts from Alternative 1 are considered not significant.

Incidental Take Effects under Alternatives 2-6

Modified management of the pollock fishery and the impact this could have on fishing pressures on marine mammals was also examined in the Chinook Salmon EIS (NPFMC/NMFS 2009). Management measures which may stop the pollock fishery in the Bering Sea earlier (either by shortening the season date or providing incentives to fish earlier in the B season) 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 not significant.

3.7.3 Prey Availability Effects

The Chinook Salmon EIS/RIR (NPFMC/NMFS 2009) identified the marine mammals in the Bering Sea that may be impacted by the pollock fishery, and their major prey items. That summary is incorporated here by reference.

The Chinook EIS/RIR (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).

Steller sea lions

The following information on Steller sea lion diet is summarized from the Biological Opinion (NMFS 2014) and is incorporated by reference. Steller sea lions are generalist predators that eat a variety of fishes and cephalopods. Prey species can be grouped into those that tend to be consumed seasonally, when they become locally abundant or aggregated when spawning (e.g., herring, Pacific cod, eulachon, capelin, salmon and Irish lords), and those that are consumed and available to Steller sea lions more or less year-round (e.g., pollock, cephalopods, Atka mackerel, arrowtooth flounder, rock sole and sand lance).

Pollock are a dominant sea lion prey species in the BSAI (Ianelli et al, 2013). Throughout the history of the domestic BS pollock fishery, NMFS has implemented management measures to reduce potential competition between the fishery and sea lions for pollock by distributing the fishery both temporally and spatially. The latest Steller sea lion protection measures for the BS pollock fishery, implemented in 2002/2003 (68 FR 204), were intended to protect sea lion prey availability by closing many nearshore areas around important sea lion sites to pollock fishing and to disperse fishing so that localized harvest rates were more consistent with annual exploitation rates and. The measures include a global control rule for setting the pollock TAC, area restrictions for the BS pollock fishery, a critical habitat harvest limit for the Sea Lion Conservation Area (SCA), and modified pollock fishing season dates and seasonal TAC allocations (69 FR 204).

The ESA consultation history for effects of the Bering Sea pollock fishery on the WDPS of Steller sea lions is extensive. Most recently, NMFS issued a biological opinion on the authorization of the Alaska groundfish fisheries under the BSAI FMP, including the Bering Sea pollock fishery, on November 24, 2010 (2010 FMP BiOp). The 2010 FMP BiOp concluded that the groundfish fisheries, as authorized, were likely to jeopardize the continued existence of the WDPS and adversely modify designated critical habitat (NMFS 2010). However, the Bering Sea pollock fishery was not implicated in the jeopardy and adverse modification finding. Rather, the jeopardy and adverse modification finding in the 2010 FMP BiOp was based on potential connections between the continued decline of WDPS populations in the western and central Aleutian Islands and the Aleutian Islands Atka mackerel and Pacific cod fisheries. NMFS subsequently modified the Steller sea lion protection measures in the Aleutian Islands Atka mackerel and Pacific cod fisheries in 2011 (75 FR 77535, December 13, 2010; corrected 75 FR 81921, December 29, 2010) and 2015 (79 FR 70286, November 25, 2014) to ensure the fisheries were not likely to jeopardize the continued existence of the WDPS or adversely modify designated critical habitat.

Killer Whales

Northern resident killer whales consume salmon that are migrating to spawning streams in nearshore waters in Alaska (NMFS 2004a). Recent studies have shown that SRKWs forage selectively for Chinook salmon which are relatively large compared with other salmon species, have high lipid content, and are available year-round (Ford and Ellis 2006). In inland waters of Washington and British Columbia, the diet of SRKWs consists of 82% Chinook salmon during May through September (Hanson et al. 2010). Stock of origin investigations have found that SRKWs forage on Chinook salmon from the Fraser River, Puget Sound runs, and other Washington and Oregon runs.

Chinook salmon PSC in the Bering Sea pollock fishery may intercept salmon that would otherwise have been available as prey for Northern and Southern Resident killer whales. Any competition with the pollock fishery for Chinook salmon would depend on the extent to which the fishery intercepts salmon that would have otherwise been available to killer whales as prey. The Chinook EIS/RIR (NPFMC/NMFS 2009) concluded that the BS pollock fishery was unlikely to cause significant effects on the availability of prey for killer whales, nor cause adverse disturbance impacts to marine mammals including killer whales. These alternatives are likely to reduce Chinook salmon PSC in the BS pollock fishery. However, any impact on the availability of prey to killer whales or other marine mammals is expected to be incremental, and insignificant. There is not likely to be any significant change in the disturbance of marine mammals, including killer whales, under these alternatives and impacts are expected to be insignificant.

Cook Inlet Beluga Whales

The following information on Cook Inlet beluga diet is from the 2008 Recovery Plan (NMFS 2008) and is incorporated by reference. Cook Inlet belugas feed on a wide variety of species, focusing on specific species when they are seasonally abundant. The groundfish fisheries directly harvest and incidentally catch several species that are important prey species for belugas, including pollock, Pacific cod, yellowfin sole, starry flounder, and staghorn sculpin. Because pollock is not likely to occur in large amounts in Cook Inlet, and appears to be eaten only in spring and fall, it is not likely an important prey species for Cook Inlet beluga whales. The groundfish fisheries also catch eulachon and salmon, which are energetically rich food sources and important prey species in spring and summer, respectively.

Cook Inlet beluga whales are not likely to compete with the BS pollock fishery for pollock because their occurrence does not overlap spatially with the pollock fishery. Any competition with the pollock fishery for Chinook salmon would depend on the extent to which the fishery intercepts salmon that would have otherwise been available to Cook Inlet belugas as prey. Annual estimates of the AEQ Cook Inlet Chinook salmon are in the hundreds of fish compared with returns of Chinook salmon to that area in the thousands of fish based on the number of river systems in the inlet with Chinook salmon runs, thus effects of Bering sea pollock fishery Chinook PSC on the volume of Cook Inlet spawning runs is likely not substantial. NMFS completed an informal ESA Section 7 consultation on the effects of the groundfish fisheries on Cook Inlet beluga whales and determined that the incidental harvest of Chinook salmon in the groundfish fisheries was not likely to adversely affect Cook Inlet beluga whales (Salveson 2009; and Brix 2010). The Chinook EIS found no evidence that Cook Inlet beluga whales were adversely affected by the BS pollock fishery (NMFS/NPFMC 2009).

Other Marine Mammals

Ribbon seals, northern fur seals, and minke, fin, and humpback whales potentially compete with the BS pollock fishery for pollock because of the overlap of their occurrence with the location of this fishery. Ribbon seals, fin whales, and humpback whales have a more diverse diet than minke whales and northern fur seals, and may therefore have less potential to be affected by any competition with the fishery. The Chinook EIS examined the impacts of the pollock fishery on these marine mammals and found no evidence that the harvest of pollock in the BS is likely to cause population level effects on these marine mammals.

Based on a review of marine mammal diets, and an evaluation of the status quo harvests of potential prey species in the BS pollock fishery, the effects of Alternative 1 on prey availability for marine mammals are not likely to cause population level effects and are therefore not significant.

Prey Availability Effects under Alternatives 2 through 6

Alternatives which provide further constraints on the number of Chinook salmon taken in the pollock fishery could benefit those species that depend on salmon (e.g., Steller sea lions, Northern and Southern Resident killer whales, beluga whales, harbor seals, ribbon seals, and northern fur seals) by limiting harvests of salmon in years of high Chinook salmon PSC. If reducing the performance standard in years of low abundance of Chinook (Alternative 5) results in the pollock fishery closing before the TAC is reached, it could also increase the availability of pollock to marine mammals. If the alternatives to provide further restrictions on the fleet (Alternative 3) or a more constraining performance standard (Alternative 5) or the combination of management measures in 2, 3, 4 and 5 (Alternative 6) result in additional fishing effort in less productive pollock areas with less salmon PSC, the shift in fishing location may result in additional pollock being available in those areas where salmon is concentrated. Salmon are also an important prey species for Steller sea lions, so reducing incidental salmon harvest under Alternatives 2 through 6 may result in reduced pollock fishery effects on their prey. However, Alternatives 2, 3, 4, 5 or 6 do not greatly change the estimated impacts from status quo thus impacts are expected to be not significant.

Alternative 4 would open the B season earlier, shorten the B season, and/or reapportion A and B season TAC allocations. BS pollock season dates and TAC allocations have been amended numerous times since fishery seasons were established in 1991.[32] Seasonal TAC allocations have varied over time. In the late 1980s the BS pollock fishery was primarily a spring and summer fishery with ~ 70 to 80% of the TAC taken from April to September. In the early to mid-1990s the amount of pollock taken in the fall and winter increased to approximately 35-65% of the TAC as the fishery targeted roe-bearing fish. As early as 1991, the BS pollock TAC was divided into an A and B season with a 40%:60% TAC allocation (56 FR 492). In 1993, the A season TAC allocation increased to 45%. During the 1990s the pollock fishery was concentrated over a period of approximately 3 months in the A season winter and B season fall. A biological opinion in 1998 concluded that the temporal concentration of the fishery may result in competition with sea lions for prey to the extent the fishery was likely to jeopardize the continued existence of Steller sea lions and adversely modify critical habitat (NMFS 1998). NMFS implemented the RPA set-out in the 1998 biological opinion in January, 1999 (64 FR 3437, corrected 64 FR 7814). The 1999 measures split the pollock TAC across 4 seasons and limited the amount of TAC in any season to 30% of the annual TAC to prevent localized depletion of pollock. These changes coincided with the implementation of the AFA which reduced factory trawler vessel capacity, further allocated TACs and ultimately resulted in broader spatial and temporal distribution of the harvest (NMFS 2000).

BS pollock season dates and allocations were modified several times from 2000 through 2002 to protect Steller sea lions from potential competition with the fishery (65 FR 3895, 66 FR 7276, and 67 FR 956). The status quo BS pollock season dates and TAC allocations were implemented with the Steller sea lion protection measure emergency rule in January 2002 (67 FR 956), and returned the season dates to approximately the same dates as in 1991 (with the exception of the B season end date) and to the exact seasonal TAC allocations as 1991. The 2002 Steller sea lion protection measures consisted of a suite of measures designed to spatially and temporally disperse fishing, control the global amount of pollock harvest, and close several areas of sea lion critical habitat to fishing for pollock. These measures in combination with numerous FMP amendments that affect the BS pollock fishery have resulted in a substantially greater spatial and temporal dispersion of pollock harvest relative to the 1990s. Section 4.5.2.2 of the 2010 FMP Biological Opinion (NMFS 2010a) provides extensive detail on the improved temporal dispersion of pollock harvest in the 2000s and the reduction of pollock harvest inside sea lion critical habitat. NMFS (2010a) shows that pollock harvest is more temporally compressed in the A season relative to the B season. As a result, increasing the amount of TAC allocated to the A season under Alternative 4, option 3, (and Alternative 6 which incorporates this provision at a 5% reallocation) may affect availability of prey for Steller sea lions in a manner not considered in the 2010 FMP Biological Opinion.

Changing the B season start date from June 10 to June 1 is not likely to result in adverse effects to sea lions beyond those considered in previous consultations. This would result in the expansion of the seasons during the time of year that is less critical for sea lions relative to fall and winter. The suboptions

[32] http://alaskafisheries.noaa.gov/sustainablefisheries/plckseas.pdf

under Alternative 4, option 2 may also reduce potential for competition between the BS pollock fishery and sea lions as it would extend the time in winter and fall when there would be no pollock fishing in the EBS. However, if selected in combination with Alternative 4, option 3, shortening the B season may result in a compression of pollock harvest, though at a lower percentage of the TAC. Thus, NMFS completed an ESA section 7 consultation to ensure this modification to the 2002 Steller sea lion protection measures does not adversely affect sea lions in a manner not considered in the 2010 FMP Biological Opinion. NMFS Sustainable Fisheries Division initiated consultation on August 28, 2015 (NMFS 2015). NMFS Sustainable Fisheries Division determined the proposed reallocation of 5 percent of the TAC from the B to the A season is not likely modify the Bering Sea pollock fishery in a manner that affects Steller sea lions or designated critical habitat in a manner not considered in previous ESA section 7 consultations. NMFS Protected Resources Division concurred with this determination (NMFS 2016).

Under Alternative 6, all but one of the proposed changes are related to the industry incentive plan agreements to avoid salmon bycatch and the PSC limits and performance standards. These provisions are not likely to alter the fishery in a manner that affects the Steller sea lion WDPS in a manner not consider in prior ESA section 7 consultations. However, the reallocation of 5 percent of the annual pollock TAC from the B season to the A season resulting in new seasonal apportionments of 45 percent in the A season and 55 percent in the B season would change a component of the status quo Steller sea lion protection measures. Under Amendment 110, as with status quo, any unharvested TAC from the A season could rollover and be harvested in the B season. NMFS conducted an informal consultation under section 7 of the ESA to determine whether (a) the proposed modification to the season allocations would be likely to adversely affect Steller sea lions, and (b) would require formal consultation and issuance of a biological opinion. That consultation is summarized below.

The proposed seasonal TAC reallocation is intended to shift pollock fishing effort away from periods of high Chinook salmon abundance and allow for more effort during the low Chinook salmon abundance periods. Available data on salmon migration patterns and Chinook salmon bycatch rates indicate that there are more Chinook salmon on the grounds early in the A season and late in the B season, and less Chinook salmon on the grounds during the late A season and early B season. Due to the existing rollover provision, this seasonal reallocation of pollock does not mandate that more pollock be harvested in the A season, but it does provide the flexibility for up to 5 percent more pollock to be harvested in times when salmon PSC is lower.

Historically, the pollock fishery has harvested all or nearly all of the available A season TAC. Given this history, for this analysis, NMFS assumes that the fishery would harvest the additional 5 percent of the TAC in the A season. Figure 40 shows the probable temporal distribution of pollock catch under the proposed reallocation along with the historical distribution in 1997 (before implementation of the AFA), 2003 (the first year after implementation of the status quo Steller sea lion protection measures) and 2014 (the most recent year of harvest data including provisions of Amendment 91). In 1997, the pollock TAC was taken over a period of 15 weeks with more than 40 percent of the TAC taken in just four weeks. Figure 40 shows the increased temporal dispersion of the fishery in 2003 and 2014 relative to 1997 with no more than 5 percent of the TAC taken in any single week and the total fishery spanning more than 25 weeks. The existing harvest capacity in the Bering Sea pollock fishery would not change as a result of Amendment 110. Therefore, NMFS expects the proposed seasonal reallocation to extend fishing in the A season by approximately three weeks at the end of the A season such that fishing would decrease beginning in late April rather than early April. NMFS expects the directed pollock fishing would end approximately three weeks earlier in the B season in mid-September rather than early-October (Figure 40).

Effects of the Expected Temporal Distribution of Catch on the Steller sea lion WDPS
The Steller Sea Lion Recovery Plan notes that the Steller Sea Lion protection measures in the Alaska groundfish fisheries should be maintained until it can be determined that reducing those protections would not reduce the likelihood for survival or increase the time to recovery, including protections developed to 1) avoid disturbance and competition around rookeries and major haulouts, 2) avoid competition during the early winter season, 3) disperse the fisheries spatially, and 4) disperse the fisheries temporally (NMFS 2008).

No net change in expected total duration of the pollock fishery
As discussed above and shown in Figure 40, NMFS expects the overall temporal distribution of the Bering Sea pollock fishery to be unchanged (e.g., approximately 25 weeks) under the proposed seasonal TAC allocation relative to the temporal distribution under the status quo Steller sea lion protection measures. Thus, the Bering Sea pollock fishery would continue to disperse the fisheries temporally.

Extended period without fishing in winter
Under the proposed seasonal TAC reallocation, the Bering Sea pollock fishery B season is projected to close approximately three weeks earlier than under the status quo (Figure 40). Under this scenario there would be no directed pollock fishing from late-September through late-January. Winter is a critical period for Steller sea lions (NMFS 2001, 2008, 2010) and the proposed seasonal reallocation may shift approximately three weeks of fishing from the early winter period to the spring period which is a less critical time for Steller sea lions. If the 5 percent TAC reallocation was ultimately not harvested in the A season and rolled-over to the B season, the temporal distribution of the fishery would reflect the distribution under the status quo. In sum, the proposed reallocation may reduce any potential adverse effects of the Bering Sea pollock fishery on Steller sea lions in winter, though this reduction would likely be insignificant. Thus, the Bering Sea pollock fishery would continue to avoid competition during the early winter season.

Spatial distribution of the fishery not likely to change
The proposed reallocation of 5 percent of the TAC from the B to the A season would not affect the status quo critical habitat area closures and harvest limits. Closures to directed pollock fishing around important rookery and haulouts would remain in place. Thus, the Bering Sea pollock fishery would continue to disperse spatially and avoid disturbance and competition around rookeries and major haulouts.

Conclusion
WDPS abundance has been increasing in the action area over the past 15 years (see Chapter 3 of NMFS 2014). The status quo Bering Sea pollock fishery Steller sea lion protection measures have been in place for the over 12 years. The proposed reallocation of 5 percent of the TAC from the B to the A season is not likely modify the Bering Sea pollock fishery in a manner that affects Steller sea lions or designated critical habitat in a manner not considered in previous ESA section 7 consultations.

Consequently, the Alternatives may reduce the potential effects of the BS pollock fishery on the availability of prey for marine mammals, especially in years when the salmon cap is reached and pollock fishing may be constrained. It is not likely that the potential effects would result in population level effects on marine mammals, and therefore the effects of Alternatives 2 through 6, are not significant.

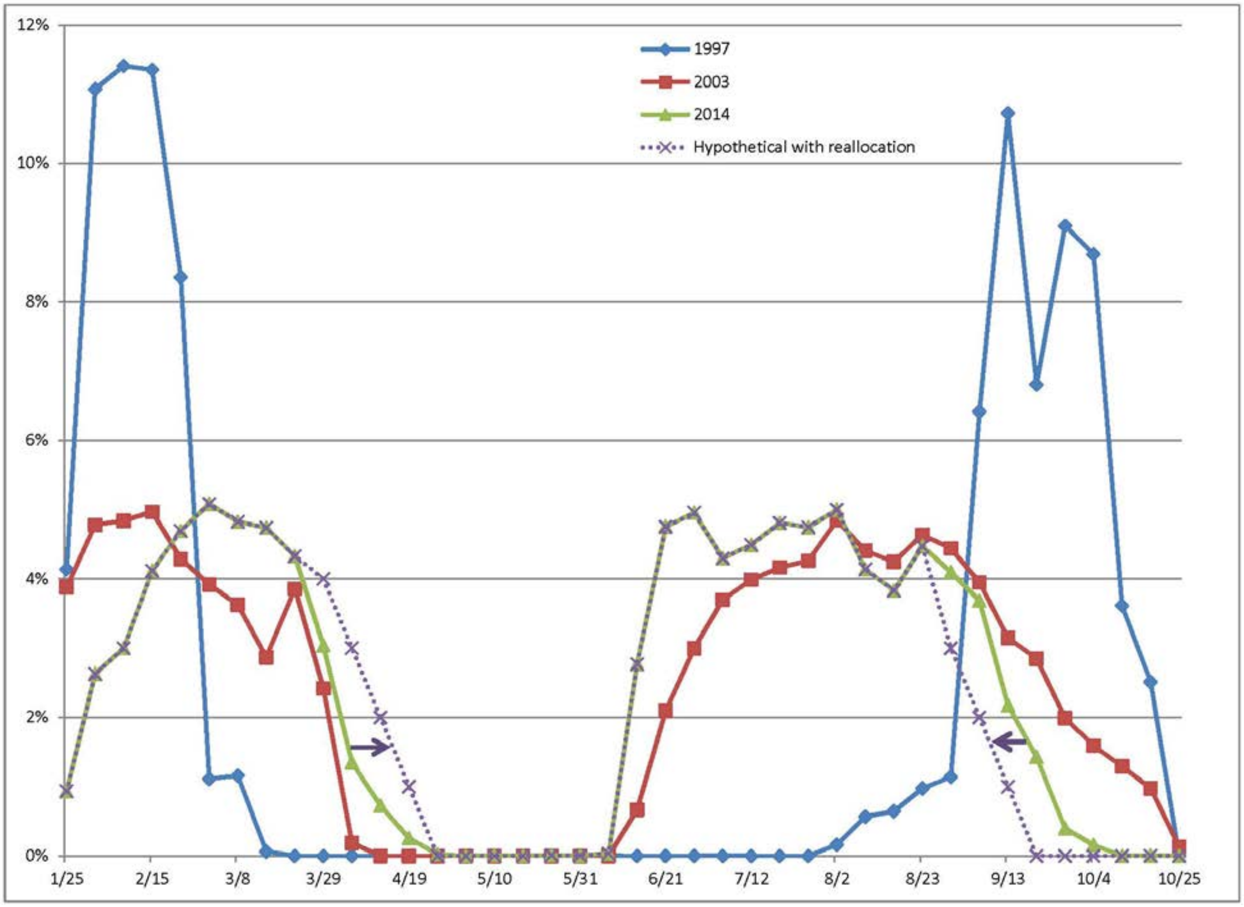

Figure 40. Percentage of the annual Bering Sea pollock TAC caught per week in 1997, 2003, and 2014. The dotted purple line indicates NMFS's assumption about the shift in the temporal distribution of catch under the proposed seasonal TAC reallocation.

3.7.4 Disturbance Effects

Disturbance Effects under Alternative 1: Status Quo

The Chinook Salmon EIS (NPFMC/NMFS 2009), summarized the likely disturbance effects of the BS 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 not significant.

Disturbance Effects under Alternatives 2 through 6

The effects on the disturbance of marine mammals by the proposed management measures are on the potential for incidental takes. Neither Alternative 2 nor 3 are expected to change the timing or location of the fishery and impacts are anticipated to be similar to Alternative 1. Under Alternative 4, the fishery may be shifted earlier slightly as well as close by regulation sooner in the fall then under Alternative 1. Any reduction in pollock fishing as a result of these modified seasonal openings and closing would reduce the potential for disturbance of marine mammals. If these measures increase the fishing pressure early in the B season, the potential for disturbance of marine mammals increases if those mammals are present in the areas to which the fleet concentrates. The Chinook Salmon EIS/RIR (NPFMC/NMFS 2009) concluded that the BS pollock fishery is 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 Alternatives 2 through 6, impacts of these alternatives are expected to be not significant.

3.8 Cumulative Effects

NEPA requires an analysis of the potential cumulative effects of a proposed Federal action and its alternatives. Cumulative effects are those combined effects on the quality of the human environment that result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of which Federal or non-Federal agency or person undertakes such other actions (40 CFR 1508.7, 1508.25(a) and 1508.25(c)). Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. The concept behind cumulative effects analysis is to capture the total effects of many actions over time that would be missed if evaluating each action individually. Concurrently, the Council on Environmental Quality (CEQ) guidelines recognize that it is most practical to focus cumulative effects analysis on only those effects that are truly meaningful. The cumulative effects on the other resources have been analyzed in numerous documents and the impacts of this proposed action and alternatives on those resources is minimal, therefore there is no need to conduct an additional cumulative impacts analysis.

This EA analyzes the cumulative effects of each alternative and the effects of past, present, and reasonably foreseeable future actions (RFFA). The past and present actions are described in the previous sections in this section.

This section provides a review of the RFFA that may result in cumulative effects on the pollock fishery, PSC management, and Chinook and chum salmon in the Bering Sea. 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 consideration of actions, whether taken by a government or by private persons that are reasonably foreseeable. This requirement is interpreted to indicate actions that are more than merely possible or speculative. In addition to these actions, this cumulative effects analysis includes climate change.

Actions are considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or NMFS’s publication of a proposed rule. Actions only “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.

Table 68. 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

3.8.1 Ecosystem-sensitive management

Ongoing research to understand the interactions between ecosystem components
Researchers are learning more about the components of the ecosystem, the ways these interact, and the impacts of fishing activity on them. Research topics include cumulative impacts of climate change on the ecosystem, the energy flow within an ecosystem, and the impacts of fishing on the ecosystem components. Ongoing research will improve the interface between science and policy-making and facilitate the use of ecological information in making policy. Many institutions and organizations are conducting relevant research.

Recent fluctuations in the abundance, survival, and growth of salmon in the Bering Sea have added significant uncertainty and complexity to the management of Bering Sea salmon resources. Similar fluctuations in the physical and biological oceanographic conditions have also been observed; however, the limited information on Bering Sea salmon ecology was not sufficient to adequately identify mechanisms linking recent changes in ocean conditions to salmon resources. North Pacific Anadromous Fish Commission (NPAFC) scientists responded by developing BASIS (Bering-Aleutian Salmon International Survey), a comprehensive survey of the Bering Sea pelagic ecosystem. BASIS was designed to improve our understanding of salmon ecology in the Bering Sea and to clarify mechanisms linking recent changes in ocean conditions with salmon resources in the Bering Sea. The Alaska Fisheries Science Center's Ocean Carrying Capacity (OCC) Program is responsible for BASIS research in U.S. waters.

Researchers with the OCC Program have conducted shelf-wide surveys on the eastern Bering Sea shelf as part of the multiyear BASIS research program. The focus of BASIS research was on salmon; however, the broad spatial coverage of oceanographic and biological data collected during late summer and early fall provided insight into how the pelagic ecosystem on the eastern Bering Sea shelf responded to changes in spring productivity. Salmon and other forage fish (e.g., age-0 walleye pollock, Pacific cod, and Pacific herring) were captured with a surface net trawl, zooplankton were collected with oblique bongo tows, and oceanographic data were obtained from conductivity-temperature-depth (CTD) vertical profiles. More information on BASIS is available at the AFSC website at: http://www.afsc.noaa.gov/ABL/occ/ablocc_basis.htm.

In 2008, North Pacific Research Board (NPRB) and 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.

3.8.2 Increasing protection of ESA-listed and other non-target species

Pollock fishing may impact a wide range of other resources, such as seabirds, marine mammals, and non-target species, such as salmon and halibut. Recent Council and NMFS actions suggest that the Council and NMFS may consider measures for protection for ESA-listed and other non-target species.

Changes in the status of species listed under the ESA, the addition of new listed species, designation of critical habitat, and results of future Section 7 consultations may require modifications to pollock fishing practices to reduce the impacts of this fishery on listed species and critical habitat.

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. Information on listed marine mammals and potential for impacts from this action are contained in Chapter 3.

3.8.3 Increasing integration of ecosystems considerations into fisheries management

Ecosystem assessments evaluate the state of the environment, including monitoring climate–ocean indices and species that indicate ecosystem changes. Ecosystem-based fisheries management reflects the incorporation of ecosystem assessments into single species assessments when making management decisions, and explicitly accounts for ecosystem processes when formulating management actions.

Ecosystem-based fisheries management may still encompass traditional management tools, such as TACs, but these tools will likely yield different quantitative results.

To integrate such factors into fisheries management, NMFS and the Council will need to develop policies that explicitly specify decision rules and actions to be taken in response to preliminary indications that a regime shift has occurred. These decision rules need to be included in long-range policies and plans. Management actions should consider the life history of the species of interest and can encompass varying response times, depending on the species' lifespan and rate of production. Stock assessment advice needs to explicitly indicate the likely consequences of alternate harvest strategies to stock viability under various recruitment assumptions.

3.8.4 Fishery management responses to the effects of climate change

While climate warming trends are being studied and increasingly understood at a global scale (IPCC 2007), the ability for fishery managers to forecast biological responses to changing climate continues to be difficult. The Bering Sea is subject to periodic climatic and ecological "regime shifts." These shifts change the values of key parameters of ecosystem relationships, and can lead to changes in the relative success of different species.

The 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 (Zador et al, 2013). 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. There is no new information available that suggests the effects of climate change combined with the effects of this action will have effects beyond those already discussed in the Alaska Groundfish Final Programmatic Supplemental EIS (NMFS 2004), the Harvest Specifications EIS (NMFS 2007a), and the Bering Sea Chinook salmon bycatch EIS (NMFS 2009b).

Many efforts are underway to assess the relationship between oceanographic conditions, ocean mortality of salmon, and their maturation timing to their respective rivers of origin for spawning. It is unclear whether the observed changes in salmon bycatch in recent years is due to fluctuations in salmon abundance, or whether there is a greater degree of co-occurrence between salmon and pollock stocks as a result of changing oceanographic conditions. Pollock distribution has been shown to be affected by bottom temperatures, with densities occurring in areas where the bottom temperatures are greater than zero (Ianelli et al. 2008). Specific ocean temperature preferences for salmon species are poorly understood. Regime shifts and consequent changes in climate patterns in the North Pacific ocean has been shown to correspond with changes in salmon production (Mantua et al. 1997). Anecdotal information suggests that Chinook and chum salmon prefer different (warmer) ocean water temperatures than adult pollock. A study linking temperature and salmon bycatch rates was conducted in the Bering Sea and preliminary evidence indicates a relationship, even when factoring for month and area; Chinook bycatch appeared to be also related to conditions for a given year, season, and location (Ianelli et al. 2010).

Compelling evidence from studies of changes in Bering Sea and Arctic climate, ocean conditions, sea ice cover, permafrost, and vegetation indicate that the area is experiencing warming trends in ocean temperatures and major declines in seasonal sea ice (IPCC, 2007; ACIA, 2005). Some evidence exists for a contraction of ocean habitats for salmon species under global warming scenarios (Welch et al. 1998). Studies in the Pacific Northwest have found that juvenile survival is reduced when in-stream temperatures increase (Marine and Cech 2004, Crozier and Zabel 2006). A correlation between sea surface temperature and juvenile salmon survival rates in their early marine life has also been proposed (Mueter et al. 2002). The variability of salmon responses to climate changes is highly variable at small spatial scales, and among individual populations (Schindler et al. 2008). This diversity among salmon populations means that the uncertainty in predicting biological responses of salmon to climate change remains large, and the specific impacts of changing climate on salmon cannot be assessed. It is not expected that the effects of this action will have effects beyond those already discussed in the Alaska Groundfish Final Programmatic Supplemental EIS (NMFS 2004), the Harvest Specifications EIS (NMFS 2007a), and the Bering Sea Chinook salmon bycatch EIS (NPFMC/NMFS 2009).

3.8.5 Traditional management tools

3.8.5.1 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).

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 number of TAC categories with low values for ABC/OFL in the BSAI is increasing which tends to increase the likelihood that NMFS will close directed fisheries to prevent overfishing. Squid harvests in BSAI groundfish fisheries for example have forced movement of the pollock fleet to avoid reaching ABC and OFL levels for squid in recent years which constrains the fishery's ability to react to areas of higher salmon bycatch and/or concentrate on areas of higher pollock density as well. 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 and fleet behavior responses to prevent overfishing which add additional complexities to the pollock fleet's ability to avoid salmon bycatch.

3.8.5.2 Reduced BSAI halibut PSC limits

The Council recommended reduced the Pacific halibut PSC limits in the BSAI groundfish fisheries, including in the pollock fishery. The objective of reducing PSC limits would be to minimize halibut bycatch to the extent practicable, potentially provide additional harvest opportunities in the directed halibut fishery, and help improve halibut stock conditions. PSC limit reductions are recommended for various sectors, including the BSAI trawl limited access sector, the Amendment 80 sector, longline catcher vessels, longline catcher processors, and the CDQ sector (i.e., a reduction to the CDQ's allocated prohibited species quota reserve). The recommended reductions to current limits would reduce halibut bycatch in the Bering Sea trawl limited access sector, which would then be distributed among four target fishery categories within that sector, of which pollock is one. However, the pollock fishery is not actually constrained by the limit, and vessels fishing with pelagic gear (as is required in the pollock fishery) may continue to fish once the PSC limit for the target fishery category that includes pollock is reached. At the same time, the pollock fishery's performance relative to the PSC limit is reported annually to the Council, and the sector has recently made voluntary adjustments to reduce halibut PSC, as requested by the Council in June 2014. To the extent that the PSC limit influences pollock participants to remain within the limit, reduced limits could impact the pollock fishery's flexibility in prosecution of the pollock fishery. NMFS is currently reviewing the Council's recommendation and, if approved, intends to implement the reduced PSC limits in 2016.

3.8.5.3 Critical Habitat designations

The ESA requires the Secretary to designate critical habitat for threatened or endangered species, unless the Secretary determines that the benefits of not designating critical habitat outweigh the benefits of any such designation. Per section 4(a)(3) of the ESA, the Secretary may, revise any critical habitat designations when appropriate.

Critical habitat is defined by section 3 of the ESA as: ''(i) The specific areas within the geographical area occupied by the species, at the time it is listed . . ., on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed . . . upon a determination by the Secretary that such areas are essential for the conservation of the species.''

Upon designation, Federal agencies are required to ensure that any action they authorize, fund, or carry-out will not destroy or adversely modify critical habitat. NMFS conducts consultations under section 7 of the ESA to ensure that the Federal fisheries do not destroy or adversely modify critical habitat.

Proposed Arctic Ringed Seal Critical Habitat

On December 28, 2012, NMFS listed the Arctic subspecies (*Phoca hispida hispida*) of the ringed seal (*Phoca hispida*) as threatened under the ESA (77 FR 76706). Arctic ringed seals are highly associated with sea ice, and are thought to migrate seasonally to maintain access to the ice. The biggest identified threat to the survival of the Arctic ringed seal is the loss of their sea ice habitat from climate warming. Ringed seals are vulnerable to habitat loss from changes in the extent or concentration of sea ice because they depend on this habitat for pupping, nursing, molting, and resting.

On December 9, 2014, NMFS proposed to designate a single specific area in the Bering, Chukchi, and Beaufort seas that contains sea ice features essential to the conservation of Arctic ringed seals (79 FR 73010; Figure 41). The proposed boundaries are generally intended to capture the extent of sea ice (which varies from year to year) within the Arctic ringed seal's range in the U.S. The southern boundary is based median position of the sea ice edge in the Bering Sea during April, derived from a time series of satellite records from 1979 to 2000 (79 FR 73010). The proposed northern and eastern boundaries are based on the outer extent of the U.S. EEZ. NMFS will issue a final determination at a future date after considering public comment received on the proposed designation.

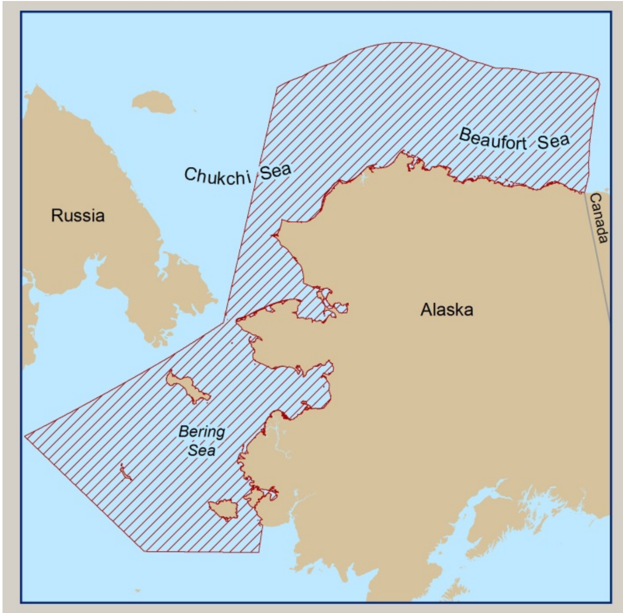

Figure 41. Proposed NMFS area for CH of Arctic ringed seals

Revisions to Critical Habitat for the Western Distinct Population Segment of Steller Sea Lions
NMFS is considering revisions to the critical habitat designation for the Western Distinct Population Segment (DPS) of Steller sea lions to take into account new information that has become available since NMFS designated critical habitat for Steller sea lions in 1993 (58 FR 45269). On November 4, 2013, NMFS published a final rule to delist the eastern DPS (78 FR 66140). In that final rule, NMFS stated that the agency will undertake a separate rulemaking to consider amendment to the existing critical habitat designation that takes into account any new and pertinent sources of information since the 1993 designation, including amending the critical habitat designation as appropriate to reflect the delisting of the eastern DPS. NMFS has begun a review of Steller sea lion critical habitat to determine if revision of the existing critical habitat is warranted. NMFS anticipates the release of a biological report, along with a peer-review of that report, the economic report, and the proposed rule to revise critical habitat for the western DPS in the late fall or early winter of 2015.[33]

3.8.5.4 Development of the salmon excluder device

Gear modifications are one way to reduce salmon bycatch in the pollock fisheries. NMFS has issued exempted fishing permits for the purpose of testing a salmon excluder device in the pollock trawl fishery of the Bering Sea since 2004 and continuing into 2015. 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.

[33] Source: http://alaskafisheries.noaa.gov/protectedresources/stellers/habitat/100814rotterman.pdf

3.8.6 Actions by Other Federal, State, and International Agencies

3.8.6.1 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 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.

3.8.6.2 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 stood 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 69 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 69. South Alaska Peninsula (Area M) chum harvests (in number of fish) from 2003-2013 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, and Wilburn pers. comm. 2014

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
2013	395,998	944,949	0.42

Stock of origin of Area M chum harvests: 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 completed in 2012 (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 is the most comprehensive stock identification project to date, including more than 75,000 chum salmon individuals from harvest samples. WASSIP results characterize stock proportions for chum salmon catches 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. Results here are characterized only for the South Peninsula Area M district fishery. Full WASSIP results for other areas are available at: http://www.adfg.alaska.gov/FedAidpdfs/sp12-25.pdf.

Results from the WASIP study for the stock of origin of the South Alaska Peninsula June fishery (primarily the Shumagin Islands and South Unimak areas) showed a high contribution from the CWAK stock grouping. This is consistent with previous genetic studies summarized above. For the years over which the study occurred, harvest rates from the CWAK reporting group comprised the highest proportion of the June fishery catch in both the Shumagin and Unimak Districts. In the Shumagin District harvest rates on the CWAK reporting group during the June fishery were consistently > 0.8% (catch/total run of the stock) with the highest rate in 2009 at > 4.6%. In the Unimak District from 2007-2009 study period the harvest rates on the CWAK ranged from 1.0% - 2.4% for the June fishery. Proportionally relative to the other stocks in the catch results for the CWAK component were similar to previous studies.

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.

3.8.6.3 Hatchery releases of salmon

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

3.8.6.4 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).

3.8.7 Private actions

3.8.7.1 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. The RIR provides more information on the Bering Sea pollock fishery.

Commercial salmon fisheries exist throughout Alaska, in marine waters, bays, and rivers. The RIR provides more information on the commercial salmon fisheries.

3.8.7.2 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 gross 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.[34]

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.

3.8.7.3 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 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. Chapter 3 provides more information on subsistence harvests and the utilization of salmon.

3.8.7.4 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.

3.8.8 Summary of cumulative impacts

Reasonably foreseeable future actions that may affect target and prohibited species are shown in Table 68**.** Ecosystem management, rationalization, and traditional management tools are likely to improve the protection and management of target and prohibited species, including pollock and Chinook and chum salmon and are not likely to result in significant effects when combined with the direct and indirect effects of Alternatives 2 through 5. Ongoing research efforts are likely to improve our understanding of the interactions between the harvest of pollock and salmon bycatch. NMFS is conducting or participating in several research projects to improve understanding of the ecosystems, fisheries interactions, and gear modifications to reduce salmon bycatch.

[34] 2009 CDQ Sector report, WACDA, p. 16. http://www.wacda.org/media/pdf/SMR_2009.pdf

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).

Considering the direct and indirect impacts of the proposed action and its alternatives 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.

4 Regulatory Impact Review

This Regulatory Impact Review (RIR) examines the benefits and costs of proposed management measures that would address Chinook and chum salmon PSC management and apply exclusively to the directed pollock fishery in the eastern Bering Sea (EBS). The measures under consideration include: modified management of chum salmon PSC by required incorporation into industry-run existing Chinook salmon incentive plan agreements (IPA), modified IPA requirements to add provisions and more stringent restrictions for Chinook salmon PSC management, reallocating 5 percent to10 percent of the pollock TAC from the summer to winter fishing season, modifying the existing pollock seasons in the summer to begin earlier and/or end sooner, and a lower performance standard threshold for use as a target in management of Chinook PSC limits within the IPAs, and/or a reduction in the PSC limit that would be employed in years of low Chinook abundance.

The preparation of an RIR is required under Presidential Executive Order (E.O.) 12866 (58 FR 51735: October 4, 1993). The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following Statement from the E.O.:

In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and Benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nonetheless essential to consider. Further, in choosing among alternative regulatory approaches agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

E.O. 12866 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be "significant." A "significant regulatory action" is one that is likely to:

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

4.1 Statutory Authority

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

The Bering Sea pollock fishery in the EEZ off Alaska is managed under the FMP for Groundfish of the Bering Sea and Aleutian Islands. The salmon PSC 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.

4.2 Purpose and Need for Action

The current chum salmon bycatch reduction program under Amendment 84 does not meet the Council's objectives to prioritize Chinook salmon bycatch avoidance, while preventing high chum salmon bycatch and focusing on avoidance of Alaska chum salmon stocks, and allowing flexibility to harvest pollock in times and places that best support those goals. Incorporating chum salmon avoidance through the Incentive Plan Agreements (IPAs) should more effectively meet those objectives by allowing for the establishment of chum measures through a program that is sufficiently flexible to adapt quickly to changing conditions.

Chinook salmon are an extremely important resource to Alaskans who depend on local fisheries for their sustenance, cultural identity, and livelihood. Multiple years of historically low Chinook salmon abundance have resulted in significant restrictions for subsistence users in western Alaska and failure to achieve conservation objectives. The current Chinook salmon bycatch reduction program under Amendment 91 was designed to minimize bycatch to the extent practicable in all years, under all conditions of salmon and pollock abundance. While Chinook salmon bycatch impact rates have been low under the program, there is evidence that improvements could be made to ensure the program is reducing Chinook salmon bycatch at low levels of salmon abundance. This could include measures to avoid salmon late in the year and to strengthen incentives across both seasons, either through revisions to the IPAs or regulations.

4.3 Alternatives

The Alternatives under consideration include:
Alternative 1: **No Action.** Current management measures are in place for both Chinook salmon PSC and chum salmon PSC. For Chinook salmon PSC, a complex management system is in place that sets overall limits to close fishing by sector and season, while incorporating some improved flexibility by including a performance standard and promoting the creation of industry-proposed IPAs to further reduce bycatch below the performance standard. The plans, as reviewed by the Council, are designed to increase incentives for vessels to lower bycatch rates even in years when salmon encounters were low. For chum salmon PSC, the pollock fleet is exempt from a large-scale closure (chum salmon savings area) in the Bering Sea for participating in a rolling hot spot (RHS) program that uses recent data from the fleet to move the fleet away from areas of highest bycatch by week. The entire fleet participated in this program which is governed by a contractual agreement and managed by third-party contractor Sea State, which assimilates fleet data, communicates information on high-bycatch areas and vessels, and closes areas of the fishing grounds to cooperatives that have the highest bycatch rates in that week. The provisions of the contractual agreement for the RHS program are in regulation.

Alternative 2: **Move Chum salmon PSC into IPAs.** This alternative addresses chum salmon PSC management measures only. An annual exemption from the Chum Salmon Savings Area is contingent upon participation in an IPA that includes the provisions for addressing chum salmon PSC within their existing program. General requirements for chum salmon PSC management in the IPAs would be included in regulation. IPAs would likely run a fleet-level RHS program similar to status quo but with improved flexibility to suspend the chum RHS closures to allow the fleet to focus on avoiding Chinook salmon PSC in the latter portion of the summer fishing season. Provisions of the RHS would be removed from regulation but the Chum Salmon Savings Area would remain in the FMP and in regulation, and vessels that do not participate in an IPA will be subject to the closure when enacted.

Alternative 3: Additional IPA provisions. This alternative addresses Chinook management measures only. Under this alternative, the IPAs would need to modify their programs to include additional provisions and restrictions intended to increase incentives to reduce Chinook PSC. These modifications include the following: restrictions or penalties for vessels that have consistently high Chinook PSC rates, require use of salmon excluders, require that a RHS program for Chinook operate throughout both A and B seasons, reduce the longevity of savings credits under savings-credit-based IPA programs (for inshore and mothership IPAs only), and additional restrictions or performance criteria to ensure that bycatch rates in October are not higher than those in the preceding months. Here the latitude to address these provisions would be left to the individual IPAs, but general requirements would be added to the regulations to include additional provisions. The options under this alternative are not mutually exclusive.

Alternative 4: Revise the Bering Sea pollock fishery season dates and seasonal allocation of pollock. This alternative addresses both Chinook and chum salmon PSC measures and modifies the existing B-season start and end dates for the pollock fishery, as well as the seasonal allocation of pollock. Here two season date options are considered: begin the season on June 1st, instead of June 10th, and end the season on September 15th, October 1st, or October 15th. The third option provides for a shift in the seasonal allocation of pollock to increase A-season allocation by from 5 percent to10 percent of the annual total. These options are not mutually exclusive. This alternative is intended to shift the fishing effort earlier in the B season when Chinook bycatch rates have historically been lower.

Alternative 5: Lower the PSC limit and/or the performance standard threshold indexed to years of low Chinook abundance. Under this alternative, the overall PSC limit (60,000 Chinook) and/or the performance standard limit threshold (47,591 Chinook annually; divided by sector and season) would be lowered in years where western Alaska Chinook salmon stocks are low. ADF&G would make the determination of 'low Chinook abundance' each fall based on an assessment of the indexed run strength of the combined run sizes of the Unalakleet, Upper Yukon, and Kuskokwim river systems. NMFS would set the performance standard's annual threshold amount based on ADF&G's determination in the annual harvest specifications. As with the status quo, sectors that exceed the applicable performance standard threshold, in 2 out of 7 years, would be held to their proportion of the 47,591 Chinook PSC limit every year thereafter. All other provisions of the current Chinook salmon PSC management program under status quo would remain in place. Options for reducing the PSC limit and/or performance standard threshold range from 25 percent to 60 percent from current limits. For the PSC limit, this is a range of 24,000 to 45,000 Chinook salmon, while for the performance standard threshold, this is a range of 19,036 to 35,693 Chinook. The performance standard threshold is the level to which IPAs are structured in the incentives to remain below. Reduced caps would only be applicable in years of low western Alaska Chinook salmon abundance, as described above.

Alternative 6 combines multiple measures included in Alternatives 2, 3, 4, and 5. This alternative was selected by the Council as its preferred alternative (PA) in April 2015. This combined management approach includes all provisions of Alternative 2 (moving chum salmon bycatch management into the IPAs), all of Alternative 3 (options to revise IPA requirements for Chinook bycatch), incorporates a reallocation of an additional 5% of pollock quota to the A-season from Alternative 4, and reduces the PSC cap and performance standard threshold in years of low abundance (Alternative 5). This results in a combined management approach that provides additional specificity and provisions to the IPA requirements, additional reporting requirements to address these changes, provides for some additional flexibility to catch pollock at times of lower Chinook encounters by a quota reallocation, and provides for more stringent measures in times of low Chinook abundance in western Alaska rivers. These provisions are grouped by category and described further below.

IPA revisions:

An annual exemption from the Chum Salmon Savings Area is contingent upon participation in an IPA that includes the chum salmon provisions below. Additional provisions address Chinook bycatch management under the IPAs.

Description of the incentive plan.
The IPA must contain a written description of the following:

- The incentive(s) that will be implemented under the IPA for the operator of each vessel participating in the IPA to avoid Chinook salmon and chum salmon bycatch under any condition of pollock and Chinook salmon abundance in all years;
- The incentive(s) to avoid chum salmon should not increase Chinook salmon bycatch;
- The rewards for avoiding Chinook salmon, penalties for failure to avoid Chinook salmon at the vessel level, or both;
- How the incentive measures in the IPA are expected to promote reductions in a vessel's Chinook salmon and chum salmon bycatch rates relative to what would have occurred in absence of the incentive program;
- How the incentive measures in the IPA promote Chinook salmon savings and chum salmon savings in any condition of pollock abundance or Chinook salmon abundance in a manner that is expected to influence operational decisions by vessel operators to avoid Chinook salmon and chum salmon;
- How the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's Chinook salmon bycatch to keep total bycatch below the performance standard described in paragraph (f)(6) of this section for the sector in which the vessel participates;
- How the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's chum salmon bycatch to avoid areas and times where the chum salmon are likely to return to Western Alaska; and
- The rolling hot spot program for salmon bycatch avoidance and an agreement to provide notifications of closure areas and any violations of the rolling hot spot program to at least one third party organization representing western Alaskans who depend on salmon and do not directly fish in a groundfish fishery.
- Restrictions or penalties targeted at vessels that consistently have significantly higher Chinook salmon PSC rates relative to other vessels fishing at the same time. Include a requirement to enter a fishery-wide in-season PSC data sharing agreement.
- Required use of salmon excluder devices, with recognition of contingencies, from Jan 20 through March 31, and Sept 1 until the end of the B season.
- A rolling hotspot program that operates throughout the entire A and B seasons.
- Salmon savings credits last for a maximum of three years for savings credit based IPAs.
- Restrictions or performance criteria used to ensure that Chinook salmon PSC rates in the month of October are not significantly higher than those achieved in the preceding months.

Quota reallocation:

Seasonal allocation of pollock is set at 45 percent in the A-season, and 55 percent in the B-season. As with current pollock management, any unused quota will be rolled over into the B-season.

Revised PSC limit and performance standard threshold in years of low Chinook abundance:

A revised PSC limit (45,000 fish) and performance standard threshold (33,318 fish) will be in place in years defined as low Chinook abundance. The performance standard and PSC limit would be lowered in the year following the year in which the index was ≤250,000 Chinook salmon. Low abundance is defined as ≤250,000 Chinook salmon, based on the post-season in-river Chinook salmon run size index of the Unalakleet, Upper Yukon, and Kuskokwim aggregate stock grouping. Sectors that exceed the applicable performance standard, in 3 out of 7 years, would be held to their proportion of the annual applicable performance standard in future years (for example, either 47,591 or the 33,318, whichever is in place that year). In a year in which the lowered performance standard is in place and there are no approved IPAs, the PSC limit allocated to sectors would equal the lower performance standard.

The specification process and timing are as described under Alternative 5. The Council also adopted into Alternative 6 the NMFS recommendations for management and enforcement improvements identified in Section 2.7, and analyzed in Section 4.8 below.

Rationale for the Council's preferred alternative:

The intent of the alternative is to create a comprehensive salmon bycatch avoidance program that works more effectively to minimize chum bycatch, avoid Alaska-origin chum, and protect Chinook, so the overall result is a better ability to minimize salmon bycatch of both species. In considering this combined management approach, the Council considered a broad suite of measures that are all estimated to result in some level of behavior change to further avoid salmon bycatch, which is the primary objective of this action. Experience has shown that PSC avoidance requires flexibility and the ability of vessels to adjust to real-time information and fishery conditions. The recommended changes in the PA are adjustments to the existing program to make it more effective. In particular the Council expressed that it remains extremely important to ensure that the program is working as intended and to evaluate whether the incentives are strong in times of historically low Chinook abundance.

Incorporating chum salmon into the IPAs meets the purpose and need statement by providing measures to prevent high chum salmon bycatch, while allowing for flexibility to target avoidance of Alaska chum stocks and to adapt to changing conditions on the water quickly. In doing so, this action for chum bycatch strikes an appropriate balance between regulatory requirements and adaptive management.

Further modifications to IPA requirements increase the incentives to reduce Chinook salmon bycatch within the IPAs. The IPA system is based on being flexible, responsive, and able to be tailored by each sector to fit its operational needs. Incorporating additional provisions was noted by the Council as intended to provide an opportunity for IPAs to increase their responsiveness and improve upon an individual vessel level in some sectors. This is intended to reduce the potential for outlier behavior as has been noted in the analysis. The action would require an excluder during almost the entire A season and the last two months of the B season, the times in which the fleet encounters Chinook. The mandate that the IPAs require all vessels to use an excluder without the need to detail what type of excluder design to use in Federal regulations provides the best approach.

The inclusion of a lower PSC limit and performance standard threshold is based on the need for additional incentives to reduce bycatch when these Chinook stocks are critically low, in order to minimize *the impact of the pollock fishery. Any additional fish returning to those rivers improves the ability to meet the escapement goals, which is necessary for long-term sustainability of the stock and the people reliant on this fishery. This action only reduces both caps, in years of very low salmon abundance. The performance standard is truly the operational cap, however, reducing the PSC limit is also appropriate given the potential for decreased bycatch reduction incentives should the performance standard threshold be exceeded with a large gap before the hard cap itself is reached. Specifically, vessels may choose not to incur the extra costs associated with bycatch avoidance once a performance standard has been exceeded, unless there's a lower hard cap in place. In years of low abundance, reducing this risk is critical; thus, the Council chose to reduce both the PSC limit and the performance standard threshold.*

Integral to the Council's decision on the level of the cap reduction is the fact that the current bycatch levels are much lower than the caps. This is likely due to low salmon abundance, as well as to the incentive programs working. Thus, all of the combined measures included in the PA are focused upon retaining the incentives to reduce salmon bycatch at all levels of abundance, as intended by the Council's original action under Amendment 91.

These alternatives contain various options for achieving the Council's objectives. The comparative table of Alternatives and options is shown below. Further detail of the content of each Alternative is contained in Chapter 2, and will not be replicated here in order to reduce duplication.

Table 70. Summary of alternatives and major policy-level trade-offs

Alt	Chinook PSC limit	Chum PSC limit	IPA requirements	Pollock seasons
1	60,000 annually with performance standard at 47,591. PSC limits and performance standard divided by sector and season.	PSC limit closes Chum Salmon Savings Area (August 1-31 by regulation). Pollock fishery exempt if in RHS program	To allow for allocation of the 60,000 PSC limit and 47,591 performance standard: Chinook IPA must meet general goals and objectives in regulation. Annual approval process by NMFS.	A season: January 20-June 9th B season: June 10-Nov 1
2	Same as Alt 1	Status quo PSC limit and closure for any vessels not participating in an IPA with includes chum bycatch management	Requirements for IPA in regulation would be modified to include chum bycatch management. Focus on avoidance of western AK chum and provisions for not increasing Chinook bycatch	Same as Alt 1
3	Same as Alt 1	Same as Alt 1	Modified IPA requirements for Chinook to include options for: • Restrictions/penalties on high bycatch rate vessels • Required use of salmon excluder devices • RHS continuously in A and B seasons • Modified duration of salmon savings credit • Restrictions/performance criteria for bycatch rates in October	Same as Alt 1
4	Same as Alt 1	Same as Alt 1	Same as Alt 1	**A season:** Jan 20th-May 31st (or Jun 9th) **B season:** Open: Jun 1- (or Jun 10th) Close: Sept 15th or Oct 1st or Oct 15th Pollock **A:B allocation** (with rollover): 1) 45:55 or 2) 50:50
5	Performance standard reduced: Option 1: 25% Option 2: 60% Suboption to also reduce PSC limit (60,000) by same % (25% and 60%).	Same as Alt 1	Same as Alt 1. However IPAs will need to adjust their programs to accommodate a lower performance standard (and PSC limit) in applicable years	Same as Alt 1

6	PSC cap 45,000 Performance standard threshold 33,318 In years of low abundance	Status quo PSC limit and closure for any vessels not participating in an IPA which includes chum bycatch management	Modified IPA requirements for Chinook to include options for: • Restrictions/penalties on high bycatch rate vessels • Required use of salmon excluder devices • RHS continuously in A and B seasons • Modified duration of salmon savings credits Restrictions/performance criteria for bycatch rates in October	Pollock **A:B allocation** (with rollover): 1) 45:55

4.4 Methodology for analysis of impacts

The evaluation of impacts in this analysis is designed to meet the requirement of E.O. 12866, which dictates that an RIR evaluate the costs and benefits of the alternatives, to include both quantifiable and qualitative considerations. The costs and benefits of this action with respect to effects on salmon, and on the pollock fishery are described in the sections that follow, comparing the No Action Alternative 1 with the action alternatives. The analysis provided here is primarily qualitative and follows closely from the analysis of impacts presented in Chapter 3.

4.5 Description of the Bering Sea Pollock Fishery

Pollock are widely distributed in the North Pacific, from Central California into the eastern Bering Sea, along the Aleutian arc, around Kamchatka, in the Okhotsk Sea, and into the southern Sea of Japan. In U.S. waters of the Bering Sea and Aleutian Islands (BSAI), NMFS manages pollock as three separate stocks: the Eastern Bering Sea (EBS) stock, found on the EBS shelf from Unimak Pass to the U.S.-Russia Convention line; the Aleutian Islands region stock, found on the Aleutian Islands shelf region from 170°W to the U.S.-Russia Convention line; and the Aleutian Basin or Bogoslof stock, which is a mixture of pollock that migrate from the U.S. and Russian shelves to the Aleutian Basin.

The largest of these is the EBS stock. The Aleutian Islands region pollock stock was closed to directed fishing between 1999 and 2003; in 2004, however, the TAC was reestablished for Aleutian Islands pollock to provide for economic development in Adak, Alaska. The Aleutian Basin pollock stock has been closed to directed fishing since 1991, due to low biomass levels.

Pollock continues to represent over 40 percent 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.

Prior to passage of the Magnuson Fishery Conservation and Management Act of 1976 (now the Magnuson Stevens Act), foreign fisheries dominated the pollock fishery off Alaska. Pollock had been harvested at low levels in the Eastern Bering Sea until the 1950s. With perfected onboard freezing technology in the 1960s, the foreign fisheries conducted mainly by Japanese, Russian, and Korean trawlers expanded. Harvests by these foreign fleets increased rapidly during the late 1960s and, in 1972, reached a reported peak catch of 2.2 million mt of pollock, flatfish, rockfish, cod, and other groundfish.

<u>The Magnuson-Stevens Act</u>

The Magnuson-Stevens Act established Federal authority over the 200-mile EEZ and, thus, effectively provided for the development of domestic fisheries. United States vessels began fishing for pollock in

1980 through, joint-ventures with foreign processing ships. By 1987, U.S. vessels were taking 99 percent of the quota. Since 1988, only U.S. vessels have been operating in this fishery, and pollock harvests now dominate the commercial groundfish fisheries in waters off Alaska.

The American Fisheries Act (AFA)

Before 1999, the Bering Sea directed pollock fishery had been a managed open-access fishery, commonly characterized as a "race for fish." In 1998, however, Congress enacted the AFA 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. After first deducting an incidental catch allowance and 10 percent of the TAC for the Community Development Quota (CDQ) program, the AFA allocates 50 percent of the remaining TAC to the inshore catcher vessel sector; 40 percent to the catcher processor sector; and 10 percent to the mothership sector.

The AFA also allowed for the development of pollock industry cooperatives. Ten such cooperatives were developed as a result of the AFA: seven inshore co-ops, two offshore co-ops, and one mothership co-op. The first cooperative was formed in 1999 by a private-sector initiative, Pollock Conservation Cooperative (PCC), and is made up of nine catcher/processor companies that divide the sector's overall quota allowance among the companies.

In rationalizing the Bering Sea pollock fishery, the AFA also gave the industry the ability to respond more deliberately and efficiently to market demands than the "race for fish" previously allowed. The AFA also gave the fishery the means to compensate for Steller sea lion conservation measures that, beginning in 1992, created fishery exclusion zones around sea lion rookeries and haulout sites and implemented gradual reductions in seasonal proportions of the TAC taken in Steller sea lion critical habitat.

As of January 1, 2000, all vessels and processors wishing to participate in the non-CDQ Bering Sea pollock fishery are required to have valid AFA permits on board the vessel or at the processing plant. AFA permits are required even for vessels and processors specifically named in the AFA, and are required in addition to any other Federal or State permits. AFA permits also may limit the take of non-pollock groundfish, crab, and prohibited species, as governed by AFA "sideboard" provisions. With the exceptions of applications for inshore vessel cooperatives and for replacement vessels, the AFA permit program had a one-time application deadline of December 1, 2000, for AFA vessel and processor permits. Applications for AFA vessel or processor permits were not accepted after this date, and any vessels or processors for which an application had not been received by this date became permanently ineligible to receive AFA permits.

Annual Pollock Fishing Seasons

The annual Bering Sea pollock fishery is divided into two seasons: the "A" season, which opens in January and typically ends in April, and the "B" season, which typically runs from July through the end of October. The "A" season fishery has historically focused on roe-bearing females, and is concentrated north and west of Unimak Island and along the 100-meter contour between Unimak and the Pribilof Islands. "A" season pollock also provide other primary products such as surimi and fillet blocks, but yields on these products are slightly lower than in the "B" season, when pollock carry a lower roe content and are thus primarily targeted and processed for surimi and fillet blocks.

4.5.1 Description of the Bering Sea Trawl Pollock Fleet

<u>Number of Vessels</u>

As shown in Table 71, in the 2014 Bering Sea pollock trawl fishery, 77 catcher vessels participated in harvesting pollock, a decline since 2004 when 86 catcher vessels participated in the fishery. Catcher processor participation has been between 14 and 16 vessels in recent years and as high as 17 vessels historically. Catcher vessels delivering to motherships have been fairly consistent in participation, ranging from 14 to 18 from 2003 through 2014, with 15 CVs delivering to motherships in 2014.

<u>Gear</u>

In 1990, in response to concerns about salmon PSC and the impact of bottom trawls on seafloor habitat, the Council reduced non-pelagic or bottom trawling, by dividing the BSAI TAC between pelagic (88 percent) and non-pelagic trawling (12 percent). Although most vessels were voluntarily using pelagic trawls by the mid-1990s, non-pelagic trawls were still responsible for amounts of PSC that were much larger than desirable; and in 1999, the Council banned the use of non-pelagic trawls entirely in the Bering Sea pollock fishery.

<u>Ports of Delivery</u>

The vast majority of inshore pollock landings take place in the ports of Dutch Harbor and Akutan. Dutch Harbor continues to be the top rank Alaska community by both landings in weight and ex-vessel value (Fissel, et al., 2014, Tables 7.3 and 7.4). Many of the west coast US-flag catcher/processors that mainly target Bering Sea pollock also target Pacific whiting (a.k.a., hake) off Washington or Oregon, as noted by the At-sea Processors Association (APA; http://www.atsea.org/).

4.5.2 Total Allowable Catch, Sector Allocations, Harvest, and Value

The pollock fishery is divided into two seasons—the winter “A” season in which most roe production occurs, and the summer/fall “B” season. The 2014 allocation of the TAC in the Bering Sea was as follows:

10 percent of TAC was reserved for the CDQ program.
2.7 percent of TAC was reserved for the incidental catch allowance
The remaining TAC was divided between catcher vessels delivering inshore (50 percent); catcher processors processing offshore (40 percent); and deliveries to motherships (10 percent).

The following table exhibits the allocations and harvests (in metric tons) in the Bering Sea trawl fisheries from 2004 through 2014. The sectors identified here are the Catcher Vessels (CV), Catcher Processor (CP), Mothership (M), and CDQ sectors. Also shown are the total product first wholesale gross values per round metric ton; the total gross value of the harvest, based on that per ton value; and a calculation of average gross revenue per vessel. Note that the average gross revenue calculation for the M sector is the average for the three mothership platforms under the AFA. The CDQ average gross revenue calculation is for the average for each of the six CDQ entities.

Table 71. Bering Sea pollock allocations, catch, and gross revenue; 2004–2014[35] (c= confidential)

Year	Sector (# of vessels)	Allocation (metric tons)	Pollock Catch (metric tons)	Total Product Value (per round metric ton)	Total Gross Revenue ($ millions)	Average Gross Revenue ($ millions per CV and CP vessel, and for 3 M, 6 CDQ)
2004	CV (86)	649,580	637,971	$681	$434	$5
	CP (17)	519,664	519,570	$816	$424	$25
	M (19)	129,916	129,222	$594	$77	$26
	CDQ	149,200	149,173	$816	$122	$20
2005	CV (84)	653,787	648,117	$815	$528	$6
	CP (16)	523,029	517,699	$961	$498	$31
	M (18)	130,757	130,669	$443	$58	$19
	CDQ	149,750	149,715	$961	$144	$24
2006	CV (81)	660,318	645,606	$798	$515	$6
	CP (16)	528,254	527,134	$916	$483	$30
	M (19)	132,063	131,404	$711	$93	$31
	CDQ	150,400	150,374	$916	$138	$23
2007	CV (82)	610,736	572,507	$792	$453	$6
	CP (16)	488,588	488,543	$1,007	$492	$31
	M (17)	122,147	121,514	$776	$94	$31
	CDQ	139,400	139,336	$1,007	$140	$23
2008	CV (80)	434,250	427,741	$1,214	$519	$6
	CP (17)	347,400	346,998	$1,533	$532	$31
	M (17)	86,850	85,364	$1,380	$118	$39
	CDQ	100,000	99,964	$1,533	$153	$26
2009	CV (79)	352,080	349,708	$1,279	$447	$6
	CP (15)	281,664	281,603	$1,330	$375	$25
	M (17)	70,416	70,308	$1,034	$73	$24
	CDQ	81,500	81,478	$1,330	$108	$18
2010	CV (81)	353,466	351,685	$1,256	$442	$5
	CP (15)	282,773	282,750	$1,321	$374	$25
	M (14)	70,693	70,576	c	c	c
	CDQ	81,300	81,275	$1,321	$107	$18
2011	CV (80)	552,748	519,095	$1,047	$543	$7
	CP (15)	442,198	423,680	$1,190	$504	$34
	M (13)	110,550	109,856	$1,219	$134	$45
	CDQ	127,100	116,978	$1,190	$139	$23
2012	CV (81)	529,050	525,184	$1,089	$572	$7
	CP (14)	423,240	423,161	$1,206	$510	$36
	M (15)	105,810	105,384	$1,153	$122	$41
	CDQ	121,900	121,854	$1,206	$147	$24
2013	CV (79)	550,801	548,966	$940	$516	$7
	CP (15)	440,640	440,591	$1,037	$457	$30
	M (14)	110,160	110,019	$808	$89	$30
	CDQ	126,600	126,538	$1,037	$131	$22
2014	CV (77)	556,640	554,640	$1,065	$591	$8
	CP (16)	445,312	443,712	$1,019	$452	$28
	M (14)	111,328	110,928	$920	$102	$7
	CDQ	128,600	128,600	$1,019	$131	$44

Source: NMFS Alaska Region Catch Accounting BSAI Annual Catch Reports: http://alaskafisheries.noaa.gov/sustainablefisheries/catchstats.htm, and Table 27 of the annual Groundfish Economic SAFE reports.

[35] The mothership sector is comprised of three permitted vessels. In some years, not all motherships participate in the BS pollock fishery. What is shown here, for vessel participation, is the number of CVs that delivered to operating motherships each year.

4.5.3 Pollock Fishery Tax Revenues

The pollock fisheries in waters off Alaska generate tax revenue collected by the State of Alaska in the form of a Fisheries Business Tax (shoreside processors) and a Fisheries Resource Landings Tax (CPs). Most of the tax revenue is collected from operations in the Aleutian and Pribilof Island areas and is derived from the Bering Sea pollock fishery. Confidentiality restrictions do not allow tax data to be shown for specific ports or communities.

Table 72 provides pollock fishery tax revenue collection data, provided by the Alaska Department of Revenue. Also shown is the percent of the statewide pollock fisheries' total that the Aleutian Pribilof area tax collections represent.

Table 72. Pollock fishery tax revenues, 2004-2013

Fisheries Business Tax

Year	Aleutians/Pribilof			Statewide Total			Aleutians Percent of Statewide Total		
	Pounds	Value	Tax Liability	Pounds	Value	Tax Liability	Pounds	Value	Tax Liability
2004	1,340,620,622	$ 142,482,037	$ 4,435,921	1,542,612,076	$ 163,876,620	$ 5,335,064	87%	87%	83%
2005	1,378,682,085	$ 170,218,664	$ 5,207,027	1,605,033,891	$ 200,970,450	$ 6,445,862	86%	85%	81%
2006	1,355,936,834	$ 174,203,650	$ 5,293,490	1,637,736,615	$ 210,842,939	$ 6,704,774	83%	83%	79%
2007	1,182,552,028	$ 159,601,604	$ 4,788,432	1,369,977,746	$ 186,819,595	$ 5,928,597	86%	85%	81%
2008	886,261,331	$ 182,634,855	$ 5,479,258	1,040,930,728	$ 214,191,414	$ 6,797,071	85%	85%	81%
2009	877,709,670	$ 166,577,274	$ 4,997,998	1,013,650,420	$ 192,813,430	$ 6,055,925	87%	86%	83%
2010	755,748,809	$ 140,338,510	$ 4,210,288	930,220,366	$ 172,460,807	$ 5,438,400	81%	81%	77%
2011	1,076,173,134	$ 178,707,640	$ 5,361,865	1,315,941,700	$ 219,076,337	$ 6,948,646	82%	82%	77%
2012	1,104,164,690	$ 193,391,182	$ 5,802,485	1,374,973,529	$ 242,157,868	$ 7,657,325	80%	80%	76%
2013	1,112,430,864	$ 169,505,507	$ 5,085,983	1,411,792,789	$ 220,350,997	$ 7,007,339	79%	77%	73%

Fishery Resource Landing Tax

Year	Aleutians/Pribilof			Statewide Total			Aleutians Percent of Statewide Total		
	Pounds	Value	Tax Liability	Pounds	Value	Tax Liability	Pounds	Value	Tax Liability
2004	1,545,543,121	$ 170,004,347	$ 5,100,130	1,791,760,541	$ 197,108,065	$ 5,913,242	86%	86%	86%
2005	1,563,018,143	$ 187,562,181	$ 5,626,865	1,809,462,262	$ 217,135,477	$ 6,514,064	86%	86%	86%
2006	1,534,011,227	$ 199,421,458	$ 5,982,644	1,819,150,690	$ 236,489,589	$ 7,094,688	84%	84%	84%
2007	1,360,483,103	$ 190,467,633	$ 5,714,029	1,690,952,394	$ 236,733,334	$ 7,102,000	80%	80%	80%
2008	782,362,236	$ 164,099,672	$ 4,922,990	1,200,463,559	$ 251,900,948	$ 7,557,028	65%	65%	65%
2009	710,979,270	$ 135,086,060	$ 4,052,582	1,003,537,069	$ 190,672,042	$ 5,720,161	71%	71%	71%
2010	709,037,668	$ 134,717,157	$ 4,041,515	1,001,771,844	$ 190,336,651	$ 5,710,100	71%	71%	71%
2011	1,168,760,008	$ 198,689,202	$ 5,960,676	1,370,070,459	$ 232,911,978	$ 6,987,359	85%	85%	85%
2012	1,192,159,676	$ 214,588,742	$ 6,437,662	1,391,757,726	$ 250,516,391	$ 7,515,492	86%	86%	86%
2013	1,438,444,180	$ 230,151,069	$ 6,904,532	1,568,725,765	$ 250,996,122	$ 7,529,884	92%	92%	92%

Total (Business + Landing Tax)

Year	Aleutians/Pribilof			Statewide Total			Aleutians Percent of Statewide Total		
	Pounds	Value	Tax Liability	Pounds	Value	Tax Liability	Pounds	Value	Tax Liability
2004	2,886,163,743	$ 312,486,384	$ 9,536,052	3,334,372,617	$ 360,984,685	$ 11,248,306	87%	87%	85%
2005	2,941,700,228	$ 357,780,845	$ 10,833,893	3,414,496,153	$ 418,105,927	$ 12,959,926	86%	86%	84%
2006	2,889,948,061	$ 373,625,108	$ 11,276,133	3,456,887,305	$ 447,332,528	$ 13,799,462	84%	84%	82%
2007	2,543,035,131	$ 350,069,237	$ 10,502,461	3,060,930,140	$ 423,552,928	$ 13,030,597	83%	83%	81%
2008	1,668,623,567	$ 346,734,527	$ 10,402,248	2,241,394,287	$ 466,092,362	$ 14,354,099	75%	75%	73%
2009	1,588,688,940	$ 301,663,334	$ 9,050,580	2,017,187,489	$ 383,485,472	$ 11,776,086	79%	79%	77%
2010	1,464,786,477	$ 275,049,048	$ 8,251,803	1,931,992,210	$ 362,797,458	$ 11,148,499	76%	76%	74%
2011	2,244,933,142	$ 377,396,841	$ 11,322,541	2,686,012,159	$ 451,988,316	$ 13,936,005	84%	83%	81%
2012	2,296,324,366	$ 407,979,923	$ 12,240,147	2,766,731,255	$ 492,674,258	$ 15,172,817	83%	83%	81%
2013	2,550,875,044	$ 399,656,576	$ 11,990,516	2,980,518,554	$ 471,347,119	$ 14,537,223	86%	85%	82%

Notes:
1) Region definition for Aleutian/Pribilof comes from Alaska Dept. of Labor, http://almis.labor.state.ak.us/?PAGEID=67&SUBID=300
2) Data for Aleutian/Pribilof region is based upon tax returns submitted to the Alaska Department of Revenue.
3) Data reported in Alaska Department of Revenue tax returns does not identify where fish are caught. Rather it identifies where processing took place (i.e., Fisheries Business Tax) or location where product was transferred in the state (i.e., Fishery Resource Landing Tax).
4) Data for the region do not include resources exported unprocessed from the state.
5) Statewide totals include amounts from all regions, as well as resources exported unprocessed from the state

4.5.4 Market Disposition of Alaska Pollock

Production

The pollock fishery in waters off Alaska is the largest U.S. fishery by volume, and the economic character of that fishery centers on a varied range of product forms produced from pollock. In the U.S., Alaska pollock catches are processed mainly for roe, surimi, and several varieties of fillet products. Fillet production increased particularly rapidly in the years after the American Fisheries Act (AFA). Many factors, including more efficient rates of harvests, increased recovery rates, and the investment in new equipment that allowed a shift by processors from surimi to fillet production, were all made possible, at least in part, by the AFA. The information in this section summarizes the more extensive information presented in the 2014 Economic SAFE Report, which is incorporated by reference and to which readers are referred to for a more detailed discussion.

Prior to the implementation of the AFA, U.S. pollock catches were processed mainly into surimi. The Bering Sea pollock fishery was then managed as an "open-access limited-entry" fishery in which vessels sought to harvest as large a share of the TAC as possible before the TAC or established bycatch limits were reached and the fishery closed. Because surimi production allows more raw material to be processed in a shorter period of time than fillet and fillet block production, committing catches for surimi production was often more profitable. With the operational and economic efficiencies gained under the AFA, the industry was able to abandon practices compelled by the economics of the 'race-for-fish' and began developing more deliberate production strategies to respond to longer-run market demands.

This shift in production practices led, as noted, primarily to a particularly rapid increase in fillet production during the early 2000s, to meet greater world demand for whitefish products. This demand was created by several factors, including declining harvests in the Russian pollock fishery and a sharp decrease in the supply of fillets from Atlantic cod. The result has been increased fillet production and growth in wholesale gross revenues from U.S. pollock fillet production, as shown in the figure below.

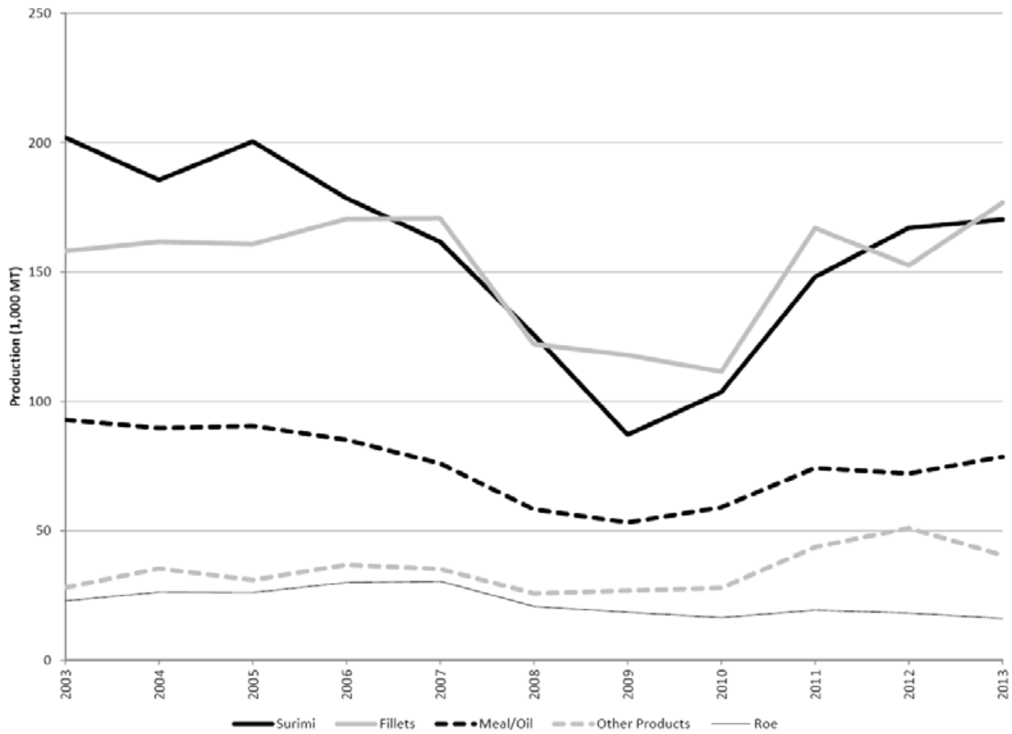

Figure 42. Alaska Primary Production of Pollock by Product Type, 2003-2013. Source: NMFS, 2014 Groundfish Economic SAFE.

The estimated wholesale value of these products over the same period is shown in Figure 43. This figure shows the dramatic increase in production and wholesale gross value of fillets from 2000 to 2007. The production volume for all pollock products declined in 2008 and 2009, due to reduced TACs, and has since rebounded as TACs have increased. Fillets have remained the most valuable pollock product from 2003 through 2013, while roe has declined in wholesale value from highs of more than $500 million in 2003, to approximately $100 million in 2010, rebounded slightly in value through 2012, and has fallen to just above $100 million again in 2013. Preliminary results show the Seattle 2014 A season pollock roe auction generated higher total gross revenue (~34%) due to increased volume (~44%) with lower prices on lesser quality roe compared with the previous year (Seafood News, April 22, 2014). The Seattle 2014 B season pollock roe auction volume was nearly 13,000 tons, or nearly 20% more than 2013, while prices declined about 7% from the B season auction of 2013. This action did not include product from Trident or American Seafoods. Downward price pressure was the result of overall production of pollock roe, by the United States and Russia combined, of more than 60,000 tons in 2014 (Alaska Seafood News, Oct. 30, 2014).

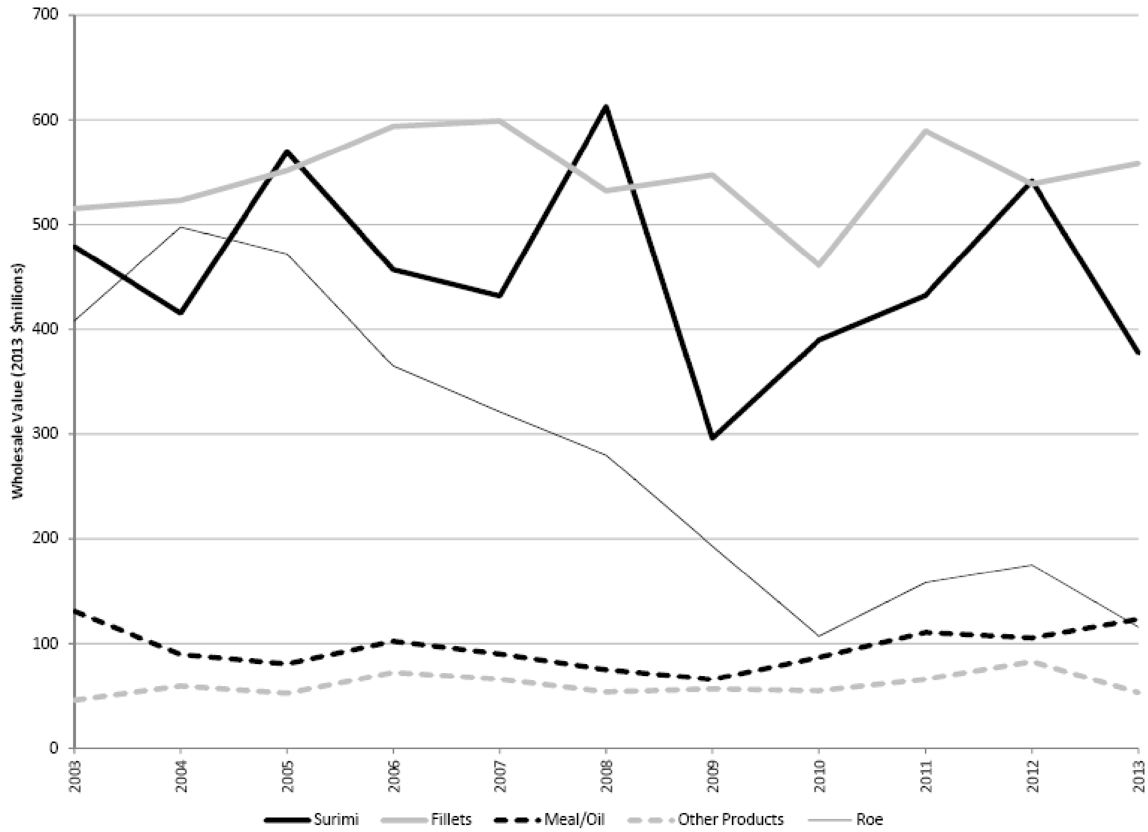

Figure 43. Wholesale gross value of Alaska pollock by product type, 2003-2013.

4.5.4.1 International Trade in Pollock Products.

Alaska pollock primary products are utilized in both domestic and foreign markets. Fillet products have been primarily used in domestic finished product production, while the other primary product forms are sold internationally for reprocessing into various finished product forms. The 2014 Economic Safe Document contains market disposition information for these various products. The background information provided here is limited to overall production and value; however, the interested reader may wish to consider the market disposition further by reviewing the 2014 Economic SAFE document.

4.5.5 Rolling Hotspot System

Amendment 84 to the BSAI FMP provides for the pollock cooperatives to enter into contractual agreements for reducing salmon PSC by the pollock fleet. These inter-cooperative agreements (ICAs) exempt participating pollock vessels from closures of the Chum Salmon Savings Area in the Bering Sea and allow those vessels to use real-time salmon PSC information to avoid high PSC rates of chum salmon by establishing hot spot closures. This system is known as the Rolling Hotspot System (RHS).

All parties to the ICA agree to abide by all tenets of the ICA, which provides for retaining the services of a private contractor to gather and analyze data, monitor the fleet, and report necessary PSC information to the parties of the ICA. The ICA requires that the PSC rate of a participating cooperative be compared to a pre-determined PSC rate (the base rate). All ICA provisions for fleet PSC avoidance behavior, closures, and enforcement are based on the ratio of the cooperative's actual salmon PSC rate to the base rate.

Each cooperative participating in the ICA is assigned to one of three tiers, based on its salmon PSC rate relative to the base rate. Higher tiers correspond to higher salmon PSC rates. Tier assignments determine access privileges to specific areas. A cooperative assigned to a high tier is restricted from fishing in a relatively larger geographic area, to avoid unacceptably high salmon PSC areas. A cooperative assigned to a low tier (based on relatively low salmon PSC rates) is granted access to a wider range of fishing areas. The private contractor tracks salmon PSC rates for each cooperative. A participating cooperative is assigned to a tier each week, based on its salmon PSC rate for the previous week. Thus, vessels have economic and operational incentives to avoid fishing behavior that results in high salmon PSC rates.

Parties to the ICA include the following AFA cooperatives: Pollock Conservation Cooperative, the High Seas Catchers Cooperative, the Mothership Fleet Cooperative, the Inshore Cooperatives (Akutan Catcher Vessel Association, Arctic Enterprise Association, Northern Victor Fleet Cooperative, Peter Pan Fleet Cooperative, Unalaska Fleet Cooperative, UniSea Fleet Cooperative, and Westward Fleet Cooperative) and all six CDQ groups. Additionally, two western Alaskan groups that have an interest in the sustainability of salmon resources would be parties in the ICA. All these groups have participated in meetings to develop the ICA and have a compliance responsibility in the agreement.

4.5.6 Donation of Bycaught Salmon: Prohibited Species Donation Program

The Prohibited Species Donation (PSD) program was initiated to reduce the amount of edible protein discarded under PSC regulatory requirements for salmon and halibut. Some groundfish fishing vessels cannot sort their catch at sea, but deliver their entire catch to an onshore processor or a processor vessel. In these cases, sorting and discarding of prohibited species occurs at delivery, after the fish have died. One reason for requiring the discard of prohibited species is that some of the fish may live if they are returned to the sea with a minimum of injury and delay (e.g., halibut and crab). However, all incidentally captured salmon die in the Alaska groundfish trawl fisheries (NMFS 1996). Therefore, to reduce the waste of edible protein, the PSD program was begun. NMFS implemented the PSD program for salmon in 1996, and expanded the program in 1998 to include Pacific halibut delivered to shoreside processors by CVs using trawl gear. The first donations were received under the PSD program in 1996.

The PSD program allows enrolled seafood processors in the Bering Sea and Gulf of Alaska trawl groundfish fisheries to retain salmon and halibut PSC for distribution to economically disadvantaged individuals through tax-exempt hunger relief organizations. Regulations prohibit authorized distributors and persons conducting activities supervised by authorized distributers from consuming or retaining prohibited species for personal use. They may not sell, trade, or barter any prohibited species that are retained under the PSD program. However, processors may convert offal from salmon or halibut that has been prepared for the PSD program, into fish meal, fish oil, or bone meal, and retain the proceeds from the sale of these products. Fish meal production is not necessarily a profitable venture. The costs for processing and packaging the salmon are donated by the processors participating in the PSD program.

The NMFS Regional Administrator, Alaska Region, may select one or more tax-exempt organizations to be an authorized distributor of the donated prohibited species. The number of authorized distributors selected by the Regional Administrator is based on the following criteria: (1) the number and qualifications of applicants for PSD permits; (2) the number of harvesters and the quantity of fish that applicants can effectively administer; (3) the anticipated level of PSC of salmon and halibut; and (4) the potential number of vessels and processors participating in the groundfish trawl fisheries. After a selection notice is published in the *Federal Register*, a PSD permit is valid for three years, unless suspended or revoked. Regulations at 50 CFR 679.26 describe numerous requirements for authorized distributors; reporting and recordkeeping requirements for vessels or processors retaining prohibited species under the PSD program; and processing, handling, and distribution requirements for PSD program processors and distributors.

Several inshore pollock processors participate in the PSD program. This program donates salmon, after being seen by an observer, to authorized distributors. Regulations require that donated salmon be headed, gutted, and frozen in a manner fit for human consumption. Generally, per regulatory design, the fishing industry may not gain economic benefit from the catch or disposition of prohibited species. However, the NOAA Office of Law Enforcement (NOAA OLE) has a policy that allows the heads and guts of these salmon to be processed into fish meal even though these may mean that prohibited species heads and guts could be sold in the form of fish meal. This policy allows processors to accrue a small economic benefit from the offal of prohibited species. Any salmon found at the plant that are not fit for human consumption are returned to the vessel and discarded whole during the vessel's next trip.

Since the program began in 1996, SeaShare (formerly Northwest Food Strategies) of Bainbridge Island, Washington, has been the sole applicant for a PSD permit for salmon from NMFS, and, therefore, the only recipient of a PSD permit for salmon. The NOAA presented SeaShare with a Marine Stewardship Award in 2006, evidence that the PSD program and its distributor SeaShare are effective. SeaShare is a 501(c)(3) tax-exempt organization that distributes seafood products through America's Second Harvest and its national network of food banks. The most recent selection notice for SeaShare was published in the Federal Register on June 11, 2014 (79 FR 33526) with permits effective through June 12, 2017.

Many trawl vessels and all three major shoreside processors operating from Dutch Harbor have participated in the PSD program since its inception as a pilot program in 1994. The shoreside processors Alyeska Seafoods, Inc., and Unisea, Inc. have participated every year; Westward Seafoods, Inc., has participated less frequently. Thirty-six trawl catcher vessels are qualified to participate in the PSD program and deliver to these shoreside processors. Additionally, there are 17 trawl catcher/processors that currently participate in the salmon PSD program; however, catcher/processors may not participate in the halibut PSD program.

There is limited information available on the volumes of non-Chinook salmon entering this distribution network. Program statistics do not discriminate between salmon species, although very little salmon of species other than Chinook salmon is believed to enter the system. The total processed or finished weight of Chinook and non-Chinook salmon distributed has ranged from about 32,700 pounds in 1999 up to about 483,400 pounds in 2005. In 2013, 349,235 steaked pounds, and 534 H&G pounds were distributed (SeaShare, personal communication 2013).[36]

Table 73 lists the annual net amount of steaked and finished pounds of PSD salmon received by SeaShare and donated to the food bank system from 1996 through 2008 (SeaShare, personal communication 2011). NMFS does not have the information to accurately convert the net weight of salmon to numbers of salmon. Note that salmon may be consolidated in temporary cold storage in Dutch Harbor awaiting later shipment, so salmon donated in November or December may appear in the results for the following year.

[36] Mary Harmon, SeaShare. Pers. Comm,, September 11, 2014, via e-mail.

Table 73. Net weight of steaked and finished PSD salmon received by SeaShare, 1996-2013

Year	Steaked Salmon (lbs.)	H&G Salmon (lbs.)
1996	89,181	
1997	99,938	
1998	70,390	
1999	38,731	
2000	62,002	
2001	32,741	
2002	102,551	
2003	248,333	
2004	463,138	
2005	483,359	
2006	171,628	
2007	87,330	
2008	74,237	
2009	59,233	
2010	52.262	
2011	252,474	
2012	83,845	30,582
2013	349,235	534

*For a time in 2001, processors stopped retaining salmon under the PSD program because regulations prohibited them from processing and selling waste parts of salmon not distributed under the PSD program. The regulations were revised through a final rule published August 27, 2004, to allow processors to use this material for commercial products (69 FR 52609).

Since 2008, the packaged PSD salmon is distributed through SeaShare to food banks has increasingly included deliveries to Alaska destinations. Table 72 shows delivery of donated salmon (all product forms combined) to Alaska from 2008 through 2014. During that time, deliveries have increased from 20,000 pounds, delivered only to Anchorage, to more than 216,000 pounds delivered to food banks in five Alaska communities. Also evident is that the Alaska portion of the total salmon donation has grown considerably over the years and was nearly equal to the outside Alaska portion in 2012.

Table 74. Prohibited Species Donation of Salmon Products in Alaska, 2008-2014

Location	2008	2009	2010	2011	2012	2013	2014
Anchorage	20,000	125,900	94,621	10,138	159,115	152,409	95,281
Cordova				29,000		3,895	
Fairbanks				3,321	6,245	40,456	80,700
Juneau						18,300	
Kodiak						1,012	2,216
St. Paul					6,650		
Alaska Total	20,000	125,900	94,621	42,459	172,010	216,072	178,197
Outside Alaska	525,566	310,392	455,280	638,147	174,932	444,973	220,390

Source: Data provided by Jim Harmon of SeaShare.

Expenses for processing the salmon and delivery to the food banks are covered by donations. Fishermen participating in the PSD program must sort, retain, and deliver to an approved storage facility, all salmon destined for the PSD program. Their costs include space on the vessel to store the fish, and maintenance of the fish in suitable condition. Processors must accept delivery, fill out the appropriate paper work, and process, refrigerate, package, and store the donated fish, incurring costs in time, labor, and equipment that must be borne by the processor. The PSD salmon must then be delivered from the processor to SeaShare, which then coordinates the temporary storage of the fish, its transportation, and routing to eligible food banks. The transportation costs to Seattle are usually donated by various freight carriers. Participation in the PSD program is entirely voluntary, so an entity that found the program requirements onerous could stop participating, without financial cost to itself (NMFS 2003a).

The PSD program reduces waste of salmon PSC. Without this program, these fish would be discarded at sea, and would not be directly used by anyone (although discards would be available to scavengers, potentially benefitting future fish productivity). The PSD program encourages human consumption of these fish, without creating an economic incentive for fishing operations to target them. Under the PSD program, salmon that are unavoidably killed as PSC are directly utilized as high quality human food, improving social welfare, and reducing fishery waste.

4.5.7 AFA Exempt and Side-boarded Vessels[37]:

As a part of AFA, the Council developed a variety of sideboards to prevent vessels from increasing their catch in other fisheries. Sideboard limits do not guarantee the sector that is side-boarded any amount of groundfish TAC. If other sectors take the available TAC before the sideboard limit is taken, both the sideboard fishery and the directed fishery will be closed to directed fishing. If the sideboard fleet reaches their sideboard limit before the TAC is taken, the sideboard fishery would be closed to directed fishing, but the remainder of the fleet may continue to fish under the remaining TAC.

NMFS will only open directed fishing for a species when adequate sideboard amounts exist at the start of the fishing year to cover both the bycatch needs for that species in other fisheries and the directed fishery harvests. NMFS will determine the bycatch of each species that is required in all of the catcher/processor target fisheries and the catcher vessel target fisheries, and then will subtract that amount from the available sideboard cap. The remainder is the amount of a species the AFA catcher/processors and AFA catcher vessels could use in a directed fishery. If that sideboard amount is too small to manage as a target fishery, NMFS would issue a closure notice at the beginning of the year and directed fishing for that sideboard species would not open.

GOA Sideboards

In the GOA, AFA catcher vessels are divided into two categories, those vessels subject to sideboard limits and those vessels exempt from sideboard limits. Similar to the BSAI, the Council provided an exemption for AFA catcher vessels that have demonstrated dependence on GOA fisheries, while having limited history in the BS pollock fishery. To qualify as an exempt AFA catcher vessel, the vessel must 1) be less than 125 feet length overall, 2) have landings of pollock in the BSAI of less than 5,100 pounds [or 1,700 metric tons, annually] from 1995 through 1997, and 3) made at least 40 landings of GOA groundfish from 1995 through 1997. Of the 117 AFA catcher vessels, 17 are exempt from GOA sideboards limit. Although not incorporated in regulation, the Council recommended and approved the exemption with the understanding that no GOA sideboard-exempt vessel would lease its BS pollock in a year that it exceeds its GOA average harvest level from 1995 through 1997. To ensure that Council's intent is satisfied, the Catcher Vessel Inter-cooperative Agreement binds vessels to this limitation.

The remaining 100 AFA catcher vessels are subject to the GOA sideboard limits, which are calculated based on the catch histories of these non-exempt vessels. Specifically, the sideboard ratio is the aggregate

[37] This section provides background information on AFA exempt and side-boarded catcher vessels. This information was excerpted from the Amendment 106 RIR/IRFA (NPFMC, 2013) for AFA Vessel Replacement (Final Rule implemented October 14, 2014). Information has been updated through the 2014 fishing season.

retained catch for each groundfish species or species group during 1995 through 1997 period, relative to the sum of the TACs for the species or species group. An inter-cooperative agreement divides the sideboard limit among the cooperatives and set penalties for exceeding the limits. Table 1-3 provides the GOA sideboard limits and usage for the non-exempt AFA catcher vessels for the 2014 fishing year.

AFA sideboard-exempt catcher vessels that participate in the Central GOA Rockfish Program are restricted by Central GOA Rockfish Program sideboard limits. Originally implemented in 2006, the Central GOA Rockfish Program includes a suite of GOA groundfish sideboard limits for catcher vessels. These sideboard limits are in effect only during the month of July. They are designed to restrict fishing during the historical month of the rockfish fishery, but allow eligible rockfish harvesters to participate in fisheries before and after that time period. Sideboard limits apply to harvest in other GOA rockfish fisheries (pelagic shelf rockfish, Pacific ocean perch, and northern rockfish) fisheries and halibut PSC (which limits participation in GOA flatfish fisheries). In 2014, 13 AFA catcher vessels participated in the Central GOA Rockfish Program, all of which were limited by the Central GOA Rockfish Program sideboards.

In addition to the AFA sideboards in the GOA, there are Stand-down requirements for trawl catcher vessels that fish in both the BSAI and GOA (§ 679.23(h)) that impact AFA catcher vessels. These measures were implemented in 1998, and are intended to prevent unexpected shifts of fishing effort between BSAI and GOA fisheries that can lead to overharvests of TAC in the Western and Central regulatory areas of the GOA. There are three Stand-down requirements:

(1) Trawl catcher vessels operating in the BSAI while the pollock or Pacific cod fisheries are open for directed fishing are prohibited from deploying trawl gear in the Western and Central GOA for three days after landing or transferring all BSAI groundfish. An exception applies to trawl catcher vessels that participate in the directed Pacific cod fisheries in the GOA and deliver to processors operating in the offshore sector.

(2) Trawl catcher vessels operating in the Western GOA area while pollock or inshore Pacific cod are open for directed fishing are restricted from using trawl gear in the BSAI for three days after landing or transferring all Western GOA groundfish.

(3) Trawl catcher vessels operating in the Central GOA area while pollock or inshore Pacific cod are open to directed fishing are restricted from using trawl gear in the BSAI for two days after landing or transferring all Central GOA groundfish.

In addition to stand-down requirements, there are exclusive fishing seasons for trawl catcher vessels that participate in the directed pollock fisheries in both the BSAI and GOA that impact AFA catcher vessels. These measures were implemented by emergency interim rule on January 25, 2000 (65 FR 3892) to address competitive interactions between the groundfish fisheries and Steller sea lions. As shown in Table 76, catcher vessels fishing in one season in the GOA or BSAI are prohibited from fishing in the alternative management area until the following season. This prohibition limits the concentration of fishing effort in one area and reduces the potential for localized depletion of Steller sea lion prey. Vessels less than 125 ft. LOA are exempt from this restriction when fishing east of 157° 00’ W longitude.

Table 75. 2014 listed GOA AFA catcher vessel groundfish sideboard limits (mt)

Species	Apportionments by season/gear	Area/component	Ratio of 1995-1997 non-exempt AFA CV catch to 1995-1997 TAC	2014 TAC (mt)	2014 non-exempt AFA CV sideboard limit (mt)	2014 AFA CV sideboard usage (mt)
Pollock	A Season Jan 20 - Mar 10	Shumagin (610)	0.6047	4,800	2,903	Confidential
		Chirikof (620)	0.1167	25,924	3,025	1,427
		Kodiak (630)	0.2028	8,680	1,760	537
	B season Mar 10 - May 31	Shumagin (610)	0.6047	4,799	2,902	Confidential
		Chirikof (620)	0.1167	30,963	3,613	2,082
		Kodiak (630)	0.2028	3,636	737	276
	C Season Aug 25 - Oct 1	Shumagin (610)	0.6047	13,235	8,003	Confidential
		Chirikof (620)	0.1167	12,448	1,453	1,056
		Kodiak (630)	0.2028	13,720	2,782	1595
	D. Season Oct 1 - Nov 1	Shumagin (610)	0.6047	13,235	8,003	Confidential
		Chirikof (620)	0.1167	12,448	1,453	2,145
		Kodiak (630)	0.2028	13,720	2,782	2234
	Annual	WYK (640)	0.3495	4,741	1,657	Confidential
		SEO (650)	0.3495	12,625	4,412	0
Pacific cod	A Season Jan10-Jun 10[1]	W	0.1331	13,753	1,831	Confidential
		C	0.0692	23,895	1,654	0
	B Season Sept 1 - Dec 31[2]	W	0.1331	9,169	1,220	Confidential
		C	0.0692	15,930	1,102	0
	Annual	E inshore	0.0079	1,792	14	Closed to directed fishing
		E offshore	0.0078	199	2	Closed to directed fishing
Sablefish	Annual, trawl gear	W	0.0000	296	0	Closed to directed fishing
		C	0.0642	936	60	Closed to directed fishing
		E	0.0433	221	10	Closed to directed fishing
Flatfish shallow water	Annual	W	0.0156	13,250	207	0
		C	0.0587	17,813	1,046	411
		E	0.0126	2,616	33	Closed to directed fishing
Flatfish deep water	Annual	W	0.0000	302	0	Closed to directed fishing
		C	0.0647	3,727	241	Confidential
		E	0.0128	9,443	121	Confidential
Rex sole	Annual	W	0.0007	1,270	1	Closed to directed fishing
		C	0.0384	6,231	239	330
		E	0.0029	1,840	5	Closed to directed fishing
Arrowtooth flounder	Annual	W	0.0021	14,500	30	Closed to directed fishing
		C	0.0280	75,000	2,100	765
		E	0.0002	13,800	3	Closed to directed fishing
Flathead sole	Annual	W	0.0036	8,650	31	Closed to directed fishing
		C	0.0213	15,400	328	164
		E	0.0009	3,696	3	Closed to directed fishing
Pacific ocean perch	Annual	W	0.0023	2,399	6	Closed to directed fishing
		C	0.0748	12,855	962	Closed to directed fishing
		E	0.0466	4,055	189	Confidential
Northern rockfish	Annual	W	0.0003	1,305	0	Closed to directed fishing
		C	0.0277	4,017	111	Closed to directed fishing
Shortraker rockfish	Annual	W	0.0000	92	0	Closed to directed fishing
		C	0.0218	397	9	Closed to directed fishing
		E	0.0110	834	9	Closed to directed fishing
Dusky rockfish	Annual	W	0.0001	317	0	Closed to directed fishing
		C	0.0000	3,584	0	Closed to directed fishing
		E	0.0067	1,585	11	Closed to directed fishing
Rougheye rockfish	Annual	W	0.0000	82	0	Closed to directed fishing
		C	0.0237	864	20	Closed to directed fishing
		E	0.0124	298	4	Closed to directed fishing
Demersal shelf rockfish	Annual	SEO	0.0020	274	1	Closed to directed fishing
Thornyhead rockfish	Annual	W	0.0280	235	7	Closed to directed fishing
		C	0.0280	875	25	Closed to directed fishing
		E	0.0280	731	20	Closed to directed fishing
Other rockfish	Annual	W	0.0034	n/a	0	Closed to directed fishing
		C	0.1699	1,031	175	Closed to directed fishing
		E	0.0000	780	0	Closed to directed fishing
Atka mackerel	Annual	Gulfwide	0.0309	2,000	62	Closed to directed fishing
Big skates	Annual	W	0.0063	589	4	Closed to directed fishing
		C	0.0063	1,532	10	Closed to directed fishing
		E	0.0063	1,641	10	Closed to directed fishing
Longnose skates	Annual	W	0.0063	107	1	Closed to directed fishing
		C	0.0063	1,935	12	Closed to directed fishing
		E	0.0063	834	5	Closed to directed fishing
Other skates	Annual	Gulfwide	0.0063	1,989	13	Closed to directed fishing
Sculpins	Annual	GW	0.0063	5,569	35	Closed to directed fishing
Sharks	Annual	GW	0.0063	5,989	38	Closed to directed fishing
Squid	Annual	GW	0.0063	1,148	7	Closed to directed fishing
Octopus	Annual	GW	0.0063	1,507	9	Closed to directed fishing

1 The Pacific cod A season for trawl gear does not open until Jan 20.
2 The Pacific cod B season for trawl gear closes Nov 1.

Table 76. Exclusive fishing seasons for trawl catcher vessels operating in the BSAI and GOA directed pollock fisheries

If you own or operate a catcher vessel and engage in directed fishing for pollock in the…	During the…	Then you are prohibited from subsequently engaging in directed fishing for pollock with that catcher vessel in the…
BSAI	A season	GOA until the following C season
	B season	GOA until the A season of the next year
GOA	A season	BSAI until the following B season
	B season	BSAI until the following B season
	C season	BSAI until the A season of the following year
	D season	BSAI of the A season the following year

Further, AFA catcher vessels are subject to trip limits for pollock that were implemented as part of the package of Steller sea lion mitigation measures adopted in 1999 (64 FR 3441). Catcher vessels are prohibited from retaining on board more than 300,000 lbs. (136 mt) of unprocessed pollock harvested in the GOA at any time during a trip (§ 679.7(b)(2)). This trip limit does not exempt vessels from regulations that require 100 percent retention of pollock when directed fishing for pollock is open. In addition, vessels in the GOA pollock fisheries are limited to landing no more than 300,000 lbs. through any delivery means, during a calendar day. A calendar day is defined as 12 AM to 12 AM (or 0001 hrs. to 2400 hrs.). The cumulative amount of pollock harvest from any GOA reporting area by an individual trawl catcher vessel is 300,000 lbs. times the number of calendar days the fishery is open in the respective reporting area.

Finally, trawl catcher vessels are prohibited from operating as pollock tenders and retaining on board more than 600,000 lbs. (272 mt) of unprocessed pollock in the GOA east of 157° 00' W longitude (§679.7(b)(3)). This regulation is intended to preclude the large scale use of tender vessels to circumvent the trip limit restriction. Tendering west of 157° 00' W longitude is allowed because smaller vessels delivering to Sand Point and King Cove are more dependent to tenders than the larger vessels that operate east of 157° 00' W longitude and deliver primarily to Kodiak.

4.5.7.1 AFA Catcher Vessel Participation and Catch

In 2011, 92 AFA trawl catcher vessels made at least one delivery of groundfish (Table 1-6). Over the years, the number of active vessels in this sector has declined as a result of the removal of less efficient vessels. Some of the oldest AFA catcher vessels are active in the GOA groundfish fisheries and are exemption from AFA GOA groundfish sideboard limits. AFA catcher vessels range in length from 73 feet to 189 feet. Of the 92 active vessels, 28 vessels are less than 100 feet in length, 15 vessels are between 100 feet and 120 feet in length, 24 vessels are between 120 feet and 129 feet, and the remaining 25 vessels are greater than 129 feet. Of the 92 active catcher vessels in 2011, 57 vessels have a BSAI only endorsement, while 35 vessels also have GOA endorsements. Of those 35 GOA-endorsed vessels, 15 vessels are exempt from GOA sideboards and 20 vessels are restricted by GOA sideboards. Eleven of the GOA sideboard-exempt vessels have both a Central and Western GOA endorsement, while four of the exempt vessels only have a Central GOA endorsement in addition to their BS endorsement. Finally, of the 20 AFA non-exempt sideboard vessels, 11 vessels have only a Central GOA endorsement, five vessels only have a Western GOA endorsement, and four vessels have both a Central and Western GOA endorsement.

Table 77. Number of AFA catcher vessels (inshore and mothership eligible) active in 2014 by vessel length with sideboard exemptions and GOA area endorsements

Vessel length (feet)	Number of active AFA eligible CVs	Number of active AFA eligible CVs with GOA sideboard exemption	Number of active AFA eligible CVs with BSAI Pcod exemption	Number of active AFA eligible CVs with CGOA endorsement	Number of active AFA eligible CVs with WGOA endorsement
<100	26	14	8	18	12
100-109	6	1	0	2	1
110-119	8	0	0	2	1
120-129	24	0	0	4	4
130-139	6	0	0	1	0
140-149	5	0	0	0	0
150-159	3	0	0	0	0
160-169	4	0	0	1	0
170-179	4	0	0	0	0
180-189	3	0	0	0	0
Total	89	15	8	28	18

Source: RAM LLP file, AK Vessel file, AK Region Sources, and Blend data

Table from AFA_Active(08-14)

Table 78. Count of sideboard-exempt and non-exempt AFA GOA-endorsed catcher vessels active in the BSAI by species from 2003 through 2014

AFA CV type	Year	Pollock	Pacific cod	Atka mackerel	Flatfish	Rockfish	Sablefish	Other
Sideboard exempt	2003	15	15	10	12	12	8	12
	2004	15	15	9	12	10	6	10
	2005	15	15	12	15	10	4	15
	2006	12	12	8	11	10	1	11
	2007	13	13	11	13	9	4	13
	2008	13	13	10	13	12	1	13
	2009	14	14	10	14	11		14
	2010	14	14	8	13	9		13
	2011	15	15	14	14	13	1	14
	2012	15	15	15	15	15		15
	2013	14	14	13	14	12		14
	2014	14	14	12	14	12	1	14
Non-exempt vessels	2003	22	23	18	21	16	16	19
	2004	22	22	20	22	19	7	21
	2005	22	22	18	21	14	11	21
	2006	22	22	19	20	17	12	18
	2007	21	22	18	20	18	16	18
	2008	21	22	13	21	14	4	19
	2009	21	22	14	20	16	2	18
	2010	21	21	14	21	17	3	17
	2011	20	20	15	20	18	5	20
	2012	20	20	15	18	17	5	17
	2013	19	19	15	16	15	1	15
	2014	20	20	15	16	15		15

Source: RAM LLP file, AK vessel file, AK Region Sources, and Blend data

Table 79. Catch (mt) of sideboard-exempt and non-exempt AFA GOA-endorsed catcher vessels in the BSAI by species from 2003 through 2014

AFA CV type	Year	Pollock	Pacific cod	Atka mackerel	Flatfish	Rockfish	Sablefish	Other
Sideboard exempt	2003	32,763	1,599	8	24	5	0	26
	2004	29,860	666	55	29	126	6	5
	2005	27,506	1,068	44	42	10	0	8
	2006	16,136	817	28	42	3	*	16
	2007	22,768	1,586	1	342	3	0	12
	2008	16,326	1,758	2	43	4	*	12
	2009	15,592	810	1	252	4		43
	2010	13,578	1,087	3	125	13		53
	2011	22,523	1,738	337	75	16	*	31
	2012	24,326	3,689	28	40	18		29
	2013	29,181	3,961	0	49	10		9
	2014	30,658	1,341	5	16	58	*	8
Non-exempt vessels	2003	115,954	16,884	118	188	54	2	139
	2004	123,917	18,183	84	222	28	1	71
	2005	131,584	14,784	96	236	81	3	122
	2006	131,329	15,215	82	526	120	2	123
	2007	121,893	13,713	29	754	60	1	129
	2008	83,151	11,864	4	658	51	0	348
	2009	70,576	12,792	5	1,206	44	*	160
	2010	73,674	9,496	39	535	42	0	162
	2011	114,658	12,428	197	782	54	0	92
	2012	110,026	14,932	60	929	57	0	249
	2013	106,758	12,472	58	558	84	*	60
	2014	111,884	12,444	1	520	79		144

Source: RAM LLP file, AK vessel file, AK Region Sources, and Blend data
*Withheld for confidentiality

4.6 Potentially Affected Salmon Fisheries

Chapter 3 provides information on chum and Chinook stock status, as well as information on commercial and subsistence fisheries. Additional detail on the importance of subsistence fisheries is contained in the appendices. That information is not repeated here; however, additional detail on the economic importance of chum and Chinook salmon fisheries is provided here.

Unfortunately, the impact analysis contained in Chapter 3 cannot provide impacts to regions of origin under the various alternatives. Impacts to salmon of the alternatives to the status quo, are measured in terms of their potential to maintain or reduce the current levels of adverse impact. Nonetheless, the alternatives, to the extent that they reduce salmon PSC, are likely to confer a beneficial impact as the mortality of salmon would be reduced. Thus, the potential benefits of the alternatives will most likely accrue as improved stock escapement and potentially improved future productivity. Thus, the information provided here is intended to highlight the importance of Chinook and chum salmon in Western Alaska under the status quo conditions, rather than as a baseline condition upon which alternatives are compared and contrasted.

4.7 Identification of Regions and Communities Principally Dependent on Commercial Fisheries

This section utilizes data on chum and Chinook salmon catch and gross value, by permit holders, to analyze the importance of chum salmon in the areas of Western Alaska most likely affected by the alternatives in question. In addition, a substantial body of analysis has been conducted by the Alaska Department of Labor, Workforce Development Division (ADOLWD) in creating their seafood industry profiles. These ADOLWD profiles provide information on the importance of various commercial fisheries, including salmon and pollock, to regions of Western Alaska. What is provided here is a summary of those profiles and it is intended to provide context of the relative importance of commercial fisheries, both for salmon and pollock, in regions and communities throughout Western Alaska. Also shown are the statewide status of both Chinook and chum salmon fisheries (Table 80 and Table 81). These tables show that chum salmon fisheries have remained open with few restrictions, while several commercial Chinook fisheries have been closed (Yukon, Kuskokwim, Norton Sound) and many other Chinook fisheries around the State are restricted.

Table 80. Statewide summary of chum salmon fishery status, 2013 [Source ADF&G]

	Chum Salmon Fishery Status		
Area	Subsistence fishery?	Commercial fishery?	Sport fishery?
Kotzebue	Yes	Yes	Yes
Northern Norton Sound	Yes	Yes, but limited	Yes, except Nome Subdistrict
Eastern Norton Sound	Yes	Yes	Yes
Yukon River summer run	Yes	Yes, but limited by low Chinook	Yes
Yukon River fall run	Yes	Yes	Yes
Kuskokwim River	Yes	Yes	Yes
Kuskokwim Bay	Yes	Yes	Yes
Bristol Bay	Yes	Yes	Yes
North Peninsula	Yes	Yes	Yes
South Peninsula	Yes	Yes	Yes
Aleutian Islands	Yes	Yes	Yes
Kodiak	Yes	Yes	Yes
Chignik	Yes	Yes	Yes
Upper Cook Inlet	Yes	Yes	Yes
Lower Cook Inlet	Yes	Yes	Yes
Prince William Sound	Yes	Yes	Yes
Southeast	Yes	Yes	Yes

Table 81. Statewide summary of Chinook salmon fishery status, 2014 [Source ADF&G]

Area	Subsistence fishery?	Commercial fishery?	Sport fishery?
Northern Norton Sound	Yes with restrictions	No	Yes with restrictions
Eastern Norton Sound	Yes very limited; with restrictions	No	Yes with restrictions
Yukon River	No	No	No
Kuskokwim River	Yes with restrictions	No	Yes with restrictions
Kuskokwim Bay	Yes	Yes with restrictions	Yes with restrictions
Bristol Bay	Yes	Yes	Yes with restrictions
North AK Peninsula	Yes	Yes	Yes
Kodiak	Yes with restrictions	Yes with restrictions	Yes with restrictions
Chignik	Yes with restrictions	Yes with restrictions	Yes with restrictions
Upper Cook Inlet	Yes	Yes with restrictions	Yes with restrictions
Lower Cook Inlet	Yes	Yes	Yes with restrictions
Prince William Sound	Yes with restrictions	Yes with restrictions	Yes
Southeast	Yes with restrictions	Yes troll fishery. No gillnet fishery	Yes with restrictions

4.7.1 Importance of Commercial Chum and Chinook Salmon Revenue to Western Alaska Limited Entry Permit Holders

The importance of commercial chum salmon varies by the region of Western Alaska in which commercial salmon fishermen live, and by the fisheries in which they participate. It is important to note that this treatment specifically considers chum salmon as opposed to the aggregation of all other non-Chinook salmon that comprise the non-Chinook PSC. This is because nearly all of the non-Chinook salmon in the Bering Sea groundfish PSC are chum salmon; however, large commercial catches of sockeye salmon occur in many areas of western Alaska. In some cases sockeye salmon catch dwarfs chum salmon catch (e.g., Bristol Bay). Thus, inclusion of sockeye salmon in an aggregate non-Chinook gross revenue analysis would drastically overstate the relative importance of non-Chinook salmon PSC versus that of chum salmon PSC. For this reason, this analysis specifically reports the importance of gross revenue earned from commercial chum salmon by limited entry permit holders residing in Western Alaska, in order to identify relative dependence on the species of fish that comprises nearly all of the non-Chinook salmon PSC that the action alternatives seek to address.

Table 82 and Table 83 summarize information on the importance of chum salmon gross revenues for western Alaska permit holders. Table 82 shows the percentage of the gross revenues earned by State of Alaska limited entry permit holders who live in a particular western or interior Alaska census district from commercial chum salmon limited entry fisheries in western Alaska. Table 83 shows the average gross revenues per person fishing received by these permit holders.

Table 82. Percent of commercial salmon gross revenue from western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts that is attributable to commercial chum harvests (source: AKFIN)

	Aleutians east	Aleutians west	Bethel	Bristol Bay	Dillingham	Lake and Peninsula	Nome	Northwest	Wade Hampton	Yukon-Koyukuk
1991	11%	6%	16%	2%	4%	2%	24%	91%	15%	61%
1992	6%	13%	11%	1%	3%	1%	17%	84%	6%	52%
1993	7%	8%	4%	0%	3%	1%	13%	80%	4%	41%
1994	14%	4%	6%	0%	3%	1%	3%	68%	2%	43%
1995	9%	5%	11%	0%	3%	1%	9%	89%	8%	72%
1996	4%	1%	4%	0%	1%	0%	2%	56%	4%	69%
1997	4%	2%	3%	0%	1%	1%	8%	71%	3%	29%
1998	3%	2%	7%	0%	1%	1%	3%	64%	1%	4%
1999	3%	1%	2%	0%	1%	0%	6%	66%	1%	3%
2000	7%	2%	1%	0%	1%	0%	4%	73%	1%	9%
2001	16%	4%	3%	0%	5%	2%	18%	86%		31%
2002	11%	3%	5%	0%	4%	1%	2%	37%	0%	9%
2003	8%	0%	2%	0%	2%	1%	4%	47%	0%	5%
2004	5%	0%	2%	0%	2%	0%	4%	51%	0%	3%
2005	4%	1%	2%	1%	3%	0%	2%	67%	15%	13%
2006	12%	2%	2%	1%	3%	1%	2%	61%	8%	14%
2007	6%	2%	2%	1%	3%	1%	5%	54%	15%	17%
2008	6%	9%	3%	1%	3%	4%	5%	77%	60%	42%
2009	13%	8%	5%	1%	3%	3%	7%	80%	87%	17%
2010	20%	8%	9%	1%	2%	7%	41%	92%	55%	22%
2011	15%	10%	26%	1%	3%	2%	42%	93%	86%	15%
2012	15%	10%	22%	0%	5%	3%	29%	90%	81%	66%
2013	9%	5%	22%	2%	5%	1%	36%	94%	86%	60%

Table 83. Average commercial salmon gross revenue from western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts that is attributable to chum harvests; nominal dollars per year (Source: AKFIN)

	Aleutians east	Aleutians west	Bethel	Bristol Bay	Dillingham	Lake and Peninsula	Nome	Northwest	Wade Hampton	Yukon-Koyukuk
1991	$8,140	$2,269	$1,212	$432	$1,114	$868	$1,076	$4,045	$1,911	$4,861
1992	$8,822	$5,122	$1,228	$258	$1,215	$1,029	$1,120	$4,130	$920	$3,996
1993	$6,349	$1,885	$394	$107	$1,103	$337	$607	$1,964	$342	$1,777
1994	$12,510	$1,085	$697	$165	$1,026	$587	$230	$2,256	$123	$3,612
1995	$10,674	$2,558	$1,157	$166	$1,151	$932	$475	$3,321	$718	$8,716
1996	$1,932	$330	$320	$88	$515	$89	$70	$1,039	$269	$7,040
1997	$2,313	$458	$102	$26	$146	$255	$330	$2,483	$227	$1,404
1998	$2,693	$720	$343	$43	$169	$274	$115	$1,488	$41	$361
1999	$2,967	$683	$102	$95	$252	$202	$152	$2,938	$106	$194
2000	$4,375	$1,050	$70	$41	$206	$140	$124	$3,762	$14	$680
2001	$5,318	$2,300	$79	$62	$593	$903	$329	$4,525		$7,851
2002	$3,810	$964	$88	$32	$296	$465	$21	$1,558	$8	$434
2003	$3,459	$55	$88	$71	$333	$270	$90	$3,839	$16	$224
2004	$3,851	$139	$105	$36	$381	$39	$186	$1,358	$19	$344
2005	$3,516	$405	$119	$173	$704	$106	$185	$2,790	$647	$1,840
2006	$9,321	$798	$148	$317	$948	$540	$174	$5,291	$523	$1,629
2007	$5,750	$1,037	$127	$324	$906	$926	$467	$4,976	$668	$2,521
2008	$9,096	$9,352	$247	$210	$1,114	$3,027	$594	$7,720	$1,822	$5,261
2009	$15,511	$7,809	$465	$254	$1,005	$2,897	$879	$5,876	$1,628	$3,345
2010	$11,836	$10,180	$762	$391	$910	$6,913	$4,135	$12,654	$1,884	$3,488
2011	19,883	11,136	1,941	407	1,077	3,859	4,215	9,559	6,679	3,825
2012	12,826	9,487	1,747	195	1,518	2,878	1,652	6,766	4,992	8,904
2013	10,788	9,931	1,734	613	1,640	1,202	3,426	10,022	6,420	5,864

These tables are meant to be indicative of the importance of chum salmon and suggest that commercial chum salmon harvest income is most important for persons living in the following census districts:

- Northwest: chum salmon revenues have historically provided the vast majority of all commercial salmon revenues in this census area. In 2013, 94 percent of all commercial salmon gross revenue earned in the Northwest Alaska census area was derived from chum salmon. In 2013, chum salmon average gross revenue was $10,022. However, the 2013 average gross revenue was lower than the $12,654 average gross revenue earned in 2010.

- Wade Hampton: although not historically a consistent source of revenue in this census area, chum salmon harvests in the most recent three years have provided the majority of gross revenue and as much as 86 percent of total commercial salmon gross revenue, in 2013. The 2013 average commercial chum salmon gross revenue earned by limited entry permit holders from this census was a period high of $6,420, which is more than triple the values observed in any of the three years prior to 2011.

- Aleutians East: chum salmon commercial gross revenues accounted for between 3 percent and 20 percent of the revenues earned by permit holders in the Aleutians East census district over the period 1991through 2013, with 2010 recording the period high of 20 percent. In 2011, chum gross revenue was 15 percent of total salmon gross revenue and recorded a period high of average gross revenues of $19,883 per permit holder. In 2013, chum salmon average gross revenue was $10,788.

- Yukon-Koyukuk: chum salmon gross revenues accounted for a majority of all commercial salmon gross revenue earned in the area in several years in the 1990s. With the decline in the Yukon River chum runs through the early 2000s, the proportion of gross revenue attributable to chum salmon declined, but rebounded to 42 percent in 2008, as Chinook stocks declined. Since then, the chum value for resident permit holders has declined, through 2011, and was 15 percent of total salmon value in 2011, representing $3,825 in average gross revenue per permit holder. Since 2011, chum average gross revenue rose dramatically in the region and was 66 percent of total commercial salmon gross revenue in 2012, and 60 percent of total salmon gross revenue in 2013. The 2012 average commercial chum gross revenue per permit holder was an historical record of $8,904; however, the 2013 value fell to $5,864.

- Nome: chum salmon revenues accounted for between 2 percent and 42 percent of the commercial salmon gross revenues earned by persons operating in the Nome census district. Average revenues ranged from $70 to $4,215 (2011). In 2013, chum salmon made up 36 percent of commercial salmon gross revenue, or $3,426 per permit holder, on average, in the Nome census district.

- Aleutians West: chum salmon revenues accounted for between 0 percent and 13 percent of the commercial salmon gross revenues earned by persons operating in the Aleutians West census district. Average chum gross revenues ranged from $55 to $11,136, with the largest average gross revenue occurring in 2011.

- Dillingham and Bristol Bay: These census areas tend to have relatively small amounts of chum salmon commercial gross revenue, owing to the greater importance of commercial sockeye fisheries in the Bristol Bay area. Nonetheless, the Dillingham census area recorded average commercial chum salmon gross revenues exceeding $1,000 in several recent years, as well as historically.

- Bethel: chum salmon gross revenues accounted for between 1 percent and 28 percent of the revenues earned by persons residing in the Bethel census district. Average revenues ranged from $70 to $1,941, with the largest average gross revenue occurring in 2011. In recent years, chum salmon commercial gross revenue, as a percent of total gross revenue, has increased from as low as 2 percent, to 26 percent in 2011, and has held at 22 percent in 2012 and 2013.

- Lake and Peninsula: chum salmon commercial gross revenues accounted for between 0 percent and 7 percent of the gross revenues earned by persons operating in the Lake and Peninsula census district, with the largest percentage occurring in 2010. Average revenues ranged from $39 to $6,913, with the largest average gross revenue occurring in 2010. Chum salmon gross revenue, as a percent of total gross revenue, decreased to 1 percent in 2013.

Table 84 and Table 85 summarize information on the importance of Chinook salmon gross revenues for western Alaskan permit holders. Table 84 shows the percentage of the gross revenues earned by State of Alaska limited entry permit holders who live in a particular western or interior Alaska census district from commercial Chinook salmon limited entry fisheries in western Alaska. Table 85 shows the average gross revenues per person fishing received by these permit holders. In sharp contrast to chum salmon gross revenues, Chinook gross revenue has played a small part in the overall salmon gross revenue earned by commercial permit holders in most regions. Historically, however, several areas have depended heavily on commercial Chinook gross receipts. The Wade-Hampton census area, which encompasses the Nushagak River Chinook salmon run, has historically relied heavily on Chinook commercial gross revenue, accounting for as much as 100 percent of salmon receipts in some years. However, Chinook gross revenue has fallen constantly in the region, through the 2000s, and was zero in 2011through 2013. The Nome census area has historically had as much as 85 percent of total salmon gross revenue come from Chinook commercial fishing during low chum runs in the early 2000s. Other areas, such as Bethel and the Yukon-Koyukuk, have relied on Chinook salmon gross revenue historically; however, with declining Chinook runs and commercial fishery restrictions, Chinook gross revenue has declined in recent years in those areas, as well.

Table 84. Percent of commercial salmon gross revenue from western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts, attributable to Chinook harvests (source: AKFIN)

	Aleutians east	Aleutians west	Bethel	Bristol Bay	Dillingham	Lake and Peninsula	Nome	Northwest	Wade Hampton	Yukon-Koyukuk
1991	0.85%	6.71%	8.57%	0.15%	0.90%	0.78%	43.41%	0.27%	81%	22%
1992	0.60%	3.28%	8.71%	0.28%	2.15%	1.38%	28.17%	2.61%	90%	26%
1993	0.95%	4.34%	5.29%	0.54%	2.41%	2.48%	34.49%	7.26%	91%	31%
1994	0.70%	2.90%	3.70%	0.27%	3.02%	1.35%	18.68%	3.08%	97%	23%
1995	0.86%	7.89%	9.95%	0.26%	2.48%	0.61%	41.18%	0.36%	88%	11%
1996	0.47%	4.17%	3.00%	0.13%	1.94%	0.30%	23.58%	0.37%	91%	7%
1997	0.48%	6.18%	14.35%	0.55%	3.44%	1.00%	65.88%	1.06%	95%	35%
1998	0.31%	3.23%	8.55%	0.38%	6.27%	0.57%	30.52%	2.89%	98%	37%
1999	0.20%	5.12%	7.27%	0.05%	0.73%	0.21%	43.65%	0.61%	99%	73%
2000	0.34%	2.77%	5.60%	0.07%	0.65%	0.09%	8.11%	0.45%	97%	24%
2001	0.26%	4.10%	7.51%	0.05%	1.31%	0.19%	3.83%	0.74%		4%
2002	0.63%	4.95%	14.56%	0.17%	2.76%	0.19%	83.50%	4.17%	100%	26%
2003	0.30%	0.01%	7.30%	0.11%	1.41%	0.35%	17.05%	0.88%	96%	32%
2004	0.42%	3.27%	7.33%	0.09%	3.29%	0.46%	18.84%	1.91%	100%	28%
2005	0.24%	1.61%	12.08%	0.17%	3.35%	0.39%	4.29%	0.66%	81%	14%
2006	0.45%	1.90%	10.26%	0.43%	4.07%	1.32%	5.80%	0.42%	90%	15%
2007	0.53%	2.30%	7.73%	0.04%	1.79%	0.22%	2.75%	6.38%	79%	17%
2008	0.27%	0.33%	6.50%	0.07%	0.93%	0.13%	0.09%	5.12%	23%	5%
2009	0.48%	1.28%	5.68%	0.05%	1.16%	0.19%	0.00%	4.60%	3%	1%
2010	0.76%	1.02%	8.59%	0.03%	0.98%	0.48%	0.78%	1.38%	42%	2%
2011	0.41%	1.07%	4.93%	0.05%	1.25%	0.22%	0.39%	0.01%	0%	6%
2012	0.61%	0.77%	3.24%	0.16%	1.29%	0.24%	0.00%	0.01%	0%	10%
2013	0.29%	0.40%	1.19%	0.09%	0.51%	0.10%	0.00%	0.01%	0%	2%

Table 85. Average commercial salmon gross revenue from western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts, attributable to Chinook harvests; nominal dollars per year (Source: AKFIN)

	Aleutians east	Aleutians west	Bethel	Bristol Bay	Dillingham	Lake and Peninsula	Nome	Northwest	Wade Hampton	Yukon-Koyukuk
1991	$658	$2,759	$662	$33	$286	$354	$1,982	$12	$10,347	$1,767
1992	$926	$1,298	$992	$120	$943	$993	$1,886	$128	$14,682	$2,012
1993	$901	$990	$472	$176	$1,038	$1,302	$1,570	$178	$7,508	$1,347
1994	$613	$799	$404	$117	$1,196	$852	$1,443	$102	$6,583	$1,935
1995	$1,041	$4,364	$1,036	$108	$1,120	$425	$2,162	$14	$8,008	$1,339
1996	$218	$1,191	$248	$48	$729	$184	$1,019	$7	$5,678	$692
1997	$301	$1,145	$530	$66	$551	$278	$2,608	$37	$8,457	$1,719
1998	$243	$1,202	$401	$64	$1,359	$220	$1,203	$67	$2,896	$2,996
1999	$220	$3,501	$361	$15	$241	$189	$1,136	$27	$7,678	$4,510
2000	$211	$1,364	$278	$14	$183	$47	$233	$23	$1,211	$1,786
2001	$83	$2,150	$216	$9	$172	$71	$72	$39		$1,020
2002	$225	$1,526	$269	$16	$232	$77	$895	$177	$3,495	$1,254
2003	$127	$2	$273	$19	$280	$144	$384	$73	$3,404	$1,337
2004	$310	$1,200	$423	$17	$749	$200	$847	$51	$5,301	$2,960
2005	$237	$937	$638	$57	$909	$189	$326	$28	$3,478	$1,900
2006	$346	$966	$622	$120	$1,362	$666	$470	$36	$5,775	$1,767
2007	$553	$1,488	$509	$16	$586	$140	$242	$585	$3,578	$2,570
2008	$393	$355	$492	$25	$304	$90	$10	$515	$695	$570
2009	$573	$1,237	$482	$21	$445	$173	$1	$340	$53	$230
2010	$457	$1,244	$766	$16	$452	$465	$78	$191	$1,428	$315
2011	$533	$1,215	$365	$27	$499	$342	$39	$1	$11	$1,656
2012	$541	$746	$257	$79	$416	$244	$0	$1	$0	$1,301
2013	$362	$741	$94	$35	$183	$133	$0	$1	$0	$232

4.7.2 Western Alaska Seafood Industry Profiles Summary

In addition to the census area level salmon gross revenue data presented above, the Alaska Department of Labor and Workforce Development (ADOLWD) maintains, an extensive analysis of fish harvesting employment, gross earning, and seafood processing employment and earning participation, by ADOLWD defined region. The ADOLWD analysis is available on their website in its entirety. However, the analysis combines all salmon species and does not provide information specific to chum salmon. Nonetheless, the information provided by ADOLWD will be used here to show the relative importance of salmon and pollock in the seafood harvesting and processing industry of Western Alaska. ADF&G commercial harvest and value information, specifically the proportion of commercial value attributable to chum and Chinook salmon, also will be provided below to highlight ADF&G management areas with high dependence on the salmon resource.

Northern Region

The ADOLWD Northern Region includes the communities, boroughs, and census areas associated with the fisheries of the Kotzebue, Norton Sound, and part of the upper Yukon River. Overall, in the Northern Region, 410 crew licenses were purchased in 2009, with about half of these coming from the Nome census area[38]. Overall, in the Northern Region, 264 permit holders were active in 2009, with 193 of these coming from the Nome Census area. ADOLWD estimates that 199 of those permits were used in local fisheries in 2009. The largest proportions of the total estimated harvest workforce and earnings in the Northern Region have historically come from the salmon fisheries (gillnet and set-net combined, $1.1 million in 2009). Gillnet salmon harvesting gross revenue declined substantially during the late 2000s; however, set-net gross revenue improved considerably during that time frame. Norton Sound pot fishing for crab is the other major source of harvesting gross earnings in the region and accounts for nearly half of the total value, or $1.3 million, in 2009. Income from fishery participation is spread widely among many communities in the region; however, none of the communities in the region have gross earnings of resident permit holders that exceed $1 million.

Northern Region fish harvesting employment, by species and month, is also tabulated by ADOLWD. Given the prevalence of the salmon fisheries in overall employment in the region, it is not surprising that harvesting employment tends to be dominated by the salmon industry and is greatest in the summer months of June, July, and August. In 2012, for example, 613 individuals were engaged in fish harvesting activity in August, with 480 engaged in salmon harvesting employment. In contrast, the twelve month average number of harvesting employment positions in all fisheries combined was 142 in 2012.

As of 2012, there were no processing facilities in the Kotzebue area; however, Norton Sound Economic Development Corporation has filed intent to operate processing facilities in Nome, Unalakleet, and Savoonga. ADOLWD also identifies processing facilities registered to operate in Tanana, Kaltag, Fairbanks, and North Pole. Note, however, that these data do not include any floating processors or buying stations that may be in operation in the region. The total processing worker count in the Northern Region seafood processing sector declined continuously from 189 processing workers in 2000, to 19 in 2004, and has rebounded somewhat to 64 in 2011. In 2012, the Northern Region processing worker total jumped to 453; however, this is due to an employer previously in a different industry being recoded into the seafood processing industry. Income earned in this region cannot be presented due to State of Alaska confidentiality restrictions.

[38] Data from 2009 is presented here because ADOLWD no longer provides an analysis of permit holdings and earnings in their seafood industry profiles available at http://labor.alaska.gov/research/seafood/seafood.htm.

Yukon Delta Region

The ADOLWD Yukon Delta Region includes the communities, boroughs, and census areas associated with the fisheries of the lower Yukon and Kuskokwim River areas. Overall, in the Yukon Delta region 1,086 crew licenses were purchased in 2009, and 1,038 local resident Alaska permit holders were active in 2009, with 987 of these having fished in the region. The vast majority of Yukon Delta region total estimated harvesting workforce has historically been employed in the salmon fisheries, where 2,517 positions of a total of 3,020 positions were supported in 2009. Salmon based employment revenue; however, was about a third of the total, with about $2.2 million in 2009, as compared to the region total of nearly $6 million. This disparity may be due to earnings of harvesting workers in the much higher valued halibut and herring fisheries. Resident permit holder salmon fishery gross earnings by community, as tabulated by ADOLWD, are spread throughout many communities in both the Wade Hampton and Bethel Census Areas; however, none of the communities in the region have gross earnings of resident permit holders that exceed $1 million from the salmon fisheries.

Yukon Delta region fish harvesting employment, by species and month, is also tabulated by ADOLWD. Similar to the Northern Region, harvesting employment is dominated by the salmon industry and is greatest in the summer months of June, July, and August. In 2012, for example, salmon employment represented 85 percent , 95 percent and 99 percent of total harvesting positions in June, July, and August, respectively. Groundfish, halibut, and herring fisheries also provide harvesting employment in the region. Of note is that there is little or no fish harvesting employment in the region from October through April

As of 2012, there were as many as 9 canneries and land based seafood processors in the Yukon Delta Region. These data do not include any floating processors or buying stations that may be in operation in the area. The total seafood processor worker count in the Yukon Delta Region seafood processing sector declined during the early 2000s as commercial harvests declined, but has rebounded from 2007 through 2012 to a period high in 2012, with 910 total workers. Non-resident workers made up a relatively small proportion of about 9 percent in 2012. Seafood processing wages are estimated to have been approximately $1.1 million in 2001, and have increased steadily to $5 million in 2012, with non-resident wages accounting for 27 percent of the total in 2012.

Bristol Bay Region

The ADOLWD Bristol Bay region communities, boroughs, and census areas associated with the fisheries of Bristol Bay including those in the Dillingham census area and the Lake and Peninsula Borough. Overall, in the Bristol Bay Region 878 crew licenses were purchased in 2009; the majority of licenses, 587, were purchased by Dillingham residents. Given the large scale of the Bristol Bay commercial sockeye salmon fishery it is not surprising that the region’s harvest employment total, which is an estimate of the total number of crew members participating in the fishery, is much larger (4,715 in 2009) than the local resident crew counts. This indicates that non-resident crew participation in the Bristol Bay fishery is about five times more than resident crew participation.

The crew counts shown above are in addition to limited entry commercial salmon permits that are actively used in the area’s fisheries. Overall, in the Bristol Bay Region, 603 resident permit holders and a total of 2,335 permit holder were active in 2009. The town of Dillingham recorded total gross earnings by resident permit holders of between $5 million and $10 million in 2009, while Togiak, Naknek, and King Salmon all recorded values of between $1 million and $5 million. Several other communities reported values less than $1 million.

ADOLWD has also tabulated data on fish harvesting employment and earning by gear type in the Bristol Bay Region. Since 2003, salmon fishery harvesting workforce in the Bristol Bay Region has stayed relatively constant, while gross earnings have steadily increased. In 2009, total workforce is estimated to have been 9,416, and total gross earnings are estimated to have been about $133 million, the vast majority of which were earned in the sockeye salmon fishery.

Salmon fisheries dominate overall fish harvesting employment in the Bristol Bay region, with the greatest employment in the summer months of June and July. In 2012, for example, 7,855 individuals were engaged in fish harvesting activity in July, as compared to the monthly average of 1,365. Halibut and herring fisheries provided most of the remaining harvesting employment in the region. Of note is that there is little or no fish harvesting employment in the region from October through March.

There are many fish processing facilities, floating processors, and buying stations in operation in the Bristol Bay area, primarily to support the sockeye salmon fishery. The total worker count in the Bristol Bay Region seafood processing sector has trended upward in the late 2000s. In 2010, the area's fisheries supported 4,886 seafood processing workers. Overall wages have increased steadily since 2003, with a period high of $33 million in total gross wages estimated for 2010. Total worker count has declined since 2010 and was 4,026, with $26 million in wages, in 2012.

Non-resident workers have made up a substantial proportion of the Bristol Bay Region workforce and accounted for approximately 86 percent in 2012. Bristol Bay non-resident wages were 87 percent of total wages in 2012.

Aleutian and Pribilof Islands Region

The ADOLWD Aleutian and Pribilof Islands Region include the communities, boroughs, and census areas associated with the fisheries of the Bering Sea and Aleutian Islands, including fishing communities in the Aleutians East Borough. Overall, in the Aleutian and Pribilof Islands Region, 4,239 commercial crew licenses were purchased in 2009, with 626 purchased by local residents of the three boroughs in the region. In total, 1,070 Alaska fishing permits were fished in the region in 2009, with 292 fished by local residents.

ADOLWD has also tabulated data on fish harvesting employment and earnings, by gear type, in the Aleutian and Pribilof Islands Region. The largest proportions of the total estimated workforce in this region have come from the pot and longline fisheries, with 1,471 and 1,995 employed in 2009, respectively. In terms of earnings, the pot fisheries dominate total earnings, with $186 million in 2009, while the trawl fisheries and longline fisheries earned $159 million and $53 million, respectively. The trawl fisheries have the highest proportions of 2009 non-resident earnings (92 percent), followed by the pot fisheries (79 percent), and longline fisheries (48 percent).

Salmon fisheries (gillnet, seine, and set-net combined), while having lower overall value, contribute substantially to the overall workforce and generally have greater local resident participation. The salmon fisheries of the region generated more than $36 million in gross revenue in 2009, and employed approximately 1,550 harvesting workers. The proportion of gross revenue earned by non-residents in salmon harvesting in the region in 2009 was 50 percent in the gillnet fleet, 20 percent in the seine fleet, and 9 percent in the set-net fleet.

Unlike other ADOLWD regions, fish harvesting employment in the Aleutian and Pribilof region tends to be dominated by the groundfish fisheries, including, but not limited to, the pollock fishery, and is spread across all months of the year. Groundfish harvesting employment is greatest in the A season months of January, February, and March. In 2012, for example, there were 1,897; 1,858; and 1,939 total fish harvesting jobs in the region in each of the first three months of the year, respectively, most of which were in the groundfish fisheries. Similar to other regions, maximum harvesting employment is observed in the summer months of June, July, and August when salmon harvesting jobs are greatest. In 2012, for example, there were 2,719; 2,460; and 2,263 total fish harvesting jobs in the region in June, July, and August, respectively. The majority of summer employment in fish harvesting comes from the salmon fisheries.

The Aleutian and Pribilof Islands Region are home to some of the largest fish processing facilities in existence. In 2012, there were five registered processing facilities operating in Dutch Harbor-Unalaska, which has the largest port landings total in the region. Akutan also has a large processing facility and additional facilities were registered to operate in 2012 in Adak, Atka, Saint Paul, False Pass, Cold Bay, King Cove, and Sand Point. Total worker count in the Aleutian and Pribilof Islands Region seafood processing sector has ranged from 7,072 in 2001, to a high of 7,899 in 2006, before falling to 5,991 in 2010. Total seafood processing worker count in the region was 7,217 in 2012. The decline in total seafood processing worker count in the late 2000s is likely related to the decline in pollock harvests. Non-resident workers have made up a large proportion of the region's workforce, more than 75 percent in all years. Total processing workforce wages in the Aleutian and Pribilof Islands Region were a period high of $129 million in 2012, 71 percent of which were earned by non-residents.

The information on employment, participation, and wages presented above for the ADOLWD Aleutian and Pribilof Islands Region is intended to provide an indication of the scale of fishing activity in the region, as well as documentation of the relative importance of groundfish and salmon fisheries to the region. The Boroughs and communities most likely affected by the proposed action on the pollock fishery are also identified. While a direct linkage of impacts of the alternatives on employment, both shoreside and among vessel crew, and on expenditures within communities dependent on these fisheries is not possible with presently available data, the information presented here is intended to provide a qualitative treatment of the scale of the fishery activity within dependent communities. This information shows that the Aleutian and Pribilof Islands Region supports diverse commercial fishing activity inclusive of pot, longline, trawl, and salmon fisheries upon which considerable numbers of local residents and non-residents depend.

4.8 Potential Effects of the Alternatives

The analytical framework of an RIR is based upon a benefit-cost method of impact analysis. Whether the analysis is quantitative or qualitative is determined by available information. This analysis is primarily qualitative, both with regard to cost and benefits, due to limited information on effects on salmon stocks of origin, as well as to the nature of the alternatives. The alternatives to the status quo, considered here, are focused on changing behavior of operators in the pollock fleet. Thus, potential impacts on the pollock fleet are treated qualitatively with respect to their potential to incentivize the avoidance of salmon PSC and provide operational efficiencies that may affect operating costs.

4.8.1 Potential Effects on Chum and Chinook Salmon

Chapter 3 contains a discussion of current trends in bycatch of both chum and Chinook salmon in the Bering Sea pollock fishery. Information is presented annually, by species, with breakout by sector, and by season. Chapter 3 also provides analysis of Chinook and chum salmon AEQ, overall and to regional stock groups, and impact rate estimates for Chinook and chum salmon. The AEQ analysis and results are presented for background information on the relative proportional estimates to regions of origin; however, information is insufficient to support carrying these calculations through to estimation of impacts to regions of origin under various alternatives. What this means is that the available information does not allow estimation of numbers of fish that could be harvested by any specific harvesting sector. As a result, it is not possibly to quantity the benefits of the alternatives to harvesters, be they subsistence, personal use, sport, or commercial.

The impact analysis for Alternatives 2 through 6, contained in Chapter 3, is based upon comparison with historical Chinook and chum bycatch (annually, seasonally, and by sector). For this reason comparative analysis of alternatives is framed in relative levels of Chinook and chum salmon PSC "saved" (reduced PSC) or in the case of alternatives estimated to increase PSC, the characterization is in additional losses (increased PSC). All of these estimated impacts are in comparison to status quo levels. Any impact to salmon under the alternatives then is estimated by whether it is likely to represent no change from status quo, an increase in the adverse impact from status quo levels, or a reduced adverse impact if PSC levels are estimated to be reduced by the alternative. A summary of the conclusions from the analysis of Chapter 3 is discussed below.

Alternative 1 retains the current Chinook and chum bycatch management programs. For Chinook this entails management under the Amendment 91 program, implemented in 2011, while for chum, management is under the program implemented in 2007 under Amendment 84, both of which are described in greater detail in Chapter 2.

Since Amendment 91 was implemented a number of changes have been noted in terms of salmon bycatch levels, rates, and vessel behavior. Under the status quo, salmon bycatch rates have declined for all sectors in recent years (Figure 27). Comparing salmon bycatch rates by week pre- and post- Amendment 91 also shows significant declines in each week and shows that the fleet is focusing on fishing earlier in the B-season (EA Figure 28). This confirms the findings of Stram and Ianelli (2014) that revised management regulations appear to have resulted in reduced bycatch of salmon overall. Also, lower salmon bycatch rates seem to reflect changing behaviour in response to new management measures. Their study also suggested that, since Amendment 91, performance at the individual vessel level improved and that the poorer performing vessels (in terms of having high PSC) improved (e.g., EA Figure 29). However, the study also suggested that not all vessels in the fleet had modified behaviour in conjunction with new management measures, and that room for improved vessel behaviour appeared to be related to fishing activities in the B-season (Stram and Ianelli, 2014).

Alternative 1 maintains the status quo level of adverse effect. However, given the impact rates (salmon PSC/aggregate run size) for chum and Chinook stocks in western Alaska, it is likely that salmon bycatch at current levels does not represent a significantly adverse impact.

Alternative 2 addresses chum salmon PSC management measures only. In October 2013, the three IPAs presented a collaborative proposal to the Council on how chum salmon bycatch could be incorporated into the existing IPAs. The proposal focuses upon the use of the current RHS program for chum salmon bycatch management. This program would operate in all sectors, with closures applying at the cooperative level (as with status quo) with some modifications. These will be based upon the intent to improve chum salmon bycatch avoidance during times of higher chum bycatch rates, while balancing Chinook salmon bycatch avoidance, and maintaining opportunities for pollock harvests in the latter portion of the B season[39]. The general changes suggested in the proposal presented to the Council in October 2013 form the basis for estimating how chum would be incorporated into IPAs in order to estimate the impacts of this alternative for purposes of this analysis.

[39] The initial proposal also contained an objective pertaining to a higher level of bycatch reduction for mature chum salmon during the months of June and July, based on previous reports to the Council on the higher proportion of western Alaska chum salmon in the bycatch during those periods. However, the value of prioritizing these months is inconclusive based on more recently presented chum salmon bycatch genetics reports (Guthrie et al, 2014). Nevertheless, some of those proposed measures, absent the specific timing considerations, may be considered in the future.

Some of the features that are included in the proposal are more stringent Base Rate definition, using a 2-week rolling average as suggested by previous analyses of RHS efficacy. Provisions are also proposed to avoid rapidly climbing Base Rates (which can serve to undermine the cooperatives impacted by closures by pushing most cooperatives into Tier 1, to which closures do not apply) and ineffective closures in periods of low chum salmon encounters (having little impact on bycatch but slowing down fishing and therefore increasing fishing later in the B-season when Chinook bycatch rates rise). These measures are all considered improvements over the current chum RHS program and would likely improve program efficacy.

One important element in the proposal is the explicit prioritization of Chinook protection when Chinook rates begin to increase. A "Chinook Protection Trigger" is proposed such that when a rate of $\geq$0.035 Chinook per ton of pollock is encountered in any ADF&G statistical area within a Region (Section 2.2), chum closures within that Region would cease and instead the applicable Chinook PSC limit and other measures within each IPA would be the primary bycatch management measures. The rationale for this dates back to the original RHS program under the regulations for Amendment 84 that operated as a combined Chinook and chum salmon bycatch management program and chum closures shifted to Chinook closures when that threshold was reached in a statistical area. As such, there was an explicit prioritization of Chinook measures if both salmon species were present. Regulations to implement Amendment 91 removed this prioritization, leaving chum RHS closures in effect late in the B-season, which can force the fleet into areas of lower pollock harvest rates and slow down the fishery. As seen in previous chum salmon bycatch management measures under consideration, anything that slows down the fishery in the B-season has the potential to exacerbate Chinook salmon bycatch later in the season.

The degree to which this provision actually would reduce the number of vessels that fish in the closures when they are in place is unknown, as many vessels are in RHS program tiers that allow them to fish in the closures, however, these vessels may nonetheless avoid fishing in the closed areas because these areas are identified as recent hotspots. December 2012 Council analysis of chum RHS closures discussed the limited amount of fishing that occurred in RHS closures and some vessel masters have mentioned in Amendment 91 skipper surveys that they always avoided the RHS closures. From 2003 through 2011, during RHS closure periods, 4.6 percent of catcher vessel pollock and 0.3 percent of pollock by the other sectors was taken inside the closure areas.

This alternative is likely to result in similar impacts to chum salmon as with status quo, although there is the potential for some increased chum salmon savings over status quo given proposed modifications to the RHS system. The increased flexibility of management under the IPA structure and specifically the inclusion of the Chinook Protection Trigger are likely to increase Chinook savings over status quo management as more potentially low-Chinook areas will be available for pollock harvests during times of increased rates of Chinook bycatch. While it is not possible to directly quantify these benefits, any reduction of Chinook and chum salmon bycatch will provide some improvement over the status quo impact on salmon stocks. **Therefore, this alternative is estimated to have some (likely small) reduced adverse impact compared to Alternative 1.**

The reduced adverse impacts to Chinook and chum salmon under this alternative assume that there remains 100% fleet-wide participation in the RHS program, as there is under the status quo (Amendment 84) chum salmon ICA. Should measures under Alternative 2 decrease the incentive to remain in an IPA, then adverse impacts to chum salmon and Chinook salmon under this alternative could increase.

Alternative 3 addresses Chinook management measures only. Under this alternative, the IPAs would need to modify their programs to include additional provisions and restrictions intended to increase incentives to reduce Chinook PSC. These modifications include the following: restrictions or penalties for vessels that have consistently high Chinook PSC rates, require use of salmon excluders, require that a

RHS program for Chinook operate throughout both A and B seasons, modify the longevity of a savings credit under savings-credit-based IPA programs (for inshore and mothership IPAs only), and additional restrictions or performance criteria to ensure that salmon bycatch rates in October are not higher than the preceding months. Here the latitude to address these provisions would be left to the individual IPAs, but general requirements would be added to the regulations to include additional provisions. The options under this alternative are not mutually exclusive. Alternative 3 would likely result in reduced adverse impact to Chinook salmon, depending on strength of incentives or penalties imposed, while the effect of Alternative 3 on chum salmon is likely similar to the status quo condition.

Alternative 4 modifies the start and end dates of the pollock season to begin earlier (option 1) and end earlier (option 2 with suboptions), as well as to shift 5% to 10% of the pollock quota from the B season to the A season (option 3). While these options are not mutually exclusive, this analysis treats them individually; however, section 2.8 further considers the overlay within and across alternatives.

Analysis of this alternative, with these options, indicates that by shifting effort to the A season (option 2 with suboptions) or early B season (option 1), and away from the period of highest Chinook PSC rates (September and October), Chinook PSC can be reduced. **This therefore suggests a reduced adverse impact to Chinook salmon relative to Alternative 1.**

Given that chum salmon bycatch rates are typically highest in August (with some indication that western Alaska chum are proportionally more common in the bycatch in June and July), shifting effort earlier into the B season (option 2 with suboptions) may result in slightly higher impact to Western Alaska chum salmon PSC compared with status quo. However, these chum PSC impacts are not estimated to be significantly adverse.

Alternative 5 would modify the existing PSC limit and/or performance standard threshold under Amendment 91 in years of low Chinook abundance. An index of the combined run sizes from three river system ('3 System Index') using the following river systems Unalakleet, Upper Yukon, and Kuskokwim in-river run reconstructions are proposed for use in determination of 'low abundance"(See Section 2.5 for more details on the justification for these river systems). If adopted by the Council, low abundance would be defined as an annual combined 3-system run size of ≤250,000 Chinook salmon. A range of proportional reductions to the PSC limit and/or performance standard threshold is evaluated annually (25% and 60%). The extensive analysis of this alternative and the many issues to be taken into consideration appear in sections 3.4.8.6 and 3.4.8.7 above. Overall, impacts to Chinook and chum under this alternative are estimated to be reduced from Alternative 1, contingent upon the IPA response to lower cap and threshold levels.

Alternative 6, the preferred alternative, combines the options and elements of Alternatives 2 through 5 into a comprehensive salmon PSC avoidance incentive package. As with each of the other alternatives, the **impacts to Chinook and chum under this alternative are estimated to be reduced from Alternative 1.** Specifically, the combination of increased incentives, flexibility in catching pollock at times where chum and Chinook bycatch may be reduced, and provisions for an explicit cap level reduction during times of low Chinook salmon abundance are considered to be complementary measures to further reduce bycatch of both salmon species and provide for improved management as compared with status quo.

Moving chum into the IPAs (Alt 2) is considered to have a similar impact to Alternative 1 on Chinook bycatch. The other elements of Alternative 6 interact to reduce Chinook salmon bycatch. Exactly how this will occur is uncertain, because Amendment 91 provides significant flexibility to the pollock industry to develop IPAs.

4.8.2 Potential Effects on the Pollock Fishery

Evaluation of the Safety of Human Life at Sea:

The preferred alternative is a combination of options amongst the various alternatives that combines provisions to minimize PSC of both chum salmon and Chinook salmon, especially Chinook PSC in times of low abundance, while providing the greatest flexibility possible to industry. The enhanced incentives to avoid salmon bycatch may mean that vessels must relocate to grounds further away from port, may have to spend more time at sea, may have to risk "prospecting" in times of bad weather. These are all conditions that exist presently in the post- Amendment 91 pollock fishery, as attested to during public testimony before the Council in April of 2015. By combining chum salmon and Chinook salmon PSC avoidance into industry managed incentive plan structure, it is intended that greater flexibly to manage PSC avoidance will be provided and will, in turn, provide for greater safety of human life at sea.

Effects on the Pollock Stock

Section 3.3.1, above, provides an assessment of the effects of the alternatives on pollock. That assessment has determined that Alternatives 2 through 5 are estimated to result in no significant changes to the pollock stock, relative to Alternative 1.

Alternative 2

Alternative 2 proposes a revised RHS system similar to the one in operation under Alternative 1, and addresses chum salmon PSC management only. In October, 2013 the representative of the three IPAs presented a collaborative proposal to the Council on how chum salmon bycatch reduction measures could be incorporated into the existing IPAs. The proposal focuses upon the use of the current RHS program for chum salmon bycatch management operating in all sectors with closures applying at the cooperative level (as with status quo) with some modifications based upon the intent to improve chum salmon bycatch avoidance during times of higher chum bycatch rates while balancing Chinook salmon bycatch avoidance and opportunities for pollock harvests in the latter portion of the B season.[40] The general changes suggested in the proposal, presented to the Council in October 2013, form the basis for estimating how chum would be incorporated into IPAs in order to estimate the impacts of this alternative for purposes of this analysis.

Some of the features that are included in the proposal are more stringent Base Rate definition and using a 2-week rolling average as suggested by previous analyses of RHS efficacy. Provisions are also proposed to avoid rapidly climbing Base Rates (which can serve to undermine the cooperatives impacted by closures by pushing most cooperatives into Tier 1 to which closures do not apply) and ineffective closures in periods of low chum salmon encounters (having little impact on bycatch, but slowing down fishing and, therefore, increasing fishing later in the B-season when Chinook bycatch rates rise). These measures are all considered improvements over the current chum RHS program and would likely improve program efficacy.

One important element in the proposal, which is likely to be included in any revised IPA proposal, is the explicit prioritization of Chinook protection when Chinook rates begin to increase. A "Chinook

[40] The initial proposal also contained an objective pertaining to a higher level of bycatch reduction for mature chum salmon during the months of June and July based on previous reports to the Council on the higher proportion of western Alaska chum salmon in the bycatch during those periods. However the value of prioritizing these months is inconclusive based on more recently presented chum salmon bycatch genetics reports (Guthrie et al, 2014). Nevertheless some of those proposed measures, absent the specific timing considerations, may be considered in the future.

Protection Trigger" is proposed such that when a rate of ≥ 0.035 Chinook per ton of pollock is encountered, in any ADF&G statistical area within a Region (Section 2.2), then chum closures within that Region would cease. Were this to happen, the applicable Chinook PSC limit and other measures within each IPA would be the primary bycatch management measures

The degree to which this provision actually would reduce the number of vessels that fish in the closures when they are in place is unknown. Many vessels are in RHS program tiers that allow them to fish in the closures; however, these vessels may nonetheless avoid fishing in the closed areas because these areas are identified as recent hotspots. December 2012 Council analysis of chum RHS closures discussed the limited amount of fishing that occurred in RHS closures and some vessel masters have mentioned in Amendment 91 skipper surveys that they always avoided the RHS closures. From 2003through 2011, 4.6 percent of catcher vessel pollock and 0.3 percent of pollock by the other sectors was taken inside the closure areas during RHS closure periods. As such, 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, while ceasing to do so as Chinook PSC increases later in August into September.

Alternative 3

Overall, the options analyzed under this alternative are all intended to increase the incentives to reduce Chinook bycatch within the IPAs. Any increased incentive at the vessel level is expected to reduce salmon bycatch overall. However, it is not possible to quantify the compliance of vessels within IPAs to these additional restrictions. Alternative 3 modifies some of the provisions within the IPAs to better address vessel-specific behavior and, thus, may increase some of the constraints on individual vessels, but is not anticipated to result in forgone pollock. Similarly, it is not possible to quantify the potential operational costs that may be incurred in further avoidance of Chinook.

Alternative 3, Option 1 imposes **"Restrictions or penalties targeted at vessels that consistently have significantly higher Chinook salmon PSC rates relative to other vessels fishing at the same time. Include a requirement to enter a fishery-wide in-season PSC data sharing agreement."**

Vessels have been repeatedly demonstrated to trade off the costs and benefits of fishing in different locations and at different periods (e.g., Eales and Wilen 1986, Haynie and Layton 2010, van Putten et al. 2012). For example, if the catch rate in an area increases, unsurprisingly vessels are more likely to visit that area, all other factors being equal. When fuel prices increase and make travel more expensive, vessels on average choose to take shorter trips, all other factors being equal. Any incentive that significantly increases the cost of catching PSC would reduce the likelihood that vessels would choose to fish in high-bycatch areas and/or at the highest bycatch time periods. Abbott, Haynie, and Reimer (2015) have shown how vessels in the Amendment 80 fishery have changed various aspects of their fishing behavior to reduce halibut bycatch when given individual-level allocations.

In evaluating different potential incentives, the question is whether the measures provide enough of an incentive to alter vessel behavior and, if so, to what degree. Because these changes may be costly, the potential cost of additional avoidance in terms of increased fuel, time, and lost product value that may result, must be justified by the benefits achieved through reductions in Chinook PSC.

Section 3.4.8.4 provides an extensive discussion regarding how restrictions or penalties may affect fishing operations. However, the option does not specifically define what restrictions or penalties may be imposed within the IPAs. In general terms, restrictions and/or penalties may increase some of the constraints on individual vessels, possibly resulting in some operational cost increase; however, it is not estimated to result in forgone pollock, but rather to incentivize the avoidance of salmon PSC.

The second part of Alternative 3, option 1 addresses a requirement for fleet-wide data-sharing. Information sharing is a core component of the IPA agreements for all sectors. For vessels to join an IPA, they are required to provide their observer data to the third party observer, which is currently Sea State. Vessels also communicate directly with Sea State when they have high salmon bycatch. Formal and informal information sharing is an integral part of the pollock industry's Chinook and chum salmon PSC management programs. Thus, this option is not likely to have adverse effects over the status quo condition.

Alternative 3, option 2 addresses a requirement for the IPAs to require the use of salmon excluder devices year-round or, as a sub-option, during specific times of the A- and B-season (see Section 2.3 description of alternatives).

In the mothership sector, salmon excluders are already employed nearly 100% of the time (with exceptions only for rare occasions such as torn nets, establishment of properly functioning nets, etc.[41]) with a pending revision to MSSIP contract formalizing 100% usage (with exceptions as noted) in 2015. In June 2014, the CP IPA feedback document proposed mandatory usage from January 20th to March 31st and again from September 1 to the end of the B season. Reporting requirements for usage were also proposed by the Inshore SSIP in June 2014, but mandating usage was not proposed under that sector's revised IPA.

Industry sources indicate[42] that the cost for the current best design of a salmon excluder (the over and under or O/U excluder), inclusive of materials, construction, and installation ranges from $13,500 to $18,000, and from $8,000 to $18,000 per excluder for tube excluders. The upper end of that range applies to higher horsepower Bering Sea CVs where it takes more webbing, floats, lead line, and construction time simply because the net is larger. The lower end of the range is an estimate for the GOA pollock CV trawlers in Kodiak. Estimates for Bering Sea pollock CPs are not available, as it is not clear whether the O/U excluder has been tried by that sector. These expenditures would accrue for each net the vessel carries. Considerations such as the number of 'excluder' configured nets per vessel (by vessel class and mode of operation); the duration of useful service-life of a net configured with an excluder; whether such a net can be repaired or restored, rather than replaced with a new set-up, all will influence the actual cost incurred by fishery participants who adopt these technologies. No empirical data are yet available with which to make such capital cost estimates.

Excluders can reduce target catch, as well as bycatch. This means that it may take more time fishing, which could push more fishing effort into September and October when Chinook bycatch is higher, and also could impose greater operational costs. Recent experimental fishing permit (EFP) results field testing excluders have shown a Chinook reduction of 38 percent, combined with a chum reduction of 7 percent, and less than one percent pollock loss.[43] However, it is not known how much these results can be generalized, and whether this percentage of salmon bycatch reduction will occur under both high and low salmon PSC conditions.

Alternative 3, option 3 addresses mandating that a rolling hot spot (RHS) program operate throughout the entire A and B seasons and an agreement to provide notifications of closure areas and any violations of the rolling hot spot program to at least one third party organization representing western Alaskans who

[41] Letter to C. Oliver from J. Bersch, Mothership Fleet Cooperative (October 2013). Summary included in staff discussion paper: http://www.npfmc.org/wp-content/PDFdocuments/bycatch/BSAIChinookDiscPaper913.pdf.

[42] Pers. Communication via e-mail with John Gauvin, consultant to the pollock CV sector, October 23, 2014 and Personal Comm. with J. Gruver, March 12, 2016.

[43] http://www.npfrf.org/uploads/2/3/4/2/23426280/salmon_excluder_efp_11-01_final_report-1.pdf. Accessed September 7, 2014.

depend on Chinook salmon and do not directly fish in a groundfish fishery. The Chinook rolling hotspot (RHS) programs that are components of the CP and Mothership IPA programs are in place in some form throughout the year. Currently, the Inshore IPA program has a provision that suspends the Chinook RHS closure program when the share of the seasonal base cap exceeds 25% of the total allocation. Mandating that a RHS program operate throughout the entire A and B seasons would apply to only the inshore RHS program. The Council could, at a future time and separate action, recommend additional changes to the CP and mothership RHS programs that would make those programs subject to these provisions in very low Chinook PSC situations, when they currently do not apply. Actually, there are times under all three RHS programs where closures are not in place, because of *low* Chinook PSC, rather than high-PSC conditions.

While there have been formal suspensions of the inshore RHS program in some years, in the other sectors the number of Chinook RHS closures actually applied – and the number of vessels impacted – has been quite limited since Amendment 91 went into place in 2011. Both the mothership and the CP sector had no RHS closures in 2012, due to extremely low Chinook bycatch rates. In the B-season of 2011 when the Inshore Chinook RHS program was suspended on September 15, there were no RHS closures in the CP sector due to Chinook PSC, while there were 4 closure announcements for the mothership sector. This proposed change would have an impact later in the season in higher PSC seasons. Given the rules in the current system, the closures would not apply to all vessels, but to those vessels with relatively high salmon bycatch.

Alternative 3, Option 4 addresses specific provisions of the time required in the Inshore and Mothership Salmon Savings Incentive Programs (SSIPs) to accrue and save salmon credits. This option does not apply to the CP sector, as its IPA is not based on salmon credits. The Inshore and Mothership SSIPs allow vessels to earn credits by avoiding salmon in one year, which they can use in the future to fish above the vessel or mothership platform's share of the performance standard for a limited number of years. Under this option the credits would be allowed to last for a maximum of three years.

As well as the duration of earned salmon credits, the rate at which vessels earn salmon credits is important. The Mothership program earns each platform one credit per 2.29 salmon avoided below the performance standard, with credits lasting for 3 years. The Inshore IPA enables vessels to earn 1 savings credit for each 3 salmon that they avoided below the performance standard, but credits last for 5 years.

The 2013 Inshore IPA report states that the 5-year window was necessary to fulfill the Council's requirements for an IPA. "*The SSIP proposed to the Council ahead of the final motion in April of 2009 included a Savings Credit lifespan of 3 years. However, once the Council included the 2 out of 7 year limitation on exceeding the Performance Standard for vessels in an IPA the SSIP, in order to keep the main incentive of the program in place (earning Savings Credits) the lifespan had to be extended to 5 years. Without the additional 2 years the SSIP may not have qualified as an Incentive Plan in all years. For example, if the inshore sector exceeded its Performance Standard 2 years in a row, and had continued with the 3-year life span, there would be no incentive by vessels to earn Savings Credits in either of the following 2 years*."[44] To ensure that incentives are always in place, the Mothership sector IPA creates a second element to its SSIP program where credits would have to be earned for vessels to fish to their sector's share of 47,591 in the event that the performance standard was exceeded in any 2 of 7 years.

[44] http://alaskafisheries.noaa.gov/sustainablefisheries/afa/coopreports/2013/inshoreipa.pdf. Accessed September 5, 2014.

A system that allows vessels to earn credits will be more effective if it is more likely that the credits will be useful. Given the low PSC totals in recent years, vessels have large quota balances. With a full "credit account", the likelihood that additional credits earned in a particular year would be useful is quite low.

Table 34 displays salmon savings that would be earned under the current salmon credit earnings rates of the Mothership and Inshore SSIP programs under different annual salmon bycatch conditions. For example, if salmon PSC were 10,000 fish per year, under the inshore SSIP program, 1 credit would be earned for each 3 salmon below the performance standard level of 47,591 the vessel tallied. For the Mothership SSIP, 1 credit would be earned for each 2.29 salmon below the performance standard level of 47,591 the operation tallied. [Note: in actuality, this would apply to each sector's share of the performance standard, but here we use the total cap values for illustration.]

It takes roughly 4 years for inshore vessels to earn the credit balances that mothership platforms acquire in 3 years for the same salmon bycatch levels. Until the 4th year, vessels could have larger amounts of total credits in the mothership program, because of faster earnings rates, but then the total credits earned in the mothership program would stay constant, because the 4-year-old credits would expire for motherships.

There is a trade-off implicit in how long salmon credits can be saved. Having salmon savings credits endure for a longer periods makes them more valuable to earn, but it also means that vessels will often have more credits "in the bank," so the value of earning additional credits declines. There is a tradeoff between credits being too hard to earn so it is not worth the effort and so easy to earn that the credits are not worth very much. After several years of low Chinook bycatch rates, Chinook bycatch conditions would have to change greatly to make more credits likely to be valuable. There is also a trade-off in whether it is more likely that people will use saved credits with shorter or longer duration. With credits that last 5 years, the credits will be available for a longer time and therefore are more likely to be used than if they had expired. Thus it is expected that requiring a 3-year credit duration would lead a reduction in salmon bycatch, on average, although in observed bycatch conditions well below the cap, the 5-year credit duration policy has not actually led to more salmon being utilized because almost all vessels are earning rather than using credits in most years. Reducing the credit duration to 3 years means that vessels on average will have less banked credits and therefore it will be less likely that the credits could be used as bycatch and therefore more likely that they will be available to the target fisheries.

As discussed in Chapter 3, the credits available under the two SSIP programs are a function of the earning rates (2.29 versus 3 salmon must be avoided to acquire a savings credit), the duration of credits, and the likelihood that credits will be needed, which is partially a function of the gap between the performance standard and the PSC limit as well as salmon stock conditions. It is possible that with the existence of the IPAs that there is a shift of salmon impact on non-pollock users from the present to the future, although the fact that there are always individual incentives for each vessel to not use credits (to preserve them for a future year), it is unclear whether there really is a net impact in the future.

Decreasing the duration of credits to 3 years would be likely to increase the incentive to earn credits for the inshore sector, but increasing the credit earning requirement from 2.29 to 3 for the mothership sector would also increase the incentive to reduce Chinook PSC. The inshore SSIP could choose to change its credit earning rate if only the duration of credits is mandated.

Alternative 3, Option 5 considers ways that the fishery would be allowed to stay open in October, contingent on vessels meeting Chinook PSC rates that are deemed acceptable by the Council. In very general terms, if criteria can be designed to ensure that vessels do not have "excessive" bycatch late in the season, this alternative would provide greater flexibility to vessels. For example, it could ensure that they have an opportunity to catch their pollock quota, and could allow them to pursue other fishing opportunities (e.g., tendering or fishing on the West Coast), while avoiding excessively high salmon bycatch. However, the detail necessary to fully evaluate the potential effects of this option is not presently specified. Chapter 3 provides a discussion of the various considerations that could help define such criteria. Such a measure has the potential to limit Chinook PSC, while allowing vessels that have a low-PSC rate to continue to fish.

Alternative 4

Alternative 4 would modify the season length in the summer B season by opening or closing the fishery earlier, as well as shifting seasonal allocations of pollock quota to provide additional quota availability in the A-season (note these are not mutually exclusive). This could affect the spatial or temporal distribution of the pollock stock and hence the size composition of the catch (e.g., see Figure 13 for changes in mean body weight within season). Under either of these options, 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 would appear to result in catches of pollock that were smaller in mean sizes-at-age (e.g., small pollock generally caught earlier in B-season; Figure 13). 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 adversely affected. Therefore, while this situation could result in minor changes in the future catches (indirectly through the stock assessment/ABC determination process), Alternative 4 would have no significant impact on the sustainability and viability of the pollock population, because it is unlikely to affect the distribution of pollock such that it has an effect on the ability of the stock to sustain itself.

Alternative 4 modifies the start and end dates of the pollock season to begin earlier (option 1) and end earlier (option 2, with suboptions). While these options are not mutually exclusive, this analysis treats them individually. Option 1, to open the pollock fishery on June 1st , suggests that shifting the B-season opening date sooner would likely help reduce Chinook salmon bycatch, assuming some vessels choose to start fishing earlier, although this may conflict with other opportunities (e.g., such as using pollock vessels to tender other non-pollock fishing operations such as directed herring and salmon).

A review of ADF&G tendering registration data shows that no AFA vessels are engaged as licensed tenders. They may act as floating processors, which certainly occurs with seafood companies that own or operate both shoreside facilities as well as catcher processors/motherships. These floating processors use the Alaska Business License (processor code) of the shoreside processing facility, thus, ADF&G has no data documentation that the CP/FP vessels are engaged in processing for a specific shoreside plant. It is possible that the CP/FP vessels are engaged in taking seafood product from tender vessels and processing that product (Pers. Comm. Gail Smith, ADF&G via e-mail August 28, 2014). Despite data limitations, anecdotal evidence from industry representatives suggests that tendering/processing in other fisheries may limit the ability of some multi-fishery AFA operations to begin fishing earlier than the current start of the B season.

Chapter 3 contains an analysis of the option to close fishing earlier (Sept 15th, Oct 1st, and Oct 15th). That analysis assumes that all pollock catch was achieved in the time frame leading up to the closure. For contrast, Table 46 provides actual values of the pollock that would have been forgone after the closure dates. This information is an approximation of the ‘worst-case scenario” for pollock; however, it is expected that additional effort would be shifted to earlier in the season in order to catch all available quota, albeit with potentially greater operational costs. However, it is not expected that pollock TAC, and thereby gross revenue, would actually be forgone.

Alternative 4, Option 3 would change the allocation of pollock to have 5% and 10% more of the annual TAC be taken in the A-season. Vessels typically come very close to their A-season allocation in virtually every year, suggesting that the 40 percent cap does constrain the fishery and that additional flexibility could lead to more fishing in the A season.

Initially, efforts were made to use regression analysis and available data on catch, annual product prices, and products produced to recover the relative monthly premium, based on the differences in recover rates and products made at different times of year. Data limitations in the end precluded conclusive analysis. Seasonal data have been compiled that show the relative values of average production and the A and B seasons and suggest increased economic benefits from moving TAC from B-season to A-season.

The economic benefits of switching quota from B-season to A-season can be estimated by examining available data on AFA pollock production.

Several caveats should be included about these values:

1. Production data are self-reported.
2. The prices are annual values reported by processors, so inter-annual variation within a category is not observed if this varies within the year or season.
3. Differences in value between the seasons are a function of 1) product recovery differences, 2) the different values of different products, and 3) seasonal differences in what products are produced (e.g., more roe in the winter).
4. Across years, differences are a function of many factors, including the relative values of different products, roe recovery rates, and what products are produced by different processors.

The following tables show the value per ton product by sector, with motherships and catcher processors combined to protect confidentiality.

Table 86. Gross Value per ton of pollock product, and gross value per metric ton of pollock round weight of catch, by sector (M and CP, inclusive of CDQ, combined; Source: AKFIN data; $US

	Value Per Product Weight				Value Per Round Weight			
	CP + MS		CV		CP + MS		CV	
Year	Season A	Season B	Season A	Season B	Season A	Season B	Season A	Season B
2009	3,888	2,922	3,143	2,636	1,533	1,107	1,323	1,023
2010	3,636	3,230	2,890	2,669	1,488	1,255	1,228	1,078
2011	3,335	2,839	2,641	2,487	1,375	1,098	1,104	1,007
2012	3,554	3,024	2,767	2,526	1,423	1,082	1,187	1,027
2013	2,815	2,534	2,334	2,246	1,145	966	992	907

The following table captures the value premium each year of both product and retained round weight caught in the A-season relative to the B-season.

Table 87. Pollock A-Season Product Value Premium, Percent of Revenue by Weight (Source: AKFIN data)

	A-season value premium			
	CP + MS		CV	
Year	Production Weight	Round Weight	Production Weight	Round Weight
2009	0.33	0.38	0.19	0.29
2010	0.13	0.19	0.08	0.14
2011	0.17	0.25	0.06	0.10
2012	0.18	0.32	0.10	0.16
2013	0.11	0.19	0.04	0.09

The following table looks at the MT of product that comes from MT of catch, by sector and year. This rate differs from values in the Economic SAFE report because of data duplication identified in submitted data. These rates are calculated by summing the total product weight and dividing by the retained round weight.

Table 88. Pollock A and B Season Calculated Product Recovery Rates (Source: AKFIN data)

	Product recovery Rate			
	CP + MS		CV	
Year	Season A	Season B	Season A	Season B
2009	0.39	0.38	0.42	0.39
2010	0.41	0.39	0.42	0.40
2011	0.41	0.39	0.42	0.41
2012	0.40	0.36	0.43	0.41
2013	0.41	0.38	0.42	0.40

Data steps

The following data utilize AFSC observer data catch totals for the offshore sectors and fish ticket data for the inshore sector. Production data come from the NMFS processor data that have been supplemented by AKFIN with the product values from the ADF&G Commercial Operators Annual Report (COAR).

To estimate the seasonal gross wholesale value per metric ton of product, the summed wholesale product value for all processors in each sector is divided by the summed product quantity for each year and season. To estimate the gross wholesale value per metric ton of catch, the summed wholesale product value for all processors in each sector is divided by the summed pollock round weight catch total for each season.

The A-season value premium represents the relative percentage increase in gross wholesale value of A season to B season product or catch.

The season product recovery rate is calculated as the metric tons of all pollock product, both primary and ancillary, divided by the metric tons of AFA pollock catch.

Alternative 4 TAC Shift Examples:
The table below shows potential results of both a 5 percent and a 10 percent shift of 2014 pollock catch from the B-Season to the A-season. The catch, rather than initial annual allocations, is valued here because it is inclusive of all in-season allocation changes and includes overages. The prices used to value additional A-season catch are the five-year average (2009 through 2013) A-season gross wholesale price premiums calculated from the tables above, by sector, and for retained catch weight. The CP and M combined prices are used for CP, M, and CDQ in this example, while the AFA inshore sector is evaluated using the CV ex vessel values. The Average per Landed Weight premium for CP+MS is $291, and for CVs is $158.

The table below shows that a 5 percent shift of pollock catch to the A-season results in more than $15 million in increased value. The 10 percent shift doubles this estimate to more than $30 million. This estimate assumes that the A-season product value premiums will be fully earned; however, that is not likely to be the case. What this TAC shift is more likely to do is to extend the A- season fishing activity into later March and April for different vessels when these premiums are not likely to be as high. Unfortunately, price data used in this analysis are only collected annually. Annual data do not allow estimation of monthly premiums that would better represent a more realistic increase in gross value from this A-season TAC shift. Further, the price premiums vary depending on changing market conditions. As a result, this example represents a high end of a range of possible premiums and it is not possible to know exactly how much of this premium would be earned from the TAC shift to the A- season. It is extremely likely that a premium would be earned for this TAC shift; however, it is not possible to say precisely where the premium would fall.

Table 89. A-Season Pollock TAC Shift Premium- Tons and Gross Wholesale Value

Sector	2014 Catch (mt)			5% Shift	10% Shift
	Total	A-Season	B-Season	Total Increase in Value Per Landed Weight	Total Increase in Value Per Landed Weight
CDQ	128,549	51,304	77,245	$2,070	$4,140
AFA Inshore	555,518	220,904	334,614	$4,049	$8,098
AFA CPs	445,178	177,201	267,977	$7,182	$14,364
AFA M	111,000	44,244	66,756	$1,789	$3,578
Total	**1,240,245**	**493,653**	**746,592**	**$15,090**	**$30,180**

Catch data source: http://www.alaskafisheries.noaa.gov/2014/car111_season_bsai_with_cdq.pdf
Source: AKFIN.

The gross wholesale values calculated in the table above also suggest that the A-season TAC shift may provide considerable secondary economic benefit to fishery dependent communities. These benefits would accrue through greater earnings for shore-based processing plants, due to higher A-season wholesale product values. There may also be greater earnings by vessel crew, with associated increases in expenditures when in port. The magnitude of such benefits cannot be quantified; however, we note that they are likely to accrue.

Thus, it is expected that there will be some economic gains from fishing in the A-season versus the B-season in all year, but the degree of this benefit will depend on market conditions for different products, fish size caught in the fishery, the product recovery rate of fish caught, the value and quantity of roe, and how much of the fish that is transferred comes from the end of the B-season. Considerable variation is likely across years.

Alternative 5

Alternative 5 would modify the existing PSC limit and/or performance standard threshold under Amendment 91 in years of low Chinook abundance. An index of the combined run sizes from three river system ('3 System Index') using the following river systems Unalakleet, Upper Yukon, and Kuskokwim in-river run reconstructions are proposed for use in determination of 'low abundance"(See Section 2.5 for more details on the justification for these river systems). Low abundance would be defined as an annual combined 3-system run size of ≤250,000 Chinook salmon. A range of proportional reductions to the PSC limit and/or performance standard threshold is evaluated annually (25% and 60%).

It should be noted that vessels would have faced a lower PSC cap and/or performance standard threshold from the beginning of the year, and in all recent years would have had an incentive to avoid Chinook throughout the year to avoid reaching the limits. Analysis of this alternative was limited to considering historical catch, and employing cut off dates based on a new B-season threshold only as a worst-case scenario evaluation. This evaluation however, is limited by an inability to quantitatively estimate what behavioral changes would occur by industry revising the IPAs to accommodate these potential restrictions and improve incentives accordingly. It is unknown whether the gap between the performance standard threshold and PSC limit would encourage those operating under IPAs to be more likely to risk exceeding the lower level in those years, and, if so, revise the IPA for the resulting PSC limit of their portion of the 47,591; and/or respond slowly to the need to operate under the lower performance standard as the PSC limit would not be imposed until the third of 7 years. In addition, it is uncertain whether sectors, cooperatives, CDQ groups, or individual vessels would opt-out of the IPA (e.g., a sector chooses not to submit an IPA, or a cooperative, CDQ group or vessel chooses not to participate in an IPA), and instead be subject to the opt-out allocation, which is the sum of each opt-out vessel's portion of the opt-out cap of 28,496 or the performance standard threshold, whichever is less. Sectors, cooperatives, or CDQ groups that opt-out would not receive any direct PSC allowance of Chinook salmon. As the opt-out cap is approached, NMFS will close the pollock fishery to opt-out vessels to prevent exceeding the opt-out PSC allowance.

Alternative 6

Alternative 6, the Council's preferred alternative (PA), is a combination of elements of Alternatives 2, 3, 4 and 5. As such, the analyses of the impacts of this alternative are best reflected in the discussion appearing immediately above. Further discussion of the implications of combining these alternatives and likely implications are summarized below.

Alternative 6 is expected to decrease the amount of pollock caught in B season by up to 5 percent. How this will affect the timing of fishing by individual vessels is unknown, but it will enable vessels to complete their pollock fishing and should reduce Chinook bycatch as a result of any reduction that occurs later in the season. Because of this and current efforts by industry to reduce Chinook bycatch, the net reduction in Chinook from the options added to the IPA requirements could be reduced because there is likely to be less fishing in October. This means, for example, operating excluders or the rolling hotspot program late in the year may not affect as many vessels or trips.

The combination of measures from Alternatives 4 and 5 (pollock reapportionment and cap reductions) is likely to make it easier for vessels to stay below their allocations under a reduced performance standard threshold and PSC limit because it is less likely that vessels will need to fish in the high Chinook bycatch period late in the B-season to catch their pollock allocation.

Because under Alternative 6 the gap between the performance standard threshold and the PSC limit has increased from 26 to 35 percent of the performance standard threshold relative to the current gap, the incentive to participate in an IPA does not appear to be diminished. The reduced duration of credits for inshore vessels makes it more likely that credits earned in a year will be useful in the future, although it is apparent from public testimony that vessels and companies are striving not to need to use the credits at any point.

4.8.3 Potential Effects on Fisheries Dependent Communities

The effects of the alternatives on the pollock fishery do not include any significant impacts to the pollock stock, no direct changes to the pollock TAC, and do not directly affect fishing communities. Several of the alternatives do have the potential to add constraints to vessel operations and possibly to increase operations' costs for things such as fuel, crew food, and gear; however, expenditures in port for such items could provide economic benefits to fishery dependent communities. Further, a shift in pollock catch seasonally from B season to A season could result in a net increase in product value for both the at-sea and shoreside sectors. Such an increase in shoreside product value would also be an economic benefit to fishing communities. In sum, adverse effects on fisheries dependent communities are not evident for any of the alternatives.

4.8.4 Improvements to Monitoring, Enforcement, and Administrative Provisions under all Alternatives

This section describes the projected costs and benefits of NMFS's recommended improvements to monitoring, enforcement, and administrative provisions under all alternatives. These provisions are described in more detail in Section 2.7.

1. Salmon Retention and Handling on Catcher Vessels

As described in Section 2.7, NMFS proposes to (1) clarify the requirement that all catcher vessels in the BS pollock fishery must retain all salmon and deliver them to the processor; (2) remove the requirement that all salmon be stored in an RSW tank; (3) require that, after observer sampling, data collection, and crew sorting is completed, any loose fish on deck would be made unavailable for sorting and discard; and (4) require that the vessel operator notify the observer at least 15 minutes before transfer, sorting, handling, or discard of any catch, prior to delivery of catch to the processor.

The requirement to retain all salmon was included in the original regulations for Amendment 91. Therefore, clarifying the wording of that requirement in regulations will impose no additional cost on the owners and operators of the trawl catcher vessels. Removing the overly specific requirement that all salmon be stored in an RSW tank will alleviate a difficult and unintended conflict between NMFS's regulations and industry practice to store some fish on deck, and will impose no additional costs on industry.

The requirement that all loose fish on deck be made unavailable for sorting or discard, and the observer notification requirement, will impose some additional costs on some vessel owners and operators. Table 90 summarizes information about the number of vessels and information about the number of deliveries that were reported as delivered with loose fish on deck in a BS pollock delivery. In 2013 and 2014, between 62 percent and 69 percent of trawl catcher vessels in the BS pollock fishery made at least one delivery with loose fish on deck. Deliveries with loose fish on deck accounted for between 7 percent and 9 percent of all pollock deliveries landed each year. The total estimated weight of the loose fish on deck in all deliveries was 428 mt in 2013 and 684 mt in 2014. Most deliveries involved less than 10 mt (22,050 lbs.) of loose fish on deck. The maximum estimated weight of loose fish on deck in a delivery was about 25 mt (55,125 lbs.).

Table 90. Summary information about loose fish on deck for trawl catcher vessels in the Bering Sea pollock fishery, 2013 and 2014.

	2013	**2014**
Number of vessels with at least one delivery with loose fish on deck	49 (62%)	53 (69%)
Total # vessels	79	77
Number of deliveries with loose fish on deck	136 (7%)	181 (9%)
Total # deliveries	1,951	1,909
Estimated weight of loose fish on deck (# deliveries where weight estimates were made)	428 t (in 134 deliveries)	684 t (in 179 deliveries)

Methods to make salmon or retained catch unavailable for sorting or discard include but are not limited to placing the catch in an enclosed container either above or below deck, securing the catch in an enclosed codend, or completely and securely covering the fish on deck. This proposed requirement would allow a vessel operator to choose how to secure the loose catch. Some methods would not impose additional costs. For example, placing all fish in fully enclosed fish holds is normal and preferred operating procedures for all vessels. Securing fish in codends on deck is an option used by vessel operators who want to retain more fish than can be contained within the vessel's holds. For vessel operators who are delivering loose fish on deck because holds are filled to capacity and the fish were not or could not be contained in the codend on deck, the requirement to secure the loose fish will mean that the fish must be placed in an enclosed container on deck, covered with a tarp or net, or otherwise secured. The cost of complying with the proposed requirement will depend on the amount of loose fish on deck and the locations and options for securing the fish available to the individual vessel. Complying with this requirement does not require vessel operators to install new equipment or build containers. However, additional costs will be incurred if a vessel owner elects to modify the vessel to provide secure storage areas on deck or must purchase tarps or netting material. The proposed requirement also would require additional crew time to store and secure catch currently left unsecured on deck.

The requirement to notify the observer at least 15 minutes before transfer of fish from one location to another on the vessel or any sorting, handling, or discard of catch prior to its delivery imposes an additional cost on the vessel operator. Current regulations at 50 CFR 679.51(e)(1)(vi) require the vessel operator to notify the observer at least 15 minutes before fish are brought on board the vessel or transferred from the vessel. The proposed new notification requirement would provide the observer the opportunity to monitor the movement or sorting of catch after it is brought on board the vessel, to ensure that no salmon are discarded and to monitor the re-securing of loose fish on deck. The existing notification requirement covers the initial sorting and storing of loose fish from each haul. The new notification requirement would apply if the vessel crew moved, sorted, or discarded catch from the secured fish on deck after its initial storage and before it was delivered. The cost of the new notification requirement to an individual vessel operator will depend on how often fish stored on deck are moved, and sorted, during the trip and the amount of crew time required to secure the loose fish.

Whether the benefits of securing loose fish on deck outweigh the costs depends on how much the current situation is undermining the salmon PSC census. The degree of incentive to discard salmon depends on the number of salmon allocated to a particular vessel from its cooperative, the salmon PSC counted thus far in the season or year, and the consequences of additional salmon PSC by the vessel. Any amount of salmon PSC is of concern to most vessel operators; however, some vessels have relatively small amounts of Chinook salmon PSC allocated from their cooperatives. Salmon PSC rates vary, and it is difficult to predict the number of salmon in the loose fish on the deck of a vessel. Many hauls have little or no salmon, but some hauls may contain a large number of salmon. Under some circumstances there may be sufficient salmon in the loose fish on deck and sufficient opportunity to create the incentive necessary for vessel crew to discard salmon without detection by the observer. NMFS recommends securing loose fish on deck to reduce the opportunity for discard.

2. ATLAS Software Aboard Catcher Vessels less than 125 feet LOA

As described in Section 2.7, NMFS recommends extending the requirement that vessel operators provide a computer with ATLAS software installed on it to vessels less than 125 feet LOA while participating in the BS pollock fishery. However, NMFS is not proposing to require the at-sea transmission of the data from these vessels.

Table 91 summarizes the number of vessels in the BS pollock fishery that currently have ATLAS software installed on a computer on board the vessel and an estimate of the additional number of vessels that will be subject to the proposed expansion of the computer and ATLAS requirement.

Table 91. Information about ATLAS requirements for trawl catcher vessels in the BS pollock fishery.

	# of Vessels in BS pollock fishery	# with ATLAS on vessel computer now	Currently required to have computer with ATLAS?
Vessel category			
≥125’ LOA	26	26	Y
<125’ LOA, w/observer	55	10	only if in GOA RP
<125’ LOA, w/o observer	5	0	N
Total, all catcher vessels	86	36	

Number of vessels is based on participation in either 2013 or 2014 BS pollock fishery.
“w/observer” means a catcher vessel that brings catch on board and delivers catch to a shoreside processor or stationary floating processor. These vessels are in the full observer coverage category and required to carry an observer. “w/o observer” means a catcher vessel that does not bring catch on board and only delivers unsorted codends to a mothership. These vessels are not required to carry observers. “only if in GOA RP” means only if the vessel participates in the Gulf of Alaska Rockfish Program

Based on recent participation information, expanding ATLAS requirements would apply to 55 catcher vessels less than 125 feet LOA. Five of these 55 vessels have voluntarily provided ATLAS to the assigned observer, another 13 of the 55 vessels participate in the rockfish program fishery which requires the vessel provide a computer and the ATLAS program to the observer. Of the 13 vessels that participate in the Rockfish Program, 5 have installed ATLAS on a computer that remains on board the vessel throughout the entire year, the remaining 8 share one or more laptops and provide the computer and ATLAS program to the observer only when required. This is possible because not all 8 vessels conduct fishing activity at the same time, so they can move the laptop from one vessel to another as they enter or exit the rockfish program fishery. This will not be the case for vessels participating in the AFA fishery because largely, the vessels are all out fishing at the same time and each vessel will need to provide the computer and ATLAS program simultaneously.

Most vessels required to install ATLAS on a computer onboard the vessel comply with this requirement by allowing NMFS to install ATLAS on an existing computer on the vessel. When this occurs, the cost of providing the computer is minimal. Some vessels may elect to purchase a new laptop separate from the vessel's existing computer and have ATLAS installed on that laptop. In the case a vessel does not already have an existing computer that supports the ATLAS program, a new computer would need to be purchased. NMFS has estimated the cost of a computer that would meet the regulatory requirements at approximately $600. If all 55 vessels affected by the proposed requirement select this option, the fleet-wide cost of providing a laptop computer would be approximately $33,000 (55 x $600), however as noted in Table 91, 10 of the 55 vessels already have ATLAS installed on a computer on the vessel, the maximum fleet-wide cost would be approximately $27,000 (45 x $600). Most, if not all, of the vessels already have a computer that meets the minimum requirements and they would only incur costs if they choose to purchase an additional computer. Therefore, the mandatory costs of providing a computer would be much less than $33,000 and may even be zero.

The requirement to have ATLAS installed on a computer accessible to the observer imposes costs associated with scheduling a visit by NMFS personnel to install the software. In addition, current regulations at § 679.51(e) require that the computer provided for observer data entry is "functional and operational." These regulations do not provide an exception for fishing without a functional and operational computer with ATLAS installed on it. Therefore, a vessel owner or operator also will incur costs associated with supplying power for the computer, equipment replacement or repair, and possibly lost fishing time, if the computer fails at any time while it is required.

Requiring vessels to provide a computer installed with observer data entry software will allow observers to electronically enter data in the field, saving NMFS the costs of hand keying observer data. Observers currently assigned to AFA catcher vessels <125 ft LOA document data on paper forms onboard the vessel and transmit data to NMFS at the end of each fishing trip using a fax machine provided by the processor receiving the vessel's AFA catch. NMFS estimates that it takes 3 hours of staff time per delivery to enter observer data received by fax. Data entry staff time costs $50/hour. Therefore, the estimated cost to NMFS of entering faxed data is $150 per delivery. Based on the number of trips by catcher vessels less than 125 feet LOA in the BS pollock fishery, NMFS estimates that the average cost of entering faxed data is about $145,000 per year. This cost would be eliminated or significantly reduced if all observer data were transmitted electronically to NMFS.

All AFA inshore processors are in the full coverage observer category and provide the assigned observer(s) a computer, NMFS-supplied data entry software and transmission capabilities. AFA processors also provide the fax machines currently used to transmit observer data from delivering catcher vessels less than 125ft. LOA. Costs incurred by the processing plants and associated with faxing vessel observer data may be eliminated or greatly reduced by the proposed action. With the new computer and software requirements, observers will enter data electronically and data will be transmitted to NMFS upon the completion of each trip from a computer instead of by fax machine. Many of these vessels are equipped with communications systems capable of transmitting observer data to NMFS. If the vessel allows the observer to transmit data, there will be no additional cost to the processor, otherwise an observer will transfer data to a thumb drive and transmit from the computer provided to the plant observer by the processor. The actual additional costs to the processor for transmitting observer data will depend on the number of vessels capable of and that allow data transmission directly from the vessel's computer at the completion of each trip.

3. View of Salmon in Storage Container

The proposed revision of the regulatory language to clarify that *the salmon storage container* on catcher/processors and motherships (and not each individual salmon in the container) must remain in view of the observer at the observer sampling station at all times during the sorting of each haul should not impose any costs on industry. All salmon storage containers currently installed on the catcher/processors and motherships comply with this requirement.

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

The proposed requirement that all salmon be removed from the salmon storage container and adjacent area at the end of each haul or delivery should not impose any additional costs on industry. Despite one challenge early in implementation of Amendment 91, all vessels and processors appear to be removing salmon at the end of each haul or delivery without a specific requirement to do so. Removal of salmon from one haul or delivery before the counting of salmon from the next haul or delivery will reduce the potential for double counting salmon, which should benefit all parties.

5. Remove Table 47, 50 CFR part 679 from regulations

The proposed revisions and removal of Table 47 to part 679 from the regulations will not impose any costs on industry and will decrease the costs of regulatory amendments necessary to update the table in the future.

6. Revision to the Deadline for Annual Reports

The preferred alternative would revise the deadline for three annual reports associated with the BS pollock fishery from April 1 to March 15 of each year. This revision will provide the annual reports to the Council and public about two weeks before the documents are reviewed each year at the April Council meeting. The annual reports themselves are significant documents that take some time for the industry to prepare. However, with the advance notice that will be provided through the rulemaking process, the requirement to have the reports prepared two weeks earlier is not expected to impose significant costs on the pollock industry.

4.9 Effects on Net National Benefits

In selecting the PA, and in particular with combining aspects across alternatives, the Council has considered policy objectives associated with each and the potential downstream impacts of pulling some aspects forward and not others. Over-arching policy goals in the suite of alternatives include provisions to provide greater flexibility to the pollock fleet to avoid salmon bycatch with provisions to prohibit bad behavior at times of higher Chinook bycatch. Nonetheless, the PA contains options of Alternative 3 that are uncertain, as they are to be determined by industry within the structure of the IPAs. The Council's Scientific and Statistical Committee correctly noted in a December 2014 review of this analysis that "The level of uncertainty about the final terms and details of the preferred alternative makes drawing summary conclusions about Net National Benefits outcomes premature." However, the PA includes those uncertain elements within this incentive based approach to salmon PSC management. Thus, uncertainty regarding Net National Benefits continues with the selection of the PA.

Further, the PA contains provisions meant to improve incentives to avoid Chinook salmon PSC, as a priority, while also improving incentives and flexibility to avoid chum salmon PSC. However, the analysis has shown that avoidance of chum salmon PSC can adversely affect Chinook salmon PSC and the PA has adopted the greatest possible flexibility for industry (Alternative 2) to avoid chum salmon

PSC while simultaneously prioritizing the avoidance of Chinook salmon PSC. This is not to say that one species is more important than the other: they are both of critical importance to the socioeconomic fabric of Western Alaska communities, people, and culture. Thus, attempting to determine the Net National Benefit of these seemingly competing elements of the PA is problematic.

At final action, the Council selected a PA which is a combination of options amongst the various alternatives. In doing so, the Council seeks to balance the goals and objective in the Purpose and Need statement (Section 1.1), the ten National Standards (Section 5.1), concerns with balancing competing conflicts, interests, and management programs as well as input from the public in selecting a PA. The balance the Council seeks also combines provisions to minimize PSC of both chum salmon and Chinook salmon, especially Chinook PSC in times of low abundance, while providing the greatest flexibility possible to the pollock industry.

On net, this incentive based approach to PSC management is intended to provide the greatest possible benefits of reduced salmon PSC, while minimizing potential impacts to industry via elements of self-management. However, the "surpluses" accruing to the pollock industry are, by-in-large, flowing to **foreign** consumers (and producers that are foreign-owned), while the surplus losses through salmon PSC accrue primarily to U.S. "consumers" (in the broadest sense) and businesses. Whether or not a "net benefit to the Nation" is forthcoming from this action is intended and hoped for but is indeterminate.

5 Magnuson-Stevens Act and FMP Considerations

5.1 Magnuson-Stevens Act National Standards

Below are the 10 National Standards as contained in the Magnuson-Stevens Act, and a brief discussion of how each alternative is consistent with the National Standards, where applicable. In recommending a preferred alternative, the Council considered how to balance the national standards.

National Standard 1 — 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.

Optimum Yield (OY) in the Bering Sea Fishery Management Plan is defined for all of the target species. This OY is defined as the range from 1.4 million to 2.0 million mt. Therefore, the TAC of all species defined "in the fishery" under the BSAI FMP must fall within this range. Due to high stock sizes of many target species, including pollock, for many years the 2.0 million mt upper end of the range has functioned as a 'cap' on harvests of groundfish species in the BSAI. Therefore, while the sum of the ABCs may exceed the OY, the sum of the TACs of all groundfish species together must be at or below the 2.0 million mt upper end of the OY range.

While OY (and adherence to NS1) is not defined on the basis of the ability of the pollock fleet to harvest its annual TAC, each of the alternatives under consideration are nonetheless intended to provide the Bering Sea pollock fishery the flexibility with which to prosecute its quota. Alternatives are designed to provide tools needed to address any potential constraints on the fishery to allow the fleet the ability to continue to catch fish; however, some Alternatives (Alt 4, option 2; Alt 5 option 2) have the potential to be more constraining than others. Alternative 5, under lower PSC limits and performance standard thresholds may constrain the fleet's ability to catch their pollock TAC depending upon fleet response to lower PSC allocations. Current salmon bycatch levels are generally well below the Alternative 5 options under consideration. None of the alternatives would impact the sustainable management of the pollock stock, which continues to be conservatively managed and remains well above its target stock size.

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

All of the alternatives are based upon 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.

The Bering Sea pollock fishery is managed as a single stock. None of the alternatives under consideration would modify the management of the pollock stock.

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 United States 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.

The Bering Sea pollock fishery is a rationalized fishery with fishing quota allocated by sector, inshore cooperative, or CDQ group. Salmon PSC is also allocated by sector, inshore cooperative, or CDQ group under the status quo management system. Alternatives under consideration do not modify the means by which either salmon or pollock are allocated.

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.

Alternatives under consideration are intended to provide tools for the pollock fishery to prosecute its quota while minimizing salmon bycatch to the extent practicable.

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

Alternatives under consideration are specifically designed to account for variations in fishery catches, salmon bycatch, and changes in fishing conditions.

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

None of the alternatives would result in additional costs to the agency for management purposes. Alternatives which constraint the fishery could result in lost revenue to the pollock fishermen. Alternatives are designed explicitly provide additional tools to minimize the potential for costs to the industry, to the extent practicable, as they work to minimize salmon bycatch.

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 by utilizing economic and social data that meets the requirements of paragraph (2) 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.

The alternatives are all designed to provide flexibility to prosecute the pollock fishery while minimizing salmon bycatch. To the extent that the Bering Sea pollock fishery is fully prosecuted, fishing communities that depend upon the fishery receive the benefits of this fishery. Allowing the BS pollock TAC to be fully utilized minimizes adverse economic impacts to fishery dependent communities. Minimizing salmon bycatch in the pollock fleet provides for sustained participation by salmon fishing communities in salmon fisheries.

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.

All of the alternatives are structured to minimize Chinook and chum salmon bycatch to the extent practicable. Some alternatives (Alt 4 option 2, Alt 5) may have more explicit top-down mechanisms for bycatch reduction than others, but all of the alternatives are intended to minimize bycatch of salmon species by providing tools and incentives to the fleet to minimize bycatch at all levels of ocean encounters.

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

None of the alternatives would reduce the safety of human life at sea.

5.2 Section 303(a)(9) Fisheries Impact Statement

Section 303(a)(9) of the Magnuson-Stevens Act requires that a fishery impact statement be prepared for each FMP amendment. A fishery impact statement is required to assess, specify, and analyze the likely effects, if any, including the cumulative conservation, economic, and social impacts, of the conservation and management measures on, and possible mitigation measures for (a) participants in the fisheries and fishing communities affected by the plan amendment; (b) participants in the fisheries conducted in adjacent areas under the authority of another Council; and (c) the safety of human life at sea, including whether and to what extent such measures may affect the safety of participants in the fishery.

The EA/RIR prepared for this plan amendment constitutes the fishery impact statement. The likely effects of the proposed action are analyzed and described throughout the EA/RIR. The effects on participants in the fisheries and fishing communities are analyzed in the RIR sections of the analysis (Sections 3 and Section 4.8.3 of the RIR). The effects of the proposed action on safety of human life at sea are evaluated in Section 4.8.2 and above under National Standard 10, in Section 5.1 Based on the information reported in this section, there is no need to update the Fishery Impact Statement included in the FMP.

The proposed action affects the Bering Sea pollock fishery in the EEZ off Alaska, which is managed under the jurisdiction of the Council. Impacts on participants in fisheries conducted in adjacent areas under the jurisdiction of other Councils are not anticipated as a result of this action.

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8 Appendix A-1 Chinook salmon escapement goals and escapements in Alaska, 2004–2013

Appendix A-1.– Chinook salmon escapement goals and escapements in Alaska, 2004–2013 [Source: ADF&G]

		2013 Goal Range			Initial	Escapement									
Regoin	System	Lower	Upper	Type	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	Blossom River	150	300	BEG	2012	333	445	339	135	257	123	363	147	205	255
	Keta River	175	400	BEG	2012	376	497	747	311	363	219	475	223	241	493
	Unuk River	1,800	3,800	BEG	2009	3,963	4,742	5,645	5,668	3,104	3,157[b]	3,835[b]	3,195[b]	956[c]	1,135[c]
	Chickamin River	450	900	BEG	1997	798	924	1,330	893	1,111	611	1,156	853	444	468
	Andrew Creek	650	1,500	BEG	1998	2,991	1,979	2,124	1,736	981	628	1,205	936	587	920
	Stikine River	14,000	28,000	BEG	2000	48,900	39,833	24,405	14,560	18,352	12,803[b]	15,116[b]	14,480[b]	22,327[b]	16,735[b]
	King Salmon River	120	240	BEG	1997	135	143	150	181	120	109	158	192	155	94
	Taku River	19,000	36,000	BEG	2009	75,032	38,599	42,296	14,749	26,645[b]	29,797[b]	28,769[b]	27,523[b]	19,429[b]	18,002[b]
	Chilkat River	1,850	3,600	inriver[d]		3,422	3,366	3,039	1,445	2,905	4,429	1,815	2,688[b]	1,744[b]	1,730[b]
		1,750	3,500	BEG	2003										
	Klukshu (Alsek) River	800	1,200	BEG	2013	2,451	1,034	568	676	466	1,466	2,159	1,667	693[b]	1,261[b]
SEAK[a]	Alsek River[e]	3,500	5,300	BEG	2013		4,478	2,323	2,827	1,885	6,239	9,518	6,668	2,660[b]	5,044[b]
	Situk River	450	1,050	BEG	2003	698	610	747	677	413	902	166[f]	240	322	912
	Bristol Bay														
	Nushagak River	55,000	120,000	SEG	2013	107,591	223,950	117,364	50,960	91,364	74,781	56,088	102,258	167,618	107,602
	Togiak River	eliminated			2013	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	Naknek River	5,000		lower-bound SEG	2007	12,878	NS	NS	5,498	6,559	3,305[g]	NS	NS	NS	NS
	Alagnak River	2,700		lower-bound SEG	2007	6,755	5,084	4,278	3,455	1,825	1,957	NS	NS	NS	NS
	Egegik River	eliminated			2013	579	335	196	458	162	350[h]	NS	NS	NS	
	Upper Cook Inlet														
	Alexander Creek	2,100	6,000	SEG	2002	2,215	2,140	885	480	150	275	177	343	181	588
	Campbell Creek	380		lower-bound SEG	2011	964	1,097	1,052	588	439	554	290	260	NS	NS
	Chuitna River	1,200	2,900	SEG	2002	2,938	1,307	1,911	1,180	586	1,040	735	719	502	1,690
	Chulitna River	1,800	5,100	SEG	2002	2,162	2,838	2,862	5,166	2,514	2,093	1,052	1,875	667	1,262
	Clear (Chunilna) Creek	950	3,400	SEG	2002	3,417	1,924	1,520	3,310	1,795	1,205	903	512	1,177	1,471
Central	Crooked Creek	650	1,700	SEG	2002	2,196	1,909	1,516	965	879	617	1,088	654	631	1,103
	Deshka River	13,000	28,000	SEG	2011	57,934	37,725	31,150	18,714	7,533	11,967	18,594	19,026	14,010	18,531

-continued-Appendix A-1.– Page 2 of 2.

gi on	System	2013 Goal Range Lower	Upper	Type	Initial Year	Escapement 2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	Goose Creek	250	650	SEG	2002	417	468	306	105	117	65	76	80	57	62
	Kenai River - Early Run	5,300	9,000	OEG	2005	11,855	16,650	13,270	9,856	6,570	6,163	6,393	8,448	5,044	2,148
		3,800	8,500	SEG	2013										
												16,21	19,68	27,71	15,39
	Kenai River - Late Run	15,000	30,000	SEG	2013	40,198	60,060	48,970	36,950	32,290	21,390	0	0	0	5
	Lake Creek	2,500	7,100	SEG	2002	7,598	6,345	5,300	4,081	2,004	1,394	1,617	2,563	2,366	3,655
	Lewis River	250	800	SEG	2002	1,000	441	341	0[i]	120	111	56	92	107	61
	Little Susitna River	900	1,800	SEG	2002	1,694	2,095	1,855	1,731	1,297	1,028	589	887	1,154	1,651
	Little Willow Creek	450	1,800	SEG	2002	2,227	1,784	816	1,103	NC	776	468	713	494	858
	Montana Creek	1,100	3,100	SEG	2002	2,117	2,600	1,850	1,936	1,357	1,460	755	494	416	1,304
	Peters Creek	1,000	2,600	SEG	2002	3,757	1,508	1,114	1,225	NC	1,283	NC	1,103	459	1,643
	Prairie Creek	3,100	9,200	SEG	2002	5,570	3,862	3,570	5,036	3,039	3,500	3,022	2,038	1,185	3,304
	Sheep Creek	600	1,200	SEG	2002	285	760	580	400	NC	500	NC	350	363	NC
	Talachulitna River	2,200	5,000	SEG	2002	8,352	4,406	6,152	3,871	2,964	2,608	1,499	1,368	847	2,285
	Theodore River	500	1,700	SEG	2002	491	478	958	486	345	352	202	327	179	476
	Willow Creek	1,600	2,800	SEG	2002	2,840	2,411	2,193	1,373	1,255	1,133	1,173	1,061	756	1,752
	<u>*Lower Cook Inlet*</u>														
	Anchor River	3,800	10,000	SEG	2011	12,016	11,156	8,945	9,622	5,806	3,455	4,449	3,545	4,509	4,388[b]
	Deep Creek	350	800	SEG	2002	1,075	1,076	507	553	205	483	387	696	447	475
	Ninilchik River	550	1,300	SEG	2008	679	1,259	1,013	543	586	528	605	668	555	571[b]
	<u>*Prince William Sound*</u>														
				lwrCI								16,77	27,99	27,39	
	Copper River	24,000		SEG	2003	30,628	21,528	58,454	34,565	32,487	27,787	1	4	5	NA[j]
AYK	<u>*Kuskokwim Area*</u>														
	North (Main) Fork Goodnews														
	River	640	3,300	SEG	2005	7,462	NS	4,159	NS	2,155	NS	NS	853	382	NS
	Middle Fork Goodnews River	1,500	2,900	BEG	2007	4,388	4,633	4,559	3,852	2,161	1,630	2,244	1,861	513	1,168
	Kanektok River	3,500	8,000	SEG	2005	28,375	14,202	8,433	NS	3,659	NS	1,228	NS	NA	2,346
			120,00				275,59	214,00	174,94	128,97	118,47	49,07	72,09	76,07	47,31
		65,000	0	SEG	2013		8	4	3	8	8	3	7	4	5
	Kogrukluk River	4,800	8,800	SEG	2013	19,651	22,000	19,414	13,029	9,730	9,702	5,690	6,891	NA	1,702

		2013 Goal Range			Initial	Escapement									
Region	System	Lower	Upper	Type	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	Kwethluk River	4,100	7,500	SEG	2013	28,604	NA	17,618	12,927	5,275	5,744	1,669	4,076	NA	NA
	Tuluksak River	eliminated			2013	1,475	2,653	1,043	374	701	362	201	286	560	
	George River	1,800	3,300	SEG	2013	5,207	3,845	4,357	4,883	2,698	3,663	1,500	1,571	2,267	1,121
	Kisaralik River	400	1,200	SEG	2005	5,157	2,206	4,734	692	1,074	NS	235	NS	610	597
	Aniak River	1,200	2,300	SEG	2005	5,362	NS	5,639	3,984	3,222	NS	NS	NS	NS	754
	Salmon River (Aniak R)	330	1,200	SEG	2005	2,177	4,097	NS	1,458	589	NS	NS	79	49	154
	Holitna River	970	2,100	SEG	2005	4,051	1,760	1,866	NS	NS	NS	587	NS	NS	670
	Cheeneetnuk River (Stony R)	340	1,300	SEG	2005	918	1,155	1,015	NS	290	323	NS	249	229	138
	Gagaryah River (Stony R)	300	830	SEG	2005	670	788	531	1,035	177	303	62	96	178	74
	Salmon River (Pitka Fork)	470	1,600	SEG	2005	1,138	1,801	862	943	1,305	632	135	767	670	475
	Yukon River														
	East Fork Andreafsky River	2,100	4,900	SEG	2010	8,045	2,239	6,463	4,504	4,242	3,004	2,413	5,213	2,517	1,998
	West Fork Andreafsky River	640	1,600	SEG	2005	1,317	1,492	824	976	NS	1,678	858	1,173	NS	1,090
	Anvik River	1,100	1,700	SEG	2005	3,679	2,421	1,876	1,529	992	832	974	642	722	940
	Nulato River (forks combined)	940	1,900	SEG	2005	1,321	553	1,292	2,583	922	2,260	711	1,401	1,373	1,118
	Gisasa River	eliminated			2010	731	958	843	593	487	515				
	Chena River	2,800	5,700	BEG	2001	9,645	NS	2,936	3,806	3,208	5,253	2,382	NS	2,200[k]	1,859
	Salcha River	3,300	6,500	BEG	2001	15,761	5,988	10,679	6,425	5,415	12,774	6,135	7,200[l]	7,165	5,465
	Canada Mainstem	42,500	55,000	agreement[m]	annual	48,469	67,985	62,630	34,904	33,883	65,278	31,818	46,017	32,456	28,500[b]
	Norton Sound														
	Fish River/Boston Creek	100		lower-bound SEG	2005	112	46	NS	NS	NS	NS	NS	NS	NS	44
	Kwiniuk River	300	550	SEG	2005	663	342	195	258	237	444	135	57	54	15
	North River (Unalakleet R)	1,200	2,600	SEG	2005	1,125	1,015	906	1,948	903	2,355	1,256	864	996	564
	Shaktoolik River	eliminated			2013	91[n]	74[o]	150[n]	412	NS	NS	NS	106	NS	
	Unalakleet/Old Woman River	550	1,100	SEG	2005	398[n]	510[o]	NS	821	NS	1,368	NS	105	NA	NS
Westward	*AK Peninsula*														
	Nelson River	2,400	4,400	BEG	2004	6,959	4,993	2,516	2,492	5,012	2,048	2,767	1,704	992	1,221[p]

		2013 Goal Range			Initial	Escapement									
Region	System	Lower	Upper	Type	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AYK	<u>*Chignik*</u>														
	Chignik River	1,300	2,700	BEG	2002	7,633	6,037	3,175	1,675	1,620	1,590	3,845	2,490	1,404	1,170
	<u>*Kodiak*</u>														
	Karluk River	3,000	6,000	BEG	2011	7,228	4,684	3,673	1,697	752	1,306	2,917	3,420	3,197[q]	1,824[q]
	Ayakulik River	4,000	7,000	BEG	2011	24,425	8,175	2,937	6,232	3,071	2,615	5,197	4,251	4,744	2,304

Note: NA = data not available; NC = no count; NS = no survey.[a] Goals are for large (≥660 mm MEF, or fish age 1.3 and older) Chinook salmon, except the goals for the Klukshu and Alsek rivers, which are germane to fish age 1.2 and older and can include fish <660 mm MEF.[b] Preliminary data.[c] 2012 and 2013 Unuk River Chinook salmon escapement estimate based on expanded aerial survey index because mark-recapture studies failed.[d] Chilkat River Chinook salmon in-river goal accounts for in-river subsistence harvest that average <100 fish.[e] Klukshu River Chinook salmon escapement is the metric used to manage Chinook salmon for the Alsek River system, which includes the Klukshu River. Alsek River Chinook salmon escapement is estimated using an expansion of the Klukshu River escapement (expansion factor = 4.0, SE=1.98).[f] Incomplete weir count due to in-season problems with weir (e.g., breach of weir).[g] In 2009, aerial surveys were only flown on Big Creek (2,834 Chinook salmon) and King Salmon River (471 Chinook salmon). Mainstem Naknek River and Paul's Creek were not surveyed in 2009.[h] Aerial surveys were conducted in the Egegik and King Salmon River systems on August 5, 2009 to provide escapement indices for Chinook and chum salmon. Resulting counts were 350 Chinook, and 277 chum salmon. Water conditions were poor; high and turbid conditions prevented observation on most of the surveyed systems. Chinook escapement indices were well below average in streams surveyed, but should be considered minimum counts due to the poor water conditions. Based on carcass distribution and observed presence, the survey was likely conducted after peak spawning.[i] Lewis River diverged into swamp 1/2 mi. below bridge. No water in channel.[j] The Copper River Chinook salmon spawning escapement estimate is not available. An in-river estimate is generated from a mark-recapture project run by the Native Village of Eyak and LGL Consulting. The spawning escapement estimate is generated by subtracting the upper Copper River state and Federal subsistence, state personal use, and sport fishery harvest estimates from the mark-recapture estimate of the in-river abundance. The estimates for the Federal and state subsistence and the state personal use fishery harvests are generally not available for about 6 months after the fishery is closed. Additionally, the sport fishery harvest estimate is based on the mail-out survey and is generally available about 12 months after the fishery ends. [k] 2012 Chena River Chinook salmon escapement estimate includes an expansion for missed counting days based on two DIDSON sonars used to assess Chinook salmon passage.[l] 2011 Salcha River Chinook escapement is based on an aerial survey because high water prevented tower counting most of the season; therefore, aerial survey represents best estimate of escapement for the year.[m] Canadian Yukon River Mainstem Chinook salmon IMEG (Interim Management Escapement Goal) of 42,500-55,000 was implemented for 2010-2013 seasons by the United States and Canada Yukon River Panel. Estimates from 2004-2013 represent escapement after subtraction of Canadian harvest.[n] 2004 and 2006 Shaktoolik River surveys and combined Unalakleet and Old Woman rivers surveys (2004) are not considered complete as they were conducted well before peak spawn. Surveys during these years were rated as acceptable, but the observer noted difficulty enumerating Chinook salmon due to large numbers of pink salmon.[o] 2005 Shaktoolik and Unalakleet River drainage surveys were conducted during peak spawning periods but Chinook salmon counts are thought to be underestimated due to large numbers of pink salmon.[p] 2013 Nelson River Chinook salmon sportfishing was catch and release only so escapement is weir count.[q] 2012 and 2013 Karluk River Chinook salmon escapements are the weir count; no upriver harvest due to fishery closure.

9 Appendix A-2 Chum salmon escapement goals and escapements in Alaska, 2004–2013.

Appendix A-2.– Chum salmon escapement goals and escapements in Alaska, 2004–2013 [Source: ADF&G]

		2013 Goal Range			Initial	Escapement									
Region	System	Lower	Upper	Type	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
SEAK	S SE Summer	54,000		lwr-bnd SEG	2012	74,000	66,000	76,000	132,000	13,000	41,000	47,000	157,000	144,000	84,000
	N SE Inside Summer	119,000		lwr-bnd SEG	2012	242,000	185,000	282,000	149,000	99,000	107,000	77,000	125,000	177,000	278,000
	N SE Outside Summer	19,000		lwr-bnd SEG	2009	86,000	77,000	57,000	34,000	46,000	15,000	24,000	23,000	28,000	18,000
	Cholmondeley Sound Fall	30,000	48,000	SEG	2009	60,000	15,000	54,000	18,000	49,500	39,000	76,000	93,000	54,000	13,000
	Port Camden Fall	2,000	7,000	SEG	2009	3,300	2,110	2,420	505	1,400	1,711	5,400	1,800	3,750	2,000
	Security Bay Fall	5,000	15,000	SEG	2009	13,100	2,750	15,000	5,400	11,700	5,100	6,500	5,100	9,800	3,000
	Excursion River Fall	4,000	18,000	SEG	2009	5,200	1,100	2,203	6,000	8,000	1,400	6,100	3,000	2,000	8,000
	Chilkat River Fall	75,000	170,000	SEG	2009	310,000	202,000	681,000	320,000	437,000	326,000	88,000	356,000	284,000	165,000
Central	*Bristol Bay*														
	Nushagak River	200,000		lwr-bnd SEG	2013	283,811	456,025	661,002	161,483	326,300	438,481	273,914	248,278	395,162	628,134
	Upper Cook Inlet														
	Clearwater Creek	3,800	8,400	SEG	2002	3,900	530	500	5,590	12,960	8,300	13,700	11,630	5,300	9,010
	Lower Cook Inlet														
	Port Graham River	1,450	4,800	SEG	2002	1,177	743	2,231	1,882	1,802	1,029	1,395	1,764	699	1,944
	Dogfish Lagoon	3,350	9,150	SEG	2002	3,617	2,746	5,394	4,919	6,200	4,380	12,703	12,936	8,842	9,300
	Rocky River	1,200	5,400	SEG	2002	17,159	6,060	11,200	1,600	3,763	2,500	1,271	4,480	3,165	8,148
	Port Dick Creek	1,900	4,450	SEG	2002	8,620	4,848	2,786	2,753	11,774	5,592	2,439	7,087	8,400	4,133
	Island Creek	6,400	15,600	SEG	2002	15,135	20,666	5,615	3,092	12,935	9,295	3,408	11,755	14,863	8,772
	Big Kamishak River	9,350	24,000	SEG	2002	57,897	25,717	58,173	14,787	4,495	15,026	NS	5,532	12,400	3,280
	Little Kamishak River	6,550	23,800	SEG	2002	45,342	12,066	42,929	15,569	21,265	4,213	18,414	19,310	30,250	6,744
	McNeil River	24,000	48,000	SEG	2008	14,613	22,496	17,403	21,629	10,617	18,766	10,520	30,977	10,388	9,498
	Bruin River	6,000	10,250	SEG	2002	15,886	21,208	7,000	3,055	17,535	10,071	6,200	3,486	16,795	8,942
	Ursus Cove	6,050	9,850	SEG	2002	15,988	12,176	15,663	20,897	6,502	12,946	11,765	10,636	2,840	10,339
	Cottonwood Creek	5,750	12,000	SEG	2002	16,277	17,914	13,243	12,522	11,561	19,405	15,848	4,730	4,111	5,206
	Iniskin Bay	7,850	13,700	SEG	2002	22,044	16,461	15,640	5,340	20,042	30,821	19,252	16,522	3,049	5,928
	Prince William Sound[a]														
	Eastern District	50,000		lwr-bnd SEG	2006	108,833	113,135	109,403	123,814	74,740	55,219	91,514	196,933	61,969	119,110
	Northern District	20,000		lwr-bnd SEG	2006	42,456	30,657	52,039	49,669	38,791	37,358	38,207	52,474	14,680	34,240
	Coghill District	8,000		lwr-bnd SEG	2006	9,685	11,979	15,900	14,052	39,660	36,724	51,589	16,368	10,281	11,369
	Northwestern District	5,000		lwr-bnd SEG	2006	10,371	12,696	25,860	10,778	28,051	34,290	30,074	11,447	7,072	4,746
	Southeastern District	8,000		lwr-bnd SEG	2006	42,344	25,547	26,739	60,464	21,614	16,453	85,138	91,218	20,467	35,942

		2013 Goal Range			Initial	Escapement									
Region	System	Lower	Upper	Type	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AYK	*Kuskokwim Area*														
	Middle Fork Goodnews River	12,000		lower-bound SEG	2005	31,616	26,690	54,699	49,285	44,699	19,715	26,687	19,974	10,723	27,673
	Kanektok River		eliminated		2013	NS	NS	NS	NS	NS	NS	NS	NS	NA	
	Kogrukluk River	15,000	49,000	SEG	2005	24,201	197,723	180,594	49,505	44,978	84,940	63,583	76,384	NA	64,826
	Aniak River	220,000	480,000	SEG	2007	672,931	1,151,505	1,108,626	696,801	427,911	479,531	429,643	345,630	NA	NA
	Yukon River - Summer														
	East Fork Andreafsky River	40,000		lower-bound SEG	2010	64,883	20,127	102,260	69,642	57,259	8,770	72,839	100,473	56,680	61,234
	Anvik River	350,000	700,000	BEG	2005	365,353	525,391	605,485	459,038	374,928	193,098	396,173	642,527	483,972	571,690
	Yukon River - Fall														
	Yukon River Drainage	300,000	600,000	SEG	2010	536,000	1,990,000	890,000	921,000	681,000	483,000	527,000	883,000	573,000	867,000
	Tanana River[b]	61,000	136,000	BEG	2001	187,000	373,000	233,000	357,000	264,000	160,000	213,000	271,000	102,000	275,000
	Delta River	6,000	13,000	BEG	2001	25,000	28,000	14,000	19,000	23,000	13,000	18,000	24,000	9,000	32,000
	Toklat River		eliminated		2010	35,000	NA	NA	NA	NA	NA				
	Upper Yukon River Tributaries	152,000	312,000	BEG	2001	195,000	1,178,000	436,000	327,000	248,000	NA	196,000	406,000	333,000	392,000
	Chandalar River	74,000	152,000	BEG	2001	137,000	497,000	245,000	228,000	178,000	NA	158,000	295,000	206,000	253,000
	Sheenjek River	50,000	104,000	BEG	2001	38,000	562,000	160,000	65,000	50,000	54,000	22,000	98,000	105,000	109,000[c]
	Fishing Branch River (Canada)	22,000	49,000	agreement	2008[d]	20,000	119,000	31,000	32,000	20,000	26,000	16,000	13,000	22,000	30,000
	Yukon R. Mainstem (Canada)	70,000	104,000	agreement	2010[e]	154,000	438,000	221,000	255,000	176,000	94,000	118,000	206,000	138,000	200,000
	Norton Sound														
	Subdistrict 1 Aggregate	23,000	35,000	BEG	2001	23,787	38,808	87,222	76,940	32,177	21,368	97,798	66,122	51,459	108,120
	Sinuk River		eliminated		2010	3,197	4,710	4,834	16,481	NS	2,232				
	Nome River	2,900	4,300	OEG	2001	3,903	5,584	5,678	7,034	2,607	1,565	5,906	3,582	1,982	4,811
		2,900	4,300	SEG	2005										
	Bonanza River		eliminated		2010	2,166	5,534	708	8,491	NS	6,744				
	Snake River	1,600	2,500	OEG	2001	2,145	2,948	4,128	8,147	1,244	891	6,973	4,343	651	2,755
		1,600	2,500	SEG	2005										
	Solomon River		eliminated		2010	1,436	1,914	2,062	3,469	NS	918				
	Flambeau River		eliminated		2010	7,667	7,692	27,828	12,006	11,618	4,075				
	Eldorado River	6,000	9,200	OEG	2001	3,273	10,426	41,985	21,312	6,746	4,943	42,612	16,227	13,393	26,121
		6,000	9,200	SEG	2005										
	Niukluk River	23,000		lower-bound SEG	2010	10,770	25,598	29,199	50,994	12,078	15,879	48,561	23,607	19,576	NS
	Kwiniuk River	11,500	23,000	OEG	2001	10,362	12,083	39,519	27,756	9,483	8,739	71,388	31,604	5,577	5,631
		10,000	20,000	BEG	2001										

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Region	System	2013 Goal Range Lower	Upper	Type	Initial Year	Escapement 2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	Tubutulik River	9,200	18,400	OEG	2001	NS	1,336	NS	7,045	NS	3,161	16,097	14,127	NS	NS
		8,000	16,000	BEG	2001										
	Unalakleet/Old Woman River	2,400	4,800	SEG	2005	NS	1,530	NS	1,902	NS	NS	NS	NS	NS	2,496
	Kotzebue Sound														
	Kotzebue Sound Aggregate	196,000	421,000	BEG	2007										
	Noatak and Eli Rivers	42,000	91,000	SEG	2007	53,058	NS	39,785	NS	270,747	69,872	NS	NS	NS	NS
	Upper Kobuk w/ Selby River	9,700	21,000	SEG	2007	26,018	NS	48,750	NS	42,622	45,155	NS	NS	NS	NS
	Salmon River	3,300	7,200	SEG	2007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Tutuksuk River	1,400	3,000	SEG	2007	NS	1,736	NS	NS	NS	NS	NS	NS	NS	NS
	Squirrel River	4,900	10,500	SEG	2007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Westward	*AK Peninsula*														
	Northern District	119,600	239,200	SEG	2007		103,675	382,583	243,334	228,537	154,131	145,310	96,952	140,418	137,251
	Northwestern District	100,000	215,000	SEG	2007		192,965	193,460	335,450	241,750	84,460	144,100	151,400	140,000	92,800
	Southeastern District[f]	106,400	212,800	SEG	1992		412,500	405,300	201,451	277,450	106,500	62,612	145,300	31,072	184,350
	South Central District	89,800	179,600	SEG	1992		235,700	119,600	126,000	140,450	18,600	85,600	169,000	86,190	155,050
	Southwestern District	133,400	266,800	SEG	1992		317,910	231,935	398,010	171,250	385,730	142,650	176,425	87,230	163,200
	Unimak District		eliminated		2013		4,200	7,915	1,200	2,800	1,400	1,050	7,000	750	
	Chignik														
	Entire Chignik Area	57,400		lower-bound SEG	2008		308,700	93,489	238,216	197,259	214,959	177,220	278,145	210,973	335,907
	Kodiak														
	Mainland District	104,000		lower-bound SEG	2008		22,500	346,140	82,600	72,000	91,106	124,500	128,700	127,850	107,400
	Kodiak Archipelago Aggregate	151,000		lower-bound SEG	2008		141,850[d]	419,000[d]	166,060[d]	83,040	177,490	160,290	192,400	159,825	291,250

Note: NA = data not available; NS = no survey.[a] No estimates for chum salmon escapements are included for the Unakwik, Eshamy, Southwestern, or Montague districts because there are no escapement goals for those districts.[b] Escapement estimated using mark-recapture 1995-2007, then based on relationship to either the Detla River or Mainstem Yukon River escapements from 2008 to present.[c] In 2013, Sheenjek River sonar was not operated and was estimated based on two bank operations relationship to Fishing Branch River escapements.[d] Fishing Branch River fall chum salmon IMEG of 22,000-49,000 was implemented for 2008-2013 by Yukon River Panel. However in 2013, weir did not operate estimate was based on border sonar estimate minus community harvest assuming most fish migrate to Fishing Branch River.[e] Yukon River Mainstem fall chum salmon IMEG of 70,000-104,000 was implemented for 2010-2013 seasons by Yukon River Panel.[f] Southeastern District chum salmon escapement goal includes Shumagin Islands Section and Southeastern District Mainland.

10 Appendix A-3 Summary of Chinook salmon fishery management actions, 2011–2013.

Appendix A-3.– Summary of Chinook salmon fishery management actions, 2011–2013. [Source: ADF&G]

Region	System/Fishery	2011	2012	2013
SEAK	Subsistence Fishery?	Yes	No, except Klukshu (Alsek) R. and Federal subsistence fishery on Stikine R., Chilkat R. normal closure extended by 2 weeks, Situk R. closed.	No, except Klukshu (Alsek) R. and Federal subsistence fishery on Stikine R., Chilkat R. normal closure extended by 2 weeks, Situk R. opened on July 16.
	Commercial Fishery?	Yes	No directed fisheries, except Taku R. - restricted then closed; Chilkat R. - normal closure extended by two weeks; Situk R. - closed. Regional purse seine - Chinook non-retention until August 6. Regional troll - Chinook non-retention July 1-August 6 and September 9-30.	No directed fisheries. Taku R. - closed; Chilkat R. - normal closure extended by two weeks; Situk R. - opened on July 16 to retention. Regional purse seine - Chinook non-retention until August 9. Regional troll - Chinook non-retention July 7-September 30.
	Sport Fishery?	Yes	Situk River and Chilkat Inlet restricted	Situk River and Chilkat Inlet restricted
Central	*<u>Bristol Bay</u>*			
	Subsistence Fishery?	No restrictions in Nushagak or Togiak.	No restrictions in Nushagak or Togiak.	No restrictions in Nushagak or Togiak.
	Commercial Fishery?	No directed Chinook fishery and sockeye fishery was restricted.	No directed Chinook fishery.	Yes, multiple directed openings in Nushagak. Weekly schedule reduced in Togiak.
	Sport Fishery?	Yes - bag and annual limit reduced June 24; annual limit reduction rescinded July 13.	Yes - reduced annual limit from June 28-July 3; reduced bag limit from June 28-July 7.	No restrictions.
	<u>Upper Cook Inlet</u>			
	Subsistence Fishery?	Yes	Yes	Yes
	Commercial Fishery?	Restricted in Northern District.	Restricted in Northern District. Set gillnetting restricted and then closed in Upper Subdistrict (Central District).	Restricted in Northern District. Set gillnetting restricted and then closed in Upper Subdistrict (Central District).

Region	System/Fishery	2011	2012	2013
	Sport Fishery?	Various restrictions including complete closure.	Various restrictions including closure of Kenai River. Anchorage area: Ship Cr. closure, none to Campbell Cr.; Crooked Creek: 1) June 15-June 30 retention naturally-produced prohibited, 2) June 22-June 30 bait multiple hook prohibited; Kenai River - Early Run: 1) June 15-June 30 catch & release trophy fishing retain <20" or 55" or greater, July 1-July 14 Bait and retention prohibited upstream of Slikok Creek, 2) June 22-June 30 closed riverwide, and June 22-July 14 closed above Slikok Creek, 3) July 15-July 31 extend closure above Slikok Creek; Kenai River - Late Run: 1) July 1-July 31 Bait prohibited riverwide, 2) July 10-July 31 catch & release trophy fishing retain <20" or 55" or greater, open only downstream of Slikok see Kenai ER, 3) July 19-July 31 Closed riverwide, 4) August 2-August 15 Bait and multiple hook prohibited downstream of the Soldotna Bridge - rescinded August 9. Personal use fishing: Retention of Chinook prohibited during Kenai River dip net open season July 10-31.	NCI- Restricted to reduce harvest by 75%; annual limit reduced to 2 over 20 inches, single hook artificial only including Deshka; catch-and-release Eastside Susitna streams, harvest limited to certain days on Yentna and Little Susitna; Crooked Creek: 1) May 1-June 30 retention naturally-produced prohibited, 2) June 20-June 30 bait multiple hook prohibited; Kenai River - Early Run: 1) May 16-June 30 catch & release trophy fishing retain <20" or 55" or greater, 2) June 20-June 30 closed riverwide, and June 20-July 14 closed above Slikok Creek, 3) July 15-July 31 extend closure above Slikok Creek; Kenai River - Late Run: 1) July 1-July 31 Bait prohibited riverwide, 2) July 25-July 31 catch & release trophy fishing retain <20" or 55" or greater, open only downstream of Slikok see Kenai ER, 3) July 28-July 31 Closed riverwide, 4) August 1-August 15 Bait and multiple hook prohibited downstream of the Soldotna Bridge. Personal use fishing: Retention of Chinook prohibited during Kenai River dip net open season July 10-31.
	<u>Lower Cook Inlet</u>			
	Subsistence Fishery?	Yes	Yes	Yes
	Commercial Fishery?	Yes	Yes	Yes

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Region	System/Fishery	2011	2012	2013
	Sport Fishery?	Inseason -gear restricted Anchor, Deep Ck., Ninilchik; and then closed Anchor river; marine also restricted.	Preseason-gear restricted Anchor, Deep Ck., Ninilchik; closed Wed. on Anchor; Inseason closed Anchor and Ninilchik; marine also restricted.	Preseason-gear, annual limit restricted Anchor, Deep Ck., Ninilchik; closed Wed. on Anchor; marine also restricted Inseason closed Anchor, Deep Ck. and Ninilchik; marine also restricted.
	Prince William Sound			
	Subsistence Fishery?	Personal use fishery closed to retention of Chinook June 27.	Personal use fishery closed to retention of Chinook June 18.	Personal use fishery closed to retention of Chinook June 16.
	Commercial Fishery?	Yes with restrictions additional periods with inside closures.	Yes with restrictions additional periods with inside closures.	Yes with restrictions additional periods with inside closures.
	Sport Fishery?	Yes	Reduced annual limit from 4 to 1 fish in the Upper Copper R drainage. No retention of Chinook in Gulkana River and single hooks, no bait effective June 30. No retention in the Klutina River and all waters downstream of the Klutina River and no bait effective July 28.	Reduced annual limit from 4 to 1 fish in the Upper Copper R drainage. No retention of Chinook in Gulkana River and single hooks, no bait effective June 15.
AYK	*Kuskokwim Area*			
	Subsistence Fishery?	3 tributaries closed, restrictions in mainstem District 1.	5 tributaries closed, restrictions in mainstem Kuskokwim River through most of the season.	5 tributaries closed, restrictions in mainstem Kuskokwim River beginning June 28.
	Commercial Fishery?	None on Kuskokwim River, limited in Kuskokwim Bay.	No fishery on Kuskokwim River, incidental retained as personal use in chum fishery. Limited fishery in Kuskokwim Bay.	No fishery on Kuskokwim River, incidental retained as personal use in chum fishery. Limited fishery in Kuskokwim Bay by delaying fishery and reduced open area of Goodnews Bay.

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Region	System/Fishery	2011	2012	2013
	Sport Fishery?	3 tributaries closed.	6 tributaries closed June 1; bag limit reduced from 3 to 1in remaining tributaries and closed mainstem June 13; closed all waters of the Kuskokwim drainage June 22.	Kuskokwim Bay bag limit reduced from 3 to 1 fish May 27. 6 tributaries closed June 1. Mainstem Kuskokwim River closed downstream of Chuathbaluk June 29. Retention of Chinook prohibited in Kuskokwim Bay tributaries effective July 10.
	Yukon River			
	Subsistence Fishery?	Yes, restricted fishing schedule.	Yes, restricted fishing schedule.	Yes, restricted fishing schedule and no Chinook-directed gear.
	Commercial Fishery?	No directed, small incidental take with chum but not sold.	No directed, small incidental take with chum but not sold.	No directed, introduced dip nets and live release of Chinook; small incidental take with chum but not sold.
	Sport Fishery?	Bag limit reduced to 1 fish all tributaries. No retention mainstem Yukon R. and Tanana R. No bait allowed Tanana R. tributaries.	Bag limit reduced from 3 to 1 in tributaries and closed mainstem May 15. No retention in Tanana River drainage and no bait in tributaries July 21. Closed Chena River drainage and confluence with Tanana July 30.	Retention of Chinook prohibited in Yukon River tributaries May 22-June 30. Bag limit of 1 fish effective July 1. Retention of Chinook prohibited July 12 in tributaries. Tributaries reopened to bag limit of 1 fish July 24. Mainstem closed to sport fishing for Chinook May 22. Retention of Chinook prohibited in Tanana River drainage and use of bait prohibited July 12. Chena River closed to sport fishing for Chinook July 29.
	Norton Sound			
	Subsistence Fishery?	Yes, with restrictions.	Yes, with restrictions.	Yes, with time and mesh restrictions.
	Commercial Fishery?	No directed fishery, incidental take not sold.	No directed fishery, incidental take not sold.	No directed fishery, incidental take not sold.

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Region	System/Fishery	2011	2012	2013
	Sport Fishery?	Started the season open then was closed and use of bait prohibited in Unalakleet and Shaktoolik rivers.	Started the season open then closed all waters of the Unalakleet and Shaktoolik drainages to sport fishing for Chinook and prohibited bait when sport fishing July 11.	Retention of Chinook prohibited in the Unalakleet and Shaktoolik drainages and prohibited bait when sport fishing effective June 17. Closed Unalakleet and Shaktoolik river drainages to sport fishing for Chinook.
Westward	*AK Peninsula*			
	Subsistence Fishery?	Yes	Yes	Yes
	Commercial Fishery?	Yes	Yes	Yes
	Sport Fishery?	Yes	Closed in-season	Yes
	Chignik			
	Subsistence Fishery?	Yes	Yes	Restricted in-season to non-retention.
	Commercial Fishery?	Yes	Yes	Restricted in-season to non-retention.
	Sport Fishery?	Yes	Restricted in-season to non-retention.	Restricted in-season to non-retention.
	Kodiak			
	Subsistence Fishery?	Yes	Yes	Yes, but restricted to nonretention in Karluk.
	Commercial Fishery?	Restricted, nonretention in Karluk and Ayakulik areas.	Restricted, nonretention in Karluk and Ayakulik areas.	Restricted, nonretention in Karluk and Ayakulik areas.
	Sport Fishery?	Restricted, nonretention in Karluk, reduced bag and annual limits in Ayakulik.	Ayakulik: Restricted preseason - reduced bag limit; Karluk: Restricted preseason - nonretention.	Ayakulik: Restricted preseason - reduced bag limit; Karluk: Restricted preseason - nonretention; both closed in-season.

11 Appendix A-4 Subsistence Utilization of Alaska Chinook and chum salmon

This information has been provided by staff at ADF&G per Council request to provide context for the discussion of Chinook salmon and chum salmon PSC in the Bering Sea pollock fishery.

11.1 Subsistence Utilization of Alaska Chinook and chum salmon

11.1.1 Importance of subsistence harvests

This introductory section provides a description of the importance of subsistence fishing and hunting to Alaska Natives and other rural Alaska residents. As discussed in Section 3.4.6, analysis of the stock composition of Chinook and chum salmon incidentally caught in the Bering Sea pollock fishery has shown that the stock structure is dominated by western Alaska stocks—stocks that have historically been harvested at high levels for subsistence. Therefore, this section focuses on the importance of subsistence to people who live in western and interior Alaska.

Subsistence salmon harvests in the Arctic-Yukon-Kuskokwim (AYK) region have cultural and practical significance to most of the approximately 120 rural communities in the region (those outside nonsubsistence areas as defined by the Alaska Joint Board of Fisheries and Game), representing approximately 16,318 households and approximately 59,098 residents in 2010. In addition, many of the 102,017 residents of the Fairbanks North Star Borough and the portions of the Denali Borough and the Southeast Fairbanks Census Area within nonsubsistence areas also use AYK salmon stocks for dietary and other cultural needs. In Bristol Bay, 18 communities with a population of 7,120 in 2,404 households (in 2010) also harvest Chinook, chum, and other salmon from local stocks for subsistence (Table 92).

Table 92. Population of Arctic-Yukon-Kuskokwim and Bristol Bay Areas, 2010

Region/Census Area	Population	Households
Arctic-Yukon-Kuskokwim: Rural Areas[1]		
Bethel Census Area	17,013	4,651
Denali Borough (portion)[2]	246	90
Nome Census Area	9,492	2,815
North Slope Borough	9,430	2,029
Northwest Arctic Borough	7,523	1,919
Southeast Fairbanks Census Area (portion)[3]	2,593	942
Wade Hampton Census Area	7,459	1,745
Yukon-Koyukuk Census Area	5,588	2,217
Total	59,098	16,318
Arctic-Yukon-Kuskokwim: Nonsubsistence Areas		
Denali Borough (portion)	1,361	612
Fairbanks Northstar Borough	97,581	36,441
Southeast Fairbanks Census Area (portion)	4,436	1,625
Total	102,017	38,066
Bristol Bay Area		
Bristol Bay Borough	997	423
Dillingham Census Area	4,847	1,563
Lake and Peninsula Borough (portion)[4]	1,276	418
Total	7,120	2,404

[1] Areas outside nonsubsistence areas defined by the Alaska Joint Board (5 AAC 99.015).

[2] Excludes areas within nonsubsistence areas and Cantwell.

[3] Excludes areas within nonsubsistence areas.

[4] Excludes communities of the Chignik Management Area.

Source: US Census data summarized at http://laborstats.alaska.gov/census/

Subsistence salmon fisheries are important nutritionally and culturally; they also greatly contribute to local economies. Many researchers have described the importance of subsistence to individual Alaskan communities and households (Coffing 1991; Krieg et al. 2007; Moncrieff 2007; Magdanz et al. 2005; Walker and Coffing 1993; Walker et al. 1989; Wolfe 1987; Wolfe 2003; Wolfe 2007; Wolfe and Walker 1987; Ahmasuk and Trigg 2008; Raymond-Yakoubian 2010; Brown et al. 2012; Fall et al. 2012; Holen et al. 2012; Brown et al. 2013; Ikuta et al. 2014; Brown et al. 2014; Braem et al. 2014). Alaska Native communities in the areas under discussion are historically subsistence-based societies. A relatively early report on findings from the Alaska Natives Commission (1994) devoted an entire volume to Alaska Native subsistence.[45] This report noted that during the past 250 years, much of the technology of subsistence harvesting and processing has changed profoundly, as people often use more modern instruments of harvest, transportation, and storage. On the surface, then, today's subsistence activities may look very different from those prior to the mid-18th century, prior to the arrival of the first non-Natives. However, beneath the visible level, older patterns of behavior and values continue. The report states:

[45] The Alaska Natives Commission (joint Federal-State Commission on Policies and Programs Affecting Alaska Natives) was created by Congress in 1990, to conduct a comprehensive study of the social and economic status of Alaska Natives and the effectiveness of the policies and programs of the U.S. and the State of Alaska that affect Alaska Natives (1994). See the UAA Justice Center link: http://justice.uaa.alaska.edu/rlinks/natives/ak_subsistence.html.

As we try to define what subsistence really is in contemporary Alaska, we must distinguish between form and function. How Native people practice it today has changed profoundly over the centuries, but what they are doing is mainly what they have always done. And what they have always done is very different from the economic organization and personal relationships of contemporary mass culture.

The Alaska Department of Fish and Game (ADF&G), Division of Subsistence, estimated in 2012 that approximately 36.9 million pounds of wild foods were harvested annually by residents of rural Alaska, representing on average 295 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; Fall et al. 2014). For example, 92 percent to 100 percent of the rural households in Arctic, Interior, Western, and Southwestern Alaska use fish, while just 75 percent to 86 percent of households actually harvest fish, which testifies to the importance of sharing within subsistence-based economies (Fall et al. 2014:2). 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 represent 53 percent of the total subsistence harvests by rural residents (with salmon providing 32 percent and other fish 21 percent), followed by land mammals (23 percent), marine mammals (14 percent), wild plants (4 percent), birds and eggs (3 percent), and shellfish (3 percent) (Figure 44) (Fall et al. 2014:2).

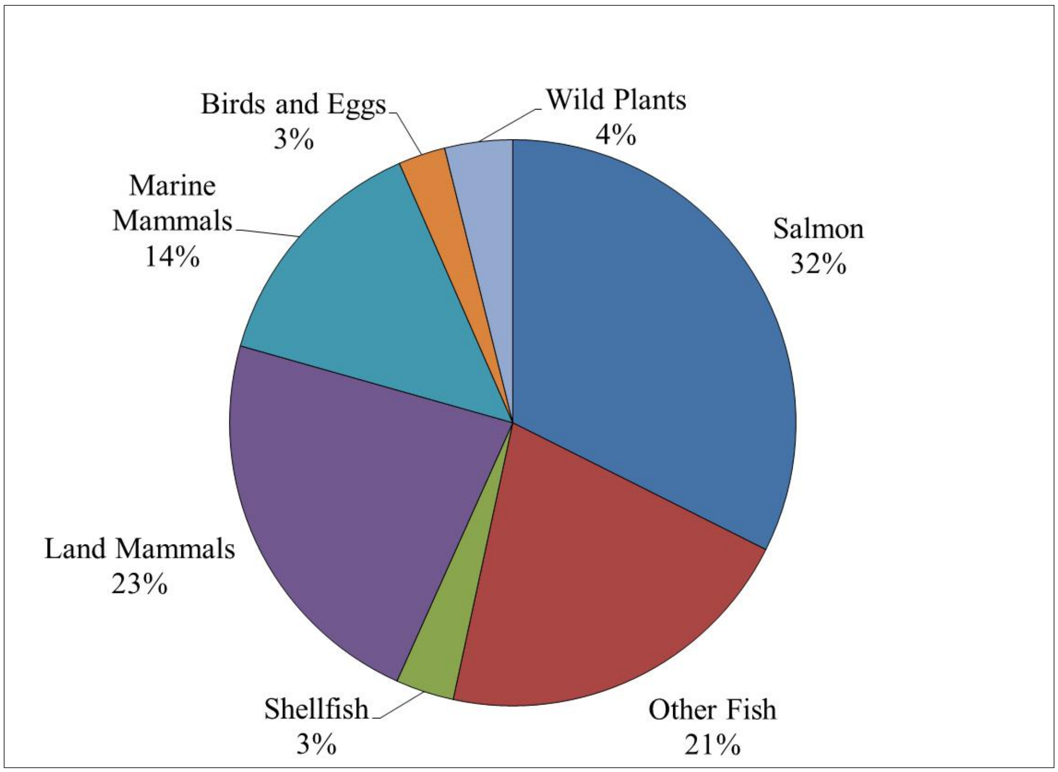

Figure 44. Composition of subsistence harvest by rural Alaska residents, 2012.

Annual per capita subsistence harvest rates range from 438 pounds of wild foods per person in Arctic communities to 320 pounds per person in rural Interior Alaska communities, to 425 pounds per person among Yukon-Kuskokwim Delta communities. Average per capita harvests in Bristol Bay/Aleutians area is estimated at 204 pounds per person (Fall et al. 2014).

Although producing a major portion of the food supply, subsistence harvests represent a small part of the annual harvest of all wild resources in Alaska (about 1.1 percent). Commercial fisheries take 98.2 percent of the wild resource harvest, personal use fisheries and general hunts about 0.2 percent, and sport fishing and hunting about 0.5 percent (Figure 45) (Fall et al. 2014).

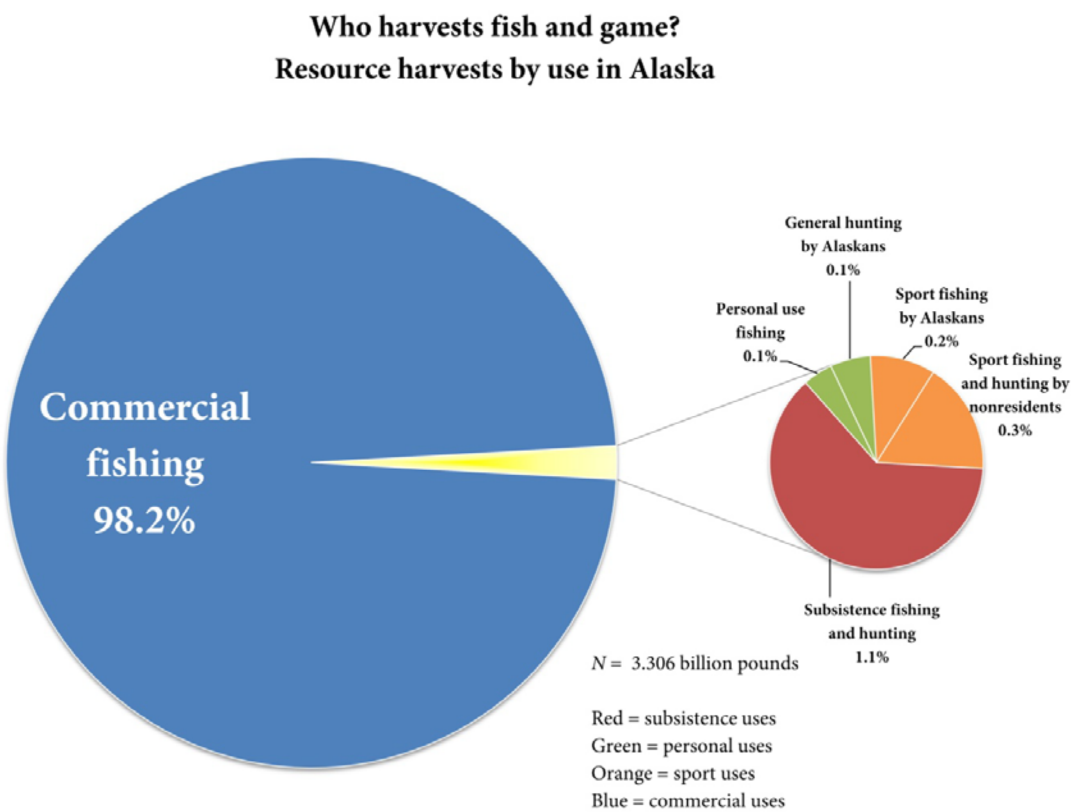

Figure 45. Resource harvests by use in Alaska.

5.4.2 Cultural background of regional Alaska Native populations

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, and the upper Kuskokwim pertains to Athabascan communities; information for the lower Yukon and lower and middle Kuskokwim as well as most of Bristol Bay pertain to Central Yup'ik communities; and information for the Alaska Peninsula area pertains to Aleut and Alutiiq communities. It is also 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 46). Athabascans inhabit areas along five major river systems in the state: 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 46. Traditional territory of the Alaska Athabascan people.

The southwest Alaska Natives are named after two main dialects of the Central Yup'ik language, known as General 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, 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 47).

Figure 47. Traditional territory of the Central Yup'ik and Cup'ik people.

The Iñupiaq and St. Lawrence Island Yupik (who speak a language distinct from Central Yup'ik) peoples continue to function as traditional hunting and gathering societies. They subsist on the land and sea of north and northwest Alaska (Figure 48). 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 by coastal and island village residents.
- 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 48. Traditional territory of the Alaska Iñupiaq and St. Lawrence Island Yupik people.

The Unangax (Aleut) and Alutiiq (Sugpiaq) peoples live in southcentral and southwest Alaska, obtaining most of their food and livelihood from the sea (Figure 49). 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 49. Traditional territory of the Unangax (Aleut) and Alutiiq (Sugpiaq) people.

11.1.2 Contemporary Cultural Context of Subsistence Salmon Fishing

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, discussion of subsistence harvests by rural Alaskan communities is limited to the fisheries management areas of interior, western, and northern Alaska and includes: the Arctic-Kotzebue Area; the Norton Sound-Port Clarence Area (these 2 management areas are referred to as the "Arctic area"); the Yukon River Area; the Kuskokwim Area (these 4 areas compose the Arctic-Yukon-Kuskokwim or "AYK" area); the Bristol Bay Area; and the Alaska Peninsula Area. Rural economies of villages in these regions of 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 percent to 247 percent of that in Anchorage. In March 2014, food costs in Deering were 338 percent that of Anchorage, Pilot Station's food costs were 214 percent, and costs in Quinhagak were 299 percent. The University of Alaska Cooperative Extension Service documents these costs through quarterly food cost surveys, although the estimates for smaller communities are not updated regularly (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 percent 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 et al. 2010:1).

During the development of BSAI Amendment 91, many individuals wrote public comment letters to NMFS and testified to the Council on the importance of subsistence harvest to their livelihoods, families, tribes, cultures, and communities. Public comments explained that salmon are especially significant to the cultural, spiritual, and nutritional needs of Alaska Natives and that analysis of impacts on subsistence users and subsistence resources must reflect the values obtained from a broad range of uses, not simply the commercial value or monetary replacement costs of these fish. Comments emphasized that strong returns of healthy salmon are critical to the future human and wildlife uses of those fish and to the continuation of the subsistence way of life. For example, public comment from the Bering Sea Elders Advisory Group follows:

Our subsistence practices and, specifically, ties to salmon go beyond commercial value or the monetary replacement cost of food. The English language term "subsistence" is not in our Yupik language and does not describe the totality of our ties to salmon.

Traditionally, Alaska Native peoples derive their food, nutrition, ethics, and values of stewardship, languages, codes of conduct, stories, songs, dances, ceremonies, rites of passage, history, and sense of place and spirituality from the lands, waters, fish, and wildlife they have depended on for millennia. Many White persons imagine that subsistence is merely the act of an individual going hunting or fishing.

Subsistence, in actual fact, is a complicated economic system and it demands the organized labor of practically every man, woman and child in a village. There are countless tasks, such as maintenance of equipment…, preparing the outfit for major hunting and fishing expeditions…dressing thousands of pounds of fish….sharing harvest of meat and fish with other communities.

Correspondingly, a study that documented traditional knowledge about Chinook salmon in three Bering Strait/Norton Sound communities (Raymond-Yakoubian 2010:23-24) noted that "Chinook, and other salmon, also have importance beyond the realm of "food". The study described "cultural impacts" of declining salmon runs and harvests, including changes to harvest and processing techniques, use of traditional fishing locations, and sharing.

While the economic value of the subsistence harvest is significant, subsistence is clearly more than an economic system and cannot solely be measured by harvest levels; it is the social foundation for many rural and Alaska Native communities. The Alaska Natives Commission report (1994) referenced subsistence surveys in 98 communities, and emphasized that virtually all of the meat, fish, and poultry annually consumed in half of the surveyed communities came from the harvest of wild resources. The report states that if subsistence resources are denied to subsistence-dependent communities, the result would be the deterioration of nutrition, public health, and social stability; primarily because the cost of buying, transporting, and storing imported replacements would be impossible for local people to bear over time. The long-term consequence would be the gradual erosion and disappearance of many rural communities through out-migration. In this way, subsistence is tied to the survival of human communities and cultures. This point is also made in Wolfe (2007), which states that "Changes in the salmon fisheries, such as decreases in subsistence and commercial harvests can have broad impacts on the local ways of life, including traditional cultures, local economies, personal identities, and societies."

Subsistence activities commonly involve an entire community. According to Wolfe (2007), "in the AYK region, salmon is harvested primarily within family groups…commonly men harvest and women process salmon for subsistence food, consumed within extended families and shared with others in the community." Subsistence Chinook salmon may be consumed directly by the person or family that harvests it, or may be distributed to other persons in the community. Many studies indicate that the traditional wide-scale sharing of subsistence products is a central activity that unifies extended families and communities. With reduced subsistence opportunities come fewer opportunities for young people to learn cultural subsistence practices and techniques, and this knowledge may be lost to them in the future. Wolfe (2007) provides more information on the relationship between salmon and culture in the AYK region.

Subsistence communities also appear to specialize by household, with a relatively small percentage (which researchers have called 'super-households') being extremely productive, harvesting most of their community's annual supplies and distributing them to less productive families. In western Alaska, entire families migrate seasonally to summer fish camps. These annual migrations, and fish camp life itself, are important elements of rural and cultural life (Wolfe 1987; Wolfe et al. 2010).

Extensive non-market sharing and exchange take place in communities with mixed subsistence economies. Through sharing, local communities' values are expressed and transmitted across generations. Salmon may be given or shared with other persons without the expectation that something specific will be given in exchange. Fish may be shared with family members or friends, in the region or outside of it. An example from Tanana: "…salmon is given to individual elders, elders' residences, and people who do not have access or ability to fish. Almost all the fishermen interviewed stated that the first salmon caught were given away to share the taste of the first fish and bring luck to the fishermen" (Moncrieff, 2007).

Salmon may also be exchanged for other goods. Trade of subsistence goods between communities has a long history in regional Native cultures. Trade involving items of western manufacture for Alaska furs across the Bering Strait predates European presence in the region (Bockstoce 2009). As Russians came into increasing contact with Natives on the Asian side of the Bering Strait several centuries ago, there was increasing trade in western manufactured goods and products, and increasing use of monetary sales as goods were exchanged. These processes continue today. An example from Holy Cross notes that Yukon River Chinook: "…is traded for a variety of items. Some people bring salmon or moose when they travel and give it as a gift to the family they stay with. Others traded their salmon for Kuskokwim River fish, berries from the stores in Anchorage, berries from the other areas, crafts, or services. Trade relationships, active in the precontact era, continue to exist today" (Moncrieff, 2007).

Given the significance of the subsistence harvest in rural Alaska, subsistence use should also be viewed as having substantial economic value. However, this economic role is often "hidden," "unmeasured in the state's indices of economic growth or social welfare and neglected in the state's economic development policy" (Wolfe and Walker 1987:56). In describing Alaska's rural economy, Goldsmith (2007:45) noted:

> *Even with consistency in definitions and improvements in the quality of data collected, the standard indicators would not provide a complete or balanced picture of the complexity of the [rural Alaska] economy. This is because the subsistence and informal sectors are nowhere captured by indicators which are designed only to measure activity in the cash economy. Because these non-market activities consume a considerable amount of time and effort for rural residents, and contribute significantly to the economic well-being of the region, they should be included for several reasons. Without them the well-being of residents is undervalued, comparisons with urban areas are misleading, and economic development strategies are not grounded in reality.*

As noted previously, food costs and living expenses are high in rural Alaska. Materials have to be transported long distances with limited transportation and distribution infrastructures, consequently, these services are expensive. Small populations may not be able to support returns to scale in transportation, distribution, storage, or support the large numbers of firms that would provide for competitive markets. The Cooperative Extension Service of the University of Alaska Fairbanks routinely surveys communities to gather information on living costs. In December 2007, it found that the cost of a week's worth of food in Bethel was 189 percent that of Anchorage. Food costs in other communities in the action area were also higher than in Anchorage. Costs in Kotzebue were 208 percent, costs in Naknek/King Salmon were 218 percent, and costs in Nome were 171 percent, that of Anchorage (UAF 2007).[46]

11.1.3 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 on a combination of local subsistence harvests, on wage labor, and on transfer payments like the Alaska Permanent Fund Dividend (Goldsmith 2007). Today, subsistence harvests remain a prominent part of the local, mixed economy of rural Alaska, and the mainstay of social welfare of the people (Wolfe and Walker 1987). In 'mixed' economies, small to moderate amounts of cash are provided at different times of the year by limited employment opportunities. Subsistence activities provide the material basis that allows these mixed subsistence and market-based economies[47] to continue. For example, in many places, involvement in the

[46] http://www.uaf.edu/ces/fcs/2007q4data.pdf

[47] The concept of a "mixed economy is described in Wolfe and Walker, 1987.

cash sector supports subsistence harvests (e.g., making money in order to buy nets or gear then used in subsistence practices). They also provide a context within which traditional elements of these cultures can persist. Cultural practices in regional communities vary between broad ethnic groupings and between smaller groups within these larger groupings. However, each of these subsistence communities was once organized completely around wild resource use, and these communities require access to these resources to support the personal relationships, ways of living, and cultural values that emerged in those earlier times.

In the latter half of the 20th century, rural Alaska experienced dramatic improvements in infrastructure – transportation, utilities, communications, education, and 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 urban Alaska and 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. Rural Alaska 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, as in most of rural Alaska, 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 et al. 2010). 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.

Today, people often move to improve their employment opportunities. Improving job opportunities and the chance of finding work were the reasons 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 the characteristics of place amenities in shaping decision about migration. Subsistence activities, such as hunting, fishing, and gathering, add substantially to the real income of rural Natives. Thus, subsistence opportunities may limit the effect of relatively limited market opportunities on Native migration (Huskey et al., 2004; Huskey 2009). In analysis of data from the Survey of Living Conditions in the Arctic (SLiCA), Berman (2009:14) concluded that:

Empirical results suggest that Inupiat respondents to the SLiCA living in small Alaska communities place a high value on local subsistence opportunities as a factor influencing their place of residence. Opportunities to earn wage income and quality of life factors such as housing and crime are also significant factors explaining whether the respondent has considered moving away from their community. However, variation in subsistence opportunities explains more of the variation in moving preferences than variation in any other place-specific factor.

Howe (2009:72, 78) noted several other factors related to subsistence fishing and hunting activities that affect households' decisions to migrate. These include the presence of extensive social networks within which subsistence resources are exchanged in rural communities, and the significant investments households have made in subsistence equipment, assets that are often lost when families move.

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 little to no return and will gradually 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 push 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 et al. 2010). 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 sectors within Alaska's mixed economies. 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 tend to be scarce, seasonal, and intermittent; finding employment in the private sector is difficult. In five case study villages along the Yukon River, the percentage of adults who earned some money through employment ranged from 50 percent to 80 percent in 2007. 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 (Wolfe et al. 2010:99). This is substantially lower than the per capita incomes in Alaska's urban areas. According to findings of the American Community Survey for the period 2008-2012, the annual per capita income was $27,646 in Fairbanks and $36,145 in Anchorage. [48]

It is also important to understand that subsistence harvesting activity is not without cost, and that often a household's subsistence use is 'capitalized' by its cash income, since the efficient harvest of large amounts of fish cannot be accomplished without commodities such as fishnets, motors, fuel, etc. So while a common assumption may be that the subsistence and cash sectors of local economies are inversely related, subsistence is its own economic sector, highly significant to those who practice it, and fully co-existing with cash-market activities. Subsistence salmon harvesters often use the same or similar types of set and/or drift gillnets, boats, and other equipment as commercial harvesters. Some subsistence harvesters also participate in commercial salmon fisheries, and they depend on income earned in the

[48] Data reported at the Alaska Department of Labor at http://live.laborstats.alaska.gov/cen/acsdetails.cfm.

commercial fisheries to help offset the costs, both of acquiring equipment and of operating it, associated with subsistence salmon fishing. Even if sufficient opportunities for subsistence harvests are available, reductions in the commercial harvest may greatly affect the subsistence fishery, to the extent some households use sales of their commercial catch to meet the costs incurred in the subsistence fishery. Thus, if the commercial Chinook fishery is reduced, it can also reduce opportunities in the subsistence Chinook fishery. Wolfe (2003) provides a more complete discussion of these commercial and subsistence fisheries relationships.

11.1.4 Regional Populations

In 2012, approximately 17 percent of Alaska's population, about 125,000 people, lived in rural areas. These people lived in about 260 communities, most of which have fewer than 500 people and are not connected by road. About 55 percent of this rural population is made up of Alaska Native people (Fall et al. 2014). In many smaller rural communities, Alaska Natives comprise more than 90 percent of the population.

Generally, the total population and rural population in the fishery management areas discussed in this document have increased since 1980, although growth slowed notably after 2000. Table 93shows 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 percent 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 percent (1980) to 64 percent (2010) of the total population of all of the communities combined in each census year reported. The population of this nonsubsistence area grew 76 percent from 1980 to 2010. The population of the communities outside the Fairbanks Nonsubsistence Area, but within the five management areas under discussion, grew 40 percent 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 percent from 2000 to 2010. The rate of increase for all areas, slowed, from a 33 percent increase from 1980 to 1990, to a 9 percent increase from 1990 to 2000 and an 11 percent increase from 2000 to 2010. For those communities outside the nonsubsistence area, the population grew about 22 percent from 1980 to 1990 and 13 percent from 1990 to 2000, but just over 1 percent from 2000 to 2010.

Table 93. Population trends by fishery management area, 1980 – 2010 Population and percent of change between census years

ADF&G Management Area	Number of Communities, 2010[a]	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 and Spaeder, 2009).

11.1.5 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 cease 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 and Spaeder, 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 et al. 2010; 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 et al. 2010).

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 et al. 2010).

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 percent of the households harvested 70 percent of the salmon by edible weight. During the study period, subsistence salmon harvests were estimated to have declined 5.8 percent annually. Most of the declines occurred during the first 5 years (1994 - 1998), when harvests trended lower by about 8 percent annually. During the latter years (1999 - 2003), harvests trended lower by about 1 percent 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).

A similar study analyzed fish harvest data for an 11-year period (1994-2004) for 6 Kotzebue District communities (Magdanz et al. 2011). Over the 11 years, subsistence harvests of chum salmon declined about 6.9 percent annually, but harvests of sheefish, Dolly Varden, and other salmon increased, resulting in a stable per capita fish harvest. Based upon interviews with 92 households, environmental factors, such as unusual water levels, were the most often cited reasons for changes in fish harvests, followed by personal factors (such as health and age of household members); financial factors (employment, rising costs) were also a frequent explanation.

11.1.6 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 seasonal activities that provided food and cash income (Andersen 1992). 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.

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[49] households in seven study communities along the Yukon River. By 2008, the number of mushing households in these same communities had dropped to 42, a decline of 56 percent. 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 percent (Table 94) (Andersen, 1992; 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 the early 21st century 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. In the lower part of the drainage, non-salmon species (e.g., eels/Arctic 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

[49] In this context, dog musher is being used as a general term encompassing all users of dog and dog teams and not distinguishing among the specific various uses of sled dogs in rural villages.

rivers, fall chum salmon and coho salmon were the most commonly harvested fish species for dogs (Andersen, 1992).

Table 94. 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

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 they were 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 as 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, which operated through the mid 1990s, greatly contributed to the number of fish used to feed dogs. After the roe was removed, the carcasses were dried and stored to feed sled dogs through the winter and were counted as part of the subsistence harvest. 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 show that 97 percent of mushers reported using fish to some extent to feed their dogs and 78 percent reported the fish comprised half or more of their dog's annual diet. In addition, 41 percent of mushers reported that locally caught fish made up 75 percent or 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 percent (316,360 pounds) of this total. 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 percent (Andersen and Scott, 2010).

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 can only be 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).

11.1.7 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 wild foods is greater in rural Alaska than anywhere else in the United States. About 36.9 million pounds of traditional foods are taken each year. This amounts to a per capita consumption of 295 pounds in rural Alaska, or just under one pound a day (Fall et al. 2014). In comparison, according to the U.S. Census Bureau, the 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.

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 295 pounds per person contains 189 percent of the protein requirements of the rural population, containing about 87 grams of protein per person per day. The subsistence harvest contains 26 percent of the caloric requirements of the rural population (Fall et al. 2014). 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 percent) 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 percent 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.[50]

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 particularly in the consumption of sugared beverages over many years. Third, the intakes of some

[50] Data from the Southeast Alaska Regional Health Consortium are not included here since this area falls outside the focus on western Alaska.

nutrients are reported to be low, including fiber, vitamin A, B vitamins, vitamin C, foliate, 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 Interior region indicates the importance of fish in the diet of Alaska Natives. Table 95below outlines the importance of salmon in the diet of participants of the ATDP study (Ballew et al., 2004).

Table 95. Total consumption (in pounds) of salmon species consumed by participants in each of the Regional Health Corporations.

Regional Health Corporation	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%	1,384 (42)	94%	3,875 (18)	88%	4,162 (16)	n/a	3,206 (23)	69%
Yukon-Kuskokwim	8,296 (12)	84%	15,722 (5)	98%	5,968 (16)	n/a	n/a	n/a	n/a	n/a
Bristol Bay	2,532 (29)	n/a	5,076 (12)	93%	3,486 (17)	86%	6,354 (10)	93%	2,261 (31)	n/a
Tannana Chiefs Conference	n/a	n/a	583 (16)	97%	243 (26)	79%	n/a	n/a	n/a	n/a

Note: 'Total Con.' = Total consumption in lbs. Numbers in parenthesis indicate where that species ranked among the top 50 foods consumed by amount.

Note: 'Percent Part.' = Percent participants. This indicates the percentage of participants (out of those surveyed) who reported eating the salmon species. The study reported the top 50 foods by percent of participants that reported the food.

Note: 'n/a' indicates that the salmon species was not in the top 50 foods reported by amount consumed or by percentage of participants that reported the food.

The most common reason given by ATDP participants for eating less subsistence foods was 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).

11.1.8 Food Budgets

As noted previously, ADF&G, Division of Subsistence, estimates that approximately 36.9 million pounds of wild foods are harvested annually by residents of rural Alaska. 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 $4 per pound, equates to over $147 million for all of rural Alaska. If a replacement value of $8 per pound is used, still likely a low figure, the estimated wild food replacement value for rural Alaska is estimated to be more than $295 million annually (Fall et al. 2014). 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.

11.1.9 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 percent of surveyed Kivalina households and 82 percent of Noatak households reported high or marginal levels of food security, compared with 89 percent 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). The Division of Subsistence has continued to investigate food security through its comprehensive household surveys in northern and western Alaska communities (e.g. Brown et al. 2012, Brown et al. 2013, Ikuta et al. 2014, Brown et al. 2014, Braem et al. 2014).

According to ADF&G's *Subsistence in Alaska: A Year 2012 Update* (Fall et al. 2014; see also Loring and Gerlach 2010:2969), 95 percent of Alaska's rural population, which represents 17 percent of the state's total population and 48 percent of the Alaska Native population, use locally procured fish for at least part of the year. Based upon research in Yukon River communities, Wolfe et al. (2010) found five factors 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 et al. 2010).

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 percent of total income to 9.9 percent of total income from 2000 to 2006. By comparison, the median amount spent by urban Anchorage households increased from 2.6 percent to 3.1 percent 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).

11.1.10 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 and Kuskokwim river drainages. 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 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 and Spaeder, 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 percent) and fish (-81.4 percent). 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 percent), but down for fish (-71.4 percent). 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 et al. 2010:14-15). Because these comparisons include just two study years for each community, they should be applied with caution as indicators of trends.

11.2 Overview of subsistence salmon harvests

The majority of the information in this section is from the Alaska Subsistence Salmon Fisheries 2012 Annual Report (Fall et al. 2014). When available, more recent information on subsistence harvests (by personal communication with ADF&G) is provided. Note that Section 3.4 contains the status of the Chinook salmon stocks.

The estimated total subsistence harvest of salmon throughout Alaska in 2012, based on annual harvest assessment programs, was 935,470 fish. The estimated statewide harvest of chum salmon was 367,692 fish (39 percent) and the estimated harvest of Chinook salmon was 74,381 fish (8 percent) (Table 96, Figure 50). In 2012, 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 (284,301 salmon; 30 percent of the statewide total); the Kuskokwim Area (190,245 salmon; 20 percent); the Bristol Bay Management Area (122,582 salmon; 13 percent); the Norton Sound-Port

Clarence Area (91,696 salmon; 10 percent)[51]; and the Kotzebue District (29,092 salmon; 3 percent) (Figure 51).

Table 96. Alaska subsistence salmon harvests, 2012.

	Households or permits		Estimated salmon harvest					
Fishery	Total[a]	Surveyed or returned	Chinook	Sockeye	Coho	Chum	Pink	Total
Adak District	1	1	0	0	0	0	0	0
Alaska Peninsula Management Area	172	138	287	9,429	1,936	1,637	941	14,230
Arctic District[b]	219	120	34	79	477	710	1,256	2,556
Batzulnetas Fishery	3	3	1	136	0	0	0	137
Bristol Bay Management Area	1,107	932	12,136	100,728	3,837	4,007	1,874	122,582
Chignik Management Area	106	87	116	5,607	1,488	220	810	8,241
Chitina Subdistrict: Federal	90	80	5	981	9	0	0	995
Copper River Flats	378	359	248	4,499	0	19	0	4,766
Glennallen Subdistrict	1,805	1,557	2,649	94,991	470	0	0	98,110
Kenai and Kasilof Rivers: Federal	133	121	0	1,438	0	0	0	1,438
Kodiak Management Area[a]	1,866	1,866	54	23,865	2,920	166	1,154	28,159
Kotzebue District[b]	545	360	16	455	1,230	26,694	697	29,092
Kuskokwim Management Area	4,294	1,569	25,336	50,616	30,221	81,912	2,160	190,245
Norton Sound - Port Clarence Area[b]	1,270	1,234	1,335	1,859	12,203	24,049	52,250	91,696
Port Graham & Koyuktolik Subdistricts[a]	8	8	24	961	414	31	482	1,912
Prince William Sound (General)	14	12	0	67	0	32	0	99
PWS Eastern District (Tatitlek)	16	8	15	954	75	8	0	1,052
PWS Southwestern District (Chenega Bay)	23	14	0	603	20	77	0	700
Seldovia Fishery	20	7	8	79	0	0	54	141
Southeast Region	2,944	2,530	718	40,007	2,639	987	1,828	46,179
Stikine River Federal Fishery	130	130	53	1,302	112	47	32	1,546
Tyonek Fishery	89	69	840	176	138	2	4	1,160
Unalaska District	211	169	20	4,960	429	43	338	5,790
Upper Yentna Fishery	21	21	0	279	24	19	21	343
Yukon Management Area[c]	3,133	1,575	30,486	0	21,633	227,032	5,150	284,301
Total	**18,598**	**12,970**	**74,381**	**344,071**	**80,275**	**367,692**	**69,051**	**935,470**

Source ADF&G Division of Subsistence, ASFDB 2013 (ADF&G 2014).

Note Included in this table are all harvest estimates based upon annual harvest monitoring programs.

a. 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.

b. Formerly included within Northwest Alaska. Partial coverage for Arctic and Kotzebue Districts; see Chapter 3 for details.

c. Includes a small personal use harvest that occurs within the Fairbanks Nonsubsistence Area.

NA = Data not available.

[51] Subsistence harvest estimates for Northwest (Arctic) Alaska for 2003, 2004, and 2012 do not include the regional center of Kotzebue, which had been included in the harvest assessment program for 1994-2002. No subsistence fisheries harvest data were collected in the Kotzebue District for 2005 through 2011; therefore, the estimated harvest totals for Northwest Alaska as reported for 2003 through 2011 are incomplete.

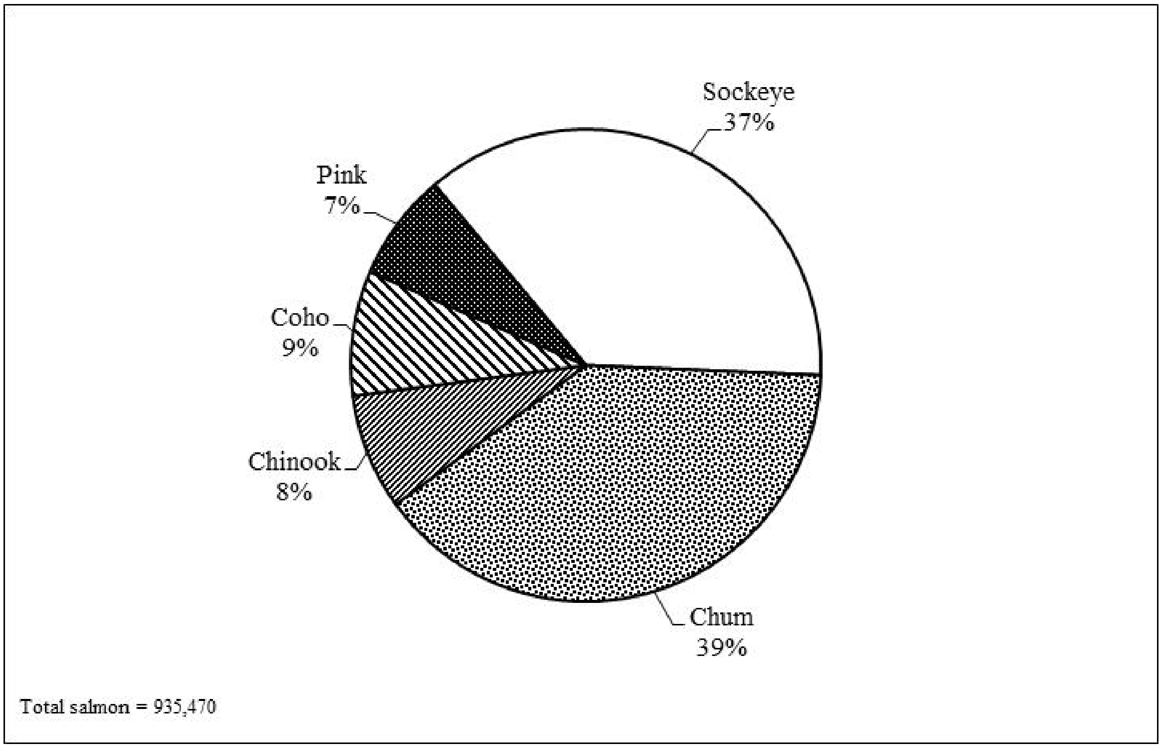

Figure 50. Alaska subsistence salmon harvest by species, 2012. (Source: Fall et al., 2014)

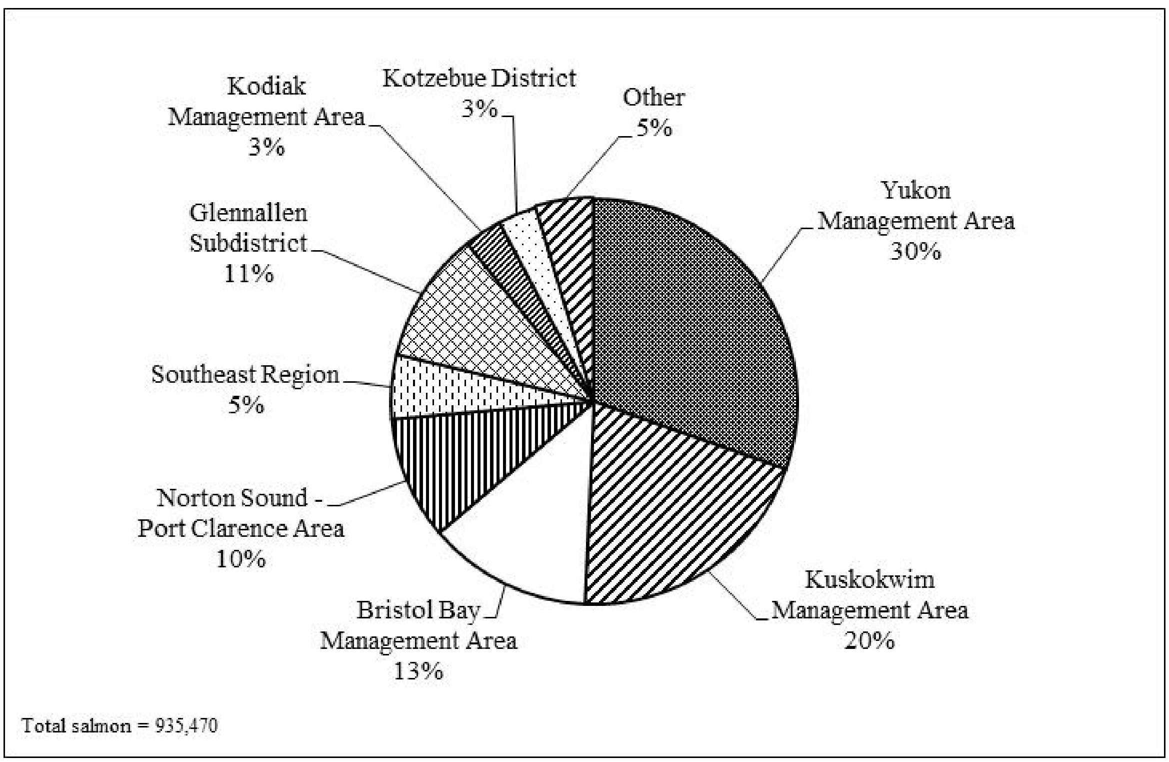

Figure 51. Alaska subsistence salmon harvest by area, 2012. (Source: Fall et al., 2014).

In 2012, as in other recent years, four areas dominated the subsistence chum salmon estimated harvest: the Yukon Area (227,032 salmon; 62 percent of the statewide harvest), the Kuskokwim Area (81,912 salmon; 22 percent), the Kotzebue District (26,694; 7 percent) Area and the Norton Sound-Port Clarence Area (24,049 salmon; 7 percent) (Table 96, Figure 52). Table 97provides trend data on the number of households in Alaska that use subsistence salmon as well estimated harvests by species for 1994 - 2012. Statewide eligibility criteria require individuals to be Alaskan residents for the preceding 12 months before harvesting salmon for subsistence uses (Fall et al., 2014).

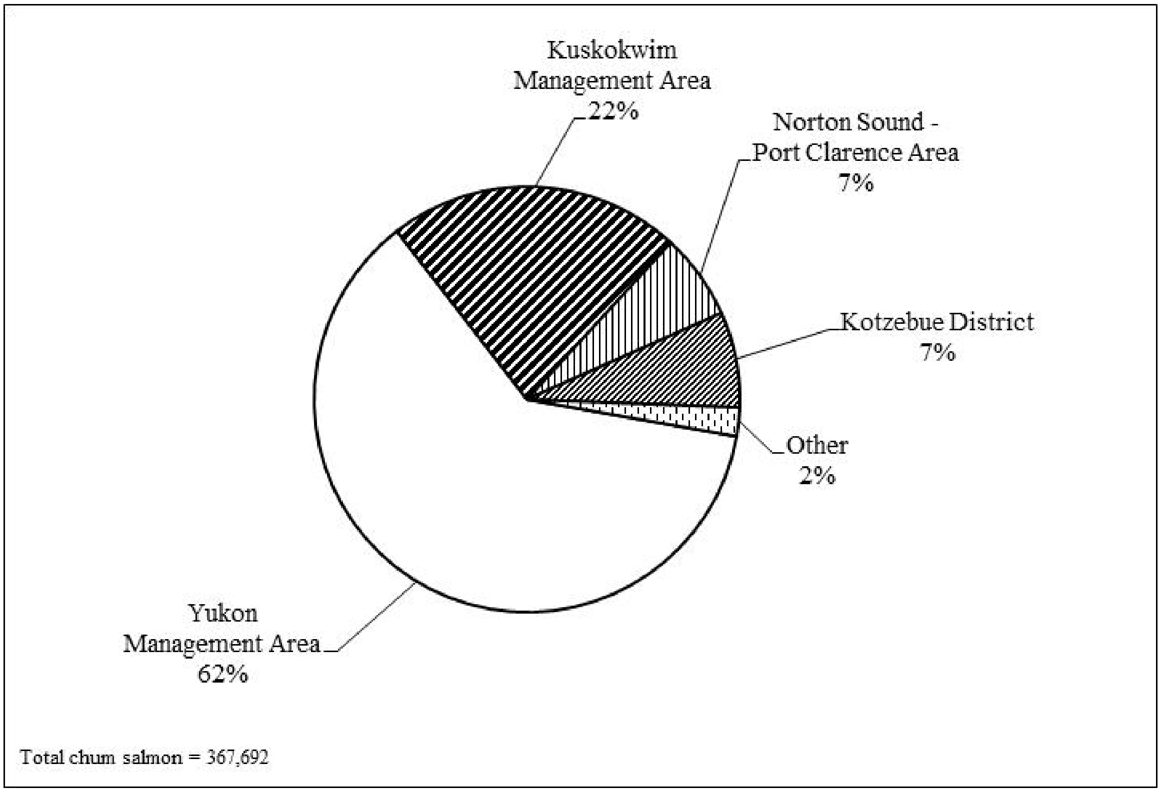

Figure 52. Subsistence chum salmon harvest by area, 2012 (Source: Fall et al., 2014).

Table 97. Historic Alaska subsistence salmon harvests, 1994 – 2012.

	Households or permits		Estimated salmon harvest					
Year	Total	Surveyed or returned	Chinook	Sockeye	Coho	Chum	Pink	Total
1994	15,493	10,553	183,936	338,946	135,896	417,199	94,469	1,170,446
1995	15,596	10,328	180,805	291,539	120,048	499,992	54,908	1,147,292
1996	16,512	11,789	158,369	320,821	121,381	498,525	80,928	1,180,026
1997	17,668	12,863	176,703	376,397	98,883	347,808	41,543	1,041,335
1998	17,772	12,513	170,271	328,857	93,055	302,037	74,216	968,436
1999	17,290	12,763	155,088	358,866	89,627	338,351	32,402	974,334
2000	16,678	12,765	130,822	296,875	99,338	247,337	51,714	826,087
2001	18,693	13,061	161,632	340,411	98,517	240,581	42,435	883,576
2002	17,266	13,026	142,459	299,182	92,192	229,179	85,431	848,443
2003	18,131	13,211	164,555	324,539	106,488	238,582	66,794	900,958
2004	18,374	13,549	173,746	332,543	100,860	239,811	91,597	938,557
2005	16,256	11,013	153,431	323,218	97,993	257,200	76,071	907,912
2006	16,988	11,400	139,815	314,435	93,478	291,510	73,234	912,473
2007	17,068	10,374	154,974	319,885	78,704	273,802	33,513	860,877
2008	17,226	11,248	174,115	315,040	113,242	270,502	85,842	958,741
2009	16,989	11,607	141,302	296,104	86,363	213,835	38,038	775,642
2010	16,020	11,381	133,252	326,363	80,217	235,763	59,031	834,627
2011	17,181	12,155	128,657	341,388	77,180	257,032	35,646	839,903
2012	18,598	11,970	74,381	344,071	80,275	367,692	69,051	935,470
5-year average (2007-2011)	16,897	11,353	146,460	319,756	87,141	250,187	50,414	853,958
10-year average (2002-2011)	17,150	11,896	150,630	319,270	92,672	250,722	64,520	877,813
Historical average (1994-2011)	17,067	11,978	156,885	324,745	99,081	299,947	62,101	942,759

Source ADF&G Division of Subsistence, ASFDB 2013 (ADF&G 2014).
Note Included in this table are all harvest estimates based upon annual harvest monitoring programs.

The amount of Chinook salmon harvested for subsistence use and the portion of subsistence Chinook salmon harvested relative to other species of salmon varies greatly by region (Table 96). Figure 53reports subsistence Chinook harvests in 2012 (74,381 Chinook) by general harvest area. The largest estimated subsistence harvests of Chinook salmon in 2012 occurred in the Yukon area (30,486 salmon; 41 percent), followed by the Kuskokwim (25,336 salmon; 34 percent), Bristol Bay (12,136 salmon; 16 percent), the Glennallen Subdistrict of the Prince William Sound Area (2,649; 4 percent), and the Norton Sound-Port Clarence Area (1,335 salmon; 2 percent).

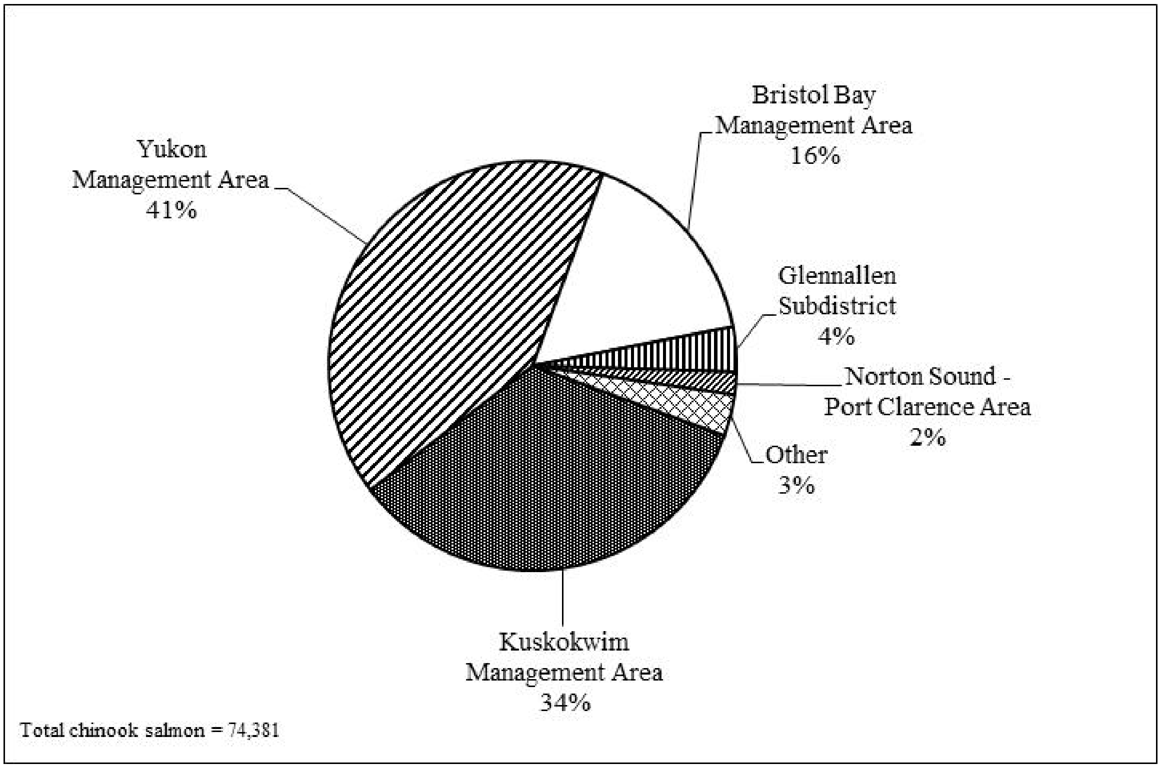

Figure 53. Estimated subsistence Chinook salmon harvest by area, 2012 (Source: Fall et al. 2014).

11.3 Overview of Regional Subsistence Harvests

Figure 54, below, summarizes historical estimates of subsistence harvest of Chinook, chum, and other salmon, by subsistence harvest area for the years in which relatively comprehensive data are available. The data provided are through 2012. Please see Section 3.4 for stock status information. In addition, the following list contains some primary points regarding regional patterns and trends:

Chinook salmon are the first salmon to arrive each year, which is key to their importance for subsistence throughout their range.

Chinook salmon are a preferred food throughout their range, including communities and areas where they are harvested in relatively small numbers.

Chinook salmon make up a relatively small portion of the subsistence harvests west of Shaktoolik, in Kotzebue Sound, and on Alaska’s North Slope. Chinook salmon also are a relatively small portion of the subsistence harvests in the Alaska Peninsula and Aleutian Islands management areas. Chinook comprised less than 1 percent of subsistence harvests in the Kotzebue District between 1994 and 2004, about 2 percent in the Alaska Peninsula Area between 2002 and 2011, and less than 0.2 percent in the Aleutian Islands Area in the same period (Fall et al. 2014). Therefore, the Alaska Peninsula and Aleutian Islands areas are not included in Figure 54.

The Norton Sound Area includes the Port Clarence and Norton Sound districts. In this area, subsistence salmon harvests are dominated by pink and chum salmon, which made up 49 percent and 23 percent, respectively, of the total subsistence salmon harvest in the area from 1994 through 2012 (Fall et al. 2014). For the area as a whole, Chinook accounted for about 5 percent of the subsistence salmon harvested between 1994 and 2012. Despite being a relatively small portion of the overall harvest, Chinook salmon are a preferred subsistence food in the Norton Sound Area. Chinook harvests were largest in the region's more southerly Norton Sound District, where they accounted for between 2 percent and 11 percent of the salmon caught; in the more northerly Port Clarence District they accounted for between less than 1percent and 2 percent of the salmon caught (Fall et al. 2014).

Chinook salmon are clearly a key species on the Yukon River. More summer and fall chum salmon are harvested (about 71 percent of the annual average for 2003-2012), but during the same period Chinook accounted for 19 percent of the number of salmon harvested. Prior to the large declines in the chum harvests in the early 1990s, Chinook accounted for a significantly smaller proportion of the harvest: from 6 percent to 13 percent (Fall et al. 2014). However, the relative total harvest of each type of salmon does not account for other important considerations, including the relative size, flavor, drying qualities, and social and cultural significance.

The subsistence salmon fisheries in the Kuskokwim Area are some of the largest in the state of Alaska, in terms of the number of residents who participate and the number of salmon harvested (Fall et al. 2014). Since 1994, when ADF&G began acquiring reasonably complete statewide coverage of subsistence harvest survey data, over 50 percent of king salmon harvested under subsistence regulations have been taken in the Kuskokwim Area, mostly in the Kuskokwim River drainage. Between 2010 and 2013 (study years 2009–2012), the Division of Subsistence conducted comprehensive subsistence harvest and use surveys in 18 Kuskokwim River communities. The results indicate that on average salmon contributes 42 percent of the total wild resource harvest (in edible pounds) in the Lower Kuskokwim communities, 65 percent in the Central Kuskokwim communities, and 25 percent in the Upper Kuskokwim communities (Brown et al. 2012, 2013; Ikuta et al. 2014).

Chinook salmon are important in the Bristol Bay region, although they represent a lower percentage of the total salmon harvest in the area because such a large portion of the subsistence harvest is sockeye salmon, especially in the Kvichak River drainage where there are few Chinook salmon. In districts where both sockeye and Chinook are available in relatively high numbers (Togiak, Naknek, and Nushagak), Chinook comprise a higher percentage of the total, and in some years in the Nushagak District may exceed sockeye when harvests are measured in pounds (James Fall, ADF&G Subsistence Division, personal communication). However, Chinook area also a favored subsistence food in the other Bristol Bay districts with relatively small Chinook runs. In the Bristol Bay Area from 2003 through 2012, Chinook harvests have ranged between 10 percent and 16 percent of total subsistence salmon harvests; from 1983 to 1992, they ranged between 5 percent and 9 percent (Fall et al. 2014).

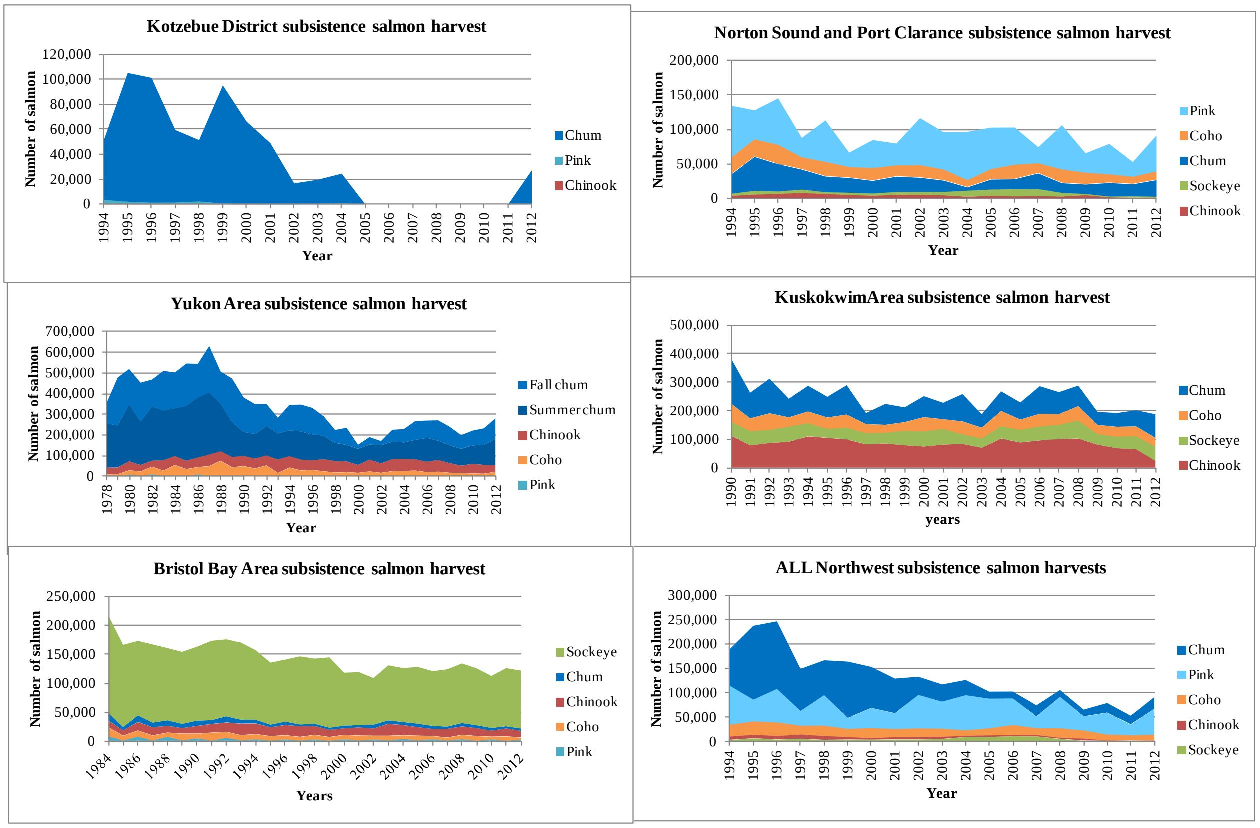

Figure 54. Estimated subsistence harvests of Chinook, chum, and other salmon, by key management areas (Source: Fall et al. 2014).

The BOF has made ANS findings for salmon throughout the areas under discussion here (Table 98). 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 54). See Table 99for a comparison of ANS ranges and recent years' subsistence salmon harvests for the Yukon River.

Since 1998, the harvests of all species have been within their respective ANS ranges for only 2 years: 2005 and 2007. As a result of the necessary restrictions to subsistence, Chinook salmon harvests have fallen below the lower end of the ANS range since 2008. In contrast, the harvests of summer chum and fall chum, which are more abundant, have been increasing, likely due to fishermen replacing their lost Chinook salmon harvests with chum species. As fishermen replace Chinook harvests with chum harvests, summer and fall chum harvests have gradually increased to more historic levels and have fallen within their ANS ranges since 2010 and 2012, respectively.

Table 98. Alaska Board of Fisheries findings pertaining to amounts reasonably necessary for subsistence (ANS).

Fisheries Management Area	Year of ANS Finding	Chinook Salmon	Chum Salmon	Summer Chum Salmon	Fall Chum Salmon	Sockeye Salmon	Coho Salmon	Pink Salmon	All Salmon
Kotzebue District	None								
Norton Sound-Port Clarence Area	1998								96,000 - 160,000
Subdistrict 1 of Norton Sound District[1]	1999		3,430-5,716						
Yukon Area[2]	2001	45,500-66,704		83,500-142,192	89,500-167,900		20,500-51,980	2,100-9,700	
Kuskokwim Area	2013								
Kuskokwim River		67,200-109,800	41,200-116,400			32,200-58,700	27,400-57,600	500-2,000	
Districts 4 and 5									6,900-17,000
Remainder of Area									12,500-14,400
Bristol Bay	2001								157,000-172,171
Kvichak River Drainage[1]						55,000-65,000			
Alaska Peninsula	1998								34,000-56,000

[1] Nested in "all salmon" finding for the management area

[2] The Board of Fisheries reviewed ANS findings for all stocks in 2013. No changes were made except a ANS range was adopted for pink salmon.

Table 99. Comparison of amounts necessary for subsistence (ANS) and estimated subsistence salmon harvests, Yukon Area, 1998–2012.

	Chinook	Coho	Summer chum	Fall chum
ANS range	45,500–66,704	20,500–51,980	83,500–142,192	89,500–167,900
Year	Estimated number of subsistence salmon harvested[a]			
1998[b]	52,910	**16,606**	**81,858**	**59,603**
1999[b]	50,711	**20,122**	**79,348**	**84,203**
2000[b]	**33,896**	**11,853**	**72,807**	**15,152**
2001	53,462	21,977	**68,544**	**32,135**
2002	**42,117**	**15,619**	**79,066**	**17,908**
2003	55,221	22,838	**78,664**	**53,829**
2004	55,102	24,190	**74,532**	**61,895**
2005	53,409	27,250	93,259	91,534
2006	48,593	**19,706**	115,093	**83,987**
2007	55,156	21,878	92,891	98,947
2008	**45,186**	**16,855**	86,514	**89,357**
2009	**33,805**	**16,006**	**80,539**	**66,119**
2010	**44,559**	**13,045**	88,373	**68,645**
2011	**40,980**	**12,344**	96,020	**80,202**
2012	**30,415**	21,533	126,992	99,309

Source Jallen et al. (*In prep*)

a. Estimates for 1998–2004 do not include personal use harvests, ADF&G test fishery distributions, or salmon removed from commercial harvests. Estimates for 2005–2012 include test fishery distributions because the ANS are based on harvests from 1990–1999 and included test fishery distribution. **Bold underlined** cells indicate harvest amounts are below the minimum ANS.

b. Species-specific ANS ranges do not apply before 2001.

Table Source: Alaska Subsistence Salmon Fisheries 2012 Annual Report (Fall et al. 2014)

Some of the reasons for not meeting an ANS threshold in a given year may include poor salmon abundance for that year, or restrictions in subsistence summer chum salmon harvest opportunity in an effort to protect the co-migrating Chinook salmon run (personal communication, C. Brown, 2010). In years of poor Chinook 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.

11.3.1 Norton Sound and Port Clarence Area

According to the Alaska Subsistence Salmon Fisheries 2012 Annual Report (Fall et al. 2014):

Most residents of the region continue to participate in a mixed subsistence-cash economy, and depend on wild foods for cultural and nutritional sustenance. While more opportunities for wage work exist in Nome itself, subsistence activities are still an important facet of life to many of its inhabitants. In summer, subsistence fishers harvest salmon with gillnets or seines in the main Seward Peninsula rivers and coastal marine waters. Beach seines are used near the spawning grounds to harvest schooling or spawning salmon and other species of fish. A major portion of fish taken during the summer months is air dried or smoked for later consumption by residents. Chum and pink salmon are the most abundant salmon species districtwide; Chinook and coho salmon are present throughout the area, but are in higher abundance in *eastern and southern Norton Sound (Subdistricts 5 and 6.) Sockeye salmon are found in a few Seward Peninsula streams.*

A study of traditional knowledge of Chinook salmon conducted in three Bering Strait/Norton Sound communities (Raymond-Yakoubian 2010:24) concluded that:
Salmon is a critically important food item for many individuals and families in communities across Western Alaska. For many families, salmon harvest is necessary for their yearly economic survival. It is a nutritional input that people expect and need to have. However, even for families that are able to financially survive without a large input of subsistence harvested salmon, it can still be stressful to have less than you were formerly able to harvest and less than you would ideally want. One wife and mother from Unalakleet stated, "It's stressful to figure out how often you can have a taste of this, trying to make it last all winter until we can get some the next year." Salmon is a culturally important food that people frequently talk about wanting to have a "taste" of, and that reminds them of their heritage and important cultural values.

Magdanz et al. (2005) reviewed several studies of subsistence harvest for the Norton Sound and Port Clarence districts. Average per capita harvest of subsistence foods was on the order of 600 usable pounds per year in some communities. Salmon accounted for a significant part of this, with weights ranging from about 100 pounds to 160 pounds per capita, depending on the study (Magdanz et al. 2005: 25-25).

Estimated subsistence salmon harvests from 1994 through 2003 trended lower by 5.8 percent annually. Most of the declines occurred during the first five years (1994 - 1998), when harvests trended lower by about 8 percent annually. During the latter years (1999 - 2003), harvests trended lower by about 1 percent annually across all communities. While harvests appeared to have stabilized in the latter years, it would not be correct to characterize the overall situation as improving, at least through 2003. For half of the study communities, the lowest estimated harvests occurred in 2003.

Despite variation in household harvests, there were harvest patterns that might be used to refine estimation and prediction. Through many different levels of abundance, through a decade of varied weather, with harvests ranging from 67,000 to 140,000 salmon, each year about 23 percent (range varies from 21.8 percent to 24.6 percent) of the households harvested 70 percent of the salmon, by weight. Predictable patterns were also apparent in the harvests by the age and gender of household heads (Magdanz 2005).

One study of dietary sources of meat and fished showed that 75 percent was derived from subsistence sources and 25 percent from store-bought meats (Figure 59). A third of the meat and fish was salmon, and the remainder was from land or marine mammals, or other fish. In 4 communities in Norton Sound, Chinook salmon accounted for 3 percent of meat and fish consumption, while chum salmon accounted for about 6 percent (Ballew et al. cited in Magdanz et al. 2005:25).

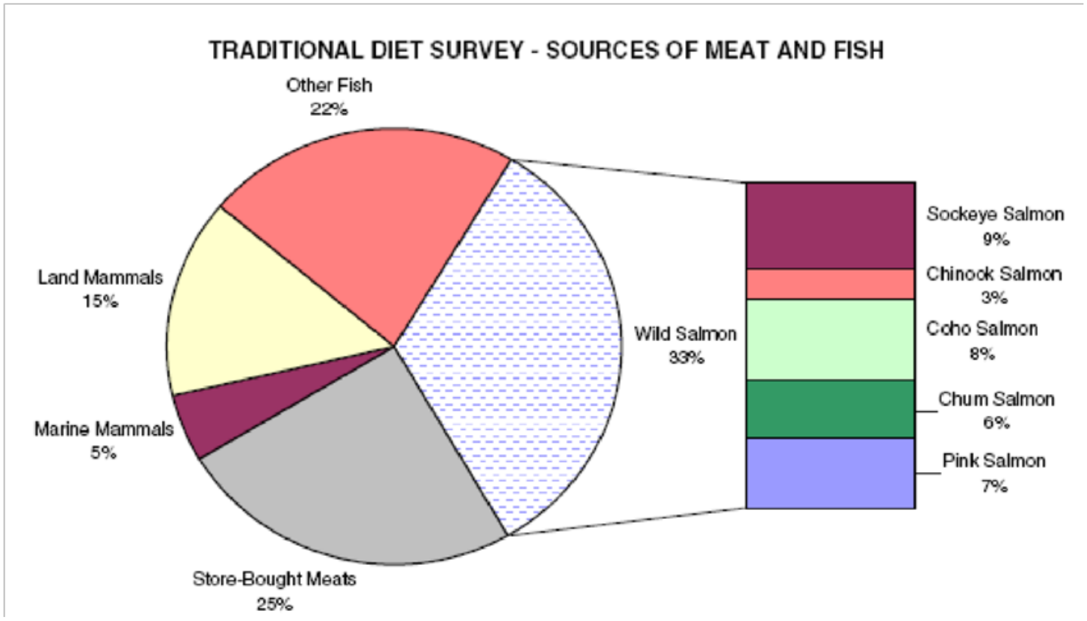

Figure 55. Results of a traditional diet of meat and fish survey in the Norton Sound and Port Clarence Districts (Source: Magdanz et al. 2005:25, citing Ballew et al. 2004)

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Information from Fall et al. 2014, provides the estimated subsistence salmon harvests by the Norton Sound, Port Clarence, Kotzebue, and Arctic districts from 1994 – 2012 (Table 100). Subsistence salmon harvests in 2012, by community and species in the Norton Sound and Port Clarence districts are provided below in Table 101.

Table 100. Historic subsistence salmon harvests by district, Norton Sound – Port Clarence, and Arctic – Kotzebue Areas, 1994 – 2012.

	Norton Sound District						
Year	Number of households	Chinook	Sockeye	Coho	Chum	Pink	Total
1994	839	7,212	1,161	22,108	24,776	70,821	126,077
1995	851	7,766	1,222	23,015	43,014	38,594	113,612
1996	858	7,255	1,182	26,304	34,585	64,724	134,050
1997[a]	1,113	8,998	1,892	16,476	26,803	27,200	81,370
1998[a]	1,184	8,295	1,214	19,007	20,032	51,933	100,480
1999	898	6,144	1,177	14,342	19,398	20,017	61,078
2000	860	4,149	682	17,062	17,283	38,308	77,485
2001	878	5,576	767	14,550	20,213	30,261	71,367
2002	935	5,469	763	15,086	17,817	64,354	103,490
2003	940	5,290	801	14,105	13,913	49,674	83,782
2004	1,003	3,169	363	8,225	3,200	61,813	76,770
2005	1,061	4,087	774	13,896	12,008	53,236	84,000
2006	1,066	3,298	901	19,476	10,306	48,764	82,745
2007	1,041	3,744	923	13,564	18,170	21,714	58,116
2008	1,151	3,087	399	18,889	11,505	56,096	89,976
2009	1,200	5,131	388	15,852	10,599	26,110	58,080
2010	1,030	2,074	554	11,517	14,295	38,710	67,149
2011	925	1,645	562	10,155	12,946	18,576	43,883
2012	1,245	1,290	437	11,500	16,247	47,050	76,524

	Port Clarence District						
Year	Number of households	Chinook	Sockeye	Coho	Chum	Pink	Total
1994	151	203	2,220	1,892	2,294	4,309	10,918
1995	151	76	4,481	1,739	6,011	3,293	15,600
1996	132	194	2,634	1,258	4,707	2,236	11,029
1997	163	158	3,177	829	2,099	755	7,019
1998	157	289	1,696	1,759	2,621	7,815	14,179
1999	177	89	2,392	1,030	1,936	786	6,233
2000	163	72	2,851	935	1,275	1,387	6,521
2001	160	84	3,692	1,299	1,910	1,183	8,167
2002	176	133	3,732	2,194	2,699	3,394	12,152
2003	242	176	4,436	1,434	2,425	4,108	12,578
2004	371	278	8,688	1,131	2,505	5,918	18,520
2005	329	152	8,532	726	2,478	6,593	18,481
2006	345	133	9,862	1,057	3,967	4,925	19,944
2007	362	85	9,484	705	4,454	1,468	16,196
2008	399	125	5,144	562	2,499	7,627	15,957
2009	328	40	1,643	799	3,060	1,887	7,429
2010	295	57	824	596	5,232	5,202	11,911
2011	271	56	1,611	393	4,338	2,610	9,008
2012	335	44	1,422	703	7,802	5,201	15,172

continued

Year	Kotzebue District[b,i] Number of households	Chinook	Sockeye	Coho	Chum	Pink	Total
1994[c]	557	135	33	478	48,175	3,579	52,400
1995[d]	1,327	228	935	2,560	102,880	2,059	108,662
1996	1,187	550	471	317	99,740	951	102,029
1997	1,122	464	528	848	57,906	1,181	60,925
1998	1,279	383	392	461	48,979	2,116	52,330
1999	1,277	9	478	1,334	94,342	841	97,004
2000	1,227	211	75	2,557	65,975	75	68,893
2001[e]	1,149	11	14	768	49,014	36	49,844
2002[f]	216	3	9	56	16,880	8	16,955
2003[g]	488	40	53	1,042	19,201	583	20,918
2004[g]	440	54	18	1,502	23,348	1,259	26,181
2005[h]	ND	ND	ND	ND	ND	ND	ND
2006[hj]	ND	ND	ND	ND	ND	ND	ND
2007[hj]	ND	ND	ND	ND	ND	ND	ND
2008[h]	ND	ND	ND	ND	ND	ND	ND
2009[h]	ND	ND	ND	ND	ND	ND	ND
2010[h]	ND	ND	ND	ND	ND	ND	ND
2011[hj]	ND	ND	ND	ND	ND	ND	ND
2012[g]	360	16	455	1,230	26,694	697	29,092

a. Includes Gambell and Savoonga.

b. Normally includes Ambler, Kiana, Kobuk, Kotzebue, Noatak, Noorvik, and Shungnak.

c. Includes Deering and Wales; does not include Kotzebue.

d. Includes Shishmaref.

e. Does not include Ambler.

f. Includes only Noatak and Noorvik.

g. Does not include Kotzebue.

h. Due to lack of funding, no collection of subsistence salmon harvest data took place in Kotzebue area communities from 2005-2011. The average yearly subsistence harvest of salmon in the Kotzebue area between 1994 and 2004 was 59,650 fish.

i. Formerly Kotzebue Area.

j. Limited data exist in 2006, 2007 and 2011 for Kiana (2006), Kivalina (2007), Noatak (2007), and Selawik (2011). These are available online through the Community Subsistence Information System (CSIS) at http://www.adfg.alaska.gov/sb/CSIS/

ND = no data.

Year	Arctic District[a] Number of households	Chinook	Sockeye	Coho	Chum	Pink	Total
2012	120	34	79	477	710	1,256	2,556

Source ADF&G Division of Subsistence, ASFDB 2013 (ADF&G 2014).

a. Includes Point Lay and Wainwright.

Table 101. Subsistence salmon harvests by community, Norton Sound-Port Clarence and Arctic-Kotzebue Area, 2012.

	Households or permits		Estimated salmon harvest[a]					
Community[b]	Total	Surveyed or returned	Chinook	Sockeye	Coho	Chum	Pink	Total
Anchorage	5	5	0	4	38	61	138	241
Brevig Mission	43	43	11	376	597	3,321	3,093	7,398
Diomede	1	1	0	0	0	0	0	0
Elim	54	54	41	0	1,281	1,465	10,379	13,166
Fairbanks	1	1	0	0	0	0	0	0
Gambell	3	3	0	0	0	0	0	0
Golovin	29	29	39	44	246	775	2,415	3,519
Koyuk	83	82	104	0	373	2,731	2,837	6,045
Nome	471	471	16	878	1,724	3,168	10,385	16,171
Palmer	5	5	4	1	0	11	13	29
Savoonga	3	3	0	0	0	0	19	19
Shaktoolik	64	63	213	9	1,043	624	4,401	6,290
St. Michael	82	82	80	20	911	2,172	457	3,640
Stebbins	117	106	121	3	1,266	3,476	3,759	8,625
Teller	45	45	26	342	100	3,864	1,951	6,283
Unalakleet	223	200	661	182	4,324	2,144	8,742	16,053
Wales	1	1	0	0	0	0	0	0
White Mountain	40	40	18	0	300	237	3,662	4,217
Total	**1,270**	**1,234**	**1,335**	**1,859**	**12,203**	**24,049**	**52,250**	**91,696**

Source ADF&G Division of Subsistence, ASFDB 2013 (ADF&G 2014).

a. Includes subsistence harvests and commercial harvests retained for home use.

b. Harvest information from residents of non-local communities (e.g. Anchorage) is available only for Norton Sound and Port Clarence permit areas. Non-local residents might subsistence fish in other northwest Alaska areas, but these harvests are not documented in the regional household surveys.

The estimated 2012 subsistence harvest of salmon in the Norton Sound and Port Clarence districts was 76,524 salmon, with 1,290 being Chinook. This was down from the 5-year average of over 116,000 salmon and 4,467 Chinook. Chinook harvests have ranged between 1,290 and 5,131 annually for the most recent five years in which data are available (2008 – 2012), but are down from previous years. The two most recent years, 2011 and 2012, are the lowest harvests recorded. Figure 56 and Figure 57show the species composition of the total subsistence salmon harvest in 2012 for the Norton Sound and Port Clarence districts, respectively. Very little of the documented subsistence salmon harvest was taken by residents from outside the area.

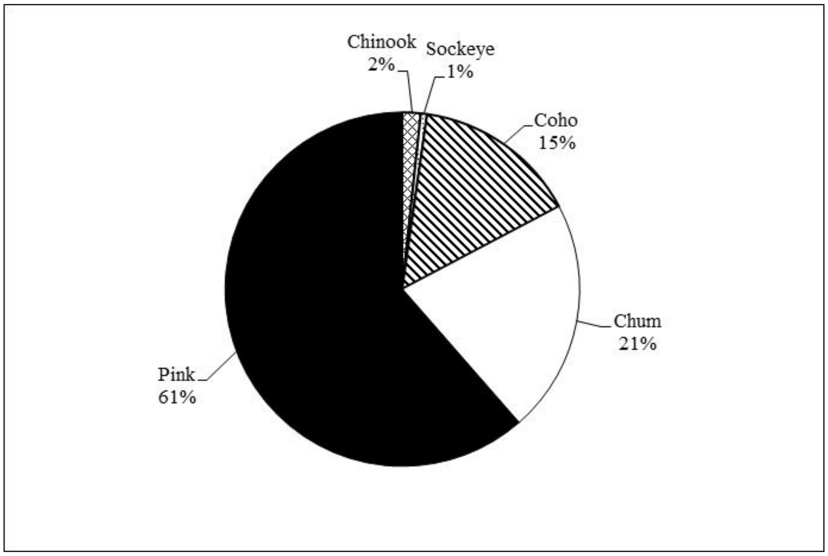

Figure 56. Species composition of 2012 estimated subsistence salmon harvests, Norton Sound District (Source: Fall et al. 2014)

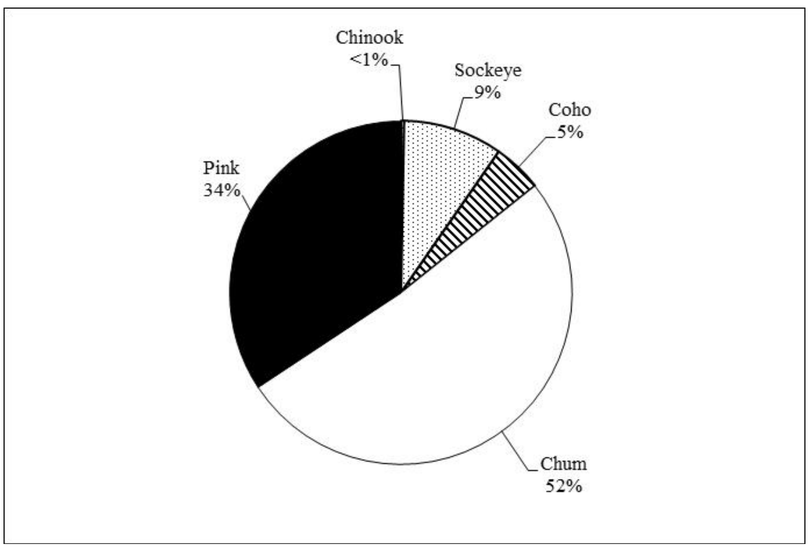

Figure 57. Species composition of 2012 estimated subsistence salmon harvests, Port Clarence District (Source: Fall et al. 2014)

11.3.2 Arctic-Kotzebue Area

This section will describe subsistence salmon in the Kotzebue and Arctic districts, where residents have relied on fish for cultural and nutritional sustenance for thousands of years. Most residents in the region continue to participate in a mixed subsistence-cash economy, harvesting a wide variety of wild foods. In the Arctic-Kotzebue Area, subsistence salmon fishing has few restrictions, other than the general statewide provisions (e.g., 5 AAC 01.010) and specifications regarding lawful subsistence gear and gear specifications (5 AAC 01.120). Standard conditions include prohibition of fishing within 300 ft of a dam, fish ladder, weir, culvert, or other artificial obstruction. Salmon may be taken in the Arctic-Kotzebue Area at any time with no harvest limits and no required permits.

The Kotzebue Area includes the subsistence fishing areas used by Point Hope, Kivalina, Noatak, Kotzebue, Kiana, Noorvik, Selawik, Ambler, Shungnak, Kobuk, Buckland, Deering, Shishmaref, and

Wales. The role of salmon in the wild food diet varies from community to community, and is affected primarily by salmon abundance. Communities that harvest few salmon typically harvest large numbers of nonsalmon fish, such as sheefish *Stenodus leucichthys*, other whitefishes *Prosopium* and *Coregonus* spp, and Dolly Varden *Salvelinius malma.* Along the Noatak and Kobuk rivers, where runs of chum salmon are strong, many households' activities in mid- and late summer revolve around the harvesting, drying, and storing of salmon for use during the winter. Chum salmon predominate in the district, composing 90 percent of the subsistence salmon harvest. Small numbers of other salmon species are present in the district.

From 1994 through 2004, with funding from the Division of Commercial Fisheries, the Division of Subsistence conducted household surveys in selected Kotzebue Sound communities to collect subsistence salmon harvest data (Fall et al. 2007:23–38). Since that time, collection of no systematic collection of salmon harvest was attempted until 2012. The average yearly subsistence harvest between 1994 and 2004 was 59,650 salmon, the majority of which were chum salmon (Table 97). This average may be low due to incomplete datasets resulting in low harvest totals for several years during that period. Harvest estimates for 1994, 2002, 2003, and 2004 do not include the regional center of Kotzebue. In 2012, 6 surveyed communities harvested an estimated 29,092 salmon. The vast majority of the harvest was chum salmon (92 percent), followed by coho salmon (4 percent), pink salmon (2 percent), sockeye salmon (2 percent), and Chinook salmon (<1 percent) (Table 97; Figure 58).

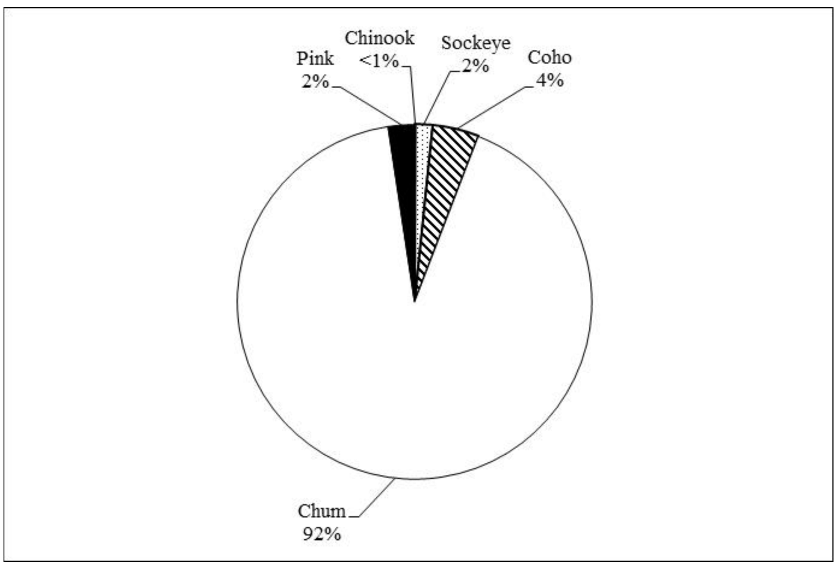

Figure 58. Species composition of estimated subsistence salmon harvests, Kotzebue District, 2012

The Arctic Area includes the subsistence fishing areas used by Anaktuvuk Pass, Atqasuk, Barrow, Kaktovik, Nuiqsut, Point Hope, Point Lay, and Wainwright. The role of salmon and nonsalmon in the wild food diet varies from community to community and is affected primarily by resource availability. Chum and pink salmon are present in the greatest abundance, although sockeye, coho, and Chinook salmon are occasionally caught. The only systematic subsistence fisheries harvest monitoring program has been conducted by the North Slope Borough's Department of Wildlife Management (Bacon et al. 2011). The most recent report by NSB described subsistence fish harvests in the region from 1994-2003; this includes harvest amounts, harvest timing, locations, gear and other qualitative information (Bacon et al. 2011). In 2012, two communities (Point Lay and Wainwright) harvested an estimated 2,556 salmon. Most of these were pink salmon (49 percent), followed by chum salmon (28 percent), coho salmon (19 percent), Chinook salmon (13 percent), and sockeye salmon (3 percent). It is likely that a lesser percentage is coho salmon, and a greater percentage chum salmon, because of misidentification issues.

11.3.3 Yukon Area

According to Fall et al. 2014:

Residents of the Yukon River drainage have long relied on fish for human food and other subsistence uses. While nonsalmon fish species are an important component of the overall fish harvest (Andersen et al. 2004, Brown et al. 2005) large numbers of Chinook salmon, summer and fall chum salmon, and coho salmon compose the majority of all subsistence harvests of fish in the Yukon River drainage. Indeed, subsistence salmon harvests occur alongside robust commercial, sport, and personal use harvests across species.

Drift gillnets, set gillnets, and fish wheels are used by Yukon Area fishers to harvest the majority of salmon. Set gillnets are utilized throughout the Yukon Area, in the main rivers and coastal marine waters, while drift gillnets are used extensively in some parts of the river (i.e., by state regulation, that portion of the Yukon drainage from the mouth through District 4-A; Federal regulations allow the use of drift gill nets upriver in federally adjacent waters in Districts 4-B and 4-C). Fish wheels are a legal subsistence or non-commercial gear type throughout the Yukon drainage, although due to river conditions and the availability of wood, they are used almost exclusively on the upper Yukon and Tanana rivers.

Depending on the area of the Yukon River drainage and run timing of different salmon species, subsistence fishing occurs from late May through early October. Fishing activities are either based from fish camps or from the home villages; fishing patterns and preferred sites vary from community to community. Extended family groups, typically representing several households, often undertake subsistence salmon fishing together. Households and related individuals typically cooperate to harvest, process, preserve, and store salmon for subsistence use.

The majority of the subsistence salmon harvest is preserved for later use by freezing, drying, or smoking, while the head, cutting scraps, and viscera are often fed to dogs. Chinook salmon are harvested and processed primarily for human consumption, although those fish deemed not suitable for human consumption due to presence of the fungus *Ichthyophonus hoferi* or some other disease or disfigurement are often fed to dogs. Small (jacks) Chinook salmon or spawned out fish may also be fed to dogs. In addition, while chum and coho salmon are primarily taken for human consumption, relatively large numbers are harvested and processed to feed sled dogs. Fall chum and coho salmon typically arrive in the upper portion of the drainage late in the season, coincident with freezing weather, allowing fish to be "cribbed" for use as dog food. This method involves the natural freezing of whole (un-cut) fish. The practice of keeping sled dogs is much more common in communities along the upper Yukon Area than in the lower river communities.

Walker et al (1989:3) state the following:

Salmon fishing occurs from late May through October, although this varies throughout the drainage. Fishing activities are based either from a fish camp or the home village, however, the degree to which one or the other is more prevalent has varied from community to community. Some people from communities not situated along the Yukon River operated fish camps along it, and these have included Birch Creek, Venetie, and some residents of Chalkyitsik. Subsistence salmon fishing was often undertaken by extended family groups representing two or several households in a community. These groups, as well as members of individual households, cooperated to harvest, cut, dry, smoke, and store salmon for subsistence use. Many people who fished for subsistence also operated as commercial fishermen in districts where commercial fishing has been allowed and families had a member with a Commercial Fisheries Entry Commission (CFEC) permit.

In 2012, 1,125 households and 450 permit holders (50 percent of the 3,133 total households in Districts 1 - 6) provided harvest data for the Yukon Area subsistence/personal use salmon fishery. A summary of the 2012 subsistence salmon harvest estimates by community is provided in Fall et al. 2014 (Table 102).

Table 102. Estimated subsistence salmon harvests by community, Yukon Area, 2012.

	Households or permits		Estimated salmon harvest[a]					
Community	Total	Surveyed or returned	Chinook	Coho	Summer chum	Fall chum	Pink	Total
Hooper Bay	218	79	1,090	7	15,799	1	1,101	17,998
Scammon Bay	99	44	1,014	86	7,442	10	1,343	9,895
Coastal District subtotal	**317**	**123**	**2,104**	**93**	**23,241**	**11**	**2,444**	**27,893**
Alakanuk	158	54	1,081	252	9,012	449	174	10,968
Emmonak	180	92	1,864	2,660	15,829	5,890	199	26,442
Kotlik	110	37	1,173	420	8,552	1,073	195	11,413
Nunam Iqua (Sheldon Point)	42	34	195	18	1,977	210	1,051	3,451
District 1 subtotal	**490**	**217**	**4,313**	**3,350**	**35,370**	**7,622**	**1,619**	**52,274**
Marshall	69	26	1,409	567	5,903	184	5	8,068
Mountain Village	152	57	1,789	256	9,031	685	207	11,968
Pilot Station	118	57	1,078	329	5,716	1,031	23	8,177
Pitka's Point	27	23	261	53	1,153	9	2	1,478
Saint Marys	127	49	2,344	141	10,763	1,423	643	15,314
District 2 subtotal	**493**	**212**	**6,881**	**1,346**	**32,566**	**3,332**	**880**	**45,005**
Holy Cross	55	31	576	237	1,147	339	0	2,299
Russian Mission	72	26	1,711	319	2,508	282	76	4,896
Shageluk	29	11	75	0	5,035	16	24	5,150
District 3 subtotal	**156**	**68**	**2,362**	**556**	**8,690**	**637**	**100**	**12,345**
Alatna	10	4	0	0	100	18	0	118
Allakaket	63	21	5	38	3,850	508	0	4,401
Anvik	35	27	435	214	1,371	569	0	2,589
Bettles	22	17	3	0	7	0	0	10
Galena	169	51	742	276	718	2,947	3	4,686
Grayling	47	18	1,081	26	2,616	804	0	4,527
Hughes	31	25	0	0	428	2	0	430
Huslia	95	33	165	165	7,306	1,909	101	9,646
Kaltag	58	15	1,346	928	186	2,830	0	5,290
Koyukuk	49	22	614	62	828	1,331	0	2,835
Nulato	72	23	1,955	41	254	2,729	0	4,979
Ruby	66	21	1,316	1,806	3,891	4,408	0	11,421

continued

District 4 subtotal	**717**	**277**	**7,662**	**3,556**	**21,555**	**18,055**	**104**	**50,932**
Beaver	31	24	71	2	27	174	0	274
Birch Creek	16	12	0	0	0	0	0	0
Central	4	4	66	0	0	0	0	66
Chalkyitsik	28	18	0	0	0	162	0	162
Circle	19	19	280	5	0	161	0	446
Eagle	33	31	167	0	0	18,731	0	18,898
Fairbanks	223	219	687	1,602	607	5,073	0	7,969
Fort Yukon	211	87	2,141	4	0	12,659	0	14,804
Rampart	5	5	190	0	71	190	0	451
Stevens Village	21	14	330	0	188	277	0	795
Tanana	103	52	2,100	3,060	4,333	20,465	3	29,961
Venetie	75	24	86	0	0	295	0	381
District 5 subtotal	**769**	**509**	**6,118**	**4,673**	**5,226**	**58,187**	**3**	**74,207**
Healy	5	5	0	760	0	595	0	1,355
Manley	17	14	174	1,374	58	2,164	0	3,770
Minto	37	33	99	0	64	2	0	165
Nenana	45	41	296	5,904	370	8,671	0	15,241
District 6 subtotal	**154**	**151**	**894**	**6,474**	**884**	**12,619**	**0**	**20,871**
Other communities	87	76	477	21	173	443	0	1,114
Total	**3,133**	**1,575**	**30,486**	**21,633**	**127,313**	**99,719**	**5,150**	**284,301**

Source Jallen et al. (2014)

a. Includes subsistence harvests, personal use harvests, commercial harvests retained for home use, and fish distributed from ADF&G test fisheries.

The estimated 2012 subsistence/personal use salmon harvest for the entire Yukon Area broken down by species includes: 30,486 Chinook (11 percent), 127,313 summer chum (45 percent), 99,719 fall chum (35 percent), 21,633 coho (8 percent), and 5,150 pink (2 percent), for a total estimate of 284,301 salmon (Figure 59). The Alaska Subsistence Salmon Fisheries 2012 Annual Report notes that this is an estimated total based on household surveys and returned permits and calendars, and it includes subsistence harvests, personal use harvests, commercial harvests retained for home use, and fish distributed from ADF&G test fisheries.

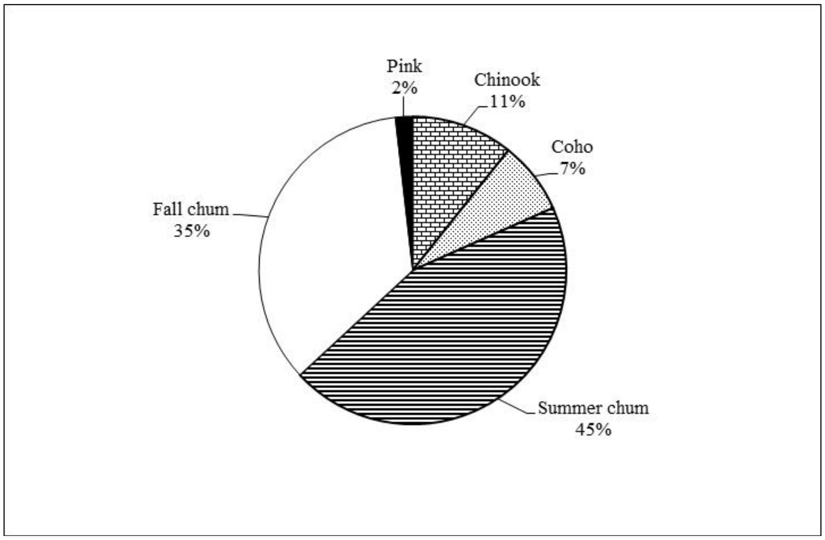

Figure 59. Species composition of 2012 estimated subsistence salmon harvests, Yukon District (Source: Fall et al. 2014).

The 2012 Chinook salmon harvest estimates were below the most recent Yukon Area 5-year averages (2007–2011), likely reflecting the restrictions put in place to protect them. The estimated subsistence and personal use harvest of 30,486 Chinook salmon in 2012 was 31 percent below the most recent 5-year average of 44,065 fish, and 37 percent below the most recent 10-year average of 48,136 fish. Other explanations for decreases in Chinook harvest include voluntary reduction of harvest by Yukon River communities and individual households. The estimated 2012 subsistence harvest of 127,313 summer chum salmon was 43 percent above the 5-year average of 89,145 fish and 41 percent above the 10-year average of 90,530 fish. Households could also replace some of their Chinook harvest with other, more abundant, salmon species. Summer and fall chum salmon for example, both experienced substantially increased harvest in 2012 from 2011 and 2010, possibly demonstrating species replacement strategies. The harvests of fall chum and coho salmon in 2012 were also higher than their respective 5-year averages (Table 103).

With continued low abundance and the risk of not meeting border passage obligations of the Yukon Salmon Treaty, 2013 and 2014 proved extremely restrictive years in terms of subsistence harvests for Chinook salmon. The border passage goal was met in 2014, but not in 2013. Consistent with the new regulation requiring the protection of the first pulse of Chinook salmon in the lower river, windowed openings were closed on the first pulse chronologically upriver. As the 2013 run progressed, in-season projections indicated a poor to below average run and subsistence fishing closures were implemented on each of the three pulses. Very limited opportunity with 6 inch mesh or smaller was provided in between pulses to allow the harvest of other salmon species and nonsalmon species (JTC report 2014:7-8). As a result of these restrictions, harvest estimates were the lowest on record for Chinook salmon: approximately 12,500 fish. Other salmon harvests included 92,000 summer chum, 112,900 fall chum, and 14,100 coho salmon (JTC report 2014:13-14). In 2014, the preseason outlook projected little to no harvestable surplus of Chinook salmon. As a result, managers in the US portion of the river closed all subsistence fishing for Chinook salmon until the bulk of the run was past, prohibiting the use of any gill nets larger than 4 inch mesh and instead limiting fishermen to the use of non-lethal methods such as dip nets, beach seines, and manned fishwheels where Chinook salmon are immediately released to the water alive.

Table 103. Yukon Area subsistence harvests, 1976 – 2012

Year	Households or permits[a]		Estimated salmon harvest[a]					
	Total	Surveyed or returned	Chinook	Coho	Summer chum	Fall chum	Pink	Total
1976			17,530	12,737		1,375		31,642
1977			16,007	16,333		4,099		36,439
1978			30,785	7,965	213,953	95,532		348,235
1979			31,005	9,794	202,772	233,347		476,918
1980			42,724	20,158	274,883	172,657		510,422
1981			29,690	21,228	210,785	188,525		450,228
1982			28,158	35,894	260,969	132,897		457,918
1983			49,478	23,905	240,386	192,928		506,697
1984			42,428	49,020	230,747	174,823		497,018
1985			39,771	32,264	264,828	206,472		543,335
1986			45,238	34,468	290,825	164,043		534,574
1987			55,039	46,213	300,042	226,990		628,284
1988	2,700	1,865	45,495	69,679	229,838	157,075		502,087
1989	2,211	983	48,462	40,924	169,496	211,303		470,185
1990	2,666	1,121	48,587	43,460	115,609	167,900		375,556
1991	2,521	1,261	46,773	37,388	118,540	145,524		348,225
1992	2,751	1,281	47,077	51,980	142,192	107,808		349,057
1993	3,028	1,397	63,915	15,812	125,574	76,882		282,183
1994	2,922	1,386	53,902	41,775	124,807	123,565		344,049
1995	2,832	1,391	50,620	28,377	136,083	130,860		345,940
1996	2,869	1,293	45,671	30,404	124,738	129,258		330,071
1997	2,825	1,309	57,117	23,945	112,820	95,141		289,023
1998	2,986	1,337	54,124	18,121	87,366	62,901		222,512
1999	2,888	1,377	50,515	19,984	79,250	83,420		233,169
2000	3,209	1,341	36,844	16,650	77,813	19,402	1,591	152,300
2001	3,072	1,355	56,103	23,236	72,392	36,164	403	188,298
2002	2,775	1,254	44,384	16,551	87,599	20,140	8,425	177,100
2003	2,850	1,377	56,872	24,866	83,802	58,030	2,167	225,737
2004	2,721	1,228	57,549	25,286	79,411	64,562	9,697	236,506
2005	2,662	1,406	53,547	27,357	93,411	91,667	3,132	269,114
2006	2,833	1,473	48,682	19,985	115,355	84,320	4,854	273,196
2007	2,819	1,495	55,292	22,013	93,075	99,120	2,118	271,618
2008	3,030	1,664	45,312	16,905	86,652	89,538	9,529	247,936
2009	2,853	1,508	33,932	16,076	80,847	66,197	2,300	199,352
2010	3,066	1,659	44,721	14,107	88,692	71,854	4,199	223,573
2011	3,060	1,574	41,069	12,576	96,459	80,549	2,291	232,944
2012	3,133	1,575	30,486	21,633	127,313	99,719	5,150	284,301
5-year average (2007-2011)	2,966	1,580	44,065	16,335	89,145	81,452	4,087	235,085
10-year average (2002-2011)	2,867	1,464	48,136	19,572	90,530	72,598	4,871	235,708
Historical average (1976-2011)	2,840	1,389	44,845	26,873	150,353	112,969	4,226	328,096

Source Jallen et al. (2014)

a. Estimates prior to 1988 are based on fish camp surveys and sampling information is unavailable. Cells that do not contain data have no data available.

Yukon River fisheries are managed in two seasons based on the timing of salmon runs, summer season (Chinook and summer chum salmon) and fall season (fall chum and coho salmon). According to ADF&G, the following management measures for the Yukon River subsistence fishery have been implemented since 1998:
1998 – Subsistence schedule reduced on upper Yukon and Tanana rivers fall season, Personal Use was closed
2000 – Subsistence schedule initially reduced, Personal Use closed, then subsistence closed for fall season drainage-wide. WF gear restriction 4 inch mesh or less gillnets
2001 – Subsistence schedule reduced then closed late summer season, early fall season, then opened in all districts. Personal Use closed part of summer and all of fall season.
2002 – Subsistence closures early portion and then reduced schedule during fall season in all districts. Personal use closures most of fall season.
2003 – Subsistence reduced schedule early portion of fall season on Yukon except Tanana River
2008 – Windowed subsistence fishing schedule, due to indications that run was low. Subsistence fishing times were reduced to 50 percent throughout the drainage during the peak of the run and gillnet mesh size was restricted to a maximum of 6 inches in the lower river subsistence fishery.
2009 – Summer season subsistence schedule reduced: subsistence fishing windows cut in half and complete closure on first pulse of Chinook salmon for entire river; reduction to 6-inch mesh for Y-1, Y-2, and Y-3.
2011 – First year of new regulation restricting all gill nets to a maximum of 7.5 inch mesh, however fishing was further reduced to 6 inch mesh to conserve Chinook salmon; first and second pulse closures for the entire river and a third closure in the upper portion of District 5 near the border due to concern for meeting Chinook salmon border passage obligations.
2012 – Mesh size restricted to 6 inch mesh prior to first pulse closure; first and second pulse closures for the entire river and a third closure in the upper portion of District 5 near the border due to concern for meeting Chinook salmon border passage obligations.
2013 – New regulation requiring first pulse closure and continued restrictions on all subsequent pulses; mesh size restricted to 6 inch and fish wheels allowed with the stipulation that all Chinook salmon be released unharmed.
2014 – Complete closure on harvest of Chinook salmon; fishing restricted to non-lethal methods of harvest, including beach seines, dip nets, and fish-friendly fish wheels.

11.3.4 Kuskokwim Area

Walker and Coffing (1993:58) state the following:
The harvest of salmon in the Kuskokwim Area has been and continues to be important both in the subsistence economy and also in the market economy. Subsistence and commercial fishermen, often the same individuals, share a real interest in the maintenance of the sustained yield of salmon stocks in the Kuskokwim Area.

Communities which depend upon the harvest of salmon for subsistence are situated throughout the Kuskokwim River drainage, along Kuskokwim Bay, and along the Bering Sea coast. In 1989, there were over 3,400 households in these communities, most of which use salmon for subsistence. Although not all households actively participated in harvesting salmon, many were directly involved in cutting and processing the fish and in distributing the finished products to other households.

According to Fall et al. 2014:
The subsistence salmon fisheries in the Kuskokwim Area are some of the largest in the state of Alaska, in terms of the number of residents who participate and the number of salmon harvested (Fall et al. 2013). Since 1994, when ADF&G began acquiring reasonably complete statewide coverage of subsistence harvest survey data, over 50 percent of king salmon harvested under subsistence regulations have been

taken in the Kuskokwim Area, mostly in the Kuskokwim River drainage. Between 2010 and 2013 (study years 2009–2012), the Division of Subsistence conducted comprehensive subsistence harvest and use surveys in 18 Kuskokwim River communities. The results indicate that on average salmon contributes 42 percent of the total wild resource harvest (in edible pounds) in the Lower Kuskokwim communities, 65 percent in the Central Kuskokwim communities, and 25 percent in the Upper Kuskokwim communities (Brown et al. 2012, 2013; Ikuta et al. 2014). Residents of the Kuskokwim Area harvest 5 species of Pacific salmon for subsistence purposes: Chinook salmon Oncorhynchus tshawytscha, chum salmon O. keta, coho salmon O. kisutch, pink salmon O. gorbuscha, and sockeye salmon O. nerka. Drift gillnetting, set gillnetting, and hook and line fishing are the primary methods used when harvesting salmon, although additional gear types are allowed as specified in 5 AAC 01.270. Kuskokwim Area communities are heavily reliant upon the annual returns of salmon not only for basic nutrition, but also for maintenance of cultural identity and cultural values, in addition to economic opportunities for commercial sales (Andrews and Coffing 1986; Andrews 1989:154; Barker 1993; Brown et al. 2012, 2013; Coffing 1991; Fienup-Riordan 1990:184, 1994:120, 123; Himmelheber 1987:32; Ikuta et al. 2014, 2013; Oswalt 1963a–b, 1990; Pete 1993; Senecal-Albrecht 1998, 1990; Walker and Coffing 1993; Wolfe et al. 1984)

For the 15-year period from 1989 through 2003, an estimated annual average of 1,443 households participated in the Kuskokwim area subsistence salmon fishery (Simon et al. 2007). In 2006, approximately 920 Kuskokwim area households participated in subsistence salmon fishing. Many households not directly involved in catching salmon assist family and friends with cutting, drying, smoking, and associated preservation activities (salting, canning, and freezing). Annual subsistence surveys are aimed at gathering harvest data on Chinook, chum, sockeye, and coho salmon.

In the Kuskokwim Area, there are 38 communities, 28 of which are surveyed each year on a voluntary basis. As Table 12 shows, in 2012, there were approximately 4,294 households in 32 communities excluding the 6 Bering Sea communities. Bethel is the largest community in the region, consisting of approximately 2,128 households in 2012. The north Kuskokwim Bay communities of Kwigillingok, Kongiganak, and Kipnuk are not located on the Kuskokwim River, but many subsistence salmon fishing households from these communities have traveled to the Kuskokwim River to fish, but may have also harvested salmon from coastal areas and local tributaries (Himmelheber 1987:7; Stickney 1984:60–61; Walker and Coffing 1993:1). Except in 2000 and 2004, only the community of Kongiganak (Carroll and Hamazaki 2012a) has participated in the voluntary ADF&G harvest survey. The communities of Quinhagak, Goodnews Bay, and Platinum, located in south Kuskokwim Bay, comprise 7 percent of the total Kuskokwim Area households (Carroll and Hamazaki 2012b), and harvest salmon primarily from the drainages of the Kanektok, Arolik, and Goodnews rivers (Walker and Coffing 1993:1; Wolfe et al. 1984:321–322). Subsistence users from Bering Sea coastal communities have chosen to not participate in the ADF&G study for most years. These include the communities of Mekoryuk (on Nunivak Island), Newtok, Tununak, Toksook Bay, Nightmute, and Chefornak (Carroll and Hamazaki 2012a–b). While little information is available, residents of Bering Sea coastal communities harvest salmon from local rivers and coastal waters, which likely include coastal stocks as well as mixed stocks that were not bound for the Kuskokwim River (Fienup-Riordan 1983:112; Walker and Coffing 1993:1). In 2011, sponsored by the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative, the Association of Village Council Presidents (AVCP) collected subsistence salmon harvest data in 7 coastal communities: Chefornak, Kipnuk, Mekoryuk, Newtok, Nightmute, Tooksook Bay, and Tununak (Kwigillingok chose not to participate in the AVCP project) (Wolfe et al. 2012). This project provides the only reliable subsistence salmon harvest data in the recent years for this portion of the Kuskokwim Area (see below), and the data were used for the ANS for subsistence determination for the remainder of the Kuskokwim Area by the BOF in 2013.

A summary of the 2012 subsistence salmon harvest estimates by community, fishing area, and species is provided in the Alaska Subsistence Salmon Fisheries 2012 Annual Report (Fall et al. 2014)(Table 104).

Table 104. Subsistence salmon harvests by community, Kuskokwim Area, 2012.

Community	Households		Estimated salmon harvest					
	Total	Contacted	Chinook	Sockeye	Coho	Chum	Pink	Total
Kipnuk[b]	--	--	--	--	--	--	--	--
Kwigillingok[b]	--	--	--	--	--	--	--	--
Kongiganak[a]	90	0	571	1,211	458	1,901	0	4,141
North Kuskokwim Bay	**90**	**0**	**571**	**1,211**	**458**	**1,901**	**0**	**4,141**
Tuntutuliak	90	53	1,123	1,516	565	2,614	15	5,833
Eek	86	45	1,004	1,490	612	1,552	50	4,708
Kasigluk	104	51	552	1,451	303	3,261	0	5,567
Nunapitchuk	111	61	845	2,396	319	5,312	32	8,904
Atmautluak	61	35	234	1,623	383	2,701	22	4,963
Napakiak	99	46	457	1,141	402	1,711	0	3,711
Napaskiak	97	42	1,108	2,065	269	3,216	122	6,780
Oscarville[c]	14	14	51	323	38	599	0	1,011
Bethel[d]	2,128	447	7,321	18,282	13,280	26,872	305	66,060
Kwethluk	164	83	1,709	2,884	1,013	3,849	91	9,546
Akiachak	157	74	2,862	3,443	714	4,150	53	11,222
Akiak[c]	79	16	856	1,820	474	2,416	0	5,566
Tuluksak	89	53	651	1,380	341	2,585	8	4,965
Lower Kuskokwim	**3,279**	**1,020**	**18,773**	**39,814**	**18,713**	**60,838**	**698**	**138,836**
Lower Kalskag	79	41	459	891	1,107	3,284	25	5,766
Kalskag (Upper)	62	31	562	770	360	1,930	30	3,652
Aniak	187	155	993	1,375	3,365	5,667	940	12,340
Chuathbaluk	33	28	103	297	179	796	2	1,377
Middle Kuskokwim	**361**	**255**	**2,117**	**3,333**	**5,011**	**11,677**	**997**	**23,135**
Crooked Creek	37	31	124	234	149	610	2	1,119
Red Devil	13	10	225	511	238	516	42	1,532
Sleetmute	40	35	132	715	784	1,004	120	2,755
Stony River[c]	16	3	212	398	372	619	0	1,601
Lime Village	14	10	29	780	117	419	129	1,474
McGrath	136	45	68	233	2,257	885	14	3,457
Takotna[a]	23	0	0	2	22	0	0	24
Nikolai	34	30	276	0	214	1,044	0	1,534
Telida[b]	2	0	--	--	--	--	--	--
Upper Kuskokwim	**315**	**164**	**1,066**	**2,873**	**4,153**	**5,097**	**307**	**13,496**
Kuskokwim River	**4,045**	**1,439**	**22,527**	**47,231**	**28,335**	**79,513**	**2,002**	**179,608**
Quinhagak	162	77	2,396	2,015	1,380	2,001	70	7,862
Goodnews Bay	68	37	389	1,197	382	322	72	2,362
Platinum	19	16	24	173	124	76	16	413
South Kuskokwim Bay	**249**	**130**	**2,809**	**3,385**	**1,886**	**2,399**	**158**	**10,637**
Mekoryuk[b]	--	--	--	--	--	--	--	--
Newtok[b]	--	--	--	--	--	--	--	--
Nightmute[b]	--	--	--	--	--	--	--	--
Toksook Bay[b]	--	--	--	--	--	--	--	--
Tununak[b]	--	--	--	--	--	--	--	--
Chefornak[b]	--	--	--	--	--	--	--	--
Bering Sea Coast	--	--	--	--	--	--	--	--
Total	**4,294**	**1,569**	**25,336**	**50,616**	**30,221**	**81,912**	**2,160**	**190,245**

Source Shelden et al. (2014)

Note Includes harvests using rod and reel and the removal of salmon from commercial harvests as well as subsistence nets.

a. These communities were not contacted during the 2012 study period. Harvests were estimated using histori average household harvest expanded by the number of households.

b. These communities were not contacted during the 2012 study period. Not enough data was available to estimate harvest.

c. Communities were contacted, but numbers of selected households or total number of surveyed households insufficient. Harvests were estimated using historical average household harvest expanded by the number o

d. A total of 888 Bethel households were contacted. Of these, 447 were preselected, and these were used for determining harvest estimates for this community.

-- Data not available.

In 2012, sharp declines in Chinook salmon abundance caused severe hardship for fishery-dependent communities in the Kuskokwim Area. Subsistence fishers were affected by the 12-day rolling closures of all subsistence salmon fishing in the Kuskokwim River and its tributaries. A poor Chinook salmon run and 35 days of management restrictions resulted in low harvests of Chinook salmon that were approximately 70 percent below the recent 10-year average (Shelden et al. 2014). As a result, the U.S. Department of Commerce declared a resource disaster for the Kuskokwim River Chinook salmon fishery on September 13, 2012.

In 2012, subsistence salmon harvest estimates for communities contacted in the Kuskokwim Area totaled 190,245 salmon; with Chinook salmon comprising 13 percent (25,336) (see Figure 60). The total chum salmon harvest was up sharply, 38 percent and 27 percent above the recent 5- and 10-year averages (Table 105). Subsistence harvesters have been targeting more abundant species in years of lower Chinook salmon abundance, and they are tied to both voluntary and involuntary changes in gear usage. Chinook salmon abundance in the Kuskokwim River drainage has substantially decreased since 2007.

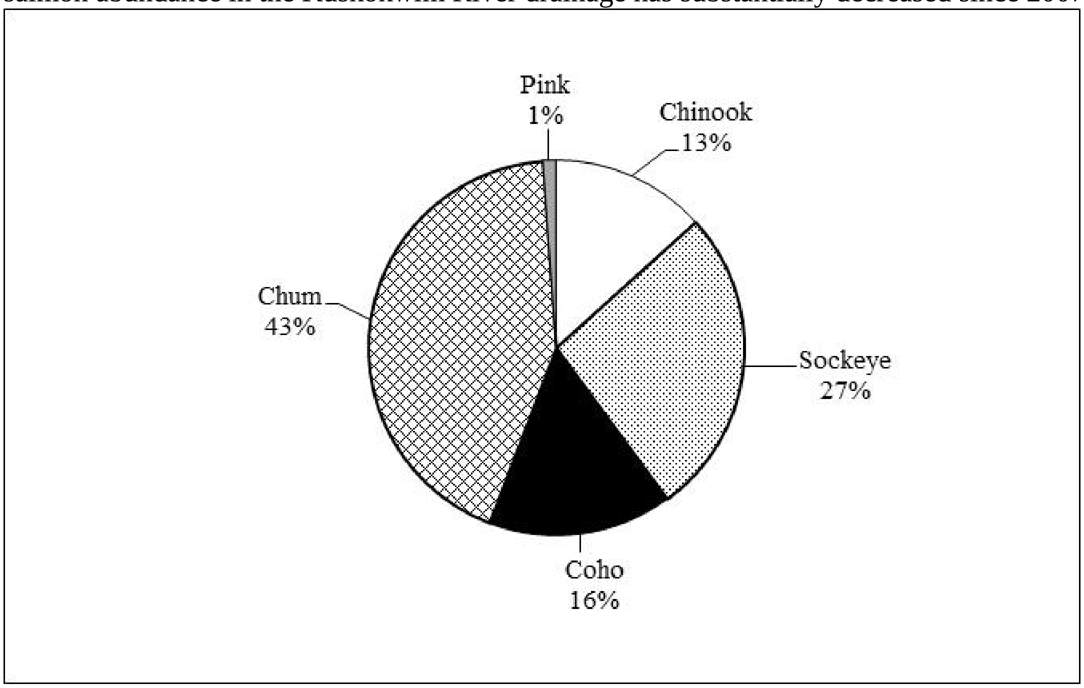

Figure 60. Species composition of 2012 estimated subsistence salmon harvests, Kuskokwim Area (Source: Fall et al. 2014).

Table 105. Historic subsistence salmon harvests, Kuskokwim Area, 1989 – 2012.

Year	Households		Estimated salmon harvest				
	Total	Surveyed	Chinook	Sockeye	Coho	Chum	Total
1989	3,422	2,135	85,322	37,088	57,786	145,106	325,302
1990	3,317	1,448	114,219	48,752	63,084	157,335	383,390
1991	3,340	2,033	79,445	50,383	44,222	89,008	263,058
1992	3,308	1,308	87,663	46,493	57,551	120,126	311,833
1993	3,269	1,786	91,973	53,631	31,971	64,551	242,126
1994	3,169	1,801	110,922	46,127	40,815	89,553	287,417
1995	3,638	1,907	105,787	31,736	39,582	71,789	248,894
1996	3,630	1,524	100,352	41,532	45,279	102,079	289,242
1997	3,501	1,919	83,022	39,827	31,324	38,073	192,246
1998	3,497	1,940	85,781	38,228	27,435	72,860	224,304
1999	4,165	2,512	79,752	50,988	30,184	51,200	212,124
2000	3,317	1,448	75,299	53,468	49,469	72,851	251,087
2001	4,469	2,215	82,106	55,290	33,474	57,060	227,930
2002	4,804	2,687	84,512	34,331	44,588	94,998	258,429
2003	4,513	2,292	70,579	33,821	36,953	46,666	188,019
2004	4,638	2,398	103,183	43,425	53,186	68,068	267,862
2005	4,603	1,593	89,538	44,637	35,793	59,220	229,188
2006	4,671	1,439	96,857	49,467	43,880	96,021	286,225
2007	4,620	1,279	101,554	50,092	37,481	76,187	265,314
2008	4,734	992	103,080	63,802	49,755	71,177	287,814
2009	4,810	1,699	81,853	37,779	31,613	45,101	196,346
2010	4,215	2,247	69,242	41,042	34,169	47,885	192,338
2011	4,241	1,822	65,852	46,296	33,943	55,995	202,086
2012	4,294	1,569	25,336	50,616	30,221	81,912	188,085
5-year average (2007-2011)	4,524	1,608	84,316	47,802	37,392	59,269	228,780
10-year average (2002-2011)	4,585	1,845	86,625	44,469	40,136	66,132	237,362
15-year average (1997-2011)	4,320	1,899	84,814	45,500	38,216	63,557	232,087
Historical average (1989-2011)	3,995	1,845	89,039	45,141	41,458	77,953	253,590

Source Shelden et al. (2014)

Lower Kuskokwim River Area communities accounted for 73 percent of the 2012 estimated subsistence salmon harvests in the Kuskokwim Area and 74 percent of the entire estimated Chinook salmon subsistence harvest. Residents of Bethel accounted for 35 percent of the Kuskokwim Area subsistence salmon harvests and 29 percent of subsistence-caught Chinook salmon and 44 percent of the estimated total of subsistence-caught coho salmon.

As noted, several coastal communities within the Kuskokwim Area have chosen not to participate in the post-season subsistence harvest surveys conducted by ADF&G. However, 7 of these communities participated in a study conducted by AVCP to estimated subsistence salmon harvests for 2011 (Wolfe et al. 2012). The total estimated subsistence harvest of salmon for these 7 communities in 2011 was 16,593 fish, including 7,226 chum (44 percent), 4,439 sockeye (27 percent), 2,864 coho (17 percent), 1,298

Chinook (8 percent), 746 pink (4 percent), and 20 salmon of unknown species (<1 percent). Harvests by species for each study communities are reported in Table 106.

Table 106. Subsistence salmon harvests in 7 coastal Kuskokwim communities, 2011.

Community	Households Total	Households Surveyed	Percent surveyed	Estimated salmon harvest Chinook	Sockeye	Coho	Chum	Pink	Other[a]	Total
Chefornak	83	69	83.1%	161	261	61	338	13	5	839
Kipnuk	131	49	37.4%	479	1,160	781	716	11	0	3,147
Mekoryuk	59	54	91.5%	0	2	201	3670	47	0	3,920
Newtok	63	58	92.1%	144	394	262	103	46	0	949
Nightmute	50	40	80.0%	98	289	64	475	13	3	942
Toksook Bay	104	94	90.4%	365	1834	1040	1637	433	4	5,313
Tununak	68	36	52.9%	51	499	455	287	183	8	1,483
Total	**558**	**400**	**71.7%**	**1,298**	**4,439**	**2,864**	**7,226**	**746**	**20**	**16,593**

Source Wolfe et al. (2012:17-18).

a. Unidentified species of salmon.

11.3.5 Bristol Bay Area

According to Fall et al. 2014:

In spite of numerous social, economic, and technological changes, Bristol Bay residents continue to depend on salmon and other fish species as an important source of food. Residents have relied on fish to provide nourishment and sustenance for thousands of years. Subsistence harvests still provide important nutritional, economic, social, and cultural benefits to most Bristol Bay households. The 5 species of salmon found in Alaska are utilized for subsistence purposes in Bristol Bay, but the most popular are sockeye, Chinook, and coho salmon. Many residents continue to preserve large quantities of fish through traditional methods such as drying and smoking, and fish are also frozen, canned, salted, pickled, fermented, and eaten fresh.

An ADF&G report of surveys and interviews in five Bristol Bay communities revealed that most subsistence resources in Bristol Bay are distributed through sharing, with no immediate exchange and no expectation of any return in the future (Krieg et al, 2007). In the five study communities (Dillingham, Naknek, Togiak, King Salmon and Nondalton), 27 households (21 percent) had a history of involvement in cash trade of subsistence-caught fish, and 16 households (13 percent) engaged in cash trade in the 2004 study year. Cash trade most often involved value-added products such as smoked sockeye or Chinook salmon, resembling a form of craft production rather than commercial manufacture. Of 40 cash trade transactions, 28 involved less than $100. In the five study communities, 54 households (42 percent) had a history of involvement in barter of subsistence-caught fish, and 48 households (38 percent) bartered fish for other goods or services in 2004. Surveyed households described 143 barter transactions in 2004 that included the exchange of 386 items or services; Chinook salmon (24 percent of all items bartered) and sockeye salmon (18 percent) were most often involved in barter. Market goods (17 percent of the items bartered) and services (7 percent) were also part of barter transactions for subsistence-caught fish.

This same report (Krieg et al. 2007:14) notes that exchanges of resources between residents of contemporary Bristol Bay communities, and with residents of communities outside the area, are common. It states:

> *For example, in Manokotak, a Central Yup'ik community east of Togiak, Schichnes and Chythlook (1988:77-78) identified 18 other communities from which community residents received subsistence foods and 15 to which Manokotak residents sent subsistence foods. The authors speculated that this*

sharing involved "gifts" (trade was not mentioned) to relatives in Anchorage and Dillingham who could not obtain their customary "Native foods" in those locations.

An important point of view expressed by Bristol Bay Yup'ik elders from western Bristol Bay communities during this study and others conducted by the Division of Subsistence was that in the past, they primarily harvested and processed meat, fish, berries, and greens for survival and not with the intent of exchange for cash or other exchange value. They stated that they preferred to give subsistence foods to someone in need, rather than trade the resources for cash. For the most-senior generation of elders, those 80 or more years of age, subsistence foods were never associated with money. Elders stated that if a family was needy, they simply gave subsistence foods to them, and expected nothing back.

The report also states that there is evidence that younger generations in Bristol Bay communities have become more accustomed to the practice of trading subsistence foods for cash rather than for other subsistence products. The report summarizes that the trade or barter in subsistence products has occurred and continues to occur in the Bristol Bay area, and that the role of cash in these types of exchanges has increased with the move toward a mixed economy.

Estimated total Bristol Bay subsistence salmon harvests in 2012 were 122,582 fish (Table 107). The 2012 salmon harvest was slightly below the 5-year (125,206 salmon) and 10-year (124,453 salmon) averages, but about 17 percent below the historical (1983–2011) average of 146,948 salmon (Table 108).

Chinook salmon harvests were estimated at 12,136 in 2012, a decrease from the previous year's harvest of 14,106, and lower than the 2003 record harvest of 21,231 fish. Estimated sockeye salmon harvests for 2012 were 100,728, which was above the recent 5-year average of 98,709 fish, and the 10-year average of 95,785 fish, but below the historical average (1983–2011) of 115,072 fish. Because returns of pink salmon to Bristol Bay are higher in even-numbered years than odd-numbered years, the number of pink salmon reported harvested was significantly higher in 2012 (1,874 fish) than in 2011 (333 fish). The estimated harvest of chum salmon in 2012 (4,007 fish) was lower than both the recent 5-year (4,648 fish) and 10-year averages (5,233 fish) and below the historical average (1983–2011) of 6,477 fish. The coho harvest in 2012 was much smaller harvest than the previous year (3,837 fish) and also lower than the 5-year average at 6,521 fish, the 10-year average at 6,724 (Table 107) and the historical 1983–2011 average at 8,320 fish (Table 108).

Table 107. Estimated subsistence salmon harvests by district and location fished, Bristol Bay Area, 2012.

Area and river system	Number of permits issued[a]	Estimated salmon harvest: Chinook	Sockeye	Coho	Chum	Pink	Total
Naknek-Kvichak District	483	785	72,708	485	127	474	74,578
Naknek River Subdistrict	280	607	20,338	396	104	384	21,828
Kvichak River/Iliamna Lake Subdistrict:	207	178	52,370	89	23	90	52,750
Igiugig	2	0	555	0	0	0	555
Iliamna Lake-General	37	0	6,655	0	0	0	6,655
Kokhanok	26	161	15,148	0	0	1	15,310
Kvichak River	21	0	3,774	0	0	0	3,774
Lake Clark	55	0	4,610	0	0	0	4,610
Levelock	3	17	845	89	23	89	1,063
Newhalen River	46	0	13,829	0	0	0	13,829
Pedro Bay	17	0	4,059	0	0	0	4,059
Six Mile Lake	13	0	2,895	0	0	0	2,895
Egegik District	38	37	1,172	190	19	7	1,425
Ugashik District	20	31	997	228	25	0	1,280
Nushagak District	517	10,350	20,587	2,642	3,072	1,309	37,960
Igushik/Snake River	12	143	937	105	20	7	1,212
Nushagak Bay Commercial	42	368	1,238	291	176	196	2,269
Nushagak Bay Noncommercial	204	2,685	7,387	1,011	796	410	12,289
Nushagak River	119	4,896	4,448	808	1,559	426	12,136
Site Unknown	1	0	80	0	0	0	80
Wood River	156	2,259	6,497	427	522	270	9,974
Togiak District	53	933	5,265	293	764	84	7,339
Total	1,107	12,136	100,728	3,837	4,007	1,874	122,582

Source ADF&G Division of Subsistence, ASFDB 2013 (Fall et al. 2014).

Note Harvests are extrapolated for all permits issued, based on those returned and on the area fished as recorded on the permit. Due to rounding, the sum of columns and rows may not equal the estimated total. Of 1,107 permits issued for the management area, 932 were returned (84.2%).

a. Sum of sites may exceed district totals, and sum of districts may exceed area total, because permittees may use more than one site.

Table 108. Estimated historical subsistence salmon harvests, Bristol Bay Area, 1983–2012

	Permits		Estimated salmon harvest					
Year	Issued	Returned	Chinook	Sockeye	Coho	Chum	Pink	Total
1983	829	674	13,268	143,639	7,477	11,646	1,073	177,104
1984	882	698	11,537	168,803	16,035	13,009	8,228	217,612
1985	1,015	808	9,737	142,755	8,122	5,776	825	167,215
1986	930	723	14,893	129,487	11,005	11,268	7,458	174,112
1987	996	866	14,424	135,782	8,854	8,161	673	167,894
1988	938	835	11,848	125,556	7,333	9,575	7,341	161,652
1989	955	831	9,678	125,243	12,069	7,283	801	155,074
1990	1,042	870	13,462	128,343	8,389	9,224	4,455	163,874
1991	1,194	1,045	15,245	137,837	14,024	6,574	572	174,251
1992	1,203	1,028	16,425	133,605	10,722	10,661	5,325	176,739
1993	1,206	1,005	20,527	134,050	8,915	6,539	1,051	171,082
1994	1,193	1,019	18,873	120,782	9,279	6,144	2,708	157,787
1995	1,119	990	15,921	107,717	7,423	4,566	691	136,319
1996	1,110	928	18,072	107,737	7,519	5,813	2,434	141,575
1997	1,166	1,051	19,074	118,250	6,196	2,962	674	147,156
1998	1,234	1,155	15,621	113,289	8,126	3,869	2,424	143,330
1999	1,219	1,157	13,009	122,281	6,143	3,653	420	145,506
2000	1,219	1,109	11,547	92,050	7,991	4,637	2,599	118,824
2001	1,226	1,137	14,412	92,041	8,406	4,158	839	119,856
2002	1,093	994	12,936	81,088	6,565	6,658	2,341	109,587
2003	1,182	1,058	21,231	95,690	7,816	5,868	1,062	131,667
2004	1,100	940	18,012	93,819	6,667	5,141	3,225	126,865
2005	1,076	979	15,212	98,511	7,889	6,102	1,098	128,812
2006	1,050	904	12,617	95,201	5,697	5,321	2,726	121,564
2007	1,063	917	15,444	99,549	4,880	3,991	815	124,679
2008	1,178	1,083	15,153	103,583	7,627	5,710	2,851	134,924
2009	1,063	950	14,020	98,951	7,982	5,052	442	126,447
2010	1,082	979	10,852	90,444	4,623	4,692	2,627	113,238
2011	1,122	1,039	14,106	101,017	7,493	3,794	333	126,744
2012	1,107	932	12,136	100,728	3,837	4,007	1,874	122,582
5-year average (2007–2011)	1,102	994	13,915	98,709	6,521	4,648	1,414	125,206
10-year average (2002–2011)	1,101	984	14,958	95,785	6,724	5,233	1,752	124,453
Historical average (1983–2011)	1,093	958	14,730	115,072	8,320	6,477	2,349	146,948

Source ADF&G Division of Subsistence, ASFDB 2013 (Fall et al. 2014).

In 2012, the Bristol Bay subsistence salmon harvest was composed of 82 percent sockeye salmon, 10 percent Chinook salmon, 3 percent coho salmon, 3 percent chum salmon, and 2 percent pink salmon (Figure 61). Of the entire Bristol Bay Area subsistence salmon harvest in 2012, residents of Bristol Bay communities harvested 113,320 salmon (92 percent), and other Alaska residents harvested 9,262 salmon (8 percent) (Table 109).

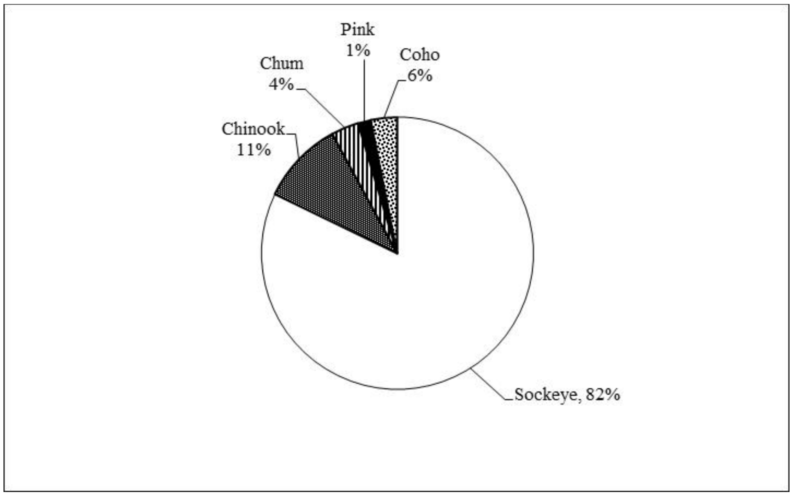

Figure 61. Species composition of 2012 estimated subsistence salmon harvests, Bristol Bay Area. (Source: Fall et al. 2014).

In 2012, as over the last several decades, most of the Bristol Bay Area subsistence harvest was taken in the Naknek–Kvichak (61 percent) and the Nushagak (31 percent) districts (Table 107). The Naknek–Kvichak total harvest of 74,578 salmon in 2012 (Table 105) was higher than in 2011 (68,675) and in 2010 (64,445 salmon). Kvichak River drainage residents within the Kvichak River–Iliamna Lake Subdistrict and other permit holders fishing in the Kvichak drainage portion of the Naknek–Kvichak District harvested an estimated 178 Chinook salmon and 52,370 sockeye salmon in 2012, while those fishing in the Naknek River Subdistrict harvested 607 Chinook salmon and 20,338 sockeye salmon (Table 107). The 2012 subsistence harvest of 52,370 sockeye salmon in the Kvichak drainage (Table 107) was higher than the 2011 harvest of 45,226 sockeye, and the 2010 harvest of 40,688 sockeye (Fall et al. 2009:69) and above historical levels (the most recent 5-year average harvest from 2007 through 2012 was 67,995 sockeye salmon) (Jones et al. 2014:93).

Subsistence sockeye salmon harvests in the Kvichak District have declined since the early 1990s (Salomone et al. 2011:113; Table 108). From 1998 to 2011, estimated harvests were below the range of 55,000 to 65,000 sockeye salmon established by the BOF as the amount reasonably necessary for subsistence uses (5 AAC 01.336 (b)(1)). Poor sockeye salmon returns, like those seen in 2000–2002, are likely one factor responsible for declining harvests, but socioeconomic and sociocultural factors may be partly responsible as well (Fall et al. 2001, 2003, 2006; Turek, et al. 2009; Stickman et al. 2003).

Table 109. Estimated subsistence salmon harvests by community, Bristol Bay Area, 2012.

	Permits		Estimated salmon harvest					
Community	Issued	Returned	Chinook	Sockeye	Coho	Chum	Pink	Total
Aleknagik	29	21	696	1,548	108	86	19	2,457
Clarks Point	13	13	99	365	189	80	149	882
Dillingham	328	277	5,055	12,921	1,420	1,331	651	21,378
Egegik	9	6	0	66	104	0	0	170
Ekwok	15	13	681	167	59	234	112	1,253
Igiugig	13	9	0	2,711	0	0	0	2,711
Iliamna	29	23	3	8,194	0	0	0	8,197
King Cove	1	1	2	24	6	2	4	38
King Salmon	81	74	173	5,329	49	17	100	5,667
Kokhanok	27	20	161	16,593	0	0	1	16,755
Koliganek	15	13	852	835	361	579	207	2,834
Levelock	3	2	0	825	0	0	0	825
Manokotak	12	9	143	937	105	20	7	1,212
Naknek	106	84	273	10,318	227	49	207	11,074
New Stuyahok	39	26	2,439	1,778	345	677	137	5,375
Newhalen	14	11	0	5,064	0	0	0	5,064
Nondalton	31	30	0	9,327	0	0	0	9,327
Pedro Bay	15	14	0	4,028	0	0	0	4,028
Pilot Point	6	5	18	307	60	24	0	409
Port Alsworth	52	49	2	4,445	0	0	0	4,447
Portage Creek	1	1	31	2	0	2	0	35
South Naknek	18	15	20	778	79	11	54	942
Togiak	53	38	951	5,364	298	779	85	7,478
Twin Hills	1	0	0	0	0	0	0	0
Ugashik	9	8	7	588	168	1	0	764
Subtotal, Bristol Bay	**920**	**762**	**11,604**	**92,514**	**3,577**	**3,891**	**1,733**	**113,320**

continued

Community	Permits Issued	Permits Returned	Estimated salmon harvest Chinook	Sockeye	Coho	Chum	Pink	Total
Anchorage	92	80	248	3,618	54	15	68	4,002
Anderson	1	0	0	0	0	0	0	0
Aniak	1	1	0	9	0	0	0	9
Barrow	2	2	64	42	0	5	0	111
Bethel	1	1	0	7	0	0	0	7
Big Lake	1	1	0	32	0	0	0	32
Chugiak	5	5	14	163	0	3	0	180
Copper Center	1	1	0	0	0	0	0	0
Cordova	2	2	0	86	0	0	0	86
Eagle River	4	4	11	238	0	19	1	269
Fairbanks	12	11	8	298	97	4	20	427
Girdwood	3	3	0	15	19	2	8	44
Homer	13	12	23	924	17	17	14	995
Kasilof	1	1	7	175	0	14	0	196
Kenai	3	3	7	146	8	0	0	161
Kipnuk	1	1	5	25	0	0	0	30
Kodiak City	9	9	55	247	1	24	0	327
Kotzebue	1	1	0	8	10	0	4	22
McCarthy	1	1	0	50	0	2	0	52
Nikiski	2	2	2	74	47	1	2	126
Palmer	9	8	7	734	0	0	0	740
Sitka	1	0	0	0	0	0	0	0
Soldotna	2	2	31	55	0	0	16	102
Talkeetna	2	2	17	29	0	2	0	48
Tok	1	1	0	16	0	3	0	19
Trapper Creek	1	1	1	71	0	0	0	72
Wasilla	14	14	32	1,153	7	5	9	1,206
Willow	1	1	0	0	0	0	0	0
Subtotal, other Alaska	**187**	**170**	**531**	**8,214**	**260**	**116**	**142**	**9,262**
Total	**1,107**	**932**	**12,136**	**100,728**	**3,837**	**4,007**	**1,874**	**122,582**

Source ADF&G Division of Subsistence, ASFDB 2013 (ADF&G 2014).

In the Nushagak District, the total estimated subsistence harvest in 2012 of 37,960 salmon (Table 107) was a decrease from the previous year (45,226 salmon). The next lowest estimated harvests were 40,373 salmon in 2006 and 43,154 salmon in 2004 (Jones et al. 2013:91). The estimated harvest in 2008 of 51,395 salmon was the highest since 55,076 salmon in 2003 (Jones et al. 2013:91). The 2008 estimated harvest more accurately recorded harvest numbers for the season due to the administration of comprehensive baseline household subsistence harvest surveys by the Division of Subsistence in Aleknagik and Manokotak. For a more detailed description of these data see Fall et al. (2012:75). The Nushagak District Chinook salmon harvest in 2012 was 10,350 (Table 107), and was a decrease from the year before (12,461 fish), but higher than in 2010, which was the lowest recorded harvest for the 20-year period from 1991 to 2010 (9,150 fish). The next lowest estimated harvests were 9,470 salmon in 2000 and 9,971 salmon in 2006 (Jones et al. 2013:99). The harvests in 2009 and 2008 (12,737 and 12,960 fish, respectively) were down from the 2003 estimate of 18,686 fish (the highest estimate on record), and below the 5-year (2007–2012) average of 12,128 fish, (Jones et al. 2014:94). The 2012 Nushagak District sockeye salmon harvest of 20,587 fish (Table 107) was lower than the 2011 harvest of 28,006 fish, and the 2010 estimate of 22,326 fish, and also the previous 5-year average (2007–2012) of 25,842 fish (Jones et al. 2014:94).

The estimated total subsistence salmon harvest for the Togiak District in 2012, 7,339 fish (Table 107), was higher than the previous year's estimate of 5,212 fish and higher than the previous 5-year average (5,756 salmon) (Jones et al. 2014:95). Estimated harvests in 2002 and from 2004 through 2007 were below those for 2001 and 2003; this likely reflects at least in part the result of postseason household surveys in Togiak and Twin Hills for 2001 and 2003. Postseason household surveys included more harvesters in the estimate because fishers who did not turn in their harvest permits were contacted. Comprehensive baseline household subsistence harvest surveys conducted in Togiak for the 2008 calendar year also showed an increase in the participation in the 2008 harvest assessment program.

The estimated subsistence salmon harvest in the Ugashik District in 2012 was 1,281 fish, which was up by almost twice from the previous year at 687 fish, the lowest count in recorded history (Table 107). The 2012 harvest was lower than the 10-year average (2002–2012) of 2,000 fish (Jones et al. 2014:94). In the Egegik District, the estimated subsistence salmon harvest of 1,425 fish (Table 107) was much lower than the 2011 estimate of 2,265 fish; however, the 2012 estimate was notably lower than the 4,711 fish estimated for 2004 (the second highest estimate since 1984), and was less than the previous 5-year average of 1,732 salmon (Jones et al. 2014:93).

11.4 Technical Appendix on calculations to re-allocate pollock from B-season to A under Alternative 4

For the date-based method used to evaluate re-allocating pollock from B to A seasons (45% and 50% in A compared to status quo of 40% in A) under Alternative 4, the following calculations were undertaken where C_{Total} is the Chinook salmon expected given the current seasonal allocation and R_A represent the bycatch rate (number / t of pollock) and P_A is pollock by season (here A-season). $P_{B\to A}$ represents the amount of pollock reallocated from the B season to the A. The variables with primes and double-primes are the analogous variables but modified to cover the appropriate date-ranges. For example, C'_A is the observed amount of Chinook salmon taken as PSC from March 15 – April 30th and R''_B is PSC rate from Sept 15th to October 31st (C'_B is the PSC from June 10th – Sept 14th). The equations describing the calculation are given in below.

Table 110. Equations describing the approach to evaluate re-allocation of PSC from B-season to A season.

$C_{Total} = P_A R_A + P_B R_B = C_A + C_B$	Chinook PSC for a year given status quo allocation
$R'_A = C'_A / P'_A$	Observed rate of Chinook PSC from Mar 15th -Apr 30th
$R'_B = C'_B / P'_B$	Observed rate of Chinook PSC from June 10th – Sep 14th
$R''_B = C''_B / P''_B$	Observed rate of Chinook PSC from Sep 15th - Oct 31st
$C'_{Total} = P_A R_A + P_{B\to A} R'_A + \left(P_B - P_{B\to A}\right) R'_B - \left(P'_{B\to A} R'_B + P''_{B\to A} R''_B\right)$	Total adjusted Chinook PSC due to reallocation
$\Delta = C'_{Total} / C_{Total} - 1$	Percentage change

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Finding of No Significant Impact for
Amendment 110 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area
[RIN 0648-BF25]

National Marine Fisheries Service

National Oceanic and Atmospheric Administration Administrative Order 216-6 (NAO 216-6) (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, 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." Each criterion listed below is relevant in making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1) Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?

Response: No. The EA analyzes the impacts of the proposed action on pollock and concludes that no significant impacts are anticipated because the pollock fishery will still be managed under the harvest specifications process (EA Section 3.3).

2) Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?

Response: No. The non-target species impacted are Chinook salmon and chum salmon. The EA analyzes the impacts of the action on salmon and no significant adverse impacts were identified. The proposed action is expected to further minimize salmon bycatch in the pollock fishery, which is anticipated to reduce the adverse impacts from status quo (EA Section 3.5).

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 FMPs?

Response: No. The EA identifies that the proposed action would have no anticipated impact on essential fish habitat because of the action would not change the footprint or prosecution of the fishery in a manner that would have an impacts on habitat. Therefore, no impacts on essential fish habitat are expected (EA Section 3.2).

4) Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?

Response: No substantial adverse impact of public health or safety is expected. By combining chum salmon and Chinook salmon PSC avoidance into the industry managed incentive plan structure, the proposed action is intended to improve flexibly to manage PSC and would, in turn, provide for greater safety of human life at sea. (EA Section 4.8.2).

5) Can the proposed action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?

Response: No. The EA identifies that the proposed action would have no adverse impact on endangered or threatened species, marine mammals, and critical habitat. The proposed action would not change the prosecution of the pollock fishery in a manner that would impact endangered or threatened species, marine mammals, or critical habitat of these species (EA Section 3.2 and 3.7).

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.)?

Response: No. Given that the proposed action would not change the prosecution of the pollock fishery, no impacts are expected on biodiversity or ecosystem function (EA Section 3.2).

7) Are significant social or economic impacts interrelated with natural or physical environmental effects?

Response: No. The EA analyzes the economic impacts of the proposed action and concludes that the social and economic impacts are not significant and not interrelated with natural or physical environmental effects (EA Chapter 4).

8) Are the effects on the quality of the human environment likely to be highly controversial?

Response: No. This is a non-controversial proposed action because it further refines salmon bycatch management in the Bering Sea pollock fishery to improve the incentives to avoid Chinook salmon and chum salmon while providing more flexibility to the pollock fleet to change fishing operations to improve its opportunity to harvest the pollock TAC. Salmon bycatch management in the pollock fishery has been controversial in the past and remains a high profile issue because of the huge importance of both the pollock fishery and the salmon commercial, sport, and subsistence fisheries that are integral to life in western Alaska.

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?

Response: No impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas, are expected because the pollock fishery occurs in the Bering Sea.

10) Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

Response: No. The potential effects of the proposed action are understood because of the fish species, harvest methods involved, and area of the activity (EA Chapter 3).

11) Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

Response: No. The EA analyzes the cumulative impacts and no other actions were identified with individually insignificant but cumulatively significant impacts (EA Section 3.8).

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?

Response: No. This proposed 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.

13) Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

Response: No. This proposed action poses no risk of the introduction or spread of nonindigenous species into the exclusive economic zone off Alaska because it would not change fishing, processing, or shipping practices that may lead to the introduction or spread of nonindigenous species.

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?

Response: No. This proposed action would not establish a precedent for future action with significant effects. Pursuant to NEPA, for all future amendments to the FMPs, appropriate environmental analysis documents 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?

Response: No. This proposed 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?

Response: No. The effects on target and non-targeted species from the proposed action 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 Section 3.8).

DETERMINATION

In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment prepared for Amendment 110 to the Fishery Management Plan (FMP) for Groundfish of the Bering Sea and Aleutian Islands Management Area, it is hereby determined that the proposed action will not significantly impact the quality of the human environment as described above and in the supporting Environmental Assessment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an EIS for this action is not necessary.

for Robert D Mecum — 3/23/16

James W. Balsiger, Ph.D. — Date
Administrator, Alaska Region

GHarrington 9/8/2015, 2/11/2016
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