INITIAL REVIEW DRAFT

Environmental Assessment/ Regulatory Impact Review/ Initial Regulatory Flexibility Analysis for Proposed Amendment [*XX*] to the Fishery Management Plan for Bering Sea Aleutian Islands Groundfish

Bering Sea Chinook and Chum salmon bycatch management measures

November 2014

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Abstract:

This Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis analyzes proposed management measures that would apply exclusively to the directed pollock fishery in the Bering Sea. The purpose of this action is to address prohibited species catch of Chinook and chum salmon in the Bering Sea pollock fishery.
The measures under consideration include modified chum salmon management within existing industry run incentive programs, modified season lengths for the summer fishery, and modifications to the performance standard implemented in the existing Chinook salmon bycatch management program.

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	Board of Fish
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 Oceanographic 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 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

Table of Contents

List of Tables

List of Figures

Executive Summary

This document analyzes 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 prohibited species catch (PSC) by required incorporation into industry run existing Chinook salmon incentive program agreements (IPA), modified IPA requirements to add provisions and more stringent restrictions for Chinook salmon PSC management, modifying the existing pollock seasons in the summer to begin earlier and/or end sooner, and a lower threshold performance standard for use as a target in management of Chinook PSC limits within the IPAs which would be employed in years of low Chinook abundance.

Under the North Pacific Bering Sea Aleutian Island (BSAI) groundfish fishery management plan (FMP), salmon have a specific status as a prohibited species and as such are afforded protections in that they cannot be retained or sold. Some salmon are donated to food banks while others are discarded. Throughout this analysis Chinook and chum that are bycaught in the fishery are noted as salmon 'PSC' but are also referred to by the Magnuson Act definition of bycatch[1] when discussing overall purpose and need, objectives and terminology within the industry incentive plan agreements.

Purpose and Need

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 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 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 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 four alternative management strategies in addition to the status quo management. Each of the four additional alternatives were designed to improve upon the current management of 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. These alternatives are not mutually exclusive.

[1] Bycatch is defined under the Magnuson–Stevens Fishery Conservation and Management Act (2007) as "fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards". [16 U.S.C. 1802 Section 3 (2)] [MSA(2007)].

Alternatives 1-5

Below is a brief description of the alternatives under consideration in this analysis including the status quo management system. Additional information regarding each of the alternatives is included in sections 2.2 – 2.5 of the EA.

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 which 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 incentive programs (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 to a large-scale closure (chum salmon savings area) in the Bering Sea for participating in 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 which assimilates fleet data and closes areas of the fishing grounds to cooperatives which 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. Under this alternative it would be incumbent upon the IPAs to include provisions for addressing chum salmon PSC within their existing program. General goals and objectives for chum salmon PSC management 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. The current chum salmon savings area and exemption would be removed from the FMP and from regulation as would the provisions of the RHS program.

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 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 additional restrictions or performance criteria to ensure that 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 4: Revise the Bering Sea pollock fishery seasons. This alternative addresses both Chinook and Chum salmon PSC measures and modifies the existing B-season start and end dates for the pollock fishery. Here two 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. 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 performance standard indexed to years of low Chinook abundance. This alternative applies to Chinook PSC management under the IPAs only. Here the performance standard (47,591 annually; divided by sector and season) to which IPAs are structured in their incentives to remain below, 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 status quo, sectors that exceed the applicable performance standard, 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. Several options for how the performance standard would be reduced are considered. These options are the following: 25% reduction annually (35,693), 60% reduction annually (19,036), 25% reduction applied to B-season portion of the performance standard only (annual total 44,022), 60% reduction applied to B-season portion of the performance standard only (annual total 39,025).

Environmental Assessment

Impacts here focus upon the relative impacts to pollock stocks and Chinook and chum salmon PSC under the different alternatives.

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) and a summer fishery ("B" season) extending from June through the end of October. The Bering Sea pollock stock is not overfished nor approaching an overfished condition. Presently the pollock stock is managed based on science covering a wide variety of facets including the capacity of the stock to yield sustainable biomass on a continuing basis. Catch levels are conservatively managed; with total allowable catch (TAC) levels set well below the Acceptable Biological Catch (ABC) levels with realized catch below the TAC annually. The present bycatch management system in place neither significantly affects the distribution of the stock spatially and temporally, nor is it reasonably expected to jeopardize the capacity of the stock productivity on a continuing basis. Alternatives 2 through 5 are not estimated to result in any significant changes to the pollock stock. 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. Alternatives 3-5 may result in fishing earlier in the B-season, in effort concentrated in areas away from core fishing grounds and/or result in some of the pollock quota being unharvested in some years. To the extent that these impacts result in pollock that are smaller in mean weight-at-age or a change in the realized catch for the season, these considerations would be incorporated into the annual stock assessment which forms the basis for catch specification recommendations in the following year. Therefore, while impacts of alternative management strategies could result in minor changes in the future catches (indirectly through the stock assessment/ABC determination process), the actions would have an insignificant impact on the sustainability and viability of the pollock population.

Chinook and chum salmon

Western Alaskan Chinook salmon stocks are in a period of 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 levels than historical periods with some stocks in Norton Sound still in decline. The pollock fishery catches chum salmon in the B-season (only). Genetic information indicates that the majority of the chum salmon caught in the fishery are of Asian –origin (~60%) while a smaller percentage (~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 to date in 2014 is ~200,000.

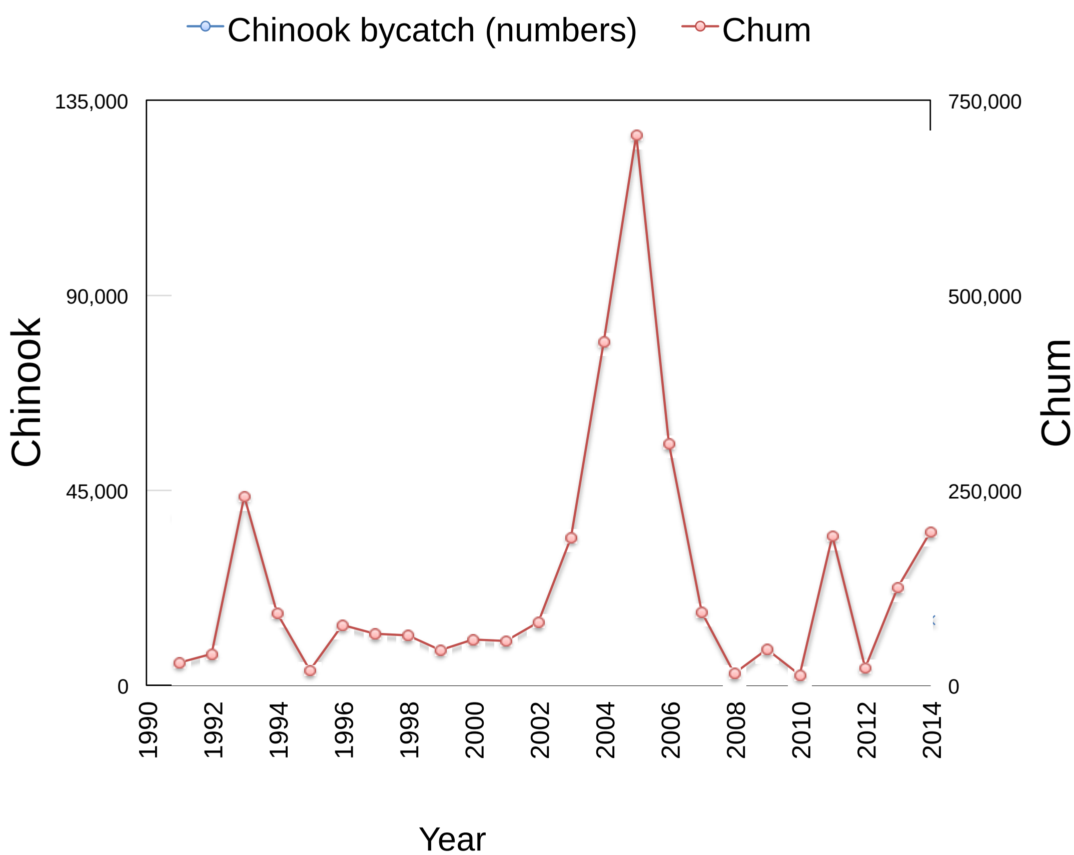

Figure 1. Time series of Chinook and chum salmon bycatch in the pollock fishery, 1991-2014.

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 3-7 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.

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 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 estmated 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%.

Alternatives 2 through 5 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 management. Alternative 2 focussed 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 reduced chum savings when chum closures are suspended. While it is not possible to directly quantify these benefits, any reduction of Chinook and chum salmon bycatch will have a reduced adverse impact 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. Any successful increased 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 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. 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. The purpose of this modification is to provide additional 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. While it is not possible to determine whether all of the pollock quota could be caught prior to these ending dates clearly some additional effort would be shifted earlier in the season. Analysis of this alternative indicates that with fishing occurring earlier in the B season under both options, there is likely to be reduced Chinook bycatch by shifting effort away from the highest rates in September and October. This alternative is estimated to reduce adverse impacts 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 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 performance standard are considered annually (25%; 60%) and for the B-season only (25% and 60%). Based on data on run reconstructions the low threshold would have been reached historically in 2000 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 constrainng impact (and thus estimates salmon savings) would be the 60% annual reduction in the year 2011. However what is difficult to predict is how the actual IPAs themselves would respond within their incentive structure to address the potential implications of a lower performance threshold when triggered. Under these conditions, vessels would have faced a lower performance standard 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 unknown whether the gap between the performance standard and hard cap 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 hard cap of their portion of the 47,591, and/or respond slowly to the need to operate under the lower performance standard as the hard cap 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. 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. Nevertheless, this alternative is estimated to be similar to status quo in impacts under most options with the possibility of a reduced adverse impact to Chinook salmon and chum salmon stocks under option 2 (60% annual reduction in the performance standard).

Other Groundfish, Marine Mammals, and the Ecosystem

The analysis of the impact of the alternatives on other resource components in addition to pollock, chum and Chinook included consideration of 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 to any other resource category.

Regulatory Impact Review

The analysis of costs and benefit of the Alternatives contained in the Regulatory Impact Review (RIR) utilizes the impacts discussion on salmon, and provides a qualitative treatment of potential effects on pollock fishery operations, which is based heavily on the analysis presented in the EA. The RIR also provides a summation of the potential effects of the Alternatives on net national benefits.

Alternative 2 is estimated to have some (likely small) reduced adverse impact, as compared with status quo, for salmon stocks. This alternative is also likely to improve the efficiency of the RHS program and thereby reduce operational costs in the pollock fishery by allowing additional areas of high pollock harvest rates with Chinook bycatch to remain open to fishing late in the season when Chinook bycatch rates generally increase. This alternative has the potential for a small increase in adverse impacts to chum salmon should bycatch increase by virtue of fishing earlier in the B season and/or higher encounters with chum salmon PSC when chum closures cease later in the season. In total, this Alternative is expected to have a small positive net benefit to the nation.

Overall, the options analyzed under Alternative 3 are all intended to increase the incentives to reduce Chinook bycatch within the IPAs. Any successful increased 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. Similarly, it is not possible to quantify the potential operational costs that may be incurred in further avoidance of Chinook. Nevertheless, this alternative is estimated to be similar to status quo in impacts under these options with the possibility of reduced adverse impacts to Chinook salmon depending upon the severity of the penalties imposed. The impacts to chum salmon under this alternative are estimated to be the same as with status quo. Thus, this Alternative is not expected to result in reduced net national benefits; however, it is not possible to directly compare the benefits of Chinook salmon saved with the operational cost impacts that may occur.

Analysis of Alternative 4 indicates that with fishing occurring earlier in the B season under both options, there is likely to be reduced Chinook bycatch by shifting effort away from the highest rates in September and October. This alternative is estimated to confer a reduced adverse impact to Chinook salmon relative to Alternative 1. However, to the extent spatial and temporal analysis of chum salmon bycatch rates indicate that any effort that is shifted earlier into the B season may result in some additional adverse impact to chum salmon PSC compared with Alternative 1. This alternative may also place some pollock catch at risk due to early closure of the B season; however, in response to the potential for some pollock to not be harvested, industry is expected to adapt to the closure dates by redeploying harvesting effort to make up this catch earlier in the season. Also important to note is that the potential impacts would be spread across the sectors and vessels in each sector likely resulting in little impact, at the individual vessel level, other than having to apply greater catch effort earlier in the season. Thus, this alternative is expected to have positive effects on net national benefits as compared to the status quo.

Alternative 5 is estimated to be similar to Alternative 1 in impacts under most options with the possibility of a reduced adverse impact to Chinook salmon and chum salmon stocks under option 2 (annual reduction of 60%), with small potential impacts on pollock harvesting operations. Thus, this alternative is expected to have positive effects on net national benefits as compared to the status quo.

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 of alternatives (Sections 2.1 through 2.5) and major policy-level trade-offs

Alternative	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 to close Chum salmon savings area (area closed August 1-31 by regulation). However pollock fishery is exempt to this closure for participating 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 that meets requirements.	A season: January 20-June 9th B season: June 10-Nov 1
2	Same as Alt 1	None	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:** Open: -Jan 20th Close: -May 31st -June 9th **B season:** 1) open: -June 1 -June 10 2) close: -Sept 15th -Oct 1st -Oct 15th
5	Overall 60,000 limit and allocations same as Alt 1. Performance standard reduced: Option 1: 25% Option 2: 60% Suboptions for reduction to B season limit only (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 in applicable years	Same as Alt 1

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

Alternative	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. • Status Quo Chinook PSC management is effective at keeping bycatch well below limits but may not be best addressing objective to affect vessel behavior under conditions of low salmon encounters. Current program is not comprehensively managing both species under common goals and 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** • Some potential for reduced incentive to participate in IPA with removal of CSSA. This reduced incentive could increase if combined with other more stringent IPA requirements under other alternatives. • Potential for increased chum when RHS closures are lifted • Back-stop measure for managing chum bycatch is missing for opt-out participants in an IPA. • Assumes that Chinook IPA provides sufficient incentive to participate.
3	**Potential benefits** • Likely to provide incremental improvement in Chinook bycatch incentives over status quo, although larger potential penalties would provide stronger incentive of 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. **Key concerns** • Depending on IPA response to action, action likely to result in only minor changes relative to Alt 1. • Management measures are outside of regulation and it may be difficult to monitor incentives and effectiveness.
4	**Potential benefits** • Options to curtail season earlier would likely 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. **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.
5	**Potential benefits** • Threshold for more restrictive management in years of low abundance. In periods of consistent Chinook declines (2010-2014) then application of different management measures can be justified. **Key concerns** • 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 unnecessarily constrain the pollock fishery. • Impacts differential by sector depending upon initial PSC allocation under Amendment 91. • Impacts will be contingent on how IPAs adapt to lower performance threshold in applicable years. Allocations to individual vessels under lowest performance standard may be too constraining and necessitate modification of the allocation formula within sectors.

1 Introduction

This document analyzes 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 program agreements (IPA), modified IPA requirements to add provisions and more stringent restrictions for Chinook salmon PSC management, modifying the existing pollock seasons in the summer to begin earlier and/or end sooner, and a lower threshold performance standard for use as a target in management of Chinook PSC limits within the IPAs which would be employed in years of low Chinook abundance.

Under the North Pacific Bering Sea Aleutian Island (BSAI) groundfish fishery management plan (FMP), salmon have a specific status as a prohibited species and as such are afforded protections in that they cannot be retained or sold. Some salmon are donated to food banks while others are discarded. Throughout this analysis Chinook and chum that are bycaught in the fishery are noted as salmon 'PSC' but are also referred to by the Magnuson Act definition of bycatch[2] when discussing overall purpose and need, objectives and terminology within the industry incentive plan agreements.

This document is an Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA). An EA/RIR/IRFA provides assessments of the environmental impacts of an action and its reasonable alternatives (the EA), the economic benefits and costs of the action alternatives, as well as their distribution (the RIR), and the impacts of the action on directly regulated small entities (the IRFA). This EA/RIR/IRFA 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/IRFA is a standard document produced by the North Pacific Fishery Management Council (Council) and the National Marine Fisheries Service (NMFS) Alaska Region to provide the analytical background for decision-making.

1.1 Purpose and Need

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

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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 1990-1995. However, the efficacy of these closures was called into question when the fleet began observing that bycatch rates were higher outside of the closures when triggered then 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 to which the fleet would adhere to short-term (4- to 7-) day closures in discrete areas of the Bering Sea when observed bycatch was high. The RHS program was initially developed to reduce bycatch of Chinook and chum in order to avoid triggering the closures themselves, however eventually it became clear that the SSAs were exacerbating bycatch by moving the fleet in areas of higher rates (NPFMC, 2005). Numerous requests from the pollock industry led to Amendment 84 to exempt 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 bycatch management measures.

In response to heightened concerns over all sources of Chinook salmon mortality, and due to high historical bycatch that has occurred in some years (Figure 2), the Council took action to reduce bycatch in the pollock fishery by imposing (in 2011) revised management measures via Amendment 91 to the Bering Sea Aleutian Islands Groundfish Fishery Management Plan (NMFS, 2010). Previous bycatch restrictions for Chinook salmon had been addressed through the time and area closures noted above (Stram and Ianelli 2009) but these measures did not serve to minimize bycatch in all years. Consequently, new measures were developed which 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 by including a performance standard in combination with the creation of industry-proposed incentive programs 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.

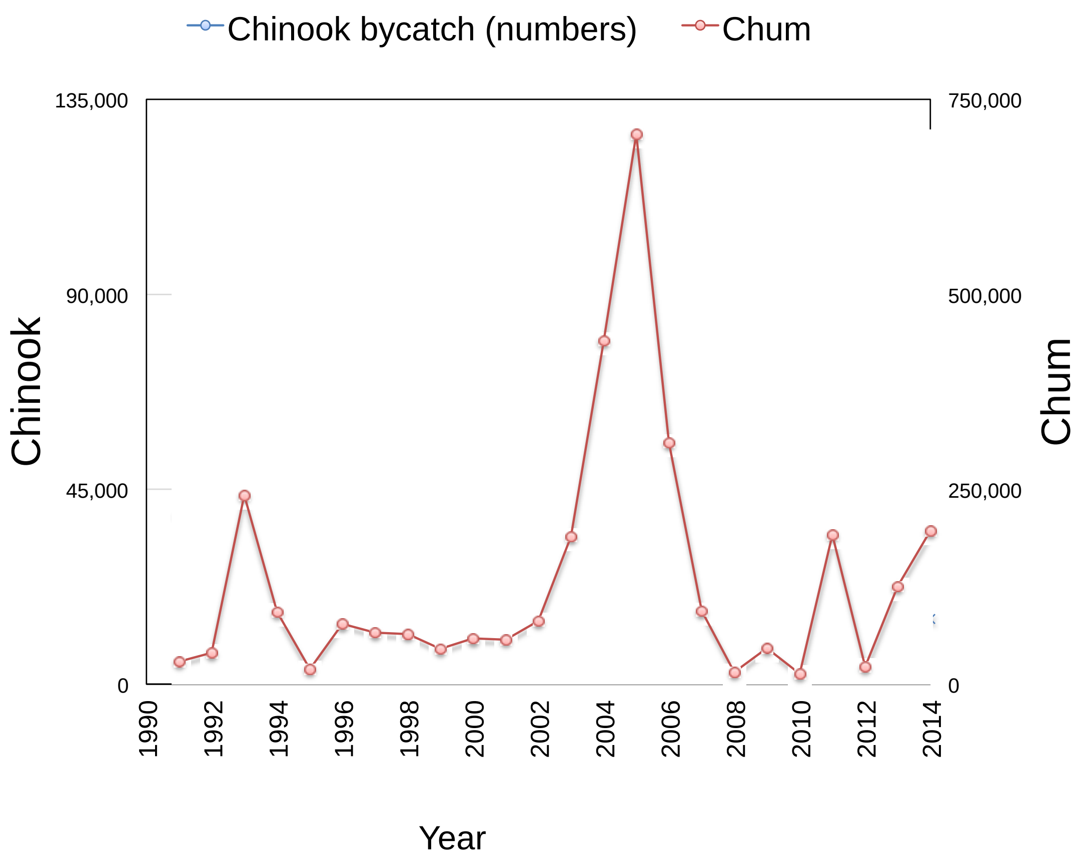

Figure 2. Time series of Chinook and chum salmon bycatch in the pollock fishery, 1991-2014.

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 under consideration were estimated to exacerbate Chinook bycatch in trying to address chum bycatch under a separate measure. Thus in Decmeber 2012, the Council moved to consider chum salmon PSC in conjunction with consideration of Chinook salmon PSC management changes in order to more comprehensively address the bycatch management of both species in the same fishery in a more holistic manner.

Due to continued concerns with extremely low returns to western Alaskan Chinook stocks, and the genetic information regarding high proportions of the 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 which provided updated Adult Equivalent (AEQ) analysis of the bycatch estimates to aggregate rivers of origin, impact rates of the bycatch to these aggregate river systems as well as an analysis of fishery and bycatch performance in the first three years of the bycatch 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, 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 initiating 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 Incentive Program Agreements (IPAs); and 2) an 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 with the alternatives listed in Chapter 2.

1.3 Description of Action Area

The Bering Sea sub-area of the Bering Sea Aleutian Islands (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.

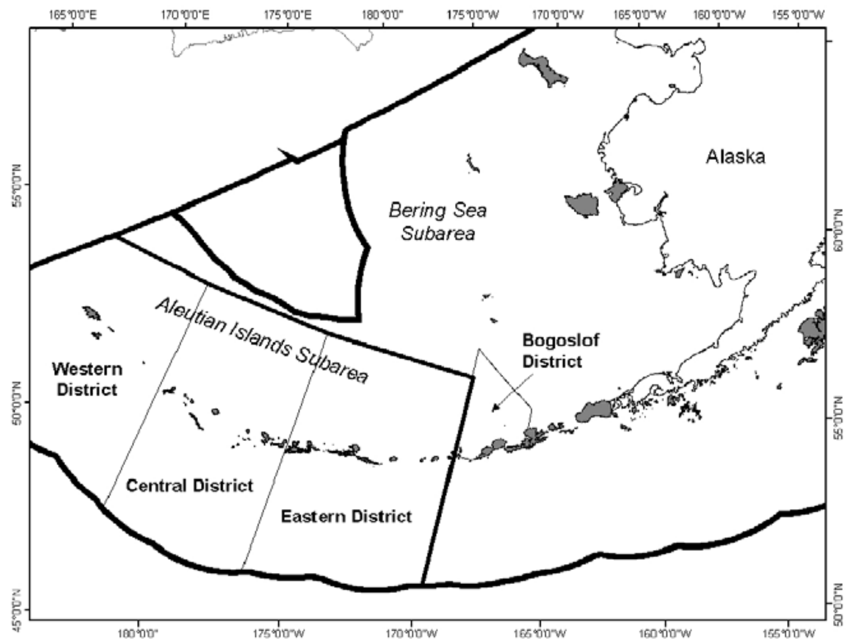

Figure 3 Bering Sea sub-areas for management

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 chapter 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 alternatives for analysis in June 2014.

2.1 Alternative 1, No Action

The status quo alternative includes both the current management of chum salmon under Amendment 84 regulations and Chinook salmon under Amendment 91 regulations.

2.1.1 Chum salmon PSC measures under status quo

Alternative 1 retains the current program of Chum Salmon Savings Area (SSA) closures in the Bering Sea triggered by separate non-Community Development Quota (non-CDQ) and CDQ non-Chinook salmon PSC limits, along with the exemption to these closures by pollock vessels participating in a Rolling Hot Spot intercooperative agreement (RHS ICA) approved by NMFS. The RHS ICA regulations were implemented in 2007 through Amendment 84 (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 Chum SSA is designed to reduce the total amount of chum incidentally caught by closing areas with historically high levels of chum salmon bycatch. The RHS ICA operates in lieu of a fixed area closure (the Chum SSA) and requires industry to identify and close areas of high salmon bycatch and move to other areas. Only vessels directed fishing for pollock are subject to the Chum SSA closure and ICA regulations.

The Chum Salmon Savings Area (Figure 4) was established in 1994 by emergency rule, and then formalized in the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP) in 1995 under Amendment 35 (ADF&G 1995). This area is closed to all trawling from August 1 through August 31. Additionally, if 42,000 non-Chinook salmon are caught in the Catcher Vessel Operational Area (CVOA) during the period August 15 through October 14, the area remains closed for the remainder of the period September 1 through October 14. As catcher/processors are prohibited from fishing in the CVOA during the B season, unless they are participating in a CDQ fishery, only catcher vessels and CDQ fisheries are affected by this PSC limit (Figure 4).

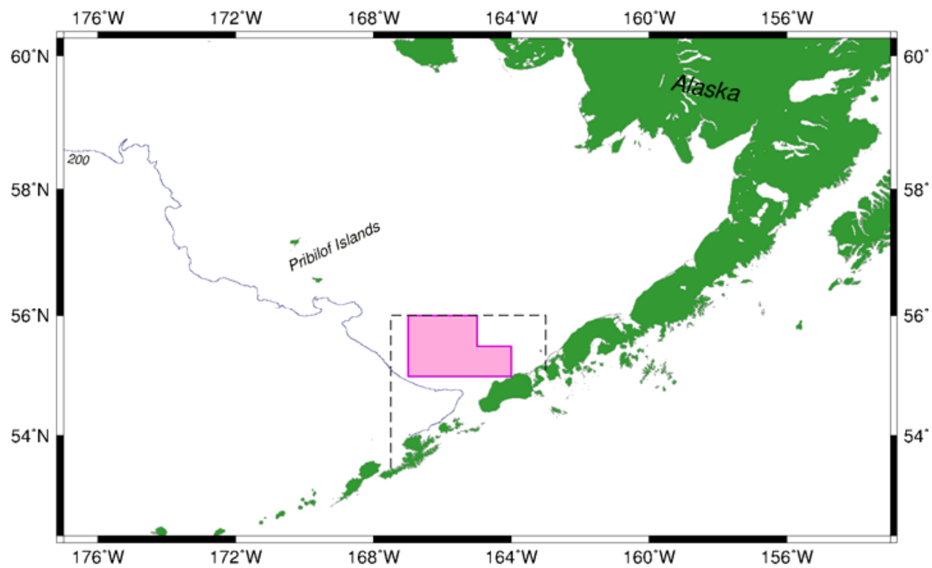

Figure 4 Chum Salmon Savings Area (CSSA), shaded and Catcher Vessel Operational Area (CVOA), dotted line.

2.1.1 Rolling Hotspot System Intercooperative Agreement

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

The RHS provides real-time salmon bycatch information so that the fleet can avoid areas of high chum salmon bycatch rates. Using a system of base bycatch rate, the ICA assigns vessels to certain tiers, based on bycatch rates relative to the base rate, and implements area closures for vessels in certain tiers. Monitoring and enforcement are carried out through private contractual arrangements. 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 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). All vessels and CDQ groups that are participating in the Bering Sea pollock fishery except the *Ocean Peace*, participate in the currently approved RHS ICA. Under Amendment 84 and based on the structure of the voluntary RHS ICA in effect prior to Amendment 84, the ICA allows participation by only AFA cooperatives or CDQ groups. Although the regulations at § 679.21(g) do not specifically prohibit participation by individual vessel owners, the fact that the "participants" paragraph of the regulations specifically refer only to AFA cooperatives and CDQ groups implies that individual vessel owners may not be parties to an ICA. The fact that the *Ocean Peace* is not a member of an AFA cooperative may explain why it is not a party to the currently approved ICA.

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

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

The ICA is structured based upon a cooperatives' bycatch rate as compared with a pre-determined "Base Rate." Once the Base Rate is determined (see Section 2.1.1.1), all provisions for fleet behavior, closures and enforcement are based upon the relation of the cooperative's rate to the Base Rate. Tier assignments (Section 2.1.1.2) are calculated from the cooperatives' proportional bycatch rate to the Base Rate with higher tiers corresponding to higher bycatch rates. These tiers then determine how access to specific areas will be determined following designation of "hot spot" closures. These areas are then closed to cooperatives in higher tiers.

2.1.1.1 Base Rate: calculation

The structure of the ICA is based upon cooperatives' bycatch rates in comparison with a calculated Base Rate established prior to the start of the season. The Base Rate (BR) is initially established as 0.19 (from June 10th to July 1st) in chum/mt of pollock harvest. 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.

2.1.1.2 Tier assignment based upon Base Rate

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

Tier Assignment rates

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

2.1.1.3 Impacts of assignment to tier

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

Closure areas are rolling and are determined by Sea State based upon the bycatch rate within specified areas. For 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- 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 bycatch conditions indicate there has likely been no change in bycatch conditions for the area.
5. The Bering Sea will be managed as two regions during the B season: a region east of 168° W. longitude (the Eastern Region) and a region west of 168° W. longitude (the Western Region).
6. Total Savings Closure area.
   i. Chum salmon
      a. The Eastern Region Savings Closures may cover up to 3,000 square miles. Note this was increased from 1,000 square miles prior to Amendment 84.
      b. The Western Region Savings Closures may cover up to 1,000 square miles.
7. There may be up to two Savings Closure areas at any one time within each region.
8. Closure areas will be described by a series of latitude and longitude coordinates and will be shaped as Sea State deems appropriate.
9. Sea State also provides additional non-binding hot-spot avoidance notices, outside of the savings closures, to the cooperatives as they occur throughout the season

One change from the previous ICA inclusive of Chinook bycatch management is the prioritization of Chinook closures over chum closures in the B season. Previously, within a single region Savings Closures must be either a chum closure or a Chinook closure, but not both. In the event Base Rates for both chum and Chinook are exceeded within a region during a week, the Savings Closure within that region was a Chinook closure. This was due to the elevated conservation concerns with respect to western Alaskan Chinook 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.

2.1.1.4 “Vessel Performance Lists”

These vessel lists are published and made available to all members and include the 20 vessels with the highest chum (and previously Chinook) bycatch rates over the Base Rate. Prior to Amendment 84 this list reported the 20 vessels with the highest bycatch rate in excess of the Tier 1 rate. Lists are published by highest rate by week, highest rate for the past 2 weeks, and highest rates for the season-to-date. Only vessels with bycatch rates over the base rate appear on the list. Only vessels with more than 500 mt of groundfish catch are included in the season-to-date list. The season-to-date list was based on appearances on the weekly list. Accumulative points are assigned to vessels as they appear on the weekly list. Vessels in the number 1 slot on the weekly list receive 20 points, those in the number 2 slot receive 19 points and so on. The 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.

2.1.1.5 RHS ICA monitoring

Monitoring and enforcement of the bycatch agreement is done by Sea State using the Base Rate as a trigger for Savings Area closures and determining the Tier Assignment of the vessel. Prior to Amendment 84 there was no enforcement monitoring by Sea State and enforcement was left to the individual cooperatives. The Vessel Monitoring System (VMS) is the main tool for monitoring and enforcement. There are VMS requirements and fines for not complying. See section 5.f of the revised ICA for a more detailed description of the RHS ICA monitoring considerations.

Penalties for savings closure violations are placed in a bank account designed for holding funds which are then used to fund research at the discretion of the cooperatives. Penalty money collected under the agreement is intended to be used in salmon stock identification research.

2.1.1.6 Annual Performance Review

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

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

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

2.1.2 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 established two Chinook salmon PSC limits (60,000 Chinook salmon and 47,591 Chinook salmon) for the Bering Sea pollock fishery. For each PSC limit, NMFS issues A season and B season Chinook salmon PSC allocations to the catcher/ processor sector, the mothership sector, the inshore cooperatives, and the CDQ groups. When a PSC allocation is reached, the affected sector, inshore cooperative, or CDQ group is required to stop fishing for pollock for the remainder of the season even if its pollock allocation had not been fully harvested.

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

The IPA component is an innovative approach for fishery participants to design industry agreements with incentives for each vessel to avoid Chinook salmon bycatch at all times and thus reduce bycatch below the PSC limits. To ensure participants develop effective IPAs, the final rule required that participants submit annual reports to the Council that evaluate whether the IPA is effective at providing incentives for vessels to avoid Chinook salmon at all times while fishing for pollock. The sector-level performance standard ensures that the IPA is effective and that sectors cannot fully harvest the Chinook salmon PSC allocations under the 60,000 Chinook salmon PSC limit in most years. Each year, each sector is issued an annual threshold amount that represents that sector's portion of 47,591 Chinook salmon. For a sector to continue to receive Chinook salmon PSC allocations under the 60,000 Chinook salmon PSC limit, that sector must not exceed its annual threshold amount three times within 7 consecutive years. Under the current program, if a sector fails this performance standard, it will continue to 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.

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

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

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

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

Since the entities involved in the Chinook salmon PSC allocations are impacted by the current non-Chinook salmon actions a brief description is provided below. Further details of the Chinook salmon allocations are found in the Final Bering Sea Chinook Salmon Bycatch Management EIS/RIR.[3]

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

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

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

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

While monitoring and enforcement provisions were put in place specifically to account for Chinook salmon, the methods are also applied to non-Chinook salmon. The monitoring of bycatch of all species of salmon is accomplished through: (1) requirements for 100 percent observer coverage for all vessels and processing plants; (2) salmon retention requirements; (3) specific areas to store and count all salmon, regardless of species; (4) video monitoring on at-sea processors; and (5) electronic reporting of salmon by species by haul (for catcher/processors) or delivery (for motherships and shoreside processors). Full retention of all salmon regardless of species is required because it is difficult to differentiate Chinook salmon from other species of salmon without direct identification by the observer. Therefore, although the monitoring was put into place to account for Chinook salmon, all species of salmon are counted using the same methods. Further details about the monitoring provisions implemented under Amendment 91 can be found in the Final Bering Sea Chinook Salmon Bycatch Management EIS/RIR.[4] 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 2.6.

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

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

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.

2.1.2.1 Details of the Chinook Incentive Plan Agreements (IPAs) implemented in 2011-2014

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 Chinook cap since 2011.
There are three IPA agreements currently in place:

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

As well as generally adhering to the requirements of Amendment 91, the three agreements share a number of characteristics. The inshore and mothership sector are both based on the same general 'Salmon savings incentive plan' (SSIP) model, so they share additional features. Below the common features of the three plans are listed, then the features common to the mothership and inshore plans are described, and finally important specific features of each plan are noted.[5]

Features common to all current IPAs

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

- The Fixed A-Season Chinook Salmon Conservation Area (CSCA) continues from the closure first imposed in 2008.
- A rolling hotspot (RHS) program exists for each sector, although details vary. Closures are imposed in "core areas" where bycatch has traditionally occurred to avoid closing areas that are actually low-bycatch relative to historically fished areas. This feature is designed to avoid closing areas that the fleet may move to in order to avoid higher-bycatch areas.
- Large fees apply for any fishing violations inside of the RHS closure boundaries.
- The base rate of the RHS programs is 0.035 Chinook/MT pollock, though this adjusts during each season.
- VMS and observer data sharing are both required
- A small "buffer" is 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 bycatch years, subject to the 60,000 Chinook overall limit.

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

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

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

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

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

- 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.

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

- Three areas in the B season form the "Chinook conservation area" are closed from October 15-31 if the Chinook base rate is above 0.015 Chinook/MT for September.
- There is full transferability within the sector, without transfer fees.

- There is the need and ability to decide collectively whether or not to exceed the sector's share of 47,591 for 2 of 7 years.
- There are limits on the size and number of RHS closures.
    - 500 sq mile & 2 areas W of 168W
    - 2 areas E of 168W
    - Max 4 areas total, 1500 sq miles total.
- RHS closures put in place for 1-week at the vessel's level compared to the base rate. Under some conditions, closures can be imposed on some vessels with a high aggregate bycatch rate for a second week.

2.1.2.2 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 salmons 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.

2.2 Alternative 2 Move chum salmon PSC management into IPAs

Alternative 2 would remove BSAI Am 84 regulations and incorporate chum salmon avoidance into the Amendment 91 Incentive Plan Agreements. Regulations at 50 CFR 679.21(c)(13) would be revised to include associated reporting requirements for chum salmon. Regulations at 50 CFR 679.21(c)(12)(iii)(B)(3) would be revised to include chum salmon bycatch avoidance. Draft regulations to revise § 679.21(c)(12)(iii)(B)(3) are proposed as follows (underline shows additions from current regulations while strike-outs would be omitted):

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

(i) The incentive(s) that will be implemented under the IPA for the operator of each vessel participating in the IPA to avoid Chinook salmon <u>and chum salmon</u> bycatch under any condition of pollock and Chinook salmon abundance in all years;

<u>(ii) The incentive(s) to avoid chum salmon should not increase Chinook salmon bycatch;</u>

(iii) The rewards for avoiding Chinook salmon, penalties for failure to avoid Chinook salmon at the vessel level, or both;

(iv) How the incentive measures in the IPA are expected to promote reductions in a vessel's Chinook salmon <u>and chum salmon</u> bycatch rates relative to what would have occurred in absence of the incentive program;

(v) 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
(vi) 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

(vii) 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.

Alternative 2 addresses only chum salmon provisions (note that it may be combined or selected in conjunction with any of the other action alternatives). Under this alternative all regulatory provisions of Am 84 would be removed as would the CSSA. Chum salmon would be managed solely under the IPAs, similar to Chinook salmon. Additional reporting requirements (drafted in the analysis by staff) would be required to address the goals and objectives in the IPA provisions related to chum. No additional chum bycatch measures would be in regulation or under the FMP.

2.3 Alternative 3 Additional IPA provisions

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.

Option 4. Salmon savings credits last for a maximum of three years for savings credit based IPAs.

Option 5. Restrictions or performance criteria used to ensure that Chinook salmon PSC bycatch 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 have provisions to address outlier vessels with significantly higher rates than other vessels fishing at the same time. A fishery-wide PSC data-sharing agreement would be done through SeaState similar to the manner in which all chum salmon PSC data is 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.

Option 3 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 2.1.2.1 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.

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 2.1.2.1 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 of 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

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].

Under Alternative 4 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.

2.5 Alternative 5 Lower performance standard indexed to years of low Chinook abundance

Alternative 5 would lower the existing performance standard under the Chinook Salmon Bycatch Management Program (Amendment 91) in years of low Chinook abundance. In years where an index of river systems has not met a specified threshold for run size (data provided by ADFG annually), the performance standard annual threshold amount would be reduced per the options and sub-options below. The threshold determination would be made based on either one year of compiled run-size data or an average of two years run size data[6]. Under Alternative 5, the overall PSC limit remains the same (60,000) as do all other provisions of Am 91 (including the opt-out cap for not participating in an IPA). As with status quo, sectors that exceed the applicable performance standard, in 3 out of 7 years, would be held to their proportion of the 47,591 PSC limit every year thereafter.

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

Suboption: Apply the reduction [25% or 60%] to the B season portion of the performance standard only.

Table 3 Seasonal and annual PSC limits resulting from application of Alternative 5 options and suboptions in comparison to the Status quo PSC limits

Sector Allocations of Chinook Salmon for Amendment 91 (status quo)

		Total annual PSC limit	Total A Season	Total B Season	Inshore A Season	Inshore B Season	MS A Season	MS B Season	C/P A Season	C/P B Season	CDQ A Season	CDQ B Season
			70.0%	30.0%	49.8%	69.3%	8.0%	7.3%	32.9%	17.9%	9.3%	5.5%
		60,000	42,000	18,000	20,916	12,474	3,360	1,314	13,818	3,222	3,906	990
		47,591	33,314	14,277	16,590	9,894	2,665	1,042	10,960	2,556	3,098	785
25%	Option 1	35,693	24,985	10,708	12,443	7,421	1,999	782	8,220	1,917	2,324	589
60%	Option 2	19,036	13,325	5,711	6,636	3,958	1,066	417	4,384	1,022	1,239	314

B Season Only Alternatives

		Total annual PSC limit	Total A Season	Total B Season	Inshore A Season	Inshore B Season	MS A Season	MS B Season	C/P A Season	C/P B Season	CDQ A Season	CDQ B Season
25%	Suboption 1	44,022	33,314	10,708	16,590	7,421	2,665	782	10,960	1,917	3,098	589
60%	Suboption 2	39,025	33,314	5,711	16,590	3,958	2,665	417	10,960	1,022	3,098	314

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 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 the portion of the adjusted annual threshold amount that sectors would receive following the determination of a 'low Chinook abundance' year. In those years the performance standard modification would be included in the annual specifications process as outlined below.

[6] Options per Council's motion in June to consider either one year or an average of two. Note that the Council would need to specific which of these options for time frame of data consideration would be used should this alternative be selected.

For the reasons described below, ADF&G will use preliminary run size estimates for the index under Alternative 5. These run size estimates will be made available to NMFS by ADF&G in October, ideally in time to coincide with the Council's October meeting where preliminary groundfish harvest specifications (including PSC limits) are set. ADF&G would provide a written notification to NMFS, which will inform the Council and the public of the combined preliminary 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 will then publish a proposed rule for the preliminary groundfish harvest specifications in the BSAI including the adjusted Chinook PSC annual threshold amount resulting from the determination of stock status. The annual threshold amount 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 4). One potential complication might be the relative deadline for notification to NMFS of the combined run size data and the timeline for submission of IPAs to NMFS for approval (both are October 1). For example in the instance of a 'low threshold year' and the resulting lower performance threshold in annual harvest specifications, IPAs may choose to modify which proposal they submit to NMFS in those years. Adjustments to the performance standard would be included in proposed and final harvest specifications in low threshold years. However because the final specifications are not usually effective until February or March, NMFS would need to issue an inseason adjustment 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 which meet or exceed the threshold as PSC limits are included in regulation.

Table 4 Proposed timeline for harvest specifications process and determination of 'low Chinook threshold'.

Date	Action
October 1	Written notification to NMFS from ADFG indicating compiled data on preliminary run size estimates and whether the data indicate a low abundance threshold year
October 1	Proposed IPAs submitted to NMFS
October Council meeting	Proposed harvest specifications including adjusted performance standard in low threshold years (Council/NMFS)
December 1	Amendments to IPAs (vessels included, etc.) submitted to NMFS
December Council meeting	Final harvest specifications including adjusted performance standard in low threshold years

An index of the combined run sizes of the Unalakleet, Upper Yukon, and Kuskokwim inriver run reconstructions are proposed for use in determination of 'low abundance" ('3 System Index') under Alternative 5. Low abundance is to be defined as an annual combined 3 system run size of ≤250,000 Chinook salmon. Note that this index and threshold differ from the Council's June 2014 motion. After the June Council meeting, ADF&G scientists evaluated the index in the motion and other alternative indices to propose an approach using the best available scientific information to meet several inherent objectives, and provided the new index to staff for inclusion in the analysis and Council consideration. In order to move forward with the 3 System Index as proposed, **the Council would need to replace its current Alternative 5 wording with the 3 System Index at Initial Review.**

The June 2014 language for the Alternative 5 index adopted by the Council was the following:

> *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].*

This wording from the Council for Alternative 5 relates a lower performance cap 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 1). A natural break in these data occurs at annual run sizes of approximately 500,000 CWAK Chinook salmon, which is the threshold for low abundance in the June Council motion. Years where total run size (inriver 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.

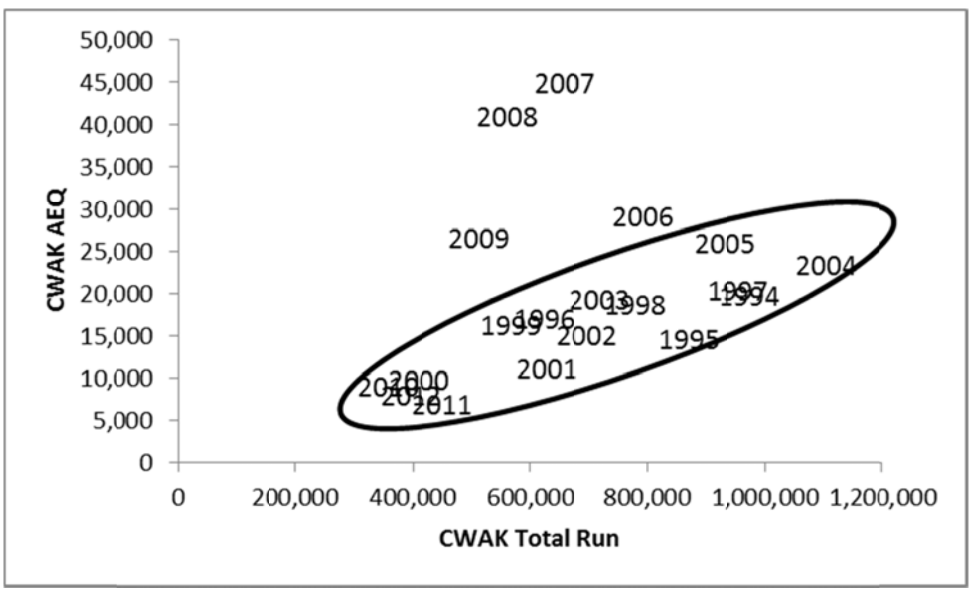

Figure 5 Relationship between the CWAK total run index estimate and bycatch AEQ for the CWAK reporting group. Those years showing a linear trend and not considered outliers are included in the ellipse ($Y=0.0227x$, $R^2 = 0.6739$).

The CWAK total run index estimate was developed specifically for the purpose of the 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. Moreover, the availability of reconstructed total run data for <u>all</u> CWAK stocks that contribute to this grouping on an annual basis is later than for those stocks for which regular inriver run reconstructions are annually produced, which could delay any abundance-based management action in the BS pollock fishery. This could put intended management measures out-of-step with trends in Chinook salmon run abundance in Western Alaska.

ADF&G fisheries scientists reviewed several alternatives to the CWAK index specified in the current Council motion, and evaluated each with respect to the following objectives: (1) data quality, (2) data transparency and accessibility to stakeholders, (3) timeliness of estimates to be used for federal regulatory processes, (4) broad regional representation of stocks, (5) likelihood that necessary data to develop run reconstructions will continue to be collected by the department on an annual basis (i.e. data are of high management importance to the department), and (6) robustness of approach to accurately classify "low" or "not low" Western Alaska Chinook salmon run abundance.

Through this evaluation it became apparent that the use of index stocks for which inriver run reconstructions are already produced on an annual basis would best satisfy these objectives. Inriver run reconstructions represent an estimate of all fish harvested in the river and respective coastal areas plus escapement; they do not include AEQ. 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. Four systems in Western Alaska have inriver Chinook salmon run reconstructions that are produced and made available to the public on an annual basis: Unalakleet River in Norton Sound, the Upper Yukon River, Kuskokwim River and Nushagak River. An index of the combined run sizes of these four systems (Unalakleet, Upper Yukon, Kuskokwim and Nushagak) demonstrates the same positive relationship to AEQ as is seen with the total CWAK run reconstruction. However, further analysis suggests that inclusion of the Nushagak River in the index is highly influential and while similar trends have been realized in the Nushagak River compared to the other systems, 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 against the AEQ (1994 – 2013), however, the same years meet a 'low' designation under either the 3 system index or a four system index in which the Nushagak is included. Based on analyses related to the six objectives above, analysts recommend a '3 System Index' composed of Unalakleet, Upper Yukon, and Kuskokwim River inriver run reconstructions, with low abundance defined as an annual run size of ≤250,000 Chinook salmon.

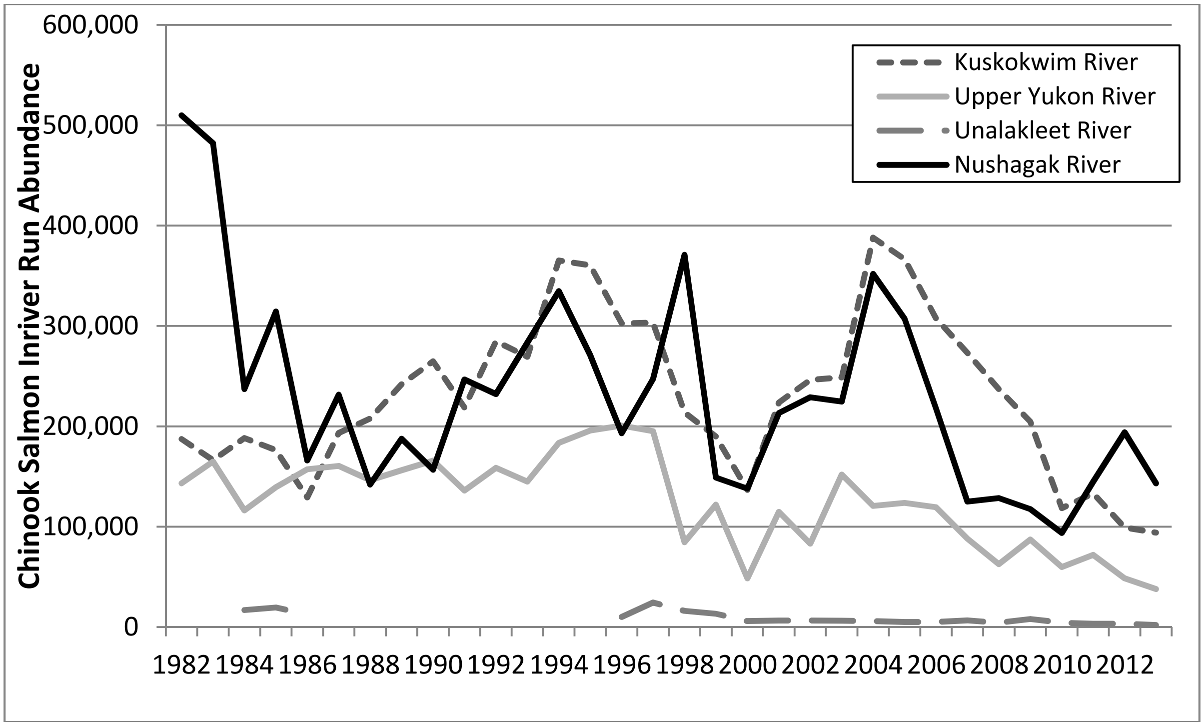

Figure 6 Inriver run abundance for Chinook salmon for Nushagak, Kuskokwim, Upper Yukon, and Unalakleet rivers. In 1982, 1983, 1998, 2012, 2013 the inriver run abundance for Nushagak River exceeds the combined run abundances of the other systems, increasing the likelihood that Nushagak River would be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

For the 3 System Index, 2006-2009 are viewed as outliers, similar to the CWAK index (Figure 1) and every other index that was evaluated, with a natural break for years of less than 250,000 index run size (Figure 3, Table 1). **The years clustering below the break are the same years (2000 and 2010-2012) as those in the CWAK index. 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. Coincidently, this reference point of 250,0000 Chinook salmon is also the combined number of Chinook salmon necessary for these three systems to meet the midpoint of escapement goals and midpoint of subsistence harvest needs. Note that 2013 and 2014 data are not shown in the figure below because AEQ has not yet been estimated for that year; however, 2013 and 2014 would also fall below the proposed threshold to designate a 'low' run abundance year (see Table 1 for data through 2013).**

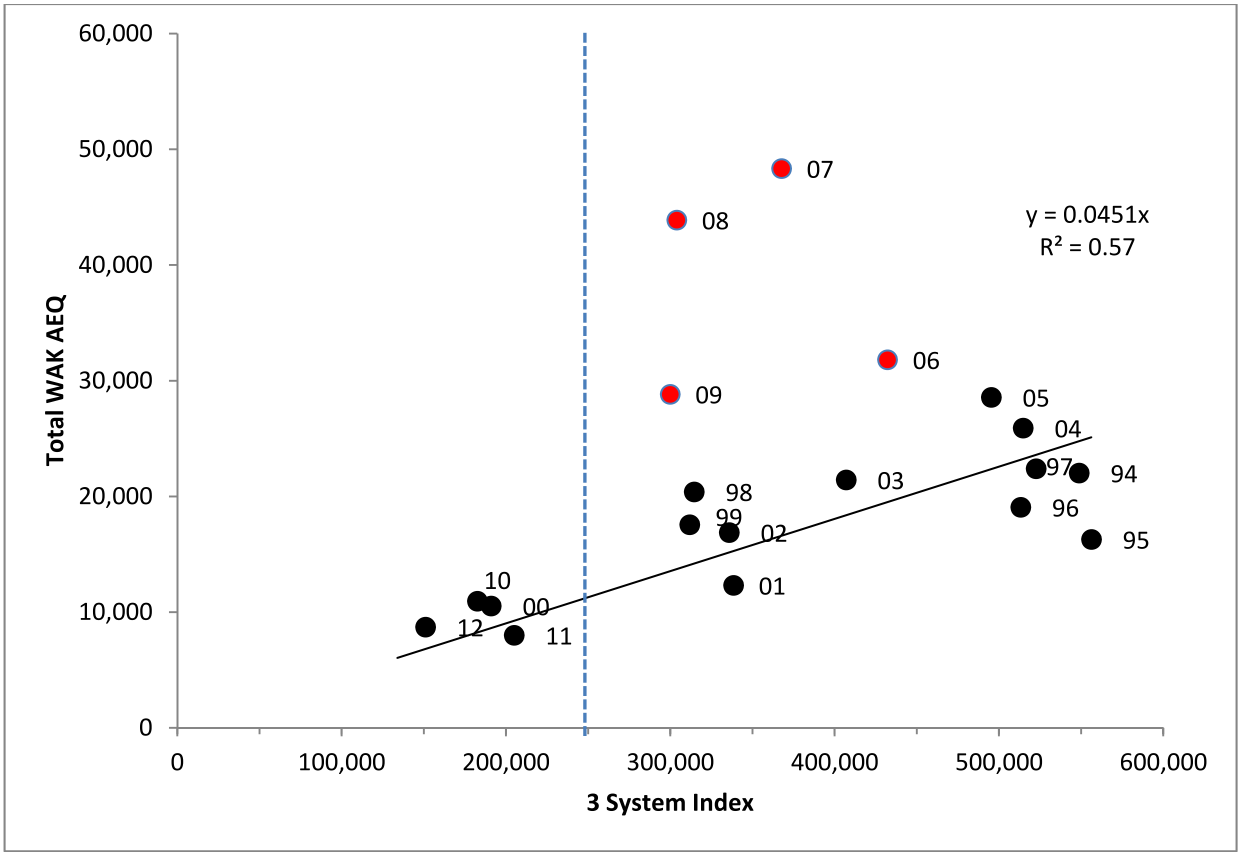

Figure 7 Relationship between inriver run abundance of the 3 System Inriver Run Index and the bycatch AEQ attributed to all Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon). The 250,000 Chinook salmon reference point is indicated by the vertical line.

Although the 3 System Index meets objectives 1, 2, 4, and 5, the timeliness of *finalized* run reconstructions (objective 3) 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), with sufficient time to be included in the harvest specifications process and potentially trigger a change in the performance cap in the following year (2016). In effect, potential action to change the performance cap would not occur until the second year following a particular Chinook salmon season. The preference would be to implement action as close as possible to realized abundance trends.

The timeliness of the index for federal fishery management could be improved by using *preliminary* run size estimates for the 3 System Index, which are available in September/October of the same year, immediately following the salmon season. For the 2014 example, our preliminary run size estimate for the 3 System Index is 212,750 as of October 1, 2014, which clearly indicates a low Western Alaska Chinook salmon abundance. Consequently, the timeliness of this information could allow for a change in the performance cap for the subsequent groundfish fishing season (2015). In preliminary run size estimates, escapement and any commercial and recreational harvest is available and known, but subsistence harvest survey data are not yet available and must be estimated by ADF&G. Thus, the difference between preliminary 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 documented in escapement, preliminary estimates are a very good surrogate for finalized run estimates (Table 1, Figures 4 and 5).

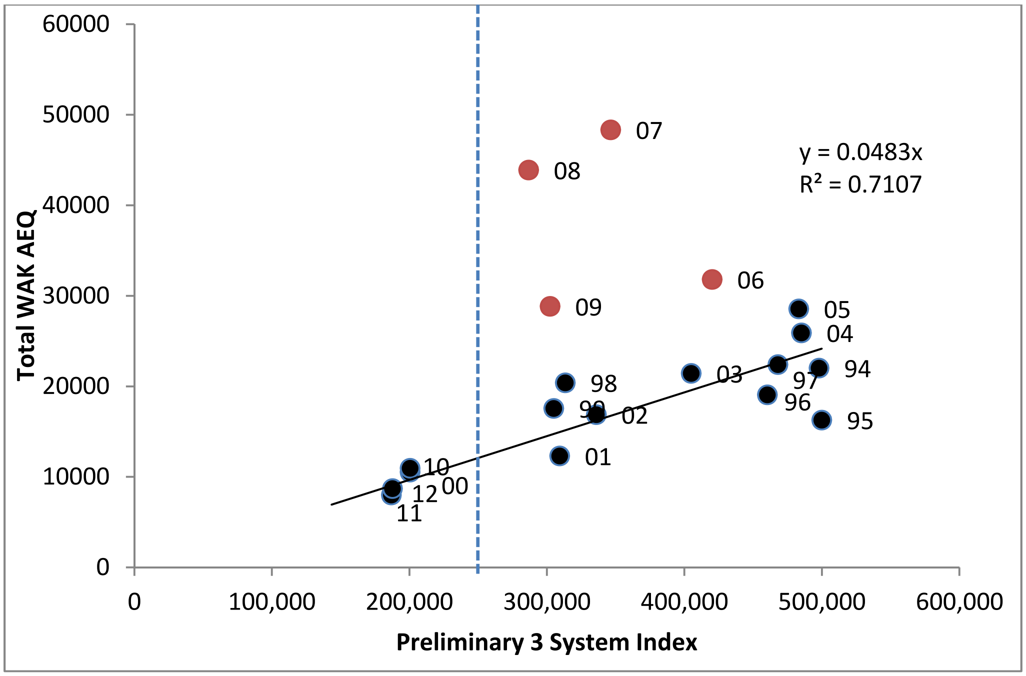

Figure 8 Relationship between preliminary inriver run abundance of the 3 System Index and the bycatch AEQ attributed to all Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon). The 250,000 Chinook salmon reference point is indicated by the vertical line.

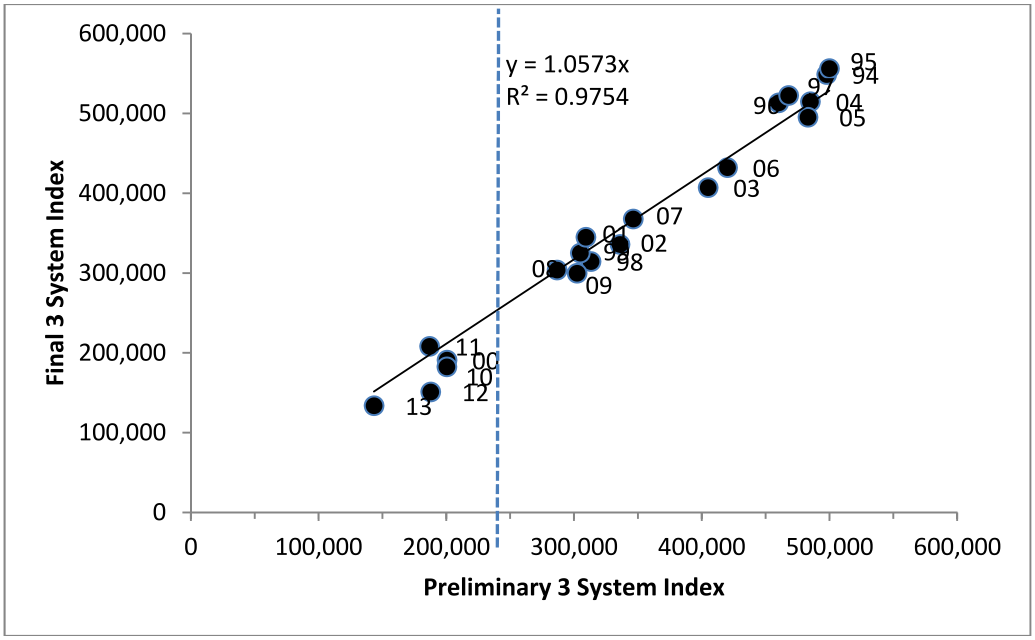

Figure 9 Relationship of preliminary 3 System Index and final 3 System Index. The 250,000 Chinook salmon reference point is indicated by the vertical line.

ADF&G staff assessed the robustness of preliminary estimates of the 3 System Index as an indicator of low Chinook salmon abundance (objective 6). Within the historical timeframe used for these analyses, there are no years in which an aggregate preliminary inriver 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 1). in It should be noted that the preliminary run index tends to slightly overestimate abundance in low run abundance years and therefore reduces the risk of a lower performance cap being triggered which would not be supported by the final inriver run index.

The sensitivity of "low" or "not low" run abundance categorization of the preliminary 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 preliminary 3 System Index appears to be robust to false positives and false negatives (Table 2).

Note that using the 3 System Index also provides more transparency (objective 2) than the CWAK index described in the current June motion and includes a broad regional representation of stocks in western Alaska (objective 4). Stakeholders can access the finalized data, as well as descriptions of run reconstruction methodology in the publications produced by the department annually, and available through the ADF&G and/or Yukon River Panel websites:

Kuskokwim River will be 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

Upper Yukon River is available in annual Joint Technical Committee to the Yukon River Panel Reports, an example:
http://yukonriverpanel.com/salmon/wp-content/uploads/2009/03/rir3a201302.pdf

Unalakleet River is currently published in the triennial Board of Fisheries 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 preliminary run index, can be accessed and monitored throughout the salmon season through a variety of outlets, including the ADF&G website.

Table 5 Preliminary and final individual run reconstruction estimates for Unalakleet, Upper Yukon, and Kuskokwim rivers, and inriver run index from the aggregate. Shaded cells are those years that would fall below a 250,000 Chinook salmon threshold.

	PRELIMINARY 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 6 Sensitivity of the preliminary inriver 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.

	PRELIMINARY INRIVER RUN ESTIMATE				PRELIMINARY INRIVER RUN ESTIMATE ASSUMING NO HARVEST IN RESTRICTED YEARS (ZERO SUBSISTENCE HARVEST)				PRELIMINARY 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

2.6 Improvements to Monitoring and Enforcement Provisions under all Alternatives

Amendment 91 monitoring measures have been in place since January 2011. These monitoring requirements are designed to provide a full census of salmon bycatch in the BS pollock fishery under Amendment 91. Generally, NMFS has noted good compliance with the monitoring requirements. Observer Program, Sustainable Fisheries, and NOAA OLE staff have worked closely with industry during the program implementation to provide outreach and support to ensure understanding and compliance with the monitoring requirements. NMFS has identified the following five issues that may result in changes to the monitoring regulations implemented under Amendment 91.

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 have been a historic and ongoing practice in the pollock fishery. NMFS began monitoring the occurrences of deliveries accompanied by a deckload in 2011. Twenty-eight percent of AFA Pollock deliveries in 2012 were accompanied by a deckload, of those four percent of deliveries included an amount of loose catch on the deck of the vessel. NMFS has continued to monitor deckload deliveries in 2013 and 2014 and has continued to document deliveries accompanied by uncontained or loose catch. Loose catch on deck which is not contained inside a codend 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. This is a significant concern and this practice is expected to continue under any of the alternatives.

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, catcher vessel deliveries have continued to arrive at the processors with large amounts of catch outside of a codend, and loose on deck.

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, this option may exacerbate pollock discard and wholesale dumping of unsorted codends which may contain salmon. Additionally, it would likely be unworkable for some in industry. Finally, if deckloads were prohibited, some vessel operators may have difficulty predicting when the last haul exceeds RSW storage capacity. 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 for all catcher vessels in the BS pollock fishery to retain all salmon and deliver it to the processor receiving the vessel's pollock catch.
- Remove the requirement that all salmon be stored in an RSW tank.
- Require that after the observer has completed sampling and data collection, all salmon and any other catch retained onboard the vessel must be made unavailable for sorting or discard. At this time, NMFS is not proposing to specify exactly how catch is made unavailable for sorting. Catch could be stored in a variety of secure locations, according to each vessel's design and available spaces. Examples of these locations are an enclosed hold like an RSW tank or a live tank, or in a codend on deck.
- No loose fish would be allowed to remain on deck after the completion of observer sampling.
- Require that the observer onboard the vessel be notified and provided the opportunity to monitor the handling, sorting, or discard of catch prior to delivery of catch to the processor.

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.

2. ATLAS Software aboard less than 125 ft AFA Catcher Vessels

Currently, all catcher vessels (CVs) greater than 125 feet length overall (LOA), catcher processors, and all shoreside and stationary floating 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. NMFS installs custom software that is used by the observers on each of these computers, called ATLAS. Together the hardware and software allow observers to communicate with, and transmit data to NMFS. In the AFA shoreside pollock fleet about 26 of the 87 CVs 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 feet 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 feet 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 there to be data modifications during this "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 their data is increased. Also, data that is transmitted electronically arrives in a more timely manner to managers. If data is 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 notify staff of potential compliance concerns. In these cases, NMFS 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 feet 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 feet 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 inseason 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 inseason 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 length overall (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.

3. View of Salmon in Storage Container

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

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

Currently no regulations exist that require all salmon to be removed from the observer sampling area and the salmon storage location after the observer has completed their sampling and counting duties at the end of each haul or delivery for catcher processors or shoreside processing facilities. In order to avoid any confusion about which haul or delivery to attribute the salmon and to avoid double counting of salmon, the agency assumed the vessels and plants would remove the salmon from the observer's area and the storage container as soon as the observer had completed their salmon counting and sampling duties. However, NMFS received a challenge to this assumption from an industry participant. Therefore, NMFS proposes to add a new sentence to regulations at § 679.21(c)(2)(iii)(F) that would require shoreside processors or stationary floating processors to remove all salmon from the salmon storage container and adjacent area after the observer has completed his or her data collection duties.

5. Corrections to Table 47c, 50 CFR part 679

Table 47c to part 679 shows the percent of the AFA inshore sector's pollock allocation, numbers of Chinook salmon used to calculate the opt-out allocation and annual threshold amount, and percent used to calculate IPA minimum participation assigned to each catcher vessel under § 679.21(f). Since Table 47c was published in August 2010, catcher vessels have changed names and consolidated pollock allocations and Chinook salmon PSC limit. 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. Table 47c was revised to show the original and revised changes and published on the AK Region's website at http://alaskafisheries.noaa.gov/rr/tables/tabl47c_2014.pdf. However, a regulatory amendment is required to change Table 47c in the regulations.

2.7 Comparison of Alternatives

Table 7 provides an overview of the major similarities and differences amongst the alternatives while Table 8 provides a summary of the major potential benefits, key concerns and policy-level trade-offs amongst them.

Table 7 Summary of alternatives and major policy-level trade-offs

Alternative	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 to close Chum salmon savings area (area closed August 1-31 by regulation). However pollock fishery is exempt to this closure for participating 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 that meets requirements.	A season: January 20-June 9th B season: June 10-Nov 1
2	Same as Alt 1	None	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:** Open: -Jan 20th Close: -May 31st -June 9th **B season:** 1) open: -June 1 -June 10 2) close: -Sept 15th -Oct 1st -Oct 15th
5	Overall 60,000 limit and allocations same as Alt 1. Performance standard reduced: Option 1: 25% Option 2: 60% Suboptions for reduction to B season limit only (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 in applicable years	Same as Alt 1

Table 8 Summary major policy-level issues and trade-offs among alternatives.

Alternative	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. • Status Quo Chinook PSC management is effective at keeping bycatch well below limits but may not be best addressing objective to affect vessel behavior under conditions of low salmon encounters. Current program is not comprehensively managing both species under common goals and 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** • Some potential for reduced incentive to participate in IPA with removal of CSSA. This reduced incentive could increase if combined with other more stringent IPA requirements under other alternatives. • Potential for increased chum when RHS closures are lifted • Back-stop measure for managing chum bycatch is missing for opt-out participants in an IPA. • Assumes that Chinook IPA provides sufficient incentive to participate.
3	**Potential benefits** • Likely to provide incremental improvement in Chinook bycatch incentives over status quo, although larger potential penalties would provide stronger incentive of 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. **Key concerns** • Depending on IPA response to action, action likely to result in only minor changes relative to Alt 1. • Management measures are outside of regulation and it may be difficult to monitor incentives and effectiveness.
4	**Potential benefits** • Options to curtail season earlier would likely 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. **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.
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 can be justified. **Key concerns** • 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 constrain the pollock fishery. • Impacts differential by sector depending upon initial PSC allocation under Amendment 91. • Impacts will be contingent on how IPAs adapt to lower performance threshold in applicable years. Allocations to individual vessels under lowest performance standard may be too constraining and necessitate modification of the allocation formula within sectors.

2.8 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 hard caps, 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 requests 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 would determine whether to further pursue this potential 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 cap level when applied in this manner versus the identical cap level 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 cap limits. Preliminary analysis of this option indicated that under many cap levels 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 the current structure of the 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 cap structure, seasonal allocations and rollover provisions would be necessary to best structure the cap 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 on only the modifications to the IPA structure that would be accomplished within the IPA proposals themselves as alternatives for analysis.

3 Environmental Assessment

There are four required components for an environmental assessment. The need for the proposal is described in Section 1, and the alternatives in Section 2. This section (Section 3) addresses the probable environmental impacts of the proposed action and alternatives. A list of agencies and persons consulted is included in Section 6.

This section evaluates the impacts of the alternatives and options on the various environmental components. The socio-economic impacts of this action are described in detail in the Regulatory Impact Review (RIR) and Initial Regulatory Flexibility Analysis portions of this analysis.

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 Protection 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 3.6.

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 chapter.

Bering Sea Chinook Salmon Bycatch Management Final Environmental Impact Statement/Regulatory Impact Review. (NPFMC, NMFS 2009).

The Bering Sea Chinook Salmon Bycatch Management Final Environmental Impact Statement/Regulatory Impact Review (Chinook EIS/RIR) 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/.

Stock Assessment and Fishery Evaluation (SAFE) Report for the Groundfish Resources of the BSAI*(NPFMC 2013)*].

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.

Final Programmatic Supplemental Environmental Impact Statement (PSEIS) on the Alaska Groundfish Fisheries (NMFS 2004).

The PSEIS evaluates the Alaska groundfish fisheries management program as a whole, and includes analysis of alternative management strategies for the GOA and Bering Sea/Aleutian Islands (BSAI) groundfish fisheries. 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.

Analytical method

The approach to modify existing measures for Chinook and chum salmon PSC in the EBS pollock fishery is limited in scope and will not likely affect all environmental components of the Bering Sea. Table 9 summarizes the impact findings on potentially affected components: pollock, Chinook and chum salmon, other groundfish, marine mammals, and the ecosystem. The effects of the alternatives on the resource components would be caused by potential changes in the harvest of pollock, changes in bycatch of Chinook and chum salmon, incidental catch of groundfish, modified season length in the summer season. 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 revenue. The effects of the pollock fishery on habitat and seabirds 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. The affected resource components in relation to each alternative are discussed in detail below.

Table 9. Resources components potentially affected by the alternatives and impact summary.

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

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

3.1 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).

3.1.1 Effects of the Alternatives

The effects of the EBS pollock fishery on the pollock stock is assessed annually in the BSAI Groundfish SAFE report (e.g., Ianelli et al., 2013). 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 10 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 levels are projected to remain above the target biomass level through 2015. It is estimated that the EBS pollock fishery under the status quo is sustainable for pollock stocks.

Table 10 Criteria used to determine significance of effects on pollock.

Effect	Criteria			
	Significantly Negative	**Insignificant**	**Significantly Positive**	**Unknown**
Stock Biomass: potential for increasing and 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 standing stock 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 pollock stocks in the EBS. Presently the pollock stock is managed based on science covering a wide variety of facets including the capacity of the stock to yield sustainable biomass on a continuing basis. Catch levels are conservative managed; with total allowable catch (TAC) levels are set well below the Acceptable Biological Catch (ABC) levels with realized catch below the TAC annually (Table 11). 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 conditions during the A-season have suffered in recent years due to the low roe recovery observed from the 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, 2013).

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 themselves 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 nor significant fleet-wide spatial/temporal changes in fishing practices.

Alternative 4 would modify the season length in the summer B season by either opening or closing the fishery earlier (note these are not mutually exclusive). This could affect the spatial or temporal distribution of the pollock stock. 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 have would appear to result in catches of pollock that were considerably smaller in mean sizes-at-age. 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. 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 performance 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 threshold 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 performance standard would have been in place from 2011-2013. As discussed further in section 3.2.7.5, the fishery would have potentially been constrained 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 more 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. 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.

Table 11 Time series of 1964-1976 catch (left) and ABC, TAC, and catch for EBS pollock, 1977-2013 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
		2011	1,270,000	1,252,000	1,199,070
		2012	1,220,000	1,200,000	1,205,258
		2013	1,375,000	1,247,000	*1,265,781*
1977-2013 average			1,377,189	1,193,629	1,170,824

3.2 Chinook and chum salmon stocks

3.2.1 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.

3.2.2 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.

3.2.3 Western Alaska Chinook and chum salmon stock status

3.2.3.1 Status of Alaskan Chinook and chum salmon stocks

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.

3.2.3.2 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 (board) adopted the Sustainable Salmon Fisheries Policy (SSFP) for Alaska, codified in 5 AAC 39.222. The SSFP defines sustained yield to mean an average annual yield that results from a level of salmon escapement that can be maintained on a continuing basis; a wide range of average annual yield levels is sustainable and a wide range of annual escapement levels can produce sustained yields (5 AAC 39.222(f)(38)).

The SSFP contains five fundamental principles for sustainable salmon management, each with criteria that are used by ADF&G and the board to evaluate the health of the state's salmon fisheries and address any conservation issues and problems as they arise. These principles are (5 AAC 39.222(c)(1-5):

- Wild salmon populations and their habitats must be protected to maintain resource productivity;
- Fisheries shall be managed to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning;
- Effective salmon management systems should be established and applied to regulate human activities that affect salmon;
- Public support and involvement for sustained use and protection of salmon resources must be maintained;
- In the face of uncertainty, salmon stocks, fisheries, artificial propagation, and essential habitats must be managed conservatively.

This policy requires that ADF&G describe the extent salmon fisheries and their habitats conform to explicit principles and criteria. In response to these reports the board must review fishery management plans or create new ones. If a salmon stock concern is identified in the course of review, the management plan will contain measures, including needed research, habitat improvements, or new regulations, to address the concern.

A healthy salmon stock is defined as a stock of salmon that has annual runs typically of a size to meet escapement goals and a potential harvestable surplus to support optimum or maximum 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 12 and Table 13. 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 board cycle.

Table 12. Historical and current Chinook salmon stocks of concern in Alaska

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 13. Historical and current chum salmon stocks of concern in Alaska

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 Alaska Board of Fisheries 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 board of allocative implications associated with escapement goals.

The key definitions contained in the SSFP with regard to scientifically defensible escapement goals and resulting management actions are: biological escapement goal, optimal escapement goal, sustainable escapement goal, and sustained escapement threshold. Biological escapement goal (BEG) means the escapement that provides the greatest potential for maximum sustained yield. BEG will be the primary management objective for the escapement unless an optimal escapement or 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 board. The SEG will be developed from the best available biological information and should be scientifically defensible on the basis of that information. The SEG will be stated as a range (SEG Range) or a lower bound (Lower Bound SEG) that takes into account data uncertainty. The SEG will be determined by ADF&G and the department will seek to maintain escapements within the bounds of the SEG Range or above the level of a lower Bound SEG (5 AAC 39.222(f)(36)).

Sustained escapement threshold (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 board for salmon stocks of management or conservation concern (5 AAC 39.222(f)(39)).

Optimal escapement goal (OEG) means a specific management objective for salmon escapement that considers biological and allocative factors and may differ from the SEG or BEG. An OEG will be sustainable and may be expressed as a range with the lower bound above the level of SET (5 AAC 39.222(f)(25)).

The Policy for Statewide Salmon Escapement Goals is codified in 5 AAC 39.223. In this policy, the board recognizes ADF&G's responsibility to document existing salmon escapement goals; to establish BEGs, SEGs, and SETs; to prepare scientific analyses with supporting data for new escapement goals or to modify existing ones; and to notify the public of its actions. The Policy for Statewide Salmon Escapement Goals further requires that BEGs be established for salmon stocks for which the department can reliably enumerate escapement levels, as well as total annual returns. Biological escapement goals, therefore, require accurate knowledge of catch and escapement by age class. Given such measures taken by ADF&G, the board will take regulatory actions as may be necessary to address allocation issues arising from new or modified escapement goals and determine the appropriateness of establishing an OEG. In conjunction with the SSFP, this policy recognizes that the establishment of salmon escapement goals is the responsibility of both the board and ADF&G. 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 14, Table 15, Table 16, 4, and Section 10 (Appendix A-3).

3.2.3.3 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.

3.2.3.3.1 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 10). This was followed by declines in run abundance across the state from 2007 to present. This is consistent with a downward trend in productivity.

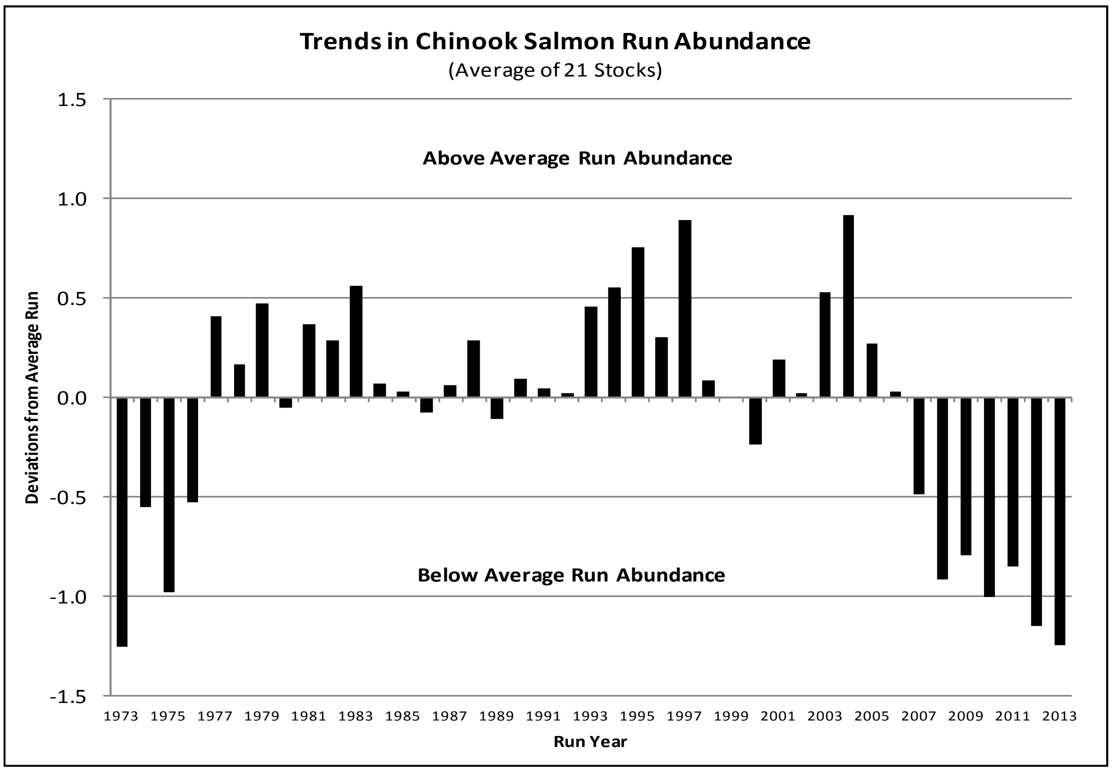

Figure 10 Average of standardized deviations from average run abundance for 21 stocks of Chinook salmon in Alaska (the Unalakleet, Nushagak, Goodnews and Kuskokwim in western Alaska; the Chena and Salcha on the Yukon River; the Canadian Yukon, the Chignik and Nelson on the Alaska Peninsula; the Karluk 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).

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 11). 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 12).

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).

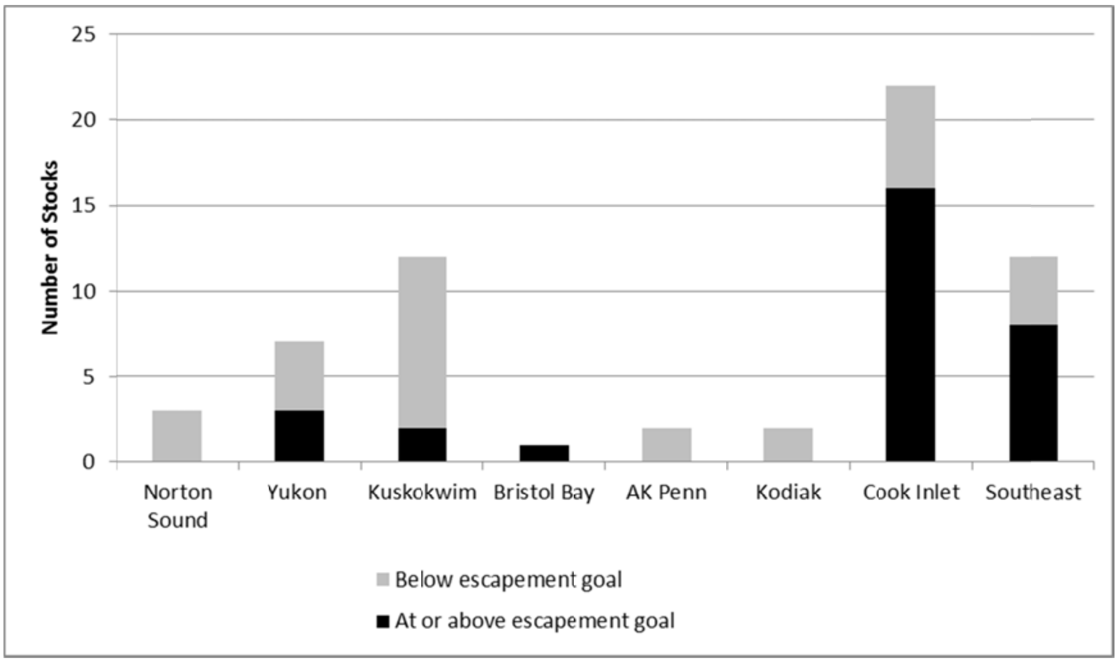

Figure 11 Number and status of monitored Chinook salmon stocks with escapement goals, 2013

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.

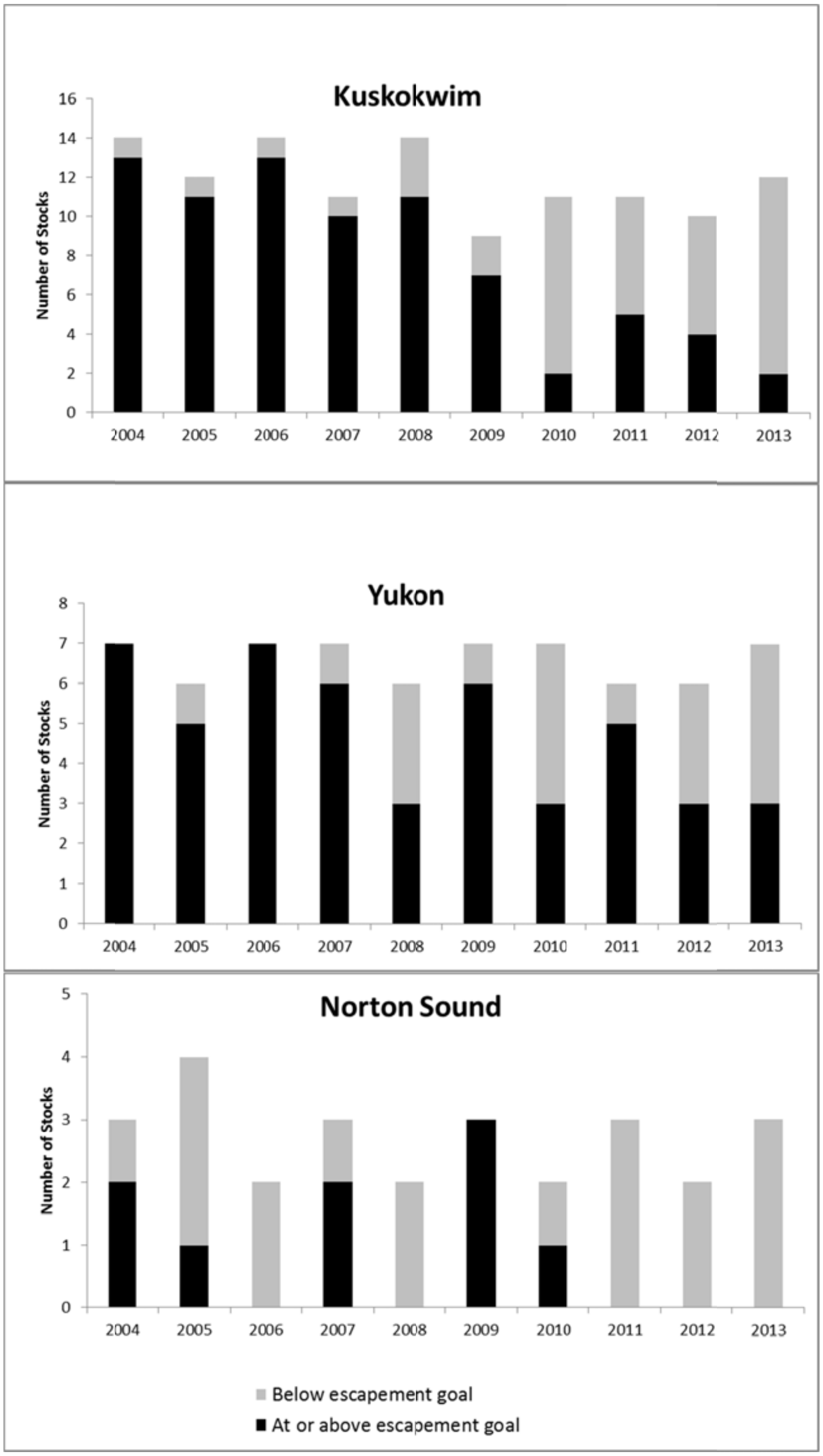

Figure 12 Number and status of monitored Chinook salmon stocks with escapement goals for the AYK Region (Kuskokwim, Yukon, and Norton Sound), 2004–2013

3.2.3.4 Chinook Salmon Management

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 14 for 2013 and Table 15 for 2014. A summary of Chinook salmon fishery management actions by region for 2011 to 2013 is presented in Section 10 (Appendix A-3).

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 3). 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 14. Overview of Alaskan Chinook salmon stock performance, 2013.

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 15 Overview of Alaskan Chinook salmon stock performance, 2014

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 management 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 (see 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 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.

3.2.3.5 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.

3.2.3.5.1 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 13 and Table 16). 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).

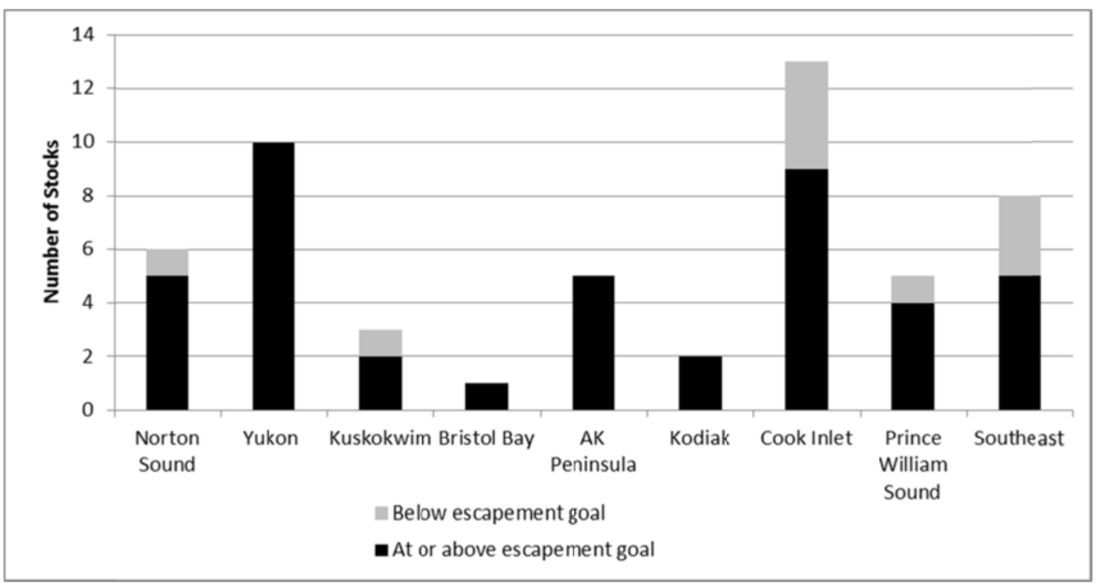

Figure 13 Number and status of monitored chum salmon stocks with escapement goals, 2013

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.

3.2.4 Chum Salmon Management

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 16). 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 Board of Fisheries adopted a proposal that opened the sport fishery for chum salmon in the Nome subdistrict with the exception of these two rivers.

Table 16 Statewide summary of chum salmon stock status, 2013

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.

3.2.5 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 2012 pollock fishery and are available at: http://legistar2.granicus.com/npfmc/meetings/2014/4/892_A_North_Pacific_Council_14-04-07_Meeting_Agenda.pdf. Genetic results are incorporated into the AEQ analysis of status quo and are discussed further under the analysis of alternatives.

3.2.6 Subsistence utilization of Alaska Chinook and chum salmon

3.2.6.1 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 3.2.5, 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 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. 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).

3.2.6.2 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).

3.2.6.3 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 BSAI Am 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).

3.2.6.4 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).

3.2.6.5 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).

3.2.6.6 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).

3.2.6.7 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).

3.2.6.8 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 17). 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 15).

Figure 16 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).

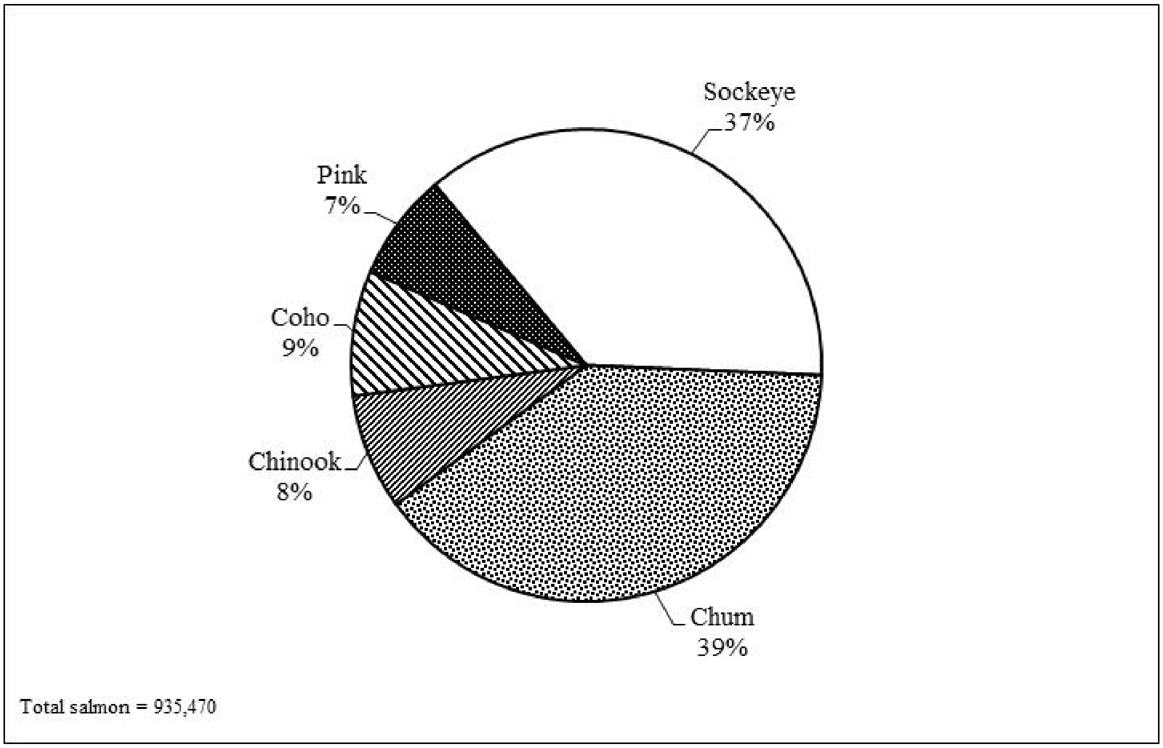

Figure 14   Alaska subsistence salmon harvest by species, 2012 (Source: Fall et al., 2014)

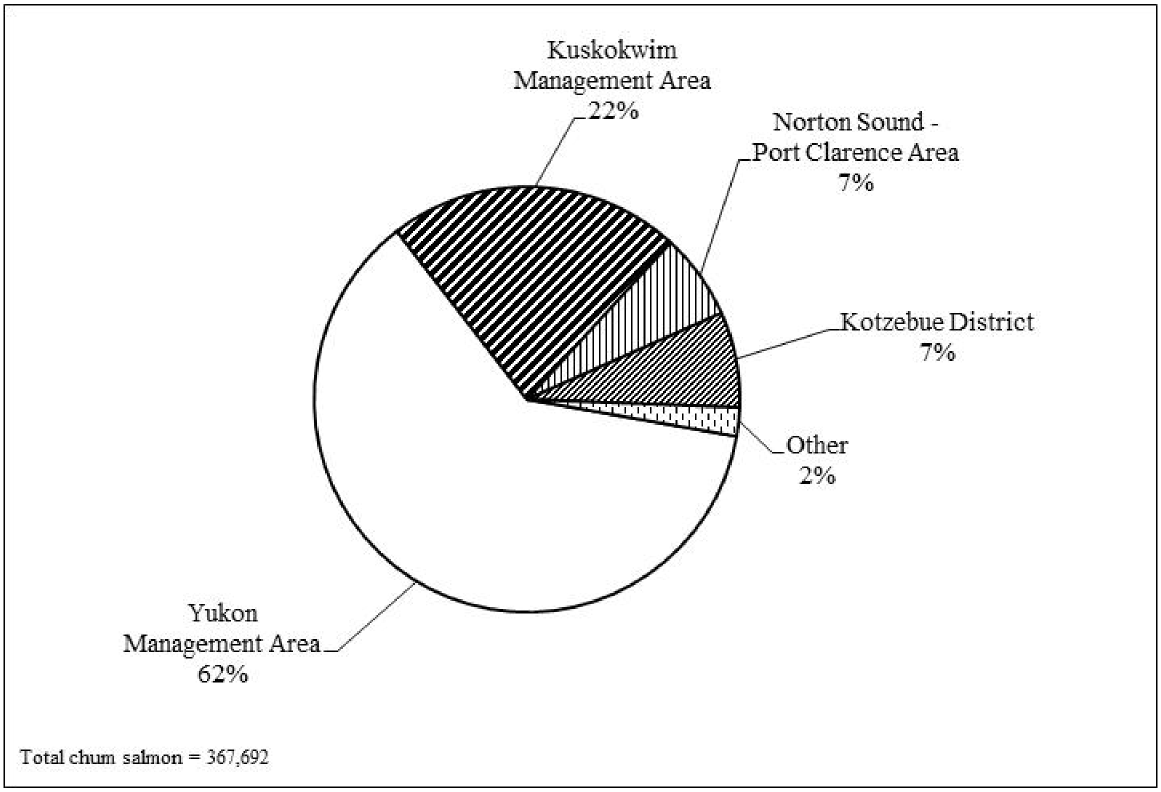

Figure 15 Subsistence chum salmon harvest by area, 2012 (Source: Fall et al., 2014).

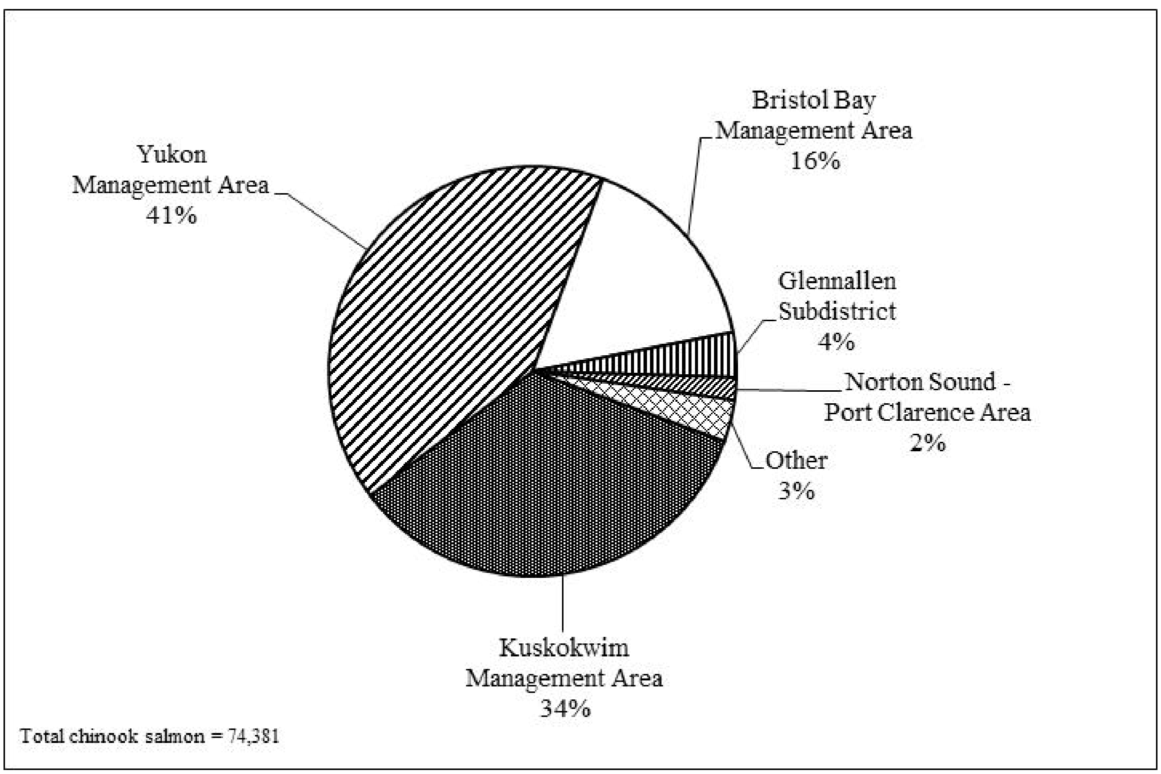

Figure 16 Estimated subsistence Chinook salmon harvest by area, 2012 (Source: Fall et al. 2014).

3.2.6.9 Overview of Regional Subsistence Harvests

Figure 17 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 3.2.3 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 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).

- 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).

3.2.6.10 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 17). 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 18). 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, inseason 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.

3.2.6.11 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 inriver 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 19). 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.

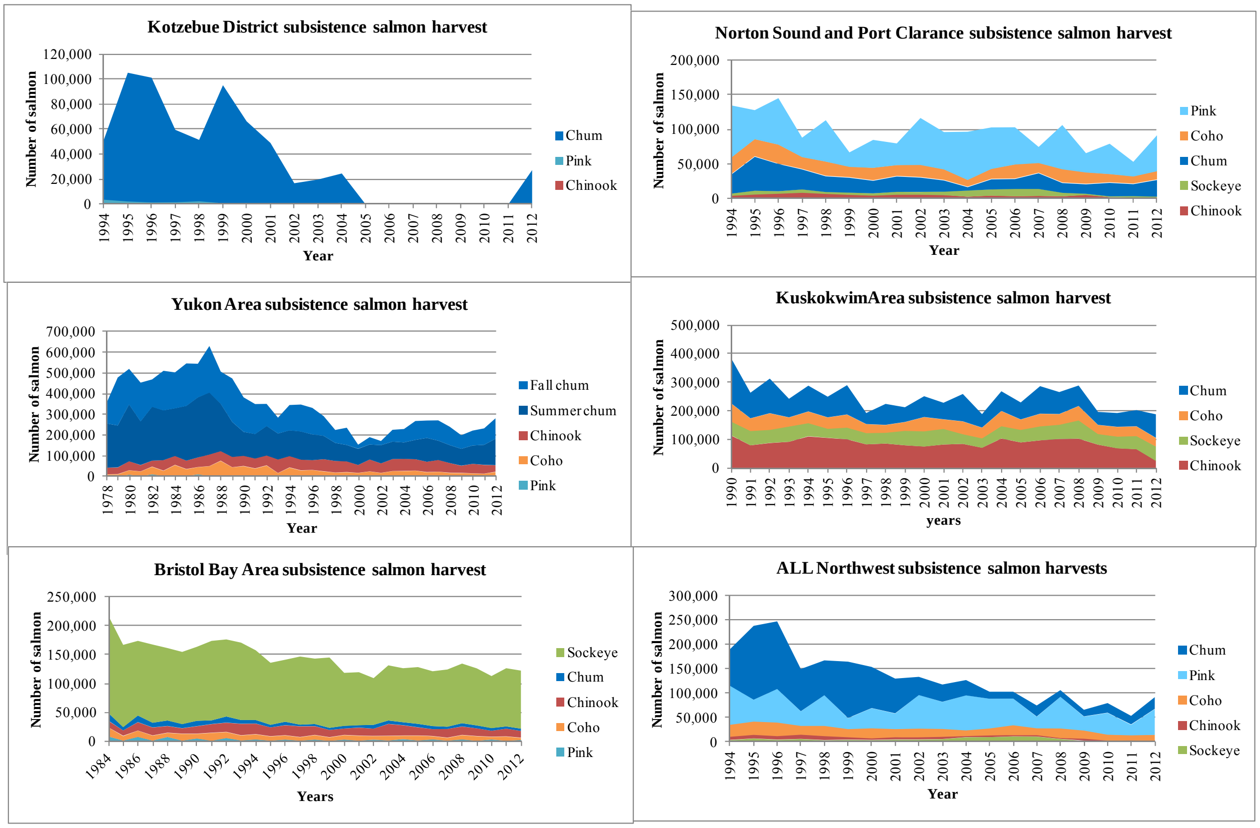

Figure 17 Estimated subsistence harvests of Chinook, chum, and other salmon, by key management areas (Source: Fall et al. 2014)

Table 17 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)

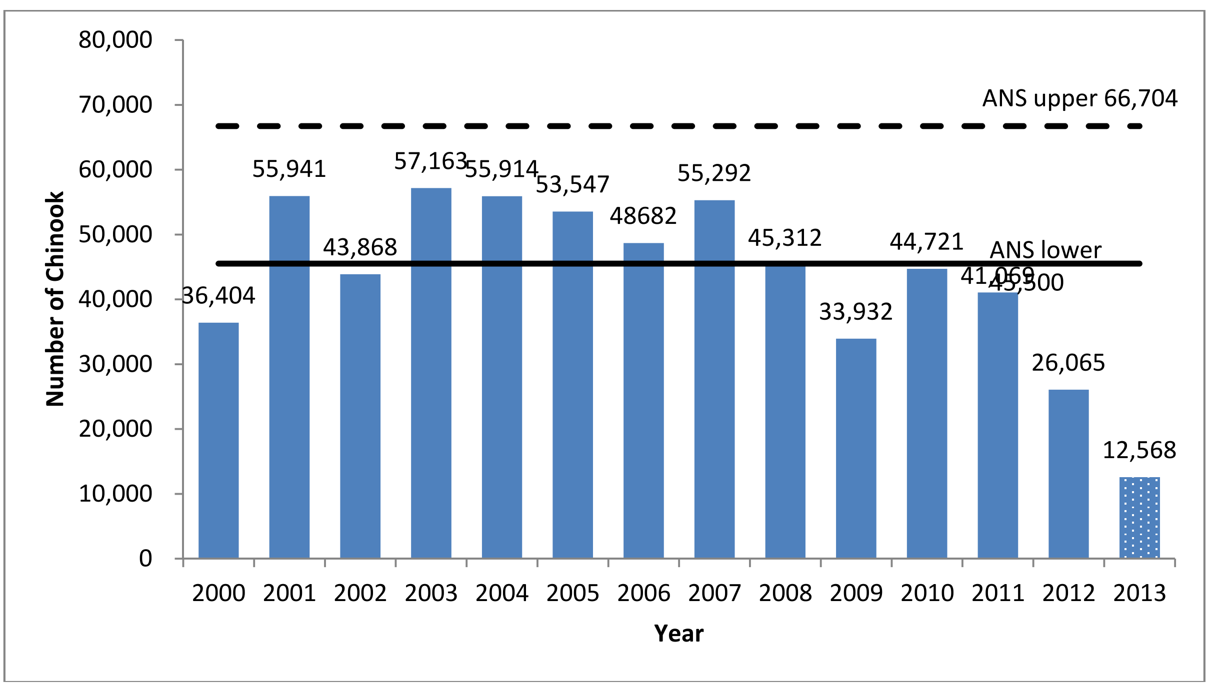

Figure 18 Yukon River Chinook salmon amounts necessary for subsistence (ANS) and estimated subsistence harvest, 2000–2013. Data for 2013 are preliminary.

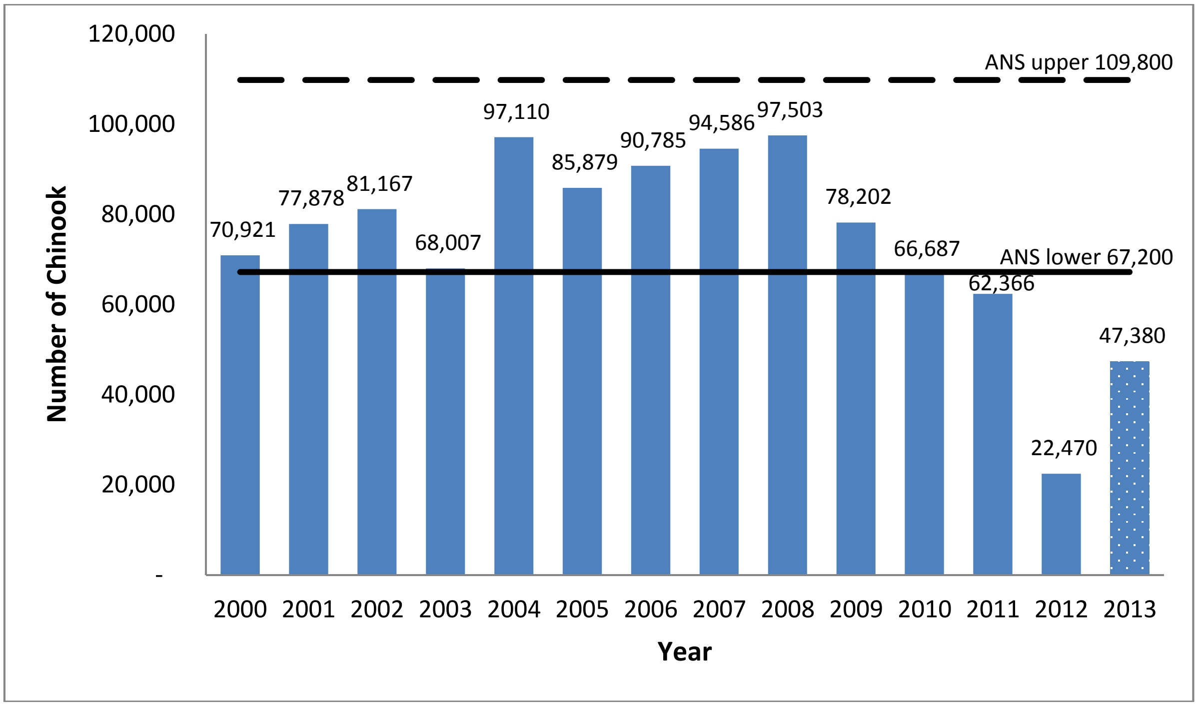

Figure 19 Kuskokwim River Chinook salmon amounts necessary for subsistence (ANS) and estimated subsistence harvest, 2000–2013. Data for 2013 are preliminary.

3.2.7 Effects of the Alternatives

Table 18 describes the criteria used to determine whether the impacts on Chinook and chum salmon stocks are likely to be significant.

Table 18 Criteria used to estimate the significance of impacts on incidental catch of Chinook and chum salmon.

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

3.2.7.1 Alternative 1

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 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 21 Figure 20). For Chinook salmon, the EBS 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 2004-2007. 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 >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).

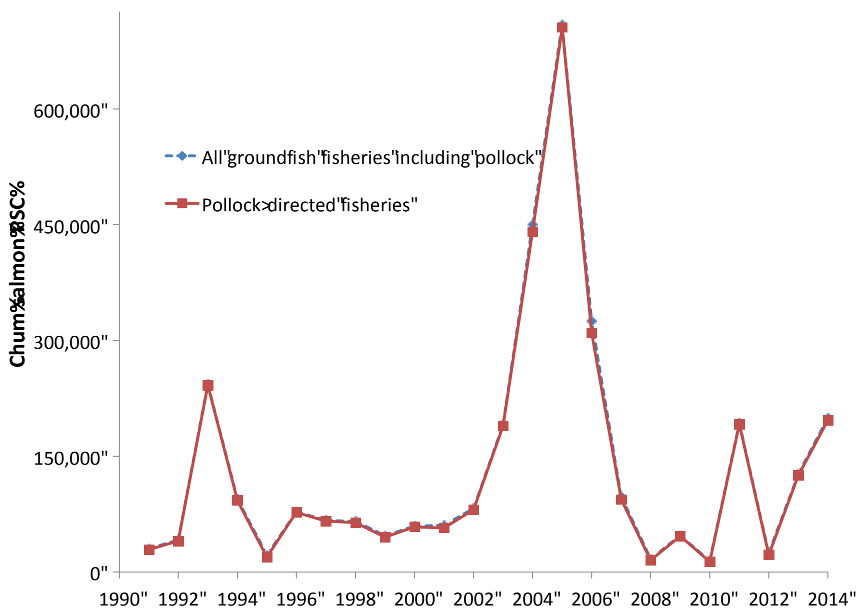

Figure 20. Chum salmon PSC by all groundfish fisheries and directed pollock fishery in the BSAI region, 1991-2014 (through Oct 25th 2014).

By sector, overall Chinook levels have declined since 2007 (Table 19). 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. As with Chinook salmon PSC the inshore CV sector continues to comprise the majority of the bycatch by sector (Table 19).

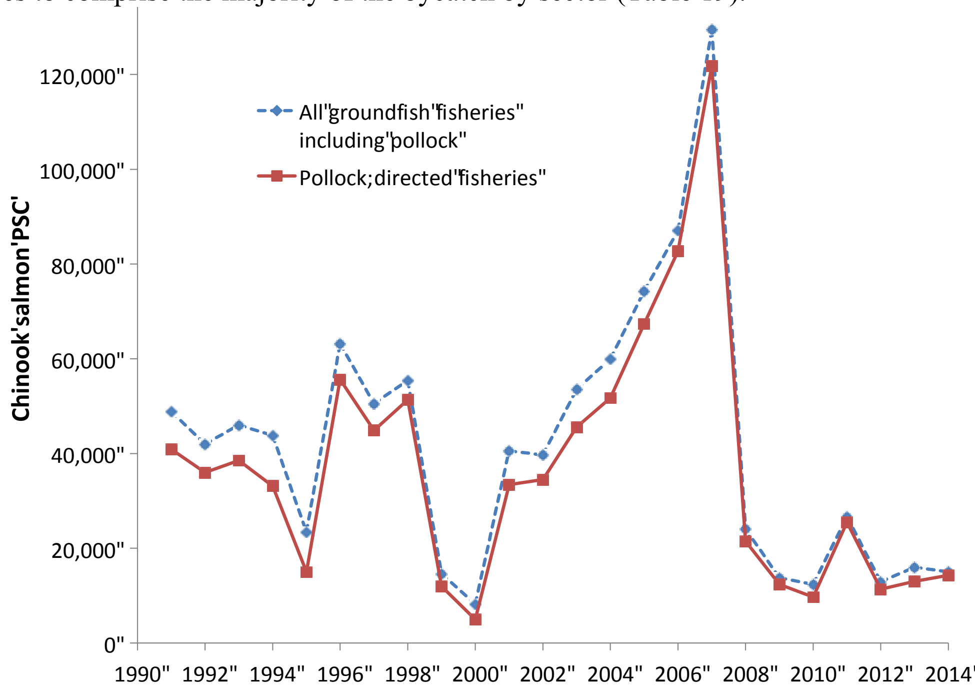

Figure 21. Chinook salmon PSC by all groundfish fisheries and directed pollock fishery in the BSAI region, 1991-2014 (through Oct 25th 2014).

Table 19. 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 Salmon PSC management measures final environmental impact statement (FEIS) (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 22).

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).

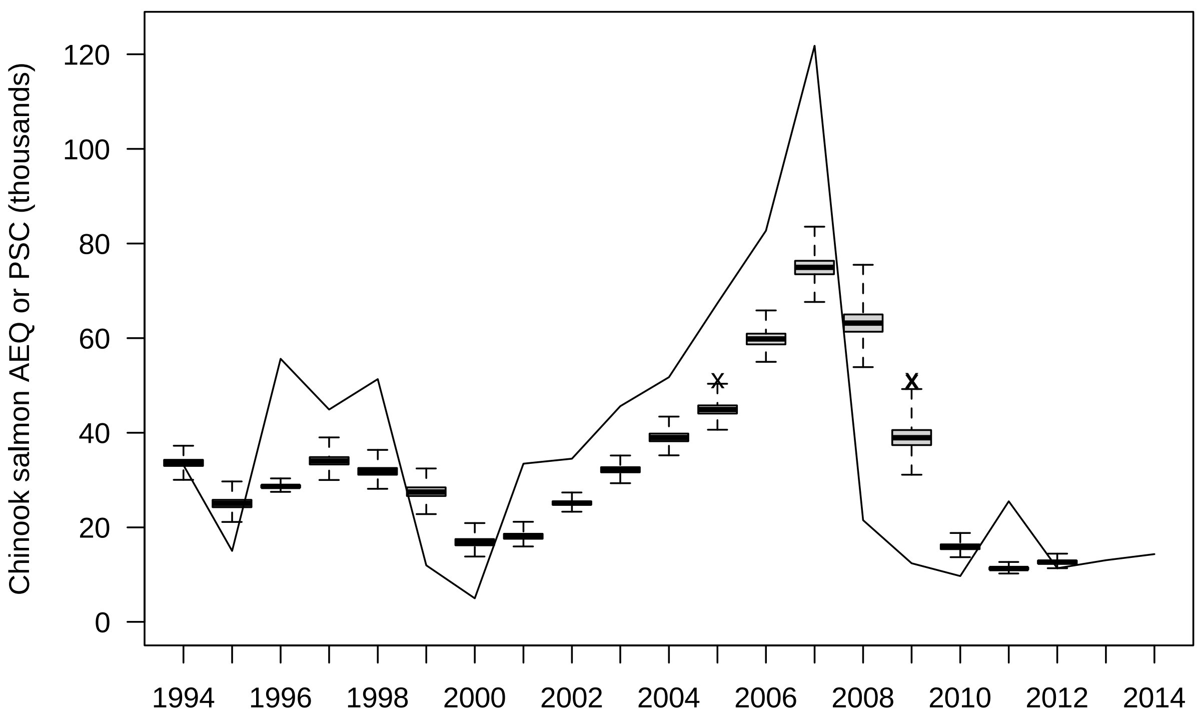

Figure 22. Estimated annual total adult equivalent (AEQ) mortality of Chinook salmon from the EBS pollock fishery, 1994-2012 (boxplots) and PSC (1994-2014). Units are numbers of salmon and height of boxes represent the uncertainty (inter-quartile ranges) due to oceanic survival and other factors that 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 3.2.5 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 20. 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 20). 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 20. 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, in press).

	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 21 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 21). The AEQ analysis has not been updated for the 2013 and 2014 years. However, the bycatch 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 s unlikely to have increased above the values observed in 2011 and 2012.

Table 21. 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%			

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 22). 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 (2004-2011) by region (with ranges over this period):

Coastal west Alaska	0.46%	(0.07% - 1.23%)
Upper Yukon	1.16%	(0.17% - 2.73%)
Combined WAK	0.57%	(0.08% - 1.31%)
Southwest Alaska	0.44%	(0.07% - 1.03%)

Table 22. 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 19 shows the Chinook and chum PSC in the pollock fishery by sector and season as well as the associated pollock catch from 2003-2014. The pollock fishery has a known mortality of salmon PSC (Chinook and chum) as represented by annual trends in Table 19 therefore an adverse impact on salmon is a result of status quo. 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.

The impact analysis for Alternatives 2-5 is based upon comparison with current 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 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 19. 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.

3.2.7.2 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[7]. The general changes suggested in the proposal presented to the Council in October 2013 for 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 may 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 hard cap 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.

[7] 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 included in a revised proposal to meet the intent of Alternative 2 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. Particularly for chum salmon PSC management, without participation in an IPA, and absent any backstop measure to further incentivize participation, there are no additional chum salmon conservation measures affecting the pollock fishery. Any action that decreases the incentive to remain in an IPA would also have adverse impacts on Chinook salmon as it would diminish the provisions for bycatch reduction under the IPAs themselves. An opt-out cap exists under Amendment 91 for vessels which do not participate in an IPA. Any vessel that chooses to opt out of an IPA is subject to a cap which is managed collectively for all vessels operating outside of an IPA. Regulations governing the amount of Chinook salmon which is allocated to the opt-out cap are listed at 679.21(f)(4). The opt-out cap was structured to be a restrictive cap (beginning with a vessel's own allocation under their sector and deducted from the sector share of the overall cap) but is managed as a group not an individual allocation among all opt-out vessels. Thus if one vessel has a higher proportion of salmon in the opt-out then another vessel, it is less beneficial to the vessel bringing in the higher limit to fish under this combined cap than to remain in their sector IPA and retain their individual allocation, all other factors being equal. Similarly, a vessel with limited salmon allocated to it under their sector has provisions within the IPA available to them to transfer or lease salmon or pollock to maximize their flexibility. These provision are unavailable under the opt-out cap and thus if a vessel is fishing alone under the opt-out cap and reaches its salmon limit it will have to cease fishing. The opt-out cap is further limited regardless of vessels participating by the initial back stop allocation (not to exceed the maximum annual backstop cap of 28,496). To date there has been 100% participation in the IPAs. However, anything that decreases the incentive to remain in the IPA and potentially fish under the opt-out provisions of Amendment 91 could result in increased bycatch and hence have an adverse impact to both Chum and Chinook salmon stocks. As alternatives under consideration are not mutually exclusive, any combination of alternatives which further erodes the incentives to participate in an IPA may exacerbate these adverse impacts.

3.2.7.3 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. Note that under all of Alternative 3, impacts to chum salmon are anticipated to be similar to Alternative 1. It should also be noted that the revised MSSIP agreement includes several of these provisions for the 2015 fishing year.

3.2.7.3.1 Option 1

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."** 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.

First, the provision to impose fishing restrictions or penalties is addressed followed by a discussion of the fleet-wide information sharing provision. 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 time required catch fish in an area decreases, unsurprisingly vessels are less 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.

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 in extremely low-bycatch conditions that cannot be avoided 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 means through which penalties could reduce bycatch 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.

The best outcome would be to inflict little actual pain but induce significant avoidance. Of course, there could be avoidance that has little benefit and substantial costs. For example, forcing vessels to travel large distances or come back partially full with minimal or no reduction in salmon PSC would be ineffective. Adding costs by forcing movement to places with the same level of bycatch is clearly undesirable.

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 intelligence from other vessels when moving operations to new areas.

When there is a threat of reaching the hard cap, vessels have an incentive to do all of these. However, at levels well below the cap, the incentives to take these actions are lower.

An "outlier incentive" as discussed more extensively in June 2014 proposals 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 time period to use for assigning a potential penalty is not clear. Basing it on too short a period could penalize vessels for completely random 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 lengths of time. For example:

- Trip-level
- Weekly
- Bi-weekly
- Monthly
- Seasonal
- Annual.

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 feedback documents submitted by IPA representatives for the June 2014 Council meeting, 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)[8]. 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 number of vessels that were above the thresholds were shown in the June 2014 salmon bycatch discussion paper. 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.

To calculate similar vessel performance over seasonal periods for CVs, the years 2003-2013 data were compiled and the standard deviation of vessels by season were compared (Table 1 and 2 in the June 2014 discussion paper). Based on the seasonal outlier definition proposed in the inshore SSIP, no vessels in recent (2011-2013) years would have qualified in the A-season (only one vessel would have qualified over the whole set of years based on rates from 2003-2005) (Table 1). For the B season, 3 vessels would have qualified for the penalty based on rates from 2010-2013 above the standard deviation cut-off threshold while several other vessels would have qualified in previous years. For the annual component,

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

Table 8 of June 2014 Discussion Paper 1[9] is referred to which shows the annual standard deviation in bycatch rates by CV vessels from 2003-2013. Based on the annual outlier definition, three vessels would have qualified between 2003 and 2013. One vessel exceeded the threshold in each year from 2010-2012. It did not exceed it in 2013 however so while restrictions would have applied to that vessel in 2013, after that year the vessel would have reset their standing and would need an additional 3 consecutive years from 2014-2016 to be subject to additional annual penalties outside of that year.

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."

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."[10] 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.

The following list is merely a **number 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.

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[9] Available at: http://legistar2.granicus.com/npfmc/meetings/2014/6/893_A_North_Pacific_Council_14-06-02_Meeting_Agenda.pdf

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

- 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.

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. 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.[11]

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.

If there were strong incentives that rewarded/punished people based on their relative performance, one might be concerned that communication about bycatch could be withheld or distorted. However, it is not clear to what to degree 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.

In order to reduce the possibility, requiring information sharing would seem prudent, although this is very likely to be requirement imposed as part of IPAs.

The observer program cannot accurately observe and report haul-level bycatch information on catcher vessels[12], 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. However, the Council could require a data sharing program and that reporting on the program be a mandatory component of IPA reports.

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. [13]

"*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.*

[11] 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.
[12] Martin Loefflad, pers. comm.
[13] http://www.pcouncil.org/wp-content/uploads/D2b_SUP_WMC_PPT_APR2013BB.pdf. Accessed September 4, 2014.

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

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

Should there be a minimum aggregate bycatch level at which the relative incentives apply? If there were very large penalties riding on whether a vessel caught 5 versus 10 salmon in a season, this could lead to a large expenditure of avoidance effort with on a small gain. Further, research presented as part of December 2012 Council analysis of chum bycatch indicates that at a very low level, closing areas may not lead to reduced bycatch because bycatch encounters become harder to predict (NPFMC 2012). On the other hand, incentives at all levels would give additional reasons for the industry to develop improved excluders or other technology to reduce bycatch even at low Chinook PSC levels.

There has been a large quantity of research in many research fields about the effectiveness of deterrents and potential penalties. Generally this research is based on the probability of detection. For example, many of us break the speed limit because we expect it is unlikely that we will be caught. This is not an issue here, however. Salmon are counted and vessels will assess whether or not the potential penalty justifies additional actions to reduce bycatch.

Any penalties imposed would occur in the context of the existing hard cap and IPA agreements (although the IPAs could potentially 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. Caution should be exercised in the design of any system in order to discourage gaming and avoid unintended consequences.

3.2.7.3.2 Option 2

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[14]) with a pending revision

[14] 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

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. 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 we the survey applied. Thus requiring excluders would impact only a portion of the fleet.

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.[15] However, it is not known how much these results can be generalized, and whether this percentage of bycatch reduction will occur under both high and low bycatch 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 day 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).

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 is impacted, 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. The sooner this reporting occurs, the more information will be available to examine

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

how excluder usage translates into bycatch outcomes. 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.

3.2.7.3.3 Option 3

Alternative 3, option 3 addresses mandating that a rolling hot spot (RHS) program operate throughout the entire A and B seasons. The Chinook rolling hotspot (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. This option 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 them applicable in very low Chinook PSC situations. 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.

Table 23 shows in 4 of the 8 seasons from 2011-2014, the Chinook RHS program was suspended for participants in the inshore SSIP.[16]

Table 23. 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

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 and hard cap. At higher Chinook PSC levels, there is a significant threat to vessels of being closed out of pollock fishing by reaching the hard cap, 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 and potentially increase Chinook and/or chum bycatch

While there have been formal suspensions of the inshore RHS program in some years, the number of Chinook RHS closures actually applied – and the number of vessels impacted – since Amendment 91 went into place in 2011 in the other sectors at the same times has generally been quite limited. 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

[16] J. Gruver, pers. comm.

was suspended on September 15, there were no RHS closures in the CP sector due to low 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 bycatch.

3.2.7.3.4 Option 4

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*."[17] 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 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 24 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, 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.

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

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 bycatch would occur for vessels that fished close to the performance standard 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.

Table 24 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 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 and the hard cap.

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.

3.2.7.3.5 Option 5

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 can be 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
- Had October bycatch rates the previous year less than the average October rate for the sector, or
- Had 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.

Vessel bycatch could also be examined at the trip-level and vessels could be forced to stand down if they exceed an October threshold. Utilizing this method could have several potential negative consequences. 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.

3.2.7.3.6 Summary of Alternative 3

The options analyzed under this alternative are all intended to increase the incentives to reduce Chinook bycatch within the IPAs. Any successful increased incentive at the vessel level that translates into increased savings of Chinook salmon results in reduced salmon bycatch overall. The options analyzed under this alternative are all intended to increase the incentives to reduce Chinook bycatch within the

IPAs. Any successful increased 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 possibility 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.**

3.2.7.4 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). While these options are not mutually exclusive, this analysis treats them individually. 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). Table 25 shows the seasonal bycatch rate for Chinook by month and Table 26 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 27). In contrast, proportionately few chum salmon are taken after this period (Table 28).

Depending on the year, the amount of Chinook salmon PSC savings from shifting the B-season opening sooner varies but is generally positive (Table 29). 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 salmon PSC (Table 30).

The analysis of the option to close fishing earlier (Sept 15th, Oct 1st and Oct 15th) is presented in Table 31 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 32 through Table 34. 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 not expected that results under this option would be exactly similar 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 this alternative indicates that with fishing occurring earlier in the B season under both options, there is likely to be reduced Chinook bycatch by shifting effort away from the highest rates in September and October. **This alternative is estimated to confer a reduced adverse impact to Chinook salmon relative to Alternative 1. 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. 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 25. 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	
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			
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	

Table 26. 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 27. 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 28. Chum salmon bycatch remaining by different dates (representing the week of closure), years, and sectors. The bottom panel is summed over all sectors.

non-Chinook salmon	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
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 29. 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	(60)	(4)	(5)	(3)	(72)
					61,981

Table 30. 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	(1,867)	(71)	(2,803)	(216)	(4,957)
					38,316

Table 31. 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. Sub-options 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

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)

Table 32. 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 33. 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 34. 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 35. 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									

3.2.7.5 Alternative 5 impacts

Alternative 5 would modify the existing performance standard 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 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 performance standard is evaluated annually (25% and 60%) and B-season only (25% and 60%).

There are two options included in this estimation of 'low abundance' threshold, 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 5 show that the years in which the 'low abundance' threshold would have been reached based on a one-year determination which would have occurred in 2000, and 2010-2013. The two-year average would have been 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 threshold the following year. Thus for example, in 2000 a determination of a 'low abundance threshold" would have been made and resulting lower performance standard 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 disrupt fishing fleet activity and affect incentive behavior controls under the IPAs.

The 'low abundance' period beginning in 2010 would have triggered a lower performance standard 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 19. 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, particularly in the B-season only suboptions. Rollover amounts of Chinook salmon from the A-season into B-season were substantial, and particularly important in estimating the relative constraints for the B-season (only) sub-options (Table 36). 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 37). Due to the A-season PSC rolled over into the B-season allowances, no constraints were reached for either Option 1 (25% annual reduction) or either B-season sub-option. Even under the more constraining B-season sub-option 2 (the 60% reduction), the PSC limits would not have been reached in any sector. Therefore results for non-constraints are omitted. Only for the option to reduce the annual limit 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 performance standard 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. 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 assume 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 and hard cap 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 hard cap of their portion of the 47,591, and/or respond slowly to the need to operate under the lower performance standard as the hard cap 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. 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 this alternative are estimated to be similar to Alternative 1 in impacts under most options with the possibility of a reduced adverse impact to Chinook salmon and chum salmon stocks under option 2 (annual reduction of 60%).**

Table 36. Rollover amounts (in numbers of Chinook salmon) from A to B season by Option and suboption for 2011-2014. Note that rollover amounts for sub-options are based on the difference of A-season bycatch and the Amendment 91 sector PSC limits.

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

Year	Shore-based CVs	Mothership	CPs	CDQ
2011	8,028	1,555	6,425	1,898
2012	7,863	1,691	5,763	1,982
2013	8,803	1,442	4,655	1,852
2014	6,023	1,536	4,259	1,632

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

Year	Shore-based CVs	Mothership	CPs	CDQ
2011	2,221	622	2,589	813
2012	2,056	758	1,927	897
2013	2,996	509	819	767
2014	216	603	423	547

Sub-option B-season only, of option 1, 25% reduction in Sector allocations of Chinook salmon

Year	Shore-based CVs	Mothership	CPs	CDQ
2011	12,175	2,221	9,165	2,672
2012	12,010	2,357	8,503	2,756
2013	12,950	2,108	7,395	2,626
2014	10,170	2,202	6,999	2,406

Sub-option B season only of option 2, 60% reduction in Sector allocations of Chinook salmon

Year	Shore-based CVs	Mothership	CPs	CDQ
2011	12,175	2,221	9,165	2,672
2012	12,010	2,357	8,503	2,756
2013	12,950	2,108	7,395	2,626
2014	10,170	2,202	6,999	2,406

Table 37. Numbers of PSC salmon that would have been saved (or t of pollock foregone) and the week of the year that the sector specific Chinook salmon limit would have been attained if Alternative 5 Options 1 and 2 would have been in place.

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

	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

	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													

3.2.7.5.1 Time lag considerations for specifications versus biological predictive capacities

In addition to the analysis of alternatives in this document, 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.

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 will be less effective in the beginning of the period (due to the lag effect between age of the bycatch and expected maturation) and overly cautious 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's less important).

3.2.8 Data and considerations for differential approaches by sector

In conjunction with the Council's June 2014 motion, a request was made for "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 27 and Table 28 (interpolated for actual closure dates for Chinook and chum salmon PSC remaining after that date) and Table 32 and Table 33 (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 3.2.7.4.

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 38, 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 38, 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 38 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)													
Actual 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%**
28,551 performance standard (Alt 5, option 2)													
Actual PSC Allocation (#)	9,955	5,936	15,891	1,599	625	2,224	6,576	1,534	8,110	1,859	471	2,330	**28,555**
2011	44%	235%	116%	28%	388%	129%	27%	108%	42%	23%	71%	33%	**89%**
2012	46%	58%	50%	19%	8%	16%	37%	6%	31%	18%	1%	15%	**39%**
2013	37%	72%	50%	35%	8%	27%	54%	29%	49%	25%	10%	22%	**46%**
2014	64%	46%	57%	29%	29%	29%	60%	37%	56%	37%	8%	31%	**53%**

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.

3.2.9 Comparison of impacts 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%.

Alternatives 2 through 5 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 management.

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. 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. 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. The purpose of this modification is to provide additional 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. 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 this alternative indicates that with fishing occurring earlier in the B season under both options, there is likely to be reduced Chinook bycatch by shifting effort away from the highest rates in September and October. This alternative is 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 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 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 are considered annually (25%; 60%) and for the B-season only (25% and 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 sectors would respond to a lower performance threshold in the development of or revisions to the incentive structures in their IPAs . Under these conditions, vessels would have faced a lower performance standard 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 (lowered) performance standard. It is unknown whether the gap between the performance standard and hard cap 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 hard cap of their portion of the 47,591, and/or respond slowly to the need to operate under the lower performance standard as the hard cap 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. 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.

	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, but still not significant
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

3.3 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).

3.3.1 Effects on other groundfish

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 2-5 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.

Alternatives 2-5 will not affect the annual assessment process, and inseason 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 alternaitves, 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 contraining PSC caps close sectors of the fishery prior to reaching their quota, the impacts on incidental catch species may be reduced.

None of the alternatives are estimated to change the incidental catch of target or non-target groundfish catch in the directed pollock fishery. 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.

3.4 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 Endangered Species Act (ESA);
- protection under the Marine Mammal Protection Act (MMPA);
- announcement as candidate or being considered as candidates for ESA listings;
- declining populations in a manner of concern to State or Federal agencies;
- experiencing large PSC or other mortality related to fishing activities; 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 2010 Marine Mammal Stock Assessment Reports (SARs) (Allen and Angliss, 2011).

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 39. 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, humpback whales, fin whales, and sperm whales (NMFS 2006a; NMFS 2010a).

Table 39 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 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*	Proposed Listing
Spotted Seal	*Phoca largha*	Threatened
Ringed Seal	*Phoca hispida*	Proposed Listing
Ribbon Seal	*Phoca fasciata*	None
Polar Bear[2]	*Ursus maritimus*	Threatened

[1] Steller sea lions are listed as endangered west of Cape Suckling, 144° W longitude.
[2] Pacific walrus, Northern sea otters, and polar bears are under the jurisdiction of the USFWS. A walrus ESA 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)[18]. 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. Amendment 91 to the BSAI Groundfish FMP analyzed the impacts of the pollock fishery on marine mammals. The preferred alternative in that analysis, ultimately selected, established the status quo alternative for this analysis. That analysis also provided a detailed description of the status marine mammals in the Bering Sea, which is incorporated here by reference.

[18]The SARs are available on the NMFS Protected Resources Division website at http://www.nmfs.noaa.gov/pr/sars/region.htm.

Table 40 and Table 41provide 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 pollock fishing vessels may occur due to overlap in the size and species of pollock harvested in the fisheries that are also important marine mammal prey, and due to temporal and spatial overlap in marine mammal occurrence and commercial fishing activities. This discussion focuses on those marine mammals that may interact with or be affected by the EBS pollock fishery**.**

Table 40. 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 and Eastern Distinct Population Segment (DPS)	Endangered (W) Threatened (E)	Depleted & a strategic stock	For the western DPS, regional increases in counts in trend sites of some areas have been offset by decreased counts in other areas so that the overall population of the western DPS appears to have stabilized (Fritz et al. 2008). The eastern DPS is steadily increasing and has been recommended to delisting consideration (NMFS 2008).	Western DPS inhabits Alaska waters from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters. Eastern DPS inhabit waters east of Prince Williams Sound to Dixon Entrance. Occur throughout AK waters, terrestrial haulouts and rookeries on Pribilof Is., Aleutian Is., St. Lawrence Is. And off mainland. Use marine areas for foraging. Critical habitat designated around major rookeries and haulouts and foraging areas.
Northern fur seal – Eastern Pacific	None	Depleted & a strategic stock	Recent pup counts show a continuing decline in the number of pups surviving in the Pribilof Islands. NMFS researchers found an approximately 9% decrease in the number of pups born between 2004 and 2006. The pup estimate decreased most sharply on Saint Paul Island.	Fur seals occur throughout Alaska waters, but their main rookeries are located in the Bering Sea on Bogoslof Island and the Pribilof Islands. Approximately 55% of the worldwide abundance of fur seals is found on the Pribilof Islands (NMFS 2007b). Forages in the pelagic area of the Bering Sea during summer breeding season, but most leave the Bering Sea in the fall to spend winter an spring in the N. Pacific.
Harbor seal – Gulf of Alaska Bering Sea	None	None	Moderate to large population declines have occurred in the Bering Sea and Gulf of Alaska stocks.	GOA stock found primarily in the coastal waters and may cross over into the Bering Sea coastal waters between islands. Bering Sea stock found primarily around the inner continental shelf between Nunivak Island and Bristol Bay and near the Pribilof Islands.
Ringed seal – Alaska	Status under review	None	Reliable data on population trends are unavailable.	Found in the northern Bering Sea from Bristol Bay to north of St. George Island and occupy ice
Bearded seal – Alaska	Status under review	None	Reliable data on population trends are unavailable.	Found in the northern Bering Sea from Bristol Bay to north of St. George Island and inhabit areas of water less than 200 m that are seasonally ice covered
Ribbon seal – Alaska	None	None	Reliable data on population trends are unavailable.	Found throughout the offshore Bering Sea waters
Spotted seal - Alaska	Status under review	None	Reliable data on population trends are unavailable.	Found throughout the Bering Sea waters
Pacific Walrus	Status under review	Strategic	Population trends are unknown. Population size estimated from a 2006 ice survey is 15,164 animals, but this is considered a low estimate. Further analysis is being conducted on the 2006 survey to refine the population estimate.	Occur primarily is shelf waters of the Bering Sea. Primarily males stay in the Bering Sea in the summer. Major haulout sites are in Round Island in Bristol Bay and on Cape Seniavan on the north side of the Alaska Peninsula.

Source: Angliss and Outlaw 2008 and List of Fisheries for 2008 (72 FR 66048).
Northern fur seal pup data available from http://www.fakr.noaa.gov/newsreleases/2007/fursealpups020207.htm.
Pacific Walrus information available from http://alaska.fws.gov/fisheries/mmm/stock/DraftPacificWalrusSAR.pdf.

Table 41 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	AT1 group has been reduced to at least 50% of its 1984 level of 22 animals, and has likely been reduced to 32% of its 1998 level of 7 animals. Unknown abundance for the eastern North Pacific Alaska resident; West Coast transient; and Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea transient stocks. Minimum abundance estimates for the Eastern North Pacific Alaska Resident and West coast transient stocks likely underestimated as researchers continue to encounter new whales in the region.	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	Abundance not known, but this stock is considered to represent only a small fraction of its precommercial whaling abundance and is arguably the most endangered stock of large whales in the world.	See 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 the 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 17,752 animals. Increasing populations in the 1990's but below carrying capacity.	Most spend summers in the shallow waters of the northern Bering Sea and Arctic Ocean. Winters spent along the Pacific coast near Baja California.
Beluga Whale – Bristol Bay, Eastern Bering Sea, Cook Inlet, and eastern Chukchi Sea	None for all stocks except Cook Inlet, which are endangered	None	Abundance estimated at 3,710 animals trend not declining for the eastern Chuckchi Sea stock. Minimum population estimate for the eastern Bering Sea stock is 14,898 animals, trend unknown. Bristol Bay stock is minimum estimate at 1,619 animals and trend stable, possibly increasing. For Cook Inlet Belugas, estimated decline of 71 percent in 30 years with 375 animals estimated in 2008.	Summer in the Arctic Ocean and Bering Sea coastal waters, and winter in the Bering Sea in offshore waters associated with pack ice. Cook Inlet belugas remain in Cook Inlet year round, but eat salmon that occur in the Bering Sea and are taken as bycatch.
Source: Angliss and Outlaw 2008 and List of Fisheries for 2008 (72 FR 66048). North Pacific right whale included based on NMFS 2006 and Salveson 2008 http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/spermwhale.htm				

3.4.1 Effects on Marine Mammals

Criteria to assess the impacts of the action on marine mammals are listed below. These criteria are adopted from the 2006-2007groundfish harvest specifications environmental assessment/final regulatory flexibility analysis (EA/FRFA). The Status Quo alternative is the pollock fishery as prosecuted under Amendment 91 to the BSAI Groundfish FMP, and as such is not considered to cause significantly adverse impacts to marine mammals in the Bering Sea. The other alternatives being considered constitute a change from status quo, and impacts are assessed as a change from status quo. Although impacts from commercial fisheries cannot be considered beneficial (incidental take, reduced prey availability, and increased disturbance are all adverse impacts), it is possible that an alternative considered in this analysis could reduce the harmful effects of commercial fisheries on marine mammals and seabirds, if it can be demonstrated that they reduce incidental take, competition for prey, or disturbance.

Table 42. 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.

3.4.1.1 Incidental Take Effects

The Alaska Groundfish Harvest Specifications EIS contains a detailed description of the effects of the groundfish fisheries on marine mammals (Chapter 8 of NMFS 2007a) and is incorporated by reference. The Amendment 91 EIS contains a description 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 EBS 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 43 provides more detail on the levels of take based on the most recent SAR (Allen and Angliss 2011). Overall, very few marine mammals are reported taken in the Bering Sea pollock fishery.

Table 43 Estimated mean annual mortality of marine mammals from observed BSAI pollock fishery and potential biological removal. Mean annual mortality is expressed in number of animals and includes both incidental takes and entanglements. The averages are from the most recent 5 years of data since the last SAR update, which may vary by stock. Groundfish fisheries mortality calculated based on Allen and Angliss (2011).

Marine Mammal Species and Stock	Years used to calculate mean annual mortality from BSIA pollock fishery	Mean annual mortality, from BSAI pollock fishery	Potential Biological Removal (PBR)
*Steller sea lions (western)	2002-2006	3.83	254
Northern fur seal	2002-2006	0.21	13,809
Harbor seal (BS)	2002-2006	0.29	603
Harbor seal (AI)	2000-2004	0	1334
Spotted seal	N/A	N/A	Undetermined
Ringed seal	N/A	N/A	Undetermined
Ribbon seal	N/A	N/A	Undetermined
Killer whale Eastern North Pacific AK resident	N/Z	N/Z	20.8
Killer whale, GOA, BSAI transient	2002-2006	0.41	5.5
Dall's porpoise	2002-2006	1.09	Undetermined
*Humpback whale, Western North Pacific	N/A	N/A	2.6
*Humpback whale, Central North Pacific	N/A	N/A	61.2
Minke whale, Alaska	N/A	N/A	Undetermined
*Fin whale, Northeast Pacific	2002-2006	0.23	11.4
Pacific walrus	N/A	N/A	2,580

* ESA-listed stock

Table 44 shows the months and locations when incidental takes of marine mammals occurred in 2003, 2004, 2005, and 2006. It is not possible to determine any seasonality to the incidental takes of killer whales, fur seals, or fin whales since only one occurrence for each is reported during this time period. It appears that Dall's porpoise may be more likely taken in July and bearded seals may be more likely taken in September and October. Steller sea lions appear to be taken in the A and B pollock fishing seasons, mostly in January through March and in September. Based on the very limited data in Table 44, bearded seals were primarily taken in the northern portion of the eastern Bering Sea. Killer whale, Dall's porpoise, and fin whale appear to be taken in the area along the shelf break. Steller sea lions appear to be taken primarily in the southern portion of the eastern Bering Sea and northwest of the Pribilof Islands.

Table 44 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

Steller sea lion	2007-03-13	517
Northern fur seal	2007-08-07	513
Northern fur seal	2007-08-21	517
Bearded seal	2007-09-11	521
Northern fur seal	2007-09-26	521
Steller sea lion	2007-10-09	521
Steller sea lion	2008-01-21	509
Steller sea lion	2008-01-30	509
Steller sea lion	2008-01-30	509
Harbor seal	2008-01-31	517
Steller sea lion	2008-03-02	517
Steller sea lion	2008-03-03	517
Steller sea lion	2008-07-04	521
Steller sea lion	2008-07-06	521
Bearded seal	2008-07-08	517
Ringed seal	2008-07-16	521
Ribbon seal	2008-08-04	521
Bearded seal	2008-08-17	521
Steller sea lion	2008-08-25	521
Ribbon seal	2008-09-05	517
Bearded seal	2008-09-05	524
Northern fur seal	2008-09-09	521
Bearded seal	2008-09-21	524
Steller sea lion	2009-01-27	509
Steller sea lion	2009-02-14	513
Steller sea lion (2)	2009-02-16	509
Steller sea lion	2009-02-17	509
Dall's porpoise	2009-02-23	509
Steller sea lion	2009-03-18	513
Ribbon seal	2009-07-19	521
Bearded seal	2009-07-30	509
Ringed seal	2009-08-06	521
Steller sea lion	2010-02-23	509
Steller sea lion	2010-03-03	521
Steller sea lion	2010-03-06	521
Spotted seal	2010-03-20	521
Steller sea lion	2010-04-06	521
Bearded seal	2010-07-06	509
Humpback whale	2010-07-19	517
Northern fur seal	2010-08-04	517
Northern fur seal	2010-08-10	521
Steller sea lion	2010-08-12	517
Steller sea lion	2011-01-30	509
Steller sea lion	2011-02-24	509
Steller sea lion	2011-02-26	513
Ringed seal	2011-04-01	521
Steller sea lion	2011-06-24	517
Steller sea lion	2011-06-27	521
Steller sea lion	2011-08-04	519
Ringed seal	2011-08-07	521
Ringed seal	2011-08-11	524
Steller sea lion	2011-08-23	517
Steller sea lion	2011-08-31	519

3.4.1.1.1 Incidental Take Effects under Alternative 1: Status Quo

Pollock fishery on the incidental takes of marine mammals are analyzed in the Amendment 91 Chinook Salmon Bycatch Management Measures EIS (NPFMC/NMFS 2009). That analysis concluded that the BSAI pollock fishery was not likely to have significant adverse impacts to marine mammals in the Bering Sea and no changes are expected under status quo. No changes in incidental take and entanglement are expected under Status Quo, therefore, impacts from Alternative 1 are considered not significant.

3.4.1.1.2 Incidental Take Effects under Alternatives 2-5

Modified management of the pollock fishery and the impact this could have on fishing pressures on marine mammals was also examined in the Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009). 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.

3.4.1.2 Prey Availability Effects

The Chinook Bycatch Management Measures EIS (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 Bycatch Management Measures EIS (NPFMC/NMFS 2009) determined that competition for key prey species under the status quo fishery is not likely to constrain foraging success of marine mammal species or cause population declines (NMFS 2009).

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 prey species in the BSAI (Ianelli et al, 2013). For the pollock fisheries, seasonal fishery catch and pollock biomass distributions (from surveys) indicated that the apparent disproportionately high seasonal harvest rates within Steller sea lion critical habitat *could* lead to reduced sea lion prey densities. Consequently, management measures redistributed the fishery both temporally and spatially according to pollock biomass distributions. This was intended to disperse fishing so that localized harvest rates were more consistent with annual exploitation rates. The measures include establishing: 1) pollock fishery exclusion zones around sea lion rookery or haulout sites; 2) phased-in reductions in the seasonal proportions of TAC that can be taken from critical habitat; and 3) additional seasonal TAC releases to disperse the fishery in time (Ianelli et al, 2013).

The effects of the status quo EBS pollock fishery and state-managed salmon fisheries on prey availability for Steller sea lions were evaluated in the recent Biological Opinion (NMFS 2010a), and were not found to cause adverse population-levels effects on Steller sea lions. Steller sea lion protection measures in the BSAI are sufficient to ensure that the groundfish fisheries are not likely to jeopardize the continued existence of Steller sea lions or adversely modify its designated critical habitat (NMFS 2014). The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009) summarized the potential impacts of Bering Sea pollock fishing on Steller sea lions, and concluded that the fishery was not likely to cause significant adverse impacts to the population of Steller sea lions in the Bering Sea. No changes are expected under Status Quo alternative and no changes in prey availability are expected under Status Quo.

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 (NPFMC/NMFS 2009) concluded that the EBS 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 Bering Sea 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 BSAI 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 EBS pollock fishery (NMFS/NPFMC 2009).

Other Marine Mammals

Ribbon seals, northern fur seals, and minke, fin, and humpback whales potentially compete with the EBS 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 EBS 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 EBS 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 2-5

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) 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. Neither Alternatives 2, 3 or 5 do not change the estimated impacts from status quo thus impacts are expected to be not significant.

Alternative 4 would open the B season earlier and/or shorten the B season. The Bering Sea pollock season dates were set with the emergency rule to implement Steller sea lion protection measures in January, 2000 (65 FR 3892). Changing the B season may change how the Bering Sea pollock fishery affects Steller sea lions from the effects considered in the 2010 Biological Opinion (NMFS 2010a) and may trigger a re-consultation on the Bering Sea pollock fishery.

Consequently, **the Alternatives 2 through 5 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 5, are not significant.**

3.4.1.3 Disturbance Effects

3.4.1.3.1 Disturbance Effects under Alternative 1: Status Quo

The Chinook Bycatch Management Measures EIS (NPFMC/NMFS 2009), summarized the likely disturbance effects of the BSAI pollock fishery and concluded that the pollock fishery is not likely to result in significantly adverse impacts to marine mammals. That summary is incorporated here by reference. No changes are expected under the Status Quo alternative, and no substantial change in the disturbance of marine mammals is likely. Therefore, impacts of the Status Quo alternative are expected to be not significant.

3.4.1.3.2 Disturbance Effects under Alternatives 2-5

The effects on the disturbance of marine mammals by the proposed management measures are on the potential for incidental takes. Neither Alternatives 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 Bycatch Management Measures EIS (NPFMC/NMFS 2009) concluded that the BSAI 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 2-5, impacts of these alternatives are expected to be not significant.

3.5 Ecosystem

Ecosystems consist of communities of organisms interacting with their physical environment. Within marine ecosystems, competition, predation, and environmental disturbance cause natural variation in recruitment, survivorship, and growth of fish stocks. Human activities, including commercial fishing, can also influence the structure and function of marine ecosystems. Fishing may change predator-prey relationships and community structure, introduce foreign species, affect trophic diversity, alter genetic diversity, alter habitat, and damage benthic habitats.

Ecosystem considerations for the groundfish fisheries are summarized annually in the Stock Assessment and Fishery Evaluation report (Zador et al, 2013). These considerations are summarized according to the ecosystem effects on the groundfish fisheries, as well as the potential fishery effects on the ecosystem.

Effects of the Alternatives

An evaluation of the effects of the EBS pollock fishery on the ecosystem is discussed annually in the Ecosystem Considerations section of the pollock chapter of the SAFE report (Ianelli et al, 2013) and was evaluated in the Chinook EIS. The analysis concluded that the current EBS Pollock fishery does not produce population-level impacts to marine species or change ecosystem-level attributed beyond the range of natural variation. Consequently, Alternative 1 (status quo) is not expected to have a significant impact on the ecosystem.

Alternatives 2-5 either main or reduce the overall level of Pollock harvest from status quo. The level of fishing effort by Pollock vessels is not expected to change except in years where sectors of the fishery may be closed early due to either a change in the season end date (Alternative 4) or by attainment of a Chinook PSC cap (Alternative 5). It is estimated that under alternatives 2-5 that the pollock quota may likely be harvested prior to attainment of a Chinook PSC cap or change in seasonal quota thus the impact on the ecosystem is not expected to change from status quo. Any change in the size and age of pollock as a result of differential harvest practices in the B-season would be taken into account in the stock assessment the following year and accommodated within the ABC and TAC-setting process the following year. Thus none of the alternatives are likely to have a significant impact on the ecosystem.

3.6 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 chapter.

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 45 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

3.6.1 Ecosystem-sensitive management[19]

3.6.2 Ongoing research to understand the interactions between ecosystem components

Researchers are learning more about the components of the ecosystem, the ways these interact, and the impacts of fishing activity on them. Research topics include cumulative impacts of climate change on the ecosystem, the energy flow within an ecosystem, and the impacts of fishing on the ecosystem components. Ongoing research will improve the interface between science and policy-making and facilitate the use of ecological information in making policy. Many institutions and organizations are conducting relevant research.

Recent fluctuations in the abundance, survival, and growth of salmon in the Bering Sea have added significant uncertainty and complexity to the management of Bering Sea salmon resources. Similar fluctuations in the physical and biological oceanographic conditions have also been observed; however, the limited information on Bering Sea salmon ecology was not sufficient to adequately identify mechanisms linking recent changes in ocean conditions to salmon resources. North Pacific Anadromous Fish Commission (NPAFC) scientists responded by developing BASIS (Bering-Aleutian Salmon International Survey), a comprehensive survey of the Bering 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.

[19] The term "ecosystem-sensitive management" is used in this analysis in preference to the terms "ecosystem-based management" and "ecosystem approaches to management." The term was chosen to indicate a wide range of measures designed to improve our understanding of the interactions between groundfish fishing and the broader ecosystems, to reduce or mitigate the impacts of fishing on the ecosystems, and to modify fisheries governance to integrate ecosystems considerations into management. The term was used because it is not a term of art or commonly used term which might have very specific meanings. When the term "ecosystem-based management" is used, it is meant to reflect usage by other parties in public discussions.

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.

3.6.3 Increasing protection of ESA-listed and other non-target species

Pollock fishing may impact a wide range of other resources, such as seabirds, marine mammals, and non-target species, such as salmon and halibut. Recent Council and NMFS actions suggest that the Council and NMFS may consider measures for protection for ESA-listed and other non-target species.

Changes in the status of species listed under the ESA, the addition of new listed species, designation of critical habitat, and results of future Section 7 consultations may require modifications to pollock fishing practices to reduce the impacts of this fishery on listed species and critical habitat.

We are not aware of any changes to the ESA-listed salmon status or designated critical habitat that may affect the future pollock fishery. The impacts of the pollock fishery on ESA-listed salmon are currently limited to the Upper Willamette and Lower Columbia River stocks. The tracking of coded-wire tagged surrogate salmon for ESA-listed stocks may result in additional ESA-listed salmon stocks being identified as potentially impacted by the pollock fisheries. The possible take of any additional ESA-listed salmon stocks would trigger ESA consultation and may result in additional management measures for the pollock fishery depending on the result of the consultation.

Information on listed marine mammals and potential for impacts from this action are contained in Chapter 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.

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).

3.6.4 Traditional management tools

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.

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.

3.6.5 Actions by Other Federal, State, and International Agencies

State salmon fishery management

ADF&G is responsible for managing commercial, subsistence, sport, and personal use salmon fisheries. The first priority for management is to meet spawning escapement goals to sustain salmon resources for future generations. Highest priority use is for subsistence under both State and Federal law. Surplus fish beyond escapement needs and subsistence use are made available for other uses. Stock assessment overviews by region for Chum stocks and a description of state management by area are contained in Chapter 5. The Alaska Board of Fisheries (BOF) adopts regulations through a public process to conserve fisheries resources and to allocate fisheries resources to the various users. Yukon River salmon fisheries management includes obligations under an international treaty with Canada. Subsistence fisheries management includes coordination with U.S. Federal government agencies where federal rules apply under ANILCA. Subsistence salmon fisheries are important culturally and greatly contribute to local economies. Commercial fisheries are also an important contributor to many local communities as well as supporting the subsistence lifestyle.

3.6.5.1.1 Area M chum harvests

The Area M fishery in the Alaska Peninsula is managed by the State of Alaska. Area M is further divided into two management areas, the North Alaska management area and the South Alaska management area. Stock status of this region and direct impacts of the action on the Area M stocks are contained in Chapter 5 of this analysis. Combined harvests in the fishery in 2010 totaled more than 1.7 million fish.

Overview of Area M chum harvests: Salmon fisheries in the South Alaska Peninsula Management Area (Area M) are prosecuted in 2 seasons, a June commercial fishery and a post-June fishery occurring after July 1. Legal fishing gear types in South Peninsula waters include purse seine, drift gillnet and set gillnet (Potter et al, 2011). All five species of salmon are commercially harvested in this management area. Information on stock assessment in Area M is contained in Chapter 5.

A separate management plan exists for the June fishery, the *South Unimak and Shumagin Islands June Fisheries Management Plan* (5 AAC 09.365). The BOF modified this plan in 2004 to establish set fishing schedules during the June fishery (Poetter et al, 2011). In 2010 the BOF discussed proposed modifications to the plan but made no changes. However, during that meeting a significant amount of time was spent on the topic of the chum salmon harvest in June. A number of amendments were put before the BOF that included closing down the June fishery, reinstating the historical chum salmon cap, and establishing a ratio-based management system (Poetter et al., 2011). Due to these concerns in 2010 and 2011 the purse seine fleet voluntarily 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 46 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 46 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.

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.

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).

3.6.6 Private actions

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.

CDQ Investments in western Alaska

The CDQ Program was designed to improve the social and economic conditions in western Alaska communities by facilitating their economic participation in the BSAI fisheries. The large-scale commercial fisheries of the BSAI developed in the eastern BS without significant participation from rural western Alaska communities. These fisheries are capital-intensive and require large investments in vessels, infrastructure, processing capacity, and specialized gear. The CDQ Program was developed to redistribute some of the BSAI fisheries' economic benefits to adjacent communities by allocating a portion of commercially important BSAI species to such communities as fixed shares, or quota, of groundfish, halibut, and crab. The percentage of each annual BSAI catch limit allocated to the CDQ Program varies by both species and management area. These allocations, in turn, provide an opportunity for residents of these communities to both participate in and benefit from the BSAI fisheries.

Sixty-five communities participate in the CDQ Program. These communities are organized under six non-profit corporations (CDQ groups) to manage and administer the CDQ allocations, investments, and economic development projects. Annual CDQ allocations provide a revenue stream for CDQ groups through various channels, including the direct catch and sale of some species, leasing quota to various harvesting partners, and income from a variety of investments. In 2009, the six CDQ groups generated nearly $180 million in revenue with operating expenses of $161 million, resulting in an increase in net assets of nearly $18 million. Operating expenses include all program costs, investments, and general and administrative expenses.[20]

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.

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.

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.

3.6.7 Summary of cumulative impacts

Reasonably foreseeable future actions that may affect target and prohibited species are shown in Table 45. 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.

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.

[20] 2009 CDQ Sector report, WACDA, p. 16. http://www.wacda.org/media/pdf/SMR_2009.pdf

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 program agreements (IPA), modified IPA requirements to add provisions and more stringent restrictions for Chinook salmon PSC management, modifying the existing pollock seasons in the summer to begin earlier and/or end sooner, and a lower threshold performance standard for use as a target in management of Chinook PSC limits within the IPAs which 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 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.

4.3 Alternatives

The Alternatives under consideration include:

- Alternative 1: Status Quo Management,
- Alternative 2: Modified management of chum salmon PSC by required incorporation into industry run existing Chinook salmon incentive program agreements (IPA),
- Alternative 3: modified IPA requirements to add provisions and more stringent restrictions for Chinook salmon PSC management,
- Alternative 4: modifying the existing pollock seasons in the summer to begin earlier and/or end sooner,
- Alternative 5: lower threshold performance standards for use as a target in management of Chinook PSC limits within the IPAs which would be employed in years of low Chinook abundance.

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 47 Summary of alternatives

Alternative	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 to close Chum salmon savings area (area closed August 1-31 by regulation). However pollock fishery is exempt to this closure for participating 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 that meets requirements.	A season: January 20-June 9th B season: June 10-Nov 1
2	Same as Alt 1	None	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:** Open: -Jan 20th Close: -May 31st -June 9th **B season:** 1) open: -June 1 -June 10 2) close: -Sept 15th -Oct 1st -Oct 15th
5	Overall 60,000 limit and allocations same as Alt 1. Performance standard reduced: Option 1: 25% Option 2: 60% Suboptions for reduction to B season limit only (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 in applicable years	Same as Alt 1

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. Additionally, the analysis should provide information for decision makers "to maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach." The costs and benefits of this action with respect to these attributes are described in the sections that follow, comparing the No Action Alternative 1 with the action alternatives. The analysis then provides a qualitative assessment of the net benefit to the Nation of each alternative, compared to no action.

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 total allowable catch (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.

<u>The American Fisheries Act (AFA)</u>

Until 1998, the Bering Sea directed pollock fishery had been a managed open access fishery, commonly characterized as a "race for fish." In 1998, however, Congress enacted the AFA 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 vessels 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

Number of Vessels

As shown in Table 48, in the 2014 Bering Sea pollock trawl fishery, 77 catcher vessels participated in harvesting pollock, a slight 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 2003-2014, with 15 CVs delivering to motherships in 2014.

Gear

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.

Ports of Delivery

The vast majority of inshore pollock landings takes place in the ports of Dutch Harbor/Akutan, which reported 699.8 million pounds in groundfish landings for 2000, "the highest landings by pound of any port in the United States" (Hiatt et.al. 2007). 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 Bering Sea pollock TAC is apportioned between inshore, offshore, and mothership sectors after allocations are subtracted for the CDQ program and incidental catch allowances. The pollock fishery is further divided into two seasons—the winter "A" roe season and the summer "B" season. The "B" season is largely non-roe. The 2013 allocation of the TAC (1,266,400 mt) 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 2003 to 2014. The sectors identified here are the Catcher Vessels (CV), Catcher Processor (CP) Mothership (M), and CDQ sectors.

Table 48 Bering Sea pollock allocations, catch, and number of participating vessels; 2004–2014[21]

Year/ TAC	Sector (# of vessels)	Allocation (metric tons)	Pollock Catch (metric tons)
2004	CV (86)	649,580	637,971
1,492,000	CP (17)	519,664	519,570
	M (10)	129,916	129,222
	CDQ	149,200	149,173
2005	CV (84)	653,787	648,117
1,478,000	CP (16)	523,029	517,699
	M (9)	130,757	130,669
	CDQ	149,750	149,715
2006	CV (81)	660,318	645,606
1,487,756	CP (16)	528,254	527,134
	M (9)	132,063	131,404
	CDQ	150,400	150,374
2007	CV (82)	610,736	572,507
1,394,000	CP (16)	488,588	488,543
	M (17)	122,147	121,514
	CDQ	139,400	139,336
2008	CV (80)	434,250	427,741
1,000,000	CP (17)	347,400	346,998
	M (17)	86,850	85,364
	CDQ	100,000	99,964
2009	CV (79)	352,080	349,708
815,000	CP (15)	281,664	281,603
	M (17)	70,416	70,308
	CDQ	81,500	81,478
2010	CV (81)	353,466	351,685
813,000	CP (15)	282,773	282,750
	M (14)	70,693	70,576
	CDQ	81,300	81,275
2011	CV (80)	552,748	519,095
1,266,400	CP (15)	442,198	423,680
	M (13)	110,550	109,856
	CDQ	127,100	116,978
2012	CV (81)	529,050	525,184
1,266,400	CP (14)	423,240	423,161
	M (15)	105,810	105,384
	CDQ	121,900	121,854
2013	CV (79)	550,801	548,966
1,266,400	CP (15)	440,640	440,591
	M (14)	110,160	110,019
	CDQ	126,600	126,538
2014	CV (77)	**394,666**	**554,640**
1,266,400	CP (16)	**305,817**	**443,712**
	M (14)	**75,906**	**110,928**
	CDQ	**100,132**	**128,600**

[21] The mothership sector is comprised of three permitted vessels. In some years not all motherships participate in the BSAI pollock fishery. What is shown here, for vessel participation, are the number of CVs that delivered to operating motherships each year.

4.5.3 Market Disposition of Alaska Pollock

Production

The pollock fishery in waters off Alaska is the largest U.S. fishery by volume, and the economic character of that fishery centers on a varied range of products produced from pollock. In the U.S., Alaska pollock catches are processed mainly for roe, surimi, and several varieties of fillet products. Fillet production has increased particularly rapidly due to more efficient rates of harvests, increased recovery rates, and the shift by processors from surimi to fillet production, all made possible, at least in part, by the AFA. The information in this section summarizes the more extensive information presented in the 2013 Economic SAFE Report, which incorporated by reference and to which readers are referred to for a more detailed discussion.

Prior to the implementation of the AFA, U.S. pollock catches were processed mainly into surimi. The Bering Sea pollock fishery was then managed as an "open-access" fishery in which vessels sought to harvest as large a share of the TAC as possible before the TAC or established bycatch limits were reached and the fishery closed. Because surimi production allows more raw material to be processed in a shorter period of time than fillet and fillet block production, committing catches for surimi production was to a vessel's operational advantage. With the operational and economic efficiencies gained through rationalization of the fishery under the AFA, the industry was able to abandon practices compelled by the economics of open access and began developing more deliberate production strategies according to market demands.

This shift in production practices led, as noted, primarily to a particularly rapid increase in fillet production during the early 2000s, to meet greater world demand for whitefish products created by several factors, including declining harvests in the Russian pollock fishery and a sharp decrease in the supply of fillets from Atlantic cod. The result has been increased fillet production and growth in wholesale gross revenues from U.S. pollock fillet production.

The estimated wholesale value of these products over the same period is shown in Figure 23. This figure show the dramatic increase in production and wholesale value of fillets from 2000 to 2007. Since 2006; however, the production volume for all pollock products declined through 2009, due to reduced TACs, and has since rebounded as TACs have increased. Fillets has remained the most valuable pollock product from 2003-2012, while roe has declined in wholesale value from highs of more than $500 million, in 2003, to approximately $100 million in 2010 and has rebounded slightly in value through 2012.

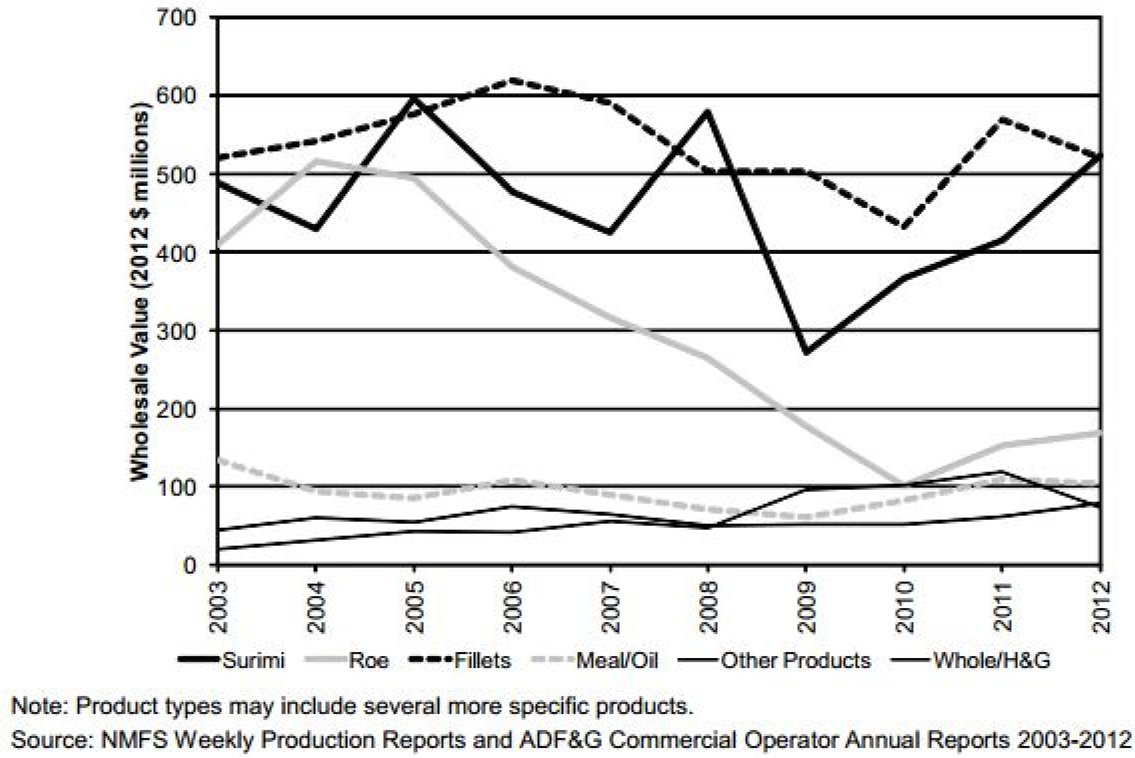

Figure 23. Wholesale value of Alaska pollock by product type, 1996-2010

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 in various finished product forms. The 2013 Economic Safe Document contains market disposition information for these various products; however, the impact analysis contained in this RIR utilizes round weight equivalent first wholesale product prices when converting potential pollock fishery impacts to potential revenue impacts and cannot further identify potential impacts to product form or international trade. Thus, 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 2013 Economic SAFE document.

4.5.4 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 ICAs exempt participating non-CDQ and CDQ 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 incidental catch 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.

4.5.5 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 caught salmon die in the Alaska groundfish trawl fisheries (NMFS 1996). Therefore, to reduce the waste of edible protein, the PSD program was begun. NMFS implemented the PSD program for salmon in 1996, and expanded the program in 1998 to include Pacific halibut delivered to shoreside processors by CVs using trawl gear. The first donations were received under the PSD program in 1996.

The PSD program allows enrolled seafood processors in the Bering Sea and Gulf of Alaska trawl groundfish fisheries to retain salmon and halibut 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 National Oceanic and Atmospheric Administration (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 July 15, 2005 (70 FR 40987). SeaShare applied for a permit renewal on March 20, 2008.

Many trawl vessels and all three major shoreside processors operating from Dutch Harbor have participated in the PSD program since its inception as a pilot program in 1994. The shoreside processors Alyeska Seafoods, Inc., and Unisea, Inc., have participated every year; Westward Seafoods, Inc., has participated less frequently. Thirty-six trawl catcher vessels are qualified to participate in the PSD program and deliver to these shoreside processors. Additionally, there are 17 trawl catcher/processors that currently participate in the salmon PSD program; however, catcher/processors may not participate in the halibut PSD program. With existing staff, SeaShare has stated that it could administer up to 40 processors and associated catcher vessels, about twice as many processors as it currently administers (SeaShare 2008).

There is limited information available on the volumes of 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).[22]

Table 49 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.

[22] Mary Harmon, SeaShare. Personal communication, September 11, 2014, via e-mail.

Table 49 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).

The packaged PSD salmon is distributed through SeaShare to food banks located primarily in the Puget Sound area of the Pacific Northwest. Less than full truckload quantities of fish are distributed to Seattle-area food banks that use their freezer trucks to pick up the frozen salmon directly from the freight carriers. Sometimes full truckloads are made available to any qualified food bank within the America's Second Harvest network that is willing to pick it up with a freezer truck and pay for shipping expenses. Due to transportation costs, donated salmon usually stays in the western U.S. Individual food banks distribute the salmon to soup kitchens, shelters, food pantries, and hospices (SeaShare 2008). Over the 12 years that the salmon PSD program has been in place, nearly 2 million pounds of steaked and finished salmon have been donated through the program. Using an estimated four meals per pound of salmon, nearly 650,000 meals have been donated on average, per year. The donated salmon provides a highly nutritious source of protein in the diets of people who have access to only meagre, and often inadequate, food (NMFS 1996).

Expenses for processing the salmon and delivery to the food banks are covered by donations. Fishermen participating in the PSD program must sort, retain, and deliver to an approved storage facility, all salmon destined for the PSD program. Their costs include space on the vessel to store the fish, and maintenance of the fish in suitable condition. Processors must accept delivery, fill out the appropriate paper work and process, refrigerate, package, and store the donated fish, incurring costs in time, labor, and equipment that must be borne by the processor. The PSD salmon must then be delivered from the processor to SeaShare, which then coordinates the temporary storage of the fish, its transportation, and routing to eligible food banks. The transportation costs to Seattle are usually donated by various freight carriers. Participation in the PSD program is entirely voluntary, so an entity that found the program requirements onerous could stop participating without financial cost to itself (NMFS 2003a).

The PSD program reduces waste of salmon PSC catch. 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.

4.6 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 date on chum and Chinook salmon catch and 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.

4.7.1 Importance of Commercial Chum and Chinook Salmon Revenue to Western Alaska Limited Entry Permit Holders

The importance of 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 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 revenue analysis would drastically overstate the relative importance of non-Chinook salmon versus that of chum salmon, which comprise nearly all of the non-Chinook PSC. For this reason, this analysis specifically reports the importance of revenue earned from 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 PSC that the action alternatives seek to address.

Table 50 and Table 51 summarize information on the importance of chum salmon revenues for western Alaskan permit holders. Table 50 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 chum salmon limited entry fisheries in western Alaska. Table 51 shows the average revenues per person fishing received by these permit holders.

Table 50 Percent of commercial salmon revenue from western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts that is attributable to 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 51 Average commercial salmon 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 revenue earned in the Northwest Alaska census area was derived from chum salmon. In 2013, chum salmon average revenue was $10,022. However, the 2013 average revenue was lower than the $12, 654 average 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 revenue and as much as 86 percent of total commercial salmon revenue, in 2013. The 2013 average commercial chum salmon 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 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 1991-2013, with 2010 recording the period high of 20 percent. In 2011 chum revenue was 15 percent of total salmon revenue and recorded a period high of average revenues of $19,883 per permit holder. In 2013, chum salmon average revenue was $10,788.

- Yukon-Koyukuk: chum salmon revenues accounted for a majority of all salmon 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 revenue attributable to chum salmon declined but had 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 revenue per permit holder. Since 2011, chum average revenue rose dramatically in the region and was 66 percent of total salmon revenue in 2012, and

60 percent of total salmon revenue in 2013. The 2012 average chum revenue per permit holder was an historical record of $8,904; howeve, the 2013 value fell to $5,864.

- Nome: chum salmon revenues accounted for between 2 percent and 42 percent of the 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 salmon 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 revenues earned by persons operating in the Aleutians West census district. Average revenues ranged from $55 to $11,136, with the largest average revenue occurring in 2011.

- Dillingham and Bristol Bay: These census areas tend to have relatively small amounts of chum salmon commercial 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 revenue exceeding $1,000 in several recent years as well as historically.

- Bethel: chum salmon 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 revenue occurring in 2011. In recent years, chum salmon revenue, as a percent of total 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 revenues accounted for between 0 percent and 7 percent of the 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 revenue occurring in 2010. Chum salmon revenue, as a percent of total revenue, decreased to 1 percent in 2013.

Table 52 and Table 53 summarize information on the importance of Chinook salmon revenues for western Alaskan permit holders. Table 52 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 Chinook salmon limited entry fisheries in western Alaska. Table 53 shows the average revenues per person fishing received by these permit holders. In sharp contrast to chum salmon revenues, Chinook revenue has played a small part in the overall salmon revenue earned by commercial permit holders in most regions. Historically; however, several areas have depended heavily on Chinook revenue. The Wade-Hampton census area, which encompasses the Nushagak River Chinook salmon run, has historically relied heavily on Chinook revenue of as much as 100 percent in some years. However, Chinook revenue has fallen constantly in the region through the 2000s and was zero in 2011-2013. The Nome census area has historically had as much as 85 percent of total salmon revenue come from Chinook during low chum runs in the early 2000s. Other areas, such as Bethel and the Yukon-Koyukuk, have relied on Chinook salmon revenue historically; however, with declining Chinook runs and commercial fishery restrictions, Chinook revenue has declined in recent years in those areas as well.

Table 52 Percent of commercial salmon revenue from western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts that is attributable to Chinook harvests (source: AKFIN)

	Aleutians east	Aleutians west	Bethel	Bristol Bay	Dillingham	Lake and Peninsula	Nome	Northwest	Wade Hampton	Yukon-Koyukuk
1991	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 53 Average commercial salmon revenue from western Alaska salmon fisheries accruing to permit holders resident in different Alaska census districts that is attributable to Chinook harvests; nominal dollars per year (Source: AKFIN)

	Aleutians east	Aleutians west	Bethel	Bristol Bay	Dillingham	Lake and Peninsula	Nome	Northwest	Wade Hampton	Yukon-Koyukuk
1991	$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 chum salmon revenue data presented above, the Alaska Department of Labor and Workforce Development (ADOLWD) maintains, presently through 2009, 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 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 salmon, also will be provided below to highlight ADF&G management areas with high dependence on the chum 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. 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). Salmon harvesting gross gillnet revenue declined substantially during the late 2000s; however, set-net 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 widely spread 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 2009, for example, 394 individuals were engaged in fish harvesting activity in August with 304 engaged in salmon harvesting employment. In contrast, the monthly average number of harvesting employment positions in all fisheries combined was 87 in 2009.
As of 2009, 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, Manley Hot Springs, 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 20 in 2004 and has rebounded somewhat to 68 in 2009. Income earned in this region cannot be presented due to State of Alaska confidentiality restrictions.

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; however nearly three times that many crew participated in the area's fisheries. Overall, in the Yukon Delta Region 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 2009, for example, salmon employment represented between 82 percent and 90 percent of total harvesting positions from June through August. Groundfish, halibut, and herring fisheries also provide harvesting employment in the region. Of note is that there is little or no fish harvesting employment in the region from October through April. Thus, all fish harvesting related income occurs from May through September.

As of 2009, there were as many as 10 canneries and land based seafood processors in the Yukon Delta Region. Since then; however, local fish processing infrastructure have been expanded through investments by the CDQ entities (e.g. CVRF's Platinum Plant) in the region. However, 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 rebounded to a period high in 2009 with 831 total workers. Non-resident workers have made up a relatively small proportion of about 5 percent in recent years. Seafood processing wages are estimated to have been approximately $1.8 million in 2005 and have increased steadily to $4.7 million in 2009, with non-resident wages accounting for 22 percent of the total in 2009. As in the Northern region, percent of non-resident wages is higher than percent of non-resident workers and indicates relatively higher wages for non-resident workers.

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 regions 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 is 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 2009, for example, 6,768 individuals were engaged in fish harvesting activity in July as compared to the monthly average of 1,161. Halibut and herring fisheries provide most of the remaining harvesting employment in the region. Of note is that there is little or no fish harvesting employment in the region from October through March. Thus, all fish harvesting related income occurs from April through September.

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 2009, the area's fisheries supported 4,522 seafood processing workers. Overall wages have increased steadily since 2003, with a period high of $31 million in total wages estimated for 2009.

Non-resident workers have made up a substantial proportion of the Bristol Bay Region workforce and accounted for approximately 87 percent in 2009. Bristol Bay Non-resident wage percentages have historically been close the overall percentages of non-resident workers. Thus, wages of non-resident workers do not appear to be much higher than wages of resident workers.

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 the three boroughs in the region. In total, 1070 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 in (92 percent) followed by the pot (79 percent) and longline fisheries (48%).

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 revenue in 2009 and employed approximately 1,550 harvesting workers. The proportion of 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 2009, for example, there were 1,148, 1,806, and 1,598 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 2009, for example, there were 2,267, 2,416, and 2,618 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 2009, 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 2009 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 7,041 in 2004, to a high of 8,236, in 2006, before falling to 6,276 in 2009. 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 2006, slightly more than three quarters 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 information, this information 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 Analysis of Impacts

The analytical framework of an RIR is framed in 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 provide operational efficiencies that may affect operating costs.

4.8.1 Alternative 1, No Action

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 further in Chapter 2. Chapter 3 contains a discussion of current trends in bycatch of both species annually, by sector, by season and the annual AEQs by stock composition region. That extensive treatment will not be duplicated here; however, it is important to point out the limitations of this analysis of salmon impacts here. The following is excerpted from Chapter 3 including references to tables that appear there.

Chapter 3 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. 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. The impact analysis for Alternatives 2-5 is based upon comparison with current 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 negative losses (increased PSC). All of these estimated impacts are in comparison to status quo levels in Table 19. Any impact to Chinook salmon under the alternatives then is estimated by whether it is likely to represent either no change from status quo, and increase in the adverse impact from status quo levels or a beneficial impact should PSC levels be estimated to be reduced under the alternative.

4.8.2 Analysis of Impacts: 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 focusses upon the use of the current RHS program for chum salmon bycatch management operated 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 rates while balancing Chinook salmon bycatch avoidance and opportunities for pollock harvests in the latter portion of the B season[23].

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

One important consideration in the proposal, and 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 then chum closures within that Region would cease and instead the applicable the Chinook hard cap 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 when and if both salmon species were present. Regulations to implement Amendment 91 removed this prioritization, leaving chum RHS closures in effect throughout 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 (Chapter 3) anything that slows down the fishery in the B-season has the potential of exacerbating Chinook salmon bycatch later in the season.

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 some operational modifications to the proposed 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

[23] 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 included in a revised proposal to meet the intent of Alternative 2 in the future.

savings over status quo management as more 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 have a reduced adverse impact on salmon stocks. **Therefore this alternative is estimated to have some (likely small) reduced adverse impact as compared with status quo for salmon stocks. This alternative is also likely to improve the efficiency of the RHS program and thereby reduce operational costs in the pollock fishery by allowing areas of high pollock harvest rates to remain open to fishing when Chinook bycatch rates increase.**

The positive benefits 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 decreases the incentive to remain in an IPA then adverse impacts to chum salmon under this alternative could increase. This is because without joining an IPA, and absent any backstop measure to further incentivize participation, there are no additional chum salmon conservation measures affecting the pollock fishery. Any action that decreases the incentive to remain in an IPA would also have adverse impacts on Chinook salmon as it would diminish the provisions for bycatch reduction under the IPAs themselves. An opt-out cap exists under Amendment 91 for vessels which do not participate in an IPA. Any vessel that chooses to opt out of an IPA is subject to a cap which is managed collectively for all vessels operating outside of an IPA. Regulations governing the amount of Chinook salmon which is allocated to the opt-out cap are listed at 679.21(f)(4). The opt-out cap was structured to be a restrictive cap (beginning with a vessel's own allocation under their sector and deducted from the sector share of the overall cap) but is managed as a group not an individual allocation amongst all vessels fishing under the cap. Thus if one vessel has a higher proportion of salmon in the opt-out then another vessel, it is less beneficial to the vessel bringing in the higher limit to fish under this combined cap than to remain in their sector IPA and retain their individual allocation, all other factors being equal. Similarly, a vessel with limited salmon allocated to it under their sector has provisions within the IPA available to them to transfer or lease salmon or pollock to maximize their flexibility. These provision are unavailable under the opt-out cap and thus if a vessel is fishing alone under the opt out cap and reaches its salmon limit it will have to cease fishing. The opt-out cap is further limited regardless of vessels participating by the initial back stop allocation (not to exceed the maximum annual backstop cap of 28,496). To date there has been 100% participation in the IPAs. However, anything that decreases the incentive to remain in the IPA and potentially fish under the opt-out provisions of Amendment 91 could result in increased bycatch and hence have an adverse impact to Chinook salmon stocks. As alternatives under consideration are not mutually exclusive, any combination of alternatives which further erodes the incentives to participate in an IPA may exacerbate these adverse impacts.

4.8.3 Analysis of Impacts: Alternative 3

The discussion of potential effects of this Alternative appears in detail in Chapter 3. A synopsis of that broader discussion is provided here along with the conclusions from that analysis. Alternative 3 increases the provisions to reduce Chinook prohibited species catch under the IPAs with a variety of options. Under all of the options contained within Alternative 3 impacts to chum salmon are anticipated to be similar to status quo.

Alternative 3, option 1 imposes, within the IPAs, **"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.

There are two ways in which restrictions or penalties might reduce Chinook salmon PSC. Vessels with high bycatch rates could be restricted from fishing at high-bycatch periods or in high bycatch locations, in some manner, that would directly lead to lower Chinook PSC. Such a penalty could potentially create increased operational costs for those vessels. Alternatively, the threat of a penalty may serve as a deterrent that sufficiently incentivizes bycatch avoidance via changes in fishing behavior. Such changes in behavior could include fishing in lower bycatch areas and could result in changes in harvest rates, potentially increasing operational costs. If the penalty serves as a deterrent then Chinook PSC may decrease for many vessels over a longer period of time and the penalty may never actually be imposed on any vessels. Whether, and to what extent, this option would impose operational cost impacts depends largely on the severity of the penalty or restriction, which is not defined at present. Chapter 3 contains a discussion of potential ways that the penalties or restrictions could be structured in order to minimize operational costs while achieving the desired reduction in Chinook PSC.

Alternative 3, option 2 addresses a requirement for the IPAs to require the use of salmon excluder devices year-round or during specific times of the A- and B-season. 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. Defining an excluder is not trivial, as designs continue to evolve and there is the potential that there will be radical innovations that any kind of restrictive definition would violate. Experimentation is also necessary to improve excluders. 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.

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[24]) 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[25] 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 $7,500 to $12,000 per excluder. The upper end of that range applies to higher horsepower vessels where it takes more webbing, floats, lead line, and construction time simply because the net is larger. The $7,500 end of the range is an estimate for the GOA pollock CV trawlers in Kodiak and the $12K applies to high horsepower Bering Sea CVs. 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.

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 have shown a Chinook reduction of 38 percent, combined with a chum reduction of 7 percent and less than one percent pollock loss.[26] However, it is not known how much these results can be generalized, and whether this percentage of bycatch reduction will occur under both high and low bycatch conditions.

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[24] 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
[25] Personal Communication via e-mail with John Gauvin, consultant to the pollock CV sector, October 23, 2014.
[26] http://www.npfrf.org/uploads/2/3/4/2/23426280/salmon_excluder_efp_11-01_final_report-1.pdf. Accessed September 7, 2014.

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.

Alternative 3, option 3 addresses mandating that a rolling hot spot (RHS) program operate throughout the entire A and B seasons. 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. This option 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 them applicable in very low Chinook PSC situations. 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, the number of Chinook RHS closures actually applied – and the number of vessels impacted – since Amendment 91 went into place in 2011 in the other sectors at the same times has generally been quite limited. 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, 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 bycatch.

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 and hard cap. At higher Chinook PSC levels, there is a significant threat to vessels of being closed out of pollock fishing by reaching the hard cap, 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 threat that closures could be costly to the fleet and potentially increase Chinook and/or chum bycatch.

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*."[27] 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 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 24 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, 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 bycatch would occur for vessels that fished close to the performance standard 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.

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 trade off 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.

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

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

likelihood that credits will be needed, which is partially a function of the gap between the performance standard and the hard cap.

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.

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 and ensure that they catch their pollock quota and could allow them to pursue other fishing opportunities (e.g., tendering or fishing on the West Coast) while not catching excessively high 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.

Overall, the options analyzed under this alternative are all intended to increase the incentives to reduce Chinook bycatch within the IPAs. Any successful increased 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. Similarly, it is not possible to quantify the potential operational costs that may be incurred in further avoidance of Chinook. Nevertheless, **this alternative is estimated to be similar to status quo in impacts under these options with the possibility of an reduced adverse impact to Chinook salmon depending upon the severity of the penalties imposed. The impacts to chum salmon under this alternative are estimated to be the same as with status quo.**

4.8.4 Analysis of Impacts: 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). 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). Table 25 (see Chapter 3) shows the seasonal bycatch rate for Chinook by month and Table 26 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 27). Whereas for chum salmon, proportionately few are taken after this period (Table 28).

Depending on the year, the amount of Chinook salmon PSC savings from shifting the B-season opening sooner varies but is generally positive (Table 29). 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 salmon PSC (Table 30).

The analysis of the option to close fishing earlier (Sept 15th, Oct 1st and Oct 15th) is presented in Table 31 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 32 through Table 34 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. Based on these examples, a September 15th closure could have historically placed from about 19,000 mt to more than 200,000 mt of pollock harvest at risk; however, more recent harvest trends (2012 and 2013) show approximately 50,000 mt put at risk of not being harvested. When the closure is moved to October 1st, the pollock harvest put at risk ranged historically from around 2,000 mt to about 90,000 mt, and was approximately 14,000 mt in 2013. Moving the closure to October 15th further lowers these numbers to an historical range of zero to about 14,000 mt, with a 2013 value of 139 mt. These examples do not incorporate the fact that industry would adapt to these closure dates by redeploying harvesting effort to make up this catch earlier in the season. Also important to note is that the potential impacts would be spread across the sectors and vessels in each sector likely resulting in little impact, at the individual vessel level, other than having to apply greater catch effort earlier in the season. It is not expected that results under this option would be exactly similar and is shown as a bookend only.

Analysis of this alternative indicates that with fishing occurring earlier in the B season under both options, there is likely to be reduced Chinook bycatch by shifting effort away from the highest rates in September and October. **This alternative is estimated to confer a reduced adverse impact to Chinook salmon relative to Alternative 1. 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.** 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.

4.8.5 Analysis of Impacts: Alternative 5

Alternative 5 would modify the existing performance standard 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 are proposed for use in determination of 'low abundance". 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 performance standard is evaluated annually (25% and 60%) and B-season only (25% and 60%).

The 3-run index of run reconstruction estimates shown in Table 5 shows that the years in which the 'low abundance' threshold would have been reached are 2000, 2010-2013. The two-year average would have been 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 would enact a lower performance threshold the following year. Thus for example, in 2000 a determination of a 'low abundance threshold" would have been made and resulting lower performance standard 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 disrupt fishing fleet activity and affect incentive behavior controls under the IPAs.

The ‘low abundance’ period beginning in 2010 would have triggered a lower performance standard 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 19. 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, particularly in the B-season only suboptions. Rollover amounts of Chinook salmon from the A-season into B-season were substantial, particularly for the sub-option specifications (Table 36). Cumulative totals were tracked for the three species (Chinook salmon, non-Chinook 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 37). However, even in that time period pollock catch put at risk fleet wide was less than 20,000 mt, and only would have occurred in 2011. This amount of pollock is likely to be captured by a re-deployment of effort with limited impacts on cost of production. Due to the fact that A-season PSC that rolled over into the B-season allowances, even for the more constraining sub-option (the 60% reduction), the biggest reduction in PSC would have been in 2011 (and 7,127 Chinook salmon or 32% of the 2011 total).

It should be noted that vessels would have faced a lower performance standard 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. 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 assume 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 and hard cap 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 hard cap of their portion of the 47,591, and/or respond slowly to the need to operate under the lower performance standard as the hard cap 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. 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.

This alternative is estimated to be similar to Alternative 1 in impacts under most options with the possibility of a reduced adverse impact to Chinook salmon and chum salmon stocks under option 2 (annual reduction of 60%), with small potential impacts on pollock harvesting operations.

4.9 Management and Enforcement Considerations

Section 2.6 provides information on NMFS recommendations for improving monitoring and enforcement under all alternatives. Several of these recommendations, if adopted, may potentially create some economic costs. However, these recommendations were being developed concurrently with the development of this Initial Review Draft. Thus analysis of these recommendations, provided they are adopted, will be presented in the Final Review Draft.

4.10 Summation of the Alternatives with Respect to Net Benefit to the Nation

Alternative 2 is estimated to have some (likely small) reduced adverse impact, as compared with status quo, for salmon stocks. This alternative is also likely to improve the efficiency of the RHS program and thereby reduce operational costs in the pollock fishery by allowing areas of high pollock harvest rates to remain open to fishing when Chinook bycatch rates increase. As these effects are considered to be positive, this Alternative will have a positive effect on net benefit to the nation.

Overall, the options analyzed under Alternative 3 are all intended to increase the incentives to reduce Chinook bycatch within the IPAs. Any successful increased 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. Similarly, it is not possible to quantify the potential operational costs that may be incurred in further avoidance of Chinook. Nevertheless, this alternative is estimated to be similar to status quo in impacts under these options with the possibility of an increased beneficial impact to Chinook salmon depending upon the severity of the penalties imposed. The impacts to chum salmon under this alternative are estimated to be the same as with status quo. Thus, this Alternative is not expected to result in reduced net national benefits; however, it is not possible to directly compare the benefits of Chinook salmon saved with the operational cost impacts that may occur.

Analysis of Alternative 4 indicates that with fishing occurring earlier in the B season under both options, there is likely to be reduced Chinook bycatch by shifting effort away from the highest rates in September and October. This alternative is estimated to confer a reduced adverse impact to Chinook salmon relative to Alternative 1. 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. This alternative may also place some pollock catch at risk due to early closure of the B season; however, in response to the potential for some pollock to not be harvested industry is expected to adapt to the closure dates by redeploying harvesting effort to make up this catch earlier in the season. Also important to note is that the potential impacts would be spread across the sectors and vessels in each sector likely resulting in little impact, at the individual vessel level, other than having to apply greater catch effort earlier in the season. Thus, this alternative is expected to have positive effects on net national benefits as compared to the status quo.

Alternative 5 is estimated to be similar to Alternative 1 in impacts under most options with the possibility of a reduced adverse impact to Chinook salmon and chum salmon stocks under option 2 (annual reduction of 60%), with small potential impacts on pollock harvesting operations. Thus, this alternative is expected to have positive effects on net national benefits as compared to the status quo.

5 Initial Regulatory Flexibility Analysis

5.1 Introduction

This Initial Regulatory Flexibility Analysis (IRFA) addresses the statutory requirements of the Regulatory Flexibility Act (RFA) of 1980, as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (5 U.S.C. 601-612). This IRFA evaluates the potential adverse economic impacts on small entities directly regulated by the proposed action.

The RFA, first enacted in 1980, was designed to place the burden on the government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA recognizes that the size of a business, unit of government, or nonprofit organization frequently has a bearing on its ability to comply with a federal regulation. Major goals of the RFA are: (1) to increase agency awareness and understanding of the impact of their regulations on small business, (2) to require that agencies communicate and explain their findings to the public, and (3) to encourage agencies to use flexibility and to provide regulatory relief to small entities.

The RFA emphasizes predicting significant adverse economic impacts on small entities as a group distinct from other entities, and on the consideration of alternatives that may minimize adverse economic impacts, while still achieving the stated objective of the action. When an agency publishes a proposed rule, it must either 'certify' that the action will not have a significant adverse economic impact on a substantial number of small entities, and support that certification with the 'factual basis' upon which the decision is based; or it must prepare and make available for public review an IRFA. When an agency publishes a final rule, it must prepare a Final Regulatory Flexibility Analysis, unless, based on public comment, it chooses to certify the action.

In determining the scope, or 'universe', of the entities to be considered in an IRFA, NMFS generally includes only those entities that are directly regulated by the proposed action. If the effects of the rule fall primarily on a distinct segment, or portion thereof, of the industry (e.g., user group, gear type, geographic area), that segment would be considered the universe for the purpose of this analysis.

5.2 IRFA Requirements

Until the North Pacific Fishery Management Council (Council) makes a final decision on a preferred alternative, a definitive assessment of the proposed management alternatives cannot be conducted. In order to allow the agency to make a certification decision, or to satisfy the requirements of an IRFA of the preferred alternative, this section addresses the requirements for an IRFA. Under 5 U.S.C., section 603(b) of the RFA, each IRFA is required to contain:

- A description of the reasons why action by the agency is being considered;
- A succinct statement of the objectives of, and the legal basis for, the proposed rule;
- A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply (including a profile of the industry divided into industry segments, if appropriate);
- A description of the projected reporting, record keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;
- An identification, to the extent practicable, of all relevant federal rules that may duplicate, overlap, or conflict with the proposed rule;
- A description of any significant alternatives to the proposed rule that accomplish the stated objectives of the proposed action, consistent with applicable statutes, and that would minimize any significant

economic impact of the proposed rule on small entities. Consistent with the stated objectives of applicable statutes, the analysis shall discuss significant alternatives, such as:

1. The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;
2. The clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;
3. The use of performance rather than design standards;
4. An exemption from coverage of the rule, or any part thereof, for such small entities.

In preparing an IRFA, an agency may provide either a quantifiable or numerical description of the effects of a proposed action (and alternatives to the proposed action), or more general descriptive statements, if quantification is not practicable or reliable.

5.3 Definition of a Small Entity

The RFA recognizes and defines three kinds of small entities: (1) small businesses, (2) small non-profit organizations, and (3) small government jurisdictions.

Small businesses. Section 601(3) of the RFA defines a “small business” as having the same meaning as “small business concern”, which is defined under Section 3 of the Small Business Act. A “Small business” or “small business concern” includes any firm that is independently owned and operated and not dominant in its field of operation. The SBA has further defined a “small business concern” as one “organized for profit, with a place of business located in the United States, and which operates primarily within the United States or which makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor... A small business concern may be in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the firm is a joint venture there can be no more than 49 percent participation by foreign business entities in the joint venture.”

The Small Business Administration (SBA) has established size standards for all major industry sectors in the U.S., including commercial finfish harvesters (NAICS code 114111), commercial shellfish harvesters (NAICS code 114112), other commercial marine harvesters (NAICS code 114119), for-hire businesses (NAICS code 487210), marinas (NAICS code 713930), seafood dealers/wholesalers (NAICS code 424460), and seafood processors (NAICS code 311710). A business primarily involved in finfish harvesting is classified as a small business if it is independently owned and operated, is not dominant in its field of operation (including its affiliates), and has combined annual gross receipts not in excess of $20.5 million, for all its affiliated operations worldwide. For commercial shellfish harvesters, the same qualifiers apply, except the combined annual gross receipts threshold is $5.5 million. For other commercial marine harvesters, for-hire fishing businesses, and marinas, the same qualifiers apply, except the combined annual gross receipts threshold is $7.5 million.

A business primarily involved in seafood processing is classified as a small business if it is independently owned and operated, is not dominant in its field of operation (including its affiliates), and has combined annual employment, counting all individuals employed on a full-time, part-time, or other basis, not in excess of 500 employees[28] for all its affiliated operations worldwide. For seafood dealers/wholesalers,

[28] In determining a concern's number of employees, SBA counts all individuals employed on a full-time, part-time, or other basis. This includes employees obtained from a temporary employee agency, professional employee organization or leasing concern. SBA will consider the totality of the circumstances, including criteria used by the IRS for Federal income tax

the same qualifiers apply, except the employment threshold is 100 employees.

The SBA has established "principles of affiliation" to determine whether a business concern is "independently owned and operated." In general, business concerns are affiliates of each other when one concern controls or has the power to control the other or a third party controls or has the power to control both. The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, are treated as one party with such interests aggregated when measuring the size of the concern in question. The SBA counts the receipts or employees of the concern whose size is at issue and those of all its domestic and foreign affiliates, regardless of whether the affiliates are organized for profit, in determining the concern's size. However, business concerns owned and controlled by Indian Tribes, Alaska Regional or Village Corporations organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601), Native Hawaiian Organizations, or Community Development Corporations authorized by 42 U.S.C. 9805 are not considered affiliates of such entities, or with other concerns owned by these entities solely because of their common ownership.

Affiliation may be based on stock ownership when (1) A person is an affiliate of a concern if the person owns or controls, or has the power to control 50 percent or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock, or (2) If two or more persons each owns, controls or has the power to control less than 50 percent of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern.

Affiliation may be based on common management or joint venture arrangements. Affiliation arises where one or more officers, directors or general partners control the board of directors and/or the management of another concern. Parties to a joint venture also may be affiliates. A contractor or subcontractor is treated as a participant in a joint venture if the ostensible subcontractor will perform primary and vital requirements of a contract or if the prime contractor is unusually reliant upon the ostensible subcontractor. All requirements of the contract are considered in reviewing such relationship, including contract management, technical responsibilities, and the percentage of subcontracted work.

<u>Small non-profit organizations</u> The RFA defines "small organizations" as any not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

<u>Small governmental jurisdictions</u> The RFA defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with populations of fewer than 50,000.

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purposes, in determining whether individuals are employees of a concern. Volunteers (*i.e.*, individuals who receive no compensation, including no in-kind compensation, for work performed) are not considered employees. Where the size standard is number of employees, the method for determining a concern's size includes the following principles: (1) the average number of employees of the concern is used (including the employees of its domestic and foreign affiliates) based upon numbers of employees for each of the pay periods for the preceding completed 12 calendar months; (2) Part-time and temporary employees are counted the same as full-time employees. *[PART 121—SMALL BUSINESS SIZE REGULATIONS §121.106]*

5.4 Reason for Considering the Proposed Action

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.

5.5 Objectives of Proposed Action and its Legal Basis

Under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), the Secretary of Commerce (NMFS Alaska Regional Office) and the North Pacific Fishery Management Council have the responsibility to prepare fishery management plans and associated regulations for the marine resources found to require conservation and management. NMFS is charged with carrying out the Federal mandates of the Department of Commerce with regard to marine fish, including the publication of Federal regulations. The Alaska Regional Office of NMFS, and Alaska Fisheries Science Center, research, draft, and support the management actions recommended by the Council. The Bering Sea and Aleutian Islands (BSAI) groundfish fisheries are managed under the Fishery Management Plan for Groundfish of the BSAI Management Area. The proposed action represents an amendment, as required, to the fishery management plan, as well as amendments to associated Federal regulations.

The Council's principal objectives, of the BSAI Groundfish FMP amendment and proposed regulations, are to prioritize Chinook salmon bycatch avoidance, while preventing high chum salmon bycatch and focusing on avoidance of Alaska chum salmon stocks; and to allow flexibility to harvest pollock in times and places that best support those goals. These objectives are consistent with National Standard 9 of the Magnuson-Stevens Act, and to enable pollock harvests to contribute to the achievement of optimum yield on a continuing basis in the GOA groundfish fishery, consistent with National Standard 1 of the Magnuson-Stevens Act.

5.6 Number and Description of Directly Regulated Small Entities

This section provides estimates of the number of harvesting vessels that are considered small entities. The RFA requires a consideration of affiliations between entities for the purpose of assessing if an entity is small. There is not a strict one-to-one correlation between vessels and entities; many persons and firms are known to have ownership interests in more than one vessel, and many of these vessels with different ownership, are otherwise affiliated with each other. For example, vessels in the American Fisheries Act

(AFA) catcher vessel sectors are categorized as "large entities" for the purpose of the RFA under the principles of affiliation, due to their being part of the AFA pollock cooperatives.

The proposed action applies only to those entities that participate in the directed pollock trawl fishery in the BS. These entities include the American Fisheries Act (AFA) affiliated pollock fleet and the six western Alaska Community Development Quota Program (CDQ) groups that receive allocations of BS pollock. All of the non-CDQ entities directly regulated by the proposed action were members of AFA cooperatives in 2008 and, therefore, NMFS considers them "affiliated" large (non-small) entities for RFA purposes.

Due to their status as non-profit corporations, the six CDQ groups are identified as "small" entities. This proposed action directly regulates the six CDQ groups, and NMFS considers the CDQ groups to be small entities for RFA purposes. As described in regulations implementing the RFA (13 CFR 121.103) the CDQ groups' affiliations with other large entities do not define them as large entities. Revenue derived from groundfish allocations and investments in BSAI fisheries enable these non-profit corporations to better comply with the burdens of this action, when compared to many of the large AFA affiliated entities. Nevertheless, the only small entities that are directly regulated by this action are the six CDQ groups.

Description of the CDQ groups

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. In aggregate, CDQ groups share a 10 percent allocation of the BSAI pollock total allowable catch (TAC).[29] These allocations, in turn, provide an opportunity for residents of these communities to participate in and benefit from the BSAI fisheries, through their association with one of the CDQ groups. The 65 communities, with approximately 27,000 total residents, benefit from participation in the CDQ Program, but are not directly regulated by this action. The six non-profit corporations (CDQ groups), formed to manage and administer the CDQ allocations, investments, and economic development projects are:

- Aleutian Pribilof Island Community Development Association (APICDA)
- Bristol Bay Economic Development Corporation (BBEDC)
- Central Bering Sea Fishermen's Association (CBSFA)
- Coastal Villages Region Fund (CVRF)
- Norton Sound Economic Development Corporation (NSEDC)
- Yukon Delta Fisheries Development Association (YDFDA)

The pollock fishery harvests on the order of 1 million metric tons of pollock each year (some years substantially more, some somewhat less) and provides millions of dollars in revenue to western Alaska CDQ communities through various channels, including the direct catch and sale or leasing of quota to various harvesting partners. The vessels harvesting CDQ pollock are the same vessels conducting AFA non-CDQ pollock harvesting. In addition to pollock allocations, CDQ groups have made significant investments in the at-sea pollock fleet as well as in hook & line and pot fisheries for such species as halibut, sablefish, crab, and Pacific cod. In addition, several of the CDQ groups have made, and continue to make, investments in fisheries and community infrastructure to support traditional local salmon fisheries in their regions.

[29] *The CDQ Program also receives allocations of other groundfish TAC that range from 10.7% for Amendment 80 species, to 7.5% for most other species; however, these allocated amounts are not affected by this action.*

5.7 Recordkeeping and Reporting Requirements.

This section will be completed once the Council has selected a preferred alternative. The Council had previously requested that the "Analysts should also develop and include recommended changes to Federal reporting requirements that would be necessary to evaluate the effectiveness of any of the alternatives." (Council motion June 2014). However given the complexity of the alternative set and the potential for mixing and matching of alternatives to form a preferred alternative this section should be best addressed once the Council has identified either a Preliminary Preferred Alternative (PPA) at initial review or a Preferred Alternative (PA) at final action. Additional monitoring requirements are suggested in Section 2.6 based upon operational experience gained with implementation of Amendment 91.

5.8 Federal Rules that may Duplicate, Overlap, or Conflict with Proposed Action

No duplication, overlap, or conflict between this proposed action and existing federal rules has been identified.

5.9 Description of Significant Alternatives to the Proposed Action that Minimize Economic Impacts on Small Entities

An IRFA requires a description of any significant alternatives to the proposed action(s) that accomplish the stated objectives, are consistent with applicable statutes, and that would minimize any significant economic impact of the proposed rule on small entities. The proposed action currently includes a range of options to accomplish the Council's stated objectives, as they are described in Section 5.5. The universe of potentially affected small entities does not vary depending upon which alternative(s) or options are selected from the ones considered in this action.

Since this is the initial RFA evaluation, and the Council has not selected a preferred alternative, all of the considered options under Alternatives 2 through 5 must be considered as part of the currently proposed action. The Council's stated objective notes an intent to prioritize Chinook salmon bycatch avoidance, while preventing high chum salmon bycatch and focusing on avoidance of Alaska chum salmon stocks; and to allow flexibility to harvest pollock in times and places that best support those goals. This analysis does not find any measures other than the ones currently under consideration, or that were considered but not advanced (see Chapter 2), that could accomplish this objective with any different impact on the regulated small entities.

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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

Regoin	System	2013 Goal Range Lower	Upper	Type	Initial Year	Escapement 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
	Lower Cook Inlet														
	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]
	Prince William Sound														
				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	*Kuskokwim Area*														
	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

-continued-Appendix A-1.– Page 3 of 4.

		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]

-continued-Appendix A-1.– Page 4 of 4.

		2013 Goal Range			Initial	Escapement									
Region	System	Lower	Upper	Type	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AYK	*Chignik*														
	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
	Kodiak														
	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 inriver goal accounts for inriver 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 inseason 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 inriver 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 inriver 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, 2004–2013.41

		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	<u>Bristol Bay</u>														
	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
	<u>Upper Cook Inlet</u>														
	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
	<u>Lower Cook Inlet</u>														
	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
	<u>Prince William Sound</u>[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

-continued-Appendix A-2.– Page 2 of 3.

		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										

-continued-Appendix A-2.– Page 3 of 3.

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.

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	_Bristol Bay_			
	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.
	Upper Cook Inlet			
	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).

-continued-Appendix A-3.– Page 2 of 5

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.
	Lower Cook Inlet			
	Subsistence Fishery?	Yes	Yes	Yes
	Commercial Fishery?	Yes	Yes	Yes

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Appendix A-3.– Page 3 of 5.

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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Appendix A-3.– Page 4 of 5.

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 fishrey, incidental take not sold.	No directed fishery, incidental take not sold.

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Appendix A-3.– Page 5 of 5.

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 inseason	Yes
	Chignik			
	Subsistence Fishery?	Yes	Yes	Restricted inseason to non-retention.
	Commercial Fishery?	Yes	Yes	Restricted inseason to non-retention.
	Sport Fishery?	Yes	Restricted inseason to non-retention.	Restricted inseason 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 inseason.

11 Appendix A-4 Subsistence Utilization of Alaska Chinook and chum salmon

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 3.2.5, 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 54).

Table 54 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.[30] 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:

> *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 24) (Fall et al. 2014:2).

[30] 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.

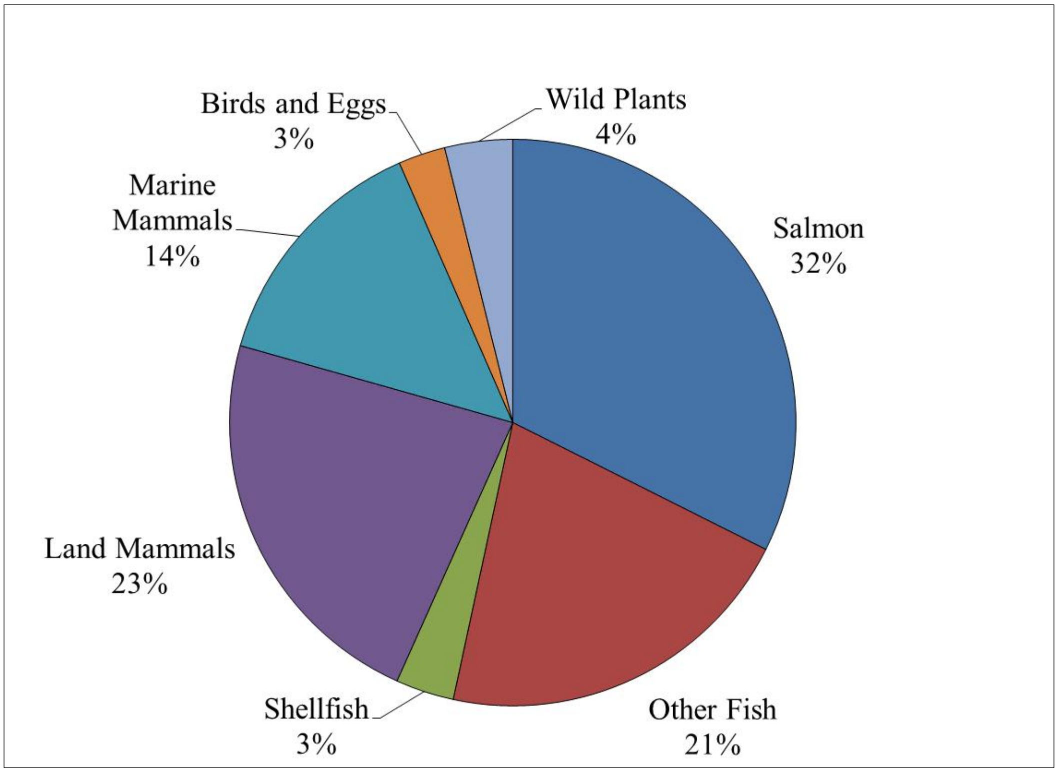

Figure 24 Composition of subsistence harvest by rural Alaska residents, 2012.

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 25) (Fall et al. 2014).

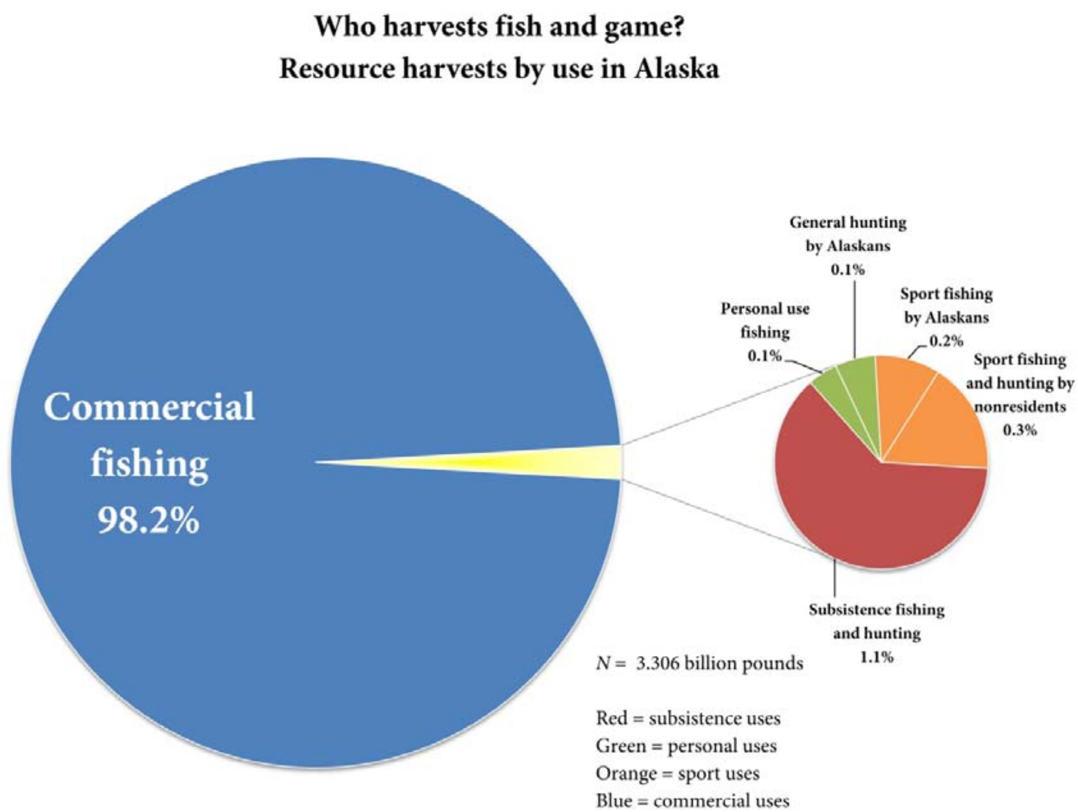

Figure 25 Resource harvests by use in Alaska.

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 26). 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 26 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 27).

Figure 27 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 28). 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 28 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 29). 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 29 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 Am 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).[31]

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[32] to continue. For example, in many places, involvement in the 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.

[31] http://www.uaf.edu/ces/fcs/2007q4data.pdf
[32] The concept of a "mixed economy is described in Wolfe and Walker, 1987.

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. [33]

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 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

[33] Data reported at the Alaska Department of Labor at http://live.laborstats.alaska.gov/cen/acsdetails.cfm

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 55shows 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 55 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[34] 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 56) (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,

[34] 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.

blackfish, pike) are more commonly fed to dogs than salmon. Along the middle Yukon, summer chum salmon is the most commonly harvested species of fish for use as dog food. Along the upper Yukon and Tanana rivers, fall chum salmon and coho salmon were the most commonly harvested fish species for dogs (Andersen, 1992).

Table 56 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.[35]

[35] Data from the Southeast Alaska Regional Health Consortium are not included here since this area falls outside the focus on western Alaska.

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 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 57below outlines the importance of salmon in the diet of participants of the ATDP study (Ballew et al., 2004).

Table 57 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 3.2.3.1 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 58, Figure 30). 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)[36]; and the Kotzebue District (29,092 salmon; 3 percent) (Figure 31).

Table 58 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.

[36] 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.

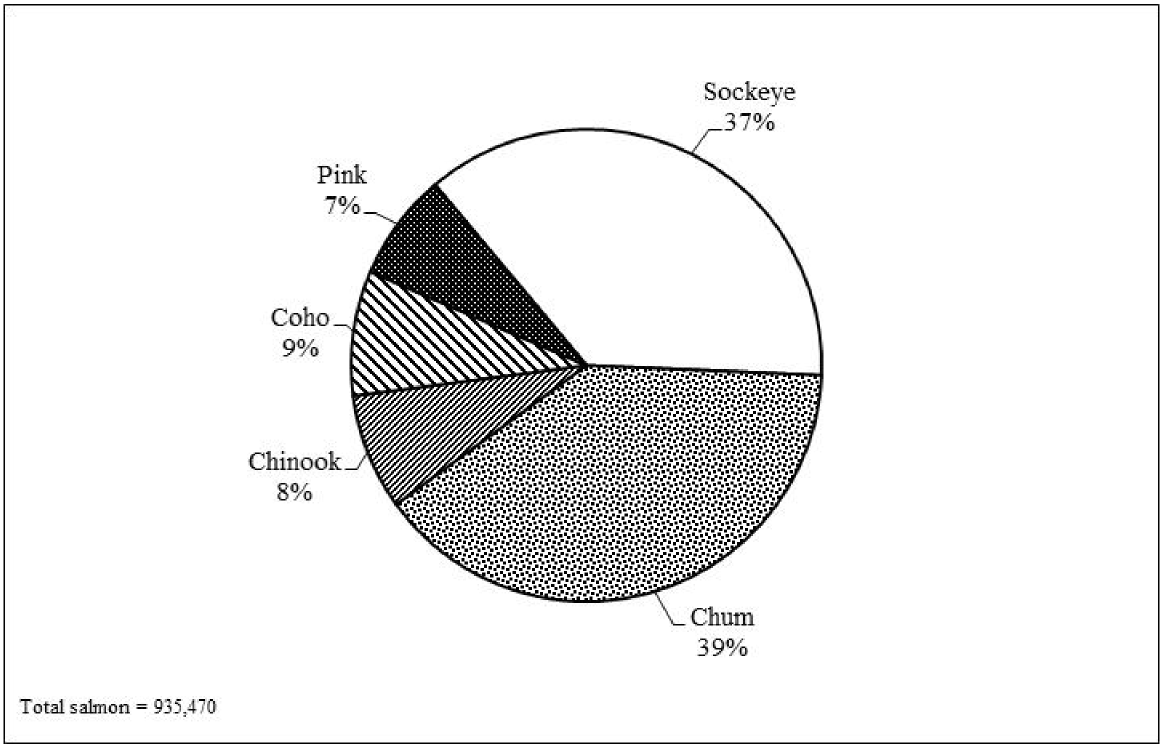

Figure 30 Alaska subsistence salmon harvest by species, 2012. (Source: Fall et al., 2014)

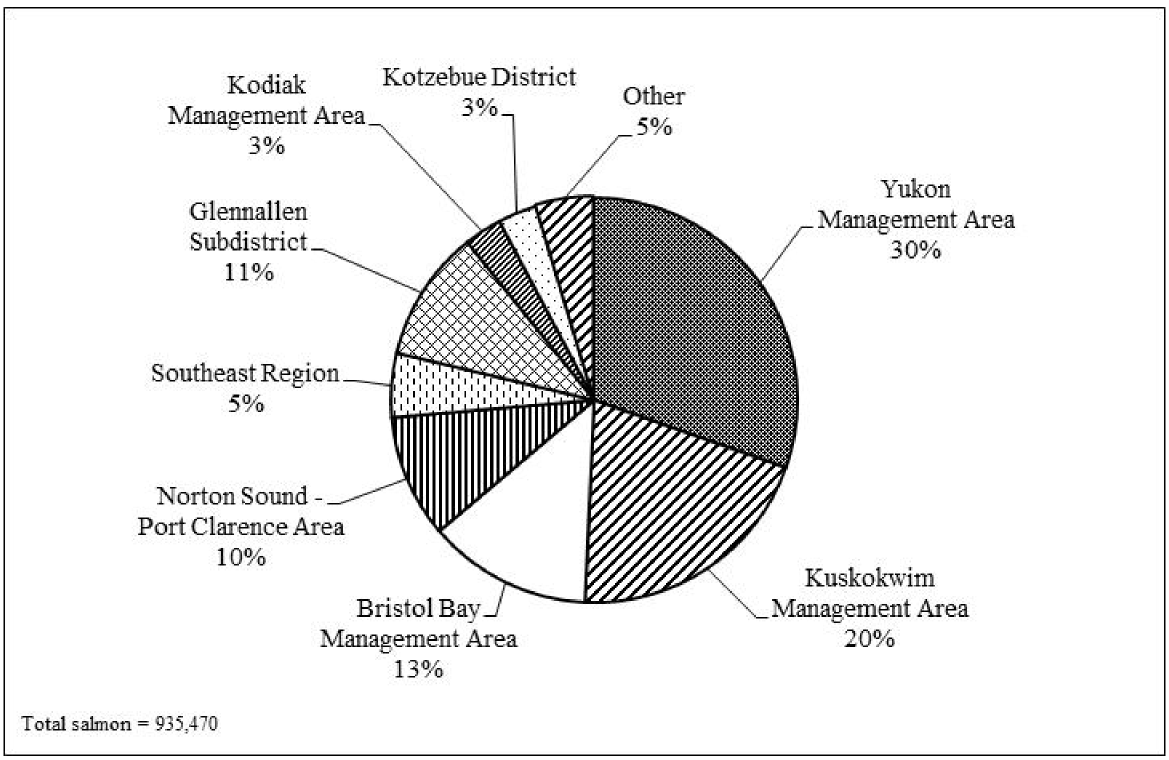

Figure 31 Alaska subsistence salmon harvest by area, 2012. (Source: Fall et al., 2014).

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 58, Figure 32). Table 59provides 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).

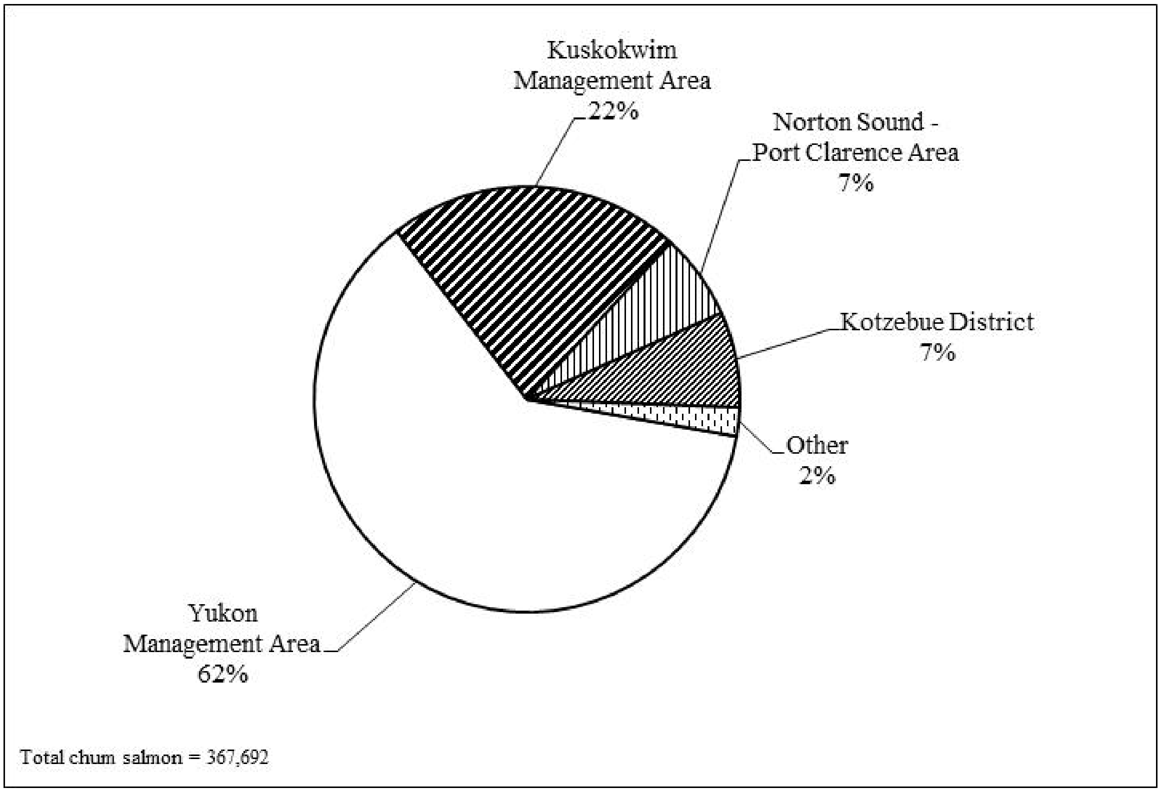

Figure 32 Subsistence chum salmon harvest by area, 2012 (Source: Fall et al., 2014).

Table 59 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 58). Figure 33reports 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).

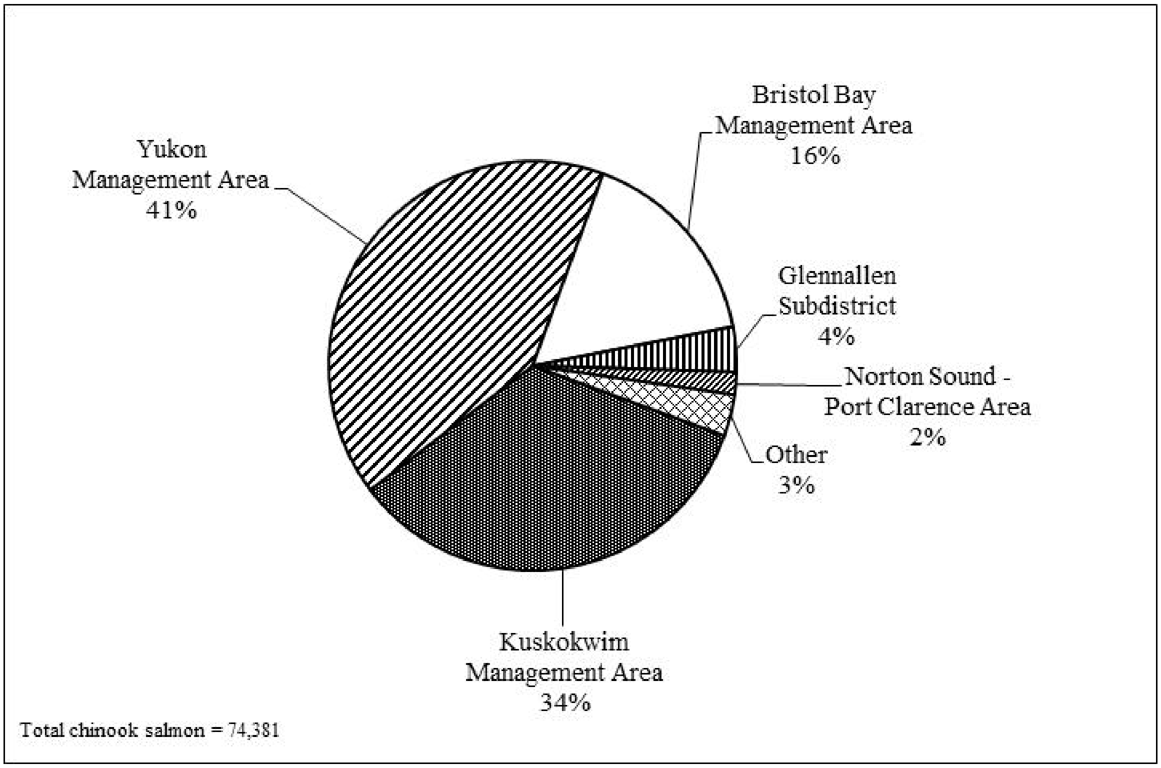

Figure 33 Estimated subsistence Chinook salmon harvest by area, 2012 (Source: Fall et al. 2014).

11.3 Overview of Regional Subsistence Harvests

Figure 34, 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 3.2.3.1 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 34.
  - 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).

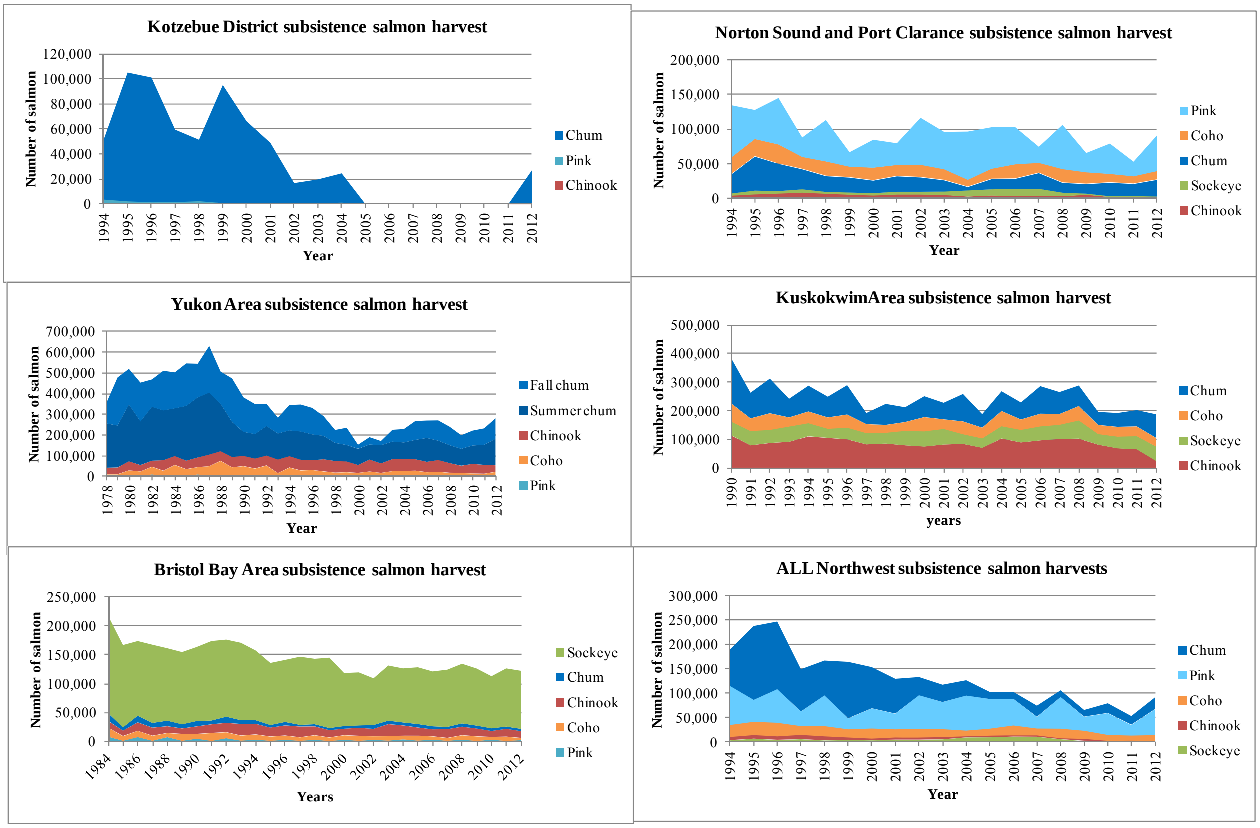

Figure 34 Estimated subsistence harvests of Chinook, chum, and other salmon, by key management areas (Source: Fall et al. 2014).

The BOF has made ANS findings for salmon throughout the areas under discussion here (Table 60). 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 34). See Table 61for 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 60 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 61 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 39). 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).

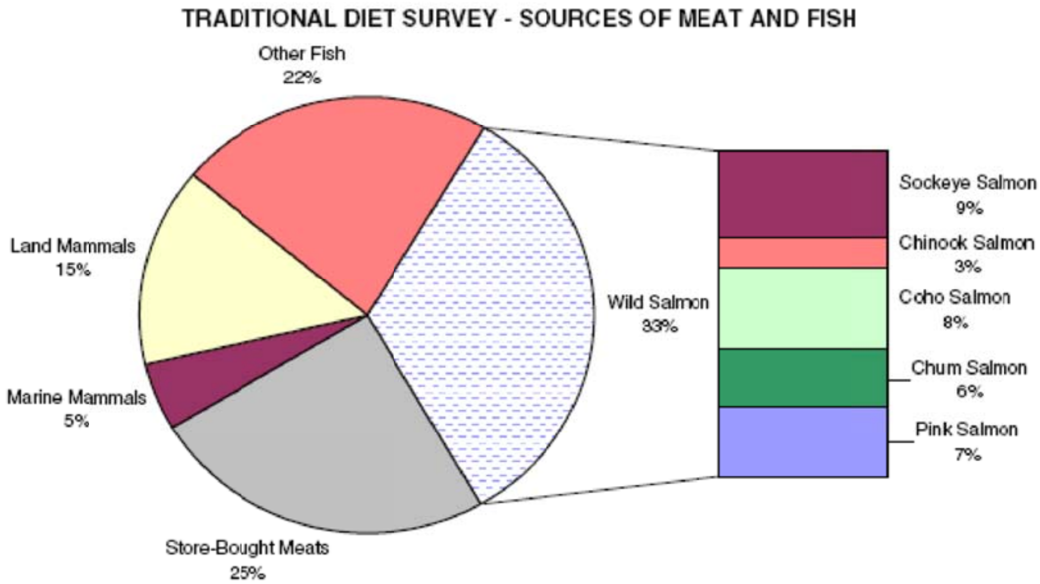

Figure 35 Results of a traditional diet of meat and fish survey in the Norton Sound and Port Clarence Districts (Source: Magdanz et al. 2005:25, citing Ballew et al. 2004)

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 et al. 2005).

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 62). Subsistence salmon harvests in 2012, by community and species in the Norton Sound and Port Clarence districts are provided below in Table 63.

Table 62 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

	Kotzebue District[b,i]						
Year	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.

	Arctic District[a]						
Year	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 63 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 36 and Figure 37show 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.

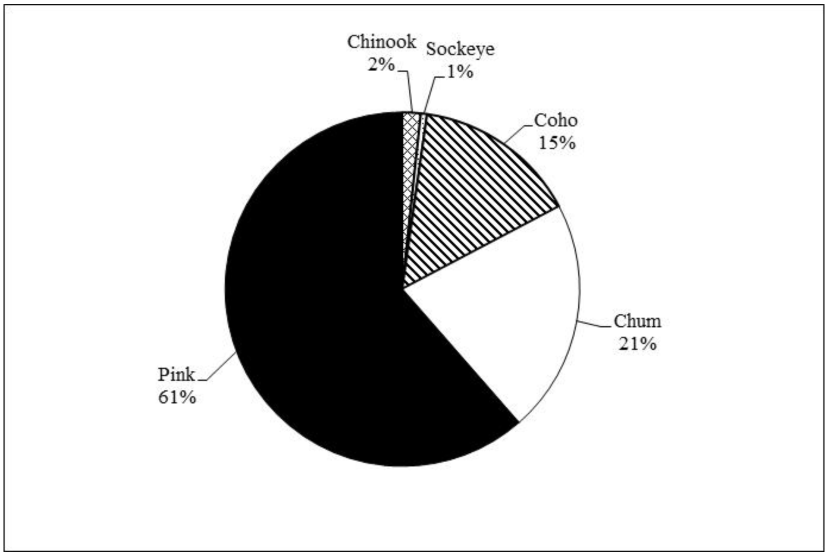

Figure 36 Species composition of 2012 estimated subsistence salmon harvests, Norton Sound District (Source: Fall et al. 2014)

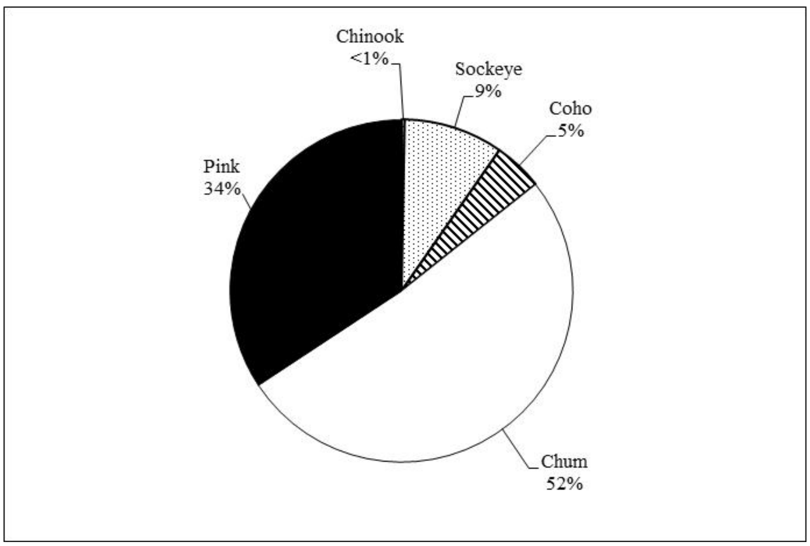

Figure 37 Species composition of 2012 estimated subsistence salmon harvests, Port Clarence District (Source: Fall et al. 2014)

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 59). 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 59; Figure 38).

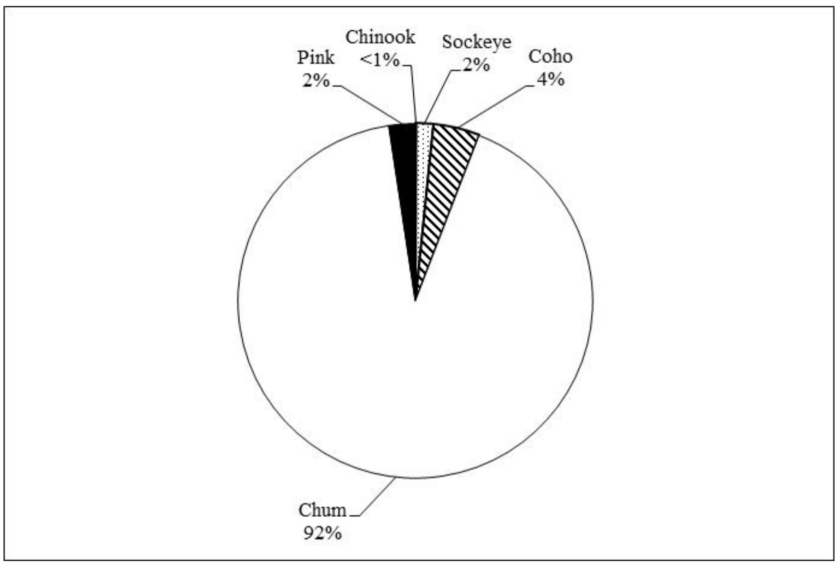

Figure 38 Species composition of estimated subsistence salmon harvests, Kotzebue District, 2012

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 64).

Table 64 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 39). 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.

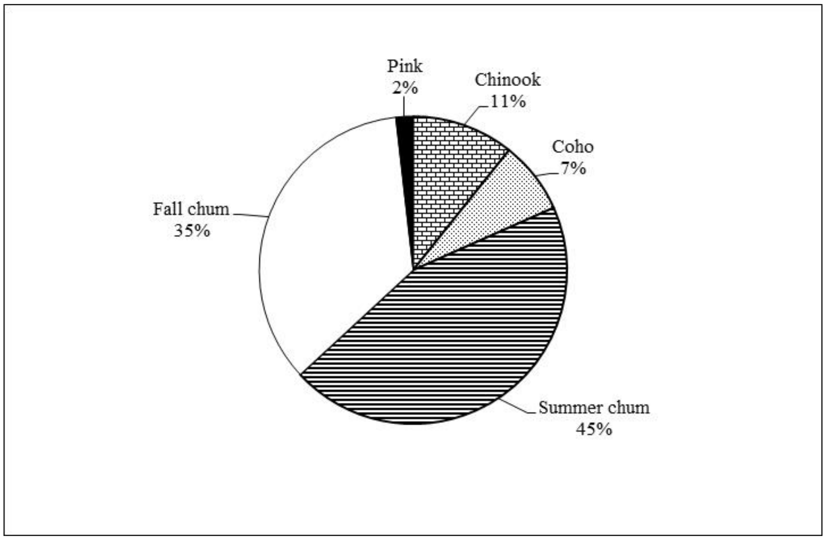

Figure 39 Species composition of 2012 estimated subsistence salmon harvests, Yukon District (Source: Fall et al. 2014).

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 65).

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, inseason 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 65 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.

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 Alaska Board of Fisheries 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 66).

Table 66 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 40). The total chum salmon harvest was up sharply, 38 percent and 27 percent above the recent 5- and 10-year averages (Table 67). 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.

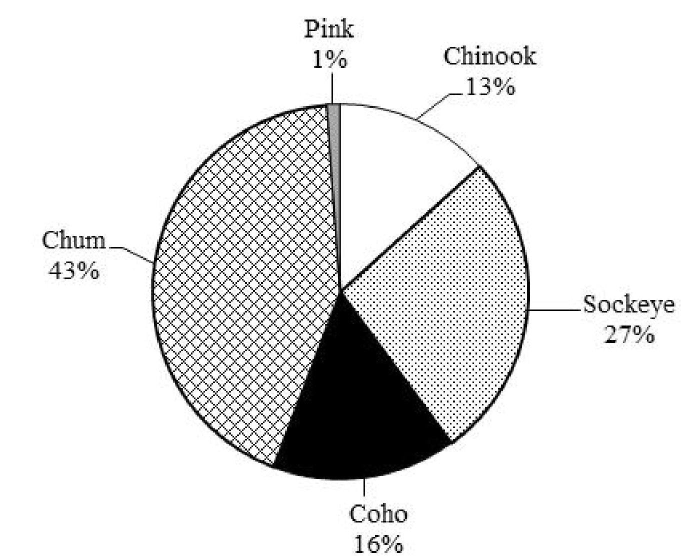

Figure 40 Species composition of 2012 estimated subsistence salmon harvests, Kuskokwim Area (Source: Fall et al. 2014).

Table 67 Historic subsistence salmon harvests, Kuskokwim Area, 1989 – 2012.

	Households		Estimated salmon harvest				
Year	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 68.

Table 68 Subsistence salmon harvests in 7 coastal Kuskokwim communities, 2011.

Community	Households		Percent	Estimated salmon harvest						
	Total	Surveyed	surveyed	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 69). 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 70).

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 69) and the historical 1983–2011 average at 8,320 fish (Table 70).

Table 69 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 70 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 41). 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 71).

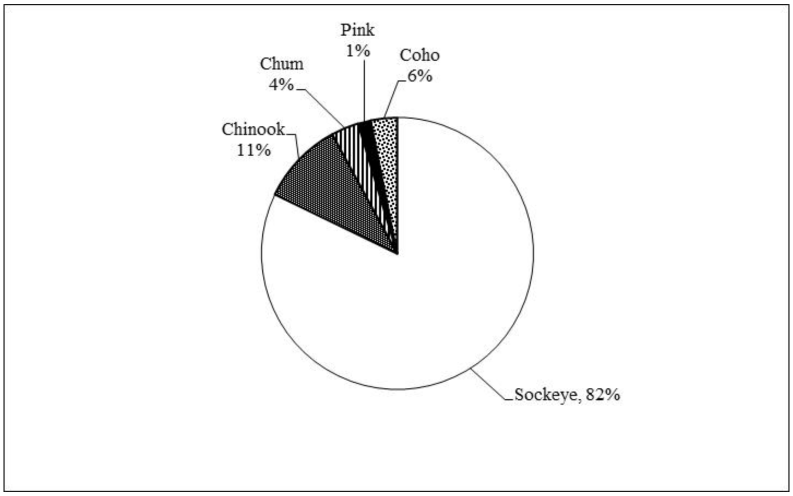

Figure 41 Species composition of 2012 estimated subsistence salmon harvests, Bristol Bay Area (Source: Fall et al. 2014).

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 69). The Naknek–Kvichak total harvest of 74,578 salmon in 2012 (Table 67) 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 69). The 2012 subsistence harvest of 52,370 sockeye salmon in the Kvichak drainage (Table 69) 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 70). 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 71 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

	Permits		Estimated salmon harvest					
Community	Issued	Returned	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 69) 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 69), 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 69) 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 69), 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 69). 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 69) 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).