PUBLIC REVIEW DRAFT

ENVIRONMENTAL ASSESSMENT / REGULATORY IMPACT REVIEW /
INITIAL REGULATORY FLEXIBILITY ANALYSIS

For a proposed Amendment to the
Fishery Management Plan for Groundfish of the Gulf of Alaska

Chinook Salmon Prohibited Species Catch in the Gulf of Alaska Non-Pollock Trawl Fisheries

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List of Acronyms and Abbreviations

‘	feet
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
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
WED	week-ending date

Table of Contents

List of Tables

List of Figures

Executive Summary

This document analyzes proposed management measures that would apply to all trawl fisheries in the Central and Western Gulf of Alaska (GOA), except the directed pollock fishery. The measures under consideration include setting prohibited species catch (PSC) limits in the Central and Western GOA for Chinook salmon (*Oncorhynchus tshawytscha*), which would close fisheries in those regulatory areas once attained, and full retention of salmon species. Implementation of the management measures evaluated in this analysis would require an amendment to the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA Groundfish FMP), as well as amendments to implementing regulations.

Purpose and need

The purpose of this action is to address the capture of Chinook salmon in the trawl fisheries of the GOA. Chinook salmon are a prohibited species in the GOA groundfish fisheries, and, as such, must be returned immediately to the sea with a minimum of injury, if caught incidentally in the groundfish fisheries[1]. Under the Magnuson-Stevens Act, the Council is required to minimize bycatch to the extent practicable, as well as to take into account the importance of fishery resources to fishing communities in order to minimize adverse economic impacts on such communities. Chinook salmon are a highly valued species for commercial, recreational, subsistence, and personal use fisheries. While the Council has recently established Chinook salmon PSC limits for the directed pollock trawl fisheries in the GOA, no such PSC limit is currently in effect for other trawl fisheries in the GOA, which also intercept Chinook salmon. Under the regulations, it is incumbent upon fishermen to avoid catching Chinook salmon, however the Council has determined it is necessary to evaluate management measures to protect against the risk of high Chinook salmon PSC in future years.

Description of the Alternatives

The alternatives that are analyzed in this amendment package were approved by the Council in February 2012, and revised at initial review in December 2012. These alternatives propose management measures that would apply exclusively to the directed non-pollock trawl fisheries in the Western and Central Gulf of Alaska.

Alternative 1: Status quo.

Alternative 2: 5,000, 7,500, 10,000, or 12,500 Chinook salmon PSC limit (hard cap).

- Option 1: Apportion limit between Central and Western GOA.
- Option 2: Apportion limit by operational type (CV vs. CP).
  - Applies to both options 1 and 2:
    - (a) Apportion proportional to historic average bycatch of Chinook salmon (5 or 10-year average);
    - (b) Apportion proportional to historic average non-pollock groundfish harvest (5 or 10-year average).
- Option 3: No more than 50% or 66% of the annual hard cap limit can be taken before June 1.
- Option 4: Separate Chinook salmon PSC limit (hard cap) to the CGOA rockfish program:
  - (a) 1,500
  - (b) 2,500
  - (c) 3,500

[1] Except when their retention is authorized by other applicable law for biological sampling or for programs such as the Prohibited Species Donation Program.

Suboption 1: Divide by sector (CV and CP) based on actual Chinook salmon PSC usage by sector for the rockfish catch share program years of 2007-2012.
Each LLP holder within sector will receive an allocation of Chinook salmon PSC equivalent to the license's proportion of the sector's target rockfish catch history from the program's initial allocations. Member LLP allocations will be allocated to their respective cooperative.

Suboption 2: On October 1st, rollover all but 200, 300, or 400 remaining Chinook salmon to support other fall non-pollock trawl fisheries.

Suboptions 1 and/or 2 can be selected for Option 4.

Alternative 3: Full retention of salmon.
Vessels will retain all salmon bycatch until the number of salmon has been determined by the vessel or plant observer and the observer's collection of any scientific data or biological samples from the salmon has been completed.

Note, both Alternative 2 and Alternative 3 could be selected by the Council in their preferred alternative. Likewise, under Alternative 2, both Option 1 and Option 2, or Option 2 and Option 3, could be selected by the Council; Option 4 can be selected with any of the other options.

Table ES-1 provides the proposed PSC limits for the non-pollock trawl fisheries under Alternative 2, and each option to Alternative 2.

Table ES-1 Proposed PSC limits for non-pollock trawl fisheries, under Alternative 2 and Options 1 and 2

			Historic basis for average apportionment	5-Year Average (2007 to 2011)					10-year Average (2002-2011)				
				%	12,500	10,000	7,500	5,000	%	12,500	10,000	7,500	5,000
Alt. 2	All GOA (W&C)			100%	12,500	10,000	7,500	5,000	100%	12,500	10,000	7,500	5,000
Option 1	WGOA		Chinook	8%	997	797	598	399	18%	2,210	1,768	1,326	884
			Groundfish	17%	2,107	1,685	1,264	843	18%	2,263	1,810	1,358	905
	CGOA		Chinook	92%	11,503	9,202	6,902	4,601	82%	10,291	8,232	6,174	4,116
			Groundfish	83%	10,393	8,315	6,236	4,157	82%	10,237	8,190	6,142	4,095
Option 2	All GOA (W&C)	Catcher Vessels	Chinook	52%	6,460	5,168	3,876	2,584	49%	6,104	4,883	3,662	2,442
			Groundfish	66%	8,260	6,608	4,956	3,304	64%	8,029	6,423	4,817	3,211
		Catcher Processors	Chinook	48%	6,039	4,831	3,623	2,416	51%	6,397	5,118	3,838	2,559
			Groundfish	34%	4,240	3,392	2,544	1,696	36%	4,471	3,577	2,683	1,789
Options 1 & 2	WGOA	Catcher Vessels	Chinook	1%	86	69	52	35	5%	606	485	363	242
			Groundfish	4%	541	433	325	216	5%	643	514	386	257
		Catcher Processors	Chinook	7%	910	728	546	364	13%	1,604	1,284	963	642
			Groundfish	13%	1,566	1,253	939	626	13%	1,620	1,296	972	648
	CGOA	Catcher Vessels	Chinook	51%	6,374	5,099	3,824	2,549	44%	5,498	4,399	3,299	2,199
			Groundfish	62%	7,719	6,175	4,631	3,088	59%	7,386	5,909	4,431	2,954
		Catcher Processors	Chinook	41%	5,129	4,103	3,077	2,052	38%	4,792	3,834	2,875	1,917
			Groundfish	21%	2,674	2,139	1,605	1,070	23%	2,851	2,281	1,711	1,140

Table ES-2 Proposed PSC limits for Central GOA rockfish program, under Alternative 2's Option 4, and Suboption 1

		6-Year Chinook salmon PSC usage (2007 to 2012)			
		%	(a) 1,500	(b) 2,500	(c) 3,500
Option 4	Separate PSC limit for CGOA rockfish program	100%	1,500	2,500	3,500
Suboption 1	Catcher Vessels	62%	937	1,561	2,186
	Catcher Processors	38%	563	939	1,314

Table ES-3 Proposed PSC limits for non-pollock trawl fisheries that are not part of the Central GOA rockfish program, under Alternative 2 with Option 4, or Alternative 2 with either Options 1 and 4, or Options 2 and 4

			Historic basis for average apportionment	5-Year Average (2007 to 2011)					10-year Average (2002-2011)				
GOA-wide Chinook cap					***12,500***	***10,000***	***7,500***	***5,000***		***12,500***	***10,000***	***7,500***	***5,000***
Option 4(a): 1,500 Chinook salmon set aside to CGOA rockfish program													
Non-CGOA rockfish non-pollock fisheries				**%**	**11,000**	**8,500**	**6,000**	**3,500**	**%**	**11,000**	**8,500**	**6,000**	**3,500**
Alt. 2	All GOA (W&C)			100%	11,000	8,500	6,000	3,500	100%	11,000	8,500	6,000	3,500
Options 1 & 4(a)	WGOA		Chinook	10%	1,112	859	606	354	20%	2,185	1,688	1,192	695
			Groundfish	21%	2,264	1,749	1,235	720	20%	2,212	1,709	1,206	704
	CGOA		Chinook	90%	9,888	7,641	5,394	3,146	80%	8,815	6,812	4,808	2,805
			Groundfish	79%	8,736	6,751	4,765	2,780	80%	8,788	6,791	4,794	2,796
Options 2 & 4(a)	All GOA (W&C)	Catcher Vessels	Chinook	49%	5,400	4,173	2,945	1,718	47%	5,201	4,019	2,837	1,655
			Groundfish	65%	7,170	5,540	3,911	2,281	64%	6,993	5,404	3,815	2,225
		Catcher Processors	Chinook	51%	5,600	4,327	3,055	1,782	53%	5,799	4,481	3,163	1,845
			Groundfish	35%	3,830	2,960	2,089	1,219	36%	4,007	3,096	2,185	1,275
Option 4(b): 2,500 Chinook salmon set aside to CGOA rockfish program													
Non-CGOA rockfish non-pollock fisheries				**%**	**10,000**	**7,500**	**5,000**	**2,500**	**%**	**10,000**	**7,500**	**5,000**	**2,500**
Alt. 2	All GOA (W&C)			100%	10,000	7,500	5,000	2,500	100%	10,000	7,500	5,000	2,500
Options 1 & 4(b)	WGOA		Chinook	10%	1,011	758	505	253	20%	1,986	1,490	993	497
			Groundfish	21%	2,058	1,543	1,029	514	20%	2,011	1,508	1,005	503
	CGOA		Chinook	90%	8,989	6,742	4,495	2,247	80%	8,014	6,010	4,007	2,003
			Groundfish	79%	7,942	5,957	3,971	1,986	80%	7,989	5,992	3,995	1,997
Options 2 & 4(b)	All GOA (W&C)	Catcher Vessels	Chinook	49%	4,909	3,682	2,455	1,227	47%	4,728	3,546	2,364	1,182
			Groundfish	65%	6,518	4,889	3,259	1,630	64%	6,358	4,768	3,179	1,589
		Catcher Processors	Chinook	51%	5,091	3,818	2,545	1,273	53%	5,272	3,954	2,636	1,318
			Groundfish	35%	3,482	2,611	1,741	870	36%	3,642	2,732	1,821	911
Option 4(c): 3,500 Chinook salmon set aside to CGOA rockfish program													
Non-CGOA rockfish non-pollock fisheries				**%**	**9,000**	**6,500**	**4,000**	**1,500**	**%**	**9,000**	**6,500**	**4,000**	**1,500**
Alt. 2	All GOA (W&C)			100%	9,000	6,500	4,000	1,500	100%	9,000	6,500	4,000	1,500
Options 1 & 4(c)	WGOA		Chinook	10%	909	657	404	152	20%	1,788	1,291	794	298
			Groundfish	21%	1,852	1,338	823	309	20%	1,810	1,307	804	302
	CGOA		Chinook	90%	8,091	5,843	3,596	1,348	80%	7,212	5,209	3,206	1,202
			Groundfish	79%	7,148	5,162	3,177	1,191	80%	7,190	5,193	3,196	1,198
Options 2 & 4(c)	All GOA (W&C)	Catcher Vessels	Chinook	49%	4,418	3,191	1,964	736	47%	4,255	3,073	1,891	709
			Groundfish	65%	5,866	4,237	2,607	978	64%	5,722	4,132	2,543	954
		Catcher Processors	Chinook	51%	4,582	3,309	2,036	764	53%	4,745	3,427	2,109	791
			Groundfish	35%	3,134	2,263	1,393	522	36%	3,278	2,368	1,457	546

Table ES-4 Maximum amount of proposed PSC limits for non-pollock trawl fisheries that could be used before June 1st, under Alternative 2 with Option 3, or Alternative 2 with either Options 2 and 3, or Options 3 and 4

Note, for usage limits that include Option 4, a set aside to the Central GOA rockfish program, the identified limit applies only to non-pollock trawl fisheries exclusive of the rockfish program.

			Usage limit for Jan-May	Historic basis for average apportionment	5-Year Average (2007 to 2011)				10-year Average (2002-2011)			
GOA-wide Chinook cap					***12,500***	***10,000***	***7,500***	***5,000***	***12,500***	***10,000***	***7,500***	***5,000***
Option 3 alone, Options 2 and 3												
Alt. 2 & Option 3	All GOA (W&C)		50%		6,250	5,000	3,750	2,500	6,250	5,000	3,750	2,500
			66%		8,250	6,600	4,950	3,300	8,250	6,600	4,950	3,300
Options 2 & 3	All GOA (W&C)	Catcher Vessels	50%	Chinook	3,230	2,584	1,938	1,292	3,052	2,442	1,831	1,221
				Groundfish	4,130	3,304	2,478	1,652	4,014	3,211	2,409	1,606
			66%	Chinook	4,264	3,411	2,558	1,705	4,029	3,223	2,417	1,612
				Groundfish	5,452	4,361	3,271	2,181	5,299	4,239	3,179	2,120
		Catcher Processors	50%	Chinook	3,020	2,416	1,812	1,208	3,199	2,559	1,919	1,280
				Groundfish	2,120	1,696	1,272	848	2,236	1,789	1,341	894
			66%	Chinook	3,986	3,188	2,391	1,595	4,222	3,378	2,533	1,689
				Groundfish	2,798	2,239	1,679	1,119	2,951	2,361	1,771	1,180
Including Option 4(a) *1,500 Chinook salmon set aside to CGOA rockfish program*												
Alt. 2 & Opt 3, 4a	All GOA (W&C)		50%		5,500	4,250	3,000	1,750	5,500	4,250	3,000	1,750
			66%		7,260	5,610	3,960	2,310	7,260	5,610	3,960	2,310
Options 2, 3 & 4(a)	All GOA (W&C)	Catcher Vessels	50%	Chinook	2,700	2,086	1,473	859	2,600	2,009	1,418	827
				Groundfish	3,585	2,770	1,955	1,141	3,497	2,702	1,907	1,113
			66%	Chinook	3,564	2,754	1,944	1,134	3,432	2,652	1,872	1,092
				Groundfish	4,732	3,657	2,581	1,506	4,616	3,567	2,518	1,469
		Catcher Processors	50%	Chinook	2,800	2,164	1,527	891	2,900	2,241	1,582	923
				Groundfish	1,915	1,480	1,045	609	2,003	1,548	1,093	637
			66%	Chinook	3,696	2,856	2,016	1,176	3,828	2,958	2,088	1,218
				Groundfish	2,528	1,953	1,379	804	2,644	2,043	1,442	841
Including Option 4(b) *2,500 Chinook salmon set aside to CGOA rockfish program*												
Alt. 2 & Opt 3, 4b	All GOA (W&C)		50%		5,000	3,750	2,500	1,250	5,000	3,750	2,500	1,250
			66%		6,600	4,950	3,300	1,650	6,600	4,950	3,300	1,650
Options 2, 3 & 4(b)	All GOA (W&C)	Catcher Vessels	50%	Chinook	2,455	1,841	1,227	614	2,364	1,773	1,182	591
				Groundfish	3,259	2,444	1,630	815	3,179	2,384	1,589	795
			66%	Chinook	3,240	2,430	1,620	810	3,120	2,340	1,560	780
				Groundfish	4,302	3,226	2,151	1,075	4,196	3,147	2,098	1,049
		Catcher Processors	50%	Chinook	2,546	1,909	1,273	636	2,636	1,977	1,318	659
				Groundfish	1,741	1,306	871	435	1,821	1,366	911	455
			66%	Chinook	3,360	2,520	1,680	840	3,480	2,610	1,740	870
				Groundfish	2,298	1,724	1,149	575	2,404	1,803	1,202	601
Including Option 4(c) *3,500 Chinook salmon set aside to CGOA rockfish program*												
Alt. 2 & Opt 3, 4c	All GOA (W&C)		50%		4,500	3,250	2,000	750	4,500	3,250	2,000	750
			66%		5,940	4,290	2,640	990	5,940	4,290	2,640	990
Options 2, 3 & 4(c)	All GOA (W&C)	Catcher Vessels	50%	Chinook	2,209	1,595	982	368	2,127	1,537	946	355
				Groundfish	2,933	2,118	1,304	489	2,861	2,066	1,272	477
			66%	Chinook	2,916	2,106	1,296	486	2,808	2,028	1,248	468
				Groundfish	3,872	2,796	1,721	645	3,776	2,727	1,678	629
		Catcher Processors	50%	Chinook	2,291	1,655	1,018	382	2,372	1,713	1,054	395
				Groundfish	1,567	1,132	696	261	1,639	1,184	728	273
			66%	Chinook	3,024	2,184	1,344	504	3,132	2,262	1,392	522
				Groundfish	2,068	1,494	919	345	2,164	1,563	962	361

Environmental Assessment

Groundfish

Under the status quo, groundfish stocks are neither overfished nor approaching an overfished condition. A lower hard cap may result in the fishery closing before the TACs are reached, while a higher hard cap would allow for groundfish fishing at current levels, and impacts would likely be similar to the status quo fishery. If the groundfish TACs are not fully harvested, fishing will have less impact on the stocks, and there will be no adverse impact on the groundfish stocks from the fishery. Any changes in fishing patterns that may result from the alternatives, however, would be monitored and updated in future stock assessments.

Chinook salmon

The non-pollock trawl fisheries have an adverse impact on Chinook salmon through direct mortality due to PSC. Under the status quo, there are no additional management measures to reduce PSC of Chinook salmon in the GOA non-pollock trawl fisheries, however, Chinook salmon are a prohibited species, and it is incumbent upon fishermen, under the regulations, to avoid catching Chinook salmon. From 2002 to 2011, the average PSC for the non-pollock trawl fisheries was 6,176 Chinook salmon. In 2012 the non-pollock trawl fishery recorded 3,665 Chinook salmon PSC. 2003 and 2010 were the years of highest Chinook salmon PSC over this time period, with catches of 10,877 and 9,694 Chinook salmon, respectively.

Since 2007, there have been poor or below average Chinook salmon runs in Western Alaska. In 2012, all monitored Chinook salmon runs in the GOA were below average. The Chinook salmon stock composition of the GOA non-pollock trawl fishery PSC is not available, however the GOA groundfish fisheries have been documented to catch Chinook salmon both from Southeast Alaska and Cook Inlet, in the GOA. It is not possible to draw any correlation between patterns of PSC and the status of salmon stocks, especially given the uncertainty associated with estimates of PSC in the groundfish fisheries, and the lack of data on river of origin of Chinook salmon PSC. This results in the inability to discern and accurately describe small scale impacts on particular individual stocks; nonetheless, we understand that setting PSC limits will likely reduce the potential to impact salmon stocks in the aggregate, and therefore are more likely to be beneficial to Chinook salmon stocks as a whole compared to status quo. There is also no evidence to indicate whether the groundfish fisheries' take of Chinook salmon is, or is not, causing escapement failures in Alaska rivers. Since 2011, efforts have been underway to improve genetic sampling of salmon PSC in the GOA pollock fishery, which should, in time, allow for a better understanding of the stock composition of PSC in that GOA trawl target fishery. While it is not one of the target fisheries that is subject to the PSC limits that are currently under consideration, the pollock target fisheries occur in similar geographical areas, and with a somewhat similar gear type, to the non-pollock trawl fisheries. As such, understanding the stock composition of PSC in that fishery would provide an additional perspective on the non-pollock trawl fisheries' Chinook salmon PSC.

Alternative 2 would establish a PSC limit that would be an upper limit on the PSC of Chinook salmon in the GOA non-pollock trawl fisheries in the Western and Central GOA. This limit would represent an upper threshold of Chinook salmon PSC in the GOA non-pollock trawl fisheries, as the non-pollock trawl fisheries will be closed when the limit is reached. The Regulatory Impact Review evaluates the PSC limit retrospectively, to see how many Chinook salmon would not have been caught had the cap been in place. Note, however, that the PSC limit and potential salmon savings in years of higher Chinook salmon PSC do not translate directly into adult salmon that would otherwise have survived to return to its spawning stream. Salmon caught as PSC in the GOA groundfish trawl fisheries are generally immature salmon, with an average weight varying between 5 and 9 pounds. Some proportion of the Chinook salmon caught as PSC would have been consumed as prey to other marine resources, or been affected by some other

source of natural or fishing mortality. In the GOA non-pollock trawl fisheries, data is not available to assess (a) how many of the intercepted salmon were likely to have returned to their streams as adults, and (b) to which river system or region they would likely have returned. It is assumed that the non-pollock trawl fisheries could be catching Chinook salmon that originate from anywhere in Alaska or elsewhere, and it is not possible to estimate the proportion any stock has contributed to the Chinook salmon PSC. Therefore our ability to assess the impacts of reducing salmon PSC on salmon populations is constrained.

Nonetheless, it is possible to develop general conclusions for the action that is being proposed. If Chinook salmon PSC is reduced in some years as a result of this action, it would likely have beneficial impacts on Chinook salmon stocks, and the harvesters and consumers of Chinook salmon, compared to the status quo. With a PSC limit in place, it is possible that Chinook salmon PSC may be curtailed in years of otherwise high PSC, such as 2003. To the extent that Alternative 2 reduces a source of direct mortality on Chinook salmon stocks, the impact to Chinook salmon overall is likely to be beneficial.

Under a PSC limit, and especially if the attainment of the threshold appears to be imminent, the non-pollock trawl fleet may be active in making efforts to avoid high PSC rates, in order to preserve the opportunity to fully harvest the groundfish TACs. Efforts to avoid Chinook PSC could take a variety of forms. Particularly at the outset, these efforts may have limited effect, as participants have little understanding of the means of avoiding Chinook PSC. Yet, the adoption of a Chinook PSC limit likely will prompt efforts to gain better information concerning Chinook avoidance, improving the ability of participants to avoid Chinook in the long run. The extent of any redistribution of effort is difficult to predict and will depend not only on the distribution of Chinook salmon catch rates on the fishing grounds and the participants' ability to accurately estimate Chinook salmon catch rates, but also participants' flexibility to alter their temporal and spatial fishing behavior. It is possible that shifting the spatial or temporal distribution of the non-pollock trawl fisheries may impact some particular Chinook salmon stocks more than others, but as we do not currently know how effort may shift in the non-pollock trawl fisheries, nor the stock composition of Chinook salmon PSC, this impact is not possible to assess.

Under Alternative 2, it appears unlikely that Chinook salmon PSC would increase from the status quo. Any impact to the Chinook salmon stocks as a whole, is likely to represent either no change from the status quo, or to be beneficial, as PSC levels either remain the same or are reduced. None of the options considered under Alternative 2, would have a significant adverse impact to Chinook salmon stocks.

Other Resource Components

Under the status quo, marine mammal and seabird disturbance and incidental take are at low levels and are mitigated by seasonal and spatial restrictions on the GOA non-pollock trawl fisheries. Under the alternatives, disturbance or incidental take is not expected to increase to a level that would result in population level effects on marine mammals or seabirds. In years where the hard cap constrains fishing, Alternative 2 may reduce the potential effects of the fishery on prey availability. If the fleet spends longer time fishing in areas with lower catch rates to avoid salmon, there may be some increase to benthic habitat impacts and potential removals of marine mammal and seabird prey. However, this increase is unlikely to result in population level effects.

Previous analyses have found no substantial adverse effects to habitat in the GOA caused by fishing activities (NMFS 2005b). A constraining hard cap may reduce any effects on habitat that are occurring under the status quo, however any effects continue to be limited by the amount of the groundfish TACs and by the existing habitat conservation and protection measures. Overall, the combination of the direct, indirect, and cumulative effects on habitat complexity for both living and non-living substrates, benthic biodiversity, and habitat suitability is not likely to be significant under any of the alternatives.

Regulatory Impact Review

Alternative 1

Selecting the status quo alternative would maintain the current regulations in the action area. Directed GOA non-pollock groundfish trawl fisheries would not be closed due to the attainment of a Chinook salmon PSC hard cap. Fishery closures would only occur if the TAC had been fully harvested, if Pacific halibut PSC limits had been reached, or in accordance with prescribed season end dates. Under existing regulation, while the fisheries would not close due to the fulfillment of Chinook salmon PSC allowances, it is still incumbent upon fishery participants to avoid catching Chinook salmon to the extent practicable.

Maintaining current GOA groundfish regulations should not impact annual harvest in the non-pollock directed fisheries. Over the last decade, harvests of GOA Pacific cod, flatfish, and rockfish have not significantly increased or decreased, and are typically constrained by TACs or halibut PSC limits. Despite this relative consistency, it is possible that harvests may decline in future years in these fisheries (with the exception of the Central GOA rockfish fishery) if reductions in halibut PSC limits result in fishery closures. Rockfish Program participants will have an advantage in being able to time their fishing to maintain their shares in other target fisheries, knowing that their rockfish allocations are secure.

Chinook salmon PSC and PSC rates (the number of Chinook salmon caught per metric ton of groundfish) have varied annually and with no distinct trend, during the analyzed 2003 to 2011 historical period. Future Chinook PSC levels are unpredictable, as are the timing and location of high trawl-Chinook interactions. Individuals, businesses, and communities that benefit from the use or existence of Chinook salmon will continue to rely on the non-pollock groundfish fleet to minimize their PSC through voluntary measures. In the absence of PSC limits, however, independent vessels participating in increasingly competitive fisheries may lack the incentives to stop fishing in an area with high Chinook salmon PSC. The recent trend of increasing participation in non-pollock groundfish trawl fisheries may limit the ability of vessels to voluntarily avoid Chinook PSC, independently or as part of cooperative agreements, without risking the loss of target catch to vessels that do not avoid Chinook PSC. If other participants continue to fish at high rates of Chinook PSC, vessels that reduce their own catch by taking salmon avoidance measures would earn less gross revenue (and likely net revenue).

The status quo alternative would not require unobserved vessels to retain salmon on board until they can be biologically sampled at shoreside facilities. Vessels carrying an observer would still be required to retain Chinook until sampling and data collection could occur. Observer duties will not change from their present definition, which does not always allow for biological sampling of Chinook salmon. Alternative 1 would not greatly enhance the understanding of the stock origins of Chinook salmon taken as non-pollock groundfish trawl PSC.

Alternative 2

Alternative 2 would establish an annual Chinook salmon PSC limit for the GOA non-pollock groundfish trawl fisheries. As noted in the Description of Alternatives, this hard cap could be applied to the GOA non-pollock trawl fleet as a whole, or apportioned to subdivisions of the fishery according to either a 5-year or 10-year history of either Chinook salmon PSC usage or non-pollock groundfish harvest. Full usage of the Chinook PSC limit would trigger the closure of directed trawl fishing in the GOA, the regulatory area (Central or Western GOA), or the operational sector (CP or CV), depending on how the limit is apportioned. Alternative 2 includes an option to apply a seasonal limit on Chinook PSC taken before June 1 to whatever annual limit is selected. Another option would “carve-out” a separate Chinook salmon PSC limit from the total GOA limit and use it to support the Central GOA Rockfish Program. The Chinook PSC reserved for the Rockfish Program could be divided between the operational sectors within

the program (CP and CV); another suboption would make unused Chinook salmon PSC from the Rockfish Program available to the rest of the GOA limited access fisheries on October 1.

Because historical annual Chinook PSC and groundfish harvest have varied from year to year, the selected metric and time period upon which PSC apportionment is based will influence which sector of the GOA non-pollock trawl fishery is more likely to be constrained by Chinook salmon PSC. In general, a sector that receives a smaller percentage of the total GOA PSC limit is more likely to experience a fishery closure, and closures that do occur would come earlier in the year. Table ES-5 summarizes the percentage of the hard cap apportioned to each user group, depending on which scenario and set of historical determinants the Council chooses.

Table ES-5 Percentage of annual Chinook salmon PSC limit apportioned to each trawl user group under Alternative 2 options

		PSC Usage		Groundfish Harvest	
		10 year History	5 year History	10 year History	5 year History
Option 1	CGOA	82%	92%	82%	83%
	WGOA	18%	8%	18%	17%
Option 1 + 4	CGOA	80%	90%	80%	79%
	WGOA	20%	10%	20%	21%
Option 2	CP	51%	48%	36%	34%
	CV	49%	52%	64%	66%
Option 2 + 4	CP	53%	51%	36%	35%
	CV	47%	49%	64%	65%
Option 1&2	CG CP	38%	41%	23%	21%
	CG CV	44%	51%	59%	62%
	WG CP	13%	7%	13%	13%
	WG CV	5%	1%	5%	4%
Option 1&2 + 4	CG CP	38%	42%	22%	20%
	CG CV	42%	48%	58%	60%
	WG CP	14%	9%	14%	15%
	WG CV	5%	1%	6%	5%

Both the amount and time-distribution (throughout the calendar year) of Chinook salmon PSC and non-pollock trawl harvests varied annually. As a result, the range of maximum potential direct harvest impacts is large. Direct harvest impacts are defined in this report as the amount of target species harvest that occurred in the weeks after a back-cast PSC closure would have occurred, and thus would not have been harvested if a given PSC limit were in place. Similarly, impacts on Chinook salmon are defined as the amount of PSC that was recorded after a PSC closure would have occurred (avoided PSC). Foregone wholesale revenue was calculated based on 2011 average per unit wholesale values ($/mt) for the sector in question and for the specific target species that the sector would have been targeting after the closure. Table ES-5 provides a general sense of the per unit wholesale value of each sector's catch, based on records from the 2011 fishing year.

Table ES-6 2011 gross first wholesale value per metric ton of harvest

	First wholesale value ($/mt)				
Target	CGOA	WGOA	CP	CV	Aggregate
Rockfish	2,081	2,058	2,108	2,030	2,076
Pacific Cod	1,513	1,496	1,327	1,516	1,510
Flatfish	980	1,155	1,183	848	986
Aggregate	1,347	1,770	1,587	1,282	1,400

The Regulatory Impact Review uses a retrospective approach to assess the potential impact of a Chinook PSC limit on non-pollock groundfish trawl harvests.[2] Tables ES-7 through ES-18 report the number of the analyzed years in which the fishery, or a sector of the fishery that received an apportionment of the PSC limit, would have closed. Tables summarizing impacts for Alternative 2 permutations that include a carve-out for the Rockfish Program (Option 4) are only analyzed back to 2007 – the first year of that program. In those cases, the maximum number of years closed is five. All other permutations are analyzed over the period from 2003 to 2011; in those cases, the maximum number of years closed is nine. The tables also report the point during the calendar year at which the closure would have occurred. Each table is accompanied by figures that bracket the range of potential impacts (forgone harvest, forgone wholesale revenue, and avoided Chinook PSC) from the closure dates listed in the table; the range covers only the PSC limits that would have triggered a fishery closure; direct impact to salmon and harvest outcomes would be zero for permutations of the Alternative 2 options would not have triggered a closure during the analyzed period.

Table ES-7 Estimated maximum impacts under a Gulf-wide Chinook salmon PSC limit (2003 to 2011)

PSC Limit	# Years Closed	Earliest Closure Week
12,500	0	None
10,000	1	Early September
7,500	2	Mid-May
5,000	6	Late April

The impact of the earliest closure is estimated to be 42,000 mt of harvest, $62 million in first wholesale revenue, and 3,350 avoided Chinook PSC. The impact of the latest closure is estimated to be 11,000 mt of harvest, $14 million in first wholesale revenue, and 1,050 avoided Chinook PSC.

Table ES-8 Estimated maximum impacts under a Gulf-wide PSC limit with a seasonal limit prior to June 1, Option 3 (2003 to 2011)

Annual PSC Limit	50/50			66/34		
	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure
12,500	6,250	1	Late April	8,250	1	Mid May
10,000	5,000	2	Late April	6,600	1	Late April
7,500	3,750	4	Early April	4,950	3	Mid April
5,000	2,500	7	Mid Feb	3,300	4	Early March

The impact of the earliest closure is estimated to be 19,000 mt of harvest, $27 million in first wholesale revenue, and 3,500 avoided Chinook PSC. The impact of the latest closure is estimated to be 2,400 mt of harvest, $3.5 million in first wholesale revenue, and 430 avoided Chinook PSC.

[2] Due to confidentiality restrictions and analytical design, harvest impacts are estimated using the week the closure would have occurred in a particular year, and applying that closure to a characteristic or average year representing the relevant time period. The source for these data is NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA, and ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD.

Table ES-9 Estimated maximum impacts on the non-Rockfish Program fishery under a Gulf-wide PSC limit with a Rockfish Program carve-out, Option 4 (2007 to 2011)

Total GOA PSC Limit	1,500 RP Carve-Out			2,500 RP Carve-Out			3,500 RP Carve-Out		
	Non-RP PSC Limit	# Years Closed	Earliest Closure	Non-RP PSC Limit	# Years Closed	Earliest Closure	Non-RP PSC Limit	# Years Closed	Earliest Closure
12,500	11,000	-	-	10,000	-	-	9,000	-	-
10,000	8,500	1	December	7,500	1	Late Oct	6,500	1	Early Oct
7,500	6,000	2	Mid Sept	5,000	2	Late April	4,000	3	Late April
5,000	3,500	3	Mid April	2,500	5	Early April	1,500	5	Early April

The impact of the earliest closure to the non-RP fishery is estimated to be 42,000 mt of harvest, $60 million in first wholesale revenue, and 4,500 avoided Chinook PSC. The impact of an October closure is estimated to be 2,300 mt of harvest, $3.2 million in first wholesale revenue, and 500 avoided Chinook PSC. The RP fishery itself could receive a Chinook PSC allowance of from 1,500 to 3,500; average annual PSC usage from 2007 to 2012 was 1,357 Chinook salmon.

Table ES-10 Estimated maximum impacts on the non-Rockfish Program fishery under a Gulf-wide PSC limit with a Rockfish Program carve-out and a seasonal limit prior to June 1, Options 3 & 4 (2007 to 2011)

		1,500 RP Carve-Out			2,500 RP Carve-Out			3,500 RP Carve-Out		
Total GOA PSC Limit	Seasonal Split	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure
12,500	50/50	5,500	-	-	5,000	1	Late April	4,500	2	Late April
	66/34	7,260	-	-	6,600	-	-	5,940	-	-
10,000	50/50	4,250	2	Late April	3,750	2	Late April	3,250	2	Mid April
	66/34	5,610	-	-	4,950	1	Late April	4,290	2	Late April
7,500	50/50	3,000	2	Mid April	2,500	3	Early April	2,000	3	Early April
	66/34	3,960	2	Late April	3,300	2	Mid April	2,640	3	Early April
5,000	50/50	1,750	3	Early April	1,250	5	Early April	750	5	Mid March
	66/34	2,310	3	Early April	1,650	4	Early April	990	5	Mid March

The impact of the earliest closure is estimated to be 14,000 mt of harvest, $16 million in first wholesale revenue, and 2,900 avoided Chinook PSC. The impact of the latest closure is estimated to be 4,500 mt of harvest, $5 million in first wholesale revenue, and 1,000 avoided Chinook PSC.

Table ES-11 Estimated maximum impacts under a Chinook salmon PSC limit apportioned by regulatory area, Option 1 (2003 to 2011)

	Total GOA PSC Limit	Chinook PSC History						Non-Pollock Groundfish History					
		5 Year			10 Year			5 Year			10 Year		
		Area PSC Limit	# Years Closed	Earliest Closure	Area PSC Limit	# Years Closed	Earliest Closure	Area PSC Limit	# Years Closed	Earliest Closure	Area PSC Limit	# Years Closed	Earliest Closure
Central GOA	12,500	11,503	-	-	10,291	-	-	10,393	-	-	10,237	-	-
	10,000	9,202	-	-	8,232	2	Mid Sept	8,315	2	Mid Sept	8,190	2	Early Sept
	7,500	6,902	2	Mid May	6,174	3	Mid May	6,236	3	Early May	6,142	3	Early May
	5,000	4,601	6	Late April	4,116	6	Late April	4,157	6	Mid April	4,095	6	Mid April
Western GOA	12,500	997	4	Early April	2,210	-	-	2,107	1	Mid Sept	2,263	-	-
	10,000	797	4	Early April	1,768	2	Mid May	1,685	2	Late April	1,810	2	Mid May
	7,500	598	4	Late March	1,326	3	Early April	1,264	4	Late March	1,358	3	Late March
	5,000	399	5	Late March	884	4	Early April	843	4	Late March	905	4	Late March

The impact of the earliest closure in the Central GOA is estimated to be 37,000 mt of harvest, $50 million in first wholesale revenue, and 3,500 avoided Chinook PSC. The impact of the latest closure in the Central GOA is estimated to be 7,000 mt of harvest, $10 million in first wholesale revenue, and 900

avoided Chinook PSC. The impact of the earliest closure in the Western GOA is estimated to be 7,500 mt of harvest, $8.5 million in first wholesale revenue, and 550 avoided Chinook PSC. The impact of the latest closure in the Western GOA is estimated to be 250 mt of harvest, $0.3 million in first wholesale revenue, and 25 avoided Chinook PSC.

Table ES-12 Estimated maximum impacts on the non-Rockfish Program fishery under a Chinook salmon PSC limit apportioned by regulatory area with a Rockfish Program carve-out, Options 1 & 4 (2007 to 2011)

	Central GOA			Western GOA		
Total GOA PSC Limit	PSC Limit	# Years Closed	Earliest Closure	PSC Limit	# Years Closed	Earliest Closure
12,500	9,888 - 7,148	0 - 1	Dec	2,264 - 909	0 - 1	Early July
10,000	7,641 - 5,162	0 - 2	Late Sept.	1,749 - 657	0 - 1	Late April
7,500	5,394 - 3,177	2 - 3	Mid April	1,235 - 404	1 - 2	Late April
5,000	3,146 - 1,191	3 - 5	Early April	720 - 152	1 - 4	Late Feb

The impact of the earliest closure in the Central GOA is estimated to be 34,000 mt of harvest, $64 million in first wholesale revenue, and 4,100 avoided Chinook PSC. The impact of a September closure in the Central GOA is estimated to be 8,000 mt of harvest, $15 million in first wholesale revenue, and 1,200 avoided Chinook PSC. The impact of the earliest closure in the Western GOA is estimated to be 10,000 mt of harvest, $17.5 million in first wholesale revenue, and 480 avoided Chinook PSC. The impact of the latest closure in the Western GOA is estimated to be 4,500 mt of harvest, $8 million in first wholesale revenue, and 150 avoided Chinook PSC.

Table ES-13 Estimated maximum impacts under a Chinook salmon PSC limit apportioned by operational type sector, Option 2 (2003 to 2011)

		Chinook PSC History						Non-Pollock Groundfish History					
		5 Year			10 Year			5 Year			10 Year		
	Total GOA PSC Limit	Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure
CP	12,500	6,039	1	Early Oct	6,397	-	-	4,240	2	Early May	4,471	2	Early May
	10,000	4,831	1	Mid May	5,118	1	Mid May	3,392	2	Late April	3,577	2	Early May
	7,500	3,623	2	Mid May	3,838	2	Mid May	2,544	6	Late April	2,683	5	Late April
	5,000	2,416	6	Late April	2,559	6	Late April	1,696	8	Late March	1,789	8	Late March
CV	12,500	6,460	-	-	6,104	-	-	8,260	-	-	8,029	-	-
	10,000	5,168	-	-	4,883	1	Early Nov	6,608	-	-	6,423	-	-
	7,500	3,876	3	Mid July	3,662	3	Early July	4,956	1	Early Nov	4,817	1	Late Oct
	5,000	2,584	4	Early March	2,442	5	Late Feb	3,304	3	Early July	3,211	3	Late April

The impact of the earliest closure to the CP sector is estimated to be 21,000 mt of harvest, $33 million in first wholesale revenue, and 2,500 avoided Chinook PSC. The impact of a mid-May closure to the CP sector is estimated to be 18,000 mt of harvest, $28 million in first wholesale revenue, and 1,100 avoided Chinook PSC. The impact of the earliest closure to the CV sector is estimated to be 34,000 mt of harvest, $44 million in first wholesale revenue, and 2,300 avoided Chinook PSC. The impact of a mid-July closure to the CV sector is estimated to be 15,000 mt of harvest, $16 million in first wholesale revenue, and 950 avoided Chinook PSC.

Table ES-14 Estimated maximum impacts under a Chinook salmon PSC limit apportioned by operational type sector with a seasonal limit prior to June 1, Options 2 & 3 (2003 to 2011)

Annual PSC Limit	Catcher/Processors						Catcher Vessels					
	50/50			66/34			50/50			66/34		
	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure
12,500	3,199 - 2,120	1 - 2	Early April	4,222 - 2,798	0 - 1	Late April	4,130 - 3,052	-	-	5,452 - 4,029	-	-
10,000	2,559 - 1,696	1 - 3	Early April	3,378 - 2,239	1 - 2	Mid April	3,304 - 2,442	0 - 1	Late April	4,361 - 3,223	-	-
7,500	1,919 - 1,272	3 - 4	Early April	2,533 - 1,679	1 - 3	Early April	2,478 - 1,831	1 - 3	Mid April	3,271 - 2,417	0 - 1	Late April
5,000	1,280 - 848	4	Early April	1,689 - 1,119	3 - 4	Early April	1,652 - 1,221	3	Mid April	2,181 - 1,612	2 - 3	Mid April

The impact of the earliest closure to the CP sector is estimated to be 3,700 mt of harvest, $4.1 million in first wholesale revenue, and 1,700 avoided Chinook PSC. The impact of the latest closure to the CP sector is estimated to be 1,800 mt of harvest, $1.9 million in first wholesale revenue, and 800 avoided Chinook PSC. The impact of the earliest closure to the CV sector is estimated to be 7,000 mt of harvest, $8 million in first wholesale revenue, and 900 avoided Chinook PSC. The impact of the latest closure to the CV sector is estimated to be 4,500 mt of harvest, $5 million in first wholesale revenue, and 600 avoided Chinook PSC.

Table ES-15 Estimated maximum impacts on the non-Rockfish Program fishery under a Chinook salmon PSC limit apportioned by operational type sector with a Rockfish Program carve-out, Options 2 & 4 (2007 to 2011)

	Catcher/Processors			Catcher Vessels		
Total GOA PSC Limit	PSC Limit	# Years Closed	Earliest Closure	PSC Limit	# Years Closed	Earliest Closure
12,500	5,799 - 3,134	0 - 1	Late April	7,170 - 4,255	0	-
10,000	4,481 - 2,263	0 - 3	Mid April	5,540 - 3,073	0 - 2	Early Oct
7,500	3,163 - 1,393	1 - 5	Early April	3,911 - 1,891	1 - 3	Late April
5,000	1,845 - 522	4 - 5	Mid March	2281 - 709	2 - 5	Mid April

The impact of the earliest closure to the CP sector is estimated to be 18,000 mt of harvest, $28 million in first wholesale revenue, and 2,300 avoided Chinook PSC. The impact of a mid-April closure to the CP sector is estimated to be 17,500 mt of harvest, $27.5 million in first wholesale revenue, and 1,400 avoided Chinook PSC. The impact of the earliest closure to the CV sector is estimated to be 22,000 mt of harvest, $28.5 million in first wholesale revenue, and 2,250 avoided Chinook PSC. The impact of the latest closure to the CV sector is estimated to be 4,000 mt of harvest, $5 million in first wholesale revenue, and 950 avoided Chinook PSC.

Table ES-16 Estimated maximum impacts on the non-Rockfish Program fishery under a Chinook salmon PSC limit apportioned by operational type sector with a Rockfish Program carve-out and a seasonal limit prior to June 1, Options 2, 3 & 4 (2007 to 2011)

			1,500 RP Carve-Out			2,500 RP Carve-Out			3,500 RP Carve-Out		
Total GOA PSC Limit	Sector	Seasonal Split	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure
12,500	CP	50/50	2,900 - 1,915	1 - 3	Early April	2,636 - 1,741	1 - 3	Early April	2,372 - 1,567	1 - 3	Early April
		66/34	3,828 - 2,528	0 - 1	Mid April	3,480 - 2,298	1 - 2	Mid April	3,132 - 2,068	1 - 3	Early April
	CV	50/50	3,585 - 2,600	-	-	3,259 - 2,364	0 - 1	Late April	2,933 - 2,127	0 - 1	Late April
		66/34	4,732 - 3,432	-	-	4,302 - 3,120	-	-	3,872 - 2,808	-	-
10,000	CP	50/50	2,241 - 1,480	2 - 3	Early April	1,977 - 1,306	3 - 4	Early April	1,713 - 1,132	3 - 4	Early April
		66/34	2,958 - 1,953	0 - 3	Early April	2,610 - 1,724	1 - 3	Early April	2,262 - 1,494	2 - 3	Early April
	CV	50/50	2,770 - 2,009	0 - 1	Late April	2,444 - 1,773	1 - 2	Mid April	2,118 - 1,537	1 - 2	Mid April
		66/34	3,657 - 2,652	-	-	3,226 - 2,340	0 - 1	Late April	2,796 - 2,028	0 - 1	Late April
7,500	CP	50/50	1,582 - 1,045	3 - 4	Early April	1,318 - 871	4	Early April	1,054 - 696	4 - 5	Late March
		66/34	2,088 - 1,379	3 - 4	Early April	1,740 - 1,149	3 - 4	Early April	1,392 - 919	4	Early April
	CV	50/50	1,955 - 1,418	1 - 2	Mid April	1,630 - 1,182	2	Mid April	1,304 - 946	2	Mid April
		66/34	2,581 - 1,872	0 - 2	Late April	2,151 - 1,560	1 - 2	Mid April	1,721 - 1,248	2	Mid April
5,000	CP	50/50	923 - 609	4 - 5	Mid March	659 - 435	5	Mid March	395 - 261	5	Early March
		66/34	1,218 - 804	4	Early April	870 - 575	4 - 5	Mid March	522 - 345	5	Early March
	CV	50/50	1,141 - 827	2 - 3	Mid April	815 - 591	3 - 4	Mid April	489 - 355	4	Late Feb
		66/34	1,506 - 1,092	2	Mid April	1,075 - 780	2 - 3	Mid April	645 - 468	4	Early April

The impact of the earliest closure to the CP sector is estimated to be 4,700 mt of harvest, $5.4 million in first wholesale revenue, and 1,930 avoided Chinook PSC. The impact of the latest closure to the CP sector is estimated to be 2,300 mt of harvest, $2.6 million in first wholesale revenue, and 850 avoided Chinook PSC. The impact of the earliest closure to the CV sector is estimated to be 12,700 mt of harvest, $14 million in first wholesale revenue, and 1,100 avoided Chinook PSC. The impact of the latest closure to the CV sector is estimated to be 5,300 mt of harvest, $5.9 million in first wholesale revenue, and 800 avoided Chinook PSC.

Table ES-17 Estimated maximum impacts under a Chinook salmon PSC limit apportioned by regulatory area and by operational type sector, Options 1 & 2 (2003 to 2011)

	Total GOA PSC Limit	Chinook PSC History						Non-Pollock Groundfish History					
		5 Year			10 Year			5 Year			10 Year		
		Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure
CG CP	12,500	5,129	-	-	4,792	-	-	2,674	3	Early May	2,851	2	Early May
	10,000	4,103	1	Early Oct	3,834	1	Mid May	2,139	6	Mid April	2,281	5	Mid April
	7,500	3,077	2	Mid May	2,875	2	Mid May	1,605	6	Mid April	1,711	6	Early April
	5,000	2,052	6	Late April	1,917	6	Mid April	1,070	8	Early April	1,140	8	Early April
CG CV	12,500	6,374	-	-	5,498	-	-	7,719	-	-	7,386	-	-
	10,000	5,099	-	-	4,399	2	Late Sept	6,175	-	-	5,909	-	-
	7,500	3,824	2	Mid July	3,299	3	Early July	4,631	1	Late Oct	4,431	2	Mid Sept
	5,000	2,549	4	Mid March	2,199	7	Mid Feb	3,088	3	Mid May	2,954	3	Late March
WG CP	12,500	910	4	Early April	1,604	3	Early May	1,566	2	Late April	1,620	2	Late April
	10,000	728	4	Late March	1,284	3	Early April	1,253	4	Late March	1,296	3	Late March
	7,500	546	4	Late March	963	4	Early April	939	4	Late March	972	4	Late March
	5,000	364	5	Late March	642	4	Late March	626	4	Late March	648	4	Mid March
WG CV	12,500	86	4	Early Feb	606	-	-	541	-	-	643	-	-
	10,000	69	4	Early Feb	485	-	-	433	-	-	514	-	-
	7,500	52	5	Early Feb	363	-	-	325	-	-	386	-	-
	5,000	35	5	Early Feb	242	-	-	216	-	-	257	-	-

Table ES-18 Estimated maximum impacts under a Chinook salmon PSC limit apportioned by regulatory area and by operational type sector with a Rockfish Program carve-out, Option 1, 2 & 4 (2007 to 2011)

	CG CP			CG CV			WG CP			WG CV		
Total GOA PSC Limit	PSC Limit	# Years Closed	Earliest Closure	PSC Limit	# Years Closed	Earliest Closure	PSC Limit	# Years Closed	Earliest Closure	PSC Limit	# Years Closed	Earliest Closure
12,500	4,585 - 1,757	0 - 4	Early April	6,589 - 3,765	0 - 1	Late Oct	1,682 - 831	0 - 1	Late April	628 - 79	0 - 2	Late Feb
10,000	3,543 - 1,269	0 - 4	Early April	5,091 - 2,719	0 - 2	Early Oct	1,300 - 600	0 - 1	Late April	486 - 57	0 - 2	Mid Feb
7,500	2,501 - 781	1 - 5	Early April	3,594 - 1,673	1 - 4	Mid April	918 - 369	1 - 2	Late April	343 - 35	0 - 2	Mid Feb
5,000	1,459 - 293	4 - 5	Early March	2,096 - 628	2 - 5	Early April	535 - 138	1 - 4	Late Feb	200 - 13	0 - 2	Late Jan

The timing of fishery closures caused by Chinook salmon PSC impacts each of the GOA non-pollock target fisheries differently. 60% of the GOA Pacific cod fishery is harvested during the A-season in the early part of the fishing year; generally, only the smallest Chinook PSC apportionments trigger closures that would preclude this catch. On the other end of the spectrum, a large proportion of the GOA flatfish fisheries (especially shallow water flatfish, which are primarily harvested by Central GOA catcher vessels) are prosecuted late in the year. So, flatfish harvests (and consequently the Central GOA CV sector) are affected by a wider range of the considered PSC limit and apportionment options. The GOA rockfish fisheries are primarily prosecuted between May and August, but the timing of fishing differs by regulatory area and operational type sector. The number of Alternative 2 options that could curtail a sector's rockfish harvest varies accordingly. In the absence of a separate PSC limit for the Rockfish Program, the CP sector is more likely to lose a greater percentage of its typical harvest to a Chinook PSC closure. If members of this sector expect a Chinook PSC closure, they may harvest their allocations earlier in the year.

In addition to potential reductions in the amount of non-pollock groundfish harvested, setting a Chinook salmon PSC limit may alter fishermen's in-season behavior, potentially causing them to incur additional costs or to impose costs on others. Vessels that typically participate in GOA fisheries later in the year may decide to fish earlier, in an attempt to reduce exposure to PSC-related fishery closures. Vessels may also alter the timing of their participation in order to fish during times of lower expected Chinook salmon encounter. Fishermen's ability to alter the timing of their participation may, however, be limited by the other fisheries in which they choose to participate, or by competing constraints such as halibut PSC. Fishermen's ability to delay participation in order to reduce expected Chinook salmon PSC may be limited by the decisions of other vessels that do not attempt to avoid PSC. Vessels may also deviate from their historical area participation patterns. These participation patterns will differ based on the options selected by the Council. For example, under a Gulf-wide limit, a vessel that typically fishes an area during a time period with high PSC rates may instead choose to fish in areas where expected PSC rates are lower. On the other hand, if separate PSC limits are established for the different regulatory areas, vessels may move opportunistically between regulatory areas in anticipation of closures. A vessel that historically only fished in one area may choose to move between two areas, if it perceives an opportunity to gain an increased share of total harvests. Fishermen's ability to alter their historical spatial participation pattern may be limited by the permits that they possess, or by their access to processing facilities, among other factors. To the extent that a PSC limit incentivizes competition between vessels to harvest available groundfish before a potential fishery closure, a hard cap may reduce the instances of voluntary coordination to avoid Chinook salmon.

In-season management of a Chinook salmon PSC limit may require NOAA Fisheries to temporarily suspend, and then re-open, fishing in order to fully utilize available TAC within the confines of a hard cap. Temporary closures could impose additional transit costs on vessels, as well as time costs that may affect vessel and crew opportunities to participate in other fisheries.

Shoreside non-pollock groundfish processors may be affected by a Chinook salmon PSC limit that could reduce harvest from fisheries, shorten the length of fishing seasons, or concentrate deliveries into shorter periods of time. Because the time-distribution of Chinook salmon PSC varies from year to year, it is difficult to anticipate the effects of the limit on fishery closures and season lengths. Processors that utilize outside labor may find it difficult to anticipate their labor demand over the course of the year, and could potentially incur additional costs from underutilized labor or increasing their workforce size in response to intensifying effort in the fisheries. Fishery closures and the associated reduction in the amount of deliveries could increase processors' per unit cost of production, which, in extreme cases, could result in an operating loss if processing revenues fall short of the amount needed to meet fixed capital costs. To the extent that vessels alter their spatial pattern of participation, processors could see some amount of the product that they historically receive being delivered to processors in another area. Finally, uncertainty about the amount of groundfish that will be harvested in a hard capped fishery could limit processors' ability to pre-contract their expected production. The effect of these impacts on total processor profitability would likely vary depending on the amount of total production that a processor generates from fisheries that are not included in this action.

Shoreside processors may incur additional costs under Alternative 2, Option 4. 200% observer coverage may be required at the plant; this would be in the Full Coverage category (sometimes called "pay as you go"), which is not part of the Partial Coverage and, thus, is outside of the scope of observer deployment through the Annual Deployment Plan and the observer fees that pay for partial coverage. Processors would also need to create a designated salmon storage area in their facility, which may impose a direct cost. Managing a hard cap may also include additional requirements to be met in the Catch Monitoring and Control Plan (CMCP).

Because the causal link between trawl Chinook salmon PSC and the number of Chinook salmon available to Alaskan users is undeveloped, this analysis does not attempt to monetize the effect of Chinook PSC limits on commercial salmon harvesters, subsistence users, or sport fishermen. The Regulatory Impact Review does estimate the potential reduction in non-pollock trawl Chinook PSC under a hard cap. The range of potential salmon savings is reported earlier in this portion of the Executive Summary.

Some additional monitoring requirements would be required to implement Alternative 2, and may impose a cost. Rockfish Program CPs will have additional monitoring requirements under Option 4. To ensure accurate counts of salmon PSC that is allocated to an entity, NMFS intends to apply the following additional requirements to the Rockfish Program catcher/processors:

- All salmon bycatch of any species must be retained until it is counted by an observer;
- Vessel crew must transport all salmon bycatch from each haul to an approved storage location adjacent to the observer sampling station so that the observer has free and unobstructed access to the salmon, and the salmon must remain within view of the observer from the observer sampling station at all times;
- The observer must be given the opportunity to count the salmon and take biological samples, even if this requires the vessel crew to stop sorting or processing catch until the counting and sampling is complete;
- The vessel owner must install a video system with a monitor in the observer sample station that provides views of all areas where salmon could be sorted from the catch and the secure location where salmon are stored;
- No salmon bycatch of any species may pass the last point where sorting occurs in the factory; and
- Operators of catcher/processors would be required to submit the count of salmon by species in each haul to NMFS using an electronic logbook.

Under Option 4 there would also be some costs for catcher vessels in the Rockfish Program to provide additional space for a salmon storage location. These costs depend on the current layout of the vessel; however costs are expected to be minimal.

Allowing the observer to count all the salmon in the previous haul prior to the beginning of the next haul may reduce the flow of fish through the factory. The degree to which the processing will be slowed would be highly variable and depend on the number of salmon in each haul. Costs would increase in concert with an increase in the time required to convey fish through the sorting area, increased processing times, and the need to reconfigure conveyor belt and sorting layouts. A video monitoring requirement would be modeled similar to those designed for the Chinook salmon monitoring requirements under Amendment 91 for AFA catcher/processors.

Alternative 3

Alternative 3 would require full retention of Chinook salmon by all unobserved non-pollock trawl vessels. Under the restructured observer program, most CP vessels are in the full coverage category, and will always have an observer onboard. In the case of CVs, requiring Chinook salmon to be brought to shore when an observer is not present on board is not expected to impact deck operations, or to be onerous in terms of utilizing hold space.

Requiring full Chinook salmon retention on unobserved trips could, at some point in the future, increase the amount of biological sampling that occurs on Chinook salmon, and advanced understanding of the stock origin of Chinook salmon taken as PSC will improve managers' ability to assess both impacts on Chinook salmon users and net benefits to the nation. However, as described in the management and enforcement considerations section, the implementation of this alternative as currently considered in the analysis would not result in more genetic data, as it would not allow NMFS to take systematic samples from a census of salmon PSC, in accordance with its current sampling approach.

An observer work station for CPs would be required. Almost all CP vessels operating in the GOA already have requirements for an observer workstation as part of the Rockfish and Amendment 80 programs.

Management and Enforcement Considerations

Alternative 1

The new Observer Program makes important changes to how observers are deployed, how observer coverage is funded, and the vessels and processors that must have some or all of their operations observed. Under observer restructuring, regardless of length, nearly all GOA catcher/processors (CPs) are included in the full coverage category and carry an observer on every trip.[3] In addition, all CPs fishing in Rockfish Program sideboard fisheries or fishing under the authority of a rockfish cooperative fishing quota (CQ) permit are required to carry 2 observers (often called "200% observer coverage") and all GOA catcher vessels (CVs) participating in the Rockfish Program are in the full coverage category and carry an observer on every trip.

Vessels participating in the non-pollock GOA trawl fisheries sort their catch extensively at sea, because of a larger amount of unmarketable bycatch. Because a large amount of sorting occurs at sea and the observers are unable to monitor this sorting while engaged in other sampling duties, it is extremely difficult to verify that no salmon PSC have been discarded at sea. Unlike the CV pollock vessels, there is a high likelihood that salmon PSC has been sorted from the catch prior to delivery. Offload counts of salmon PSC are not possible in these fisheries because of the amount of sorting that occurs in these fisheries. Therefore, PSC estimates from CVs in other GOA trawl fisheries are all derived from at-sea samples. Biological data are not collected at sea or shoreside from fish outside of the observers' composition samples.

Monitoring and enforcement provisions were implemented in the Rockfish Program to ensure that harvesters maintain catches within annual allocations and do not exceed sideboard limits. In addition to the full observer coverage requirements outlined in the previous section, there are several other monitoring requirements for vessels participating in the Rockfish Program. Specifically, NMFS: 1) requires that vessels participating in a rockfish cooperative or a rockfish sideboard fishery carry and use a NMFS-approved VMS transmitter; 2) requires CPs in the program to completed a NMFS-approved electronic logbook; 3) requires that CPs in a rockfish cooperative or rockfish sideboard fishery follow specified catch handling procedures prior to processing; 4) requires the weighing of all catch from rockfish cooperatives on NMFS or State approved scales; and 5) requires that shoreside processors receiving rockfish CQ operate under a NMFS approved Catch Monitoring and Control Plan (CMCP).

Observer sampling aboard CVs in the Rockfish Program is the same as other trawl fisheries besides pollock. However, 100% observer coverage is required so that the vessels in a rockfish cooperative obtain a vessel specific halibut PSC rate to support transferable PSC allocations.

Sampling methods used on catcher/processors (CPs) allow observers to collect larger samples under more controlled conditions than CVs because the observer is able to collect samples downstream of the fish holding tanks, just prior to the catch sorting area that precedes the fish processing equipment.

[3] The following CPs may be included in the partial observer coverage category: (1) CPs less than 60 ft. LOA with a history of CP and CV activity in a single year from January 1, 2003, through January 1, 2010; (2) any CP with an average daily groundfish production of less than 5,000 pounds round weight equivalent in the most recent full calendar year of operation from January 1, 2003, to January 1, 2010; or (3) CPs that processed no more than one metric ton round weight of groundfish on any day (up to a maximum of 365 mt per year) in the previous calendar year.

Additionally, on many CPs that are in the CGOA Rockfish and Amendment 80 Programs, the observer has access to catch weighing scales and an observer sampling station.

At shoreside processing plants for all CV trawl fisheries other than pollock, biological data are only collected from those salmon encountered within the at-sea composition samples. Biological data are not collected at the shoreside processor. Additionally, no observers are currently assigned to shoreside processors receiving deliveries from CV trawl fisheries other than pollock.

Shoreside processors in the central GOA receiving catch from vessels participating in the Rockfish Program are required to operate under a CMCP that details how the processing plant will ensure that all catch delivered is sorted and weighed to species within view of a CMCP specialist. Biological data are not collected from salmon encountered during the delivery.

Chinook salmon PSC estimates from trawl CP and non-pollock trawl CV fisheries in the GOA are based on at-sea sampling for salmon. NMFS uses the at-sea samples on observed trips and extrapolates the sample to the week (CP) or trip (CV). These estimates are used to create PSC rates that are applied to unobserved vessels. There is a relationship between the abundance of given species in a haul, sample size, and the level of precision in the resulting estimate of species catch from sampling. In general, we can have very high precision in the catch estimate for common (target species) with very small samples of the haul. Conversely, even extremely large samples of a haul provide relatively imprecise estimates of catch for very rare species, such as Chinook salmon.

In addition, from an inseason management perspective, the PSC rates change as additional observer information is obtained. This creates temporal variation in Chinook salmon PSC estimates, resulting in a high degree of uncertainty associated with inseason management of Chinook salmon PSC limits.

Alternative 2

The implementation of Alternative 2 and the associated PSC limits in the GOA non-pollock trawl fisheries would require various changes to Federal regulations and NMFS management practices, when compared to the status quo. Depending on the options and suboptions selected, these changes would include changes to inseason management, monitoring requirements, catch accounting, and enforcement responsibilities.

PSC limits by fishery (e.g. non-pollock trawl) or area (e.g. Western GOA) or sector (CV and CP) would non-transferable Chinook salmon PSC limits managed by NMFS with a directed fishing closure once this limit was reached. This would be similar to how current PSC limits in the GOA pollock fishery are managed. NMFS would likely need to take a conservative inseason management approach and there are likely to be constraints on the ability of the fleet to fully harvest target species, especially in fast-paced fisheries and in years of high PSC.

For the GOA non-pollock trawl fisheries NMFS would consider PSC limits that are less than the historic highest weekly rate for the managed fishery to be too small to manage inseason. For the non-pollock trawl CV and CP sector fisheries these amounts are about 1,500 Chinook salmon a week each for the Central GOA and 1,000 Chinook salmon for the CPs and 100 Chinook salmon for the CVs for the Western GOA. These estimates include the rockfish fisheries. If the fishery that is limited by the Chinook salmon PSC is managed under a catch share program then a lower PSC limit may be possible for an entity to manage accurately.

Catch share programs that include PSC limits to entities, such as the Rockfish Program cooperatives, give participants more specific control over their fisheries. Therefore, the general management approach

changes with catch share programs. Entities that receive allocations generally are prohibited from exceeding their allocations. If they exceed an allocation, NOAA may initiate an enforcement action against the entity. Currently, halibut PSC limits are allocated the Rockfish Program cooperatives. NMFS does not issue fishery closures once these PSC limits are reached. Instead, the cooperatives monitor their halibut PSC relative to their PSC limit and are prohibited from exceeding their halibut PSC limits. PSC limits that were allocated to the Rockfish Program cooperatives could include provision for transfers of Chinook salmon PSC between entities.

PSC accounting of Chinook salmon PSC in GOA fisheries at vessel-specific level would require implementation of sophisticated management and enforcement protocols, such as those implemented under Amendment 91 in the Bering Sea. For example, sorting at sea would need to be curtailed and shoreside processors would need to modify sorting line configurations to allow for sorting and weighing of salmon within view of an observer. In addition, a suite of monitoring tools including additional observer coverage, salmon storage containers, and video monitoring on CPs would need to be implemented. However, the catch monitoring infrastructure does not exist in the GOA to the same degree that it did in the Bering Sea when Amendment 91 was developed and the amount of change would be much greater for vessels and shoreside processors than was needed in the BSAI. These monitoring requirements would impose large costs on the industry without the benefit and management infrastructure of a catch share program.

Management of catch limits to a specific entity, like a cooperative, are enforced through regulatory provisions that prohibit the entity from exceeding its allocation, therefore a more comprehensive catch monitoring and accounting system is required compared to managing catch limits at a fishery or sector level. This is particularly true when groundfish catch or PSC data collected by observers must be used as a basis for enforcement action should an entity exceed a catch limit. PSC generally is required to be discarded and PSC often limits the catch of economically valuable target species. The greater the potential to limit the target species catch, the greater the incentive created to not have PSC identified and estimated. Under Option 4, with Chinook salmon PSC limits to Rockfish Program entities, NMFS recommends the following additional monitoring requirements for CVs and CPs that would enable census level accounting of Chinook salmon PSC and ensure effective monitoring and enforcement.

In summary, for both CPs and CVs, this action attempts to implement a high-precision management tool in fisheries with very little monitoring infrastructure to support precise PSC estimates and is highly susceptible to introduction of intentional bias into salmon PSC estimation.

Alternative 3

In non-pollock CV trawl fisheries, such as flatfish or Pacific cod fisheries, sorting at sea is very common and some vessels have conveyor systems on deck to facilitate this sorting. Unlike the pollock fishery, the likelihood that full retention of salmon PSC would occur in the non-pollock trawl fisheries aboard vessels without an observer is highly unlikely given the incentives to under-report salmon PSC. The full retention of salmon PSC requirement may be more effective aboard vessels that are required to carry an observer at all times and have some of the monitoring tools (increased observer coverage, flow scales, CMCPs, observer sampling stations) necessary to monitor and enforce a full retention requirement, such as CGOA Rockfish Program CVs and CPs. However, even in these programs, NMFS will have no way of verifying that full retention of salmon has occurred aboard unobserved vessels. Therefore, NMFS would continue to calculate Chinook salmon PSC numbers and manage a PSC cap for Chinook salmon using the existing system of extrapolating PSC rates from observed vessels to the unobserved portion of the fleet

The operational characteristics of the pollock fishery allow full retention of salmon and thus collection of genetic samples following sampling methods developed for the Bering Sea (Pella and Geiger 2009).

However, this sampling method does not lend itself to the operational characteristics and current monitoring protocols of non-pollock CV fisheries in the GOA, with the potential exception of the Rockfish Program. The Rockfish Program requires 100% observer coverage, and deliveries are monitored by NMFS staff, which would allow observers to verify full retention and NMFS staff could collect genetic samples at offload.

1 Introduction

This document analyzes proposed management measures that would apply to all trawl fisheries in the Central and Western Gulf of Alaska (GOA), except the directed pollock fishery. The measures under consideration include: setting prohibited species catch (PSC) limits in the Central and Western GOA for Chinook salmon (*Oncorhynchus tshawytscha*), which would close fisheries in those regulatory areas once attained, and full retention of salmon species. Implementation of the management measures evaluated in this analysis would require an amendment to the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA Groundfish FMP), as well as amendments to implementing regulations.

This document is a Regulatory Impact Review/Environmental Assessment /Initial Regulatory Flexibility Analysis (RIR/EA/IRFA). An RIR/EA/IRFA provides assessments of the economic benefits and costs of the action alternatives, as well as their distribution (the RIR), the environmental impacts of an action and its reasonable alternatives (the EA), and the impacts of the action on directly regulated small entities (the IRFA). This RIR/EA/IRFA addresses the statutory requirements of the Magnuson Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), the National Environmental Policy Act (NEPA), Presidential Executive Order 12866, and the Regulatory Flexibility Act. An RIR/EA/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 purpose of this action is to address the capture of Chinook salmon in the trawl fisheries of the GOA. Chinook salmon are a prohibited species in the GOA groundfish fisheries, and, as such, must be returned immediately to the sea with a minimum of injury, if caught incidentally in the groundfish fisheries[4]. Under the Magnuson-Stevens Act, the Council is required to minimize bycatch to the extent practicable, as well as to take into account the importance of fishery resources to fishing communities in order to minimize adverse economic impacts on such communities. Chinook salmon are a highly valued species for commercial, recreational, subsistence, and personal use fisheries. While the Council has recently established Chinook salmon PSC limits for the directed pollock trawl fisheries in the GOA, no such PSC limit is currently in effect for other trawl fisheries in the GOA, which also intercept Chinook salmon. Under the regulations, it is incumbent upon fishermen to avoid catching Chinook salmon, however the Council has determined it is necessary to evaluate management measures to protect against the risk of high Chinook salmon PSC in future years.

The Council adopted the following problem statement in February 2012.

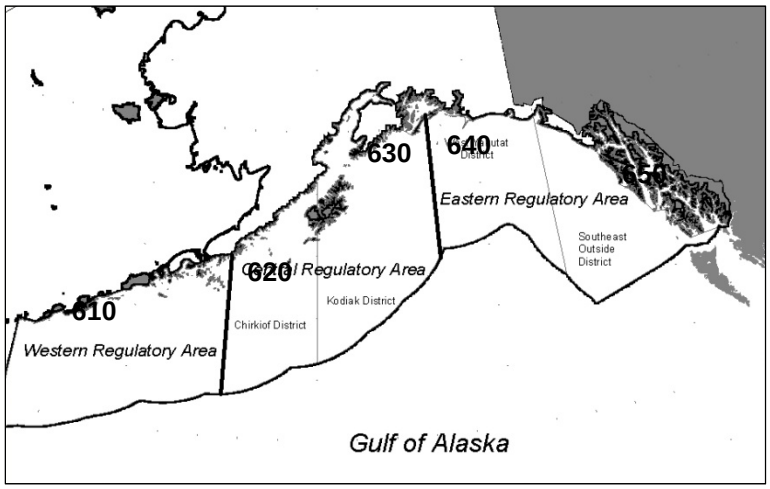
> *Magnuson-Stevens Act National Standards require balancing achieving optimum yield with minimizing bycatch, while minimizing adverse impacts on fishing dependent communities. Chinook salmon prohibited species catch (PSC) taken incidentally in GOA trawl fisheries is a concern, and incidental take is limited in the Biological Opinion for ESA-listed Chinook salmon stocks. The Council recently adopted a PSC limit of 25,000 Chinook salmon for the Western and Central GOA pollock trawl fisheries, while also indicating an intent to evaluate Chinook salmon bycatch in the non-pollock GOA trawl fisheries, which currently do not have a Chinook salmon bycatch control measure.*

[4] Except when their retention is authorized by other applicable law for biological sampling or for programs such as the Prohibited Species Donation Program.

1.2 Action Area

The proposed action would be implemented through an amendment to the GOA Groundfish FMP and through rulemaking. This action specifically regulates the non-pollock trawl fishery in the Western and Central GOA. Figure 1-1 illustrates the action area, spanning regulatory areas 610, 620 and 630. In 1998, a gear type prohibition on trawl fisheries went into effect in the Southeast Outside district (regulatory area 650). The West Yakutat district (area 640) accounts for a negligible portion of the GOA trawl fisheries.

Figure 1-1 GOA regulatory areas, and NMFS reporting areas



1.3 Bycatch and Prohibited Species Catch Terminology

Bycatch, as defined by the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; 16 U.S.C. § 1802(2)), "means fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards". The term "regulatory discards" refers to harvested fish "which fishermen are required by regulation to discard whenever caught, or are required by regulation to retain but not sell."

Within the GOA Groundfish FMP, several economically, ecologically, and/or culturally important fish species are identified, and their capture is required to be minimized and retention is prohibited[5]. These "Prohibited Species" include all five species of Pacific salmon, Pacific herring, several economically important king crab and Tanner crab species, and Pacific halibut. The Secretary, upon the recommendation of the Council, determined that sufficiently compelling need existed within the management contexts of the GOA Groundfish FMP (as well as the FMP for the Groundfish Fishery of the Bering Sea and Aleutian Islands) to specifically differentiate prohibited species catch (PSC) from incidental removals of other fish species (i.e., bycatch). These two distinct categories of unintended removals are separately monitored and controlled under the Groundfish FMP.

1.4 History of this Action

In December 2010, the Council initiated two sequential amendments to address GOA Chinook salmon PSC. The first amendment package was expedited; it addressed Chinook salmon bycatch in the GOA pollock fisheries through the implementation of a PSC limit for those target fisheries in the Western and Central GOA. At the same time, longer-term amendment packages were initiated to address

[5] Except when retention is authorized by other applicable law for biological sampling or for programs such as the Prohibited Species Donation Program.

comprehensive Chinook salmon bycatch management in all GOA trawl fisheries and to evaluate a broader suite of bycatch reduction management measures.

In June 2011, the Council took final action on Amendment 93 to the GOA Groundfish FMP, which established an overall PSC limit for the Central and Western GOA pollock fisheries of 25,000 Chinook salmon. The Central GOA annual PSC limit was set at 18,316 Chinook salmon, and the Western GOA PSC limit was set at 6,684 Chinook salmon. A provision was made to implement the PSC limits in mid-2012, and prorated PSC limits were established for the C and D seasons of the implementation year. Also, the Council required full retention of all salmon taken in the pollock trawl fishery, in order to allow NMFS to implement a robust sampling protocol for Chinook salmon, and allow for genetic stock identification of Chinook salmon taken as PSC. The final rule to implement Amendment 93 became effective on August 25, 2012 (77 FR 42629).

In February 2012, the Council reviewed a discussion paper on the problem statement and the alternatives in the comprehensive amendment package. The analysis had been initiated with a suite of alternatives evaluating a range of PSC limits for the GOA non-pollock trawl fisheries, the establishment of a bycatch cooperative for these fisheries, and full retention of salmon in all GOA trawl fisheries. Options were included which would allow apportionment of the PSC limits gulf-wide, allocated to the Western and Central GOA trawl fisheries separately, allocated between directed GOA trawl fisheries separately, or allocated by both regulatory area and directed trawl fishery. The Council had also requested discussion of several other potential tools for PSC reduction in the pollock fishery. In response to the analysis in the discussion paper, the Council chose to revise the scope and suite of alternatives of the comprehensive amendment package, and focus specifically on the non-pollock trawl fisheries. Alternatives and discussion items from the discussion paper that were not selected by the Council are described in greater detail in Section 2.4. Note, the Council has also continued the general discussion of tools to help in the reduction of PSC for Central GOA trawl fisheries (including both Chinook salmon and halibut) in a separate discussion paper.

The Council originally derived the range of total Gulf-wide PSC analyzed in this report from the Chinook salmon threshold identified in the incidental take statement accompanying the November 30, 2000 Biological Opinion on the effects of the Alaska groundfish fisheries on Endangered Species Act-listed salmon of the Pacific Northwest (NMFS 2007). The incidental take statement established a threshold of 40,000 Chinook salmon caught in the GOA groundfish fisheries (all targets) annually. According to NMFS, such a level of incidental Chinook salmon catch in the GOA groundfish fisheries would not jeopardize the continued existence of ESA-listed Chinook salmon stocks. In December 2010, the Council reviewed data illustrating that the pollock trawl fishery accounts for approximately 75 percent of Chinook salmon PSC in the GOA groundfish fisheries, based on average bycatch from 2001 to 2010. Amendment 93 to the GOA Groundfish FMP was approved in June 2011, and apportioned 25,000 Chinook salmon PSC to the GOA pollock trawl fishery. At that time, the Council set the upper level of PSC limits considered for the non-pollock trawl fisheries at 10,000 Chinook salmon.

In February 2012, the Council made two substantial changes to the options analyzed in the present analysis. First, the option to apportion PSC among directed fisheries was replaced with an option to apportion PSC limits between operational types (catcher vessels or catcher processors). Second, the Council increased the range of PSC limits under consideration to the present options between 5,000 to 12,500 Chinook salmon. The Council cited recent deliberations in setting the Chinook salmon PSC limits for the pollock fisheries, and noted that it wished to consider a range of PSC limits that encompassed historical catch levels of Chinook salmon in the GOA non-pollock trawl fisheries.[6] Moreover, the Council wanted to maintain the flexibility allowed by analyzing the higher limit, given the imprecision of data on

[6] NOAA catch accounting estimated Chinook salmon PSC at 10,877 in 2003 for the affected fisheries.

actual PSC levels (resulting from relatively low levels of observer coverage in the affected fisheries), and in view of options that could apportion the Council's selected PSC limit among multiple user groups, resulting in very small sector PSC allowances. The Council noted, however, that even if the upper end of the range was selected as a PSC limit for the non-pollock trawl fisheries, the combined PSC limits for GOA trawl fisheries would still remain below the 40,000 Chinook salmon threshold originally identified in the 2000 Biological Opinion (NMFS 2007).

The Council received an initial review draft of this analysis in December 2012. At initial review, the Council made a number of revisions to Alternative 2, including adding an option for a separate PSC limit for the Central GOA rockfish program, adding an option to limit the amount of PSC that could be taken in the first part of the year, and adding a provision to proportion the PSC limit based on average annual harvest of groundfish (rather than average annual prohibited species catch of Chinook salmon).

1.5 Other Relevant Council Actions

Over the course of the past few years, the Council has advanced a number of actions to reduce the use of PSC (Chinook salmon, crab, halibut) in the GOA fisheries. While this series of actions reflects the Council's commitment to reduce PSC in the GOA fisheries, participants in these fisheries, particularly in the Central GOA, have raised concerns that the current limited access management creates a substantial disincentive for them to take actions to reduce PSC usage, especially actions that also reduce target species catch rates. Throughout the discussions of PSC avoidance in GOA fisheries, the Council has acknowledged that a more comprehensive consideration of management measures that would help fleets in achieving PSC reductions is needed.

In October 2012, the Council approved a purpose and need statement, and goals and objectives, for a bycatch management program in the Central GOA trawl fisheries. The Council revised its purpose and need statement in February 2013 to include trawl fisheries in the Western GOA. The purpose of the proposed analysis is to create a new management structure for the GOA trawl fisheries that mitigates the impacts of a derby-style race for fish, and may allocate allowable harvest to individuals, cooperatives, or other entities. The program will be designed to provide tools for the effective management and reduction of PSC and bycatch, as well as to promote increased utilization of target and secondary species harvested in the GOA.

The Council also expressed concern that announcing an intention to develop a program that may include catch shares could induce speculative entry to the fisheries. Members of the public testified that there is already evidence of increased participation in the fishery. To dampen this effect, the Council stated that it may not credit Central GOA trawl catch history after December 31, 2012 for purposes of making any allocation under a future fishery management program. The Council issued a similar statement pertaining to Western GOA trawl catch history, setting March 1, 2013 as the control date.

In June 2013, the Council will review a preliminary discussion paper on several aspects of a bycatch management regime that may feature allocations and/or cooperatives, as an early step in the process of developing alternatives for an analysis. This first set of issues for discussion include potential interaction with state-waters management, the effect of limited duration quota allocations and allocation via auction mechanisms, and potential avenues for community welfare protection. The development of alternatives and iterative review of the subsequent analysis will likely mean that this issue will be on the Council's agenda for many meetings before the Council is ready to make a final recommendation.

2 Description of Alternatives

The alternatives that are analyzed in this amendment package were approved by the Council in February 2012, and revised at initial review in December 2012. They are listed below and described in detail in the sections that follow. These alternatives propose management measures that would apply exclusively to the directed non-pollock trawl fisheries in the Western and Central Gulf of Alaska.

Alternative 1: Status quo.

Alternative 2: 5,000, 7,500, 10,000, or 12,500 Chinook salmon PSC limit (hard cap).

- Option 1: Apportion limit between Central and Western GOA.
- Option 2: Apportion limit by operational type (CV vs. CP).
  - Applies to both options 1 and 2:
    - (a) Apportion proportional to historic average bycatch of Chinook salmon (5 or 10-year average);
    - (b) Apportion proportional to historic average non-pollock groundfish harvest (5 or 10-year average).
- Option 3: No more than 50% or 66% of the annual hard cap limit can be taken before June 1.
- Option 4: Separate Chinook salmon PSC limit (hard cap) to the CGOA rockfish program:
  - (a) 1,500
  - (b) 2,500
  - (c) 3,500
  - Suboption 1: Divide by sector (CV and CP) based on actual Chinook salmon PSC usage by sector for the rockfish catch share program years of 2007-2012.
    Each LLP holder within sector will receive an allocation of Chinook salmon PSC equivalent to the license's proportion of the sector's target rockfish catch history from the program's initial allocations. Member LLP allocations will be allocated to their respective cooperative.
  - Suboption 2: On October 1st, rollover all but 200, 300, or 400 remaining Chinook salmon to support other fall non-pollock trawl fisheries.
  - Suboptions 1 and/or 2 can be selected for Option 4.

Alternative 3: Full retention of salmon.
Vessels will retain all salmon bycatch until the number of salmon has been determined by the vessel or plant observer and the observer's collection of any scientific data or biological samples from the salmon has been completed.

Note, both Alternative 2 and Alternative 3 could be selected by the Council in their preferred alternative. Likewise, under Alternative 2, both Option 1 and Option 2, or Option 2 and Option 3, could be selected by the Council; Option 4 can be selected with any of the other options.

2.1 Alternative 1: No Action

Alternative 1 is the no action alternative (status quo). There are currently no Chinook salmon PSC limits or specific management measures to address Chinook salmon PSC in the GOA non-pollock trawl fisheries. NMFS regulations require that Chinook salmon PSC be minimized and discarded in the non-pollock GOA groundfish fisheries.

2.2 Alternative 2: PSC limit(s) between 5,000 and 12,500 Chinook Salmon

Alternative 2 would amend the FMP to create GOA Chinook salmon PSC limits for the non-pollock trawl fisheries, with the option for them to be subdivided by management area, operation type (catcher vessel vs. catcher processor), or both simultaneously. Another option would limit the amount of the PSC limit that could be taken in the first part of the year, and an additional option would also allow a separate PSC limit apportionment to the Central GOA rockfish program.

The total PSC thresholds under consideration for the entire action area are 5,000, 7,500, 10,000, or 12,500 Chinook salmon. The action area is defined as the Western GOA (610) and Central GOA (620 and 630). The PSC limit would be a hard cap, meaning that any fishery to which the PSC limit applies would be closed for directed fishing if the PSC limit is reached in a particular year.

The PSC limit could be applied to all Western and Central GOA non-pollock trawl fisheries as a whole, or it could be divided between the two regulatory areas, establishing separate PSC limits for each area (Option 1). The limit could also be divided among the operation types (Option 2) – catcher vessels (CV) and catcher/processor vessels (CP). Options 1 and 2 could be applied in combination, with separate limits applied to the different operation types (CV/CP) in each regulatory area (Western GOA and Central GOA). Under either option, the PSC limit would be apportioned either according to historic average Chinook salmon prohibited species catch, or according to historic average harvest of non-pollock groundfish, using either a 5- or a 10-year average. Table 2-1 provides the proposed PSC limits for the non-pollock trawl fisheries under Alternative 2, and Options 1 and 2 to Alternative 2.

Table 2-1 Proposed PSC limits for non-pollock trawl fisheries, under Alternative 2, and Options 1 and 2

			Historic basis for average apportionment	5-Year Average (2007 to 2011)					10-year Average (2002-2011)				
				%	12,500	10,000	7,500	5,000	%	12,500	10,000	7,500	5,000
Alt. 2	All GOA (W&C)			100%	12,500	10,000	7,500	5,000	100%	12,500	10,000	7,500	5,000
Option 1	WGOA		Chinook	8%	997	797	598	399	18%	2,210	1,768	1,326	884
			Groundfish	17%	2,107	1,685	1,264	843	18%	2,263	1,810	1,358	905
	CGOA		Chinook	92%	11,503	9,202	6,902	4,601	82%	10,291	8,232	6,174	4,116
			Groundfish	83%	10,393	8,315	6,236	4,157	82%	10,237	8,190	6,142	4,095
Option 2	All GOA (W&C)	Catcher Vessels	Chinook	52%	6,460	5,168	3,876	2,584	49%	6,104	4,883	3,662	2,442
			Groundfish	66%	8,260	6,608	4,956	3,304	64%	8,029	6,423	4,817	3,211
		Catcher Processors	Chinook	48%	6,039	4,831	3,623	2,416	51%	6,397	5,118	3,838	2,559
			Groundfish	34%	4,240	3,392	2,544	1,696	36%	4,471	3,577	2,683	1,789
Options 1 & 2	WGOA	Catcher Vessels	Chinook	1%	86	69	52	35	5%	606	485	363	242
			Groundfish	4%	541	433	325	216	5%	643	514	386	257
		Catcher Processors	Chinook	7%	910	728	546	364	13%	1,604	1,284	963	642
			Groundfish	13%	1,566	1,253	939	626	13%	1,620	1,296	972	648
	CGOA	Catcher Vessels	Chinook	51%	6,374	5,099	3,824	2,549	44%	5,498	4,399	3,299	2,199
			Groundfish	62%	7,719	6,175	4,631	3,088	59%	7,386	5,909	4,431	2,954
		Catcher Processors	Chinook	41%	5,129	4,103	3,077	2,052	38%	4,792	3,834	2,875	1,917
			Groundfish	21%	2,674	2,139	1,605	1,070	23%	2,851	2,281	1,711	1,140

Alternative 2 also includes an option that would create a separate PSC limit apportionment to the Central GOA rockfish program (Option 4). The PSC limit apportionments under consideration for the program are 1,500, 2,500, or 3,500 Chinook salmon. A suboption (Suboption 1) would allow the limit to be divided between catcher vessels and catcher processors, based on actual Chinook salmon PSC usage in the program between 2007 and 2012. The resulting PSC limits are provided in Table 2-2. The PSC limits would be further apportioned by cooperative within the sector, based on each member LLP holder's proportion of target rockfish catch history from the program's initial allocations. Additionally, a second suboption (Suboption 2) would permit a rollover of remaining Chinook salmon apportioned to the

program on October 1st, with the exception of either 200, 300, or 400 Chinook salmon. These salmon would be rolled over to the other non-pollock fisheries, in accordance with the Council's chosen apportionment methodology for these fisheries. The Council could choose either or both suboptions as part of their preferred alternative.

Table 2-2 Proposed PSC limits for Central GOA rockfish program, under Alternative 2's Option 4, and Suboption 1

		6-Year Chinook salmon PSC usage (2007 to 2012)			
		%	(a) 1,500	(b) 2,500	(c) 3,500
Option 4	Separate PSC limit for CGOA rockfish program	100%	1,500	2,500	3,500
Suboption 1	Catcher Vessels	62%	937	1,561	2,186
	Catcher Processors	38%	563	939	1,314

The Council could choose Option 4 by itself, with the remainder of the PSC limit to apply to all other non-pollock trawl fisheries that are not part of the Central GOA rockfish program, or the Council could choose to apply Option 4 in combination with Option 1 or Option 2. Some of the PSC limits that result from these combinations are extremely small, and are untenable as they would be very difficult for NMFS to manage (further discussion of the management challenges associated with small PSC limits, and a metric for defining a manageability threshold, is provided in Section 5.2.1.1). Table 2-3 lists the proposed PSC limits for the non-pollock trawl fisheries that are not part of the Central GOA rockfish program, under Alternative 2 with Option 4, and Alternative 2 with Options 1 and 4, or Options 2 and 4.

Finally, a last option (Option 3) would limit the amount of the annual hard cap that could be taken before June 1st. If the non-pollock trawl fisheries reached either 50% or 66% of their respective annual apportionments of the PSC limit before that date, their fishery would be closed until June 1st. Option 3 is a usage limit, but not a seasonal apportionment, so if the specified proportion of the PSC limit is not taken before June 1st, it is still available to be used later in the year.

This option could either be chosen with the GOA-wide PSC limit, in combination with Option 2 (the apportionment between catcher vessels and catcher processors), in combination with Option 4 (separate apportionment to the Central GOA rockfish program), or in combination with Options 2 and 4. With respect to combinations that include Option 4, staff have interpreted that Option 3, the seasonal usage limit on the hard cap, would only apply to the portion of the PSC limit that is remaining to the non-pollock trawl fisheries that are not a part of the rockfish program. It would not make sense to apply the seasonal limit to the rockfish program's separate PSC limit apportionment. The Central GOA rockfish program fishery does not begin until May 1st, and the purpose of apportioning a separate PSC limit to this program would be because it has the requisite management tools, through the cooperative structure, for participants to be able to manage their own PSC limit inseason. Table 2-4 provides the maximum amount of the proposed PSC limits for the non-pollock trawl fisheries that could be taken before June 1st, for the various combinations of Option 3.

Table 2-3 Proposed PSC limits for non-pollock trawl fisheries that are not part of the Central GOA rockfish program, under Alternative 2 with Option 4, or Alternative 2 with either Options 1 and 4, or Options 2 and 4

			Historic basis for average apportionment	5-Year Average (2007 to 2011)					10-year Average (2002-2011)				
GOA-wide Chinook cap					***12,500***	***10,000***	***7,500***	***5,000***		***12,500***	***10,000***	***7,500***	***5,000***
Option 4(a): 1,500 Chinook salmon set aside to CGOA rockfish program													
Non-CGOA rockfish non-pollock fisheries				**%**	**11,000**	**8,500**	**6,000**	**3,500**	**%**	**11,000**	**8,500**	**6,000**	**3,500**
Alt. 2	All GOA (W&C)			100%	11,000	8,500	6,000	3,500	100%	11,000	8,500	6,000	3,500
Options 1 & 4(a)	WGOA		Chinook	10%	1,112	859	606	354	20%	2,185	1,688	1,192	695
			Groundfish	21%	2,264	1,749	1,235	720	20%	2,212	1,709	1,206	704
	CGOA		Chinook	90%	9,888	7,641	5,394	3,146	80%	8,815	6,812	4,808	2,805
			Groundfish	79%	8,736	6,751	4,765	2,780	80%	8,788	6,791	4,794	2,796
Options 2 & 4(a)	All GOA (W&C)	Catcher Vessels	Chinook	49%	5,400	4,173	2,945	1,718	47%	5,201	4,019	2,837	1,655
			Groundfish	65%	7,170	5,540	3,911	2,281	64%	6,993	5,404	3,815	2,225
		Catcher Processors	Chinook	51%	5,600	4,327	3,055	1,782	53%	5,799	4,481	3,163	1,845
			Groundfish	35%	3,830	2,960	2,089	1,219	36%	4,007	3,096	2,185	1,275
Option 4(b): 2,500 Chinook salmon set aside to CGOA rockfish program													
Non-CGOA rockfish non-pollock fisheries				**%**	**10,000**	**7,500**	**5,000**	**2,500**	**%**	**10,000**	**7,500**	**5,000**	**2,500**
Alt. 2	All GOA (W&C)			100%	10,000	7,500	5,000	2,500	100%	10,000	7,500	5,000	2,500
Options 1 & 4(b)	WGOA		Chinook	10%	1,011	758	505	253	20%	1,986	1,490	993	497
			Groundfish	21%	2,058	1,543	1,029	514	20%	2,011	1,508	1,005	503
	CGOA		Chinook	90%	8,989	6,742	4,495	2,247	80%	8,014	6,010	4,007	2,003
			Groundfish	79%	7,942	5,957	3,971	1,986	80%	7,989	5,992	3,995	1,997
Options 2 & 4(b)	All GOA (W&C)	Catcher Vessels	Chinook	49%	4,909	3,682	2,455	1,227	47%	4,728	3,546	2,364	1,182
			Groundfish	65%	6,518	4,889	3,259	1,630	64%	6,358	4,768	3,179	1,589
		Catcher Processors	Chinook	51%	5,091	3,818	2,545	1,273	53%	5,272	3,954	2,636	1,318
			Groundfish	35%	3,482	2,611	1,741	870	36%	3,642	2,732	1,821	911
Option 4(c): 3,500 Chinook salmon set aside to CGOA rockfish program													
Non-CGOA rockfish non-pollock fisheries				**%**	**9,000**	**6,500**	**4,000**	**1,500**	**%**	**9,000**	**6,500**	**4,000**	**1,500**
Alt. 2	All GOA (W&C)			100%	9,000	6,500	4,000	1,500	100%	9,000	6,500	4,000	1,500
Options 1 & 4(c)	WGOA		Chinook	10%	909	657	404	152	20%	1,788	1,291	794	298
			Groundfish	21%	1,852	1,338	823	309	20%	1,810	1,307	804	302
	CGOA		Chinook	90%	8,091	5,843	3,596	1,348	80%	7,212	5,209	3,206	1,202
			Groundfish	79%	7,148	5,162	3,177	1,191	80%	7,190	5,193	3,196	1,198
Options 2 & 4(c)	All GOA (W&C)	Catcher Vessels	Chinook	49%	4,418	3,191	1,964	736	47%	4,255	3,073	1,891	709
			Groundfish	65%	5,866	4,237	2,607	978	64%	5,722	4,132	2,543	954
		Catcher Processors	Chinook	51%	4,582	3,309	2,036	764	53%	4,745	3,427	2,109	791
			Groundfish	35%	3,134	2,263	1,393	522	36%	3,278	2,368	1,457	546

Table 2-4 Maximum amount of proposed PSC limits for non-pollock trawl fisheries that could be used before June 1st, under Alternative 2 with Option 3, or Alternative 2 with either Options 2 and 3, or Options 3 and 4

Note, for usage limits that include Option 4, a set aside to the Central GOA rockfish program, the identified limit applies only to non-pollock trawl fisheries exclusive of the rockfish program.

			Usage limit for Jan-May	Historic basis for average apportionment	5-Year Average (2007 to 2011)				10-year Average (2002-2011)			
GOA-wide Chinook cap					***12,500***	***10,000***	***7,500***	***5,000***	***12,500***	***10,000***	***7,500***	***5,000***
Option 3 alone, Options 2 and 3												
Alt. 2 & Option 3	All GOA (W&C)		50%		6,250	5,000	3,750	2,500	6,250	5,000	3,750	2,500
			66%		8,250	6,600	4,950	3,300	8,250	6,600	4,950	3,300
Options 2 & 3	All GOA (W&C)	Catcher Vessels	50%	Chinook	3,230	2,584	1,938	1,292	3,052	2,442	1,831	1,221
				Groundfish	4,130	3,304	2,478	1,652	4,014	3,211	2,409	1,606
			66%	Chinook	4,264	3,411	2,558	1,705	4,029	3,223	2,417	1,612
				Groundfish	5,452	4,361	3,271	2,181	5,299	4,239	3,179	2,120
		Catcher Processors	50%	Chinook	3,020	2,416	1,812	1,208	3,199	2,559	1,919	1,280
				Groundfish	2,120	1,696	1,272	848	2,236	1,789	1,341	894
			66%	Chinook	3,986	3,188	2,391	1,595	4,222	3,378	2,533	1,689
				Groundfish	2,798	2,239	1,679	1,119	2,951	2,361	1,771	1,180
Including Option 4(a) *1,500 Chinook salmon set aside to CGOA rockfish program*												
Alt. 2 & Opt 3, 4a	All GOA (W&C)		50%		5,500	4,250	3,000	1,750	5,500	4,250	3,000	1,750
			66%		7,260	5,610	3,960	2,310	7,260	5,610	3,960	2,310
Options 2, 3 & 4(a)	All GOA (W&C)	Catcher Vessels	50%	Chinook	2,700	2,086	1,473	859	2,600	2,009	1,418	827
				Groundfish	3,585	2,770	1,955	1,141	3,497	2,702	1,907	1,113
			66%	Chinook	3,564	2,754	1,944	1,134	3,432	2,652	1,872	1,092
				Groundfish	4,732	3,657	2,581	1,506	4,616	3,567	2,518	1,469
		Catcher Processors	50%	Chinook	2,800	2,164	1,527	891	2,900	2,241	1,582	923
				Groundfish	1,915	1,480	1,045	609	2,003	1,548	1,093	637
			66%	Chinook	3,696	2,856	2,016	1,176	3,828	2,958	2,088	1,218
				Groundfish	2,528	1,953	1,379	804	2,644	2,043	1,442	841
Including Option 4(b) *2,500 Chinook salmon set aside to CGOA rockfish program*												
Alt. 2 & Opt 3, 4b	All GOA (W&C)		50%		5,000	3,750	2,500	1,250	5,000	3,750	2,500	1,250
			66%		6,600	4,950	3,300	1,650	6,600	4,950	3,300	1,650
Options 2, 3 & 4(b)	All GOA (W&C)	Catcher Vessels	50%	Chinook	2,455	1,841	1,227	614	2,364	1,773	1,182	591
				Groundfish	3,259	2,444	1,630	815	3,179	2,384	1,589	795
			66%	Chinook	3,240	2,430	1,620	810	3,120	2,340	1,560	780
				Groundfish	4,302	3,226	2,151	1,075	4,196	3,147	2,098	1,049
		Catcher Processors	50%	Chinook	2,546	1,909	1,273	636	2,636	1,977	1,318	659
				Groundfish	1,741	1,306	871	435	1,821	1,366	911	455
			66%	Chinook	3,360	2,520	1,680	840	3,480	2,610	1,740	870
				Groundfish	2,298	1,724	1,149	575	2,404	1,803	1,202	601
Including Option 4(c) *3,500 Chinook salmon set aside to CGOA rockfish program*												
Alt. 2 & Opt 3, 4c	All GOA (W&C)		50%		4,500	3,250	2,000	750	4,500	3,250	2,000	750
			66%		5,940	4,290	2,640	990	5,940	4,290	2,640	990
Options 2, 3 & 4(c)	All GOA (W&C)	Catcher Vessels	50%	Chinook	2,209	1,595	982	368	2,127	1,537	946	355
				Groundfish	2,933	2,118	1,304	489	2,861	2,066	1,272	477
			66%	Chinook	2,916	2,106	1,296	486	2,808	2,028	1,248	468
				Groundfish	3,872	2,796	1,721	645	3,776	2,727	1,678	629
		Catcher Processors	50%	Chinook	2,291	1,655	1,018	382	2,372	1,713	1,054	395
				Groundfish	1,567	1,132	696	261	1,639	1,184	728	273
			66%	Chinook	3,024	2,184	1,344	504	3,132	2,262	1,392	522
				Groundfish	2,068	1,494	919	345	2,164	1,563	962	361

Methodology for Determining PSC Limits

The Council has proposed annual gulf-wide Chinook salmon PSC limits of 5,000, 7,500, 10,000 and 12,500 for analysis in this document. The selected limit could be applied to entire action area (Central and Western GOA regions combined), apportioned separately to the Central and Western GOA, apportioned

to the CV and CP fleets across the entire action area, or apportioned to the CV and CP fleets within each of the Central and Western GOA areas. The Council proposes that any PSC apportionment to a subset of the entire GOA non-pollock groundfish trawl fleet should be based on either historic average Chinook salmon bycatch, or historic average non-pollock groundfish harvest; the Council could choose to base these apportionments on either a 5- or a 10-year fishing history.

For this analysis, 5- and 10-year historic average Chinook salmon PSC or groundfish harvest are calculated from data covering the 2007 to 2011 and 2002 to 2011 periods, respectively. Equation 1 is the formula used to apportion Chinook salmon PSC to a given subset of the GOA non-pollock groundfish trawl fishery based on a 5-year average of historic PSC, and Equation 2 is a similar formula for using a 10-year average basis.

Equation 1

$$\boldsymbol{Apportionment_i} = \left(\frac{\sum_{y=2007}^{2011} \boldsymbol{BASIS_{i,y}} / \mathbf{5}}{\sum_{y=2007}^{2011} \boldsymbol{BASIS_{GOA,y}} / \mathbf{5}} \right) \times \boldsymbol{GOA\ Limit_a}$$

Equation 2

$$\boldsymbol{Apportionment_i} = \left(\frac{\sum_{y=2002}^{2011} \boldsymbol{BASIS_{i,y}} / \mathbf{10}}{\sum_{y=2002}^{2011} \boldsymbol{BASIS_{GOA,y}} / \mathbf{10}} \right) \times \boldsymbol{GOA\ Limit_a}$$

$BASIS$ is the annual amount – to be summed – of either Chinook salmon PSC or GOA non-pollock groundfish harvest, depending on which historical metric the Council chooses to use in determining apportionment; GOA represents the entire action area (Central and Western GOA); i represents any of the potential subsets of the GOA trawl fishery that could receive an apportionment of PSC, as described in Alternative 2; and a represents the set of proposed gulf-wide PSC limits (5,000, 7,500, 10,000 or 12,500). This methodology arrives at the apportionment by taking the ratio of the period average PSC usage (or groundfish harvest) for a subset of the GOA and the period average PSC (or groundfish harvest) of the entire GOA, and then multiplying the ratio by the proposed gulf-wide PSC limit for non-pollock groundfish trawl.

Table 2-5 summarizes historic average Chinook salmon PSC by the GOA-subsets defined in Alternative 2 and Options 1 and 2. The percentage value listed next to the period average indicates a given subset's proportional share of average historic PSC within each Alternative 2 option. Table 2-6 provides the same information for historic non-pollock groundfish harvest. Under Option 4 in Alternative 2, the Central GOA rockfish program would be apportioned a separate PSC allowance. Table 2-7 provides actual Chinook salmon PSC usage by the program since its inception in 2007. Table 2-8 and Table 2-9 summarize Chinook salmon PSC usage and non-pollock groundfish harvest for all trawl activity that occurred outside of the Central GOA rockfish program. Table 2-1 through Table 2-4, above, report the resulting proposed PSC limits, by option.

Table 2-5 Historic Chinook salmon PSC and 5- & 10-year basis averages in all non-pollock trawl fisheries by apportionment subsets defined in Alternative 2 including Options 1 and 2.

Fishery		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	5-Year Average (2007-2011)		10-Year Average (2002-2011)	
All GOA non-pollock trawl		7,758	10,877	4,593	3,343	3,060	5,304	5,157	5,075	9,694	6,902	**6,427**	**100%**	**6,176**	**100%**
Western GOA		2,420	2,122	1,850	1,616	351	304	282	117	1,277	582	**512**	**8%**	**1,092**	**18%**
Central GOA		5,338	8,755	2,743	1,728	2,709	5,000	4,876	4,958	8,418	6,320	**5,914**	**92%**	**5,084**	**82%**
WGOA & CGOA	Catcher Vessels	4,629	4,601	2,271	617	1,431	2,329	2,506	2,793	5,064	3,916	**3,322**	**52%**	**3,016**	**49%**
	Catcher/Processors	3,129	6,275	2,322	2,726	1,628	2,975	2,651	2,282	4,631	2,986	**3,105**	**48%**	**3,161**	**51%**
WGOA	Catcher Vessels	2,349	143	20	58	201	9	107	10	0	96	**44**	**1%**	**299**	**5%**
	Catcher/Processors	72	1,979	1,830	1,558	150	295	174	107	1,277	487	**468**	**7%**	**793**	**13%**
CGOA	Catcher Vessels	2,281	4,458	2,251	559	1,230	2,320	2,399	2,783	5,064	3,821	**3,277**	**51%**	**2,717**	**44%**
	Catcher/Processors	3,057	4,297	492	1,168	1,479	2,680	2,477	2,175	3,354	2,499	**2,637**	**41%**	**2,368**	**38%**

Table 2-6 Historic non-pollock groundfish harvest (mt) and 5- & 10-year basis averages in all non-pollock trawl fisheries
by apportionment subsets defined in Alternative 2 including Options 1 and 2.

Fishery		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	5-Year Average (2007-2011)		10-Year Average (2002-2011)	
All GOA non-pollock trawl		56,886	60,631	49,127	52,434	59,208	63,835	73,512	64,265	69,360	69,570	**68,109**	**100%**	**61,883**	**100%**
Western GOA		13,334	10,888	8,316	10,070	12,036	14,472	13,674	11,024	9,596	8,627	**11,479**	**17%**	**11,204**	**18%**
Central GOA		43,552	49,743	40,812	42,363	47,172	49,363	59,839	53,241	59,765	60,944	**56,630**	**83%**	**50,679**	**82%**
WGOA & CGOA	Catcher Vessels	33,302	34,401	34,305	33,564	36,874	42,478	51,213	42,085	46,529	42,725	**45,006**	**66%**	**39,747**	**64%**
	Catcher/Processors	23,584	26,230	14,823	18,870	22,335	21,357	22,300	22,180	22,832	26,846	**23,103**	**34%**	**22,136**	**36%**
WGOA	Catcher Vessels	4,967	1,412	1,704	4,271	4,740	4,316	4,685	1,804	1,833	2,099	**2,947**	**4%**	**3,183**	**5%**
	Catcher/Processors	8,367	9,476	6,612	5,799	7,296	10,157	8,989	9,220	7,762	6,528	**8,531**	**13%**	**8,021**	**13%**
CGOA	Catcher Vessels	28,335	32,989	32,601	29,293	32,133	38,163	46,528	40,280	44,685	40,626	**42,058**	**62%**	**36,564**	**59%**
	Catcher/Processors	15,217	16,754	8,211	13,070	15,039	11,200	13,311	12,960	15,069	20,318	**14,572**	**21%**	**14,115**	**23%**

Table 2-7 Historic Chinook salmon PSC usage, 2007-2012, and 6-year basis average in the Central GOA Rockfish Program

	2007	2008	2009	2010	2011	2012	Average	
Catcher Vessels	*	*	*	965	397	817	**847**	**62%**
Catcher/Processors	*	*	*	248	340	439	**510**	**38%**
CG Rockfish Program Total	**1940**	**1929**	**1068**	**1213**	**736**	**1256**	**1357**	**100%**

Table 2-8 Historic Chinook salmon PSC and 5- & 10-year basis averages in all non-pollock trawl fisheries EXCEPT Central GOA Rockfish Program
by apportionment subsets defined in Alternative 2 including Options 1 and 2.

Fishery		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	5-Year Average (2007-2011)		10-Year Average (2002-2011)	
All GOA non-pollock trawl		7,758	10,877	4,593	3,343	3,058	3,388	3,228	4,006	8,534	6,195	**5,070**	**100%**	**5,498**	**100%**
Western GOA		2,420	2,122	1,850	1,616	351	304	282	117	1,277	582	**512**	**10%**	**1,092**	**20%**
Central GOA		5,338	8,755	2,743	1,728	2,707	3,083	2,947	3,889	7,258	5,613	**4,558**	**90%**	**4,406**	**80%**
WGOA & CGOA	Catcher Vessels	4,629	4,601	2,271	617	1,429	1,869	857	2,019	4,152	3,549	**2,489**	**49%**	**2,599**	**47%**
	Catcher/Processors	3,129	6,275	2,322	2,726	1,628	1,519	2,371	1,987	4,383	2,646	**2,581**	**51%**	**2,899**	**53%**
WGOA	Catcher Vessels	2,349	143	20	58	201	9	107	10	0	96	**44**	**1%**	**299**	**5%**
	Catcher/Processors	72	1,979	1,830	1,558	150	295	174	107	1,277	487	**468**	**9%**	**793**	**14%**
CGOA	Catcher Vessels	2,281	4,458	2,251	559	1,228	1,859	750	2,010	4,152	3,453	**2,445**	**48%**	**2,300**	**42%**
	Catcher/Processors	3,057	4,297	492	1,168	1,479	1,224	2,197	1,880	3,106	2,159	**2,113**	**42%**	**2,106**	**38%**

Table 2-9 Historic non-pollock groundfish harvest (mt) and 5- & 10-year basis averages in all non-pollock trawl fisheries EXCEPT Central GOA Rockfish Program
by apportionment subsets defined in Alternative 2 including Options 1 and 2.

Fishery		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	5-Year Average (2007-2011)		10-Year Average (2002-2011)	
All GOA non-pollock trawl		56,886	60,631	49,127	52,434	59,208	53,391	62,677	53,905	53,653	55,262	**55,778**	**100%**	**55,717**	**100%**
Western GOA		13,334	10,888	8,316	10,070	12,036	14,472	13,674	11,024	9,596	8,627	**11,479**	**21%**	**11,204**	**20%**
Central GOA		43,552	49,743	40,812	42,363	47,172	38,919	49,003	42,881	44,057	46,635	**44,299**	**79%**	**44,514**	**80%**
WGOA & CGOA	Catcher Vessels	33,302	34,401	34,305	33,564	36,874	34,210	42,439	33,952	36,926	34,252	**36,356**	**65%**	**35,422**	**64%**
	Catcher/Processors	23,584	26,230	14,823	18,870	22,335	19,181	20,238	19,952	16,727	21,010	**19,422**	**35%**	**20,295**	**36%**
WGOA	Catcher Vessels	4,967	1,412	1,704	4,271	4,740	4,316	4,685	1,804	1,833	2,099	**2,947**	**5%**	**3,183**	**6%**
	Catcher/Processors	8,367	9,476	6,612	5,799	7,296	10,157	8,989	9,220	7,762	6,528	**8,531**	**15%**	**8,021**	**14%**
CGOA	Catcher Vessels	28,335	32,989	32,601	29,293	32,133	29,894	37,754	32,148	35,093	32,154	**33,409**	**60%**	**32,239**	**58%**
	Catcher/Processors	15,217	16,754	8,211	13,070	15,039	9,025	11,248	10,733	8,965	14,482	**10,890**	**20%**	**12,274**	**22%**

2.3 Alternative 3: Full Retention

Alternative 3 would require full retention of Chinook salmon by all non-pollock trawl vessels. This provision would require a regulatory change to existing requirements prohibiting salmon retention in the GOA non-pollock fisheries. Current regulations require vessel operators to discard salmon when an observer is not aboard. When an observer is aboard, they are required to allow for sampling by an observer before discarding prohibited species.

Under this alternative, all trawl vessels targeting groundfish in the Central and Western GOA would be required to retain all salmon of any species. The retention requirement does not focus specifically on Chinook salmon, because it can be difficult to identify salmon species unless the fish is in hand. Salmon retained under this provision would not be allowed to be kept for human consumption, and would be discarded, following collection of any scientific data or biological samples. An exception is provided if the Chinook salmon are delivered under an authorized prohibited species donation program.

2.4 Management and Monitoring

The management methods used for a PSC limit depends on whether NMFS manages PSC limits for a group of vessels or whether these PSC limits are allocated among specific entities within a fishery. There are two general types of PSC limits 1) fishery, area, or sector-level PSC limits; and 2) PSC limits to specific entities. Catch share programs that include PSC limits to entities, such as the Rockfish Program cooperatives, give participants more specific control over their fisheries. Therefore, the general management approach changes with catch share programs. Entities that receive allocations generally are prohibited from exceeding their allocations. If they exceed an allocation, NOAA may initiate an enforcement action against the entity. Under Alternative 2, Option 4, with Chinook salmon PSC limits to Rockfish Program entities, NMFS recommends the following additional monitoring requirements for CVs and CPs that would enable census level accounting of Chinook salmon PSC and ensure effective monitoring and enforcement (see Section 5.2 for more detail):

Rockfish program CPs

The monitoring requirements for Rockfish Program CPs would include maintaining all current observer coverage and monitoring requirements plus adding requirements for a salmon storage container, video monitoring of relevant locations, and retention of all salmon for observer sampling.

Rockfish Program CVs and Shoreside Processors

For the rockfish program CVs the necessary monitoring would include maintaining current observer coverage, while adding the following additional requirements: Retain all salmon until delivered to processor. For shoreside processing plants the requirements would include 200% observer coverage at plant, additional Catch Monitoring and Control Plan (CMCP) provisions, salmon storage areas, and retention of all salmon.

2.5 Alternatives Considered but not Advanced

In the December 2010 Council motion initiating this analysis as a longer-term amendment package, the Council had included other alternatives, and discussion items to potentially address Chinook salmon PSC reduction goals. Following the development of Amendment 93 (PSC limits for the GOA pollock fishery), and a staff discussion paper preparing for this analysis in February 2012, the Council chose to eliminate some alternatives from consideration.

PSC limits for the non-pollock trawl fisheries, subdivided by directed fishery

After reviewing the range of proposed PSC limits by target fishery resulting from this option, the Council determined that apportioning PSC limits across the many GOA target species, according to historical catch levels, would likely result in very low PSC limits for some directed fisheries. The ability of NMFS to manage such small PSC allocations inseason, especially considering that Chinook salmon encounters can be low and unpredictable in these fisheries, would be extremely challenging, and would likely involve frequent and onerous standdowns. Additionally, the directed fishery for a trip is determined ex post facto, and in special cases may be an artifact of unexpected high levels of incidental catch. Data from catcher vessels, for which target species are not determined until landing at port, are particularly exposed to

misidentification. Consequently, the Council chose to replace this option with the option to subdivide Chinook salmon PSC by operation type.

Mandatory Chinook Salmon PSC Cooperatives

The Council initially included an alternative requiring membership in Chinook salmon PSC cooperatives, similar to the alternative considered in an earlier action to set Chinook PSC limits in the GOA pollock fisheries (Amendment 93). These cooperatives were intended to facilitate a coordinated effort among participants to avoid Chinook salmon. Sharing information on the timing and location of Chinook PSC could promote Chinook salmon avoidance by enhancing fishers' ability to schedule fishing activity in avoidance of Chinook. Mandatory membership could ameliorate any competitive imbalance caused by the reduced catch rates of those fishers who are actively avoiding Chinook salmon. For example, if a vessel delays fishing or moves from an area of relatively high Chinook catches, that vessel would lose fishing time relative to other vessels that might have chosen not to alter their fishing.

In considering the alternative, NOAA Fisheries suggested that given the mandatory cooperative membership, in the absence of specific approval of annual cooperative contracts and any penalties for violations of those contracts, NMFS' management authority over the fishery may not be adequately maintained. In essence, allowing cooperatives to define certain management measures and define and enforce penalties for failure to comply with those measures without agency oversight could be considered a delegation of management authority in the fishery. Whether cooperatives would be able to serve their intended purpose, while maintaining a level of oversight that maintains that authority, is uncertain. For example, the imposition of certain cooperative penalties would likely require notice, and an opportunity for a hearing, consistent with applicable Magnuson-Stevens Fishery Conservation and Management Act and Administrative Procedures Act requirements. These administrative reviews typically take several weeks (or even months). These delays may make time sensitive penalties (such as standdowns) wholly ineffective.

The staff discussion paper indicated that it could be possible to develop a cooperative alternative that maintains NMFS management authority while providing flexibility, though the development of an option to allow for fishing outside of a cooperative. However, measures intended to provide reasonable fishing opportunities for non-cooperative members are likely to constrain their catches more some years than others. More problematic is that the opportunity to fish may be greatest for these non-cooperative vessels in years of high bycatch. Consequently, it is uncertain whether an alternative can be developed that maintains Chinook avoidance incentives for cooperatives while maintaining a reasonable fishing opportunity for vessels that choose not to join a cooperative. As a result, the Council chose not to proceed with this alternative.

Discussion items for PSC reduction tools for the pollock fishery

The Council had also requested discussion of several other potential tools for PSC reduction in the pollock fishery, such as trip limits, development of a bycatch cooperative, cooperative management of the pollock fishery, restricting fisheries by season or time of day in order to reduce bycatch, and salmon excluders. These were included in the Council's February 2012 discussion paper. The only tool that appeared promising was the development of a cooperative management program for the GOA pollock fishery. The Council chose to focus the current amendment package exclusively on the non-pollock fisheries, and advance the consideration of a cooperative management program on a separate track.

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 addresses the probable environmental impacts of the proposed action and alternatives. Information with which to understand the affected environment for each resource component is summarized in the relevant subsection, however a more detailed description is also available in the Alaska Groundfish Fisheries Harvest Specifications Environmental Impact Statement (EIS) (NMFS 2007a), and the Final Programmatic Supplemental EIS on the Alaska Groundfish Fisheries (NMFS 2004a). A list of agencies and persons consulted is included in Section 10.

3.1 Methodology for Impacts Analysis

This document analyzes proposed Chinook salmon prohibited species catch (PSC) control measures for the Western and Central Gulf of Alaska (GOA) non-pollock trawl fisheries. Alternative 2 proposes Chinook salmon PSC limits for the Western and Central GOA regulatory areas, while Alternative 3 would require full retention of all salmon in the non-pollock trawl fisheries. There are no environmental impacts for requiring full retention of salmon, as this alternative will not change fishing practices. Potential economic and management impacts of this alternative are addressed in Section 4.8 of the RIR, and Section 5.3. Consequently, the Environmental Assessment focuses on the impacts of the status quo (Alternative 1) and the implementation of PSC limits (Alternative 2).

The proposed action affects vessels fishing in the federal non-pollock trawl fisheries in the Central and Western GOA and may affect vessels fishing in "parallel" Pacific cod fisheries in the adjacent waters of the State of Alaska. In this section, the impacts of the alternatives and options on the various environmental components are evaluated. 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 (Sections 3 and 6).

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

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

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

Section 5 addresses the management and enforcement considerations of the proposed alternatives and options.

In the relevant subsection for each resource component, criteria are identified to evaluate the significance of 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 documents listed below contain information about the fishery management areas, fisheries, marine resources, ecosystem, social, and economic elements of the GOA groundfish fisheries, and are referenced in the analysis of impacts in this chapter.

Alaska Groundfish Harvest Specifications Final Environmental Impact Statement (NMFS 2007a).

This EIS provides decision makers and the public an evaluation of the environmental, social, and economic effects of alternative harvest strategies for the federally managed groundfish fisheries in the GOA and the Bering Sea and Aleutian Islands management areas and is referenced here for an understanding of the state of the fishery.[7] The EIS examines alternative harvest strategies that comply with federal regulations, the Fishery Management Plan (FMP) for Groundfish of the GOA, and the Magnuson-Stevens Fishery Conservation and Management Act. These strategies are applied to the best available scientific information to derive the total allowable catch (TAC) estimates for the groundfish fisheries. The EIS evaluates the effects of different alternatives on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the GOA fisheries.

Stock Assessment and Fishery Evaluation (SAFE) Report for the Groundfish Resources of the GOA (NPFMC 2011).

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 GOA ecosystem and the economic condition of the groundfish fisheries off Alaska. This document is available from: http://www.afsc.noaa.gov/refm/stocks/assessments.htm.

Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis to Revise Gulf of Alaska Halibut Prohibited Species Catch Limits (NPFMC 2012).

This analysis accompanied proposed Amendment 95 to the GOA Groundfish FMP, recommending a change to the process for setting halibut PSC limits applicable to GOA groundfish fisheries. The amendment also proposes reducing limits for the groundfish trawl gear sector, the groundfish catchvher vessel hook-and-line sector, and the catcher processor hook-and-line sector. The environmental assessment includes an evaluation of the environmental impacts of the non-pollock trawl fisheries.

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

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 GOA fisheries.

[7] The alternatives considered in this EA will not cause any of the potentially significant impacts addressed in the Alaska Groundfish Harvest Specifications Final EIS to recur.

3.2 Groundfish Species

The non-pollock directed trawl fisheries in the GOA include rockfish species, arrowtooth flounder, Pacific cod, shallow water flatfish, rex sole, flathead sole and deep water flatfish. The primary rockfish species harvested in the GOA are Pacific ocean perch, northern rockfish, and dusky rockfish (formerly part of the pelagic shelf rockfish complex). Shortraker, rougheye, and thornyhead rockfish are also caught incidentally in directed rockfish fisheries, as are "other rockfish" species. Pacific ocean perch is the highest biomass rockfish species, with a wide distribution throughout the Gulf of Alaska and beyond. The primary species in the shallow water flatfish complex are Northern rock sole and Southern rock sole; other shallow water flatfish species include Alaska plaice, starry flounder, yellowfin sole, sand sole, butter sole and English sole. Dover sole is the primary harvest species in the deep water flatfish complex, with deep-sea sole and Greenland turbot making up the remainder.

Many of the non-pollock trawl fisheries are multi-species fisheries, and catch other groundfish species incidentally, in addition to the trip's assigned target. The assessments also list non-FMP species that are caught incidentally in the non-pollock trawl fisheries, such as grenadiers. The SAFE report (NPFMC 2011) includes an appendix on grenadiers, which the Council is considering moving into the FMP.

Annual stock assessments include a comprehensive evaluation of their biology and distribution. Consequently, the GOA Stock Assessment and Fishery Evaluation (SAFE) report is incorporated by reference (NPFMC 2011). All groundfish harvest during the GOA groundfish fisheries is counted toward the total allowable catch (TAC) for that species or species group. Groundfish stocks are assessed annually, and are managed using conservative catch quotas. Biomass trends for each of the trawl target species are available in NPFMC (2011).

TACs and harvests, especially in the GOA, are often set lower than they would be otherwise, in order to protect other species, especially halibut, which may be taken as incidental removals. Some flatfish quotas are set well below the acceptable biological levels (ABCs) due to halibut PSC constraints. Directed fishing for many species is frequently restricted before TACs are reached, in order to comply with PSC limits. Inseason management closes directed fisheries when TACs are harvested, and restricts fishing in other fisheries taking the species as incidental removals when OFLs are approached.

3.2.1 Effects of the Alternatives

The effects of the GOA non-pollock trawl fisheries on groundfish stocks are assessed annually in the GOA SAFE report (NPFMC 2011), and were also evaluated in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). Table 3-1 and Table 3-2 describe the criteria used to determine whether the impacts on target and ecosystem component fish stocks are likely to be significant. The effects of the GOA non-pollock trawl fisheries on fish species that are caught incidentally have been comprehensively analyzed in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). These fisheries were also evaluated recently under the GOA halibut PSC EA/RIR/IRFA (NPFMC 2012). These analyses concluded that under the status quo, neither the level of mortality nor the spatial and temporal impacts of fishing on fish species or prey availability are likely to jeopardize the sustainability of the target and ecosystem component fish populations. The groundfish stocks are neither overfished nor subject to overfishing (see Figure 3-1 for age-structured GOA stocks).

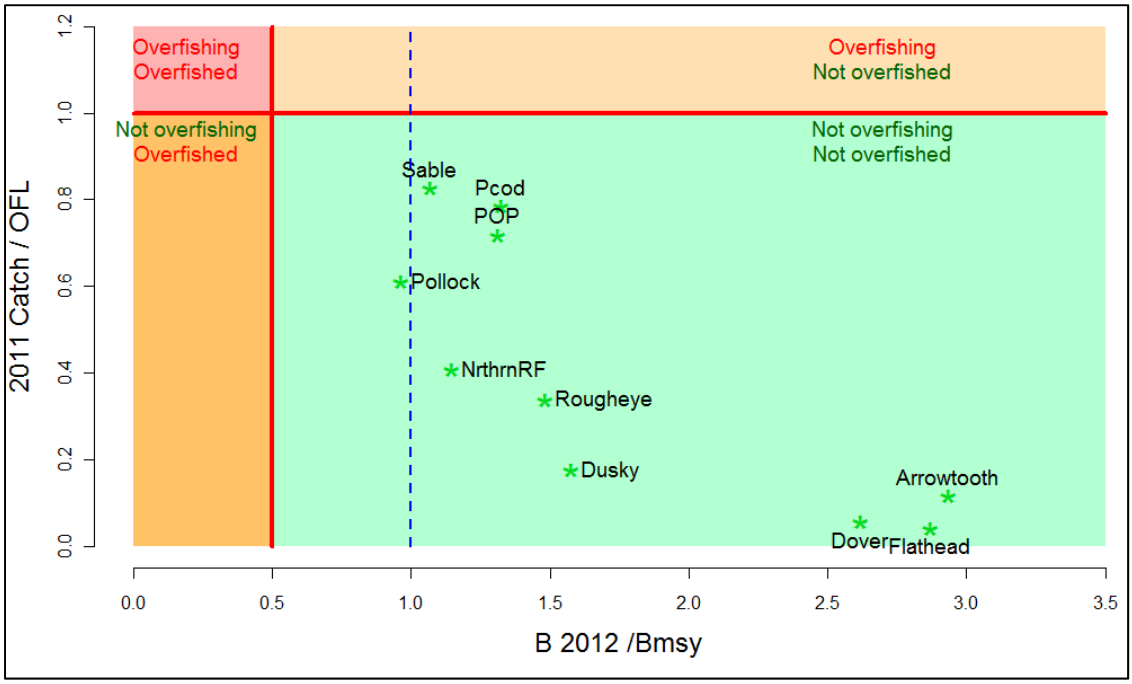
Table 3-1 Criteria used to determine significance of effects on target groundfish stocks.

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

Table 3-2 Criteria used to determine significance of effects on ecosystem component (including prohibited) species.

No impact	No incidental take of the ecosystem component species in question.
Adverse impact	There are incidental takes of the ecosystem component species in question
Beneficial impact	Natural at-sea mortality of the ecosystem component species in question would be reduced – perhaps by the harvest of a predator or by the harvest of a species that competes for prey.
Significantly adverse impact	An action that diminishes protections afforded to prohibited species in the groundfish fisheries would be a significantly adverse impact.
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the groundfish fishery on the ecosystem component species, and significantly beneficial impacts are not defined for these species.
Unknown impact	Not applicable

Figure 3-1 Summary status of age-structured GOA species relative to 2011 catch levels (vertical axis) and projected 2012 spawning biomass relative to B_{msy} levels



Note that the 2010 MSY level is defined as the 2011 catch at F_{OFL}.

Alternative 2 would establish a hard cap that limits PSC of Chinook salmon in the GOA non-pollock trawl fisheries. A lower hard cap may result in the non-pollock trawl fisheries closing before the TACs are reached, while a higher hard cap would allow for groundfish fishing at current levels, and impacts would likely be similar to the status quo fishery. The tables included in Section 4.7.1 of the RIR, shows when the fishery would have been closed in the past nine years, applying the PSC limits retrospectively to the non-pollock trawl fisheries in the Central and Western GOA. The subsections in that part of the analysis discuss the avoided Chinook PSC and forgone groundfish harvest associated with closures could have occurred at key marking points during the course of the fishing year.

If the groundfish TACs are not fully harvested, fishing will have less impact on the stocks, and there will be no significantly adverse impact on the groundfish stocks from the fisheries. If the implementation of a PSC limit curtails the fisheries, it is likely the fall seasons that will be most impacted, that is, fishing in the early part of the year is most likely to remain unchanged, while fishing patterns may be altered later in the year when the fisheries are approaching the PSC limit. Changing fishery patterns or seasonal changes in the timing of the fishing pressure may result in the fisheries focusing on different ages of groundfish than would otherwise have been taken. These changes, however, would be monitored and updated in future stock assessments.

The risk to the stocks is considered minor, since conservation goals for maintaining spawning biomass would remain central to the assessments. None of the options considered under Alternative 2 would affect the annual assessment process, and inseason monitoring of catch quotas. Thus any changes in fishing patterns or the timing of fishing pressure would not be expected to affect the sustainability of the stocks. However, the change in fishing pattern could result in lower overall ABC and TAC levels, depending on how the age composition of the catch changed.

The potential biological effects of the alternatives are expected to be correctly incorporated in the present groundfish stock assessment and harvest specifications system, and there is no anticipated adverse impact

to the target or incidental catch groundfish stocks that would result from a fishery with lower catch per unit effort. Consequently, Alternative 2 is not likely to result in adverse impacts to groundfish stocks, and are likely insignificant.

Similarly, with respect to the ecosystem component and non-FMP species, the implementation of a PSC limit under Alternative 2 is not likely to increase fishing pressure, as even if there is a redistribution of effort to avoid Chinook salmon, the fishery, overall, will likely remain within the established footprint of the non-pollock trawl fishing grounds. If the fisheries close early because the PSC limit has been reached, impacts on these species may be reduced. The impacts of Alternative 2 are expected to be insignificant compared to the status quo.

3.3 Chinook Salmon

3.3.1 Overview of Biology and Ecological Role

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. In summer, Chinook salmon concentrate around the Aleutian Islands and in the Western GOA. 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. 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.

Food Habits and Ecological Role

For Pacific salmon, oceanic foraging conditions and food relationships are important to growth. They are omnivorous and opportunistic feeders. Major categories of prey found in stomach contents of Pacific salmon species usually include either one or a combination of fish, squid, euphausiids, amphipods, copepods, pteropods, larval crustaceans, zooplankton, polychaetes, ostracods, mysids, and shrimps. By switching their diets to micronekton (fish and squid), salmon can sustain themselves through seasons or years of low zooplankton production. At the same time, Pacific salmon are selective feeders. Prey selectivity in salmon is related to inter- and intra-specific differences in functional morphology, physiology, and behavior. In general, Chinook salmon tend to feed on large prey (Kaeriyama et al. 2000).

The Bering Sea-Aleutian Salmon International Survey (BASIS) is a program of pelagic ecosystem research on salmon and forage fish in the Bering Sea coordinated by the North Pacific Anadromous Fish Commission (NPAFC). A major goal of this program is to understand how changes in the ocean conditions affect the survival, growth, distribution, and migration of salmon in the Bering Sea. At this time, no such coordinated research plan exists for the GOA. As a result, ecological information specifically related to Chinook salmon in the GOA is limited.

Ocean salmon feeding ecology is highlighted by the BASIS program given the evidence that salmon are food limited during their offshore migrations in the North Pacific and Bering Sea. Increases in salmon abundance in North America and Asia stocks have been correlated to decreases in body size of adult salmon, which may indicate a limit to the carrying capacity of salmon in the ocean. International high seas research results suggest that inter- and intra-specific competition for food and density-dependent growth effects occur primarily among older age groups of salmon particularly when stocks from different geographic regions in the Pacific Rim mix and feed in offshore waters (Ruggerone et al. 2003).

Results of a fall study to evaluate food habits data in 2002 indicated Chinook salmon consumed predominately small nekton and did not overlap their diets with sockeye and chum salmon. Shifts in prey composition of salmon species between season, habitats, and among salmon age groups were attributed to changes in prey availability (Davis et al. 2004).

Stomach sample analysis of ocean age .1 and .2 fish from basin and shelf area Chinook salmon indicated that their prey composition was more limited than chum salmon. This particular study did not collect many ocean age .3-year or .4-year Chinook salmon although those collected were located predominantly in the basin. Summer Chinook salmon samples contained high volumes of euphausiids, squid, and fish while fall stomach samples in the same area contained primarily squid and some fish. The composition of fish in salmon diets varied with area with prey species in the basin primarily northern lamp fish, rockfish, Atka mackerel, pollock, sculpin, and flatfish while shelf samples contained more herring, capelin, pollock, rockfish, and sablefish. Squid was an important prey species for ocean age .1, .2, and .3 Chinook salmon in summer and fall. The proportion of fish was higher in summer than fall as was the relative proportion of euphausiids. The proportion of squid in Chinook salmon stomach contents was larger during the summer in year (even numbered) when there was a scarcity of pink salmon in the basin (Davis et al. 2004).

Results from the Bering Sea shelf on diet overlap in 2002 indicated that the overlap between chum and Chinook salmon was moderate (30%), with fish constituting the largest prey category, results were similar

in the basin. However, notably on the shelf, both chum and Chinook salmon consumed juvenile pollock, with Chinook salmon consuming somewhat larger than those consumed by chum salmon. Other fish consumed by Chinook salmon included herring and capelin while chum salmon stomach contents also included sablefish and juvenile rockfish (Davis et al. 2004).

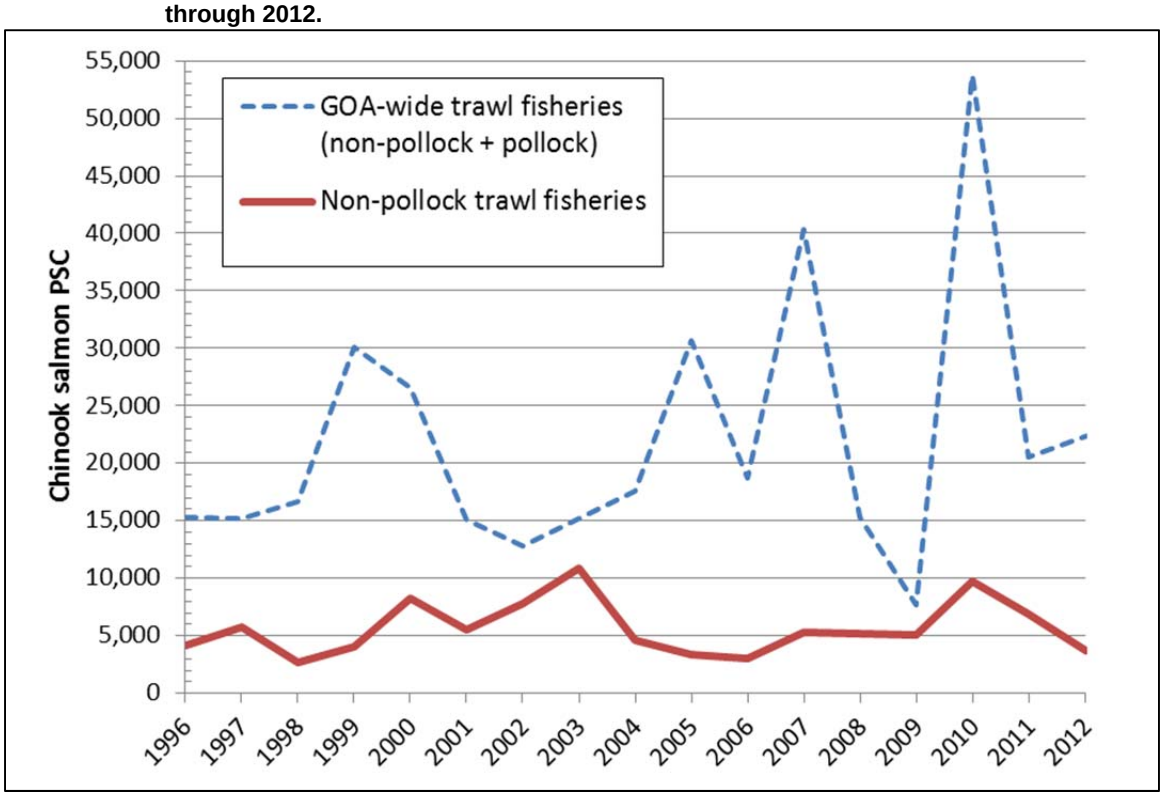
General results from the study found that immature chum salmon are primarily predators of macrozooplankton while Chinook salmon tend to prey on small nektonic prey such as fish and squid. Prey compositions shift between species and between seasons in different habitats and a seasonal reduction in diversity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

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

3.3.2 Prohibited Species Catch of Chinook Salmon in the GOA Non-pollock Fisheries

Figure 3-2 shows the PSC of Chinook salmon in the GOA non-pollock trawl fisheries since 1996, compared to the total PSC of Chinook salmon the GOA trawl fisheries over that time period. Chinook salmon PSC in the non-pollock trawl fisheries accounts for approximately one-quarter of total Chinook salmon PSC in the GOA on average; the majority of Chinook salmon is taken in the pollock trawl fishery. As can be seen from Figure 3-2, PSC levels are highly variable from year to year. The highest Chinook salmon loss in the non-pollock trawl fisheries occurred in 2003. Chinook salmon loss was also high in 2010. It is assumed that salmon caught in groundfish fisheries have a 100% mortality rate.

Figure 3-2 Prohibited species catch of Chinook salmon in Gulf of Alaska non-pollock trawl fisheries, 1996 through 2012.



Source: NMFS PSC database, prepared by AKFIN.
2012 data reported through 11/4/2012.

Historical Chinook salmon PSC is discussed in detail in the RIR, Sections 4.4.9 and 4.4.11. Figure 3-3 illustrates Chinook salmon PSC in the non-pollock trawl fisheries for 1996 through 2011, among catcher vessels and catcher processors in the Western and Central GOA. The Western GOA accounted for approximately 16% of the PSC during this time period, although in the last five years, the Western GOA has accounted for only 8% of total Chinook salmon PSC, on average. In recent years, the CP and CV sectors have each intercepted approximately half of the Chinook salmon caught as PSC in the non-pollock fisheries, although the ratio was higher for CPs in the late 1990s as well as in 2005.

Figure 3-3 Annual estimated Chinook salmon PSC in non-pollock groundfish fisheries, 1996 to 2012, for the Western (WG) and Central GOA (CG), catcher processors (CP) and catcher vessels (CV).

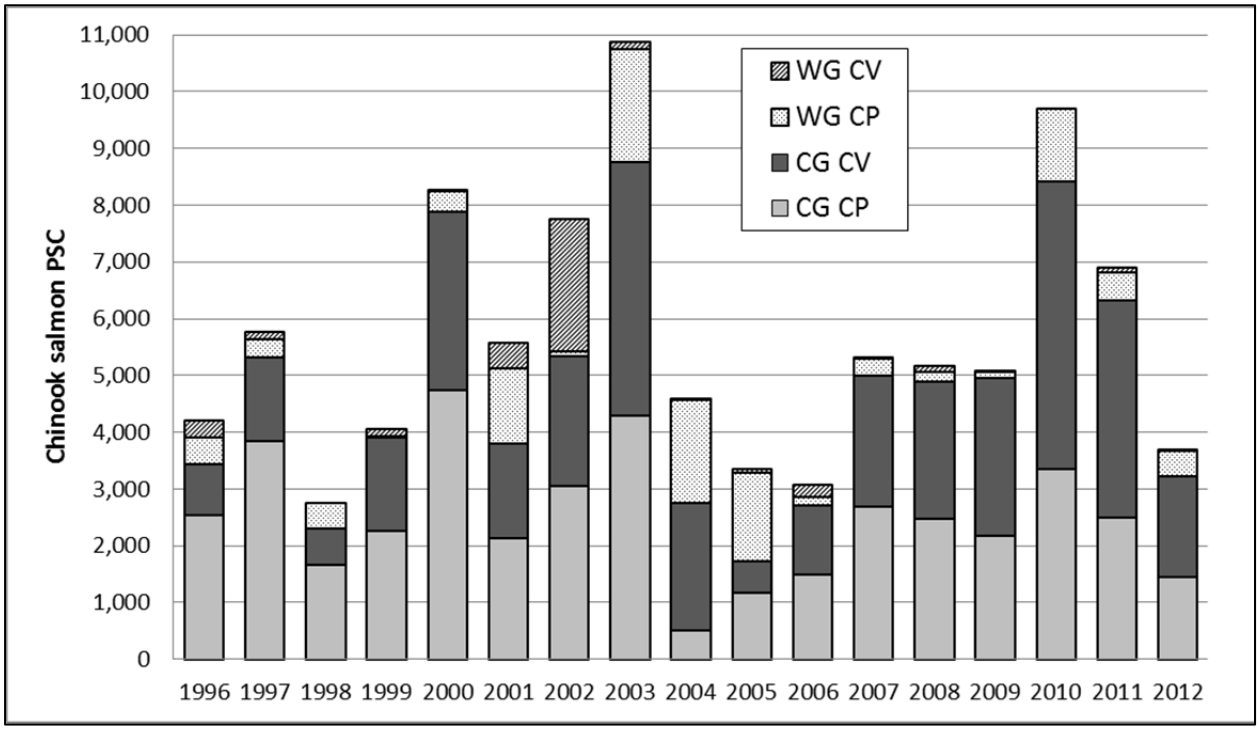
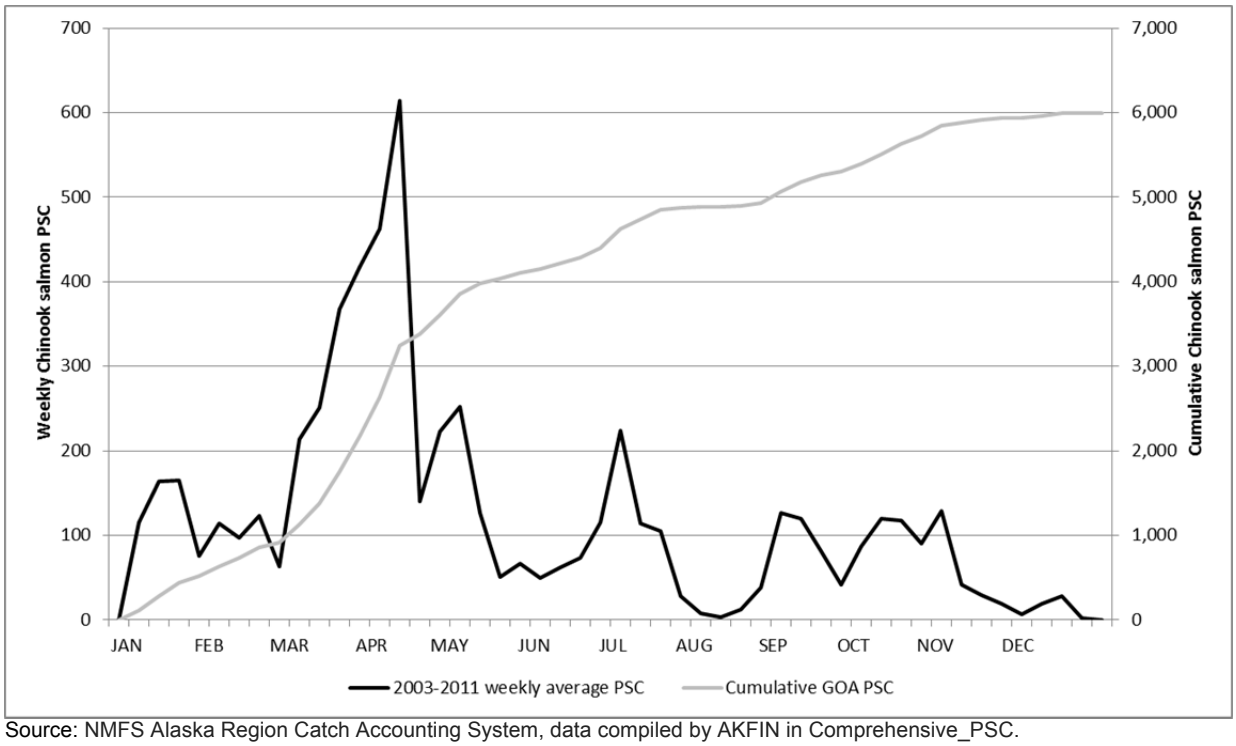


Figure 3-4 illustrates the distribution of Chinook salmon PSC throughout the calendar year, based on 2003 to 2011. In the general pattern, Chinook PSC is first taken in the Pacific cod A-season fishery in January and early February. The early spring (March – April) spike in PSC represents increasing PSC in the rex sole fishery, as well as the most intense period of arrowtooth flounder-related PSC. The rockfish fishery drives non-pollock PSC from the typical season opening in May, through August (when rockfish volume falls off significantly, although the fishery can occur as late as November). Some additional PSC during the late spring occurs in the arrowtooth and rex sole fisheries, but rockfish trips are the predominant source of summer PSC. Much of the September and October PSC is recorded in B-season Pacific cod trips, though shallow water flatfish trips emerge as a PSC source in late-September and continue through November, once the cod season has ended. After the end of the cod season, trips targeting arrowtooth also contribute to increased Chinook catch.

Figure 3-4 Seasonal distribution of GOA Chinook salmon PSC, average Chinook PSC from 2003 to 2011



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

3.3.2.1 Size and Weight of Chinook Salmon Prohibited Species Catch

Chinook salmon PSC in the GOA non-pollock trawl fisheries in the Central and Western GOA tend to be smaller fish, averaging between 5 and 9 pounds, based on observer samples taken during 2002 through 2012. Because there is more observer coverage in the Central GOA groundfish fisheries, the number of samples for the Central GOA is considerably higher than is available for the Western GOA.

3.3.2.2 Chinook Salmon Abundance in the Gulf of Alaska

A simple measure by which to assess the overall abundance of Chinook salmon in the affected fishing areas does not exist. As a result, it is difficult to say whether or not years with high Chinook salmon PSC in the GOA trawl fishery, such as 2003 and 2010 (Table 2-5), were the result of more numerous Chinook salmon present in the fishing grounds.

The best available information on salmon abundance covers only the Aggregate Abundance Based Management fisheries in the Pacific Salmon Treaty areas. The Pacific Salmon Commission's 2012 Exploitation Rate Analysis lists abundance indices for Chinook salmon in the Southeast Alaska, Northern British Columbia and West Coast Vancouver Island troll fishery areas, from 1999 to 2012. Abundance indices for the high GOA Chinook salmon PSC years were not substantially different from the period average index values, and in some regions were lower than the index values for years with relatively low GOA Chinook salmon PSC.[8] The best available source of information on Chinook salmon abundance in the areas directly affected by this action is the escapement estimates listed in Appendix 1. These tables do not reflect a significant deviation above average escapement totals or percentages of escapement goals met for the highest trawl PSC years.

[8] See Table 3-3 on page 28 of the report, available at http://www.psc.org/pubs/TCCHINOOK12-4.pdf

3.3.3 River of Origin Information and Prohibited Species Catch Composition Sampling

3.3.3.1 Genetic Analysis of Salmon Prohibited Species Catch

While genetic and scale pattern-derived stock composition analyses have been completed for available sample sets from the Chinook salmon PSC of the BSAI pollock trawl fishery (Myers and Rogers 1988; Myers et al. 2004; NMFS 2009b; Guyon et al. 2010a; Guyon et al. 2010b; Guthrie et al., 2012; Guthrie et al., 2013), limited sampling has precluded stock composition of the salmon PSC in the GOA trawl fisheries. Table 3-3 shows the number of genetic samples that are available for the GOA trawl fisheries, from 2007 to 2012. The small number of Chinook salmon PSC samples is insufficient to represent the annual catch for stock composition analysis, especially for an average annual PSC of approximately 26,700 Chinook salmon (over the period 2007 to 2012, for all GOA trawl fisheries combined, including pollock). In 2011, efforts were instituted to improve genetic sampling in the GOA, so that stock composition analysis of the GOA PSC can be accurately completed. In January 2012, vessels participating in the directed pollock trawl fisheries agreed to voluntarily retain all salmon encountered while fishing pollock in the Western and Central GOA in anticipation of Amendment 93 to the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA FMP) requiring 100% retention of all salmon caught in Western and Central GOA pollock fisheries. More refined regional stock composition analyses than those currently available using the Alaska Department of Fish and Game (ADF&G) single nucleotide polymorphism (SNP) baseline (Templin et al. 2011) will require a combined approach using both coded-wire tag (CWT) information (Celewycz et al. 2012; Section 3.3.3.2) and increased baseline coverage of Pacific Northwest salmon populations.

Table 3-3 Number of Chinook salmon genetic samples available from GOA groundfish trawl fisheries, 2007 to 2012.

Year	Number of samples	Samples as proportion of total GOA PSC	Notes
2007	19	0.0005	From the 2007 pollock B season
2008	38	0.0025	
2009	10	0.0013	
2010	161	0.0030	116 from area 610 (Western GOA), 45 from area 620
2011	240	0.0173	13 from area 610, 143 from area 620. 84 from area 630
2012	1005		334 from area 610, 394 from area 620, 236 from area 630, 5 from area 640, and 36 from area 649

In 2009, a study was completed providing recommendations for improving sample representation to meet the data requirements for estimating geographic stock origins of the Bering Sea salmon PSC based on genetic markers (Pella and Geiger 2009). The report proposed a systematic sampling regimen for the collection of both Chinook salmon and chum PSC samples, whereby observers would sample every n^{th} fish from the census of salmon. Because all Chinook salmon stocks are not randomly distributed at sea (Guyon et al. 2010a; NMFS 2009b), systematic sampling was preferred as a means to generate a random sample set from a non-uniform distribution. An unbiased sample set, achieved by incorporating randomness at all levels of sampling so that each fish made available to the dockside observer has an equal probability of being included in the sample set, is required for producing unbiased stock composition estimates of the salmon PSC, both in the Bering Sea and the GOA. In addition, the sample set must be large enough to facilitate analysis of stock identification at pre-determined time and space domains. Due to the presence of a wide variety of salmon stocks in both the GOA and the Bering Sea, a goal of 400 representative genetic samples was established, based on (1) sample sizes used in previous genetic analyses (Guyon et al. 2010a; Guyon et al. 2010b; NMFS 2009b), and (2) recommendations that the coefficient of variation be no greater than 50% (defined as Standard Deviation/Estimated Value) for estimates with a 95% confidence that the individual stock contributed to the fishery (Marlowe and Busack 1995). Even with these criteria, a sample set of 400 would only be 2% of a hypothetical total PSC of

20,000. Given the non-random distribution of stocks, it is possible that even with a sample set size of 400, that the sample set may not be fully representative of rare stocks.

The majority of genetic samples are from Chinook salmon caught incidentally in GOA directed pollock trawl fisheries. This is because the majority of Chinook salmon intercepted in the GOA are captured in the pollock fishery (Section 5.1.2.1). Beginning in 2011, the agency's sampling procedures for Chinook (and chum) salmon were revised in the Bering Sea to be consistent with the Pella and Geiger (2009) report. Changes were made to sampling procedures in the Bering Sea pollock fishery under Amendment 91 to the FMP for Groundfish of the BSAI (75 FR 53026, August 30, 2010), and were also revised in the GOA pollock fishery to be consistent with this protocol to the extent possible. From 2011 forward, genetic samples of salmon were taken systematically from all salmon encountered in observed pollock deliveries. Beginning in the second half of 2012, GOA Amendment 93 also required full retention of salmon from unobserved pollock deliveries. The 2013 Observer Annual Deployment Plan (NMFS 2012) identifies that, beginning in 2013, dockside observers will be deployed to conduct the same systematic sampling for unobserved pollock deliveries, however salmon genetic samples are not collected from the non-pollock trawl fisheries. Instituting offload sampling for these fisheries, as occurs with pollock deliveries, is not viable, as most of the catch is sorted at sea (see Chapter 5). Therefore, a future stock composition analysis for Chinook salmon PSC in the GOA will be specific to the GOA pollock fishery, although it should still provide perspective on PSC composition in other GOA trawl fisheries.

The most recent year for which genetic samples have been analyzed is 2011. 240 Chinook salmon axillary process samples from the GOA were received by the NMFS Auke Bay Laboratory from the Alaska pollock trawl fisheries PSC. The overall fraction sampled was 1.7%. Genetic samples were collected opportunistically, so the following stock composition estimates should be considered as stock compositions of the sample set rather than a representative composition of the entire GOA Chinook salmon bycatch. Chinook stocks from British Columbia (40%) and the U.S. west coast (26%) comprised the largest stock groups, with smaller contributions from Northwest GOA (15%) and Coastal Southeast Alaska (14%) stocks (Guthrie et al., 2013). The results provide "presence" indicators of Chinook salmon stocks, rather than relative abundance.

Salmon scales have also been collected by the North Pacific Groundfish Observer Program (Observer Program) from the Alaska groundfish fisheries. Collected scales are placed in envelopes, and each scale packet contains several scales from the same fish. These scales have been used to verify the observer's species identification, to age the salmon, and to identify life history characteristics. A report prepared for the North Pacific Fishery Management Council (Council) in 1983 found higher percentages of ocean-type (freshwater age-0) Chinook salmon in the GOA than in the Bering Sea (Myers and Rogers 1983). Age information is listed for both the Shumagin and Chirikof International North Pacific Fisheries Commission statistical areas. This information highlights that the age compositions of Chinook salmon intercepted in the Bering Sea and GOA are very different, and suggests stock compositions may also be different (Kate Myers and Jeff Guyon, personal communication, January 2011). Freshwater age-0 fish are more common in the Pacific Northwest and California. However, hatcheries in Alaska have also released freshwater age-0 Chinook salmon. A stock identification analysis of freshwater age-0 fish was not conducted.

Through 2010, the Observer Program had 28,389 Chinook salmon scales from the BSAI (taken from 1986 to 2010, excluding 1991 through 1996) and 8,138 Chinook salmon scales from the GOA (taken from 1987 to 2010, excluding 1991 through 1996) (Patti Nelson, personal communication, January 2011). Of the 264 scale samples that were collected from GOA trawl fisheries in 2011, 197 are from fish for which genetic samples were already taken, so there are 67 scales from additional fish available. For 2012, 305 of 328 scale samples are from fish for which genetic samples were already taken, yielding a potential 23 additional fish. Scales are collected by the Observer Program for species identification purposes.

While possible, genetic stock composition analysis from scales can be difficult due to: (1) low yield of DNA from scales, (2) lack of available scales in the preferred area due to loss during capture, and/or (3) potential contamination issues from mixing of scales between fish during hauls. Most importantly, the scales would have to have been collected in a representative manner, without bias.

3.3.3.2 Origins of Coded-Wire Tagged Chinook Salmon in the GOA

Coded-wire tags (CWTs) are an important source of information for the stock-specific ocean distribution of those Chinook salmon stocks that are tagged and caught as PSC in the BSAI and GOA groundfish fisheries. The Regional Mark Processing Center operated by the Pacific States Marine Fisheries Commission provides the regional coordination of the organizations involved in marking anadromous salmonids throughout the Pacific Region. The coastwide CWT system is coordinated through the activities of two principal organizations: (1) Regional Mark Committee, and (2) Pacific Salmon Commission (established by the United States–Canada Pacific Salmon Treaty) (Nandor et al. 2010). The Regional Mark Processing Center is the United States site for exchanging United States CWT data with Canada for Pacific Salmon Treaty requirements. After 40 years, the CWT program in the greater Pacific region of North America continues to be an important tool for salmonid research and management and remains the only stock identification tool that is Pacific coastwide in scope and provides unparalleled information about ocean distribution patterns, fishery impacts, and survival rates for Pacific salmon along the Pacific coast (Nandor et al. 2010).

CWT recoveries provide reliable documentation of the presence of a stock that is caught by the groundfish fisheries, and can inform presence of stocks at the ESU-level, where genetic sampling may not. However, the recoveries to date cannot be used to establish the relative abundance of stocks, nor can they be used to estimate the number harvested from any one stock as PSC, due to sampling issues. CWTs do not represent the true composition of all stocks of Chinook salmon PSC in the GOA groundfish fisheries. Rather, they represent the composition of the samples that are taken, that originate from the sites where a CWT program is in place. There are no CWT tagging programs on Western Alaska Chinook salmon stocks, so these stocks are not represented in stock composition estimates based on CWT recoveries. Additionally, not all Chinook salmon stocks along the Pacific coast are marked at equal rates. Furthermore, although there are CWT tagging programs on wild stocks of Chinook salmon all along the Pacific coast, wild stocks are probably under-represented by CWTs as compared with hatchery stocks, which are much easier to tag in large numbers. Exploitation rates for naturally spawning populations of Chinook salmon are difficult to estimate. The capture and tagging of juveniles and enumeration of adult escapement from wild stocks is logistically challenging and costly. The impacts of fisheries on naturally spawning populations can be estimated based on CWT-based age- and fishery-specific exploitation rates of hatchery stock indicators. However, direct validation of the assumption that selected hatchery indicator stocks are representative of their associated natural stocks is also difficult and costly (PSC 2005).

CWT programs have been established to achieve various program goals; these include the evaluation of hatchery survival and returns, ESA stock management, ocean survival studies, PST issues, and tracking of indicator stocks that aid in modeling for incidental catch salmon targets. Again, due to sampling issues in the fisheries and to the non-random distribution of CWT programs, CWT recoveries are not a sufficient metric for describing the proportion of GOA trawl-caught Chinook salmon PSC by stock of origin. In the future, increased CWT effort in specific Alaska runs of particular interest may provide additional insight into the effects of the GOA trawl fishery, but that information, too, would be of limited use in determining proportional stocks of PSC Chinook salmon origin.

Information on high seas salmonid CWT recoveries has been reported annually to the International North Pacific Fisheries Commission (1981 through 1992) and to the NPAFC (1993 to present). Reports are available at http://www.npafc.org. In 2012, 279 salmonids with CWTs were reported to the Pacific States

Marine Fisheries Commission/Regional Mark Processing Center for the first time. Of these recoveries, 13 Chinook salmon were recovered from the 2011 and 2012 GOA pollock trawl fishery (Celewycz et al. 2012), and one Chinook salmon was recovered in the U.S. trawl research in the GOA.

From 1995 through 2010, the majority of CWT Chinook salmon recovered as PSC in the GOA originated from British Columbia and Alaska. Recoveries of CWT Chinook salmon in the GOA groundfish fishery are summarized by state or province of origin (Table 3-4). Since 1995, 32% of the observed CWTs of Chinook salmon in the GOA fishery have originated each from British Columbia and Alaska, followed by Oregon (21%), Washington (15%), and Idaho (<1%). When accounting for mark expansions for each tag code (see section on Recovery Estimation Techniques), British Columbia provided 50% of Chinook salmon PSC, followed by Alaska (35%), Oregon (8%), Washington (7%), and Idaho (<1%). In 6 out of those 16 years, however, Alaska was the major provider of the year's CWT Chinook salmon PSC in the GOA.

Table 3-4 Observed Number and Mark Expansion of CWT Chinook salmon prohibited species catch of the GOA groundfish fishery by run year and state or province of origin, 1995 through 2010.

	Total		**Mean**		**Average % of Total**	
Region	**Observed Number**	**Mark Expansion**	**Observed Number**	**Mark Expansion**	**Observed Number**	**Mark Expansion**
Alaska	192	1326.7	12.0	82.9	32%	35%
British Columbia	196	1876.7	12.3	117.3	32%	50%
Idaho	1	1.0	0.1	0.1	0%	0%
Oregon	130	293.2	8.1	18.3	21%	8%
Washington	90	259.6	5.6	16.2	15%	7%
Total	**609**	**3757.2**	**38.1**	**234.8**	**100%**	**100%**

Source: NMFS 2011a.

Alaskan Chinook salmon represented by CWTs and harvested in the GOA originated from two basins, Cook Inlet and Southeast Alaska. Most of the CWT Alaskan Chinook salmon recovered in the GOA originated from Southeast Alaska (Table 3-5). Since 1995, 75% of the observed CWTs of Alaska-origin Chinook salmon in the GOA originated from Southeast Alaska and 25% from Cook Inlet. When accounting for mark expansions, Southeast Alaska provided 92% of Alaska-origin Chinook salmon PSC in the GOA, with Cook Inlet at 8%. However, as discussed above, CWTs do not represent the true composition of all stocks of Chinook salmon in the PSC of GOA groundfish fisheries.

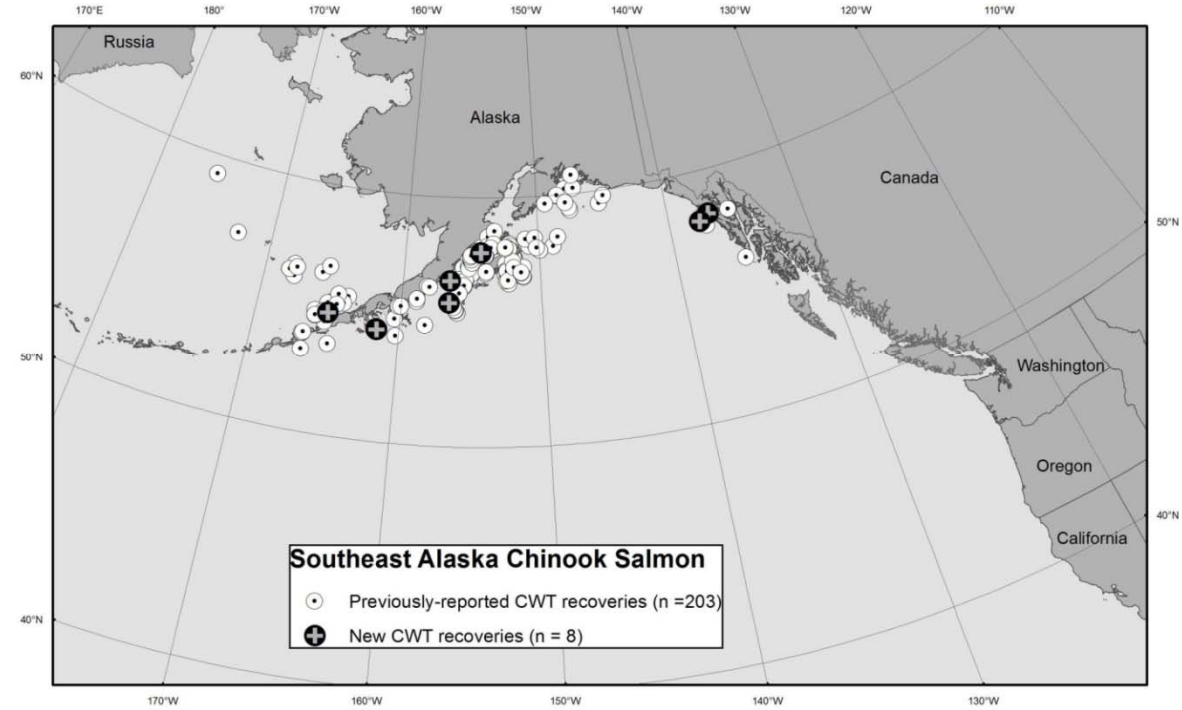
Table 3-5 Observed Number and Mark Expansion of CWT Alaska-origin Chinook salmon prohibited species catch of the GOA groundfish fishery by run year and release basin, 1995 through 2010.

	Cook Inlet, Alaska		Southeast Alaska		Alaska TOTAL	
Run Year	**Observed Number**	**Mark Expansion**	**Observed Number**	**Mark Expansion**	**Observed Number**	**Mark Expansion**
1995	1	4.0	3	8.0	4	11.9
1996	4	10.7	10	81.7	14	92.4
1997	1	5.3	1	12.1	2	17.4
1998	14	41.4	16	116.4	30	157.8
1999	20	37.6	25	206.6	45	244.3
2000	2	4.2	22	220.7	24	224.9
2001	2	2.0	8	98.2	10	100.2
2002	1	1.0	9	46.2	10	47.2
2003	0	0.0	2	22.4	2	22.4
2004	0	0.0	3	30.5	3	30.5
2005	0	0.0	3	33.6	3	33.6
2006	0	0.0	10	58.3	10	58.3
2007	0	0.0	13	99.1	13	99.1
2008	2	2.0	4	50.3	6	52.3
2009	1	1.0	4	40.4	5	41.4
2010*	0	0.0	11	93.1	11	93.1
TOTAL	48	109.2	144	1217.5	192	1326.7
mean	3.0	6.8	9.0	76.1	12.0	82.9
average % of total	25%	8%	75%	92%	100%	100%

Source: NMFS 2011a, and Balsiger 2012

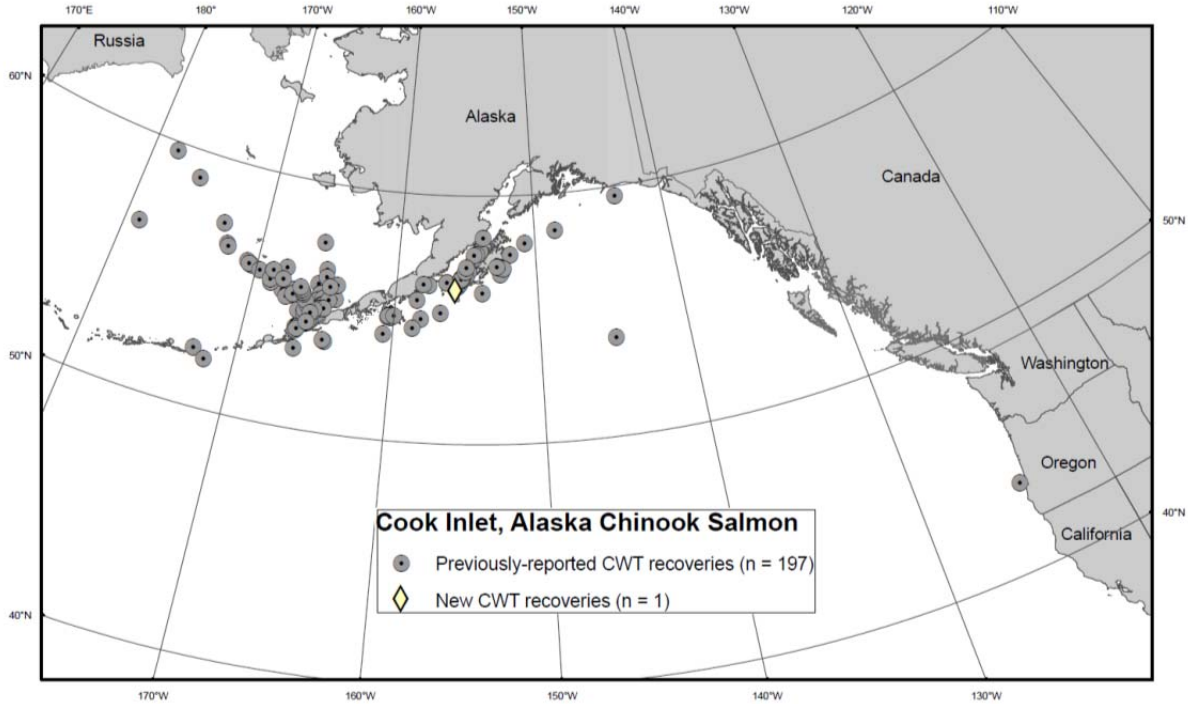
Maps of CWT Chinook salmon distribution in the North Pacific Ocean, GOA, and Bering Sea by state or province of origin are shown (Figure 3-5 through Figure 3-11). These maps are compiled from CWT recoveries from high seas commercial fisheries and research surveys, 1981 through 2012, and are updated annually (Celewycz et al. 2012). High seas commercial fisheries include fisheries that occur in the exclusive economic zone (EEZ) off Alaska.

Figure 3-5 Ocean distribution for Southeast Alaska Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2012. Points reflect recovery locations.



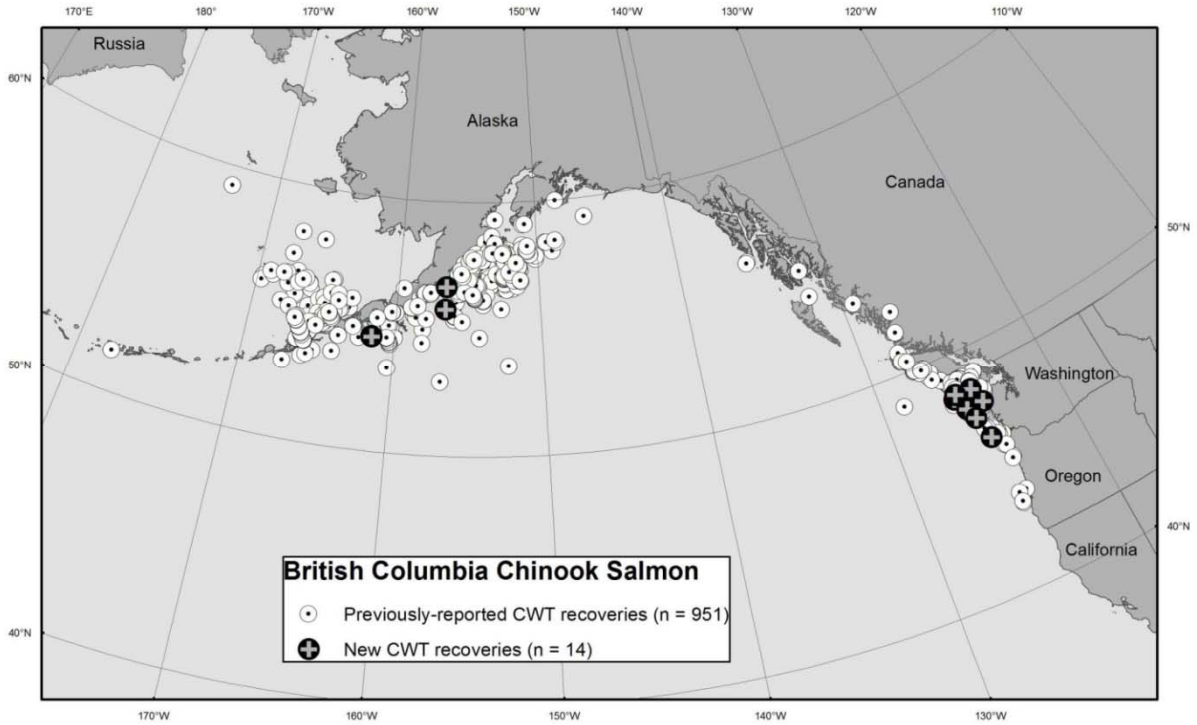
Source: Celewycz et al. 2012

Figure 3-6 Ocean distribution for Cook Inlet Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2011. Points reflect recovery locations.



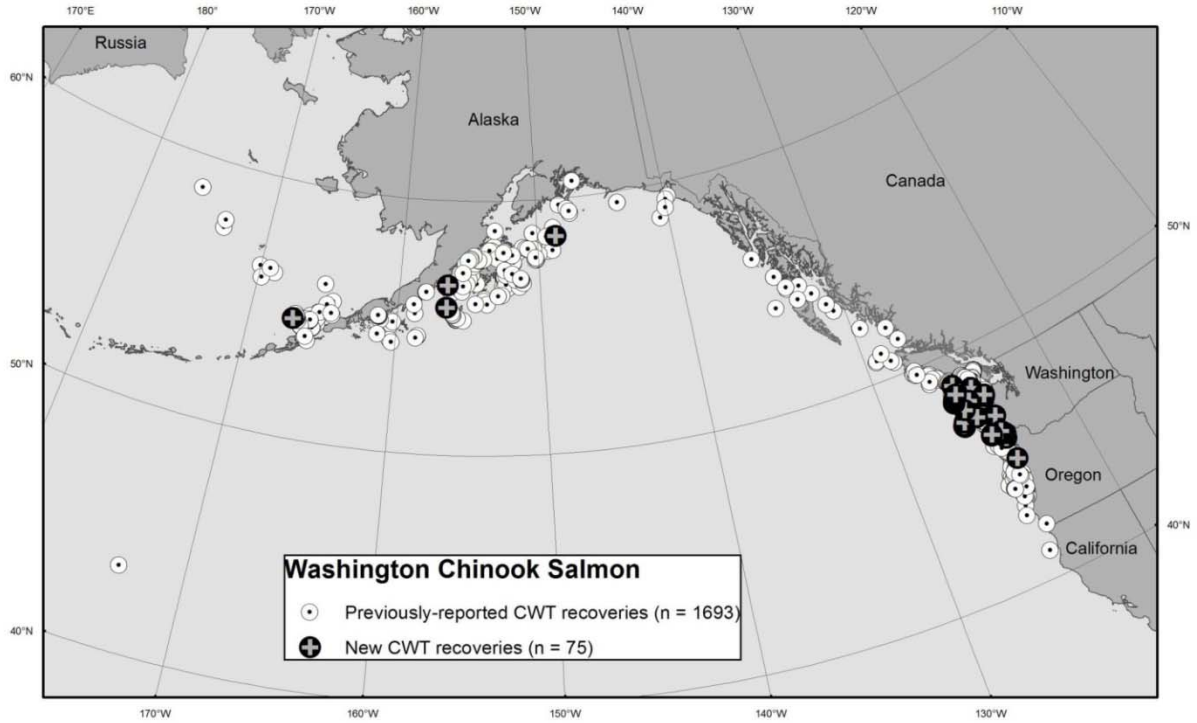
Source: NMFS Alaska Fisheries Science Center Auke Bay Lab, Adrian Celewycz, 10/27/2011.

Figure 3-7 Ocean distribution for British Columbia Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2012. Points reflect recovery locations.



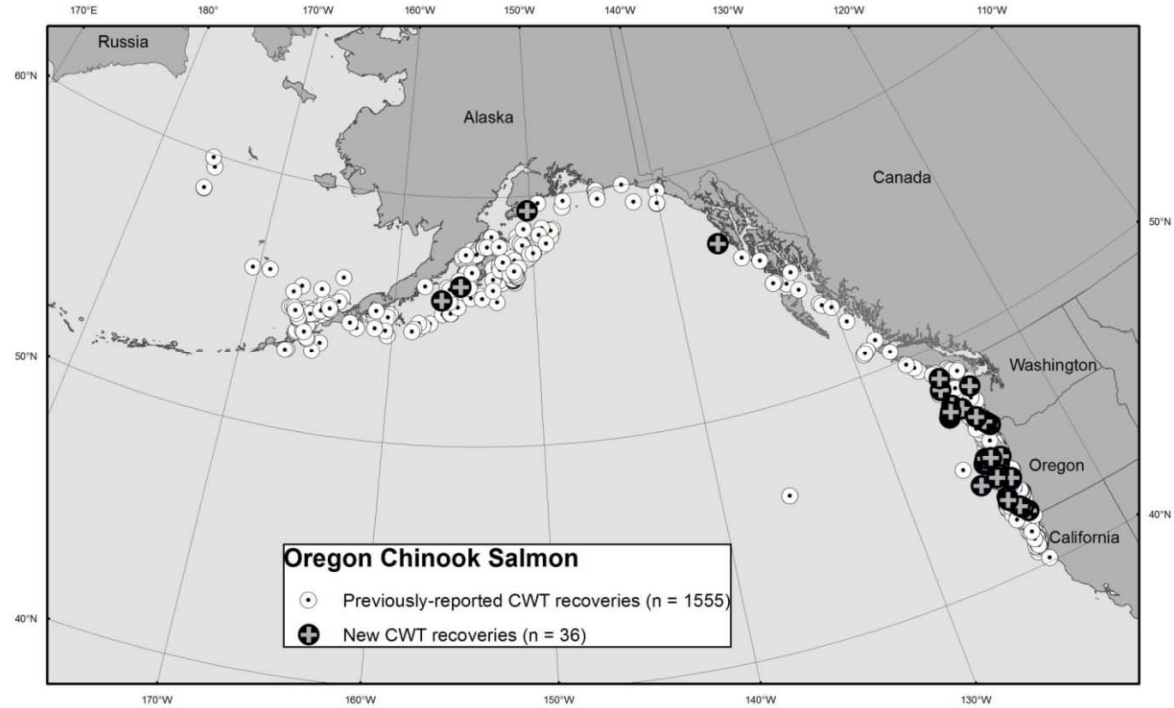
Source: Celewycz et al. 2012

Figure 3-8 Ocean distribution for Washington Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2012. Points reflect recovery locations.



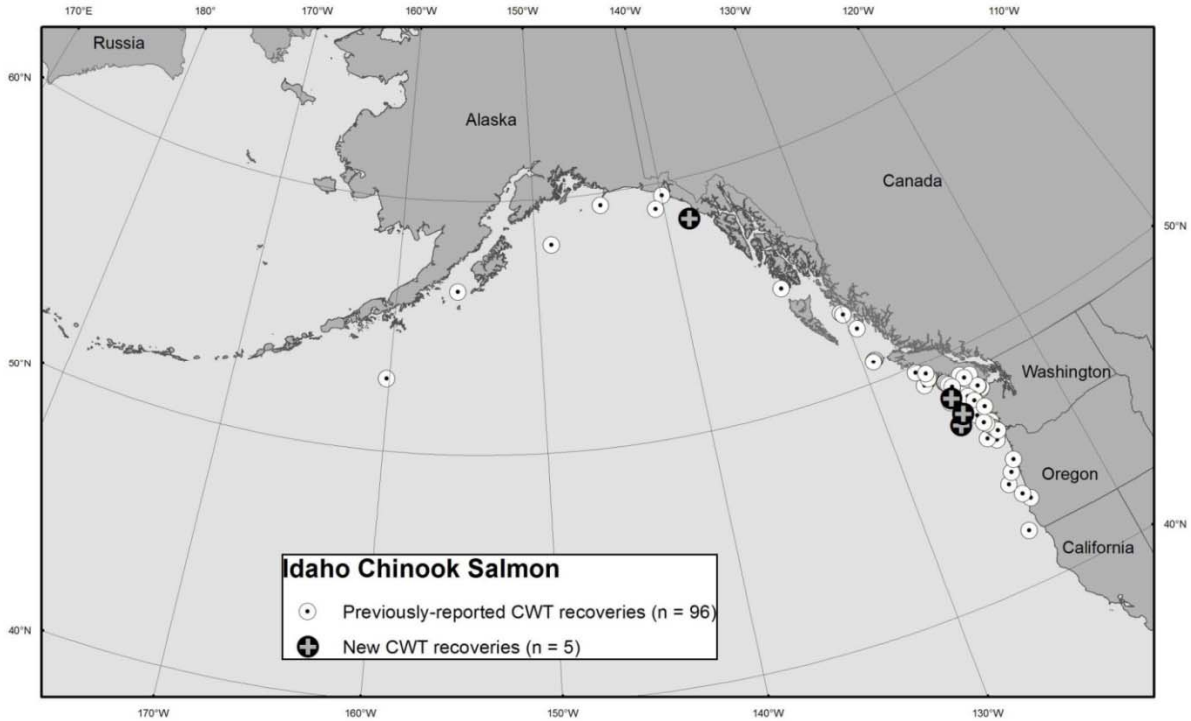
Source: Celewycz et al. 2012

Figure 3-9 Ocean distribution for Oregon Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2012. Points reflect recovery locations.



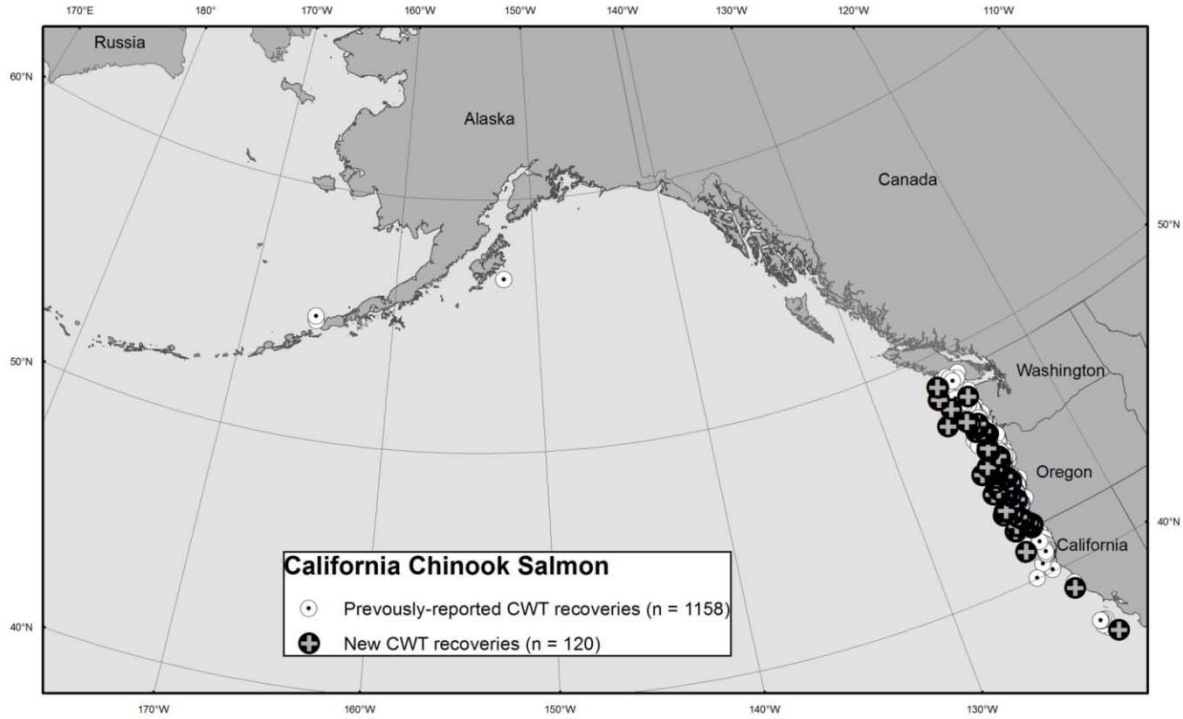
Source: Celewycz et al. 2012

Figure 3-10 Ocean distribution for Idaho Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2012. Points reflect recovery locations.



Source: Celewycz et al. 2012

Figure 3-11 Ocean distribution for California Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2012. Points reflect recovery locations.



Source: Celewycz et al. 2012

Most of the Chinook salmon represented by CWTs and harvested in the GOA originated from hatchery production (Table 3-6). Overall since 1995, 95% of the CWT Chinook salmon PSC was of hatchery origin, 3% from wild stocks, and 2% of mixed hatchery-wild stocks. For Alaska-origin CWT Chinook salmon however, wild stocks increased to 9% of the PSC of Alaskan stocks in the GOA, with hatcheries providing the other 91%. For all the CWT Chinook salmon that have been released in Alaska from the 1992 brood onward, 87% were of hatchery origin, and 13% were from wild stocks. Washington was the only other state of origin for wild stocks recovered in the GOA. However, as discussed above, CWTs do not represent the true composition of all stocks of Chinook salmon in the PSC of GOA groundfish fisheries.

Table 3-6 Observed Number of CWT Chinook salmon captured in the prohibited species catch of the GOA groundfish fishery by state or province of origin, 1995 through 2010.

	Rearing Type				
Origin	**Unknown**	**Hatchery**	**Mixed**	**Wild**	**TOTAL**
Alaska	0	174	0	18	192
British Columbia	0	196	0	0	196
Idaho	1	0	0	0	1
Oregon		130	0	0	130
Washington	0	76	11	3	90
TOTAL	**1**	**576**	**11**	**17**	**605**
average % of total	0%	95%	2%	3%	100%

Source: NMFS 2011a.

Chinook salmon represented by CWTs and recovered in the GOA were composed of a variety of run-types, and the percentage of each run-type varied by state or province of origin (Table 3-7). The different designated run-types are determined by the tagging agency. Overall, the most prevalent run-type of CWT Chinook salmon in the GOA was Spring, followed by Fall, Summer, and small numbers of other run-types. Percent composition of different run-types varied by state or province of origin. For Alaska stocks, 99% of CWT recoveries were Spring run-type. For British Columbia, the most prevalent run-type was Summer (41%), followed by Fall (32%) and Spring (27%). Washington Chinook salmon were predominantly Fall run-type (54%), followed by Summer (30%), Spring (8%), Late Fall (4%), and Late Fall Upriver Bright (3%). Oregon Chinook salmon were predominantly Spring (54%), followed by Fall (45%) and Winter (2%).

Table 3-7 Percent run-type of CWT Chinook salmon captured in the prohibited species catch of the GOA groundfish fishery by state or province of origin, 1995 through 2010.

Origin	Run-type						TOTAL
	Spring	Summer	Fall	Winter	Late Fall	Late Fall Upriver Bright	
Alaska	99%	1%	0%	0%	0%	0%	100%
British Columbia	27%	41%	32%	0%	0%	0%	100%
Oregon	54%	0%	45%	2%	0%	0%	100%
Washington	8%	30%	54%	0%	4%	3%	100%
Mean	48%	20%	31%	0%	1%	1%	100%

Source: NMFS 2011a.

3.3.4 Management and Assessment of Chinook Salmon Stocks

North Pacific Chinook salmon are the subject of commercial, subsistence, personal use, and sport/recreational (used interchangeably) fisheries. Chinook salmon are the least abundant of the five salmon species found on both sides of the Pacific Ocean and the least numerous in the Alaska commercial harvest. The majority of the Alaska commercial catch is made in Southeast Alaska, Bristol Bay, and the Arctic-Yukon-Kuskokwim area. The majority of catch is made with troll gear and gillnets. Approximately 90% of the subsistence harvest is taken in the Yukon and Kuskokwim rivers. The Chinook salmon is one of the most highly prized sport fish in Alaska and is extensively fished by anglers in the Southeast and Cook Inlet areas. The sport fishing harvest of Chinook salmon is over 170,000 fish annually with Cook Inlet and adjacent watersheds contributing over half the catch. Unlike other Pacific salmon species, Chinook salmon rear in inshore marine waters and are, therefore, available to commercial and sport fishers all year round (http://www.adfg.alaska.gov/index.cfm?adfg=chinook.main).

The Alaska State Constitution establishes, as state policy, the development and use of replenishable resources, in accordance with the principle of sustained yield, for the maximum benefit of the people of the state. In order to implement this policy for the fisheries resources of the state, the Alaska Legislature created the Alaska Board of Fisheries (BOF) and the ADF&G. The BOF was given the responsibility to establish regulations guiding the conservation and development of the state's fisheries resources, including the distribution of benefits among subsistence, commercial, recreational, and personal uses. ADF&G was given the responsibility to implement the BOF's regulations and management plans through the scientific management of the state's fisheries resources. Scientific and technical advice is provided by ADF&G to the BOF during its rule-making process. 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 (http://www.adfg.alaska.gov/index.cfm?adfg=chinook.management).

ADF&G's fishery management activities fall into two categories: inseason management and applied science. For inseason management, the division employs fishery managers near the fisheries. Local fisheries managers are given authority to open and close fisheries to achieve two goals: the overriding goal is conservation to ensure an adequate escapement of spawning stocks, and the secondary goal is an allocation of fish to various user groups based upon management plans developed by the BOF. The BOF develops management plans in open, public meetings after considering public testimony and advice from various scientists, advisors, fishermen, and user interest groups (Woodby et al. 2005). Decisions to open and close fisheries are based on the professional judgment of area managers, the most current biological data from field projects, and fishery performance. Research biologists and other specialists conduct applied research in close cooperation with the fishery managers. The purpose of the division's research staff is to ensure that the management of Alaska's fisheries resources is conducted in accordance with the sustained yield principle and that managers have the technical support they need to ensure that fisheries are managed according to sound scientific principles and utilizing the best available biological data. The division works closely with the Division of Sport Fisheries in the conduct of both management and research activities (http://www.adfg.alaska.gov/index.cfm?adfg=chinook.management).

By far, most salmon in Alaska are caught in commercial troll, gillnet, and purse seine fisheries in which participation is restricted by a limited entry system. Troll gear works by dragging baited hooks through the water. Gillnet gear works by entangling the fish as they attempt to swim through the net. Gillnets are deploying in two ways: from a vessel that is drifting and from an anchored system out from the beach. Purse seines work by encircling schools of fish with nets that are drawn up to create giant "purses" that hold the school until the fish can be brought aboard. Other kinds of gear used in Alaska's smaller fisheries include fishwheels, which scoop fish up as the wheel is turned by river currents (Woodby et al. 2005). More information on the management of Alaska Chinook salmon commercial, sport/recreational, and subsistence fisheries may be found in the RIR, Section 4.5.

3.3.4.1 Escapement Goals and Stock of Concern Definitions

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

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

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

This policy requires that ADF&G describe the extent salmon fisheries and their habitats conform to explicit principles and criteria. In response to these reports the board must review fishery management

plans or create new ones. If a salmon stock concern is identified in the course of review, the management plan will contain measures, including needed research, habitat improvements, or new regulations, to address the concern.

A healthy salmon stock is defined as a stock of salmon that has annual runs typically of a size to meet escapement goals and a potential harvestable surplus to support optimum or maximum yield. In contrast, a depleted salmon stock means a salmon stock for which there is a conservation concern. Further, a stock of concern is defined as a stock of salmon for which there is a yield, management, or conservation concern (5 AAC 39.222(f)(16)(7)(35)). A conservation concern may arise from a failure to maintain escapements above a sustained escapement threshold. 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.

Escapement is defined as the annual estimated size of the spawning salmon stock. Quality of the escapement may be determined not only by numbers of spawners, but also by factors such as sex ratio, age composition, temporal entry into the system, and spatial distribution within salmon spawning habitat ((5 AAC 39.222(f)(10)). Scientifically defensible salmon escapement goals are a central tenet of fisheries management in Alaska. It is the responsibility of ADF&G to document, establish, and review escapement goals, prepare scientific analyses in support of goals, notify the public when goals are established or modified, and notify the board of allocative implications associated with escapement goals.

The key definitions contained in the SSFP with regard to scientifically defensible escapement goals and resulting management actions are: biological escapement goal, optimal escapement goal, sustainable escapement goal, and sustained escapement threshold. Biological escapement goal (BEG) means the escapement that provides the greatest potential for maximum sustained yield. BEG will be the primary management objective for the escapement unless an optimal escapement or inriver run goal has been adopted. BEG will be developed from the best available biological information and should be scientifically defensible on the basis of available biological information. BEG will be determined by ADF&G and will be expressed as a range based on factors such as salmon stock productivity and data uncertainty (5 AAC 39.222(f)(3)).

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

SEG means a level of escapement, indicated by an index or an escapement estimate, that is known to provide for sustained yield over a 5- to 10-year period, and used in situations where a BEG cannot be estimated or managed for. The SEG is the primary management objective for the escapement, unless an optimal escapement or inriver run goal has been adopted by the board. The SEG will be developed from the best available biological information, and should be scientifically defensible on the basis of that information. The SEG will be determined by the ADF&G, and will be stated as a range (SEG Range) or a lower bound (Lower Bound SEG) that takes into account data uncertainty. ADF&G 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)).

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)).

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. As such, 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.

3.3.5 Chinook Salmon Stocks by area

A brief overview of Chinook salmon stocks by area is included in this section. Available information on individual stocks and run strengths varies greatly by river and management area. The 2011 escapement goals, and escapement for 2003 through 2011, are provided by river for each Alaska region in . Section 3.3.5.11 provides a summary of Alaska Chinook salmon stock performance in 2012. Information on stock status and abundance for non-Alaskan Chinook salmon populations is periodically published by the North Pacific Anadromous Fish Commission.[9]

3.3.5.1 Southeast Alaska and Yakutat

Native Chinook salmon stocks occur throughout Southeast Alaska and Yakutat, primarily in the large mainland rivers and their tributaries. Of the 34 known rivers that produce runs of Chinook salmon the Alsek, Taku, Stikine, Chilkat, and the Behm Canal Rivers (i.e., Unuk, Chickamin, Blossom, and Keta Rivers) are the most important (Pahlke 2010). Some of these important rivers are transboundary systems which originate in Canada and flow through Alaska to the Pacific Ocean. The Pacific Salmon Commission, under the terms of the Pacific Salmon Treaty, address shared ownership and coordinated management of the Taku, Stikine, and Alsek rivers.

Commercial Chinook salmon harvests are based on three components: (1) the all-gear Pacific Salmon Treaty defined harvest ceiling, based on coastwide abundance forecasts; (2) directed fisheries on returns to the Stikine and/or Taku rivers, also based on forecasts and harvest sharing agreements contained in the Pacific Salmon Treaty; and (3) production from Alaska enhancement programs (Der Hovanisian et al 2011). In addition to commercial fisheries, Chinook salmon are also taken in sport, personal use, and subsistence fisheries. A majority of the Chinook salmon sport harvest occurs in the Ketchikan, Sitka, and Juneau areas.

Spawning escapement is monitored on eleven river systems as biological escapement goals (Munro and Volk 2012) and these counts are used as indicators of relative salmon abundance as part of a coast-wide Chinook salmon model. The Taku, Stikine, and Chilkat rivers make up over 75% of the summed escapement goals in the region.

3.3.5.2 Prince William Sound

The Prince William Sound (PWS) management area encompasses all coastal waters and inland drainages entering the north Central GOA between Cape Suckling and Cape Fairfield. Chinook salmon are

[9] For example, see Heard 2007.

harvested in commercial fisheries (primarily by drift gillnets), sport, personal use, and subsistence fisheries. The entire Chinook salmon run originates from wild upriver stocks (Botz et al. 2010).

The Copper River is the only river in the PWS area where Chinook salmon escapement is monitored. In 2003 the Department established a SEG of 24,000 Chinook salmon for the Copper River. With the exception of 2005 and 2010, this lower-bound SEG has been achieved in all years since implementation.

Beginning during 2011 and continuing in 2012, additional restrictions were placed on fishing inside the barrier around the Copper River mouth due to low Chinook returns. These restrictions may cause smaller boats to fish outside of the protected areas inside the barrier islands, where weather conditions can be more difficult.

3.3.5.3 Cook Inlet

The Cook Inlet management area is divided into two areas, the Upper Cook Inlet (Northern and Central districts) and the Lower Cook Inlet. The Upper Cook Inlet commercial fisheries management area consists of that portion of Cook Inlet north of the latitude of the Anchor Point Light. There is one optimal escapement goal (Kenai River early run) and 21 sustainable escapement goals in effect for Chinook salmon in the Upper Cook Inlet area. Chinook salmon are harvested in the commercial fishery by set and drift gillnet gear and are an important component of subsistence and sport fisheries in the area. Chinook salmon may not be retained in most of the personal use fisheries of Upper Cook Inlet; exceptions include the Kenai River dip net fishery and the Kasilof River set gillnet personal use fishery (Shields 2010).

Chinook salmon runs in a number of areas of the state, including Upper Cook Inlet, have fallen below expected levels in recent years. Strict fishery management actions were made in the efforts to meet escapement objectives and ensure sustained yield. Chinook salmon fisheries were curtailed and fisheries for other more abundant salmon species were limited in areas where their harvest could affect weakened Chinook runs. In Upper Cook Inlet, emergency orders were issued restricting sport fisheries for Chinook salmon in fresh and salt waters. Commercial set gillnetting was closed for much of the season in the Kenai Kasilof, and East Foreland sections of the Upper Subdistrict. In the Northern District, the commercial setnet fishery was restricted and in river sport fisheries were tightly constrained to conserve Chinook salmon.

Chinook salmon runs in Upper Cook Inlet were below average to poor in recent years (Table 3-8 and

). The majority of the Chinook salmon escapement goals in Upper Cook Inlet were not met in 2011 or 2012.

The Lower Cook Inlet management area is comprised of all waters west of the longitude of Cape Fairfield, north of the latitude of Cape Douglas, and south of the latitude of Anchor Point. There are three SEGs in effect for Chinook salmon in the Lower Cook Inlet area. Chinook salmon are not a commercially important species in Lower Cook Inlet and most of the catch occurs incidental to fisheries targeting sockeye (Hammarstrom and Ford 2010). Chinook salmon are monitored in Lower Cook Inlet: Deep Creek, and Anchor and Ninilchik rivers. Chinook salmon runs have been below average in recent years (Table 3-8 and Appendix 1). However, escapement goals have generally been met, but only with restrictions and/or closures to sport fisheries.

3.3.5.4 Alaska Peninsula

The North Alaska Peninsula portion of the Alaska Peninsula Management Area includes those waters of the Alaska Peninsula from Cape Sarichef to Cape Menshikof. The majority of Chinook salmon harvest occurs incidental to sockeye salmon fisheries, although directed fisheries do occur. Sport and subsistence fisheries also harvest Chinook salmon in the North Alaska Peninsula area.

The Nelson River is the only river on the North Alaska Peninsula with a Chinook salmon escapement goal. The biological escapement goal was set at 2,400 to 4,400 Chinook salmon. In both 2011 and 2012 the Chinook salmon escapement goal was not met however the goal was met in 2010.

The South Alaska Peninsula Area includes waters from Kupreanof Point west to Scotch Cap. No Chinook salmon are known to spawn in South Alaska Peninsula streams. Chinook salmon are commercially harvested by purse seine, drift gillnet, and set gillnet gear. Most of the Chinook salmon are taken by seine gear incidental to other fisheries. The 10-year average commercial harvest is approximately 5,000 fish (Poetter et al. 2011). Chinook salmon are also taken in subsistence and sport fisheries.

3.3.5.5 Chignik

The Chignik Management Area encompasses all coastal waters and inland drainages of the northwest GOA between Kilokak Rocks and Kupreanof Point. Chinook salmon are harvested in commercial, sport, and subsistence fisheries.

The Chignik River is the only stream with substantial Chinook salmon production in the Chignik area. In 2002, a biological escapement goal was established for the Chignik River at 1,300 to 2,700 Chinook salmon (Jackson and Anderson 2010). The BEG has been met or exceeded in all years since implementation.

3.3.5.6 Kodiak

The Kodiak Management Area comprises the waters of the Western GOA surrounding the Kodiak Archipelago and that portion of the Alaska Peninsula bordering the Shelikof Straight between Cape Douglas and Kilokak Rocks. The majority of commercial Chinook salmon harvest is taken by seine fishermen during June and early July in the Afognak, Northwest Kodiak, Eastside Kodiak and Mainland districts. Chinook salmon harvest also occurs in sport and subsistence fisheries.

Chinook salmon occur in six streams and biological escapement goals are established for both the Karluk and Ayakulik rivers. In 2012 fisheries targeting sockeye salmon occurred along the Westside of Kodiak Isalnd and in the Outer Karluk Section of the Southwest Kodiak District. During these fishing periods

nonretention of Chinook salmon by purse seine gear was implemented from Cape Kuliuk to Low Cape. After not achieving the escapement goal from 2007-2010, Karluk Chinook salmon escapement was within the escapement goal range of 3,000 to 6,000 fish in 2011 and 2012. Ayakulik Chinook salmon have achieved the escapement goal of 4,000 to 8,000 fish every year since 2008.

3.3.5.7 Bristol Bay

The Bristol Bay Area includes all coastal waters and inland waters east of a line from Cape Newenham to Cape Menshikof. The area is further divided into five fishing districts: Togiak, Nushagak, Naknek-Kvichak, Egegik, and Ugashik. Harvests of Chinook salmon in the commercial fishery predominantly occur in the Nushagak District (Morstad et al. 2010). Chinook salmon are popular targets in both the sport and subsistence fisheries.

Chinook salmon runs in Bristol Bay were poor to below average in recent years (Table 3-8 and Appendix 1). Directed commercial fishing for Chinook salmon was limited in Nushagak District in some recent years. In addition, sport and subsistence fisheries were also restricted and/or closed in some recent years.

The Nushagak River has an SEG of 40,000 to 80,000 Chinook salmon and the Togiak, Naknek, Alagnak, and Egegik rivers all have lower-bound SEGs. The escapement goal for the Nushagak River was not met in 2010, met in 2011, and exceeded 2012 (Table 3-8 and Appendix 1). The other Chinook salmon goals in Bristol Bay are based on aerial surveys. Most of these aerial survey-based escapement goals were not assessed due to inclement weather or poor survey conditions in 2011 and 2012; therefore we do not know if the escapement goals were met for these systems.

3.3.5.8 Kuskokwim

The Kuskokwim Management Area includes the Kuskokwim River drainage, all waters of Alaska that flow into the Bering Sea between Cape Newenham and the Naskonat Peninsula, and Nunivak and St. Mathew Islands. Kuskokwim River Chinook salmon are harvested primarily for subsistence use, although incidental harvest in the chum salmon commercial fisheries does occur during late June and July, and some sport fishing occurs (Bavilla et al. 2010).

Chinook salmon escapements are evaluated through aerial surveys, by enumeration at weirs, and through mark and recapture at the mainstem tagging project near Upper Kalskag. The Middle Fork Goodnews River has a biological escapement goal of 1,500 to 2,900 Chinook salmon. The remaining 13 streams have SEGs which were implemented in either 2005 or 2007. Escapement goals have not been achieved on most river systems since implementation.

3.3.5.9 Yukon River

The Yukon Salmon Management Area encompasses the largest river in Alaska. The Yukon River and its tributaries drain an area of approximately 220,000 square miles within Alaska, while the Canadian portion of the river accounts for another 110,000 square miles. The river flows 2,300 miles from its origin 30 miles from the GOA to its terminus in the Bering Sea. Spawning populations of Chinook salmon occur throughout the Yukon River drainage in tributaries from as far downstream as the Archuelinuk River to as far upstream as the headwaters of the Yukon River in Canada.

The Yukon is managed as a single river and catches are reported by district and use (sport, commercial, personal use, and subsistence). Chinook salmon production for many Yukon River stocks has been declining in recent years and the Yukon River Chinook salmon was designated as a Stock of Yield Concern in 2000 (Hayes and Norris 2010). Biological escapement goals have been established for the

Chena and Salcha rivers, while SEGs have been established for the East and West Fork Andreafsky, Anvik, and Nulato rivers.

3.3.5.10 Norton Sound

Norton Sound, Port Clarence, and Kotzebue Sound management districts include all waters from Point Romanof in southern Norton Sound to Point Hope at the northern edge of Kotzebue Sound, and St. Lawrence Island. There are few Chinook salmon in the Port Clarence District. In the Norton Sound District, only the eastern area has sizeable runs of Chinook salmon and the primary salmon producing rivers are the Shaktoolik and Unalakleet subdistricts. The Shaktoolik and Unalakleet Chinook salmon stock was classified as a stock of yield concern in 2004. Commercial fishing typically begins in June and targets Chinook salmon if sufficient run strength exists (Menard et al. 2010). Sport and subsistence fisheries for Chinook salmon also occur in the Norton Sound area.

Escapement goals are established for five stocks in the Norton Sound Area, all are SEGs: Fish River/ Boston Creek, Kwiniuk River, North River (Unalakleet River), Shaktoolik River, and Unalakleet/ Old Woman River. Norton Sound Chinook salmon run since 2008 have been among the poorest on record.

3.3.5.11 Summary of 2012 Alaska Chinook Salmon Stock Status

Chinook salmon runs in Western Alaska have been below average since 2007, and management of the fisheries has been conservative in many systems. No directed Chinook salmon commercial fisheries occurred in the Yukon River, Kuskokwim River, or in Norton Sound in 2012, and only small commercial fisheries occurred in the Nushagak and Kuskokwim Bay (Table 3-8). Sport fisheries were restricted or closed in the Nushagak River, Yukon (Chena River), Kuskokwim (Kwethluk and Tuluksak rivers), and Unalakleet and Shaktoolik rivers of Norton Sound Management Area. More significantly, subsistence fisheries in the Nushagak River, two tributaries of the Kuskokwim River (Kwethluk and Tuluksak rivers; U.S. Fish and Wildlife Service [USFWS] federal closure), and Norton Sound (Unalakleet and Shaktoolik rivers) were restricted or closed. In spite of conservative management strategies, which in some cases were at great cost to the people who rely on these resources for food and income, few escapement goals were achieved in Western Alaska.

Kodiak Island Chinook salmon escapement was well below the previous 10-year average. Returns to the Karluk River barely met the escapement goal despite restrictions of nonretention implemented preseason to the sport and commercial fisheries. Escapement through the Ayakulik weir was within the established escapement goal due in part to preseason emergency order fishery restrictions to the sport fishery. In the Western GOA, the 2012 escapement to the Chignik River was approximately 100 fish above the lower end of the escapement goal.

The Upper Cook Inlet commercial fishery harvested 2,358 Chinook salmon in 2012. This level was 85% less than the 1966-2011 average annual harvest, and the total ex-vessel value of Chinook salmon ($98,000) was approximately 0.3% of the total Upper Cook Inlet commercial fishery (ADFG, 2012).

In 2011, State managers developed an action plan that aimed to reduce both sport and commercial Chinook salmon harvest for stocks of management concern in the northern Cook Inlet. Directed commercial fishing for Chinook was closed for the entire 2011 season in the area from approximately three miles south of Tyonek north to the Susitna River. Commercial fishing in the area was further restricted in 2012, reducing the Northern District fishery periods from 12 hours to 6 hours in duration. The Northern District's 2012 Chinook salmon harvest was 57% less (1,037 fish) than the previous 10-year average. In 2012, only 4 of 17 Chinook salmon escapement goals were met in northern Cook Inlet, despite preseason restrictions to sport and commercial fisheries, and inseason closures of several inriver

sport fisheries. The Deshka River was the only system in the northern Cook Inlet with inseason weir monitoring; in 2012, the Deshka River achieved the low-end of its escapement goal (14,088 fish, with a sustainable escapement goal defined between 13,000 and 28,000 fish). This escapement was 48% below the previous 10-year average, and was attributed to closures and restrictions on both the sport and commercial fisheries (ADFG, 2012).

In response to weak runs of early returning Chinook salmon in the Upper Cook Inlet, the 2012 sport fishery for late-run (July 1) Kenai River Chinook had a no-bait restriction. In addition, the commercial set gillnet fishery was heavily restricted – the set gillnet fishery was closed for the first three periods of the year – with the intent to allow enough Chinook escapement so that the gillnet fishery for sockeye salmon could be opened in late July. Chinook salmon passage estimates in the Kenai River remained lower than expected, resulting in a July 19 closure of the sport fisher and the Upper Subdistrict set gillnet fishery. Passage estimates improved enough to allow an Upper District set gillnet fishery for the regular periods beginning on August 6, and an additional period on August 12. Overall, the estimated Chinook salmon harvest in the Upper Subdistrict set gillnet fishery (584 fish) was the lowest since 1966, approximately 95% less than the previous 10-year average (ADFG, 2012).

Table 3-8 Overview of Alaskan Chinook salmon stock performance, 2012.

Chinook salmon stock	Total run size?	Escapement goals met?[a]	Subsistence fishery?	Commercial fishery?	Sport fishery?	Stock of concern?
Bristol Bay	Below average	0 of 1[b] (4 not surveyed)	Yes	Limited in Nushagak	Restricted on Nushagak for a portion of the season	No
Kuskokwim	Poor	2 of 7 (5 not surveyed)	Restricted on Kuskokwim River	None on Kuskokwim River, limited in Bay	Closed on Kuskokwim River, not in Bay	No
Yukon	Poor	3 of 5 (1 not surveyed)	Restricted	No	Bag limit reduced in all tributaries, no retention in mainstem and Tanana, no bait allowed on Tanana tributaries; Chena closed	Yield
Norton Sound	Poor	0 of 2 (3 not surveyed)	Restricted	No	No	Yield
Alaska Peninsula	Below average	0 of 1	Yes	Yes	Closed	No
Kodiak	Below average	2 of 2	Yes	Restricted, nonretention in Karluk and Ayakulik areas	Restricted, nonretention in Karluk, reduced bag and annual limits in Ayakulik	Management (Karluk)
Chignik	Below average	1 of 1	Yes	Yes	Restricted, nonretention, reduced bag and annual limits	No
Upper Cook Inlet	Poor	4 of 21[c]	Yes, with restrictions	Restricted in Northern District and Eastside set gillnets in Central District	Various restrictions including complete closure	6 stocks of conern
Lower Cook Inlet	Below average	3 of 3	Yes	Yes	Restricted; Closed Anchor River	No
Prince William Sound	Below average	1 of 1	Yes	Yes	Yes	No
Southeast	Below average	N/A	Yes	Yes	Yes	No

[a] Some aerial survey-based escapement goals were not assessed due to inclement weather or poor survey conditions, therefore we do not know if the escapement goals were met for these systems.
[b] The Chinook salmon escapement goal of 40,000 – 80,000 and the inriver goal of 75,000 were exceeded on the Nushagak River in 2012.
[c] Uncertainty in measuring the inriver abundance of early- and late-run Kenai River Chinook salmon do not provide clear assessment if the escapement goal of these two stocks were met.

3.3.5.12 Pacific Northwest Stocks

Chinook salmon stocks in the Pacific Northwest include over 200 stocks from British Columbia, Oregon and Washington State. The specific stocks are listed in 2010 BSAI Chinook salmon EIS (Chapter 3, NMFS 2009b). A specific discussion of Chinook salmon stocks in the Pacific Northwest listed under the Endangered Species Act (ESA) is addressed in Section 3.3.6, and more information on non-ESA-listed species may be found on the NMFS Northwest Region website, http://www.nwr.noaa.gov/, or at the Pacific Salmon Commission website, www.psc.org .

3.3.5.13 Asian Stocks

On the Asian coast, Chinook salmon occur from the Anadyr River area of Siberia southward to Hokkaido, Japan.[10] Chinook salmon occur primarily in Russia, from the Amur River, northward to the Anadyr River (center of abundance is the Kamchatka Peninsula). High seas tagging experiments have provided little information on ocean ranges of Asian Chinook salmon. There are only two Asian coastal recoveries of high-seas tagged Chinook salmon. One was a fish released just off the coast of Hokkaido, Japan, and recovered in Japan, and the other released south of the Aleutians in the Central North Pacific (172°03´W, 49°35´N) and recovered in East Kamchatka (Kamchatka River).

3.3.6 ESA-listed Chinook Salmon Stocks in the Pacific Northwest

Of the nine Chinook salmon Evolutionarily Significant Units (ESUs) in the Pacific Northwest that are listed under the ESA, three are known to have been taken as PSC in the Alaska groundfish fisheries. The information currently available on Chinook salmon ESA-listed ESUs in the GOA is from CWTs. Chinook salmon from the Lower Columbia River, Upper Columbia River, and Upper Willamette River Spring ESUs have been recovered in the GOA trawl fishery. Small numbers of the Puget Sound Chinook salmon ESU, the Snake River Spring/Summer Chinook salmon ESU, and the Snake River Basin steelhead ESUs have been documented by research surveys in the GOA, indicating that these stocks also occur in the GOA. All of the Chinook salmon from ESA-listed ESUs that have been recovered in the GOA trawl fishery have been spring run. One of the Lower Columbia River CWTs recovered in high seas research (2001) was a fall run (Adrian Celewycz, personal communication, November 2010).

In January 2007, the NMFS Northwest Region completed a supplemental biological opinion to the November 30, 2000 biological opinion on the effects of the Alaska groundfish fisheries on ESA-listed salmon (NMFS 2007c). An incidental take statement was included in the 2000 and 2007 biological opinions, which established a threshold of 40,000 Chinook salmon caught as PSC in the GOA groundfish fisheries. The 2000 biological opinion concluded that the GOA groundfish fisheries are not likely to jeopardize the continued existence of ESA-listed Chinook salmon stocks. If, during the course of the fisheries, the specified level of take is exceeded, a reinitiation of consultation is required, along with a review of the reasonable and prudent measures identified in the 2007 supplemental biological opinion.

Because of the high number of Chinook salmon taken in the GOA groundfish fisheries in 2010, the NMFS Alaska Region reinitiated ESA section 7 formal consultation with NMFS Northwest region on the 2010 incidental take of Chinook salmon (Balsiger 2010). The incidental take of Chinook salmon in the 2010 GOA groundfish fisheries was 54,576 fish (NMFS Alaska Region Catch Accounting System February 10, 2011). In 2012, the Northwest Region responded that, given the recently adopted Council actions to further reduce Chinook PSC and improve PSC estimation, monitoring, and sampling, the effect of the GOA groundfish fishery on listed Chinook salmon is likely to remain within the limits proscribed n the supplemental 2007 biological opinion (Stelle 2012).[11]

Detailed information on listed stocks is available in updated status reports of listed ESUs (Good et al. 2005; McElheny et al. 2007), and in the Interim Regional Recovery Plan for Washington management units of the listed ESUs in the Lower Columbia River (LCFRB 2004). Additional information related to the status of Lower Columbia River and Upper Willamette River Chinook salmon is summarized in biological opinions (NMFS 1999; NMFS 2005a; NMFS 2007c; NMFS 2009a) and the EIS for Amendment 91 (NMFS 2009b). No critical habitat is designated in Alaska waters for the Chinook salmon ESA-listed stocks.

[10] http://www.adfg.state.ak.us/pubs/notebook/fish/chinook.php
11 Further information on the challenges encountered in the early stages of managing Chinook salmon PSC under a hard cap management structure is discussed in the RIR (Section 4.4.5) and in Section 5.2.1.1.

In 2010, NMFS initiated a planned 5-year review of Pacific salmon and steelhead populations listed under the ESA to ensure the accuracy and classification of each listing. The review addresses the salmon species taken in the GOA fisheries and research cruises. NMFS has developed a strategy for recovery planning in Washington, Idaho, Oregon, and California that combines ESA-listed salmon and steelhead distinct population segments into geographic areas. The Northwest Region has identified its four recovery planning areas, or recovery domains, and has established technical recovery teams of scientists for each domain. Recovery plans in each domain will address all salmon species within that geographic area, and will involve stakeholders on a local level. Draft recovery plans for some regions are available for public review. More information on the recovery activities is available from http://www.nwr.noaa.gov/Salmon-Recovery-Planning/index.cfm.

The only Chinook salmon ESA-listed ESUs that have been documented in the BSAI groundfish fisheries are from the Lower Columbia River and Upper Willamette River, suggesting that spring-run populations from the Lower Columbia River (the Willamette River is a tributary that enters the lower Columbia near Portland, Oregon) are distinct in having the most northerly distribution, at least among the ESA-listed Chinook salmon from the southern United States (NMFS 2009b). Chinook salmon from ESA-listed ESUs are observed more frequently in the GOA groundfish fishery than the BSAI groundfish fishery because the GOA is closer to the streams from which these stocks originate (NMFS 2009b). The probability that an ESA-listed Chinook salmon will be taken in the GOA groundfish fishery depends on the duration of the time period considered and the cumulative total Chinook salmon PSC over that time. During 2003 through 2011, the total catch of Chinook salmon in the GOA groundfish fisheries was 219,785 (Section 3.3.2).

3.3.6.1 Observer Program Prohibited Species Catch Sampling

Genetic samples, comprised of a pelvic axillary processes, maturity information, sex/length/weight and five scales were collected from Chinook salmon in the 2012 GOA pollock fisheries. In addition, scale samples for species identification and snouts from salmon with a missing adipose fin (CWT recovery) were collected. Genetic samples were taken systematically from all salmon encountered in observed pollock deliveries. This provides samples from throughout the observed deliveries in the GOA. Detailed instructions on the procedures observers use to collect the data, which are inputs into the estimation process, are in the series of observer manuals available at:
http://www.afsc.noaa.gov/FMA/document.htm.

3.3.6.2 Coded-Wire Tag Results

The Regional Mark Processing Center maintains a coastwide database for CWT releases and recoveries, as well as associated catch and sample data. Over 50 million salmonids with CWTs are released yearly by 54 federal, provincial, state, tribal, and private entities. This database dates back to the 1970s and contains data contributed by the states of Alaska, Washington, Oregon, Idaho, and California; the province of British Columbia; federal agencies including NMFS, U.S. Fish and Wildlife Service, and Canadian Department of Fisheries and Oceans; and tribal groups including the Columbia River Inter-Tribal Fish Commission, Metlakatla Indian Community, and the Northwest Indian Fisheries Commission. The coastwide CWT database is the authority on the historic and current use of CWTs in West Coast salmon populations, both wild and hatchery. For a complete overview of the Regional Mark Processing Center and the coastwide CWT database go to: http://www.rmpc.org/.

Through this coordinated coastwide system, CWT recovery data have enabled scientists and managers to determine exploitation patterns for individual groups of fish and to assist in decision-making to manage salmon populations. CWTs have been used for cohort analysis into simulation models, identification of

migration and exploitation patterns, estimating and forecasting abundance, and in-season regulation of fisheries (PSC 2005). CWTs are increasingly being used with other stock identification technologies such as genetic markers, scale pattern, and otolith banding to provide a better analysis of salmonid population dynamics.

After the CWT tags are decoded, processed, and validated, data from the "observed recoveries" are made available for use in preliminary reports. This includes expansion of the observed recoveries into "estimated recoveries" for the given area time stratum once the catch sample data are available (Nandor et al. 2010). The estimated recoveries and expansion factors are explained below in the discussion on ESA-listed salmon.

3.3.6.3 Processing Snouts from Adipose Fin-Clipped Salmon at Auke Bay Laboratories CWT Lab

A missing adipose fin indicates that a salmon may have a CWT. Salted snouts from adipose fin-clipped salmon collected by the Observer Program from the salmon PSC in the GOA and BSAI groundfish fisheries are periodically sent to the NMFS Auke Bay Laboratories (Auke Bay Lab) CWT Lab from Observer Program offices in Seattle, Dutch Harbor, and Kodiak. After the snouts are processed with the CWT extracted from each snout, read under a microscope, and verified under a microscope, then recovery data associated with each snout are entered into a Microsoft Access database. At this point, the recovery data included with each snout are considered preliminary because they are often incomplete (e.g., missing recovery dates, missing recovery locations). The recovery data are sent to the Observer Program for error checking, verification, and filling in the blanks. Once the corrected data are received back at Auke Bay Lab, they are incorporated into the master historical database of all CWTs processed by Auke Bay Lab's CWT Lab. At that point the data are finalized and then available for further analysis.

3.3.6.4 CWT Expansions

Ideally, it would be preferable to calculate a total estimated contribution of Chinook salmon from ESA-listed ESUs harvested in the GOA in order to determine the impact of the fishery on these stocks. Total estimated contributions for CWT recoveries can be calculated in a two-step process involving a sampling expansion factor and a marking expansion factor. For an explanation of Recovery Estimation Technique see Appendix 7 in NMFS (2011).

Unfortunately, sampling expansion factors cannot be calculated for the CWT recoveries of ESA-listed ESUs in the GOA because of data limitations. For most of the recoveries of CWTs in the GOA trawl fishery, it is unknown whether the CWTs were collected systematically from inside the observers' species composition sample or non-systematically from outside the observers' species composition sample. A sampling expansion factor can only be calculated from CWTs recovered from inside a sample where the total number of sampled fish is known, as in the percent composition samples. CWT recoveries from outside the percent composition sample ("select" or opportunistic recoveries where the total number of fish examined is unknown) cannot be used to calculate a sampling expansion factor.

However, marking expansions can still be calculated for each CWT recovery from the mark expansion factors for each tag code. Because not all fish in a tag release group are actually tagged with CWTs, marking expansion factors account for the fraction of each release group that is tagged (NMFS 2011a, Appendix 7). Without being able to calculate total estimated contributions because of unknown sampling expansion factors, mark expansions offer the closest approximation to the contribution of Chinook salmon from ESA-listed ESUs in the GOA and BSAI. Mark expansions should be considered a very minimal estimate for the actual total contribution of Chinook salmon from ESA-listed ESUs in the GOA and BSAI.

3.3.6.5 Occurrence of ESA-listed Chinook Salmon ESUs in the GOA

Recoveries of CWTs from outside the sample (or from unknown sample origin) are still important for documenting occurrence of ESA-listed ESUs in the GOA trawl fisheries. Chinook salmon from the Lower Columbia River, Upper Willamette River, and Upper Columbia River Spring ESUs have been recovered in the GOA trawl fishery. Since 1984, CWTs have been recovered from 23 Lower Columbia River, 97 Upper Willamette River, and 1 Upper Columbia River Chinook salmon in the GOA trawl fishery, both pre- and post-listing (Table 3-9). By applying mark expansion factors, the estimated numbers increase to 112 Lower Columbia River, 275 Upper Willamette River, and 1 Upper Columbia River Chinook salmon in the GOA (Table 3-9). These numbers should be considered as very minimum estimates of the number of ESA-listed ESUs in the GOA groundfish fisheries. Until adequate numbers of CWTs are recovered from inside the observers' samples, where the total number of fish sampled is known, an estimate of total contribution of ESA-listed ESUs in the GOA fishery will remain indeterminable.

Table 3-9 Observed Number and Mark Expansion of ESA-listed CWT salmon by ESU captured in the prohibited species catch of the GOA trawl fisheries, summed over pre-listing and post-listing periods, 1984 through 2010.

		Chinook salmon in GOA Trawl Fisheries	
Listing Status	**ESU Name**	Observed Number	Mark Expansion
Pre-listing	Lower Columbia River spring Chinook	12	82.1
	Upper Willamette River Chinook	40	129.7
Post-listing	Lower Columbia River spring Chinook	11	29.8
	Upper Willamette River Chinook	57	145.4
	Upper Columbia River spring Chinook	1	1.0

Source: NMFS 2011a.

NMFS research surveys, a majority of which were conducted for salmon research, have documented the occurrence of other ESUs of ESA-listed Chinook salmon in the GOA besides the Lower Columbia River, Upper Willamette River, and Upper Columbia River. Small numbers of the Puget Sound Chinook salmon ESU, the Snake River Spring/Summer Chinook salmon ESU, and the Snake River Basin steelhead ESUs have also been recovered in the GOA in addition to the three Chinook salmon ESUs that have been documented in the GOA fishery. Since 1991, CWTs have been recovered from 3 Lower Columbia River, 1 Puget Sound, 5 Snake River Spring/Summer, 4 Upper Columbia River, 11 Upper Willamette River Chinook salmon, and 1 Snake River Basin steelhead in domestic and foreign research surveys in the GOA (Table 3-10). By applying mark expansion factors, the estimated numbers increase to 6 Lower Columbia River, 1 Puget Sound, 9 Snake River Spring/Summer, 4 Upper Columbia River, 72 Upper Willamette River Chinook salmon, and 1 Snake River Basin steelhead.

Table 3-10 Observed Number and Mark Expansion of ESA-listed CWT salmon captured in GOA research surveys, post-listing, 1991 through 2010.

		Chinook salmon in GOA Research Surveys	
Listing Status	**ESU Name**	Observed Number	Mark expansion
Post-listing	Lower Columbia River Chinook	3	6.5
	Puget Sound Chinook	1	1.0
	Snake River spring/summer Chinook	5	9.2
	Upper Columbia River spring Chinook	4	4.1
	Upper Willamette River Chinook	11	72.0
	Snake River Basin steelhead	1	1.0

Source: NMFS 2011a.

The Council and NMFS contracted with Cramer Fish Sciences in 2010 to develop information to improve estimates of the potential impact of Chinook salmon PSC on ESA-listed ESUs from the Pacific Northwest. Since 2011, the database now includes all production (counted and estimated, tagged and

untagged) of both wild and hatchery components of each ESU on an annual basis, dating back to when each ESU was first defined by NMFS.

3.3.7 Hatchery Releases

Commercial salmon fisheries exist around the Pacific Rim with most countries releasing salmon fry in varying amounts by species. The North Pacific Anadromous Fish Commission (NPAFC) summarizes information on hatchery releases by country and by area where available. Reports submitted to the NPAFC were used to summarize hatchery information by country and by U.S. state below (Table 3-11, Table 3-12). For more information see the following: Russia (Akinicheva and Volobuev 2008; Anon. 2007; TINRO-centre 2006, 2005); Canada (Cook et al. 2008); United States (Volk and Josephson 2010, 2009; Josephson 2008, 2007; Eggers 2006, 2005; Bartlett 2007, 2006, 2005); all (Irvine et al. 2009).

Chinook salmon hatchery releases by country are shown below in Table 3-11. There are no hatchery releases of Chinook salmon in Japan and Korea and only a limited number in Russia.

Table 3-11 Hatchery releases of juvenile Chinook salmon in millions of fish.

Year	Russia	Japan	Korea	Canada	USA	TOTAL
1999	0.6	-	-	54.4	208.1	263.1
2000	0.5	-	-	53.0	209.5	263.0
2001	0.5	-	-	45.5	212.1	258.1
2002	0.3	-	-	52.8	222.1	275.2
2003	0.7	-	-	50.2	210.6	261.5
2004	1.17	-	-	49.8	173.6	224.6
2005	0.84	-	-	43.5	184.0	228.3
2006	0.78	-	-	40.9	181.2	223.7
2007	0.78	-	-	44.6	182.2	227.6
2008	1	-	-	38	198.4	237.4
2009	0.78	-	-	41.6	201.0	243.4
2010	0.88	-	-	44.1	201.9	246.9

For Chinook salmon fry, the United States has the highest number of annual releases (72% of total in 2009), followed by Canada (~27%). In Canada, enhancement projects have been on-going since 1977 with approximately 300 different projects for all salmon species (Cook and Irvine 2007). Maximum production for Chinook salmon releases was reached in 1991 with 66 million fish in that year (Cook and Irvine 2007). Releases of Chinook salmon in 2006 occurred in the following regions: Yukon and Transboundary River, Skeena River, North Coast, Central Coast, West Coast and Vancouver Island, Johnstone Strait, Straits of Georgia, and the Lower and Upper Fraser rivers. Of these the highest numbers were released in the West Coast Straits of Georgia (20 million fish) followed by Vancouver Island area (12.4 million fish) the Lower Fraser River (3.3 million fish) (Cook and Irvine 2007).

Of the releases from the United States, however, a breakout by area shows that the highest numbers are coming from the State of Washington (63% in 2007), followed by California (19% in 2007), and then Oregon (7% in 2007) (Table 3-12).

Table 3-12 USA west coast hatchery releases of juvenile Chinook salmon in millions of fish.

Year	Alaska	Washington	Oregon	California	Idaho	WA/OR/CA/ID (combined)	TOTAL
1999	8.0	114.5	30.5	45.4	9.7		208.1
2000	9.2	117.4	32.3	43.8	6.8		209.5
2001	9.9	123.5	28.4	45.0	5.4		212.1
2002	8.4					213.6	222.0
2003	9.3					201.3	210.6
2004	9.35	118.2	17.0	27.4	1.7	164.2	173.6
2005	9.46	117.7	19.2	28.8	8.7	174.5	184.0
2006	10.2	110.5	19.2	29.4	12.0	171.0	181.2
2007	10.5	114.5	13.2	34.8	9.2	171.7	182.2
2008	11.4					201.4	212.4
2009	10.5					201.0	211.5
2010	11.0					201.9	212.9

Hatcheries in Alaska are located in southcentral and southeast Alaska. Prince William Sound and Southeast Alaska are the regions in the state with the greatest amount of salmon enhancement, and pink and chum salmon are the predominant species produced. The Cook Inlet and Kodiak regions also have salmon enhancement programs. Production levels, in terms of egg takes and releases, have largely remained stable. Enhancement programs have matured and are generally operating at current planned capacities (Vercessi 2012).

The private nonprofit hatchery corporations produce salmon mainly for commercial harvest. They recoup their operational costs from a special harvest of returning adult fish, called a cost recovery harvest. All other returning adult fish are available for harvest in Alaska's common property fisheries open to the public (sport, personal use, and subsistence). ADF&G Division of Sport Fish operates two hatcheries, primarily to produce salmonid species intended for both salt and freshwater recreational fisheries at many locations along the coast and in numerous interior lakes (Vercessi 2012).

In 2011, the statewide commercial salmon harvest was 177 million fish. The Alaska salmon enhancement program produced an estimated 48 million returning adult salmon (dominated by pink and chum salmon). Statewide, the program is credited with contributing 53% of the chum, 26% of the coho, 21% of the pink, 16% of the Chinook, and 6% of the sockeye salmon to the commercial common property harvest. An estimated 45 million enhanced salmon were harvested commercially, and the remaining 3 million enhanced salmon were used for broodstock, or harvested in the personal use/ sport/ subsistence fishery. Hatchery-produced Chinook salmon returned to Southeast Alaska, where the enhancement program accounted for 22% of the Chinook salmon in the common property commercial harvest (Vercessi 2012).

3.3.8 Effects of Alternatives on Chinook Salmon

The impact of the GOA groundfish fisheries on Chinook salmon was analyzed most recently in the Alaska Groundfish Fisheries Harvest Specifications Supplemental EIS (NMFS 2007a). Table 3-13 describes the criteria used to determine whether the impacts on Chinook salmon stocks are likely to be significant.

Table 3-13 Criteria used to estimate the significance of impacts on incidental catch of Chinook salmon.

No impact	No incidental take 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 – perhaps by the harvest of a predator or by the harvest of a species that competes for prey.
Significantly adverse impact	An action that diminishes protections afforded to prohibited species in the groundfish fisheries would be a significantly adverse impact.
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the groundfish fishery on the prohibited species, and significantly beneficial impacts are not defined for these species.
Unknown impact	Not applicable

The non-pollock trawl fisheries have an adverse impact on Chinook salmon through direct mortality due to PSC. Under the status quo, there are no additional management measures to reduce PSC of Chinook salmon in the GOA non-pollock trawl fisheries, however, Chinook salmon are a prohibited species, and it is incumbent upon fishermen, under the regulations, to avoid catching Chinook salmon. The EIS also considered impacts of the fisheries on the genetic structure of the population, reproductive success, and habitat, and concluded that it is unlikely that groundfish fishing has indirect impacts on these aspects of Chinook salmon sustainability. The non-pollock trawl fisheries also incidentally catch salmon prey species, including squid, capelin, eulachon, and herring, however the catches of these prey species are very small relative to the overall populations of these species. Thus, non-pollock trawl fishing activities are considered to have minimal and temporary effects on prey availability for salmon (NMFS 2005b). With respect to direct mortality, the 2007 analysis indicates that there is insufficient information available to directly link PSC in the groundfish fisheries to salmon stock biomass levels; therefore there is an inability to discern very small scale impacts because data are not available at the individual stock level. The first priority of the State of Alaska in managing Chinook salmon is to meet spawning escapement goals, in order to sustain salmon resources for future generations. Salmon surplus above escapement needs are made available for subsistence and other uses. The 2007 analysis concludes that minimum escapement had generally been met in the preceding years, despite increasing levels of Chinook and chum salmon PSC in the Bering Sea pollock fishery.

Since 2007, there have been poor or below average Chinook salmon runs in Western Alaska (Table 3-8). In 2010 and 2011, monitored Chinook salmon run sizes were also below average in most of the GOA, except in Chignik and Southeast Alaska where escapement goals were largely met. In 2012, however, all Chinook salmon runs in the GOA were below average, and in the Upper Cook Inlet, only four escapement goals of 21 were met (Table 3-8). The Chinook salmon stock composition of the GOA non-pollock trawl fishery PSC is not available, however the GOA groundfish fisheries have been documented to catch Chinook salmon both from Southeast Alaska and Cook Inlet, in the GOA. The average PSC for the non-pollock trawl fisheries is 6,176 Chinook salmon over the ten analyzed historical years (Table 2-5). Chinook salmon PSC in the GOA non-pollock trawl fisheries was highest in the Central GOA in 2003 and 2010, particularly low in 2005 and 2006, and at approximately average levels in the remaining years. It is not possible to draw any correlation between patterns of PSC and the status of salmon stocks, especially given the uncertainty associated with estimates of PSC in the groundfish fisheries, and the lack of data on river of origin of Chinook salmon PSC. This results in the inability to discern and accurately describe small scale impacts on particular individual stocks; nonetheless, we understand that setting PSC limits will likely reduce the potential to impact salmon stocks in the aggregate, and therefore are more likely to be beneficial to Chinook salmon stocks as a whole compared to status quo. There is also no evidence to indicate whether the groundfish fisheries' take of Chinook salmon is, or is not, causing escapement failures in Alaska rivers. Since in 2011, efforts have been underway to improve genetic sampling of salmon PSC in the GOA pollock fishery, which should, in time, allow for a better understanding of the stock composition of PSC in that GOA trawl target fishery. While it is not one of the target fisheries subject to the PSC limits that are currently under consideration, the pollock target fisheries occur in similar geographical areas, and with a somewhat similar gear type, to the non-pollock trawl

fisheries. As such, understanding the stock composition of PSC in that fishery would provide an additional perspective on the non-pollock trawl fisheries' Chinook salmon PSC.

To the extent to which Alternative 2 benefits Chinook salmon stocks, which is described above as unknown, a PSC limit may benefit commercial, sport and subsistence users of Chinook salmon. Section 3.3.5.11 identifies a number of river systems in the action area – on the Alaska Peninsula, around Kodiak Island, and in Southcentral Alaska – where low salmon returns have led to management actions that closed or curtailed these non-trawl resource uses in 2012.

Alternative 2 would establish a PSC limit that would be an upper limit on the PSC of Chinook salmon in the GOA non-pollock trawl fisheries in the Western and Central GOA. This limit would represent an upper threshold of Chinook salmon PSC in the GOA non-pollock trawl fisheries, as the non-pollock trawl fisheries will be closed when the limit is reached.

One way to evaluate the effect of the alternative PSC limits is to look retrospectively at Chinook salmon PSC levels from 2003 through 2011, and see how many Chinook salmon would not have been caught had the cap been in place. This, of course, assumes that there would have been no change in fleet behavior under a PSC limit, which is unlikely. It does, however, provide some sense of whether a PSC limit would have resulted in salmon savings during a year that was typical of the analyzed historical period. At the highest possible level, lower PSC limits generated more "avoided Chinook salmon PSC," based on historical fishing patters, than did higher limits. An analysis of the closures, identifying how each PSC limit apportionment option, or suite of options, specifically relates to salmon savings and forgone groundfish harvest is provided in the RIR (Section 4.7.1).

Evaluating what salmon savings may occur under the alternatives does not necessarily provide insight into potential impacts to the Chinook salmon stocks, however. The PSC limit and potential salmon savings in years of high Chinook salmon PSC do not translate directly into adult salmon that would otherwise have survived to return to its spawning stream. As described in Section 3.3.2.1, salmon caught as PSC in the GOA groundfish trawl fisheries are generally immature salmon, with an average weight varying between 5 and 9 pounds. Some proportion of the Chinook salmon caught as PSC would have been consumed as prey to other marine resources, or been affected by some other source of natural or fishing mortality.

In the Bering Sea Chinook salmon PSC analysis (NMFS 2009b), an adult equivalent (AEQ) model was used to estimate (a) how many of the bycaught salmon were likely to have returned to their streams as adults, and (b) to which river system or region they would likely have returned. Many more Chinook salmon samples have been taken in the Bering Sea pollock fishery, which is subject to much higher levels of observer coverage. Consequently, in the Bering Sea, sufficient age and length data were available to construct a model estimating how many salmon are likely to have survived to adults. Additionally, PSC composition estimates were available to provide some indication as to the origin of Chinook salmon PSC in the fishery. This meant that the Bering Sea analysis could include a quantitative impact analysis of salmon savings on salmon fisheries or communities. This analysis was not without controversy, since the underlying data was largely obtained from relatively small sample sizes, collected opportunistically. For this GOA non-pollock trawl fisheries analysis, we do not have sufficient data to develop an AEQ model. Moreover, the currently available data is not sufficient to link the size of the Chinook salmon taken as PSC to a specific age-class. It is assumed that the non-pollock trawl fisheries could be catching Chinook salmon that originate from anywhere in Alaska or elsewhere (see Section 3.3.3), and it is not possible to estimate the proportion any stock has contributed to the Chinook salmon PSC. Therefore our ability to assess the impacts of reducing salmon PSC on salmon populations is constrained.

While an AEQ model has not been developed for the Chinook salmon that are taken as PSC in the GOA groundfish trawl fisheries, this report can provide very high-level information that gives an approximate range of a reasonable AEQ rate. The State generally uses assumed natural mortality rates of 40% for 2 year old Chinook, 30% for 3 year olds, 20% for 4 year olds, and 10% for 5 year olds and older. Deriving an AEQ rate would require adjusting these percentages by an AEQ factor that accounts for other demographic characteristics. These age-specific factors change from year to year, and none are currently calculated for the GOA trawl fishery. However, for a rough measure, one might look at AEQ factors for the salmon troll fishery in Southeast Alaska. These factors are available for Age-2 to Age 5+ salmon. The following AEQ factors are for ocean-type stocks, and would have to be applied to an age group one year greater when dealing with stream-type stocks such as the stocks considered in this analysis. For Age-2 salmon, the assumed natural mortality rate would be multiplied by 0.59 to arrive at an Age 3 AEQ rate; the Age-3 natural mortality rate would be multiplied by 0.82 to arrive at an Age 4 AEQ rate; the Age-4 natural mortality rate would be multiplied by 0.96; and the Age-5+ natural mortality rate would be multiplied by 1.00. These figures are not intended to be applied to Chinook salmon PSC estimates to adjust the impacts of Alternative 2, especially considering the above statement that much of the Chinook salmon PSC in the GOA trawl fishery is immature salmon. Rather, they are included in an effort to present the best available, most applicable information, with the modest goal of characterizing the range of what a reasonable AEQ rate *might* look like in these fisheries.

Some information is available from genetic analysis of samples taken in the GOA groundfish fisheries, which originate primarily from the GOA pollock fishery (as the target fishery where most Chinook salmon PSC is intercepted; see Section 3.3.3.1). To date, the number of samples has not been sufficient to produce a stock composition analysis, but rather documents the presence of a particular salmon stock in the Chinook salmon PSC. In 2011 (the most recent year for which analysis is available), GOA samples were predominantly from Chinook salmon stocks from British Columbia, the Pacific Northwest, the Northwest GOA, and coastal Southeastern Alaska (Section 3.3.3.1).

Information is also available from CWT recoveries in GOA groundfish fisheries and research surveys (see Section 3.3.3.2). CWT recoveries provide reliable documentation of the presence of a specific salmon stock in the Chinook salmon PSC, although the recoveries, to date, cannot be used to establish the relative abundance of stocks in the PSC, nor to estimate the number harvested from any one stock as PSC, due to sampling issues. There are also likely to be other Chinook salmon stocks that are taken in the GOA non-pollock trawl fisheries that originate in river systems with no tagging program. Since 1995, however, CWTs of Chinook salmon recovered in the GOA groundfish fisheries have originated from British Columbia, Alaska, Oregon, Washington, and Idaho.

While it is not possible to assess the impacts to individual Chinook salmon stocks that are being taken in the GOA non-pollock trawl fisheries, nonetheless, it is possible to develop general conclusions for the action that is being proposed. If Chinook salmon PSC is reduced in some years as a result of this action, it would likely have beneficial impacts on Chinook salmon stocks, and the harvesters and consumers of Chinook salmon, compared to the status quo. With a PSC limit in place, it is likely that Chinook salmon PSC will be curtailed in years of otherwise high PSC, such as 2003 or 2010. To the extent that Alternative 2 reduces a source of direct mortality on Chinook salmon stocks, the impact to Chinook salmon overall is likely to be beneficial. Because we do not know the relative abundance of specific stocks in the GOA non-pollock trawl fisheries PSC, however, it is not possible to determine which, nor to what degree, individual stocks are likely to be affected.

There are currently no specific prohibited species control measures in place for Chinook salmon in the GOA non-pollock trawl fisheries, although the regulations require that the operator of each vessel engaged in directed fishing for groundfish in the GOA, including non-pollock trawl fisheries, minimize its catch of prohibited species, including Chinook salmon. The Council's consideration of this amendment

has emphasized the importance of Chinook salmon avoidance among the non-pollock trawl fleet. Under a PSC limit, and especially if the attainment of the threshold appears to be imminent, the non-pollock trawl fleet may be active in making efforts to avoid high PSC rates, in order to preserve the opportunity to fully harvest the groundfish TACs. Efforts to avoid Chinook PSC could take a variety of forms. Particularly at the outset, these efforts may have limited effect, as participants have little understanding of the means of avoiding Chinook PSC. Yet, the adoption of a Chinook PSC limit likely will prompt efforts to gain better information concerning Chinook avoidance, improving the ability of participants to avoid Chinook in the long run. As information concerning Chinook avoidance is improved, participants may use that information to redirect effort to times and areas with lower Chinook catch rates. Over time, effort may become more concentrated in areas that experience lower Chinook salmon PSC rates and decrease (or may be eliminated altogether) in areas of higher Chinook salmon catch rates. The extent of any redistribution of effort is difficult to predict and will depend not only on the distribution of Chinook salmon catch rates on the fishing grounds and the participants' ability to accurately estimate Chinook salmon catch rates, but also participants' flexibility to alter their temporal and spatial fishing behavior (see Section 4.7.3). It is possible that shifting the spatial or temporal distribution of the non-pollock trawl fisheries may impact some particular Chinook salmon stocks more than others, but as we do not currently know how effort may shift in the non-pollock trawl fisheries, nor the stock composition of Chinook salmon PSC, this impact is not possible to assess.

Under Alternative 2, it appears unlikely that Chinook salmon PSC would increase from the status quo. Any impact to the Chinook salmon stocks as a whole, is likely to represent either no change from the status quo, or to be beneficial, as PSC levels either remain the same or are reduced. None of the options considered under Alternative 2, would have a significant adverse impact to Chinook salmon stocks.

As described in the methodology for the environmental assessment, there are no environmental impacts of implementing full retention of salmon, as proposed in Alternative 3. The retention of salmon would affect neither fishing practices, nor Chinook salmon PSC in the regulated fisheries. Requiring full salmon retention on non-pollock trawl fisheries could, at some point in the future, increase the amount of biological sampling that occurs on Chinook salmon, and advanced understanding of the stock origin of Chinook salmon taken as PSC will improve managers' ability to assess impacts on individual Chinook salmon stocks. However, as described in the management and enforcement considerations section (Section 5.3), the implementation of this alternative, as currently considered in the analysis, would not result in more genetic data, as it would not allow NMFS to take systematic samples from a census of salmon PSC, in accordance with NMFS' current sampling approach.

3.4 Marine Mammals

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

- competition with fisheries for prey species;
- disturbance by fishing activities; or
- vulnerability 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 GOA Halibut PSC EA/RIR/IRFA (NPFMC 2012) provides the most recent analysis of the potential impacts of GOA non-pollock trawl fisheries on marine mammals. The most recent status information is available in the 2011 Marine Mammal Stock Assessment Reports (SARs) (Allen and Angliss 2012).

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 3-14. All of these species are managed by NMFS, with the exception of 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). In 2000, a Biological Opinion concluded that the FMPs, as then implemented, were likely to jeopardize the continued existence of the Western distinct population segment (DPS) of Steller sea lions and adversely modify its designated critical habitat (NMFS 2000). In 2001, a Biological Opinion was released that provided protection measures that did not jeopardize the continued existence of the Steller sea lion or adversely modify its designated critical habitat; that opinion was supplemented in 2003.

In 2006, NMFS reinitiated a FMP-level Section 7 consultation on the effects of the groundfish fisheries on Steller sea lions, humpback whales, and sperm whales to consider new information on these species and their interactions with the fisheries (NMFS 2006a). The Biological Opinion (NMFS 2010a) concluded that the groundfish fisheries may be likely to jeopardize the continued existence or adversely modify designated critical habitat (JAM) for the western Distinct Population Segment (DPS) of Steller sea lions. An Interim Final Rule (75 FR 77535, December 13, 2010, corrected 75 FR 81921, December 29, 2010) implemented a reasonable and prudent alternative (RPA) to remove the likelihood of JAM for Steller sea lions. The RPA did not change Steller sea lion protection measures in the GOA.

Table 3-14 Marine mammals likely to occur in the Gulf of Alaska.

	Species	Stocks
NMFS Managed Species		
Pinnipeds	Steller sea lion*	Western U.S (west of 144° W long.) and Eastern U.S. (east of 144° W long.)
	Northern fur seal**	Eastern Pacific
	Harbor seal	Southeast Alaska, Gulf of Alaska
	Ribbon seal	Alaska
	Northern elephant seal	California
Whales and dolphins	Beluga Whale*	Cook Inlet
	Killer whale	Eastern North Pacific Northern Resident, Eastern North Pacific Alaska Resident, Eastern North Pacific GOA, Aleutian Islands, and Bering Sea transient, AT1 transient**, West Coast Transient
	Pacific White-sided dolphin	North Pacific
	Harbor porpoise	Southeast Alaska, Gulf of Alaska, and Bering Sea
	Dall's porpoise	Alaska
	Sperm whale*	North Pacific
	Baird's beaked whale	Alaska
	Cuvier's beaked whale	Alaska
	Stejneger's beaked whale	Alaska
	Gray whale	Eastern North Pacific
	Humpback whale*	Western North Pacific, Central North Pacific
	Fin whale*	Northeast Pacific
	Minke whale	Alaska
	North Pacific right whale*	North Pacific
	Blue whale*	North Pacific
	Sei whale*	North Pacific
USFWS Managed Species		
	Northern sea otter*[3]	Southeast Alaska, Southcentral Alaska, Southwest Alaska

Source: Allen and Angliss 2012.
*ESA-listed species; **Listed as depleted under the MMPA.
[1] Steller sea lions are listed as endangered west of Cape Suckling and threatened east of Cape Suckling.
[2] NMFS designated critical habitat for the northern right whale on July 6, 2006 (71 FR 38277).
[3] Northern sea otters are under the jurisdiction of the USFWS

3.4.1 Marine Mammals Status

The GOA 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).

The PSEIS (NMFS 2004a) provides descriptions of the range, habitat, diet, abundance, and population status for marine mammals. The most recent marine mammal stock assessment reports for the strategic GOA marine mammal stocks (Steller sea lions, northern fur seals, harbor porpoise, North Pacific right whales, humpback whales, sperm whales, and fin whales) were updated in the 2011 SARs (Allen and Angliss 2012). Northern sea otters were assessed in 2008. The information from NMFS (2004a) and Allen and Angliss (2012) are incorporated by reference. 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 GOA halibut PSC limits EA/RIR/IRFA provides information on the effects of the GOA non-pollock trawl fisheries on marine mammals (NPFMC 2012), and concluded that the fisheries, as currently prosecuted, do not result in significantly adverse impacts to marine mammals in the GOA. That analysis is incorporated here by reference. This discussion presents new information, where applicable, and analyzes the potential effects of alternate Chinook salmon PSC management options on species that may be affected by non-pollock trawl fisheries in the GOA. These species are listed in Table 3-15 and Table 3-16. Note that Table 3-16 includes Southern Resident killer whales. This stock does not occur in the GOA, but this analysis considers the potential effects of Chinook salmon PSC in the GOA non-pollock trawl fisheries on prey availability for this population of killer whales. The GOA non-pollock trawl fisheries take Chinook salmon from Pacific Northwest stocks, which are important prey for the Southern Resident killer whales. Additional background information is provided here on the status of ESA-listed species.

Steller Sea Lion

The Steller sea lion inhabits many of the shoreline areas of the GOA, using these habitats as seasonal rookeries and year-round haulouts. The Steller sea lion has been listed as threatened under the ESA since 1990. In 1997, two distinct population segments, the Western and eastern (wDPS and eDPS) were recognized based on genetic and demographic dissimilarities. Because of a pattern of continued decline, the Western DPS was listed as endangered on May 5, 1997 (62 FR 30772), while the eastern DPS remained listed as threatened. NMFS is currently considering delisting the eDPS (75 FR 77602, December 13, 2010). The western DPS inhabits an area of Alaska approximately from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters (west of 144° W longitude).

Throughout the 1990s, particularly after critical habitat was designated, various fishing closures around rookeries, haulouts, and some offshore foraging areas were designated. These closures affect commercial harvests of pollock, Pacific cod, and Atka mackerel, which are important components of the western DPS diet. In 2001, a Biological Opinion was released that provided protection measures to prevent jeopardy to the continued existence of the Steller sea lion or adverse modification to its designated critical habitat; that opinion was supplemented in 2003 (NMFS 2001a, Appendix A, NMFS 2003). In 2006, NMFS reinitiated a FMP-level Section 7 consultation on the effects of the groundfish fisheries on Steller sea lions, humpback whales, and sperm whales to consider new information on these species and their

interactions with the fisheries (NMFS 2006a). The Biological Opinion (NMFS 2010a) concluded that the groundfish fisheries may be likely to jeopardize the continued existence or adversely modify designated critical habitat (JAM) for the western Distinct Population Segment (DPS) of Steller sea lions. An Interim Final Rule (75 FR 77535, December 13, 2010, corrected 75 FR 81921, December 29, 2010) implemented a reasonable and prudent alternative (RPA) to remove the likelihood of JAM for Steller sea lions. The RPA did not change Steller sea lion protection measures in the GOA.

In the GOA, extensive closures are in place for Steller sea lions including no transit zones and closures of critical habitat around rookeries and haulouts. Pollock is an important prey species for Steller sea lions (NMFS 2010a). The harvest of pollock in the GOA is temporally dispersed into 4 seasons (§ 679.23). Based on the most recent completed biological opinion, these harvest restrictions on the pollock fishery decrease the likelihood of disturbance, incidental take, and competition for prey to ensure the groundfish fisheries do not jeopardize the continued existence or adversely modify the designated critical habitat of Steller sea lions (NMFS 2000, NMFS 2001a, and NMFS 2010a).

A detailed discussion of Steller sea lion population trends in the GOA is included in the most recent Biological Opinion (NMFS 2010a) and is summarized here. Based on non-pup counts of Steller sea lions on trend sites throughout the range of the western DPS in the GOA and Aleutian Islands, the overall population trend for the western DPS of Steller sea lions is stable and may be increasing, but the trend is not statistically significant. The number of non-pups counted at trend sites increased by 12% between 2000 and 2008. However, counts increased by only 1% between 2004 and 2008 (DeMaster 2009).

Population trends differ across the range of the western DPS. Non-pup counts have declined severely in the western Aleutian Islands, and less severely in the eastern Aleutian Islands (7% decline in management area 543, 1% to 4% decline in management areas 542 and 541; NMFS 2010a). Pup and non-pup counts in the remainder of the western DPS range are either stable or increasing, ranging from 0% to 5% increases in population growth from 2000 to 2008 (NMFS 2010a).

Northern Sea Otter

The southwest Alaska DPS of northern sea otter is listed as threatened under the ESA (70 FR 46366, August 9, 2005). This population segment ranges from the Western Aleutian Islands to the Central GOA. NMFS completed an informal consultation on Northern sea otters in 2006 and found that the Alaska fisheries were not likely to adversely affect Northern sea otters (Mecum 2006). The USFWS has determined that, based on available data, Northern sea otter abundance is not likely to be significantly affected by commercial fishery interaction at present (Allen and Angliss 2012), and commercial fishing is not likely a factor in the population decline (70 FR 46366, August 9, 2005). Otters feed primarily in the rocky near shore areas on invertebrates, while groundfish fisheries are conducted further offshore on groundfish species (Funk 2003). Trawl closures where sea otters feed reduce potential interaction between trawl vessels and sea otters and ensure the clam habitat used by sea otters is not disturbed. Critical habitat for sea otters has been designated and is located primarily in nearshore waters (74 FR 51988, October 8, 2009), reducing the potential for effects by federal fisheries. The USFWS is developing a recovery plan for the southwest Alaska DPS of northern sea otters.

Table 3-15 Status of Pinnipedia and Carnivora stocks potentially affected by the action.

Pinnipedia and Carnivora species and stock	Status under the ESA	Status under the MMPA	Population trends	Distribution in action area
Steller sea lion – Western (W) and Eastern (E) Distinct Population Segment (DPS)	Endangered (W) Threatened (E)	Depleted & a strategic stock	For the WDPS, 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 WDPS appears to have stabilized (NMFS 2010a). The EDPS is steadily increasing and is being considered for delisting.	WDPS inhabits Alaska waters from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters. EDPS inhabit waters east of Prince William Sound to Dixon Entrance. Occur throughout AK waters, terrestrial haulouts and rookeries on Pribilof Islands, Aleutian Islands, St. Lawrence Island, and off the mainland. Use marine areas for foraging. Critical habitat designated around major rookeries, 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 St. 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 and spring in the N. Pacific.
Harbor seal – Gulf of Alaska	None	None	A moderate to large population decline has occurred in the GOA stock.	GOA stock found primarily in the coastal waters and may cross over into the Bering Sea coastal waters between islands.
Ribbon seal Alaska	None*	None	Reliable data on population trends are unavailable.	Widely dispersed throughout the Bering Sea and Aleutian Islands in the summer and fall. Associated with ice in spring and winter and may be associated with ice in summer and fall. Occasional movement into the GOA (Boveng et al. 2008)
Northern sea otters – SW Alaska	Threatened**	Depleted & a strategic stock	The overall population trend for the southwest Alaska stock is believed to be declining, particularly in the Aleutian Islands.	Coastal waters from Central GOA to W Aleutians within the 40 m depth contour. Critical habitat designated in primarily nearshore waters with few locations into federal waters in the GOA.

Source: Allen and Angliss 2012; List of Fisheries for 2011 (75 FR 68468, November 8, 2010).
Northern fur seal pup data available from http://www.alaskafisheries.noaa.gov/newsreleases/2007/fursealpups020207.htm.
*NMFS determined that ribbon seals were not to be listed on September 23, 2008. The Center for Biological Diversity and Greenpeace filed suit against NMFS regarding this decision on September 3, 2009.
**Northern sea otter information from http://www.nmfs.noaa.gov/pr/pdfs/sars/seaotter2008_ak_sw.pdf and 74 FR 51988, October 8, 2009

Cook Inlet Beluga Whale

In 2008, the Cook Inlet DPS of beluga whales was listed as an endangered species under the ESA following a significant population decline. NMFS has identified more than one third of Cook Inlet as critical habitat. In 2011, NMFS estimated the Cook Inlet beluga whale population to be 284 individuals, nearly 20% lower than the 2010 estimate, and the second lowest since aerial surveys began in 1993. The 2011 estimate remains within the 10-year annual trend, which shows an annual decline of 1.1% per year. Historical abundance is estimated at approximately 1,300 whales (NMFS 2008b). Cook Inlet belugas primarily occur in the northern portion of Cook Inlet. Beluga whales do not normally transit outside of Cook Inlet, and thus are unlikely to encounter vessels fishing in the federal groundfish fisheries. NMFS

has determined that the only potential impact of the groundfish fisheries on Cook Inlet belugas is though competition for prey species (Brix 2010).

Southern Resident Killer Whale

The Southern Resident killer whale (SRKWs) was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). SRKWs range from the Queen Charlotte Islands to Central California. The population declined from historical abundance estimates of 140 to200 whales in the 1960s and 1970s to fewer than 90 whales in recent years, and was listed as endangered under the ESA in 2005. The stock is currently under a 5-year status review (75 FR 17377, April 6, 2010). Numerous factors have likely caused the decline, including a reduction in availability of preferred prey. 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, 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. There have been recent reports of SRKWs in poor body condition (Durban et al. 2009). Ford et al. (2005) found a correlation between the reduction in Chinook salmon abundance off Alaska, British Columbia, and Washington and decreased survival of Northern and SRKWs. In 2009, NMFS released a Biological Opinion that evaluates the effects of the ocean salmon fisheries off Washington, Oregon, and California on SRKWs, and found that the proposed action is not causing jeopardy or adverse modification (NMFS 2009d). NMFS is currently conducting a scientific review of new evidence that strongly suggests that Chinook salmon abundance is very important to the survival and recovery of SRKWs, which may have implications for salmon fisheries and other activities that affect Chinook salmon abundance.

Table 3-16 Status of Cetacea stocks potentially affected by the action.

Cetacea species and stock	Status under the ESA	Status under the MMPA	Population trends	Distribution in action area
Killer whale – AT1 Transient, E N Pacific transient, W Coast transient, Alaska resident, Southern resident	Southern resident endangered; remaining stocks none	AT1 depleted and a strategic stock, Southern Resident depleted. The rest of the stocks: None	Southern residents have declined by more than half since 1960s and 1970s. Unknown abundance for the Alaska resident; and Eastern North Pacific GOA, Aleutian Islands, and Bering Sea transient stocks. The minimum abundance estimate for the Eastern North Pacific Alaska Resident stock is likely underestimated because researchers continue to encounter new whales in the Alaskan waters.	Southern resident do not occur in GOA. Transient-type killer whales from the GOA, Aleutian Islands, and Bering Sea are considered to be part of a single population.
Dall's porpoise Alaska	None	None	Reliable data on population trends are unavailable.	Found in the offshore waters from coastal Western Alaska throughout the GOA.
Pacific white-sided dolphin	None	None	Reliable data on population trends are unavailable.	Found throughout the GOA.
Harbor porpoise GOA	None	Strategic	Reliable data on population trends are unavailable.	Primarily in coastal waters in the GOA, usually less than 100 m.

Cetacea species and stock	Status under the ESA	Status under the MMPA	Population trends	Distribution in action area
Humpback whale – Western and Central North Pacific	Endangered and under status review	Depleted & a strategic stock	Increasing. The Structure of Populations, Levels of Abundance, and Status of Humpbacks (SPLASH) abundance estimate for the North Pacific represents an annual increase of 4.9% since 1991–1993. SPLASH abundance estimates for Hawaii show annual increases of 5.5% to 6.0% since 1991–1993 (Calambokidis et al. 2008).	W. Pacific and C. North Pacific stocks occur in GOA waters and may mingle in the North Pacific feeding area.
North Pacific right whale Eastern North Pacific	Endangered	Depleted & a strategic stock	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. A reliable estimate of trend in abundance is currently not available.	Before commercial whaling on right whales, concentrations were found in the GOA, eastern Aleutian Islands, south-Central Bering Sea, Sea of Okhotsk, and Sea of Japan (Braham and Rice 1984). During 1965–1999, following large illegal catches by the U.S.S.R., there were only 82 sightings of right whales in the entire eastern North Pacific, with the majority of these occurring in the Bering Sea and adjacent areas of the Aleutian Islands (Brownell et al. 2001). Critical habitat near Kodiak Island in the GOA
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. Much of the North Pacific range has not been surveyed.	Found in the GOA, Bering Sea and coastal waters of the Aleutian Islands.
Beluga whale-Cook Inlet	Endangered	Depleted & a strategic stock	2008 abundance estimate of 375 whales is unchanged from 2007. Trend from 1999 to 2008 is not significantly different from zero.	Occurrence only in Cook Inlet.
Minke whale Alaska	None	None	There are no data on trends in Minke whale abundance in Alaska waters.	Common in the Bering and Chukchi Seas and in the inshore waters of the GOA. Not common in the Aleutian Islands.
Sperm whale North Pacific	Endangered	Depleted & a strategic stock	Abundance and population trends in Alaska waters are unknown.	Inhabit waters 600 m or more depth, south of 62°N lat. Widely distributed in North Pacific. Found year-round In GOA.
Baird's, Cuvier's, and Stejneger's beaked whale	None	None	Reliable data on population trends are unavailable.	Occur throughout the GOA.

Sources: Allen and Angliss 2012; List of Fisheries for 2011 (75 FR 68468, November 8, 2010); http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/spermwhale.htm. North Pacific right whale included based on NMFS (2006a) and Salveson (2008). AT1 Killer Whales information based on 69 FR 31321, June 3, 2004. North Pacific Right Whale critical habitat information: 73 FR 19000, April 8, 2008. For beluga whales: 73 FR 62919, October 27, 2008.

3.4.2 Effects on Marine Mammals

3.4.2.1 Significance Criteria for Marine Mammals

Table 3-17 contains the significance criteria for analyzing the effects of the proposed action on marine mammals. The Status Quo alternative is the non-pollock trawl fisheries as currently prosecuted in the GOA. These fisheries were evaluated under the GOA halibut PSC EA/RIR/IRFA (NMFS 2012) and were determined not to cause significant adverse impacts to marine mammals. As such, the Status Quo alternative is not considered to cause significant adverse impacts to marine mammals in this analysis. The other alternatives being considered constitute a change from status quo management, and impacts are assessed as a change from status quo. Although impacts to marine mammals from commercial fisheries cannot be considered beneficial (incidental take, reduced prey availability, and increased disturbance are all adverse impacts), it is possible that alternatives 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 3-17 Criteria for determining significance of impacts to marine mammals.

	Incidental take and entanglement in marine debris	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 marine 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 or important time of year.	Insufficient information as to what constitutes disturbance.

3.4.2.2 Incidental Take Effects

The GOA Halibut PSC EA/RIR/IRFA (NPFMC 2012) contains a detailed description of the incidental take effects of the groundfish fisheries on marine mammals and is incorporated by reference. Marine mammals can be taken in groundfish fisheries by entanglement in gear (e.g., trawl, longline, and pot) and, rarely, by ship strikes for some cetaceans. Steller sea lion (western U.S.), Fin whale, and Northern elephant seal were taken in the GOA non-pollock trawl fisheries during the most recent five years of observer data that have been analyzed (Allen and Angliss 2012). In addition to these species, the List of Fisheries for 2011 reports that fin whale and northern elephant seal have been taken in previous years in the GOA non-pollock trawl fishery, but not recently (75 FR 68468, November 8, 2010). Other marine mammals are assumed to be unlikely to be incidentally taken by any of the alternatives due to the absence of incidental take and entanglement records. No records exist of Alaska groundfish fisheries takes of North Pacific right whales.

Potential take in the GOA non-pollock trawl fisheries is well below the PBR for all marine mammals for which PBR has been determined. The GOA non-pollock trawl fisheries are Category III fisheries based on annual mortality and serious injury of a stock being less than or equal to 1% of the PBR level. Overall, very few marine mammals are reported taken in the GOA non-pollock trawl fisheries, and estimated mortality from federally managed fisheries has not been estimated. Considering the number of marine mammals taken incidentally in the fishery in relation to the PBR, it is unlikely that incidental takes would impact the subsistence harvest of marine mammals. While possible, the incidence of ship strikes and/or serious injury to whales from ships involved in the Alaska groundfish fisheries are likely to be minimal and not expected to result in an adverse population level effects.

Incidental Take Effects under Alternative 1: Status Quo

The effects of the status quo fisheries on incidental takes of marine mammals are detailed in the 2007 harvest specifications EIS (NMFS 2007a). The potential take of marine mammals in the GOA non-pollock trawl fisheries is well below the PBRs or a very small portion of the overall human caused mortality for those species for which a PBR has not been determined. No significantly adverse effects are expected.

Incidental Take Effects under Alternative 2: Hard Caps

The range of hard caps under Alternative 2 may result in different potential for incidental takes of marine mammals. A lower hard cap may result in the trawl fisheries closing early, before the TACs are reached, which would reduce the potential for incidental takes in areas where marine mammals may interact with trawl fishing vessels. If the fleet is able to identify hotspots with high Chinook salmon catch rates, and avoid fishing in these areas, the distribution of effort in the fishery may change to some extent. A higher hard cap would allow for more groundfish fishing and more potential for interaction and incidental takes of marine mammals than a lower cap.

Alternative 2 may reduce the potential adverse effects of incidental takes on marine mammals, compared to the status quo, if the fisheries close early. To the extent that the redistribution of effort results in more vessel-days of effort, there could potentially be an increase in the likelihood of incidental takes of marine mammals compared to the status quo. However, the likely closures are relatively small compared to the capacity of the GOA groundfish trawl fleet, and seasons are likely to remain short. Under the status quo fisheries, the number of incidental takes is well below the PBRs, and is a very small proportion of overall total human caused mortality. No substantial change in the number of incidental takes is expected under Alternative 2, and the impacts of Alternative 2 on incidental takes of marine mammals are likely to be insignificant.

3.4.2.3 Harvest of Prey Species

The Alaska Groundfish Harvest Specifications EIS contains a detailed description of the effects of the groundfish fisheries on prey species for marine mammals (NMFS 2007a) and is incorporated by reference. Harvests of marine mammal prey species in the GOA groundfish fisheries may limit foraging success through localized depletion, overall reduction in prey biomass, and dispersion of prey, making it more energetically costly for foraging marine mammals to obtain necessary prey. Overall reduction in prey biomass may be caused by removal of prey or disturbance of prey habitat. The timing and location of fisheries relative to foraging patterns of marine mammals and the abundance of prey species may be a more relevant management concern than total prey removals. The GOA non-pollock trawl fisheries may impact availability of key prey species of Steller sea lions, harbor seals, northern fur seals, ribbon seals; and fin, minke, humpback, beluga, and resident killer whales. Animals with varied diets may be less likely to be impacted than those with more restricted diets. Table 3-18 shows the GOA marine mammal

species and their prey species that may be impacted by the GOA non-pollock trawl fisheries. Non-pollock groundfish targets and salmon prey are in **bold**.

Table 3-18 Prey species used by GOA marine mammals that may be impacted by the GOA non-pollock trawl fisheries.

Species	Prey
Fin whale	Zooplankton, squid, fish (herring, **cod**, capelin, and pollock), and cephalopods
Humpback whale	Zooplankton, schooling fish (pollock, herring, capelin, saffron cod, sand lance, Arctic cod, and **salmon**)
Minke whale	Pelagic schooling fish (including herring and **pollock**)
Beluga whale	Wide variety of invertebrates and fish including **salmon** and pollock
Killer whale	Marine mammals (transients) and fish (residents) including herring, halibut, **salmon**, **and cod**.
Ribbon seal	**Cod**, pollock, capelin, eelpout, sculpin, flatfish, crustaceans, and cephalopods.
Northern fur seal	Pollock, squid, herring, **salmon**, capelin
Harbor seal	Crustaceans, squid, fish (including **salmon**), and mollusks
Steller sea lion	Pollock, Atka mackerel, Pacific herring, Capelin, Pacific sand lance, Pacific cod, and **salmon**

Sources: NOAA 1988; NMFS 2004a; NMFS 2007b; Nemoto 1959; Tomilin 1957; Lowry et al. 1980; Kawamura 1980; and http://www.adfg.state.ak.us/pubs/notebook/marine/orca.php

Chinook salmon PSC in the non-pollock trawl fisheries may remove salmon that would otherwise have been available as prey for marine mammals. CWT recoveries from Chinook salmon PSC in the GOA provide information on occurrence of specific salmon stocks in the GOA. Although CWT recoveries provide reliable documentation of the presence of a stock in the PSC, the recoveries to date can't be used to establish the relative abundance of stocks in the PSC, nor to estimate the number harvested from any one stock due to sampling issues. CWTs do not represent the true composition of all stocks of Chinook salmon in the PSC in the GOA groundfish fisheries (see Section 3.3.3.1). Between 1995 and 2010, 34% of the observed CWTs of Chinook salmon in the GOA fishery have originated from British Columbia, followed by Alaska (31%), Oregon (21%), Washington (13%), and Idaho (<1%). MARK expansions of the CWT recoveries estimate Chinook salmon to have originated in British Columbia (52%), Alaska (33%), Oregon (8%), Washington (7%), and Idaho (<1%). It is important to note that in 6 out of the 16 years that CWT recovery data were collected, the majority of tagged fish were from Alaska. MARK expansions should be considered a minimum estimate of the actual PSC of specific Chinook salmon stocks. Genetic analysis of stock composition, and AEQ analysis on Chinook salmon PSC in the GOA is not yet available. NMFS recently initiated improvements to the sampling process for Chinook salmon in the GOA pollock trawl fishery.

Several marine mammals in the GOA may be affected indirectly by impacts of non-pelagic trawl gear on benthic habitat. Table 3-19 lists marine mammals that may depend on benthic prey and known depths of diving. Sperm whales are not likely to be affected by any potential impacts on benthic habitat from non-pelagic trawling because they generally occur in deeper waters than where trawling occurs (Table 3-19). Benthic habitat for harbor seals and sea otters is also not likely to be affected by non-pelagic trawling because they occur primarily along the coast where trawling is not conducted. Cook Inlet beluga whales are not likely to be affected by non-pelagic trawling benthic impacts because they do not range outside of Cook Inlet and do not overlap spatially with the trawl fisheries.

Table 3-19 Benthic dependent GOA marine mammals, foraging locations, and diving depths.

Species	Depth of diving and location
Ribbon seal	Mostly dive < 150 m on shelf, deeper off shore. Primarily in shelf and slope areas.
Harbor seal	Up to 183 m. Generally coastal.
Sperm whale	Up to 1,000 m, but generally in waters > 600 m.
Northern sea otter	Rocky nearshore < 75 m
Gray whale	Benthic invertebrates

Sources: Allen and Angliss 2012; Burns et al. 1981; http://www.adfg.state.ak.us/pubs/notebook/marine/rib-seal.php; http://www.afsc.noaa.gov/nmml/species/species_ribbon.php; http://www.adfg.state.ak.us/pubs/notebook/marine/harseal.php; http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/spermwhale.htm

Prey Availability Effects under Status Quo: Alternative 1

The GOA Halibut PSC EA/RIR/IRFA concluded that competition for key prey species with the non-pollock trawl fisheries is not likely to constrain the foraging success of marine mammals in the GOA or cause population declines (NPFMC 2012). The introduction to this section reviewed the marine mammal species that depend on groundfish or salmon, and the potential impacts of the non-pollock trawl fisheries on benthic habitat that supports marine mammal prey. Below is additional information regarding potential effects of the GOA non-pollock trawl fisheries on prey availability for Steller sea lions, Cook Inlet belugas, and SRKW.

Steller sea lions

The following information on Steller sea lion diet is summarized from the 2010 Biological Opinion (NMFS 2010a) 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.

Stomach content analysis from animals in Kodiak in the 1970s showed that walleye pollock was the most important prey in fall, winter, and spring, while in summer the most frequently eaten prey were small forage fishes (capelin, herring, and sand lance) (Merrick and Calkins 1996). Prey occurrence of pollock, Pacific cod, and herring were higher in the 1980s than in the 1950s through 1970s in stomach content samples for both eastern and Western Steller sea lion populations. In a recent study in the Kodiak Archipelago, the most frequent Steller sea lion prey were found to be Pacific sand lance, walleye pollock, arrowtooth flounder, Pacific cod, salmon, and Pacific herring (McKenzie and Wynne 2008). Other studies since 1990 have shown that pollock continue to be a dominant prey species in the GOA. Pacific cod is also an important prey species in winter in the GOA. Salmon was eaten most frequently during the summer months in the GOA.

The effects of the status quo GOA Pacific cod 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 GOA 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 2010a).

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.

The non-pollock trawl fisheries may intercept salmon that would otherwise have been available as prey for Northern and Southern Resident killer whales. Any competition with the fisheries 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. Data are not available to quantitatively evaluate the extent of this effect.

Cook Inlet Beluga Whales

The following information on Cook Inlet beluga diet is from the 2008 Recovery Plan (NMFS 2008b) 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 GOA non-pollock trawl fisheries because their occurrence does not overlap spatially with the fisheries. Any competition with the fisheries 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. Data are not available to quantitatively evaluate the extent of this effect. Even though the GOA fisheries take Cook Inlet salmon as PSC, it is not likely that the number of salmon taken under status quo would have a measurable effect on Cook Inlet beluga whales. Of the Alaska Chinook salmon CWT recoveries, 9% are estimated to be Cook Inlet fish. Returns of Chinook salmon are in the thousands of fish based on the number of river systems in the inlet with Chinook salmon runs, and the effects of GOA 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).

Other Marine Mammals

Ribbon seals, northern fur seals, and minke, fin, and humpback whales potentially compete with the GOA non-pollock trawl fisheries 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 fisheries. There is no evidence that the harvest of groundfish in the GOA 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 GOA non-pollock trawl fishery, the effects of Alternative 1 on prey availability for marine mammals are not likely to cause population level effects and are therefore insignificant.

Prey Availability Effects under Alternative 2

A hard cap on the number of Chinook salmon taken in the non-pollock trawl fisheries 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 salmon PSC. If the hard cap

results in the fisheries closing before the TACs are reached, it could also increase the availability of groundfish to marine mammals. If the hard cap results in additional fishing effort in less productive groundfish areas with less salmon PSC, the shift in fishing location may result in additional groundfish being available in those areas where salmon is concentrated, and would provide a benefit if these areas are also used by groundfish- and salmon-dependent marine mammals for foraging. A higher hard cap would be less constraining on the fishery and would likely result in effects on prey availability similar to the status quo. A lower hard cap would be more constraining on the fishery, making more salmon available for prey; and may also increase availability of groundfish if the fishery is closed before the groundfish TACs is reached.

Consequently, Alternative 2 may reduce the potential effects of the GOA non-pollock trawl fisheries on the availability of prey for marine mammals, especially in years when the salmon cap is reached and fishing may be constrained. It is not likely that the potential effects would be substantially different from status quo, and therefore the effects of Alternative 2 are likely insignificant.

3.4.2.4 Disturbance

Disturbance Effects under Status Quo: Alternative 1

The GOA Halibut PSC EA/RIR/IRFA contains a detailed description of the disturbance of marine mammals by the non-pollock trawl fisheries (NPFMC 2012). The EA concluded that the status quo fishery does not cause significantly adverse impacts to marine mammals. Fishery closures limit the potential interaction between fishing vessels and marine mammals (e.g., 3-nm no groundfish fishing areas around Steller sea lion rookeries). Because disturbances to marine mammals under the status quo fishery are not likely to cause population level effects, the impacts of Alternative 1 are likely insignificant.

Disturbance Effects under Alternative 2: Hard Caps

The effects of the proposed hard caps on disturbance would be similar to the effects on incidental takes. If the groundfish fishery closes early because the hard cap is reached, then less potential exists for disturbance of marine mammals. If the non-pollock trawl fisheries increase the duration of fishing in areas with lower concentrations of groundfish to avoid areas of high salmon PSC, there may be more potential for disturbance if this increased fishing activity overlaps with areas used by marine mammals. Fishing under the higher hard cap is likely similar to status quo because it is less constraining than fishing under the lower caps and less likely to cause a change in fishing activities.

None of the disturbance effects on other marine mammals under Alternative 2 are expected to result in population level effects on marine mammals. Disturbance effects are likely to be localized and limited to a small portion of any particular marine mammal population. Because disturbances to marine mammals under Alternative 2 is not likely to be substantially different from status quo, the impacts of Alternative 2 are likely insignificant.

3.5 Seabirds

3.5.1 Seabird Species and Status

Thirty-eight species of seabirds breed in Alaska (Table 3-20). Breeding populations are estimated to contain 36 million individual birds in Alaska, and total population size (including subadults and nonbreeders) is estimated to be approximately 30% higher. Five additional species that breed elsewhere but occur in Alaskan waters during the summer months contribute another 30 million birds (Table 3-20).

More information on seabirds in Alaska's EEZ may be found in several NMFS, Council, and USFWS documents:

- The URL for the USFWS Migratory Bird Management program is at: http://alaska.fws.gov/mbsp/mbm/index.htm
- Section 3.7 of the PSEIS (NMFS 2004a) provides background on seabirds in the action area and their interactions with the fisheries. This may be accessed at http://www.alaskafisheries.noaa.gov/sustainablefisheries/seis/final062004/Chaps/chpt_3/chpt_3_7.pdf
- The annual Ecosystems Considerations chapter of the SAFE reports has a chapter on seabirds. Back issues of the Ecosystem SAFE reports may be accessed at http://www.afsc.noaa.gov/REFM/REEM/Assess/Default.htm.
- The Seabird Fishery Interaction Research webpage of the Alaska Fisheries Science Center: http://www.afsc.noaa.gov/refm/reem/Seabirds/Default.htm
- The NMFS Alaska Region's Seabird Incidental Take Reduction webpage: http://www.alaskafisheries.noaa.gov/protectedresources/seabirds.html
- The BSAI and GOA groundfish FMPs each contain an "Appendix I" dealing with marine mammal and seabird populations that interact with the fisheries. The FMPs may be accessed from the Council's home page at http://www.alaskafisheries.noaa.gov/npfmc/default.htm
- Washington Sea Grant has several publications on seabird takes, and technologies and practices for reducing them: http://www.wsg.washington.edu/publications/online/index.html
- The seabird component of the environment affected by the groundfish FMPs is described in detail in Section 3.7 of the PSEIS (NMFS 2004a).
- Seabirds and fishery impacts are also described in Chapter 9 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007a).

Table 3-20 Seabird species in Alaska

Type	Common name	Status
Albatrosses	Black-footed	
	Short-tailed	Endangered
	Laysan	
Fulmars	Northern fulmar	
Shearwaters	Short-tailed	
	Sooty	
Storm petrels	Leach's	
	Fork-tailed	
Cormorants	Pelagic	
	Red-faced	
	Double-crested	
Gulls	Glaucous-winged	
	Glaucous	
	Herring	
	Mew	
	Bonaparte's	
	Sabine	
	Ivory	
	Ross's	
Murres	Common	
	Thick-billed	
Jaegers	Long-tailed	
	Parasitic	
	Pomarine	

Type	Common name	Status
Guillemots	Black	
	Pigeon	
Eiders	Common	
	King	
	Spectacled	Threatened
	Steller's	Threatened
Murrelets	Marbled	
	Kittlitz's	Candidate
	Ancient	
Kittiwakes	Black-legged	
	Red-legged	
Auklets	Cassin's	
	Parakeet	
	Least	
	Whiskered	
	Crested	
	Rhinoceros	
Terns	Arctic	
	Aleutian	
Puffins	Horned	
	Tufted	

3.5.1.1 ESA-Listed Seabirds in the GOA

Several species of conservation concern occur in the GOA (Table 3-21). Short-tailed albatross is listed as endangered under the ESA, and Steller's eider is listed as threatened. Kittlitz's murrelet is a candidate species for listing under the ESA, and the USFWS is currently working on a 12-month finding for black-footed albatross.

Table 3-21 ESA-listed and candidate seabird species that occur in the GOA.

Common Name	Scientific Name	ESA Status
Short-tailed Albatross	*Phoebaotria albatrus*	Endangered
Steller's Eider	*Polysticta stelleri*	Threatened
Kittlitz's Murrelet	*Brachyramphus brevirostris*	Candidate

Short-tailed Albatross

Short-tailed albatross (*Phoebaotria albatrus*) is listed as endangered under the ESA. Short-tailed albatross populations were decimated by feather hunters and volcanic activity at nesting sites in the early 1900s, and the species was reported to be extinct in 1949. In recent years, the population has recovered at a 7% to 8% annual rate. The world population of short-tailed albatross in 2009 was estimated at 3,000 birds. The majority of nesting occurs on Torishima Island in Japan, where an active volcano threatens the colony. No critical habitat has been designated for the short-tailed albatross in the United States, because the population growth rate does not appear to be limited by marine habitat loss (NMFS 2004b). Short-tailed albatross feeding grounds are continental shelf breaks and areas of upwelling and high productivity. Short-tailed albatross are surface feeders, foraging on squid and forage fish.

As part of a 5-year project, chicks have been translocated from Torishima Island to a new breeding colony on Mukojima in the Ogasawara Islands, which is not threatened by volcanic activity. In February 2011, researchers noted the first return of a short-tailed albatross chick to its hand-reared home on Mukojima, a promising sign that the chicks may return to Mukojima to breed.

Steller's Eider

Steller's eider (*Polysticta stelleri)* is listed as threatened under the ESA. While designated critical habitat for Steller's eiders does overlap with fishing grounds in the Bering Sea, there has never been an observed take of this species off Alaska (USFWS 2003a, 2003b; NMFS 2008a), and no take estimates are produced by AFSC. Therefore, impacts to Steller's eider are not analyzed in this document.

Kittlitz's Murrelet

Kittlitz's murrelet (*Brachyramphus brevirostris*) is a small diving seabird that forages in shallow waters for capelin, Pacific sandlance, zooplankton, and other invertebrates. It feeds near glaciers, icebergs, and outflows of glacial streams, sometimes nesting up to 45 miles inland on rugged mountains near glaciers. Most recent population estimates indicate that it has the smallest population of any seabird considered a regular breeder in Alaska (9,000 to 25,000 birds). This species appears to have undergone significant population declines in several of its core population centers. USFWS believes that glacial retreat and oceanic regime shifts are the factors that are most likely causing population-level declines in this species. Kittlitz's murrelet is currently a candidate species for listing under the ESA. No Kittlitz's murrelets were reported taken in the observed groundfish fisheries between 2007 and 2010 (NMFS 2011b).

3.5.1.2 Status of ESA Consultations on Seabirds

The USFWS has primary responsibility for managing seabirds, and has evaluated effects of the BSAI and GOA FMPs and the harvest specifications process on currently listed species in two Biological Opinions (USFWS 2003a and 2003b). Both Biological Opinions concluded that the groundfish fisheries off Alaska are unlikely to jeopardize populations of listed species or adversely modify or destroy critical habitat for listed species. The current population status, life history, population biology, and foraging ecology of these species, as well as a history of ESA Section 7 consultations and NMFS actions carried out as a result of those consultations are described in detail in Section 3.5.2 of the GOA Halibut PSC EA/RIR/IRFA (NPFMC 2012).

3.5.1.3 Seabird Distribution in the Gulf of Alaska

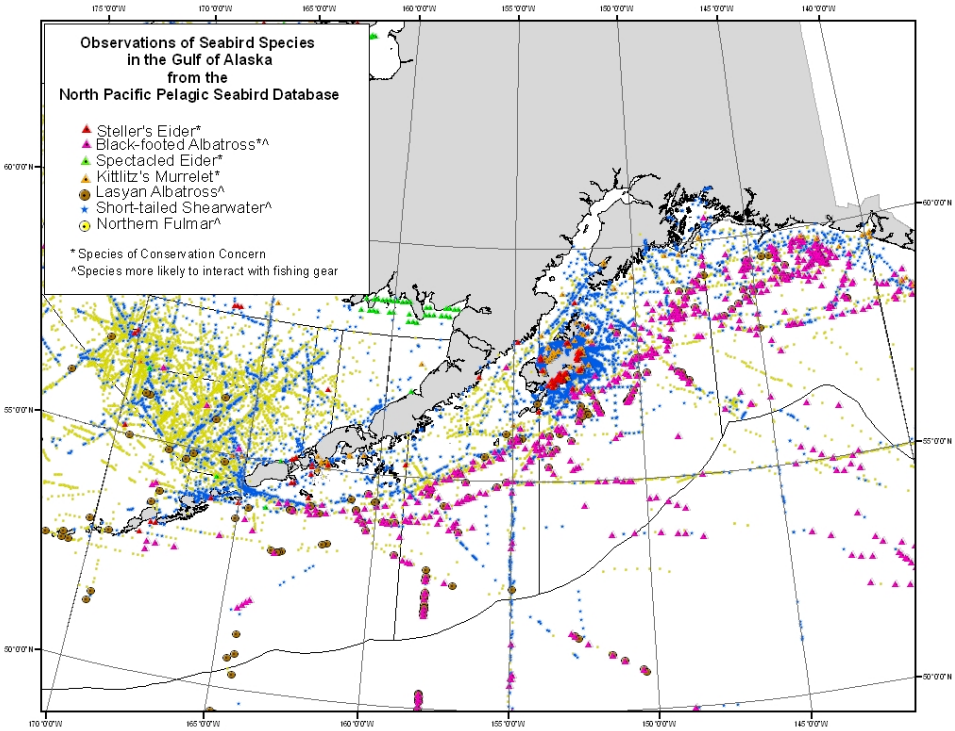
Figure 3-12 shows observations of several seabird species that may interact with fishing gear in the GOA. Figure 3-13 shows locations of short-tailed albatross seen on surveys from 2002 through 2004 (Melvin et al. 2006). Melvin et al. (2006) provides the most current and comprehensive data on seabird distribution patterns off Alaska.

Satellite Tracking of Short-tailed Albatross

USFWS and Oregon State University placed 52 satellite tags on Laysan, black-footed, and short-tailed albatrosses in the Central Aleutian Islands to study movement patterns of the birds in relation to commercial fishing activity and other environmental variables. From 2002 to 2006, 21 individual short-tailed albatrosses (representing about 1% of the entire population) were tagged, including adults, sub-adults, and hatch-year birds. During the non-breeding season, short-tailed albatross ranged along the Pacific Rim from southern Japan through Alaska and Russia to northern California, primarily along continental shelf margins (Suryan et al. 2006).

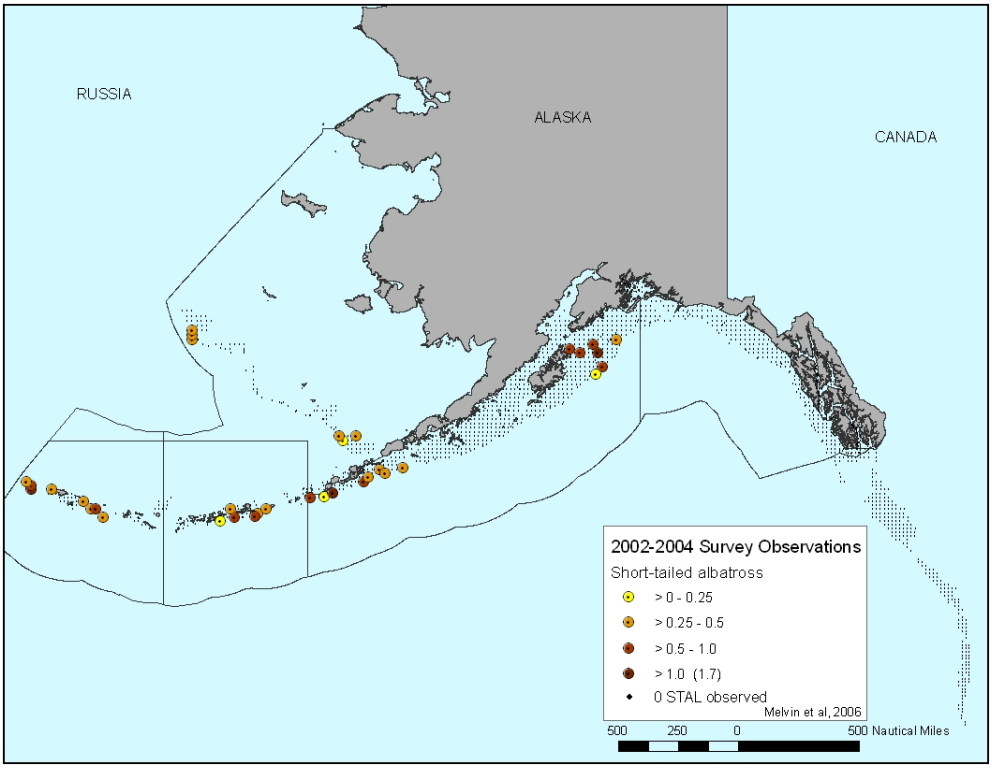
Sufficient data existed for 11 of the 14 to analyze movements within Alaska. Within Alaska, albatrosses spent varying amounts of time among NMFS reporting areas, with six of the areas (521, 524, 541, 542, 543, 610) being the most frequently used (Suryan et al. 2006). Non-breeding albatross concentrate foraging in oceanic areas characterized by gradients in topography and water column productivity. The primary hot spots for short-tailed albatrosses in the Northwest Pacific Ocean and Bering Sea occur where a variety of underlying physical processes enhance biological productivity or prey aggregations. The Aleutian Islands, in particular, were a primary foraging destination for short-tailed albatrosses.

Figure 3-12 Observations of seabird species with conservation status and/or likely to interact with fishing gear in the Gulf of Alaska.



Source: NPPSD 2004

Figure 3-13 Observations of short-tailed albatrosses



Source: Melvin et al. 2006

Short-tailed Albatross Takes in Alaska Fisheries

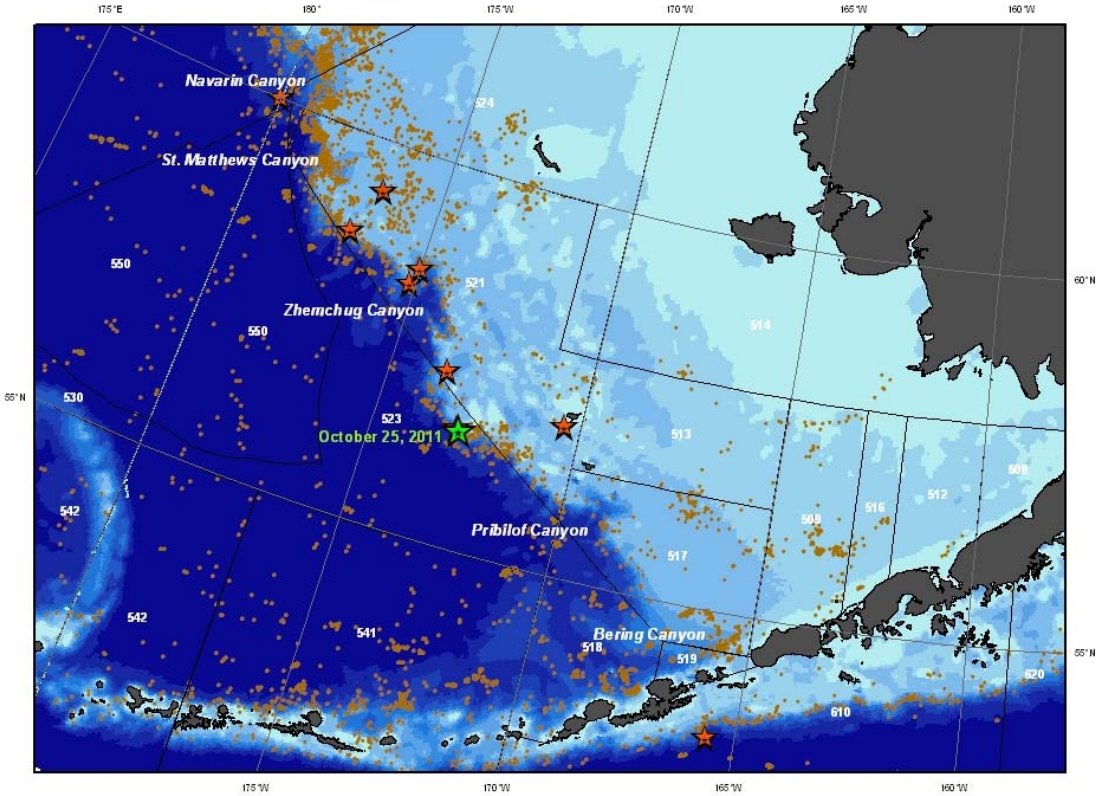
Table 3-22 lists the short-tailed albatrosses reported taken in Alaska fisheries since 1983. With the exception of one take in the Western GOA, all takes occurred along the shelf break in the Bering Sea. The Western GOA take was in the hook-and-line halibut fishery. No takes were reported from 1999 through 2009. No takes with trawl gear have been reported. While the incidental take statement take limits for short-tailed albatross have never been met or exceeded, three short-tailed albatrosses were taken in the BSAI hook-and-line Pacific cod fishery in 2010 (Table 3-22 and Figure 3-14). NMFS is working closely with industry and the observer program to understand the specific circumstances of these incidents.

Table 3-22 Reported takes of short-tailed albatross in Alaska fisheries.

Date of take	Location	Fishery	Age when taken
July 1983	BS	brown crab	juvenile (4 mos)
1 Oct 87	GOA	halibut	juvenile (6 mos)
28 Aug 95*	EAI	hook-and-line	sub-adult (16 mos)
8 Oct 95	BS	hook-and-line	sub-adult
27 Sept 96	BS	hook-and-line	sub-adult (5 yrs)
21 Sept 98	BS	Pacific cod hook-and-line	adult (8 yrs)
28 Sept 98	BS	Pacific cod hook-and-line	sub-adult
27 Aug 2010	BS	Pacific cod hook-and-line	Sub-adult (7 yrs 10 mos)
14 Sept 2010	BS	Pacific cod hook-and-line	Sub-adult (3 yrs 10 mos)
25 Oct 2010	BS	Pacific cod hook-and-line	Sub-adult (less than 2 years)

Source: AFSC.

Figure 3-14 Locations (brown dots) of all Short-tailed albatross locations during September to November 2001-2010, and locations of all STAL takes in Alaska fisheries (red stars) from 1983 to 2010, and location of the most recent STAL take (green star).



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3.5.2 Effects on Seabirds

The PSEIS identifies how the GOA groundfish fisheries activities may directly or indirectly affect seabird populations (NMFS 2004a). Direct effects may include incidental take in fishing gear and vessel strikes. Indirect effects may include reductions in prey (forage fish) abundance and availability, disturbance to benthic habitat, discharge of processing waste and offal, contamination by oil spills, presence of nest predators in islands, and disposal of plastics, which may be ingested by seabirds.

3.5.2.1 Significance Criteria for Seabirds

Criteria for analyzing the potential impacts of these alternatives on seabirds are identified in Table 3-23. These criteria are adopted from the 2006-2007 groundfish harvest specifications EA/FRFA. The GOA Halibut PSC EA (NPFMC 2012) analyzed the GOA non-pollock trawl fisheries as currently prosecuted, and concluded that the fisheries are not likely to result in significantly adverse impacts to seabirds. Alternative 1 is Status Quo, and under that alternative no changes are expected, and no significantly adverse impacts are expected for any seabirds. As with marine mammals, potential impacts from other alternatives are addressed as changes from status quo.

Table 3-23 Criteria used to determine significance of impacts on seabirds.

	Incidental take	Prey availability	Benthic habitat
Insignificant	No substantive change in takes of seabirds during the operation of fishing gear.	No substantive change in forage available to seabird populations.	No substantive change in gear impact on benthic habitat used by seabirds for foraging.
Adverse impact	Non-zero take of seabirds by fishing gear.	Reduction in forage fish populations, or the availability of forage fish, to seabird populations.	Gear contact with benthic habitat used by benthic feeding seabirds reduces amount or availability of prey.
Beneficial impact	No beneficial impact can be identified.	Availability of offal from fishing operations or plants may provide additional, readily accessible, sources of food.	No beneficial impact can be identified.
Significantly adverse impact	Take levels increase substantially from the baseline level, or level of take is likely to have population level impact on seabirds.	Food availability decreased substantially from baseline such that seabird population level survival or reproduction success is likely to decrease.	Impact to benthic habitat decreases seabird prey base substantially from baseline such that seabird population level survival or reproductive success is likely to decrease. (ESA-listed eider impacts may be evaluated at the population level).
Significantly beneficial impact	No threshold can be identified.	Food availability increased substantially from baseline such that seabird population level survival or reproduction success is likely to increase.	No threshold can be identified.
Unknown impacts	Insufficient information available on take rates or population levels.	Insufficient information available on abundance of key prey species or the scope of fishery impacts on prey.	Insufficient information available on the scope or mechanism of benthic habitat impacts on food web.

3.5.2.2 Incidental Take of Seabirds in Trawl Fisheries

The impacts of the Alaska groundfish fisheries on seabirds were analyzed in the Alaska Harvest Specifications EIS (NMFS 2007a), and the GOA halibut PSC EA evaluated these fisheries for their potential impacts to seabirds. Those documents are incorporated here by reference.

Seabirds interact with trawl fishing vessels in several ways. Birds foraging at the water surface or in the water column are sometimes caught in the trawl net as it is brought back on board. These incidental takes are recorded by fisheries observers as discussed below. In addition to getting caught in the fishing nets of trawl vessels, some species strike cables attached to the infrastructure of vessels or collide with the infrastructure itself. Large winged birds such as albatrosses are most susceptible to mortalities from trawl-cable strikes (CCAMLR 2006). Third wire cables have been prohibited in some southern hemisphere fisheries since the early 1990s due to substantial albatross mortality from cable strikes. No short-tailed albatross or black-footed albatross have been observed taken with trawl gear in Alaska fisheries, but mortalities to Laysan albatrosses have been observed.

From 2007 to 2010, the estimated seabird bycatch for the Alaskan groundfish GOA fisheries, pelagic and non-pelagic gear combined, ranged from 0 in 2009 to 122 in 2010 (NMFS 2011b). Northern fulmars were the only species of seabird reported in GOA trawl nets during those years.

Seabird takes in the GOA trawl fisheries are relatively low, based on standard observer sampling and NMFS estimation. However, standard species composition sampling of the catch does not account for

additional mortality due to gear interactions. Special data collections of seabird gear interactions have been conducted, and preliminary information indicates that mortalities can be greater than the birds accounted for in the standard species composition sampling (Melvin 2011; Fitzgerald in prep). To date, strikes of trawl vessels or gear by the short-tailed albatross have not been reported by observers. The probability of short-tailed albatross collisions with third wires or other trawl vessel gear in Alaskan waters cannot be assessed; however, given the available observer data and the observed at-sea locations of short-tailed albatrosses relative to trawling effort, the likelihood of short-tailed albatross collisions are very rare, but the possibility of such collisions cannot be completely discounted. USFWS' biological opinion included an Incidental Take Statement (ITS) of two short-tailed albatross for the trawl groundfish fisheries off Alaska (USFWS 2003b).

3.5.2.3 Prey Availability Disturbance of Benthic Habitat

As noted in Table 3-24, seabird prey species in the GOA are not usually fish that are targeted by non-pelagic commercial fishing gear. However, seabird species may be impacted indirectly by effects of the non-pelagic trawl gear on the benthic habitat of seabird prey, bottom fish, mollusks, and crustaceans. The essential fish habitat final environmental impact statement provides a description of the effects of trawling on bottom habitat in the appendix (NMFS 2005b), including the effects of the commercial fisheries on the GOA slope and shelf.

It is not known how much seabird species use benthic habitat directly, although research funded by the North Pacific Research Board has been conducted on foraging behavior of seabirds in the Bering Sea in recent years. Thick-billed murres easily dive to 100 m, and have been documented diving to 200 m; common murres also dive to over 100 m. Since cephalopods and benthic fish compose some of their diet, murres could be foraging on or near the bottom (K. Kuletz, USFWS, personal communication, October 2008).

A description of the effects of prey abundance and availability on seabirds is found in the PSEIS (NMFS 2004a) and the Alaska Groundfish Harvest Specifications EIS (NMFS 2007a). Detailed conclusions or predictions cannot be made regarding the effects of forage fish bycatch on seabird populations or colonies. NMFS (2007a) found that the potential impact of the entire groundfish fisheries on seabird prey availability was limited due to little or no overlap between the fisheries and foraging seabirds based on either prey size, dispersed foraging locations, or different prey (NMFS 2007a). The majority of bird groups feed in vast areas of the oceans, are either plankton feeders or surface or mid-water fish feeders, and are not likely to have their prey availability impacted by the nonpelagic trawl fisheries. There is no directed commercial fishery for those species that compose the forage fish management group, and seabirds typically target juvenile stages rather than adults for commercial target species. Most of the forage fish bycatch is smelt taken in the pollock fishery, which is not included in this action.

Table 3-24 Seabirds in the Gulf of Alaska: foraging habitats and common prey species.

Species	Foraging habitats	Prey
Short-tailed albatross	Surface seize and scavenge	Squid, shrimp, fish, fish eggs
Black-footed albatross	Surface dip, scavenge	Fish eggs, fish, squid, crustaceans, fish waste
Laysan albatross	Surface dip	Fish, squid, fish eggs and waste
Spectacled eider	Diving	Mollusks and crustaceans
Steller's eider	Diving	Mollusks and crustaceans
Black-legged kittiwake	Dip, surface seize, plunge dive	Fish, marine invertebrates
Murrelet (Kittlitz's and marbled)	Surface dives	Fish, invertebrates, macroplankton
Shearwater spp.	Surface dives	Crustaceans, fish, squid
Northern fulmar	Surface fish feeder	Fish, squid, crustaceans
Murres spp.	Diving fish-feeders offshore	Fish, crustaceans, invertebrates
Cormorants spp.	Diving fish-feeders nearshore	Bottom fish, crab, shrimp
Gull spp.	Surface fish feeder	Fish, marine invertebrates, birds
Auklet spp.	Surface dives	Crustaceans, fish, jellyfish
Tern spp.	Plunge, dive	Fish, invertebrates, insects
Petrel spp.	Hover, surface dip	Zooplankton, crustaceans, fish
Jaeger spp.	Hover and pounce	Birds, eggs, fish
Puffin spp.	Surface dives	Fish, squid, other invertebrates

Source: USFWS 2006, Dragoo et al. 2010.

Seabirds that feed on benthic habitat, including Steller's eiders, scoters, cormorants, and guillemots, may feed in areas that could be directly impacted by nonpelagic trawl gear (NMFS 2004b). A 3-year otter trawling study in sandy bottom of the Grand Banks showed either no effect or increased abundance in mollusk species after trawling (Kenchington et al. 2001), but clam abundance in these studies was depressed for the first 3 years after trawling occurred. McConnaughey et al. (2000) studied trawling effects using the Bristol Bay area Crab and Halibut Protection Zone. They found more abundant infaunal bivalves (not including *Nuculana radiata*) in the highly fished area compared to the unfished area. In addition to abundance, clam size is important to these birds. Handling time is very important to birds foraging in the benthos, and their caloric needs could change if a stable large clam population is converted to a very dense population of small first year clams. Additional impacts from nonpelagic trawling may occur if sand lance habitat is adversely impacted. This would affect a wider array of piscivorous seabirds that feed on sand lance, particularly during the breeding season, when this forage fish is also used for feeding chicks.

Recovery of fauna after the use of nonpelagic trawl gear may also depend on the type of sediment. A study in the North Sea found biomass and production in sand and gravel sediments recovering faster (2 years) than in muddy sediments (4 years) (Hiddink et al. 2006). The recovery rate may be affected by the animal's ability to rebury itself after disturbance. Clams species may vary in their ability to rebury themselves based on grain size and whether they are substrate generalist, substrate specialist, or substrate sensitive species (Alexander et al.1993).

3.5.2.4 Alternative 1 Status Quo

Incidental Take

The effects of the status quo fisheries on incidental take of seabirds are described in seabirds is described in the GOA halibut PSC EA (NPFMC 2012), which concluded that these fisheries are not likely to result in significantly adverse impacts to seabirds. It is reasonable to conclude that incidental take of seabirds would not change under the Status Quo alternative.

Prey Availability and Benthic Habitat

The status quo groundfish fisheries do not harvest seabird prey species in an amount that would decrease food availability enough to impact survival rates or reproductive success, nor do they impact benthic habitat enough to decrease seabird prey base to a degree that would impact survival rates or reproductive success. Under the Status Quo alternative no substantive changes are expected, and impacts are expected to be negligible.

3.5.2.5 Alternative 2

Incidental Take

The range of hard caps under Alternative 2 could potentially decrease the number of incidental takes of seabirds in the GOA trawl fisheries. A lower hard cap may preclude trawl fishing in the non-pollock GOA fisheries at some point in the fishing season, which would reduce the potential for incidental takes in fishing areas that overlap with seabird distributions. If the fleet is able to identify hotspots with high Chinook salmon catch rates, and avoid fishing in these areas, the distribution of effort in the fishery may change to some extent, although likely within the existing footprint of the fishery. To the extent that the redistribution of effort results in more vessel-days of effort, there could potentially be an increase in the likelihood of incidental takes of seabirds, compared to the status quo. However, the likely closures are relatively small compared to the capacity of the GOA groundfish trawl fleet, and seasons are likely to remain short. Overall effects on seabird takes are not likely to change substantially, and impacts are expected to be negligible. A higher hard cap would allow for more fishing and potentially more incidental takes of seabirds than a lower cap.

Prey Availability and Benthic Habitat

Under a hard cap, the fishing season has the potential to be shorter than the status quo fishery in high Chinook salmon PSC years. Decreased fishing effort could further reduce removals of seabird prey species and further mitigate any effects on benthic habitat at an insignificant level. Again, changes are not expected to be substantial, and any impacts are expected to be negligible.

3.5.2.6 Summary of Effects

Many seabird species utilize the marine habitat of the GOA. Several species of conservation concern and many other species could potentially interact with trawl cables. The AFSC estimates of incidental takes are small relative to total estimates of seabird populations. However, those estimates do not include cable-related trawl mortalities. Recent modeling suggests that even if there were to be a large increase in trawl cable incidental takes of short-tailed albatross (the only seabird listed as endangered under the ESA), it would have negligible effects on the recovery of the species. Table 3-25 summarizes the action alternatives' impacts to seabird populations.

Table 3-25 Summary of impacts to seabirds from alternatives in this analysis.

Alternative	Impact on incidental take of seabirds in Alaska waters	Impact on prey density and benthic habitat
Alternative 1	Seabird takes and disruptions to benthic habitat and prey availability are at low levels and are mitigated (to some degree) by current spatial restrictions on the fisheries in the Gulf of Alaska. Insignificant effects.	Seabird takes and disruptions to benthic habitat and prey availability are at low levels and are mitigated (to some degree) by current spatial restrictions on the fisheries in the Gulf of Alaska. Insignificant effects.
Alternative 2	Seabirds are taken by fisheries in minor amounts compared to population levels. Insignificant effects. Increased observer coverage would improve monitoring of incidental takes.	Overall prey availability is not affected by the groundfish fisheries at a level resulting in population level effects. Insignificant effects.

3.6 Habitat

Fishing operations may change the abundance or availability of certain habitat features used by managed fish species to spawn, breed, feed, and grow to maturity. These changes may reduce or alter the abundance, distribution, or productivity of species. The effects of fishing on habitat depend on the intensity of fishing, the distribution of fishing with different gears across habitats, and the sensitivity and recovery rates of specific habitat features. In 2005, NMFS and the Council completed the EIS for EFH Identification and Conservation in Alaska (NMFS 2005b). The EFH EIS evaluates the long term effects of fishing on benthic habitat features, as well as the likely consequences of those habitat changes for each managed stock based on the best available scientific information. Maps and descriptions of EFH for the GOA groundfish species are available in the EFH EIS (NMFS 2005b). This document also describes the importance of benthic habitat to different groundfish species and the impacts of different types of fishing gear on benthic habitat. In the trawl fishery, doors, sweeps, and bobbins on the net may contact the seafloor.

3.6.1 Effects of the Alternatives

The effects of the GOA non-pollock trawl fisheries on benthic habitat and EFH were analyzed in the EFH EIS (NMFS 2005b), and that evaluation is incorporated by reference. Table 3-26 describes the criteria used to determine whether the impacts on EFH are likely to be significant. The GOA non-pollock trawl fisheries are prosecuted primarily with non-pelagic trawl gear, although pelagic gear is sometimes used in the rockfish target fishery. Year-round area closures protect sensitive benthic habitat. Appendix B to the EFH EIS describes how non-pelagic and pelagic trawl gear impacts habitat. The long-term effects index (LEI) estimates the proportion of habitat attributes that would be lost if recent fishing patterns continued. In the GOA, estimated reductions of epifaunal and infaunal prey due to fishing are less than 1% for all substrate types. For living structure, LEI impacts ranged between 3% and 9% depending on the substrate. Local areas with LEI values in excess of 50% occur to the east of Kodiak Island in Barnabus, Chiniak, and Marmot Gullies (NMFS 2005b).

In addition to impacting benthic habitat, the non-pollock trawl fisheries catch salmon prey species incidentally, for example, pollock. The catches of these prey species are very small relative to the overall populations of these species. Thus, fishing activities are considered to have minimal and temporary effects on prey availability for salmon.

Table 3-26 Criteria used to estimate the significance of impacts on essential fish habitat.

No impact	Fishing activity has no impact on EFH.
Adverse impact	Fishing activity causes disruption or damage of EFH.
Beneficial impact	Beneficial impacts of this action cannot be identified.
Significantly adverse impact	Fishery induced disruption or damage of EFH that is more than minimal and not temporary.
Significantly beneficial impact	No threshold can be identified.
Unknown impact	No information is available regarding gear impact on EFH.

The analysis in the EFH EIS concludes that current fishing practices in the GOA non-pollock trawl fisheries have minimal or temporary effects on benthic habitat and essential fish habitat. These effects are likely to continue under Alternative 1, and are not considered to be significant.

Alternative 2 would establish a hard cap that limits PSC of Chinook salmon in the GOA non-pollock trawl fisheries. A lower hard cap may result in the non-pollock trawl fisheries closing before the TACs are reached, which may reduce impacts of this fishery on benthic habitat. If the fleet is able to identify hotspots with high Chinook salmon catch rates, and avoid fishing in these areas, the distribution of effort in the fishery may change to some extent, although it is likely to remain within the overall footprint of the non-pollock trawl fisheries. A higher hard cap would allow for more groundfish fishing, and impacts to benthic habitat may be similar to the status quo fishery.

Alternative 2 may reduce the potential adverse effects of fishing on benthic habitat compared to the status quo, if the fishery closes early. To the extent that the redistribution of effort results in more vessel-days of effort, there could potentially be an increase in the habitat impacts compared to the status quo. However, regulatory constraints (e.g., seasonal allocations of TAC and halibut PSC) will continue to shape the temporal pattern of fishing, and the overall footprint of the fishery is unlikely to change. The potential effects on an area would be constrained by the amount of the groundfish TACs and by the existing habitat conservation and protection measures. To the extent that Alternative 2 reduces effort in the GOA non-pollock trawl fisheries, this alternative would reduce impacts on habitat relative to the status quo. Because Alternative 2 is not likely to result in significantly adverse effects to habitat, the impacts of Alternative 2 are likely insignificant.

Mitigation

Currently, non-pelagic and pelagic trawl gear is subject to a number of area closures in the GOA to protect habitat and marine species. If new information emerges to indicate that the GOA non-pollock trawl fisheries are having more than a minimal impact on EFH, the Council may consider additional habitat conservation measures. The Council conducts a review of EFH for all managed species every five years.

3.7 Ecosystem

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

The GOA non-pollock trawl fisheries potentially impact the GOA ecosystem by relieving predation pressure on shared prey species (i.e., species which are prey for both groundfish and other species),

reducing prey availability for predators of target groundfish, altering habitat, imposing PSC and bycatch mortality, or by ghost fishing caused by lost fishing gear. Ecosystem considerations for the GOA groundfish fisheries are summarized annually in the GOA Stock Assessment and Fishery Evaluation report (Zador 2012). 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 GOA groundfish fisheries on the ecosystem is discussed annually in the Ecosystem Considerations sections of each chapter of the SAFE report (NPFMC 2011), and was evaluated in the Harvest Specifications EIS (NMFS 2007a). The significance criteria used in that analysis are incorporated here by reference. The analysis concluded that the current GOA non-pollock trawl fisheries do not produce population-level impacts to marine species or change ecosystem-level attributes beyond the range of natural variation. Consequently, Alternative 1 is not expected to have a significant impact on the ecosystem.

Alternative 2 will either maintain or reduce the overall level of groundfish harvest from the status quo. The level of fishing effort by non-pollock trawl vessels is not expected to change, except in years where the fisheries are closed early due to the attainment of the Chinook salmon PSC cap. While the location and timing of fishing activities may show some localized changes, overall the fleets are constrained by regulatory measures (e.g., seasonal allocations of TAC and halibut PSC) in the location and timing of the fisheries. As a result, Alternative 2 is not likely to have a significant impact on the ecosystem.

3.8 Cumulative Effects

This section analyzes the cumulative effects of the actions considered in this environmental assessment. A cumulative effects analysis includes the effects of past, present, and reasonably foreseeable future action (RFFA). The past and present actions are described in several documents and are incorporated by reference. These include the PSEIS (NMFS 2004), the EFH EIS (NMFS 2005b), the harvest specifications EIS (NMFS 2007a), the Central Gulf of Alaska Rockfish Program EA (NPFMC 2011b), and the EA/RIR/IRFA to Revise GOA Halibut PSC Limits (NPFMC 2012). This analysis provides a brief review of the RFFAs that may affect environmental quality and result in cumulative effects. Future effects include harvest of federally managed fish species and current habitat protection from federal fishery management measures, harvests from state managed fisheries and their associated protection measures, efforts to protect endangered species by other federal agencies, and other non-fishing activities and natural events.

The most recent comprehensive analysis of RFFAs for the groundfish fisheries is in the Harvest Specifications EIS (NMFS 2007a). No additional RFFAs have been identified for this proposed action. The RFFAs are described in the Harvest Specifications EIS Section 3.3 (NMFS 2007a), are applicable for this analysis, and are incorporated by reference. A summary table of these RFFAs is provided below (Table 3-27). The table summarizes the RFFAs identified applicable to this analysis that are likely to have an impact on a resource component within the action area and timeframe. Actions are understood to be human actions (e.g., a proposed rule to designate northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). CEQ regulations require a consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. This is interpreted as indicating actions that are more than merely possible or speculative. Actions have been considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or the publication of a proposed rule. Actions simply "under consideration" have not generally been included because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen. Identification of actions

likely to impact a resource component within this action's area and time frame will allow the public and Council to make a reasoned choice among alternatives.

Table 3-27 Reasonably Foreseeable Future Actions.

Ecosystem-sensitive management	• Increasing understanding of the interactions between ecosystem components, and ongoing efforts to bring these understandings to bear in stock assessments, • Increasing protection of ESA-listed and other non-target species components of the ecosystem, • Increasing integration of ecosystems considerations into fisheries decision-making
Fishery rationalization	• Continuing rationalization of federal fisheries off Alaska, • Fewer, more profitable, fishing operations, • Better harvest, PSC, and bycatch control, • Rationalization of groundfish in waters in and off Alaska, • Expansion of community participation in rationalization programs
Traditional management tools	• Authorization of groundfish fisheries in future years, • Increasing enforcement responsibilities, • Technical and program changes that will improve enforcement and management
Other federal, state, and international agencies	• Future exploration and development of offshore mineral resources • Reductions in United States Coast Guard fisheries enforcement activities • Continuing oversight of seabirds and some marine mammal species by the USFWS • Expansion and construction of boat harbors • Expansion of state groundfish fisheries • Other state actions • Ongoing EPA monitoring of seafood processor effluent discharges
Private actions	• Commercial fishing • Increasing levels of economic activity in coastal zone off Alaska • Expansion of aquaculture

Reasonably foreseeable future actions that may affect target and prohibited species are shown in Table 3-27. These actions include but are not limited to the implementation of Amendment 89 Area closures for *Chinoecetes Bairdi* Crab Protection in the Gulf of Alaska Groundfish Fisheries (NPFMC 2010b), and Amendment 95 Revision GOA Halibut PSC Limits. The Council is also in the very early stages of considering an action to institute a catch share system for the Central GOA trawl fisheries, in order to provide necessary tools for PSC management (Section 1.5), but this action is not yet sufficiently advanced to be considered reasonably foreseeable. Ecosystem management, rationalization, and traditional management tools are likely to improve the protection and management of target and prohibited species, including targets of the non-pollock trawl fleet and Chinook salmon, and are not likely to result in significant effects when combined with the direct and indirect effects of Alternative 2. Ongoing research efforts are likely to improve our understanding of the interactions between the harvest of groundfish and salmon. NMFS is conducting or participating in several research projects to improve understanding of the ecosystems, fisheries interactions, and gear modifications to reduce salmon PSC. The State of Alaska manages the commercial salmon fisheries off Alaska. The State's first priority for management is to meet spawning escapement goals to sustain salmon resources for future generations. Subsistence use is the highest priority use under both State and federal law. Surplus fish beyond escapement needs and subsistence use are made available for other uses, such as commercial and sport harvests. The State carefully monitors the status of salmon stocks returning to Alaska streams and controls fishing pressure on these stocks. Other government actions and private actions may increase pressure on the sustainability of target and prohibited fish stocks either through extraction or changes in the habitat or may decrease the market through aquaculture competition, but it is not clear that these would result in significant

cumulative effects. Any increase in extraction of target species would likely be offset by federal management. These are further discussed in Sections 4.1.3 and 7.3 of the Harvest Specifications EIS (NMFS 2007a).

Reasonably foreseeable future actions for non-specified and forage species include ecosystem-sensitive management, traditional management tools, and private actions. Impacts of ecosystem-sensitive management and traditional management tools are likely to be beneficial as more attention is brought to the taking of non-specified species in the fisheries and accounting for such takes.

Reasonably foreseeable future actions for marine mammals and seabirds include ecosystem-sensitive management; rationalization; traditional management tools; actions by other federal, state, and international agencies; and private actions, as described in Sections 8.4 and 9.3 of the Harvest Specifications EIS (NMFS 2007a). Ecosystem-sensitive management, rationalization, and traditional management tools are likely to increase protection to marine mammals and seabirds by considering these species more in management decisions, and by improving the management of the non-pollock trawl fisheries through the restructured Observer Program, catch accounting, seabird avoidance measures, and vessel monitoring systems (VMS). Research into marine mammal and seabird interactions with the non-pollock trawl fisheries are likely to lead to an improved understanding leading to trawling methods that reduce adverse impacts of the fisheries. Changes in the status of species listed under the ESA, the addition of new listed species or critical habitat, and results of future Section 7 consultations may require modifications to groundfish fishing practices to reduce the impacts of these fisheries on listed species and critical habitat. Any change in protection measures for marine mammals likely would have insignificant effects because any changes would be unlikely to result in the PBR being exceeded and would not be likely to jeopardize the continued existence or adversely modify or destroy designated critical habitat. Additionally, since future TACs will be set with existing or enhanced protection measures, we expect that the effects of the fishery on the harvest of prey species and disturbance will not increase in future years.

Any action by other entities that may impact marine mammals and seabirds will likely be offset by additional protective measures for the federal fisheries to ensure ESA-listed mammals and seabirds are not likely to experience jeopardy or adverse modification of critical habitat. Direct mortality by subsistence harvest is likely to continue, but these harvests are tracked and considered in the assessment of marine mammals and seabirds. The cumulative effect of these impacts in combination with measures proposed under Alternative 2 is not likely to be significant.

Reasonably foreseeable future actions for habitat and the ecosystem include ecosystem-sensitive management; rationalization; traditional management tools; actions by other federal, state, and international agencies; and private actions, as detailed in Sections 10.3 and 11.3 of the Harvest Specifications EIS (NMFS 2007a). These actions include but are not limited to the implementation of Amendment 89 Area closures for *Chinoecetes Bairdi* Crab Protection in the Gulf of Alaska Groundfish Fisheries (NPFMC 2010b), and Amendment 95 Revise GOA Halibut PSC Limits. Ecosystem-sensitive management, rationalization, and traditional management tools are likely to increase protection to ecosystems and habitat by considering ecosystems and habitat more in management decisions and by improving the management of the fisheries through the Observer Program, catch accounting, seabird and marine mammal protection, gear restrictions, and VMS. Continued fishing under the harvest specifications is likely the most important cumulative effect on EFH but the EFH EIS (NMFS 2005b) has determined that this effect is minimal. The Council is also considering improving the management of non-specified species incidental takes in the fisheries to provide more protection to this component of the ecosystem. Any shift of fishing activities from federal waters into state waters would likely result in a reduction in potential impacts to EFH because state regulations prohibit the use of trawl gear in much of state waters. Nearshore impacts of coastal development and the management of the Alaska Water Quality Standards may have an impact on EFH, depending on the nature of the action and the level of protection

the standards may afford. Development in the coastal zone is likely to continue, but Alaska overall is lightly developed compared to coastal areas elsewhere and therefore overall impact to EFH are not likely to be great. Many of the GOA non-pollock trawl fisheries have been independently certified to the Marine Stewardship Council environmental standard for sustainable fishing. Overall, the cumulative effects on habitat and ecosystems under Alternative 2 are not likely to be significant.

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). Commercial fishing has not been largely implicated in the GOA ecosystem changes; however, studies of other ecosystems with much larger fishing pressures indicate that fishing, in combination with climate change, can alter ecosystem species composition and productivity (NMFS 2004). 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 groundfish stocks as a result of changing oceanographic conditions. 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). A study linking temperature and salmon bycatch rates in the pollock fishery 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 over the long-term, 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 (NMFS 2009b).

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable future actions listed above, the cumulative impacts of the proposed action are determined to be not significant.

4 Regulatory Impact Review

This Regulatory Impact Review (RIR) examines the costs and benefits of a proposed regulatory amendment to implement Chinook salmon prohibited species catch limits in the trawl fisheries of the Central (regulatory areas 620 and 630) and Western GOA (regulatory area 610) Alaska groundfish fisheries. This chapter includes a description of the current Gulf of Alaska groundfish trawl fisheries, an

analysis of the potential effects of the proposed action on the groundfish fisheries operating under Chinook salmon PSC limitations, and identification of the individuals or groups that may be affected by the action. This section addresses the requirements of Presidential Executive Order 12866 (E.O. 12866), which requires a cost and benefit analysis of Federal regulatory actions.

The requirements of E.O. 12866 (58 51735; October 4, 1993) are summarized in the following statement from the order:

> *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 alternatives 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 further 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.

This RIR examines the costs and benefits of proposed alternatives which include the establishment of a Chinook salmon PSC limit in the Central and Western Gulf of Alaska groundfish trawl fisheries and the apportionment of PSC by regulatory area, harvest type (catcher vessel and catcher/processor), or both.

4.1 Statutory Authority

Under the Magnuson-Stevens Act (16 USC 1801, et seq.), the United States has exclusive fishery management authority over all marine fishery resources found within the EEZ. The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in the regional fishery management councils. In the Alaska Region, the Council has the responsibility for preparing FMPs and FMP amendments for the marine fisheries that require conservation and management, and for submitting its recommendations to the Secretary. Upon approval by the Secretary, NMFS is charged with carrying out the federal mandates of the Department of Commerce with regard to marine and anadromous fish. Gulf of Alaska groundfish fisheries in the EEZ off Alaska are managed under the FMP for Groundfish of the Gulf of Alaska. The Chinook salmon prohibited species catch 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

The purpose of this action is to address the capture of Chinook salmon in the trawl fisheries of the GOA. Chinook salmon are a prohibited species in the GOA groundfish fisheries, and, as such, must be returned

immediately to the sea with a minimum of injury, if caught incidentally in the groundfish fisheries[12]. Under the Magnuson-Stevens Act, the Council is required to minimize bycatch to the extent practicable, as well as to take into account the importance of fishery resources to fishing communities in order to minimize adverse economic impacts on such communities. Chinook salmon are a highly valued species for commercial, recreational, subsistence, and personal use fisheries. While the Council has recently established Chinook salmon PSC limits for the directed pollock trawl fisheries in the GOA, no such PSC limit is currently in effect for other trawl fisheries in the GOA, which also intercept Chinook salmon. Under the regulations, it is incumbent upon fishermen to avoid catching Chinook salmon, however the Council has determined it is necessary to evaluate management measures to protect against the risk of high Chinook salmon PSC in future years.

4.3 Description of the Alternatives

The alternatives that are analyzed in this amendment package were approved by the Council in December 2012; they are listed below and detailed in the sections that follow. These alternatives propose management measures that would apply exclusively to the directed non-pollock trawl fisheries in the Western and Central Gulf of Alaska. A more detailed description of alternatives is included in Sections 2.1, 2.2, and 0.

Alternative 1: Status quo.
Alternative 2: 5,000, 7,500, 10,000, or 12,500 Chinook salmon PSC limit (hard cap).
- Option 1: Apportion limit between Central and Western GOA.
- Option 2: Apportion limit by operational type (CV vs. CP).
- Applies to both options:
  - (a) Apportion proportional to historic average bycatch of Chinook salmon (5 or 10-year average);
  - (b) Apportion proportional to historic average non-pollock groundfish harvest (5 or 10-year average).
- Option 3: No more than 50% or 66% of the annual hard cap limit can be taken before June 1.
- Option 4: Separate Chinook salmon PSC limit (hard cap) to the CGOA rockfish program:
  - (a) 1,500
  - (b) 2,500
  - (c) 3,500
  - Suboption 1: Divide by sector (CV and CP) based on actual Chinook salmon PSC usage by sector for the rockfish catch share program years of 2007-2012.
    Each LLP holder within sector will receive an allocation of Chinook salmon PSC equivalent to the license's proportion of the sector's target rockfish catch history from the program's initial allocations. Member LLP allocations will be allocated to their respective cooperative.
  - Suboption 2: On October 1st, rollover all but 200, 300, or 400 remaining Chinook salmon to support other fall non-pollock trawl fisheries.
  - Suboptions 1 and/or 2 can be selected for Option 4.

Alternative 3: Full retention of salmon.
Vessels will retain all salmon bycatch until the number of salmon has been determined by the vessel or plant observer and the observer's collection of any scientific data or biological samples from the salmon has been completed.

[12] Except when their retention is authorized by other applicable law for biological sampling or for programs such as the Prohibited Species Donation Program.

Note, both Alternative 2 and Alternative 3 could be selected by the Council in their preferred alternative. Likewise, under Alternative 2, both Option 1 and Option 2, or Option 2 and Option 3, could be selected by the Council; Option 4 can be selected with any of the other options.

4.4 Description of Gulf of Alaska Trawl Fisheries

The groundfish trawl fisheries in the Central and Western regulatory areas of the Gulf of Alaska are comprised of directed fisheries for pollock, Pacific cod, flatfish, and rockfish species. GOA trawl fisheries open on January 20 and close on December 31, unless NMFS intercedes with a closure to prevent the exceeding of annual TAC or established PSC limits for Pacific halibut (or Chinook salmon in the GOA pollock trawl fishery). Regulations prescribe seasons for pollock, Pacific cod and rockfish within the fishing year (50 C.F.R. 679.23). In the absence of management closures, directed pollock fishing is permitted in A- and B-seasons from January 20 to May 31 and in C and D seasons from August 25 to November 1. Likewise, directed Pacific cod fishing is permitted in the A season from January 20 to June 10 and the B season from September 1 to November 1. In the Central GOA, directed rockfish fishing is permitted from May 1 to December 31. In the Western GOA, directed rockfish fishing is permitted beginning on July 1. Directed flatfish fishing is permitted in either regulatory area from January 20 to December 31.

While these regulatory fishing seasons define beginning- and end-points for GOA trawl activity, the pattern of fishing behavior in a given year is complex and largely driven by participants' ability to be active in multiple fisheries. Beyond regulatory-established season dates, the factors that influence intra-annual behavior include relative value of various target species, interacting directed fishing closures due to species TAC limits or PSC limits, and seasonal fish stock abundance. Section 4.4.2 outlines the extent to which registered license holders participate in multiple GOA fisheries, and Section 4.4.8 details recent historical fishing patterns in GOA non-pollock trawl fisheries. Though this analysis focuses on GOA non-pollock trawl fisheries, it is important to note that many participants also trawl for GOA pollock (see Section 4.4.5 for a breakdown of GOA groundfish vessels that landed pollock and non-pollock). Historical Chinook salmon PSC for trips targeting pollock are not directly considered in the analysis of proposed non-pollock Chinook salmon PSC apportionment, but understanding fishermen's total GOA groundfish participation is nonetheless critical to discussing potential regulatory impacts.

A variety of factors influence the potential return that may be realized from fisheries and PSC usage. Local processing markets vary across species. The timing of fish aggregations (particularly in the Pacific cod fishery) may affect choices of when to prosecute those fisheries, as increased aggregation often results in cost savings from increased catch per unit of effort and decreased PSC. Roe conditions also influence the timing of fishing activity (especially in the pollock fishery). Understanding both these choices and their interaction with management is critical when considering the potential effects of implementing Chinook salmon PSC limits in the GOA non-pollock trawl fisheries. Historical time trends in the prosecution of GOA target fisheries reflect these choices in aggregate, and provide a guideline in developing this analysis.

Several existing management actions interact in the GOA and are relevant to the present Council action under review. GOA trawl fisheries are currently subject to PSC limits on Pacific halibut (GOA Groundfish FMP Amendment 18, modified by Amendment 95) and Chinook salmon in the pollock fishery (Amendment 93). The Chinook salmon PSC limit in the pollock fishery only went into effect during the C-season of the 2012 fishing year, so its effect is not yet reflected in the historical catch records reported in this analysis. Halibut PSC limits are apportioned by gear sector, while Chinook salmon PSC in the pollock trawl fishery is apportioned by regulatory area. Moreover, a portion of the GOA trawl fleet participates in cooperative programs such as the Central GOA Rockfish Program, the Bering Sea pollock cooperative program (or American Fisheries Act), the Bering Sea and Aleutian

Islands crab program, and the Amendment 80 (Bering Sea and Aleutian Islands non-pollock trawl catcher/processor) fisheries. Direct apportionment of PSC to cooperatives, such as the halibut PSC that was allocated to the Rockfish Program in Amendment 95, can reduce the negative effect of non-apportioned PSC on a cooperative's ability to mitigate a race to fish (and the associated harms and inefficiencies). Further discussion of cooperative management structures under a PSC hard cap is included in Section 4.7.3.

4.4.1 Data Caveats

Because the Council has asked for consideration of both 5- and 10-year groundfish and PSC histories as the basis for potential PSC apportionment, this analysis utilizes some data that pre-dates the full implementation of NOAA's current Catch Accounting System (CAS). CAS, fully implemented during the 2003 fishing year, utilizes logbook data, while data from prior time periods come from a blend of fish ticket records and the weekly production reports made by processors. The shift to CAS did not directly alter PSC estimation methods. Throughout the document, the analysts use CAS data from 2003 to 2011 in order to maintain data source consistency and because the pre-2003 blend data is less reliable in distinguishing between catch that occurred in federal waters and catch that occurred inside the three-mile management boundary.

The analysts will often refer to target species or target fisheries as a frame for describing the last decade of GOA non-pollock trawl fishing, and for characterizing the potential impacts of establishing Chinook salmon PSC limits.[13] A fishing trip may still be designated as having targeted a species for which directed fishing was closed, if the majority of a trip's landings were comprised of a closed species retained under MRAs. Secondary species, for which directed fisheries do not exist, may also be recorded as a trip target. Trip target records represent the best available harvest data.

NOAA's CAS reports the timing of harvest records by week-ending date (WED). WED is the calendar date (month and day) on the end of the week during which catch was recorded. The reported WED for CVs is generally determined based on when catch is delivered to shoreside facilities. A fishing trip may span parts of multiple weeks; in some cases, the recorded WED may correspond to the week after fish were actually brought on board. CPs may account for harvest and record a WED while still at sea during an extended trip; as such, WED may be a slightly more precise measure of when catch occurred for CP vessels. This analysis often notes the timing of harvest and Chinook PSC throughout the year by WED. These data are as accurate as possible, but should be considered accurate to one-to-two weeks from the time that actual catch was made. When comparing WED across years, the analysts report the "AGENCY_WEEK," numbered 1 through 53. The agency week is not linked to a particular set of calendar days. Using agency weeks assists in making comparisons across years, but important regulatory opening and closure dates (such as the January 20 GOA groundfish opening, or the September 1 Pacific cod B-season opening) may occur during a slightly different agency weeks over a set of years.

4.4.2 Participation

The data used to describe fishery participation come from diversification tables provided by AKFIN. These data represent actual landings of each species group, whereas the data used to describe groundfish harvest and Chinook salmon PSC history are categorized by trip target species. For this reason, the revenue figures reported in Table 4-2 and Table 4-7 are *not* used for direct comparison to harvest (as

[13] Target species is the designation used by NOAA's CAS when reporting on fishing and related activity. When catch from a fishing trip is reported, the trip target is designated *ex post facto* according to an algorithm that relies on quantities of the various species harvested. The recorded trip target is often, but not always, the species that the skipper was directing on during fishing activity. It is important to note that target species is a classification for catch reporting, but it is not the management lever used by NMFS. The Agency may close directed fishing for a given species, pursuant to TAC usage or PSC allowances.

dollars per metric ton) and PSC (as revenues generated per Chinook salmon PSC). Rather, revenue data in the following subsections reflect the GOA trawl fleets' level of dependency on various target species and GOA groundfish in general. Also note that these tables aggregate several flatfish species that are reported separately in trip target data. Here, "flatfish" includes shallow water flatfish, deep water flatfish, arrowtooth flounder, rex sole, and flathead sole.

Table 4-2 and Table 4-7 also describe the amount of latent effort in the GOA trawl fisheries. Many CV and CP vessels hold Central and Western GOA trawl licenses, but have not been active during the analyzed time period. The difference between the number of licensed vessels and active vessels reflects the potential amount of increased participation in a particular fishery. Moreover, fishers with licenses to trawl in both the Central and Western GOA may have an opportunity to move between areas and fish where Chinook PSC is available. If PSC is apportioned by regulatory area, fishers licensed in both the Central and Western GOA could relocate and continue fishing once the PSC limit has been attained in one area. As a result, dual licensed fishers may feel less incentive to avoid PSC in an area that is nearing its limit.

4.4.2.1 Annual pattern of trawl fleet participation

Individual GOA non-pollock trawl participants may not prosecute every available directed fishery throughout the entire calendar year. Those participants that focus on early season fisheries, such as A-season Pacific cod, or mid-season fisheries, such as rockfish, could experience a lesser incentive to reduce Chinook salmon PSC if the expected consequence is a late-year closure. Conversely, participants that derive a significant share of their revenue from late-season fisheries, such as flatfish, could be disproportionately disadvantaged by other participants' lack of incentive to avoid PSC.

Table 4-1 provides an active vessel count for each potential pattern of annual fishery participation. The calendar year is divided into four three-month quarters (January-March, April-June, July-September, October-December). A vessel that participates throughout the calendar year, recording his or her first landing during a week ending in Quarter 1 and his or her final landing in a Quarter 4 week, would be counted in the top-right cell (1,4). A vessel that participates only in the first calendar quarter would be counted in the top-left cell (1,1). Calendar quarters are a rough measure of participation, but they capture the major time-distribution patterns of fishing behavior as dictated by participation in the principal non-pollock groundfish target fisheries. For example, vessels that do not begin fishing in Quarter 1 are likely not targeting Pacific cod; vessels that begin fishing in Quarter 2 or 3 are likely focused on rockfish; vessels that do not participate in Quarter 4 are not "topping off" on late-year flatfish trips. The number of vessels whose participation ends in Quarters 3 and 4 may provide a rough measure of the active participants who are most susceptible to Gulf-, area-, or sector-wide PSC closures that affect the targeting any non-pollock groundfish species.

Table 4-1 indicates that a significant proportion of the CP fleet completes their GOA participation during Quarter 3 (July-September). Moreover, many of these vessels do not participate in early season fisheries. Only a small portion of the CP fleet fished into Quarter 4, though this could have been an artifact of TAC or Pacific halibut PSC closures during the analyzed period.

By contrast the CV fleet consists of many vessels (~30% to 50%) that fish solely during Quarter 1. These fishers are likely targeting A-season Pacific cod. Excepting 2004 and 2005, a similar proportion of the CV fleet fished throughout all four quarters of the calendar year (2004 and 2005 records show this same proportion of the fleet fishing from Quarter 1 to 3, likely reflecting the effect of a regulatory closure to a key target fishery occurring prior to October). In summary, Table 4-1 indicates that premature Chinook salmon PSC closures would more greatly impact the typical time-distribution of fishing trips for the CV sector.

Table 4-1 Vessel entry and exit of GOA non-pollock trawl fisheries by calendar quarter (2004 to 2011)

Year: 2004

Catcher/Processors

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	1		4		5
2			3		3
3			8		8
4					0
Total	1	0	15	0	16

Catcher Vessels

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	16	3	39		58
2					0
3			6		6
4					0
Total	16	3	45	0	64

Year: 2005

Catcher/Processors

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	1		6		7
2					0
3			9		9
4					0
Total	1	0	15	0	16

Catcher Vessels

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	29	3	30	1	63
2		1			1
3			4		4
4					0
Total	29	4	34	1	68

Year: 2006

Catcher/Processors

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1			1	2	3
2				2	2
3			10		10
4					0
Total	0	0	11	4	15

Catcher Vessels

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	28	4	5	20	57
2				1	1
3			3		3
4					0
Total	28	4	8	21	61

Year: 2007

Catcher/Processors

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1			4	2	6
2			3		3
3			6		6
4					0
Total	0	0	13	2	15

Catcher Vessels

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	31	1	4	19	55
2		1	1	6	8
3					0
4					0
Total	31	2	5	25	63

Year: 2008

Catcher/Processors

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	1		1	2	4
2			1	2	3
3			7		7
4					0
Total	1	0	9	4	14

Catcher Vessels

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	29	3	1	22	55
2			2	4	6
3			1	3	4
4					0
Total	29	3	4	29	65

Year: 2009

Catcher/Processors

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1				2	2
2			2	1	3
3			13		13
4					0
Total	0	0	15	3	18

Catcher Vessels

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	27	2	2	25	56
2				1	1
3				2	2
4					0
Total	27	2	2	28	59

Year: 2010

Catcher/Processors

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1			2	2	4
2			1	1	2
3			11		11
4					0
Total	0	0	14	3	17

Catcher Vessels

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	19	1	6	25	51
2			1		1
3					0
4					0
Total	19	1	7	25	52

Year: 2011

Catcher/Processors

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	1		1	1	3
2		1	2	2	5
3			9		9
4					0
Total	1	1	12	3	17

Catcher Vessels

Beginning Quarter	Ending Quarter 1	2	3	4	Total
1	16	1		29	46
2				1	1
3				3	3
4				3	3
Total	16	1	0	36	53

*(See footnote 14 for further guidance on interpreting Table 4-1). Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

4.4.2.2 Catcher Vessel Fleet

The active GOA catcher vessel (CV) trawl fleet included 100 unique vessels during the 2003 to 2011 period. The most CVs landing GOA groundfish in any given year was 71 (2003), and the fewest was 52 (2010). 62 CVs were active during the 2012 fishing year. 35 of those vessels were part of a Central GOA Rockfish Program cooperative, though only 28 actually made Rockfish Program landings (Table 4-36). 18 active CVs, all of them Rockfish Program participants, were also part of the AFA pollock fleet; only five of these vessels were licensed to an Alaska owner. Overall, 12 of the 36 CVs that were part of a cooperative management fishery in 2012 were Alaska-owned. 26 GOA CVs were not part of any cooperative management program; 13 of these vessels were Alaska-owned.

Table 4-2 summarizes the number of CVs that recorded groundfish landings of a given species or species group, as well as the aggregate revenue generated. CV revenue represents the ex-vessel price received by harvesters when catch is delivered to shoreside processors or tender vessels.[15] Total revenue reflects the gross earnings from all activities, including participation in non-groundfish fisheries.

The table also reports the number of GOA CVs that landed groundfish from the Bering Sea/Aleutian Islands management area. 57 of the 100 GOA CVs landed groundfish from the BSAI management area in at least one year. On average, GOA CVs that landed BSAI groundfish did so in between four and five of the nine years, with a median frequency of three years landing BSAI groundfish. Participants in the GOA CV trawl fleet harvested BSAI groundfish in all years, though yearly revenues from these landings were never greater than those generated by fishing in the Gulf region. On aggregate, CVs that participated in both the GOA and BSAI groundfish fisheries generated 32% of their total 2003-to-2011 revenue in the BSAI. Counting only the records from years that each vessel actually landed BSAI groundfish, the 57 vessels generated 44% of their aggregate revenue in the BSAI when active in that region. Looking only at 2010 and 2011 – the years since recency measures went into effect – BSAI groundfish accounted for 28% of the 57 vessels' aggregate revenue, or 40% of their aggregate revenue in the years that they fished the region.

Table 4-2 Catcher Vessels landing GOA Groundfish, 2003 to 2011

	CV Vessels														Revenue (MM$)		
			Western GOA					Central GOA						BSAI			
				Active Vessels					Active Vessels								
YEAR	Total Licensed Vessels	Active Vessels	WG Licensed Vessels	Flatfish	Pacific Cod	Rockfish	Pollock	CG Licensed Vessels	Flatfish	Pacific Cod	Rockfish	Pollock	Dual Licensed Vessels (CG&WG)	All Groundfish	GOA Groundfish Revenue	BSAI Groundfish Revenue	Total Revenue
2003	221	71	162	21	24	11	19	179	54	51	47	53	120	37	20.6	22.8	58.5
2004	221	63	162	21	21	10	20	179	52	52	46	52	120	33	22.6	16.8	53.0
2005	220	67	178	28	30	25	28	161	45	45	45	45	119	29	31.8	16.3	65.5
2006	218	61	160	28	28	26	28	176	41	41	41	41	118	19	33.1	11.6	63.6
2007	218	63	160	31	31	27	30	176	37	37	37	37	118	28	34.8	19.4	74.3
2008	217	65	160	22	24	15	23	176	42	42	39	42	118	26	45.8	22.2	93.1
2009	211	59	154	24	25	15	25	171	34	34	33	34	114	22	25.0	10.3	53.8
2010	124	52	78	16	16	12	16	97	40	40	37	40	51	23	37.1	12.5	60.3
2011	124	53	78	12	14	11	13	97	46	47	41	46	51	28	38.0	17.5	74.0

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT and AFSC Gross Earnings data compiled by AKFIN; RAM LLP file.

From 2003 to 2009, more than half of the Central and Western GOA CV trawl fleet held licenses for both regulatory areas; this proportion has been lower since 2010. Of the 100 groundfish CVs active during the total period, 29 participated exclusively in the Western GOA and 49 participated exclusively in the Central GOA.

[14] For Table 4-1, cells in the top row of each matrix indicate the number of vessels that reported their first catch of the year in the 1st Quarter (January to March) – and so on. Cells in the first column indicate the number of vessels that recorded their final landing of the year during the 1st Quarter. As an example, the number in the Row 2, Column 4 indicates the number of vessels that made their first landing in the 2nd Quarter (April to June) and their final landing in the 4th Quarter (October to December).
[15] The data in Table 4-2 reflect actual landings by species, as opposed to landings by designated trip target.

For the 2012 fishing year, 18 GOA CVs participated in both the AFA and the Central GOA Rockfish Program fisheries. Of these 18 vessels, 10 were endorsed for groundfish trawling in both the Central and the Western GOA, seven were endorsed only in the Central GOA, and one was endorsed only in the Western GOA. 18 other GOA CVs participated in the Rockfish Program, but not the AFA fishery. Eight of these vessels were endorsed in both the Central and the Western GOA, and the other 10 were endorsed for the Central GOA only. Finally, 26 GOA CVs did not participate in any cooperative management program. 21 of these vessels were endorsed in both the Central and the Western GOA, two were endorsed only in the Central GOA, and three were endorsed only in the Western GOA.

Latent effort in the CV fleet ranged from 150 to 158 inactive license holders between 2003 and 2009. This number fell to 72 and 71 inactive licenses in 2010 and 2011, respectively, with implementation of the GOA trawl recency action in 2010 (GOA FMP Amendment 82). A greater number of licenses were held in the Central GOA, but the proportion of inactive licenses was typically greater in the Western GOA. The same number of CVs, 124, held licenses in 2012 as in 2011; however, the number of active vessels increased from 53 to 62. 16 vessels that did not fish in the GOA non-pollock trawl fishery in 2011 did so in 2012, meaning that seven vessels active in 2011 did not participate. Of the 16 new 2012 vessels, 10 were registered to Alaska owners and six were registered to Washington owners (AKFIN, Catch Accounting data).

Vessel length in the CV fleet directly affects the level of observer coverage and, by extension, the degree to which PSC are based on extrapolation and estimation. Under the current North Pacific Groundfish Observer Program, vessels under 60’ in length are exempt from observer coverage. A vessel greater than or equal to 60’ but less than 125’ must carry an observer during at least 30% of its fishing days in a calendar quarter, and the vessel owners and operators in this coverage category choose when to carry observers. Vessels greater than or equal to 125’ are required to carry an observer on 100% of fishing days. The proposed rule to restructure the Observer Program places all CVs into the partial coverage category – removing the exemption for vessels under 60’ – except when participating in fisheries requiring full observer coverage. The only such full coverage fishery involving GOA groundfish CVs is the Central GOA Rockfish Program fishery.

CVs that landed GOA groundfish during the 2003 to 2011 period ranged in length from 58’ to 144’. The average vessel length in the fleet was 80’, and the median was 81’. The most common vessel length was also the shortest, with 36 vessels of 58’. These 36 vessels comprised the entire portion of the fleet that was less than 60’ in length. Only two GOA CVs measured more than 125’ in length, and each of these vessels was active in only one year (2008).

4.4.2.3 Communities listed on LLP Licenses of catcher vessels

The Economic Stock Assessment and Fishery Evaluation (SAFE), prepared by NMFS, reports vessel operator residency according to the owner’s listed residence, citing the NMFS Restricted Access Management (RAM) License Limitation Program (LLP) records. Tracking participation by the mailing address listed on a vessel owner’s LLP license provides information about which communities are economically dependent on GOA groundfish fisheries. Operator residence, however, is a rough measure of community economic impact, as LLP license addresses do not necessarily reflect a vessel’s homeport. It is likely that a portion of net revenue generated from fishing will also enter the license holder’s home community.

Table 4-3 provides a snapshot of participation and groundfish-related revenue for the 2011 fishing year. Here, groundfish includes rockfish, flatfish, Pacific cod and pollock. On aggregate, the 53 trawl CVs active in 2011 derived 68% of their total groundfish revenue from GOA fisheries. These figures,

presented in millions of dollars, include pollock revenues. Pollock revenue accounted for 54% of Central GOA groundfish revenue (52% for Alaska LLPs, 54% for Washington LLPs, and 52% for Oregon LLPs), and 72% of Western GOA revenue (79% for Alaska LLPs, and 68% for Washington LLPs). Groundfish trawl license holders with Alaska and Oregon addresses derived around three-quarters of their groundfish revenue from GOA fisheries, while Washington-based license holders generated just over half of their 2011 revenue from the GOA. For the 2012 fishing year, 25 of the 62 active CVs were owned by Alaska interests.

Table 4-3 2011 vessel count and groundfish revenue for active GOA catcher vessels, by owner's LLP mailing address

LLP Address		# Catcher Vessels	Groundfish Revenue (MM$)			% Revenue from GOA
State	Locality		Central GOA	Western GOA	BSAI	
Alaska	Kodiak	13	11.22	0.00	4.04	74%
	Other	7	1.65	1.64	0.80	80%
Alaska Total		20	12.87	1.64	4.84	75%
Washington Total		18	6.58	2.96	8.45	53%
Oregon Total		15	14.00	0.00	4.23	77%
Grand Total		53	33.45	4.60	17.52	68%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT and AFSC Gross Earnings data compiled by AKFIN; RAM LLP file.

Table 4-4 provides the full list of communities that were listed on at least one 2011 CV LLP license. Three of the Alaska communities (together representing five active vessels), five of the Washington communities (together representing five active vessels), and two of the Oregon communities (together representing three active vessels) derived 100% of groundfish-related revenue from GOA fisheries.

Table 4-4 Communities listed as owner mailing address on 2011 GOA groundfish trawl LLP catcher vessel licenses

Alaska	Washington	Oregon
Girdwood	Bellingham	Brookings
Homer	Camas	Charleston
King Cove	East Wenatchee	Clackamas
Kodiak	Gig Harbor	Florence
Petersburg	Issaquah	Newport
	Mercer Island	Port Orford
	Renton	Siletz
	Seattle	Sisters
	South Bend	South Beach

Source: RAM LLP file

Tracking participation by vessel home port, rather than owner residence, may give a better indication of where the money spent to operate a vessel enters local economies via fishery-supporting industry. Table 4-5 indicates that 11 vessels whose owners live outside of Alaska are homeported in the state. This 2011 snapshot also shows that vessels homeported in Alaska derive a greater proportion of their groundfish revenue from the GOA groundfish fisheries. As above, the groundfish revenues in Table 4-5 include rockfish, flatfish, Pacific cod and pollock. Table 4-6 lists the communities where the CVs active in 2011 homeported.

Table 4-5 2011 vessel count and groundfish revenue for active GOA catcher vessels, by home port

Home Port		# Catcher Vessels	Groundfish Revenue (MM$)			% Revenue from GOA
State	Locality		Central GOA	Western GOA	BSAI	
Alaska	Kodiak	19	16.60	0.36	4.12	80%
	Other	12	1.57	3.07	3.84	55%
Alaska Total		31	18.17	3.43	7.96	73%
Washington Total		9	4.26	1.62	7.13	45%
Oregon Total		13	12.57	0.00	6.32	67%
Grand Total		53	34.99	5.05	21.40	65%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT and AFSC Gross Earnings data compiled by AKFIN.

Table 4-6 Home port communities for catcher vessels active in the 2011 GOA groundfish trawl fishery

Alaska	Washington	Oregon
Anchorage	Blaine	Brookings
Girdwood	Seattle	Charleston
Juneau		Newport
King Cove		Portland
Kodiak		
Petersburg		
Sand Point		
Unalaska		

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

The Alaska Fisheries Science Center has compiled extensive community profiles for 195 fishing dependent communities in the state. Full community profiles are available at: http://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/CPU.php. It may also be useful to reference these profiles for the communities identified as home to key processing ports in Table 4-10 and Table 4-12.

4.4.2.4 Catcher/Processor Fleet

The active GOA catcher/processor (CP) trawl fleet included 22 unique vessels during the 2003 to 2011 period. The most CP vessels landing GOA groundfish in any given year was 21 (2003), and the fewest was 14 (2008). All 17 of the CPs that were active in the most recent year (2012) are affiliated with the Amendment 80 program. Four active CPs are currently participating in the Central GOA Rockfish Program. One of the Amendment 80/Rockfish Program CPs is also the only AFA CP that is permitted to operate in the GOA. Under the restructured Observer Program, each CP is required to carry an observer on 100% of fishing days.

Table 4-7 summarizes the number of CP vessels that recorded groundfish landings of a given species or species complex, as well as the aggregate revenue generated. CP revenue is based upon first wholesale prices. Total revenue includes earnings generated in non-groundfish fisheries, or when acting in a non-harvest capacity such as a mothership or a tender vessel. As in the CV section, the summary table includes entries for pollock. While there is no directed pollock fishery for CPs in the GOA, the vessels can still harvest pollock up to the MRA limit. The table also reports the number of GOA CP vessels that landed groundfish in the BSAI management area. On aggregate, it is evident that active GOA CP vessels derive the greater part of their gross revenue from fishing outside of the Gulf. Only two CP vessels logged years in which they generated no revenue from BSAI groundfish. One vessel was inactive in the BSAI in eight of nine years, and the other was inactive in the BSAI in one year.

Table 4-7 Catcher/Processor vessels landing GOA groundfish, 2003 to 2011

	CP Vessels														Revenue (MM$)		
			Western GOA					Central GOA					Dual	BSAI			
YEAR	Total Licensed Vessels	Active Vessels	WG Licensed Vessels	Active Vessels				CG Licensed Vessels	Active Vessels				Licensed Vessels (CG&WG)	All Groundfish	GOA Groundfish Revenue	BSAI Groundfish Revenue	Total Revenue
				Flatfish	Pacific Cod	Rockfish	Pollock		Flatfish	Pacific Cod	Rockfish	Pollock					
2003	38	21	31	15	9	14	15	29	15	12	13	10	19	20	19.7	124.2	165.8
2004	38	16	29	14	14	13	11	28	9	10	11	7	19	16	13.5	121.7	143.1
2005	38	16	29	12	13	11	10	28	9	11	12	9	19	15	20.7	148.8	185.1
2006	38	15	27	11	11	10	9	28	12	11	8	8	17	14	27.3	119.6	159.7
2007	37	15	26	13	13	11	12	27	9	9	8	8	16	14	21.2	131.2	176.3
2008	37	14	26	11	11	11	10	27	9	9	10	9	16	12	20.3	148.3	217.5
2009	37	18	26	14	14	14	13	27	12	11	11	11	16	17	20.3	196.5	234.9
2010	28	17	20	13	13	13	13	21	9	9	10	10	13	16	24.1	241.8	264.9
2011	28	17	20	14	14	14	14	21	9	9	9	9	13	16	36.3	284.1	366.2

Source: NMFS Alaska Region At-Sea Production Reports, data compiled by AKFIN in Comprehensive_WPR; RAM LLP file.

Roughly half of the Central and Western GOA CP trawl fleet held licenses for both regulatory areas. Of the 22 active groundfish CP vessels, four participated only in Western GOA fisheries, while three participated only in Central GOA fisheries (with one additional vessel that recorded Western GOA groundfish landings for one species in one year). Participation in the BSAI groundfish fishery was consistent across vessels. On average, GOA CP vessels landed BSAI groundfish in at least six of the nine years analyzed, with a median value of 7.5 years landing BSAI groundfish. Each of the vessels in this operational type sector landed BSAI groundfish in at least one year, and only four recorded BSAI landings in fewer than four years.

Latent effort in the CP fleet ranged from 17 to 23 inactive licenses from 2003 to 2009. Inactive permits fell to 11 in 2010 and 2011, following the GOA trawl recency action. The total number of licenses held was roughly similar in the two regulatory areas, though on the whole more vessels participated in Western GOA fisheries. License holdings in 2012 have remained at the same level as 2011.

Table 4-8 provides a snapshot of 2011 CP participation and revenue in Alaskan groundfish fisheries. Here, groundfish includes rockfish, flatfish, Pacific cod and pollock. CP vessels derived the vast majority of their revenue outside of the GOA, particularly those vessels that were homeported in Alaska. Confidentiality limitations prevent reporting Alaska vessels by their home port community. 2011 active vessels that homeported in Alaska did so in Kodiak and Dutch Harbor. The vessels that homeported in Kodiak did not participate in the Central GOA groundfish trawl fisheries.

Table 4-8 2011 vessel count and groundfish revenue for active GOA catcher/processors, by home port

Home Port	# Catcher/Processors	Groundfish Revenue (MM$)			% Revenue from GOA
State		Central GOA	Western GOA	BSAI	
Alaska	5	0.45	3.33	67.57	5%
Other	12	26.35	6.17	221.95	13%
Grand Total	17	26.80	9.50	289.53	11%

Source: NMFS Alaska Region At-Sea Production Reports, data compiled by AKFIN in Comprehensive_WPR

4.4.3 Processor Participation

Since 2003, GOA catcher vessels have delivered non-pollock groundfish to 10 Alaska communities. CV deliveries reached Alaskan processing interests in Akutan, Dutch Harbor, Homer, Kenai, King Cove, Kodiak, Ninilchik, Sand Point, Seward and Unalaska. Harvest has not been delivered to Homer or Kenai since 2003, and Ninilchik received deliveries in only one year (2006) since 2003. Processors in Seward only received non-pollock harvest in 2004 and 2011. The catcher/processor interests that harvest GOA non-pollock species are registered in four Washington cities, Dutch Harbor, Alaska, and Rockland, Maine. Washington interests are based in Bellingham, Renton, Seattle and South Bend.

Table 4-9 Location or Intent to Operate (ITO) registration for processors taking non-pollock groundfish deliveries, 2007 to 2011

		Shorebased Processor	Floating Processor	Catcher/ Processor
AK	Akutan	1		
	Dutch Harbor	2	1	6
	King Cove	1	1	
	Kodiak	14		
	Sand Point	1		
	Seward	3		
	Unalaska	1		
WA	Bellingham			2
	Renton			4
	Seattle		6	22
	South Bend			1
Other				2

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

The data used in this section to describe processor participation by port location are presented as cumulative totals from 2007 to 2011. Summed harvest weight or catch value illustrate each location's relative share of GOA non-pollock activity. Because wholesale revenue is the most appropriate measure for considering processor outcomes, catch value is presented as first wholesale gross revenue for both CPs and CVs. The 2007 to 2011 period was chosen for analysis in order to avoid summing together years before and after Rockfish Pilot Program implementation, which is likely to have altered temporal and spatial aspects of landings for a set of important GOA non-pollock groundfish species.

During the 2007 to 2011 period, 62% (212,006 mt) of all GOA non-pollock groundfish was processed in Kodiak. These landings generated $248.2 million dollars, or 59% of all GOA non-pollock groundfish trawl gross first wholesale revenue. Over the same period, slightly more than 30% of harvest was taken by Washington-based CPs, accounting approximately 30% of total GOA non-pollock gross wholesale revenue. Sand Point and King Cove shoreplants and Dutch Harbor based catcher processors shared roughly equally in the majority of the remaining GOA harvest and revenue.

Port cities, regardless of size, tend to either receive landings from CVs or serve as home ports for CPs. Since 2007, only Dutch Harbor, AK received landings from CVs and served as a homeport for non-pollock CP vessels. Harvest processed by CPs comprised the overwhelming majority of groundfish passing through Dutch Harbor (97.6%). Table 4-10 and Table 4-11 break down recent harvest and gross revenue by operational type. It is important to note that Kodiak, AK, the highest volume port city, relies on deliveries from the CV fleet.

Table 4-10 GOA non-pollock sector CV harvest and revenue by processing port, 2007 to 2011

CITY	Harvest (mt)	% GOA share	Wholesale Gross Revenue ($1,000)	% GOA share
Kodiak	212,006	93%	248,210	90%
Other AK*	14,767	7%	26,440	10%
GOA TOTAL	**226,773**		**274,651**	

* Other AK includes Akutan, Dutch Harbor, King Cove, Sand Point, Seward and Unalaska

Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

Table 4-11 GOA non-pollock sector CP harvest and revenue by home port, 2007 to 2011

CITY	Harvest (mt)	% GOA share	Wholesale Gross Revenue ($1,000)	% GOA share
Dutch Harbor	7,248	6%	9,642	7%
Washington & other #	108,267	94%	136,840	93%
GOA TOTAL	**115,514**		**146,482**	

"Washington includes Bellingham, Renton, Seattle and South Bend; "other" refers to CP vessels owned by interests outside of the North Pacific region
Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

Table 4-12 describes the regulatory area that was the source of harvest for processing localities, from 2007 to 2011. Harvest area, as reflected in the data supporting this table, is determined for each fishing trip and recorded in NOAA's CAS. Most Alaska port cities do generate a portion of wholesale revenue from harvest taken outside of the geographic regulatory area in which they are located. Akutan, for example, is located on the Aleutian Chain but receives 5.7% of its Gulf harvest weight (generating 8.6% of its Gulf wholesale gross revenue) from Central GOA trips. By contrast, Seward and Unalaska, which were also CV-only ports during this period, received only harvest taken in their respective regulatory areas. In Dutch Harbor, the entirety of the revenue-generating harvest weight received from outside of its regulatory area (from the Central GOA) comes from CP harvest registered to Dutch Harbor interests. Washington interests generate a significant proportion of their revenue from both the Central and Western GOA.

Table 4-12 Source of harvest (by regulatory area) for port cities receiving GOA non-pollock groundfish, 2007 to 2011

CITY	Harvest Area	Harvest (mt)	% Port City Total	Wholesale Gross Revenue ($1,000)	% Port City Total
Kodiak	CG	209,319	100.0%	244,804	100.0%
	WG	90	<0.1%	120	<0.1%
Other AK	CG	3,153	14.3%	4,685	13.0%
	WG	18,862	85.7%	31,398	87.0%
Washington & other #	CG	72,423	65.3%	92,670	66.1%
	WG	38,441	34.7%	47,457	33.9%
GOA TOTAL		**342,288**		**421,133**	

"Washington includes Bellingham, Renton, Seattle and South Bend; "other" refers to CP vessels owned by interests outside of the North Pacific region
Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

The highest volume localities – Kodiak, AK and Washington – receive landings throughout the year. However, other important processing locations receive the bulk of their wholesale revenue generating inputs during a particular season. From 2007 to 2011, Dutch Harbor did not receive any landings after August, while King Cove and Sand Point had received nearly all of their respective GOA non-pollock groundfish landings by the end of March (Table 4-13). Processors in these locations do, however, take deliveries from non-groundfish fisheries in the GOA as well as Bering Sea fisheries.

Though the alternatives considered in this Council action do not propose Chinook salmon PSC apportionment by target species, it is worth noting that four of the nine processing localities relied entirely on Pacific cod harvest in order to generate revenue and maintain operations (Akutan, King Cove, Sand

Point, and Unalaska). Processing operations in these cities are tied closely to A-season Pacific cod harvest. Dutch Harbor receives a diverse harvest including nine different target species (or species complexes); nevertheless, rockfish harvest during June and July accounted for a full 67% of the total harvest that Dutch Harbor received from 2007 to 2011 (59% in July alone).

Table 4-13 Monthly GOA non-pollock groundfish harvest received (mt), by port city, 2007 to 2011

CITY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Akutan		*	*									
Dutch Harbor	*	*	*	*	*	*	4,418	*				
King Cove	*	*	*									
Kodiak	17,735	21,846	5,916	34,971	23,222	15,335	13,333	17,195	28,187	24,536	6,003	1,129
Sand Point	*	*	*							*		
Seward	*						*			*		
Unalaska		*										
Washington	2,404	2,122	3,145	16,068	2,345	2,229	55,218	9,585	5,309	8,618	2,119	345
Other					*		*	*				

Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

4.4.4 Community Profiles

Any effects of this action will be most apparent in three communities: Kodiak, Sand Point, and King Cove. This section briefly profiles some of the most relevant characteristics of each of these communities. These profiles are generally summarized from previously published profiles that are available in their entirety at:
http://www.alaskafisheries.noaa.gov/npfmc/current_issues/crab/CommunityProfiles/AK%20Community%20Profiles%20Vol%201.pdf and
http://www.alaskafisheries.noaa.gov/npfmc/current_issues/crab/CommunityProfiles/AK%20Community%20Profiles%20Vol%202.pdf.

Kodiak is a first class city in the Kodiak Island Borough. Although Kodiak has a diversified economy, its identity is that of a fishing community. Its vessels and processing plants are diversified, participating in a variety of GOA and Bering Sea fisheries. Kodiak is the dominant port for vessels and landings from the Central Gulf trawl fisheries. The community is homeport for a substantial minority of the vessels in the fishery and a very large majority of the fishery's processing activity. From 2003 to 2011, between 30% and 40% of the CVs active in GOA groundfish fisheries homeported in Kodiak. The other CVs spend a substantial amount of time in in the community during the pollock fishery and other Central Gulf groundfish trawl fisheries. Approximately 6 or 7 Kodiak processors compete for and process the large majority of the landings from the Central Gulf trawl fisheries. These characteristics effectively mean that the Central Gulf trawl fisheries are Kodiak based. Kodiak is also home to the largest and most diverse fishery support sector in Alaska. These businesses serve all of the fleets homeported in Kodiak and that deliver to Kodiak processors.

Processors are among the largest employers in Kodiak and are known to support a year-round resident workforce. This workforce is supplemented in peak seasons with labor from outside the community. Although non-pollock groundfish are of secondary importance in value to species such as salmon and halibut and have less volume than pollock, they are important contributors to both the overall value and volume of processing and to filling gaps in processing in the community. Similarly, the trawl fleet has relatively few vessels when compared to the larger Kodiak fleets that participate in the halibut, salmon, and fixed gear cod fisheries. The non-pollock groundfish fisheries, however, are an important component of the annual operations of both the trawl fleet and processors.

King Cove is one of two bases of the Western Gulf non-pollock groundfish trawl fisheries. King Cove is a first class city within the organized Aleutians East Borough. The city has a single processor (Peter Pan

Seafoods). Although the community initially engaged primarily in local commercial salmon fisheries, over time activities have diversified into GOA and Bering Sea groundfish fisheries and Bering Sea crab fisheries. The community has a long history of maintaining a local fleet that delivers to the local plant, with between 5 and 10 vessels participating in the Western Gulf Pacific cod fishery delivering to the plant each year from 2003 through 2011. During the 2003 to 2011 period, between 1 and 5 vessels that participate in the Western GOA non-pollock fisheries reported themselves as homeported in King Cove.[16] The vessels that make deliveries into the community bring additional tax revenues and economic activity to King Cove, and also spend substantial time in the community and employ local residents.

The King Cove processor is known as a diversified plant that supports operations in all available fisheries. As a consequence of its diversity, the plant's dependence on the different species varies with performance of the fisheries in general. Although specific data cannot be released for the plant, Western Gulf Pacific cod is one of the many fisheries from which the plant draws landings. In the Western Gulf Pacific cod fishery, the King Cove plant relies on tenders for deliveries from distant grounds. The use of tenders allows participants to make more deliveries and save on fuel costs that would be associated with steaming to and from fishing grounds. Employment at the plant is primarily transient workers who come to King Cove to work at the plant. A few of these workers have relocated their families to the community, but the large majority of plant employees are not King Cove residents.

The community has a variety of fisheries support services, some of which are connected with the processing plant to some degree. Almost all of the private businesses in the community are largely dependent on fisheries. Consequently, any changes in fisheries performance may be anticipated to be distributed throughout the community.

Sand Point is the other base of the Western Gulf pollock fishery. Sand Point is also a first class city located in Aleutians East Borough. Sand Point's economy is almost exclusively dependent on fisheries, as the community is home to a fleet that participates in local fisheries. Almost all local vessels are less than 60 feet in length to allow their participation in state fisheries that limit entry based on vessel length. Local vessels provide benefits to communities, not only through their owners' revenues, but also through deliveries to the local processing plant, employment of local crews, and the use of local support services.

Sand Point is homeport to a large portion of the Western Gulf trawl fleet, as approximately 10 vessels from Sand Point, on average, have participated in the fisheries between 2003 and 2010. While most of these vessels deliver to the Sand Point processor, some deliver to the processor in King Cove. Trawl caught groundfish have accounted for slightly less than half of the local fleet's catch in pounds, but make up a substantially smaller share of the local fleet's revenues. The local plant, operated by Trident Seafoods, processes primarily groundfish. The plant experiences peak production during the first few months of the year and again through the summer months. The plant uses a primarily transient labor force, employing few locals. The plant is the primary provider of fishery support services in the community and often provides fuel and basic support to vessels. Some local residents also provide some services.

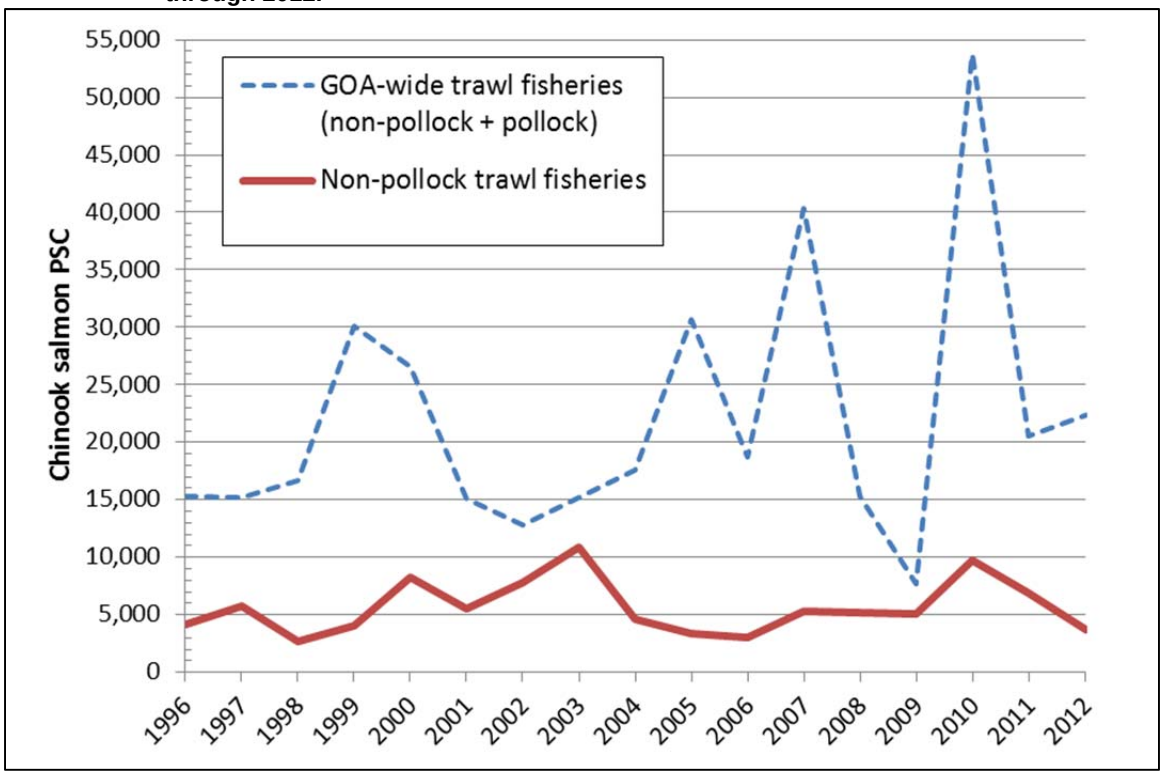
4.4.5 Pollock

In 2012, the Council approved an annual gulf-wide trawl PSC limit of 25,000 Chinook salmon in the GOA pollock fishery. The bottom and midwater pollock fisheries (considered jointly in this analysis) comprise the majority of GOA trawl harvest. There is no directed pollock fishery in the GOA for CP trawl vessels. From 2003 to 2011, GOA pollock harvest accounted for 49% of groundfish trawl harvest

[16] Anecdotal reports are that two vessels homeported in King Cove deliver to the King Cove plant, as well as several vessels homeported in Sand Point.

by weight. Trips targeting pollock comprised a high of 60% of trawl harvested groundfish weight in 2005 (79,713 mt of total 132,147 mt) and a low of 37% in 2009 (37,811 mt of total 102,076 mt). GOA pollock has accounted for 75% of trawl Chinook salmon PSC over the analyzed period, peaking at 89% in 2005 (27,381 of 30,724 Chinook salmon) and lowest at 28% in 2003 (4,295 of 15,172 Chinook salmon; Figure 4-1). The average annual PSC rate for Chinook salmon in the GOA pollock trawl fishery (0.30 Chinook salmon per mt of pollock harvested) was second only to GOA rex sole (0.46), and higher than the average gulf-wide PSC rate of 0.20 Chinook salmon per mt of groundfish.

Figure 4-1 Prohibited species catch of Chinook salmon in Gulf of Alaska non-pollock trawl fisheries, 1996 through 2012.



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC. 2012 data reported through 11/4/2012.

Nearly all CP and CV vessels that landed non-pollock groundfish also landed pollock, including all active CPs from 2009 to 2011 and all active CVs in 2006, 2007, 2009 and 2010. All active vessels in 2012 landed pollock.

Table 4-14 GOA Non-pollock groundfish vessels that also targeted pollock

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Catcher/ Processors	# Vessels Landing Pollock	18	13	14	12	14	13	18	17	17	17
	Total Vessels	21	16	16	15	15	14	18	17	17	17
Catcher Vessels	# Vessels Landing Pollock	65	61	63	61	63	64	59	52	51	62
	Total Vessels	71	63	67	61	63	65	59	52	53	62

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

The PSC limit for GOA pollock fisheries is subdivided between the Central and Western GOA regulatory areas. The Central GOA receives 73.3% of Chinook salmon PSC and the Western GOA receives 26.7%. In each year from 2003 to 2011, the Central GOA has harvested 39,459 mt of pollock on average while the Western GOA has harvested 21,394 mt. Pollock harvest comprised 43% of Central GOA groundfish harvest and 66% of Western GOA groundfish harvest during those years. Over the same period, pollock harvest accounted for 71% of Chinook salmon PSC in the Central GOA and 87% in the Western GOA. The average PSC rate for Chinook salmon was 0.31 in the Central GOA pollock trawl fishery and 0.29 in the Western GOA.

Trips targeting GOA pollock generated $513.4 million in wholesale gross revenue from 2003 to 2011 – more than twice the amount generated in the next highest value GOA fishery (rockfish). The average annual wholesale value of GOA pollock harvest during this period was $57.0 million, reaching a high of $71.7 million in 2011 and a low of $31.9 million in 2009. Here, because pollock is only a directed fishery for CVs, wholesale value is determined by applying an annual average wholesale price to the yearly total harvest of trips targeting pollock. The CV fleet generated an average ex-vessel value of approximately $22.8 million per year from harvesting pollock.

The GOA pollock fleet recorded 165,779 Chinook salmon PSC from 2003 to 2011. During this period, the pollock fleet generated $3,097 in wholesale revenue per Chinook salmon, or $1,239 per Chinook salmon in estimated ex-vessel value.

GOA pollock trawl fishery performance under a Chinook salmon hard cap, 2012

The first hard cap on Chinook salmon PSC in the GOA was implemented during the 2012 C Season for pollock, which opens by regulation on August 25 (see Sections 1.4). Looking back at the 2012 C and D GOA pollock seasons provides the first available sample of how the GOA trawl fleet might respond under a hard cap.[17] In doing so, it is important to understand that the new PSC limit was only one of several new developments influencing the fishery during that period. At the time, the trawl CV fishery was also experiencing some additional vessel participation that has been anecdotally linked to fishing for catch history in the period upon which a future allocative management program might be based (Section 4.4.2.2). In relation, the 2012 fall season also featured some deviation from historical patterns of participation across the management boundary that divides the Western GOA and the Central GOA.[18]

In recent years, the Central GOA pollock trawl fishery has operated under a voluntary quasi-cooperative structure. These agreements were intended to facilitate PSC avoidance through enhanced fleet communication and slowing down the fishery, to improve inseason management of the available pollock TAC, and to better coordinate deliveries to shoreside processing facilities.

Participants in the voluntary Central GOA pollock cooperative coordinated to delay starting their C season until mid-September, in order to allow shoreside processors in the area time to finish pink salmon production. By this time the Western GOA pollock fishery, in which some Central GOA-based vessels with Area 610 endorsements participated, had met its available harvest limit. When the Central GOA C season began, more vessels participated than had done so in the past; the perception that additional vessels who would deliver to westward-bound tenders were entering the fishery motivated all vessels to concentrate early activity in Area 620, where tendering was possible. As a result, industry representatives reported that participants in the Central GOA deviated from their original voluntary catch sharing plan. Noting the additional effort, the Agency announced an upcoming closure with 24 hours of notice. The ensuing race to catch pollock resulted in a fishery that occurred in poor weather conditions, and, according to industry representatives, with target harvest prioritized ahead of bycatch avoidance. After the

17 Also refer to 5.2.1.1 for a description of early experience with inseason management of a Chinook salmon hard cap.
[18] Refer to **Error! Reference source not found.** for a map of the management areas (610, 620, 630) included in these fisheries.

fishery had closed, the Agency determined that a seasonal TAC overage had occurred; in addition, the season's largest Chinook salmon PSC encounters were recorded during this period. Inseason management was further complicated by an influx of participation by vessels with low observer coverage (under 60' vessels from the Western GOA, and AFA vessels that had fulfilled their quarterly observer-days requirement in the Bering Sea).

The D season for GOA pollock opens by regulation on October 1. The Agency determined that if all Central GOA endorsed vessels targeted Area 620 upon the opening – around 60 vessels, based out of both Central and Western GOA ports – the remaining available pollock TAC for that area could be harvested in one or two days. With this consideration, coupled with the need to manage a Chinook salmon PSC hard cap, the Agency decided not to re-open the Area 620 fishery until the two fleets developed a plan to manage the available TAC. The fleet agreed to a voluntary catch sharing plan with a one trip limit, as opposed to a one day race. Those vessels participating in the voluntary share agreement that fished closer to the Area 610/620 boundary encountered difficult fishing conditions, and did not harvest their entire share of the available "quota." As a result, the Area 620 D season ultimately ended with a portion of the allowable catch unharvested.

Meanwhile, the D season opened in the Western GOA on October 1, but was closed in mid-October as the harvest limit was approached. The fishery was re-opened for four days under a voluntary catch sharing plan in order to fully utilize the TAC. At the time, the Catch Accounting System indicated that there was enough available Chinook Salmon PSC to support the reopening. However, as delayed observer data entered the system, PSC from earlier weeks was retroactively applied to unobserved trips and it was later determined that a salmon overage had occurred.

While the action under consideration deals specifically with non-pollock fisheries, the preceding summary provides some notion of the multiple moving parts that influence inseason management of a hard-capped fishery. Within the broader context of increased participation and limited observer coverage, a PSC limit might be viewed as one of several exacerbating factors that ultimately resulted in instances of overharvest, underharvest, and a PSC overage. That said, it is important to acknowledge that the Fall 2012 pollock season is a single sample that occurred during a transitional management period, and is not necessarily indicative of future outcomes.

4.4.6 Non-pollock target species: harvest and value

The non-pollock directed trawl fisheries in the GOA – in descending order of total weight harvested from 2003 to 2011 – include rockfish, arrowtooth flounder, Pacific cod, shallow water flatfish, rex sole, flathead sole and deep water flatfish (Table 4-17). The primary species in the shallow water flatfish complex is rock sole; other shallow water flatfish species include Alaska plaice, starry flounder, yellowfin sole, sand sole, butter sole and English sole. Dover sole is the primary harvest species in the deep water flatfish complex, with deep-sea sole and Greenland turbot making up the remainder. Further information on GOA non-pollock groundfish species is included in Section 3.2.

In this section, harvest weights and revenues are reported by trip target, meaning that the reported values represent all species harvested in that target fishery (as determined by NOAA's Catch Accounting System).

4.4.6.1 Harvest

Non-pollock groundfish trawl harvest has ranged from 49,127 mt to 73,512 mt during the historical period analyzed in this report; the median harvest weight was 63,835 mt, recorded in 2007 (Table 4-15). Total GOA harvest displayed annual variability without a trend. Variability likely stems from a

combination of year-specific factors including regulatory closures (TAC and halibut PSC), environmental factors, and relative product prices.

Table 4-15 Annual non-pollock groundfish trawl harvest in the Gulf of Alaska, 2003 to 2011

Year	Harvest (mt)
2003	60,631
2004	49,127
2005	52,434
2006	59,208
2007	63,835
2008	73,512
2009	64,265
2010	69,359
2011	69,564

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

From 2003 to 2011, the Central GOA accounted for 82% of the total non-pollock harvest weight in the action area (Table 4-16). Rockfish species made up the greatest proportion of total harvest in both the Central and Western regulatory areas (Table 4-17). Rockfish, arrowtooth flounder, Pacific cod and shallow water flatfish comprised 92% of Central GOA total harvest weight. Rockfish, Pacific cod and arrowtooth flounder totaled 93% of Western GOA harvest weight.

During the same period, GOA non-pollock trawl catcher vessels harvested 65% of total weight in the action area. Pacific cod accounted for the greatest proportion of catch, followed by arrowtooth flounder, rockfish and shallow water flatfish. Rockfish species harvest made up 53% of total weight in the catcher/processor sector, with arrowtooth flounder and rex sole also accounting for a significant proportion of total harvest. Rockfish species were the only target species or complex for which catcher/processors harvested a larger share of gulf-wide trawl harvested weight than did catcher vessels.

Taken by operational type within each regulatory area, the Central GOA catcher vessel sector accounted for the greatest proportion of total harvest weight, at 60%. Central GOA catcher/processors harvested 22% of total weight; Western GOA catcher/processors harvested 13% of total weight; and Western GOA catcher vessels harvested 5% of total weight. Rockfish species accounted for 70% of Western GOA catcher/processor harvest weight, while Pacific cod accounted for 98% of Western GOA catcher vessel harvest weight. Central GOA operational type sectors reflected multiple important target species: rockfish, arrowtooth flounder and rex sole were the fisheries of greatest relative importance in the catcher/processor sector, while arrowtooth flounder, Pacific cod, rockfish and shallow water flatfish each made up similarly significant proportions of total harvest weight in the catcher vessel sector.

Table 4-16 Cumulative groundfish harvest (mt) in the Gulf of Alaska non-pollock trawl fisheries, by trip target, 2003 to 2011

	Harvest (mt)	% of GOA TOTAL
GOA TOTAL	561,935	100.0%
Central GOA	463,217	82.4%
Western GOA	98,718	17.6%
GOA Catcher Vessels	364,164	64.8%
GOA Catcher/Processors	197,772	35.2%
CGOA Catcher Vessels	337,300	60.0%
CGOA Catcher/Processors	125,917	22.4%
WGOA Catcher Vessels	26,863	4.8%
WGOA Catcher/Processors	71,855	12.8%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

Table 4-17 to Table 4-20 provide cumulative target harvest weight and proportions of total harvest for each of the predominant fisheries, from 2003 to 2011. These totals are subdivided and repeated to reflect each potential division of the GOA non-pollock trawl fisheries envisioned in Alternative 2 and the associated options for this Council action.

Table 4-17 Non-pollock groundfish harvest by trip target species (mt) and proportion of total Gulf of Alaska non-pollock trawl groundfish harvest, 2003 to 2011

Total GOA Trawl			
TARGET	**Harvest (mt)**	**% Total**	**Rank**
Rockfish	187,319	33%	1
Arrowtooth Flounder	148,061	26%	2
Pacific Cod	117,494	21%	3
Shallow Water Flatfish	66,502	12%	4
Rex Sole	25,858	5%	5
Flathead Sole	11,439	2%	6
Deep Water Flatfish	1,952	0%	7
Other Species	1,752	0%	8
Sablefish	1,345	0%	9
Atka Mackerel	214	0%	10
GOA TOTAL	**561,935**	**100%**	

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

Table 4-18 Non-pollock groundfish harvest of trip target species by regulatory area (mt), and proportion of subarea and total Gulf of Alaska non-pollock trawl groundfish harvest, 2003 to 2011

Western GOA				
TARGET	**Harvest (mt)**	**% Subtotal**	**% Total**	**Rank**
Rockfish	50,717	51%	9%	1
Pacific Cod	28,275	29%	5%	2
Arrowtooth Flounder	13,080	13%	2%	3
WG SUBTOTAL	**98,718**	**93%**		
GOA TOTAL	**561,935**		**16%**	

Central GOA				
TARGET	**Harvest (mt)**	**% Subtotal**	**% Total**	**Rank**
Rockfish	136,602	29%	24%	1
Arrowtooth Flounder	134,981	29%	24%	2
Pacific Cod	89,219	19%	16%	3
Shallow Water Flatfish	66,070	14%	12%	4
CG SUBTOTAL	**463,217**	**92%**		
GOA TOTAL	**561,935**		**76%**	

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

Table 4-19 Non-pollock groundfish harvest of trip target species by operational type (mt), and proportion of sector and total Gulf of Alaska non-pollock trawl groundfish harvest, 2003 to 2011

GOA Trawl Catcher Vessels				
TARGET	**Harvest (mt)**	**% Subtotal**	**% Total**	**Rank**
Pacific Cod	113,495	31%	20%	1
Arrowtooth Flounder	95,138	26%	17%	2
Rockfish	82,416	23%	15%	3
Shallow Water Flatfish	63,631	17%	11%	4
CV SUBTOTAL	**364,164**	**97%**		
GOA TOTAL	**561,935**		**63%**	

GOA Trawl Catcher/Processors				
TARGET	**Harvest (mt)**	**% Subtotal**	**% Total**	**Rank**
Rockfish	104,904	53%	19%	1
Arrowtooth Flounder	52,923	27%	9%	2
Rex Sole	24,710	12%	4%	3
CP SUBTOTAL	**197,772**	**92%**		
GOA TOTAL	**561,935**		**32%**	

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

Table 4-20 Non-pollock groundfish harvest of trip target species by regulatory area and operational type (mt), and proportion of sector and total Gulf of Alaska non-pollock trawl groundfish harvest, 2003 to 2011

Western GOA Trawl Catcher Vessels				
TARGET	Harvest (mt)	% Subtotal	% Total	Rank
Pacific Cod	26,359	98%	5%	1
WG CV SUBTOTAL	**26,863**	**98%**		
GOA TOTAL	**561,935**		**5%**	

Western GOA Trawl Catcher/Processors				
TARGET	Harvest (mt)	% Subtotal	% Total	Rank
Rockfish	50,363	70%	9%	1
Arrowtooth Flounder	13,063	18%	2%	2
Flathead Sole	3,804	5%	1%	3
Rex Sole	2,279	3%	0%	4
Pacific Cod	1,916	3%	0%	5
WG CP SUBTOTAL	**71,855**	**99%**		
GOA TOTAL	**561,935**		**13%**	

Central GOA Trawl Catcher Vessels				
TARGET	Harvest (mt)	% Subtotal	% Total	Rank
Arrowtooth Flounder	95,120	28%	17%	1
Pacific Cod	87,137	26%	16%	2
Rockfish	82,062	24%	15%	3
Shallow Water Flatfish	63,585	19%	11%	4
CG CV SUBTOTAL	**337,300**	**97%**		
GOA TOTAL	**561,935**		**58%**	

Central GOA Trawl Catcher/Processors				
TARGET	Harvest (mt)	% Subtotal	% Total	Rank
Rockfish	54,540	43%	10%	1
Arrowtooth Flounder	39,861	32%	7%	2
Rex Sole	22,432	18%	4%	3
CG CP SUBTOTAL	**125,917**	**93%**		
GOA TOTAL	**561,935**		**21%**	

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

4.4.6.2 Value

NOAA's CAS reports the first wholesale value (gross revenue) of harvest. This value is generated by applying annual average wholesale prices to yearly harvest. Wholesale value is an appropriate measure of value for CP vessels, but ex-vessel value is a more relevant measure for CVs. Within this section, unless otherwise noted, the analysts report all harvest values in terms of the wholesale market for ease of comparison. As with harvest weight, historical harvest values are presented in terms of the ex-post-determined trip target.

During the 2003 to 2011 period, the proportional distribution of wholesale value across regulatory areas or harvest sectors is quite similar to the observed distribution of harvested weight. Central GOA non-pollock harvest generates $538.8 million (81% of the GOA total), while CV harvest generates more wholesale harvest value than the CP sector ($429.0 million; 64%). Comparing Table 4-21 to Table 4-16 reveals that, pound-for-pound, the Western GOA generates slightly more wholesale value from its harvest than the Central GOA. This difference appears to derive from the Western GOA CV sector, for which the percentage-share of Gulf-wide wholesale value is 2% higher than the percentage-share of Gulf-wide harvest weight (6.8% vs. 4.8%). This effect, in turn, arises from the fact that the Western GOA CV sector almost exclusively harvests Pacific cod, which has had higher value than other non-pollock groundfish species.

Table 4-17 to Table 4-25 provide cumulative target first wholesale value and proportion of total fishery value for each of the predominant fisheries, from 2003 to 2011. These totals are subdivided and repeated to reflect each potential apportionment of the GOA non-pollock trawl fisheries envisioned in Alternative 2 and the associated options for this Council action.[19]

On a gulf-wide target species level, different species' wholesale values create a minor reordering in proportional share of total GOA value, as compared to shares of GOA harvest. Rockfish species, relatively high in value, generated 37% of GOA wholesale value while accounting for only 33% of total harvest. Conversely, arrowtooth flounder generated only 20% of total wholesale value in comparison to 26% of total harvest. Table 4-22 summarizes gulf-wide wholesale value by target species and provides direct comparison for Table 4-17.

[19] Average annual wholesale value (as opposed to aggregate over the 2003 to 2011 period) is summarized for each target species in **Error! Reference source not found.**, located in Section 4.7. That table also breaks out average annual wholesale value by regulatory area and operational type sector.

Table 4-23 to Table 4-25 show the relative importance of key harvest species to the total GOA cumulative wholesale value from 2003 to 2011. As with the gulf-wide wholesale value data, the order of species importance is similar to the order of harvest data in Table 4-18 to Table 4-20. Key differences, again driven by different product prices for different target species, center around lower rankings for arrowtooth flounder and higher rankings for rockfish and Pacific cod. Notable differences between harvest rank and wholesale value rank include the following: gulf-wide CV arrowtooth flounder trips accounted for 26% of operational type harvest weight, but only 17% of CV wholesale value; Central GOA CV arrowtooth flounder trips accounted for 28% of sector harvest weight, but only 19% of Central GOA CV wholesale value. Conversely, gulf-wide CV Pacific cod and rockfish trips respectively accounted for 31% and 23% of operational type harvest weight, but generated 40% and 26% of wholesale value; Central GOA CV Pacific cod and rockfish accounted for 26% and 24% of sector harvest, but generated 33% and 29% of wholesale value.

Table 4-21 Wholesale value of GOA non-pollock groundfish trawl fisheries by trip target, 2003 to 2011

	Wholesale Value ($1000)	% of GOA TOTAL
GOA TOTAL	668,807	100.0%
Central GOA	538,839	80.6%
Western GOA	129,968	19.4%
GOA Catcher Vessels	429,045	64.2%
GOA Catcher Processors	239,762	35.8%
CGOA Catcher Vessels	383,768	57.4%
CGOA Catcher/Processors	155,071	23.2%
WGOA Catcher Vessels	45,278	6.8%
WGOA Catcher/Processors	84,690	12.7%

Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

Table 4-22 Wholesale value by trip target species and proportion of total Gulf of Alaska non-pollock trawl groundfish value, 2003 to 2011 (ordered by total harvest weight)

Total GOA Non-Pollock Trawl			
TARGET	Wholesale Value ($1000)	% Total	Rank
Rockfish	247,715	37%	1
Arrowtooth Flounder	130,810	20%	3
Pacific Cod	177,651	27%	2
Shallow Water Flatfish	57,149	9%	4
Rex Sole	30,233	5%	5
Flathead Sole	12,150	2%	6
Deep Water Flatfish	1,856	0%	8
Other Species	1,378	0%	9
Sablefish	9,541	1%	7
Atka Mackerel	324	0%	10
GOA TOTAL	**668,807**	**100%**	

Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

Table 4-23 Wholesale value of trip target species by regulatory area, and proportion of subarea and total Gulf of Alaska non-pollock trawl groundfish value, 2003 to 2011 (ordered by total harvest weight)

Western GOA				
TARGET	Wholesale Value ($1000)	% Subtotal	% Total	Rank
Rockfish	61,588	47%	9%	1
Arrowtooth Flounder	12,910	10%	2%	3
Pacific Cod	47,556	37%	7%	2
Flathead Sole	4,680	4%	1%	4
WG SUBTOTAL	**129,968**	**98%**		
GOA TOTAL	**668,807**		**19%**	

Central GOA				
TARGET	Wholesale Value ($1000)	% Subtotal	% Total	Rank
Rockfish	186,126	35%	28%	1
Arrowtooth Flounder	117,900	22%	18%	3
Pacific Cod	130,094	24%	19%	2
Shallow Water Flatfish	56,685	11%	8%	4
Rex Sole	27,500	5%	4%	5
Flathead Sole	7,469	1%	1%	6
CG Subtotal	**538,839**	98%		
GOA TOTAL	**668,807**		79%	

Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

Table 4-24 Wholesale value of trip target species by operational type, and proportion of sector and total Gulf of Alaska non-pollock trawl groundfish value, 2003 to 2011 (ordered by total harvest weight)

GOA Trawl Catcher Vessels				
TARGET	Wholesale Value ($1000)	% Subtotal	% Total	Rank
Rockfish	112,794	26%	17%	2
Arrowtooth Flounder	73,443	17%	11%	3
Pacific Cod	172,556	40%	26%	1
Shallow Water Flatfish	53,808	13%	8%	4
CV SUBTOTAL	**429,045**	**96%**		
GOA TOTAL	**668,807**		**62%**	

GOA Trawl Catcher/Processors				
TARGET	Wholesale Value ($1000)	% Subtotal	% Total	Rank
Rockfish	134,921	56%	20%	1
Arrowtooth Flounder	57,367	24%	9%	2
Rex Sole	29,098	12%	4%	3
Flathead Sole	9,313	4%	1%	4
CP SUBTOTAL	**239,762**	**96%**		
GOA TOTAL	**668,807**		**34%**	

Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

Table 4-25 Wholesale value of trip target species by regulatory area and operational type, and proportion of sector and total Gulf of Alaska non-pollock trawl groundfish value, 2003 to 2011 (ordered by total harvest weight)

Western GOA Trawl Catcher Vessels				
TARGET	Wholesale Value ($1000)	% Subtotal	% Total	Rank
Pacific Cod	45,071	100%	7%	1
WG CV SUBTOTAL	**45,278**	**100%**		
GOA TOTAL	**668,807**		**7%**	

Western GOA Trawl Catcher/Processors				
TARGET	Wholesale Value ($1000)	% Subtotal	% Total	Rank
Rockfish	61,469	73%	9%	1
Arrowtooth Flounder	12,910	15%	2%	2
Pacific Cod	2,485	3%	0%	5
Rex Sole	2,733	3%	0%	4
Flathead Sole	4,627	5%	1%	3
WG CP SUBTOTAL	**84,690**	**99%**		
GOA TOTAL	**668,807**		**13%**	

Central GOA Trawl Catcher Vessels				
TARGET	Wholesale Value ($1000)	% Subtotal	% Total	Rank
Rockfish	112,674	29%	17%	2
Arrowtooth Flounder	73,443	19%	11%	3
Pacific Cod	127,484	33%	19%	1
Shallow Water Flatfish	53,775	14%	8%	4
CG CV SUBTOTAL	**383,768**	**96%**		
GOA TOTAL	**668,807**		**55%**	

Central GOA Trawl Catcher/Processors				
TARGET	Wholesale Value ($1000)	% Subtotal	% Total	Rank
Rockfish	73,452	47%	11%	1
Arrowtooth Flounder	44,457	29%	7%	2
Rex Sole	26,365	17%	4%	3
Flathead Sole	4,686	3%	1%	4
CG CP SUBTOTAL	**155,071**	**96%**		
GOA TOTAL	**668,807**		**22%**	

Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

4.4.6.3 Relationship between harvest levels and gross wholesale revenue

Average annual harvest (mt) and average annual gross wholesale revenue ($) are positively correlated in the key GOA non-pollock directed groundfish fisheries. Based upon this observation, the analysts can presume that a reduction in harvest would likely decrease the fleet's revenue and, assuming no changes in cost structure, profit.

The correlation coefficients reported in Table 4-26 capture the strength of the linear relationship between groundfish harvest weight and the gross wholesale revenue generated. Values greater than zero indicate a positive relationship, where high (or low) harvest results in high (or low) gross revenue. The maximum

value of 1.0 would indicate perfectly simultaneous percentage changes in the paired data. Noting that the coefficient for rockfish was low relative to other species, the analysts included measures of correlation for only the period of cooperative rockfish management (2007 to 2011). The even lower coefficient on rockfish (0.57) for these later years may signal a weaker connection between the amount harvested and the prices received under cooperative management fisheries, thus creating a possible exception to the earlier statement that decreased harvest reduces revenue by a similar margin.

Table 4-26 Measure of correlation between average annual groundfish harvest (mt) and average annual gross wholesale revenue ($), 2003 to 2011 & 2007 to 2011

TARGET	Correlation Coefficient (2003-2011)	Correlation Coefficient (2007-2011)
Arrowtooth Flounder	0.76	0.68
Pacific Cod	0.83	0.87
Rockfish	0.76	0.57
Shallow Water Flatfish	0.94	0.83
Rex Sole	0.96	0.99
Flathead Sole	0.93	0.96
Deep Water Flatfish	0.95	0.99

(Note: averages are derived from NOAA Catch Accounting System records at the fishing trip level)

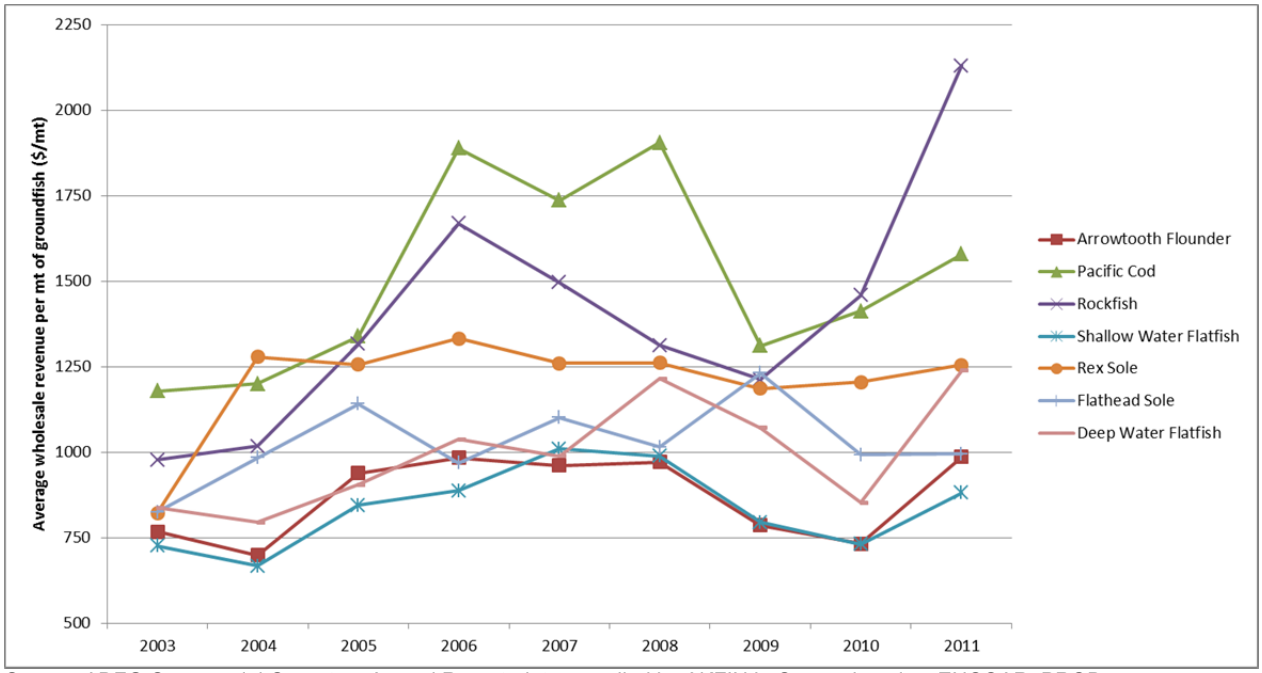
One might expect a price effect where prices increase when harvest supply is low, thereby mitigating some of the revenue loss created by any groundfish harvest constraints under PSC limits. However, data from the 2003 to 2011 period reflect a strong positive correlation between harvest weight and gross wholesale revenue (Table 4-26). From this, the analysts can conclude that prices did not adjust to maintain fairly constant gross revenue in low harvest years. Rather, prices are at least partially shaped by external factors such as supplies of substitute products, domestic and foreign market prices, foreign exchange rates, seafood consumption, and consumer and producer price indices (Fissel et al., 2012).

Figure 4-2 through Figure 4-7 illustrate the relatively stable nature of non-pollock groundfish prices during the analyzed period, as reflected in first wholesale gross revenue. Given the strong correlation between harvest (mt) and wholesale revenue ($), the chosen metric is annual average wholesale revenue per metric ton of non-pollock groundfish. Deflating nominal values to a base year reveals that per unit harvest revenue has not substantially increased or decreased during the analyzed period (Figure 4-3, Figure 4-5, and Figure 4-7).[20]

Figure 4-3 does indicate that wholesale revenues generated from trips targeting rockfish have increased in real dollar value per metric ton since 2009. Data on the wholesale value per metric ton of rockfish product – as opposed to all species product harvested on trips targeting rockfish – indicate that the value of that particular species is driving the increase in trip target value. The average annual value of one metric ton of rockfish product declined from 2006 to 2009, reaching a low of $985; this value increased to $1,258 in 2010, and $2,010 in 2011. Anecdotal reports from Central GOA processors suggest that the increase in rockfish value can be attributed to higher product quality under the Rockfish Pilot Program and subsequent Rockfish Program, as derby-style fishing has been reduced. These sources note that the increase in the value of rockfish product lagged behind program implementation by one to two years as it took time for the perception of Central GOA rockfish product quality to match the fishery's performance.

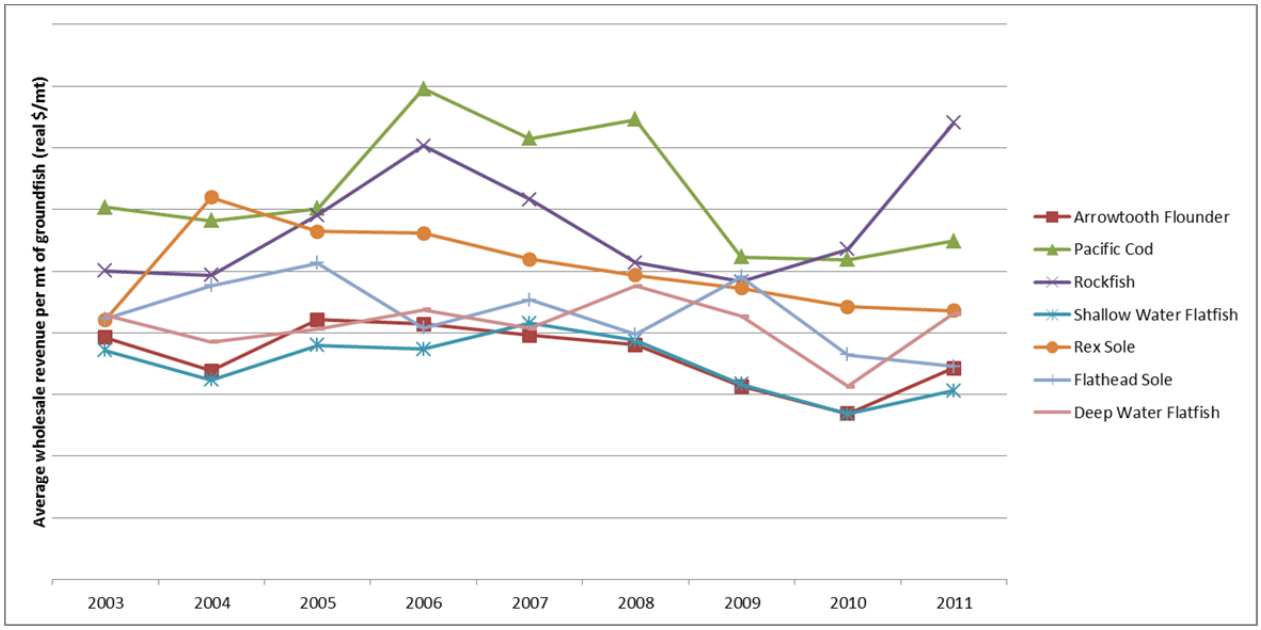
[20] Nominal to real dollar adjustments were made using the Bureau of Labor Statistics Producer Price Index for "unprocessed and packaged fish" (Series ID WPU0223 available at http://data.bls.gov/cgi-bin/srgate), which is the same index used in Economic SAFE Reports.

Figure 4-2 Annual average wholesale revenue per mt of GOA non-pollock groundfish harvest by trip target, nominal value from 2003 to 2011



Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

Figure 4-3 Annual average wholesale revenue per mt of GOA non-pollock groundfish harvest by trip target, inflation-adjusted trend from 2003 to 2011



Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

Figure 4-4 Annual average wholesale revenue per mt of GOA non-pollock groundfish harvest by operational type, nominal value from 2003 to 2011

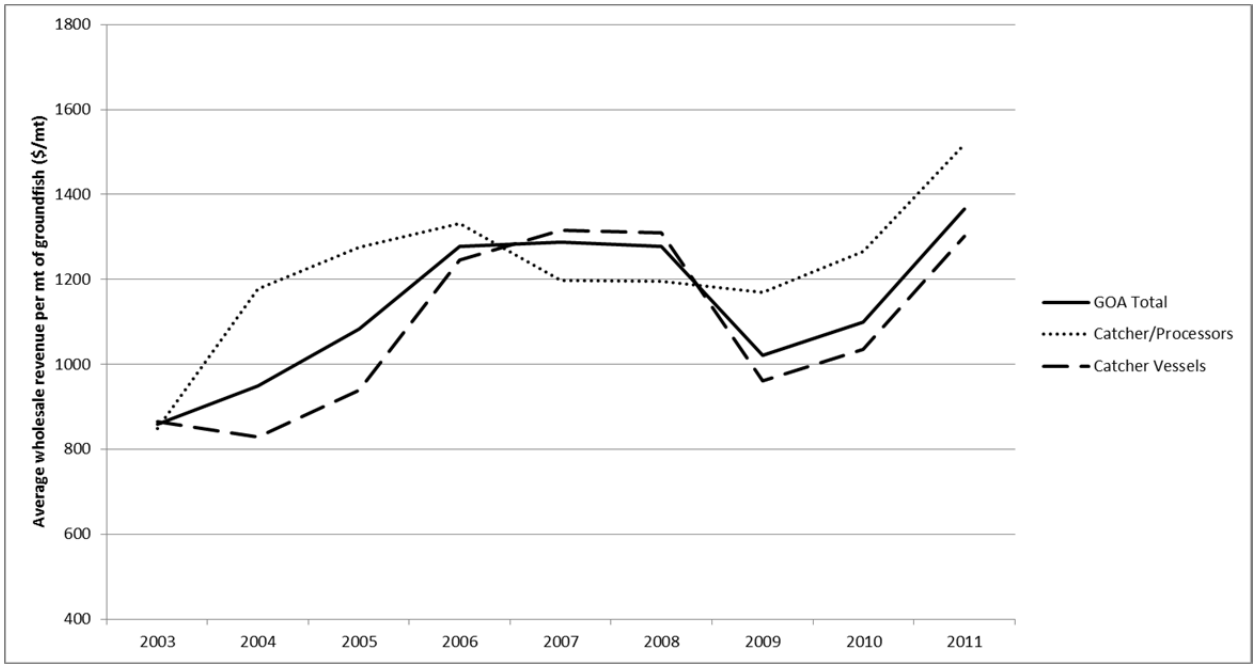


Figure 4-5 Annual average wholesale revenue per mt of GOA non-pollock groundfish harvest by operational type, inflation-adjusted trend from 2003 to 2011

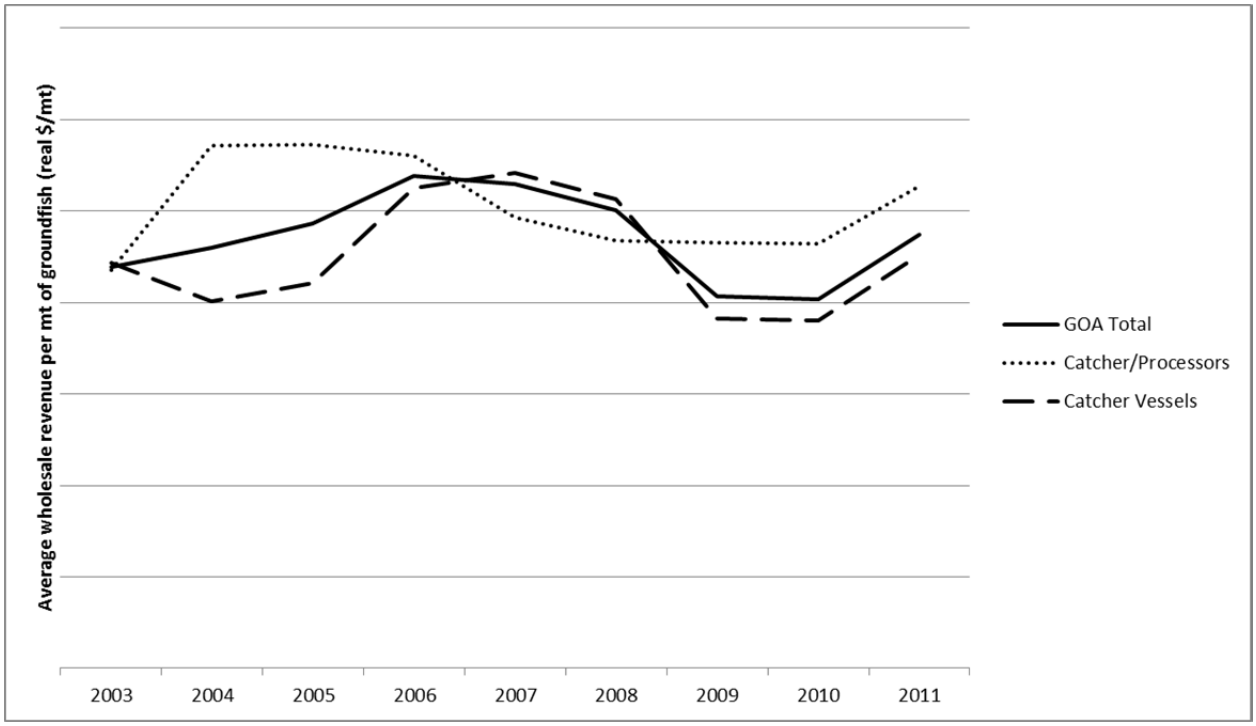


Figure 4-6 Annual average wholesale revenue per mt of GOA non-pollock groundfish harvest by regulatory area, nominal value from 2003 to 2011

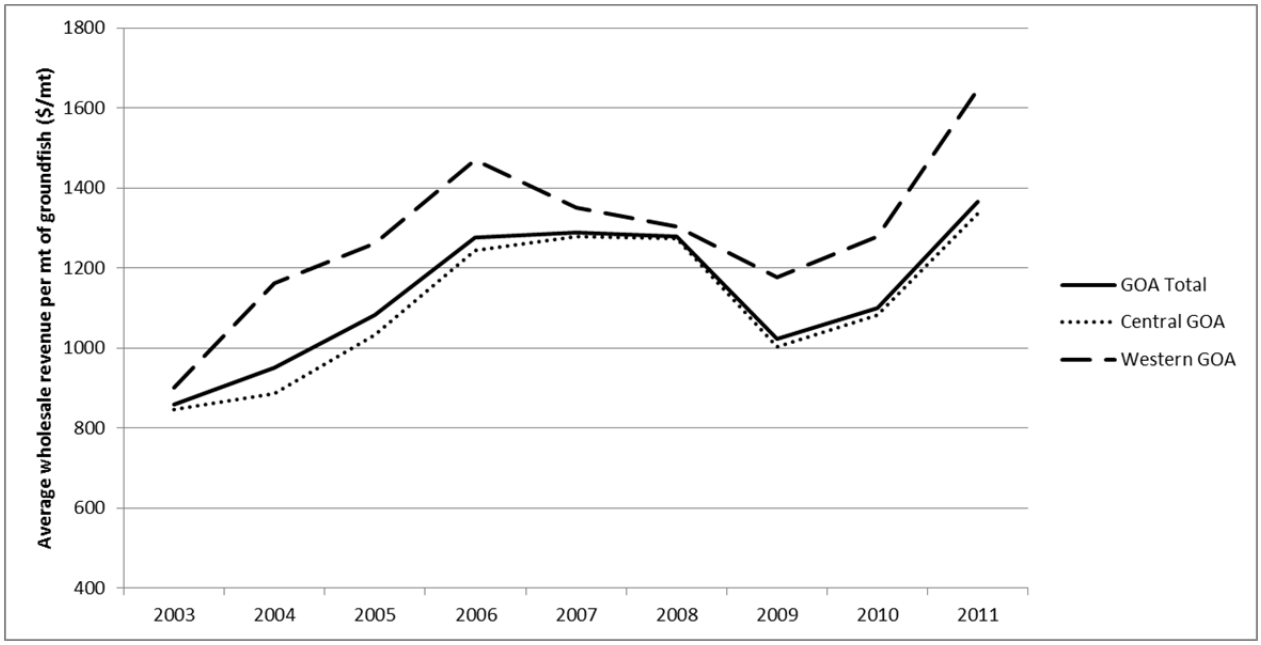
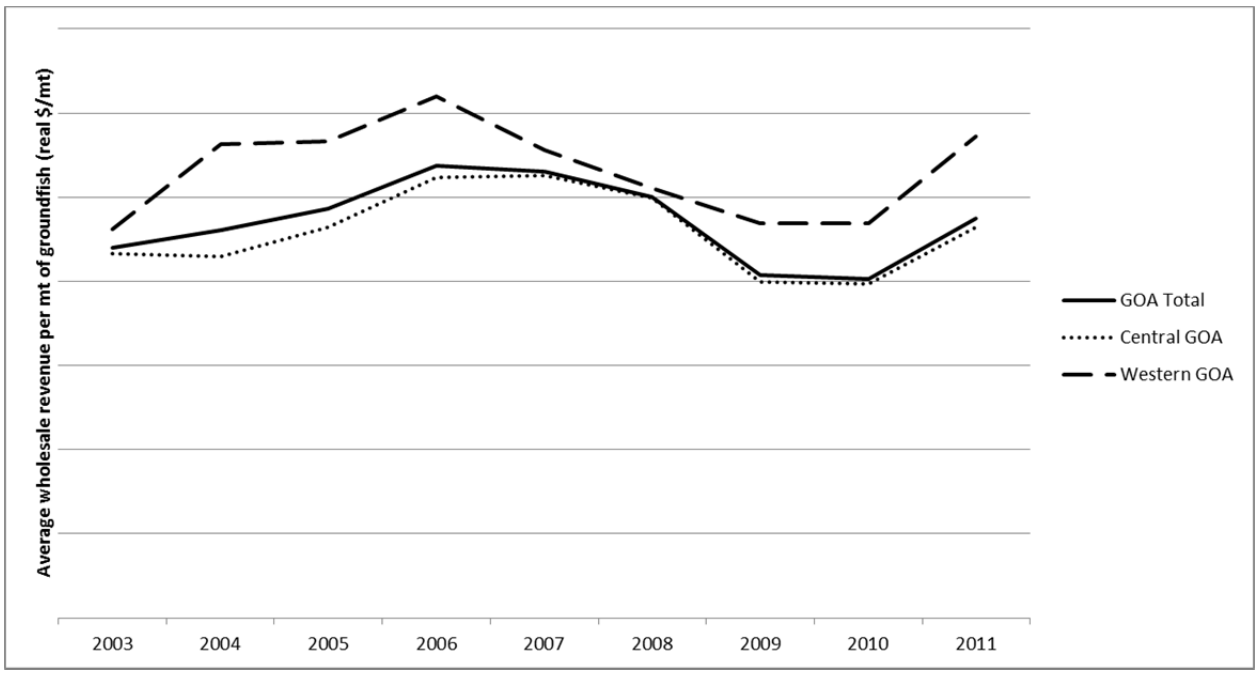


Figure 4-7 Annual average wholesale revenue per mt of GOA non-pollock groundfish harvest by regulatory area, inflation-adjusted trend from 2003 to 2011



4.4.7 Total Allowable Catch (TAC) and Utilization

NMFS Alaska Regional Office publishes annual catch reports that include harvest (mt) and total allowable catch (TAC) by regulatory area and directed fishery. These figures provide a measure to assess the degree to which a particular fishery is being utilized. This information also provides a broad

understanding of whether a reduced ability to harvest a species, through PSC limits or any other restriction, is likely to alter fishers' behavior from recent patterns.

The catch report data cited in this section comes from the Gulf of Alaska Groundfish Annual Catch Reports. Most relevant species are reported by Central or Western GOA regulatory area. The exception is Atka mackerel, reported for the entire gulf, which is not a directed fishery but does appear as a target species in Central GOA records within NOAA's Catch Accounting System.

The species listings in the Annual Catch Reports reflect several direct allocations within the GOA groundfish fishery.

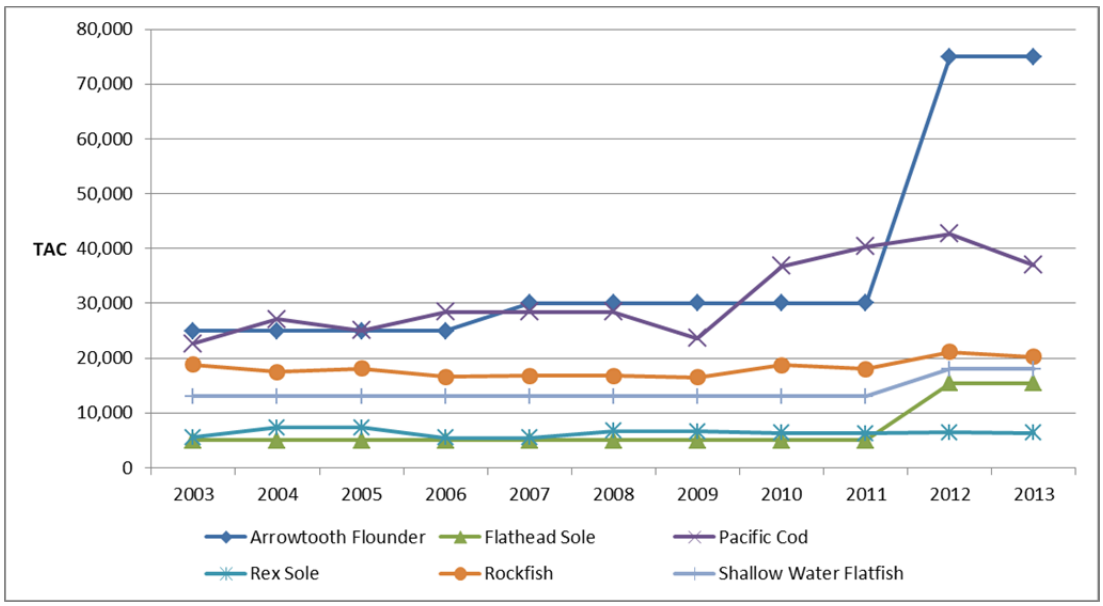
- Pacific cod is reported by inshore and offshore components, where inshore generally indicates catcher vessel prosecution and offshore indicates catcher/processor prosecution. Through 2011, GOA CVs received 90% of Pacific cod TAC and CPs received 10%. This remains the case in the Eastern GOA (outside of the scope of this analysis), but beginning in 2012 Western and Central GOA TAC is apportioned according to sector splits between CV and CP trawl, hook-and-line, and pot gear sectors (50 C.F.R. §679.20(a)(12)(i)). Within each regulatory area, 60% of TAC is available in the A-season and 40% is available in the B-season; this measure is related to Steller Sea Lion protection. For the entire fishing year, the trawl sector is apportioned 40.8% of Western GOA Pacific cod TAC and 45.8% of Central GOA Pacific cod TAC. Of the TAC apportioned to trawl vessels, CVs receive 94% of the Western GOA allowance and 91% of the Central GOA allowance.
- Rockfish harvest and TAC are reported by species. Elsewhere in this analysis, they have been viewed in aggregate, in accordance with the NOAA Catch Accounting System's trip target designations. Individual rockfish species include: Pacific ocean perch, pelagic shelf rockfish, dusky rockfish, , northern rockfish, rougheye rockfish, shortraker rockfish, thornyhead rockfish, and "other rockfish" (which includes slope rockfish, yellowtail rockfish, widow rockfish and demersal shelf rockfish). Directed fisheries exist for Pacific ocean perch, northern rockfish, and dusky rockfish.[21] Shortraker rockfish and rougheye rockfish were separated and managed under separate TACs beginning in 2005. These species were of special concern in designing the Central GOA Rockfish Program to ensure that harvests would not affect stock conditions, particularly shortraker rockfish stocks. Shortraker and rougheye rockfish were not allocated to the catcher vessel sector in the Rockfish Pilot Program, as that fleet had relatively minimal historical catches of those species. Instead, catcher vessel harvests of shortraker rockfish and rougheye rockfish are managed under MRAs set low enough to discourage harvest in excess of historical catch amounts. Catcher/processors in the Rockfish Program receive a reduced allocation of the species to ensure that their harvests do not harm stocks.

The previous section identified six species or species complexes that make up the majority of GOA non-pollock groundfish trawl harvest: arrowtooth flounder, Pacific cod, rockfish, rex sole, flathead sole, and shallow water flatfish. Figure 4-8 and Figure 4-9 illustrate the TAC levels for these key species over the analyzed period. The figures reflect a substantial increase in TAC for several GOA flatfish species in 2012 (arrowtooth flounder, flathead sole and shallow water flatfish). The large gap between TAC and ABC that had existed prior to 2012 was a hold-over from years before halibut PSC was managed through seasonal mortality limits. During that time, industry had requested lower flatfish TACs as a measure to slow halibut mortality enough to prosecute late year fisheries where halibut was likely to be a constraint.

[21] Beginning with the final 2012 and 2013 groundfish harvest specifications for the GOA, the directed fishery for pelagic shelf rockfish (PSR) was changed by SSC, AP and Council recommendation. Widow rockfish and yellowtail rockfish were moved to the "other rockfish" species group, and dusky rockfish began receiving treatment as a directed fishery, as the PSR species group had been treated previously. The rationale for this action is discussed in the preamble to the proposed 2012 and 2013 groundfish harvest specifications for the GOA (76 FR 79620, December 22, 2011).

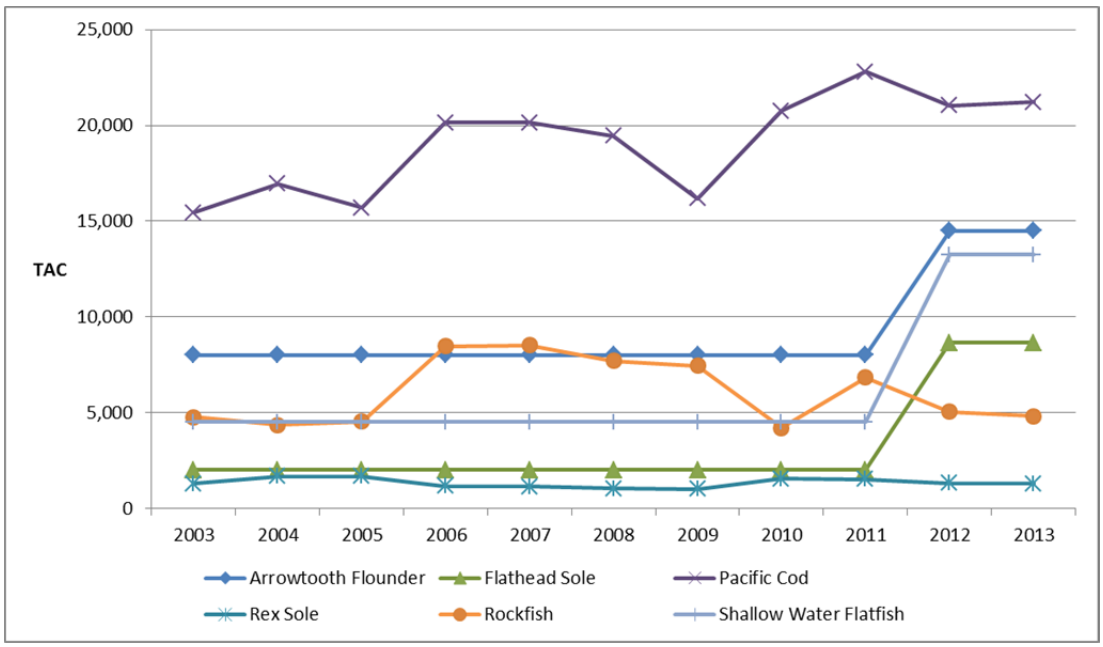
As arrowtooth flounder evolved into a viable target fishery, harvest levels increased to the point where a TAC closure was a legitimate concern. The Central GOA trawl fleet approached its arrowtooth flounder TAC in 2011. With the new system of halibut PSC management obviating the need to use TAC as a halibut safeguard, the Council recommended higher flatfish TACs in 2012.[22] Rex sole TACs did not increase, as they were already set at a level equal to ABC.

Figure 4-8 Recent TAC history for Central GOA non-pollock groundfish trawl fisheries



Source: NMFS Alaska Regional Office catch reports, available at: http://www.fakr.noaa.gov/sustainablefisheries/catchstats.htm

Figure 4-9 Recent TAC history for Western GOA non-pollock groundfish trawl fisheries



Source: NMFS Alaska Regional Office catch reports, available at: http://www.fakr.noaa.gov/sustainablefisheries/catchstats.htm

[22] Personal communication with Julie Bonney, Alaska Groundfish Data Bank (April 2013).

The following paragraphs provide a coarse summary of utilization relative to harvest specifications for these key fisheries, from 2003 to 2011. This information develops a preliminary notion of which fisheries are typically prosecuted to the fullest extent allowed (up to regulatory TAC closures), which could raise the likelihood of being impacted by further constraints in the form of Chinook salmon PSC limits. It is important to note that some of the fisheries that are not fully utilized under current regulations are typically constrained by Pacific halibut PSC, or are secondary species fished under MRAs. The typically observed seasonal effect of halibut PSC as a groundfish harvest constraint is further detailed in Section 4.4.8, and potential interactions between co-existing PSC limits for both halibut and Chinook salmon are explored in the impact analysis for the action alternative (Section 4.7).

Pacific cod CV TAC has ranged from around 20,000 to 42,000 mt in the Central GOA and 14,000 to 23,000 mt in the Western GOA. The Central GOA inshore TAC was exceeded in five of the nine years from 2003 to 2011(peaking at 111% of TAC in 2003), and above 75% of the TAC was harvested in all other years considered. In the Western GOA, the inshore TAC was exceeded by a small margin (1% of TAC) in two years, 2003 and 2010. Harvest in the inshore component area was between 75% and 100% of TAC in the five other years considered. The Pacific cod CP TAC ranged from around 1,700 to 4,000 mt in the Central GOA and 1,500 to 2,200 mt in the Western GOA. The Central GOA offshore TAC was not exceeded in any year and harvests fell below 75% of available TAC in six of nine years. The Western GOA offshore TAC was exceeded by 661 mt in 2003 (43% of TAC), and harvest totaled more than 75% of TAC in three additional years. The roughly 2% of total Pacific cod trawl harvest allocated to Rockfish Pilot Program participants from 2008-2011 was harvested close to the limit annually, ranging from 83% to 98% of the allocated amount.

Participants in the GOA rockfish trawl fisheries harvest directed rockfish species as well as other "secondary species," which are allocated in the Central GOA under the Rockfish Program. During the 2003 to 2011 period, directed fisheries existed for Pacific ocean perch, pelagic shelf rockfish, and northern rockfish. The Central GOA Pacific ocean perch harvest level was never less than 94% of the available TAC, and has been consistently close to full harvest in all years since 2007 when cooperative management was put into place by the Rockfish Pilot Program. Central GOA northern rockfish was similarly harvested near or above capacity until the RPP years, reporting between 92% and 110% of TAC from 2003 to 2006; harvest in the fishery stayed between 74% and 89% of lowered TAC levels from 2008 to 2011. Central GOA pelagic shelf rockfish was less fully utilized, topping 75% of available TAC two times since the implementation of the RPP. The TAC levels for the three directed rockfish fisheries were slightly reduced under the RPP; these fisheries were not overharvested in 2007, with the directed fisheries taking between 71% and 89% of the available quota. Secondary species TACs in the Central GOA are considerably lower (less than 1,010 mt) and were not harvested at or near full utilization under the RPP. The "other rockfish" species group (slope rockfish and demersal shelf rockfish, at the time) had experienced overharvest in each year prior to 2007.

Though managed differently in recent years – the Western GOA is not included in the RPP or Rockfish Program – Western GOA rockfish harvest reflects similar outcomes for directed fisheries. Prior to 2008, Pacific ocean perch and northern rockfish were more fully utilized than pelagic shelf rockfish, though a lower percentage of the lower TACs were harvested in the Western GOA compared to the Central GOA (northern rockfish in 2004 was an exception with 134% of the available TAC harvested). From 2008 to 2010, Pacific ocean perch was fully utilized at between 100% and 108% of TAC (falling to 65% in 2011), while Northern rockfish and pelagic shelf rockfish were harvested between 60% and 95% of TAC. Western GOA secondary species fisheries, with low TAC levels (40 to 600 mt), experienced more variability in utilization. "Other rockfish" species were overharvested from 2003 to 2005 and from 2009 to 2011, but utilized as little as 44% of available TAC in the intervening years. Thornyhead rockfish harvest topped 75% of TAC in only three years. Shortraker and rougheye rockfish were overharvested in

their jointly managed years (prior to 2005); shortraker rockfish have been relatively more utilized since then, topping 100% of available TAC in three of seven years.

Arrowtooth flounder TAC has been exceeded in one year for each the Central (2006) and Western (2003) GOA. The arrowtooth flounder TAC in the Western GOA was steady at 8,000 mt until 2011, and less than 40% of this total was harvested in each year since 2004. Western GOA TAC was increased to 14,500 mt in 2012. The Central GOA TAC increased from 25,000 mt to 30,000 mt in 2008, and dramatically increased to 75,000 mt in 2012. Through 2011, the Central GOA arrowtooth TAC was exceeded in one year and harvested at over 75% of TAC in four additional years.

In the Central GOA, shallow water flatfish harvest did not exceed 70% of the 13,000 mt TAC set throughout the 2003 to 2011 period, and was more typically less than 50%. Western GOA TAC was set at 4,500 mt; harvest reached no greater than 17% of available TAC, and was more typically less than 10%. Shallow water flatfish TAC levels also increased in 2012, and now set at 18,000 mt in the Central GOA and 13,250 mt in the Western GOA.

Utilization of flathead sole TAC was similarly low across the GOA. Central GOA flathead sole harvest did not exceed 70% of the 5,000 mt TAC set throughout the analyzed period. Western GOA harvest was even lower at no more than 41% of the TAC of 2,000 mt. In 2012, flathead sole TAC levels increased to 15,400 mt in the Central GOA, and 8,650 mt in the Western GOA.

Rex sole fisheries have not exceeded 70% of available TAC in either regulator area of the GOA, and are more typically below 50% of the allowed harvest. Central GOA TACs were set between 5,500 and 7,500 mt during this period, while Western GOA TAC ranged from 1,000 to 1,700 mt. The rex sole fisheries did not experience the same 2012 TAC level increase that was noted in the other GOA flatfish fisheries.

In general, GOA groundfish species are underutilized, in terms of harvest as a percentage of allowable catch. The amount of groundfish harvested is most often constrained by the existing PSC limits for halibut, rather than TAC limits; this is particularly the case in the flatfish fisheries and in the B season for Pacific cod. As such, recent increases in flatfish TAC levels is not indicative of greater groundfish harvest levels. Greater detail on the interaction between seasonal halibut PSC limits and groundfish harvest patterns is provided in Section 4.4.8.

4.4.8 Intra-annual pattern of fishing for GOA non-pollock trawl trips

4.4.8.1 GOA groundfish prosecution, 2007 to 2011

Currently, fishery participants determine when and where to prosecute directed fisheries based on the scheduled season openings and the distribution of existing PSC limits for Pacific halibut and Chinook salmon. The NOAA Catch Accounting System data used to support this analysis reports activity by 11 trip target species. Of these, sablefish, Atka mackerel and “other species” (including sharks and skates) are managed, but not directed, trawl fisheries in the GOA – though participants in the Central GOA Rockfish Program do receive a secondary species allocation for sablefish. Individual decisions on timing and targeting are typically made with the aim of generating the greatest economic return on fishing effort, given the available target fisheries and the amount of limited PSC species that is unused at the time of a trip.

This analysis uses years 2007 to 2011 to describe the prevalent distribution of fishing, by targeted trips, during the course of a year. The 2007 starting point was selected because the implementation of the Rockfish Pilot Program altered the timing of rockfish fishing by establishing cooperatives in the Central GOA. For background purposes, the aggregate sum of harvest across this five-year period is separated by

month to minimize the previously discussed challenge of reporting fishing activity by trip week-ending date (WED), which does not always correspond to the week in which the fish was caught (Section 4.4.1). Table 4-27 to Table 4-30 illustrate the annual distribution of each GOA non-pollock trawl target species' aggregate catch from 2007 to 2011. These figures are repeated and broken out to reflect the possible Chinook salmon PSC apportionment levels outlined in Alternative 2 of this action. As a measure of relative importance, the catch distribution tables indicate each species' proportional share of total aggregate GOA non-pollock trawl harvest, and as a proportion of harvest at the considered Chinook salmon PSC apportionment group levels.

Pacific cod

The GOA CV trawl fleet begins fishing Pacific cod heavily upon the January 20 fishery opening, harvesting over 30% (on aggregate) of total Pacific cod harvest during those last 12 days in January. The CV Pacific cod fleet typically reached its A season TAC limit by late January in the Central GOA and by mid-to-late February in the Western GOA. The CP component of the Pacific cod fleet begins harvest in February and typically reached its A-season allotment by late February or early March in both regulatory areas. The Pacific cod B-season, beginning on September 1, has been intermittently interrupted by halibut PSC closures. On aggregate, roughly 30% of the GOA Pacific cod trawl fishery was harvested during September and October in the years analyzed. Only a very small amount of B-season harvest occurred in the Western GOA.

Arrowtooth Flounder

Arrowtooth flounder trawling begins in February, but is most heavily harvested in April until Halibut PSC limits closed the directed fishery – typically from May through the late summer. Approximately 60% of Gulf-wide arrowtooth flounder harvest occurred between the January 20 fishery opening and May. February fishing occurred primarily in the Central GOA, while the majority of May fishing occurred in the Western GOA. February Central GOA arrowtooth fishing is mainly done by CVs that have just finished with the Pacific cod A-season or the pollock roe season. May Western GOA arrowtooth fishing is mainly done by CPs that have just finished with the Bering Sea rock sole and yellowfin sole (shallow water flatfish) season.

Fall arrowtooth flounder harvest concluded earlier in the Western GOA, where only 7% of subarea harvest occurred after August and none occurred in November or December. Nearly 40% of Central GOA harvest occurred between August and November; the subarea experienced several halibut PSC closures in October and November, but has typically ended the fishing year on December 31as an open directed fishery. The catcher vessel sector – which only prosecutes arrowtooth in the Central GOA – takes a greater proportion of its arrowtooth flounder harvest in the spring months, while the catcher/processor sector targets arrowtooth more heavily in the fall.

Rockfish

Gulf-wide, 87% of rockfish trawl harvest has occurred between May and July during the analyzed years. The Central GOA rockfish trawl fishery opens in May and the Western GOA rockfish trawl fishery opens in July. Western GOA rockfish harvests are smaller by harvested weight comparison. In general, the Central GOA rockfish TAC is allocated as a catch share program, and the Western GOA TAC is managed as a directed fishery.

Central GOA rockfish trawlers harvested 84% of their aggregate catch from May to July (46% in July). The Western GOA harvested 98% of its aggregate catch in July and August (93% in July).

The CV sector took nearly 60% of its harvest in May and June. Virtually all CV rockfish harvest occurred in the Central GOA. Gulf-wide, the CP sector harvested 98% of its catch from June to August (91% in

July). In the Central GOA, the CP sector fished mainly in June and July, whereas the Western GOA CP sector fished in July and August.

In both regulatory areas, the CP sector took a small portion of aggregate 2007-to-2011 harvest (approximately 1.5%) in October. Secondary rockfish species – shortraker rockfish, rougheye rockfish, thornyhead rockfish and "other rockfish" (slope rockfish and demersal shelf rockfish) – were fished under MRAs throughout the calendar year. In the Western GOA, "Other rockfish" and shortraker rockfish were typically placed on no-retention PSC status between mid-July and early August.

In addition to the Central GOA Rockfish Program and the Western GOA limited entry fishery, GOA rockfish TAC is allocated to an entry level fishery and to other GOA fisheries with incidental catch allowances (under MRA limitations).

Shallow water flatfish

Shallow water flatfish are harvested across a relatively large part of the year in the GOA. Relatively high harvest months include April, May, July, August and October. Together, August and October accounted for 40% of aggregate harvest. Relative to other non-pollock GOA groundfish species, a significant percentage of shallow water flatfish harvest occurs in November and December (9%). Shallow water flatfish fisheries were typically open during the first half of the year, but harvest dipped in September due to halibut PSC closures. Halibut PSC closures occurred in August of 2007, and as early as March and May in 2008 (2008 also featured a short halibut PSC closure in January for sideboarded Amendment 80 vessels).

The Western GOA comprised less than one-tenth of one percent (< 0.1%) of total GOA shallow water flatfish harvest between 2007 and 2011. Likewise, the CP sector accounted for less than 3% of aggregate GOA shallow water flatfish harvest during this period. Accordingly, the Central GOA CV sector is the sector of interest for this fishery.

Rex sole

Nearly 60% of GOA rex sole is harvested from February to April, with 37% of aggregate catch occurring in April. Approximately 40% occurred from July through September, and low monthly harvest levels persisted through the end of the calendar year. 95% of gulf-wide rex sole harvest occurred in the Central GOA and 93% was taken by the CP sector, so the Central GOA CP sector is the sector of interest in this fishery.

From 2008 to 2011, the Central GOA rex sole fishery consistently closed from late April through June due to halibut PSC limits. An earlier halibut PSC closure occurred from early March to April 1 in 2009. The halibut PSC closure for Central GOA rex sole occurred later, in mid-May, in 2007. The Central GOA fishery also experienced halibut PSC closures during the last three weeks of August and parts of October in 2007. In 2008, halibut PSC closed the Central GOA fishery for the last three weeks of September and mid-November. Western GOA rex sole fisheries followed the same management pattern with the addition of a halibut PSC closure for CV participants in the Rockfish Program during July 2011.

Flathead sole

Though it made up only 2% of total GOA non-pollock groundfish trawl harvest between 2007 and 2011, GOA flathead sole fisheries recorded a greater proportion of its catch during the late-year months than any other target species (24% from October to December). Gulf-wide, late-year harvest occurred predominantly in the CP sector. 71% of aggregate gulf-wide harvest occurred from February through June.

October dominated late-year flathead sole harvest in the Central GOA, while November accounted for the majority of late-year harvest in the Western GOA. 77% of Western GOA harvest occurred from February through May. No flathead sole harvest occurred in the Western GOA CV sector.

Flathead sole fisheries experienced the same regulatory and PSC closures as the shallow water flatfish fisheries, with halibut PSC closures occurring mainly in September. Earlier halibut PSC closures in 2007 and 2008 are described above (see shallow water flatfish).

Table 4-27 Monthly distribution of GOA non-pollock groundfish trawl harvest, 2007 to 2011 (Gulf-wide)

	MONTH												
TARGET	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	% of TOTAL GOA HARVEST
Arrowtooth Flounder													29%
Deep Water Flatfish													0%
Flathead Sole													2%
Pacific Cod													20%
Rex Sole													5%
Rockfish													31%
Shallow Water Flatfish													13%

1-5% of species aggregate catch, 2007-11
5.01-10% of species aggregate catch, 2007-11
10.01-100% of species aggregate catch, 2007-11

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

Table 4-28 Monthly distribution of GOA non-pollock groundfish trawl harvest by regulatory area, 2007 to 2011

		MONTH													
TARGET		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	% of Subarea Harvest	% of TOTAL GOA HARVEST
CG	Arrowtooth Flounder													33%	27%
	Deep Water Flatfish													0%	0%
	Flathead Sole													2%	2%
	Pacific Cod													18%	15%
	Rex Sole													6%	5%
	Rockfish													25%	21%
	Shallow Water Flatfish													15%	13%
WG	Arrowtooth Flounder													9%	1%
	Flathead Sole													3%	0%
	Pacific Cod													27%	5%
	Rex Sole													2%	0%
	Rockfish													60%	10%
	Shallow Water Flatfish													0%	0%

1-5% of species aggregate catch, 2007-11
5.01-10% of species aggregate catch, 2007-11
10.01-100% of species aggregate catch, 2007-11

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

Table 4-29 Monthly distribution of GOA non-pollock groundfish trawl harvest by operational type, 2007 to 2011

TARGET		MONTH												% of Operational Type Harvest	% of TOTAL GOA HARVEST
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
CP	Arrowtooth Flounder													25%	8%
	Flathead Sole													4%	1%
	Pacific Cod													1%	0%
	Rex Sole													14%	5%
	Rockfish													55%	19%
	Shallow Water Flatfish													1%	0%
CV	Arrowtooth Flounder													31%	20%
	Deep Water Flatfish													0%	0%
	Flathead Sole													1%	1%
	Pacific Cod													29%	19%
	Rex Sole													1%	0%
	Rockfish													19%	12%
	Shallow Water Flatfish													19%	12%

1-5% of species aggregate catch, 2007-11
5.01-10% of species aggregate catch, 2007-11
10.01-100% of species aggregate catch, 2007-11

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

Table 4-30 Monthly distribution of GOA non-pollock groundfish trawl harvest by regulatory area and operational type, 2007 to 2011

TARGET		MONTH												% of Sector Harvest	% of TOTAL GOA HARVEST
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
CGOA CP	Arrowtooth Flounder													33%	7%
	Flathead Sole													5%	1%
	Pacific Cod													0%	0%
	Rex Sole													21%	4%
	Rockfish													40%	9%
	Shallow Water Flatfish													2%	0%
CGOA CV	Arrowtooth Flounder													33%	20%
	Deep Water Flatfish													0%	0%
	Flathead Sole													1%	1%
	Other Species													0%	0%
	Pacific Cod													25%	15%
	Rex Sole													1%	0%
	Rockfish													20%	12%
	Shallow Water Flatfish													20%	12%
WGOA CP	Arrowtooth Flounder													12%	1%
	Flathead Sole													3%	0%
	Pacific Cod													2%	0%
	Rex Sole													2%	0%
	Rockfish													80%	10%
	Shallow Water Flatfish													0%	0%
WGOA CV	Pacific Cod													98%	4%

1-5% of species aggregate catch, 2007-11
5.01-10% of species aggregate catch, 2007-11
10.01-100% of species aggregate catch, 2007-11

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

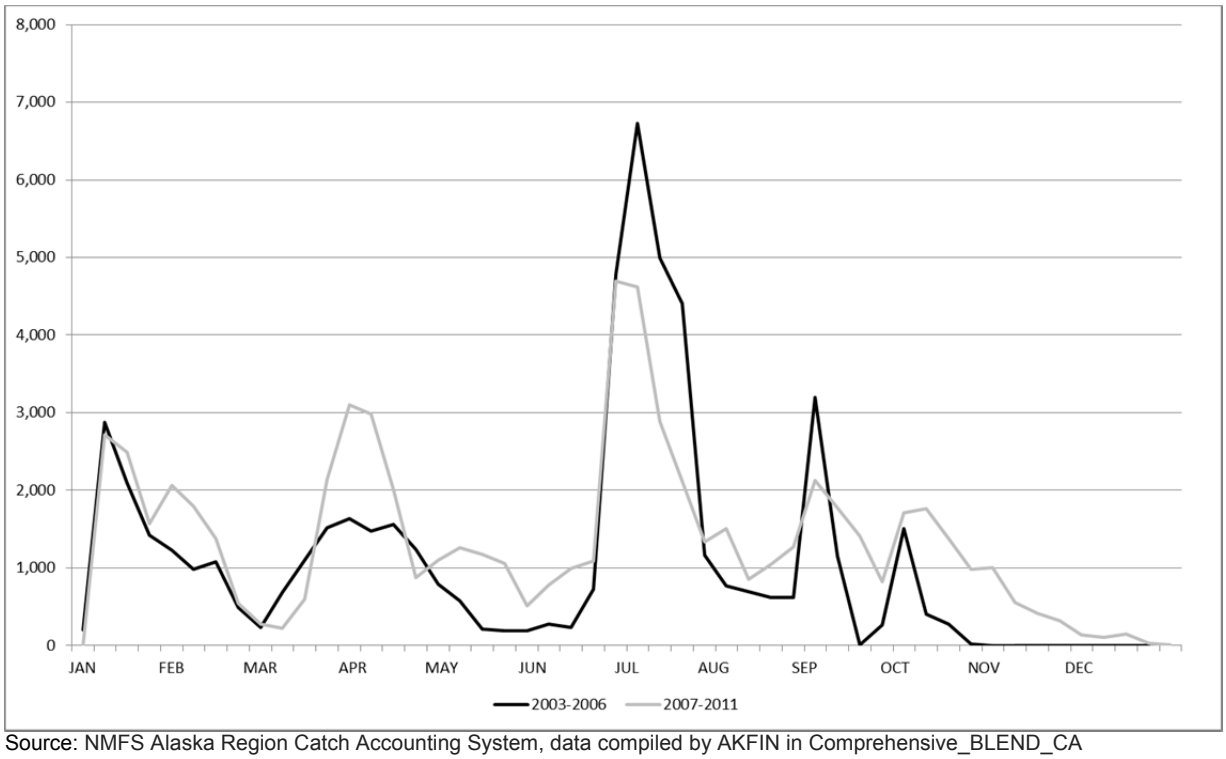
4.4.8.2 Pacific halibut PSC limits in the GOA trawl fishery

As noted above, halibut PSC limits have played a critical role in both the timing of GOA groundfish harvest, and in the fishery's overall ability to harvest groundfish at or near specified TAC levels. Under current regulations, the GOA trawl gear sector operates under a halibut PSC mortality limit that is apportioned out over five seasons, and further divided between shallow-water and deep-water groundfish species complexes. Of the target species examined in this analysis, the shallow-water complex includes Pacific cod, flathead sole and shallow water flatfish, while the deep-water complex includes rockfish, arrowtooth flounder and rex sole. Halibut PSC closures for the shallow-water complex also impact the directed fisheries for pollock, Atka mackerel and skates; shallow-water closures typically exempt participants fishing in the Central GOA Rockfish Program, and vessels fishing for pollock with pelagic trawl gear in the portions of the GOA that are open to that type of directed pollock fishing. Deep-water

closures also impact the directed fisheries for deep water flatfish, but exempt Rockfish Program participants.

Figure 4-10 illustrates the impact of halibut PSC closures on total GOA groundfish harvest. Halibut PSC limits were a significant constraint between 2003 and 2006, which partially explains the low aggregate harvest levels seen during the spring flatfish season and late in the calendar year; directed fisheries did not open during the final calendar quarter of 2004 and 2005. The effect of halibut PSC on overall GOA groundfish fishery activity is especially relevant to this action when considering alternatives that may base Chinook salmon PSC apportionments on historical harvest or PSC, as past halibut-related closures surely account for some of the difference in Chinook PSC and groundfish harvest between the years captured in a 10-year and a 5-year history.

Figure 4-10 Seasonal GOA groundfish harvest, 2003 to 2006 and 2007 to 2011



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

Table 4-31 describes the apportionment of halibut PSC to the GOA groundfish trawl fisheries for the 2013 fishing year. Currently, the GOA trawl gear sector faces a PSC limit of 1,973 mt of halibut mortality. In June 2012, the Council took final action to progressively reduce the halibut PSC limit over a three-year implementation plan. The action is currently pending secretarial approval, and would begin in 2014, at the earliest, using the 1,973 mt mortality limit as a baseline. The GOA trawl sector would ultimately face a halibut PSC limit of 1,705 mt in the third year after implementation and in subsequent years.

Table 4-31 Final 2013 apportionment of Pacific halibut PSC trawl limits

		Amount (mt)		
Season	**Percent**	**Total**	**Shallow-water Complex**	**Deep-water Complex**
January 20 - April 1	27.5%	543	444	99
April 1 - July 1	20.0%	395	99	296
July 1 - September 1	30.0%	592	197	395*
September 1 - October 1	7.5%	148	148	Any remainder
October 1 - December 31	15.0%	296	Unapportioned	
Total	**100%**	**1,973**		

* Vessels participating in cooperatives in the Central GOA Rockfish Program will receive 191 mt of the third season (July 1 through September 1) deep-water complex halibut PSC apportionment.
Source: NMFS Alaska Region

Noting the exemptions listed above, the halibut PSC closures in the GOA groundfish trawl fisheries from 2007 to 2012 are described below, according to the halibut PSC seasons listed in Table 4-31. At the broadest level of generalization, halibut PSC mortality typically closed the deep-water complex directed fisheries (excepting the Rockfish Program) from late April through the end of June, and closed the shallow-water complex directed fisheries during September.

The apportioned mortality allowance for the first halibut PSC season (January 20 – April 1) triggered only one deep-water complex closure (March 2009), and two shallow-water complex closures (March 2008, and very late March 2012). Sideboarded Amendment 80 vessels were closed out of the shallow-water complex fisheries earlier in 2008 and 2012.

Deep-water complex directed fisheries were closed for halibut mortality from late April through the end of June, during the second halibut PSC season, for all years since 2008; these fisheries closed from mid-May through June in 2007. Shallow-water complex directed fisheries only experienced second season halibut PSC closures in 2007, 2008 and 2012.

The third halibut PSC seasonal allowance similarly triggered shallow-water complex fishery closures during the season's latter half in 2007, 2008 and 2012. Third season deep-water complex fisheries were closed for halibut PSC during August 2007 and 2012. Rockfish (Pilot) Program vessels were closed out of non-program fisheries in July of 2007 and 2011. These sideboard closures only applied to CPs in the shallow-water complex fisheries; for the deep-water complex, they applied to both CPs and CVs during July 2007, and only to CVs in 2011.

The shallow-water complex fisheries consistently experienced halibut PSC closures in the fourth halibut PSC season, throughout the 2007 to 2012 period, with intermittent 12 to 48 hour reopenings to aid in fully harvesting shallow-water TACs. Deep-water fisheries were only closed for halibut mortality during September in 2008.

The fifth halibut PSC seasonal allowance is not apportioned between the shallow- and deep-water species complexes. GOA groundfish trawl fisheries have not been closed for halibut mortality after October 1 since 2008. The fisheries experienced short closures and reopenings during 2007 and 2008, and in both

cases they reopened after unused halibut PSC was reallocated from the Rockfish Pilot Program in mid-November.

4.4.9 Chinook Salmon Prohibited Species Catch in Non-pollock Trawl Fisheries

4.4.9.1 Chinook Salmon PSC Data and Estimation

NMFS determines the number of Chinook salmon PSC in the GOA groundfish fisheries using the catch accounting system (Section 5.1.3). Chinook salmon PSC estimates from trawl CP and non-pollock trawl CV fisheries in the GOA are based on at-sea sampling for salmon. NMFS uses the at-sea samples on observed trips and extrapolates the sample to the week (CP) or trip (CV). These estimates are used to create PSC rates that are applied to unobserved vessels. There is a relationship between the abundance of given species in a haul, sample size, and the level of precision in the resulting estimate of species catch from sampling. In general, we can achieve precision in the catch estimate for common target species with very small samples of the haul. Conversely, even extremely large samples of a haul provide relatively imprecise estimates of catch for very rare species, such as Chinook salmon.

This analysis uses CAS PSC estimates from 2003 to 2011. During that time period, vessels greater than 125' LOA (generally CPs or CVs delivering to motherships greater than 125' in length) were required to have 100% observer coverage. Vessels 60' LOA and above were required to have observers onboard during 30% of their fishing effort in each calendar quarter, including one trip in each target fishery. The majority of trawl CVs fishing in the central GOA fall into this category; also a small number of vessels fishing in the Western GOA. Vessels under 60' LOA were not required to have an observer onboard. Many trawl CVs fishing in the central GOA fall into this category.

In October 2010, the Council took final action on Amendment 76 to the GOA Groundfish FMP, to restructure the Observer Program for vessels and processors (NPFMC 2010c). The final rule to implement the restructured program is expected to be effective for the beginning of the 2013 fishing year. The new Observer Program will make important changes to how observers are deployed, which will reduce sources of bias that currently jeopardize the statistical reliability of catch, bycatch and PSC data collected by the program. The restructuring also expands observer coverage to previously unobserved fisheries. Further description of the restructured program is included in Section 5.1.1.

4.4.9.2 Chinook salmon PSC trends in the Gulf of Alaska non-pollock trawl fisheries

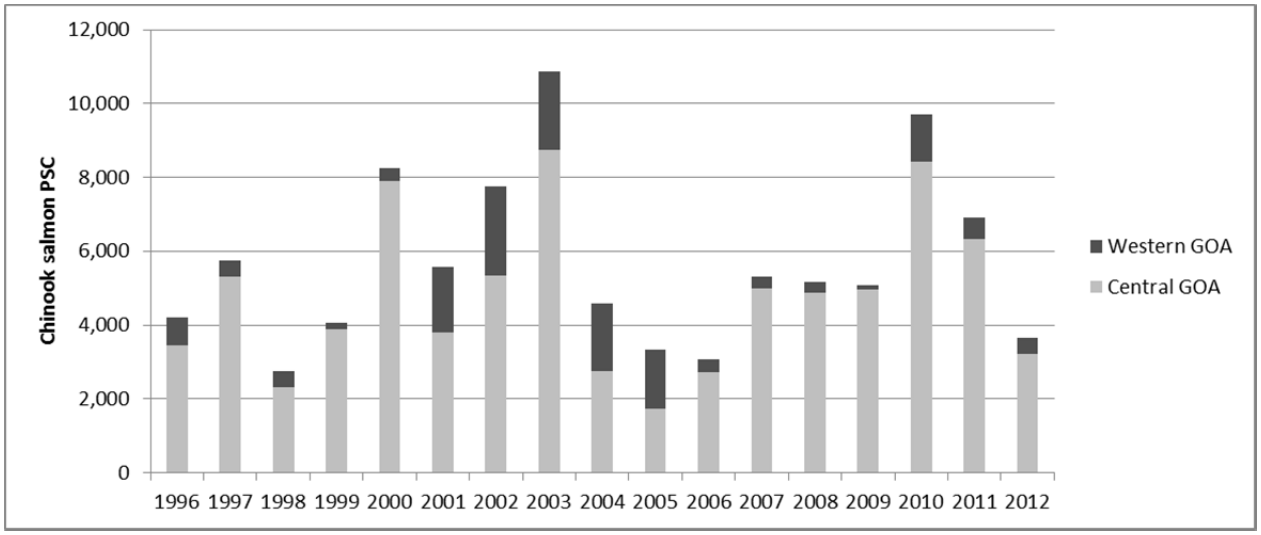
Since 1996, annual Chinook salmon PSC in GOA non-pollock trawl fisheries has varied widely. Gulf-wide PSC averaged 5,770 Chinook salmon (5,231 median), with a maximum annual PSC of 10,877 in 2003 and a minimum PSC of 2,739 in 1998. The time series does not display a trend, and the standard deviation from the mean was 2,355. Moreover, Chinook salmon PSC levels displayed a weak statistical relationship to the harvested amount of non-pollock groundfish. Across all analyzed harvest records, the correlation coefficient between metric tons of harvest and the estimated number of Chinook salmon PSC was 0.23.[23]

Fishing trips in the Central GOA accounted for 84% of PSC during the 1996 to 2011 period. Mean annual Central GOA PSC was 4,842 (4,917 median), with a maximum of 8,755 in 2003 and a minimum of 1,728 in 2005. Mean annual Western GOA PSC was 928 (510 median), with a maximum of 2,420 in 2002 and a minimum of 117 in 2009. 2005 was the only year in which Central and Western GOA PSC were

[23] A correlation coefficient of 1.0 (or -1.0) signals a perfectly simultaneous percent change in the paired data – with positive coefficients indicating a change in the same direction and negative coefficients indicating a change in the opposite direction – while a coefficient of 0.0 indicates no relationship whatsoever.

comparable. The Eastern GOA accounted for less than 2% of total Gulf PSC; a large part of this area, the Southeast Outside (Regulatory Area 650), has been closed to trawling since 1998.

Figure 4-11 Annual estimated Chinook salmon PSC in non-pollock groundfish fisheries, 1996 to 2012



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

4.4.9.3 Chinook salmon PSC by Alternative 2 apportionment group and target species

During the 2003 to 2011 time period, GOA non-pollock trawl fisheries averaged 6,001 Chinook salmon PSC annually.[24] This figure represents 25% of trawl fishery Chinook salmon PSC in the action area, with trips targeting pollock recording the balance. The highest non-pollock Chinook salmon PSC level reported in a given year was 10,877 in 2003, and the lowest was 3,060 in 2006. Note that the 2003 to 2011 average PSC levels reported in Table 4-32 to Table 4-35 are not an exact match to the 10-year averages used to calculate the Alternative 2 PSC apportionments reported in Table 2-1. 2002 data was excluded because it pre-dates the implementation of NOAA's Catch Accounting System and relies upon a blend of fish tickets and processors' weekly production reports.

Gulf-wide Chinook salmon PSC

Gulf-wide, the directed arrowtooth flounder trawl fisheries have reported the highest average Chinook salmon PSC. Arrowtooth flounder fisheries have taken the largest portion of Gulf-wide Chinook PSC in five of the nine reported years, with uncharacteristically low Chinook PSC years in 2004 and 2009. Trips targeting rex sole, rockfish, and Pacific cod typically account for the majority of remaining PSC. Flathead sole and shallow water flatfish fisheries experienced one-year PSC spikes in 2004 and 2009, respectively. Table 4-32 presents yearly PSC data for GOA non-pollock groundfish trawl targets in descending order of average annual PSC.

[24] The following PSC summary tables exclude a negligible amount of Chinook salmon PSC that was taken by trips that were *ex post* designated in NOAA's CAS as having targeted Atka mackerel. This PSC occurred in only one year, and cannot be reported due to confidentiality constraints. This withholding explains the difference in the listed GOA average annual PSC, but does not impact the relative magnitude of overall PSC or PSC by principal target species.

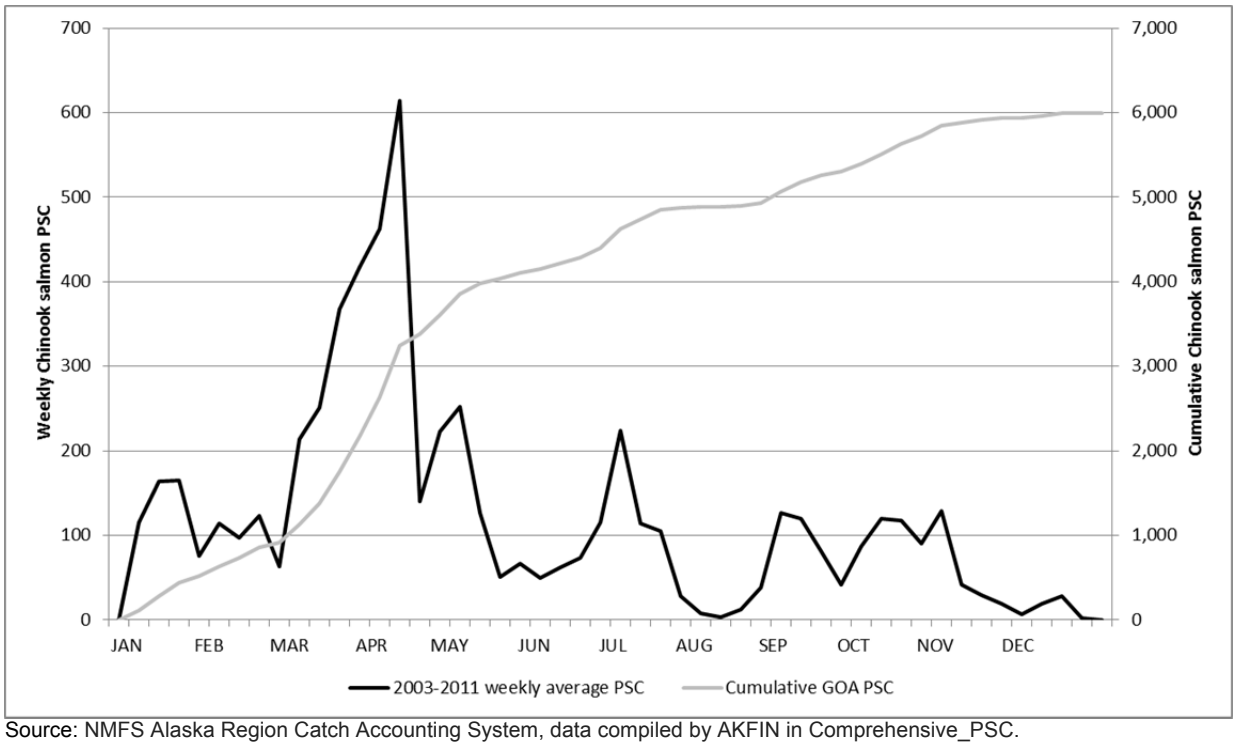
Table 4-32 Chinook salmon PSC for principal GOA non-pollock groundfish trawl target fisheries, 2003 to 2011

		Arrowtooth Flounder	Rex Sole	Rockfish	Pacific Cod	Shallow Water Flatfish	Flathead Sole	GOA TOTAL
2003	PSC	3,377	2,819	801	3,167	116	598	**10,877**
	%	31%	26%	7%	29%	1%	6%	**100%**
2004	PSC	359	498	885	908	498	1,446	**4,593**
	%	8%	11%	19%	20%	11%	31%	**100%**
2005	PSC	1,798	982	450	41	56	16	**3,343**
	%	54%	29%	13%	1%	2%	0%	**100%**
2006	PSC	408	1,444	263	888		56	**3,060**
	%	13%	47%	9%	29%		2%	**100%**
2007	PSC	1,502	714	2,026	624	438		**5,304**
	%	28%	13%	38%	12%	8%		**100%**
2008	PSC	2,596		1,918	436	208		**5,157**
	%	50%		37%	8%	4%		**100%**
2009	PSC	6	1,911	1,179	111	1,749	118	**5,075**
	%	0%	38%	23%	2%	34%	2%	**100%**
2010	PSC	3,943	2,299	1,510	435	1,012	496	**9,694**
	%	41%	24%	16%	4%	10%	5%	**100%**
2011	PSC	3,013	1,354	980	1,351	82	36	**6,816**
	%	44%	20%	14%	20%	1%	1%	**100%**
2003-2011 Avg.	**PSC**	**1,889**	**1,336**	**1,112**	**884**	**462**	**307**	**5,991**
	%	**31%**	**22%**	**19%**	**15%**	**8%**	**5%**	**100%**

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Figure 4-12 illustrates the distribution of Chinook salmon PSC throughout the calendar year. Weekly levels represent the average Chinook PSC taken in all non-pollock target fisheries in a given calendar week, over the 2003 to 2011 period. Chinook PSC taken in Weeks 4 through 7 largely occurred in the Pacific cod A-season fishery. Chinook PSC taken in Weeks 8 through 11 are primarily recorded by trips targeting rex sole. The early spring spike in PSC (Weeks 12 through 17, typically falling in March and April) represents continued increasing PSC in the rex sole fishery as well as the most intense period of arrowtooth flounder-related PSC. The rockfish fishery, which occurs as late as November but falls off significantly in volume by August (Week 31), drives non-pollock PSC from the typical season opening (May, Week 18) through August. The highest weekly averages for rockfish-related PSC occur in July, as average weekly rockfish harvest peaks before falling sharply. Some additional PSC during this late spring (Weeks 18 through 20) occur in the arrowtooth and rex sole fisheries, but rockfish trips are the predominant source of summer PSC. Much of the September and October PSC (Weeks 35 through 42) is recorded by B-season Pacific cod trips, though shallow water flatfish trips emerge as a PSC source in late-September (around Week 38) and continue through November once the cod season has ended. Trips targeting arrowtooth also display a resurgence in PSC after the end of the cod season (Weeks 43 through 46), though the increased Chinook catch does not correspond to an increase in arrowtooth target harvest levels.

Figure 4-12 Time distribution of Gulf-wide Chinook salmon PSC, 2003 to 2011



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Central and Western GOA Chinook salmon PSC

Chinook salmon PSC in the Central GOA non-pollock trawl fisheries totaled 45,506 (84% of total GOA Chinook salmon PSC) from 2003 to 2011. Western GOA PSC totaled 8,500 (16% of total PSC) over the same period. On average, trips targeting rex sole, rockfish and shallow water flatfish fisheries contributed more to area PSC in the Central GOA than in the Western GOA. Conversely, PSC in the arrowtooth flounder and flathead sole fisheries was more prevalent in the Western GOA than it was in the Central GOA. Table 4-33 presents yearly PSC data for the principal GOA non-pollock groundfish trawl fisheries by regulatory area, in descending order of average annual PSC.

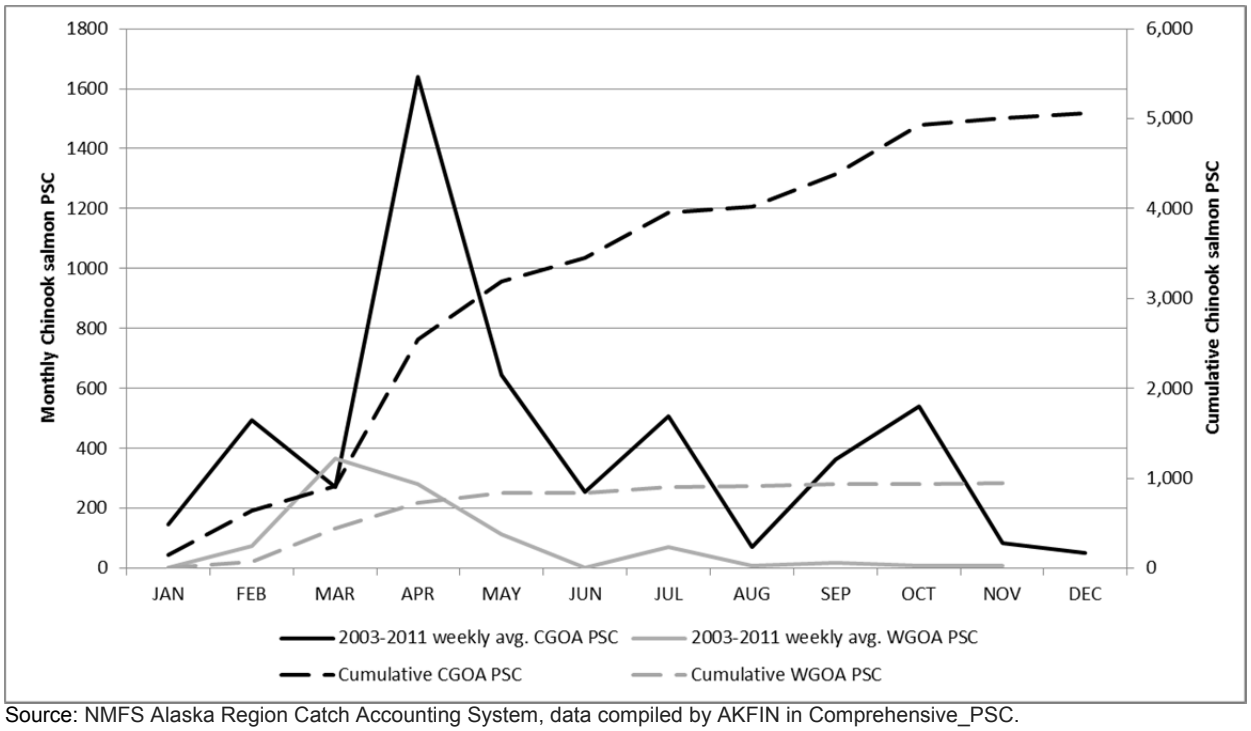
Table 4-33 Chinook salmon PSC for principal GOA non-pollock groundfish trawl target fisheries, by regulatory area, 2003 to 2011

		Western GOA							Central GOA						
		Arrowtooth Flounder	Flathead Sole	Pacific Cod	Rockfish	Rex Sole	Shallow Water Flatfish	Western GOA TOTAL	Arrowtooth Flounder	Rex Sole	Rockfish	Pacific Cod	Shallow Water Flatfish	Flathead Sole	Central GOA TOTAL
2003	PSC	1,878		215		27	*	*	1,499	2,791	801	2,952	114	598	**8,755**
	%	88%		10%		1%	*	*	17%	32%	9%	34%	1%	7%	**100%**
2004	PSC	276	1,348	95		*	*	*	83	371	885	813	494	98	**2,743**
	%	15%	73%	5%		*	*	*	3%	14%	32%	30%	18%	4%	**100%**
2005	PSC	1,422	16			*	*	*	377	812	450	41	48		**1,728**
	%	88%	1%			*	*	*	22%	47%	26%	2%	3%		**100%**
2006	PSC	53	*	201		*		**351**	355	*	263	687	0	2	*
	%	15%	*	57%		*		**100%**	13%	*	10%	25%	0%	0%	*
2007	PSC	46		200	19	*	*	**304**	1,456	*	2,007	424	437		*
	%	15%		66%	6%	*	*	**100%**	29%	*	40%	8%	9%		*
2008	PSC	125		108	49			**282**	2,471		1,868	328	208		**4,876**
	%	44%		38%	18%			**100%**	51%		38%	7%	4%		**100%**
2009	PSC			10	107			**117**	6	1,911	1,072	101	1,749	118	**4,958**
	%			8%	92%			**100%**	0%	39%	22%	2%	35%	2%	**100%**
2010	PSC	*	144		292			**1,277**	3,103	2,299	1,217	435	1,012	352	**8,418**
	%	*	11%		23%			**100%**	37%	27%	14%	5%	12%	4%	**100%**
2011	PSC	*	*	342	225			**582**	3,012	1,354	755	1,009	82	21	**6,234**
	%	*	*	59%	39%			**100%**	48%	22%	12%	16%	1%	0%	**100%**
2003-2011 Avg.	**PSC**	**516**	**175**	**130**	**77**	**45**	**2**	**945**	**1,374**	**1,291**	**1,035**	**754**	**460**	**132**	**5,047**
	%	**55%**	**19%**	**14%**	**8%**	**5%**	**0%**	**100%**	**27%**	**25%**	**20%**	**15%**	**9%**	**3%**	**100%**

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

The arrowtooth flounder fisheries in both the Western and Central GOA reported the most Chinook salmon PSC, accounting for over half of average annual Western GOA PSC (55%). With the exception of low PSC years in the Central GOA in 2004 and 2009, arrowtooth flounder typically ranked in the top three for yearly Chinook salmon PSC by species. Pacific cod fisheries recorded 14% and 15% of area subtotal PSC in the Western and Central GOA, respectively. Since 2007, the Central GOA Pacific cod fishery has decreased in PSC rank relative to other subarea target fisheries. Rockfish fisheries also accounted for significant proportions of Chinook salmon PSC in each region, reporting 8% of the Western GOA subtotal and 20% of the Central GOA subtotal. Yearly PSC ranking, relative to other subarea target fisheries, has increased in the Western GOA rockfish fishery since 2008. The Central GOA rockfish fishery displayed a PSC spike in 2007, following implementation of the Rockfish Pilot Program, and has declined steadily since then (further discussion of Central GOA rockfish PSC trends is included in Section 4.4.10). Western GOA flathead sole fisheries accounted for 19% of the Chinook salmon PSC area subtotal, while flathead sole Chinook PSC makes up only 3% of the Central GOA subtotal. The Western GOA flathead sole fishery experienced a one-year spike in PSC in 2004, reporting 1,348 Chinook salmon (73% of the subarea PSC total for that year). Rex sole and shallow water flatfish fisheries, on the other hand, were significant sources of Chinook salmon PSC in the Central GOA (25% and 9%, respectively), while together accounting for a very small proportion of total PSC in the Western GOA. The Central GOA shallow water flatfish target fishery experienced a PSC spike in 2009, reporting 1,749 Chinook salmon (35% of the subarea PSC total for that year).

Figure 4-13 Time distribution of Central GOA and Western GOA Chinook salmon PSC, 2003 to 2011



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Figure 4-13 illustrates the distribution of Chinook salmon PSC in each regulatory area throughout the calendar year. Monthly levels represent the average PSC taken in all non-pollock target fisheries in a given calendar month, over the 2003 to 2011 period. Weekly PSC records were suppressed due to confidentiality constraints.

Chinook salmon PSC in the Western GOA mainly occurred from March to May (Weeks 11 through 20). 69% of the PSC recorded during this time of year occurred on trips targeting arrowtooth flounder; arrowtooth trips also accounted for 69% of non-pollock trawl harvest during that period. July PSC (Weeks 27 through 29) occurred during the early weeks of the Western GOA rockfish season. September PSC (Weeks 35 through 37) occurred largely in the Pacific cod B-season fishery, which was not a large fishery by harvest weight; on average, Western GOA B-season Pacific cod harvest totaled 75 mt on average (between Week 36 and Week 42). November PSC in the Western GOA accrued to trips that were designated as targeting rockfish and flathead sole.

Chinook PSC patterns in the Central GOA are largely similar to those observed for the Gulf as a whole (illustrated in Figure 4-12), which is not surprising considering that the area accounted for 84% of Chinook salmon PSC. Early year PSC occurred primarily in the Pacific cod A-season fishery and the rex sole fishery, though one February week exhibited an average of 35 arrowtooth-related Chinook salmon. The early spring spike is attributed mainly to rex sole and arrowtooth trips, while summer PSC was mainly associated with rockfish harvest. Fall and early-winter PSC occurred mainly in the Pacific cod B-season (Weeks 35 through 42) and in the shallow water flatfish fishery (Weeks 37 through 45).

GOA catcher/processor and catcher vessel Chinook salmon PSC

GOA catcher/processors took 53% of the total Chinook salmon PSC from 2003 to 2011 (28,477 Chinook salmon), while catcher vessels took 47% (25,529 Chinook salmon). The relative importance of individual target fisheries to Gulf-wide Chinook salmon PSC is somewhat different when taken by operational type

rather than regulatory area, in a manner that largely follows operation type participation in the various fisheries. Over the analyzed period, the rex sole fishery recorded the highest aggregate Chinook salmon PSC in the CP sector, while Pacific cod contributed the most PSC to the CV sector. During the analyzed years, the CV sector accounted for over 90% of the total Chinook salmon PSC taken by Pacific cod trips, which is not surprising given the split of Pacific cod TAC between the inshore and offshore sectors (and later CV and CP sectors). Arrowtooth flounder fisheries, which had recorded the highest aggregate Chinook salmon PSC levels by regulatory area, rank second in aggregate PSC for both CP and CV sectors. Rockfish fisheries remain an important contributor to Chinook salmon PSC for both operational types, accounting for 13% and 24% of the average yearly PSC for the CP and CV sector, respectively. 74% of Chinook salmon PSC in the flathead sole fisheries was taken by the CP sector, accounting for 7% of total CP PSC. Similarly, over 98% of Chinook salmon PSC in the shallow water flatfish fisheries was taken by the CV sector, representing 16% of total CV PSC. Table 4-34 presents yearly PSC data for GOA non-pollock groundfish trawl fisheries by operational type sector, in descending order of average annual PSC.

Table 4-34 Chinook salmon PSC for principal GOA non-pollock groundfish trawl target fisheries, by operational type, 2003 to 2011

		Catcher Vessels							Catcher/Processors						
		Pacific Cod	Arrowtooth Flounder	Rockfish	Shallow Water Flatfish	Flathead Sole	Rex Sole	CV TOTAL	Rex Sole	Arrowtooth Flounder	Rockfish	Flathead Sole	Pacific Cod	Shallow Water Flatfish	CP TOTAL
2003	PSC	3,006	86	800	114	588	7	**4,601**	2,811	3,291	*	11	161	*	**6,275**
	%	65%	2%	17%	2%	13%	0%	**100%**	45%	52%	*	0%	3%	*	**100%**
2004	PSC	772	83	810	496	111		**2,271**	498	276	*	1,335	136	*	**2,322**
	%	34%	4%	36%	22%	5%		**100%**	21%	12%	*	58%	6%	*	**100%**
2005	PSC	41	434	98	44			**617**	982	1,364	352	16		12	**2,726**
	%	7%	70%	16%	7%			**100%**	36%	50%	13%	1%		0%	**100%**
2006	PSC	868	298	263		2		**1,431**	1,444	*		54	*		**1,628**
	%	61%	21%	18%		0%		**100%**	89%	*		3%	*		**100%**
2007	PSC	433	957	501	437			**2,329**	714	545	1,525		*	*	*
	%	19%	41%	22%	19%			**100%**	24%	18%	51%		*	*	*
2008	PSC	431	278	1,588	208			**2,506**		2,318	329		4		**2,651**
	%	17%	11%	63%	8%			**100%**		87%	12%		0%		**100%**
2009	PSC	111	6	773	1,749		153	**2,793**	1,758		406	118			**2,282**
	%	4%	0%	28%	63%		5%	**100%**	77%		18%	5%			**100%**
2010	PSC	435	2,676	966	957	5	*	*	2,273	*	543	492		*	**4,631**
	%	9%	53%	19%	19%	0%	*	*	49%	*	12%	11%		*	**100%**
2011	PSC	1,105	2,258	374	82	4	*	*	1,260	755	607	32	*		*
	%	28%	58%	10%	2%	0%	*	*	43%	26%	21%	1%	*		*
2003-2011	**PSC**	**800**	**786**	**686**	**454**	**79**	**70**	**2,837**	**1,305**	**1,103**	**426**	**229**	*	*	**3,155**
Avg.	**%**	**28%**	**28%**	**24%**	**16%**	**3%**	**2%**	**100%**	**41%**	**35%**	**13%**	**7%**	*	*	**100%**

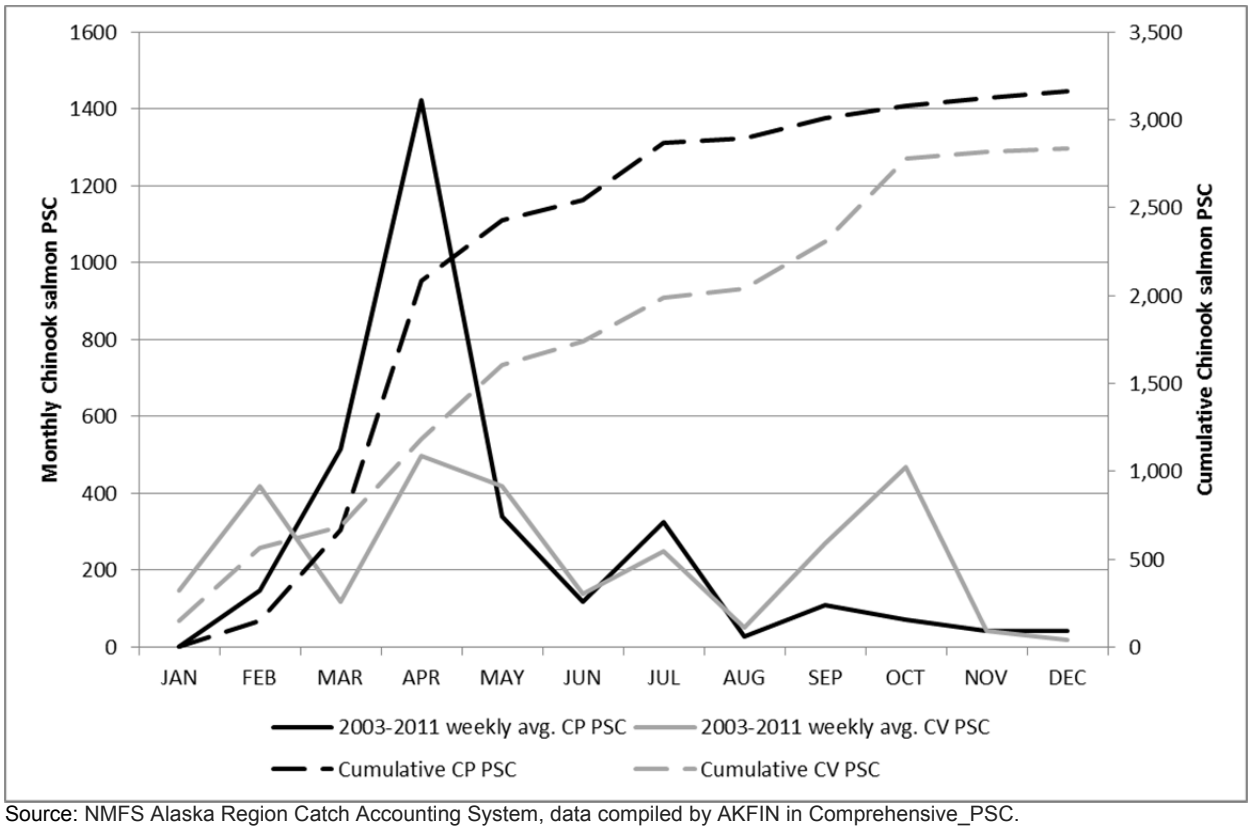
Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Figure 4-14 illustrates the distribution of Chinook salmon PSC in each operational type sector throughout the calendar year. Monthly levels represent the average PSC taken in all non-pollock target fisheries in a given calendar month, over the 2003 to 2011 period. Weekly PSC records were suppressed due to confidentiality constraints.

The CV sector records the majority of early season PSC, as it mainly occurs in the Pacific cod fishery for which CPs receive a relatively smaller portion of TAC. Between Weeks 14 and 20 (April and May), trips targeting arrowtooth flounder account for the majority of PSC in the CV sector. CVs harvest significant amounts of both rockfish and shallow water flatfish during the summer season, but nearly all PSC in Weeks 20 through 30 occurs in the rockfish fishery. Rockfish-related PSC decreases to very small average weekly amounts during Weeks 31 through 46 (late-July through November) when smaller, but not insignificant, amounts of rockfish have been harvested. Most of the CV sector's fall PSC occurs in the Pacific cod B-season, though shallow water flatfish trips emerge as the principal source of PSC from late-September through November. Weeks 43 through 45 (typically falling in late-October and early-November) recorded, on average, more than half of CV PSC in those weeks from arrowtooth trips, though those weeks do not directly correspond to the highest levels of late-year arrowtooth harvest.

The CP sector tended to record more of its average annual Chinook salmon PSC in the earlier part of the year. Trips targeting rex sole and arrowtooth flounder supplied the majority of the spring spike in PSC from Week 8 to Week 20, with two weeks in March (Weeks 12 and 13) displaying high average PSC from the flathead sole fishery. Summer CP PSC, from Week 24 to Week 30, occurred mainly in the rockfish fishery, with a re-emergence of rex sole-related PSC occurring in the latter half of the summer (Weeks 28 through 31). The majority of late year CP PSC was recorded in the rex sole fishery.

Figure 4-14 Time distribution of GOA catcher/processor and catcher vessel Chinook salmon PSC, 2003 to 2011



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Operational type sector (CP/CV) Chinook salmon PSC within each GOA regulatory area (Central and Western GOA)

Gulf-wide Chinook salmon PSC totaled 54,006 from 2003 to 2011. The Central GOA CV sector caught 46% of this amount, followed by the Central GOA CP sector (38%), the Western GOA CP sector (15%), and the Western GOA CV sector (1%). Table 4-35 presents yearly PSC data for principal GOA non-pollock groundfish trawl fisheries by regulatory area and operational type sector, in descending order of average annual PSC.

Within the Central GOA CV sector, the arrowtooth flounder, Pacific cod and rockfish fisheries have produced the highest average annual Chinook salmon PSC. Though it ranks fourth in average annual PSC for this sector, the vast majority of Chinook salmon taken in the shallow water flatfish fishery comes from this sector. The Central GOA CV shallow water flatfish fishery experienced a one-year spike in PSC in 2009, reporting 1,749 Chinook salmon (63% of the 2009 sector subtotal). With the exception of a very low PSC year in 2009, the Central GOA CV arrowtooth fishery has been among the sector's highest

Chinook PSC targets since 2005. This sector's Pacific cod and rockfish target fisheries experienced notably high PSC years in 2003 and 2008, respectively.

Trips targeting the rex sole fishery accounted for 55% of average annual Chinook salmon PSC in the Central GOA CP sector. Excepting 2007 and 2008, the rex sole fishery was responsible for more than half of the sector's Chinook salmon PSC in every year. Arrowtooth flounder trips accounted for 26% of Chinook salmon PSC on average, with notably high PSC years in 2008 (89% of yearly sector PSC) and 2003 (33%). Central GOA CP rockfish trips accounted for 15% of Chinook salmon PSC on average, taking more than any other target fishery in 2007 (56% of yearly sector PSC).

In the Western GOA CP sector, trips targeting arrowtooth flounder accounted for 58% of Chinook salmon PSC on average. PSC in the arrowtooth flounder fishery was variable across years, but accounted for more than half of the Chinook salmon taken in the sector in four of nine years and 95% of PSC in 2003. The sector's flathead sole fishery took 20% of Chinook salmon PSC on average, though no Chinook PSC were recorded from 2007 through 2009. The flathead sole fishery experienced a particularly high PSC year in 2004, catching 1,333 Chinook salmon (73% of the yearly sector PSC). The rockfish and Pacific cod fisheries accounted for 9% and 8% of the sector's average annual PSC, respectively. Western GOA CP trips accounted for an atypically high proportion of the sector's PSC in 2007. Trips targeting rockfish species did not report any Chinook salmon PSC until 2007; the rockfish fishery's PSC level has been increasing since then, taking all 107 Chinook salmon reported in the sector in 2009 and peaking at 292 PSC in 2010.

The Western GOA CV sector has averaged only 72 Chinook salmon per year over the analyzed period. The Pacific cod fishery accounted for 88% of the average PSC total, reporting Chinook salmon catch in all years but 2005 and 2010. PSC data for other Western GOA CV targets are restricted due to confidentiality rules. No target species besides Pacific cod recorded Chinook salmon PSC in more than one of the analyzed years.

Table 4-35 Chinook salmon PSC for principal GOA non-pollock groundfish trawl target fisheries, by regulatory area and operational type, 2003 to 2011

		Western GOA Catcher Vessels						Western GOA Catcher/Processors						
		Pacific Cod	Arrowtooth Flounder	Flathead Sole	Shallow Water Flatfish	Rockfish	WG CV TOTAL	Arrowtooth Flounder	Flathead Sole	Rockfish	Pacific Cod	Rex Sole	Shallow Water Flatfish	WG CP TOTAL
2003	PSC	143					**143**	1,878			*	27	*	**1,978**
	%	100%					**100%**	95%			*	1%	*	**100%**
2004	PSC	3		*	*		**20**	276	1,333		92	*	*	**1,830**
	%	16%		*	*		**100%**	15%	73%		5%	*	*	**100%**
2005	PSC		*				*****	1,364	16			*	*	**1,558**
	%		*				*****	88%	1%			*	*	**100%**
2006	PSC	201					**201**	53	*			*		**150**
	%	100%					**100%**	36%	*			*		**100%**
2007	PSC	9				*	*****	46		19	*	*	*	**295**
	%	98%				*	*****	16%		6%	*	*	*	**100%**
2008	PSC	107					**107**	125		49	*			*****
	%	100%					**100%**	71%		28%	*			*****
2009	PSC	10					**10**			107				**107**
	%	100%					**100%**			100%				**100%**
2010	PSC						**0**	*	144	292				**1,276**
	%						**100%**	*	11%	23%				**100%**
2011	PSC	96					**96**	*	*	225	*			**487**
	%	100%					**100%**	*	*	46%	*			**100%**
2003-2011	**PSC**	**63**	*****	*****	*****	*****	**72**	**509**	**174**	**77**	**67**	**45**	**1**	**873**
Avg.	**%**	**88%**	*****	*****	*****	*****	**100%**	**58%**	**20%**	**9%**	**8%**	**5%**	**0%**	**100%**

		Central GOA Catcher Vessels							Central GOA Catcher/Processors						
		Arrowtooth Flounder	Pacific Cod	Rockfish	Shallow Water Flatfish	Flathead Sole	Rex Sole	CG CV TOTAL	Rex Sole	Arrowtooth Flounder	Rockfish	Flathead Sole	Pacific Cod	Shallow Water Flatfish	CG CP TOTAL
2003	PSC	86	2,863	800	114	588	7	**4,458**	2,784	1,413	*	*	89		**4,297**
	%	2%	64%	18%	3%	13%	0%	**100%**	65%	33%	*	*	2%		**100%**
2004	PSC	83	769	810	494	96		**2,251**	371		*	*	44		**492**
	%	4%	34%	36%	22%	4%		**100%**	75%		*	*	9%		**100%**
2005	PSC	377	41	98	44			**559**	812	*	352			*	**1,168**
	%	67%	7%	18%	8%			**100%**	70%	*	30%			*	**100%**
2006	PSC	298	667	263		2		**1,230**	1,402	*			*		**1,479**
	%	24%	54%	21%		0%		**100%**	95%	*			*		**100%**
2007	PSC	957	424	501	437			**2,320**	*	*	1,506				**2,680**
	%	41%	18%	22%	19%			**100%**	*	*	56%				**100%**
2008	PSC	278	324	1,588	208			**2,399**		2,193	*		*		**2,477**
	%	12%	14%	66%	9%			**100%**		89%	*		*		**100%**
2009	PSC	6	101	773	1,749		153	**2,783**	1,758		*	*			**2,175**
	%	0%	4%	28%	63%		6%	**100%**	81%		*	*			**100%**
2010	PSC	2,676	435	966	957	*	*	**5,064**	2,273	*	251	*		*	**3,354**
	%	53%	9%	19%	19%	*	*	**100%**	68%	*	7%	*		*	**100%**
2011	PSC	2,258	1,009	374	82	*	*	**3,821**	1,260	754	*	*			**2,413**
	%	59%	26%	10%	2%	*	*	**100%**	50%	30%	*	*			**100%**
2003-2011	**PSC**	**780**	**737**	**686**	**454**	**77**	**31**	**2,765**	**1,259**	**594**	**349**	**55**	*****	*****	**2,282**
Avg.	**%**	**28%**	**27%**	**25%**	**16%**	**3%**	**1%**	**100%**	**55%**	**26%**	**15%**	**2%**	*****	*****	**100%**

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Figure 4-15 illustrates the distribution of Chinook salmon PSC for each operational type sector in each considered regulatory area throughout the calendar year. Monthly levels, displayed in the upper panel, represent the average PSC taken in the principal non-pollock target fisheries in a given calendar month during the 2003 to 2011 period. The lower panel shows the accumulation of average annual sector PSC throughout the year. Weekly PSC records were suppressed due to confidentiality constraints.

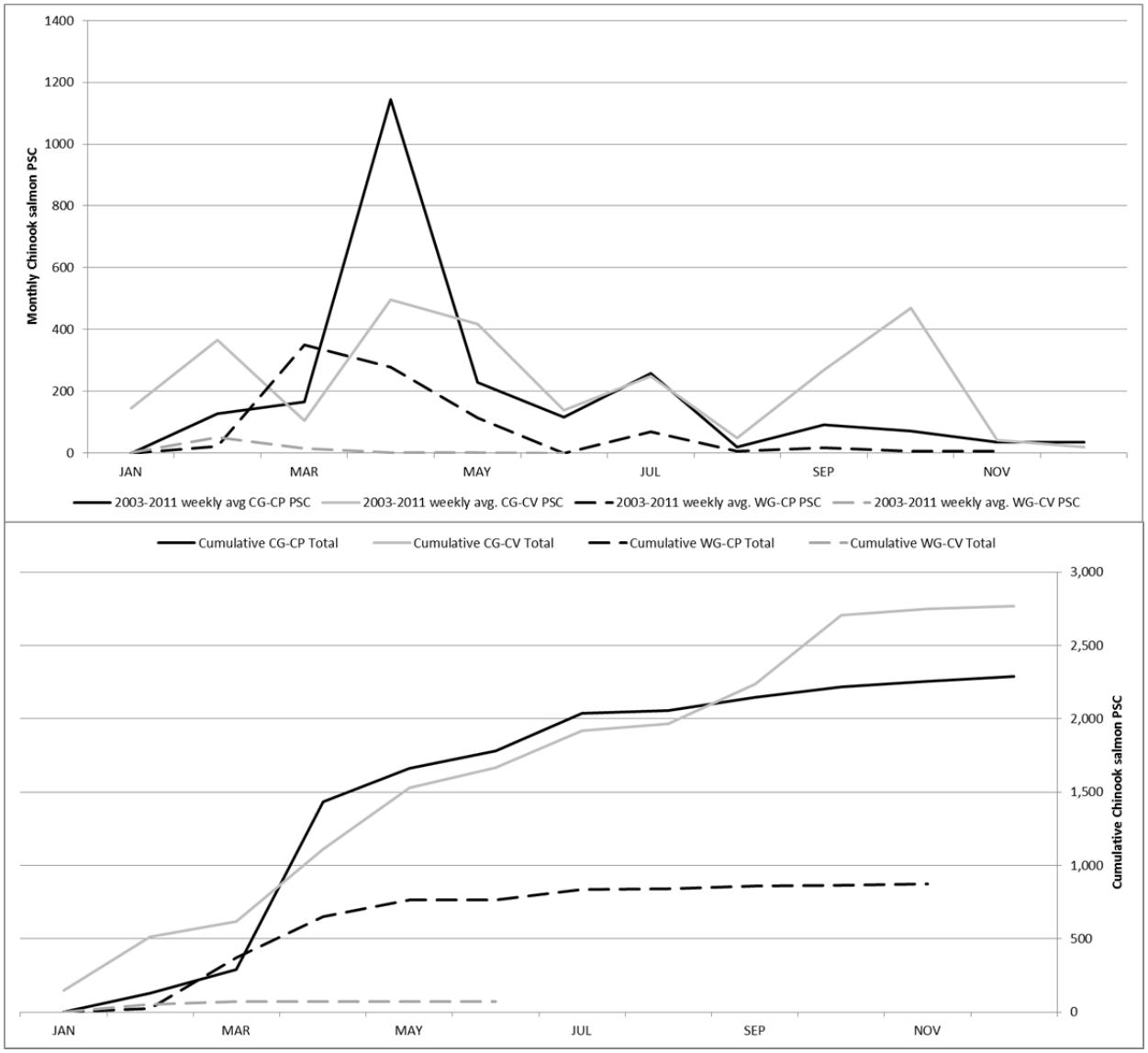
Central GOA CVs typically recorded the highest Chinook salmon PSC levels during the earliest and latest portion of the year. As is typically the case, January and February PSC (Weeks 3 through 8) are driven by the Pacific cod A-season. The uptick in Central GOA CV PSC in March (Weeks 9 through 11) come primarily from trips targeting flathead sole. Arrowtooth fishing also contributes to February PSC in this sector, but do not become the primary driver of PSC until the spring season from late-March through May (Weeks 13 through 19). Rockfish trips account for nearly all of the Central GOA CV sector's PSC from late-May through late-July (Weeks 18 through 30). The Pacific cod B-season accounts for most of the early-fall spike in PSC, while a second spike in November is mainly attributed to shallow water flatfish and arrowtooth fishing.

From February to May (Weeks 5 to 20), PSC in the Central GOA CP sector comes primarily from trips targeting rex sole. Arrowtooth trips contribute a similar amount of PSC during the peak PSC time that occurs in April (Weeks 14 to 17). This increase in arrowtooth-related PSC mirrors the increase in arrowtooth harvest at that time of year; however, one should note that significant amounts of flathead sole and shallow water flatfish are harvested during portions of this spring season, and are not generating much in the way of Chinook salmon PSC. Like the Central GOA CV sector, area CPs record the majority of summer PSC in the rockfish fishery. This activity begins later in the CP sector, as CP rockfish harvest does not begin until June (Week 24). In the Central GOA CP sector, fall PSC is mainly attributed to rex sole and, to a lesser extent, flathead sole fishing, whereas it was largely driven by Pacific cod and shallow water flatfish in the Central GOA CV sector. Several non-consecutive fall weeks recorded spikes in arrowtooth-related PSC; arrowtooth trips generally comprise the greatest proportion of Central GOA CP harvest from the late summer through the fall.

PSC in the Western GOA CP sector spiked in late-March and early-April (Weeks 12 through 14). These Chinook salmon were mainly recorded in the flathead sole and arrowtooth fisheries, which were also the leading harvest fisheries for the sector during that time. The late-April spike centered around the arrowtooth fishery in Week 17, which was again the dominant harvest fishery at the time. As with the Central GOA CP sector, summer PSC (July, Weeks 27 through 29) occurred at the start of the rockfish season. Fall PSC occurred at a low level in this sector, and was mainly related to the Pacific cod B-season.

Western GOA CV PSC occurred at low levels throughout the year, as harvested amounts were typically smaller in this sector. February and early-March PSC was linked to the Pacific cod A-season, while late-March PSC (Week 13) corresponded to the one week when the sector targeted arrowtooth.

Figure 4-15 Time distribution of GOA catcher/processor and catcher vessel Chinook salmon PSC within each regulatory area (Central and Western GOA), 2003 to 2011



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

4.4.10 Central GOA Rockfish Program

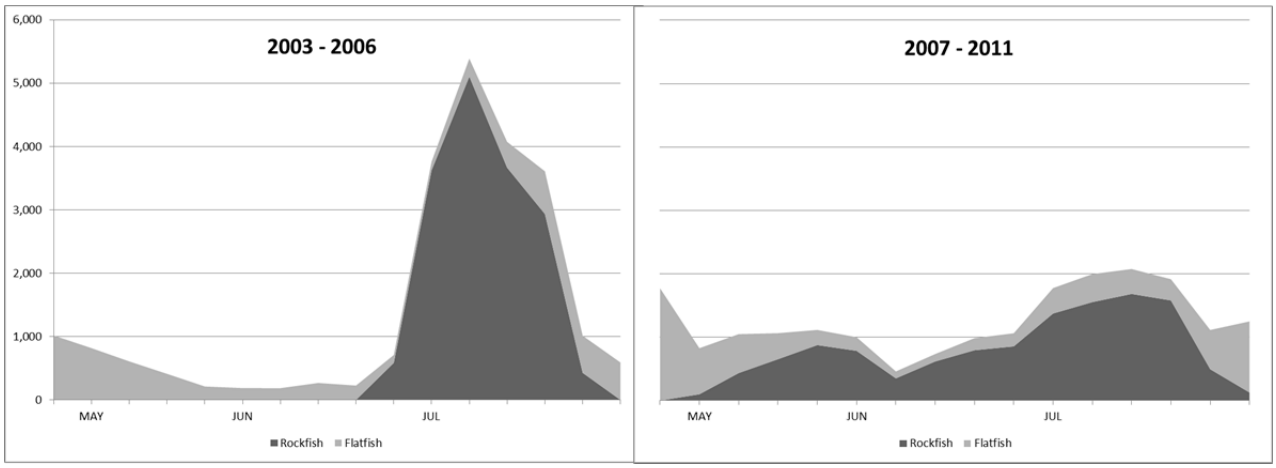
From 2003 to 2011, rockfish trips made up one-third of total GOA non-pollock groundfish trawl harvest, and the Central GOA landed 73% of that amount. Over that period, 84% of GOA non-pollock related Chinook salmon PSC occurred in the Central GOA. Trips targeting rockfish accounted for 19% of total non-pollock trawl fishery Chinook salmon PSC; Central GOA rockfish trips accounted for 93% rockfish-related PSC. [25]

The purpose and need drivers of the Rockfish Pilot Program (RPP)[26] identified fishery participants' limited ability to minimize bycatch under the previous limited entry management structure. The RPP,

[25] If pollock trips are also considered, rockfish trips accounted for 17% of GOA groundfish harvest and 5% of Chinook salmon PSC.
[26] Established under Amendment 68 to the Gulf of Alaska FMP.

which was replaced by the Rockfish Program (RP)[27] after the RPP's sunset in 2011, established a cooperative management structure in which members can coordinate and distribute fishing activity over a greater portion of the year. Many of the RP outcomes are beyond the scope of this analysis, but Central GOA rockfish trawlers made several behavioral changes that may be causally linked to a trend in Chinook salmon PSC. Implementation of the RPP in 2007 increased the length of the rockfish trawl season, increased the gross weight delivered to processors during May and June, and helped drive a shift from non-pelagic to semi-pelagic trawl gear (Figure 4-16).[28]

Figure 4-16 Seasonal distribution of harvest (mt) on trips targeting rockfish and flatfish, before and after 2007



The gear shift, which was at least partially an effort to reduce constraining halibut PSC mortality, may have contributed to higher levels of Chinook salmon PSC. Figure 4-17 illustrates the post-RPP increase in Chinook salmon PSC. From 2007 to 2011, the Central GOA's share of non-pollock Chinook salmon PSC increased to 92%, and Central GOA rockfish trips accounted for 22% of that amount. However, the figure also suggests that rockfish trawlers have utilized the tools of coordinated cooperative harvest of exclusive groundfish allocations to reduce Chinook PSC in the Central GOA rockfish fishery since that time. In recent years, Central GOA rockfish CVs have made a programmatic effort to report Chinook salmon hot spots, and cooperative organizations have focused on building awareness about Chinook salmon PSC.

For the years since the implementation of the RPP, it is possible to report groundfish harvest and Chinook salmon PSC for trips that are identified as occurring under the Program's cooperative management structure. The data reported above provide a sense of the relative size and importance of fishing activity targeting rockfish in the Central GOA, but may include catch by non-cooperative members and does not capture Program trips that are recorded under a different target species in the Catch Accounting System. The data in Table 4-37 and Table 4-38 (below) report only the fishing activity that occurred within the program, *including* those trips that were designated ex post with a non-rockfish target. Figure 4-17 illustrates this distinction, which is small but important for precision when considering alternatives that may apportion Chinook salmon PSC directly to the Rockfish Program.

[27] Established under Amendment 88 to the Gulf of Alaska FMP.
[28] The RPP lengthened the rockfish trawl season by moving the regulatory start date from July 1 to May. Reasons for moving up the start date included: stabilizing residential processor work force opportunities in Kodiak (May and June had previously been a period of low worker utilization), allowing AFA participants to fish earlier in the Bering Sea (when BS salmon encounter was lower), and improving product value by having fresh, well-handled rockfish product available for a greater portion of the year (see Figure 4-2 in Section 4.4.6.3, and Figure 4-16).

Table 4-36 Number of vessels making landings under the Rockfish (Pilot) Program, 2007 to 2012

Year	CP	CV	Total
2007	1	25	26
2008	2	25	27
2009	2	24	26
2010	4	24	28
2011	4	23	27
2012	5	28	33

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA, data compiled by AKFIN in Comprehensive_PSC and other Catch Accounting sources.

Table 4-37 Chinook salmon PSC recorded on Rockfish (Pilot) Program trips, 2007 to 2012

	2007	2008	2009	2010	2011	2012	Average	
Catcher Vessels	*	*	*	965	397	817	**847**	**62%**
Catcher/Processors	*	*	*	248	340	439	**510**	**38%**
CG Rockfish Program Total	**1940**	**1929**	**1068**	**1213**	**736**	**1256**	**1357**	**100%**

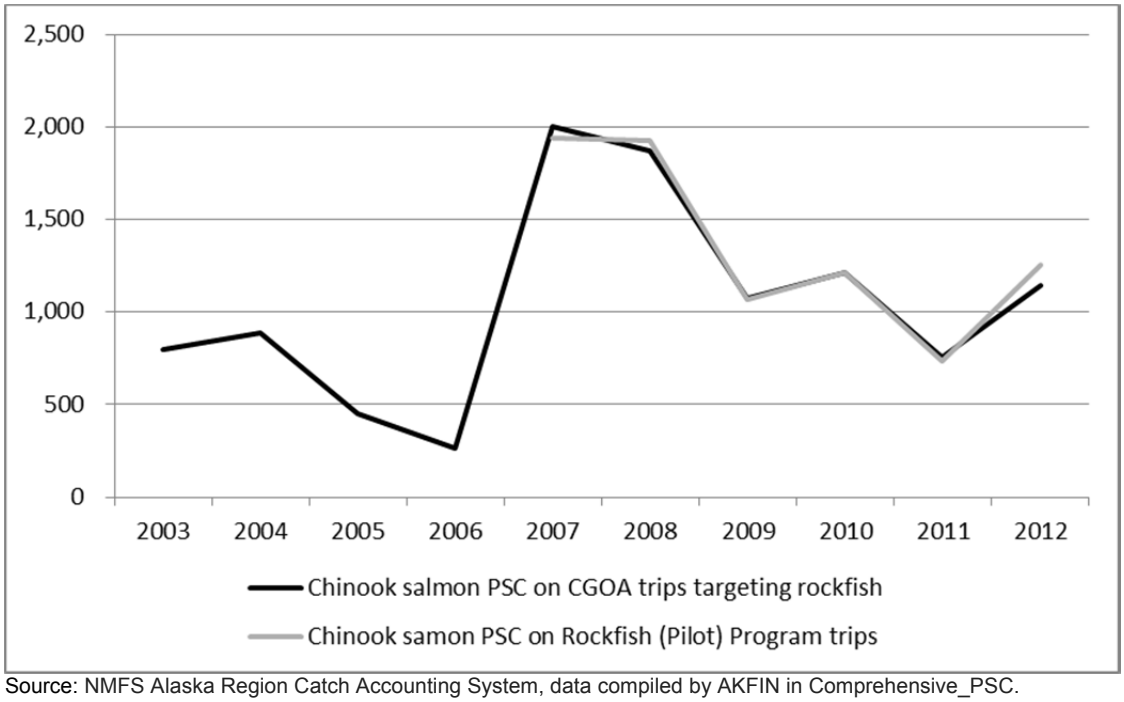
Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 4-38 Groundfish harvest (mt) recorded on Rockfish (Pilot) Program trips, 2007 to 2012

	2007	2008	2009	2010	2011	2012	Average	
Catcher Vessels	*	*	*	9,602	8,561	11,973	**9,218**	**67%**
Catcher/Processors	*	*	*	6,105	5,836	9,061	**4,578**	**33%**
CG Rockfish Program Total	**10,444**	**10,836**	**10,360**	**15,707**	**14,397**	**21,034**	**13,796**	**100%**

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

Figure 4-17 Chinook salmon PSC associated with the Central GOA rockfish fishery, 2003 to 2012



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Since the implementation of cooperative management in the Central GOA rockfish fishery, Program participants have averaged a total of 1,352 Chinook salmon PSC per year. Table 4-39 reports the average annual Chinook PSC recorded on Rockfish (Pilot) Program trips for each calendar month, by operational harvest type. Most Chinook salmon encounter occurs during the May to July period, when harvest is most

intense. From 2007 to 2012, CVs harvested 62% of their average annual RP-related groundfish during May and June, while CPs harvested 75% of their average annual RP-related groundfish during July. More information on PSC rates in the Rockfish Program is provided in Section 4.4.11.

Table 4-39 Average monthly Chinook salmon PSC recorded on Rockfish (Pilot) Program trips, 2007 to 2012

	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Total
CP		168	280	23	39			510
CV	485	265	40	6	44		3	843
Total	485	433	319	29	83		3	1,352

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

4.4.11 Rates of Chinook Salmon PSC in GOA Non-pollock Fisheries

In considering the Chinook salmon PSC action for the pollock fishery (Amendment 93), the Council recognized that the GOA trawl fisheries have highly variable Chinook PSC rates. The PSC rates reported and analyzed in this document reflect the number of Chinook salmon caught per metric ton of non-pollock groundfish trawl harvest. While not necessarily indicative of total Chinook salmon PSC, a rate provides a measure of bycatch frequency or intensity for a given area, harvest sector, or time period.

For this analysis, PSC rates are calculated in a manner that weights the relevant week-ending date (WED) records by the amount of fishing activity that took place. For example, when calculating the PSC rate for a given harvest sector, the sum of Chinook salmon PSC for all WED records in that sector is divided by the sum of all groundfish harvest (mt) in the same WED records. This method is preferable to averaging the Chinook PSC/mt ratios for the set of records. Doing so would effectively weight each WED record equally, potentially allowing records that account for a small amount of the sector's total fishing activity to bias the sector's overall PSC rate. Note that the PSC rates reported here are derived from weekly estimates of catch and PSC from NMFS CAS. These PSC rates are not the same PSC rates as those used within CAS to estimate PSC for management.

4.4.11.1 PSC Rate Trends by Year

The historical Chinook salmon PSC rates reported here focus on annual average rates, and average rates for a given calendar month during a set of years (Table 4-40).

Given the variability in observed historical Chinook salmon PSC rates, the extrapolated nature of PSC estimates, and the confluence of environmental factors and harvester choices that determine Chinook salmon encounter in trawl fishing, this analysis does not attempt to speculate on the cause of PSC rate trend changes. Rather, this section provides a comparative history of PSC rates for the regulatory areas, operation types and target fisheries that are relevant to the Council's proposed alternatives. This review of PSC rate history also provides a comparison of the approximate 5- and 10-year time periods under consideration as the basis for Chinook PSC apportionment by this action. While describing recent PSC rate trends may highlight the relative importance of GOA areas, operational types, or target species, the high degree of annual variability should be a caution against expecting future rates to conform to recent trends.

Table 4-40 Annual Chinook salmon PSC rates for all GOA non-pollock target fisheries

	Year									Period Average		
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003-2011	2003-2006	2007-2011
Total GOA	0.18	0.09	0.06	0.05	0.08	0.07	0.08	0.14	0.10	**0.10**	0.10	0.09
Central GOA	0.18	0.07	0.04	0.06	0.10	0.08	0.09	0.14	0.10	**0.10**	0.09	0.10
Western GOA	0.19	0.22	0.16	0.03	0.02	0.02	0.01	0.13	0.07	**0.10**	0.15	0.05
GOA CP	0.24	0.16	0.14	0.07	0.14	0.12	0.10	0.20	0.11	**0.14**	0.15	0.14
GOA CV	0.13	0.07	0.02	0.04	0.06	0.05	0.07	0.11	0.09	**0.07**	0.06	0.07
CGOA CP	0.26	0.06	0.09	0.10	0.24	0.19	0.17	0.22	0.12	**0.16**	0.13	0.19
CGOA CV	0.14	0.07	0.02	0.04	0.06	0.05	0.07	0.11	0.09	**0.07**	0.07	0.08
WGOA CP	0.21	0.28	0.27	0.02	0.03	0.02	0.01	0.16	0.07	**0.12**	0.19	0.06
WGOA CV	0.10	0.01	0.01	0.04	0.00	0.02	0.01	0.00	0.05	**0.03**	0.04	0.02

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC, and NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

Gulf-wide, the annual Chinook salmon PSC rate ranged between 0.05 and 0.18 during the analyzed period (Table 4-40). These rates suggest that the GOA non-pollock trawl fleet, which annually harvested an average of 62,437 mt, caught one Chinook salmon for every 20 mt of groundfish in the lowest PSC year, and one for every 5.5 mt in the highest PSC year.

Table 4-41 lists average PSC rates by trip target for the entire analyzed period and for the five most recent years. Flathead sole, arrowtooth flounder and rex sole trips recorded the highest PSC rates over the entire period, and rates generally decreased in recent years. Rockfish trips were among the targets where PSC rates increased, which may be linked to the increased halibut avoidance measures in 2007 and 2008, noted in Section 4.4.10 and apparent in Figure 4-18 and Figure 4-20. On its own, the rex sole target fishery would have recorded the highest average PSC rate; however, trips targeting arrowtooth flounder and rex sole are combined here, and in later discussion, as participants have reported that the two species are generally targeted together.[29] Analyzing these two targets separately may be misleading, as the attribution of a trip target to one species or another may largely be a function of the Catch Accounting System.

Table 4-41 PSC rate by GOA non-pollock target species, 2003 to 2011 & 2007 to 2011

Target	2003-2011	2007-2011
Flathead Sole	0.24	0.10
Arrowtooth & Rex Sole	0.17	0.15
Pacific Cod	0.07	0.04
Shallow Water Flatfish	0.06	0.08
Rockfish	0.05	0.07

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC, and NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

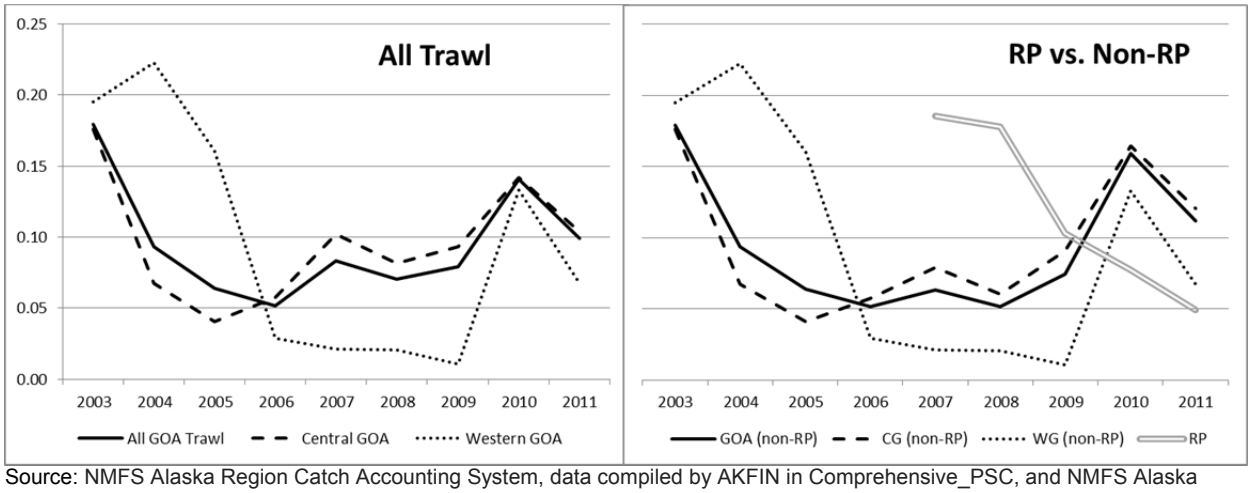
In the Western GOA, Chinook salmon PSC rates averaged over the 2007 to 2011 period tend to be lower than PSC rates for the 2003 to 2006 period. The opposite appears true for the Central GOA, where PSC rates have generally increased.[30] Figure 4-18 plots average Chinook salmon PSC rates for each regulatory

[29] The fact that arrowtooth flounder and rex sole are often targeted simultaneously is evident in the seasonal harvest distribution of target species, presented in Table 4-27 and
Table 4-28.

[30] Industry representatives familiar with the Central GOA CV sector have noted, anecdotally, that some increase in Chinook PSC rates since 2010 may be attributable to recent voluntary fleet-managed catch sharing plans for the C season pollock fishery (October). It has been suggested that pollock fishermen who are not in a race may opportunistically switch targets to Pacific cod or flatfish – if directed fishing is open – thus creating the possibility for a trip containing Chinook salmon PSC to be counted in the non-pollock targets, whereas the Catch Accounting System would normally have recorded it as a pollock trip. The analysts offer this note as relevant background concerning the prosecution of GOA groundfish fisheries, and not as causal explanation of increasing non-pollock Chinook PSC rate trends in this sector.

area by year. The right-hand panel treats Chinook PSC recorded on Rockfish Program trips separately, and illustrates the relative PSC rates of RP and non-RP fishing in the early years of the Program and the more recent years. As discussed in Section 4.4.10, higher PSC rates in the early RP years may have been associated with halibut avoidance measures, while the subsequent decline could be the result of improved cooperative management capacity (though the RP PSC rate did increase to 0.06 in 2012 – primarily driven by the CV sector). Table 4-42 shows yearly trends in average Chinook salmon PSC rates with RP trips held out separately, which may inform the Council's consideration of Alternative 2, Option 4 in this action.

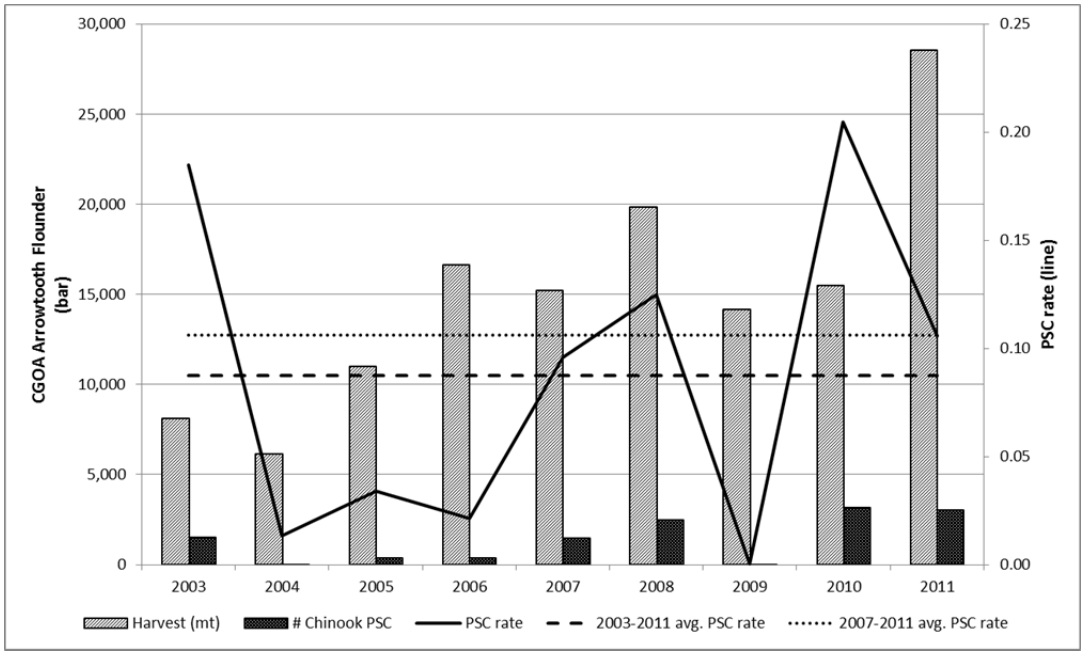
Figure 4-18 Yearly average Chinook salmon PSC rates in Central and Western GOA non-pollock fisheries (2003 to 2011)



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC, and NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

To illustrate the wide variation in annual PSC rates, Figure 4-19 provides harvest and Chinook salmon PSC trends for Central GOA arrowtooth flounder trips, which accounted for 29% of aggregate Central GOA harvest and 24% of total GOA harvest during the analyzed period. This example shows that PSC rates are not a necessarily a strong indicator of total Chinook salmon PSC or of harvest; it also shows that variable annual PSC rates do not necessarily result in dissimilar average PSC rates over five- and nine-year historical periods. Recognizing that target harvest and Chinook PSC levels are not directly correlated, one should exercise caution in drawing conclusions from a superficial inspection of rates.

Figure 4-19 Central GOA arrowtooth flounder target trips: harvest, Chinook salmon PSC and PSC rate, 2003 to 2011



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC, and NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

Table 4-42 Chinook salmon PSC rates by Rockfish (Pilot) Program participation, 2007 to 2011

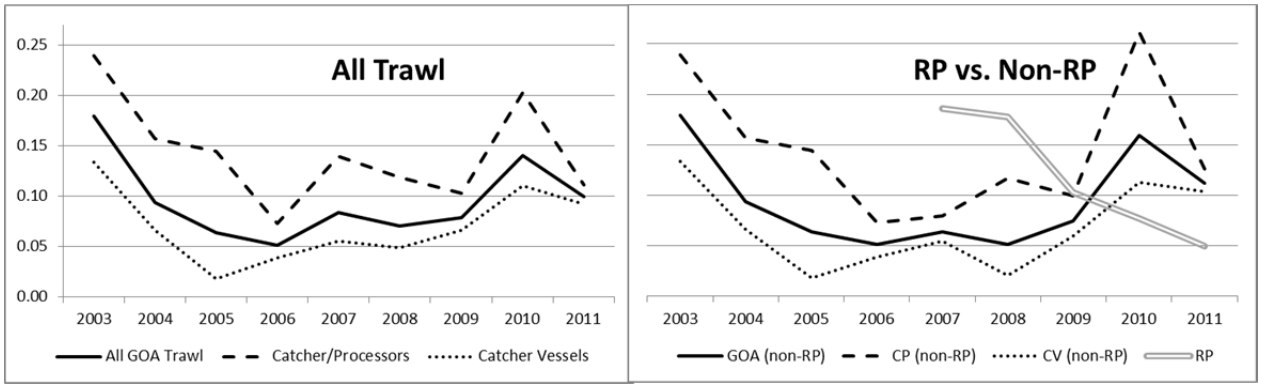
	Rockfish	Year					Period Average	
	Program	2007	2008	2009	2010	2011	2007-2011	2008-2011
Total GOA	N	0.06	0.05	0.07	0.16	0.11	0.09	0.10
	Y	0.19	0.18	0.10	0.08	0.05	0.12	0.10
CP	N	0.08	0.12	0.10	0.26	0.13	0.14	0.15
	Y	*	*	*	0.04	0.06	0.21	0.09
CV	N	0.05	0.02	0.06	0.11	0.10	0.07	0.07
	Y	0.06	0.19	0.10	0.10	0.04	0.10	0.11

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC, and NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

From a Gulf-wide perspective, the catcher/processor sector recorded higher Chinook salmon PSC rates and displayed greater variability across years (Figure 4-20). CP vessels recorded an average annual PSC rate of 0.14 from 2003 to 2011, and from 2007 to 2011. The sector's highest rates of Chinook salmon encounter occurred in 2003 (0.24) and 2010 (0.20), which were both high PSC years (Table 4-40). CP vessels accounted for only 35% of total non-pollock GOA groundfish harvest over the period, but took 53% of total GOA Chinook salmon PSC. By contrast, GOA catcher vessels recorded an average PSC rate of 0.07 from 2003 to 2011, and from 2007 to 2011, with no years in excess of 0.13 Chinook salmon per metric ton of non-pollock groundfish harvest. Higher average Chinook PSC rates for CP vessels persist when looking at operational types within each regulatory area (Table 4-40).

The right-hand panel of Figure 4-20 breaks out RP trips, resulting in lower PSC rates for non-RP fishing in 2007 and 2008. The change in PSC rates in more noticeable for non-RP CVs, as CVs make up the bulk of the RP fleet (Table 4-36). Average annual PSC rates for RP trips cannot be reported on the operational type level, as the low number of CPs participating in the RP make CP PSC rates confidential from 2007 to 2009.

Figure 4-20 Yearly average PSC rates in GOA non-pollock fisheries, by operational harvest type (2003 to 2011)



Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC, and NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

Harvest sector PSC rates over the 2008 to 2011 period were not substantially different from the 2007 to 2011 period; CPs recorded a rate of 0.13 Chinook salmon per metric ton of groundfish, and CVs had a rate of 0.08. The 2008 to 2011 time period merits a note as 2008 was the first year of implementation for Amendment 80 cooperatives in the CP sector. Noting this small difference is not meant to dismiss the potential for Amendment 80 cooperative relationships to develop into an effective tool for PSC avoidance, merely that no significant effect was apparent in data from the early program years.

Comparing the Chinook salmon PSC rates of GOA CPs and CVs presents an analytical challenge in two key respects. First, the CP and CV harvest sectors experience different levels of observer coverage. The restructured Observer Program requires all CPs to have 100% observer coverage when fishing in the GOA.[31] This analysis does not attempt to determine whether carrying an observer affects the reported PSC rate. Nevertheless, it should be acknowledged that unobserved fishing activity at least presents an opportunity to discard PSC at sea. This, and other differences in sampling procedures, is further discussed in Chapter 5.

The second, more fundamental, reason is that the two operational type sectors prosecute the GOA groundfish fisheries for different primary targets, at different times and in different locations. Some target species, such as Pacific cod, are primarily harvested by only one sector of the trawl fleet – CVs, in this example. Whether it has to do with the mechanics of cod fishing, or environmental factors related to cod fishing areas in late January, CVs derive a large proportion (over 30%) of their total harvest from this target fishery that has produced relatively lower levels of Chinook encounter compared to flatfish (Table 4-32 and Table 4-33). By comparison, CPs derive 39% of their groundfish harvest from the relatively Chinook salmon intense arrowtooth flounder and rex sole fisheries (Table 4-19).

It is not common for CPs and CVs to be targeting the same groundfish species in the same reporting area at the same time, which would be ideal for comparing Chinook salmon intensity across sectors while assuming that other determinant background factors are similar. Perhaps the only case that is somewhat suitable for comparison is the targeting of arrowtooth flounder and rex sole in the Central GOA during April.[32] In 2010 and 2011, combined, April trips targeting Central GOA arrowtooth flounder and rex sole

[31] Though it is not required, Amendment 80 CPs fishing in the GOA will occasionally carry two observers (200% coverage). This may occur when a CP plans to fish in the Bering Sea and in the GOA on the same trip, without returning to port. A CP may elect to keep 200% observer coverage in the GOA as a means to avoid possible logistical delays when dropping off or picking up personnel.
[32] The analysts chose to examine only the Central GOA (subareas 620 and 630) because the Western GOA arrowtooth flounder and rex sole fishery is a low-volume fishery that is only prosecuted by CPs. The years 2010 and 2011 were selected because CVs were not targeting arrowtooth flounder and rex sole in Area 620 during April of 2008 and 2009.

accounted for 42% of the total Chinook salmon PSC taken in all GOA groundfish trawl fisheries over those two years (April CV trips targeting these species accounted for 40% of total CV PSC, and April CP trips targeting these species accounted for 45% of total CP PSC). For these Central GOA fisheries in these years, CPs recorded a Chinook PSC rate of 0.56, compared to the CV rate of 0.28. Unfortunately, this superficial comparison breaks down when noting that CPs target these species primarily in Area 620, while CVs fish primarily in Area 630. Ultimately, there is an attribution problem that prevents one from concluding that CPs fish with an inherently higher PSC rate. In other words, it is not possible to say whether Chinook PSC rates are higher in Area 620 because mainly CPs fish there, or if CPs have higher PSC rates because they mainly fish in Area 620.

4.4.11.2 PSC Rate Trends within Years (by month, by week)

Considering the historical record of Chinook salmon PSC rates in GOA non-pollock fisheries throughout the calendar year can aid in developing a sense for how PSC limits are likely to affect fishery closure dates. In addition, if retrospective analysis of the 2003 to 2011 and 2007 to 2011 periods indicates that GOA non-pollock groundfish fisheries would likely close earlier under a PSC hard cap, PSC rates for the weeks and months coming after that predicted closure could provide a measure of Chinook salmon savings.

One should keep in mind that, without considering the tons of target species harvested, high PSC rates do not necessarily predict large amounts of Chinook salmon PSC. PSC rates are simply a measure of Chinook salmon catch per unit of effort (where one unit is a metric ton of target species harvest). In view of this fact, it is also useful to look back at the monthly distribution of target harvest from 2007 to 2011 described in Section 4.4.8. In doing so, the following notes bear mention:

- Gulf-wide –
    - 29% of non-pollock groundfish harvest occurred in July, when average PSC rates were very low (0.04) compared to the average annual rate (0.09);
    - only 0.3% of non-pollock harvest occurred in December, when average PSC rates were very high (0.30) compared to the average annual rate (0.09);
    - 14% of non-pollock groundfish harvest occurred in April, when average PSC rates (0.23) were well above the average annual rate (0.09);
- 70% of Western GOA occurred in February and July (21% in February and 49% in July), when average PSC rates (0.03 in February and 0.02 in July) were near the average annual rate (0.04);
- in the catcher/processor sector –
    - 54% of harvest occurred in July, when average PSC rates (0.04) were low compared to the average annual rate of 0.13;
    - the 0.00 average PSC rate in January was recorded during a month that accounted for only 0.07% of sector harvest.

Table 4-43 includes three panels of 2007 to 2011 average monthly PSC rates for each harvest sector that could potentially receive a PSC apportionment under Alternative 2. The first panel draws from all GOA groundfish trips; the second panel draws from all groundfish trips that were not part of the Rockfish (Pilot) Program; and the third panel shows monthly PSC rates derived from RP trips. Due to the small number of active vessels, only rates for CPs participating in the RP in July are non-confidential. The average PSC rate reported for each potential Chinook PSC apportionment subdivision (row) is weighted by the number of records in each month, meaning that not all months contribute equally to the average.

Table 4-43 Monthly average Chinook salmon PSC rates for all GOA non-pollock target fisheries, 2007 to 2011

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
All GOA Trips													
Total GOA	0.02	0.04	0.11	0.23	0.16	0.12	0.04	0.02	0.06	0.14	0.11	0.30	**0.09**
Central GOA	0.02	0.04	0.11	0.22	0.17	0.12	0.05	0.02	0.06	0.14	0.10	0.30	**0.11**
Western GOA	0.01	0.03	0.10	0.34	0.03		0.02	0.02	0.00	*	*		**0.04**
Catcher/Processors	0.00	0.32	0.31	0.47	0.16	0.37	0.04	0.02	0.12	0.04	0.23	*	**0.13**
Catcher Vessels	0.02	0.01	0.03	0.12	0.16	0.08	0.02	0.01	0.05	0.18	0.06	0.15	**0.07**
CGOA CP	*	0.41	0.30	0.49	0.29	0.37	0.06	0.02	0.13	0.04	0.21	*	**0.18**
CGOA CV	0.02	0.01	0.04	0.12	0.16	0.08	*	0.01	0.05	*	0.06	0.15	**0.08**
WGOA CP	*	0.18	0.32	0.34	0.03		0.02	0.02	0.00	0.00	*		**0.05**
WGOA CV	*	0.01	0.02				*			0.02			**0.02**
Non-Rockfish (Pilot) Program Trips													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
Total GOA	0.02	0.04	0.11	0.23	0.13	0.01	0.02	0.02	0.07	0.15	0.13	0.30	**0.09**
Central GOA	0.02	0.04	0.11	0.22	0.14	0.01	0.01	0.02	0.07	0.16	0.11	0.30	**0.10**
Western GOA	0.01	0.03	0.10	0.34	0.03		0.02	0.02	0.00	0.00	*	*	**0.04**
Catcher/Processors	0.00	0.32	0.31	0.47	0.16	0.28	0.02	0.02	0.12	0.04	0.23	*	**0.13**
Catcher Vessels	0.02	0.01	0.03	0.12	0.11	0.00	0.01	0.01	0.05	0.20	0.08	0.15	**0.07**
CGOA CP	*	0.41	0.30	0.49	0.29	0.28	0.01	0.02	0.13	0.05	0.21	*	**0.19**
CGOA CV	0.02	0.01	0.04	0.12	0.11	0.00	*	0.01	0.05	*	0.08	0.15	**0.07**
WGOA CP	*	0.18	0.32	0.34	0.03		0.02	0.02	0.00	0.00	*		**0.05**
WGOA CV	*	0.01	0.02				*			0.02			**0.02**
CGOA Rockfish (Pilot) Program Trips													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
Total GOA					0.19	0.15	0.08	0.02	0.03	0.00	0.01		**0.11**
Catcher/Processors						*	0.10	*		*			**0.14**
Catcher Vessels					0.19	0.10	0.04	0.01	0.03	0.00	0.01		**0.10**

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC, and NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

The following notes relate 2007 to 2011 Gulf-wide PSC rates to harvest on the trip target level.

On average, 35% of the arrowtooth flounder harvest occurred from August to October when Chinook salmon PSC rates were near or below the annual average rate. February, accounting for over 12% of arrowtooth harvest, was also well below the annual average PSC rate. On the other hand, 40% of harvest occurred in April when the PSC rate was 0.20 compared to an average annual rate of 0.11 for arrowtooth. Trips targeting arrowtooth in May incurred a relatively high PSC rate of 0.24, but these trips accounted for only 4% of average annual harvest.

Chinook salmon PSC rates for GOA Pacific cod trips are generally low, with an annual average of 0.04. 58% of Pacific cod harvest occurs at the A-season opening in January and February, when PSC rates are 0.02 and 0.03 respectively. A further 8% of average annual harvest occurs in March before the A-season closure; these trips incurred a higher PSC rate of 0.07. 31% of annual Pacific cod harvest occurs in September and October when the B-season opens. The average September PSC rate was 0.06 and the average rate for October was 0.11, both above the average annual rate.

GOA Shallow water flatfish trips also recorded an average annual Chinook salmon PSC rate of 0.08. September and October were the only months where PSC rates exceeded this level (0.15 and 0.28, respectively). Trips occurring during these months accounted for 25% of total harvest (5% in September and 20% in October).

Overall, trips targeting rockfish have recorded an annual average Chinook salmon PSC rate of 0.07. 26% of harvest occurred in May and June when PSC rates were high (0.20 and 0.16, respectively). 61% of harvest occurred in July when the PSC rate was much lower (0.04). During the Rockfish Pilot Program

years, declared RP trips incurred a Chinook PSC rate of 0.12. RP PSC rates in May and June were also 0.20 and 0.16, and the rate for July was 0.08. These numbers are upwardly influenced by high RP PSC rates in 2007 and 2008. Trips taken outside of the RP that ended up designated with a rockfish target had an average annual Chinook PSC rate of only 0.02; for these trips, June was an outlier with an average monthly PSC rate of 0.22.

NMFS generally makes inseason management decisions based on weekly catch reports. For each analyzed year, Table 4-44 lists the highest weekly Chinook salmon PSC records for the considered sectors of the GOA non-pollock trawl fishery. These figures give a sense of the target fisheries that are susceptible to the largest one week spikes in Chinook salmon encounter, as well as the magnitude of what might be considered a high PSC event. Section 5.2.1.1 notes that NMFS would consider PSC limits that are less than the historic highest weekly rate for the managed fishery to be too small to manage inseason.

Table 4-44 Maximum weekly Chinook salmon PSC, by year

GOA

	Max PSC	Month	Primary Target
2003	1,467	April	Arrowtooth/Rex sole
2004	716	March	Flathead sole
2005	786	March	Arrowtooth/Rex sole
2006	587	April	Arrowtooth/Rex sole
2007	607	September	Pacific cod
2008	1,547	March	Arrowtooth/Rex sole
2009	714	October	Shallow water flatfish
2010	1,572	April	Arrowtooth/Rex sole
2011	1,780	April	Arrowtooth/Rex sole

Central GOA

	Max PSC	Month	Primary Target
2003	853	February	Pacific cod
2004	473	September	Pacific cod
2005	329	July	Rockfish
2006	582	April	Arrowtooth/Rex sole
2007	607	September	Pacific cod
2008	1,532	April	Arrowtooth/Rex sole
2009	714	October	Shallow water flatfish
2010	1,462	April	Arrowtooth/Rex sole
2011	1,765	April	Arrowtooth/Rex sole

Catcher/Processors

	Max PSC	Month	Primary Target
2003	1,443	April	Arrowtooth/Rex sole
2004	710	March	Flathead sole
2005	768	March	Arrowtooth/Rex sole
2006	433	April	Arrowtooth/Rex sole
2007	515	June	Rockfish
2008	1,408	April	Arrowtooth/Rex sole
2009	619	April	Arrowtooth/Rex sole
2010	929	April	Arrowtooth/Rex sole
2011	642	April	Arrowtooth/Rex sole

Western GOA

	Max PSC	Month	**Primary Target**
2003	746	April	Arrowtooth/Rex sole
2004	713	March	Flathead sole
2005	768	March	Arrowtooth/Rex sole
2006	111	February	Pacific cod
2007	125	February	Pacific cod
2008	105	April	Arrowtooth/Rex sole
2009	107	July	Rockfish
2010	840	April	Arrowtooth/Rex sole
2011	173	July	Rockfish

Catcher Vessels

	Max PSC	Month	**Primary Target**
2003	824	February	Pacific cod
2004	473	September	Pacific cod
2005	270	February	Arrowtooth/Rex sole
2006	225	February	Pacific cod
2007	490	April	Arrowtooth/Rex sole
2008	680	May	Rockfish
2009	714	October	Shallow water flatfish
2010	651	April	Arrowtooth/Rex sole
2011	1,223	April	Arrowtooth/Rex sole

4.4.11.3 PSC Rate Trends by Regulatory Area

Central GOA

The key target species in each regulatory area display Chinook salmon PSC rates similar to those observed on a gulf-wide basis. Together, arrowtooth flounder, Pacific cod, rockfish and shallow water flatfish accounted for 92% of Central GOA harvest. The PSC rates for these species in the Central GOA were 0.11, 0.04, 0.10 and 0.08, respectively.

Considering trip target monthly PSC rates within a specific regulatory area may provide anecdotal evidence on Chinook salmon abundance as it relates to environmental factors. For example, a high PSC rate recorded in a month with low target species harvest could indicate that PSC was driven by a higher concentration of Chinook salmon.

Central GOA arrowtooth flounder displayed both high and low PSC rates during high harvest months. The annual average Chinook salmon PSC rate for Central GOA arrowtooth was 0.11. The PSC rate was less than 0.01 in February, when 13% of 2007 to 2011 area harvest was taken. Conversely, trips targeting arrowtooth recorded a PSC rate of 0.19 in April when 39% of harvest was taken. The high harvest months of August through October also displayed great variation in PSC rates; the PSC rate in August was close to zero, the September PSC rate was 0.01, and the October rate was 0.11. May and December PSC rates were relatively high (0.30 and 0.30, respectively) but May harvest accounted for only 4% of total 2007 to 2011 harvest while December harvest was negligible, illustrating the previous point regarding randomly high Chinook salmon encounters.

Rex sole, also a high-PSC rate species gulf-wide, are targeting primarily by CPs. Rex sole trips recorded a 0.39 annual average rate in the Central GOA. July and August, which accounted for 22% of area rex sole harvest, where low PSC rate months (0.01 and 0.08, respectively). All other harvest months, excepting January, recorded high PSC rates (0.24-0.61) with little correlation to the total amount harvested.

Central GOA Pacific cod – which is most intensely harvested by CVs in January, February, September and October – displayed less PSC rate variation from the annual average of 0.04. Rates were low in the early months (0.02) and above the average in the region's later harvest months (0.06 and 0.11).

Chinook PSC rates in the Central GOA rockfish fishery were highest in the early season harvest months (0.20 in May and 0.16 in June). The rate dropped to 0.06 in July, which covered the largest proportion of harvest at 46%. PSC rates remained below the annual average rate of 0.10 through the end of harvesting in November.

Because shallow water flatfish are almost exclusively harvested in the Central GOA (by CVs), monthly PSC rates in relation to harvest patterns are the same as described in the Gulf-wide section, above.

Flathead sole, which had been identified as a high-PSC rate species in the previous gulf-wide section, recorded only a 0.09 PSC rate in the Central GOA. Excepting March, the late-year months (October-December) that accounted for 24% of species harvest in the area recorded PSC rates higher than the spring and summer months.

Western GOA

Western GOA PSC rates were more variable and even less correlated to total species harvest amounts. The CP rockfish fishery, which made up 60% of the area's trawl fishery, recorded a 0.02 PSC rate in July (covering 92% of rockfish harvest). On the other hand, Western GOA Pacific cod trips – mainly CVs – encountered low PSC rates in January and February (0.01 and 0.03, together accounting for 73% of

harvest) and high rates of Chinook salmon in some heavy harvest months (0.09 PSC rate in March, covering 26% of harvest). Western GOA CP arrowtooth flounder trips recorded high PSC rates in heavy harvest month of April, but had near-zero PSC rates during August and October when harvest combined to account for 20% of total arrowtooth catch in the area. PSC rates for Western GOA CP rex sole and flathead sole were lower compared to the Central GOA, especially for months later in the year. Rex sole area PSC rates for July through September were near-zero; harvest in those months made up 63% of the area total.

4.4.12 Gulf of Alaska Non-pollock Groundfish Products and Product Prices

Non-pollock groundfish landed in the GOA generate a number of marketed products. AKFIN provides product price data from both the at-sea and shoreside processor reports.[33] Products that are processed by CP vessels at-sea and sold at wholesale include whole fish, headed-and-gutted fish, and headed-and-gutted fish with roe. Average prices for ancillary products, such as cheeks, chins and heads, are not reported for the at-sea processing sector. Shoreside products, delivered by CVs to onshore processors or stationary floating processors include whole fish, bled whole fish, gutted fish (head on, viscera removed) headed-and-gutted fish, headed-and-gutted fish with roe, split-and-salted fish (head and viscera removed, fillets cut but attached, and salted), fillets, surimi (a paste made from fish flesh and additives), kirimi (headed, gutted, and cut for steaks), fish meal, fish oil, minced fish (ground flesh), and roe. Both processing sectors report a number of ancillary products that were retained, but these products were only priced and sold from the shoreside processing sector. Ancillary products include heads, stomachs, chins, cheeks, cartilage, flesh, and milt.

This section considers processor data from 2008 to 2011. Average price per pound is derived from actual prices received at the first wholesale (at-sea) or ex-vessel (shoreside) level, rather than applying yearly average prices per pound to total annual harvests.[34] Prices per pound reflect the price for a pound of marketed product, as opposed to the product value per round pound of harvest. Table 4-45 shows the product-type breakdown of prices for non-pollock groundfish products that were processed at-sea (CP vessels), and includes total weight harvested and total revenue generated. Table 4-46 show average prices for the products generated at shoreside operations (onshore and stationary floating processors). Shoreside product data is not available in gear-specific format; harvest, product weight and revenue figures would include production from hook-and-line and pot gear harvest, which are less relevant to the considered action, and thus are not included. As mentioned in Section 4.4.2, many participants in the GOA groundfish trawl fleet also fish in BSAI waters. The data presented in this section comes from GOA processor reports, so it is impossible to state with absolute certainty that all of the fish going into these products were harvested in GOA waters. However, it is reasonable to present these prices for background purposes.

[33] The Draft 2012 Economic SAFE Report notes that prices declined in 2009 as a result of the general U.S. economic downturn. However, this external factor appears to have affected all non-pollock groundfish products in a similar fashion.
[34] Price data provided by AKFIN

Table 4-45 Product prices and volume for at-sea processing by catcher/processors active in the Gulf of Alaska, 2008 to 2011

Species	Product	Average Price ($/lb)	Total Weight (mt)	Total Revenue ($1,000)
Pacific Cod	H&G	1.13	1,951	5,357
	Whole fish	0.55	253	305
	Roe	0.79	4	7
Pacific Cod Total		0.95	2,208	5,668
Rockfish	H&G	0.94	25,087	59,073
	Whole fish	0.93	1,730	4,660
Rockfish Total		0.94	26,816	63,732
Rex Sole	H&G	0.59	485	673
	Whole fish	0.95	9,249	19,310
Rex Sole Total		0.71	9,734	19,983
Flathead Sole	H&G	0.64	2,284	3,698
	H&G w.Roe	1.00	335	738
	Whole fish	0.43	270	257
Flathead Sole Total		0.68	2,889	4,693
Flatfish	H&G	0.62	105	107
	H&G w.Roe	0.84	5	11
	Whole fish	0.41	4	4
Flatfish Total		0.59	113	121
Arrowtooth Flounder	H&G	0.58	10,417	12,504

Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

Table 4-46 Product prices for shoreside processors active in the Gulf of Alaska, 2008 to 2011

Species	Product	Average Price ($/lb)
Rockfish	Whole fish	0.977
	Whole (bled)	0.989
	Fillet	3.232
	H&G	1.743
	Gutted	1.609
	Kirimi	1.339
	Fish Meal	0.370
	Surimi	1.360
	Roe	1.317
	Ancillary	0.719
Rockfish Total		1.923
Pacific Cod	Whole fish	0.597
	Whole (bled)	0.603
	Fillet	2.932
	H&G	1.393
	Gutted	1.838
	Kirimi	1.200
	Salted & Split	1.643
	Fish Oil	1.364
	Minced	0.933
	Surimi	0.897
	Fish Meal	0.600
	Roe	0.896
	Ancillary	0.864
Pacific Cod Total		1.400
	Whole fish	0.935
	Fillet	2.106
	H&G	0.689
	Fish Meal	0.328
Rex Sole Total		1.200

Species	Product	Average Price ($/lb)
Flatfish	Whole fish	0.508
	Fillet	1.974
	Kirimi	0.856
	H&G	0.651
	H&G w.Roe	0.709
	Surimi	0.900
	Roe	0.430
	Fish Meal	0.464
	Ancillary	0.100
Flatfish Total		1.069
Flathead Sole	Whole fish	0.476
	Fillet	2.126
	Kirimi	0.681
	H&G	0.535
	H&G w.Roe	0.725
	Surimi	0.926
	Fish Meal	0.328
	Roe	0.430
	Ancillary	0.180
Flathead Sole Total		0.945
Arrowtooth Flounder	Whole fish	0.617
	Fillet	1.061
	Kirimi	0.653
	H&G	0.517
	H&G w.Roe	0.902
	Surimi	0.833
	Fish Meal	0.328
	Ancillary	0.341
Arrowtooth Flounder Total		0.642
Atka Mackerel	Whole fish	0.900
	Fish Meal	0.306
Atka Mackerel Total		0.504

Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

4.4.13 Taxes Generated by the GOA Non-pollock Fishery

4.4.13.1 State of Alaska taxes

There are three fisheries taxes that are levied on groundfish catch by the State of Alaska. The descriptions of these taxes were taken from the Alaska Department of Revenue Tax Division website (http://www.tax.alaska.gov/programs/programs/index.aspx?60620), and are provided below. The first two taxes are levied as a percentage of ex-vessel value, and the third is based on first wholesale value. For the ex-vessel linked taxes, the State calculates actual tax liability by multiplying unprocessed harvest weight by a statewide average price (SWAP). Here, the analysts use an average of AKFIN data on actual ex-vessel prices paid to harvesters (based on fish ticket records), which should not be substantially different

from the SWAP method. Aggregated, annual average tax liabilities are presented in order to preserve processor confidentiality.

The ex-vessel value of non-pollock trawl harvest was provided by AKFIN, and is based on fish ticket records.

1) "A **Fisheries Business Tax** is levied on persons who process or export fisheries resources from Alaska. The tax is based on the price paid to commercial fishers or fair market value when there is not an arms-length transaction. Fisheries business tax is collected primarily from licensed processors and persons who export fish from Alaska."

Shore-based processors are assessed at a rate of 3%, and floating processors are assessed at a rate of 5% of the ex-vessel price paid to GOA CVs. Between 2003 and 2011, non-pollock groundfish were delivered to 26 different shore-based processors[35] and three floating processors in Alaska communities. During the analyzed period the GOA shore-based processors, as a group, paid the State an average of $563,999 per year in Fisheries Business Tax levied on non-pollock groundfish trawl product. Over the same period, the group of three floating processors paid a combined average of $13,169 per year. Note that not all processors took deliveries in every year, and these figures represent the yearly portion of a nine-year average as if they did.

2) "A **Fishery Resource Landing Tax** is levied on fishery resources processed outside the 3-mile limit and first landed in Alaska or any processed fishery resource subject to sec. 210(f) of the American Fisheries Act. The tax is based on the unprocessed value of the resource, which is determined by multiplying a statewide average price (determined by the Alaska Department of Fish and Game data) by the unprocessed weight. The Fishery Resource Landing Tax is collected primarily from factory trawlers and floating processors which process fishery resources outside of the state's 3-mile limit and bring their products into Alaska for transshipment."

The Fishery Resource Landing Tax is also levied at a rate of 3% of ex-vessel value. 46 different vessels processed non-pollock groundfish outside of the 3-mile limit between 2003 and 2011. As a group, these operators paid the State an average of $217,993 per year in Fishery Resource Landing Tax.

3) "A **Seafood Marketing Assessment** is levied at a rate of 0.5% of the value of seafood products processed first landed in, or exported from Alaska."

The Seafood Marketing Assessment is based upon the first wholesale value of seafood products, regardless of whether the products were processed at sea or on shore. The first wholesale prices used in this analysis are provided by AKFIN and are based upon COAR data. From 2003 to 2011, the 75 processing operations that landed non-pollock groundfish in Alaska (or exported non-pollock groundfish from Alaska) collectively paid the State an average of $376,075 per year under the Seafood Marketing Assessment.

4.4.13.2 Municipality raw fish taxes

Some municipalities levy raw fish taxes on fish first landed at processing plants located in their communities. Municipalities that levied fish taxes and had processors that took deliveries of GOA non-pollock groundfish between 2003 and 2011 are listed in Table 4-47. The table reports the municipalities' populations, raw fish tax rates, 2011 reported raw fish tax revenues for all species, and an estimated

[35] One of the operations included as a shore-based processor is listed as an exporter-buyer, which are also taxed at a rate of 3% of the ex-vessel value paid to harvesters.

annual average of raw fish tax revenue from non-pollock groundfish. Estimated non-pollock tax revenues are calculated by applying each municipality's raw fish tax rate to the ex-vessel value derived from fish ticket records and reported by AKFIN.

Table 4-47 Raw fish (and other) taxes imposed by Alaska municipalities

Municipality	Population	Raw Fish Tax	2011 Raw Fish Tax Revenue	Est. average annual GOA non-pollock tax revenue (2003-2011)
Kodiak Island Borough	13,592	1.05%^	$1,649,275^	$172,359
Unalaska	4,376	2%	$5,381,778	(confidential)
Aleutians East Borough	3,141	2%	$4,584,570	$48,596
King Cove	938	2%/Flat amount*	$100,000*	(confidential)
Sand Point	976	2%	$834,681	(confidential)
Akutan	1,027	1%	$478,460	(confidential)

* Fisheries Impact Tax of $100,000

^ Kodiak Borough imposes a severance tax on harvested natural resources, including commerical fishing, timber sales, gravel extraction, and mining activities.

Source for population, tax rate and 2011 tax revenue: State of Alaska, DCED, 2012, available at http://w w w .dced.state.ak.us/dca/osa/pub/11Taxable.pdf

Kodiak Island Borough, which is home to 13 shore-based processors that took non-pollock groundfish deliveries, levies a severance tax of 1.05%. This levy is a form of excise tax on the performance of commercial fishing, but also applies to the harvest or extraction of other natural resources. Processors located in King Cove, Sand Point and Akutan pay a raw fish tax to both their respective municipalities and to the Aleutians East Borough. Two processors taking non-pollock deliveries operate in King Cove, and Sand Point and Akutan have one non-pollock processor each. King Cove levies a Fisheries Impact Tax that is a flat fee of $100,000 per year; this charge helps pay for city resourcs that are utilized by the processing operations.

The reported value of $48,596 is an estimate of the average annual tax paid to the Borough, only. Collectively, these processors paid a similar amount to their municipalities. The estimate of the annual tax paid to Unalaska on non-pollock groundfish processing is also withheld for confidentiality, as only one non-pollock processor is located there. In general, estimates of the tax paid on non-pollock processing indicate that these shore-based processors generate a significant portion of their revenue from species that are not regulated by this proposed action.

Harvest constraints that may result from the implementation of a Chinook salmon PSC limit could reduce the amount of tax revenue available to these communities.

4.4.14 Market Profiles for Selected GOA Non-pollock Target Species

This section provides additional information on the markets for several of the non-pollock target species that comprise a significant part of GOA trawl harvest (as identified in Section 4.4.6), that could experience reduced harvest under the considered Chinook salmon PSC limits (as assessed in Section 4.7.1), and for which the Alaska Fisheries Science Center has compiled market profiles. The species-markets profiled here include Pacific cod, yellowfin and rock sole, and arrowtooth flounder. Note that yellowfin and rock sole are only two of the seven species that are jointly considered as "shallow water flatfish" within this document.[36]

[36] Other shallow water flatfish include Alaska plaice, starry flounder, sand sole, butter sole, and English sole.

Not all target species are profiled because the amount of information available for explaining historical market trends varies greatly by species (Hiatt, 2011). Generally, the amount of information available for each species is related to its value or market share. AFSC's market profiles, provided in annual Economic SAFE reports, describe recent trends in pricing, volume, supply and demand for each species. The profiles consider trends in the volume of exports to different trading partners; these trade relationships are important for identifying the species for which Alaska fisheries have a large share of the world market. If Alaska fisheries do contribute a large share of a given species's world supply, product prices may be tied to TAC in the North Pacific region. For other species, the Alaskan share of the world product may be relatively low and market dynamics could be driven by the actions of other countries. AFSC market profiles attempt to define whether Alaska fisheries' product market share is growing or declining.

The impacts of proposed Alternative 2 (discussed in detail in Section 4.7) do not go so far as to speculate on how a Chinook salmon PSC limit could affect world product markets and prices. At a broad level, it may be useful to consider the possibility that a harvest-constraining PSC limit could have a price effect for species where Alaska is a dominant supplier to the world market. In such a case, resulting increased product prices may mitigate some of the revenue lost to reduced harvest under early season closures.

4.4.14.1 Pacific cod markets

U.S. Pacific cod harvest has remained relatively stable since the 1980s, as production volume in Japan and the Soviet Union/Russia declined by roughly half.[37] By the middle of last decade, the U.S. supplied more than two-thirds of the world Pacific cod supply as a result (Knapp, 2006). Alaska fisheries account for about 99% of U.S. Pacific cod harvest. Because of declining Atlantic cod harvest, Pacific cod has recently increased its market share to between one-fourth and one-third of all types of cod product. This Atlantic cod decline has opened new European markets for U.S. Pacific cod.

Most Pacific cod filets enter the domestic market, while the majority of H&G product is exported to international markets. Wholesale prices are highest for fillet products, but headed-and-gutted (H&G) fish account for the largest share of Alaska Pacific cod production – roughly 69% in 2010. The shift from fillets to H&G is attributed to increased exports to China, where H&G are processed into boneless fillets and re-exported. Trawl vessels tend to receive a lower price for Pacific cod than fixed gear freezer longliners. This is mostly attributable to freezer longliners' ability to first process the fish while they are fresh, and the fact that most trawl caught fish come from inshore areas where the cod can be infected with parasitic codworms (causing shoreside processors to treat at an increased cost).

World market prices for Pacific cod – mainly H&G product in the international and re-export market – have strengthened since 2006, when Pacific cod gained acceptance as a substitute for decreasingly available Atlantic cod and European whitefish. Recent increases in demand for healthy, sustainably caught whitefish has increased demand for "Alaska cod" since 2008. Alaska Pacific cod may face future competition from growing cod aquaculture development in Norway, Scotland, Ireland and Canada.

4.4.14.2 Yellowfin sole and rock sole markets

AFSC's profile of yellowfin and rock sole markets indicates that the majority of Alaskan product comes from BSAI fisheries. In any event, an assessment of demand for these Alaskan shallow water flatfish as a whole can still be informative on the potential for price effects if GOA harvest is reduced.

Together, yellowfin sole and rocksole account for around 50% of U.S. flatfish landings. Domestic catch of yellowfin sole occurs entirely in the waters off Alaska, as does over 99% of domestic rock sole catch.

[37] U.S. harvests include both GOA and BSAI Pacific cod. GOA Pacific cod harvest in the trawl and longline fisheries is tied to a Pacific halibut mortality limit, which has sometimes constrained the timing and amount of GOA harvest.

Inadequate data from other countries and a lack of uniformity in flatfish species grouping for landings data make it impossible to state that *all* yellowfin and rock sole on the world market come from U.S. fisheries, but it is clear that Alaskan waters are the predominant source of world product.[38]

Alaskan yellowfin and rock sole compete with substitute flatfish products from revitalized New England flatfish fisheries. Demand for Alaskan yellowfin has remained strong in Europe due to the E.U. Fishing Council's quota cuts for their most valuable flatfish, plaice. Alaska products also compete in domestic and foreign markets with farmed flatfish. Flatfish aquaculture accounts for a small percentage of worldwide flatfish production, but it is expected to increase steadily. Flatfish aquaculture is driven by declining trends in wild catch and the higher prices that these declining catches have created. Domestic flatfish aquaculture has, thusfar, included commercial farming of summer flounder and Southern flounder on the Atlantic Coast.

H&G products from the CP sector are primarily exported to re-processors in China, who often re-export fillets to the United States. Re-exporters commonly include yellowfin and rock sole in the same pack, so it is not surprising that market prices for fillets of the two species follow the same trends. Whole rock sole with roe are exported to Japan; while the price for this product has been decreasing since 2006, it remains an important source of early season revenue for the H&G trawl fleet. Whole yellowfin sole are generally sold to South Korea, while H&G product is shipped to China for re-processing into fillets and eventual Chinese domestic consumption or re-exportation to North America and Europe. The Chinese and European markets for re-processed yellowfin fillets have largely emerged since 2007.

Shore-based processors in the U.S. produce some fillets for Chinese and domestic markets, though an increasing proportion of yellowfin is being exported to Chinese re-processors who employ cheaper labor. Yellowfin that is processed as kirimi (steak-like cuts) are exported to Japan. The export value of U.S. yellowfin and rock sole going to Japan has declined since 2004. The value of product going to China grew from 2000 to 2007, but has since flattened for rock sole and significantly fallen for yellowfin sole.

4.4.14.3 Arrowtooth flounder markets

According to the AFSC's market profile (Hiatt, 2011), most of the total world arrowtooth flounder harvest comes from Alaska fisheries. Arrowtooth are abundant in the waters off of the Pacific Northwestern United States, but catch is constrained by efforts to rebuild the overfished canary rockfish.

Past efforts to market arrowtooth were constrained by the rapid degradation of muscle tissue at cooking temperature, resulting in a paste-like texture of the cooked product. In recent years, several food grade additives have been successfully used to inhibit the enzymatic breakdown of the muscle tissue. These discoveries have enabled a targeted fishery in the Kodiak Island area for marketable products, including whole fish, surimi, headed and gutted (both with and without the tail on), fillets, frills (fleshy fins), bait, and meal (NMFS, 2007d). Most arrowtooth flounder are processed as H&G product with the tail removed. Frills are the primary arrowtooth product; they are used for sashimi, soup stock, and a more affordable version of engawa (normally a premium sushi made from halibut or Greenland turbot). Japan is the primary market for arrowtooth flounder engawa. Arrowtooth has also been used to make surimi, and this market could expand in the future if U.S. pollock harvest declines.

The U.S. Department of Commerce does not track export data specifically for arrowtooth flounder, so the AFSC's market profile does not address export volumes and prices. However, industry representatives indicate that all of the H&G product is sent to China for re-processing. A large portion of the arrowtooth

[38] AFSC notes that scientific and industry literature makes reference to Russian harvest of yellowfin sole in the Bering Sea, but records of such catch are not reported in United Nations Food and Agriculture Organization statistics.

exported to China is re-imported to the U.S. as inexpensive flounder fillets. China re-exports some fillets to the Japanese market and, recently, has sent a smaller portion to European markets.

4.5 Description of Potentially Affected Chinook Salmon Fisheries

North Pacific Chinook salmon are the subject of commercial, subsistence, personal use, and sport/recreational (used interchangeably) fisheries. Chinook salmon are the least abundant of the five salmon species found on both sides of the Pacific Ocean and the least numerous in the Alaska commercial harvest. The majority of the Alaska commercial catch is made in Southeast Alaska, Bristol Bay, and the Arctic-Yukon-Kuskokwim area. The majority of commercial catch is made with troll gear or gillnets. Approximately 90% of the subsistence harvest is taken in the Yukon and Kuskokwim rivers. Predominant gear types in the subsistence fishery include gill nets, seine, fish wheels and long lines. Alaska Department of Fish & Game (ADF&G) reports that harvest by subsistence and personal use fishers averaged 167,000 fish from 1994-2005. The Chinook salmon is one of the most highly prized sport fish in Alaska and is extensively fished by anglers in the Southeast and Cook Inlet areas. ADF&G reports that the Alaska sport fishing harvest averaged 170,000 Chinook salmon per year from 1989-2006 (60% taken in South-central Alaska; 26% in Southeast Alaska; and 4% in the Arctic-Yukon-Kuskokwim area). Unlike other Pacific salmon species, Chinook salmon rear in inshore marine waters and are, therefore, available to commercial and sport fishermen all year round.[39]

The Alaska State Constitution establishes, as state policy, the development and use of replenishable resources, in accordance with the principle of sustained yield, for the maximum benefit of the people of the state. In order to implement this policy for the fisheries resources of the state, the Alaska Legislature created the Alaska Board of Fisheries (BOF) and the Alaska Department of Fish & Game. The BOF was given the responsibility to establish regulations guiding the conservation and development of the state's fisheries resources, including the distribution of benefits among subsistence, commercial, recreational, and personal uses. ADF&G was given the responsibility to implement the BOF's regulations and management plans through the scientific management of the state's fisheries resources. Scientific and technical advice is provided by ADF&G to the BOF during its rule-making process. 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 surpluses above escapement needs and subsistence uses are made available for other uses.[40]

ADF&G's fishery management activities fall into two categories: inseason management and applied science. For inseason management, the division employs fishery managers near the fisheries. Local fisheries managers are given authority to open and close fisheries to achieve two goals: the overriding goal is conservation to ensure an adequate escapement of spawning stocks, and the secondary goal is an allocation of fish to various user groups based upon management plans developed by the BOF. The BOF develops management plans in open, public meetings after considering public testimony and advice from various scientists, advisors, fishermen, and user interest groups (Woodby et al. 2005). Decisions to open and close fisheries are based on the professional judgment of area managers, the most current biological data from field projects, and fishery performance. Research biologists and other specialists conduct applied research in close cooperation with the fishery managers. The purpose of the division's research staff is to ensure that the management of Alaska's fisheries resources is conducted in accordance with the sustained yield principle and that managers have the technical support they need to ensure that fisheries are managed according to sound scientific principles and utilizing the best available biological data. The division works closely with the ADF&G Division of Sport Fisheries in the conduct of both management and research activities.

[39] http://www.adfg.alaska.gov/index.cfm?adfg=chinook.main; http://www.adfg.alaska.gov/index.cfm?adfg=chinook.uses
[40] http://www.adfg.alaska.gov/index.cfm?adfg=chinook.management

By far, most salmon in Alaska are caught in commercial troll, gillnet, and purse seine fisheries, in which participation is restricted by a limited entry system. Troll gear works by dragging baited hooks through the water. Gillnet gear works by entangling the fish as they attempt to swim through the net. Gillnets are deployed in two ways: from a vessel that is drifting and from an anchored system out from the beach. Purse seines work by encircling schools of fish with nets that are drawn up to create giant "purses" that hold the school until the fish can be brought aboard. Other kinds of gear used in Alaska's smaller fisheries include fishwheels, which scoop fish up as the wheel is turned by river currents (Woodby et al., 2005).

Information on the status of Chinook salmon stocks in Alaska is included in Section 3.3.5, although a summary is also provided below in Section 4.5.6. The High Seas Salmon Research Program states that almost all stock-specific information on spatial and temporal distribution of Chinook salmon with in the U.S. 200-mile EEZ in the Northern and Western GOA comes from recoveries of coded-wire tagged fish by the U.S. North Pacific Groundfish Observer Program. These recoveries show that North American stocks, originating from Central Alaska to the Sacramento River, California, range northward into the Eastern Bering Sea. The reference further states that coded-wire tag recoveries provided the first information on winter distribution of Yukon Territory Chinook salmon in the Bering Sea, revealing their distribution along the shelf break (200-meter contour) from Unimak Pass and Northwestward into the Central Bering Sea. A recovery off the South Central Oregon coast of a coded-wire tagged immature Chinook salmon from the Kenai River, Alaska marks the southernmost recovery of an Alaska origin Chinook salmon on the U.S. Pacific Coast.[41] More information on the origin of Chinook salmon intercepted in the GOA groundfish fisheries is included in Section 3.3.3, and a discussion of Pacific Northwest salmon listed under the ESA is included in Section 3.3.6.

4.5.1 State Commercial Salmon Fishery Management

Commercial fishing is defined by the State of Alaska as the taking of fish with the intent of disposing of them for profit, or by sale, barter, trade, or in commercial channels (AS 16.05.940 (5)). Commercial fisheries in Alaska fall under a mix of state and federal management jurisdictions. In general, the state has management authority for all salmon, herring, and shellfish fisheries, and for groundfish fisheries within three nautical miles of shore. Under the Magnuson-Stevens Act, the Federal Government has management authority for the majority of groundfish fisheries three to two hundred nautical miles offshore.

The state manages a large number of commercial salmon fisheries in waters from Southeast Alaska to the Bering Strait. Management of the commercial salmon fisheries is the responsibility of the ADF&G Division of Commercial Fisheries, under the direction of the BOF. The fisheries are managed under a limited entry system; participants need to hold a limited entry permit for a fishery in order to fish and the number of permits for each fishery is limited. The state originally issued permits to persons with histories of participation in the various salmon fisheries. Permits can be bought and sold; thus, new persons have entered into the commercial fishery since the original limitation program was implemented by buying permits on the open market.

Alaska's commercial salmon fisheries are administered through the use of management areas throughout the state. For information on commercial regulations refer to: www.adfg.alaska.gov/index.cfm?adfg=CommercialByFisherySalmon.main.

The value of the commercial salmon harvest varies with both the size of the runs and with foreign currency exchange rates. Information on the annual commercial Chinook salmon harvest in Alaska is

[41] http://www.fish.washington.edu/research/highseas/known_range.html

reported at http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.bluesheet. Blue Sheet reports extend back to 1994 and provide information by region as well as the state total. Table 4-48 summarizes commercial Chinook salmon harvest and ex-vessel value for the period considered throughout this analysis.

Table 4-48 Alaska commercial Chinook salmon harvest and ex-vessel value (2003 to 2012)

Year	Number of Fish	Pounds (million)	Ex-vessel value (million $)
2003	634,000	10.3	13.5
2004	816,000	12.9	24.9
2005	699,000	10.7	24.4
2006	645,000	10.1	30.7
2007	571,000	8.7	26.7
2008	376,000	5.6	25.6
2009	359,000	5.1	14.1
2010	376,000	5.3	19.2
2011	445,000	6.1	20.4
2012 (preliminary)	333,000	4.4	17.6

Source: ADF&G Commercial Fisheries Division, http://www.adfg.alaska.gov/index.cfm?adfg=CommercialByFisherySalmon.exvesselquery

4.5.2 State Management of Personal Use and Sport Salmon Fisheries

The State of Alaska defines personal use fishing as the taking, fishing for, or possession of finfish, shellfish, or other fishery resources, by Alaska residents for personal use and not for sale or barter, with gill or dip net, seine, fish wheel, longline, or other means defined by the BOF (AS 16.05.940(25)). Personal use fisheries differ from subsistence fisheries because they either do not meet the criteria established by the Joint Board of Fisheries and Game (Joint Board) for identifying customary and traditional fisheries (5 AAC 99.010) or because they occur within nonsubsistence areas.

The Joint Board is required to identify "nonsubsistence areas,'" where "dependence upon subsistence is not a principal characteristic of the economy, culture, and way of life of the area or community" (AS 16.05.258(c)). The BOF may not authorize subsistence fisheries in nonsubsistence areas. Personal use fisheries provide opportunities for harvesting fish with gear other than rod and reel in nonsubsistence areas. The Joint Board has identified Ketchikan, Juneau, Anchorage-Matsu-Kenai, Fairbanks, and Valdez as nonsubsistence areas (5 AAC 99.015). Persons may participate in personal use or recreational harvests for subsistence purposes within nonsubsistence use areas, but subsistence use does not have a preference in those areas.

Generally, fish may be taken for personal use purposes only under authority of a permit issued by ADF&G. Personal use fishing is primarily managed by ADF&G, Division of Sport Fish, but some regional or area fisheries for various species of fish are managed by the Division of Commercial Fisheries. For more information on state management of personal use fisheries, refer to the ADF&G website: www.adfg.alaska.gov/index.cfm?adfg=fishingPersonalUse.main.

The ADF&G Division of Sport Fish also manages the state's recreational fisheries. Alaska statute defines sport fishing as the taking of or attempting to take for personal use, and not for sale or barter, any fresh water, marine, or anadromous fish by hook-and-line held in the hand, or by hook-and-line with the line attached to a pole or rod which is held in the hand or closely attended, or by other means defined by the BOF (AS 16.05.940(30)). By law, the division's mission is to protect and improve the state's recreational fisheries resources. For more information on state management of recreational fisheries, refer to the ADF&G website: www.adfg.alaska.gov/index.cfm?adfg=fishingSport.main.

Per Alaska statute (5 AAC 75.075(c)), the ADF&G, Division of Sport Fish is also responsible for overseeing the annual licensing of sport fish businesses and guides. A "sport fishing guide" means a person who is licensed to provide sport fishing guide services to persons who are engaged in sport fishing (AS 16.40.299). "Sport fishing guide services" means assistance, for compensation or with the intent to receive compensation, to a sport fisherman to take or to attempt to take fish by accompanying or physically directing the sport fisherman in sport fishing activities during any part of a sport fishing trip. Salmon is one of the primary species targeted in the states' recreational fisheries. For further information, refer to the ADF&G website: www.adfg.alaska.gov/index.cfm?adfg=prolicenses.sportfishguides. This site contains information important to the ADF&G requirements for sport fish charter businesses, sport fish guides, and saltwater charter vessels.

Chinook salmon are a prized sport fish in Alaska's recreational fisheries, and most anglers sport fishing for anadromous (sea-run) Chinook salmon (king) salmon must have purchased (and have in their possession) a current year's king salmon stamp. For further information, refer to the ADF&G website: http://www.sf.adfg.state.ak.us/Guides/index.cfm/FA/guides.home. This site contains information important to the ADF&G requirements for sport fish charter businesses, sport fish guides, and saltwater charter vessels. Table 4-49 reports Alaska's total and regional sport harvest of Chinook salmon for recent years.

Table 4-49 Statewide sport harvest of Chinook salmon by region, freshwater and saltwater combined

Region	2008	2009	2010	2011
Southeast	49,265	69,565	58,503	66,575
Southcentral	77,334	59,855	55,291	57,511
Arctic-Yukon-Kuskokwim	5,658	3,908	3,850	4,021
Alaska Total	**132,257**	**133,328**	**117,644**	**128,107**

Source: http://www.adfg.alaska.gov/sf/sportfishingsurvey/index.cfm?ADFG=region.results

4.5.3 State Subsistence Management

ADF&G, under the direction of the Alaska BOF, manages subsistence, personal use, and commercial salmon harvests in waters within the State of Alaska out to the three nautical mile limit. The state has 82 local fish and game advisory committees that review, make recommendations, submit proposals, and testify to the Alaska BOF concerning subsistence and other uses in their areas.

The state defines subsistence uses of wild resources as noncommercial, customary, and traditional uses for a variety of purposes. These include:

> Direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption (AS 16.05.940[33]).

Under Alaska's subsistence statute, the BOF must identify fish stocks that support subsistence fisheries and, if there is a harvestable surplus of these stocks, determine the amount of the harvestable surplus that is reasonably necessary for subsistence uses, and adopt regulations that provide reasonable opportunities for these subsistence uses to take place. Statute defines "reasonable opportunity" as an opportunity that allows a subsistence user to participate in a subsistence fishery that provides a normally diligent participant with a reasonable expectation of success of taking of fish (AS 16.05.258(f)). The BOF evaluates whether reasonable opportunities are provided by existing or proposed regulations by reviewing harvest estimates relative to the "amount reasonably necessary for subsistence use" findings as well as subsistence fishing schedules, gear restrictions, and other management actions. Whenever it is necessary

to restrict harvest, subsistence fisheries have a preference over other uses of the stock (AS 16.05.258). ADF&G, Division of Commercial Fisheries, manages subsistence fisheries in the area of potential effect. Subsistence and other uses may be restricted or closed to provide for sustainability based upon relevant adopted fishery management plans.

Alaska subsistence fishery regulations do not, in general, permit the sale of resources taken in a subsistence fishery. State law recognizes "customary trade" as a legal subsistence use. Alaska statute defines customary trade as "…the limited noncommercial exchange, for minimal amounts of cash, as restricted by the appropriate board, of fish or game resources" (AS 15.05.940(8)). This is applicable in certain regions of Alaska, including the customary trade in finfish (including salmon) within the Norton Sound-Port Clarence Area (5 AAC 01.188). Presently, the BOF has not received regulatory change proposals to allow customary trade in salmon resources under state subsistence regulations in other areas under consideration in this document.

ADF&G Division of Commercial Fisheries prepares annual fishery management reports for most fishery management areas in the state. Although fishery management reports focus primarily on commercial fisheries, most also routinely summarize basic data for programs that collect harvest information for subsistence fisheries. Detailed annual reports about subsistence fisheries harvest assessment programs are prepared for the Norton Sound/Kotzebue, Yukon River, and Kuskokwim areas; however, it is important to recognize the limitations associated with the effort to present a comprehensive annual report on Alaska's subsistence fisheries. Because of such limitations, harvest data may be a conservative estimate of the number of salmon being taken for subsistence uses in Alaska. These limitations include:

1) Annual harvest assessment programs do not take place for all subsistence fisheries although programs are in place for most salmon fisheries such as the Yukon and Kuskokwim river drainages through post-season household surveys and for the Bristol Bay Area through subsistence salmon permits. There is no longer an annual subsistence harvest monitoring program for the Kotzebue Fisheries Management Area. Similarly, since 2004 annual harvest monitoring in the Norton Sound-Port Clarence Area has been limited to post-season household surveys in Shaktoolik and Unalakleet and through catch and gear information obtained from subsistence fishing permits in other parts of the Norton Sound-Port Clarence Area.
2) Annual subsistence harvest data are largely dominated by fish harvested under efficient gear types authorized by regulation, which, especially for salmon, generally means fish taken with gillnets, beach seines, or fish wheels. However, in portions of the Kotzebue Fisheries Management Area (5 AAC 01.120(b) &(f)), Norton Sound-Port Clarence Area (5 AAC 01.170(b) & (h)), and Yukon-Northern Area (5 AAC 01.220(a) & (k)), as well as the entire Kuskokwim Fisheries Management Area (5 AAC 01.270(a)), hook-and-line attached to a rod or pole (i.e., rod and reel) are recognized as legal subsistence gear under state subsistence fishing regulations. In these areas significant numbers of households take salmon for subsistence uses with rod and reel or retain salmon from commercial harvests for home use. Where the BOF has recognized rod and reel gear as legal subsistence gear, annual harvest assessment programs or subsistence fishing permits also document salmon harvested with rod and reel. Federal subsistence management represents different subsistence gear regulations in some cases. For example, in Kotzebue Sound federally qualified users are authorized under federal subsistence regulations to harvest salmon by gillnet, beach seine, or rod and reel, but these harvests are not documented through either a state or federal harvest monitoring program and the numbers of salmon (largely chum salmon) harvested by gillnet or beach seine compared to rod and reel is unknown.
3) Annual harvest assessment programs are generally limited to post-season household surveys in communities located within the fisheries management area. Subsistence permits are used as a basis for annual harvest assessments, but such permits are not required in some areas (such as the

Yukon River drainage). No subsistence salmon harvest data collection took place in the Kotzebue area from 2005 through 2009 due to a lack of funding.

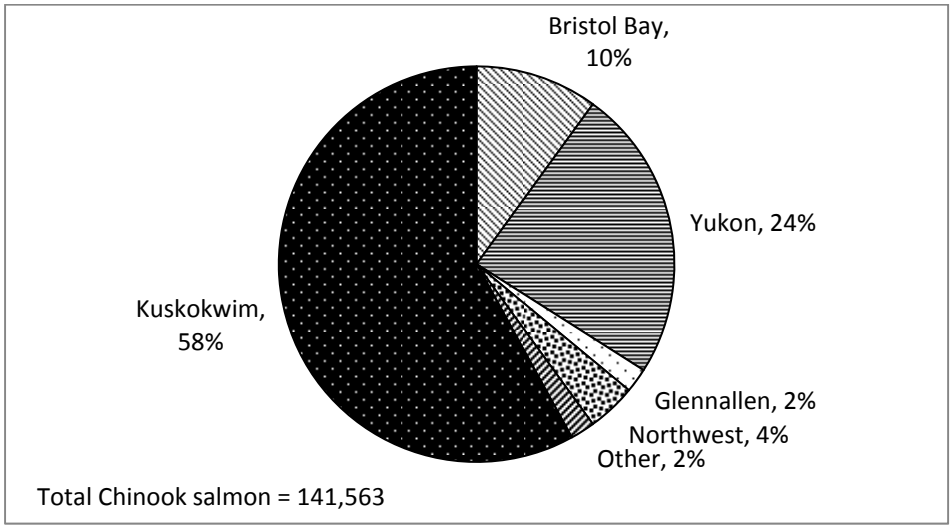
4) Between management areas, and sometimes between districts within management areas, there is inconsistency in how subsistence harvest data are collected, analyzed, and reported.
5) In some areas there are no routine mechanisms for evaluating the quality of subsistence harvest data. For example, in some areas it is not known if all subsistence fishermen are obtaining permits and providing accurate harvest reports. This can result in an underestimation of harvests.
6) There are few programs for contextualizing annual subsistence harvest data so as to interpret changes in harvests. However, in some cases, Fishery Management Reports do contain discussions of data limitations and harvest trends.

For more information on state management of salmon subsistence fisheries, refer to the ADF&G website at www.adfg.alaska.gov/index.cfm?adfg=fishingSubsistence.main and the Alaska Subsistence Salmon Fisheries 2009 Annual Report at http://www.adfg.alaska.gov/techpap/TP373.pdf.

Chinook salmon are the first salmon to arrive in the spring, which is fundamental to their importance for subsistence. In 2009, subsistence take of Chinook salmon was estimated at 141,563 fish (16% of the total 879,185 subsistence salmon harvested). Information on State management of the salmon subsistence fisheries is provided in the Alaska Subsistence Salmon Fisheries 2009 Annual Report, available on the State of Alaska website.[42] This is the most recent publicly available report, published and revised in June 2012.

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. 12 subsistence fishing areas are defined in the state of Alaska: Northern, Northwest, Yukon, Kuskokwim, Bristol Bay, Aleutian Islands, Alaska Peninsula, Chignik, Kodiak, Cook Inlet, Prince William Sound/Copper River, and Southeast.[43] The largest estimated subsistence harvests of Chinook salmon in 2009 occurred in the Kuskokwim Area (82,100 salmon, 58%), followed by the Yukon Area (33,932 salmon; 24%), Bristol Bay Area (14,020 salmon; 10%), the Northwest Area (5,171 salmon; 4%), and the Glennallen Subdistrict (3,341 salmon; 2%).

Figure 4-21 Alaska subsistence Chinook salmon harvest by area, 2009



[42] http://www.adfg.alaska.gov/techpap/TP373.pdf
[43] See Figure 1-1 of the Alaska Subsistence Salmon Fisheries 2009 Annual Report (p. 5) for a map of the Alaska subsistence areas.

4.5.4 Federal Subsistence Management

The Alaska National Interest Lands Conservation Act (ANILCA) of 1980 mandates that, among consumptive uses of fish and wildlife, rural residents of Alaska be given a priority opportunity for customary and traditional subsistence use on federal lands. In 1986 Alaska amended its subsistence law, mandating a rural subsistence priority to bring it into compliance with ANILCA. However, in the 1989 McDowell decision the Alaska Supreme Court ruled that the priority in the state's subsistence law could not be exclusively based on location of residence under provisions of the Alaska Constitution. Other federal court cases regarding the state's administration of Title VIII of ANILCA ruled that the state would not be given deference in interpreting federal statute. Proposed amendments to ANILCA and the constitution were not adopted to rectify these conflicts, so the Secretaries of Interior and Agriculture implemented a duplicate regulatory program to assure the rural subsistence priority is applied under ANILCA on federal lands. As a result, beginning in 1990, the state and federal governments both provide subsistence uses on federal public lands and waters in Alaska, which covers about 230 million acres or 60% of the land within the state.[44] In 1992, the Secretaries of the Interior and Agriculture established the Federal Subsistence Board and ten Regional Advisory Councils to administer the responsibility. The Board's composition includes a chair appointed by the Secretary of the Interior with concurrence of the Secretary of Agriculture; the Alaska Regional Director, U.S. Fish and Wildlife Service; the Alaska Regional Director, National Park Service; the Alaska State Director, Bureau of Land Management; the Alaska Regional Director, Bureau of Indian Affairs; and the Alaska Regional Forester, U.S. Department of Agriculture Forest Service.

Through the Federal Subsistence Board, these agencies participate in developing regulations which establish the program structure, determine which Alaska residents are eligible to take specific species for subsistence uses, and establish seasons, harvest limits, methods and means for subsistence take of species in specific federal areas. The Regional Advisory Councils provide recommendations and information to the Federal Subsistence Board; review proposed regulations, policies, and management plans; and provide a public forum for subsistence issues. Each Regional Advisory Council consists of residents representing subsistence, sport, and commercial fishing and hunting interests.

4.5.5 Pacific Salmon Treaty

Overview information on the Pacific Salmon Treaty can be found at:
http://www.psc.org/about_treaty.htm.

Interception of Pacific salmon bound for rivers of one country in fisheries of the other has been the subject of discussion between the Governments of Canada and the United States for over a century. Intercepting fisheries were identified through research conducted by the two countries on species and stocks originating from Alaska, British Columbia, Washington, and Oregon. Management of stocks subject to interception became a matter of common concern to both Canada and the United States. A mechanism to enable the countries to reap the benefits of their respective management and enhancement efforts was required and that mechanism is currently provided through the Pacific Salmon Treaty, ratified by the United States and Canada in 1985.

The Pacific Salmon Treaty is built upon two basic principles:

- Prevent overfishing and provide for optimum production both countries agree to respond to conservation concerns related to the interception of stocks of mutual concern.

[44] The U.S. Supreme Court has ruled that ANILCA's use of "in Alaska" refers to the boundaries of the State of Alaska and concluded that ANILCA does not apply to the outer continental shelf region (*Amoco Prod. Co. v. Village of Gambell*, 480 U.S. 531, 546-47 (1987)). However, NMFS aims to protect such uses pursuant to other laws, such as the National Environmental Policy Act and the Magnuson-Stevens Act.

- Equity each country should receive benefits equivalent to the production of salmon originating in its waters.

The twin principles of conservation and equity are to be implemented, taking into account:

- The desirability in most cases of reducing interceptions;
- The desirability in most cases of avoiding undue disruption of existing fisheries; and
- Annual variations in abundance.

The arrangements and institutions established in 1985 were effective in the early years of the Treaty but became outmoded after 1992 when the original fishing arrangements expired. From 1992 to 1998, Canada and the United States were not able to reach agreement on comprehensive, coast-wide fisheries arrangements. In 1999, government-to-government negotiations culminated in the successful renewal of long-term fishing arrangements under the Pacific Salmon Treaty.

Some of the key elements introduced with the 1999 Agreement include the creation of the Transboundary Panel and the Committee on Scientific Cooperation; the inclusion of habitat provisions in the Treaty; a move from fisheries based on negotiated catch ceilings to abundance-based management fisheries; and the establishment of the Northern and Southern Restoration and Enhancement funds ("Northern Fund" and "Southern Fund").

In May 2008, the Pacific Salmon Commission recommended a new bilateral agreement for the conservation and harvest sharing of Pacific salmon to the Governments of Canada and the United States. The product of nearly 18 months of negotiations, the agreement represents a major step forward in science-based conservation and sustainable harvest sharing of the salmon resource between Canada and the United States of America. Approved in December 2008 by the respective governments, the new fishing regimes are in force from the beginning of 2009 through the end of 2018.

The agreement replaces previous versions of the Chapters. The new fishing regimes are contained in the following Chapters of Annex IV of the Treaty:

- Chapter 1. Transboundary Rivers
- Chapter 2. Northern British Columbia and Southeast Alaska Boundary Area
- Chapter 3. Chinook salmon
- Chapter 5. Coho Salmon
- Chapter 6. Southern British Columbia and Washington State Chum Salmon

4.5.6 Summary of 2012 Alaska Chinook Salmon Stock Status

Chinook salmon runs in Western Alaska have been below average since 2007, and management of the fisheries has been conservative in many systems. No directed Chinook salmon commercial fisheries occurred in the Yukon River, Kuskokwim River, or in Norton Sound in 2012, and only small commercial fisheries occurred in the Nushagak and Kuskokwim Bay (Table 3-8). Sport fisheries were restricted or closed in the Nushagak River, Yukon (Chena River), Kuskokwim (Kwethluk and Tuluksak rivers), and Unalakleet and Shaktoolik rivers of Norton Sound Management Area. More significantly, subsistence fisheries in the Nushagak River, two tributaries of the Kuskokwim River (Kwethluk and Tuluksak rivers; U.S. Fish and Wildlife Service [USFWS] federal closure), and Norton Sound (Unalakleet and Shaktoolik rivers) were restricted or closed. In spite of conservative management strategies, which in some cases were at great cost to the people who rely on these resources for food and income, few escapement goals were achieved in Western Alaska.

Kodiak Island Chinook salmon escapement was well below the previous 10-year average. Returns to the Karluk River barely met the escapement goal despite restrictions of nonretention implemented preseason so the sport and commercial fisheries. Escapement through the Ayakulik weir was within the established escapement goal due in part to preseason emergency order fishery restrictions to the sport fishery. The 2012 escapement to the Chignik River was approximately 100 fish above the lower end of the escapement goal. Only 4 of 17 Chinook salmon escapement goals were met in northern Cook Inlet, despite preseason restrictions to sport and commercial fisheries, and inseason closures of several inriver sport fisheries. At this time it does not appear the escapement goal was met for early-run Kenai River Chinook salmon and, if achieved for late-run Kenai River Chinook salmon, it happened at the cost of closure of the inriver and marine sport fisheries and the Upper Subdistrict set gillnet commercial fishery.

Note, a more detailed discussion of the Alaska Chinook salmon stocks, as well as other Chinook salmon stocks that are present in the GOA, is included in Section 3.3.5.

Table 4-50 Overview of Alaskan Chinook salmon stock performance, 2012.

Chinook salmon stock	Total run size?	Escapement goals met?[a]	Subsistence fishery?	Commercial fishery?	Sport fishery?	Stock of concern?
Bristol Bay	Below average	0 of 1[b] (4 not surveyed)	Yes	Limited in Nushagak	Restricted on Nushagak for a portion of the season	No
Kuskokwim	Poor	2 of 7 (5 not surveyed)	Restricted on Kuskokwim River	None on Kuskokwim River, limited in Bay	Closed on Kuskokwim River, not in Bay	No
Yukon	Poor	3 of 5 (1 not surveyed)	Restricted	No	Bag limit reduced in all tributaries, no retention in mainstem and Tanana, no bait allowed on Tanana tributaries; Chena closed	Yield
Norton Sound	Poor	0 of 2 (3 not surveyed)	Restricted	No	No	Yield
Alaska Peninsula	Below average	0 of 1	Yes	Yes	Closed	No
Kodiak	Below average	2 of 2	Yes	Restricted, nonretention in Karluk and Ayakulik areas	Restricted, nonretention in Karluk, reduced bag and annual limits in Ayakulik	Management (Karluk)
Chignik	Below average	1 of 1	Yes	Yes	Restricted, nonretention, reduced bag and annual limits	No
Upper Cook Inlet	Poor	4 of 21[c]	Yes, with restrictions	Restricted in Northern District and Eastside set gillnets in Central District	Various restrictions including complete closure	6 stocks of conern
Lower Cook Inlet	Below average	3 of 3	Yes	Yes	Restricted; Closed Anchor River	No
Prince William Sound	Below average	1 of 1	Yes	Yes	Yes	No
Southeast	Below average	N/A	Yes	Yes	Yes	No

[a] Some aerial survey-based escapement goals were not assessed due to inclement weather or poor survey conditions, therefore we do not know if the escapement goals were met for these systems.
[b] The Chinook salmon escapement goal of 40,000 – 80,000 and the inriver goal of 75,000 were exceeded on the Nushagak River in 2012.
[c] Uncertainty in measuring the inriver abundance of early- and late-run Kenai River Chinook salmon do not provide clear assessment if the escapement goal of these two stocks were met.

4.6 Analysis of Impacts: Alternative 1, Status Quo

Selecting the status quo alternative would maintain the current regulations for the non-pollock groundfish trawl fisheries in the action area. Recording a certain level of Chinook salmon PSC would not close any of the fisheries under consideration. Directed fishing would only close if directed fishery TAC had been harvested, if Pacific halibut PSC limits had been reached, or in accordance with prescribed season end dates.[45] While the fisheries would not close due to the fulfillment of Chinook salmon PSC allowances, it is still incumbent upon fishery participants to avoid catching Chinook salmon to the extent practicable under existing regulation. Yet, no regulatory measures are defined for enforcing this requirement.

Estimated Chinook salmon PSC in the GOA non-pollock fisheries varied greatly between 2003 and 2012. **Error! Reference source not found.** illustrates the annual record of Chinook salmon PSC by year and by

[45] Section 4.4.8 reviews the annual pattern of GOA non-pollock trawl fishery closures for these reasons during recent fishing years.

sector, for all GOA groundfish trawl trips. The figure also reflects the total annual PSC rate (number of Chinook salmon PSC per mt of non-pollock groundfish) which is not a perfect predictor of the annual PSC total but does generally track with PSC levels over this sample of years. For this set of annual data, annual harvest and PSC have a correlation coefficient of 0.28, and one can compare years where PSC rates are similar but annual PSC is not (see 2006 and 2012). Studies of salmon PSC rates in the Bering Sea concluded that rates were highly variable across a number of factors beyond the timing, location and duration of fishing effort; these factors include water temperature, location, and salmon abundance by year and season (Ianelli, 2010). The data analyzed in this document also show seasonal variation in estimated PSC rates throughout the year. A published report that reviewed earlier bycatch patterns found that Chinook salmon PSC occurred in every week during which groundfish were prosecuted (Witherell, 2002).

Figure 4-22 Estimated Chinook salmon PSC in the GOA non-pollock groundfish fisheries, 2003 to 2011

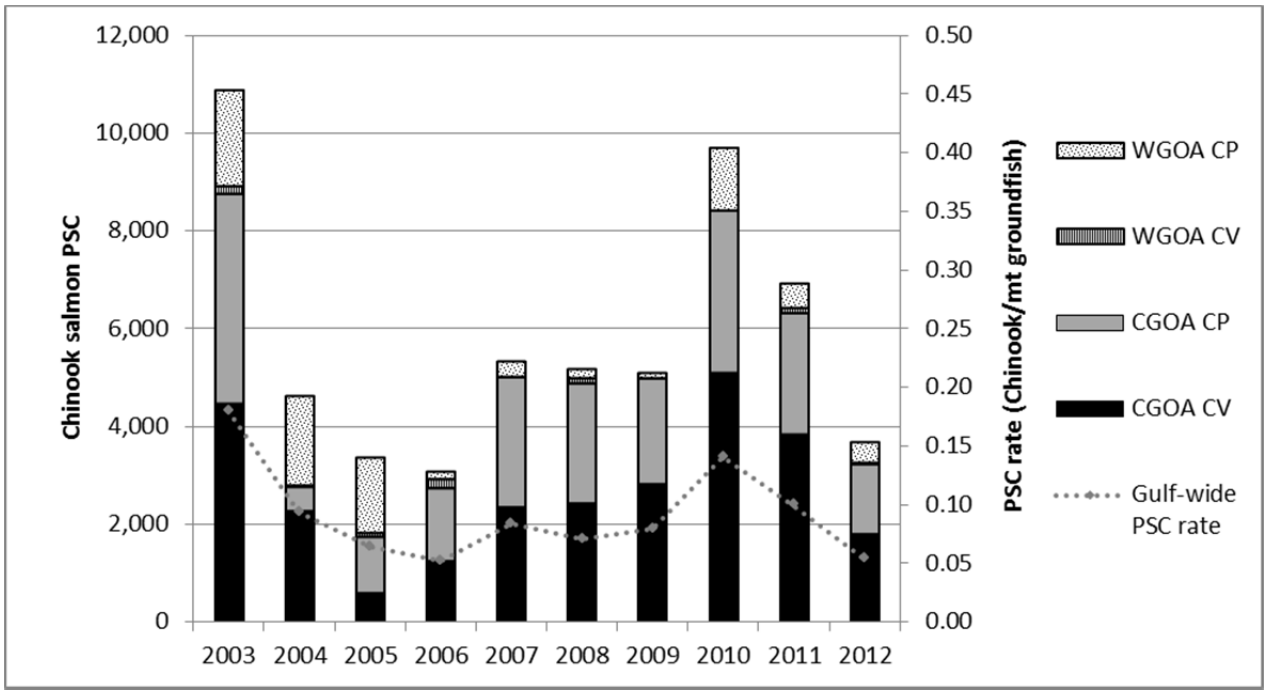


Table 4-51 to Table 4-54 report 2003 to 2011 average annual non-pollock groundfish trawl harvest, Chinook salmon PSC, and Chinook PSC rate (by GOA trip target) for the regulatory areas and/or operational harvest sectors to which this action could apportion Chinook PSC allowances. These figures summarize the recent historical disposition of non-pollock trawl harvests and Chinook salmon PSC in the GOA. Trips that are declared as part of the Rockfish Pilot Program (2007 to 2011) are included in these summary data, and pulled out separately in Table 4-55.

Table 4-51 Average annual GOA non-pollock harvest, Chinook salmon PSC, and PSC rate by trip target, 2003 to 2011

TARGET	2003 to 2011 annual average		
	Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
Rockfish	20,813	1,112	0.05
Arrowtooth Flounder	16,451	1,889	0.12
Pacific Cod	13,055	884	0.07
Shallow Water Flatfish	7,389	462	0.06
Rex Sole	2,873	1,336	0.46
Flathead Sole	1,271	307	0.24

Table 4-52 Average annual trip target non-pollock harvest, Chinook salmon PSC, and PSC rate, by regulatory area, 2003 to 2011

	TARGET	2003 to 2011 annual average		
		Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
Central GOA	Rockfish	15,178	1,035	0.07
	Arrowtooth Flounder	14,998	1,374	0.09
	Pacific Cod	9,913	754	0.08
	Shallow Water Flatfish	7,341	460	0.06
	Rex Sole	2,620	1,291	0.49
	Flathead Sole	839	132	0.16
	TARGET	Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
Western GOA	Rockfish	5,635	77	0.01
	Arrowtooth Flounder	1,453	516	0.35
	Pacific Cod	3,142	130	0.04
	Shallow Water Flatfish	48	2	0.03
	Rex Sole	253	45	0.18
	Flathead Sole	432	175	0.41

Table 4-53 Average annual trip target non-pollock harvest, Chinook salmon PSC, and PSC rate, by operational harvest type, 2003 to 2011

	TARGET	2003 to 2011 annual average		
		Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
CP	Rockfish	11,656	426	0.04
	Arrowtooth Flounder	5,880	1,103	0.19
	Pacific Cod	444	84	0.19
	Shallow Water Flatfish	319	8	0.02
	Rex Sole	2,746	1,305	0.48
	Flathead Sole	872	229	0.26
	TARGET	Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
CV	Rockfish	9,157	686	0.07
	Arrowtooth Flounder	10,571	786	0.08
	Pacific Cod	12,611	800	0.06
	Shallow Water Flatfish	7,070	454	0.06
	Rex Sole	128	31	0.24
	Flathead Sole	399	79	0.20

Table 4-54 Average annual trip target non-pollock harvest, Chinook salmon PSC, and PSC rate, by regulatory area and operational harvest type, 2003 to 2011

	TARGET	2003 to 2011 annual average		
		Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
Central GOA CP	Rockfish	6,060	349	0.06
	Arrowtooth Flounder	4,429	594	0.13
	Pacific Cod	231	17	0.08
	Shallow Water Flatfish	276	7	0.02
	Rex Sole	2,492	1,259	0.51
	Flathead Sole	449	55	0.12
	TARGET	Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
Central GOA CV	Rockfish	9,118	686	0.08
	Arrowtooth Flounder	10,569	780	0.07
	Pacific Cod	9,682	737	0.08
	Shallow Water Flatfish	7,065	454	0.06
	Rex Sole	128	31	0.24
	Flathead Sole	390	77	0.20
	TARGET	Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
Western GOA CP	Rockfish	5,596	77	0.01
	Arrowtooth Flounder	1,451	509	0.35
	Pacific Cod	213	67	0.31
	Shallow Water Flatfish	43	1	0.03
	Rex Sole	253	45	0.18
	Flathead Sole	423	174	0.41
	TARGET	Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
Western GOA CV	Pacific cod	2,929	63	0.02

Table 4-55 Average annual trip target non-pollock harvest, Chinook salmon PSC, and PSC rate for Rockfish Pilot Program trips, by operational harvest type, 2007 to 2011

	TARGET	2007 to 2011 annual average		
		Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
CP	Rockfish	3,619	503	0.14
	Arrowtooth Flounder	*	*	*
	TARGET	Harvest (mt)	Chinook salmon PSC	PSC rate (# Chinook/mt)
CV	Rockfish	7,937	834	0.11
	Other	462	13	0.03

* "Other" includes trips that were recorded in CAS as targeting arrowtooth flounder, Pacific cod and shallow water flatfish

Under current regulations, GOA non-pollock groundfish harvest levels are unlikely to increase significantly. In general (as previously discussed in Section 3.2), GOA flatfish TACs are set conservatively below acceptable biological levels (ABCs) in order to protect other species, such as halibut. As a result, directed flatfish fishing is frequently restricted before TACs are fully harvested. GOA rockfish and Pacific cod TACs are set in relation to ABC. The TAC levels for GOA flatfish and rockfish have been relatively stable over the analyzed period, though flatfish TACs increased in 2012 (Figure 4-8 and Figure 4-9).

In addition, it is possible that harvest rates could decline. The recent action to reduce available halibut PSC for Gulf fisheries could lead to earlier seasonal closures if those lower mortality levels are exceeded. These closures could reduce harvests from the Gulf. Since halibut-related closures would be seasonal – affecting the periods of the fishing year when halibut PSC rates are high – they could affect not only total

harvest, but also the distribution of harvest throughout the year. While these closures have the potential to reduce Chinook PSC, they would not affect Chinook PSC in the Central Gulf Rockfish Program fishery, as cooperatives in that fishery have exclusive halibut PSC apportionments in addition to rockfish allocations.

Selecting the status quo alternative would not alter current regulations, and thus would not directly affect the costs or revenues that non-pollock groundfish harvests bring to harvesters, processors, consumers and communities. While some of the trawl fleet may continue to take actions to voluntarily limit Chinook PSC, in the absence of PSC limits, vessels working in relatively short, competitive fisheries may lack the incentives to stop fishing in an area with high Chinook salmon PSC. This tendency may be exacerbated by the recent decrease in allowable halibut PSC, if participants in the fisheries expect those limits to be reached. In that case, participants may perceive added pressure to disregard Chinook PSC rates if they believe that the fishery will be closed on halibut PSC in the nearer-term. Taking action to avoid salmon may further reduce their own target catch and gross revenue (and likely net revenue), particularly if other participants do little or nothing to avoid Chinook PSC. On the other hand, if halibut PSC limits close fisheries early, the reduction in fishing effort from those closures could reduce Chinook PSC.

Without a Chinook PSC limit, fishermen are left to weigh the individual economic risks associated with Chinook avoidance against the unenforceable regulatory directive to avoid PSC to the extent practicable. Some participants in the fisheries affected by this action have taken steps to reduce Chinook PSC in the absence of a regulatory limit. To date, some groundfish participants have attempted voluntary standdowns during times of high Chinook salmon encounters, and some have participated in salmon excluder gear trials (further discussed in Section 5.1.4). Under the status quo alternative, fishermen who are members of voluntary harvest cooperatives could still utilize the tools of coordinated action. Under the current limited access management structure, an influx of vessels that are not party to voluntary avoidance measures could reduce the amount of TAC available to those salmon-avoiding vessels. The Council has heard testimony expressing some concern about the future viability of voluntary Chinook avoidance. Recent fishery activity suggests that participation in GOA groundfish fisheries has increased due to speculation about other potential bycatch management strategies that may allocate quota, of an undetermined type, according to historical participation (see Table 5-1). This influx of fishing pressure could compound other pressures to disregard Chinook PSC rates, as participants' shares of the catch would be eroded by the additional added effort, particularly if those new entrants attempt to maximize catches by deploying maximum effort and taking no steps to avoid Chinook PSC.

One Chinook PSC trend that is not evident in summary tables above is the 2007 spike in Chinook PSC from Central GOA rockfish trips, followed by a moderate annual decline (illustrated in Figure 4-17). Industry representatives indicate that the increase may have been related to gear changes, meant to avoid halibut PSC, and an earlier CV rockfish season opening that allowed vessels to harvest fish earlier to avoid delivery conflicts while stabilizing residential processor employment. Voluntary measures to reduce Chinook PSC in this fishery include fleet awareness and communication between vessels about Chinook encounters. These voluntary measures are unlikely to be successful outside of the Central Gulf Rockfish Program, as participants in those fisheries expose themselves to loss of harvest share when adopting Chinook avoidance measures that slow their rate of target catch. Again, this competitive disadvantage may be exacerbated by the increased harvest participation associated with a race for catch history. In the Rockfish Program, share allocations insulate participants from that risk.

Table 4-56 summarizes average annual Chinook salmon PSC usage for the most recent five years of available data, 2008 to 2012. These figures provide a reasonable point of reference by which to assess how constraining an apportioned PSC hard cap might be, noting that this analysis does not treat PSC levels from past years as an accurate predictor of future Chinook salmon encounter. Table 4-57 presents

similar information for Chinook salmon PSC usage prior to June 1st. Each table breaks out PSC that occurred on trips that were, or were not, declared as fishing under the Central GOA Rockfish Program.

Table 4-56 Average annual Chinook salmon PSC usage, 2008 to 2012

	All Trips	Non-RP Trips	RP Trips
Total GOA	6,109	4,874	1,235
Central GOA	5,570	4,335	1,235
Western GOA	539	539	
Catcher/Processors	2,888	2,568	320
Catcher Vessels	3,221	2,307	914
Central GOA CP	2,391	2,071	320
Central GOA CV	3,179	2,264	914
Western GOA CP	497	497	
Western GOA CV	43	43	

Table 4-57 Average Chinook salmon PSC usage prior to June 1st, 2008 to 2012

	All Trips	Non-RP Trips	RP Trips
Total GOA	3,759	3,205	554
Central GOA	3,447	2,893	
Western GOA	312	312	
Catcher/Processors	2,057	2,057	
Catcher Vessels	1,702	1,148	554
Central GOA CP	1,787	1,787	
Central GOA CV	1,660	1,105	554
Western GOA CP	269	269	
Western GOA CV	43	43	

The full retention alternative (Alternative 3) is intended to improve the understanding of the stock origins of Chinook salmon taken as PSC in the non-pollock trawl fishery. Under the status quo, no full retention requirement would be set in place. In the absence of a full retention requirement, restructured Observer Program, implemented in 2013, may create some additional opportunity for biological sampling of Chinook salmon, as more vessels – particularly in the CV fleet – will be carrying an observer. If an observer is aboard, salmon are prohibited from being discarded at sea until data collection and biological sampling has taken place.

4.7 Analysis of Impacts: Alternative 2, PSC limit(s) between 5,000 and 12,500 Chinook Salmon

This section of the analysis considers the impacts of the Chinook salmon PSC limits that the Council has proposed for consideration. Analysis of Alternative 2 is retrospective. Given the variation in harvest, annual Chinook salmon PSC (illustrated in Table 4-15 and Figure 4-22), and the lack of fishing experience under Chinook salmon PSC limits, there is no solid basis for making forecasts of actual future PSC levels. For each option under Alternative 2, the analysis first examines the potential direct effect on Chinook PSC and Central and Western GOA non-pollock groundfish harvests and revenues. Direct impacts on harvest and revenue include the avoided Chinook PSC and forgone groundfish harvest that might arise from early seasonal closures triggered by usage of Chinook salmon PSC allowances. Other

potential related impacts are addressed in Sections 4.7.2 through 4.7.4; they include changes in the number of Chinook salmon available to non-trawl users, reduced processing revenue and available hours of employment at groundfish processing facilities, reduced groundfish products available to consumers, reduced groundfish skipper and crew employment, and reduced groundfish harvester wages.

This analysis also considers – in broader terms – potential benefits for Chinook salmon harvesters, processors, and product consumers (Section 4.7.2). PSC limits could increase the number of Chinook salmon available to inshore and freshwater fisheries. Any such benefit should be considered when assessing a Chinook salmon PSC limit's net benefit to the nation. Potential benefits to the Chinook salmon fishery are not directly quantifiable with present data, as the biological data to assess the origin of Chinook salmon caught in GOA trawl nets is lacking. Future analyses should benefit from the mandatory full retention for biological sampling that the Council approved for the GOA pollock fisheries in GOA Groundfish Amendment 93 and, potentially, Alternative 3 of this action. Further, no available studies address the total ecosystem benefit that trawl-caught salmon, regardless of stock origin, would have provided had they not been taken.

Because the impact analysis that follows is retrospective, it assumes no change in fleet behavior as a result of implementing a PSC limit. This assumption does not affect the validity of comparing one PSC limit option to another, but one can presume that all estimates of forgone harvest may be overstated to a degree. Regulated trawlers are likely to modify their behavior in order to reduce their Chinook salmon PSC rate. With no behavior change, some GOA fisheries are predicted to close earlier than in recent years, once PSC limits are reached. Reducing PSC rates through salmon avoidance could mitigate the predicted shift in fishery closure dates. However, since historical Chinook salmon PSC encounter has been highly variable and unpredictable, in both time and space, the analysts note that avoidance measures could be unreliable in their effectiveness. Therefore, the analysts believe that any overstatement of forgone harvest and gross revenue caused by assumptions about fishing behavior should be modest. Moreover, when thinking about the potential effect of PSC avoidance strategies, one should also consider that behavior changes often impose a cost. These could include increased variable costs associated with relocating away from areas of high Chinook salmon encounter (fuel, ice, time), or increased fixed costs associated with capital investment in any salmon excluding gear that may be developed in the future.[46]

On the other hand, a retrospective analysis could potentially underestimate the cost of PSC closures if future non-pollock groundfish harvest levels were to increase. Under the status quo, the primary harvest constraint is halibut PSC. Future improvement in managing halibut PSC could make the historical trawl harvest levels used in this analysis seem low. By extension, forgone harvest levels that are based on a halibut-constrained fishery would also seem low. If the value of the groundfish fishery grows in the future, early closures on Chinook salmon PSC would have a more costly effect than they currently do, in terms of lost opportunity. Recent TAC history (Figure 4-8 and Figure 4-9) was stable or only moderately increasing from 2003 to 2011. Pacific cod TAC began increasing in 2009, but has since leveled off. Rockfish has been stable throughout the analyzed period. Flatfish TACs increased in 2012, but harvest levels have not displayed a similar rise, and are not likely to do so in the near-term given the possibility of further reductions in constraining halibut PSC limits. Upward trends in Pacific cod TAC (in both the Central and Western GOA) provide the most likely *potential* concern for this type of underestimation, as Pacific cod TACs are both generally increasing and well-utilized.[47] Additional information on recent TAC history can be found in Section 4.4.7.

[46] Note, to date, salmon excluder gear has only been developed for the pollock trawl fishery; gear modifications have yet to be designed for non-pelagic trawl target fisheries.
[47] Recall that – through 2011 – 90% of Pacific cod TAC is allocated to the inshore (CV) fleet, meaning that the underestimation of forgone benefits would primarily impact CVs.

In general, revenue impacts are roughly proportional to harvest impacts, so a reduction in groundfish harvest would likely decrease the fleet's revenue (and likely profit, as well). This statement is based on the assumption that ex-vessel and first wholesale values will remain in line with recent trends, in which harvest weight and gross wholesale revenue are closely related by a consistent ratio, and no price effect was observed in low harvest years. Refer back to Section 4.4.6.3 for information on the statistical relationship between harvest and revenue trends.

4.7.1 Impacts on Chinook salmon PSC levels and non-pollock groundfish trawl harvest

This section of the analysis assesses the effect of Chinook salmon PSC limits on both Chinook PSC and non-pollock groundfish trawl harvests. These effects depend on the likelihood that a Chinook salmon PSC limit will constrain non-pollock groundfish harvest and, by extension, reduce groundfish revenues. These harvest constraints arise if the Chinook salmon allowance is met and the fishing season is closed prior to either harvesting all available TAC or reaching a PSC limit on a different species, such as halibut.

Below, the report reviews the key target harvest species and seasonal catch distribution for each operational harvest type (CP and CV) in each regulated subarea (Central and Western GOA). This information aids in understanding which target fisheries might experience less effort if participants adopt a PSC-reducing strategy, or which are likely to receive increased effort if participants adopt a defensive position and increase effort over a shortened season (further discussion of these, and other, behavioral responses to a PSC limit is provided in Section 4.7.3). While reviewing the CV and CP sector in each regulatory area, the analysts also note the distribution of area endorsements to trawl for groundfish. License and participation information reflects harvesters' ability to redirect effort to a different regulatory area in response to Chinook PSC limits; effort redirection is discussed as a potential behavioral response Section 4.7.3.

Next, the analysts provide a high-level overview of how apportioning a PSC limit according to either a 5- or a 10-year historical period differently shapes the timing and number of simulated fishery closures during the analyzed period (2003 to 2011). In addition the length of the basis period, the Council will choose whether to apportion PSC allowances in accordance with either historical Chinook salmon PSC usage, or GOA non-pollock groundfish harvest.

The following numbered subsections summarize the range of projected future impacts that Alternative 2 (and its options) might have, in terms of forgone non-pollock groundfish harvest and avoided Chinook salmon PSC. In general, forgone harvest impacts and forgone revenue impacts are strongly correlated. Harvest and gross revenue display a correlation coefficient of 0.94 across all analyzed trip reports. In other words, reduced harvest would result in reduced gross revenue. As described in Section 4.4.6.3, the relationship between harvest weight and wholesale revenue has been stable in real dollar terms. Figure 4-4 and Figure 4-6 provide a sense of how many dollars in wholesale revenue would be forgone with each metric ton of forgone harvest. Figure 4-2 provides the same information at a trip target species level. For shorthand reference, Table 4-58 reports the 2011 average first wholesale value of GOA non-pollock groundfish species.

In 2011, rockfish and Pacific cod generated higher wholesale revenue per metric ton in the Central GOA than in the Western GOA, while flatfish generated higher per unit revenue in the Western GOA. Again looking at the most recent year, per unit rockfish revenue was roughly equivalent in the CP and CV sectors. The CV sector generated higher per unit revenue from Pacific cod, and the CP sector generated higher per unit revenue from the flatfish targets. These comparisons align with expectations, as the Pacific cod is a key target fishery for the CV sector, while CPs demonstrate a relatively greater focus on flatfish in the GOA non-pollock trawl fisheries.

Table 4-58 2011 first wholesale value per metric ton of harvest

	First wholesale value ($/mt)				
Target	CGOA	WGOA	CP	CV	Aggregate
Rockfish	2,081	2,058	2,108	2,030	2,076
Pacific Cod	1,513	1,496	1,327	1,516	1,510
Flatfish	980	1,155	1,183	848	986
Aggregate	1,347	1,770	1,587	1,282	1,400

Note: First wholesale prices are reported at the trip target level; flatfish includes arrowtooth flounder, shallow water flatfish, rex sole and flathead sole.
Source: ADFG Commercial Operators Annual Report, data compiled by AKFIN in Comprehensive_ENCOAR_PROD

Using retrospective data reported by week-ending date, it is possible to determine the date in each year when the non-pollock groundfish trawl fisheries would have been closed under a Chinook PSC limit. Any harvest recorded in weeks following that simulated closure would have been forgone by the fisheries subject to the limit, or apportionment of the limit. Similarly, any Chinook salmon PSC recorded in the post-closure weeks would not have occurred. Chinook salmon PSC that occurred after a retrospective closure date is referred to as "salmon savings." Section 4.7.1.2 discusses the caveats associated with performing a retrospective impact analysis, in specific reference to participants' likelihood to alter their pattern of participation under a hard cap, and the annually variable effect of halibut PSC closures that was present during the analyzed historical period.

This analysis does not make suppositions about the Council's preference, or lack of preference, on generating a specified percentage return in salmon savings on forgone harvest. The recommending authority's desire to reduce Chinook salmon PSC at the potential cost of groundfish trawl harvest will likely be guided by the Magnuson-Stevens Act National Standards, and an assessment of the net benefit to the nation (50 C.F.R §600.350(d)). Under this criterion, it may be deemed preferable to reduce PSC at a higher per unit cost in forgone harvest. However, this is difficult to assess without greater information on the proportion of GOA trawl-caught Chinook salmon that return to United States rivers, and their total socioeconomic value to United States entities.

The Council is considering a range of levels at which to set an annual total Chinook salmon PSC limit for the GOA non-pollock trawl fishery. The Gulf-wide cap levels analyzed in this report are 5,000, 7,500, 10,000 and 12,500 Chinook salmon per year. If none of the options under Alternative 2 are selected, the PSC limit, and any Chinook-based fishery closure, would apply jointly to all trawlers in the Central and Western GOA fisheries. The options under consideration propose various schemes for apportioning the total GOA PSC limit to subdivisions of the GOA fishery and fleet. In addition, the Council could sub-apportion a user group's allowable Chinook salmon PSC limit over different periods of the fishing year.

The Council has the ability to select some of the four Alternative 2 Options in conjunction. The Council's December 2012 motion, included in Section 2 of this report, specifies which options could be selected together. Setting aside the size of the total GOA Chinook PSC limit and the choice of method for basing PSC limit apportionment on historical activity – by PSC usage or by groundfish harvest, and by 5-year history or by 10-year history – the Council has defined 12 different scenarios for analysis. These paths are summarized in Table 4-59. The analysis of Alternative 2 is organized according to these 12 potential end-points.

Table 4-59 Options and combined options to be considered under Alternative 2

	Scenario	Description
Gulf-wide PSC limit	No Option selected	PSC limit shared by all operational types, across all affected areas
	Option 3	PSC limit shared by all operational type sectors, across all regulated areas; only a portion of the annual PSC limit can be used prior to June 1
	Option 4	Some PSC is set aside for the CG Rockfish Program; the remainder of the total GOA PSC limit is shared by all operational type sectors, across all regulated areas
	Options 3 & 4	Some PSC is set aside for the CG Rockfish Program; the remainder of the total GOA PSC limit is shared by all operational type sectors, across all regulated areas; only a portion of the annual limit can be used prior to June 1
PSC limit apportioned by user group	Option 1	PSC limit divided between the Central GOA and Western GOA fisheries
	Options 1 & 4	Some PSC is set aside for the CG Rockfish Program; the remainder of the total GOA PSC limit is divided between the Central GOA and Western GOA fisheries
	Option 2	PSC limit divided between the CP and CV sectors
	Options 2 & 3	PSC limit divided between the CP and CV sectors; only a portion of the annual limit can be used prior to June 1
	Options 2 & 4	Some PSC is set aside for the CG Rockfish Program; the remainder of the total GOA PSC limit is divided between the CP and CV sectors
	Options 2, 3 & 4	Some PSC is set aside for the CG Rockfish Program; the remainder of the total GOA PSC limit is divided between the CP and CV sectors; only a portion of the annual limit can be used prior to June 1
	Options 1 & 2	PSC limit divided between the Central GOA and Western GOA fisheries, and subdivided between the CP and CV sectors within each area
	Options 1, 2 & 4	Some PSC is set aside for the CG Rockfish Program; the remainder of the total GOA PSC limit is divided between the Central GOA and Western GOA fisheries, and subdivided between the CP and CV sectors within each area

4.7.1.1 Key non-pollock harvest species, by GOA trawl harvest sector

The Central GOA CV trawl sector records the highest average annual harvest of non-pollock trawl groundfish, by a wide margin (see Table 4-16). Participants in this sector derive a significant portion of average annual harvest from trips targeting arrowtooth flounder, Pacific cod, rockfish, and shallow water flatfish. The majority of arrowtooth and Pacific cod harvest is taken by trips that occur in the first half of the year, while shallow water flatfish tend to be harvested in later months. Trips targeting arrowtooth and Pacific cod contribute the greatest proportion of the sector's average annual Chinook salmon PSC. PSC in the arrowtooth fishery tends to be higher in the first half of the year, while the Pacific cod fishery takes similar amounts of Chinook PSC in both the A- and the B-seasons. Rockfish trips, which rank third within this sector for both harvested weight and Chinook salmon PSC, begin four to six weeks before the Central GOA CP rockfish harvest.[48] In 2011, 51 of the 97 CVs with Central GOA trawl endorsements were also licensed to trawl in the Western GOA, and 37 were licensed in the Bering Sea (one was also licensed to trawl in the Aleutian Islands regulatory area). Of the 47 Central GOA CVs that were active in

[48] This timing difference between the Central GOA CV and CP rockfish fisheries has emerged since the implementation of the Rockfish Pilot Program, in 2007. Refer to Section 4.4.10 for further detail.

2011, 27 also landed BSAI groundfish, 8 also landed Western GOA groundfish, and 3 were active in both GOA regulatory areas *and* the BSAI. 46 of the 47 vessels active in 2011 participated in the Central GOA pollock fishery. 14 of the 15 active vessels who participated exclusively in the Central GOA landed some amount of Pacific cod, rockfish, flatfish and pollock; the remaining Central GOA-only vessel did not record any rockfish landings.

The Western GOA CV sector is almost entirely a Pacific cod fishery. Nearly all of the sector's harvest and PSC is linked to the Pacific cod A-season. In 2011, 51 of the 78 CVs with Western GOA trawl endorsements were also licensed to trawl in the Central GOA, and 21 were licensed in the Bering Sea (one was also licensed to trawl in the Aleutian Islands regulatory area). Of the 14 Western GOA CVs that were active in 2011, 4 also landed BSAI groundfish, 8 also landed Central GOA groundfish, and 3 were active in both GOA regulatory areas *and* the BSAI. 13 of the 14 vessels that were active in 2011 participated in the Western GOA pollock fishery. Most harvesters who fished exclusively in the Western GOA landed some amount of Pacific cod, rockfish, flatfish and pollock, but the 3 active vessels who displayed more selective participation in 2011 targeted only Pacific cod, or cod and pollock.

The Central GOA CP sector mainly harvests rex sole early in the fishing year, and trips targeting this species account for the greatest proportion of the sector's average annual PSC. Rockfish trips account for the most significant percentage of harvested weight. This sector's rockfish fishery primarily occurs in June and July (Weeks 24 and 31), owing to harvesters' demonstrated preference to prosecute other fisheries in May. Selecting a limit that does not separately apportion PSC to the CP and CV sectors could create an incentive for Central GOA CPs to start targeting rockfish earlier in the year, as a defensive measure against losing revenue to a PSC closure; this behavioral shift would, of course, require a trade-off in the harvest that Central GOA CPs currently target in May. It is likely that such a trade-off would result in decreased revenue, or else they would already be prosecuting rockfish at that time. The majority of Central GOA CP trips targeting arrowtooth tend to occur in the summer and fall months, which is later than the arrowtooth harvest occurring in other sectors. In 2011, 13 of the 21 CPs with Central GOA trawl endorsements were also licensed to trawl in the Western GOA, and 20 held endorsements for the Bering Sea (15 were also permitted to trawl in the Aleutian Islands regulatory area). Of the 9 Central GOA CPs that were active in 2011, 8 also landed BSAI groundfish, and 6 were active in both GOA regulatory areas *and* the BSAI. All Central GOA CPs that were active in 2011 landed some amount of Pacific cod, rockfish, flatfish, and pollock. The 3 Central GOA CPs that did not also fish in the Western GOA are each members of Amendment 80 cooperatives. This is noteworthy in that these vessels have other opportunities to harvest groundfish if the Central GOA CP fishery is closed for PSC. Were it not the case, a PSC limit that apportioned Chinook salmon allowances by regulatory area would have placed these vessels in a more precarious situation if dual-licensed vessels redirected effort from the Western GOA and triggered an earlier closure in the Central GOA.

The Western GOA CP sector primarily targets rockfish, but also recorded significant arrowtooth harvest. As stated above, arrowtooth tend to be targeted earlier in the year in the Western GOA than in the Central GOA (refer back to

Table 4-28 to see the monthly distribution of target harvest broken out by regulatory area). Spring arrowtooth harvest contributed the greatest proportion of the sector's Chinook salmon PSC, though trips targeting flathead sole accounted for the most PSC relative to harvested target species weight. Voluntary action to reduce Western GOA CP PSC rates could potentially focus on avoiding flathead sole fisheries during March. In 2011, 13 of the 20 CPs with Western GOA trawl endorsements were also licensed to trawl in the Central GOA, and all 20 carried Bering Sea endorsements as well (18 were also licensed to trawl in the Aleutian Islands regulatory area). All 14 of the Western GOA CPs that were active in 2011 also landed BSAI groundfish, and 6 were active in both GOA regulatory areas. All active Western GOA CPs in 2011 landed some amount of Pacific cod, rockfish, flatfish, and pollock. 19 Western GOA CPs made non-pollock groundfish landings from 2003 to 2011, and 5 of these did not operate in the Central

GOA. Each of these 5 CPs are Amendment 80 cooperative members, so, as noted in the previous paragraph, there should be somewhat less concern about these vessels losing all of their groundfish access due to increased redirected effort from dual-licensed vessels under an area-apportioned PSC limit.

Basing apportionment on either a 5-year or 10-year history of Chinook salmon PSC usage or non-pollock groundfish harvest

The selected metric and time period upon which PSC apportionment is based will influence which sector of the GOA non-pollock trawl fishery is more likely to be constrained by Chinook salmon PSC. In general, a sector that receives a smaller percentage of the total GOA PSC limit is more likely to experience a fishery closure, and closures that do occur would come earlier in the year. Table 4-60 summarizes the percentage of the hard cap apportioned to each user group, depending on which scenario and set of historical determinants the Council chooses. For this analysis, the 10-year historical period includes 2002 to 2011, and the 5-year period includes years 2007 to 2011.

Entries in Table 4-60 that include Option 4, which apportions a segment of the total GOA Chinook salmon PSC limit directly to the Central GOA Rockfish Program (RP), reflect the historical division of PSC or harvest that occurred on all trips that are not flagged as part of the RP in NMFS Catch Accounting System. The records that are eliminated by removing RP trips from the historical data pool all come from the Central GOA, all occurred during the 2007 to 2011 time period, and were primarily from the CV sector's history pool. As such, the apportionment percentages based only on non-RP trips end up shifting slightly more of the PSC allowance toward the Western GOA and CP sectors.

Table 4-60 Percentage of annual Chinook salmon PSC limit apportioned to each trawl user group under Alternative 2 options

		PSC Usage		Groundfish Harvest	
		10 year History	5 year History	10 year History	5 year History
Option 1	CGOA	82%	92%	82%	83%
	WGOA	18%	8%	18%	17%
Option 1 + 4	CGOA	80%	90%	80%	79%
	WGOA	20%	10%	20%	21%
Option 2	CP	51%	48%	36%	34%
	CV	49%	52%	64%	66%
Option 2 + 4	CP	53%	51%	36%	35%
	CV	47%	49%	64%	65%
Option 1&2	CG CP	38%	41%	23%	21%
	CG CV	44%	51%	59%	62%
	WG CP	13%	7%	13%	13%
	WG CV	5%	1%	5%	4%
Option 1&2 + 4	CG CP	38%	42%	22%	20%
	CG CV	42%	48%	58%	60%
	WG CP	14%	9%	14%	15%
	WG CV	5%	1%	6%	5%

Selecting groundfish harvest instead of PSC usage as the basis for apportionment, under either historical time frame, makes the greatest difference in scenarios that involve Option 2 – dividing the PSC limit by operational type sector. The CP sector would have to prosecute the GOA non-pollock fishery with 15% fewer allowable Chinook salmon PSC if harvest history serves as the basis for apportionment. On the surface, it may seem that apportioning the hard cap by historical PSC usage "rewards" sectors that fished

with higher rates of Chinook salmon per metric ton of groundfish harvest. While this may be true in effect – as the likelihood of a CP sector closure increases under a groundfish history apportionment scheme – the Council should weigh this policy decision in view of the fact that estimated CP and CV PSC rates are hard to compare; refer back to Section 4.4.11.1 for more discussion on differing rates of observer coverage and the lack of a sufficient test case where CPs and CVs prosecuted the same target fishery in the same time and space.

4.7.1.2 Methodology for impact analysis

The following subsections describe the range of potential Chinook salmon PSC and GOA non-pollock groundfish harvest impacts that are suggested by observations of harvest and Chinook PSC records from 2003 to 2011. Because this analysis is retrospective, and participants were not under a PSC cap at the time, regulatory impacts must be viewed with the caveat that fishermen did not alter their behavior to avoid Chinook salmon and forestall PSC-related fishery closures; as such, the figures reported in this analysis might be viewed as a moderate overestimation of maximum impacts. Chinook salmon interception is an unpredictable event, and annual groundfish harvest – both on aggregate and by target fishery – vary from year to year. Moreover, the effect of halibut PSC limits on aggregate GOA and target-specific groundfish harvest varies from year to year. As such, the reported impacts should not be interpreted as a forecast of future conditions.

The presented range of impacts is derived by identifying the dates of the earliest and latest simulated closures that would have occurred if a PSC limit had been in place from 2003 to 2011. These closure dates are then applied to the weekly groundfish harvests and Chinook salmon PSC of a "characteristic fishing year" that typifies the analyzed period. The characteristic fishing year is constructed by averaging Chinook PSC and non-pollock groundfish harvest level for each calendar week, as it occurred in each of the 9 analyzed years. Figure 4-23 illustrates the seasonal distribution of non-pollock groundfish harvest in the characteristic year. In order to estimate the effects of a closure under each apportionment scenario, the closure weeks that were retrospectively simulated on 2003 to 2011 records are applied to the characteristic fishing year Chinook PSC usage and groundfish harvests. The resulting salmon savings and forgone harvest estimates reflect the regulatory impact that might be experienced in the best approximation of a typical fishing year, given the available historical record. The characteristic fishing year displayed annual Gulf-wide key species harvest of 62,070 mt and 5,991 Chinook salmon PSC, which is very near to the observed average levels for all GOA non-pollock target species – 62,438 mt and 6,008 Chinook salmon.

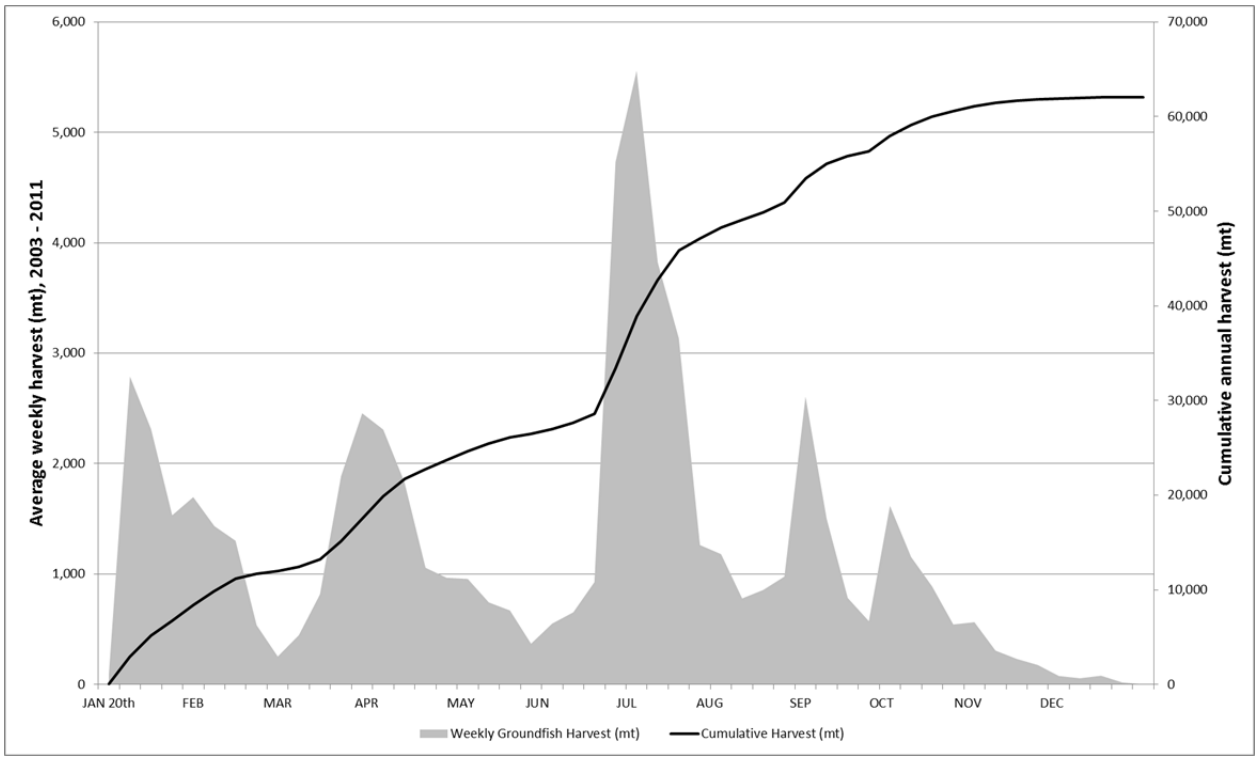
Analysts elected to rely on a "characteristic fishing year" for two reasons. First, the use of a characteristic fishing year allows analysts to present estimated salmon savings and forgone groundfish harvests for all years and options without being restricted by confidentiality limitations. Confidentiality issues would prevent the disclosure of estimated impacts for a large number of weeks as a result of relatively few vessels participating in some of the non-pollock target fisheries at certain times. These low-vessel weeks typically occur later in the year, and frequently coincide with the time at which retrospective simulated Chinook PSC limits are being triggered.

The second reason for using a characteristic fishing year is to smooth the effect of annually variable factors on retrospectively estimated impacts. Such key factors include Chinook PSC estimates, the seasonal distribution of target harvest, and the variable timing and impact of halibut PSC-related closures. Because of this variability, simply relying on past simulated closures to identify the range of likely future outcomes may overstate or understate expected salmon savings and forgone harvest. For example, some apportionment scenarios may only have triggered a simulated fishery closure during one or two of the analyzed historical years (most likely the years with high overall Chinook salmon PSC, or with high PSC levels in the early months of the year). Because annual harvest and PSC display no stable trend, simulated

forgone harvest and salmon savings for a given year are not necessarily reliable indicators of future expected outcomes for the apportionment scenario being analyzed. Many factors could make one year exceptional from harvest and PSC conditions in the future; using measures of central tendency to construct a characteristic fishing year absorbs some of this variability. The same logic supports the use of the full 2003 to 2011 period to construct the characteristic year. While some aspects of seasonal harvest distribution shifted following the 2007 implementation of the Rockfish Pilot Program (see Figure 4-10 in Section 4.4.8.2), a larger sample of fishing years is still preferable to absorb more of the annual variation in other determinant factors, such as environmental conditions, market conditions, and seasonal halibut PSC closures.

As a corollary to the second point described above, using a characteristic fishing year also circumvents an analytical problem where potential impacts under one apportionment scenario are based on the fishing history of a particular year, while impacts under another scenario are based upon a different year or a set of years. Again, using measures of central tendency to define a typical year increases the validity of comparing option, or bundle of options, to another based on estimated impacts.

Figure 4-23 Seasonal harvest distribution in the characteristic fishing year



This analysis breaks down the potential range of impacts by target species. However, one should keep in mind that Alternative 2 would apply a Chinook salmon PSC limit to all non-pollock groundfish trawl target fisheries. PSC recorded by trips targeting a given species accrues to the entire PSC apportionment group (as determined by the Alternative 2 option, or options, selected). Because of this, harvesters cannot simply switch targets *in response to* a PSC closure. However, harvesters may alter their fishing behavior in anticipation of a constraining PSC limit. Such a preemptive response could take one (or more) of three forms: (1) harvesters may shift fishing activity away from target fisheries that record high levels of PSC in order to prevent or forestall a non-pollock groundfish closure; (2) harvesters could standdown from a directed fishery that is, or is expected to be, recording high Chinook salmon PSC; or (3) harvesters may accept that a closure is imminent and respond by increasing participation in early season or high-value

target fisheries in order to generate as much revenue as possible while the season is still open. Participants may be limited in their ability to adjust inseason behavior according to these strategies. Limiting factors include, among others, seasonal TAC allocations for Pacific cod (described in Section 4.4.7), competitive disincentives to coordinate temporary standdowns, and seasonal Pacific halibut PSC limits (which are not apportioned separately to the CP and CV sectors). The behavioral response aspects of shared PSC limits are further discussed in Section 4.7.3.

4.7.1.3 Options resulting in a Gulf-wide Chinook salmon PSC limit

If the Council selects Alternative 2, four of the 12 analyzed end-points (selected options, or combination of options) would result in a Chinook salmon PSC limit that is shared across all participants in the segment of the GOA trawl fishery that is regulated by this action. These end-points, listed in Table 4-59, include: selecting Alternative 2 with no options, selecting Option 3, selecting Option 4, and selecting Options 3 and 4 together.

4.7.1.3.1 No Option Selected

The GOA non-pollock trawl fishery, including all affected management areas and harvest sectors, recorded around 6,000 Chinook salmon PSC per year from 2003 to 2011. By that measure of central tendency, one might conclude that the only considered PSC limit that could be regularly expected to close the fishery is 5,000 Chinook salmon per year. However, this analysis has noted throughout that annual Chinook PSC levels are highly variable and unpredictable. Noting this, the analysts present maximum potential impacts, as determined by calculating the dates of fishery closures that would have occurred during the analyzed period, had the considered cap levels been in place. The magnitude of the maximum impact is estimated by evaluating the avoided PSC and forgone harvest that would have been realized if such a closure occurred in the characteristic year.

Table 4-61 Estimated maximum potential impacts under a Gulf-wide PSC limit

PSC Limit	# Years with PSC closure	Earliest Closure Week	Impact	GOA Total		Forgone Harvest (mt) and Chinook savings (# fish) by species											
						Rockfish		Pacific Cod		Rex Sole		Shallow Water		Flathead Sole		Arrowtooth	
				mt, # fish	% Lost, Saved	mt, # fish	% Lost, Saved	mt, # fish	% Lost, Saved	mt, # fish	% Lost, Saved	mt, # fish	% Lost, Saved	mt, # fish	% Lost, Saved	mt, # fish	% Lost, Saved
12,500	0	None	Foregone Harvest	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Chinook Savings	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10,000	1	Early Sept.	Foregone Harvest	11,181	18%	1,016	5%	3,926	30%	318	11%	1,931	26%	191	15%	3,801	23%
			Chinook Savings	1,057	18%	16	1%	330	37%	104	8%	343	74%	40	13%	224	12%
7,500	2	Mid May	Foregone Harvest	38,351	62%	20,517	99%	4,246	33%	1,054	37%	5,602	76%	377	30%	6,555	40%
			Chinook Savings	2,384	40%	1,054	95%	368	42%	149	11%	371	80%	43	14%	400	21%
5,000	6	Late April	Foregone Harvest	42,208	68%	20,813	100%	4,264	33%	1,485	52%	6,319	86%	581	46%	8,705	53%
			Chinook Savings	3,361	56%	1,112	100%	369	42%	523	39%	411	89%	48	16%	898	48%

Table 4-61 summarizes the impacts under the earliest simulated closure dates for each considered GOA PSC hard cap level. During the analyzed period, GOA non-pollock harvest in the key target fisheries averaged around 60,000 mt per year. The smallest cap level, 5,000 Chinook salmon, would have triggered a closure at some point in six of the nine analyzed years, including each of the five most recent years. A late-April closure would have precluded around two-thirds of average annual groundfish harvest, and would have prevented 56% of average annual Chinook PSC. The fact that an April closure prevents only 56% of PSC reflects the fact that a large portion of annual Chinook salmon catch occurs in the early-year fisheries – primarily Pacific cod, arrowtooth flounder and rex sole. By comparison, a fall closure would preclude around one-fifth of average annual harvest and Chinook PSC, primarily impacting the Pacific cod B season and the fall shallow water flatfish fishery (both Central GOA fisheries). Note that a fall closure precludes only 26% of average annual shallow water flatfish harvest, but prevents 74% of the average annual Chinook PSC that occurs on trips targeting shallow water flatfish; this type of spread in the two impact metrics indicates that targeting shallow water flatfish is more Chinook-intensive later in the year.

The direct impact on the value of the fishery can be gauged by comparing the forgone harvest weights listed above to the 2011 first wholesale values reported in Table 4-58. Applying target-specific first wholesale values ($/mt), the analysts estimate maximum forgone wholesale revenue to be around $66 million for a 5,000 Chinook salmon PSC limit, around $62 million for a 7,500 PSC limit, and around $14 million for a 10,000 PSC limit. No direct revenue loss is estimated for a 12,500 Chinook salmon PSC limit as a fishery closure is unlikely to occur in all but the most extreme PSC year. The analysts emphasize that these figures only capture direct revenue impacts from groundfish that is not harvested. Indirect costs may be incurred through altered fishing behavior or investment in PSC-reducing technology. Other indirect costs to the fishing economy of a shortened season could include reduced revenue for fishery supporting businesses and wages paid to processing employees; these items are further discussed in Section 4.7.4.

Closures that may occur under the higher considered cap levels are likely to occur later in the year. Attempts to coordinate Chinook avoidance across vessels may be more successful in late-year fisheries when fewer vessels are active (Table 4-1). A limit that only affects the small subset of participants who are active late in the year could be viewed as inequitable. On the other hand, Chinook PSC rates tend to be relatively high later in the year, so creating an incentive for these vessels to give more attention to Chinook PSC may have a greater effect on total PSC usage.

Selecting a PSC limit with a low perceived probability of closing the fishery, such as the 12,500 Chinook hard cap, may still impact the fishery relative to the status quo (no cap at all). Simply having a limit in place my cause some participants to alter their fishing behavior. Participants may take action to avoid Chinook PSC, especially as the fleet approaches a PSC limit. The extent to which a looming cap affects behavior may vary, depending on the fleet's confidence in its ability to manage a small amount of available bycatch; sectors of the fleet that participate in voluntary or programmatic cooperatives may behave differently than those that are characterized by individual operations competing to harvest groundfish prior to a closure. Inseason changes to patterns of participation may be more dramatic in years where a large amount of Chinook salmon encounter occurs early in the year, effectively putting the fleet on notice. Potential behavior changes under a Chinook PSC limit are further discussed in Section 4.7.3.

4.7.1.3.2 Option 3 – Seasonal PSC Limit Prior to June 1

Option 3 would limit Chinook salmon PSC usage to no more than 50% or 66% of the selected total annual hard cap before June 1. In effect, Option 3 would create a seasonal sub-limit that has the force to trigger a fishery closure if it is exceeded. Option 3 does not, however, apportion the annual PSC limit to the pre- and post-June 1 time periods. Chinook salmon PSC that is unused as of June 1 rolls into the PSC allowance that was held back in order to support fisheries that occur later in the year.

Over the most recent five years of available data (2008 to 2012), the GOA non-pollock trawl fisheries recorded an average of 3,759 Chinook salmon PSC between the start of the fishing year and June 1 (Table 4-57). This represents the best available information, and is in line with the figure used for impact analysis – an annual average of 4,030 Chinook salmon prior to June 1 from 2003 to 2011. Assuming away all year-to-year variability in early-year PSC, one could conclude that a pre-June PSC closure is unlikely under an annual Gulf-wide PSC limit of 10,000 or 12,500. Using similar logic, a spring closure would be unlikely under a 7,500 annual PSC limit if up to 66% of the cap can be taken before June 1.

Table 4-62 Seasonal PSC sub-limits and simulated closure results (2003 to 2011)

Annual PSC Limit	50/50			66/34		
	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure
12,500	6,250	1	Late April	8,250	1	Mid May
10,000	5,000	2	Late April	6,600	1	Late April
7,500	3,750	4	Early April	4,950	3	Mid April
5,000	2,500	7	Mid Feb	3,300	4	Early March

In some years, Chinook salmon PSC may be more heavily weighted toward the early months. Moreover, years with high early-season PSC are not always the years with the highest annual PSC total. Annual Chinook PSC was roughly similar in 2004 and 2008 (~550 fish difference), but 1,500 more Chinook salmon were taken prior to June in 2008 than in 2004. Chinook PSC was 2,000 fish greater in 2007 than in 2005 or 2006, but 1,000 fewer Chinook had been taken in 2007 entering June. For this reason, the analysts again estimate potential impacts by applying closure dates derived from the actual fishing history of the analyzed period to the characteristic fishing year.

Prior to June 1, key target harvest in the GOA non-pollock fisheries averaged around 26,000 mt per year. The smallest total GOA PSC limit, 5,000 Chinook salmon, triggered closures as early as mid-February and early March. In the characteristic year, such closures would result in the loss of 15,000 to 19,000 mt of groundfish harvest that occurred prior to June 1. The earliest closures triggered under higher GOA PSC limits fell between early April and mid-May; generating a direct harvest impact ranging from 12,800 mt to 2,400 mt of groundfish. Taking these years in aggregate, the non-pollock harvest that occurred prior to June consisted of roughly 35% Pacific cod (A season) and 45% arrowtooth flounder and rex sole. The percentage of pre-June harvest recorded on trips targeting rockfish increased from 6% of the total to 10% when considering only 2007 to 2011, which is when the CV sector moved its rockfish season up from July to early May under the Rockfish Pilot Program.

One can roughly gauge the maximum potential revenue impact using the aggregate first wholesale value per metric ton figure of $1,400 (including all targets). A mid-February closure would result in a revenue loss on the order of $27 million; an early April closure would cause around $18 million in forgone revenue; and a mid-May closure would generate a loss of around $3.5 million.

Closures that occur after March would mainly affect the arrowtooth flounder and rex sole target fishery, which is a relatively low value fishery, but is still important to maintaining processing volume and crew employment in between the Pacific cod and rockfish seasons. It should also be noted that participants are likely to shift their seasonal pattern of participation in certain target fisheries according to which fishery is most valuable. If the non-pollock fishery was closed in May under Option 3, it is probable that the CV sector would simply open its rockfish season on June 1, instead of early May. This would not be without cost, but it is probably an overstatement of the impact to conclude that harvesters would simply forgo that month's portion of the relatively valuable rockfish fishery.

4.7.1.3.3 Option 4 – PSC Carve-out for the Central GOA Rockfish Program

Option 4 would apportion some amount of the total annual GOA Chinook salmon PSC limit directly to the Central GOA Rockfish Program. As a result, the non-Rockfish Program segment of the GOA non-pollock trawl fishery would operate under a smaller hard cap. This analysis considers RP carve-outs of 1,500, 2,500 and 3,500 Chinook salmon per year.

The size of the RP carve-out has a fairly simple impact on the non-RP fisheries; larger carve-outs result in less Chinook salmon PSC available to support the non-RP fisheries. On the other hand, Chinook PSC that is recorded on trips within the Program are not credited against the non-RP remainder of the GOA hard cap. In general, however, reducing the size of the non-RP PSC limit brings those fisheries closer to the cap size where they are susceptible to unpredictable high PSC events that can trigger closures. This is even more so the case when the non-RP PSC limit is apportioned between multiple areas or sectors (as when Options 1 & 4 or Options 2 & 4 are selected together, for example). The Council may wish to consider whether it is prioritizing "fully funding" the historical Chinook salmon PSC usage in the Rockfish Program fishery, or whether it is managing the risk of mid-year closures to the non-RP fishery.

From 2007 to 2012, average annual Chinook salmon PSC use in the RP has been 1,357. The highest single year PSC total was 1,940 (in 2007), and the lowest was 736 (in 2011). An undivided 2,500 or 3,500 PSC limit for the RP would not have been exceeded in any of the six historical years. A 1,500 Chinook salmon PSC limit would have closed the RP fishery in the first two years of the Program. Section 4.4.10 provides additional discussion of why RP PSC might have spiked in 2007 and 2008, and what programmatic learning may have occurred since then. With the caveat that putting too much analytical stock in the first two years of a new program is of limited use, the data show that a 1,500 Chinook hard cap would have closed the RP fishery in late June or early July during those years. Were such a closure to occur in the characteristic RP fishery year (based on 2007 to 2012), participants would have lost the opportunity to harvest between 7,000 and 8,000 mt of groundfish[49], and around 400 Chinook salmon would not have been taken. For comparison, average annual RP harvest was 12,050 mt from 2007 to 2011.

Rockfish Program cooperative members may have a greater ability to coordinate harvest in order to minimize Chinook salmon PSC. Delaying harvest until low-PSC rate periods, such as July, is a more viable approach to bycatch management in a catch share fishery with a direct allocation of halibut PSC mortality, whereas a race to harvest before a PSC closure occurs is a more likely response in a limited access fishery with more vessels and less coordination. RP participants may shift the timing of their participation more dramatically if a RP PSC cap is perceived to pose a constraint. While shifting harvest patterns to prevent a fishery closure would seem to preserve fishing revenues, participants may bear the opportunity cost of forgoing their typical July revenue streams. CVs are more likely to delay RP participation, as CPs already tend to target rockfish in July. However, many RP CVs also participate in the Bering Sea AFA pollock fishery, which opens on June 10; some CVs also operate as tender vessels in July. If the RP CV fleet feels that fishing in July is the only way to stay under a constraining PSC cap, they may have to trade off tendering revenues, or incur the additional operational cost of transiting to the Bering Sea in June and then returning to the GOA in July.

Suboption 1 – Divide Rockfish Program PSC between the CP and CV sectors

The Council may choose a suboption (Suboption 1) that divides the RP carve-out between the CP and CV sectors in the Program. If the PSC is divided, the Council's December 2012 motion stipulates that it would be apportioned in accordance with each sector's historical Chinook salmon PSC usage (during RP trips) from 2007 through 2012. For reference, Table 4-37 shows each sector's annual Chinook salmon PSC usage in the Rockfish Program.[50] Under Suboption 1, the CP sector would receive 38% of the annual PSC apportionment, and the CV sector would receive 62%. Table 4-63 summarizes the PSC apportionments to each sector under each of the three considered carve-out cap levels.

[49] Trips flagged as participating in the Rockfish Program do not solely consist of rockfish species catch. Other targets appearing in the Catch Accounting System data include Pacific cod, arrowtooth flounder, shallow water flatfish, sablefish and Atka mackerel.
[50] Each sector experienced one year since 2007 during which annual Chinook salmon PSC usage was dramatically higher than the period average. These high PSC years occurred in different years (CPs in 2007, CVs in 2008). The actual numbers are redacted in this document, as the low number of CP vessels in the Rockfish Program prior to 2010 trigger confidentiality restrictions.

Table 4-63 Apportioned Rockfish Program PSC limit under Option 4, Suboption 1

Total RP PSC Limit	CP Limit	CV Limit
1,500	563	937
2,500	939	1561
3,500	1314	2186

As part of this suboption, each LLP holder will receive an allocation of Chinook salmon PSC that is a percentage of the sector's total PSC allowance; the percentage would be determined by the license's proportion of the sector's target rockfish catch, as it was determined at the Program's initial allocation. An individual LLP's PSC allocation would then accrue to its respective RP cooperative. The proportion of the total RP quota pool that is allocated to the LLPs in each sector is quite similar to the sector PSC apportionment percentages. LLPs associated with CPs account for 40% of the quota share, and LLPs on CVs account for 60%. Membership rosters in RP cooperatives can be fluid from year to year; Table 4-64 lists the amount of Chinook salmon PSC that would be available to each co-op – as they existed in 2011 – under Suboption 1.

The co-ops within each sector performed similarly to one another in regards to Chinook salmon PSC, and the co-ops that would receive small PSC allowances based on 2011 membership (for example, CV 1 and CV 5) did not experience more simulated closures than did the others. The CP co-ops each recorded one year (2007) that would have closed out their season under any apportioned RP CP hard cap level. Each of the CV co-ops would have been closed under the apportioned 1,500 Chinook hard cap in 2008. If, instead, each LLP's average annual Chinook PSC (from 2007 to 2012) is credited to its cooperative, the data show that CP and CV co-ops would only have experienced closures under an apportioned 1,500 PSC limit. CP PSC was high enough in 2007 to bring both of the co-ops' average annual PSC usage over their individual share of the 1,500 cap in three of six years. Each of the CV co-ops' average annual PSC usage would have exceeded their share of the 1,500 cap in one year. These results should be considered in view of the notion that cooperatives may have additional tools available to manage a small PSC limit. These tools may include enhanced communication and/or catch sharing plans that could reduce the incentive to race for target harvest at the cost of actively avoiding Chinook salmon. Nevertheless, the Council may wish to consider how small an allocation of Chinook salmon PSC is too small to manage, noting that some of these co-op level hard caps are small enough to be encountered in one haul.

Table 4-64 PSC available to each Rockfish Program Co-op (2011 rosters) under Option 4, Suboption 1

Catcher-Processors					PSC Allowance (by RP Limit)		
Co-op	**# LLPs**	**# Vessels**	**%CP_QS**	**%TotalQS**	**1,500**	**2,500**	**3,500**
CP 1	3	3	47%	19%	267	446	624
CP 2	8	7	53%	21%	296	493	690
TOTAL	11	10	100%	40%	563	939	1,314

Catcher Vessels					PSC Allowance (by RP Limit)		
Co-op	**# LLPs**	**# Vessels**	**%CV_QS**	**%TotalQS**	**1,500**	**2,500**	**3,500**
CV 1	3	3	2%	1%	20	34	47
CV 2	6	6	13%	8%	122	203	285
CV 3	10	9	16%	9%	147	245	343
CV 4	9	8	25%	15%	234	390	546
CV 5	2	2	4%	3%	41	68	96
CV 6	11	10	28%	17%	264	440	616
CV 7	5	5	12%	7%	108	180	253
TOTAL	46	43	100%	60%	937	1,561	2,186

Impacts on the Non-Rockfish Program Fishery

Because Option 4 directly apportions some amount of the total GOA Chinook salmon PSC limit to the Rockfish Program, it is necessary to consider how the rest of the GOA trawl fishery might fare under a reduced PSC limit. While the amount of the total hard cap apportioned to the non-RP fishery would be lower, Chinook salmon caught on RP trips would not be debited against the non-RP fishery's PSC allowance. This could be a benefit to the non-RP fishery in years when the RP fleet encounters a large amount of Chinook salmon, though that has only been the case in a few years.

Table 4-56 indicates that the non-RP fishery recorded an annual average of 4,874 Chinook salmon PSC from 2008 to 2012 (the most recent five years of data available). This amount of Chinook salmon would have closed the fishery under a total GOA PSC limit of 5,000 with any of the considered carve-outs for the Rockfish Program; it also would have closed the fishery under a total PSC limit of 7,500 with a 3,500 Chinook salmon carve-out for the Rockfish Program.

Table 4-65 Simulated closures for the GOA non-Rockfish Program fishery (2007 to 2011), under Option 4

Total GOA PSC Limit	1,500 RP Carve-Out			2,500 RP Carve-Out			3,500 RP Carve-Out		
	Non-RP PSC Limit	# Years Closed	Earliest Closure	Non-RP PSC Limit	# Years Closed	Earliest Closure	Non-RP PSC Limit	# Years Closed	Earliest Closure
12,500	11,000	-	-	10,000	-	-	9,000	-	-
10,000	8,500	1	December	7,500	1	Late Oct	6,500	1	Early Oct
7,500	6,000	2	Mid Sept	5,000	2	Late April	4,000	3	Late April
5,000	3,500	3	Mid April	2,500	5	Early April	1,500	5	Early April

Table 4-65 describes the Chinook salmon PSC available to the non-RP fishery under the considered levels of Rockfish Program carve-outs. The table also lists the number of years, from 2007 to 2011, in which the non-RP fishery would have closed under these limits. Earlier years are not considered as this option relates specifically to a program that was established in 2007. As such, an outcome that resulted in five years with a closure means that the non-RP fishery was directly impacted in every analyzed year. This

occurs twice in the table – when either a 2,500 or a 3,500 RP carve-out is applied to a GOA fishery with a total Chinook salmon PSC limit of 5,000. The earliest simulated closures occurred around the same time, but it bears mention that the latest of the five closures occurred much earlier under a 3,500 RP carve-out (mid-May as opposed to mid-October). This should indicate that the larger RP carve-out *is more probable* to impact the non-RP fishery in a manner that is significant.

The following maximum potential harvest impacts are derived by applying the closure dates listed in Table 4-65 to a characteristic year constructed to typify the 2007 to 2011 period, in which total non-RP groundfish harvest was 55,600 mt. A non-RP fishery closure triggered in early April would result in roughly 42,000 mt of forgone groundfish harvest; a late April closure would result in roughly 34,000 mt of forgone harvest; a mid-September closure would preclude roughly 11,000 mt of harvest; an early October closure would preclude roughly 7,500 mt of harvest; and a late October closure would preclude roughly 2,300 mt of harvest.

The non-RP fishery recorded 5,070 Chinook salmon PSC in the 2007 to 2011 characteristic year. The amount of Chinook salmon PSC that occurred in the weeks following the closures in Table 4-65 (avoided PSC) ranges from 4,500 for an early April closure to 500 for a late October closure.

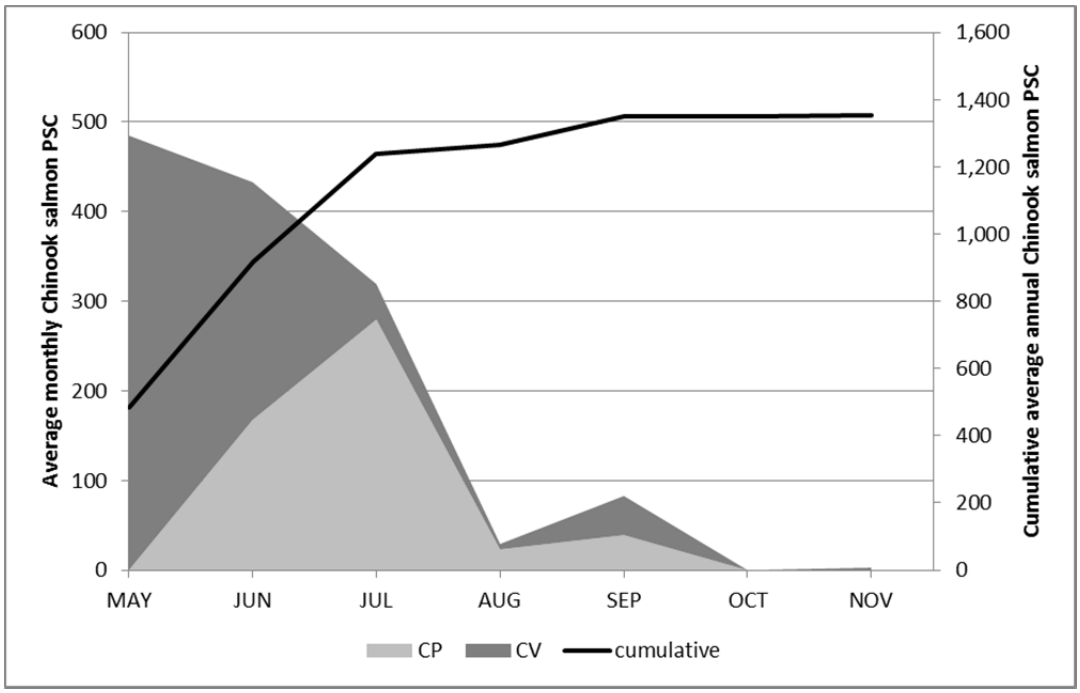
The GOA non-RP fleet does target rockfish, as well as the both Pacific cod seasons and flatfish targets throughout the year. Noting this, general revenue impacts are estimated using the aggregated 2011 wholesale value per metric ton ($1,400). The revenue impact of the forgone harvest levels described above ranges from $3.2 million to $60 million.

Suboption 2 – Roll over a portion of unused Rockfish Program Chinook salmon PSC to support fall non-pollock trawl fisheries

The Council may also choose a suboption (Suboption 2) which stipulates that if the RP fishery has not used its full allocation of Chinook salmon PSC as of October 1, some portion of the remainder will be rolled back into the general GOA Chinook PSC pool. This analysis considers “rolling over” all but 200, 300 or 400 of the remaining PSC on October 1 to support other fall non-pollock trawl fisheries. The amount that is not rolled over (200, 300 or 400) could be used to support RP trips that occur later in the year.

PSC recorded on RP trips from May to September averaged 1,354 Chinook salmon per year – 510 in the CP sector and 839 in the CV sector. PSC usage in the Rockfish Program after October 1 has been very low, averaging 3 Chinook salmon per year on an average post-October harvest of 311 mt of groundfish per year (Figure 4-24, see also Table 4-39); nearly all post-September activity occurred in the CV sector. If this trend is indicative of the future, the unused Chinook PSC (up to 400) that is not rolled over into the non-Rockfish Program fisheries would effectively function as a PSC retirement.

Figure 4-24 Average monthly Rockfish Program Chinook salmon PSC, 2007 to 2012



The amount of Chinook PSC that would be rolled over into the non-RP fisheries can be estimated by taking the total RP PSC limit (1,500 to 3,500) and subtracting the amount of Chinook PSC that is unused (in the characteristic year) on October 1. This results in an excess of RP PSC of 151 fish under a 1,500 hard cap, 1,151 fish under a 2,500 hard cap, and 2,151 fish under a 3,500 hard cap. The actual amount of unused RP PSC is variable from year to year. There obviously would have been less unused PSC to rollover in the high PSC years of 2007 and 2008, and more from 2009 to 2012. Keeping with the characteristic year as a measure of central tendency, the analysts propose Table 4-66 as a straw-man estimate of how much additional Chinook PSC could be used to support the GOA non-RP non-pollock trawl fisheries.

Table 4-66 Estimated PSC to be rolled back into the non-Rockfish Program fisheries after October 1, under Option 4, Suboption 2

Total PSC Limit	All but…	Rollover
1,500	200	-
	300	-
	400	-
2,500	200	951
	300	851
	400	751
3,500	200	1951
	300	1851
	400	1751

The estimated 151 fish remaining under a 1,500 RP cap would not provide any rollover PSC, after netting out the 200 to 400 fish, as stipulated in the Council's motion. The estimated 751 to 951 fish rolled over under a 2,500 RP cap would be enough to cover the total non-RP Chinook PSC that occurred in October

to December of the characteristic year. This amount of fall fishery-supporting PSC would have covered the actual October to December PSC usage in all years except for 2009, 2010 and 2011. The non-RP fishery encountered a large amount of October PSC while targeting shallow water flatfish in 2009, arrowtooth flounder in 2010, and Pacific cod in 2011. The estimated 1,751 to 1,951 fish rolled over under a 3,500 RP cap would also have covered the late year non-RP PSC in the characteristic year. Actual PSC records indicate that the late-year fishery would still have closed with a rollover in 2009 and 2010, due to PSC in the target fisheries mentioned above.

If the non-RP fishery reaches its annual limit prior to October 1, one might consider whether individuals waiting for a rollover from the Rockfish Program will incur substantial losses while delayed in the GOA, or create any general inefficiency by targeting non-pollock groundfish (especially the Pacific cod B season, for the Central GOA CV fleet) on October 1. In theory, it is possible that waiting to prosecute the Pacific cod B season until October 1 would cause an efficiency loss, because the pollock D season also opens on that date and is generally more valuable; participants would likely opt to target pollock when the season opens. However, history shows that in some years Pacific cod participants are already standing down in September due to halibut constraints, so the action under consideration would not be causing a new trade-off in the fishery by forcing vessels to choose to fish for pollock or cod on October 1.

4.7.1.3.4 Options 3 & 4 – Rockfish Program Carve-out with a Seasonal PSC limit for Non-Rockfish Program Trips

As noted above, any recommendation by the Council that involves Option 4 reduces the size of the Chinook salmon PSC limit for the non-Rockfish Program fishery. Selecting Options 3 and 4 together would result in a reduced amount of Chinook salmon PSC available to support non-RP fishing prior to June 1.

The seasonal split created by Option 3 would not apply to the Rockfish Program, meaning that Rockfish Program harvest occurring in May would be unaffected. From 2007 to 2011, May RP activity (all in the CV sector) accounted for 9.5% of total GOA pre-June 1 harvest (2,800 mt per year) and 14% of GOA pre-June 1 Chinook salmon PSC (525 fish per year). May RP harvest consisted primarily of trips targeting rockfish, according to NMFS CAS, but trips targeting Pacific cod and Sablefish also occurred; all of the RP's Chinook salmon PSC recorded during this part of the year occurred on trips targeting rockfish.

Table 4-67 Seasonal PSC sub-limits and simulated closure results for the GOA non-Rockfish Program fishery (2007 to 2011), under Options 3 & 4

		1,500 RP Carve-Out			2,500 RP Carve-Out			3,500 RP Carve-Out		
Total GOA PSC Limit	Seasonal Split	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure
12,500	50/50	5,500	-	-	5,000	1	Late April	4,500	2	Late April
	66/34	7,260	-	-	6,600	-	-	5,940	-	-
10,000	50/50	4,250	2	Late April	3,750	2	Late April	3,250	2	Mid April
	66/34	5,610	-	-	4,950	1	Late April	4,290	2	Late April
7,500	50/50	3,000	2	Mid April	2,500	3	Early April	2,000	3	Early April
	66/34	3,960	2	Late April	3,300	2	Mid April	2,640	3	Early April
5,000	50/50	1,750	3	Early April	1,250	5	Early April	750	5	Mid March
	66/34	2,310	3	Early April	1,650	4	Early April	990	5	Mid March

The seasonal PSC limits in Table 4-67 are simply downward adjustments of the seasonal limits for the entire GOA fishery under Option 3 (Table 4-62). The non-RP fishery recorded 3,266 Chinook salmon PSC prior to June 1, in the characteristic year constructed to typify 2007 to 2011. This figure is similar to the most recent five years of data, during which the non-RP fishery took 3,205 Chinook over those

months (Table 4-57). Comparing those totals to the seasonal PSC limits in Table 4-67, the analysts suggest that an April fishery closure is a probable outcome under total GOA PSC limits of 7,500 or less and with some sort of PSC carve-out for the Rockfish Program.

The results listed in Table 4-62, for Option 3, include some earlier closure dates, such as mid-February or early March. Those simulated closures typically occurred in the years from 2003 to 2006, when early year PSC was particularly high (especially in 2003). Because selecting Options 3 and 4 together deals specifically with the Rockfish Program, these results deal only with the years since 2007. It would be invalid to compare the apportioned PSC limits for Options 3 & 4 to the pre-RP years where PSC from RP trips is not removed.

Similar to the analysis of Option 4 (above), an outcome noting five closure years should be interpreted as the non-RP fishery closing in every analyzed year. The earliest simulated closures for these particular outcomes occurred in mid-March or early April; the latest observed closures occurred in early May. So, for these outcomes, the analysis suggests a high likelihood of losing some of the May non-RP fishery, at a minimum.

The non-RP fishery harvested an average of 26,500 mt of groundfish between January and May of 2007 to 2011. Based on 2007 to 2011 non-RP fishery data, a seasonal mid-March closure would preclude around 14,000 mt of groundfish harvest and 2,900 Chinook salmon PSC. An early April closure would preclude around 13,000 mt of groundfish harvest and 2,700 PSC. A mid-April closure would preclude around 7,500 mt of groundfish harvest and 1,650 PSC. A late April closure would preclude around 4,500 mt of groundfish harvest and 1,000 PSC. An early May closure would preclude around 1,800 mt of groundfish harvest and 200 PSC.

Prior to June, the GOA non-RP fleet primarily targets Pacific cod, arrowtooth flounder and rex sole. During the years considered, and in the months prior to June, non-RP harvest generated an average wholesale value of $1,136 per metric ton on Pacific cod and flatfish. Based on the forgone harvest estimates listed above, the approximate revenue effect of the estimated maximum impacts would range between $2 million and $16 million per year.

4.7.1.4 Options that apportion the Gulf-wide Chinook salmon PSC limit by area or by harvest sector

If the Council selects Alternative 2, eight of the 12 analyzed end-points (selected options, or combination of options) would result in a Chinook salmon PSC limit that is apportioned to the different regulatory areas or operational type sectors that are affected by this action. In making its recommendation, the Council would need to specify the time period and metric upon which to base PSC limit apportionment. This analysis considers four potential bases for apportionment, combining either historical Chinook salmon PSC usage or historical non-pollock groundfish harvest with either a 5-year or a 10-year time period. The 5-year time period analyzed in this report includes the years 2007 to 2011, and the 10-year time period includes the years 2002 to 2011.

The Council may select options that apportion the total GOA hard cap in conjunction with one another, or in conjunction with options that would superimpose a seasonal PSC limit or make a direct PSC apportionment to the Central GOA Rockfish Program fishery. These end-points are listed in Table 4-59.

The following subsections adhere to the letter of the Council's December 2012 motion, wherein apportionment of the total annual GOA PSC limit is, in all cases, done according to the metrics listed above. The Council may wish to consider whether or not it is appropriate to use a 10-year historical period to apportion Chinook PSC in cases where there is a carve-out for the Rockfish Program. End-

points that include Option 4 require that a new set of apportionment percentages is calculated for the non-Rockfish Program fisheries (Table 4-60). The non-RP fishery in the Western GOA may not have changed substantially during the 2002 to 2011 basis period, but in the Central GOA all trips that were taken under the Program are removed from the historical baseline for apportionment. As a result, under a 10-year basis the Central GOA non-RP fisheries are receiving the history from vessels prosecuting the Central GOA directed rockfish fishery from 2002 to 2006, but not from 2007 to 2011. Also, in the case of rolling over unused Chinook PSC from the Rockfish Program to the fall non-Rockfish Program fisheries (on October 1), the Council may wish to consider whether it is appropriate to apportion the rollover amount according to the same metrics used to apportion the annual limit. Doing so may apportion some rollover PSC to fisheries which have little or no activity after September. This case arises in suites of options (end-points) that include both Options 2 and 4.

4.7.1.4.1 Option 1 – PSC limit apportioned between the Central GOA and Western GOA

Option 1 would establish an apportioned Chinook salmon PSC limit that applies separately to the fishing activity in either affected regulatory area. In evaluating the impact of such a cap structure on participants, one should consider that more than half of the LLPs in the fishery are endorsed for both areas (see Section 4.7.1.1). If, for whatever reason, an area-specific hard cap closes the non-pollock fishery in one area, individuals with dual-endorsements would have a greater opportunity to continue trawling in the GOA. This and other aspects of behavioral responses to an apportioned PSC hard cap are further discussed in Section 4.7.3. This portion of the analysis focuses on the probable timing and direct harvest and PSC impact of an area-based apportionment scheme, as well as how the proposed basis metrics would differently divide the allowable Chinook PSC between the areas.

The most recent five years of data available (2008 to 2012) indicate that the Central GOA fishery encounters 5,570 Chinook salmon per year, on average, and the Western GOA fishery encounters 539 (Table 4-56). Comparing those annualized PSC levels to the apportioned limits listed in Table 4-68 suggests that only a total GOA PSC limit of 5,000 would be expected to close down the fisheries with a high probability. However, Chinook salmon PSC is highly variable across years, and the table also indicates that the fisheries would have closed in a number of years since 2003 based on their actual yearly Chinook salmon encounter.

The relative percentage of allowable PSC apportioned to each area turns out to be similar if historical PSC usage and groundfish harvest are evaluated over a 10-year period. On a 5-year basis period, however, the Central GOA benefits substantially when using PSC history for apportionment (an 11% difference).

Table 4-68 Simulated closures for the GOA non-pollock fishery (2003 to 2011), under Option 1

	Total GOA PSC Limit	Chinook PSC History						Non-Pollock Groundfish History					
		5 Year			10 Year			5 Year			10 Year		
		Area PSC Limit	# Years Closed	Earliest Closure	Area PSC Limit	# Years Closed	Earliest Closure	Area PSC Limit	# Years Closed	Earliest Closure	Area PSC Limit	# Years Closed	Earliest Closure
Central GOA	12,500	11,503	-	-	10,291	-	-	10,393	-	-	10,237	-	-
	10,000	9,202	-	-	8,232	2	Mid Sept	8,315	2	Mid Sept	8,190	2	Early Sept
	7,500	6,902	2	Mid May	6,174	3	Mid May	6,236	3	Early May	6,142	3	Early May
	5,000	4,601	6	Late April	4,116	6	Late April	4,157	6	Mid April	4,095	6	Mid April
Western GOA	12,500	997	4	Early April	2,210	-	-	2,107	1	Mid Sept	2,263	-	-
	10,000	797	4	Early April	1,768	2	Mid May	1,685	2	Late April	1,810	2	Mid May
	7,500	598	4	Late March	1,326	3	Early April	1,264	4	Late March	1,358	3	Late March
	5,000	399	5	Late March	884	4	Early April	843	4	Late March	905	4	Late March

The Central GOA non-pollock fishery harvested around 51,000 mt of groundfish per year, from 2003 to 2011, and took around 5,000 Chinook salmon. Rockfish trips accounted for around 30% of harvest,

arrowtooth flounder and rex sole combined to account for roughly 35% of total area harvest, while Pacific cod accounted for around 20% (60% of which occurred during the A season). PSC closures that occur before May would preclude the entire area rockfish fishery. The impact of a closure that occurs in later in May would fall more heavily on the CP sector, as CPs do not typically begin targeting rockfish until July. In regards to fall closures, there is a large difference in the impact of a closure that occurs in mid-to-late September and one that precludes the entire Pacific cod B season. The B season has historically accounted for 40% of Central GOA Pacific cod harvest, and 8% of total area non-pollock harvest; it has generated on the order of $6 million per year in wholesale revenue. Late season harvest occurs primarily on trips targeting arrowtooth flounder and shallow water flatfish; shallow water flatfish trips, primarily taken by CVs, contribute the greatest amount of Chinook salmon PSC of any fall fishery.

A mid-to-late April closure in the Central GOA would preclude around 35,000 to 37,000 mt of harvest, and prevent between 3,000 and 3,500 Chinook salmon PSC, based on fishing outcomes in the characteristic year. A closure in early-to-mid May would cause the fishery to forgo roughly 30,000 to 32,000 mt of harvest, depending on how much of the CV rockfish fishery had occurred; a closure in this time range would prevent the catch of around 2,200 to 2,400 Chinook salmon. An early September closure would cause a harvest loss of around 12,000 mt, but a mid-September closure would have an impact closer to 7,000 mt; the large difference in harvest impacts is mainly attributable to the productive early weeks of the Pacific cod B season. The Pacific cod B season has averaged around 350 Chinook salmon per year, over the analyzed time period. A closure at the start of the fall cod season would prevent around 1,100 Chinook salmon PSC, while a closure that is triggered part-way through the fishery would prevent around 900. The average annual wholesale revenue generated in the Central GOA non-pollock fishery is roughly $58 million. In 2011, the average value generated per metric ton of harvest was roughly $1,350, across all key targets. Based on the forgone harvest estimated above, the range of revenue impacts on the Central GOA fishery is between $10 million and $50 million.

Almost 80% of the average annual Western GOA harvest consists of A season Pacific cod (primarily a CV fishery) and rockfish trips from June to August (primarily a CP fishery). The dates of the earliest simulated closures, above, fall after the early Pacific cod season is typically completed. In effect, the PSC taken by the CV fleet could trigger closures that would more heavily impact the Western GOA CP fleet. Estimated impacts based on the 2003 to 2011 characteristic year, below, may actually understate the effect of future closures, as the gross amount of Western GOA rockfish harvest has increased since 2007.

Average annual Western GOA non-pollock harvest was approximately 11,000 mt over the analyzed period, while average annual PSC was around 950 Chinook salmon. A closure occurring in late March or early April would result in forgoing roughly 7,500 mt of harvest, and would preclude the catch of 500 to 600 Chinook. A closure in mid-to-late April would result in a harvest loss of around 7,000 mt and avoid the catch of around 425 Chinook. The harvest impact of a mid-May closure is around 6,500 mt and the PSC impact is around 180 avoided Chinook. A fall closure in mid-September would preclude only about 250 mt of harvest – mainly of rockfish, arrowtooth flounder and flathead sole – and would prevent the catch of around 25 Chinook salmon. Because the most likely Western GOA closures would primarily impact trips targeting rockfish and flatfish, general revenue impacts are estimated using an aggregate wholesale value per metric ton that is specific to Western GOA records and excludes Pacific cod trips ($1,170/mt). Based on this, early spring closures have an estimated maximum revenue impact of between $8 million and $9 million dollars, while a late spring closure would have an impact of around $7.5 million.

4.7.1.4.2 Options 1 & 4 – PSC limit apportioned by regulatory area, with a carve-out for the Central GOA Rockfish Program

This section addresses the potential impacts of the area-based Chinook salmon PSC limits as they would be implemented alongside a PSC carve-out for the Central GOA Rockfish Program. The impacts analyzed here relate to the non-Rockfish Program non-pollock fishery; impacts within the Rockfish Program are discussed in Section 4.7.1.3.3.

The relative apportionment percentages to the non-RP fisheries are listed in Table 4-60. Removing the historical PSC usage or groundfish harvest that occurred in the Central GOA RP fishery from the historical apportionment baseline would increase the Western GOA's share of the non-RP PSC cap by 2% to 4%, depending on the selected baseline metrics and time frame. Under a 10-year historical basis period, the choice between PSC history and groundfish harvest history does not affect the relative apportionment of the non-RP PSC cap between the two areas. Under a 5-year basis period, the Central GOA non-RP fishery would be able to take 11% more Chinook salmon PSC if apportionment is based on historical PSC usage, as opposed to historical groundfish harvest. The converse is true for the Western GOA non-RP fishery.

Table 4-69 summarizes 96 different area-specific outcomes, covering a range of permutations on the considered sizes of the RP carve-out and the considered historical baselines for apportionment of the non-RP PSC limit. For the Central GOA, the non-RP PSC limits at the top end of the ranges arise from apportioning based on a 5-year PSC history. The top end of the Western GOA non-RP PSC limits are the result of apportioning based on a 5-year groundfish harvest history.

Table 4-56 reported the most up-to-date five year average non-RP PSC usage (2008 to 2012); the Central GOA non-RP fishery recorded an average of 4,335 Chinook salmon per year, and the Western GOA non-RP fishery took an average of 539 Chinook per year. If this best-available average were any indication of future PSC levels, a non-RP fishery closure would be unlikely for the total PSC cap levels greater than 7,500.

Table 4-69 Simulated closures for the GOA non-Rockfish Program fishery (2007 to 2011), under Options 1 & 4

	Central GOA			Western GOA		
Total GOA PSC Limit	PSC Limit	# Years Closed	Earliest Closure	PSC Limit	# Years Closed	Earliest Closure
12,500	9,888 - 7,148	0 - 1	Dec	2,264 - 909	0 - 1	Early July
10,000	7,641 - 5,162	0 - 2	Late Sept.	1,749 - 657	0 - 1	Late April
7,500	5,394 - 3,177	2 - 3	Mid April	1,235 - 404	1 - 2	Late April
5,000	3,146 - 1,191	3 - 5	Early April	720 - 152	1 - 4	Late Feb

The analysts applied the seasonal harvest and PSC distribution from the non-RP fisheries' characteristic year – based on 2007 to 2011 records – to the earliest simulated closures that would have occurred if such limits had been in place. In a year that typifies the period since the Rockfish Program was implemented, non-RP trips in the Central GOA harvest around 44,000 mt of groundfish and take 4,550 Chinook salmon; trips in the Western GOA amount to around 11,500 mt and 500 Chinook salmon (note that these Western GOA characteristic year numbers differ from those used to analyze Option 1 without a RP carve-out because the analysts are considering only 2007 to 2011, when Western GOA PSC tended to be lower than in earlier years).

With a total GOA PSC limit of 5,000 Chinook salmon, the Central GOA non-RP fishery would have experienced a closure in every analyzed year, under all but one permutation of the RP carve-out and apportionment scheme scenarios. These high probability closures would occur between early April and mid-May if 3,500 Chinook salmon are allocated to the RP, and between mid-April and early October if the RP carve-out is 1,500 or 2,500 Chinook. Forgone harvest in the Central GOA non-RP fishery would be on the order of 34,000 mt for an early-April closure, and 23,000 mt for a mid-May closure. Using the 2011 average wholesale value per metric ton, these closures would have a wholesale revenue impact of between $31 million and $64 million. Avoided Chinook PSC would be around 4,100 and 1,700 for the same closures, respectively. The large difference between the estimated salmon savings for these closures lies mainly in the April Central GOA fishery for arrowtooth flounder and rex sole.

When a total GOA PSC limit of 10,000 triggered a closure in the Central GOA non-RP fishery, it tended to occur in late September, or after. A late September closure would preclude the harvest of around 8,000 mt of groundfish, and prevent the taking of around 1,200 Chinook salmon.

Option 4 includes a suboption that would roll over unused RP PSC to support the non-RP fisheries that occur in the fall, and predominantly take place in the Central GOA. From 2007 to 2011, the Central GOA non-RP fishery harvested an average of 7,400 mt and recorded an average of 1,160 Chinook salmon after October 1.[51] The estimated rollover amount resulting from the Rockfish Program characteristic year (listed in Table 4-66) would likely be enough to support the late-year arrowtooth, rex sole and shallow water flatfish fishery through October if the size of the RP carve-out is large (2,500 or 3,500)[52]; however, these larger RP carve-out options are more likely to have closed the Central GOA non-RP fishery before September, meaning that the fall season for Pacific cod may be pushed back to October 1, and the demand for Chinook salmon PSC in the post-rollover time period would be higher upon re-opening than what was during that period in the analyzed years. In broad terms, as smaller RP carve-out would decrease the probability of having the Central GOA fishery closed when the Pacific cod B season normally occurs, but a larger RP carve-out (with the rollover option) would likely ensure at least some fall re-opener. The Council may wish to consider whether there is any ancillary benefit to "over-funding" the Rockfish Program with PSC if the likely result is a fall non-RP fishery that is delayed until October 1. The preceding scenario is, of course, dependent on the RP fishery reaching October with an excess of Chinook PSC, as opposed to fishing in a manner that fully utilizes its carve-out apportionment.

The Western GOA was observed to close as early as late February when the RP carve-out was set high (3,500). A closure this early would preclude around 9,000 or 10,000 mt of groundfish harvest (a portion of the Pacific cod A season and the entirety of the Western GOA limited access rockfish fishery); recall that average annual Western GOA harvest totaled around 11,500 mt per year, which would have generated $20.3 million based on 2011 average wholesale value per metric ton. Late April closures would likely be triggered by trips targeting arrowtooth flounder, and would primarily impact trips targeting rockfish. A closure around this time period would prevent the catch of around 450 Chinook salmon. The earliest closures for the lower carve-out levels tended to occur in mid-to-late April, at which time the projected harvest loss would be around 7,500 or 8,000 mt. Such a closure would cost the fishery around $16 million in wholesale revenues. Western GOA non-RP closures could still occur alongside smaller carve-outs for the RP. These closures fell in early July, and were observed when apportionment of the total GOA PSC cap was based on a 5-year PSC history – the least favorable for the Western GOA. An early July closure impacts the limited access rockfish fishery, and would carry a harvest impact of

[51] By comparison, the fall fishery in the Western GOA is very small. From 2007 to 2011, the Western GOA averaged 270 mt of groundfish harvest and 25 Chinook salmon from October to December.
[52] The analysts interpret the Council's December 2012 motion to infer that any PSC rolled over from the Rockfish Program after October 1 would have to be apportioned between the Central and Western GOA fisheries by the same percentages listed in Table 4-60, meaning that the Western GOA would still receive between 10% and 21% of the rollover amount, even though PSC demand in the area is very low after September.

between 4,500 mt and 7,500 mt, depending on how many weeks of this high-intensity, short-duration fishery were completed. Western GOA rockfish trips generated an average of $2,060/mt in 2011, which would compute to a revenue loss in the range of $9 million to $15 million.

4.7.1.4.3 Option 2 – PSC limit apportioned between the CP and CV sectors

Option 2 would apportion the total GOA Chinook salmon PSC limit between the catcher/processor and the catcher vessel harvest sectors. Chinook salmon PSC taken in either the Western or the Central GOA would accrue to the sector's hard cap in the same manner. The apportionment percentages listed in Table 4-60 indicate that choosing to divide the total GOA limit according to historical PSC usage has a very different impact than apportioning based on historical groundfish harvest. By PSC usage, the CP and CV sectors would receive comparable amounts of the total Chinook salmon limit, but the CV sector would receive around 65% of the hard cap if the basis is historical target catch. Regardless of the metric used for apportionment, the CP sector would receive a larger share of the total PSC limit if 10 years of history are considered, while the CV sector would receive a larger share under a time period restricted to five years.

This report has highlighted some of the fundamental differences between the sectors, including which target fisheries they prosecute, when and where they fish, as well as their rates of observer coverage and sampling protocols (Sections 5.1.1 and 5.1.2). Apportioning separate PSC limits to the two trawl harvest sectors may reduce some perverse incentives to "race for bycatch" – fishing intensively for groundfish with less regard to avoiding PSC. Such a race could arise if one sector feels exposed to large, fast-occurring spikes in credited PSC that may occur in a fleet that is engaged in a totally unrelated fishery. It is possible that either harvest sector could perceive the other as a PSC risk, as CPs have historically recorded higher PSC rates, and CVs operate with a substantially lower rate of observer coverage. Any shared cap creates a dynamic where rewards accrue to the individual, but penalties accrue to the collective. The risk-averse reaction to the threat of being closed down by another sector would be to prioritize target harvest while the fishery is still open. Moreover, existing sector-based harvest cooperatives – such as the Amendment 80 co-op structure that covers most of the CP fleet, or the CP and CV co-ops in the Rockfish Program – may be an effective management level at which to promote individual vessel accountability.

One issue that a sector-based Chinook salmon PSC would not address is the competitive dynamic created by seasonal halibut PSC limits, which are shared between the CP and CV sectors. It would be difficult for a particular harvest sector to follow a Chinook PSC management plan that called on vessels to wait until the later end of a halibut PSC season to target, for example, arrowtooth flounder and rex sole. If the other sector is using up the allowable seasonal halibut mortality, the deep-water complex may already be nearing a closure by the time the Chinook-avoiding sector opens participation.

The most recent five years of data available (2008 to 2012) indicate that the CP fleet encounters 2,888 Chinook salmon per year, on average, and the CV fleet encounters 3,221 (Table 4-56). As with the other options, PSC at the level of the period average would only cause a fishery closure under the smaller of the of the considered total GOA PSC limits (7,500 and 5,000 Chinook salmon). The analysis assesses impacts under volatile annual PSC scenarios by applying the simulated closures from 2003 to 2011 to the harvest and PSC patterns of a characteristic year. Over this set of years, the CP sector averaged roughly 22,000 mt of groundfish harvest and 3,164 Chinook salmon; the CV sector averaged roughly 40,000 mt of harvest and 2,845 Chinook salmon.

Table 4-70 Simulated closures for the GOA non-pollock fishery (2003 to 2011), under Option 2

	Total GOA PSC Limit	Chinook PSC History						Non-Pollock Groundfish History					
		5 Year			10 Year			5 Year			10 Year		
		Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure
CP	12,500	6,039	1	Early Oct	6,397	-	-	4,240	2	Early May	4,471	2	Early May
	10,000	4,831	1	Mid May	5,118	1	Mid May	3,392	2	Late April	3,577	2	Early May
	7,500	3,623	2	Mid May	3,838	2	Mid May	2,544	6	Late April	2,683	5	Late April
	5,000	2,416	6	Late April	2,559	6	Late April	1,696	8	Late March	1,789	8	Late March
CV	12,500	6,460	-	-	6,104	-	-	8,260	-	-	8,029	-	-
	10,000	5,168	-	-	4,883	1	Early Nov	6,608	-	-	6,423	-	-
	7,500	3,876	3	Mid July	3,662	3	Early July	4,956	1	Early Nov	4,817	1	Late Oct
	5,000	2,584	4	Early March	2,442	5	Late Feb	3,304	3	Early July	3,211	3	Late April

The lowest total GOA PSC limit was observed to close the CP sector between late March and late April, with a fairly high probability. CP closures in this time range would be driven by PSC taken in the arrowtooth flounder and rex sole fishery, and would result in between 18,000 mt and 21,000 mt of foregone harvest (out of 22,000 total). Avoided PSC would likely fall between 1,500 and 2,500 Chinook salmon. Higher total GOA PSC limits would have closed the CP sector with less frequency (though earlier and more often when apportioned based on historical groundfish harvest). The general maximum potential impact would be a closure in early or mid-May, which would preclude the entire CP rockfish fishery that accounts for over 50% of average annual CP harvest. The estimated forgone harvest from a May closure is around 17,000 or 18,000 mt, which would have generated around $28 million in wholesale revenue based on 2011 values for CP-caught rockfish and flatfish ($1,592/mt). A closure in early or mid-May would have prevented between 900 and 1,100 Chinook salmon PSC.

In the most recent years analyzed, the PSC rates of CPs operating in the Western GOA were lower than those of CPs in the Central GOA. For CP vessels with trawl endorsements in both areas, a limit that jointly apportions PSC across both areas could induce a race to harvest Central GOA groundfish ahead of a more probable closure. Another potential response could be the redirection of flatfish harvest into the Western GOA, thus preserving the later months of key Central GOA rockfish harvest. The real likelihood of an early season flatfish race in the Western GOA is likely constrained by harvester's ability to realign their delivery relationships with processors.

The CV sector would have experienced fewer years with Chinook PSC closures if a cap like Option 2 was in place during the analyzed period. Closures were rarely observed when comparing past CV PSC records to the sector's apportioned cap under a 10,000 or 12,500 GOA limit. However, due to the size and intensity of the early-year Pacific cod fishery, the earliest observed CV closures would have shut down the sector sooner and with a greater impact. A late February closure would have precluded around 34,000 mt of harvest (out of 40,000 mt), causing a revenue loss of around $44 million.

Other maximum potential impacts, based on the closure dates contained in Table 4-70, could cause the CV sector to forgo between 24,000 mt (late April) and 15,000 mt (mid-July) of groundfish harvest. The bulk of the groundfish value that is harvested during this interval comes from rockfish and, to a lesser extent, shallow water flatfish trips in the Central GOA. The roughly 15,000 mt of groundfish that occurs after the rockfish season tapers off consists mainly of Pacific cod, arrowtooth flounder and shallow water flatfish; in 2011, this forgone harvest would have generated around $16 million in wholesale value.

4.7.1.4.4 Options 2 & 3 – PSC limit apportioned between the CP and CV sectors, with a seasonal limit prior to June 1

Selecting Option 2 and Option 3 together would put a seasonal limit on the Chinook salmon PSC hard cap apportioned to each harvest sector. As described in Section 4.7.1.3.2 (Option 3), a sector that reaches its

seasonal PSC sub-limit before June would be closed from fishing non-pollock groundfish until June 1. Unused PSC from the pre-June period would roll into whatever portion of the sectors annual limit is reserved for the latter half of the year.

The CP sector is relatively less active in the early months of the year. CPs focus on arrowtooth flounder and rex sole during April, which tends to be a high Chinook PSC rate fishery. The CV sector, by contrast, is busy prosecuting the Pacific cod A season, April flatfish, and the beginning of the CV rockfish season in May. The Pacific cod A season generated just under 8,000 mt of groundfish per year, accounting for roughly 20% of the sector's annual average groundfish harvest.

From 2003 to 2011, the CP sector averaged 5,050 mt of groundfish harvest and 2,425 Chinook salmon PSC per year, prior to June. During the same months, the CV sector averaged 21,000 mt of harvest and 1,600 Chinook salmon PSC. Table 4-57 presents average annual January-to-May PSC, by sector, for a more recent sample of years; from 2008 to 2012, the CP sector averaged 2,057 Chinook and the CV sector averaged 1,702. During the most recent five years, April through May accounted for over 70% of the CP sector's average annual Chinook salmon PSC.

Table 4-71 Seasonal PSC sub-limits and simulated closure results for the GOA non-pollock fishery (2003 to 2011), under Options 2 & 3

Annual PSC Limit	Catcher/Processors						Catcher Vessels					
	50/50			66/34			50/50			66/34		
	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure
12,500	3,199 - 2,120	1 - 2	Early April	4,222 - 2,798	0 - 1	Late April	4,130 - 3,052	-	-	5,452 - 4,029	-	-
10,000	2,559 - 1,696	1 - 3	Early April	3,378 - 2,239	1 - 2	Mid April	3,304 - 2,442	0 - 1	Late April	4,361 - 3,223	-	-
7,500	1,919 - 1,272	3 - 4	Early April	2,533 - 1,679	1 - 3	Early April	2,478 - 1,831	1 - 3	Mid April	3,271 - 2,417	0 - 1	Late April
5,000	1,280 - 848	4	Early April	1,689 - 1,119	3 - 4	Early April	1,652 - 1,221	3	Mid April	2,181 - 1,612	2 - 3	Mid April

Based on the average pre-June PSC recorded from 2008 to 2012, the CP sector would appear to be exposed to spring closures under even the higher of the total annual GOA Chinook salmon hard caps, whereas the CV sector would expect a closure under only the lowest cap. Section 4.7.1.3.2 outlined the variability in early-year PSC, and the lack of correlation between high annual PSC and high PSC prior to June. In regards to assessing Options 2 and 3 together, the analysts note that pre-June PSC was more variable from year to year in the CP sector, displaying a greater variance around the period mean.

Maximum potential impacts on the CP sector were derived from applying early-to-late April closures to the sector's weekly harvest and Chinook salmon records in the characteristic year. A closure from early April to June 1 would have precluded the harvest of roughly 3,700 mt of groundfish (primarily arrowtooth flounder and rex sole), and prevented the catch of around 1,700 Chinook salmon. A closure from late April to June 1 would have precluded the harvest of roughly 1,800 mt of groundfish, and prevented the catch of around 800 Chinook salmon. In 2011, flatfish taken by the CP sector prior to June generated an average wholesale revenue value of $1,132 per metric ton. By this measure, the maximum potential revenue impacts would be on the order of $1.9 million to $4.1 million.

In scenarios where the CV sector experienced a spring closure, the highest PSC years triggered closures around mid-to-late April. A closure from mid-April to June 1 would have precluded the harvest of roughly 7,000 mt of groundfish (primarily flatfish and rockfish), and prevented the catch of around 900 Chinook salmon. A closure from late April to June 1 would have precluded the harvest of roughly 4,500 mt of groundfish, and prevented the catch of around 600 Chinook salmon. In 2011, flatfish and rockfish taken by the CV sector generated an average wholesale revenue value of $1,146 per metric ton. By this measure, the maximum potential revenue impacts would be on the order of $5 million to $8 million.

4.7.1.4.5 Options 2 & 4 – PSC limit apportioned by harvest sector, with a carve-out for the Central GOA Rockfish Program

This section addresses the potential impacts of the harvest sector-based Chinook salmon PSC limits as they would be implemented alongside a PSC carve-out for the Central GOA Rockfish Program. The impacts analyzed here relate to the non-Rockfish Program non-pollock fishery; impacts within the Rockfish Program are discussed in Section 4.7.1.3.3.

The relative apportionment percentages to the non-RP fisheries are listed in Table 4-60. Removing the historical PSC usage or groundfish harvest that occurred in the Central GOA RP fishery from the historical apportionment baseline would increase the CP sector's share of the non-RP PSC cap by up to 3%, depending on the selected baseline metrics and time frame. As with Option 2 in the absence of a RP carve-out, apportioning the total GOA hard cap according to historical PSC usage results in a somewhat even division of allowable Chinook salmon PSC, while apportioning on the basis of historical catch would lead to a tighter limit on the CP sector.

Table 4-56 reported the most up-to-date five year average non-RP PSC usage (2008 to 2012); the non-RP CP sector recorded an average of 2,568 Chinook salmon per year, and the CV sector averaged 2,307. By this measure, the non-RP CV sector would not expect to be closed down on its Chinook salmon encounter if the total GOA hard cap is set at 7,500 or above, but Table 4-72 indicates that PSC years large enough to close down the fishery under higher caps did occur during the analyzed years since 2007. Recent average annual PSC in the non-RP CP sector, on the other hand, could have triggered closures under total GOA PSC limits of up to 10,000 Chinook salmon. Simulated closures to the non-RP CP sector could have occurred under any size RP carve-out (1,500 to 3,500), though impactful closures under the smallest of the three carve-out options only occurred when apportioning PSC based on historical groundfish harvest.

Table 4-72 summarizes 96 different area-specific outcomes, covering a range of permutations on the considered sizes of the RP carve-out and the considered historical baselines for apportionment of the non-RP PSC limit. Apportionments to the CP sector tend to be the highest when a 10-year PSC history is considered, and the lowest under a 5-year history of groundfish harvest. The opposite is true for CVs.

Table 4-72 Simulated closures for the GOA non-Rockfish Program fishery (2007 to 2011), under Options 2 & 4

	Catcher/Processors			Catcher Vessels		
Total GOA PSC Limit	PSC Limit	# Years Closed	Earliest Closure	PSC Limit	# Years Closed	Earliest Closure
12,500	5,799 - 3,134	0 - 1	Late April	7,170 - 4,255	0	-
10,000	4,481 - 2,263	0 - 3	Mid April	5,540 - 3,073	0 - 2	Early Oct
7,500	3,163 - 1,393	1 - 5	Early April	3,911 - 1,891	1 - 3	Late April
5,000	1,845 - 522	4 - 5	Mid March	2281 - 709	2 - 5	Mid April

In the characteristic year the typifies the 2007 to 2011 time period, the non-RP CP sector averaged around 19,500 mt of groundfish harvest and 2,580 Chinook salmon PSC per year. The non-RP CV sector averaged around 36,000 mt of groundfish harvest and 2,490 PSC per year. The analysts applied the seasonal harvest and PSC distribution from the non-RP fisheries' characteristic year – based on 2007 to 2011 records – to the earliest simulated closures that would have occurred if such limits had been in place.

When Options 2 & 4 are selected, and the total GOA PSC limit is set at 5,000 Chinook salmon, the earliest non-RP CP sector closure was observed between mid-March and early April of every analyzed

year. Such a closure would result in the loss of around 18,000 mt of harvest, and 1,800 to 2,300 avoided Chinook salmon. Most of the forgone harvest would be in flatfish, but the non-RP CP sector still averages around 9,000 mt of groundfish taken on July trips designated as targeting rockfish. Under the same scenarios, but in low PSC years, closures occurred between mid-May and September. A mid-May closure would preclude around 14,500 mt of harvest, and a September closure would preclude around 2,500 mt.

With a total GOA cap of 7,500, the non-RP CP sector closed in anywhere between one and five of the five analyzed years. The apportionment scenarios that suggest a high probability of closing the sector tend to be those where the RP carve-out is the largest, though a carve-out of only 1,500 Chinook for the RP could still the non-RP CP sector as early as mid-April, causing a direct harvest impact of 17,500 mt.

Maximum potential harvest impacts on the non-RP CV sector fall in mid-to-late April under the small considered total GOA cap levels. A closure at that point in the season would preclude between 18,000 and 22,000 mt of groundfish harvest, and would completely preclude the B season for Pacific cod. A 10,000 total PSC limit could, in high PSC years, close the sector in October – even with the smallest RP carve-out selected. An October closure would cause a harvest loss of around 4,000 mt, and would catch the tail end of the Pacific cod B season as well as the fall arrowtooth and shallow water flatfish fisheries. The non-RP CV sector's October-to-December Chinook salmon PSC record was around 950 fish per year, on average.

Option 4 includes a suboption that would roll over unused RP PSC to support the non-RP fisheries that occur in the fall, and predominantly take place in the Central GOA. From 2007 to 2011, the non-RP CP sector harvested an average of 2,150 mt and recorded an average of 220 Chinook salmon after October 1. The non-RP CV sector harvested an average of 5,500 mt and, as mentioned above, recorded around 950 Chinook salmon in the post-September months. Table 4-73 lists the estimated amount of unused Chinook salmon PSC that would be rolled back into the fall non-RP fisheries, based on a characteristic year that typifies Rockfish Program fishing activity based on week-by-week records. Any rollover amount would have to be re-apportioned between the CP and CV sectors. The ranges presented in Table 4-73 represent the variance in each sector's potential rollover allowance, depending on how the Council chooses to base apportionment. As before, the CP receives the largest apportionment based on a 10-year history of PSC usage, while the CV sector receives the largest apportionment based on a 5-year history of groundfish harvest. The apportionment scheme that benefits either sector the most is also the one that generates the worst outcome for the other sector.

In the 2007 to 2011 characteristic year for the non-RP fisheries, the non-RP CV sector is targeting arrowtooth flounder and shallow water flatfish through the end of the calendar year, and is finishing the Pacific cod B season around the end of October. The non-RP CP sector targets primarily arrowtooth flounder and rex sole, with some flathead sole, in the post-September months.

Table 4-73 Estimated PSC to be rolled back into the non-Rockfish Program fisheries after October 1, under Option 2 & Option 4, Suboption 2

Total PSC Limit	All but…	Total Rollover	CP	CV
1,500	200	-	-	-
	300	-	-	-
	400	-	-	-
2,500	200	951	331 - 504	447 - 620
	300	851	296 - 451	400 - 555
	400	751	261 - 398	353 - 489
3,500	200	1,951	679 - 1,034	917 - 1,272
	300	1,851	644 - 981	870 - 1,206
	400	1,751	610 - 928	823 - 1,141

4.7.1.4.6 Options 2, 3 & 4 – PSC limit apportioned by harvest sector, with a seasonal limit prior to June 1 and a carve-out for the Central GOA Rockfish Program

Selecting Options 2, 3 and 4 would combine the apportioned seasonal limit and the Rockfish Program carve-out described in the previous sections. As before, a sector that reaches its seasonal PSC sub-limit before June would be closed from fishing non-pollock groundfish until June 1. Unused PSC from the pre-June period would roll into whatever portion of the sectors annual limit is reserved for the latter half of the year.

From 2007 to 2011, the non-RP CP sector averaged 5,150 mt of groundfish harvest prior to June 1 (primarily flatfish) and recorded roughly 2,025 Chinook salmon PSC; the average spring PSC total was slightly lower than the updated 2008 to 2012 average of 2,057 Chinook salmon listed in Table 4-57. During the same period, the non-RP CV sector harvested an average of 21,300 mt of groundfish (40% of which was Pacific cod, with the balance primarily in flatfish) and recorded roughly 1,250 PSC. The Pacific cod A season accounted for only about 13% of the non-RP CV sector's pre-June Chinook PSC. This CV PSC figure is slightly higher than the updated 2008 to 2012 average of 1,148, also listed in Table 4-57.

Table 4-74 summarizes 192 different seasonal apportionments that could be applied to the non-RP CP and CV sectors, depending on the size of the total GOA PSC limit, the size of the RP carve-out, the amount of the sector's annual apportioned hard cap that is available prior to June 1 (50% or 66%), and the selected apportionment basis metrics.

Table 4-74 Seasonal PSC sub-limits and simulated closure results for the non-Rockfish Program fishery (2007 to 2011), under Options 2, 3 & 4

			1,500 RP Carve-Out			2,500 RP Carve-Out			3,500 RP Carve-Out		
Total GOA PSC Limit	Sector	Seasonal Split	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure	Jan-May Limit	# Years Closed	Earliest Closure
12,500	CP	50/50	2,900 - 1,915	1 - 3	Early April	2,636 - 1,741	1 - 3	Early April	2,372 - 1,567	1 - 3	Early April
		66/34	3,828 - 2,528	0 - 1	Mid April	3,480 - 2,298	1 - 2	Mid April	3,132 - 2,068	1 - 3	Early April
	CV	50/50	3,585 - 2,600	-	-	3,259 - 2,364	0 - 1	Late April	2,933 - 2,127	0 - 1	Late April
		66/34	4,732 - 3,432	-	-	4,302 - 3,120	-	-	3,872 - 2,808	-	-
10,000	CP	50/50	2,241 - 1,480	2 - 3	Early April	1,977 - 1,306	3 - 4	Early April	1,713 - 1,132	3 - 4	Early April
		66/34	2,958 - 1,953	0 - 3	Early April	2,610 - 1,724	1 - 3	Early April	2,262 - 1,494	2 - 3	Early April
	CV	50/50	2,770 - 2,009	0 - 1	Late April	2,444 - 1,773	1 - 2	Mid April	2,118 - 1,537	1 - 2	Mid April
		66/34	3,657 - 2,652	-	-	3,226 - 2,340	0 - 1	Late April	2,796 - 2,028	0 - 1	Late April
7,500	CP	50/50	1,582 - 1,045	3 - 4	Early April	1,318 - 871	4	Early April	1,054 - 696	4 - 5	Late March
		66/34	2,088 - 1,379	3 - 4	Early April	1,740 - 1,149	3 - 4	Early April	1,392 - 919	4	Early April
	CV	50/50	1,955 - 1,418	1 - 2	Mid April	1,630 - 1,182	2	Mid April	1,304 - 946	2	Mid April
		66/34	2,581 - 1,872	0 - 2	Late April	2,151 - 1,560	1 - 2	Mid April	1,721 - 1,248	2	Mid April
5,000	CP	50/50	923 - 609	4 - 5	Mid March	659 - 435	5	Mid March	395 - 261	5	Early March
		66/34	1,218 - 804	4	Early April	870 - 575	4 - 5	Mid March	522 - 345	5	Early March
	CV	50/50	1,141 - 827	2 - 3	Mid April	815 - 591	3 - 4	Mid April	489 - 355	4	Late Feb
		66/34	1,506 - 1,092	2	Mid April	1,075 - 780	2 - 3	Mid April	645 - 468	4	Early April

Based on the average pre-June PSC recorded by the non-RP sectors from 2008 to 2012, the CP sector would appear to be exposed to spring closures under even the highest total annual GOA Chinook salmon hard caps, regardless of the size of the RP carve-out (1,500 to 3,500). By contrast, the CV sector's average spring PSC usage falls below the apportioned seasonal cap for all but a total annual GOA limit of 5,000 Chinook salmon. In short, a sector-based seasonal limit combined with a RP carve-out poses a more likely constraint to the CP sector, which typically records the majority of its annual PSC in the spring flatfish fisheries. As noted in Section 4.7.1.4.4 (Options 2 & 3), spring PSC is also more variable from year to year in the CP sector.

The maximum potential impacts on the non-RP CP sector would be generated by closures ranging from early March to mid-April, depending on the size of the RP carve-out and the total GOA annual PSC limit. The cells in Table 4-74 indicating that the sector would have closed in five years means that the likelihood of *some* impact is fairly high, based on retrospective analysis. In these cases, the latest simulated closure observed from 2007 to 2011 fell around mid-April to mid-May, again depending on the size of the total annual GOA cap and the size of the RP carve-out. A seasonal closure beginning in early March would generate a harvest loss of around 4,700 mt, and avoid about 1,930 Chinook salmon. A closure from mid-April to June 1 would preclude around 2,300 mt of harvest and 850 PSC. With a 2011 average wholesale value per metric ton of $1,150 (based on pre-June records of flatfish and some Pacific cod trips), these closures would cause a maximum wholesale revenue loss on the order of $2.6 million to $5.4 million.

The maximum potential impacts on the non-RP CV sector would be generated from closures ranging from late February to late April. While the CV sector displayed a lower likelihood of being constrained by an apportioned seasonal cap, smaller hard caps could trigger more impactful closures when the Pacific cod A season encounters an above-average amount of Chinook salmon. A seasonal closure beginning in late February would generate a harvest loss of around 12,700 mt of groundfish and avoid about 1,100 Chinook salmon. A closure from late April to June 1 would preclude around 5,300 mt of harvest and 800 PSC. The lower PSC-per-forgone-ton is reflecting the higher PSC rates in the spring CP flatfish fishery. With a 2011 average wholesale value per metric ton of $1,110, these closures would have caused a maximum wholesale revenue loss of between $5.9 million and $14 million.

In regards to the option to roll over unused PSC from the Rockfish Program to the non-RP fisheries on October 1, the non-RP CV sector would have a higher demand for fall Chinook salmon allowances than the CP sector. From 2007 to 2011, the non-RP CV sector averaged 965 Chinook salmon after September; the non-RP CP sector used only 220. On average, the CV sector is the more active sector in the late-year

months, recording around 5,500 mt of Pacific cod and flatfish per year, while the CP sector recorded around 2,150 mt per year (mainly arrowtooth flounder and flathead sole). In the previous section, Table 4-73 lists the range of estimated apportioned rollover amounts, as determined by the metrics chosen to determine sector apportionment. Little or no rollover is expected under a 1,500 Chinook salmon RP carve-out. The rollover from a 2,500 or 3,500 Chinook carve-out would likely fund the fall CP fisheries. If no non-RP PSC is left over as of October 1, the fall CV sector would likely struggle to fish through the end of the calendar year relying only on PSC rolled over from a 2,500 RP carve-out. Relying on rollover from a 3,500 RP carve-out would leave the fall CV sector with a PSC allowance that is just above or below its average fall PSC usage, depending on the selected apportionment basis metrics.

4.7.1.4.7 Options 1 & 2 – PSC limit apportioned between the CP and CV sectors within each area

Table 4-75 summarizes the apportioned PSC limits and simulated closure results for a GOA Chinook salmon hard cap that is subdivided to apply to each harvest sector's activity in each regulatory area. For discussion on how apportioning a hard cap by area or by sector might affect behavior, refer back to Sections 4.7.1.4.1 (Option 1) and 4.7.1.4.3 (Option 2).

Because the Central GOA CP was the most PSC-intensive sector during the analyzed years, it is the only one of the four sectors considered under this scenario that would not benefit from apportioning based on past groundfish harvest. Allowable Chinook PSC in the Central GOA CP sector would drop by either 16% or 22% when apportioning on the basis of harvest, depending on the length of the basis time period. Both Western GOA harvest sectors would benefit from the use of the longer 10-year basis period, as their relative share of harvest and PSC has declined since 2007.

At the broadest level, the Western GOA CV sector is the only sector that would be affected by fewer simulated closures (based on yearly PSC from 2003 to 2011) if its PSC limit was separated from both the CP sector and from the CV sector in the Central GOA. Even so, apportionment to the Western GOA CV sector could be so low (less than 100 Chinook salmon per year, under a 5-year PSC historical apportionment basis) that it is still exposed to very early closures. An early February closure would result in the loss of around 1,600 mt of the sector's 3,000 mt average annual harvest. At an average wholesale value of $1,539/mt, the maximum potential impact on the sector would be around $2.5 million.

Table 4-75 shows that the other three sectors experienced either earlier closures, closures in more of the analyzed years, or closures under higher total GOA hard cap levels than they did under a limit that was apportioned only by harvest sector or by area (compare to Table 4-68 and Table 4-70). Under this range of cap levels, the Western GOA CP fishery displays a significant likelihood of being closed prior to its limited access rockfish fishery, which begins in July and accounts for 70% of the sector's annual harvest (5,500 mt); this precluded fishery would be worth over $11 million in wholesale revenue, based on average wholesale value per metric ton for Western GOA CP rockfish trips is 2011 ($2,060).

The Central GOA CV averaged roughly 37,000 mt of groundfish harvest in the characteristic year. The sector appears to have a low probability of closing under an apportioned 10,000 or 12,500 total GOA PSC limit, though late September closures did occur in the highest PSC years. A late September closure would impact around 4,500 mt of groundfish harvest, including part of the important Pacific cod B season, shallow water flatfish, arrowtooth flounder, and the tail end of the rockfish fishery – a revenue loss of around $9 million based on an average wholesale value per metric ton of $2,034 in 2011. Other apportionment scenarios resulted in sector closures ranging from mid-February to mid-July. A mid-February closure would preclude around 31,000 mt of harvest, including the entire rockfish fishery; a mid-July closure would preclude around 14,000 mt of groundfish harvest.

The Central GOA CP fishery is smaller, by comparison, averaging roughly 14,000 mt of groundfish harvest during the analyzed period. The sector targets primarily arrowtooth flounder and rex sole in April, and again in the fall; it heavily focuses on the rockfish fishery in July. This sector would likely experience the largest marginal increase in the probability of being closed down under Options 1 & 2, compared to either option applied separately. Apportioning a PSC limit based on historical groundfish harvest would significantly increase the probability of a Central GOA CP closure, as simulated closures to the sector occurred in more than half of the nine retrospectively analyzed years for any total GOA PSC limit set at 10,000 or below. An early April closure would cause the sector to forgo around 13,000 mt of harvest. A closure around mid-May would preclude around 11,000 mt of harvest. All but one of the maximum impact scenarios (the earliest simulated closure under each apportionment level) resulted in a sector closure that occurred prior to the Central GOA CP rockfish fishery, which generates around $13 million in wholesale revenue, based on a 2011 target-specific average value per metric ton of $2,150.

Table 4-75 Simulated closures to the GOA non-pollock fishery (2003 to 2011), under Options 1 & 2

	Total GOA PSC Limit	Chinook PSC History						Non-Pollock Groundfish History					
		5 Year			10 Year			5 Year			10 Year		
		Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure	Sector PSC Limit	# Years Closed	Earliest Closure
CG CP	12,500	5,129	-	-	4,792	-	-	2,674	3	Early May	2,851	2	Early May
	10,000	4,103	1	Early Oct	3,834	1	Mid May	2,139	6	Mid April	2,281	5	Mid April
	7,500	3,077	2	Mid May	2,875	2	Mid May	1,605	6	Mid April	1,711	6	Early April
	5,000	2,052	6	Late April	1,917	6	Mid April	1,070	8	Early April	1,140	8	Early April
CG CV	12,500	6,374	-	-	5,498	-	-	7,719	-	-	7,386	-	-
	10,000	5,099	-	-	4,399	2	Late Sept	6,175	-	-	5,909	-	-
	7,500	3,824	2	Mid July	3,299	3	Early July	4,631	1	Late Oct	4,431	2	Mid Sept
	5,000	2,549	4	Mid March	2,199	7	Mid Feb	3,088	3	Mid May	2,954	3	Late March
WG CP	12,500	910	4	Early April	1,604	3	Early May	1,566	2	Late April	1,620	2	Late April
	10,000	728	4	Late March	1,284	3	Early April	1,253	4	Late March	1,296	3	Late March
	7,500	546	4	Late March	963	4	Early April	939	4	Late March	972	4	Late March
	5,000	364	5	Late March	642	4	Late March	626	4	Late March	648	4	Mid March
WG CV	12,500	86	4	Early Feb	606	-	-	541	-	-	643	-	-
	10,000	69	4	Early Feb	485	-	-	433	-	-	514	-	-
	7,500	52	5	Early Feb	363	-	-	325	-	-	386	-	-
	5,000	35	5	Early Feb	242	-	-	216	-	-	257	-	-

Based on the most recent five years of available data (2008 to 2012), the four sectors specified in Options 1 and 2 have recorded the following average annual Chinook salmon PSC: the Central GOA CP sector averaged 2,391 Chinook salmon, the Central GOA CV sector averaged 3,179 Chinook salmon, the Western GOA CP sector averaged 497 Chinook salmon, and the Western GOA CV sector averaged 43 Chinook salmon. If future PSC levels conform to these levels, direct salmon savings could be interpreted as the difference between the average annual amounts (listed) and the apportioned PSC hard caps noted in the table.

4.7.1.4.8 Options 1, 2 & 4 – PSC limit apportioned between the harvest sectors within each area, with a carve-out for the Central GOA Rockfish Program

This section addresses the potential impacts of Chinook salmon PSC limits that are apportioned to each operational type sector in each affected regulatory area, as they would be implemented alongside a PSC carve-out for the Central GOA Rockfish Program. The impacts analyzed here relate to the non-Rockfish Program non-pollock fishery; impacts within the Rockfish Program are discussed in Section 4.7.1.3.3.

The relative apportionment percentages to the non-RP fisheries are listed in Table 4-60. Removing the historical PSC usage or groundfish harvest that occurred in the Central GOA RP fishery from the historical apportionment baseline would decrease the Central GOA CV sector's portion of the total Chinook PSC cap by between 1% and 3%, depending on the selected basis for apportionment; this would

be the result of removing some of the Chinook PSC or groundfish harvest recorded on RP trips from the apportionment baseline amounts. Apportionment to the Central GOA CP sector would remain more or less the same if Option 4 is selected, with 1% increases or reductions depending on the baseline metrics. Western GOA PSC and groundfish harvest history would not be "carved-out" of the apportionment history if RP records are removed, so both sectors in that regulatory area stand to receive a greater percentage of the total apportioned cap with the inclusion of Option 4.

The non-RP Central GOA CP sector is the only one of the four sectors that receives its largest possible apportionment if PSC history is selected as the basis for apportionment. If PSC is selected, a 5-year history results in the largest apportionment percentage, but if groundfish harvest history is selected then a 10-year history brings a better result. The non-RP Western GOA CP sector fairs best under a 5-year groundfish history, but would achieve its second-best result under a 10-year PSC history, and its smallest possible apportionment under a 5-year PSC history. The non-RP Central GOA CV sector always receives a higher apportionment percentage under a groundfish harvest basis and under a 5-year history. The non-RP Western GOA CV sector would fair best under a 10-year basis history, and when groundfish harvest history is the metric for apportionment.

Table 4-56 reported the most up-to-date five year average non-RP PSC usage (2008 to 2012). The non-RP Central GOA CP sector recorded an average of 2,071 Chinook salmon per year, and the non-RP Central GOA CV sector averaged 2,264; the non-RP Western GOA CP sector recorded an average of 497 Chinook PSC per year, and the non-RP Western GOA CV sector averaged 43. Comparing these best-available average PSC figures to the ranges of apportioned PSC limits in Table 4-76 suggests that the non-RP Central GOA CP sector is susceptible to PSC closures at any total GOA cap level, while the other three sectors are susceptible to closures at either of the two lower total GOA cap levels. Nevertheless, Table 4-76 indicates that all sectors would have experienced at least one simulated closure under any cap level, owing to the annual variability in PSC. Furthermore, some of the apportioned PSC limits that could be applied to the Western GOA sectors are quite small, and may push the threshold of what hard caps are too small to be managed inseason by the Agency, as defined in Section 5.2.1.1.

Table 4-76 summarizes 192 different sector-specific outcomes, covering a range of permutations on the considered sizes of the RP carve-out and the considered historical baselines for apportionment of the total GOA non-RP PSC limit.

Table 4-76 Simulated closures for the GOA non-Rockfish Program fishery (2007 to 2011), under Options 1, 2 & 4

	CG CP			CG CV			WG CP			WG CV		
Total GOA PSC Limit	PSC Limit	# Years Closed	Earliest Closure	PSC Limit	# Years Closed	Earliest Closure	PSC Limit	# Years Closed	Earliest Closure	PSC Limit	# Years Closed	Earliest Closure
12,500	4,585 - 1,757	0 - 4	Early April	6,589 - 3,765	0 - 1	Late Oct	1,682 - 831	0 - 1	Late April	628 - 79	0 - 2	Late Feb
10,000	3,543 - 1,269	0 - 4	Early April	5,091 - 2,719	0 - 2	Early Oct	1,300 - 600	0 - 1	Late April	486 - 57	0 - 2	Mid Feb
7,500	2,501 - 781	1 - 5	Early April	3,594 - 1,673	1 - 4	Mid April	918 - 369	1 - 2	Late April	343 - 35	0 - 2	Mid Feb
5,000	1,459 - 293	4 - 5	Early March	2,096 - 628	2 - 5	Early April	535 - 138	1 - 4	Late Feb	200 - 13	0 - 2	Late Jan

In the characteristic year the typifies the 2007 to 2011 time period, the non-RP Central GOA CP sector averaged around 11,000 mt of groundfish harvest and 2,100 Chinook salmon PSC per year. The non-RP Central GOA CV sector averaged around 33,000 mt of groundfish and 2,450 PSC per year. The non-RP Western GOA CP sector averaged around 8,500 mt of groundfish and 470 PSC per year. The non-RP Western GOA CV sector averaged around 3,000 mt of groundfish and 45 PSC per year. The analysts applied the seasonal harvest and PSC distribution from the non-RP fisheries' characteristic year – based on 2007 to 2011 records – to the earliest simulated closures that would have occurred if such limits had been in place.

When Options 1, 2 & 4 are selected and the total GOA PSC limit is set at 5,000 Chinook salmon, the non-RP Central GOA CP sector experienced a simulated closure under almost all apportionment basis scenarios. The earliest would have fallen in early March, generating a harvest loss on the order of 10,500 mt in groundfish, or basically all harvest less some early year rex sole. The gross wholesale revenue loss, based on 2011 records for rockfish and flatfish processed in that non-RP sector ($1,250/mt) would have been around $13 million. A closure that early would have precluded the catch of around 2,000 Chinook salmon. Under the 5,000 Chinook total GOA limit, even the latest closures fell around mid-May. Such a closure would forgo around 7,000 mt of harvest, and would avoid around 460 Chinook. The large difference in avoided Chinook salmon indicates that the vast majority of the sector's PSC is incurred in the spring rex sole and arrowtooth flounder fishery. The higher considered total GOA PSC limits would generate maximum impact closures in early April, preventing around 10,200 mt of harvest and 1,900 Chinook salmon PSC.

The earliest simulated closures observed in the non-RP Central GOA CV sector tended to occur later in the year, giving a rough indication that this sector would be the least constrained. That said, there is still potential for closures to occur as early as April, and the lowest considered total GOA PSC limit would have closed the sector in four or five of the five analyzed years under most apportionment scenarios. The latest observed closure for the scenarios that closed the fishery in all analyzed years occurred in mid-October; this can be taken as an estimate of "minimum likely impact." Closures in early or mid-April would impact limited access trips targeting rockfish, shallow water flatfish, fall arrowtooth trips, and the Pacific cod B season. Forgone harvest would be on the order of 18,000 mt to 22,000 mt, and avoided Chinook PSC would be in the 1,750 to 2,250 range. Based on an aggregate 2011 average wholesale value per metric ton for non-RP catch of all species groups (rockfish, Pacific cod and flatfish), forgone harvest would cost around $1,071/mt. The estimated maximum revenue impact would be around $19 million to $23.5 million. The higher total GOA PSC limits carry a maximum potential impact of fishery closure in October. October closures would generate a loss of around 1,500 mt to 5,500 mt. The value of the forgone harvest largely depends on whether or not the Pacific cod B season is complete at the time of closure. For this subset of the fishery, a 2011 estimated wholesale value per mt for flatfish-only would be around $848/mt. October closures were observed to avoid between 350 and 950 Chinook salmon PSC.

The non-RP Western GOA CP sector still derives the majority of its groundfish catch from trips designated in Catch Accounting data as targeting rockfish – over 6,000 mt per year. A late February closure, observed when the sectors apportioned limit was minimal and Pacific cod or arrowtooth trips encountered Chinook, would preclude around 8,300 mt of groundfish harvest and around 460 Chinook PSC. A late April closure would preclude around 7,750 mt of harvest and 330 Chinook PSC. In either case, the key impact is the loss of the summer rockfish harvest. In 2011, the sector's post-April harvest of rockfish and some fall flatfish generated around $2,025/mt, resulting in an estimated maximum revenue impact for these closures of around either $17 million (late February closure) or $15.5 million (late April closure).

Potential impacts to the non-RP Western GOA CV sector depend almost entirely on the early-year PSC recorded in the Pacific cod A season, which typically concludes by early March. A late January closure would preclude around 2,800 mt of harvest and avoid around 40 Chinook salmon. A late February closure would preclude around 1,600 mt of harvest and avoid around 20 Chinook. The estimated wholesale revenue impact of these closures would be between $2.4 million and $4.3 million, based on the sector's 2011 per unit average wholesale revenue of $1,530/mt.

Option 4 includes a suboption that would roll over unused RP PSC to support the non-RP fisheries that occur in the fall. The fall fisheries primarily occur in the Central GOA (from 2007 to 2011, the non-RP Western GOA CP sector averaged around 270 mt of groundfish catch and 25 Chinook salmon from October through the end of the year). By contrast, after September the non-RP Central GOA CV sector

has averaged around 5,500 mt of groundfish harvest (primarily arrowtooth, shallow water flatfish, and the end of the Pacific cod B season) and 950 Chinook salmon PSC; the non-RP Central GOA CP sector has averaged around 1,900 mt of groundfish (arrowtooth, rex sole and flathead sole) and 200 Chinook PSC.

The amount of unused RP PSC to be rolled over is contingent upon the size of the RP carve-out, and the amount of PSC used in the Program prior to October 1. Table 4-73 (in Section 4.7.1.4.5, Options 2 & 4) provides estimated ranges of how much PSC the Gulf-wide CP and CV sectors might expect to receive as an October 1 rollover in a typical fishing year, depending on the size of the carve-out and the selected basis for sector apportionment. The rolled-over, apportioned PSC limits would have to be further subdivided by area (in addition to by sector) if Options 1, 2 & 4 are selected. The apportionment percentages for this subdivision are summarized in Table 4-60. Having noted the small amounts of post-September Chinook PSC (or virtual absence, in the case of the non-RP Western GOA CV sector), the Council may wish to consider whether the method of apportioning the rollover in the same percentages used to apportion the annual PSC limit "over-funds" the Western GOA non-RP sectors. Depending on the selected apportionment basis metrics, the CVs in those sectors could receive as much as 6% of the rollover, and the CPs could receive as much as 15%.

The non-RP Central GOA CV sectors average post-September PSC usage (950) would only be covered by its expected apportioned rollover allowance under a 3,500 Chinook RP carve-out, and only if the selected apportionment scheme is one of the ones that are more favorable to that sector (groundfish harvest basis). That said, even a smaller amount of rollover to that portion of the CV fleet could help complete the valuable Pacific cod B season harvest in a high-PSC year. The non-RP Central GOA CP sector tends to record fewer late-year Chinook PSC, and could likely support – or come close – its fall flatfish season with the expected rollover from a 2,500 or 3,500 RP carve-out, regardless of the selected apportionment basis.

4.7.2 Impacts on Chinook Salmon Users

As a "prohibited species," retention of a Chinook salmon for commercial use may never be authorized in a GOA groundfish fishery and, by law, its capture must be avoided. Notwithstanding this prohibition, experience demonstrates that 100% avoidance is not practicable at a cost society is willing to incur. In recognition of this trade-off, an allowance is made to absorb some PSC loss, with the expectation that trawl operators will seek to minimize these losses to the extent practicable (Section 4.7.2 addresses the question of whether a hard cap incentivizes PSC minimization, or merely compliance). A PSC limit would fix the maximum number of Chinook salmon removals that will be tolerated without remedial management action. Reaching a PSC limit would result in non-pollock groundfish fishery closures.

The primary impact of the GOA non-pollock groundfish fishery on Chinook salmon is through direct PSC mortality. Groundfish trawlers also incidentally catch salmon prey species including squid, capelin, eulachon, and herring. The catches of these prey species are small relative to overall species populations, and there is no available evidence that the incidental trawl catch of these prey species has a measureable impact on food availability for Chinook salmon.

In the Bering Sea Chinook salmon PSC analysis (NMFS 2009b), an adult equivalent (AEQ) model was used to estimate (a) how many of the PSC salmon were likely to have returned to their streams as adults, and (b) to which river system or region they would likely have returned. As a result, the Bering Sea analysis could include a quantitative impact analysis of Chinook savings on salmon fisheries or user-communities. This analysis was not without controversy, since the underlying data were obtained from relatively small sample sizes and collected opportunistically. For this GOA Chinook salmon PSC analysis, sufficient data to develop an AEQ model are not available (see further discussion in Section 3.3). The non-pollock groundfish fishery is intercepting Chinook salmon that originate from Alaska, Asia,

and the Pacific Northwest, as Chinook salmon from all these areas are present for extended periods of their life-cycle in the North Pacific and Eastern Bering Sea. It is, however, not possible at this time to estimate the proportion of Chinook salmon removals that impact each specific stock. Therefore, our ability to quantitatively assess the impacts of reducing Chinook salmon PSC on salmon populations is limited. Reducing Chinook salmon mortality in the GOA trawl fishery would have beneficial impacts on Chinook salmon stocks, no matter their source-of-origin, and would benefit harvesters (e.g., commercial, tribal, subsistence, hatchery) and consumers of Chinook salmon, relative to the status quo.

With available information, neither the total cost of Chinook salmon PSC taken in the Central and Western GOA, nor the total value of Chinook salmon savings can be estimated for the various user groups. The estimated annual savings (reported in Section 4.7.1) may represent a cost to groundfish trawl harvesters, processors, and consumers that is realized as a reduction in the harvested amount of groundfish. Information on lost GOA groundfish harvest was provided with the caveat that historical behavior of these user groups does not reflect any response to an action that limits Chinook salmon PSC. Additional cost data are needed to more fully describe these impacts, but those data are not available. Remedial management action to prevent the exceeding of Chinook PSC limits could negatively impact the communities where groundfish fishing operations are based, crew on the vessels, and suppliers of fishing materials (see Sections 4.7.2 and 4.7.4). However, data necessary to quantitatively estimate the costs incurred by these groups from forgone groundfish harvest, should the PSC limit be reached, are not available.

The Chinook salmon PSC taken in non-pollock target fisheries also has value to the commercial Chinook salmon harvesters, sport fishermen, subsistence users, species that prey upon salmon, and salmon stocks that are protected under the ESA and prioritized for conservation and recovery. However, the analysts cannot estimate the change in the number of Chinook salmon that would accrue to each user group as a result of this action. The potential salmon savings that are estimated in this analysis do not translate directly into adult salmon that would otherwise have survived and returned to its spawning stream. Salmon caught as PSC in the GOA non-pollock trawl fisheries are generally immature (Section 3.3.2.1). Some proportion of the Chinook salmon caught as PSC would have been consumed as prey by other marine creatures, or been affected by some other source of natural or fishing mortality. Increasing the number of Chinook salmon available as prey has a positive, but unquantifiable impact on species that rely on them.

Because of data limitations, it is beyond the scope of this analysis to monetize or even quantify the benefits of reducing Chinook PSC. Therefore, the estimated value of Chinook salmon PSC savings to each user group, which would allow the reader to rank the costs and benefits to each group, cannot be generated. Chinook salmon are, arguably, the most prized of the five Pacific salmon species present off the west coast of North America. Chinook salmon contribute cultural, commercial, recreational, societal, subsistence, and ecological value in many forms, to many users. Society, through the public sector, has invested heavily in their protection, recovery, and enhancement, devoting expenditures to fish passageway, habitat recovery, migration assistance, and Chinook salmon hatcheries; all clear demonstrations of the value society places on these fish.

Groundfish trawl stakeholders have outlined potential negative impacts on their industry, which include reduced revenue, increased operating cost, and a reduced ability to use voluntary agreements to manage PSC under a hard cap. At the same time, proponents of the private-sector Chinook salmon user groups have indicated that they feel the benefit of reducing PSC outweighs the cost to the trawl industry. Many of the benefits generated by these Chinook salmon user groups do not involve a market transaction. The lack of a market price makes comparing the value accruing to various users more difficult, but nonetheless important. As a result, value judgments are often based on the utility that individuals derive

from Chinook salmon remaining in the ecosystem or being taken by a particular user group (e.g., Native Americans, subsistence-users, recreational fishermen), and not simply the "cost" of a fish.

Even with the lack of information on the stock composition of Chinook salmon taken as PSC, Chinook salmon that are taken from ESA-listed runs[53] pose a high cost to the nation. ESA-listed evolutionary significant unit (ESU) Chinook salmon runs have been harmed by decades of built development in and around the freshwater habitat in many of these areas. This development has often simplified and truncated the diverse habitats that support Chinook salmon populations (Lindley 2009). Reducing the number of fish that return to these rivers has greatly increased the value of the individual fish that do return. As a result, efforts to recover Chinook salmon populations have imposed substantial costs on the hydroelectric, agricultural, irrigation, forestry, land development, and recreational fishing industries in the Pacific Northwest, Northern California, parts of Alaska, and British Columbia. Limitations have also been imposed on the subsistence users of these resources. The United States has longstanding treaty obligations to Canada, as well as Native American tribes, committing the nation to the protection of Chinook runs for escapement and use by treaty signatories.

Chinook salmon from nine of the ESA-listed ESUs are known to be present in the GOA during some stages of their life-cycle. Any of these fish that are being intercepted by the GOA groundfish trawl fleet as PSC are highly valued in a National context due to their scarcity. Fish that are the subject of treaties, as described above, may also have a higher value in the national context. Additionally, Chinook salmon bound for Alaska drainages that are not meeting their escapement goals are more highly valued by society than Chinook salmon from rivers that are meeting their escapement goals or receiving inputs from hatcheries.

Individual user groups may value Chinook salmon differently. For example, it is unlikely that a sea lion cares if the Chinook salmon it consumes is from one of the nine ESA-listed ESU runs or from a hatchery in Asia. In much the same way, a PSC-limited groundfish industry only has one Chinook debited against the allowed limit, regardless of whether the fish was from a hatchery in Southeast Alaska or the endangered Sacramento River winter-run. However, the Nation has placed a much higher value on the nine ESA-listed ESU stocks, and so it does differentiate among trawl-caught Chinook salmon based on their source of origin. This difference in value highlights the importance of developing a better understanding of the origin of Chinook salmon taken as PSC.

4.7.3 Other Impacts on Groundfish Trawl Harvesters

The preceding impact assessment describes outcomes that would have been realized if the proposed action were in place during the analyzed years. This sort of retrospective analysis does not consider the behavior modifications that may occur in the presence of a potentially constraining Chinook salmon PSC limit. Aside from behavior, this section addresses potential changes in harvesters' operating cost structures, competition incentives, and ability to manage PSC through existing or future programmatic or voluntary agreements.

Setting an upper limit on Chinook salmon PSC may have little effect on the number of salmon that are caught, so long as harvesters perceive little potential for the total to exceed the cap. In other words, if a harvester has a reasonable expectation that the apportioned PSC limit in his or her sector will not be constraining, he or she would have no economic rationale for incurring additional costs to decrease PSC or PSC rates. Moreover, if inseason PSC levels are well below the annual allowance, a harvester operating near the end of the fishing season may be rational in prosecuting the fishery in a manner that

[53] California coastal, Central Valley spring-run, Lower Columbia River, Upper Columbia River spring-run, Puget Sound, Sacramento River winter-run, Snake River fall-run, Snake River Spring/Summer-run, and Upper Willamette River.

maximizes TAC utilization with little or no additional effort to avoid PSC. On the other hand, compared to a fishery with no hard cap, simply setting a limit could lead to *some* strategic behavior if the cap is thought to be even potentially constraining in an exceptional year. In the most general sense, any shared constraint creates a situation where costs are borne by individuals, while benefits are dispersed to the collective. If a PSC cap appears to be constraining, or that it could become constraining in the future, harvesters could incur additional costs prior to fishery closure by relocating to low-PSC areas that may be farther away or less productive.

Annual PSC limits may relatively advantage harvesters who derive most or all of their revenue from fisheries that occur early in the fishing year. Section 4.4.2.1 illustrated that the GOA trawl fleet is made up of some participants who fish early in the year, and others who do not make their first landing until mid- or late-year; this is especially evident in the CV sector. Participants who rely upon late-year harvest (principally in flatfish, though B-season Pacific cod is an important source of revenue for the Central GOA CV sector[54]) are more likely to lose revenue to PSC closures. One should note that the historically observed time-distribution of fishing activity reflects behavior in the absence of an annual PSC limit. One might expect the harvesters who rely upon late-year catch to exert greater effort to avoid Chinook PSC than those who only fish early in the year. This effect could, in turn, allow those who only prosecute GOA non-pollock groundfish early in the year to increase their catch at the expense of late-year participants who are already actively avoiding Chinook PSC in a way that may reduce their target catch rate. While this analysis does not include vessel-level data to analyze the point, it may be the case that the participants who are most likely to fish late into the year are from the local fleet. Late-year flatfish fisheries are generally less valuable, and vessels returning to distant homeports may be closer to indifference when it comes to preserving a marginal week of harvest at the end of the fishing year. The analysis notes that the late-year fisheries are more heavily prosecuted by the CV sector. The Council has included several options to Alternative 2 that address the issue of late-year fisheries closing at the expense of spring and summer fisheries that may incur high rates of PSC while bearing little individual cost; refer to the sections on Options 3 and Option 4 (Suboption 2) for additional detail (4.7.1.3.2 and 4.7.1.3.3).

Participants may reallocate fishing effort across space, in addition to time. If a PSC limit is not apportioned by regulatory area, harvesters with multiple area endorsements may choose to redirect fishing effort; they may have an incentive to fish more in areas that generate lower PSC rates, in an attempt to prevent or forestall a season closure. While this sort of PSC avoidance may be desirable, altered fishing patterns may increase costs for harvesters who travel greater distances to fish. This could affect fishing opportunities or profitability for those who have historically prosecuted the fisheries that experience an influx of effort.

A PSC limit apportioned by regulatory area may also create an incentive for GOA trawlers to redistribute fishing behavior spatially. Harvesters with groundfish endorsements in both the Central and Western GOA may alter their historical fishing pattern to focus effort in the regulatory area that is expected to reach its PSC limit earlier. Harvesters may compete to generate as much revenue as possible in that area before the closure, which in turn makes the perceived closure risk all the more real. Such competition could trigger the negative impacts that are typically associated with a race to fish – over capitalization, shortened derby-style fishing seasons, increased propensity to fish in poor weather conditions, and increased incentive to make illegal discards on unobserved trips. To the extent that harvesters redirect effort to other areas, area-based PSC limits could relatively advantage entities with endorsements in both of the regulated GOA areas. Derby-style fishing, in general, increases uncertainty in the fishery and may impair business planning; it may also affect the Agency's willingness to keep fisheries open when TAC

[54] On average, the Pacific cod B-season generated $5.25 million per year in the Central GOA CV sector from 2003 through 2011. This figure captures trips targeting Pacific cod that occurred in Weeks 35 to 41 (typically covering September and most of October).

or PSC limits are nearing their cap, as deviations from historical relationships and voluntary harvest plans become more likely to break down.[55]

Many participants, however, are limited in their ability to alter their temporal and spatial fishing behavior. These harvesters may be limited by seasonal TAC allocations (specifically in regards to Pacific cod), halibut PSC restrictions, plans to participate in limited access fisheries outside of the scope of this action, seasonal product market demand, and access to processor capacity. Harvesters often develop a relationship with the processors to whom they historically deliver catch. This relationship is important in coordinating the timing of deliveries, minimizing fishing time lost to waiting in port, and associated additional costs. Uncertainty about fitting into a new processor's delivery rotation may mitigate harvesters' incentive to fish outside of their home area. Moreover, current regulations prohibit Western GOA tender vessels from moving east of the 157 degree longitude line, so, absent access to Central GOA processor operations, Western GOA CVs may be less likely to increase effort in reporting area 630. Shifting harvest to times of lower expected Chinook encounter, such as July (Table 4-43), may generate the best outcome in terms of salmon avoidance, but would impose opportunity costs on harvesters. For example, delaying rockfish harvest until July might mean that AFA participants have to transit to the Bering Sea for the June pollock season and then return to the GOA; or, vessels who operate as tenders in July would have to forgo that revenue stream in order to prosecute a fishery that might otherwise have already been completed.

The interaction of the proposed Chinook PSC limit with the existing halibut PSC limit could also be an important limitation on fishermen's motivation and ability to avoid Chinook salmon. Halibut PSC has been a major concern for groundfish fishermen, and halibut PSC limits were recently reduced. If halibut PSC closures are perceived as more imminent, vessels may focus primarily on avoiding halibut and fish in a manner that increases the likelihood of high Chinook PSC events. More broadly, the manner in which halibut PSC is managed is not a perfect match with current and considered management measures for Chinook PSC in the GOA fisheries. Halibut PSC mortality limits are divided between the deep-water and shallow-water groundfish complexes, but shared by both the CP and CV sectors; also, halibut mortality is limited on a seasonal basis as opposed to an annual limit (Table 4-31). One can imagine a scenario where a Chinook PSC limit is apportioned separately to the CP and CV sectors (as in Option 2), and one sector wishes to delay fishing in order to avoid a time of high-probability Chinook encounter. However, if the other sector is fishing and using up the seasonal limit of halibut PSC, the target fishery may soon be closed and the decision to avoid Chinook PSC by waiting would not pay off in opportunities to catch groundfish.

GOA CP harvesters may experience less pressure to exhibit defensive behavior than CVs if the total Chinook salmon PSC limit is apportioned separately by operational type under Option 2. All CP vessels are in the full observer coverage category under the restructured Observer Program (see Section 5.1.1), so PSC accountability should be greater. Also, many of the CPs that participate in GOA non-pollock groundfish fisheries are members of cooperatives – either associated with the Central GOA Rockfish Program or with BSAI harvest co-ops (Amendment 80). In general, cooperative associations provide a foundation for the development of additional agreements to limit use of Chinook PSC. Conversely, if the GOA Chinook PSC limit is shared between the two sectors, the sector with the higher level of observer coverage may be wary of potential spikes in credited Chinook PSC that can result from the extrapolation of a few observed hauls to many unobserved vessels operating at the same time. Such uncertainty could undermine the optimal use of the cooperative management tools available within a particular sector.

[55] Refer to 4.4.5 for a discussion of early experience with managing a hard cap under changing area-participation in the 2012 GOA pollock C and D season.

It should be noted that harvesters' available range of responses to a looming PSC cap is not limited to offensive or defensive strategies, such as redirecting effort into more tightly constrained areas or racing to fish ahead of an imminent closure. Harvesters may react to the possibility of PSC closures by taking individual inseason measures to control their PSC rate, in lieu of – or in addition to – timing and area shifts. Such measure could include additional investment in gear or technology that aids in Chinook avoidance. Again, the incentive for such action would be moderated by the fact that a PSC hard cap typically distributes the benefit of individual Chinook avoidance across the entire fleet, potentially at the cost of the individual who takes action.

As discussed in Section 5, it is common for a time lag to exist between the time that Chinook salmon are caught and when they are offloaded and counted. NMFS inseason management of a hard cap may require non-pollock fisheries to be closed and then re-opened in order to maximize TAC utilization without exceeding Chinook salmon PSC limits. Temporary closures could force harvesters to suspend fishing in an area and then return to fishing once the closure is lifted. Additional transit time would likely increase variable fishing costs (such as fuel) and opportunity costs to crew-members who would take more trips to earn their groundfish income, leaving less time available to work elsewhere.

Given the current context of speculation on future quota-based bycatch management measures in the GOA, a Chinook salmon PSC limit may only have the effect of intensifying whatever race for target catch history may be occurring. To the extent that harvest cooperative members and limited access participants find themselves competing for the same target catch history under a shared PSC cap, an intensified race to fish could hinder cooperative management strategies designed to reduce PSC rates. Harvesters who suspend fishing activity during high PSC events may lose opportunities to participants who are not a party to such agreements and choose not to abide by the standdown. A hard cap measure that exacerbates competition would likely reduce the instances of voluntary bycatch coordination. Given the stage of the current discussion on quota-based management measures in the GOA, the analysts think it unlikely that a large number of latent (inactive) LLPs that have not already entered the fishery will do so in the near-future. The likelihood that a Chinook PSC hard cap will act as a binding constraint can be assessed effectively in relation to the current level of fishery participation.

Central GOA Rockfish Program cooperatives are an example of a stakeholder group whose PSC management efforts could be undermined, or whose members could be placed at a competitive disadvantage. This action considers a direct allocation of Chinook salmon PSC to the Rockfish Program fishery (Option 4). The Council may wish to consider whether forcing Rockfish Program cooperative members to share Chinook salmon PSC allowances with non-members lessens the cooperative's ability to avoid PSC without putting harvest opportunities at risk. In the absence of a Rockfish Program PSC allowance, Central GOA CPs that target rockfish may feel it necessary to move their typical start date (historically in June) up to May – when the CVs start – in order to avoid losing harvest to a PSC closure. This move would appear to conflict with the Council's purpose in this action, since Chinook PSC rates have tended to be higher in May than in June. In general, one can assume that the historical timing of target harvest reflects the best available strategy to maximize revenue under current regulations, so a seasonal shift caused by Chinook salmon PSC limitation is likely to make these rockfish CPs less well-off. The action could result in additional Chinook PSC, if the historical trend of higher Chinook PSC rates in May continues in the future.

As described in Section 5, Rockfish Program catcher/processors will have additional monitoring requirements under Alternative 2, Option 4. To ensure accurate counts of salmon PSC that is allocated to an entity, NMFS intends to apply the following additional requirements to the Rockfish Program catcher/processors:

- All salmon bycatch of any species must be retained until it is counted by an observer;

- Vessel crew must transport all salmon bycatch from each haul to an approved storage location adjacent to the observer sampling station so that the observer has free and unobstructed access to the salmon, and the salmon must remain within view of the observer from the observer sampling station at all times;
- The observer must be given the opportunity to count the salmon and take biological samples, even if this requires the vessel crew to stop sorting or processing catch until the counting and sampling is complete;
- The vessel owner must install a video system with a monitor in the observer sample station that provides views of all areas where salmon could be sorted from the catch and the secure location where salmon are stored;
- No salmon bycatch of any species may pass the last point where sorting occurs in the factory; and
- Operators of catcher/processors would be required to submit the count of salmon by species in each haul to NMFS using an electronic logbook.

CP vessels may incur additional costs related to providing additional space in the observer sample station for a salmon storage location. These costs depend on the current layout of the observer sample station and the extent to which modifications to the area will be required to comply with the new requirements. Therefore, these costs are difficult to estimate.

The requirement to allow the observer to count all the salmon in the previous haul prior to the beginning of the next haul may reduce the flow of fish through the factory. The degree to which the processing will be slowed would be highly variable and depend on the number of salmon in each haul. Ensuring no salmon bycatch pass the last point where sorting occurs in the factory would likely impose processing costs associated with lower throughputs of retained catch and potential decreases in product quality if fish remain unprocessed for longer periods of time. Costs would increase in concert with an increase in the time required to convey fish through the sorting area, increased processing times, and the need to reconfigure conveyor belt and sorting layouts. However, the variability in the flow of fish through a given factory and the changes to sorting conditions make it difficult to predict costs to industry. Further, the magnitude of these costs would likely be vessel-specific as needed to facilitate a salmon census of observed deliveries

The video requirements would be modeled similar to those designed for the Chinook salmon monitoring requirements under Amendment 91 for AFA catcher/processors. A vessel must provide and maintain cameras, a monitor, and a digital video recording system for all areas where sorting, storage, and discard of salmon prior to being counted by an observer could be located. The video data must be maintained and made available to NMFS upon request for no less than a 120 day period. The video systems would also be subject to approval by NMFS at the time of the observer sample station inspection.

Costs for the video include cameras, waterproof monitors, a digital video recorder (DVR), associated software, storage of the data, installation of the equipment, and maintenance of the system. Because vessel configurations are variable, the costs for a vessel to implement video to ensure an observer can monitor all locations where sorting, storage, and discard of salmon prior to being counted could be located could be quite variable, depending on the nature of the system chosen. In most cases, the system would be expected to consist of one DVR/computer system, a monitor and between two and five cameras.

Waterproof or water-resistant monitors may range in price between $2,000 and $12,000 dollars depending on the size of the monitor and the degree of protection against intrusion of foreign objects, such as water. DVR systems range in price from $1,500 to $10,000 and cameras cost between $75 and $450 each. Storage costs will vary depending on the frame rate, color density, amount of compression, and image size. The system would be expected to record data at a rate of between 5 and 20 GB (gigabits)/day. Assuming that vessels choose to purchase redundant storage capacity, and that USB compatible hard

drives cost approximately $1.00 per GB, NMFS estimates that storage will cost between $400 and $3,000. Installation costs will be a function of where the DVR/computer can be located in relation to an available power source, cameras, and the observer sampling station. The installation costs for a fairly simple installation are estimated at approximately $4,000, while a complex installation is estimated to cost approximately $22,000. However, these costs can be considerably lower if the vessel owner chooses to install the equipment while upgrading other wiring. Thus, total installed system costs would be expected to range between $6,050 and $46,650 per vessel.

Maintenance costs are difficult to estimate because it can vary between vessels. However, we estimate a hard disk failure rate of 20 percent per year, and a DVR/computer lifespan of three years, or between $680 and $4,100 per year. We estimate one camera replacement at between $75 and $450 every three years depending on how much vibration and shocks the camera might endure. During the first years of implementation, the video systems aboard the Amendment 80 vessels have been reported to cost between $10,000 and $40,000 depending on the systems. However, the systems in place for the Amendment 80 vessels occur in harsher environments such as inside the fish bins and must sometimes cover large areas that may need up to 8 cameras to allow viewing of all areas. The systems required for catcher/processors participating in the Rockfish fishery may not operate in as harsh environments or may require fewer cameras to achieve the needed coverage.

Operators of CPs participating in the Rockfish fishery would be required to submit to NMFS using an electronic logbook so that the data is readily available to NMFS in an electronic format. The electronic logbooks are already a requirement under the Rockfish Program, so there would be no additional costs associated with entering the Chinook salmon data in the elogbook.

Under Option 4 there would also be some costs for catcher vessels in the Rockfish Program to provide additional space for a salmon storage location. These costs depend on the current layout of the vessel; however costs are expected to be minimal.

A requirement described in Section 5, Alternative 3 would require the addition of an observer work station for CPs currently described in regulations at 679.28(d). Almost all CP vessels operating in the GOA already have requirements for an observer workstation as part of the Rockfish and Amendment 80 programs. However, this alternative could incur additional costs related to providing additional space for an observer sample station and a salmon storage location for any vessels that do not already have these areas designated. These costs depend on the current layout of the vessels and the extent to which modifications to the area will be required to comply with the new requirements. Therefore, these costs are difficult to estimate.

4.7.4 Other Impacts on Groundfish Processors

This section describes impacts that may accrue to the processing sector if GOA Chinook salmon PSC limits are constraining. These potential impacts are additional to direct revenue losses associated with the reduced harvest described in Section 4.7.1. The issues addressed include: ability to anticipate the need for and utilization of labor, fixed processing costs per unit of production, loss of input supply products to processors in other regions, and fulfillment of output supply contracts.

Before the fishing season begins, processors estimate the number of workers that are needed to process expected deliveries. Because of the remote locations and the relatively small communities in which some processors operate, those processors are required to bring in labor from outside the local community. Processors with less diverse operations may experience greater impacts from Chinook salmon closures, as they have fewer alternative activities to which labor can be redirected during groundfish down time. Processors that take more deliveries from fishers prosecuting state-managed fisheries may be relatively

less exposed to federal groundfish closures, depending on the timing of the closures. Processors in King Cove and Sand Point tend to have larger numbers of non-resident employees, and may incur a greater cost from closures, if they need to retain underutilized labor at their plants for an extended period of time between fisheries. By comparison, Kodiak plants tend to have a more resident work force. While these plants may incur fewer expenses related to housing and feeding employees, they may incur costs associated with keeping quality employees on the job and maintaining workforce morale.

In addition to their employed work force, some Western GOA processors use tender vessels to support their operations. The tenders are typically paid for their services on a daily basis. Both processors and tender operators are likely to bear added costs associated with deploying tenders if fishery closures suspend operations.

PSC limits that constrain harvest are likely to impact processors' unit production costs. Processors may wish to reduce employment at the time of PSC closure; however, the results reported in Section 4.7.1 indicate that variability in the time-distribution of PSC from year to year makes it difficult to anticipate closure dates. Moreover, to manage PSC limits, NMFS may be compelled to use short openings or re-open groundfish fisheries after a closure to allow vessels to use PSC up to the limit, but not exceed the limit. These short opening and re-openings will require processors to balance the added cost of maintaining their workforces during down times against the need for additional labor when the fisheries reopen.

Decreasing the amount of groundfish harvested increases fixed capital costs per unit of production. Fixed costs are those that are incurred regardless of production volume, such as frozen storage capacity and amortized facility or equipment costs. Processors sell to a wholesale market where prices are determined by many outside factors, including retail market demand, import product prices, and substitute product prices. Processors cannot simply set the wholesale price at a level that ensures the coverage of total production costs. Decreasing production may lower variable costs, but processors will still incur a loss if fixed unit production costs exceed market wholesale revenue. Because cost structure data for processing facilities are not available, the analysts cannot estimate the amount of groundfish deliveries required to break even on amortized fixed costs and per unit variable costs at historic production levels and first wholesale prices. Therefore, it is not possible to estimate the impact of a given Chinook salmon PSC allowance on processor profitability.

To the extent that a PSC cap is apportioned separately to Western and Central GOA harvesters (for example, Alternative 2, Option 1), processors may see a portion of their historical input supply delivered to processors in another region. Harvesters and processors often maintain a working relationship that aids in managing delivery capacity. PSC closure in one GOA regulatory area (or even slowing effort in an attempt to control PSC in an area) could result in harvesters redirecting effort into an open area, but delivering catch to their home port. This scenario could be aided by processors using tender vessels to receive deliveries across regulatory areas. The extraction of processor input supply (deliveries) from one GOA region could exacerbate the previously described impacts on labor force management and increased per unit production costs, as well as impacts on the processing communities themselves.

Any alteration of delivery patterns throughout the fishing year can impact processor revenues, even if total deliveries are not reduced. An approaching PSC cap may create incentive for fishers who historically rely upon harvest from that area to intensify local fishing effort. As deliveries become concentrated into earlier parts of the year, processors may be forced to employ additional staff.

Processors typically estimate the amount of groundfish product that they will produce and begin marketing that product before the fishing season. An early fishery closure could result in a processor being unable to fulfill their output supply contracts. Such an outcome could result in the loss of future

contracts and market share. Processors may experience a reduction in pre-contracted sales in future years, thereby reducing revenue predictability and stability in their operations.

In addition to direct impacts on processing businesses, changes in the volume or flow of processing activity can impact the larger community in which a processing business is located (see Sections 4.4.2.3 and 4.4.4 for more information on the processing communities located in the action area). As mentioned above, some processing communities are more remote than others, meaning that some rely more heavily on non-resident labor (the extent to which the migrant labor force spends money locally also varies by community). The total volume of processed product affects the amount of money spent in the community. The length of the processing season also affects the amount of time over which wage earnings might be spent in the community. Each dollar spent circulates throughout community businesses. The number of times a dollar is spent and re-spent in the community – known as the velocity of money – can increase the total size of the local economy, and have a positive downstream economic impact on entities within and beyond the entities directly related to fishing.

Finally, in reference to Table 5-2 in the management section on Alternative 2, the analysts note that shoreside processors may incur additional costs under Alternative 2, Option 4. Section 5 notes that 200% observer coverage may be required at the plant; this would be in the Full Coverage category (sometimes called "pay as you go"), which is not part of the Partial Coverage and, thus, is outside of the scope of observer deployment through the Annual Deployment Plan and the observer fees that pay for partial coverage. Processors would also need to create a designated salmon storage area in their facility, which may impose a direct cost.

Last, NMFS notes that managing a hard cap may include additional requirements to be met in the Catch Monitoring and Control Plan (CMCP). Under current regulations, each inshore processor that receives Rockfish Program catch is required to develop and operate under a NMFS-approved CMCP. Each processor must annually submit a CMCP to NMFS. The monitoring standards for CMCP are described in regulation at 50 CFR 679.28(g). Plant layouts and operations vary widely among processors; therefore, the CMCP regulations were developed as a series of performance-based standards that each processor must meet. Each CMCP describes how a particular processor will meet each standard. NMFS would need to implement additional measures to existing CMCP performance standards in order to ensure that fisheries observers have the means to count all Chinook salmon in each delivery.

The procedures established under the Rockfish Program for the CMCPs were designed to monitor the weighing of rockfish species at the onshore processing plants. Proper weighing of large volumes of a target species require different conditions than does the proper sorting, identification, and counting of a more infrequently occurring bycatch species such as salmon. Salmon can be difficult to see, identify, and count amidst the large volume of target catch. The factory areas of processing plants can be large and complex. Preventing observers from seeing Chinook salmon that enter the factory area of the processing plant would not be difficult. In addition, observers must examine each salmon to verify the species identification.

Proposed changes to inshore monitoring requirements would likely impose processing costs associated with lower throughputs of fish in the plant to properly sort out all of the salmon bycatch. In addition, product quality could decline if fish remain unprocessed for longer periods of time. Costs would increase in concert with an increase in the time required to convey fish through a processing facility, increased vessel offload times, and the need to reconfigure conveyor belt and sorting layouts. However, the variability in the flow of fish through a given plant and the changes to sorting conditions make it difficult to predict costs to industry. Further, the magnitude of these costs would likely be plant-specific as needed to facilitate a salmon census of observed deliveries.

4.7.5 Impacts on Communities

This section provides a brief summary of community impacts arising from Alternative 2. In general, impacts on communities that are realized through trawl vessel operations will be distributed in proportion to the scale of trawl vessel operations in each community. Confidentiality data limit the extent to which these data can be disaggregated by target fishery, but they provide a general basis for understanding the distribution of impacts. Kodiak and Sand Point are each home to in excess of 10 vessels, with Kodiak vessels generating slightly less than 75 percent of the ex-vessel revenues of Gulf trawl vessels in Alaska. Sand Point vessels have generated slightly more than 20 percent of the Gulf trawl ex vessel revenues of Alaska based vessels, while King Cove vessels have generated almost 7 percent of the Gulf trawl ex-vessel revenues of Alaska based vessels. In general, the effects of alternatives that constrain fishing in the Central Gulf will primarily affect Kodiak based vessels, while alternatives that constrain Western Gulf fishing will primarily affect Sand Point and King Cove based vessels.

Table 4-77 Alaska communities with annual average number of locally owned GOA groundfish trawl vessels equal to or greater than 1, 2003 to 2010

	Number of Vessels	Percent of Alaska Total	Percent of Grand Total
Kodiak	15.9	48.8%	17.5%
Sand Point	10.6	32.5%	11.7%
King Cove	3.5	10.7%	3.9%
Anchorage	1.3	4.0%	1.4%
Petersburg	1.0	3.1%	1.1%
Homer	0.4	1.2%	0.4%
All Other Alaska	0.0	0.0%	0.0%
Alaska Total	32.6	100.0%	36.0%
Oregon Total	16.5	na	18.2%
Washington Total	39.1	na	43.2%
All Other States Total	2.4	na	2.6%
All Geographies Total	90.6	na	100.0%

Table 4-78 GOA groundfish trawl vessels annual average ex-vessel gross revenues, by Alaska community of ownership, 2003 to 2010

Community*	Millions (dollars)	Percent of Alaska Total	Percent of Grand Total
Kodiak	$11.3	72.8%	18.3%
Sand Point	$3.1	20.2%	5.1%
All Other Alaska	$1.1	6.9%	1.7%
Alaska Total	$15.5	100.0%	25.1%
Washington Total	$33.5	na	54.4%
All Other States Total	$12.6	na	20.5%
All Geographies Total	$61.5	na	100.0%

*Table displays all Alaska communities with at least 4 or more vessels present each year (minimum to allow data disclosure for each individual year).

In general, it is not possible to quantitatively differentiate potential impacts of the different Chinook PSC reduction alternatives on an individual community basis. Qualitatively, however, it is possible to anticipate the communities where adverse impacts, if any, would most likely accrue, along with the nature, direction, and at least rough order of magnitude of those impacts. Adverse impacts could be felt at the individual operation level for at least a few vessels in a number of Alaska communities, if either limits are perceived as constraining and those vessels choose to change fishing practices to reduce Chinook PSC, or if a season-ending closure occurs. Additionally, recent community and social impact assessments for North Pacific fishery management actions suggest that, as locally operating vessels experience adverse impacts, indirect impacts are also soon felt by at least some local support service providers, to the extent that fishery participants reduce their purchase from those suppliers because of the closure.

The three communities where community-level impacts are most likely are King Cove, Sand Point, and Kodiak (based on the relative involvement with the trawl fleet and processing of that fleet's landings in those communities); these communities are briefly described in Section 4.4.4. The magnitude of any effects will depend on the timing of any fishery closures and the foregone harvests caused by those closures. Kodiak is substantially engaged in a wide range of Gulf groundfish trawl fisheries through both its local fleet and processors. Kodiak processing operations form the core of Central Gulf groundfish shore-based processing. Kodiak would be especially likely to experience adverse impacts from closures of Central Gulf non-pollock groundfish trawl fisheries. Important activity occurs in the rockfish fishery from May through July, in the Pacific cod fisheries in late summer and early fall, and in the flatfish fisheries (including both shallow-water flatfish and arrowtooth flounder) late in the year. These fisheries fill important gaps in non-GOA-groundfish activity for both the fleet harvesting these species and processing plants that receive deliveries. A potential mitigating factor for adverse community-level impacts in Kodiak is that the community is substantially engaged in and dependent upon a wide range of fisheries, beyond the Gulf groundfish fisheries, and multiple gear types within the Gulf groundfish fisheries. For the local Gulf groundfish fleet, ex-vessel gross revenues are roughly comparable for the fixed gear and trawl segments of the fleet. For processing operations, a closure of the flatfish late in the year, in particular, could create a range of challenges with respect to continuity of operations and processing labor. For Kodiak shore-based processors, flatfish (year-round) accounted for roughly 10 percent of combined flatfish and other groundfish first wholesale gross revenues on an annual average basis in recent years, and roughly 5 percent of first wholesale gross revenues for all species combined.

Although non-pollock groundfish fisheries serve an important role in King Cove and Sand Point economies, those communities are likely to be largely unaffected by any closure that occurs after the Pacific cod A season, as the catcher vessel sector has little involvement in any other Western Gulf non-pollock trawl fisheries. As a consequence, the impacts of any Chinook PSC limit, except for the most constraining limits, to King Cove and Sand Point are likely to be minimal. In most other Alaska communities, the scope of overall impacts anticipated to result from any of the management alternatives assessed for the proposed Chinook PSC limits, however, community-level impacts would likely not be discernible for most of the engaged communities.

In general, adverse community-level impacts are not likely to be significant for any of the involved communities, and the sustained participation of these communities in fishing would not generally be put at risk by this action; however, some individual operations in the Kodiak trawl fleet and the Kodiak processing sector that are substantially dependent upon Gulf groundfish trawl fisheries, adverse impacts occur, especially under the more constraining Chinook PSC limits.

Table 4-79 Shore-based processors annual average first wholesale gross revenues from deliveries of GOA groundfish by gear type and by Alaska community of operation, 2003 to 2010

Community*	First Wholesale Gross Revenues by Gear Sector (Millions of Dollars)			Percentage of Combined Total
	Trawl	Hook-and-Line	Combined	
Kodiak	$75.6	$8.5	$84.1	75.6%
All Other Geographies	$25.5	$1.6	$27.1	24.4%
Total	$101.1	$10.1	$111.2	100.0%

*Table displays all Alaska communities with at least 4 or more processors present each year (minimum to allow data disclosure for each individual year).

4.7.6 Impacts on Tax Revenue

In addition to impacts on community economies, if groundfish fisheries are constrained by Chinook PSC limits, fisheries tax revenues on groundfish harvests will be lost to both the State of Alaska and the communities. The State will lose fishery business tax revenues equal to 3 percent of the ex-vessel revenues of any shore plant deliveries (and 5 percent of any floating processor deliveries) that are lost because the limit constrains harvests. In addition, the State of Alaska would lose fishery landing taxes on groundfish processed outside of the 3 mile limit that are first landed in Alaska, most of which is harvested and processed by catcher/processors. The tax is generally 3 percent of the unprocessed value of the harvested resource. Consequently, the lost revenues would be those groundfish that are unharvested because of the limit on Chinook PSC. In addition, a seafood marketing assessment is levied at a rate of 0.5 percent on the value of processed seafood products that are first landed in or exported from Alaska.

Some municipalities also levy raw fish taxes on fish first landed at processing plants located in their communities. These tax revenues would also be lost, if any Chinook PSC limit causes a closure. Municipalities that charged a raw fish tax on GOA groundfish deliveries in 2010 are shown in Section 4.4.13.2. Also reported in the table is each municipality's population, raw fish tax rates, 2010 reported raw fish tax revenue, and estimated average annual tax revenue from GOA non-pollock groundfish fisheries from 2003 to 2011.

Municipalities that charged a raw fish tax on GOA groundfish deliveries set the tax rate at 2% of ex vessel revenue. King Cove was the only municipality to charge a Fisheries Impact Tax and it is set at a flat rate of $100,000. The Fisheries Impact Tax is levied against the local processor, to help pay for city resources used by the plant. The cities of King Cove, False Pass, and Sand Point impose a 2% fish tax in addition to the 2% fish tax imposed by the Aleutians East Borough. Chignik imposes a 2% fish tax on vessels and a 1% fish tax on processors. Unalaska imposes a 2% fish tax. Estimates of the municipal fish taxes cannot be reported, because fewer than three groundfish processors are located in each community.

Instead of a raw fish tax, the Kodiak Borough imposed a severance tax of 1.05% on harvested natural resources, including fish. In June 2011, Kodiak lawmakers increased the Borough's severance tax rate to 1.25%. In general, the reductions in raw fish taxes assessed by municipalities would, potentially, have the greatest impact on the community of Kodiak. Under the proposed action, their groundfish tax revenues would be reduced when the Chinook PSC limits cause closures of the Central GOA non-pollock groundfish fisheries, reducing harvests from those fisheries.

4.8 Analysis of Impacts: Alternative 3, Full Retention of Chinook Salmon PSC

Alternative 3 would require full retention of salmon by all non-pollock trawl vessels. This provision would require a regulatory change to existing requirements prohibiting salmon retention in the GOA non-pollock fisheries. Current regulations require vessel operators to discard salmon when an observer is not aboard. When an observer is aboard, they are required to allow for sampling by an observer before discarding prohibited species.

Analysis of Alternative 3 is qualitative, and directly relates to the management and enforcement analysis in Section 5. As of 2013, under the restructured observer program, most CP vessels are in the full coverage category, and will always carry an observer onboard (see full description in Section 5.1.1). In the case of CVs, requiring Chinook salmon to be brought to shore when an observer is not present on board is not expected to impact deck operations, or to be onerous in terms of utilizing hold space.

Requiring full Chinook salmon retention on unobserved trips could, at some point in the future, increase the amount of biological sampling that occurs on Chinook salmon, potentially including genetic samples.

Increased biological sampling and data collection are likely to aid in addressing the knowledge gaps identified in Section 4.7.2. As stated in that section, the best available data do not yet distinguish between trawl-caught Chinook salmon of local origin and trawl-caught Chinook salmon from biologically threatened runs. Understanding the stock origin of Chinook salmon taken as PSC will improve managers' ability to assess both impacts on Chinook salmon users and net benefits to the nation.

As described in Section 5.1.2, implementation of this alternative would not modify observer sampling procedures. Under the agency's current procedure for genetic sampling of Chinook salmon, the implementation of this alternative without effective monitoring tools would not allow NMFS to verify that full retention of salmon has occurred aboard unobserved vessels. If Alternative 3 is implemented in conjunction with a PSC limit as considered under Alternative 2, incentives to under report salmon PSC may exist, depending on how constraining the limit is perceived to be. Consequently, NMFS would not have in place the requisite conditions for conducting an offload census of retained salmon, as is used in the pollock fishery, to improve estimates of Chinook salmon PSC for catch accounting purposes, nor would it be able to take systematic genetic samples of retained salmon in accordance with the Pella and Geiger (2009) approach, as is used in the Bering Sea and GOA pollock fisheries. In Section 5, the agency notes that a different sampling methodology could perhaps be considered for these fisheries, but such an approach has yet to be investigated. In terms of direct costs to harvesters, Alternative 3 would require an observer sampling station onboard CP vessels; this would only be an additional cost to one vessel, as most have already added this facility as part of participation in the Amendment 80 fishery.

5 Management and Enforcement Considerations

5.1 Status Quo

NMFS estimates Chinook salmon prohibited species catch (PSC) for the Gulf of Alaska (GOA) trawl fisheries based on data from the North Pacific Groundfish Observer Program (Observer Program) and mandatory fishing industry reports. This section describes observer coverage, observer sampling, catch estimation, and inseason management in the GOA trawl fisheries. In some sub-sections, descriptions of pollock and non-pollock fisheries are provided in order to compare the methods that are currently being used for PSC limits in the GOA pollock fishery and the status quo in other GOA trawl fisheries.

5.1.1 Observer Coverage and Monitoring

5.1.1.1 Observer Coverage under restructure

In October 2010, the North Pacific Fishery Management Council (Council) took final action on Amendment 76 to the GOA Groundfish FMP to restructure the Observer Program for vessels and processors (NPFMC 2010c). The final rule to implement the restructured program became effective in 2013.

The new Observer Program makes important changes to how observers are deployed, how observer coverage is funded, and the vessels and processors that must have some or all of their operations observed. These changes reduce sources of bias that jeopardized the statistical reliability of catch, bycatch, and PSC data collected by the program, address cost inequality among fishery participants, and expand observer coverage to previously unobserved fisheries.

All sectors of the groundfish fishery, including vessels less than 60 feet length overall (LOA) and the commercial halibut sector, are included in the new Observer Program. Coverage levels are no longer based on vessel length and processing volume; rather, NMFS has the flexibility to decide when and where

to deploy observers based on a scientifically defensible deployment plan. The new Observer Program places all vessels and processors in the groundfish and halibut fisheries off Alaska into one of two observer coverage categories: (1) a full coverage category, and (2) a partial coverage category.

Under observer restructuring, regardless of length, nearly all GOA catcher/processors (CPs) are included in the full coverage category and carry an observer on every trip.[56] In addition, all CPs fishing in Rockfish Program sideboard fisheries or fishing under the authority of a rockfish cooperative fishing quota (CQ) permit are required to carry 2 observers (often called "200% observer coverage") and all GOA catcher vessels (CVs) participating in the Rockfish Program are in the full coverage category and carry an observer on every trip.

The 2013 Annual Deployment Plan (ADP) (NMFS 2013a) describes the methodology to deploy observers on vessels in the partial coverage category. In preparing the ADP, NMFS also found the Environmental Analysis for the restructured observer program was adequate and did not need to be supplemented (NMFS 2013b). In brief, NMFS implemented the partial coverage category in 2013 by placing vessels in one of three observer selection pools with differing requirements:

- *No selection:* Vessels less that 40 ft LOA or fishing with jig gear are in the "no selection" pool which means that they will not be selected for observer coverage. NMFS will not to deploy observers on these vessels in 2013 due to logistical issues. NMFS will consider expanding coverage to vessels less than 40 ft and/or vessels fishing with jig gear if data collection needs warrant coverage and logistical issues are resolved.

- *Vessel Selection*: This category applies to CVs fishing with hook-and-line and pot gear that are less than 57.5 ft LOA. A sub-set of these vessels will be required to take observers for every groundfish or halibut fishing trip that occurs during a specified 2-month period.

- *Trip Selection*: This category applies to all CVs of any length fishing with trawl gear, and to hook-and-line and pot gear CVs that are greater than or equal to 57.5 ft LOA. Vessel owners or operators whose vessel is in the trip selection pool are required to log each fishing trip into the Observer Declare and Deploy System (ODDS) and each trip has a probability of being selected for observer coverage.

Under the restructured Observer Program, all shoreside processing facilities in the GOA are under the partial coverage category. However, in the first year of the program, all observer coverage in shoreside processing facilities in the GOA will occur during deliveries of pollock to Kodiak to prioritize the collection of genetic samples for Chinook salmon. Some processors that take pollock from both the GOA and the BS are in full coverage when they are receiving or processing BS pollock.

The restructured Observer Program is anticipated to reduce the number of vessels without any chance of coverage, increase the number of vessels in the partial coverage category, and result in an overall increase in observer coverage due to full coverage requirements on CPs. The sampling methods achieve representative sampling of fishing events for trawl vessels in the partial coverage category and will reduce sampling bias that results from non-representative deployment of observers (deployment bias). The random deployment result in observer coverage that is proportional to fishing effort; vessels that make more trips will receive more observer coverage. Thus, combinations of gear, time, target, and FMP area

[56] The following CPs may be included in the partial observer coverage category: (1) CPs less than 60 ft. LOA with a history of CP and CV activity in a single year from January 1, 2003, through January 1, 2010; (2) any CP with an average daily groundfish production of less than 5,000 pounds round weight equivalent in the most recent full calendar year of operation from January 1, 2003, to January 1, 2010; or (3) CPs that processed no more than one metric ton round weight of groundfish on any day (up to a maximum of 365 mt per year) in the previous calendar year.

combinations with high amounts of effort are expected to receive more observer coverage than those with low effort.

Since 2013 is the first year of the new Observer Program it will take time before NMFS can evaluate how observer deployment in the GOA non-pollock trawl fisheries compares to what was seen in the past. However, through the analysis presented in the 2013 ADP, the median coverage rate for vessels in the partial coverage category is anticipated to be higher than was seen under the previous deployment system (using 2011 as a comparison year) in nine of the ten trawl fisheries in the GOA. Specifically, observer coverage is expected to increase for the non-pollock trawl CV fisheries for deep-water and shallow-water flatfish, compared with the coverage prior to 2013.

5.1.1.2 Monitoring in the Rockfish Program

The Council adopted the Central Gulf of Alaska Rockfish Program (Rockfish Program) on June 14, 2010, to replace the expiring Pilot Program. The Rockfish Program became effective in 2011 and fishing under it began in 2012. Monitoring and enforcement provisions were implemented in the Rockfish Program to ensure that harvesters maintain catches within annual allocations and do not exceed sideboard limits. In addition to the full observer coverage requirements outlined in the previous section, there are several other monitoring requirements for vessels participating in the Rockfish Program. Specifically, NMFS: 1) requires that vessels participating in a rockfish cooperative or a rockfish sideboard fishery carry and use a NMFS-approved VMS transmitter; 2) requires CPs in the program to completed a NMFS-approved electronic logbook; 3) requires that CPs in a rockfish cooperative or rockfish sideboard fishery follow specified catch handling procedures prior to processing; 4) requires the weighing of all catch from rockfish cooperatives on NMFS or State approved scales; and 5) requires that shoreside processors receiving rockfish CQ operate under a NMFS approved Catch Monitoring and Control Plan (CMCP).

5.1.2 Observer Sampling

5.1.2.1 Sampling on Catcher Vessels Delivering to Shoreside Processors

When an observer is deployed on a catcher vessel (CV), they are responsible for assessing the fishing activities and determining how to sample the unsorted catch for species composition and biological information using methodologies described in the Observer Program Sampling Manual (AFSC 2013). In the GOA trawl CV fisheries, observers are expected to sample every haul for composition and biological data. In some cases, an observer is unable to sample all the hauls during a trip and is instructed to use a random break table. This could be a result of observer illness or injury, or rough weather preventing the observer from completing their duties. For each sampled haul, observers are instructed to collect a random species composition sample of the total catch. Observers are trained and encouraged to use a systematic sample whenever it is logistically feasible, and they strive to take multiple, equal sized samples from throughout the haul to obtain the largest sample size possible. However, gear handling methods in different fisheries, vessel layout, and the associated safety concerns, can restrict an observer's access to unsorted catch at sea. Therefore there are differences in the catch sampling in the GOA trawl fisheries. Descriptions of the sampling differences between pollock and non-pollock fisheries are provided in order to compare the data that are currently being used for PSC limits in the pollock fishery and what is available in other GOA trawl fisheries.

<u>Sampling on GOA trawl pollock CVs</u>

Catch of CVs fishing for pollock is generally either dropped or mechanically pumped from a codend (i.e., the end of the trawl net where catch accumulates) directly into Refrigerated Seawater (RSW) tanks. Because of the size of the codends, opportunities for sorting of any species, including salmon PSC, are extremely low. Observers attempt to obtain random, species composition samples by collecting small

amounts of catch as it flows from the codend to the RSW tanks. Therefore, in the GOA pollock fishery, observer samples are often obtained opportunistically and sample fractions vary. For uncommon species such as salmon, a larger sample size is desired and large sample sizes are generally not logistically possible on pollock CVs. For this reason, whenever possible, estimates of salmon PSC by CVs are based on counts of the salmon PSC that are generated from offload sampling that occurs during the delivery to the shoreside processor.

Sampling on GOA trawl non-pollock CVs

Unlike CVs in pollock fisheries, vessels in other GOA trawl fisheries, which include deep and shallow-water flatfish and Pacific cod, sort their catch extensively at sea. Sorting at sea is a critical attribute associated with the fisheries because of a larger amount of unmarketable bycatch. For example, vessels frequently have conveyor systems on deck to facilitate sorting of uneconomical species and PSC, which must be discarded at sea. If vessels do not have a sorting conveyor then they often sort directly from the trawl alley. Observers collect species composition samples prior to any sorting of catch by the fishing crew. Because a large amount of sorting occurs at sea and the observers are unable to monitor this sorting while engaged in other sampling duties, it is extremely difficult to verify that no salmon PSC have been discarded at sea. Because of the extensive sorting for unmarketable bycatch at sea, there is a high likelihood that salmon PSC has been sorted from the catch prior to delivery. Offload counts of salmon PSC are not possible in these fisheries because of the amount of sorting that occurs at sea in these fisheries. Therefore, PSC estimates from CVs in other GOA trawl fisheries are all derived from at-sea samples. Biological data are collected from salmon inside of the observers' composition samples. No genetic samples are collected from salmon found inside observer's composition samples since the current genetic sampling protocol developed for the Bering Sea by Pella and Geiger (2009) requires complete enumeration of all salmon and systematic sampling.

Sampling on Rockfish Program CVs

Observer sampling aboard CVs in the Rockfish Program is the same as other trawl fisheries besides pollock. However, 100% observer coverage is required so that the vessels in a rockfish cooperative obtain a vessel specific halibut PSC rate to support transferable PSC allocations. Observers collect species composition samples at sea prior to any sorting occurring. Since the majority of species caught in these fisheries are allocated to the cooperative and full retention of these species is required, sorting at sea is limited to the species that are required to be discarded such as PSC and other prohibited species like lingcod during certain times of the year. As in the pollock fishery, codends in the rockfish fishery tend to be larger and sorting at sea is limited to PSC, including salmon and halibut, which is required to be discarded but are difficult to sort from large codends as they are being dumped directly into RSW tanks. PSC estimates from CVs in Rockfish Program are derived from at-sea samples. Biological data are collected from salmon inside of the observers' composition samples. No genetic samples are collected from salmon found inside the observers' composition samples since the current genetic sampling protocol developed for the Bering Sea by Pella and Geiger (2009) requires complete enumeration and systematic sampling of all salmon.

5.1.2.2 Sampling for Salmon at Shoreside Processors

As is described in the previous section, gear handling methods differ between trawl fisheries and these factors impact observer's access to unsorted catch at sea. These factors also result in differences in the catch sampling that occurs in shoreside processing facilities in the GOA trawl fisheries. Sampling at shoreside processors for the pollock and non-pollock deliveries are described in order to compare the methods that are being used for PSC limits in pollock fishery and what data are available in other GOA trawl fisheries.

Shoreside sampling of GOA pollock deliveries

Shoreside processors in the GOA are not required to sort and weigh all catch by species prior to the offload entering the factory. Therefore, several GOA shoreside processors do not have a dedicated sorting operation and the vessel observer is frequently the only person sorting out the salmon from a delivery.

For some shoreside processors, the majority of the sorting of PSC from a pollock delivery occurs inside the processing area of the shoreside processor. This is very different from Bering Sea/Aleutian Islands (BSAI) shoreside processors, which are required by regulations to provide NMFS with a Catch Monitoring and Control Plan (CMCP) that details how the processor will ensure that all species are sorted and weighed within view of the observer. CMCPs require the processor to identify a designated sorting area that precedes the fish holding bins and processing equipment and allows an observer to monitor all locations where catch could be sorted. Under a CMCP, no other species besides pollock are allowed to enter the processing area without first being sorted and weighed. CMCPs also require a designated storage location for salmon within view of the observer at all times during the offload and specific handling requirements for salmon found during the offload.

At a GOA shoreside processor, salmon that are missed during sorting of the delivery end up inside the processing facility, which requires special treatment by the shoreside processor and the observers to ensure they are counted. These “after-scale” salmon (so called because they were initially weighed along with pollock) create tracking difficulties for the shoreside processor and the observer. Although after-scale salmon are required to be given to an observer, there is no direct observation of salmon once they are moved past the observer and into the processing area. Vessel observers currently record after-scale salmon as if they had collected them. However, after-scale salmon can better be characterized as shoreside processor reported information. The vessel observer will generally only receive this after-scale salmon information from the plant observer if a plant observer has been assigned to the processor and the processor provides the salmon to the plant observer. Further complications in shoreside processor salmon accounting occur when multiple CVs are delivering in quick succession, making it difficult or impossible to determine which CV these salmon should be assigned. Also, shoreside processor personnel may not be saving after-scale salmon for observers; therefore, after-scale salmon numbers are difficult to quantify and verify for each delivery.

In the GOA pollock fishery, shoreside processors have been requested to sort the salmon from the offload, place them in a tote, and notify the plant observer that the offload is complete so the plant observer can collect biological data. The biological data include: sex/length, scales to enable identification of species, sex/length/weight, genetic samples, and coded-wire tags (CWT). Sex/length, scales, and CWT data, are collected from all salmon species but currently genetic samples and sex/length/weight data are only collected from chum and Chinook salmon. Using a similar method in the BSAI pollock CV fishery, observers are instructed to follow a random systematic sample design to collect biological data for chum and Chinook salmon.

Shoreside sampling of non-pollock deliveries

In all CV trawl fisheries other than pollock, biological data are only collected from those salmon encountered within the at-sea composition samples. Biological data are not collected at the shoreside processor. Additionally, no observers are currently assigned to shoreside processors receiving deliveries from CV trawl fisheries other than pollock.

Shoreside sampling of Rockfish Program deliveries

Shoreside processors in the central GOA receiving catch from vessels participating in the Rockfish Program are required to operate under a CMCP that details how the processing plant will ensure that all catch delivered is sorted and weighed to species within view of a CMCP specialist. The CMCP specialist

is a NMFS employee who monitors portions of the offloads to ensure that the processor is following their CMCP and provides feedback to the processors to improve sorting and weighing of all species delivered. Biological data are not collected from salmon encountered during the delivery. No observers are currently assigned to shoreside processors receiving deliveries from CV trawl vessels in the Rockfish Program.

5.1.2.3 Sampling on Trawl Catcher/Processors

Sampling methods used on catcher/processors (CPs) allow observers to collect larger species composition samples under more controlled conditions than CVs because the observer is able to collect samples downstream of the fish holding tanks, just prior to the catch sorting area that precedes the fish processing equipment. Crew sorting of catch is done under more controlled conditions than aboard CVs and all CPs have at least one observer aboard. Additionally, on many CPs that are in the Rockfish and Amendment 80 Programs, the observer has access to catch weighing scales and an observer sampling station. Many CPs that participate in these cooperatives also have flow scales which enhance an observer's ability to collect larger samples. Although these flow scales and observer sample stations are not required outside the Rockfish or Amendment 80 Programs, most CPs continue to use the flow scale and allow the observer access to the sampling station in other fisheries in the GOA. Biological data are collected from those salmon encountered within the species composition samples, but currently no genetic samples are collected from these salmon. The number of salmon PSC in each haul is derived from observer samples. Because observers are frequently completing other duties during the sorting of each haul and may not be available during the end of a haul, the total salmon count per haul, or census, is not available.

5.1.3 Prohibited Species Catch Estimation

NMFS determines the number of Chinook salmon PSC in the GOA groundfish fisheries using the catch accounting system (CAS). The catch, bycatch, and PSC estimation methods are described in detail in Cahalan et al. 2010. The CAS was developed to receive catch reports from multiple sources, evaluate data for duplication and errors, and estimate total catch by species (or species group). The catch estimates are specific to species and fisheries to allow effective monitoring of the allocations in the Federal regulations and annual harvest specifications. In general, the degree to which a seasonal or annual allocation requires NMFS management is often inversely related to the size of the allocation. Often, the smaller the catch limit, the more intensive the management that is required to ensure that it is not exceeded.
Industry reports of landings and production are generated for all fishing activity in Federal groundfish fisheries through a web-based interface, eLandings. Each industry report submitted via eLandings undergoes error checking. Data are then stored in a database and made available to the three collaborating agencies: NMFS, Alaska Department of Fish and Game, and the International Pacific Halibut Commission. There are two basic eLandings report types used for catch estimation:

- Production Reports: At-sea production reports are mandatory for CPs and motherships that are issued a Federal Fisheries Permit. At-sea production reports include information about the gear type used, area fished, and product weights (post-processed) by species. As of 2009, the at-sea processors have submitted these reports daily (prior to 2009, at-sea production reports were submitted weekly). Shore based plants also complete production reports, but these are not used for PSC estimation.
- Landing Reports: when a CV makes a delivery to a shoreside processor a landing report is required. On making a landing, a representative of the shoreside processor submits the landing report into eLandings and a paper "fish ticket" is printed for both the processor and the CV representative. The collection period for a landing report is a trip where a trip is defined as the time period between when fishing gear is first deployed and the day the vessel offloads groundfish. Landing reports are mandatory for all processors required to have a Federal Processor Permit, including motherships who receive groundfish from Federally permitted CVs.

As was described in the previous section, there are differences in observer sampling between vessel types and fisheries in the GOA and the diversity of sampling methods results in differences in how PSC is estimated among fisheries. The estimation methods are described in the following sections. A description of PSC estimation in the GOA pollock fisheries is also included to contrast the data and methods that are being used to manage the PSC limit in that fishery and what is available in other GOA trawl fisheries.

5.1.3.1 PSC Estimation in GOA Pollock Trawl Fisheries

For each vessel trip, observer sampling for salmon on pollock CVs in the GOA is conducted as follows: (1) samples are taken from each tow while the vessel is at sea, and (2) the entire observed offload is followed into the shoreside processor as the catch is delivered and a count of delivered salmon is completed by the vessel observer. The on board vessel observers assess any PSC that is discarded at sea and the total amount of PSC discarded at sea is added to the salmon counted at offload to obtain the total amount of species-specific PSC for the trip. NMFS uses the total discard information (estimated salmon discard at sea plus salmon counted at offload) to create PSC rates that are applied to unobserved vessels and hauls. There are rare circumstances where the offload count is not completed, for example if a vessel observer was ill and could not monitor offload, and a plant observer was not available to assist with the offload sampling. If the offload data are not available, then NMFS uses the at-sea samples and extrapolates that sample to the entire delivery of groundfish. Spatial information is obtained by apportioning the total estimate of salmon for an observed trip (at-sea estimate plus offload count) to a haul based on the amount of haul-specific groundfish.

In the CAS, the observer data are used to create PSC rates (a ratio of the estimated PSC to the estimated total catch in sampled hauls). The observed information from both at-sea samples and offload counts is used to create PSC rates that are applied to unobserved vessels. For trips that are unobserved, the PSC rates are applied to industry supplied landings of retained catch. Depending on the observer data that are available, the extrapolation from observed vessels to unobserved vessels is based on varying levels of aggregated data (post-stratification). Data are matched based on processing sector (e.g., CVs), week, fishery (e.g., Pacific cod), gear (e.g., non-pelagic trawl), and Federal reporting area. Further detail on the estimation procedure, including levels of post-stratification is available in Cahalan et al. (2010).

5.1.3.2 PSC Estimation in GOA Non-Pollock Trawl Fisheries

Chinook salmon PSC estimates from trawl CP and non-pollock trawl CV fisheries in the GOA are based on at-sea sampling for salmon. NMFS uses the at-sea samples on observed trips and extrapolates the sample to the week (CP) or trip (CV). These estimates are used to create PSC rates that are applied to unobserved vessels. As described in the observer sampling section, observers use a systematic sample and they strive to take multiple, equal sized samples from throughout the haul to obtain the largest sample size possible. However, even with large sample sizes that reduce detectability issues, Chinook salmon is a relatively uncommon species and is characterized by an over-dispersed data distribution. This distribution is characterized by many small and zero counts (i.e., right skewed distribution) with occasional large counts. There is a relationship between the abundance of given species in a haul, sample size, and the level of precision in the resulting estimate of species catch from sampling. In general, we can have very high precision in the catch estimate for common (target species) with very small samples of the haul. Conversely, even extremely large samples of a haul provide relatively imprecise estimates of catch for very rare species.

<u>PSC estimation on CPs and Rockfish Program CVs</u>

As described in the previous section, under the restructured observer program all CPs and any vessels participating in the Rockfish Program are in the full observer coverage category and all of their trips are

observed with at least one observer (or in the case of CPs participating in the Rockfish Program fisheries, with two observers). On observed vessels, the estimates of the Chinook PSC are specific to the observed vessels' data. The observer samples are extrapolated to the haul and the amount of PSC in the sampled hauls is used to calculate a vessel specific PSC rate for the week (CPs) or trip (CVs).

All CPs are required to have the Atlas software for observers to enter and transmit their data while at sea. CVs in the Rockfish Program are also required to use Atlas software; however, the observers transmit at the end of the trip at the shoreside processor. After deployment in the field, which may be as long as three months, observers review their data with NMFS staff and ensure that data were collected following NMFS protocols. The use of Atlas software increases the timeliness and quality of the observer data, since the software contains data quality checks. However, there it is still normal for there to be data modifications during this "debriefing" and quality control process.

PSC estimation on non-Rockfish Program CVs

Non-pollock catcher vessels that are not participating in the Rockfish Program, which includes vessels participating in shallow-water flatfish, deep-water flatfish, and Pacific cod fisheries, are in the partial coverage category and their trips are randomly selected for observer coverage. In estimating PSC, the Chinook estimates on observed trips are specific to the observed vessels' data, while unobserved vessels receive PSC rates that may be averaged across multiple vessels and trips. As a consequence, salmon PSC information from multiple observed vessels is averaged into PSC rates that are used for multiple unobserved vessels. From an inseason management perspective, the PSC rates on unobserved vessels change as additional observer information is obtained. This creates temporal variation in Chinook salmon PSC estimates, resulting in uncertainty associated with inseason management of Chinook salmon PSC limits. This uncertainty complicates management of salmon PSC limits because PSC rates can change from day-to-day, resulting in PSC estimates that oscillate around limits in concert with changing observer information.

The catch estimation methods are designed to provide an estimate of catch, bycatch, and PSC as quickly as possible so that inseason managers have information to make decisions. The CAS makes use of observer data as soon as they are available, but the estimates are updated and refined as more observer data becomes available. For trawl CVs in the GOA, it may take anywhere from a few days to over a week for NMFS to receive preliminary observer data. After deployment in the field, which may be as long as three months, observers review their data with FMA Division staff and ensure that data were collected following NMFS protocols. It is normal for there to be many data modifications during this "debriefing" and quality control process. For all of these reasons, PSC estimates change on a regular basis, and there can be large variations in the estimates until well after the fishery is closed and smaller variations as the observer data are finalized in late February to early March of the year following the fishery.

5.1.4 Inseason Management of GOA Non-Pollock Trawl Fisheries

The GOA non-pollock trawl fisheries include shallow-water and deep-water flatfish and Pacific cod. These fisheries can be high-pulsed fisheries due to the amount of seasonal or annual allocations and the fleets catch rates. A fishery may open for only a few days, and NMFS may announce the closure date of non-pollock fisheries before the fishery actually opens. High-pulsed fisheries are challenging to manage, and a brief explanation of the challenges for these fisheries is provided.

Prior to the fishery opening, for high-pulsed fisheries the CPs and/or shoreside processors that have historically participated in the fisheries are contacted and the amount of expected effort is calculated. NMFS then queries historical catch rates based on that effort and projects a range of possible catch rates. To account for uncertainty and to be conservative, estimated catch is calculated using historical maximum

catch rates and the most recent information. NMFS then projects a closure date and makes a decision whether to announce a closure prior to the opening of the season or to manage inseason. Managing inseason is defined as allowing the fishery to open with no closure date announced, collecting information while the fishery is ongoing, and using that information to project a closure date.

The decision to manage inseason is made if the allocation is large enough to allow NMFS the time to assess the catch rates and close the fishery before the allocation is exceeded. The weekday that the fishery opens must also be taken into account. To close a fishery, NMFS processes the required paperwork at least one working day before the closure. A Federal closure notice is required to be published in the *Federal Register* which is open Monday through Friday; therefore, closures for Friday, Saturday, or Sunday have to be decided before Friday.

In projecting a closure date there is a risk that the fleet will not harvest the entire directed fishing allowance in which case the fishery may need to reopen. To reopen the fishery, NMFS has to ensure that all catch information has been reported and that there is enough remaining directed fishing allowance to reopen the fishery. NMFS usually has enough information to make a decision approximately three to five days after the closure. NMFS will then calculate catch rates, determine why the allocation was not fully harvested, and examine other factors (such as weather, participation) before determining if a fishery needs to reopen. If a fishery reopens then NMFS must then go through the same protocol and associated timeline discussed above for issuing a closure. To ensure the fleet has prior notice and is available to participate, NMFS usually will reopen a fishery about four days after the day it is announced. There is usually about a week between the closure and the subsequent reopening.

Table 5-1 shows that, from 2007 through 2012, an average of three shoreside processors, 21 CVs, and 13 CPs participated in the Western GOA non-pollock trawl fisheries (Area 610). In the Central GOA (Areas 620 and 630), an average of 11 shoreside processors, 40 CVs, and 10 CPs participated in non-pollock trawl fisheries over the same time period. The largest increase over these years was the 2012 increase of 48 catcher vessels in the Central GOA.

Table 5-1 Number of shoreside processors (SP), catcher vessels (CV), and catcher/processors (CP) in the Western and Central non-pollock trawl fisheries, by year, 2007 to 2012

Area	2007			2008			2009			2010			2011			2012			Average 2007 to 2012		
	SP	CV	CP	SP	CV	CP	SP	CV	CP	SP	CV	CP	SP	CV	CP	SP	CV	CP	SP	CV	CP
WGOA	4	28	13	2	24	11	2	25	14	4	15	13	3	12	14	4	24	15	3	21	13
CGOA	11	37	9	11	41	10	9	34	12	10	38	10	13	42	8	10	48	8	11	40	10

Source: NMFS Catch Accounting System.

Rockfish Program

The Rockfish Program allocates PSC limits for halibut but does not include limits on salmon PSC. The rockfish cooperatives have developed awareness of the importance of avoiding Chinook salmon. For the CV sector participants, the Rockfish Program cooperatives require hotspot reporting on Chinook salmon rates from the fishing grounds. This information can be helpful for vessels to avoid salmon; however, there is a lot of variance between vessels, times of day, and locations. Some vessels have tried salmon excluder devices designed for the pollock fisheries, but the current design does not appear to function well in the rockfish fishery. The fleet will need to invest in new technologies to develop a functional excluder device for the rockfish fishery. Further tools will need to be developed as the fleet continues to research avoidance tools.

Amendment 80

In 2008, Amendment 80 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (Amendment 80) established a limited access privilege program for the non-AFA trawl CP sector. Since 2011, the Amendment 80 CPs, except the F/V GOLDEN FLEECE, formed two cooperatives, Alaska Seafood Cooperative and Alaska Groundfish Cooperative. These cooperatives were formed to manage Amendment 80 species in the BSAI, but the cooperatives also are used to manage fisheries they pursue in the GOA. Cooperatives provide tools for more precise and efficient management of allocations than NMFS inseason management. However, salmon PSC limits shared by two cooperatives would require management by NMFS unless the two cooperatives developed an inter-cooperative agreement. An inter-cooperative agreement could be voluntary or regulated by NMFS. The inter-cooperative agreement would have to include all non-AFA trawl CPs including the F/V GOLDEN FLEECE since they would not be exempt from the Chinook salmon PSC limits and are not a member of an Amendment 80 cooperative.

The Amendment 80 Program established groundfish and halibut PSC sideboard limits to limit the ability of Amendment 80 Program participants to expand their harvest efforts in the GOA. In the Western and Central GOA, these sideboard limits include pollock and Pacific cod, and in the Western GOA include Pacific ocean perch, dusky rockfish, and northern rockfish. The F/V GOLDEN FLEECE is exempt from these sideboard limits; however, it is prohibited from directed fishing for pollock, Pacific cod, Pacific ocean perch, pelagic shelf rockfish, and northern rockfish in the GOA. The Amendment 80 vessels use the cooperative structure to help NMFS inseason management manage the Amendment 80 GOA sideboard limits.

5.2 Alternative 2: Chinook salmon PSC Limit

Alternative 2 would create a PSC limit or hard cap for Chinook salmon in the non-pollock trawl fisheries with various options for how the limit could be subdivided by management area (Option 1), operation type (Option 2), time of year (Option 3). Option 4 would allow a separate PSC limits for the Rockfish Program entities.

The implementation of Alternative 2 and the associated PSC limits in the GOA non-pollock trawl fisheries would require various changes to Federal regulations and NMFS management practices, when compared to the status quo. Depending on the options and suboptions selected, these changes would include changes to inseason management, monitoring requirements, catch accounting, and enforcement responsibilities. These options are summarized in Table 5-2 and described in the following sections.

Table 5-2 Summary of the management, PSC estimation, and monitoring for sectors of the GOA non-pollock trawl fishery under the status quo and other considered alternatives

		Rockfish Program CPs	Non-Rockfish CPs*	Rockfish Program CVs	Non-Rockfish Program CVs**
Alternative 1: Status Quo		• 200% observer coverage ("pay as you go" by industry). • NMFS-approved flow scale. • Observer sampling station. • Atals software • elogbook • Must follow specified catch handling procedures. • VMS	• Full observer coverage ("pay as you go" by industry). • Atlas software • Must follow specified catch handling procedures. • VMS	Catcher vessels: • Full observer coverage ("pay as you go" by industry) when checked to Rockfish Program • VMS • Atlas software Shoreside processors: • Operate under NMFS-approved CMCP • NMFS CMCP Specialist monitors rockfish deliveries	Catcher vessels: • Partial observer coverage (paid for from observer fee). Shoreside processors: • Partial coverage – however in 2013 no shoreside observers other than GOA pollock deliveries.
Alternative 2: Chinook Salmon PSC limit	Options 1-3: Fishery, area, or sector PSC limits (based on extrapolated observer data)	• Maintain 200% observer coverage & monitoring as under status quo.	• Maintain current full observer coverage & monitoring levels as under status quo.	• Maintain current full observer coverage & monitoring levels as under stauts quo. • No changes to shoreside observer coverage.	• Maintain current partial observer coverage as under status quo. • No changes to shoreside observer coverage. • Note that timeliness of data and high variance in the estimates likely make it extremely difficult to accurately manage a small PSC limit.

Table 5-2 continued

		Rockfish Program CPs	Non-Rockfish CPs*	Rockfish Program CVs	Non-Rockfish Program CVs**
Alternative 2: Chinook Salmon PSC limit (continued)	Option 4: PSC limit for entities (census-level accounting)	• Maintain 200% observer coverage & monitoring as under status quo. • Salmon storage container. • Video monitoring of all locations where salmon could be sorted and the salmon storage container. • Retain all salmon for observer and remove salmon from area once observer has completed sampling.	Not applicable	Catcher vessels: • Maintain current full observer coverage & monitoring as under status quo. • Retain all salmon until delivery to processor. Shoreside processors: • 200% observer coverage at plant; full coverage, "pay as you go" by industry. • Additional CMCP requirements. • Designate a salmon storage area at processor. • Retain all salmon for observer and remove salmon from area once observer has completed sampling.	Not applicable

Table 5-2 continued

	Rockfish Program CPs	Non-Rockfish CPs*	Rockfish Program CVs	Non-Rockfish Program CVs**
Alternative 3: Full retention to enable biological sampling	• Maintain 200% observer coverage & monitoring as under status quo. • All salmon must be retained from each haul until the observer has had the opportunity to collect biological samples. • Designated area to store the salmon.	• All salmon must be retained from each haul until the observer has had the opportunity to collect biological samples. • Designated area to store the salmon. • Observer Sampling Station.	Catcher vessels: • Retain all salmon until delivery to a processor. Shoreside processors: • Processor must retain all salmon from each trip until a sampler has had the opportunity to collect biological samples.***	• Full retention not feasible under current fishing and sorting practices from both CVs and shoreside processors. • Observers could collect genetic samples from salmon encountered in species composition samples however a new genetic sampling protocol would need to be developed. Number of samples that could be collected likely low due to rare occurrence of Chinook.
	Note: samples would be combined and analyzed as a single strata. NMFS would conduct genetic stock composition analysis; however, it may not be possible to determine the stock composition of the catch and results could be limited to presence of stocks.			

* Includes CPs fishing under Rockfish Program sideboards or Amendment 80 sideboards, but does not include the F/V GOLDEN FLEECE.
** Includes CVs participating in the GOA Pacific cod and shallow & deep water flatfish fisheries.
*** Could be a sampler provided by industry, or NMFS staff, or an observer.

5.2.1 Management of PSC Limits (Hard Caps)

The management methods used for a PSC limit depends on whether NMFS manages PSC limits for a group of vessels or whether these PSC limits are allocated among specific entities within a fishery. There are two general types of PSC limits: 1) fishery, area, or sector-level PSC limits; and 2) PSC limits to specific entities.

5.2.1.1 Management of fishery, area, or sector-level PSC limits (Options 1-3)

PSC limits by fishery (e.g. non-pollock trawl) or area (e.g. Central and Western GOA) or sector (CV and CP) would be non-transferable Chinook salmon PSC limits managed by NMFS with a directed fishing closure once this limit was reached. This would be similar to how current PSC limits in the GOA pollock fishery are managed. For example, a notice is issued in the *Federal Register* to close directed fishing for GOA pollock as a result of reaching the Chinook salmon PSC limit. These closures apply to all vessels participating in the relevant directed fisheries. Any vessel fishing after the closure is in violation of regulations governing the closure.

As was described under the status quo, the decision to manage a fishery inseason is made if the catch limit is large enough and the data are available to allow NMFS the time to assess the catch rate and close the fishery before the catch limit is exceeded. NMFS' ability to manage Chinook salmon PSC limits in the GOA non-pollock fisheries is likely to be difficult for several reasons:

- depending on which option was selected, the PSC limits could be very small and the smaller the catch limit, the more conservative the management that is required to ensure that the catch limit is not exceeded;
- non-pollock trawl fisheries can be high-pulsed fisheries; however, there is a time-delay in getting the data needed to derive PSC estimates, the observer data can change substantially throughout the fishery and debriefing process;
- high variance in the Chinook salmon PSC estimates which are derived from at-sea samples that are extrapolated to the haul level on the observed vessel and then all hauls extrapolated to the unobserved trips.

For these reasons, NMFS would likely need to take a conservative inseason management approach and there are likely to be constraints on the ability of the fleet to fully harvest target species, especially in fast-paced fisheries and in years of high PSC.

For the GOA non-pollock trawl fisheries NMFS would consider PSC limits that are less than the historic highest weekly rate for the managed fishery to be too small to manage inseason. For the non-pollock trawl CV and CP sector fisheries these amounts are about 1,500 Chinook salmon a week each for the Central GOA and 1,000 Chinook salmon for the CPs and 100 Chinook salmon for the CVs for the Western GOA. These estimates include the rockfish fisheries. If the fishery that is limited by the Chinook salmon PSC is managed under a catch share program then a lower PSC limit may be possible for an entity to manage accurately. An annual record of the highest weekly PSC event, by area or by operational type sector, is provided in Table 4-44.

Following is a description of the challenges inherent in managing small PSC limits in an open access fishery using the pollock fishery as an example. In the 2012 Western GOA C and D season pollock fisheries, the 5,598 Chinook salmon PSC limit was exceeded by 1,258 Chinook salmon for a total PSC of 6,856 Chinook salmon. The challenge in managing the PSC limits in these fisheries is related to the timing of the fisheries and reporting of the data. In 2012, Chinook salmon PSC limits were effective for the C and D season pollock fisheries. The 2012 limits were 5,598 salmon in the Western GOA and 8,929

salmon in the Central GOA, to account for only the C and D seasons PSC compared to the full limits for all seasons in future years of 6,684 salmon in the Western GOA and 18,316 salmon in the Central GOA. The C and D season are concurrent, August 25 through October 1 and October 1 through November 1, respectively. However, in 2012, the Western GOA C season reached the total allowable catch and the season closed September 10. At that time the Western GOA pollock fishery Chinook salmon PSC was estimated as 458 salmon or 5,140 salmon below the PSC limit. The 2012 D season pollock fishery opened October 1. The Chinook salmon PSC rates are often, but not always, higher in October than September. This is one reason that the Chinook salmon PSC limit for the 2012 Western GOA C and D seasons was set at 84 percent of the annual PSC limit in future years.

In 2012, observer coverage was under the old program and was based on vessel length. For the 2012 Western GOA pollock C and D seasons, 26 vessels participated of which 6 were over 60 feet length overall (LOA) with 30% observer coverage and no vessels were 125 feet LOA or greater with 100% coverage. Twenty of the participating vessels were less than 60 feet LOA and exempt from observer coverage requirements in 2012. Five vessels had observers on board, two vessels in the C season and all five vessels in the D season. All five of the observed vessels fished both the C and D seasons. Participation by one of the six vessels over 60 feet LOA was low enough to not require observer coverage (less than 3 days).

Western GOA D season Pollock fishery opened October 1 and closed October 23, 2012. When the fishery closed the estimate for salmon PSC was 4,702 salmon or 896 salmon below the PSC limit. However, because of the timing of when observer data is available for these fisheries, not all the observer data was in the system when the fishery was closed; observer data with high PSC rates from the GOA D pollock season, appeared in the catch accounting system (CAS) 9 to 10 days after the Western GOA pollock fishery closed for 2012. It was this observer data that extrapolated to unobserved vessels and produced the PSC rates that resulted in the 2012 PSC limit being exceeded in the Western GOA. At this time in the Western GOA, the 5,598 Chinook salmon PSC limit was exceeded by 2,209 Chinook salmon for a total PSC of 7,807 Chinook salmon. The data was rechecked for possible reporting errors. However, not all of the observers had been debriefed. At this time there was a back log in debriefing since many of the observers had finished for the year. In mid-December 2012, revised observer data entered the CAS as a result of observer debriefing. As the result of debriefing changes made to the observer data the Chinook salmon PSC decreased to 6,856 salmon. The revised amount of the PSC overage is 1,258 Chinook salmon. The high rates from the observed vessels match fairly closely with the industry's fish ticket counts. It is mainly 3 high rates that are extrapolated to most of the unobserved vessels.

Compared to the Western GOA, the 2012 Central GOA C and D pollock fisheries had more vessel participation and observer coverage, 55 catcher vessels participated of which 40 were over 60 feet LOA with 30% observer coverage and none were 125 feet LOA or greater with 100%. Fifteen of the participating vessels were less than 60 feet LOA and exempt from observer coverage requirements in 2012. Thirty-six vessels had observers on board, 19 vessels in the C season and all 36 vessels in the D season. Most vessels fished both the C and D seasons. The final 2012 Chinook salmon PSC for the Central GOA C and D pollock fisheries is 8,217 Chinook salmon out of the 8,929 Chinook salmon limit with 712 Chinook salmon remaining.

Table 5-3 2012 final Chinook salmon PSC (number of salmon) and pollock catch (mt) by season

Chinook Salmon PSC					Pollock				Chinook salmon/pollock rate		
Season	**610**	**620**	**630**	**CGOA**	**610**	**620**	**630**	**CGOA**	**610**	**620**	**630**
A/B total	806	2,399	215	2,614	8,177	30,886	6,891	37,777	0.10	0.08	0.03
C total	1,649	2,982	1,380	4,362	9,339	9,107	9,039	18,146	0.18	0.33	0.15
D total	5,207	1,907	1,948	3,854	9,353	4,253	7,684	11,937	0.56	0.45	0.25
C/D total	6,857	4,889	3,328	8,217	18,692	13,359	16,723	30,082	0.37	0.37	0.20
2012 total	7,663	7,288	3,543	10,831	26,869	44,245	23,614	67,859	0.29	0.16	0.15

Source: NMFS Catch Accounting System

Small PSC limits may be for the fleet to respond to in the open access non-pollock fisheries. Depending on the option(s) selected, the salmon PSC limits proposed under this alternative could be very small. Without the management structure of a catch share program, vessels may not have the tools or the incentives to move from an area of higher salmon PSC if the race for fish still exists, particularly in high-paced fisheries. In catch share programs with PSC limits, the programs can provide the participating vessel with the tools and incentives necessary to reduce PSC while improving efficiency. Under a catch share program, the flexibility of new adaptive internal management measures may ease the burdens associated with complying with the monitoring measures and potential harvest constraints imposed by a PSC limit. Without these catch share tools, PSC limit management may be ineffective in reducing salmon PSC. In addition, in years where PSC is near the PSC limit, estimate imprecision may impose costs on industry through constraints on target species catch and the inability for fishers to realize efficiency gains created through catch share programs, particularly in a race for fish situation.

5.2.1.2 Management of PSC limits made to Rockfish Program entities (Option 4)

Catch share programs that include PSC limits to entities, such as the Rockfish Program cooperatives, give participants more specific control over their fisheries. Therefore, the general management approach changes with catch share programs. Entities that receive allocations generally are prohibited from exceeding their allocations. If they exceed an allocation, NOAA may initiate an enforcement action against the entity. Currently, halibut PSC limits are allocated the Rockfish Program cooperatives. NMFS does not issue fishery closures once these PSC limits are reached. Instead, the cooperatives monitor their halibut PSC relative to their PSC limit and are prohibited from exceeding their halibut PSC limits. Similar prohibitions against exceeding Chinook salmon PSC limits to specific entities were created under Amendment 91 in the Bering Sea pollock fishery. PSC limits that were allocated to the Rockfish Program cooperatives could include provision for transfers of Chinook salmon PSC between entities.

Option 4, suboption 2 allows for a reallocation of all but 200, 300, or 400 of the remaining Chinook salmon limit from CGOA Rockfish Program to the other non-pollock trawl fisheries on October 1st. Since the Rockfish Program ends by regulation on November 15 most of the groundfish and PSC data should be in the CAS by October 1. However, the data may still change and the amount of Chinook salmon remaining may increase or decrease until the data is finalized in February to April of the next year. NMFS would need to issue an inseason action to reallocate the PSC limit to another fishery. The completion of this action may require a week. **NMFS suggest that if the option be worded *after* October 1 instead of *on* October 1.**

5.2.2 Monitoring, Observer Sampling, and PSC Accounting for a PSC Limit

The observer sampling, monitoring requirements, and PSC accounting for a PSC limit will depend on the option or suboptions that are selected under Alternative 2 and whether NMFS manages PSC limits for a group of vessels or whether these PSC limits are allocated among specific entities within a fishery.

5.2.2.1 Monitoring, observer sampling, and PSC estimation for fishery, area, or sector-level PSC limits (Options 1-3)

As described in the previous section, the management structure under an area, time, or sector PSC limit is fundamentally different from one in which a PSC limit is allocated to an entity. In programs where PSC limits are allocated to entities, such as the Amendment 80 Program, Amendment 91, and the Rockfish Program, NMFS has concluded that use of PSC rates from observed vessels to estimate the PSC by unobserved vessels is not appropriate due to the incentive for unobserved vessels to fish differently than observed vessels. Also, it is difficult to enforce penalties for overages based in part on PSC rates from other vessels. Furthermore, the ability for vessels within a cooperative to collude could allow them to manipulate their PSC rates to the degree that NMFS would be prevented from collecting and estimating accurate PSC data. For a PSC limit to be the most effective, estimation of PSC needs to be credible to create incentives at the vessel level for Chinook salmon and other PSC avoidance. The monitoring requirements to enable PSC accounting under a catch share program, where a PSC limit is allocated to an entity, impose large costs on the industry. However, these costs may be offset by, or be small in comparison to the benefit and management infrastructure of a catch share program.

PSC accounting of Chinook salmon PSC in GOA fisheries at vessel-specific level would require implementation of sophisticated management and enforcement protocols, such as those implemented under Amendment 91 in the Bering Sea. For example, sorting at sea would need to be curtailed and shoreside processors would need to modify sorting line configurations to allow for sorting and weighing of salmon within view of an observer. In addition, a suite of monitoring tools including additional observer coverage, salmon storage containers, and video monitoring on CPs would need to be implemented. However, the catch monitoring infrastructure does not exist in the GOA to the same degree that it did in the Bering Sea when Amendment 91 was developed and the amount of change would be much greater for vessels and shoreside processors than was needed in the BSAI. These monitoring requirements would impose large costs on the industry without the benefit and management infrastructure of a catch share program. Even under Amendment 91, NMFS has concerns with the adequacy of the monitoring and the enforceability of the program, especially in years of high PSC. In an open access fishery there would be little incentive to reduce PSC, and high incentive to bias PSC accounting so the level of monitoring needed would be even greater.

For all of these reasons, the observer sampling protocols and the PSC estimation methods in the CAS would change under Alternative 2, options 1-3. NMFS would continue to use the species composition samples for obtaining Chinook salmon PSC estimates[57]. Full retention of salmon and subsequent offload sampling and counts derived at shoreside processors would not occur under this option for trawl CVs. As described under the status quo, on unobserved non-Rockfish Program CVs trips NMFS estimates of PSC are derived from PSC rates on observed trips that are applied to the unobserved trips landings data. The CAS makes use of all observer data available and if observer data are not available, the CAS aggregates (post-stratifies) the data until an appropriate PSC rate can be matched with the landings data. Under the restructured observer program, the randomization of observer coverage by trip throughout the GOA will

[57] Note that the Alaska Groundfish Data Bank, Pacific States Marine Fisheries Commission, and the observer program are working on a North Pacific Research Board project (no. 1017), funded through January 2013 that is evaluating two alternative methods of sampling catch that will be discarded at sea with the overall goal of improving precision in catch estimates derived from observer data. The project may result in changes in the sampling methodology used on CVs in the future.

mitigate the impact of the old observer program, where observer data were only available for the PSC estimates when vessels chose to take an observer. However, gaps may still occur and the review of the first year of the new observer program won't be available until June, 2014. NMFS expects that even under the new observer program it is still possible that in a given week and target there may be minimal observer data available within an area for a PSC estimate. Therefore, if a Chinook salmon PSC limit is put in place and the limit is allocated between areas then there is a possibility that the observer data from one area will contribute to the PSC rates used in the other area.

As described under the status quo, PSC estimates change on a regular basis and there can be large variations in the estimates as more observer data becomes available, data quality controls are performed, and the observer data are finalized. Decisions on quota management must be made long before the data are finalized. Changes in the PSC estimates that result from the data quality controls may make it difficult to manage a PSC limit, especially if the GOA trawl fisheries are fast-pulse fisheries. The impact of changes is exacerbated when they are applied to PSC limits that are very small.

Options 1-3 will require programming modifications to the CAS to accommodate PSC limit allocations by Federal reporting area and/or operation type (CP or CV), or season. However, PSC limits by area and operation type are not hugely complicated and will not require a large programming effort.

5.2.2.2 Monitoring, observer sampling, and PSC estimation for PSC limits made to Rockfish Program entities (Option 4)

Monitoring and managing Chinook salmon PSC limits allocated to the Rockfish Program cooperatives under option 4 would increase the complexity of changes that would be required to be made to NMFS's Catch Accounting System (CAS) and the online Electronic Fisheries Information System (eFISH) that Rockfish cooperatives use to monitoring their catch and complete transfers. Modifications to both CAS and eFISH would be required to enable NMFS and cooperatives to track PSC limits and accommodate Chinook PSC transfers.

Management of catch limits to a specific entity, like a cooperative, are enforced through regulatory provisions that prohibit the entity from exceeding its allocation therefore a more comprehensive catch monitoring and accounting system is required compared to managing catch limits at a fishery or sector level. This is particularly true when groundfish catch or PSC data collected by observers must be used as a basis for enforcement action should an entity exceed a catch limit. The catch of most target species is readily determined using observer and landings data because the target species must be retained, landed, and sold for the vessel owner to receive earnings from that catch. However, PSC generally is required to be discarded and PSC often limits the catch of economically valuable target species. The greater the potential to limit the target species catch, the greater the incentive created to not have PSC identified and estimated.

Current observer sampling and methods for estimating Chinook salmon PSC in the non-pollock trawl fisheries is described in Section 5.1. Estimates of PSC by CVs delivering to shoreside processors are based on data collected by observers. Data collected by an observer on a vessel is used to estimate the PSC by that vessel and PSC rates from observed vessels are used to estimate the PSC by unobserved vessels. There are two primary problems associated with using estimated PSC rates when enforcing a prohibition against exceeding a PSC limit:

- The CAS method of applying information from observed vessels to non-observed vessels to estimate PSC by CVs delivering to shoreside processors assumes that the observed CVs fish in a manner similar to the unobserved CVs. From a legal perspective, calculated PSC rates (based on other CVs fishing activities) do not reliably represent a vessels fishing behavior for prosecution purposes. Thus, calculated PSC rates cannot be used as a basis for imposing liability for

exceeding a PSC limit.

- As new observer information becomes available, the CAS continuously updates PSC rates, which are applied to non-observed vessels or hauls. The CAS rate calculation would continuously change account balances (positive or negative) for PSC limit holders. Thus, an entity may exceed a particular allocation due to the CAS analytical process. This can present several problems for enforcement, including whether the entity was even aware of the overage.

PSC limits that are allocated to entities are used in the Bering Sea pollock fisheries as implemented by Amendment 91 to the BSAI FMP and the allocations to the non-AFA trawl CPs under Amendment 80 to the BSAI FMP. These fisheries provide the model for NMFS's recommendations about the management and monitoring requirements that would be needed to implement a PSC limit under option 4. Amendment 80 cooperatives receive allocations of six BSAI groundfish and four PSC species. Similar to the constraint that exists as a result of a Chinook salmon PSC limit, halibut PSC by the Amendment 80 cooperatives could limit their catch of target species. The analysis prepared to evaluate the monitoring requirements for the Amendment 80 Program concluded that the use of PSC rates from observed vessels to estimate the PSC by unobserved vessels was not appropriate due to the incentive for unobserved vessels to fish differently than observed vessels and the difficulty of enforcing penalties for overages based in part on PSC rates from other vessels. Furthermore, while the Amendment 80 limited access sector was not issued cooperative quota, it could be composed of participants that acted like a single entity. The ability for such vessels to collude could allow them to manipulate their PSC rates to the degree that NMFS would be prevented from collecting and estimating accurate PSC information.

Catch monitoring tools necessary to manage the halibut PSC limit allocated to CV entities was also a large component of the implementation of the Rockfish Program. This catch share program increased the incentive of participants to misreport and high grade catch, while at the same time increasing the burden on managers to provide highly defensible estimates of catch, especially when those estimates directly impact cooperative quota holders. NMFS dealt with these issues by clearly articulating goals for the management of catch share programs and imposing new and more stringent monitoring and observer requirements as these programs have been developed.

Under option 4, with Chinook salmon PSC limits to Rockfish Program entities, NMFS recommends the following additional monitoring requirements for CVs and CPs that would enable census level accounting of Chinook salmon PSC and ensure effective monitoring and enforcement.

Rockfish Program CVs

Some of the tools that exist in the Rockfish Program for CVs that would assist with monitoring the Chinook salmon PSC limit include: 100% observer coverage to estimate vessel-specific halibut PSC at sea; CMCPs to ensure accurate sorting, weighing and reporting of all cooperative quota species; and near real time reporting of observer data. However, additional monitoring would be required to implement a census of salmon for CGOA Rockfish Program CVs. First, in addition to 100% observer coverage aboard the CVs, there would be a requirement that all salmon must be retained until delivery to a shoreside processor. Problems exist with this full retention requirement because these vessels are required to sort certain prohibited species, such as lingcod during specific times during the year and halibut PSC at all times. Also, because CGOA Rockfish Program CVs have allocations of Pacific cod and sablefish, there are times when sorting at sea could be extensive. As mentioned under the status quo description this creates challenges for an observer to monitor full retention of salmon while completing other duties.

Additionally, the shoreside processors would be required to have 200% observer coverage so that all deliveries could be monitored for sorting of salmon. Lower observer coverage (100%) might be possible if the shoreside processor only took deliveries over a 12 hour period. These plants would fall under the

full coverage requirements and would be required to procure their own observers. Observer would not be deployed under the partial coverage program and fees would not be used to fund these observers.

Finally, CMCPs and potentially shoreside processor factory configurations would need to be modified to accommodate additional monitoring requirements to ensure that observers have access to all salmon PSC prior to the fish being conveyed into the factory area of the processing plant:

- Processors would be prohibited from allowing salmon to pass from the area where catch is sorted and into the factory area of the processing plant;
- No salmon of any species would be allowed to pass the observer's sampling area;
- The observer work station currently described in regulations at 679.28(g) would be required to be located within the observation area;
- A location must be designated within the observation area for the storage of salmon, and;
- All salmon of any species must be stored in the observation area and within view of the observer at all times during the offload.

Rockfish Program CPs

Tools exist in the Rockfish Program for CPs that could assist with monitoring salmon PSC limits to entities: every haul sampled by an observer (200% coverage); the use of flow scales; and the availability of an observer sampling station. The additional monitoring that would be required to implement a census on CPs would include:

- All salmon PSC of any species must be retained until it is counted by an observer;
- Vessel crew must transport all salmon PSC from each haul to an approved storage location adjacent to the observer sampling station so that the observer has free and unobstructed access to the salmon, and the salmon must remain within view of the observer from the observer sampling station at all times;
- The observer must be given the opportunity to count the salmon and take biological samples, even if this requires the vessel crew to stop sorting or processing catch until the counting and sampling is complete;
- The vessel owner must install a video system with a monitor in the observer sample station that provides views of all areas where salmon could be sorted from the catch and the secure location where salmon are stored;
- No salmon bycatch of any species may pass the last point where sorting occurs in the factory; and
- Operators of CPs would be required to submit the count of salmon by species in each haul to NMFS using an electronic logbook.

5.3 Alternative 3: Full Retention of Salmon

Alternative 3 would require all GOA non-pollock trawl vessels to retain all salmon to enable collection of scientific or biological samples. This requirement would be focused on collection of samples from Chinook salmon; however, because it is difficult to identify salmon species unless the fish is in hand, all species of salmon would be required to be retained.

Current regulations differentiate when retention of salmon is required based on whether an observer is aboard. If an observer is aboard, vessel operators are prohibited from discarding salmon at sea until the

number of salmon has been determined and the collection of any scientific data or biological samples has been completed by the vessel observer. Retention of salmon is prohibited in the GOA groundfish fisheries, other than pollock, if an observer is not aboard.

Alternative 3 requiring full retention would not change the method by which NMFS calculates fleet-wide Chinook salmon PSC estimates. Full retention would enable the collection of biological samples, but NMFS will not have all the monitoring to verify that full retention of salmon has occurred aboard these vessels. Therefore, under Alternative 3 NMFS would not modify the catch estimation protocols and NMFS would calculate Chinook salmon PSC using the existing system of extrapolating PSC rates from observed vessels to the unobserved vessels.

5.3.1 Biological sampling under Full Retention

The GOA pollock fishery provides a useful reference point for full retention to enable collecting biological samples from salmon in the GOA. NMFS has historically collected scales, sex-length frequencies, genetic samples and coded wire tags from salmon. The GOA pollock fishery currently has a shoreside sampling program for biological samples with a focus on genetic tissues, and a secondary objective of CWT sampling. The genetic tissues collections emulate, to the extent practical, sampling methods developed for the Bering Sea (Pella and Geiger 2009) of full retention and systematic sampling. Heads are removed from the same fish selected for gentic sampling if they have a clipped adipose fin, indicating a possible CWT. The operational characteristics of the pollock fishery facilitate full retention for genetic tissue collections without a large amount of on board monitoring. In the pollock fishery, it is very common for vessel operators to retain all salmon, regardless of whether an observer is aboard, because of operational characteristics where large volumes of pollock are brought aboard and rapidly stowed in below-deck tanks. Detecting salmon as the pollock are brought aboard and stowed is likely not practical, and is considered generally unsafe due to deck space limitations and stability concerns. There is still potential for bias in the shoreside samples if at-sea operations adopt at-sea sorting practices; however, given the nature of fishing activity this bias would require considerable adjustment in fishing operations. Thus, NMFS assumes that no sporting occurred at sea for the purposes of obtaining genetic samples. NMFS is then also dependent on the shore-side processing plants to sort and set aside salmon for follow up sampling by observers. Unlike the model employed in the Bering Sea, limited coverage was assigned to the shore-side processing plants and observer sorting and verification of each delivery is not possible without significant increases in resources. Thus, observers take samples from the salmon set aside by shoreside processing plants, from catch we assume was not sorted. NMFS cannot independently ensure that all salmon were set aside, or that fish were not sorted at-sea. Comparable assumptions about at-sea sorting cannot be made for non-pollock fisheries because of different at-sea catch handling practices.

Unlike the pollock fishery, in the non-pollock fisheries there are opportunities to sort salmon at sea prior to being sampled for biological information. However, there are differences between the vessels types and fisheries that impact whether full retention for biological data collection is feasible. These differences are summarized in Table 5-2 (in the previous section) and are described here.

<u>Full Retention for Biological Sampling on GOA CPs</u>

Starting in 2013, all trawl CPs operating in the GOA have full observer coverage. Sampling on these vessels follows a randomized design. It does not follow the Pella-Geiger protocols for genetic tissue sampling as that approach was only adopted on CPs fishing for pollock in the Bering Sea. Currently the number of salmon collected through random sampling on these vessels is very low and does not follow the recommended sampling design. Full observer coverage coupled with full retention could enable Pella-Geiger protocols for genetic sampling on GOA CPs. Regulations would require CPs to retain of the salmon for each haul, notify the observer that the haul was complete, and allow the observer to collect

biological samples from these salmon. The vessels would also have to have a designated area to store the salmon and an observer sampling station where samples could be processed.

One caveat with a full retention requirement to enable genetic sampling is that there exists the potential for bias. As discussed under quota monitoring, without additional monitoring requirements there is a possible risk that not all salmon are being sorted, resulting in a potentially biased population of caught salmon from which to take biological samples. For example, without the measures put in place under in Amendment 91, such as video systems and requirements for the crew to sort and record the salmon, there are opportunities to the vessel to discard the salmon prior to allowing the observer to collect the sample. It is also difficult without additional monitoring for the observer to verify which haul the salmon came from.

Full Retention for Biological Sampling on Rockfish Program CVs

The operational characteristics for the Rockfish Program CVs, except for the hauls targeting Pacific cod and sablefish under the catch share program, are similar to the pollock fishery and thus full retention to enable collection of genetic samples following sampling methods developed for the Bering Sea (Pella and Geiger 2009) could be feasible. The regulations could be modified to require full retention. Shoreside processors and CVs operating in this fishery have CMCP requirements and at-sea observer coverage in place that would facilitate shoreside collection of salmon. In the first year of the full retention requirement for the GOA pollock fishery, NMFS has noted several issues with the ability of observers to get the needed samples and they are frequently unsure that these salmon all came from one delivery. Therefore, modifications to the CMCPs for the Rockfish Program fishery would be required to facilitate retention of salmon delineated by delivery until an observer or sampler had the opportunity to collect the genetic samples and allow salmon to be linked to a particular offload and trip. These changes would allow better characterization of the area where the salmon catch originated and other vessel trip characteristics.

Once the salmon where sorted and available at the shoreside processors then they would be retained from each trip until an observer or some other sampler was given the opportunity to collect genetic samples. Currently, under the restructured observer program, shoreside processors taking deliveries of Rockfish Program catch are under the partial coverage category. However, in 2013 plant observers are only deployed to shoreside processors for pollock deliveries in Kodiak to collect biological samples from salmon.

If plant observers also were deployed to shoreside processors for Rockfish Program deliveries this observer coverage would come at the cost of at-sea observer coverage. Methods that do not require observer coverage to collect salmon at shoreside processors may be more economical and some options that could be explored are using existing NMFS personnel currently collecting rockfish information or an industry led collection program.

A NMFS CMCP Specialist monitors the Rockfish Program deliveries to shoreside processors and there is a possibility that NMFS staff could collect some genetic samples at some offloads. However, NMFS staff are tasked with monitoring all Rockfish Program deliveries and ensuring that all cooperative quota species are sorted, weighed, and accounted for correctly and may not be able to collect genetic samples for salmon collected at the end of a delivery. While assistance may be provided to collect samples, NMFS does not see this as a long term, on-going role for staff.

Currently the industry is exploring a cooperative study with NMFS to collect biological data from Chinook salmon during Rockfish Program CV deliveries. The biological data would include scales for identification verification, sex/length/weight, genetic samples, and coded-wire tags (CWT). In this case,

planned procedure is for the biological information to be collected by an industry port sampler and samples sent to NMFS for analysis.

If the Council is interested in detecting the presence of ESA listed Chinook salmon, or hatchery produced salmon in the GOA-non pollock fishery, it also might be possible to institute the coded wire tag (CWT) tunnel detector program. However, in order to do this, the processors would need to manage the program. This would require the purchase or lease and maintenance of the coded wire tunnel detector, the training of staff to operate the machine and collect the samples and record biological information, and the delivery of the CWT fish to NMFS. Requirements for the operation and maintenance of the CWT tunnel detector and the collection of samples would need to be developed by NMFS in regulations.

Full Retention for Biological Sampling on non-Rockfish Program CVs

In non-Rockfish Program CV trawl fisheries, such as flatfish or Pacific cod fisheries, sorting at sea is very common and frequently vessels have systems on deck to facilitate this sorting. For example, vessels frequently have conveyor systems on deck to facilitate sorting of uneconomical species and halibut PSC, which must be discarded at sea. Thus, salmon is easily discarded under normal operational conditions. Additionally, even when an observer is aboard these vessels, they are frequently carrying out other sampling duties and not able to monitor all the sorting that is occurring at sea. Thus, full retention on these vessels is not feasible given the complexity of vessels with layouts designed to facilitate sorting and would likely generate biased samples. Without full observer coverage and additional monitoring tools, NMFS will have no way of verifying that full retention of salmon has occurred aboard these vessels.

The current genetic sampling protocol used in the Bering Sea (Pella & Geiger 2009) requires a count of all the Chinook salmon followed by a systematic sample for tissues. This is a resource intensive protocol. However, the potential for an alternative sampling design was raised by the SSC in October 2009 and again during its February 2013 meeting regarding genetic sampling in the non-pollock GOA trawl fishery. For example, biological samples could be efficiently collected through random sampling schemes currently used by observers deployed randomly on trips of vessels. This type of protocol would be less resource intensive but its applicability to genetic stock composition analyses would need evaluation. In summary, although full retention for genetic sampling is not feasible in the non-Rockfish Program CV fisheries, alternatives to a constant sample rate across all samples, and a non-census approach, using the current observer sampling methods could be investigated.

5.3.2 Genetic analysis resulting from Full Retention requirement

Under Alternative 3, samples from all non-pollock trawl (CPs, Rockfish Program CVs and any that could be collected in the non-Rockfish Program CVs) would be combined and analyzed as a single strata. NMFS would conduct genetic stock composition analysis; however, it may not be possible to determine the stock composition of the catch and results could be limited to presence of stocks. The results of genetic stock composition analysis will depend on the number of samples collected, the number that NMFS will be able to analyze, and the variability of the genetic composition of the samples.

In general, a minimum of 400 genetic samples for each particular strata is considered sufficient for performing genetic stock composition analysis of wide ranging stocks like salmon. Establishing a minimum sample size of 400 fish was roughly based on (1) sample sizes used in previous genetic analyses (Guthrie et al., 2013; Guthrie et al., 2012; Guyon et al., 2010a; Guyon et al., 2010b; NMFS, 2009; Wilmot et al., 1998), and (2) recommendations that the confidence value (CV) be no greater than 0.5 (defined as Standard Deviation/Estimated Value) for estimates with a 95% CV that the individual stock contributed to the fishery (Marlowe and Busack, 1995).

6 Initial Regulatory Flexibility Analysis

6.1 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.

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.

6.2 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.

6.3 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 (SBA). '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 SBA has established size criteria for all major industry sectors in the United States, including fish harvesting and fish processing businesses. Effective January 5, 2006, a business involved in fish harvesting is a small business if it is independently owned and operated, not dominant in its field of operation (including its affiliates), and if it has combined annual gross receipts not in excess of $4.0 million for all its affiliated operations worldwide.[58] A seafood processor is a small business if it is independently owned and operated, not dominant in its field of operation, and employs 500 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide. A business involved in both the harvesting and processing of seafood products is a small business if it meets the $4.0 million criterion for fish harvesting operations. Finally, a wholesale business servicing the fishing industry is a small business if it employs 100 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide.

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 when a third party controls or has the power to

[58] Effective January 6, 2006, SBA updated the Gross Annual Receipts thresholds for determining "small entity" status under the RFA. This is a periodic action to account for the impact of economic inflation. The revised threshold for "commercial fishing" operations (which, at present, has been determined by NMFS to include catcher/processors, as well as catcher vessels) changed from $3.5 million to $4.0 million in annual gross receipts, from all its economic activities and affiliated operations, worldwide.

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, controls the board of directors and/or the management of another concern. Parties to a joint venture also may be affiliates. A contractor and subcontractor are treated as joint ventures 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.

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

Small governmental jurisdictions. 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.

6.4 Reason for considering the proposed action, action objectives, and legal basis

The Council has identified the following problem statement regarding the affected areas and sectors for the proposed action. Further background information and detail on the intent of the proposed action is provided in Section 1.1.

> *Magnuson-Stevens Act National Standards require balancing achieving optimum yield with minimizing bycatch, while minimizing adverse impacts on fishing dependent communities. Chinook salmon prohibited species catch (PSC) taken incidentally in GOA trawl fisheries is a concern, and incidental take is limited in the Biological Opinion for ESA-listed Chinook salmon stocks. The Council recently adopted a PSC limit of 25,000 Chinook salmon for the Western and Central GOA pollock trawl fisheries, while also indicating an intent to evaluate Chinook salmon bycatch in the non-pollock GOA trawl fisheries, which currently do not have a Chinook salmon bycatch control measure.*

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 the Alaska Fisheries Science Center research, draft, and support the management actions recommended by the Council. The Gulf of Alaska (GOA) groundfish fisheries are managed under the Fishery Management Plan for Groundfish of the Gulf of Alaska. The proposed action represents amendments to the GOA groundfish fishery management plan, as well as amendments to associated federal regulations. Two principal objectives of the FMP amendment and proposed regulations are to reduce Chinook salmon PSC in the Central and Western GOA non-pollock groundfish trawl fisheries to the minimal practicable level, consistent with National Standard 9 of the Magnuson-Stevens Act, and to enable GOA groundfish harvests to contribute to the achievement of optimum yield on a continuing basis, consistent with National Standard 1 of the Magnuson-Stevens Act.

6.5 Number and description of directly regulated small entities

The SBA has established size criteria for all major industry sectors in the United States, including fish harvesting and fish processing businesses. Effective January 5, 2006, a business involved in fish harvesting is a small business if it is independently owned and operated, not dominant in its field of operation (including its affiliates), and if it has combined annual gross receipts not in excess of $4.0 million for all its affiliated operations worldwide.

The entities directly regulated by this action are those entities that participate in harvesting groundfish from the federal or parallel non-pollock target fisheries of the Central or Western GOA. Table 6-1 shows the estimated number of small and other entities in the Central and Western GOA fisheries that are directly regulated by the proposed action. These estimates may overstate the number of small entities (and conversely, understate the number of large entities) for two reasons.

First, these estimates include only groundfish revenues earned from activity in the exclusive economic zone off Alaska. Some of these vessels may also be active in the salmon and other state managed fisheries off of Alaska, or in fisheries off the west coast of the United States. Ideally, all such activity would be accounted for within this IRFA evaluation. The data used to define small entities in this analysis does consider revenues generated from fishing activity in the federal fisheries off Washington, Oregon and California; however, data and access limitations preclude the consideration of revenue from state-managed fisheries.

Second, the IRFA requires a consideration of affiliations between entities for the purpose of assessing if an entity is small. The estimates in Table 6-1 do not take into account all affiliations between entities. 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 IRFA under the principles of affiliation, due to their being part of the AFA pollock cooperatives.[59] Other relevant

[59] 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 when 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

cooperative programs include Amendment 80 and the Central GOA Rockfish Program. However, other means of vessel affiliation – such as common vessel ownership or processor affiliation – are not tracked in the available data, and may lead to the misclassification of a vessel as a small entity.

Table 6-1 shows the number of harvesting vessels that participated in the Central and Western Gulf non-pollock fisheries from 2003 through 2011 to provide information on how the number of directly regulated entities would have changed over time.[60] However, this analysis will focus on the number of entities that were active in 2011. It is those vessels that are assumed to be directly regulated by this action. There were 35 catcher vessels and 15 catcher/processors that fished in the regulated fisheries of the Central or Western Gulf that were not classified as small entities on the basis of either harvest revenues or affiliation. The Amendment 80 program co-ops are voluntary, and thus membership is not Agency verified. As a result, Amendment 80 participation is not considered in the table. However, the CP vessels that are listed as small entities show up as co-op members on their cooperative's public website. In effect, there have been no small entity CP vessels operating in the regulated fisheries during recent years.

Table 6-1 Estimated number of directly regulated entities (vessels) in the Central and Western GOA non-pollock trawl fisheries

Year	CP			CV			GOA
	Small	Other	Total	Small	Other	Total	Total
2003	3	18	21	53	21	74	**95**
2004	3	13	16	43	21	64	**80**
2005	3	14	17	48	20	68	**85**
2006	1	14	15	45	16	61	**76**
2007	0	15	15	28	35	63	**78**
2008	1	14	15	29	35	64	**79**
2009	2	16	18	28	31	59	**77**
2010	2	15	17	18	34	52	**69**
2011	2	15	17	18	35	53	**70**

Source: NOAA Catch Accounting Data, 2003-2011

6.6 Record keeping and reporting requirements

Currently, no new record keeping and reporting requirements have been identified for the alternatives under consideration.

6.7 Federal rules that may duplicate, overlap, or conflict with proposed action

No relevant federal rules have been identified that would duplicate or overlap with the considered action. Some current federal regulations would need modification to implement a Chinook PSC limit, or to require retention of Chinook salmon in the Central and Western GOA non-pollock fisheries. These regulatory changes are described in detail in Section 5.

6.8 Impacts of the action on small entities

Small entities that participate in the GOA non-pollock fishery will be directly regulated by the Chinook salmon PSC limits created by this action. The extent of the regulatory impact is the extent to which those entities incur additional costs in the avoidance of Chinook salmon, or are limited in their groundfish catch

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.

[60] Size, revenue and affiliation data for 2012 were not available at the time of publishing. Determination of small entity size relies, in part, on COAR data that is collected from participants on an extended timeline that reduces the burden placed on respondents.

by a closure due to the limit being reached. Operational costs could arise from changing the location of fishing or from suspending fishing when relatively high Chinook salmon PSC occurs. In addition, it is possible that some costs may be incurred in attempting to determine Chinook PSC rates, in order to decide whether Chinook avoidance measures are needed. The extent to which the fleet may adopt these measures is uncertain. The incentive for adopting Chinook avoidance measures will increase with Chinook PSC in the GOA groundfish fisheries. If participants perceive that the limits will constrain their fishery, they will be more likely to pursue Chinook PSC avoidance measures. Section 4.7.1 contains the analysts' description of which combination of options, under Alternative 2, are the most likely to constrain the fishery. The incentive to adopt Chinook salmon avoidance measures will also depend on the tendency of the fleet to coordinate Chinook PSC avoidance. If fleet coordination is deemed critical to effective participation in a hard-capped fishery, small entities that lack cooperative affiliations may experience greater difficulty in avoiding Chinook salmon.

It is not clear whether all fleet participants would need to take immediate action in order to stay under a shared PSC hard cap. This observation relates to the fundamental lack of individual accountability in a non-cooperative system where multiple individuals share a hard cap (discussed more broadly in the RIR). It may be the case that costly measures taken by some entities benefit all others, to a degree. Also, for example, it may be that non-small entity vessels incur the near-term costs of testing salmon excluding technology. It could also be possible for vessels in the fisheries regulated by this action to adopt technology that has been tested in other fisheries (such as the GOA or BSAI pollock fleet). The type and cost of actions taken in response to a PSC hard cap, as well as their distribution across entity-types, are not possible to know a priori.

The proposed action to require full retention of salmon on board non-pollock trawl vessels operating in the regulated fisheries is not expected to impact small entities in any way that is distinct from impacts on other entities.

6.9 Description of significant alternatives to the proposed action

In 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 6.4. 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 Alternative 2 must be considered as part of the currently proposed action. The Council's stated objective notes an intent to evaluate Chinook salmon bycatch control measures in fisheries where none currently exist. This analysis does not find any measures other than the ones currently under consideration, or that were considered but not advanced (see Section 2.5), that could accomplish this objective with any different impact on the regulated small entities.

7 FMP and Magnuson-Stevens Act Considerations

7.1 Magnuson-Stevens Act National Standards

Below are the 10 National Standards as contained in the Magnuson-Stevens Fishery and Conservation Act (Magnuson-Stevens Act), and a brief discussion of the consistency of the proposed alternatives with those National Standards, where applicable.

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

The proposed action would impose a prohibited species catch (PSC) limit on the Western/ Central Gulf of Alaska (GOA) non-pollock trawl fisheries. Under some levels and apportionments, the PSC limits identified in Alternative 2 may prevent the non-pollock trawl fisheries from achieving total allowable catches (TACs) in some years, unless fishermen can find other methods to avoid Chinook salmon PSC. The groundfish stocks are not currently in danger of overfishing and are considered stable. The FMP establishes optimum yield for the GOA groundfish fishery as a whole. This action is not expected to interfere with the achievement of optimum yield in the groundfish fishery on a continuing basis. The proposed action would likely reduce the PSC of Chinook salmon species in years of high PSC, either by closing the non-pollock trawl fisheries early, or by encouraging fishermen to pursue ways to reduce Chinook salmon PSC. Although the direct relationship between Chinook salmon removals in the groundfish fisheries and the availability of Chinook salmon to the directed fisheries is not understood, a reduction in PSC of Chinook salmon species may result in an increase in yield from the directed salmon fisheries. In terms of achieving "optimum yield" from a fishery, the Act defines "optimum", with respect to yield from the fishery, as the amount of fish which—

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

With information that is currently available, neither the total "cost" of Chinook salmon PSC, taken in the Central and Western GOA non-pollock trawl fisheries, nor the total "value" of Chinook salmon savings can be estimated for the various user groups. The estimated annual savings of Chinook salmon may represent a cost to the non-pollock trawl fishery harvesters, processors, and consumers that is realized as a reduction in the amount of groundfish that is harvested. To the extent possible, the value of these fish to the non-pollock trawl fishery harvesters and processors was described for each alternative and option in the RIR. Chinook salmon PSC in the non-pollock trawl fisheries also has value to the commercial harvesters of Chinook salmon, sport fishermen, subsistence users, as prey for other species, and as stocks that are protected under the Endangered Species Act (ESA) and identified as needing to be conserved and recovered. A general description of each of these user groups was also provided in the Regulatory Impact Review/Environmental Assessment (RIR/EA). However, we cannot estimate the change in the number of Chinook salmon that would accrue to each use as a result of this action. The potential salmon savings that are estimated in this analysis do not translate directly into adult salmon that would otherwise have survived to return to its spawning stream.

The North Pacific Fishery Management Council (Council) has heard testimony and been provided additional information by representatives of most groups that utilize the Chinook salmon resource, demonstrating the breadth and variety of values associate with this species. Many of the benefits generated by these user groups do not involve a market transaction. The lack of a market price makes comparing the value derived from various users more difficult, but none the less important. Even with the lack of information on the stock composition of Chinook salmon taken as PSC in the GOA non-

pollock trawl fisheries, if any Chinook salmon taken in the non-pollock trawl fisheries are from runs that are listed in the ESA,[61] their value to the Nation is high.

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

Information in this analysis represents the most current, comprehensive set of information available to the Council, recognizing that some information (such as operational costs) is unavailable. Information previously developed on the GOA non-pollock trawl fisheries, as well as the most recent information available, has been incorporated into this analysis. It represents the best scientific information available.

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

The annual TACs are set for GOA groundfish according to the Council and NMFS' harvest specification process. NMFS conducts the stock assessments for this species and makes allowable biological catch recommendations to the Council. The Council sets the TACs for these species based on the most recent stock assessment and survey information. GOA groundfish will continue to be managed either as single stocks or stock complexes, or where appropriate, in conjunction with BSAI groundfish stocks, under the alternatives in this analysis.

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

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

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

Efficiency in the context of this change refers to economic efficiency. The analysis presents information relative to the relative importance of economic efficiency versus other considerations and provides information on the economic risks associated with the proposed PSC reduction measures.

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

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

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

[61] California coastal, Central Valley spring-run, Lower Columbia River, Upper Columbia River spring-run, Puget Sound, Sacramento River Winter-run, Snake River fall-run, Snake River Spring/Summer-run, and Upper Willamette River.

All of the alternatives under consideration appear to be consistent with this standard. The monitoring requirements for Alternative 2, Option 4 may impose additional costs on the industry; Table 5-2 in Section 5.2 notes the additional monitoring that would be necessary to account for a PSC limit that is allocated to individual entities under a catch share program. However, these costs may be offset by, or may be small in comparison to, the benefits of a catch share management structure wherein the Agency does not have to inseason manage as conservatively.

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

Many of the coastal communities in the Central and Western GOA, as well as coastal communities elsewhere in Alaska and the Pacific Northwest, participate in the GOA non-pollock trawl fisheries in one way or another, such as homeport to participating vessels, the location of processing activities, the location of support businesses, the home of employees in the various sectors, or as the base of ownership or operations of various participating entities. A summary of the level of fishery engagement in communities and dependence of vessels affected by the proposed action is provided in the RIR.

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

The alternatives are specifically crafted to address Chinook salmon PSC in the non-pollock trawl fisheries. The practicability of PSC reduction is discussed in the analysis of the impacts of the various alternatives and options.

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

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

7.2 Section 303(a)(9) Fisheries Impact Statement

Section 303(a)(9) of the Magnuson-Stevens Act requires that any plan or amendment include a fishery impact statement which shall assess and describe the likely effects, if any, of the conservation and management measures on (a) participants in the fisheries and fishing communities affected by the plan or amendment; and (b) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants taking into account potential impacts on the participants in the fisheries, as well as participants in adjacent fisheries.

The alternative actions considered in this analysis are described in Section 1.5. The impacts of these actions on participants in the fisheries and fishing communities are the topic of the RIR and Initial Regulatory Flexibility Analysis (Sections 3 and 6).

Fishery Participants

The proposed actions directly impact participants in the GOA non-pollock trawl fisheries occurring in the Western and Central GOA. From 2003 through 2011, there have been a total of 122 different vessels participating in the directed fisheries (100 catcher vessels and 22 catcher/processors).

Fishing Communities

The fishing communities that are expected to be potentially directly impacted by the proposed action are those communities which serve as homeports to the vessels potentially affected by the area closures, where they offload product, take on supplies, provide vessel maintenance and repair services, and provide homes to vessel owners and crew. Information on the residence of the vessel crew and processing crew that work aboard the potentially affected vessels is not readily available; however, generally companies operating vessels in the Central GOA groundfish sector tend to recruit crew from many locations. A summary of the level of fishery engagement in communities and dependence of vessels affected by the proposed action is provided in the RIR.

Detailed information on the range of fishing communities relevant to the proposed action may be found in a number of other documents, including the *Alaska Groundfish Fisheries Final Programmatic Supplemental EIS* (NMFS 2004a), *Sector and Regional Profiles of the North Pacific Groundfish Fishery* (Northern Economics and EDAW 2001), and in a technical paper (Downs 2003) supporting the *Final EIS for Essential Fish Habitat Identification and Conservation in Alaska* (NMFS 2005b) as well as that environmental impact statement itself. These sources also include specific characterizations of the degree of individual community and regional engagement in, and dependency upon, the North Pacific groundfish fishery. Additionally, a summary of information on particular communities affected by this action may be found in the RIR.

Participants in Fisheries in Adjacent Areas

The alternatives considered in this action would not significantly affect participants in the fisheries conducted in adjacent areas under the authority of another Council.

7.3 GOA FMP — Groundfish Management Policy Priorities

The alternatives discussed in this action accord with the management policy of the Fishery Management Plan for Groundfish of the GOA. The Council's management policy (NPFMC 2011) includes the following objectives:

- Control the removal of prohibited species through PSC limits or other appropriate measures.
- Continue and improve current incidental catch, prohibited species catch, and bycatch management program.
- Continue to manage incidental catch, prohibited species catch, and bycatch through seasonal distribution of total allowable catch and geographical gear restrictions.
- Continue program to reduce discards by developing management measures that encourage the use of gear and fishing techniques that reduce groundfish bycatch, which includes economic discards.

The alternatives considered in this analysis to control Chinook salmon PSC in the GOA non-pollock trawl fisheries are consistent with the Council's longstanding management policy.

8 NEPA Summary

One of the purposes of an environmental assessment is to provide the evidence and analysis necessary to decide whether an agency must prepare an environmental impact statement (EIS). The Finding of No Significant Impact (FONSI) is the decision maker's determination that the action will not result in significant impacts to the human environment, and therefore, further analysis in an EIS is not needed. The Council on Environmental Quality regulations at 40 CFR 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." An action must be evaluated at different spatial scales and settings to determine the context of the action. Intensity is evaluated with respect to the nature of impacts and the resources or environmental components affected by the action. NOAA Administrative Order (NAO) 216-6 provides guidance on the National Environmental Policy Act (NEPA) specifically to line agencies within NOAA. It specifies the definition of significance in the fishery management context by listing criteria that should be used to test the significance of fishery management actions (NAO 216-6 §§ 6.01 and 6.02). These factors form the basis of the analysis presented in this Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis. The results of that analysis are summarized here for those criteria.

Context: For this action, the setting is the Western and Central Gulf of Alaska (GOA) pollock fishery. Any effects of this action are limited to these regulatory areas. The effects of this action on society are on individuals directly and indirectly participating in these fisheries and on those who use the ocean resources. Because this action concerns the use of a present and future resource, this action may have impacts on society as a whole or regionally.

Intensity: Considerations to determine intensity of the impacts are set forth in 40 CFR 1508.27(b) and in the NAO 216-6, Section 6. Each consideration is addressed below in order as it appears in the NMFS Instruction 30-124-1 dated July 22, 2005, Guidelines for Preparation of a FONSI. The sections of the EA that address the considerations are identified.

1) *Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?*

No. No significant adverse impacts on target species were identified for the alternatives. Under Alternative 2, the implementation of a lower hard cap may result in the non-pollock trawl fisheries closing before the TACs are reached, while a higher hard cap would allow for non-pollock trawl fishing at current levels with no change from the status quo. Target species are managed under harvest specifications that prevent overfishing. Therefore, no impacts on the sustainability of any target species are expected.

2) *Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?*

No. Alternative 2 considers PSC limits for Chinook salmon in the Central and Western GOA. To the extent that Chinook salmon prohibited species catch is controlled or reduced as a result of this action, it will likely have beneficial impacts on Chinook salmon stocks relative to the status quo. Effects cannot be measured at the individual stock level because data are not available at this scale. Potential effects of Alternative 2 on other non-target and prohibited species are expected to be insignificant and similar to status quo, as fishing pressure is unlikely to increase. The alternatives are not expected to jeopardize the sustainability of any ecosystem component or prohibited species.

3) *Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in the fishery management plans (FMPs)?*

No. No significant adverse impacts were identified for Alternative 2 on ocean or coastal habitats or EFH. The impact of the GOA non-pollock trawl fisheries on benthic habitat is unlikely to change substantially as a result of the alternative. The implementation of a lower hard cap may result in the non-pollock trawl fisheries closing before the TACs are reached, which would reduce overall impact on benthic habitat.

4) *Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?*

No. Public health and safety will not be affected in any way not evaluated under previous actions or disproportionately as a result of the proposed action. The action under Alternative 2 will not change fishing methods (including gear types).

5) *Can the proposed action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?*

The analysis in the EA shows that the impacts of Alternative 2 on ESA-listed species (marine mammals, seabirds, and salmon), designated critical habitat, or marine mammals are likely insignificant. The only critical habitat designated for an ESA-listed species in the GOA is for Steller sea lions and Cook Inlet beluga whale. Alternative 2 would not change the Steller sea lion protection measures, ensuring the action is not likely to result in adverse effects not already considered under previous ESA consultations for Steller sea lions and their critical habitat. The fisheries are not being changed under either alternative that would result in effects beyond those already analyzed in the 2010 Biological Opinion for the authorization of the Alaska groundfish fisheries. This consultation covered all ESA-listed marine mammals occurring in the action area except Cook Inlet Beluga Whales and Southern Resident Killer whales. ESA consultations are being conducted with the Protected Resources Divisions, Alaska Region and Northwest Region, on the potential effects of this action on Cook Inlet beluga whales, Southern Resident killer whales, and ESA-listed Chinook salmon. NMFS Sustainable Fisheries Division Alaska Region has determined that the groundfish fisheries as managed under this action may affect these species and their designated critical habitat, but these effects are likely not measurable or *de minimus*; and therefore, this action is not likely to adversely affect ESA listed species or their designated critical habitat. For ESA-listed Chinook salmon, implementing a PSC limit would increase the likelihood that the GOA groundfish fisheries will remain below the threshold identified in the incidental take statement. This action also would limit the amount of Chinook salmon taken in the non-pollock trawl fisheries which would reduce the likelihood of affecting prey for Cook Inlet Beluga whales, Southern Resident Killer whales and of affecting the primary constituent elements of designated critical habitat.

6) *Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?*

No significant adverse impacts on biodiversity or ecosystem function were identified for Alternative 2. No significant effects are expected on biodiversity, the ecosystem, marine mammals, or seabirds, as overall the GOA non-pollock trawl fleet is constrained in the location and timing of the fishery by regulatory constraints (e.g., seasonal allocations of TAC and halibut PSC).

7) *Are significant social or economic impacts interrelated with natural or physical environmental effects?*

Socioeconomic impacts of this action result from the potential that the non-pollock trawl fisheries will be closed before the TACs are achieved, or additional costs associated with voluntary efforts of the fleet to avoid areas with high prohibited species catch rates. These impacts are a direct result of the action of imposing PSC limits on the fisheries. These impacts are independent of the natural or physical effects of imposing PSC limits on the fisheries and are not expected to be significant. Beneficial but insignificant social impacts may occur for those who depend on directed fisheries for Chinook salmon, however there is insufficient information to determine how specific Chinook stocks will be impacted by this proposed action.

8) Are the effects on the quality of the human environment likely to be highly controversial?
This action directly affects the GOA non-pollock trawl fisheries in the Western and Central GOA, which includes fisheries of value to the groundfish fleet. There is uncertainty associated with the estimates of Chinook salmon prohibited species catch for the unobserved portion of the groundfish fleet, and uncertainty surrounding the origin of Chinook stocks caught as prohibited species catch in the fishery. However, development of the proposed action has involved participants from the scientific and fishing communities and the potential impacts on the human environment are understood; therefore, this action is considered high-interest but not highly controversial as far as understanding the impacts of this action on the human environment.

9) Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?
No. This action would not affect any categories of areas on shore. This action takes place in the geographic area of the Central and Western GOA. The land adjacent to this marine area may contain archeological sites. This action would occur in adjacent marine waters so no impacts on these cultural sites are expected. The marine waters where the fisheries occur contain ecologically critical areas. Effects on the unique characteristics of these areas are not anticipated to occur with this action because the amount of fish removed by vessels are within the specified TAC harvest levels and the alternatives provide protection to EFH and ecologically critical nearshore areas.

10) Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?
No. The potential effects of the action are understood because of the fish species, harvest methods involved, and area of the activity. For marine mammals and seabirds, enough research has been conducted to know about the animals' abundance, distribution, and feeding behavior to determine that this action is not likely to result in population effects. The potential impacts of different gear types on habitat also are well understood, as described in the EFH EIS (NMFS 2005b). Alternative 2 may reduce Chinook salmon PSC but effects cannot be measured at the individual stock level because data are not available at this scale.

11) Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?
No. Beyond the cumulative impact analyses in the Groundfish Harvest Specifications EIS (NMFS 2007a), the Central Gulf of Alaska Rockfish Program EA (NMFS 2011c), and the EA/RIR/IRFA to Revise GOA Halibut PSC Limits (NPFMC 2012), no other additional past or present cumulative impact issues were identified. The combination of effects from the cumulative effects of past, present, and reasonably foreseeable future actions and this proposed action are not likely to result in significant effects for any of the environmental component analyzed and are therefore not significant.

12) Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources?
No. This action will have no effect on districts, sites, highways, structures, or objects listed or eligible for listing in the National Register of Historic Places, nor cause loss or destruction of significant scientific, cultural, or historical resources.

13) Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

No. This action poses no risk of the introduction or spread of nonindigenous species into the GOA beyond those previously identified because it does not change fishing, processing, or shipping practices that may lead to the introduction of nonindigenous species.

14) Is the proposed action likely to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?

No. Alternative 2 considers a PSC limit to control the risk of high Chinook salmon prohibited species catch occurring in the GOA non-pollock trawl fisheries. This action does not establish a precedent for future action because PSC control measures have been frequently used as a management tool for the protection of marine resources in the Alaska groundfish fisheries. Pursuant to NEPA, for all future actions, appropriate environmental analysis documents (EA or EIS) will be prepared to inform the decision makers of potential impacts to the human environment and to implement mitigation measures to avoid significant adverse impacts.

15) Can the proposed action reasonably be expected to threaten a violation of federal, state, or local law or requirements imposed for the protection of the environment?

No. This action poses no known risk of violation of federal, state, or local laws or requirements for the protection of the environment.

16) Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

No. The effects on target and non-targeted species from the alternatives are not significantly adverse as the overall harvest of these species will not be affected. No cumulative effects were identified that, added to the direct and indirect effects on target and non-targeted species, would result in significant effects.

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Appendix 1: Chinook salmon escapement goals and 2003 through 2011 escapement levels, by region and system

Excerpted from Munro and Volk 2012.

Table 1.–Southeast Region Chinook salmon escapement goals and escapements, 2003 to 2011[a].

	2011 Goal Range			Year	Escapement								
System	Lower	Upper	Type	Implemented	2003	2004	2005	2006	2007	2008	2009	2010	2011
Blossom River	250	500	BEG	1997	203	333	445	339	135	257	123	180	147
Keta River	250	500	BEG	1997	322	376	497	747	311	363	172	475	223
Unuk River	1,800	3,800	BEG	2009	5,546	3,963	4,742	5,645	5,668	3,104	3,157[b]	4,854[b]	3,272[b]
Chickamin River	450	900	BEG	1997	964	798	924	1,330	893	1,111	611	1,156	853
Andrew Creek	650	1,500	BEG	1998	1,160	2,991	1,979	2,124	1,736	981	628	1,205	936
Stikine River	14,000	28,000	BEG	2000	46,824	48,900	40,501	24,405	14,560	18,352	11,086[b]	15,180[b]	14,569[b]
King Salmon River	120	240	BEG	1997	119	135	143	150	181	120	109	158	192
Taku River	19,000	36,000	BEG	2009	36,435	75,032	38,725	42,296	14,854	27,383	20,762[b]	29,307[b]	27,523[b]
Chilkat River	1,850	3,600	Inriver[c]		5,657	3,422	3,366	3,039	1,445	2,905	4,429[b]	1,815[b]	2,803[b]
	1,750	3,500	BEG	2003									
Klukshu (Alsek) River	1,100	2,300	BEG	1998	1,661	2,455	1,034	568	676	466	1,466	2,159	1,667[b]
Situk River	450	1,050	BEG	2003	2,163	698	595	695	677	413	902	167[d]	240

Note: NA = data not available.

[a] Goals are for large (≥660 mm MEF, or fish age 1.3 and older) Chinook salmon, except the Alsek River goal, which is germane to fish age 1.2 and older and can include fish <660 mm MEF.

[b] Preliminary data.

[c] Inriver goal accounts for inriver subsistence harvest, which averages <100 fish.

[d] Incomplete weir count due to inseason problems with weir (e.g., breach of weir).

Table 2.–Central Region (Bristol Bay, Cook Inlet, and Prince William Sound/Copper River) Chinook salmon escapement goals and escapements, 2003 to 2011.

	2011 Goal Range			Year	Escapement								
System	Lower	Upper	Type	Implemented	2003	2004	2005	2006	2007	2008	2009	2010	2011
Bristol Bay													
Nushagak River	40,000	80,000	SEG	2007	72,420	107,591	163,506	117,364	50,960	91,653	73,379	56,134	59,728
Togiak River	9,300		lower-bound SEG	2007	NS	NS	NS	NS	NS	NS	NS	NS[a]	NS
Naknek River	5,000		lower-bound SEG	2007	6,081	12,878	NS	NS	5,498	6,559	3,305[b]	NS[a]	NS
Alagnak River	2,700		lower-bound SEG	2007	8,209	6,755	5,084	4,278	3,455	1,825	1,957	NS[a]	NS
Egegik River	450		lower-bound SEG	2007	790	579	335	196	458	162	350[c]	NS[a]	NS
Upper Cook Inlet													
Alexander Creek	2,100	6,000	SEG	2002	2,012	2,215	2,140	885	480	150	275	177	343
Campbell Creek	380		lower-bound SEG	2011	747	964	1,097	1,052	588	439	554	290	260
Chuitna River	1,200	2,900	SEG	2002	2,339	2,938	1,307	1,911	1,180	586	1,040	735	719
Chulitna River	1,800	5,100	SEG	2002	NS	2,162	2,838	2,862	5,166	2,514	2,093	1,052	1,875
Clear (Chunilna) Creek	950	3,400	SEG	2002	NS	3,417	1,924	1,520	3,310	1,795	1,205	903	512
Crooked Creek	650	1,700	SEG	2002	2,554	2,196	1,903	1,516	964	881	617	\1,088	654
Deshka River	13,000	28,000	SEG	2011	39,257	57,934	37,725	31,150	18,714	7,533	11,967	18,594	19,026
Goose Creek	250	650	SEG	2002	175	417	468	306	105	117	65	76	80
Kenai River Early Run	5,300	9,000	OEG	2005	10,097	11,855	16,387	18,428	12,504	11,732	9,771	NA[d]	NA[e]
	4,000	9,000	SEG	2011									
Kenai River Late Run	17,800	35,700	SEG	2011	23,736	40,198	26,046	24,423	32,618	24,144	17,158	NA[d]	NA[e]
Lake Creek	2,500	7,100	SEG	2002	8,153	7,598	6,345	5,300	4,081	2,004	1,394	1,617	2,563
Lewis River	250	800	SEG	2002	878	1,000	441	341	0[f]	120	111	56	92
Little Susitna River	900	1,800	SEG	2002	1,114	1,694	2,095	1,855	1,731	1,297	1,028	589	887
Little Willow Creek	450	1,800	SEG	2002	879	2,227	1,784	816	1,103	NC	776	468	713
Montana Creek	1,100	3,100	SEG	2002	2,576	2,117	2,600	1,850	1,936	1,357	1,460	755	494
Peters Creek	1,000	2,600	SEG	2002	3,998	3,757	1,508	1,114	1,225	NC	1,283	NC	1,103
Prairie Creek	3,100	9,200	SEG	2002	4,095	5,570	3,862	3,570	5,036	3,039	3,500	3,022	2,038
Sheep Creek	600	1,200	SEG	2002	NS	285	760	580	400	NC	500	NC	350
Talachulitna River	2,200	5,000	SEG	2002	9,573	8,352	4,406	6,152	3,871	2,964	2,608	1,499	1,368
Theodore River	500	1,700	SEG	2002	1,059	491	478	958	486	345	352	202	327
Willow Creek	1,600	2,800	SEG	2002	3,855	2,840	2,411	2,193	1,373	1,255	1,133	1,173	1,061
Lower Cook Inlet													
Anchor River	3,800	10,000	SEG	2011	9,238	12,016	11,156	8,945	9,622	5,806	3,455	4,449	3,547[g]
Deep Creek	350	800	SEG	2002	1,008	1,075	1,076	507	553	205	483	387	696
Ninilchik River	550	1,300	SEG	2008	517	679	1,259	1,013	543	586	528	605	668[g]
Prince William Sound													
Copper River	24,000		lower-bound SEG	2003	34,034	30,628	21,528	58,454	34,565	32,487	27,787	16,771	27.000[h]

[a] Aerial surveys for Chinook salmon were not flown in 2010 due to poor weather conditions and high water levels.
[b] 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.
[c] 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.
[d] TS-based escapement estimate deemed unreliable.
[e] TS-based escapement estimate not available.
[f] Lewis River diverged into swamp 1/2 mi. below bridge. No water in channel.
[g] Preliminary escapement estimates.
[h] The Copper River Chinook salmon spawning escapement estimate is preliminary. The 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 ~6 months after the fishery is closed. Additionally, the sport fishery harvest estimate is based on the mail-out survey and is generally available ~12 months after the fishery ends.

Table 3.–Arctic-Yukon-Kuskokwim Region Chinook salmon escapement goals and escapements, 2003 to 2011.

System	2011 Goal Range		Type	Year Imple-mented	Escapement								
	Lower	Upper			2003	2004	2005	2006	2007	2008	2009	2010	2011
Kuskokwim Area													
North (Main) Fork Goodnews River	640	3,300	SEG	2005	3,935	7,462	NS	4,159	NS	2,155	NS	NS	853
Middle Fork Goodnews River	1,500	2,900	BEG	2007	2,389	4,388	4,633	4,559	3,852	2,161	1,630	2,244	1,861
Kanektok River	3,500	8,000	SEG	2005	6,206	28,375	14,202	8,433	NS	3,659	NS	1,228	NS
Kogrukluk River	5,300	14,000	SEG	2005	11,771	19,651	22,000	19,414	13,029	9,730	9,702	5,690	6,891
Kwethluk River	6,000	11,000	SEG	2007	14,474	28,604	NA	17,618	12,927	5,275	5,744	1,669	4,076
Tuluksak River	1,000	2,100	SEG	2007	1,064	1,475	2,653	1,043	374	701	362	201	286
George River	3,100	7,900	SEG	2007	4,693	5,207	3,845	4,357	4,883	2,698	3,663	1,500	1,571
Kisaralik River	400	1,200	SEG	2005	654	5,157	2,206	4,734	692	1,074	NS	235	NS
Aniak River	1,200	2,300	SEG	2005	3,514	5,362	NS	5,639	3,984	3,222	NS	NS	NS
Salmon River (Aniak R)	330	1,200	SEG	2005	1,292	2,177	4,097	NS	1,458	589	NS	NS	79
Holitna River	970	2,100	SEG	2005	NS	4,051	1,760	1,866	NS	NS	NS	587	NS
Cheeneetnuk River (Stony R)	340	1,300	SEG	2005	810	918	1,155	1,015	NS	290	323	NS	249
Gagaryah River (Stony R)	300	830	SEG	2005	1,095	670	788	531	1,035	177	303	62	96
Salmon River (Pitka Fork)	470	1,600	SEG	2005	1,241	1,138	1,801	862	943	1,305	632	135	767
Yukon River													
East Fork Andreafsky River	2,100	4,900	SEG	2010	4,336	8,045	2,239	6,463	4,504	4,242	3,004	2,413	5,213
West Fork Andreafsky River	640	1,600	SEG	2005	1,578	1,317	1,492	824	976	262	1,678	858	1,173
Anvik River	1,100	1,700	SEG	2005	1,100	3,679	2,421	1,876	1,529	992	832	974	642
Nulato River	940	1,900	SEG	2005	NS	1,321	553	1,292	2,583	922	2,260	711	1,401
Gisasa River	420	1,100	SEG	2005	NS	731	958	843	593	487	515	264	906
Chena River	2,800	5,700	BEG	2001	11,100	9,696	4,075	2,936	3,806	3,208	5,253	2,382	
Salcha River	3,300	6,500	BEG	2001	15,500	15,761	5,988	10,679	6,425	5,415	12,774	6,135	3,537
Canada Mainstem	45,000		Agreement[a]	Annual	80,594	48,469	67,985	62,630	34,904	33,883	65,278	32,010	46,844
Norton Sound													
Fish River/Boston Creek	100		lower-bound SEG	2005	240	112	46	NS	NS	NS	67[b]	29	NS
Kwiniuk River	300	550	SEG	2005	744	663	342	195	194	237	444	135	57
North River (Unalakleet R)	1,200	2,600	SEG	2005	1,452	1,104	1,015	906	1,948	903	2,352	1,256	864
Shaktoolik River	400	800	SEG	2005	15[c]	91[c]	74[d]	150[c]	412	NS	129[b]	29	106
Unalakleet/Old Woman River	550	1,100	SEG	2005	168[c]	398[c]	510[d]	NS	821	NS	1,368	1,021[e]	1,111

Note: NA = data not available; NS = no survey.

Note: 2011 escapements are preliminary because harvest estimates are not completed until around the beginning of the following season.

[a] Canadian Yukon River Mainstem Chinook salmon IMEG (Interim Management Escapement Goal) of 42,500-55,000 was implemented for 2010 and 2011 seasons by the United States and Canada Yukon River Joint Technical Committee (JTC). Estimates from 2005-2011 represent escapement, after subtraction of Canadian harvest.

[b] 2009 aerial surveys of the Shaktoolik River and Boston Creek are rated as incomplete as they were conducted on August 9 and 12, respectively, well after peak Chinook salmon spawning. Several carcasses and moribund Chinook salmon were observed during survey.

[c] 2003, 2004 and 2006 Shaktoolik River surveys and combined Unalakleet and Old Woman rivers surveys (2003 and 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.

[d] 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.

[e] 2010 escapement estimate for Unalakleet/Old Woman River is a weir count.

Table 4.–Westward Region (Alaska Peninsula/Aleutian Islands, Kodiak, and Chignik areas) Chinook salmon escapement goals and escapements, 2003 to 2011.

	2011 Goal Range			Year	Escapement								
System	Lower	Upper	Type	Implemented	2003	2004	2005	2006	2007	2008	2009	2010	2011
AK Peninsula													
Nelson River	2,400	4,400	BEG	2004	5,154	6,959	4,993	2,516	2,492	5,012	2,048	2,769	NA
Chignik													
Chignik River	1,300	2,700	BEG	2002	6,412	7,633	6,037	3,175	1,675	1,620	1,590	3,373[a]	NA
Kodiak													
Karluk River[a]	3,000	6,000	BEG	2011	6,986	7,228	4,684	3,673	1,697	752	1,306	2,917	3,420
Ayakulik River[b]	4,000	7,000	BEG	2011	17,106	24,425	8,175	2,937	6,232	3,071	2,615	5,291	NA

Note: NA = data not available.
[a] 2010 Chignik River Chinook salmon escapement is the weir count minus 300 fish for subsistence harvest.

Table 5.–Assessment of whether escapements met (Met), exceeded (Over), or did not meet (Under) the escapement goal in place at the time of enumeration for Chinook salmon stocks in Southeast Region.

System	2003	2004	2005	2006	2007	2008	2009	2010	2011
CHINOOK SALMON									
Blossom River	Under	Met	Met	Met	Under	Met	Under	Under	Under
Keta River	Met	Met	Met	Over	Met	Met	Under	Met[a]	Under
Unuk River	Met	Met	Met	Met	Met	Met	Met[a]	Over	Met[a]
Chickamin River	Over	Met	Over	Over	Met	Over	Met	Over	Met[a]
Andrew Creek	Met	Over	Over	Over	Over	Met	Under	Met[a]	Met[a]
Stikine River	Over	Over	Over	Met	Met	Met	Under	Met[a]	Met[a]
King Salmon River	Under	Met	Met	Met	Met	Met	Under	Met[a]	Met[a]
Taku River	Met	Over	Met	Met	Under	Under	Met[b]	Met[a]	Met[a]
Chilkat River	Over[c]	Met	Met	Met	Under	Met	Over	Met[a]	Met[a]
Klukshu (Alsek) River	Met	Over	Under	Under	Under	Under	Met	Met[a]	Met[a]
Situk River	Over[b]	Met	Met	Met	Met	Under	Met	Under	Under

Note: NA = data not available. Blank cells indicate that there was no official escapement goal for the stock in that particular year.
[a] Prior to 2009 goal was based on index count of escapements.
[b] Escapement goal reevaluated, goal range changed.

Table 6.–Assessment of whether escapements met (Met), exceeded (Over), or did not meet (Under) the escapement goal in place at the time of enumeration for Chinook salmon stocks in Central Region (Bristol Bay, Cook Inlet, and Prince William Sound/Copper River).

System	2003	2004	2005	2006	2007	2008	2009	2010	2011
Chinook salmon									
Bristol Bay									
Nushagak River	Over	Over	Over	Over	Met[a]	Over	Met	Met	Met
Togiak River	NS	NS	NS	NS	NS[b]	NS	NS	NS	NS
Naknek River	Over	Over	NS	NS	Met[b]	Met	Under	NS	NS
Alagnak River					Met	Under	Under	NS	NS
Egegik River					Met	Under	Under	NS	NS
Upper Cook Inlet									
Alexander Creek	Under	Met	Met	Under	Under	Under	Under	Under	Under
Campbell Creek	Over	Over	eliminated			Met[c]	Met	Met	Under
Chuitna River	Met	Over	Met	Met	Under	Under	Under	Under	Under
Chulitna River	NS	Met	Met	Met	Over	Met	Met	Under	Met
Clear (Chunilna) Creek	NS	Over	Met	Met	Met	Met	Met	Under	Under
Crooked Creek	Over	Over	Over	Met	Met	Met	Under	Met	Met
Deshka River	Over	Over	Over	Over	Met	Under	Under	Met	Met
Goose Creek	Under	Met	Met	Met	Under	Under	Under	Under	Under
Kenai River Early Run	Met	Met	Over[d]	Over	Over	Over	Over	NA	NA
Kenai River Late Run	Met	Over	Met	Met	Met	Met	Under	NA	NA
Lake Creek	Over	Over	Met	Met	Met	Under	Under	Under	Met
Lewis River	Over	Over	Met	Met	Under	Under	Under	Under	Under
Little Susitna River	Met	Met	Over	Over	Met	Met	Met	Under	Under
Little Willow Creek	Met	Over	Met	Met	Met	NC	Met	Met	Met
Montana Creek	Met	Met	Met	Met	Met	Met	Met	Under	Under
Peters Creek	Over	Over	Met	Met	Met	NC	Met	NC	Met
Prairie Creek	Met	Met	Met	Met	Met	Under	Met	Under	Under
Sheep Creek	NS	Under	Met	Under	Under	NC	Under	NC	Under
Talachulitna River	Over	Over	Met	Over	Met	Met	Met	Under	Under
Theodore River	Met	Under	Under	Met	Under	Under	Under	Under	Under
Willow Creek	Over	Over	Met	Met	Under	Under	Under	Under	Under
Lower Cook Inlet									
Anchor River	Under	Over	eliminated			Met[e]	Under	Under	Under[f]
Deep Creek	Over	Over	Over	Met	Met	Under	Met	Met	Met
Ninilchik River	Under	Met	Met	Met	Met	Met[g]	Under	Met	Met
Prince William Sound									
Copper River	Met	Met	Under	Met	Met	Met	Met	Under	Met

Note: NA = data not available; NC = no count; NS = no survey.
[a] Escapement goal reevaluated, point goal changed to a range.
[b] Escapement goal reevaluated, point goal changed to a lower-bound goal.
[c] Previous escapement goal reinstated.
[d] Escapement goal reevaluated, goal range changed.
[e] Escapement goal from 2001-2004 based on aerial surveys, escapement numbers in Table 2 are not comparable.
[f] Escapement goal reevaluated, lower-bound goal changed to a range.

Table 7.–Assessment of whether escapements met (Met), exceeded (Over), or did not meet (Under) the escapement goal in place at the time of enumeration for Chinook salmon stocks in Arctic-Yukon-Kuskokwim Region.

System	2003	2004	2005	2006	2007	2008	2009	2010	2011
Chinook salmon									
Kuskokwim Area									
North (Main) Fork Goodnews River	Met	Met	NS[a]	Over	NS	Met	NS	NS	Met
Middle Fork Goodnews River	Under	Met	Over[a]	Over	Over[b]	Met	Met	Met	Met
Kanektok River	Met	Met	Over[a]	Over	NS	Met	NS	Under	NS
Kogrukluk River	Met	Met	Over[a]	Over	Met	Met	Met	Met	Met
Kwethluk River	Over	Over	Over	NA	Over[c]	Under	Under	Under	Under
Tuluksak River					Under	Under	Under	Under	Under
George River					Met	Under	Met	Under	Under
Kisaralik River	Under	Met	Over[a]	Over	Met	Met	NS	Under	NS
Aniak River	Met	Met	NS[a]	Over	Over	Over	NS	NS	NS
Salmon River (Aniak R)	Met	Met	Over[a]	NS	Over	Met	NS	NS	Under
Holitna River	NS	Met	Over[a]	Over	NS	Under	NS	Under	NS
Cheeneetnuk River (Stony R)			Met	Met	NS	Under	Under	NS	Under
Gagaryah River (Stony R)			Met	Met	Over	Under	Met	Under	Under
Salmon River (Pitka Fork)	Met	Under	Over[a]	Met	Met	Met	Met	Under	Met
Yukon River									
East Fork Andreafsky River	Under	Met	Over[a]	Under	Over	Under	Under	Met[c]	Over
West Fork Andreafsky River	Met	Under	Met[a]	Met	Met	Under	Over	Met	Met
Anvik River	Under	Met	Over[a]	Over	Met	Under	Under	Under	Under
Nulato River	NS	Met	Under[a]	Met	Over	Under	Over	Under	Met
Gisasa River	NS	Met	Met[a]	Met	Met	Met	Met	eliminated	
Chena River	Over	Over	Met	Met	Met	Met	Met	Under	
Salcha River	Over	Over	Met	Over	Met	Met	Over	Met	Met
Canada Mainstem[d]	Met	Met	Met	Met	Met	Under[d]	Met	Under[d]	Met
Norton Sound									
Fish River/Boston Creek	Met	Met	Under[e]	NS	NS	NS	Under	Under	NS
Kwiniuk River	Over	Over	Met[f]	Under	Under	Under	Met	Under	Under
North River (Unalakleet R)	Met	Under	Under[b]	Under	Met	Under	Met	Met	Under
Shaktoolik River	Under	Under	Under[f]	Under	Met	NS	Under	Under	Under
Unalakleet/Old Woman River	Under	Under	Under[f]	NS	Met	NS	Over	Met	Over

Note: NA = data not available; NS =no survey; ND = not determined yet. There are no escapement goals for pink salmon in Kuskokwim Area and Yukon River and there are no escapement goals for sockeye salmon in Yukon River.

[a] Escapement goal reevaluated, lower-bound goal changed to a range.

[b] Escapement goal reevaluated, goal value changed.

[c] Previous escapement goal was based on aerial surveys, replaced with escapement goal based on weir counts. Escapements in Table 3 are weir counts.

[d] Escapement goal revised by The United States and Canada Yukon River Joint Technical Committee (JTC).

[e] Escapement goal reevaluated, goal range changed to a lower-bound goal.

[f] Escapement goal reevaluated, goal type changed but goal value remained the same.

Table 8.–Assessment of whether escapements met (Met), exceeded (Over), or did not meet (Under) the escapement goal in place at the time of enumeration for Chinook salmon stocks in Westward Region (Alaska Peninsula/Aleutian Islands, Kodiak, and Chignik areas).

System	2003	2004	2005	2006	2007	2008	2009	2010	2011
Chinook salmon									
AK Peninsula									
Nelson River	Met	Over[a]	Over	Met	Met	Over	Under	Met	NA
Chignik									
Chignik River	Over	Over	Over	Over	Met	Met	Met	Over	NA
Kodiak									
Karluk River	Met	Met	Met	Met	Under	Under	Under	Under	Met[a]
Ayakulik River	Over	Over	Met	Under	Met	Under	Under	Met	NA[a]

Note: There are no coho salmon escapement goals in Chignik Area.
[a] Escapement goal reevaluated, goal range changed.

Table 9.–Southeast Region Chinook salmon escapements compared to escapement goals for the years 2003 to 2011.

	2003	2004	2005	2006	2007	2008	2009	2010	2011
CHINOOK SALMON									
Number Below	2	0	1	1	4	3	5	2	3
Number Met	5	7	7	7	6	7	5	7	8
Number Above	4	4	3	3	1	1	1	2	0
% Below	18	0	9	9	36	27	45	18	27
% Met	45	64	64	64	55	64	45	64	73
% Above	36	36	27	27	9	9	9	18	0

Table 10.–Central Region (Bristol Bay, Cook Inlet, Prince William Sound/Copper River) escapements for Chinook salmon compared to escapement goals for the years 2003 to 2011.

	2003	2004	2005	2006	2007	2008	2009	2010	2011
CHINOOK SALMON									
Number Below	4	2	2	2	7	12	16	15	14
Number Met	9	9	16	17	18	12	12	7	10
Number Above	11	16	6	5	2	2	1	0	0
% Below	17	7	8	8	26	46	55	68	58
% Met	38	33	67	71	67	46	41	32	42
% Above	46	59	25	21	7	8	3	0	0

Table 11.–Arctic-Yukon-Kuskokwim Region Chinook salmon escapements compared to escapement goals for the years 2003 to 2011.

	2003	2004	2005	2006	2007	2008	2009	2010	2011
CHINOOK SALMON									
Number Below	6	5	5	4	2	13	7	15	10
Number Met	10	14	8	8	13	10	10	7	8
Number Above	4	4	10	9	7	1	4	0	2
% Below	30	22	22	19	9	54	33	68	50
% Met	50	61	35	38	59	42	48	32	40
% Above	20	17	43	43	32	4	19	0	10

Table 12.–Westward Region (Alaska Peninsula/Aleutian Islands, Kodiak, and Chignik areas) escapements for Chinook salmon compared to escapement goals for the years 2003 to 2011.

	2003	2004	2005	2006	2007	2008	2009	2010	2011
CHINOOK SALMON									
Number Below	0	0	0	1	1	2	3	1	0
Number Met	2	1	2	2	3	1	1	2	1
Number Above	2	3	2	1	0	1	0	1	0
% Below	0	0	0	25	25	50	75	25	0
% Met	50	25	50	50	75	25	25	50	100
% Above	50	75	50	25	0	25	0	25	0

Table 17.–Summary of Chinook salmon stocks of concern in Alaska.

Region	System	Species	Year	Level of Concern	Year Last Reviewed[a]
Central	Chuitna River	Chinook	2010	Management	2010
	Theodore River	Chinook	2010	Management	2010
	Lewis River	Chinook	2010	Management	2010
	Alexander Creek	Chinook	2010	Management	2010
	Willow Creek	Chinook	2010	Yield	2010
	Goose Creek	Chinook	2010	Yield	2010
Westward AYK	Karluk River	Chinook	2010	Management	2010
	Yukon River	Chinook	2000	Yield	2009
	Norton Sound Sub-district 5 & 6	Chinook	2003	Yield	2009

[a] Indicates start of Board of Fisheries cycle in which stock of concern was designated or last reviewed (e.g. 2011/2012 BOF cycle = 2011).

Table 18.–Methods used to enumerate and develop escapement goals for Southeast Region Chinook salmon stocks.

System	Enumeration Method	Goal Development Method
CHINOOK SALMON		
Blossom River	Peak Aerial Survey[a]	SRA[b]
Keta River	Peak Aerial Survey	SRA
Unuk River	Mark-Recapture	SRA
Chickamin River	Peak Aerial Survey	SRA
Andrew Creek	Peak Aerial Survey (Expanded)	SRA
Stikine River	Mark-Recapture	SRA
King Salmon River	Peak Aerial Survey (Expanded)	SRA
Taku River	Mark-Recapture	SRA
Chilkat River	Mark-Recapture	Theoretical SRA
Klukshu (Alsek) River	Weir Count	SRA
Situk River	Weir Count	SRA

[a] One or more aerial surveys are attempted during the peak of the run. Peak count is used to index the escapement.
[b] SRA = Spawner-recruit analysis.

Table 19.–Methods used to enumerate and develop escapement goals for Central Region (Bristol Bay, Cook Inlet, and Prince William Sound/Copper River) Chinook salmon stocks.

System	Enumeration Method	Goal Development Method
CHINOOK SALMON		
Bristol Bay		
Nushagak River	Sonar	SRA[a], Yield Analysis
Togiak River	Single Aerial Survey[b]	Risk Analysis
Naknek River	Single Aerial Survey	Risk Analysis
Alagnak River	Single Aerial Survey	Risk Analysis
Egegik River	Single Aerial Survey	Risk Analysis
Upper Cook Inlet		
Alexander Creek	Single Aerial Survey	Percentile
Campbell Creek	Single Foot Survey	Risk Analysis
Chuitna River	Single Aerial Survey	Percentile
Chulitna River	Single Aerial Survey	Percentile
Clear (Chunilna) Creek	Single Aerial Survey	Percentile
Crooked Creek	Weir Count	Percentile
Deshka River	Weir Count	SRA
Goose Creek	Single Aerial Survey	Percentile
Kenai River Early Run	Sonar	SRA
Kenai River Late Run	Sonar	SRA
Lake Creek	Single Aerial Survey	Percentile
Lewis River	Single Aerial Survey	Percentile
Little Susitna River	Single Aerial Survey	Percentile
Little Willow Creek	Single Aerial Survey	Percentile
Montana Creek	Single Aerial Survey	Percentile
Peters Creek	Single Aerial Survey	Percentile
Prairie Creek	Single Aerial Survey	Percentile
Sheep Creek	Single Aerial Survey	Percentile
Talachulitna River	Single Aerial Survey	Percentile
Theodore River	Single Aerial Survey	Percentile
Willow Creek	Single Aerial Survey	Percentile
Lower Cook Inlet		
Anchor River	Sonar, Weir Count	SRA
Deep Creek	Single Aerial Survey	Percentile
Ninilchik River	Weir Count	Percentile
Prince William Sound		
Copper River	Mark-Recapture	Empirical Observation

[a]SRA = Spawner-recruit analysis.
[b] Single survey done around time of presumed peak of the run with no expansion of counts.

Table 20.–Methods used to enumerate and develop escapement goals for Arctic-Yukon-Kuskokwim Region Chinook salmon stocks.

System	Enumeration Method	Goal Development Method
CHINOOK SALMON		
Kuskokwim Area		
North (Main) Fork Goodnews River	Single Aerial Survey[a]	Percentile
Middle Fork Goodnews River	Weir Count	SRA[b]
Kanektok River	Single Aerial Survey	Percentile
Kogrukluk River	Weir Count	Percentile
Kwethluk River	Weir Count	Percentile
Tuluksak River	Weir Count	Percentile
George River	Weir Count	Percentile
Kisaralik River	Single Aerial Survey	Percentile
Aniak River	Single Aerial Survey	Percentile
Salmon River (Aniak R)	Single Aerial Survey	Percentile
Holitna River	Single Aerial Survey	Percentile
Cheeneetnuk River (Stony R)	Single Aerial Survey	Percentile
Gagaryah River (Stony R)	Single Aerial Survey	Percentile
Salmon River (Pitka Fork)	Single Aerial Survey	Percentile
Yukon River		
East Fork Andreafsky River	Weir Count	Percentile
West Fork Andreafsky River	Peak Aerial Survey[c]	Percentile
Anvik River	Peak Aerial Survey	Percentile
Nulato River (forks combined)	Peak Aerial Survey	Percentile
Chena River	Tower, Mark-Recapture	SRA
Salcha River	Tower, Mark-Recapture	SRA
Canada Mainstem	Sonar	Agreement (U.S./Canada Joint Technical Committee
Norton Sound		
Fish River/Boston Creek	Peak Aerial Survey	Percentile
Kwiniuk River	Tower Count	SRA
North River (Unalakleet R)	Tower Count	Percentile
Shaktoolik River	Peak Aerial Survey	Theoretical SRA
Unalakleet/Old Woman River	Peak Aerial Survey	Theoretical SRA

Note: NA = data not available.
[a] Typically single survey done around time of presumed peak of the run with no expansion of counts.
[b] SRA = Spawner-recruit analysis.
[c] One or more aerial surveys are attempted during the peak of the run. Peak count is used to index the escapement.

Table 21.–Methods used to enumerate and develop escapement goals for Westward Region (Alaska Peninsula/Aleutian Islands, Kodiak, and Chignik areas) Chinook salmon stocks.

System	Enumeration Method	Goal Development Method
CHINOOK SALMON		
AK Peninsula		
Nelson River	Weir, Peak Aerial Survey[a]	Spawning Habitat Model, SRA[b]
Chignik		
Chignik River	Weir Count	SRA
Kodiak		
Karluk River	Weir Count	SRA
Ayakulik River	Weir Count	SRA

[a] One or more aerial surveys are attempted during the peak of the run. Peak count is used to index the escapement.
[b] SRA = Spawner-recruit analysis.