INITIAL REVIEW DRAFT

**Environmental Assessment/ Regulatory Impact Review/
Initial Regulatory Flexibility Analysis
for 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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Abstract: This document analyzes proposed management measures that would apply to all trawl fishing by catcher vessels (CV) in the groundfish fisheries of the Central and Western Gulf of Alaska (GOA), except the directed pollock fishery. Trawl fishing in the GOA is limited by prohibited species catch (PSC) of Chinook salmon (*Oncorhynchus tshawytscha*). PSC limits cap the amount of Chinook salmon that can be taken in the trawl fishery (or a sector of the fishery); directed fishing with trawl gear is closed if that limit is met. The action alternatives under consideration would increase the existing Chinook salmon PSC limits for non-pollock trawl CVs, and CVs fishing under the authority of a Central GOA Rockfish Program cooperative quota permit. 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.

List of Acronyms and Abbreviations

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
t	tonne, or metric ton
NAICS	North American Industry Classification System
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
NMFS	National Marine Fishery Service
NOAA	National Oceanic and Atmospheric Administration
NPAFC	North Pacific Anadromous Fish Commission
NPFMC	North Pacific Fishery Management Council
NPPSD	North Pacific Pelagic Seabird Database
Observer Program	North Pacific Groundfish and Halibut Observer Program
OEG	optimal escapement goal
OMB	Office of Management and Budget
PBR	potential biological removal
PSC	prohibited species catch
PPA	Preliminary preferred alternative
PRA	Paperwork Reduction Act
PSEIS	Programmatic Supplemental Environmental Impact Statement
PWS	Prince William Sound
RFA	Regulatory Flexibility Act
RFFA	reasonably foreseeable future action
RIR	Regulatory Impact Review
RPA	reasonable and prudent alternative
RSW	refrigerated seawater
SAFE	Stock Assessment and Fishery Evaluation
SAR	stock assessment report
SBA	Small Business Act
Secretary	Secretary of Commerce
SEG	sustainable escapement goal
SET	sustainable escapement threshold
SNP	single nucleotide polymorphism
SPLASH	Structure of Populations, Levels of Abundance, and Status of Humpbacks
SRKW	Southern Resident killer whales
SSFP	Sustainable Salmon Fisheries Policy
SW	southwest
TAC	total allowable catch
U.S.	United States
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VMS	vessel monitoring system
W	West

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Executive Summary

This document analyzes proposed management measures that would apply to all trawl fishing by catcher vessels (CV) in the groundfish fisheries of the Central and Western Gulf of Alaska (GOA), except the directed pollock fishery. Trawl fishing in the GOA is limited by prohibited species catch (PSC) of Chinook salmon (*Oncorhynchus tshawytscha*). PSC limits cap the amount of Chinook salmon that can be taken in the trawl fishery (or a sector of the fishery); directed fishing with trawl gear is closed if that limit is met. The action alternatives under consideration would increase the existing Chinook salmon PSC limits for non-pollock trawl CVs, and CVs fishing under the authority of a Central GOA Rockfish Program cooperative quota permit. 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 Magnuson-Stevens Act (MSA) National Standards require the Council to balance the objectives of achieving optimum yield, minimizing bycatch, and minimizing adverse impacts on fishery-dependent communities. Chinook salmon PSC taken in GOA trawl fisheries is a resource concern, and the Council has taken action to set hard cap PSC limits that are below the incidental take amount that would trigger reconsultation under the Endangered Species Act (ESA). Attainment of a PSC hard cap closes the trawl fishery. Since the 2015 implementation of Chinook salmon PSC limits for the GOA non-pollock groundfish trawl CV sector, the fishery has continued to display variable levels and unpredictable timing of salmon encounter. Potential closures and PSC encounter rates that vary from year-to-year or even week-to-week create uncertainty for fishery participants, which in turn can exacerbate a “race for fish,” make business planning more difficult, or directly lead to forgone harvest opportunities. Those outcomes adversely affect trawl harvesters, crew, processors, and GOA coastal communities.

Relative to what was available when the Council established the PSC limits, new information about the resource and the fishery’s rate of salmon encounter has been gathered from salmon genetic identification studies and the expansion of observer sampling onto smaller trawl vessels. Meanwhile, the fishery continues to operate under a limited access management structure where harvesters must compete for a share of the available catch without formalized cooperative tools to minimize PSC. As a result, individual actions to avoid PSC often confer an individual competitive disadvantage. Voluntary collective action is costly to organize, and agreements to stand down from fishing to minimize PSC have not always held.

The proposed action would reconsider Chinook salmon PSC limits for the GOA non-pollock trawl CV sector and/or the Central GOA Rockfish Program CV sector. Alternatives to increase PSC limits are offered in light of new information and multiple years of experience fishing under constraining hard caps in a limited access fishery with variable and unpredictable PSC rates. The action would not modify other existing features of the GOA Chinook salmon PSC limits for non-pollock trawl fisheries such as PSC rollovers from the Rockfish Program CV sector to the limited access CV sector, and NMFS’s ability to make in-season Chinook salmon PSC limit reapportionments between certain trawl sectors. The action seeks to find the most appropriate PSC limit for this fishery by considering historical PSC levels and providing a margin that accommodates expected variability, while remaining within previously established outer bounds for annual GOA-wide PSC levels that are not expected to jeopardize the Chinook salmon resource.

Alternatives

Alternative 1: No action

Alternative 2: Increase the Chinook salmon PSC limit for the GOA non-pollock non-Rockfish Program CV sector by:

- Option 1: 1,000 fish
- Option 2: 2,000 fish
- Option 3: 3,000 fish

Alternative 3: Increase the Chinook salmon PSC limit for the Central GOA Rockfish Program CV sector by:

- Option 1: 300 fish
- Option 2: 600 fish
- Option 3: 900 fish

The Council may select either Alternative 2 or 3 or may select both in combination. The Council did not specify whether increasing the base PSC limit for either of these sectors would affect the performance standard and resulting buffer amount for the incentive measure described in Section 2.1, or whether additional PSC that is allocated to the Rockfish Program CV sector would be available for the October 1 "rollover" if unused. The Council may also wish to clarify whether the cap on inseason reallocations of Chinook PSC between GOA trawl sectors (GOA Amendment 103) will increase in proportion to any higher limit that is selected under Alternatives 2 or 3.

Table ES-1 shows the maximum amount of Chinook salmon PSC that could be taken under Alternative 2 during a single year across all GOA trawl fisheries, including the pollock fishery and the non-pollock CV sector. If the Council also selects Alternative 3, the overall PSC limit would increase by up to 900 Chinook.

Table ES-1 Maximum annual GOA trawl Chinook salmon PSC under Alternative 2

	No action	Option 1	Option 2	Option 3
Base PSC Limits	32,500	33,500	34,500	35,500
Base + Non-RP CV Incentive Buffer + CP Incentive Buffer (480)	33,340	34,473	35,607	36,740

Environmental Assessment

Groundfish

Under the status quo, groundfish stocks are neither overfished nor approaching an overfished condition. Increased PSC limits are not likely to increase fishing pressure. Even if there is a redistribution of effort to avoid Chinook salmon, the fishery will likely remain within the established footprint of the non-pollock trawl fishing grounds. The choice of a lower hard cap option 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, the annual hard cap PSC limit for the Western and Central GOA non-pollock trawl fishery is 7,500 Chinook salmon. Chinook salmon are a prohibited species, and it is incumbent upon fishermen, under the regulations, to avoid catching Chinook salmon. From 2003 through

2017, the average PSC for the non-pollock trawl fisheries was 5,572 Chinook salmon. In 2017, the non-pollock trawl fishery recorded 3,408 Chinook salmon PSC. The years with the highest Chinook salmon PSC during this time period were 2003, 2010, and 2017 with catches of 10,967, 9,853, and 10,389 Chinook salmon, respectively (NMFS Alaska Region Catch Accounting System, January 2018).

Since 2007, there have been poor or below average Chinook salmon runs in Western Alaska. In 2016, runs improved for the Westward stocks (i.e., Yukon, Kuskokwim, and Nushagak) but overall these runs are still below the long-term average. Runs also improved in Kodiak and Cook Inlet in 2016, but still, compared to the long-term average, their overall runs are still below average. Unfortunately, Chinook salmon runs from the Copper River to southern Southeast Alaska have declined and in 2016 the runs there were the lowest on record.

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 increasing PSC limits could increase the potential to impact salmon stocks in the aggregate. However, there is no evidence to indicate whether the groundfish fisheries' take of Chinook salmon is, or is not, causing escapement failures in Alaska rivers.

The options under each of the alternatives would establish an increased 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 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 affected by some other source of natural or fishing mortality. We now have better information about stock composition of Chinook salmon caught in GOA trawl fisheries relative to the last analysis for Amendment 97 (see Guthrie et al. 2017), however, insufficient data are 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 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 it is not possible to assess the impacts to individual Chinook salmon stocks that are being taken in the GOA non-pollock trawl fisheries, it is nonetheless possible to develop general conclusions for the action that is being proposed. If Chinook salmon PSC is increased in some years as a result of this action, it may impact Chinook salmon stocks, and the harvesters and consumers of Chinook salmon, compared to the status quo. 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 individual stocks are likely to be affected, nor to what degree.

If the attainment of the PSC limit 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. The extent of any redistribution of effort is difficult to predict and will depend not only on the distribution of Chinook salmon PSC rates on the fishing grounds and the participants' ability to accurately estimate Chinook salmon PSC 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 Alternatives 2 and 3, Chinook salmon PSC may increase slightly 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 cause minor impact, as PSC levels either remain the same or are slightly increased. None of the options considered under Alternatives 2 or 3 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 PSC limit constrains fishing, the chosen limit 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 2005; NPFMC and NMFS 2017). A more 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 either alternative.

Regulatory Impact Review

Alternative 1

Selecting the No Action alternative would maintain status quo Chinook salmon PSC limits for GOA non-pollock trawl CV fisheries. The RIR considers the impact of the existing Chinook PSC limits on social and economic benefits across GOA non-pollock trawl CV harvesters, processors, and communities, as well as the Chinook salmon resource and its users. The status quo PSC limits were established in the preferred alternative for GOA Groundfish FMP Amendment 97 (NPFMC 2014). As such, the broad effects of selecting Alternative 1 are similar in nature to the effects described in that analysis.

The most obvious effect of a PSC limit on the GOA non-pollock trawl CV sector is the potential to close a fishery prematurely. An early closure affects vessel revenues and crew compensation in a manner that reverberates throughout stakeholder communities. Hard cap PSC limits are a blunt tool in terms of incentivizing participants to minimize Chinook salmon PSC at all times in the context of a competitive limited access fishery, where actions to avoid salmon – such as standing down, relocating, or employing a net excluder device – are individually costly but benefit the fleet as a whole by decreasing the likelihood of a closure. The Council has set PSC hard caps with dual-objectives in mind: preventing PSC from exceeding established conservation goals and supporting the regulated fishery and its dependent stakeholders at historic levels of participation. In selecting the status quo PSC limit for the fisheries affected by this action, the Council intended to select a limit that supported the non-pollock trawl sector's historical PSC use over an average of years but did not select a level that covered the highest years in order to incentivize bycatch minimization. The purpose and need for this action notes that new information from observer coverage that was not available during the years analyzed for Amendment 97 might indicate that estimated Chinook PSC for that segment of the fishery was lower than the actual rate that supported historical harvest levels. Though it is not possible to retrospectively prove or disprove that smaller trawl vessels had been encountering more Chinook salmon than was estimated based on PSC rates extrapolated from larger Western and Central GOA trawl CVs, the marked increase in maximum estimated Chinook PSC for that sector post-restructuring warrants consideration.

Retrospective analysis of annual harvest and PSC distribution throughout the years since the hard cap was implemented and the observer program was restructured suggest that a PSC closure is not expected befor the end of March. This means that direct harvest and revenue impacts on the non-pollock fishery would not occur in the Western GOA non-pollock CV sector. The impact of a PSC closure hinges on whether or not the Central GOA Pacific cod B season fishery and the late-year Central GOA flatfish fisheries can remain open. Those fisheries account for roughly 23% of harvest and 24% of ex-vessel revenues in the non-pollock non-Rockfish Program CV fisheries. A closure that occurs in April or May could preclude as much as 60% of average annual harvest and revenue. A closure that occurs during the summer months has a modest marginal impact relative to any other closure that falls after the Pacific cod A season.

The Rockfish Program fishery is fully observed, cooperatively managed, and represents a smaller, more interconnected fleet compared to the GOA limited access non-pollock CVs. Stand-downs or cooperative test-fishing to mitigate and adjust to unexpectedly high PSC rates are easier to coordinate. The first two months of the Rockfish Program CV season (May/June) account for 72% of the sector's average annual Chinook PSC, and 66% of its groundfish harvest by weight. Analysis suggest that it is not impossible for the Rockfish Program CV sector to reach its annual PSC limit of 1,200 Chinook, but it is highly improbable for that to occur early in the season.

In addition to any revenue loss associated with forgone non-pollock groundfish harvest, the processing sector might be impacted vis-à-vis its ability to anticipate the need for and utilization of labor, fixed processing costs per unit of production, loss of input supply products to value-added processors in other regions, and fulfillment of output supply contracts. One of the greatest impacts of hard cap PSC limits on processors is uncertainty about the amount and/or timing of groundfish deliveries. Processing workers may be impacted by unexpected lost wages and employment opportunities during times of year when non-pollock groundfish are the only product moving through Central GOA plants.

Limiting the amount of Chinook salmon PSC taken in non-pollock fisheries provides value to commercial Chinook salmon harvesters and processors, consumers, sport fishermen, charter operators, subsistence users, species that prey upon salmon (including ESA-listed species), and salmon stocks that are protected under the ESA. The economic activity generated by salmon harvesting in commercial and non-commercial sectors creates employment and other socioeconomic benefits multipliers throughout coastal communities. Taking fewer Chinook in the trawl fishery represents a benefit to other users of the resource in aggregate, but the direct effect of a marginal "saved" Chinook salmon cannot be quantified; it is not possible to draw any correlation between patterns of PSC and the status of individual salmon stocks. The most recent available data from genetic stock of origin analyses indicates that roughly 80% of the sampled GOA trawl Chinook PSC come from British Columbia and the U.S. west coast; roughly 15% come from Southeast Alaska, and 3% come from Northwest GOA stocks. These proportions only describe the fish that were sampled, and not the entire population of Chinook taken as trawl bycatch.

Alternative 2

The non-pollock non-Rockfish Program CV sector was apportioned the smallest amount of "head room" in its base PSC limit (2,700) relative to its historical PSC use as analyzed when the Council took action on Amendment 97. PSC estimates for the sector in recent years suggest that the sector's expected annual PSC encounter is even closer to the allotted hard cap of 2,700 Chinook salmon. Since the implementation of Amendment 97 in 2015, the sector has recorded Chinook PSC levels of 2,873, 425, and 2,244. Those widely varying totals, plus the acknowledged risk of a lightning strike PSC event of up to 1,000 estimated Chinook PSC in a week, illustrate the fact that the sector operates in an unstable setting. The analysis also considers the possibility that the true probability of a non-Rockfish Program CV closure in any given year is higher than what was assumed when the existing PSC limit was defined; this consideration is based on the coincidence of expanded observer coverage onto smaller Western GOA trawl CVs and increased PSC levels in that segment of the fleet.

Increasing the sector's base PSC limit would reduce the likelihood of unpredictable closures, providing security to groundfish harvesters, processors, and communities. That security could allow for better business planning, encourage investment in the affected fishery, stabilize the shoreside and at-sea workforce, and reduce uncertainty in an important source of public revenues. The benefits of reducing unpredictability in the frequency and timing of PSC closures are likely to be felt more strongly by stakeholders in the Central GOA fishery, where harvest and revenues continue to accrue later in the calendar when closure is more likely.

The Council should weigh the potential benefits to the trawl sector and its stakeholders against the possibility that higher PSC limits will decrease incentives to avoid Chinook PSC and result in higher bycatch levels relative to the No Action alternative. Chinook salmon provide direct and indirect benefits to a wide range of consumptive and non-consumptive user groups, and that actions that increase Chinook removals represent a marginal adverse impact on those stakeholders.

Alternative 3

Historical annual Chinook PSC levels recorded for the Rockfish Program CV sector are expected to be a strong indicator of annual average PSC levels that can be expected in the future. Average Chinook PSC from 2007 through 2017 was 848 fish, with a low of 158 (2016) and a high of 1,802 (2015). The fact that the highest and lowest PSC levels occurred in consecutive years reflects the supposition that Chinook PSC is unpredictable and that hard caps should account for expected variability, even in cooperatively managed fisheries with secure groundfish species allocations that remove the incentive to race for fish. The sector recorded Chinook PSC levels higher than the status quo PSC limit in three of the 11 years since the Pilot Program was implemented. Moreover, even in the context of a full observer coverage fishery, lightning strike PSC events have occurred.

The sector operates under a PSC limit that is high relative to its historical average use, and it has the operational advantages conferred by cooperative management. As a result, the most likely impact of increasing the sector's PSC limit is that the probability of a PSC closure will marginally decrease while the expected amount of the October 1 PSC rollover to the non-Rockfish sector will increase. Increasing the expected October 1 rollover to the non-Rockfish CV sector is in accordance with the Council's original intent for apportioning the Rockfish sector with a base PSC limit that exceeded its historical average use; an average of 87% of Rockfish CVs participate in Central GOA Pacific cod and/or flatfish fisheries after October 1 on an annual basis.

Actions that increases the amount of Chinook PSC available for use in a given year entail potential adverse impacts on direct and indirect users of the Chinook salmon resource. The level and distribution of those impacts are not quantifiable with available information.

1 Introduction

This document analyzes proposed management measures that would apply to all trawl fishing by catcher vessels (CV) in the groundfish fisheries of the Central and Western Gulf of Alaska (GOA), except the directed pollock fishery. Trawl fishing in the GOA is limited by prohibited species catch (PSC) of Chinook salmon (*Oncorhynchus tshawytscha*). PSC limits cap the amount of Chinook salmon that can be taken in the trawl fishery (or a sector of the fishery); directed fishing with trawl gear is closed if that limit is met. The action alternatives under consideration would increase the existing Chinook salmon PSC limits for non-pollock trawl CVs, and CVs fishing under the authority of a Central GOA Rockfish Program cooperative quota permit. 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 an Environmental Assessment/Regulatory Impact Review. An EA/RIR provides assessments of the environmental impacts of an action and its reasonable alternatives (the EA), and the economic benefits and costs of the action alternatives, as well as their distribution (the RIR). This EA/RIR addresses the statutory requirements of the Magnuson Stevens Fishery Conservation and Management Act, the National Environmental Policy Act, and Presidential Executive Order 12866. An EA/RIR 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 Magnuson-Stevens Act (MSA) National Standards require the Council to balance the objectives of achieving optimum yield, minimizing bycatch, and minimizing adverse impacts on fishery-dependent communities. Chinook salmon PSC taken in GOA trawl fisheries is a resource concern, and the Council has taken action to set hard cap PSC limits that are below the incidental take amount that would trigger reconsultation under the Endangered Species Act (ESA). Attainment of a PSC hard cap closes the trawl fishery. Since the 2015 implementation of Chinook salmon PSC limits for the GOA non-pollock groundfish trawl CV sector, the fishery has continued to display variable levels and unpredictable timing of salmon encounter. Potential closures and PSC encounter rates that vary from year-to-year or even week-to-week create uncertainty for fishery participants, which in turn can exacerbate a “race for fish,” make business planning more difficult, or directly lead to forgone harvest opportunities. Those outcomes adversely affect trawl harvesters, crew, processors, and GOA coastal communities.

Relative to what was available when the Council established the PSC limits, new information about the resource and the fishery’s rate of salmon encounter has been gathered from salmon genetic identification studies and the expansion of observer sampling onto smaller trawl vessels. Meanwhile, the fishery continues to operate under a limited access management structure where harvesters must compete for a share of the available catch without formalized cooperative tools to minimize PSC. As a result, individual actions to avoid PSC often confer an individual competitive disadvantage. Voluntary collective action is costly to organize, and agreements to stand down from fishing to minimize PSC have not always held.

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1.2 History of this Action

This document analyzes proposed modifications to regulations established under GOA Groundfish FMP Amendment 97 (NPFMC 2014), and the Central GOA Rockfish Program.[1] The final rule for Amendment 97 established annual Chinook salmon PSC limits for three GOA trawl sectors: the Central GOA Rockfish Program CV sector, the non-pollock non-Rockfish Program CV sector, and the GOA trawl CP sector. The Final Rule was published on June 5, 2014 (79 FR 32525). Annual Chinook PSC limits were first applied to the non-pollock trawl sectors during the 2015 fishing year. Prior to that, the Council had developed Chinook salmon PSC limits for the GOA pollock fishery, with separate limits for the Central GOA and the Western GOA. Those limits were implemented under GOA Groundfish FMP Amendment 93 and became effective in August of 2012.

Chinook salmon bycatch, or PSC, taken incidentally in GOA pollock trawl fisheries is a concern to stakeholders, and the Council is required to minimize bycatch under National Standard 9 in the MSA. The Council developed GOA trawl Chinook salmon PSC limits with that standard in mind, and as a measure to avoid exceeding the annual Chinook salmon threshold of 40,000 Chinook salmon identified in NMFS's incidental take statement of a Biological Opinion published on November 30, 2000 (see Section 4.5.3.1 for greater detail on the need for, and findings in, the Biological Opinion). When selecting the levels for pollock and non-pollock trawl fishery PSC limits, the Council analyzed a range of options that would appropriately balance the need to minimize bycatch with the National Standards that set objectives to achieve optimum yield from the fishery (NS 1) and to minimize adverse impacts on fishery-dependent communities (NS 8). For the non-pollock trawl fishery, the Council set a total annual PSC limits of 7,500 Chinook salmon. The Council considered a range of PSC limit options that spanned 5,000 fish to 12,500 fish per year. The Council selected the 7,500 Chinook limit and the sector apportionments described below based on available data for historical PSC use and observer information from the period of 2003 through 2011. In describing its preferred alternative, the Council relied on historical Chinook PSC levels from 2007 through 2011 as a guide for how much PSC the non-pollock trawl CV sectors were likely to use in a typical year (NPFMC 2014).

The annual non-pollock hard cap of 7,500 Chinook salmon is apportioned among the three trawl sectors as follows: CPs (3,600 fish), CVs participating in the Central GOA Rockfish Program (1,200 fish), and CVs participating in all other directed GOA non-pollock groundfish trawl fisheries in the Western and Central GOA Regulatory Areas (2,700 fish). If a sector reaches its Chinook salmon PSC limit, NMFS prohibits further directed fishing for non-pollock groundfish by vessels in that sector. Note that the vessels that participate in the Central GOA Rockfish Program also participate in the non-Rockfish Program CV sector. Amendment 97 provides for reapportionments (or "rollovers") of unused Chinook salmon PSC from the Rockfish Program CV Sector to the non-Rockfish Program CV sector on October 1 and November 15.

[1] The final EA/RIR/IRFA for GOA Groundfish FMP Amendment 97 is available at https://alaskafisheries.noaa.gov/sites/default/files/analyses/goa97earirirfa.pdf. CGOA Rockfish Program was established under GOA Groundfish FMP Amendment 88; final rule published in the Federal Register on December 27, 2011 (76 FR 81248).

On May 3, 2015 – the first year that the non-pollock Chinook PSC cap was in effect – all GOA non-pollock groundfish trawl fisheries were closed for the remainder of the year after the non-pollock non-Rockfish Program CV sector reached its PSC limit of 2,700 fish. In June 2015, the Council requested that NMFS implement an Emergency Rule to allocate an additional 1,600 Chinook salmon PSC to the non-pollock/non-Rockfish Program CV sector of the GOA groundfish trawl fishery. NMFS determined that an emergency existed because the early closure of the non-Rockfish Program CV groundfish fishery caused adverse, significant, and unforeseen impacts on harvesters, processors, and the community of Kodiak. The Final Rule for the emergency action was published on August 10, 2015 (80 FR 47864).[2] Providing 1,600 additional Chinook salmon PSC allowed the sector to harvest its recent average amount of groundfish during the remainder of the 2015 fishing year, while keeping the total Chinook salmon PSC well below the annual 40,000 Chinook PSC threshold for all GOA trawl fisheries. The additional allocation of 1,600 Chinook salmon was determined to be consistent with the overall goals of Chinook salmon PSC management in the GOA trawl fisheries and did not substantially increase Chinook salmon PSC relative to the limits established under Amendments 93 and 97, in aggregate.

The language of the Emergency Rule noted that the action was a direct response measure intended to mitigate the estimated costs of the 2015 closure while the Council develops an FMP amendment to permanently address the ability of the GOA trawl fleet to operate within the established conservation limits. The Emergency Rule was referring to the Council's efforts to develop a cooperative-based GOA trawl management program that would allocate quota for groundfish and PSC species (Chinook salmon and halibut). That effort began in 2013 but was tabled in December 2016 without achieving final action. This complete history of that action is described in Section 1.1.2 of a preliminary economic analysis that the Council reviewed in December 2016.[3] Other supporting documents that describe the program that was considered but not implemented – including the set of alternatives considered, an EIS public comment scoping report prepared by NMFS, and a preliminary social impact analysis – can be found under Item C-10 from the Council's December 2016 meeting agenda.[4]

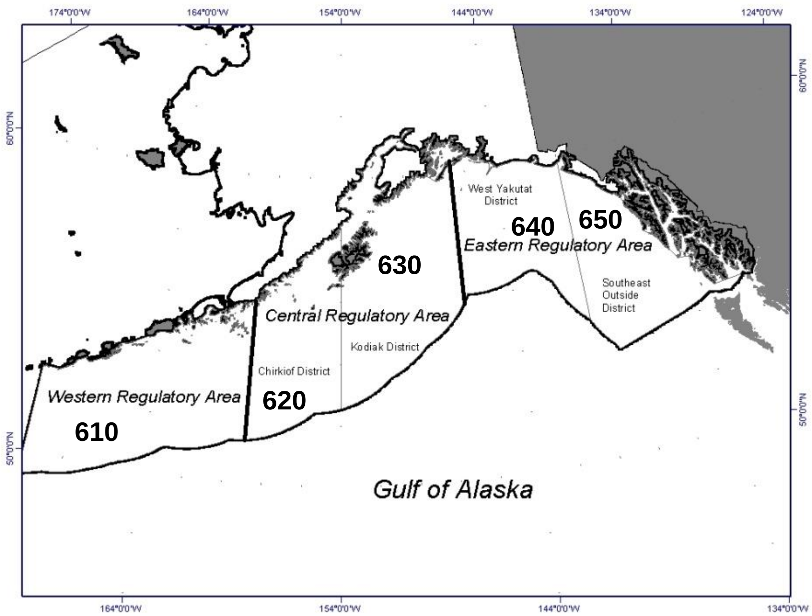
Following the 2015 non-pollock trawl closure and concurrent with the development of the Emergency Rule – and while the cooperative-based "management tools" program was still under development – the Council began developing an action that would provide NMFS inseason managers the ability to reallocate Chinook PSC between GOA trawl sectors based on projected need and use. The Council took final action in December 2015, increasing flexibility to respond to unforeseen or unanticipated changes in Chinook salmon PSC levels. The rule became effective in the 2017 fishing year. To date, NMFS has used this authority on one occasion, moving 404 Chinook PSC from the Central GOA pollock trawl sector to the Western GOA pollock trawl sector on November 15, 2017.[5] The intent of that action was not to encourage higher levels of Chinook salmon PSC. The action entails no guarantee that a sector would be entitled to a total Chinook salmon PSC limit that exceeds the amount set forth for that sector in existing regulations. No sector would experience a reduction in the amount Chinook salmon PSC apportioned for its use if that reapportionment would, in the judgment of NMFS inseason managers, jeopardize the sector's ability to harvest available groundfish. When eligible sectors are not sufficiently under their respective PSC limits to allow a reapportionment, Chinook salmon reapportionments do not occur. That uncertainty provides an incentive for each GOA trawl sector to stay within the initial PSC limit that is defined for it in regulation (see Section 2.1 of this document).

[2] RIR for the Emergency Rule is available at: https://alaskafisheries.noaa.gov/sites/default/files/analyses/goatrawl-chinookpsc-rir0715.pdf
[3] http://npfmc.legistar.com/gateway.aspx?M=F&ID=0636d970-11cf-4f6a-8037-cfb9b7ca34a3.pdf
[4] http://legistar2.granicus.com/npfmc/meetings/2016/12/950_A_North_Pacific_Council_16-12-06_Meeting_Agenda.pdf
[5] https://www.gpo.gov/fdsys/pkg/FR-2017-11-20/pdf/2017-25115.pdf

1.3 Description of Management 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, including the West Yakutat district. Figure 1 illustrates the action area, spanning regulatory areas 610, 620, 630, and 640. In 1998, a gear type prohibition on trawl fisheries went into effect in the Southeast Outside district (regulatory area 650).

Figure 1 Regulatory and reporting areas in the GOA



2 Description of Alternatives

NEPA requires that an EA analyze a reasonable range of alternatives consistent with the purpose and need for the proposed action. The alternatives in this chapter are designed to accomplish the stated purpose and need for the action, which is to provide non-pollock trawl CV sectors with an amount of PSC that is reflective of their historical use, provides a reasonable opportunity to prosecute the fishery in a limited access regulatory environment, accounts for variability and unpredictability in Chinook salmon encounter, and does not jeopardize the health of ESA-listed Chinook salmon stocks. The Council adopted the following alternatives for analysis in April 2017.[6]

Alternative 1: No action

Alternative 2: Increase the Chinook salmon PSC limit for the GOA non-pollock non-Rockfish Program CV sector by:
- Option 1: 1,000 fish
- Option 2: 2,000 fish
- Option 3: 3,000 fish

Alternative 3: Increase the Chinook salmon PSC limit for the Central GOA Rockfish Program CV sector by:
- Option 1: 300 fish
- Option 2: 600 fish
- Option 3: 900 fish

The Council may select either Alternative 2 or 3 or may select both in combination. If an action alternative is not selected, that CV sector's Chinook salmon PSC limit will remain at the status quo level described in Section 2.1. Selecting either (or both) action alternative would require an amendment to the GOA Groundfish FMP and to Federal Regulations at Section 679.21(h).

The Council did not specify whether increasing the base PSC limit for either of these sectors would affect the performance standard and resulting buffer amount for the incentive measure described in Section 2.1, or whether additional PSC that is allocated to the Rockfish Program CV sector would be available for the October 1 "rollover" if unused (also described in Section 2.1). This analysis considers the effects of treating additional PSC both as a simple increase to the base limit – i.e., affects the performance standard and the rollover provision – and as a special apportionment of additional Chinook PSC that may only be used in that sector. The Council may also wish to clarify whether the cap on inseason reallocations of Chinook PSC between GOA trawl sectors (GOA Amendment 103) will increase in proportion to any higher limit that is selected under Alternatives 2 or 3. **At final action, the Council should explicitly identify how any PSC limit increase, if recommended, should be applied.**

2.1 Alternative 1, No Action

Selecting the "no action" alternative would result in status quo management for the GOA non-pollock trawl fishery. The status quo Chinook salmon PSC limits for the CV sector of the GOA non-pollock trawl fishery are defined in regulation at Section 679.21(h) and in Section 3.6.2.2 of the GOA Groundfish FMP.[7] The annual PSC limit is 3,900 Chinook salmon. From this total, 1,200 Chinook salmon are for use during fishing activity that takes place under the authority of a Central GOA Rockfish Program cooperative quota permit, between May 1 and November 15. The limit for all other GOA trawl catcher

[6] http://npfmc.legistar.com/gateway.aspx?M=F&ID=b3912c18-195a-491c-8600-9c2fc251b0b8.pdf
[7] www.npfmc.org/wp-content/PDFdocuments/fmp/GOA/GOAfmp.pdf

vessel activity is 2,700 Chinook salmon. If more than 150 Chinook salmon PSC are available to the Central GOA Rockfish Program CV sector on October 1, the NMFS Alaska Regional Administrator may reapportion Chinook salmon PSC to the non-Rockfish Program catcher vessel sector, so long as no fewer than 150 Chinook salmon PSC remain with the Rockfish Program CV sector. Any Chinook salmon PSC that remain available to the Central GOA Rockfish Program CV sector on November 15 may be made available to the non-Rockfish Program catcher vessel sector upon that date.

Table 1 Base annual GOA Chinook salmon trawl sector PSC limits (status quo)

Trawl Fishery	Sector	Base PSC Limit
Pollock	Central GOA	18,316
	Western GOA	6,684
Non-Pollock	Rockfish Prog. CV	1,200
	Non-Rockfish Prog. CV	2,700
	All CP	3,600
Total		**32,500**

In order to promote further avoidance of Chinook salmon, the Council established an incentive for the non-Rockfish Program CV sector to meet a PSC performance standard that is lower than the hard cap (GOA Groundfish FMP Section 3.6.4.1). If the sector's PSC use in one year is less than or equal to 2,340 Chinook, then its effective limit for the following year is increased from 2,700 to 3,060 Chinook. The additional 360 Chinook PSC cannot be rolled over into future years if it is unused. Requiring the threshold to be met each year in order to earn the "buffer" for the following year ensures that the sector's average PSC use over any two consecutive years does not exceed 2,700 Chinook.[8]

Within a calendar year, NMFS may reapportion Chinook salmon PSC limits to CV sectors on the basis of need for, and availability of, Chinook PSC that is projected to be unused by the sector to which it was initially apportioned for that year (GOA Groundfish FMP Section 3.6.2.2.1). Total reapportionments *to* any particular sector during a year may not exceed 50% of that sectors annual base PSC limit (i.e., notwithstanding any "buffer" that the sector carries per the incentive measure described above). The non-pollock non-Rockfish Program CV sector may not receive total reapportionments that sum to more than 1,350 Chinook salmon, and the Rockfish Program CV sector may not receive more than 600 reapportioned Chinook salmon. These two sectors may receive reapportionments from any other GOA trawl sector that has a Chinook PSC limit, including the CP sector (base limit of 3,600 Chinook) and the Central and Western GOA pollock trawl CV fisheries (base limits of 18,316 and 6,684 Chinook, respectively).

Under current regulations, the absolute maximum amount of Chinook PSC that each sector affected by this action could use in one year is:

- Non-pollock non-Rockfish Program CV: **4,410 Chinook salmon** (2,700 base limit + 360 incentive buffer + 1,350 maximum reapportionments). This amount could also be supplemented after October 1 by a rollover of unused PSC from the Rockfish Program CV sector.
- Rockfish Program CV: **1,800 Chinook salmon** (1,200 base limit + 600 maximum reapportionments).

Under current regulations, the absolute maximum amount of Chinook PSC that can be taken across all sectors of the GOA trawl fishery is 33,340 Chinook salmon. That total includes the base limits defined in

[8] The GOA trawl CP sector is also eligible to earn an incentive buffer of 480 additional Chinook PSC if it performs to a standard of 3,120 Chinook in the previous year. If the sector meets that standard, its limit for the following year is increased from 3,600 to 4,080 Chinook.

Table 1 (32,500 Chinook), plus the incentive buffers for the non-pollock non-Rockfish Program CV sector (360 Chinook) and the GOA trawl CP sector (480 Chinook). As noted above, the mechanism behind the earned incentive buffer ensures that the maximum Chinook salmon PSC that can be taken over any two consecutive years cannot exceed 32,500 Chinook per year.

2.2 Alternative 2: Increase the Non-Pollock Non-Rockfish Program CV Sector Chinook Salmon PSC Limit

Alternative 2 would increase the Chinook salmon PSC limit for the non-pollock non-Rockfish Program CV sector of 2,700 by 1,000, 2,000, or 3,000 fish depending on the option selected. Table 2 shows the PSC limits and maximum inseason reapportionments that the sector would receive, presuming that the Council intends for the additional Chinook PSC that is made available through this action to be treated as part of a new, larger base limit. The performance standards listed in the table are scaled to match existing regulations, where the sector must leave at least 13.3% of its base PSC limit unused in order to receive an incentive buffer in the following year. The size of the incentive buffer is set equal to 13.3% of the base limit. The maximum inseason reapportionment that the sector can receive during a calendar year is similarly scaled to 50% of the base limit.

Table 3 shows the maximum PSC limit if the Council maintains the current structure of the incentive buffer and the inseason reapportionment cap while increasing the base limit. These two tables provide end-points that contain the maximum amount of Chinook PSC available if the Council were to change the application of one mechanism but leave the structure of the other in place. For example, under Alternative 2 Option 1, if the calculation of the performance standard and the incentive buffer are scaled to the new base limit of 3,700 Chinook salmon but the maximum reapportionment remains capped at 1,350 Chinook then the resulting maximum available PSC for the sector would be 5,543 Chinook (3,700 + 493 + 1,350); this falls between the maximum limits for Option 1 in each of the following tables (6,043 and 5,410, respectively).

Table 2 Non-pollock non-Rockfish Program CV sector Chinook salmon PSC limits and maximum possible PSC available with all existing mechanisms applied

Option	Base Limit	Performance Standard	Incentive Buffer	Maximum Reapportionment	Maximum Possible Limit
No action	2,700	2,340	360	1,350	4,410
Option 1	3,700	3,207	493	1,850	6,043
Option 2	4,700	4,073	627	2,350	7,677
Option 3	5,700	4,940	760	2,850	9,310

Table 3 Non-pollock non-Rockfish Program CV sector Chinook salmon PSC limits and maximum possible PSC available (other existing PSC mechanisms unchanged)

Option	Base Limit	Performance Standard	Incentive Buffer	Maximum Reapportionment	Maximum Possible Limit
No action	2,700	2,340	360	1,350	4,410
Option 1	3,700				5,410
Option 2	4,700				6,410
Option 3	5,700				7,410

As noted in Section 1.2, total annual Chinook PSC across all GOA trawl sectors cannot exceed 40,000 fish. Exceeding that amount would trigger an ESA Section 7 consultation. The Council should consider whether options for higher PSC limits could result in reaching the 40,000 Chinook ceiling if every sector hits its cap in the same year. Currently, GOA trawl Chinook PSC limits total 32,500 fish, and those limits were set with the 40,000 Chinook ceiling as a reference point. Considering incentive buffers that can be carried into a new year, the theoretical ceiling for any given year under current regulations is 33,340. That amount includes the 360 Chinook incentive buffer for the non-pollock non-Rockfish Program CV sector, and a 480 Chinook buffer for the trawl CP sector.[9] If the Council increases the base PSC limit *and* the incentive buffer for the non-pollock non-Rockfish Program CV sector then the theoretical ceiling for Chinook salmon PSC in a given year increases to the amounts shown in Table 4. Whether or not increasing the sector's base PSC limit affects the in-season reapportionment cap does not change the maximum Chinook salmon take because any reapportioned PSC would be coming out of a reduction in the annual cap of another GOA trawl sector.

Table 4 Maximum annual GOA trawl Chinook salmon PSC under Alternative 2

	No action	Option 1	Option 2	Option 3
Base PSC Limits	32,500	33,500	34,500	35,500
Base + Non-RP CV Incentive Buffer (Table 2) + CP Incentive Buffer (480)	33,340	34,473	35,607	36,740

Alternative 3, described in Section 2.3, could be selected in combination with Alternative 2. At a maximum, Alternative 3 could increase the total GOA trawl Chinook salmon PSC limit by 900 fish (Alternative 3 Option 3). At that level, the highest possible Chinook salmon PSC limit for a single year would 37,640 (36,740 + 900). This amount is below the threshold that could trigger ESA Section 7 consultation, per the incidental take statement referenced in Section 4.5.3.1of this document.

It is critical to understand that incentive buffers do not increase the maximum average annual PSC level in the GOA trawl fishery over any set of consecutive years because the additional PSC provided by the buffer in one year are the result of equal or more Chinook PSC "savings" in the preceding year. Moreover, inseason reapportionments do not increase the maximum possible PSC level because they represent the movement of currently allocated Chinook PSC from one sector to another. As a result – over any set of years – **the absolute maximum average annual Chinook PSC that could occur as a result of this action is 36,400 Chinook salmon**. That amount is equal to the current PSC limits for pollock and non-pollock CV and CP fisheries (25,000 plus 7,500) plus an additional 3,600 Chinook PSC that would result from selecting Option 3 under Alternatives 2 and 3 (3,000 additional Chinook PSC for the non-pollock non-Rockfish Program CV sector, and 900 additional Chinook PSC for the Rockfish Program CV sector).

2.3 Alternative 3: Increase the Central GOA Rockfish Program Chinook Salmon PSC Limit

Alternative 3 would increase the Chinook salmon PSC limit for the Central GOA Rockfish Program CV sector of 1,200 by 300, 600, or 900 fish depending on the option selected. Table 5 shows the PSC limits and maximum inseason reapportionments that the sector would receive. The table shows two different maximum PSC limits, depending on whether the Council chooses to scale the inseason reapportionment mechanism to the original base limit (1,200 Chinook), or to the PSC limit as modified by this alternative. Unlike the non-pollock limited access CV sector, the Rockfish Program CV sector is not eligible to earn

[9] Note that the incentive buffer does not increase maximum Chinook PSC averaged over any two consecutive years because the additional PSC that is available in the second year is balanced or – more likely – outweighed by avoidance at or below the performance standard in the previous year.

an incentive buffer that can be added to its PSC limit for one year based on performance below a PSC threshold in the preceding year.

Table 5 Central GOA Rockfish Program CV sector Chinook salmon PSC limits and maximum possible PSC available with all existing mechanisms applied (a), and with existing mechanisms unchanged (b)

Option	Base Limit	Maximum Reapportionment (a)	Maximum Possible Limit (a)	Maximum Reapportionment (b)	Maximum Possible Limit (b)
No action	1,200	600	1,800	600	1,800
Option 1	1,500	750	2,250	600	2,100
Option 2	1,800	900	2,700	600	2,400
Option 3	2,100	1,050	3,150	600	2,700

As noted in Section 2.1, NMFS has the option to reapportion any unused Rockfish Program CV sector Chinook salmon PSC to the non-pollock sector (less 150 fish) on October 1. NMFS determines whether or not to execute this reapportionment based on anticipated need for Chinook PSC. The Council could specify whether any additional Chinook PSC that is allocated to the Rockfish Program CV sector is eligible for the October 1 reapportionment, noting that all unused Chinook PSC in the Rockfish Program CV sector are automatically made available to the non-pollock CV sector when the Rockfish Program fishery closes by regulation on November 15, or when all cooperatives have checked out of the fishery. If additional PSC is not allowed to be rolled over on October 1, then the unused amount of unused Chinook PSC in the Rockfish Program CV sector on that date could not be less than 450, 750, or 1,050 Chinook (as opposed to the current minimum of 150 Chinook). It is worth noting that the October 1 reapportionment provision was designed and implemented before NMFS was granted the ability to reapportion Chinook PSC between sectors based on its own discretion and management expertise (GOA Groundfish FMP Amendment 103). With that management tool in place, there is less need to maintain precautionary inseason reapportionment limits to prevent a scenario where a sector could not meet an unexpected need for Chinook PSC; NMFS managers now have to tools to prevent (or address) such an unforeseen scenario.

2.4 Comparison of Alternatives

Table 6 through Table 8 summarize the alternatives and potential impacts at a high level. For additional detail on potential impacts, refer to Section 3 and Section 4.7 of this document.

Table 6 Summary of alternatives

	Alternative 1	Alternative 2	Alternative 3
	No action (status quo)	Increase non-pollock non-Rockfish Program CV sector Chinook PSC limit	Increase Rockfish Program CV sector Chinook PSC limit
PSC Limits	Non-pollock non-Rockfish Program CVs: 2,700 fish Rockfish Program CVs: 1,200 fish	Increase by: 1,000 fish 2,000 fish 3,000 fish	Increase by: 300 fish 600 fish 900 fish
Flexibility Mechanisms	NMFS may reallocate inseason between sectors. Non-pollock non-Rockfish program can use 360 additional Chinook if sector has fewer than 2,340 PSC the previous year.	Does additional PSC affect incentive buffer and/or inseason reapportionment caps?	Does additional PSC affect inseason reapportionment caps?

Table 7 Summary of environmental impacts

	Alternative 1	Alternatives 2 & 3
Groundfish	Under the status quo, neither the level of mortality nor the spatial and temporal impacts of fishing on target stocks are likely to jeopardize the sustainability of groundfish.	Increased PSC limits are not likely to increase fishing pressure. Even if there is a redistribution of effort to avoid Chinook salmon, the fishery will likely remain within the established footprint of the non-pollock trawl fishing grounds. Consequently, this alternative is not likely to result in adverse impacts to groundfish stocks.
Chinook salmon	No changes.	Chinook salmon PSC may increase slightly 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 cause minor impact, as PSC levels either remain the same or are slightly increased.
Marine mammals	No changes.	No substantial change in the number of incidental takes is expected under either alternative.
Seabirds	No changes.	Effects on seabird takes are not likely to change substantially, and impacts are expected to be negligible.
Habitat	No changes.	Neither alternative is likely to result in significantly adverse effects to habitat.
Ecosystem	No changes	No anticipated population-level impacts to marine species or change ecosystem-level attributes beyond the range of natural variation

Table 8 Summary of socioeconomic impacts

	Alternative 1	Alternatives 2 & 3
Groundfish harvesters	Unpredictable frequency and timing of fishery closure; highly variable annual outcomes for non-pollock non-Rockfish Program CV sector. Likely to rely on inseason PSC reallocations and PSC rollovers from the Rockfish Program	Reduced uncertainty regarding ability to prosecute Central GOA Pacific cod B season and late-year flatfish fisheries. Change in expected outcomes is greater for non-pollock non-Rockfish Program CV sector than for Rockfish Program CV sector
Processors and communities	Uncertainty regarding business planning, investment, product flows, and public revenues. Possible concentration in the time span of a fishery. Possible reduced opportunity for shoreside workers.	Reduced uncertainty. Benefits concentrated in groups that participate in Central GOA fisheries.
Chinook salmon users	Impact to salmon stocks that provide commercial/charter/recreational/option values is limited. Distribution of benefits is not determined.	Potential for marginal increase in trawl PSC removals; frequency of years in which PSC would exceed status quo levels is not determined. Impact on specific stocks/runs is not determined.

3 Environmental Assessment

There are four required components for an environmental assessment. The need for the proposal is described in Chapter 1, and the alternatives in Chapter 2. This chapter addresses the probable environmental impacts of the proposed action and alternatives. Information with which to understand the affected environment for each resource component 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).

3.1 Methods

This chapter evaluates the direct, indirect, and cumulative impacts of the alternatives and options on the various resource components. The socio-economic impacts of this action are described in the Regulatory Impact Review (RIR) portion of this analysis (Chapter 4).

Recent and relevant information, necessary to understand the affected environment for each resource component, is summarized in the relevant section. For each resource component, the analysis identifies the potential impacts of each alternative, and uses criteria to evaluate the significance of these impacts. If significant impacts are likely to occur, preparation of an EIS is required. Although an EA 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).

An environmental assessment 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 concept behind cumulative effects analysis is to capture the total effects of many actions over time that would be missed if evaluating each action individually. Concurrently, the CEQ guidelines recognize that it is most practical to focus cumulative effects analysis on only those effects that are truly meaningful.

3.1.1 Documents incorporated by reference in this analysis

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

Federal regulations, the Fishery Management Plan (FMP) for Groundfish of the GOA, the Fishery Management Plan (FMP) for Groundfish of the BSAI Management Area, and the Magnuson-Stevens Fishery Conservation and Management Act. These strategies are applied using 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 groundfish fisheries. This document is available from https://alaskafisheries.noaa.gov/fisheries/groundfish-harvest-specs-eis.

Stock Assessment and Fishery Evaluation (SAFE) Report for the Groundfish Resources of the GOA (NPFMC 2017).

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

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 catcher 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.

Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis to set GOA Chinook PSC limits for non-pollock trawl fisheries (NPFMC 2014).

This analysis accompanied proposed Amendment 97 to the GOA Groundfish FMP, recommending a process for setting Chinook salmon PSC limits applicable to GOA non-pollock trawl fisheries.

Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis to allow the reapportionment of Chinook salmon PSC between the pollock and non-pollock GOA trawl fisheries (NPFMC 2016).

This analysis accompanied proposed Amendment 103 to the GOA Groundfish FMP, recommending a process allowing NMFS to make inseason reallocations of Chinook salmon PSC between GOA trawl sectors based on projected use and need.

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

The PSEIS evaluates the Alaska groundfish fisheries management program as a whole and includes analysis of alternative management strategies for the GOA and Bering Sea/Aleutian Islands (BSAI) groundfish fisheries. The EIS is a comprehensive evaluation of the status of the environmental components and the effects of these components on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. A Supplemental Information Report (NPFMC and NMFS 2015) was prepared in 2015 which considers new information and affirms that new information does not indicate that there is now a significant impact from the groundfish fisheries where the 2004 PSEIS concluded that the impact was insignificant. The PSEIS document is available from https://alaskafisheries.noaa.gov/node/33552, and the Supplemental Information Report from https://alaskafisheries.noaa.gov/sites/default/files/sir-pseis1115.pdf.

3.1.2 Cumulative effects analysis

This EA analyzes the cumulative effects of each alternative and the effects of past, present, and reasonably foreseeable future actions (RFFA). Each section below provides a review of the relevant past, present, and RFFA that may result in cumulative effects on the resource components analyzed in this document. 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 2005), the harvest specifications EIS (NMFS 2007a), the Central Gulf of Alaska Rockfish Program EA (NPFMC 2011), the EA/RIR/IRFA to Revise GOA Halibut PSC Limits (NPFMC 2012), and the EA/RIR/IRFA to establish GOA Chinook Salmon PSC Limits (NPFMC 2014). 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.

In addition, the supplemental information report (SIR) NMFS prepares to annually review the latest information since the completion of the Alaska Groundfish Harvest Specifications EIS is incorporated by reference (NMFS 2017c). SIRs have been developed since 2007 and are available on the NMFS Alaska Region website. Each SIR describes changes to the groundfish fisheries and harvest specifications process, new information about environmental components that may be impacted by the groundfish fisheries, and new circumstances, including present and reasonably foreseeable future actions. NMFS reviews the reasonably foreseeable future actions described in the Harvest Specifications EIS each year to determine whether they occurred and, if they did occur, whether they would change the analysis in the Harvest Specifications EIS of the impacts of the harvest strategy on the human environment. In addition, NMFS considered whether other actions not anticipated in the Harvest Specifications EIS occurred that have a bearing on the harvest strategy or its impacts. The SIRs provide the latest review of new information regarding Alaska groundfish fisheries management and the marine environment since the development of the Harvest Specifications EIS and provide cumulative effects information applicable to the alternatives analyzed in this EA.

A summary table of these RFFAs is provided below (Table 9). 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 designation of northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). CEQ regulations require consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. This requirement is interpreted to indicate actions that are more than merely possible or speculative. In addition to these actions, this cumulative effects analysis includes the effects of climate change.

Actions are considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or NMFS's publication of a proposed rule. Actions only "under consideration" have not generally been included, because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen. Identification of actions likely to impact a resource component within this action's area and time frame will allow the public and Council to make a reasoned choice among alternatives.

Table 9 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

3.2 Target species

3.2.1 Status

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 2017) includes more information.

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 2017). 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 2017).

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.

3.2.2 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 2017) and were also evaluated in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). Table 10 and Table 11 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) and the GOA Chinook salmon PSC EA/RIR/IRFA (NPFMC 2014). 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.

Table 10 Criteria used to determine significance of effects on target groundfish stocks

Effect	Criteria			
	Significantly Negative	**Insignificant**	**Significantly Positive**	**Unknown**
Fishing mortality	Changes in fishing mortality are expected to jeopardize the ability of the stock to sustain itself at or above its MSST (minimum stock size threshold)	Changes in fishing mortality are expected to maintain the stock's ability to sustain itself above MSST	Changes in fishing mortality are expected to enhance the stock's ability to sustain itself at or above its MSST	Magnitude and/or direction of effects are unknown
Stock Biomass: potential for increasing and reducing stock size	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 11 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

Alternative 2 would increase the Chinook salmon PSC limit for the GOA non-pollock non-Rockfish Program CV sector of 2,700 by 1,000, 2,000, or 3,000 fish depending on the option selected. A lower PSC limit may result in the non-pollock trawl fisheries closing before the TACs are reached, while a higher PSC limit would allow for groundfish fishing at current levels, and impacts would likely be similar to the status quo fishery.

Alternative 3 would increase the Chinook salmon PSC for the Central GOA Rockfish Program CV sector of 1,200 by 300, 600, or 900 fish depending on the option selected. As described in Section 2.3, Alternative 3 could be selected in combination with Alternative 2. At a maximum, Alternative 3 could increase the total GOA trawl Chinook salmon PSC limit by 900 fish (Alternative 3, Option 3). At that level, the highest possible Chinook salmon PSC limit for a single year would be 37,640 (36,740 + 900).

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 PSC limits 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 the alternatives 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, neither alternative is likely to result in adverse impacts to groundfish stocks and are likely insignificant.

Similarly, with respect to the ecosystem component and non-FMP species, increased PSC limits under the alternatives are 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 Alternatives 2 and 3 are expected to be insignificant compared to the status quo.

Cumulative Effects on Groundfish

RFFAs that may affect groundfish are shown in Table 10. 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 Alternatives 2 and 3. 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) and in the 2017 SIR (NMFS 2017c).

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

3.3 Chinook Salmon

3.3.1 Overview of Biology and Ecological Role

An 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).

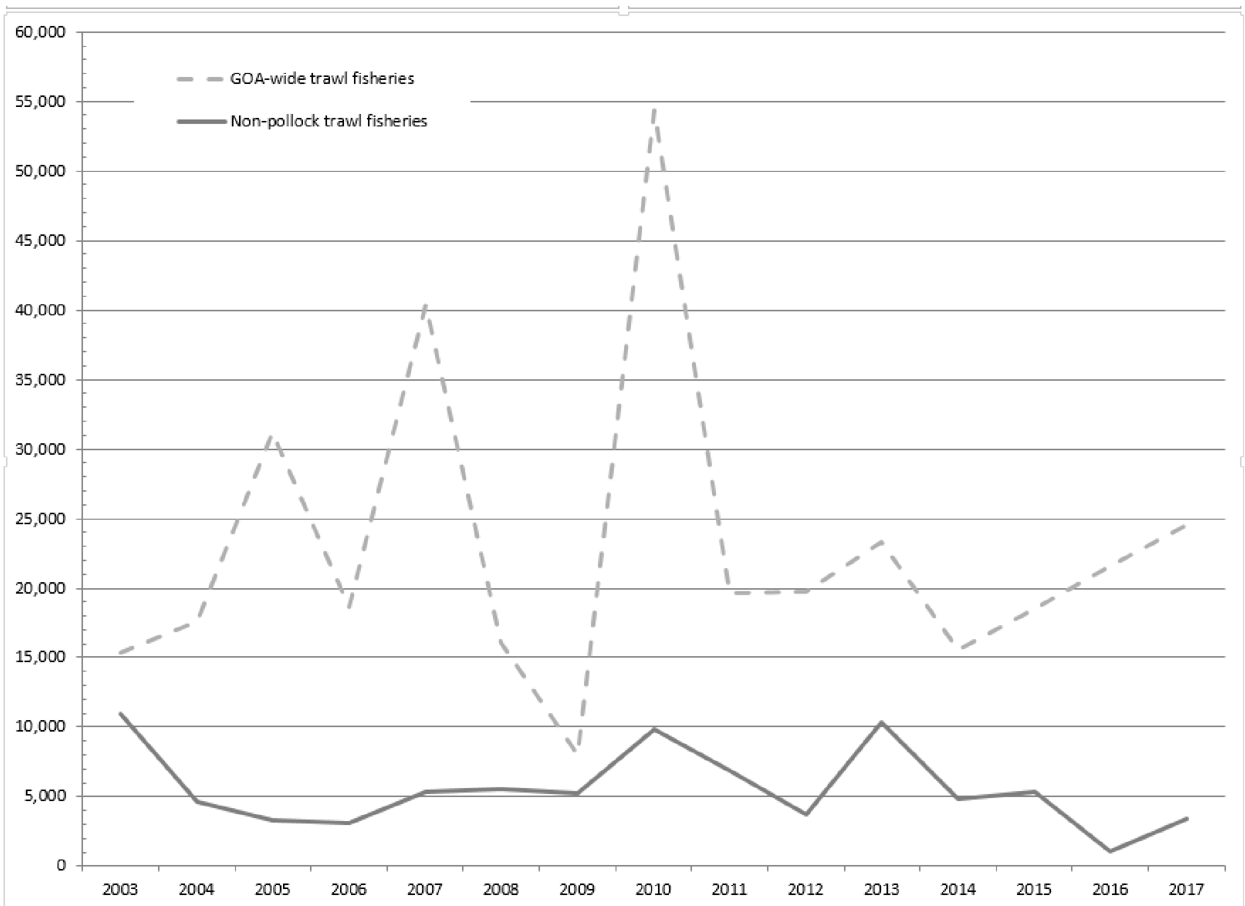
General results from the study found that immature chum salmon are primarily predators of macrozooplankton while Chinook salmon tend to prey on small nektonic prey such as fish and squid. Prey compositions shift between species and between seasons in different habitats and a seasonal reduction in diversity 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 2 shows the PSC of Chinook salmon in the GOA non-pollock trawl fisheries since 2003, 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 in Figure 2, PSC levels are highly variable from year to year. The highest Chinook salmon PSC levels in the non-pollock trawl fisheries occurred in 2003, 2010 and 2013. It is assumed that salmon caught in groundfish fisheries have a 100% mortality rate.

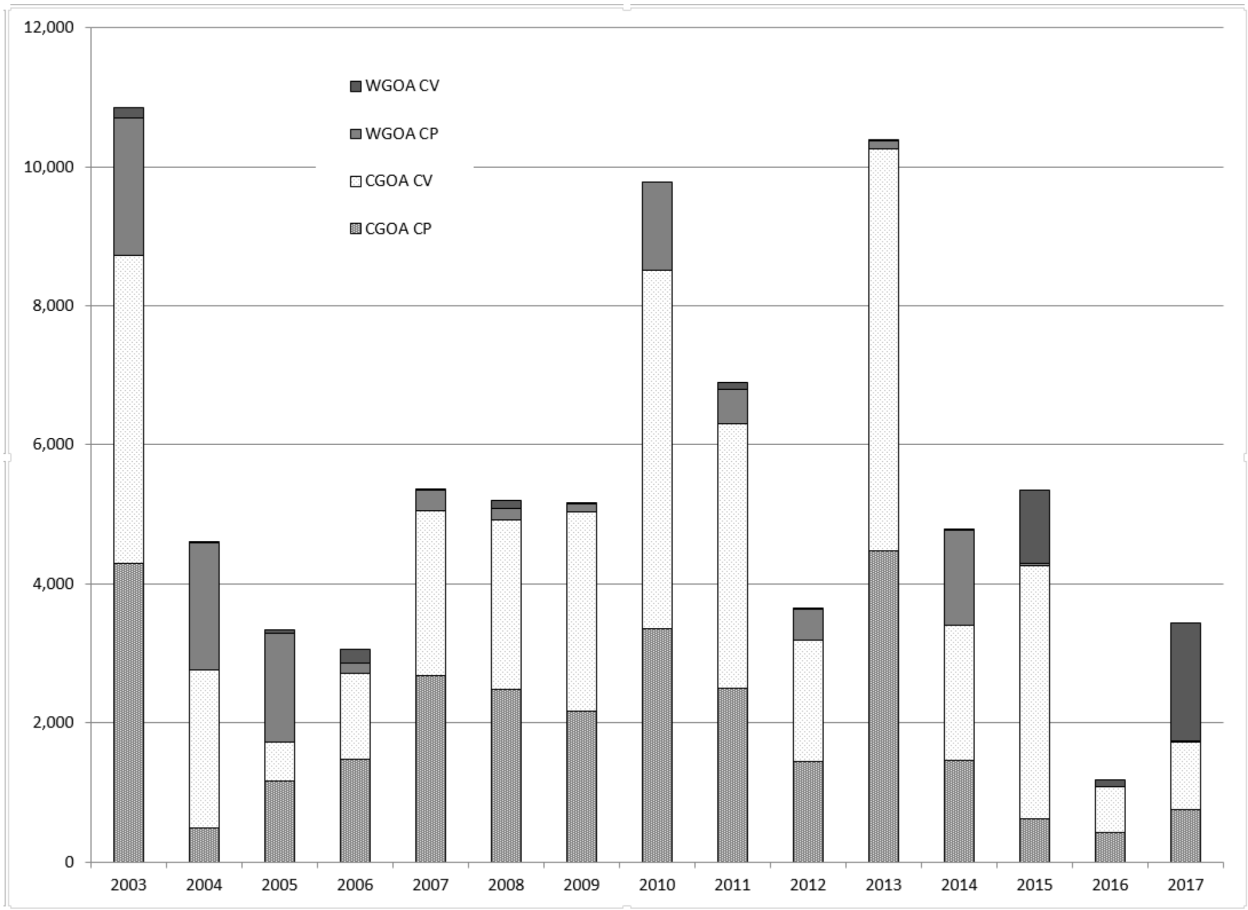
Figure 2 Prohibited species catch of Chinook salmon in Gulf of Alaska non-pollock trawl fisheries, 2003 through 2017 (number of fish)



Source: NMFS Alaska Region Catch Accounting System, January 17, 2018

Historical Chinook salmon PSC is discussed in detail in the RIR. Figure 3 illustrates Chinook salmon PSC in the non-pollock trawl fisheries for 2003 through 2017 among catcher vessels and catcher processors in the Western and Central GOA. Additional data for Western GOA catcher vessels is seen in more recent years in part due to the observer program restructuring that was implemented starting in 2013.

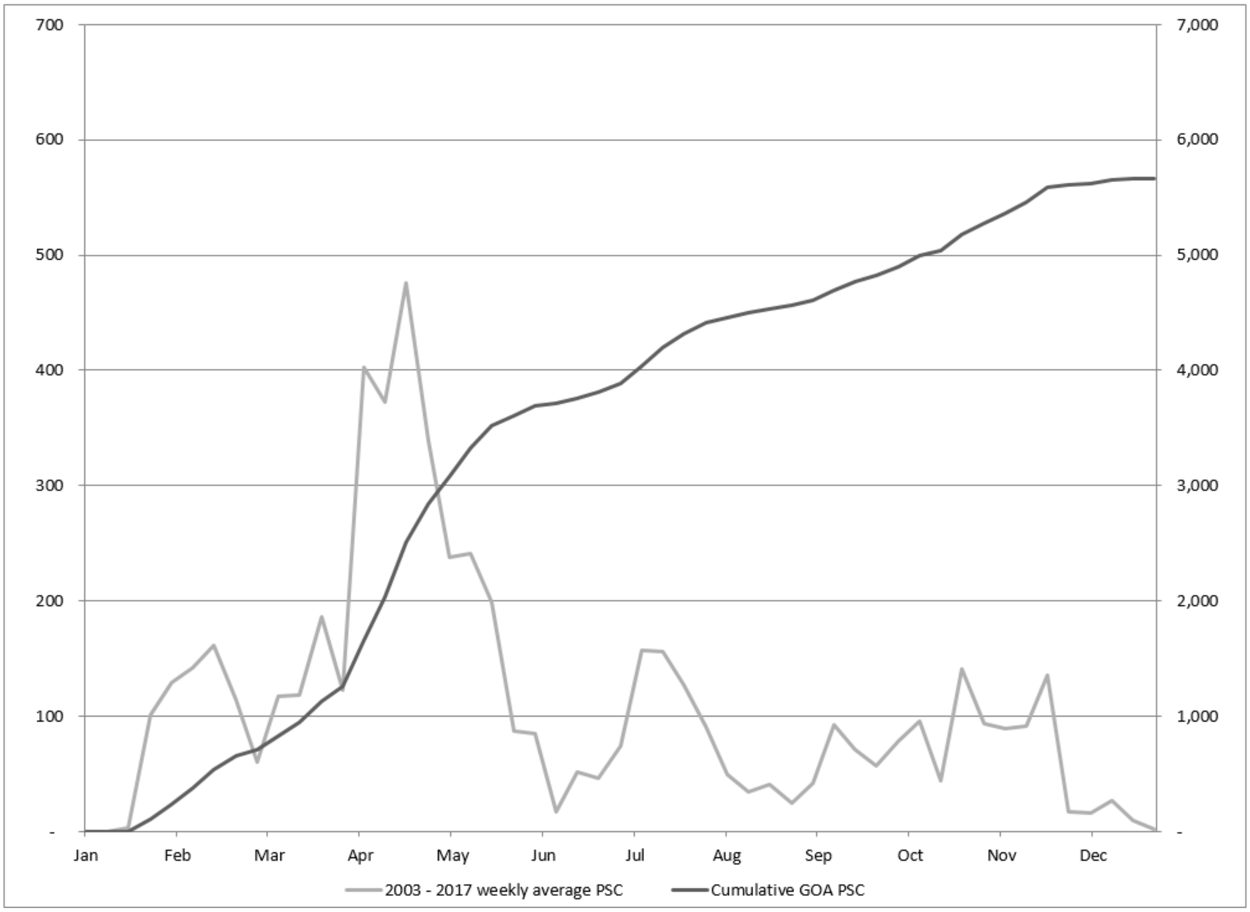
Figure 3 Annual estimated Chinook salmon PSC in non-pollock groundfish fisheries, 2003 to 2017, for the Western (WG) and Central GOA (CG), catcher processors (CP) and catcher vessels (CV)



Source: NMFS Alaska Region Catch Accounting System, January 17, 2018

Figure 4 illustrates the distribution of non-pollock trawl Chinook salmon PSC throughout the calendar year, based on 2003 to 2017. 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 4 Seasonal distribution of GOA Chinook salmon PSC, average Chinook PSC from 2003 to 2017



Source: NMFS Alaska Region Catch Accounting System

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. This information is as last reported in 2012, and insufficient data is available to update it at this time.

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 2013, 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 2014 Exploitation Rate Report lists abundance indices for Chinook salmon in the Southeast Alaska, Northern British Columbia and West Coast Vancouver Island troll fishery areas from 1999 to 2014. Abundance indices for the high GOA Chinook salmon PSC years were not substantially different from the period's average index values, and in some regions were lower than the index values for years with relatively low

GOA Chinook salmon PSC.[10] In addition, the Commission's most recent 2016 Annual Report of Catch and Escapement reviews catch and mortality for Chinook salmon in the same areas from 1999 to 2016 (PSC 2017).

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 12 shows the number of genetic samples that are available for the GOA trawl fisheries, from 2007 to 2017. The small number of Chinook salmon PSC samples has been insufficient to represent the annual catch for stock composition analysis, but sample collection has been increasing. The number of samples successfully genotyped is smaller than what is collected, but data is typically gathered from over 85% of samples collected (personal communication with Chuck Guthrie [AFSC], January 2018).

Table 12 Number of Chinook salmon genetic samples available from GOA groundfish trawl fisheries, 2007 to 2017

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	1,005		334 from area 610, 394 from area 620, 236 from area 630, 5 from area 640, and 36 from area 649
2013	740		
2014	1,395		
2015	2,645		
2016	5,542		
2017	3,960		

Source for 2013-2017: Personal communication with Chuck Guthrie, January 2018. "Samples as a proportion of GOA PSC" will be updated when the newest update of Chinook salmon PSC genetics becomes available in early 2018.

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. However, Amendment 93 did not mandate complete observer coverage, and not all GOA pollock trips were observed at-sea (Guthrie et al. 2017).

In light of these limitations in the GOA, starting in 2014, the observer program implemented a simple random sampling (SRS) protocol with respect to trip for the collection of genetic samples in the GOA (Faunce et al. 2014). This method randomly samples from trips and censuses the salmon bycatch encountered in each associated delivery to the processor (Faunce 2015). Samples of axillary process tissue for genetic analysis were collected throughout 105 from the GOA. Axillary process tissues were

[10] See Table 3-3 on page 95 of the report, available at http://www.psc.org/pubs/tcchinook15-1_v1.pdf

stored in coin envelopes which were labeled, frozen, and shipped to the AFSC's Auke Bay Laboratories (Guthrie et al. 2017).

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. As of the writing of this paper (January 2018) the most recent year for which genetic samples have been analyzed is 2015. From the 2015 GOA pollock trawl fishery, a total of 2,608 samples were analyzed, of which 2,414 were successfully genotyped. From the 2015 GOA rockfish CV trawl fishery, a total of 638 samples were analyzed, of which 635 were successfully genotyped. And from the 2015 GOA CP trawl non-pollock trawl fishery, a total of 365 samples were analyzed, of which 342 samples were successfully genotyped (Guthrie et al. 2017).

2015 was the second year for this sampling protocol and resulted in the largest available genetic sample set to date with 17.8% of the salmon bycatch successfully genotyped. Based on the analysis of 2,414 Chinook salmon bycatch samples, British Columbia (51%), West Coast U.S. (32%), Coastal Southeast Alaska (14%), and Northwest Gulf of Alaska stocks (3%) comprised the largest stock groups. The stock composition estimates in 2015 were very similar to that seen for previous years, although care must be taken when comparing estimates across years due to differences in sampling (Guthrie et al. 2017).

AFSC's Auke Bay genetics laboratory is currently in the process of finalizing their analysis of 2016 samples. A report on results is expected early in 2018 but was not available at the time of the writing of this analysis. Preliminary results for 2016 indicate that British Columbia continues to comprise the largest stock group for sampled Chinook, but that the proportion of stock composition from B.C. fell from 51% in 2015 to around 40%, while the West Coast U.S. increased from 32% in 2015 to around 40%. Coastal Southeast Alaska appears to increase slightly relative to the 2015 estimate of 14% but is still lower than the composition levels estimated for 2012 and 2014.

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 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.

In 2016, the 100% retention of all salmon by vessels with observers in the GOA pollock fishery allowed catcher vessel observers to check every salmon encountered in their randomly collected at-sea composition samples for missing adipose fins and collect a scale sample to verify species identification. In the 2016 GOA pollock fishery, 5,439 Chinook salmon were measured for length. Of these fish, 5,381 Chinook salmon were sampled for genetic tissue. And in the 2016 GOA non-pollock fisheries, observers measured a total of 166 Chinook salmon, of which 161 Chinook salmon were sampled for genetic tissue (NMFS 2017a).

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 many 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. 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. 23 Chinook salmon with readable CWT were recovered from the GOA rockfish trawl fishery in 2016, and 25 Chinook salmon were recovered from the U.S. trawl research in the GOA in 2015 (Masuda et al. 2017).

Table 13 Number of Chinook salmon sampled, number with clipped adipose fins (ad-clipped), and number with readable coded-wire tags (CWTs) in the various sampling programs in the Gulf of Alaska (GOA) and Bering Sea-Aleutian Islands (BSAI) in 2015 and 2016. The number of Chinook salmon with readable CWTs that were also ad-clipped is in parentheses. Only sampling programs based on electronic detection can be expected to recover CWTs from fish that are not ad-clipped.

Region	Year	Fishery and gear	Sampling program	Detection method	Number sampled	Number ad-clipped	Number with readable CWTs
GOA	2015	Research trawl	National Marine Fisheries Service	Electronic and visual	93	84	25 (19)
GOA	2016	Groundfish trawl	Observer Program	Visual	5,542[1,2]	932[2]	234 (234)
		Rockfish trawl	Alaska Groundfish Data Bank	Electronic	496	86	23 (20)
		Survey midwater trawl	National Marine Fisheries Service	Electronic	-	1	2 (1)
BSAI	2016	Groundfish trawl	Observer Program	Visual	2,408[2,3]	69[2]	28 (28)
		Salmon excluder device trawl	North Pacific Fisheries Research Foundation	Electronic	437	11	5 (3)

Source: NMFS 2016 Annual Report for the Alaska Groundfish Fisheries Chinook salmon CWT and Recovery Data for ESA Consultation
[1]Number of Chinook salmon sampled for genetics in the pollock and non-pollock fisheries.
[2]Number from the Fisheries Monitoring and Analysis Division of the Alaska Fisheries Science Center.
[3]Number of Chinook salmon sampled for length in the pollock and non-pollock fisheries.

Recoveries of CWT Chinook salmon in the GOA groundfish fishery in recent years are summarized by state or province of origin (Table 14 and Table 15), with Idaho being the state with the fewest observed CWTs.

Table 14 Observed and CWT mark-expanded numbers of coded-wire tagged Chinook salmon captured in the bycatch of the Gulf of Alaska groundfish fisheries, by run year and state or province of origin, 2001 through 2011

	Alaska		British Columbia		Idaho		Oregon		Washington		Total	
Run year	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number
2001	10	100.2	6	74.8	0	0	12	16.5	4	4	**32**	**195.6**
2002	10	47.2	5	113	0	0	4	4.3	3	3.7	**22**	**168.2**
2003	2	22.4	2	28.6	0	0	4	8.3	1	1	**9**	**60.3**
2004	3	30.5	4	22	0	0	5	16.9	1	1.1	**13**	**70.6**
2005	3	33.6	4	86.5	0	0	2	3.1	2	2.2	**11**	**125.4**
2006	10	58.3	7	158.3	0	0	2	2.1	5	14.5	**24**	**233.1**
2007	13	99.1	3	50.9	0	0	2	2.1	5	21.3	**23**	**173.3**
2008	6	52.3	1	1	0	0	3	9.3	12	12.9	**22**	**75.5**
2009	5	41.4	2	5.2	0	0	2	2.8	4	4.5	**13**	**53.9**
2010	10	81.3	4	4	0	0	10	25.9	12	23.7	**36**	**135**
2011	3	32.3	1	51.4	0	0	2	13.4	2	2	**8**	**99.2**
Mean	**6.8**	**54.4**	**3.5**	**54.2**	**0**	**0**	**4.4**	**9.5**	**4.6**	**8.3**	**19.4**	**126.4**
% total averaged over years	**34%**	**46%**	**20%**	**38%**	**0%**	**0%**	**23%**	**9%**	**23%**	**7%**		

Source: NMFS 2016 Annual Report for the Alaska Groundfish Fisheries Chinook salmon CWT and Recovery Data for ESA Consultation

Table 15 Observed and CWT mark-expanded numbers of coded-wire tagged Chinook salmon captured in the bycatch of the Gulf of Alaska groundfish fisheries (excluding augmented sampling in the rockfish trawl fishery, 2013–2016, and salmon excluder device testing, 2013–2014), by run year and state or province of origin, 2012 through 2016

	Alaska		British Columbia		Idaho		Oregon		Washington		Total	
Run year	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number
2012	11	78	13	34.7	1	2	25	135.1	30	59.2	**80**	**309**
2013	5	25.9	9	38.1	0	0.4	7	69.4	5	7.4	**27**	**140.7**
2014	5	54.9	10	48.8	1	1	13	77.9	5	6.7	**34**	**189.4**
2015	27	305.8	30	176.2	0	0	15	15.9	30	48.7	**102**	**546.6**
2016	55	356.6	64	261.4	0	0	48	234.8	67	95.3	**234**	**948.1**
Mean	**20.6**	**164.2**	**25.2**	**111.8**	**0.4**	**1.5**	**21.6**	**106.6**	**27.6**	**43.5**	**95.4**	**426.8**
%total averaged over years	**19%**	**33%**	**27%**	**25%**	**1%**	**0%**	**26%**	**32%**	**26%**	**9%**		

Source: NMFS 2016 Annual Report for the Alaska Groundfish Fisheries Chinook salmon CWT and Recovery Data for ESA Consultation

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 16). However, as discussed above, CWTs do not represent the true composition of all stocks of Chinook salmon in the PSC of GOA groundfish fisheries.

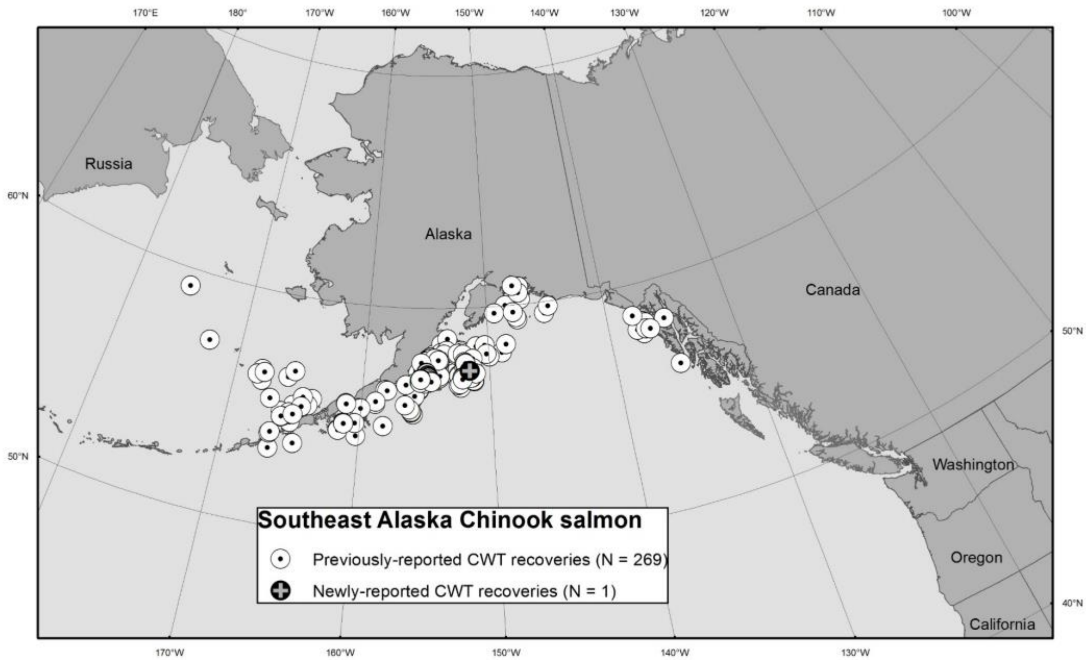
Table 16 Observed and CWT mark-expanded numbers of coded-wire tagged, Alaska-origin Chinook salmon captured in the bycatch of the Gulf of Alaska groundfish fisheries (excluding augmented sampling in the rockfish trawl fishery, 2013–2016, and salmon excluder device testing, 2013–2014) by run year and release region.

	Cook Inlet, Alaska		Southeast Alaska		Alaska Total	
Run year	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number	Observed number	CWT mark expanded number
2001	2	2	8	98.2	**10**	**100.2**
2002	1	1	9	46.2	**10**	**47.2**
2003	0	0	2	22.4	**2**	**22.4**
2004	0	0	3	30.5	**3**	**30.5**
2005	0	0	3	33.6	**3**	**33.6**
2006	0	0	10	58.3	**10**	**58.3**
2007	0	0	13	99.1	**13**	**99.1**
2008	2	2	4	50.3	**6**	**52.3**
2009	1	1	4	40.4	**5**	**41.4**
2010	0	0	10	81.3	**10**	**81.3**
2011	0	0	3	32.3	**3**	**32.3**
2001-11 Mean	*0.5*	*0.5*	*6.3*	*53.9*	***6.8***	***54.4***
2012	0	0	11	78	**11**	**78**
2013	0	0	5	25.9	**5**	**25.9**
2014	0	0	5	73.2	**5**	**73.2**
2015	0	0	27	305.8	**27**	**305.8**
2016	0	0	42	356.6	**42**	**356.6**
2012-16 Mean	*0*	*0*	*18.0*	*167.9*	***18.0***	***167.9***

Source: NMFS 2016 Annual Report for the Alaska Groundfish Fisheries Chinook salmon CWT and Recovery Data for ESA Consultation.
Note: The Chinook salmon tagging program in the Cook Inlet, Alaska region has been intermittent since the 2008 brood year (2010 release).

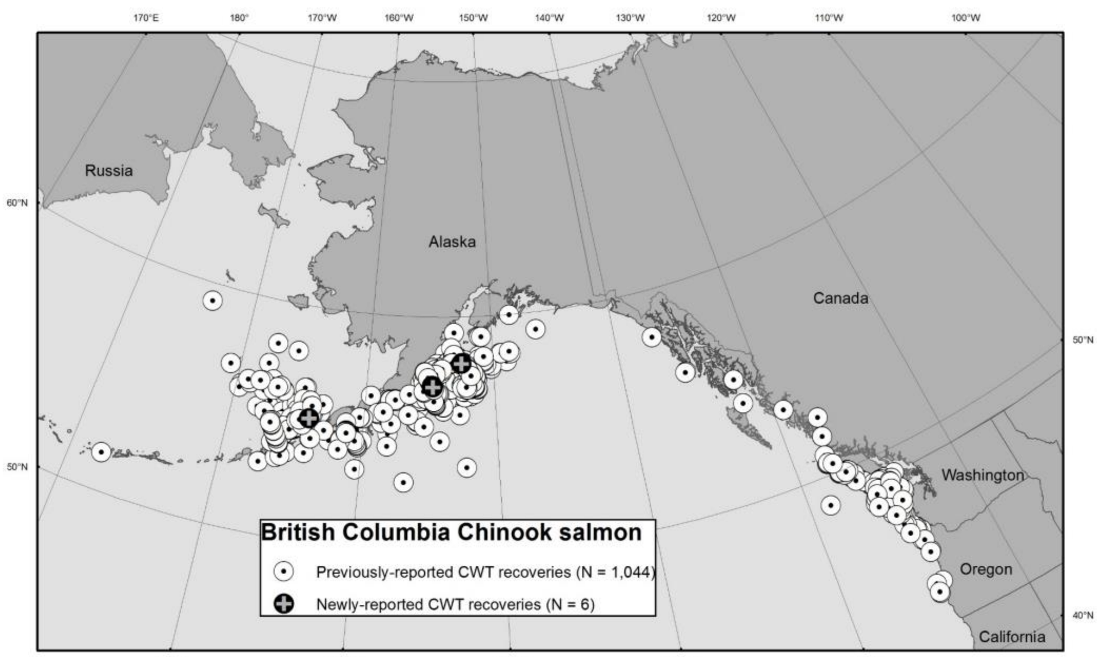
Maps of CWT Chinook salmon distribution in the North Pacific Ocean, GOA, and Bering Sea by state or province of origin are shown (Figure 5 through Figure 10). These maps are compiled from CWT recoveries from high seas commercial fisheries and research surveys, 1981 through 2016, and are updated annually (Masuda et al. 2017). High seas commercial fisheries include fisheries that occur in the exclusive economic zone (EEZ) off Alaska.

**Figure 5	Ocean distribution for Southeast Alaska Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2016. Points reflect recovery locations.**



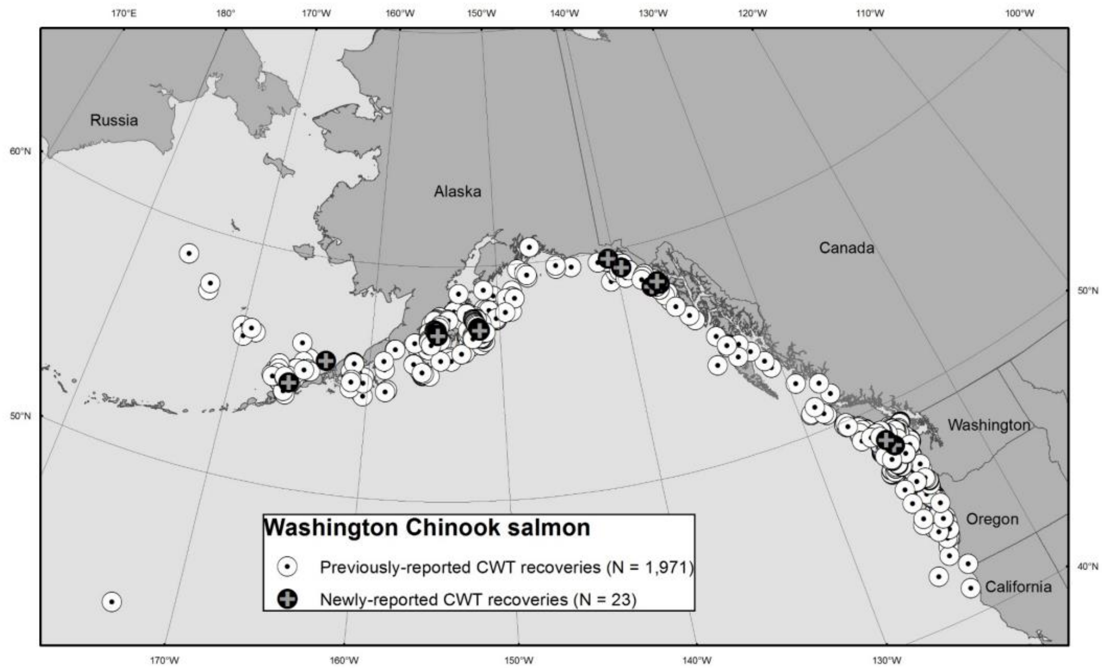
Source: Masuda et al. 2017

**Figure 6	Ocean distribution for British Columbia Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2016. Points reflect recovery locations.**



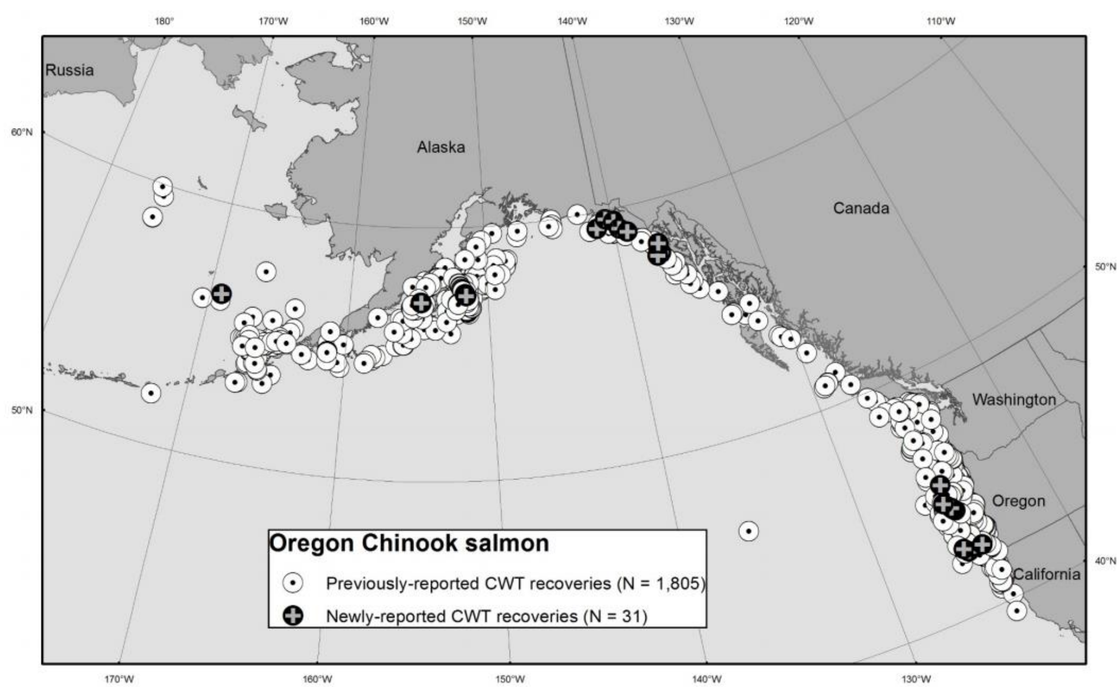
Source: Masuda et al. 2017

Figure 7 Ocean distribution for Washington Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2016. Points reflect recovery locations.



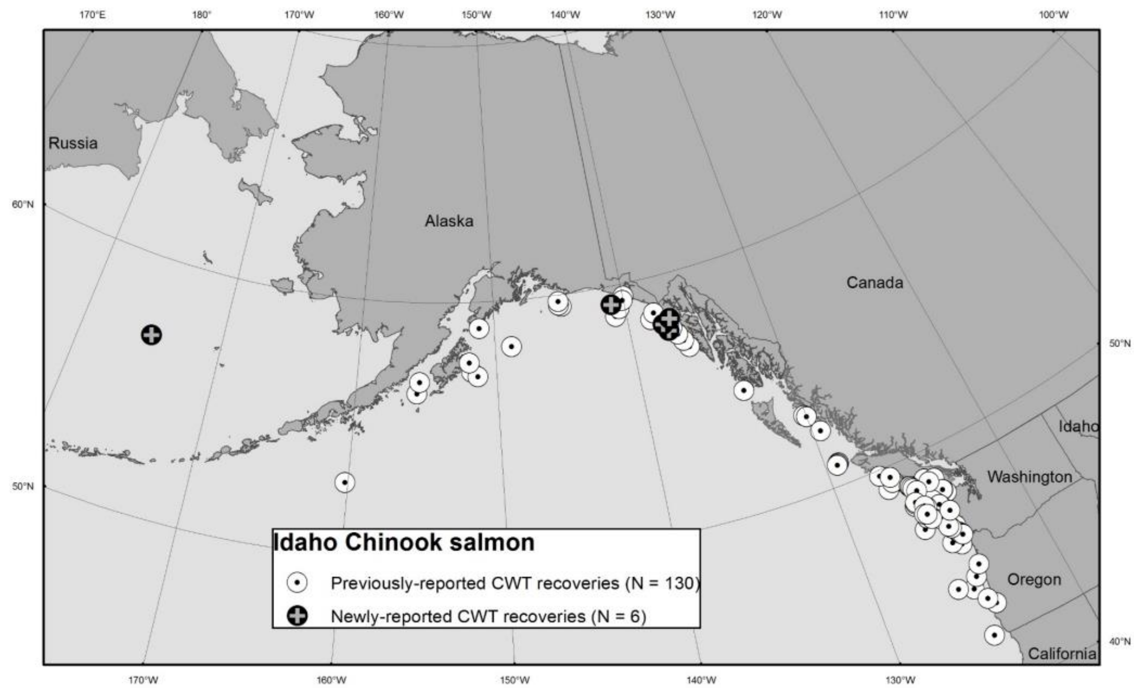
Source: Masuda et al. 2017

Figure 8 Ocean distribution for Oregon Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2016. Points reflect recovery locations.



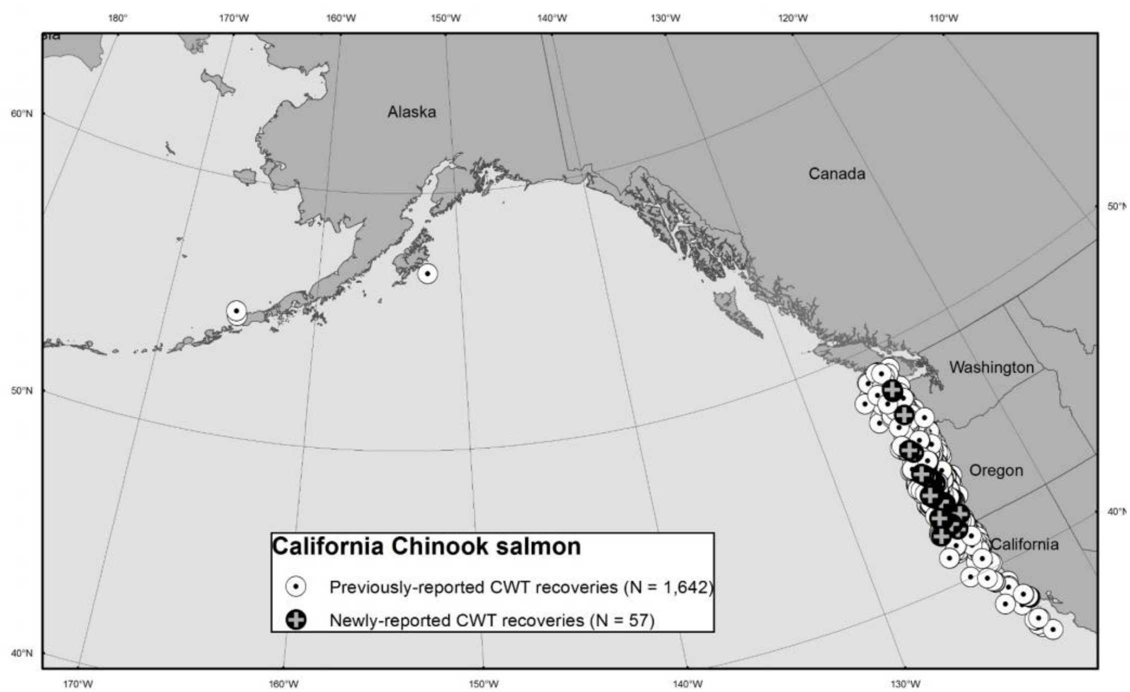
Source: Masuda et al. 2017

Figure 9 Ocean distribution for Idaho Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2016. Points reflect recovery locations.



Source: Masuda et al. 2017

Figure 10 Ocean distribution for California Chinook salmon from CWT recoveries in high seas commercial fisheries and research surveys, 1981 through 2016. Points reflect recovery locations.



Source: Masuda et al. 2017

Most of the Chinook salmon represented by CWTs and harvested in the GOA originated from hatchery production (Table 17). 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 17 Observed numbers of coded-wire tagged Chinook salmon captured in the bycatch of the Gulf of Alaska groundfish fisheries (excluding augmented sampling in the rockfish trawl fishery, 2013–2016, and salmon excluder device testing, 2013–2014) by rearing type and state or province of origin.

		Rearing type		
	Origin	**Hatchery**	**Mixed**	**Wild**
2001 - 2011	Alaska	59	0	6
	British Columbia	33	0	0
	Idaho	0	0	0
	Oregon	36	0	0
	Washington	35	10	2
	% of total	**90%**	**6%**	**4%**
2012 - 2016	Alaska	93	0	5
	British Columbia	113	0	0
	Idaho	1	0	0
	Oregon	83	0	1
	Washington	109	0	1
	% of total	**98%**	**0%**	**2%**

Source: NMFS 2016 Annual Report for the Alaska Groundfish Fisheries Chinook salmon CWT and Recovery Data for ESA Consultation

Chinook salmon represented by CWTs and recovered in the GOA were composed of a variety of run-types, and the observed numbers of CWT Chinook salmon of each run-type varied by state or province of origin (Table 18). 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 late fall.

Table 18 Observed numbers of coded-wire tagged Chinook salmon captured in the bycatch of the Gulf of Alaska groundfish fisheries (excluding augmented sampling in the rockfish trawl fishery, 2013–2016, and salmon excluder device testing, 2013–2014) by run type and state or province of origin.

	Run type			
Origin	**Spring**	**Summer**	**Fall**	**Late fall upriver bright**
Alaska	67	0	0	0
British Columbia	7	12	20	0
Idaho	0	0	0	0
Oregon	20	0	25	3
Washington	1	18	29	3
% of 2001-11 total	**46%**	**15%**	**36%**	**3%**
Alaska	95	3	0	0
British Columbia	8	81	24	0
Idaho	0	0	0	1
Oregon	52	0	30	2
Washington	11	49	42	8
% of 2012-16 total	**41%**	**33%**	**24%**	**3%**

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 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).

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. Escapement goals are provided by river for each Alaska region up to 2016. Section 3.3.5.11 provides a summary of Alaska Chinook salmon stock performance in 2016. Information on stock status and abundance for non-Alaskan Chinook salmon populations is periodically published by the North Pacific Anadromous Fish Commission.

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 BEG (Munro and Volk 2012) and these counts are used as indicators of relative salmon abundance as part of a coast-wide Chinook salmon model. In 2016, preliminary estimates indicate that 2 of the 11 Chinook salmon index systems monitored in Southeast Alaska met or exceeded the lower bound of spawning escapement goals. This was a reduction from 2015, when 9 of the 11 index systems were within BEG goals. The 2 river systems that were within BEG ranges in 2016 were the Keta River, a clearwater stream located on the south end of Misty Fjords National Monument near Ketchikan, and the King Salmon River, a small non-glacial system located near the head of Seymour Canal on Admiralty Island (Hagerman et al. 2017).

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 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, 2010, 2014, and 2016, this lower-bound SEG has been achieved in all years since implementation.

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. 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 runs in a number of areas of the state, including Upper Cook Inlet, have fallen below expected levels in recent years. The 2016 Upper Cook Inlet harvest of 10,027 Chinook salmon was the 15th smallest since 1966 and was approximately 6% less than the previous 10-year (2006-2015) average annual harvest of 10,227 fish. The recent pattern of below average Chinook salmon harvests is the result of lower abundance of Chinook salmon in the Upper Cook Inlet, but also related to restrictions placed up on commercial fisheries for the conservation of this species (Shields 2016).

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 19). However, escapement goals have generally been met. Most recently, Chinook salmon escapements from 2013 to 2016 were sufficient to meet their respective escapement goals with the exception of the Anchor River, which failed to meet escapement in 2014 (Otis et al. 2016).

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 2015 Nelson River Chinook salmon escapement of 2,890 fish met the BEG range of 2,400–4,400 fish (Sagalkin and Erickson 2013).

The South Alaska Peninsula Area includes waters from Kupreanof Point west to Scotch Cap. There are no known Chinook salmon spawning streams along the South Alaska Peninsula waters. 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 harvest for Chinook salmon, for all gear combined, ranged from 5,412 in 2006 to 13,449 in 2016 (Fox et al. 2017).

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). Aside from 2013 when it was slightly below the lower bound, the BEG has been met or exceeded in all years since implementation. At 1,843 fish, the Chinook salmon escapement in 2016 was within the BEG range of 1,300–2,700 fish (Wilburn and Stumpf 2017).

3.3.5.6 Kodiak

The Kodiak Management Area (KMA) 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 achieved the escapement goal of 4,000 to 9,000 fish every year since 2008, but were below in 2009, 2013, 2014 and 2015.

There has been concern regarding the low returns of Chinook salmon escapement in the Karluk and Ayakulik rivers in recent years. In an attempt to increase escapement, regulation 5 AAC 18.395 provides ADF&G emergency order authority to prohibit retention of Chinook salmon 28 inches or greater in length by seine gear during fisheries in the Inner Karluk, Outer Karluk, Inner Ayakulik, and Outer Ayakulik sections and that portion of the Central Section south of the latitude of Cape Kuliuk when weir counts indicate inadequate escapement. Additionally, for the 2014–2016 salmon seasons the Board of Fisheries (BOF) has mandated nonretention of Chinook salmon 28 inches or greater in length for the entire KMA from June 1 to July 5. The 2016 Karluk River Chinook salmon season total weir count of 3,434 fish was within the BEG range of 3,000–6,000 fish (Anderson et al. 2016).

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 19). 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 19). 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.

Chinook salmon harvests in 2013 were well below recent 20-year (1993–2012) averages in all districts, as were 2014 harvests. In 2014, the Nushagak River Chinook salmon SEG was met; however, escapement was below the inriver goal. The 2016 baywide commercial harvest of 32,990 Chinook salmon was 38% below the 20-year (1996–2015) average of 52,000 fish. The Naknek-Kvichak, Egegik, and Ugashik Districts had harvests above the 20-year (1995–2015) averages and the Togiak District was below. The largest producer of Chinook salmon in the Bay, the Nushagak District, achieved a harvest of 23,783, below the 20-year (1996–2015) average of 44,000 fish. The Nushagak River Chinook salmon escapement was 125,368, above the sustainable escapement goal range of 55,000–120,000 (Salomone et al. 2017).

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). BEGs 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.

The 2011 and 2013 Chinook salmon runs came in at the low end of the preseason outlook with the Anvik river goals not met in both 2011 and 2013 and the Chena river escapement goals not met in 2013 (Estensen et al. 2011, Estensen et al. 2013). Although below average, the 2014 and 2015 Chinook salmon runs came in above the upper end of the preseason outlook range and all escapement goals that could be assessed were either met or exceeded (Estensen et al. 2014, Estensen et al. 2015).

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. The 2009 Chinook salmon run had some of the best escapements seen in years throughout most of Norton Sound, while the 2010 run had some of the poorest. 2011 -2013 were weak years, but improvement was seen in 2014 and 2015 after restrictions to fishing time in southern Norton Sound likely helped get more fish to the spawning grounds (Menard et al. 2015).

3.3.5.11 Summary of 2016 Alaska Chinook Salmon Stock Status

Chinook salmon runs in Alaska have been below average since 2007, and management of the fisheries has been conservative in many systems. Implementation of strict fishery management actions has been necessary to meet escapement objectives, and many fisheries have been curtailed to protect Chinook salmon. In the Yukon and Kuskokwim Rivers, weak runs of Chinook salmon resulted in extensive restrictive management actions in the subsistence, sport, personal use, and commercial fisheries by the department.[11]

In 2016, runs improved for the western Alaska stocks (i.e., Yukon, Kuskokwim, and Nushagak) but overall these runs are still below the long-term averages. While also remaining below the long-term averages, runs improved in Kodiak and Cook Inlet in 2016. Unfortunately, Chinook salmon runs from the Copper River to southern Southeast Alaska declined in 2016 and were the lowest on record. It is unclear whether runs will continue to improve over the long term in Kodiak, southcentral, and western Alaska. Runs to the Kenai River were good in 2017, the Copper River run was better than expected, and over 80% of Chinook salmon escapement goals in western Alaska were met in 2017. However, the near-term outlook for southeast Alaska is not positive as very few "jacks," typically a strong indicator of future production, were seen in 2016, and escapements to most systems in 2017 were historically low despite restrictions to fishing.[12] Runs in this region are expected to remain low in 2018.[13]

[11] See http://www.adfg.alaska.gov/index.cfm?adfg=chinookinitiative.main
[12] http://www.adfg.alaska.gov/index.cfm?adfg=pressreleases.pr08072017
[13] http://www.adfg.alaska.gov/index.cfm?adfg=pressreleases.pr12222017

Table 19 Overview of Alaskan Chinook salmon stock performance, 2016

Chinook salmon stock	Total run size	Escapement goals met[a]	Subsistence fishery	Commercial fishery	Sport fishery	Stock of concern
Bristol Bay	Average	1 of 2	Yes	Yes	Yes	No
Kuskokwim	Below average	9 of 14	Yes, Restricted on Kuskokwim River	None	Closed on Kuskokwim River, not in Bay	No
Yukon	Below long-term average	2 of 2 (3 not surveyed; 1 incomplete)	Yes, with restrictions	No	Closed in Yukon Drainage, bait restricted in Chena and Salcha	Yield (Yukon River)
Norton Sound	Poor	0 of 2	Restricted in Subdistricts 4-6	No	No	Yield (Subdistricts 5 & 6)
Alaska Peninsula	Below average	1 of 1	Yes	Yes	Open to non-retention by regulation	No
Kodiak	Karluk - poor Ayakulik - below average	1 of 2	Restricted for Karluk Not restricted for Ayakulik	Restricted, non-retention in Karluk and Ayakulik areas for season, all KMA through July 30	Karluk closed preseason Ayakulik closed preseason, opened to restricted harvest.	Management (Karluk R.)
Chignik	Below average	1 of 1	Yes	Yes	Yes	No
Upper Cook Inlet	Below average	12 of 18 (3 not surveyed; 2 no counts)	Yes, with restrictions	Restricted in Northern District and Eastside set gillnets in Central District	Kenai –made goals with restrictions. Northern Cook Inlet- Various restrictions including complete closure	6 stocks of concern (1 yield; 5 management)
Lower Cook Inlet	Average	2 of 2 (1 not surveyed)	Yes	Yes	Opened the Ninilchik River to hatchery Chinook salmon two weeks early	No
Prince William Sound	Below average	0 of 1	Yes	Yes	Yes	No
Southeast	Poor	2 of 12	Yes	Yes	Restricted early in season and closed entirely June 25	No

[a] Some escapement goals were not assessed due to inclement weather or poor survey conditions; therefore, it is not known whether the escapement goals were met for these systems.
Source: ADFG staff, Personal Communication (January 2018).

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 2009). 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.westcoast.fisheries.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.[14] 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, five 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, Snake River fall run, Snake River spring/summer run, Upper Columbia River, and Upper Willamette River Spring ESUs have been recovered in the GOA trawl fisheries (NMFS 2017a).

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). 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). The incidental take of Chinook salmon in the 2017 GOA groundfish fisheries was 24,892 fish, compared to 54,576 fish in 2010 (NMFS Alaska Region Catch Accounting System February 10, 2011, January 2018). Detailed information on listed stocks is available in updated status reports of listed ESUs (Northwest Fisheries Science Center 2015), and in the ESA Recovery Plan for Lower Columbia River coho, Chinook, and chum salmon; and Lower Columbia River Steelhead (NMFS 2013).

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. That review was completed in 2016 and found that no species warranted a change in status. More information on that 5-year review and on recovery activities is available from and 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, Snake River spring/summer run, 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

[14] http://www.adfg.state.ak.us/pubs/notebook/fish/chinook.php

distribution, at least among the ESA-listed Chinook salmon from the southern United States (NMFS 2017a; 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.

3.3.6.1 Observer Program Prohibited Species Catch Sampling

Amendment 93 to the GOA groundfish fishery management plan required industry to retain all Chinook salmon caught as bycatch in the GOA pollock trawl fishery. Starting in 2014, the observer program implemented a simple random sampling (SRS) protocol with respect to trips for the collection of genetic samples in the GOA. This method randomly samples from trips and censuses the salmon bycatch encountered in each associated delivery to the processor. An estimated 13,612 Chinook salmon were taken as bycatch in the GOA pollock trawl fisheries in 2015, and samples of axillary process tissue for genetic analysis were collected throughout 2015 from the GOA. The genotyped sample set for the 2015 Chinook salmon bycatch was 2,414 fish, corresponding to a sampling rate of 17.7%. This is the largest sample set by both number and proportion for the incidental catch of Chinook salmon captured in the GOA pollock trawl fishery (Guthrie et al. 2017).

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. 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 2011, 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 are still important for documenting occurrence of ESA-listed ESUs in the GOA trawl fisheries. CWT Chinook salmon from ESA-listed ESUs have been recovered in GOA and BSAI trawl fisheries (Table 20). Since 1981, CWT tagged Chinook salmon have been recovered in the GOA groundfish trawl fisheries from the Lower Columbia River, Snake River fall run, Snake River spring/summer run, Upper Columbia River spring run, and the Upper Willamette River ESUs (Tables 3-9 and 3-10). A total mark expansion factor was applied to observed recoveries to account for the wild, untagged component of each ESU.

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 1981, CWTs have been recovered from 29 Lower Columbia River, 120 Upper Willamette River, 1 Upper Columbia River, 3 Snake River fall run, and 1 Snake River spring/summer run Chinook salmon in the GOA trawl fishery (Table 20). By applying mark expansion factors, the estimated numbers increase to 123.6 Lower Columbia River, 367.9 Upper Willamette River, 1 Upper Columbia River, 4 Snake River fall run, and 1.9 Snake River spring/summer run Chinook salmon in the GOA (Table 20). 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 20 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, 1981-2016

	GOA		
Chinook salmon ESU	Observed number	CWT Mark Expanded Number	Total mark expanded number
Lower Columbia River	29	123.6	138.4
Snake River fall run	3	4.0	5.4
Snake River spring/summer run	1	1.9	2.6
Upper Columbia River spring run	1	1.0	1.1
Upper Willamette River	120	367.9	448.7

Source: NMFS 2017a.

CWT Chinook salmon from ESA-listed ESUs have been recovered in salmon excluder device testing in the GOA and BSAI trawl fisheries and include Upper Willamette River and Snake River fall run in the GOA. In addition, U.S. trawl research directed at juvenile salmon has also documented the occurrence of Chinook salmon from ESA-listed ESUs in the GOA. Siknce 1996, trawl research in the GOA has recovered CWT Chinook salmon from the Lower Columbia River, Puget Sound, Snake River fall run, Snake River spring/summer run, Upper Columbia River, and Upper Willamette River ESUs.

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 21 and Table 22). 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 21. There are no hatchery releases of Chinook salmon in Japan and Korea and only a limited number in Russia.

Table 21 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
2011	0.82	-	-	38.6	197.8	237.2
2012	0.91	-	-	41.3	209.9	252.1
2013	0.91	-	-	39.2	200.29	240.4
2014	1	-	-	35.9	202.6	239.5
2015	0.89	-	-	35.5	187.86	224.3
2016	0.99	-	-	37.4	199.57	238.0

For Chinook salmon fry, the United States has the highest number of annual releases, followed by Canada. 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, followed by California, and then Oregon (Table 22).

Table 22 United States 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	181.3
2007	10.5	114.5	13.2	34.8	9.2	171.7	182.2
2008	11.4	115.9	27.7	47.7	11.1	201.4	213.8
2009	10.5	119.4	31.2	40.2	12.6	201.0	213.9
2010	11.0	118.9	33.2	41.5	14.5	201.9	219.1
2011	8.4	107.9	29.3	45.6	14.9	197.7	206.1
2012	9.52					200.3	
2013	9.0					191.3	
2014	9.25					193.3	
2015	8.96					178.9	
2016	11.87					187.7	

Hatcheries in Alaska are located in southcentral and southeast Alaska. Altogether, a total of 27 production hatcheries and 1 research hatchery are currently operataing in Alaska. Of these, private nonprofit corporations (PNPs) operate 24 of the hatcheries: 11 facilities owned by the state, and 13 owned by PNPs. ADF&G Division of Sport Fish operates 2 additional state-owned hatcheries in Anchorage and Fairbanks. The Metlakatla Indian Community on the federal Annette Islands Reserve south of Ketchikan operates Tamgas Creek Hatchery. NMFS operates a federal research hatchery in Little Port Walter in lower Chatham Strait (Stopha 2017).

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's two hatcheries primarily produce salmonid species intended for both salt and freshwater recreational fisheries at many locations along the coast and in numerous interior lakes.

The hatchery harvests alone in both 2013 and 2015 were greater than the entire statewide commercial salmon harvest in every year prior to statehood except for 7 years (1918, 1926, 1934, 1936, 1937, 1938 and 1941). The 2013 season was a record harvest overall, with the 283 million fish commercial salmon harvest composed of the second highest catch for wild stocks (176 million fish) and the highest catch for hatchery stocks (107 million fish) in Alaska's history. The 2015 season was the second highest harvest, with the 263 million fish commercial harvest composed of the third highest catch for wild stocks (170 million fish) and the second highest catch for hatchery stocks (93 million fish). In 2016, Alaska hatcheries contributed an estimated 24 million fish to the commercial fishery. Hatchery fish made up 22% of the statewide commercial salmon harvest of 109 million fish (Stopha 2017).

3.3.8 Effects of the Alternatives

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 23 describes the criteria used to determine whether the impacts on Chinook salmon stocks are likely to be significant.

Table 23 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, the annual hard cap PSC limit for the Western and Central GOA non-pollock trawl fishery is 7,500 Chinook salmon. 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. In 2016, runs improved for the Westward stocks (i.e., Yukon, Kuskokwim, and Nushagak) but overall these runs are still below the long-term average. Runs also improved in Kodiak and Cook Inlet in 2016, but still, compared to the long-term average, their overall runs are still below average. Unfortunately, Chinook salmon runs from the Copper River to southern Southeast Alaska have declined and in 2016 the runs there were the lowest on record.

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, it is understood that increasing PSC limits could increase the potential to impact salmon stocks in the aggregate. However, there is no evidence to indicate whether the groundfish fisheries' take of Chinook salmon is, or is not, causing escapement failures in Alaska rivers.

Evaluating what salmon savings may occur under the alternatives does not necessarily provide insight into potential impacts to the Chinook salmon stocks. 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.

We now have better information about stock composition of Chinook salmon caught in GOA trawl fisheries relative to the last analysis for Amendment 97 (see Guthrie et al. 2017), however information is still insufficient to develop an AEQ model for the GOA. The Gulf pollock fishery collects fish scales, which can be used to gather age information for salmon, but there is inadequate funding to process the scales (personal communication with Jeff Guyon, January 2018). Industry has been sampling 100% of salmon bycatch in the GOA rockfish trawl fishery since 2013, but that has been for genetics information and doesn't include age information (personal communication with Jeff Guyon, January 2018).

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 Alternatives 2 or 3, 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 2015 (the most recent year for which analysis is available), GOA samples were predominantly from Chinook salmon stocks from British Columbia (51%), West Coast U.S. (32%), Coastal Southeast Alaska (14%), and Northwest Gulf of Alaska stocks (3%) (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, it is nonetheless possible to develop general conclusions for the action that is being proposed. If Chinook salmon PSC is increased in some years as a result of this action, it may impact Chinook salmon stocks, and the harvesters and consumers of Chinook salmon, compared to the status quo. 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 individual stocks are likely to be affected, nor to what degree.

There are currently prohibited species control measures in place for Chinook salmon in the GOA non-pollock trawl fisheries. In addition, regulations do 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 action has emphasized the importance of Chinook salmon avoidance among the non-pollock trawl fleet. Under the options for PSC limits, and especially if the attainment of the threshold appears to be imminent, the non-pollock trawl fleet may take active measures 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. 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. 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 Alternatives 2 and 3, Chinook salmon PSC may increase slightly 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 cause minor impact, as PSC levels either remain the same or are slightly increased. None of the options considered under Alternatives 2 or 3 would have a significant adverse impact to Chinook salmon stocks.

Cumulative Effects on Chinook Salmon PSC

RFFAs that may affect prohibited species are shown in Table 9. 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 Alternatives 2 and 3. 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.

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

3.4 Marine Mammals

3.4.1 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).

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

- listing as endangered or threatened under the Endangered Species Act (ESA);
- protection under the Marine Mammal Protection Act (MMPA);
- announcement as candidate or being considered as candidates for ESA listings;
- declining populations in a manner of concern to State or Federal agencies;
- experiencing large PSC or other mortality related to fishing activities;
- being vulnerable to direct or indirect adverse effects from some fishing activities;
- 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 most recent status information is available in the 2016 Marine Mammal Stock Assessment Reports (SARs) (Muto et al. 2016).

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 24. All of these species are managed by NMFS, with the exception of Pacific walrus, polar bears, and Northern sea otters, which are managed by USFWS. ESA section 7 consultations with respect to the actions of the Federal groundfish fisheries have been completed for all of the ESA-listed species, either individually or in groups. Of the species listed under the ESA and present in the action area, several species may be adversely affected by commercial groundfish fishing. These include Steller sea lions, humpback whales, fin whales, and sperm whales (NMFS 2006; NMFS 2010). 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.

Table 24 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	Hawaii, Mexico*, Central America*
	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*[1]	Southeast Alaska, Southcentral Alaska, Southwest Alaska

Source: Muto et al., 2016.
*ESA-listed species; **Listed as depleted under the MMPA.
[1] Northern sea otters are under the jurisdiction of the USFWS

The 2010 Biological Opinion was challenged in the U.S. District Court, and although the court ruled that the conclusions of the Biological Opinion were valid, the court ruled that the Agency should have prepared an Environmental Impact Statement (EIS) rather than an Environmental Assessment (EA) to meet their National Environmental Policy Act (NEPA) requirements. The Agency completed a new review of the effects of recommended changes to the groundfish fisheries in the Aleutian Islands on the Western DPS of the Steller sea lion and, with new information available since the publication of the 2010 review, concluded that the recommended changes were not likely to jeopardize the continued existence of the Western DPS of the Steller sea lion or adversely modify its designated critical habitat (NMFS 2014). This decision was, subsequently, challenged in court, but the Agency’s decision was upheld by by both the U.S. District Court for Alaska and the Ninth Circuit Court of Appeals.

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 2016 SARs (Muto et al., 2016). Northern sea otters were assessed in 2008. The information from the PSEIS and the SARs is incorporated by reference. The Alaska Groundfish Harvest Specifications EIS provides information on the effects of the groundfish fisheries on marine mammals (NMFS 2007) and has been updated with Supplemental Information Reports (SIRs) (NMFS 2017c). These documents are also incorporated by reference. Direct and indirect interactions between marine mammals and groundfish fishing vessels may occur due to overlap in the size and species of groundfish harvested in the fisheries that are also important marine mammal prey, and due to temporal and spatial overlap in marine mammal occurrence and commercial fishing activities.

This discussion focuses on marine mammals that may be affected by Chinook salmon PSC management measures for non-pollock trawl fisheries in the GOA. These species are listed in Table 25 and Table 26. Note that Table 26 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.

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 until 2013 when the eDPS was removed from the ESA list. 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.

The 2010 Biological Opinion was challenged in the U.S. District Court, and although the court ruled that the conclusions of the Biological Opinion were valid, the court ruled that the Agency should have prepared an Environmental Impact Statement (EIS) rather than an Environmental Assessment (EA) to meet their National Environmental Policy Act (NEPA) requirements. The Agency completed a new review of the effects of recommended changes to the groundfish fisheries in the Aleutian Islands on the Western DPS of the Steller sea lion and, with new information available since the publication of the 2010 review, concluded that the recommended changes were not likely to jeopardize the continued existence of the Western DPS of the Steller sea lion or adversely modify its designated critical habitat (NMFS 2014). This decision was, subsequently, challenged in court, but the Agency's decision was upheld by by both the U.S. District Court for Alaska and the Ninth Circuit Court of Appeals.

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 2014) 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 increasign, but substantial variation exists between subregions of the wDPS' range. Non-pup counts have declined severely in the western Aleutian Islands, and less severely in the eastern Aleutian Islands (NMFS 2014). Pup and non-pup counts in the remainder of the western DPS range are either stable or increasing (NMFS 2014).

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). Critical habitat for sea otters has been designated and is located primarily in nearshore waters (74 FR 51988, October 8, 2009). The USFWS published a recovery plan for the southwest Alaska DPS of northern sea otters in 2013 (USFWS 2013).

Table 25 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)	Depleted & a strategic stock (W)	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 be growing slowly (Sweeney et al. 2017). The EDPS is steadily increasing and was removed from the list of threatened or endangered species.	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	Pup counts on St. Paul Island have declined 55% (-4.1% annually) since 1998. Pup production on St. George Island is approximately stable over the same time. Overall, 3.5% decline annually since 1998.	Fur seals occur throughout Alaska waters, but their main rookeries are located in the Bering Sea on Bogoslof Island and the Pribilof Islands. Approximately 45% of the worldwide abundance of fur seals is found on the Pribilof Islands.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: Muto et al. 2016; 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.
*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 2014, NMFS estimated the Cook Inlet beluga whale population to be 340 individuals (Muto et al. 2016). The 2014 estimate remains within the 10-year annual trend, which shows an annual decline of 1.3% per year (Muto et al. 2016). 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 to 200 whales in the 1960s and 1970s to fewer than 90 whales in recent years and was listed as endangered under the ESA in 2005. A 5-year status review of Southern Resident killer whales was completed in 2016. 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 26 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 – Hawaii, Mexico, Central America	Mexico and Central America stocks are endangered	Depleted & a strategic stock	Increasing overall. 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).	Hawaii, Mexico, and Central America 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: Muto et al. 2016; 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 27 contains the significance criteria for analyzing the effects of the proposed alternatives 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.

Table 27 Criteria for determining significance of impacts to marine mammals

	Incidental take / 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.	Generally, there is no beneficial impacts, with the possible exception for certain net or hook and line fisheries, of increased prey availability from removals from gear.	There is no beneficial impact.
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. The List of Fisheries for 2016 reports that Steller sea lion and northern elephant seal were taken in the GOA non-pollock trawl fisheries. (81 FR 20550, April 8, 2016). 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 Alternatives 2 and 3

The range of PSC limits under Alternatives 2 and 3 may result in different potential for incidental takes of marine mammals. A lower limit 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 PSC limit would allow for more groundfish fishing and more potential for interaction and incidental takes of marine mammals than a lower limit.

To the extent 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 Alternatives 2 or 3, and the impacts of Alternatives 2 and 3 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 28 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 28 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 3.3.6.2). MARK expansions should be considered a minimum estimate of the actual PSC of specific Chinook salmon stocks. AEQ analysis on Chinook salmon PSC in the GOA is not yet available; however, most of the Chinook salmon represented by CWTs and harvested in the GOA originated from hatchery production. Chinook salmon recovered in the GOA are comprised of a variety of run types that are designated by the tagging agency (Masuda et al. 2017).

Several marine mammals in the GOA may be affected indirectly by impacts of non-pelagic trawl gear on benthic habitat. Table 29 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 29). 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 29 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 2010) 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 2010) 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 2010).

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 Alternatives 2 and 3

If a new PSC limit for Chinook salmon results in the fisheries closing before the TACs are reached, it could increase the availability of groundfish to marine mammals. If the PSC limit 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 PSC limit would be less constraining on the fishery but could result in reduced prey availability. A lower PSC limit 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, Alternatives 2 and 3 may slightly increase the potential effects of the GOA non-pollock trawl fisheries on the availability of prey for marine mammals, except 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 Alternatives 2 and 3 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 Alternatives 2 and 3

The effects of the proposed PSC limits 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.

None of the disturbance effects on other marine mammals under Alternatives 2 or 3 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 Alternatives 2 and 3 are not likely to be substantially different from status quo, the impacts of Alternatives 2 and 3 are likely insignificant.

Cumulative Effects on Marine Mammal Species

See cumulative effects section for marine mammals and seabirds below.

3.5 Seabirds

3.5.1 Status

Alaska's waters support extremely large concentrations of seabirds. Over 80 million seabirds are estimated to occur in Alaska annually, including 40 million to 50 million individuals from the numerous species that breed in Alaska (Table 30; USFWS 2009). An additional 40 million to 50 million individuals do not breed in Alaska but spend part of their life cycle there. These include short-tailed and sooty shearwaters and three albatross species: the black-footed albatross, the Laysan albatross, and the endangered short-tailed albatross (Table 31; USFWS 2009).

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).
- Seabird Bycatch and Mitigation Efforts in Alaska Fisheries Summary Report: 2007 through 2015 (Eich et al. 2016).
- Seabird Bycatch Estimates for Alaska Groundfish Fisheries Annual Report: 2015 (Eich et al. 2017).

Table 30 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	
	Pelagic	
	Red-faced	
	Double-crested	
Gulls	Glaucous-winged	
	Glaucous	
	Herring	
	Mew	
	Bonaparte's	
	Slaty-backed	
Murres	Common	
	Thick-billed	
Jaegers	Long-tailed	
	Parasitic	
	Pomarine	
Guillemots	Black	
	Pigeon	
Eiders	Common	
	King	
	Spectacled	Threatened
	Steller's	Threatened
Murrelets	Marbled	
	Kittlitz's	
	Ancient	
Kittiwakes	Black-legged	
	Red-legged	
Auklets	Cassin's	
	Parakeet	
	Least	
	Whiskered	
	Crested	
Terns	Arctic	
Puffins	Horned	
	Tufted	

3.5.1.1 ESA-Listed Seabirds in the GOA

Two species of conservation concern occur in the GOA (Table 31). Short-tailed albatross is listed as endangered under the ESA, and Steller's eider is listed as threatened.

Table 31 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

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 2014 was estimated at 4,354 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 2004). 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.

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 2008), and no take estimates are produced by AFSC. Therefore, impacts to Steller's eider are not analyzed in this document.

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

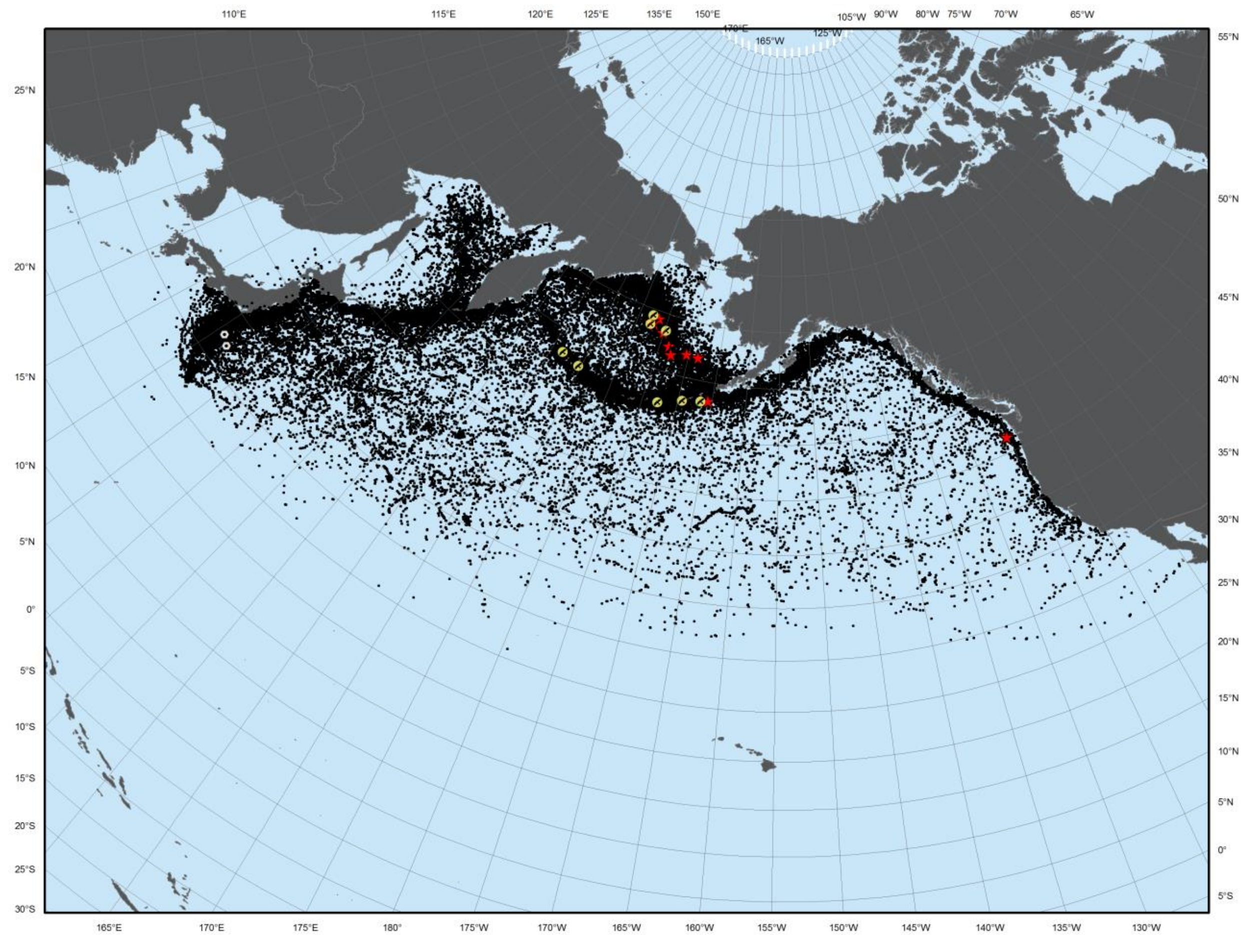
Figure 11 shows locations of short-tailed albatross seen on surveys through 2013. Eich et al. 2017 provides the most current and comprehensive data on seabird distribution patterns off Alaska.

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 11 Observations of short-tailed albatrosses



Black dots indicate location of short-tailed albatross (from multiple sources of sightings data) on the map; data from 2002, 2003, 2005 through 2006, and 2008 through 2013 (data provided by the Yamashina Institute for Ornithology, Oregon State University, U.S. Fish and Wildlife Service). Short-tailed albatross bycatch locations (excluding Russian fisheries) are depicted by red stars on the map. Short-tailed albatross hotspot locations (Piatt et al. 2006) are depicted by yellow circles on the map.
Source: Eich et al. 2016

Short-tailed Albatross Takes in Alaska Fisheries

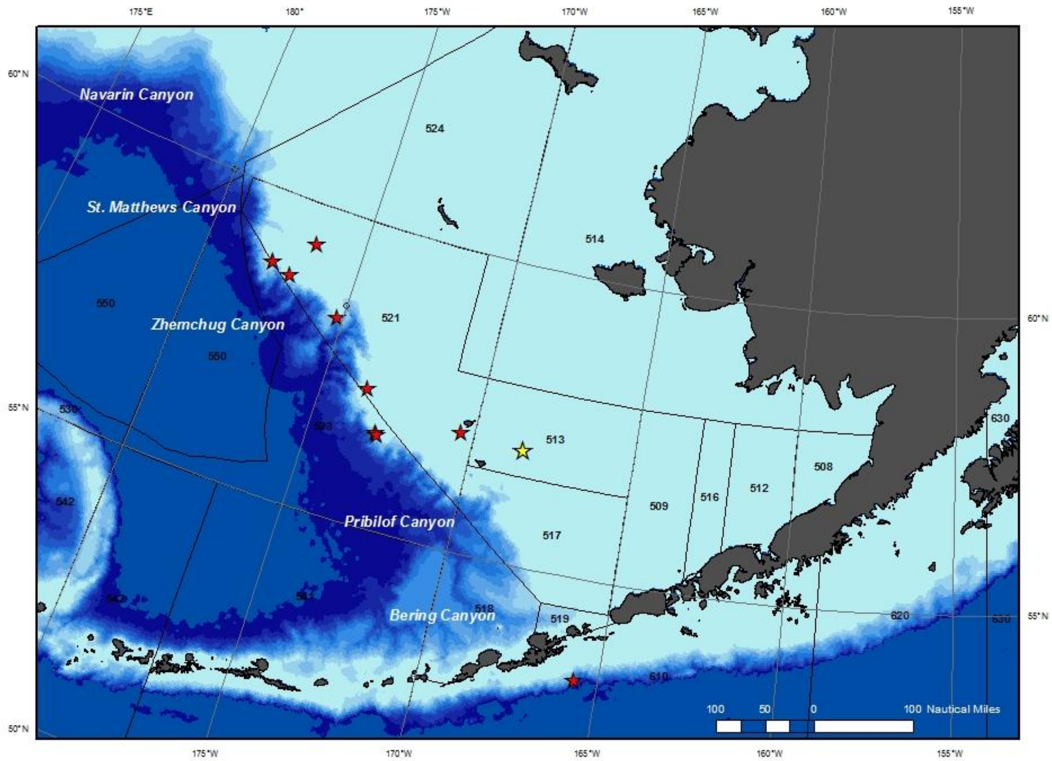
Table 32 lists the short-tailed albatrosses reported taken in Alaska fisheries since 1983. With the exception of one take in the Western GOA, all takes occurred along the shelf break in the Bering Sea. The Western GOA take was in the hook-and-line halibut fishery. No takes were reported from 1999 through 2009. No takes with trawl gear have been reported. The incidental take statement take limits for short-tailed albatross have never been met or exceeded (Table 32 and Figure 12). NMFS is working closely with industry and the observer program to understand the specific circumstances of these incidents.

Table 32 Reported takes of short-tailed albatross in Alaska fisheries

Date	Fishery	Observer Program	In sample*	Bird age	Location	Source
7/15/1983	Net	No	n/a	4 months	Bering Sea	USFWS (2014)
10/1/1987	Halibut	No	n/a	6 months	GOA	USFWS (2014)
8/28/1995	IFQ sablefish	Yes	No	1 year	Aleutian Islands	USFWS (2014)
10/8/1995	IFQ sablefish	Yes	No	3 years	Bering Sea	USFWS (2014)
9/27/1996	Hook-and-line CP targeting Pacific cod	Yes	Yes	5 years	Bering Sea	USFWS (2014)
4/23/1998	Russian salmon drift net	n/a	n/a	Hatch-year	Bering Sea, Russia	USFWS (2014)
9/21/1998	Hook-and-line CP targeting Pacific cod	Yes	Yes	8 years	Bering Sea	USFWS (2014)
9/28/1998	Hook-and-line CP targeting Pacific cod	Yes	Yes	Sub-adult	Bering Sea	USFWS (2014)
7/11/2002	Russian**	n/a	n/a	3 months	Sea of Okhotsk, Russia	USFWS (2014)
8/29/2003	Russian demersal hook-and-line	n/a	n/a	3 years	Bering Sea, Russia	USFWS (2014)
8/31/2006	Russian**	n/a	n/a	1 year	Kuril Islands, Russia	USFWS (2014)
8/27/2010	Hook-and-line CP targeting Pacific cod	Yes	Yes	7 years	BSAI	USFWS (2014)
9/14/2010	Hook-and-line CP targeting Pacific cod	Yes	Yes	3 years	BSAI	USFWS (2014)
4/11/2011	Sablefish demersal hook-and-line	Yes	Yes	1 year	Pacific Ocean, Oregon	USFWS (2014)
10/25/2011	Hook-and-line CP targeting Pacific cod	Yes	Yes	1 year	Bering Sea	USFWS (2014)
5/24/2013	Hook-and-line, seabird bycatch mitigation research	No	n/a	1 year	Pacific Ocean, Japan	USFWS (2014)
9/7/2014***	Hook-and-line CP targeting Greenland turbot	Yes	No	5 years	Bering Sea	NOAA Fisheries (NMFS 2014b); S. Fitzgerald, pers. comm., NOAA Fisheries AFSC, June 2015
9/7/2014***	Hook-and-line CP targeting Greenland turbot	Yes	Yes	Sub-adult	Bering Sea	NOAA Fisheries (NMFS 2014a); S. Fitzgerald, pers. comm., NOAA Fisheries AFSC, June 2015
12/16/14***	Hook-and-line CP targeting Pacific cod	Yes	Yes	Immature	Bering Sea	NOAA Fisheries (NMFS 2015b); S. Fitzgerald, pers. comm., NOAA Fisheries AFSC, June 2015

CP = catcher/processor
* *In sample* refers to whether a specimen was in a sample of catch analyzed by a fisheries observer.
**Specifics regarding the type of fishery are unknown.
***These data were not included in USFWS (2014).

Figure 12 **Observed locations of short-tailed albatross takes in Alaska groundfish fisheries since 1995 (red stars). Two takes, in September 2014, occurred in the same location and are represented by one star. Latest confirmed take on December 16, 2014, is shown by the yellow star. (NMFS Informational Bulletin 31 [2015])**



3.5.2 Effects on Seabirds

The PSEIS identifies how the GOA groundfish fisheries activities may directly or indirectly affect seabird populations (NMFS 2015). 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 33. 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 33 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 2007), and the GOA halibut PSC EA evaluated these fisheries for their potential impacts to seabirds. Those documents are incorporated here by reference.

From 2007 to 2015, the estimated seabird bycatch for the Alaskan groundfish GOA fisheries, pelagic and non-pelagic gear combined, ranged from 0 in 2009 to 143 in 2013 (Eich et al. 2017). Northern fulmars and black-footed albatross were the only species of seabird reported in GOA trawl nets during those years.

Table 34 Estimated seabird bycatch for the Alaska groundfish Gulf of Alaska fishery management plan area, pelagic and non-pelagic trawl gear combined

Species/Species Group	2007	2008	2009	2010	2011	2012	2013	2014	2015
Black-footed Albatross	0	0	0	0	0	60	0	0	0
Northern Fulmar	91	39	0	121	27	0	143	20	0
Grand Total	91	39	0	121	27	60	143	20	0

Seabirds can interact with trawl fishing vessels in several ways including getting caught in the trawl net or vessel wires and striking the vessel infrastructure. Birds foraging at the water's surface or in the water column are sometimes caught in the trawl net as it is brought back on board. No short-tailed albatross

have been observed taken in trawl gear, but Laysan albatross mortalities have been observed. While trawl vessels do not offer any attraction from bait, they may produce a great amount of offal if the vessel is a CP. Birds are attracted to the net when it is being deployed and retrieved. Also, whole fish may be discarded as decks and equipment are washed or fish spill overboard when the codend is emptied.
The non-pelagic and pelagic trawl fisheries differ in the types and biomass of discards, which can play a role in the type of seabird attracted to vessels. The non-pelagic trawl fishery discards a greater biomass than does the pelagic trawl fishery even though it has a smaller amount of total catch than the pelagic trawl fishery. This is due in part to the ability of the larger pelagic trawl CPs to have a fish meal plant on board (Eich et al. 2016).

Overall seabird bycatch in recent years is nearly an order of magnitude less in the trawl fishery than in the hook-and-line fishery, based on the observer sample. However, sampling bias is known to exist with commercial trawl fisheries and is discussed below (Eich et al. 2016).

Seabird bycatch estimates derived from the observer species composition sample are biased low because observer sampling focuses on catch from the codend. However, on trawl vessels, seabirds can strike net monitoring equipment, such as paravanes or third wires, strike the trawl warp cables, or get caught in the net wings and thus not be brought on board with the fish so are not available to the observer during the species composition sampling period (Fitzgerald et al. in prep). Trawl-induced seabird mortality is difficult to quantify because birds that strike the cables may fall into the water and go unobserved (Dietrich and Melvin 2007; Zador and Fitzgerald 2008). Studies in the southern hemisphere also note these additional sources of mortality in trawl fisheries (Weimerskirch et al. 2000; Sullivan et al. 2006; Bull 2009). In the Alaska groundfish trawl fisheries, these additional mortalities were only noted on an ad-hoc basis by observers for many years (Labunski and Kuletz 2004; Fitzgerald et al. in prep).
The AFSC completed a multi-year observer special project in 2009 that compared observed seabird bycatch from the haul-level estimate, derived from the standard species composition sample, to seabird mortality from the supplemental sample of trawl gear (net wings, trawl warps, and third wires) (unpublished data in Fitzgerald et al. in prep). The study showed that there were 3.5 times as many birds in the supplemental sample than in the standard sample for the 9,395 hauls observed. The supplemental sample included six Laysan albatross while the standard sample did not have any, although the bycatch rate (0.0006 birds per haul) for the observed hauls was extremely low (Eich et al. 2016).

Based on this special project, in 2010 the Observer Program implemented standardized data recording measures for these additional sources of mortality, although the observer's ability to complete sampling for these data is constrained by matters of safety and other duties. While these data have been collected since 2010, the estimation procedures have not yet been developed so that they can be included in the annual bycatch report. However, work is underway to determine the best way to monitor and include these in annual estimates (Eich et al. 2016).

3.5.2.3 Prey Availability Disturbance of Benthic Habitat

As noted in Table 35, 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. 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 non-pelagic 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 35 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 non-pelagic 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 non-pelagic 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 non-pelagic 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 Alternatives 2 and 3

Incidental Take

The range of increased PSC limits under Alternatives 2 and 3 could potentially increase the number of incidental takes of seabirds in the GOA trawl fisheries. However, the lower PSC limit options 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. A higher PSC limit would allow for more fishing and potentially more incidental takes of seabirds than a lower cap. Overall effects on seabird takes are not likely to change substantially, and impacts are expected to be negligible.

Prey Availability and Benthic Habitat

Under higher PSC limits, the fishing season has the potential to be slightly longer than the status quo fishery in high Chinook salmon PSC years. 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 use 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 36 summarizes the action alternatives' impacts to seabird populations.

Table 36 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.
Alternatives 2 and 3	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.

Cumulative Effects on Seabird Species and Marine Mammals

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 Alternatives 2 and 3 is not likely to be significant.

3.6 Habitat

3.6.1 Status

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. The EFH EIS also describes the importance of benthic habitat to different groundfish species and the past and present effects of different types of fishing gear on EFH. Based on the best available scientific information, the EIS analysis concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because the analysis finds no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. The EIS concludes that no Council managed fishing activities have more than minimal and temporary adverse effects on EFH for any FMP species, which is the regulatory standard requiring action to minimize adverse effects under the Magnuson-Stevens Act (50 CFR 600.815(a)(2)(ii)). Additionally, the analysis indicates that all fishing activities combined have minimal, but not necessarily temporary, effects on EFH.

The Council and NMFS have updated available habitat information, and their understanding of the impacts of fishing on habitat, in periodic 5-year reviews of the EFH components in the Council fishery management plans (NPFMC and NMFS 2010) and (Simpson et al. 2016). These 5-year reviews have not indicated findings different from those in the 2005 EFH EIS with respect to fishing effects on habitat, although new and more recent information has led to the refinement of EFH for a subset of Council-managed species. Maps and descriptions of EFH for groundfish species are available in the applicable fishery management plan.

3.6.2 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 37 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 37 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.

Alternatives 2 and 3 would increase limits PSC of Chinook salmon in the GOA non-pollock trawl fisheries. A lower PSC limit 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 current non-pollock trawl fisheries. A higher PSC limit would allow for more groundfish fishing, and impacts to benthic habitat may be similar to the status quo fishery.

Alternatives 2 and 3 may not change the potential adverse effects of fishing on benthic habitat compared to the status quo. 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 Alternatives 2 and reduce effort in the GOA non-pollock trawl fisheries, these alternatives would reduce impacts on habitat relative to the status quo. Because Alternatives 2 and 3 are not likely to result in significantly adverse effects to habitat, the impacts of Alternatives 2 and 3 are likely insignificant.

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.

Cumulative Effects on Habitat

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 Alternatives 2 and 3 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.

3.7 Ecosystem

3.7.1 Status

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 that are prey for both target groundfish and other species), reducing prey availability for predators of the 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 Stock Assessment and Fishery Evaluation report (NPFMC 2017b). These considerations are summarized according to the ecosystem effects on the groundfish fisheries, as well as the potential fishery effects on the ecosystem.

3.7.2 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 2017b) and was evaluated in the Harvest Specifications EIS (NMFS 2007). 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.

Alternatives 2 and 3 will likely maintain 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, Alternatives 2 and 3 are not likely to have a significant impact on the ecosystem.

Cumulative Effects on the Ecosystem

See section on cumulative effects on habitat above.

3.8 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. These factors form the basis of the analysis presented in this EA/RIR. The subsequent public review draft of this analysis will include responses to the 16 questions that must be considered in order to determine the intensity of impacts (FONSI or no FONSI)

4 Regulatory Impact Review

This Regulatory Impact Review (RIR) examines the benefits and costs of a proposed regulatory amendment to increase the existing Chinook salmon PSC limits for Central and Western GOA non-pollock trawl CVs and CVs fishing under the authority of a Central GOA Rockfish Program cooperative quota permit. Trawl fishing in the GOA is limited by Chinook salmon PSC; directed fishing with trawl gear is closed if that limit is met.

The preparation of an RIR is required under Presidential Executive Order (E.O.) 12866 (58 FR 51735, October 4, 1993). The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following Statement from the E.O.:

> *In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and Benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nonetheless essential to consider. Further, in choosing among alternative regulatory approaches agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.*

E.O. 12866 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be "significant." A "significant regulatory action" is one that is likely to:

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, local or tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

4.1 Statutory Authority

Under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1801, *et seq*.), the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in the regional fishery management councils. In the Alaska Region, the Council has the responsibility for preparing fishery management plans (FMPs) and FMP amendments for the marine fisheries that require conservation and management, and for submitting its recommendations to the Secretary. Upon approval by the Secretary, NMFS is charged with carrying out the Federal mandates of the Department of Commerce with regard to marine and anadromous fish.

The trawl fishery for non-pollock groundfish species in the EEZ off Alaska is managed under the FMP for Groundfish of the GOA. The proposed action under consideration would amend this FMP and Federal regulations at 50 CFR 679.21(h). Actions taken to amend FMPs or implement other regulations governing these fisheries must meet the requirements of Federal law and regulations.

4.2 Purpose and Need for Action

The Magnuson-Stevens Act (MSA) National Standards require the Council to balance, among others, the objectives of achieving optimum yield, minimizing bycatch, and minimizing adverse impacts on fishery-dependent communities. Chinook salmon PSC taken in GOA trawl fisheries is a resource concern, and the Council has taken action to set hard cap PSC limits that are below the incidental take amount that would trigger reconsultation under the Endangered Species Act (ESA). Attainment of a PSC hard cap closes the trawl fishery. Since the 2015 implementation of Chinook salmon PSC limits for the GOA non-pollock groundfish trawl CV sector the fishery has continued to display variable levels and unpredictable timing of salmon encounter. Potential closures and PSC encounter rates that vary from year-to-year or even week-to-week create uncertainty for fishery participants, which in turn can exacerbate a "race for fish," make business planning more difficult, or directly lead to forgone harvest opportunities. Those outcomes adversely affect trawl harvesters, processors, and GOA coastal communities.

Relative to what was available when the Council established the PSC limits, new information about the resource and the fishery's rate of salmon encounter has been gathered from salmon genetic identification studies and the expansion of observer sampling onto smaller trawl vessels. Meanwhile, the fishery continues to operate under a limited access management structure where harvesters must compete for a share of the available catch without formalized cooperative tools to minimize PSC through coordinated avoidance measures. As a result, individual actions to avoid PSC often confer an individual competitive disadvantage.

The proposed action would reconsider Chinook salmon PSC limits for the GOA non-pollock trawl CV sector and/or the Central GOA Rockfish Program CV sector. Alternatives that would increase PSC limits are offered in light of new information and multiple years of experience fishing under constraining hard caps in a limited access fishery with variable and unpredictable PSC rates. The action would not modify other existing features of the GOA Chinook salmon PSC limits for non-pollock trawl fisheries such as PSC rollovers from the Rockfish Program CV sector to the limited access CV sector, and NMFS's ability to make in-season Chinook salmon PSC limit reapportionments between certain GOA trawl sectors. The action seeks to find the most appropriate PSC limit for this fishery by considering historical PSC levels and providing a margin that accommodates expected variability, while remaining within previously established outer bounds for annual GOA-wide PSC levels that are not expected to harm the Chinook salmon resource and its various direct and indirect stakeholder groups.

4.3 Alternatives

The Council adopted the following alternatives for analysis in April 2017.

Alternative 1: No action

Alternative 2: Increase the Chinook salmon PSC limit for the GOA non-pollock non-Rockfish Program CV sector by:
- Option 1: 1,000 fish
- Option 2: 2,000 fish
- Option 3: 3,000 fish

Alternative 3: Increase the Chinook salmon PSC limit for the Central GOA Rockfish Program CV sector by:

Option 1: 300 fish
Option 2: 600 fish
Option 3: 900 fish

The Council may select either Alternative 2 or 3 or may select both in combination. If an action alternative is not selected, that CV sector's Chinook salmon PSC limit will remain at the status quo level described in Section 2.1.

4.4 Methodology for Analysis of Impacts

The evaluation of impacts in this analysis is designed to meet the requirement of E.O. 12866, which dictates that an RIR evaluate the costs and benefits of the alternatives, to include both quantifiable and qualitative considerations. Additionally, the analysis should provide information for decisionmakers "to maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach." The costs and benefits of this action with respect to these attributes are described in the sections that follow, comparing the No Action Alternative 1 with the action alternatives. The analyst then provides a qualitative assessment of the net benefit to the Nation of each alternative, with "no action" as a baseline.

This analysis was prepared using data from the NMFS catch accounting system, which is the best available data to estimate total catch and PSC in the groundfish fisheries off Alaska. Total catch estimates are generated from information provided through a variety of required industry reports of harvest and at-sea discard, and data collected through an extensive fishery observer program. In 2003, NMFS changed the methodologies used to determine catch estimates from the NMFS blend database (1995 through 2002) to the catch accounting system (2003 through present). The catch accounting system was implemented to better meet the increasing information needs of fisheries scientists and managers. Currently, the catch accounting system relies on data derived from a mixture of production and observer reports as the basis of the total catch estimates. The 2003 modifications in catch estimation included providing more frequent data summaries at finer spatial and fleet resolution, and the increased use of observer data. Redesigned observer program data collections were implemented in 2008 and include recording sample-specific information in lieu of pooled information, increased use of systematic sampling over simple random and opportunistic sampling, and decreased reliance on observer computations. As a result of these modifications, NMFS is unable to recreate blend database estimates for total catch and retained catch after 2002. Therefore, NMFS is not able to reliably compare historical data from the blend database to the current catch accounting system. This analysis relies solely on total catch and PSC estimates during years more recent than 2003. In particular, this analysis focuses on data beginning in 2007, which coincides with the implementation of the Central GOA Rockfish Pilot Program. The Rockfish Program would be directly regulated by Alternative 3; moreover, the implementation of the Rockfish Program broadly affected the annual patterns of effort and business strategies in multiple key non-pollock trawl fisheries that are at the core of this action.

The analysis of potential impacts provided in Section 4.7 draws heavily on the analysis that was provided for the Council's previous consideration of alternatives when establishing GOA Groundfish FMP Amendment 97 (NPFMC 2014). That analysis considered a range of alternatives that could have set the Chinook salmon PSC limit for GOA non-pollock trawl fisheries as high as 12,500 fish per year, making the overall GOA trawl Chinook salmon PSC limit 37,500 fish per year (25,000 PSC limit for pollock trawl fisheries and 12,500 for non-pollock). The Council ultimately selected a non-pollock trawl limit of 7,500 Chinook PSC, which is apportioned between the CV and CP non-pollock sectors (3,900 and 3,600 Chinook, respectively). The highest possible average annual amount of GOA trawl Chinook salmon PSC that could be taken as a result of this action would be 36,400 salmon (refer to Section 2 of this document). That amount would represent selecting both Alternative 2, Option 3 and Alternative 3, Option 3 – adding

3,900 Chinook PSC to the status quo overall GOA trawl Chinook PSC limit of 32,500 per year. In summary, the Council has previously considered the cumulative impacts of removing 36,400 Chinook salmon PSC on the environment, groundfish stakeholders, non-trawl users of Chinook salmon, and net benefits to the nation.

4.5 Description of GOA Non-Pollock Trawl Fisheries

The groundfish trawl fisheries in the Central and Western regulatory areas of the GOA 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. 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. The seasonal apportionment of pollock and Pacific cod harvest is considered necessary to ensure that groundfish fisheries are not likely to cause jeopardy of extinction or adverse modification of critical habitat for Steller sea lions. In the Central GOA, directed rockfish fishing with trawl gear is permitted from May 1 to December 31. CVs that participate in the Central GOA Rockfish Program are permitted to fish cooperative quota from May 1 to November 15. In the Western GOA, directed rockfish fishing is permitted beginning on July 1 (CVs do not historically target rockfish with trawl gear in the Western GOA). 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 – including trawl and fixed-gear, state and federal, and GOA and BSAI fisheries. Beyond regulatory-established season dates, the factors that influence annual business plans include the relative value of various target species in local processing markets, interacting directed fishing closures due to species TAC limits or PSC limits, and seasonal fish stock abundance. The timing of fish aggregations (particularly in the Pacific cod fishery) might affect decisions about 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). While this analysis focuses on GOA non-pollock trawl fisheries, it is important to note that many participants also trawl for GOA pollock (Table 43).

As of January 1, 2000, an LLP license is required for vessels participating in directed fishing for "License Limitation" groundfish species in Federal waters in the GOA or BSAI. License Limitation groundfish in the GOA means "target species and the 'other species' category, specified annually pursuant to 679.20(a)(2). A vessel must be named on an original LLP license that is onboard the vessel. The LLP is authorized in Federal regulations at 50 CFR 679.4(k), definitions relevant to the program are at 679.2, and prohibitions are at 679.7."

The set of vessels that participates in the fisheries that could be affected by this action is diverse. Some operators depend on the GOA groundfish trawl fishery for the majority of their annual business, while others are substantially engaged in BSAI trawl fishing, fixed-gear fisheries, and state-managed fisheries for non-FMP species such as salmon. Non-groundfish revenues for trawl vessels may also include work as tender vessels. Vessel dependency information is provided in Section 4.5.2.4 of this document. Only a subset of the trawl CVs that would be affected by this action participate in the Central GOA Rockfish Program, though all Rockfish Program CVs also participate in the GOA limited access trawl fishery.

This section also describes the diversity in the processing sector (Section 4.5.4) and communities (4.5.5) that participate in the GOA non-pollock trawl fishery, and their relative dependence on non-pollock trawl fishing relative to other activity. Community descriptions draw heavily on previously provided documents, including Social Impact Assessments prepared for the Council's consideration of a GOA Trawl Bycatch Management Program[15] and the MSA-mandated review of the Central GOA Rockfish Program.[16] Finally, management and harvest of Chinook salmon in the state-managed commercial fishery, the state-managed sport/personal use fishery and state/federal subsistence fisheries is described in Section 4.6.

4.5.1 Management

4.5.1.1 Catch and PSC Monitoring and Estimation

NMFS estimates total groundfish catch and Chinook salmon PSC for the GOA trawl fisheries based on Observer Program data and mandatory fishing industry reports. A brief overview of the North Pacific Observer Program is available on the NMFS Alaska Region website.[17] NMFS uses at-sea samples on observed trips to create Chinook PSC rates that are applied to unobserved vessels based on varying levels of aggregation (Cahalan et al. 2014). This section provides a summary of the current observer sampling and salmon PSC estimation methods in the GOA trawl fisheries. NMFS's catch, bycatch, and PSC estimation methods are described in more detail in Cahalan et al. (2014). The most recent overview of Observer Program's operation and performance is available in the 2016 Annual Report (AFSC 2017a).[18] The deployment strategy for the current year is detailed in the final Annual Deployment Plan (ADP) for 2018 (NMFS 2017b).[19]

Vessels with FFPs that fish in the Federal groundfish fisheries in the GOA are placed in either the full observer coverage or partial coverage categories, as defined in regulation at Section 679.51(a)(2). CVs that are fishing Central GOA Rockfish Program cooperative quota operate within the full coverage category. Within the Rockfish Program, extrapolation of observers' PSC estimates occurs only within hauls on a trip, and not from one Rockfish Program vessel to another. All non-Rockfish Program GOA trawl CVs are in the partial coverage category. Each year NMFS develops an ADP that describes the methodology to deploy observers on vessels in the partial coverage category. Vessel owners or operators 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. The selection rate for partial coverage trawl CVs has evolved through each subsequent ADP since the restructured Observer Program was implemented in 2013.

Prior to 2013, the observer coverage level for vessels in the partial coverage category was based on length overall (LOA). Groundfish trawl vessels of less than 60' LOA were not required to carry observers; trawl vessels of 60' to 125' LOA were required to carry observers for 30% of their total fishing time; and trawl vessels of 125' LOA or greater were required to carry observers 100% of the time. This observer deployment strategy had been implemented in 1990 as an interim measure under BSAI/GOA Groundfish FMP Amendments 13/18, when the Council had limited options for designing an observer program because the MSA did not provide authority to charge the industry fees to pay for the cost of observers and the Federal government did not provide funds. During the period from 1990 to 2012, NMFS provided operational oversight, observer certification training, definitions of observer sampling duties and methods, observer debriefing, and data management, but vessels (and processing plants) were responsible for

[15] http://npfmc.legistar.com/gateway.aspx?M=F&ID=e3852a81-a379-4676-a27a-ef2d3938b3e1.pdf
[16] http://npfmc.legistar.com/gateway.aspx?M=F&ID=1c813c58-b346-4cef-aa74-44dbe2a24b42.pdf
[17] https://alaskafisheries.noaa.gov/sites/default/files/observer-prog-summary.pdf, updated January 3, 2018.
[18] https://www.afsc.noaa.gov/Publications/ProcRpt/PR2017-07.pdf
[19] https://alaskafisheries.noaa.gov/sites/default/files/final_2018_adp.pdf

contracting and paying direct observer deployment costs. The data biases that were inherent to that program design provided the impetus for the restructuring that was implemented in 2013. During that period—including the years of historical Chinook salmon PSC information that were used in the analysis of GOA Groundfish FMP Amendment 97—total catch and PSC estimates for trawl fisheries that were primarily prosecuted by vessels with no coverage requirements were derived using sampled rates from vessels that carried observers. Such was the case for a significant portion of the Western GOA non-pollock trawl fishery. Under that system, Chinook PSC estimates for trawl vessels of less than 60' LOA fishing in the Western GOA were derived from larger vessels fishing in the Western GOA at the same time, or from vessels fishing in the Central GOA.

Since 2013, partial coverage GOA trawl CVs of any size (LOA) have all been subject to the same annual observer selection rate, and observer coverage for trawl activity has been randomly assigned on a trip-by-trip basis. This development has reduced the coverage gap that had previously existed in the Western GOA where roughly three-quarters of vessels were less than 60' LOA.[20] Table 38 summarizes the target observer selection rates for partial coverage trawl CVs that were established in each year's final ADP. Beginning in 2017, the ADP includes a separate selection stratum of trawl vessels that deliver to tenders, as a further effort to generate representative, unbiased data that reflects the diversity in fishing operations. For reference, the final ADPs for 2017 and 2018 forecast the total number of trawl trips that were expected to carry an observer given the designated selection probability for that year; tender trips were expected to account for 5.3% of observed trawl activity in 2017 (24 out of 457 trips) and 2.2% of observed trawl activity in 2018 (15 out of 685 trips).

Table 38 Observer selection rate for partial coverage GOA trawl CVs

Year	ADP Selection Probability
2013	15%
2014	16%
2015	24%
2016	28%
2017	18% shoreside 14% tender
2018	20% shoreside 17% tender

Table 39 illustrates the change in effective observer coverage levels before and after the 2013 implementation of restructuring. The table shows the proportion of groundfish harvest that occurred on trips that carried an observer, broken out by trips that were classified in the Catch Accounting System as having either a pollock or a non-pollock target. Percentages are used in order to accommodate confidentiality rules for harvest volume data that involves fewer than three individual entities. Prior to the 2013 restructuring, observer coverage levels on trawl vessels of less than 60' LOA were at zero or very low. Since 2013, coverage levels for non-pollock trips on smaller vessels in the Western GOA have increased from near-zero to an annual range of 3% to 14%. On balance, a greater percentage of overall pollock harvest occurs on observed trips because the pollock fishery accounts for a larger proportion of total GOA trawl trips, and selection is not based on target species. For larger vessels, which had to meet observer coverage requirements prior to the 2013 restructure, the proportion of their total catch that occurs on observed trips has decreased because observer-days are spread out over a larger set of vessels than includes those less than 60' LOA.

[20] In 2013 and 2014, the ADP stratified selection rates for fixed-gear vessels based on length overall, but partial coverage trawl CVs were all placed in the same selection stratum with a uniform probability of trip selection in ODDS.

Table 39 Percentage of GOA non-Rockfish Program trawl CV harvest by observed/unobserved trips, 2007 through 2017

Central GOA		% Harvest Observed				Western GOA		% Harvest Observed			
Vessel Size	Year	Non-Pollock	Vessel Count	Pollock	Vessel Count	Vessel Size	Year	Non-Pollock	Vessel Count	Pollock	Vessel Count
< 60'	2007	0.0%	2	0.0%	1	< 60'	2007	0.0%	24	0.0%	16
	2008	0.0%	2	0.0%	2		2008	1.0%	23	0.0%	16
	2009	0.0%	1	0.0%	1		2009	0.0%	25	0.0%	17
	2010	0.0%	3	0.0%	4		2010	0.0%	13	0.0%	20
	2011	0.0%	3	0.0%	7		2011	0.0%	10	0.2%	19
	2012	7.3%	10	0.0%	15		2012	0.0%	20	0.0%	21
	2013	4.6%	15	13.0%	7		2013	3.3%	21	11.6%	17
	2014	3.5%	19	16.6%	7		2014	4.2%	23	11.6%	21
	2015	8.8%	7	22.0%	12		2015	5.8%	22	21.4%	17
	2016	3.2%	4	29.4%	11		2016	13.7%	22	23.8%	21
	2017	0.0%	5	26.3%	7		2017	9.4%	22	17.3%	22
Total		3.7%		16.5%		Total		4.8%		10.8%	
60'-125'	2007	23.3%	35	31.4%	37	60'-125'	2007	68.0%	4	30.0%	9
	2008	24.8%	39	34.0%	42		2008	-	-	50.4%	3
	2009	22.9%	33	47.1%	39		2009	-	-	74.1%	5
	2010	26.4%	35	31.5%	37		2010	43.9%	2	37.0%	6
	2011	25.8%	39	35.1%	40		2011	59.1%	2	29.1%	4
	2012	28.4%	38	39.3%	45		2012	87.7%	3	33.0%	8
	2013	15.0%	34	16.9%	42		2013	0.0%	2	17.6%	7
	2014	9.1%	29	16.0%	42		2014	31.0%	1	30.4%	4
	2015	14.9%	27	25.5%	42		2015	39.4%	1	22.7%	3
	2016	11.8%	31	31.7%	43		2016	-	-	24.6%	8
	2017	8.8%	25	21.5%	40		2017	26.8%	6	19.2%	7
Total		20.2%		26.8%		Total		37.7%		27.0%	

Note: Vessel counts across pollock and non-pollock categories are not additive; GOA vessels that target non-pollock species also target pollock.

4.5.1.1.1 Observer Sampling

Observers are responsible for assessing 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 2017b). In the GOA trawl fisheries, observers are expected to sample every haul for composition and biological data.[21] 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 possible sample size. 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, such as Chinook.

[21] 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 his or her duties.

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 catch sampling and PSC estimation procedures among the GOA trawl fisheries.

PSC estimation on non-Rockfish Program CVs

CVs using trawl gear to fish for non-pollock species 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, unlike CVs targeting pollock, PSC estimates from CVs in non-pollock GOA trawl fisheries are all derived from at-sea samples.

Chinook estimates on observed trips are specific to the observed vessels' data, while unobserved vessels receive Chinook 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 Chinook 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 Chinook 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, observers review their data with FMA Division staff and ensure that data were collected following NMFS protocols. It is normal for data modifications to occur during this debriefing and quality control process. For those reasons, Chinook PSC estimates can change after the fishery is closed as the observer data are finalized in late February to early March of the year following the fishery.

PSC estimation on Rockfish Program CVs

The observer sampling protocol aboard CVs in the Central GOA Rockfish Program is the same as in other non-pollock trawl CV fisheries. However, 100% observer coverage is required so that the vessels in a rockfish cooperative obtain a vessel-specific halibut PSC rate to support transferable halibut PSC allocations. Observers collect species composition samples at sea prior to any sorting of the catch by the vessel's crew. 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. Those species would include non-salmon PSC and other prohibited species like lingcod (during certain times of the year).

PSC estimates from Rockfish Program CVs are derived from at-sea samples. On observed vessels, the estimates of the Chinook PSC are specific to the observed vessel's data. The observer samples are extrapolated to the haul and the amount of Chinook PSC in the sampled hauls is used to calculate a vessel specific PSC rate for the trip. Shoreside processors in the Central GOA that receive catch from Rockfish

Program vessels are required to operate under a Catch Monitoring and Control Plan (CMCP) that details how the processing plant will ensure that all delivered catch is sorted and weighed within view of a CMCP specialist. The CMCP specialist is a NMFS employee who monitors portions of the offload. The role of the NMFS CMCP specialist is not to conduct observer sampling. The CMCP specialist ensures that the processor is following their CMCP and provides feedback to the processors to improve sorting, weighing, and reporting of delivered species.

4.5.1.2 In-Season Management

The GOA non-pollock non-Rockfish Program trawl fisheries can be high-pulse fisheries. The competitive nature of limited access fisheries can induce the fleet to fish at a concentrated time if seasonal or annual TAC and PSC allocations are constraining. NMFS generally makes inseason management decisions about whether to open or close fisheries based on weekly catch reports and available observer data. Prior to a fishery opening, NMFS contacts processors that have historically participated in the fishery to calculate expected effort. 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 of groundfish or remaining PSC 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 closure notice is required to be published in the *Federal Register*, which is open Monday through Friday; therefore, closures for Friday, Saturday, or Sunday must be decided before Friday.

When 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 will typically 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.

In general, the degree to which a seasonal or annual allocation requires inseason management is inversely related to the size of the allocation. Smaller the catch limits or lower PSC limits require more intensive management to ensure that a limit is not exceeded. The timeliness of getting observer data to manage a partially observed fleet from week-to-week or day-to-day is challenging. That factor, coupled with high variance in the estimates of rare PSC species such as Chinook salmon, sometimes means that inseason managers must take a conservative approach.

GOA Groundfish FMP Amendment 103, implemented in 2017, provided inseason managers with additional flexibility to keep fisheries open when a sector is constrained by a low remaining Chinook PSC limit and effort or PSC rates display variance or uncertainty. Amendment 103 allows managers to reapportion Chinook salmon PSC limits between GOA trawl sectors based on need and availability, helping the Agency to maximize benefits from the fishery. As noted in Section 1.2, NMFS has used this tool one time since its implementation, moving 404 Chinook PSC from the Central GOA pollock trawl sector to the Western GOA pollock trawl sector on November 15, 2017. NMFS works closely with each sector before issuing reapportionments to understand the need for PSC during the period remaining in the year. Before making an inseason reapportionment, NMFS goes through the following steps:

1. NMFS determines that a sector's PSC limit has been reached or is projected to be reached;
2. If sufficient PSC is not available for reapportionment from another sector, close the sector;
3. If PSC limit is available from another sector, proceed with reapportionment (Step #4);
4. Review current effort (# of vessels, rate of PSC, amount of groundfish in the sector that reached its PSC limit ("limited sector");
5. Project future effort in the limited sector based on and on discussions with the fleet;
6. Review current effort (# of vessels, rate of PSC, amount of groundfish TAC remaining in the sector with projected excess PSC ("reapportion sector");
7. Project future effort in the reapportion sector based on both historical effort and discussions with the fleet;
8. Issue a reapportionment by writing and processing an Inseason Action.

While the Amendment 103 reapportionment action provides NMFS with an important tool to respond to variability within the fishery and the environment, the agency notes that PSC management within the GOA trawl CV sector can be particularly complicated for the following reasons:

- Chinook PSC is highly variable by fisheries and year, and it is thus difficult to project future PSC rates based on rates in the current or prior year;
- The GOA trawl CV sector encompasses various fisheries with many different rates (nine non-pelagic trawl gear target fisheries and six pelagic trawl gear target fisheries);
- Trawl CVs vary in their dependence upon different target fisheries, and may not uniformly favor reapportionments;
- TAC levels may increase or decrease from year to year, which can change the amount of PSC that may be necessary to permit harvest of the available TAC;
- The GOA limited access trawl fleet may have difficulty organizing to avoid or limit Chinook salmon PSC after a reapportionment has occurred, thus, limiting NMFS's confidence in PSC rate projections for a reopening under a low remaining limit.

When the Council was first considering non-pollock trawl Chinook salmon PSC limits under Amendment 97, NMFS advised that—given the timeliness of fishery data and the high variance in Chinook PSC rates—hard caps that are lower than the highest historical weekly PSC amount are a proxy for what is difficult to manage inseason. Section 5.2.1.1 of the Amendment 97 analysis placed that number at roughly 1,500 Chinook salmon for the Central GOA non-pollock trawl CV sector, and 100 Chinook salmon for the Western GOA. Those figures represent the historical period from 2003 through 2011. The data available for the Western GOA critically do not reflect the direct observer coverage of the segment of that area's trawl CV fleet that is smaller than 60' LOA—roughly 75% of the typical fleet.

During the time period from 2007 through 2017, there were 444 weeks during which the Catch Accounting System recorded Chinook salmon PSC in the GOA non-pollock non-Rockfish Program CV trawl fishery. In the Central GOA, the largest amount of Chinook PSC estimated for a week was 1,302 fish. Of those 444 weeks, 100 or fewer Chinook salmon were estimated during 281 weeks. Estimates of 500 or more Chinook salmon occurred in only 15 weeks. Those high-Chinook events were concentrated in April and October. Most of these PSC pulses occurred in flatfish target fisheries, though three were recorded during the Pacific cod B season (October). The largest amount of Chinook PSC estimated during one week in the Western GOA was 920 fish. However, only eight weeks recorded more than 100 estimated Chinook PSC and only three weeks were greater than 200. Each of these high-Chinook events occurred during the Pacific cod A season.

Catch share programs that apportion Chinook PSC limits to entities, such as the Rockfish Program cooperatives (in aggregate), give participants more specific control over their fisheries. Rockfish Program cooperatives have a greater ability to manage the effort of their fleet, and incentives to change fishing behavior to minimize Chinook PSC in real-time do not come at an individual cost to a vessel operator. As a result, the management approach required for a catch share program does not have to be as conservative because inseason managers can consult with the fleet to make effort projections with greater precision.

Since 2007, Chinook salmon PSC has been recorded within the Rockfish Program during 262 weeks. Fewer than 100 Chinook salmon were estimated during 196 of those weeks, and fewer than 200 were estimated during 233 of those weeks. The highest estimated PSC in a given week was 899 Chinook. Only four weeks had an estimated PSC of 500 or more Chinook.

4.5.1.2.1 Voluntary Cooperative Fleet Management

Industry and NMFS have worked together to meet management challenges within the limited access CV trawl fisheries, particularly in regards to fishing under constraining PSC limits. In some cases, the fleet has developed short-term voluntary catch sharing agreements so that inseason managers can open or reopen a fishery with a reduces risk of exceeding catch or bycatch limits. These agreements tend to occur within a management area (Central GOA or Western GOA) and have been more common in the Central GOA where fleet managers can sometimes leverage relationships that exist through other cooperative structures, such as the Rockfish Program. Even in the Central GOA, however, voluntary agreements can be tenuous, and are costly to transact under the best of circumstances. Central GOA fleet managers report that developing an agreement for a single pollock season has taken as many as nine pre-season meetings. In some cases, an agreement is not reached at all; in other cases, special considerations are necessary to accommodate hold-outs.

Voluntary catch sharing agreements have been most widely used in the Central GOA trawl pollock fishery. Table 40 shows the voluntary catch share plans for Areas 620 and 630, by season, for the years 2010 through 2016. “CSP” denotes 100% agreement by the trawl fleet to manage effort and the timing of fishing by internally allocating the pollock TAC. “Race” denotes the lack of an agreement, and a competitive open access style fishery among LLP holders with Central GOA trawl endorsements. Some CSPs were developed by the fleet amidst concern about Chinook PSC closing the fishery, which is of greatest concern during the fall seasons (C and D seasons) when salmon bycatch rates are the highest. Moreover, annual PSC hard caps close a fishery after a cumulative limit is reached; that event is obviously more likely later in the year after more cumulative fishing time has occurred. Annual GOA pollock TACs have been high in recent years (2014 through 2017) relative to the preceding decade, so there are more fish to catch under a static Chinook PSC limit.[22] Moreover, in recent years the seasonal apportionment of the GOA pollock TAC has shifted more pollock into the fall seasons, reflecting the best scientific estimates of seasonal biomass distribution. In some years the fleet agreed to a CSP during the A/B seasons in order to bank salmon PSC for the fall when it is most needed. CSPs have also been developed during times when the remaining pollock TAC is small, and NMFS would otherwise be unable to open the fishery because the 24-hour harvesting capacity of the fleet exceeds the remaining available quota; that type of agreement typically occurs in the A/B season in Area 630. Finally, Central GOA pollock CSPs also develop due to market factors, sometimes allowing the fleet to work with processors to manage plant capacity at the end of the summer when the commercial salmon fishery overlaps the pollock C season or allowing plants and vessels to harmonize delivery schedules and catch composition (all pollock, or a mix of pollock and other groundfish) to increase the profitability of trips by producing

[22] GOA groundfish TAC summary, 1986 through 2018:
https://alaskafisheries.noaa.gov/sites/default/files/GOA_harvest%20specs_1986-2018.pdf

higher-value product forms. In some cases, vessels agree to take fewer trips if they can receive a higher dock price.

Organizing voluntary agreements requires trust within the fleet, between the fleet and NMFS, and in AGDB who monitors compliance with the agreements to the extent possible; individuals do not always comply fully with the fleet's voluntary agreement. The four biggest hurdles for developing voluntary CSPs are: (1) how to allocate the fish; (2) how to develop a closed class of participants for the fishery when "new" vessels with latent LLPs can enter the fishery; (3) how to set and meet bycatch objectives; and (4) how to get 100% consensus from the participants. Building structure around each of these provisions creates opportunities for gaming the system.

Voluntary agreements, when executed have used the following tools to minimize Chinook PSC: individual vessel allocations of Chinook PSC based on internal pollock allocations; individual vessel accountability measures for poor bycatch performance; mandatory stand-downs for other vessels within the voluntary cooperative when internal PSC limits are exceeded; trip-level self-monitoring using processors' fish ticket information; and Chinook hot spot reporting based on self-reported PSC rates. Fleet managers have noted that not all vessels file timely hot spot reports, and there is no consequence for non-reporting or authority to prevent other vessels from fishing in ad hoc hot spots.

Table 40 Voluntary catch sharing agreements (CSP) in the Central GOA pollock trawl fishery, 2010 through 2016

Year	Regulatory Area 630			
Season	A	B	C	D
2016	Race	Race	CSP	CSP
2015	CSP	CSP	CSP	CSP
2014	CSP	CSP	CSP	CSP
2013	CSP	CSP	CSP	Race/CSP
2012	CSP	CSP	CSP	CSP
2011	CSP	CSP	CSP	CSP
2010	Race/CSP	CSP	Race	Race/CSP

Year	Regulatory Area 620			
Season	A	B	C	D
2016	Race	Race	CSP	Race
2015	CSP	CSP	CSP	CSP
2014	CSP	CSP	CSP	CSP
2013	Race	Race	CSP	Race/CSP
2012	Race	Race	CSP	CSP
2011	Race	Race	CSP	CSP
2010	Race	Race	Race	Race

Source: Alaska Groundfish Data Bank (personal communication, 2016)

Voluntary catch sharing agreements have occasionally been attempted during the Central GOA Pacific cod trawl B season when bycatch rates tend to be higher compared to the A season, and cod are less aggregated (the Western GOA CV sector does not prosecute a directed Pacific cod fishery during the B season). Low catch per unit effort—sometimes coinciding with low TACs—increases the chance that bycatch caps will be reached and makes it more difficult for NMFS to keep the fishery open. From 2006 through 2012, the Central GOA fleet coordinated "pulse" openings that were sometimes as short as 12 hours due to halibut bycatch constraints. Since 2013, vessels have reported their real-time halibut and Chinook salmon PSC rates to a fleet manager who shares that information with other vessels and, coordinates with NMFS inseason managers. The Central GOA Pacific cod trawl CV fleet executed voluntary CSPs in the 2010, 2011, and 2012 B seasons, but have not done so since. The 2010 agreement was developed in response to a low seasonal TAC, and the 2011 and 2012 agreements were necessitated by low halibut PSC availability after September 1. In some cases, the fleet voluntarily separated itself into subsets of vessels that took turns fishing so that projected effort and expected halibut PSC would not exceed the level at which NMFS could open the fishery.

No voluntary CSPs or fleet management measures have been implemented in GOA flatfish fisheries. However, observed vessel PSC rates are posted on the NMFS website and circulated among the fleets by their trade group representatives and processors in the form of weekly updates.

4.5.2 Participation and Harvest

4.5.2.1 LLP Licenses and Vessel Counts

Table 41 summarizes the GOA LLP licenses that have a trawl endorsement. While not all eligible LLPs are active in the GOA trawl fishery, this table establishes the limit of how many vessels could potentially participate in the fisheries affected by this action. There are 152 GOA groundfish LLP licenses with a trawl endorsement; most of those licenses (124) have a CV endorsement. The table further breaks down the licenses by whether the trawl endorsement is for the Central GOA, Western GOA, or both. The table also show whether the license is endorsed for trawl gear only or both trawl and non-trawl gear.

Table 41 CV and CP LLP licenses issued with a GOA trawl endorsement

License	Area	Trawl only	Trawl and non/trawl	Total
CV	CG & WG	17	34	51
	CG only	14	32	46
	WG only	7	20	27
	Total	**38**	**86**	**124**
CP	CG & WG	11	2	13
	CG only	6	2	8
	WG only	7	0	7
	Total	**24**	**4**	**28**
All	CG & WG	28	36	64
	CG only	20	34	54
	WG only	14	20	34
	Total	**62**	**90**	**152**

Source: NMFS RAM division

Table 42 is a matrix of the endorsements associated with the 124 GOA CV trawl licenses. This table shows the broader suite of endorsements associated with the CV licenses. For example, the table shows that the 97 licenses with a CG trawl endorsement also contain 37 Bering Sea trawl endorsements and four Aleutian Islands trawl endorsements. Six of those 97 licenses also have a CG Pacific cod pot endorsement and 17 are endorsed to fish Pacific cod with pot gear in the WG. Similar information is provided for the Pacific cod endorsed license for other areas and gear types.

Table 42 Endorsements associated with the 124 GOA CV trawl endorsed LLPs

	AI_TRW	BS_TRW	CG_TRW	WG_TRW	AI_CV_PCOD_HAL	AI_CV_PCOD_POT	BS_CV_PCOD_HAL	BS_CV_PCOD_POT	CG_CV_PCOD_HAL	CG_CV_PCOD_POT	CG_CV_PCOD_JIG	WG_CV_PCOD_HAL	WG_CV_PCOD_POT	WG_CV_PCOD_JIG
AI_TRW	8	7	4	5	1	0	0	0	1	0	0	0	0	0
BS_TRW	7	47	37	31	0	0	0	0	0	1	0	0	2	0
CG_TRW	4	37	97	51	0	0	0	0	0	6	0	0	17	0
WG_TRW	5	31	51	78	1	0	0	1	2	3	0	0	30	1
AI_CV_PCOD_HAL	1	0	0	1	1	0	0	0	1	0	0	0	0	0
AI_CV_PCOD_POT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BS_CV_PCOD_HAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BS_CV_PCOD_POT	0	0	0	1	0	0	0	1	0	0	0	0	1	0
CG_CV_PCOD_HAL	1	0	0	2	1	0	0	0	2	0	0	0	1	0
CG_CV_PCOD_POT	0	1	6	3	0	0	0	0	0	7	0	0	1	0
CG_CV_PCOD_JIG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WG_CV_PCOD_HAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WG_CV_PCOD_POT	0	2	17	30	0	0	0	1	1	1	0	0	31	1
WG_CV_PCOD_JIG	0	0	0	1	0	0	0	0	0	0	0	0	1	1

Source: NMFS RAM division

Forty-six CV LLP license are allocated quota for the primary species in the Central GOA Rockfish Program. Those LLPs are associated with 43 unique vessels, which fish in seven different cooperatives. Cooperate membership ranges in size from 2 vessels (2 LLPs) to a cooperative with 11 vessels (12 LLPs). Of the 43 vessels that are associated with Rockfish Program LLPs, typically between 25 and 28 vessels actively harvest cooperative quota in a given year. CVs that actively participate in the Rockfish Program generally tend to fish in the GOA non-Rockfish Program trawl fisheries during the latter months of the year, when Chinook salmon PSC limits are most likely to constrain the fishery. On average, 87% of active RP CVs in a given year participate in non-pollock non-Rockfish Program GOA trawl fisheries after October 1, which is the date on which NMFS is able to reallocate a portion of unused Chinook salmon PSC from the Rockfish Program to other GOA trawl fisheries. Those vessels tend to focus on Pacific cod and shallow water flatfish during the latter months of the fishing year, as fits the general pattern of effort in the fishery (see Section 4.5.2). The significance of this percentage is that Rockfish Program CVs as a group have a stake in ensuring that Chinook salmon PSC is available throughout the year for the non-Rockfish Program fishery, and thus have an incentive to conserve PSC throughout the year. No vessels harvest GOA groundfish *only* after October 1.

From 2007 through 2017, a total of 91 unique trawl CVs harvested non-pollock groundfish in the GOA limited access fishery. One hundred trawl CVs participated in the fishery during the 2003 through 2011 period that was analyzed for Amendment 97, reflecting a modest contraction in the overall size of the fleet. Seventy vessels trawled for non-pollock species in the Central GOA from 2007 through 2017, and 45 vessels trawled in the Western GOA during that period. Twenty-four CVs were active in both GOA areas for which there are Chinook salmon PSC limits. Table 43 provides a total vessel count for the 2007 through 2017 GOA non-pollock trawl CV fleet, broken out by area fished and participation in the Rockfish Program, the GOA pollock fishery, and groundfish trawl fisheries in the BSAI FMP area. Total fleet size has trended downwards but appears stable, noting that as many as 71 CVs were active in the fishery in 2003. Active participation in the Central GOA Rockfish Program has remained fairly stable as cooperatives have been able to allocate their available quota among an efficient number of harvesters. For the years shown in Table 43, an average of 24 CVs have remained active in the fishery after October 1. The number of active vessels during the latter portion of the fishing year peaked at 33 CVs in 2011, but was as low as 14 and 15, respectively, in 2013 and 2016. That subset of the fleet reflects the vessels that would be most impacted by fishery closures that occur as a result of volatility around the existing Chinook salmon PSC limits and the amount and time-distribution of PSC that the fleet accumulates in a typical year. Information about the time distribution of Chinook salmon PSC is provided in Section 4.5.3.3.

Table 43 Active trawl CVs in the GOA non-pollock trawl fishery, 2007 through 2017

	GOA Non-Pollock					
Year	Total	CGOA	WGOA	CGOA RP	GOA Pollock	BSAI Trawl
2007	**63**	37	28	27	50	28
2008	**65**	41	24	27	53	26
2009	**59**	34	25	26	50	22
2010	**52**	38	15	27	48	23
2011	**53**	42	12	25	47	27
2012	**61**	48	23	28	59	28
2013	**58**	49	23	29	53	21
2014	**58**	51	24	28	57	17
2015	**57**	39	23	28	51	16
2016	**56**	36	22	27	54	16
2017	**56**	36	28	25	53	22

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

4.5.2.2 TAC Allocation and Utilization

Annual catch limits (TAC) for GOA groundfish and Rockfish Program species are published on the NMFS Alaska Region website, at https://alaskafisheries.noaa.gov/harvest-specifications. An annually updated summary table that provides GOA groundfish OFLs, ABCs, and TACs from 1986 through 2018 is available at https://alaskafisheries.noaa.gov/sites/default/files/GOA_harvest%20specs_1986-2018.pdf. Table 44 excerpts ABC and TAC levels from recent years for species that are targeted in the GOA non-pollock trawl CV fishery and primary or key secondary Rockfish Program species.

Table 45 illustrates the trend in GOA groundfish TAC levels from 2012 through 2018. In that table, 100% represents the 2012 GOA-wide TAC level; values greater than 100% represent an increase and values less than 100% represent a decrease. The most notable trend is the recent and projected decline in GOA Pacific cod TAC levels. The GOA Pacific cod TAC is reduced by 80% in 2018 compared to 2017; the reduction for the Central and Western GOA trawl CV sectors is 82% and 77%, respectively. According to a notice published on the NPFMC website in December 2017, the most likely cause of the decrease in Pacific cod biomass is a warm water mass in the Pacific Ocean that persisted from 2014 through 2016, increasing fish metabolism and reducing available food; low Pacific cod TACs are expected to persist for at least the near-term future.[23] Sablefish ABC and TAC are slightly lower in 2018 relative to 2012 levels, but the most current Groundfish SAFE report projects a significant 41% uptick in ABC from 2018 to 2019, from 11,505 mt to 16,194 mt.[24] While Table 45 shows that arrowtooth flounder TAC decreased in 2018 relative to 2012, it should be noted that the 2012 TAC was a large step up from previous levels; GOA arrowtooth TAC was less than 50,000 mt from 2003 through 2011. The 2012 increase in arrowtooth TAC reflected the development of a viable target market for arrowtooth and the possibility of exceeding a quota that had been set much lower than ABC due to a previous lack of market interest and as a means to

[23] http://npfmc.legistar.com/gateway.aspx?M=F&ID=8ed82d4e-449c-468d-9e3a-22e5bd706a83.pdf
[24] Sablefish SAFE chapter, p.332: https://www.afsc.noaa.gov/REFM/Docs/2017/GOAsablefish.pdf

slow a fishery that can have high rates of halibut PSC. Less than 50% of the arrowtooth TAC—and more often on the order of 25%—was taken during the time from 2012 through 2017 when Central GOA arrowtooth TAC was set at 75,000 mt.

Though not directly affected by this action, it is worth noting that GOA pollock TACs had been on a steady and marked increase from a low of 49,900 mt in 2009 to a peak of 257,872 mt in 2016. GOA pollock TAC decreased to 208,595 mt in 2017 and again to 166,228 mt in 2018; pollock TAC is expected to fall further in the GOA SAFE TAC projections for 2019. The pollock fishery is connected to this action as GOA non-pollock trawl CV harvesters and processors also rely on pollock as a significant source of revenue (Table 54). Moreover, the 25,000 Chinook salmon PSC that are apportioned to the GOA pollock trawl fishery can be reallocated to non-pollock fisheries by inseason managers if there is a need and the PSC is not projected to be used in the pollock fishery. Even at high TAC levels, pollock has a fairly high utilization rate, particularly in Areas 630 and 610 (90% or above in recent years). Lower TAC does not necessarily correspond to lower Chinook PSC; however, if the GOA pollock fishery is able to harvest a lower TAC quickly and efficiently, it could provide a source of Chinook PSC that can be reallocated in-season during years of need in the non-pollock CV sector.

Table 44 ABC and TAC for selected GOA non-pollock groundfish species, 2012 through 2018

Species		2012		2013		2014		2015		2016		2017		2018	
	Area	ABC	TAC	ABC	TAC	ABC	TAC	ABC	TAC	ABC	TAC	ABC	TAC	ABC	TAC
Pacific Cod	WG	28,032	21,024	28,280	21,210	32,745	22,922	38,702	27,091	40,503	28,352	36,291	25,404	8,082	5,657
	CG	56,940	42,705	49,288	36,966	53,100	39,825	61,320	45,990	49,312	36,984	44,180	33,135	8,118	6,089
	EG	2,628	1,971	3,232	2,424	2,655	1,991	2,828	2,121	8,785	6,589	7,871	5,903	1,800	1,350
	Total	**87,600**	**65,700**	**80,800**	**60,600**	**88,500**	**64,738**	**102,850**	**75,202**	**98,600**	**71,925**	**88,342**	**64,442**	**18,000**	**13,096**
Arrowtooth Flounder	WG	27,495	14,500	27,181	14,500	31,142	14,500	30,752	14,500	28,183	14,500	28,100	14,500	37,253	14,500
	CG	143,162	75,000	141,527	75,000	115,612	75,000	114,170	75,000	107,981	75,000	107,934	75,000	73,480	48,000
	EG	42,225	13,800	41,743	13,800	48,604	13,800	47,999	13,800	50,024	13,800	50,059	13,800	40,212	13,800
	Total	**212,882**	**103,300**	**210,451**	**103,300**	**195,358**	**103,300**	**192,921**	**103,300**	**186,188**	**103,300**	**186,093**	**103,300**	**150,945**	**76,300**
SWF	WG	21,994	13,250	19,489	13,250	20,376	13,250	22,074	13,250	20,851	13,250	20,921	13,250	25,206	13,250
	CG	22,910	18,000	20,168	18,000	17,813	17,813	19,297	19,297	19,242	19,242	19,306	19,306	25,315	25,315
	EG	5,779	5,779	5,827	5,827	2,616	2,616	2,834	2,834	4,271	4,271	4,287	4,287	4,167	4,167
	Total	**50,683**	**37,029**	**45,484**	**37,077**	**40,805**	**33,679**	**44,205**	**35,381**	**44,364**	**36,763**	**44,514**	**36,843**	**54,688**	**42,732**
DWF	WG	176	176	176	176	302	302	301	301	186	186	256	256	413	413
	CG	2,308	2,308	2,308	2,308	3,727	3,727	3,689	3,689	3,495	3,495	3,454	3,454	3,400	3,400
	EG	2,642	2,642	2,642	2,642	9,443	9,443	9,344	9,344	5,545	5,545	5,582	5,582	5,571	5,571
	Total	**5,126**	**5,126**	**5,126**	**5,126**	**13,472**	**13,472**	**13,334**	**13,334**	**9,226**	**9,226**	**9,292**	**9,292**	**9,384**	**9,384**
Rex Sole	WG	1,307	1,307	1,300	1,300	1,270	1,270	1,258	1,258	1,315	1,315	1,459	1,459	3,086	3,086
	CG	6,412	6,412	6,376	6,376	6,231	6,231	5,816	5,816	4,445	4,445	4,930	4,930	8,739	8,739
	EG	1,893	1,893	1,884	1,884	1,840	1,840	2,076	2,076	1,733	1,733	1,922	1,922	3,548	3,548
	Total	**9,612**	**9,612**	**9,560**	**9,560**	**9,341**	**9,341**	**9,150**	**9,150**	**7,493**	**7,493**	**8,311**	**8,311**	**15,373**	**15,373**
Flathead Sole	WG	15,300	8,650	15,729	8,650	12,730	8,650	12,767	8,650	11,027	8,650	11,098	8,650	12,690	8,650
	CG	25,838	15,400	26,563	15,400	24,805	15,400	24,876	15,400	20,211	15,400	20,339	15,400	20,238	15,400
	EG	6,269	6,269	6,446	6,446	3,696	3,696	3,706	3,706	3,782	3,782	3,806	3,806	2,338	2,338
	Total	**47,407**	**30,319**	**48,738**	**30,496**	**41,231**	**27,746**	**41,349**	**27,756**	**35,020**	**27,832**	**35,243**	**27,856**	**35,266**	**26,388**
Sablefish	WG	1,780	1,780	1,750	1,750	1,480	1,480	1,474	1,474	1,272	1,272	1,349	1,349	1,544	1,544
	CG	5,760	5,760	5,540	5,540	4,681	4,681	4,658	4,658	4,023	4,023	4,514	4,514	5,158	5,158
	EG	5,420	5,420	5,220	5,220	4,411	4,411	4,390	4,390	3,792	3,792	4,211	4,211	4,803	4,803
	Total	**12,960**	**12,960**	**12,510**	**12,510**	**10,572**	**10,572**	**10,522**	**10,522**	**9,087**	**9,087**	**10,074**	**10,074**	**11,505**	**11,505**
POP	WG	2,102	2,102	2,040	2,040	2,399	2,399	2,302	2,302	2,737	2,737	2,679	2,679	3,312	3,312
	CG	11,263	11,263	10,926	10,926	12,855	12,855	15,873	15,873	17,033	17,033	16,671	16,671	20,112	20,112
	EG	3,553	3,553	3,446	3,446	4,055	4,055	2,837	2,837	4,667	4,667	4,568	4,568	5,812	5,812
	Total	**16,918**	**16,918**	**16,412**	**16,412**	**19,309**	**19,309**	**21,012**	**21,012**	**24,437**	**24,437**	**23,918**	**23,918**	**29,236**	**29,236**
Northern Rockfish	WG	2,156	2,156	2,008	2,008	1,305	1,305	1,226	1,226	457	457	432	432	420	420
	CG	3,351	3,351	3,122	3,122	4,017	4,017	3,772	3,772	3,547	3,547	3,354	3,354	3,261	3,261
	EG	0	0	0	0	0	0	0	0	4	0	4	0	4	0
	Total	**5,507**	**5,507**	**5,130**	**5,130**	**5,322**	**5,322**	**4,998**	**4,998**	**4,004**	**4,004**	**3,790**	**3,786**	**3,685**	**3,681**
Dusky Rockfish	WG	409	409	377	377	317	317	296	296	173	173	158	158	146	146
	CG	3,849	3,849	3,533	3,533	3,584	3,584	3,336	3,336	4,147	4,147	3,786	3,786	3,502	3,502
	EG	860	860	790	790	1,585	1,585	1,477	1,477	366	366	334	334	309	309
	Total	**5,118**	**5,118**	**4,700**	**4,700**	**5,486**	**5,486**	**5,109**	**5,109**	**4,686**	**4,686**	**4,278**	**4,278**	**3,957**	**3,957**
Thornyhead Rockfish	WG	150	150	150	150	235	235	235	235	291	291	291	291	344	344
	CG	766	766	766	766	875	875	875	875	988	988	988	988	921	921
	EG	749	749	749	749	731	731	731	731	682	682	682	682	773	773
	Total	**1,665**	**1,665**	**1,665**	**1,665**	**1,841**	**1,841**	**1,841**	**1,841**	**1,961**	**1,961**	**1,961**	**1,961**	**2,038**	**2,038**

Source: https://alaskafisheries.noaa.gov/sites/default/files/GOA_harvest%20specs_1986-2018.pdf
EG = Eastern GOA (West Yakutat + Southeast Outside); SWF = Shallow-Water Flatfish; DWF = Deep-Water Flatfish; POP = Pacific Ocean Perch.

Table 45 Trend in GOA TAC, relative to 2012 level

Species	2012	2013	2014	2015	2016	2017	2018
Pacific Cod	100%	92%	99%	114%	109%	98%	20%
Northern Rock.	100%	93%	97%	91%	73%	69%	67%
Arrowtooth	100%	100%	100%	100%	100%	100%	74%
Dusky Rock.	100%	92%	107%	100%	92%	84%	77%
Flathead Sole	100%	101%	92%	92%	92%	92%	87%
Sablefish	100%	97%	82%	81%	70%	78%	89%
SWF	100%	100%	91%	96%	99%	99%	115%
Thornyhead Rock.	100%	100%	111%	111%	118%	118%	122%
Rex Sole	100%	99%	97%	95%	78%	86%	160%
POP	100%	97%	114%	124%	144%	141%	173%
DWF	100%	100%	263%	260%	180%	181%	183%

SWF = Shallow-Water Flatfish; DWF = Deep-Water Flatfish; POP = Pacific Ocean Perch.

The primary rockfish species in the Rockfish Program are Pacific ocean perch, northern rockfish, and dusky rockfish. Rockfish Program primary and secondary species allocations to cooperatives are publicly available in .csv format on the NMFS website.[25] ABC and TAC is specified for each species, which is apportioned to the GOA management areas (Western, Central, and Eastern) based on the distribution of survey biomass. The primary species TACs are further allocated in the Central GOA area to Rockfish Program CV and CP cooperatives. The Central GOA is apportioned 69.7% of the overall GOA ABC and TAC for Pacific ocean perch. The GOA TAC for 2018 is 29,236 mt, which is a 22% increase over 2017 and a 73% increase relative to 2012. Trawl vessels in the Rockfish Program typically target Pacific ocean perch first and then switch to northern and dusky rockfish. Pacific ocean perch has a higher value and substantially higher TAC relative to other rockfish species. Northern rockfish are targeted almost exclusively by trawl gear, and most of the Central GOA TAC is allocated to Rockfish Program cooperatives. The majority of the GOA harvest for northern rockfish occurs near Kodiak Island, with 88.5% of the ABC allocated to the Central GOA area. The GOA-wide northern rockfish stock has been stable or slightly declining since 2004. The TAC for 2018 is 3,681 mt in the GOA, a 2.8% decrease from 2017 and a 33% decrease relative to 2012. Trawl vessels in the Rockfish Program target dusky rockfish near Kodiak Island around the same time they target northern rockfish. Dusky rockfish is generally a bycatch species in hauls targeting northern rockfish. A large amount of the dusky rockfish TAC is unharvested due to fishery closures triggered by other species such as Pacific ocean perch. The GOA-wide dusky rockfish stock has been stable, with only a recent slight decline that began in 2015. The Central GOA receives 88.5% of the GOA ABC. The GOA-wide TAC for 2018 is 3,957 mt, which is a 7.5% decrease from 2017 and a 23% decrease relative to 2012.

The Rockfish Program secondary species include Pacific cod, sablefish, thornyhead rockfish, rougheye rockfish, and shortraker rockfish (shortraker and rougheye rockfish are allocated to Rockfish Program CP cooperatives, but not to CV cooperatives). Pacific cod are allocated by gear type in the GOA. Sablefish are primarily targeted by longline IFQ vessels in the GOA with a proportion of the overall TAC allocated to the Rockfish Program. The remaining three rockfish species are targeted by vessels using trawl gear. NMFS allocates Pacific cod TAC between gear type, operation type, and vessel length and the Rockfish Program is allocated 3.81% of the GOA TAC for the trawl sector. Sablefish is the most valuable species per pound in the Rockfish Program. NMFS allocates 80% of the Central GOA sablefish TAC to the fixed gear sector which is managed under an IFQ system. The remaining 20% of the TAC is allocated to the trawl sector. The Rockfish Program CV cooperatives are allocated 6.78% and the catcher/processor cooperatives are allocated 3.51% of the Central GOA sablefish TAC. The Central GOA is apportioned

[25] 2017 allocations can be found at https://alaskafisheries.noaa.gov/sites/default/files/reports/17rpallocations.xls

50% of the GOA ABC for thornyhead rockfish. Rockfish Program CV and CP cooperatives receive 7.84% and 26.5% of the Central GOA TAC, respectively. The thornyhead rockfish biomass estimates have recently been stable in the GOA; the TAC for 2018 was 2,038 mt in the GOA, which is a 3.9% increase over 2017 and a 22% increase relative to 2012.

The final Rockfish Program harvest specifications table for 2018 is not yet officially available, but GOA and Central GOA TACs are shown in Table 44. The 2017 allocations were published in the Federal Register on February 27, 2017. Table 46 shows the quota allocations for CV cooperatives in 2017. In 2018, Rockfish Program CV quota is set to increase for Pacific ocean perch, sablefish, and thornyhead rockfish. Rockfish Program CV quota will decrease for Pacific cod, northern rockfish, and dusky rockfish.

Table 46 Rockfish Program 2017 catcher vessel allocations

Species		RP CV Quota	CGOA TAC
Primary	Pacific Ocean Perch	8,917	16,671
	Northern Rockfish	1,827	3,354
	Dusky Rockfish	2,171	3,786
Secondary	Pacific Cod	1,262	33,135
	Sablefish	306	4,514
	Thoryhead Rockfish	77	988

Table 47 shows total TAC utilization for the key targeted GOA groundfish species from 2012 through 2017. These data are taken from NMFS's annual catch reports, and thus are aggregating across multiple gear and operational types.[26] Sablefish is shown for trawl-only, which includes Rockfish Program catch and incidentally caught sablefish that are retained in the limited access trawl fisheries up to the maximum retainable amount (for most groundfish basis species, the maximum retainable amount for sablefish is 20% of the total fish onboard the vessels).[27] The GOA Pacific cod TAC is apportioned among gear and operational type sectors within each regulatory area, and then apportioned into A and B seasons such that 60% of total removals in each area occur during the A season (January through June 10) and 40% occur during the B season (September 1 through November 1 for trawl, and through December 31 for fixed-gear). Table 48 shows Pacific cod TAC utilization that is specific to each area and season that is affected by this action; Central GOA data does not include Pacific cod that is allocated to the Rockfish Program in the Central GOA. Rockfish Program TAC utilization is summarized in Table 49; those data are also derived from NMFS catch reports, which do not disaggregate CV and CP Rockfish Program cooperatives. Historical data on actual Rockfish Program CV catch is reported in Table 50. Table 49 reflects that Pacific ocean perch, which makes up the bulk of the allocation, and sablefish, which is the most valuable secondary species, are near fully harvested. Pacific cod is allocated to Rockfish Program cooperatives for incidental catch, and utilization of that TAC is variable but typically less than 50%.

[26] https://alaskafisheries.noaa.gov/fisheries-catch-landings
[27] Maximum retainable amounts for secondary species are defined in regulation at Table 10 to Part 679, available at https://alaskafisheries.noaa.gov/sites/default/files/tab10.pdf.

Table 47 TAC utilization of GOA groundfish species (all gear), 2012 through 2017

	2012		2013		2014		2015		2016		2017	
	CG	WG	CG	WG	CG	WG	CG	WG	CG	WG	CG	WG
Pacific Cod	87%	91%	87%	91%	101%	95%	79%	70%	65%	65%	51%	72%
Arrowtooth	28%	6%	28%	6%	46%	13%	25%	4%	25%	7%	35%	2%
SWF	30%	1%	30%	1%	25%	2%	16%	2%	19%	1%	12%	2%
DWF	9%	11%	9%	11%	7%	22%	5%	18%	6%	2%	7%	8%
Sablefish (TRW)	60%	4%	60%	4%	80%	21%	86%	15%	103%	18%	132%	24%
Flathead Sole	14%	7%	14%	7%	15%	3%	12%	2%	14%	3%	13%	1%
Rex Sole	57%	8%	57%	8%	55%	10%	32%	6%	35%	13%	29%	3%
POP	103%	22%	103%	22%	107%	87%	93%	89%	104%	97%	111%	100%
Northern Rock.	87%	108%	87%	108%	85%	65%	79%	80%	93%	26%	48%	54%
Dusky Rock.	83%	57%	83%	57%	79%	44%	78%	62%	78%	55%	65%	79%
Thornyhead Rock.	71%	203%	71%	203%	76%	104%	67%	99%	70%	71%	62%	53%

TRW = trawl. SWF = Shallow-Water Flatfish; DWF = Deep-Water Flatfish; POP = Pacific Ocean Perch.

Table 48 GOA Pacific cod trawl CV sector TAC utilization by season, 2012 through 2017

	Central GOA			Western GOA		
	A	B	Total	A	B	Total
2012	103%	32%	85%	100%	70%	99%
2013	107%	52%	92%	12%	73%	101%
2014	111%	42%	93%	106%	53%	98%
2015	84%	77%	82%	97%	8%	72%
2016	69%	28%	55%	96%	1%	70%
2017	69%	16%	43%	109%	1%	79%

Table 49 Central GOA Rockfish Program TAC utilization (CV plus CP), 2012 through 2017

	2012	2013	2014	2015	2016	2017
POP	99%	98%	100%	99%	100%	95%
Northern Rock.	96%	80%	83%	75%	95%	47%
Dusky Rock.	91%	80%	79%	76%	76%	62%
Pacific Cod	49%	35%	90%	45%	14%	4%
Sablefish	96%	95%	100%	95%	96%	92%
Thornyhead Rock.	32%	50%	63%	68%	87%	81%

TAC utilization for the period from 2003 through 2011 is detailed in Section 4.4.7 of the RIR that was prepared to analyze GOA Groundfish FMP Amendment 97. During that time period, the CV trawl TAC for Pacific cod ranged from 20,000 to 42,000 mt in the Central GOA, and from 14,000 to 23,000 mt in the Western GOA. At least 75% of the TAC was caught in each area and year, including TAC closures in five of the nine years from 2003 through 2011. As noted above, arrowtooth flounder TACs were met or exceeded when they were set at low levels, but TAC utilization dropped to below 50% when the TAC was increased in 2012. Shallow water flatfish TAC was typically harvested at less than 50% in the Central GOA, and utilization did not exceed 17% 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 TAC, and no more than 41% of the Western GOA TAC was taken in any single year. Rex sole fisheries did not exceed 70% of the available TAC in either regulatory area of the GOA and were typically below 50% of the allowed harvest. Directed and secondary rockfish species that are targeted in the Rockfish Program were generally well utilized during the period spanning the 2008 implementation of the pilot program to 2011. The Central GOA Pacific ocean perch harvest level was never less than 94% of the available TAC and northern rockfish harvest ranged from 74% to 89%, while pelagic shelf rockfish was less fully utilized but topped 75% harvest during two of the years under the pilot program.

In general, GOA non-pollock groundfish TACs are not fully harvested. The amount of groundfish harvested is most often constrained by PSC limits for halibut or, in some cases, Chinook salmon. Low utilization of flatfish TACs is also a function of market demand, as some vessels and processors find it uneconomical to stay active in a lower-value fishery outside of the focal seasons of A season cod, A/B season pollock, summer salmon seining, B season cod, and C/D season pollock. Pacific cod TACs might not be fully harvested if fish aggregation does not align with the timing of the fishery. Low aggregation and undeveloped markets for Pacific cod in the Western GOA B season result in most of that TAC going unharvested or reallocated to other gear sectors in-season.

4.5.2.3 Historical Catch and Value

Table 50 and Table 51 report GOA trawl CV harvest and ex-vessel revenue of non-pollock groundfish species. Catch data is reported from 2007 through 2017; at the time of this report's preparation, revenue data for 2017 is not yet available.

The Central GOA non-pollock non-Rockfish Program CV fishery recorded an average annual harvest of roughly 28,000 mt, with an ex-vessel value around $13 million; catch and nominal value levels have displayed a decline relative to the period average since 2015. Thirty-five percent of the sector's non-pollock harvest and 51% of its ex-vessel value was derived from trips targeting Pacific cod, which portends a decrease in expected revenues beginning in 2018 as the GOA Pacific cod TAC has been reduced by roughly 80% relative to 2017 (Table 44). Roughly 70% of Pacific cod revenues for the Central GOA non-Rockfish Program fleet occur in the A season, and 30% occur in the B season. The non-pollock fishery makes up a smaller portion of total GOA trawl groundfish catch, relative to pollock. From 2007 through 2017, pollock harvest accounted for 73% of total weight landed (and 63% of ex-vessel revenues through 2016)

Rockfish Program CVs harvested an average of roughly 11,000 mt within the program, with a nominal average ex-vessel value around $6 million. Harvest and nominal value for the sector have remained fairly stable and higher than the period average since 2014, largely due to an increase in biomass and TAC for Central GOA Pacific ocean perch. The average monthly distribution of that harvest and revenue activity is shown in Table 53, below.

The Western GOA non-pollock trawl CV fishery is essentially a Pacific cod fishery that is prosecuted in the A season (typically January 20 through March), leaving the sector relatively exposed to projected near-term declines in Pacific cod TAC. In recent years, the Western GOA sector has harvested around 7,000 mt of non-pollock groundfish, worth a nominal ex-vessel value of $3 million to $4 million dollars. Similar to the Central GOA non-Rockfish Program CV sector, non-pollock harvest is small relative to the pollock fishery. The pollock fishery accounted for 84% of total trawl groundfish landed from 2007 through 2017 (and 69% of ex-vessel revenues through 2016).

Table 50 Harvest of non-pollock groundfish (mt) by GOA trawl CVs, 2007 through 2017

	CGOA CV			WGOA CV	GOA Total
Year	Non-RP	RP	CG Total		
2007	28,916	9,261	38,177	4,316	42,493
2008	37,731	8,797	46,528	4,685	51,213
2009	31,583	8,697	40,280	1,804	42,085
2010	34,587	10,108	44,694	1,833	46,528
2011	31,916	8,772	40,688	2,099	42,787
2012	24,684	11,966	36,651	5,662	42,313
2013	29,314	10,324	39,639	5,688	45,327
2014	28,714	12,595	41,309	6,803	48,112
2015	21,952	12,558	34,509	6,843	41,352
2016	23,852	14,388	38,240	7,206	45,446
2017	18,538	10,359	28,898	7,484	36,381
Total	311,788	117,825	429,613	54,422	484,035
Average	28,344	10,711	39,056	4,947	44,003
Median	28,916	10,324	39,639	5,662	42,787

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

Table 51 Nominal Ex-vessel revenues ($) for GOA non-pollock trawl CVs, 2007 through 2017

	CGOA CV			WGOA CV	GOA Total
Year	Non-RP	RP	CG Total		
2007	14,583,755	5,046,227	19,629,982	4,330,563	23,960,544
2008	20,524,484	5,258,773	25,783,256	5,480,939	31,264,195
2009	10,443,875	3,700,011	14,143,886	939,083	15,082,968
2010	12,977,697	4,953,010	17,930,706	702,364	18,633,070
2011	14,143,213	6,143,459	20,286,672	1,168,603	21,455,275
2012	12,531,760	9,193,828	21,725,588	3,771,095	25,496,682
2013	11,651,813	6,257,234	17,909,047	3,147,889	21,056,936
2014	12,842,047	7,037,035	19,879,081	3,424,887	23,303,968
2015	9,351,624	6,628,812	15,980,435	3,555,314	19,535,750
2016	9,512,961	7,440,794	16,953,755	3,995,214	20,948,969
2017	-	-	-	-	-
Total	128,563,226	61,659,182	190,222,408	30,515,951	220,738,359
Average	12,856,323	6,165,918	19,022,241	3,051,595	22,073,836
Median	12,686,903	6,200,347	18,780,344	3,490,101	21,256,106

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

Table 52 shows how harvest volume and ex-vessel value is distributed throughout the year in GOA non-pollock non-Rockfish CV trawl fisheries. The Central GOA data breaks out trips that targeted Pacific cod which, as noted above, accounts for 35% of harvest volume and 51% of ex-vessel value. The overall value generated from the fishery tends toward the earlier months of the year, driven by the fact that CVs prosecute the Pacific cod A season in both GOA regulatory areas. Non-pollock CV participation during the latter months of the year, when a constraining PSC hard cap is most likely to curtail fishing opportunities, occurs exclusively in the Central GOA. Considering all Central GOA non-pollock trawl target species, roughly 27% of harvest and 30% of ex-vessel revenues are generated from September through December. Figure 13 illustrates the accumulation of non-pollock non-Rockfish Program ex-vessel revenues over the calendar year. The figure reflects that the Western GOA CV sector completes its non-pollock activity by the end of March. By contrast, the Central GOA non-Rockfish Program CVs have generally only accumulated 40% of average annual ex-vessel revenues by the end of March, reaching around 70% by the end of August, and 96% by the end of October.

Table 52 GOA non-pollock non-Rockfish Program groundfish harvest (mt; 2007–2017) and ex-vessel value ($; 2007–2016), by month

	Central GOA						Western GOA		GOA Non-RP Total	
	Pacific Cod		Flatfish		Subtotal		Pacific Cod		All Species	
Month	Harvest	Ex-Vessel	Harvest	Ex-Vessel	Harvest	Ex-Vessel	Harvest	Ex-Vessel	Harvest	Ex-Vessel
JAN	21%	22%	1%	1%	8%	12%	8%	7%	8%	11%
FEB	15%	17%	8%	7%	11%	13%	66%	68%	19%	23%
MAR	25%	24%	7%	6%	13%	15%	26%	25%	15%	17%
APR	6%	4%	31%	26%	23%	15%			19%	12%
MAY	1%	< 1%	11%	10%	7%	5%			6%	4%
JUN			4%	4%	3%	2%			2%	1%
JUL			5%	8%	3%	4%			3%	3%
AUG	< 1%	< 1%	9%	10%	6%	5%			5%	4%
SEP	21%	21%	7%	7%	12%	14%			10%	12%
OCT	10%	11%	11%	13%	11%	12%			9%	10%
NOV	< 1%	< 1%	5%	6%	3%	3%			3%	2%
DEC			1%	1%	1%	1%			1%	1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

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

Figure 13 Cumulative percent of GOA trawl CV annual average non-pollock non-Rockfish Program ex-vessel revenues, by month, 2007 through 2017

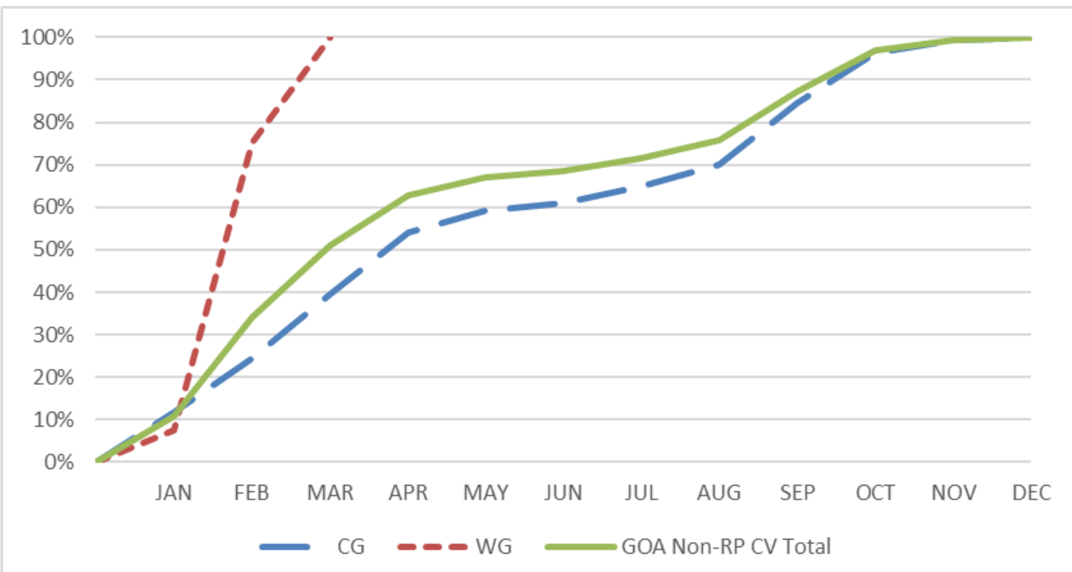


Table 53 Monthly distribution of Rockfish Program CV harvest (mt; 2007–2017) and ex-vessel value ($; 2007–2016)

Month	Harvest	Ex-Vessel
MAY	40%	39%
JUN	26%	24%
JUL	10%	14%
AUG	5%	6%
SEP	7%	8%
OCT	5%	3%
NOV	7%	5%

4.5.2.4 Vessel Dependency

Table 54 and Table 55 are diversification tables provided by AKFIN that reflect the dependency of GOA non-pollock trawl CVs on that fishery, relative to other sources of gross revenue. Table 54 includes all activity by the 88 unique trawl CVs that landed GOA non-pollock groundfish from 2007 through 2016 (revenue information is not yet available for 2017). Note that the vessel counts and value data reflect the activity in each year of all CVs that landed GOA non-pollock groundfish in any year during the period; refer to Table 43 for a count of vessels that harvested GOA non-pollock groundfish in each year. “Other” revenues include non-trawl activity in both Federal and state waters, including fixed-gear Pacific cod fisheries and salmon seining. Other revenues also include shellfish fishing and work as a tender vessel. Revenues from the Central GOA Rockfish Program are included in the column for GOA non-pollock trawl activity. The downward trend in dependency on non-pollock trawl revenues is mainly a reflection of a significant increase in pollock TACs over the period covered in the tables. (Note that 2018 GOA pollock TAC is down 20% from 2017, year-on-year, and down 36% from a historical peak in 2016; GOA pollock TAC is projected to decline further in 2019.)

The set of vessels represented in Table 55 is restricted to the 45 unique trawl CVs that landed GOA non-pollock groundfish since 2007 but have not fished for groundfish in the BSAI. This set of vessels is not exclusive to smaller trawl CVs but is a better reflection of their pattern of participation. These vessels are likely to earn more of their gross revenues from non-trawl fisheries such as Pacific cod pots and salmon seining.

Table 54 Combined nominal ex-vessel revenues ($million) for all CVs that harvested GOA non-pollock groundfish with trawl gear, 2007 through 2016

							GOA Non-Pollock Trawl Revenue as...		
Year	Vessels	GOA Non-Pollock TRW	GOA Pollock TRW	BSAI TRW	Other Revenue	Total Revenue	% GOA Trawl	% AK Trawl	% Total
2007	72	25.3	12.0	30.5	13.7	95.4	68%	37%	26%
2008	75	31.7	17.9	35.8	15.9	120.6	64%	37%	26%
2009	73	15.2	13.7	24.0	12.1	75.2	53%	29%	20%
2010	68	19.1	25.1	23.0	9.1	90.4	43%	28%	21%
2011	69	22.1	27.4	35.3	17.3	123.8	45%	26%	18%
2012	71	26.4	35.5	45.2	10.4	134.6	43%	25%	20%
2013	71	21.5	31.8	39.7	14.5	130.0	40%	23%	17%
2014	72	22.7	38.4	40.4	7.5	132.5	37%	22%	17%
2015	72	20.0	38.6	33.6	12.2	114.8	34%	22%	17%
2016	72	20.3	30.9	33.9	7.0	107.6	40%	24%	19%
Total	88	224.2	271.3	341.4	119.6	1,124.8	45%	27%	20%

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

Table 55 Combined nominal ex-vessel revenues ($million) for CVs that harvested GOA non-pollock groundfish with trawl gear but did not fish BSAI groundfish, 2007 through 2016

					GOA Non-Pol TRW as...	
Year	Vessels	GOA Non-Pollock TRW	GOA Pollock TRW	Total Revenue	% GOA Trawl	% Total
2007	36	8.6	5.6	53.8	61%	16%
2008	34	10.3	6.7	64.6	61%	16%
2009	35	5.9	5.2	42.0	53%	14%
2010	30	7.8	8.3	48.3	48%	16%
2011	33	12.8	13.5	70.7	49%	18%
2012	36	11.3	17.5	84.0	39%	13%
2013	32	7.0	14.9	72.0	32%	10%
2014	28	6.4	15.9	73.4	29%	9%
2015	29	5.1	16.6	59.5	24%	9%
2016	28	5.2	11.3	56.5	32%	9%
Total	45	80.3	115.4	624.7	41%	13%

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

4.5.2.5 Catcher Vessel Crew

The best available information on CV crew participation in the GOA groundfish trawl fisheries (including pollock) is available in Section 5.4 of the Preliminary Social Impact Assessment that was prepared for the Council's consideration of the GOA Trawl Bycatch Management Program in December 2016.[28] Table 74 in that section provides a 2015 snapshot of licensed crew members by their reported community of residence cross-tabulated with the community of ownership for the vessel they crewed on. That table reports that 387 licensed crew worked on GOA trawl CVs in 2015.

Among Alaska communities, for Sand Point, King Cove, and Petersburg resident-owned vessels, 2015 EDR data show a close correspondence between community of crew residence and the vessels they work on. Roughly 80% of crew members from Sand Point work on Sand Point-owned vessels (and 70.8% of the crew positions on Sand Point-owned vessels are filled by Sand Point residents); 88.9% of crew members from King Cove work on King Cove-owned vessels (and 61.5% of the crew positions on King Cove-owned vessels are filled by King Cove residents); and 75.0% of crew members from Petersburg work on Petersburg-owned vessels (and 37.5% of the crew positions on Petersburg-owned vessels are filled by Petersburg residents). By comparison, 56.0% of crew members from Kodiak work on Kodiak-owned vessels (and 54.7% of the crew positions on Kodiak-owned vessels are filled by Kodiak residents).

Patterns of employment vary considerably for crew who are residents of Washington and Oregon communities. Roughly 91% of crew members from the Seattle municipal area work on Seattle-owned vessels (17.2% of the crew positions on Seattle MSA-owned vessels are filled by Seattle MSA residents); 34.1% of crew members from other Washington communities work on vessels owned by residents of Washington communities other than the Seattle area (and 36.8% of the crew positions on vessels owned by residents of Washington communities other than the Seattle are filled by residents of Washington communities other than the Seattle area). For Oregon, 21.7% of crew members from Newport work on Newport-owned vessels (and 17.2% of the crew positions on Newport-owned vessels are filled by Newport residents); 31.7% of crew members from other Oregon communities work on vessels owned by residents of Oregon communities other than Newport (and 48.7% of the crew positions on vessels owned

[28] http://npfmc.legistar.com/gateway.aspx?M=F&ID=e3852a81-a379-4676-a27a-ef2d3938b3e1.pdf

by residents of Oregon communities other than Newport are filled by residents of Oregon communities other than Newport).

Table 56 GOA trawl CV crew participants by community of residence, 2015

Crew Residence	# Crew	Crew Residence	# Crew
Kodiak	84	Anchor Point	2
Other OR	60	Chiniak	2
Sand Point	43	Cantwell	1
Other WA	41	Gustavus	1
Newport OR	23	Juneau	1
Seattle MSA	22	Old Harbor	1
Other States	21	Salcha	1
King Cove	9	Soldotna	1
Anchorage	8	Unalakleet	1
Petersburg	4	Wasilla	1
Palmer	4	Unknown	56
		TOTAL	**387**

Source: NMFS 2016.

4.5.3 Chinook Salmon Prohibited Species Catch

4.5.3.1 ESA Origins of the GOA Chinook Salmon PSC Limit

In recent years, the Council has amended the GOA Groundfish FMP to limit the amount of Chinook salmon PSC that can be taken in trawl fisheries. Those efforts culminated in limits for the directed pollock trawl fishery (Amendment 93), and the non-pollock trawl fisheries including the Central GOA Rockfish Program (Amendment 97). Amendment 93 set a limit of 25,000 Chinook salmon, and Amendment 97 set a limit of 7,500 Chinook salmon. NMFS has conducted Endangered Species Act (ESA) Section 7 consultations to ensure that the GOA groundfish fisheries the Alaska Region determination that the GOA groundfish fisheries, as modified with changes under Amendment 93, were not likely to adversely affect the Southern Resident Killer whale population or its designated critical habitat. These determinations were reached prior to the additional limits on Chinook salmon PSC implemented under Amendment 97. NMFS determined that Amendment 97 was unlikely to change the basic conduct of the GOA trawl fisheries that were analyzed in the previous Section 7 consultations. Thus, NMFS determined that the GOA groundfish fisheries as modified by Amendment 97 were not likely to affect Southern Resident killer whales in a manner not previously considered in an ESA consult.

An action to increase flexibility to reapportion Chinook salmon PSC among sectors but that does not change the total Chinook salmon PSC limit, would not affect listed species in a manner not considered in previous ESA consultations.

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 2007b). 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 re-initiation of consultation is required, along with a review of the reasonable and prudent measures identified in the 2007 supplemental biological opinion.

Since 1994, Chinook salmon PSC in the GOA groundfish trawl fisheries has generally remained below its incidental take limit of 40,000, except in 2007 (40,540) and 2010 (54,559). The high Chinook salmon PSC in 2010 prompted the most recent ESA reconsultation in 2012 (Stelle 2012). The 2012 reconsultation concluded that exceeding the Chinook salmon incidental take limit in the GOA fishery was not a chronic situation and retained the provisions in the incidental take statement in the 2007 Biological Opinion (NMFS 2007b), which included an overall incidental take limit of 40,000 Chinook salmon.

The 40,000 Chinook salmon GOA limit in the incidental take statement originates from a 1994 Biological Opinion (NMFS 1994) on the impacts of the BSAI and GOA groundfish fisheries on ESA listed Snake River sockeye, spring/summer Chinook, and fall Chinook salmon. In that Biological Opinion, NMFS assumed that the annual PSC of Chinook salmon in 1994, and "for the foreseeable future," will be 40,000 or fewer. The NMFS used that assumption, and the estimated number of Snake River sockeye, spring/summer, and fall Chinook salmon present in the GOA and BSAI to conclude that the GOA and BSAI groundfish trawl fisheries were not likely to jeopardize the continued existence of listed Snake River sockeye and Chinook salmon. The 1994 Biological Opinion contained conservation recommendations that, among other things, recommended that the Council and NMFS should take necessary actions to ensure that Chinook salmon PSC is minimized to the extent practicable, and does not exceed 40,000 Chinook salmon per year in the GOA fisheries.

Subsequent incidental take statements have maintained the 40,000 Chinook salmon threshold established in 1994. Data from coded wire tags retrieved from GOA trawl-caught Chinook salmon have supported the underlying assumption that taking fewer than 40,000 GOA Chinook salmon PSC per year would not be likely to jeopardize the continued existence of ESA-listed Snake River salmon[29], as only a small proportion of the tags indicated that the salmon originated from that protected river system.

4.5.3.2 Current Management of GOA Chinook PSC Limits

Regulations at 50 CFR 679.21(h) define the trawl Chinook salmon PSC limits for the GOA pollock fishery, and 50 CFR 679.21(i) defines the trawl Chinook salmon PSC limits for the non-pollock fisheries. Salmon retention is required until offload to a processing facility that takes the delivery. In the GOA trawl pollock fishery Chinook salmon PSC limits are set for the Western and Central reporting areas of the GOA. A PSC limit of 18,316 Chinook salmon is set for vessels engaged in directed fishing for pollock in the Central GOA. In the Western GOA, a limit of 6,684 Chinook salmon is set. Because the pollock fishery is only open to directed fishing by the inshore sector, this PSC limit is available to catcher vessels.

GOA non-pollock trawl Chinook salmon PSC limits are established for the trawl CP sector, the non-Rockfish Program CV sector, and the Rockfish Program CV sector (Table 57). The non-pollock PSC limit covers fishing in both the Central and Western GOA.[30] As a result, when the PSC limit is reached it closes both areas to directed fishing for the groundfish species subject to the limit. The CV PSC limit is also set for the entire calendar year. Therefore, when the PSC limit is taken and the fisheries are closed, the fisheries are not reopened until additional Chinook salmon are available. Additional Chinook PSC could become available through the reapportionment process established under GOA Amendment 103 or not until the next year when a new annual apportionment is available.

[29] Snake River salmon were the focus of this study. The Northwest Region's 2007 Supplemental Biological Opinion had a broader focus.

[30] Chinook salmon taken in the West Yakutat district does not currently accrue to a PSC limit. Only a small number of Chinook are taken in WY non-pollock trawling, as trawl activity in that area is historically low. The EA/RIR produced to support GOA FMP Amendment 97 noted that less than 2% of GOA Chinook salmon PSC occurred in WY.

Table 57 GOA non-pollock Chinook salmon PSC limits for combined Western and Central GOA (number of fish)

Sector	Baseline Annual Limit	If the previous year's annual use is less than:	The next year's limit will be:
Trawl CP	3,600	3,120	4,080
Rockfish Program CV	1,200	N/A	
Non-Rockfish Program CV	2,700	2,340	3,060

The reapportionment amendment (GOA Amendment 103) provides NMFS the authority to roll-over limited amounts of the Chinook salmon that is projected to be unused to the catcher vessel sectors. The action prohibited the reapportionment of Chinook salmon PSC from catcher vessel sectors to the catcher/processor sector. In summary the provision:

1. Rollover of Chinook salmon PSC from the Rockfish Program CV sector to the non-Rockfish Program CV sector would be made at the discretion of the NMFS Regional Administrator, and not prescribed by regulation. This changed the obligation of the Regional Administrator from being required to roll-over any unused Rockfish Program CV Chinook salmon PSC, in excess of 150, on October 1. The amendment gives the Administrator authority to determine if a rollover is appropriate at that time. A rollover to the non-Rockfish Program CV sector could also be made after October 1.
2. Limit the amount of roll-over PSC that a CV sector may receive such that the annual total does not exceed 50% of the sector's initial Chinook salmon PSC limit during a calendar year (excluding any uncertainty buffer that may have been added as a result of the previous year's performance per Amendment 97, as shown in Table 57).

The Chinook salmon PSC limit for the CP sector is established so that no more than 66% of the annual limit may be taken prior to June 1 (2,376 out of 3,600 fish). If the trawl CP sector has an annual Chinook salmon PSC limit of 4,080 Chinook salmon, then the sector's seasonal limit prior to June 1 is 2,693 Chinook salmon. The number of Chinook salmon available to the trawl CP sector as a PSC limit on June 1 through the remainder of the calendar year is equal to the annual limit minus the number of Chinook salmon PSC used by that sector prior to June 1.

4.5.3.3 GOA Non-Pollock CV Trawl Chinook Salmon PSC

Annual Chinook salmon PSC levels

Figure 2 through Figure 4 in Section 3.3.2 of this document summarizes annual GOA Chinook salmon PSC (pollock and non-pollock targets), Chinook PSC by area and operational-type sector (Central/Western GOA; CV/CP), and the average intra-annual distribution of Chinook salmon PSC in the GOA non-pollock trawl fisheries from 2003 through 2017.

Table 58, below, summarizes the NMFS Catch Accounting System estimates of non-pollock trawl CV Chinook salmon PSC that are used to manage the GOA hard caps. The table provides annual values, an average over the entire analyzed period (2007 through 2017), and averages over the sets of years that preceded or followed the 2013 implementation of the Observer Program restructuring. Figure 14 plots estimated Chinook salmon PSC for each sector against the non-pollock PSC limits that were implemented in 2015 under GOA Groundfish FMP Amendment 97. The PSC limits established under Amendment 97 were based on analysis of PSC levels from 2003 through 2011 for the non-Rockfish Program sector, and from 2007 through 2012 for the Rockfish Program CV sector. For comparison, Table 59 shows the historical average Chinook PSC that was reported in Section 4.4.9.2 of the RIR prepared for Amendment 97.

The total annual Chinook salmon PSC limit for these fisheries is set at 3,900 fish. Over the 2007 through 2017 period, the CV sector averaged 3,112 Chinook salmon per year, in aggregate. The highest level of GOA non-pollock Chinook PSC occurred in 2013 (5,805 fish), before the 3,900-fish hard cap was implemented in 2015. From 2007 through 2017, the CV hard cap level was (or would have been) exceeded in four of 11 years. The cap would also have been exceeded in 2003, when the combined non-pollock CV PSC level was 4,601 Chinook salmon.

The implemented cap for the non-Rockfish Program CV sector was exceeded in 2015, causing a temporary closure that halted the fishery in May and kept it closed until NMFS took an emergency action to reopen the fishery in August (see Section 1.2 of this document for further explanation). The 2015 fishing year was partly notable because of the early-year Chinook salmon PSC that occurred in the Western GOA Pacific cod trawl CV A season. As is evident in Table 58, the Western GOA non-pollock trawl CV sector had not recorded significant estimated Chinook salmon PSC levels in earlier years. Total estimated PSC for that sector had not previously exceeded 200 Chinook in any year, extending back to 2003 which marks the beginning of the time period that was considered when setting the Amendment 97 hard cap. In 2015, CVs targeting Pacific cod in the Western GOA had accumulated 874 estimated Chinook salmon PSC by the end of February. Similar to 2015, in 2017 the Western GOA non-pollock trawl CVs again reached of Chinook salmon PSC during the Pacific cod A season that was well above historically estimated annual totals. In 2017, Western GOA CVs targeting cod took 1,686 Chinook salmon by the end of February. To illustrate the high variance in estimated Chinook PSC levels, this same sector recorded 15 or fewer estimated Chinook PSC in 2013, 2014, and 2016 (also years under the restructured Observer Program).

The time-period averages provided in Table 58 highlight not only the inter-annual variation in annual Chinook PSC (variance relative to the average), but also the marked difference in estimated levels of Western GOA CV PSC before and after observer coverage was reprogrammed to sometimes select vessels less than 60’ LOA. As noted in Section 4.5.1.1, three-quarters or more of the active Western GOA trawl CV fleet in a given year is made up of vessels less than 60’ LOA. The average PSC estimate for Western GOA CVs (all sizes) during non-pollock fishing was 37 Chinook salmon per year from 2007 through 2012 but was 554 Chinook per year—with extreme variations—from 2013 through 2017. For reference, Western GOA CVs’ average annual PSC estimate from 2003 through 2011—which was the figure presented in the analysis for Amendment 97—was 72 Chinook salmon per year.

Average annual Chinook salmon PSC within the Rockfish Program CV sector was 848 Chinook during the entire 2007 through 2017 period. The analysis presented to the Council when considering Amendment 97, which defined the 1,200 Chinook salmon PSC limit, identified an average annual PSC level of 847 during the 2007 through 2012 time-period. The RP CV sector’s annual Chinook PSC has exceeded the level of the 1,200-fish cap three times since 2007. The sector recorded 1,690 Chinook in 2008, 1,261 Chinook in 2013, and 1,802 Chinook in 2015 after the cap was implemented.

The sector exceeded its cap in 2015 largely as a result of recording 899 Chinook PSC in a single weekly reporting period during the final week of the season (November). NMFS notes that this isolated PSC shock was idiosyncratic – partly an artifact of a trip where a low proportion of hauls was sampled due to inclement weather conditions, thus requiring extrapolation of a basket sample containing a high Chinook rate to an unusually large proportion of unsampled catch. NMFS had no recourse to close the fishery as the season was ending by regulation at that time, and also noted that total 2015 Chinook PSC for all trawl fisheries (pollock and non-pollock; CV and CP) was well below the aggregate PSC limit – 18,452 Chinook were taken, compared to the overall trawl limit of 32,500 Chinook.

The relatively high years of Rockfish Program CV Chinook PSC in 2008 and 2013 are not easily explained by individual PSC events. High PSC years have multiple determining factors, including both fleet behavior and environmental factors, among other unobservable determinants. The analysis for Amendment 97 noted industry participants' anecdotal report that the early years of the Rockfish Pilot Program reflected a new fishery that was learning to utilize cooperative tools to minimize PSC, and also noted that halibut PSC was capped but Chinook salmon PSC was not. It is reasonable to hypothesize that in 2008 the fleet was focused on avoiding halibut PSC, and thus fished in a manner (higher off the bottom) that increased Chinook PSC rates. The sector's relatively high PSC level in 2013 might reflect a generally higher Chinook PSC encounter rate across all Central GOA trawl fisheries, suggesting that unpredictable environmental factors played a role. Given the large variations in year-on-year PSC levels in a fishery that has cooperative management tools, it is difficult to attribute PSC entirely to fleet behavior. If one were to argue that fully observed CVs cooperatives—with the time and aligned incentives to communicate with each other about bycatch conditions on the fishing grounds—can control Chinook PSC encounters with reliable precision, then one would have to conclude that Rockfish Program CVs prosecuted the fishery much differently in 2015 (1,802 Chinook) than in 2016 (158 Chinook). This analysis does not accept that argument, noting rather that Chinook PSC is highly variable under even the most favorable management conditions.

Table 58 Estimated Chinook salmon PSC for GOA non-pollock catcher vessels, 2007 through 2017

	Non-Rockfish Program CV			Rockfish Program CV	GOA CV Total
Year	CG	WG	Subtotal		
2007	1,857	9	1,867	510	**2,376**
2008	749	107	856	1,690	**2,546**
2009	2,007	10	2,016	860	**2,877**
2010	4,161	0	4,161	995	**5,156**
2011	3,444	96	3,540	368	**3,908**
2012	942	1	943	800	**1,743**
2013	4,529	15	4,544	1,261	**5,805**
2014	1,430	1	1,430	503	**1,933**
2015	1,817	1,056	2,873	1,802	**4,675**
2016	412	13	425	158	**582**
2017	557	1,686	2,244	387	**2,631**
Total	21,905	2,994	24,899	9,332	**34,231**
Avg. 2007-17	1,991	272	2,264	848	**3,112**
Avg. 2007-12	2,193	37	2,230	870	**3,101**
Avg. 2013-17	1,749	554	2,303	822	**3,125**

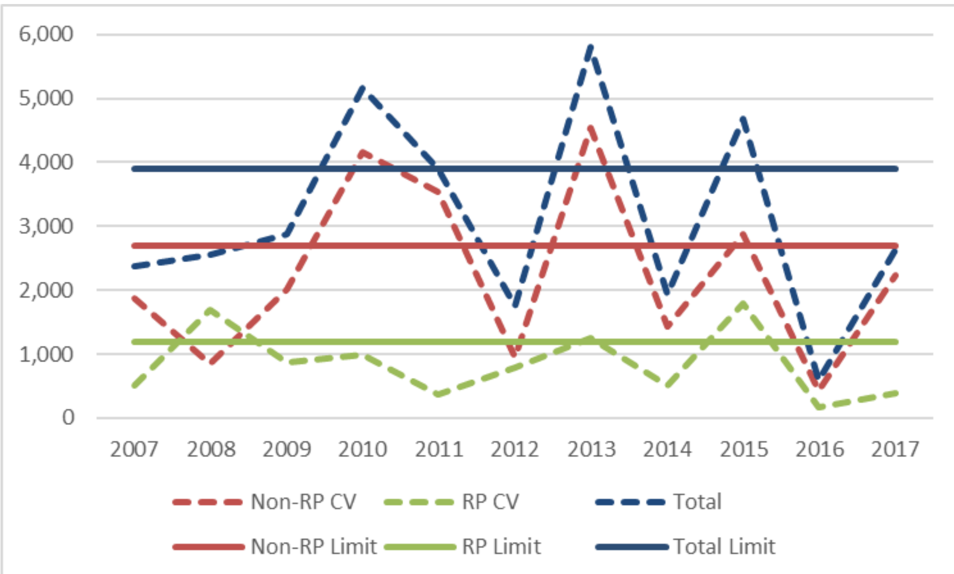
Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 59 Average Chinook salmon PSC reported in the RIR considered by the Council when taking action on GOA Groundfish FMP Amendment 97 (NPFMC 2014)

Basis Period	Sector	Avg. PSC
2003 - 2011	CGOA CV*	2,765
	WGOA CV	72
	GOA CV Total	2,837
2007 - 2012	Rockfish Prog. CV	847

* Average CGOA CV Chinook salmon PSC from 2003 through 2011 includes fishing that occurred under the Rockfish Pilot Program from 2007 through 2011.

Figure 14 Annual Chinook salmon PSC plotted against Amendment 97 PSC limits, 2007 through 2017



Chinook salmon PSC taken in the West Yakutat (WY) district is omitted from this data summary. There is no Chinook PSC hard cap for trawl gear in the WY district. Less than 1% of total estimated GOA trawl Chinook PSC from 2007 through 2017 occurred in WY, including both pollock and non-pollock fisheries (1,529 fish). Effort in the WY non-pollock trawl fisheries is very low; WY non-pollock trawl Chinook PSC accounted for only 29 Chinook salmon from 2007 through 2017. The data also do not include Chinook salmon PSC encountered in fixed-gear and state-managed trawl fisheries that occur in Prince William Sound and the Eastern GOA. Chinook PSC encountered in those fisheries does not accrue to the PSC hard caps that would be affected by this action. Moreover, incidental catch of Chinook salmon in federal fixed-gear (hook-and-line) fisheries was not well tracked prior to the 2013 observer restructure. NMFS does track this data and includes estimated Chinook PSC from the Prince William Sound trawl fishery as a component of total GOA Chinook salmon PSC estimates, which are published on the NMFS catch and landings report website.[31]

[31] For example, the 2017 PSC report is available at https://alaskafisheries.noaa.gov/sites/default/files/reports/car142_goa_salmon2017.pdf. The total estimate for GOA trawl Chinook salmon PSC is 24,810 Chinook, but that includes 281 Chinook from the PWS fishery that do not accrue to a hard cap. From 2010 through 2017, the average amount of Chinook PSC estimated for the PWS fishery was 237 Chinook (low of 27 Chinook and high of 471 Chinook).

Chinook Salmon PSC Rates

The PSC rate represents the number of Chinook salmon that are estimated to be caught per metric ton of groundfish catch. Across all GOA non-pollock trawl CVs, including the Rockfish Program, the overall Chinook PSC rate from 2007 through 2017 was 0.071. This measure can also be read in the inverse as one Chinook salmon PSC estimated for every 14.14 mt of groundfish catch (1/0.071). The overall annual PSC rate for GOA non-pollock trawl CVs does not vary when looking separately at the set of years prior to observer restructuring (2007 through 2012) or after restructuring (2013 through 2017).

Table 60 provides PSC rates by non-pollock CV sector, and further breaks out the PSC rates for the non-Rockfish Program CVs into Western and Central GOA activity. Over the length of the analyzed period, the PSC rate for the Central GOA non-Rockfish Program fishery has remained fairly consistent and close to the overall PSC rate for the GOA non-pollock trawl CV fishery; this is intuitive because the Central GOA non-Rockfish Program fishery accounts for the majority of the Chinook PSC and basis weight that make up the GOA CV total.

Over the full analyzed period, the Rockfish Program CV sector has had a slightly higher PSC rate than the GOA CV total. This value is relatively more susceptible to the effects of a few high PSC years or events – such as the November 2015 PSC event described earlier – because total PSC and groundfish basis weight in the RP sector is comparatively low (Rockfish Program CVs account for 27% of total GOA trawl CV PSC from 2007 through 2017, and 24% of total weight landed).

The most remarkable element of Table 60 is the change in the Western GOA non-pollock CV sector's PSC rate before and after the restructured observer program increased coverage levels in that fishery. The Western GOA's PSC rate from 2007 through 2012 was 0.011, or one Chinook salmon per 91 mt of groundfish catch. From 2013 through 2017, the sector's PSC rate was 0.081 – a roughly seven-fold increase to one Chinook per 12 mt of groundfish catch. The Western GOA PSC rate for the most recent set of years is not greatly out of line with the overall GOA non-pollock CV rate but is a notable departure from the rate that was estimated and considered when the Amendment 97 PSC limit was established based on data from 2003 through 2011.

Table 60 Chinook salmon PSC rate by non-pollock CV sector, 2007 through 2017

	Central GOA			Western GOA			Non-RP Total			RP CV			GOA Non-Pollock CV Total		
	PSC	mt	Rate	PSC	mt	Rate	PSC	mt	Rate	PSC	mt	Rate	PSC	mt	Rate
2007-2017	21,905	311,788	0.070	2,994	54,422	0.055	24,899	366,209	0.068	9,332	117,825	0.079	34,231	484,035	0.071
2007-2012	13,160	189,417	0.069	223	20,399	0.011	13,383	209,816	0.064	5,222	57,601	0.091	18,605	267,417	0.070
2013-2017	8,745	122,370	0.071	2,771	34,023	0.081	11,516	156,394	0.074	4,110	60,224	0.068	15,626	216,618	0.072

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

The Central GOA non-pollock trawl CV sector is the only fishery analyzed here that has a multispecies characteristic throughout the year. The fishery tends to focus on Pacific cod in January and February, but gradually shifts toward flatfish over the course of the spring. Effort is lower during the summer when vessels focus on the Rockfish Program fishery, BSAI groundfish, or work as a support vessel in the directed salmon fishery. Central GOA vessels return to the non-pollock fishery for the Pacific cod B season at the end of the summer, and those that remain active throughout the calendar year will fish flatfish in the late fall.

By volume (mt), trips targeting flatfish species account for 65% of the Central GOA non-pollock non-Rockfish Program CV sector's harvest from 2007 through 2017. Arrowtooth flounder represents 44% of harvest volume and shallow water flatfish represent 18%. Other species including rex sole, flathead sole, and deep-water flatfish make up the remainder of designated flatfish trip targets. Flatfish trips accounted for 72% of the sector's Chinook salmon PSC during the analyzed period, with a PSC rate of 0.089 (one Chinook per 11.2 mt of groundfish). The remainder of the sector's non-pollock activity is trips targeting

Pacific cod in both the A and B seasons. In total, Pacific cod trips accounted for 35% of total landed volume and 18% of Chinook PSC, with a PSC rate of 0.036 (one Chinook per 28.1 mt of groundfish). Roughly 70% of the sector's Pacific cod harvest occurs in the A season and 30% occurs in the B season, while Chinook PSC over the entire period is split 50%/50% over the two seasons. That fact, coupled with A and B season PSC rates of 0.026 and 0.057, respectively, suggest a higher intrinsic rate of Chinook encounter in the fall (September/October). If one rejects the notion that CVs fish differently in the fall compared to the early portion of the year, it is reasonable to conclude that higher PSC rates occur either because target species are less aggregated in the fall—requiring more tow time to harvest the target quota—or that more Chinook salmon occur in trawl areas during the fall.

Seasonality of Chinook Salmon PSC

During the analyzed period, Chinook salmon PSC in the GOA non-pollock fisheries displays a consistent annual pattern (Table 61). In aggregate, the non-Rockfish Program fishery has accumulated 64% of its Chinook PSC from January 20 through the end of May. This period generally encompasses the Pacific cod A season and the Central GOA spring flatfish fishery. The bulk of Western GOA Pacific cod harvest and associated PSC occurs in February before much of the fleet turns to state-managed Pacific cod fixed-gear fisheries, while the Central GOA Pacific cod fishery may stretch into March depending on cod aggregation and how long the fleet spend targeting pollock after the January 20 opening. The Rockfish Program CV sector has accumulated 72% of its Chinook PSC during May and June; those months have historically represented 66% of the sector's groundfish harvest.

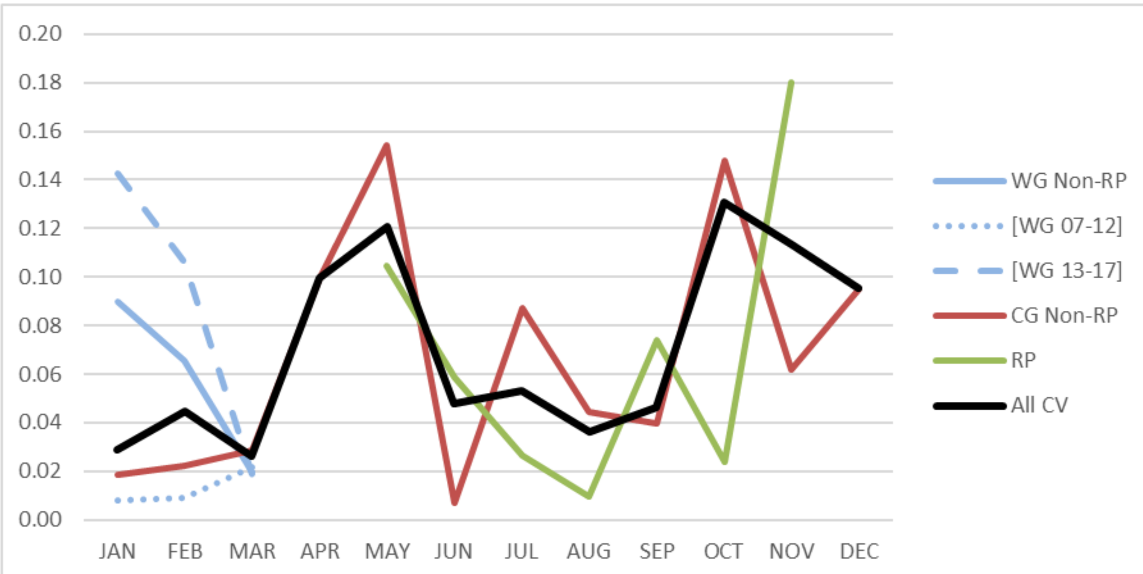
Table 61 Percent of average annual Chinook PSC by month, 2007 through 2017

Month	CG Non-RP	WG Non-RP	Total Non-RP	RP	All CV
JAN	2%	12%	3%		2%
FEB	3%	78%	12%		9%
MAR	5%	9%	6%		4%
APR	32%		28%		20%
MAY	16%		14%	53%	24%
JUN	0%		0%	19%	5%
JUL	4%		4%	4%	4%
AUG	4%		3%	1%	3%
SEP	7%		6%	7%	6%
OCT	23%		20%	1%	15%
NOV	3%		3%	16%	6%
DEC	1%		1%		1%

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

Figure 15 illustrates average monthly Chinook salmon PSC rates aggregated over the period 2007 through 2017. For reference, recall from Table 60 that the average annual overall GOA non-pollock trawl CV PSC rate for the period was 0.07 Chinook per mt of groundfish catch. The overall PSC rate is largely driven by the Central GOA non-Rockfish Program CV sector, as that fishery accounts for the greatest proportion of total non-pollock harvest and PSC. The overall rate is relatively low during the Pacific cod A season, but rises above the annual average in April and May when the Central GOA non-Rockfish Program fishery tends to shift focus to flatfish species. PSC rates also trend higher in the late fall, again when vessels increase flatfish targeting (though, as noted above, PSC rates in the Pacific cod B season are higher than in the Pacific cod A season). The uptick in Rockfish Program CV PSC rates at the end of the year could reflect changing seasonal environmental factors such as target fish aggregation and/or presence of Chinook PSC; especially high rate levels in November might also be an artifact of previously noted "lightning strike" events that were large enough to skew the data. Finally, note that the trend in Western GOA CV PSC rates reflect the trend from the five years since the observer restructuring more so than the six years prior to restructure. The Western GOA Pacific cod trawl CV fishery tends to decrease its PSC rate as the fishery progresses from January to March, which could reflect target fish aggregation (catch per unit effort, and trawl-time with nets in the water) or could reflect the fleet learning the PSC conditions on the fishing grounds in real-time.

Figure 15 Average monthly Chinook salmon PSC rates by non-pollock CV sector, 2007 through 2017



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

4.5.4 Processors

From 2010 through 2017, between 10 and 15 inshore processing facilities received deliveries from GOA non-pollock non-Rockfish Program trawl CVs in a given year. Eighteen total facilities processed GOA non-pollock groundfish during that period. Table 62 reflects that Kodiak has the most individual facilities involved in this GOA fishery. Of the communities situated in the Western GOA (King Cove, Sand Point, Akutan, Dutch Harbor/Unalaska, and False Pass), only King Cove and Sand Point had a facility that was active in the fishery during every year; each of those communities has a single processing facility. Those two facilities combined to account for 97% of the gross first wholesale value that was derived from non-pollock trawl-caught groundfish in the “Western GOA” communities during this time period (60% in Sand Point; 37% in King Cove). The processing facilities that are listed under Washington state represent floating processing plants, whose “Intent to Operate” city designation is based on the location of the firm that owns the floating processor. Five different floating processors have participated in the GOA non-pollock non-Rockfish Program CV fishery since 2010. Two floating processors are associated with a firm or firms based in Kirkland, WA, and three are associated with firm(s) based in Seattle, WA. The floating processors were primarily engaged in the processing of Pacific cod in the Central GOA, and pollock in the Western GOA. From 2010 through 2017, floating processors combined to receive only 1.8% of the total groundfish caught by the non-Rockfish Program CV sector, accounting for 3% of total gross first wholesale revenue.

On average, shore-based and stationary floating processors received 32,200 mt of non-pollock non-Rockfish Program groundfish per year from 2010 through 2017. Additional information of harvest levels and ex-vessel revenues is provided in Section 4.5.2 of this document. The City of Kodiak received 78% of those deliveries (be weight landed), and Western GOA communities received 20%. Kodiak’s share of landings was particularly high in 2010 and 2011; excluding those years, Kodiak received an average of 73% of non-pollock non-Rockfish Program landings and Western GOA communities received 26%. The

RIR prepared for the analysis of GOA Groundfish FMP Amendment 97 noted that Kodiak accounted for 93% of non-pollock processing by volume and 90% of processing revenues for this sector from 2007 through 2011. The relative decrease in Kodiak's share of total processing market share is mostly attributed to increased non-pollock production in Sand Point and King Cove. In 2010 and 2011 the plants in Sand Point and King Cove combined to account for roughly 7% of total first wholesale revenue from GOA non-pollock non-Rockfish Program trawl fisheries; during the 2012 through 2016 period that percentage rose to between 27% to 33%. Furthermore, the processing plant in Akutan dramatically increased its pollock processing volume in 2016 and 2017 relative to previous levels; the development of that plant has also involved a modest increase in the amount of non-pollock groundfish that are processed there.

Table 62 Number of processing plants in the inshore sector that took deliveries of GOA non-pollock non-Rockfish Program trawl groundfish, 2010 through 2017

City	2010	2011	2012	2013	2014	2015	2016	2017
Kodiak	8	9	7	7	7	5	6	5
King Cove, Sand Point, Akutan, Dutch Harbor/Unalaska, False Pass	4	3	2	3	3	3	3	4
Sitka, Seward	1	2	2	1	0	0	0	0
Washington	1	1	1	1	2	2	3	2
Total	**14**	**15**	**12**	**12**	**12**	**10**	**12**	**11**

Source: AKFIN summary of CAS and COAR data

Table 63 GOA non-pollock non-Rockfish Program groundfish CV trawl deliveries (mt) by community, 2010 through 2017

City	2010	2011	2012	2013	2014	2015	2016	2017	Total
Kodiak	33,639	31,251	21,805	26,045	25,780	20,776	23,386	18,120	200,804
King Cove, Sand Point, Akutan, Dutch Harbor/Unalaska, False Pass	1,833	2,114	8,574	8,649	9,526	6,569	7,117	7,126	51,509
Sitka, Seward	C	C	C	C					789
Washington	C	C	C	C	C	C	554	C	4,499
Total	*	**34,609**	**30,602**	*	*	*	**31,057**	*	**257,601**

Source: AKFIN summary of CAS and COAR data

The Central GOA Rockfish program includes a requirement that all fish harvested under RP cooperative quota is delivered to a processor located in the City of Kodiak. The Council included the Kodiak delivery requirement to address concerns that the Rockfish Program would allow harvesters to deliver outside of the traditional landing port. In addition to protecting historical processors, the requirement was intended to protect other local business and onshore workers who are reliant on the fishery. From 2010 through 2017, as many as eight different shore-based facilities processed fish caught under the Rockfish Program. The annual number of processors has decreased from eight in 2010 to six during the 2015 through 2017 period. Dating back to the implementation of the Rockfish Pilot Program in 2007, the average annual shoreside landings of RP groundfish is 10,700 mt. Nominal average annual gross first wholesale value from 2007 through 2016 (the most recent year for which pricing information is available) was $9.2 million. That value peaked at a high of $14.7 million in 2012.

Table 64 summarizes the nominal gross first wholesale value generated by inshore processing facilities that received GOA non-pollock trawl groundfish from 2007 through 2016. Overall, GOA groundfish trawl CV deliveries generated around 10% of these processors' aggregate first wholesale revenues. Pollock landings contributed roughly 5% of total gross first wholesale revenues, with non-pollock and

Rockfish Program CV landings contributing the other 5%. Other contributors to GOA processors' gross revenues included fixed-gear Pacific cod, salmon, halibut and sablefish IFQ, crab, and herring.

Table 64 Nominal gross first wholesale revenue ($million) generated by inshore processing facilities that received GOA non-pollock trawl groundfish, 2007 through 2016

	GOA Groundfish Trawl Fisheries						All Fisheries	
Year	Non-Pollock	% Total	Rockfish Prog.	% Total	Pollock	% Total	Total	% GOA Trawl
2007	20.4	4.5%	5.0	1.1%	12.9	2.9%	449.4	8.5%
2008	27.0	4.9%	5.3	1.0%	18.6	3.4%	554.6	9.2%
2009	13.8	3.4%	3.7	0.9%	14.1	3.5%	403.9	7.8%
2010	20.8	4.1%	5.0	1.0%	26.8	5.3%	508.0	10.4%
2011	22.8	3.3%	9.0	1.3%	28.1	4.0%	696.6	8.6%
2012	23.3	3.1%	14.7	2.0%	37.2	5.0%	740.0	10.2%
2013	21.4	3.2%	11.1	1.7%	34.6	5.2%	667.2	10.1%
2014	24.1	3.7%	12.3	1.9%	40.2	6.1%	654.0	11.7%
2015	20.3	3.3%	12.9	2.1%	40.7	6.6%	619.2	11.9%
2016	18.8	3.3%	12.7	2.2%	33.1	5.7%	576.1	11.2%
Total	**212.7**	**3.6%**	**91.7**	**1.6%**	**286.2**	**4.9%**	**5,869.0**	**10.1%**

Source: AKFIN summary of CAS and COAR data

For the 2007 through 2016 period, processors located in Kodiak accounted for 94% of the gross first wholesale revenues generated from the Central GOA non-pollock non-Rockfish Program trawl CV fisheries. Other processing communities—including Sand Point, King Cove, Akutan, and floating processors owned by Washington-based companies—must be reported in aggregate in order to preserve confidentiality. Kodiak processors generated 58% of their total wholesale revenues from January through May, 11% from June through August, and 31% from September through December (27% occurred during September and October, spanning the Pacific cod B season). Processors in other municipalities generated 94% of their gross first wholesale revenues from January through April, reflecting the fact that they were mostly participating in the Pacific cod A season.

Processors that participated in the Western GOA non-pollock non-Rockfish Program trawl CV fisheries were located in Sand Point, King Cove, Unalaska, Akutan, False Pass, Kodiak, and on floating processors owned by Washington-based companies. Virtually all gross first wholesale revenues were generated from January through March, with 68% occurring in February.

The best available information on processing plant workers who participate in the GOA groundfish trawl fisheries (including pollock) is available in Section 5.2 of the Preliminary Social Impact Assessment that was prepared for the Council's consideration of the GOA Trawl Bycatch Management Program in December 2016.[32] That analysis relies on information from 2015 Economic Data Reports for shoreside processing operations and a 2014 social science survey that was administered by the Alaska Fisheries Science Center. Table 65 provides labor payment information for processing workers at GOA shoreside processors that accepted trawl-caught groundfish deliveries in 2015. While the shoreside processors in Kodiak consisted exclusively of shore-based processing plants, the shoreside processors outside of Kodiak include shore-based plants in Sand Point, King Cove, and False Pass, plus three stationary floating processors. Table 66 provides wage and salary information for non-processing workers at shoreside processors in Kodiak and elsewhere that accepted GOA trawl-caught deliveries in 2015.

[32] http://npfmc.legistar.com/gateway.aspx?M=F&ID=e3852a81-a379-4676-a27a-ef2d3938b3e1.pdf

Table 65 GOA groundfish processor workers and labor hours/payments by month, 2015

Month	Number of Federal Processor Permits	Number of Groundfish Processing Employees	Processing Labor Person-Hours		Processing Labor Payment	
			Housed	Not Housed	Housed	Not Housed
Kodiak						
January	7	1,422	34,440	182,484	$326,052	$2,165,849
February	7	1,645	127,474	214,655	$1,339,541	$2,659,635
March	7	1,686	126,612	315,540	$2,390,093	$3,958,886
April	7	1,567	82,725	213,604	$954,102	$2,785,893
May	7	1,136	25,805	160,411	$286,175	$1,874,488
June	7	1,123	18,898	119,953	$225,211	$1,478,947
July	7	533	6,714	83,271	$82,558	$1,024,004
August	7	532	6,903	78,400	$97,876	$952,292
September	7	1,447	98,001	264,578	$1,095,659	$3,411,559
October	7	1,403	107,747	244,705	$1,272,712	$3,172,959
November	7	1,108	28,320	100,738	$340,911	$1,286,226
December	7	407	4,768	46,271	$68,512	$579,133
Total	**--**	**--**	**668,407**	**2,024,610**	**$8,479,402**	**$25,349,871**
All Other Geographies						
January	6	890	109,932	0	$1,228,038	$0
February	6	1,201	255,023	101	$2,810,615	$1,446
March	6	1,186	364,564	627	$4,417,681	$1,395
April	5	1,017	260,233	0	$3,100,578	$0
May	5	176	27,440	0	$322,100	$0
June	5	500	31,835	0	$392,269	$0
July	5	474	124,382	0	$1,575,885	$0
August	5	488	97,974	0	$1,260,775	$0
September	5	601	250,365	0	$3,053,302	$0
October	5	544	192,045	0	$2,291,918	$0
November	5	236	13,558	0	$168,687	$0
December	5	0	0	0	$0	$0
Total	**--**	**--**	**1,727,351**	**728**	**$20,621,848**	**$2,841**

Source: NMFS 2016.

Table 66 Total wages and salaries for GOA groundfish processor non-processing employees, 2015

Community	Number of Non-Processing Employees	Total Wages and Salaries
Kodiak	105	$6,046,418
All Others	687	$11,109,935
Total	**792**	**$17,156,353**

Source: NMFS 2016.

4.5.5 Communities

Table 67 lists the self-reported communities of residence for the owners of trawl CVs that participated in the GOA non-pollock groundfish fisheries from 2007 through 2016.[33] In total, 86 unique CVs participated

[33] The data for these tables is drawn from revenue diversification information, which is not yet available for 2017.

during that period, but 112 vessel owners are listed due to cases with more than one name and/or residence for some vessels. Table 68 lists the 13 different self-reported homeport communities for CVs that harvested GOA non-pollock groundfish from 2007 through 2016. Seven of the listed homeport communities are in Alaska, with the other six located in Oregon and Washington.

Table 67 Communities of residence for owners listed on trawl CVs that harvested GOA non-pollock groundfish, 2007 through 2016

Alaska	Count	Washington	Count	Oregon	Count	Other	Count
Anchorage	1	Anacortes	1	Brookings	1	Holualoa, HI	1
Girdwood	2	Bellingham	4	Charleston	1	Kailua Kona, HI	1
King Cove	5	Camas	1	Dallas	1	Fruitland, ID	1
Kodiak	35	East Wenatchee	1	Depoe Bay	1	Tenants Harbor, ME	1
Petersburg	3	Edmonds	1	Florence	2		
Sand Point	12	Gig Harbor	1	Independence	1		
		Issaquah	1	Newport	9		
		Lynnwood	1	Port Orford	1		
		Mercer Island	1	Siletz	1		
		Renton	2	South Beach	1		
		Seattle	21	Warrenton	1		
		South Bend	2				
		Spanaway	1				
		Vashon	1				

Source: NMFS LLP database and COAR data provided by AKFIN.

Table 68 GOA non-pollock trawl CVs by homeport, 2007 through 2016

State	City	# Vessels
AK	Kodiak	29
	Sand Point	14
	King Cove	6
	Petersburg	4
	Juneau	3
	Unalaska	1
	Girdwood	1
OR	Newport	9
	Portland	2
	Charleston	1
	Brookings	1
WA	Seattle	14
	Blaine	1

Source: NMFS LLP database and COAR data provided by AKFIN.

4.5.5.1 Community Profiles

Detailed community profiles that provide the specific context of GOA groundfish trawl fishery participation are available in Section 5 of the December 2016 Preliminary SIA that was prepared for the Council's consideration of the GOA Trawl Bycatch Management Program.[34] That document covers the Alaska communities of Kodiak, Sand Point, King Cove, Akutan, Unalaska, Petersburg, Homer, Seward, and Anchorage, as well as the Seattle, WA municipal area, "Other Washington communities," Newport, OR, and "Other Oregon communities." The reader is also referred to the SIA that was prepared in

[34] http://npfmc.legistar.com/gateway.aspx?M=F&ID=e3852a81-a379-4676-a27a-ef2d3938b3e1.pdf

October 2017 for the Central GOA Rockfish Program review.[35] Section 5 of that document provides the community context for the Rockfish Program with specific information on Kodiak, “Other Alaska communities,” the Seattle, WA municipal area, “Other Washington communities,” Lincoln County, OR, and “Other Oregon communities.”

The Alaska Fisheries Science Center’s Resource Ecology & Fisheries Management (REFM) division has compiled community profiles, community snapshots, interactive mapping tools, and a compendium of social science analyses on its website, available at https://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/communities.

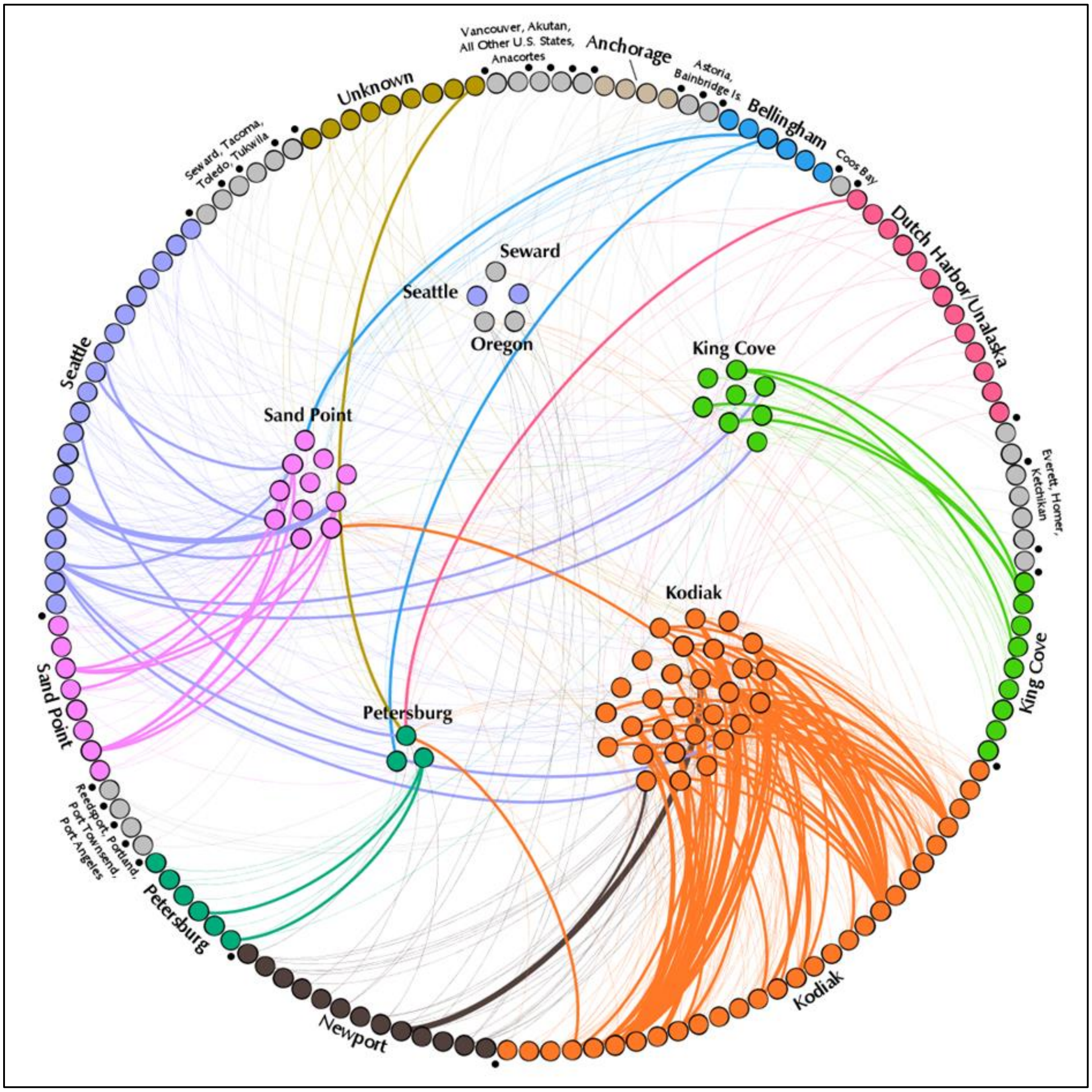
4.5.5.2 Support services

Section 5 of the December 2016 Preliminary SIA cited above provides the best available description of engagement and reliance upon the GOA trawl groundfish fishery for support services sectors. Support sectors include a range of businesses that cater to the commercial fishing industry, including fishmeal plants, marine hardware/gear supply, hydraulics, welding, marine electronics, marine mechanical, fuel sales, general stores, boatyard services, bookkeeping, and shipping. The 2016 SIA notes that Kodiak is distinguished from most other Alaskan fishing ports by the number and range of support service businesses that it provides. Many support service businesses in Kodiak are independent operators, while most fishery-linked support businesses in Sand Point and King Cove are provided through the local processing plants and/or buying stations.

Figure 16 graphically illustrates the relationship of the community of GOA trawl catcher vessel ownership and the communities where those vessels obtain support services, utilizing data from the 2014 AFSC GOA Trawl Social Survey. Vessels and their community of ownership are shown as clustered dots within the circle, and support service businesses are shown, arranged by community where goods and services were obtained, as dots forming the circle itself. Thicker connecting lines represent multiple mentions for single businesses, while the thin lines in the background show the pervasive interconnections that result from unique mentions on the survey. The figure reflects the greater provision and utilization of local support services in Kodiak relative to other communities of vessel ownership.

[35] http://npfmc.legistar.com/gateway.aspx?M=F&ID=1c813c58-b346-4cef-aa74-44dbe2a24b42.pdf

Figure 16 Community of GOA Trawl Catcher Vessel Ownership and Community of Vessel Support Service Businesses Utilized by those Vessels, 2014



Source: NOAA 2015.

4.5.5.3 Taxes Generated by GOA Trawl Fisheries

4.5.5.3.1 State of Alaska Taxes

The State of Alaska levies three fisheries taxes on groundfish. The descriptions of these taxes are taken from the Alaska Department of Revenue Tax Division website, which provides additional information about resource taxes in Alaska.[36,37] The first two taxes are levied as a percentage of ex-vessel value, and

[36] http://www.tax.alaska.gov/programs/programs/index.aspx?60620

[37] The State also levies taxes on commercially caught salmon, including the Regional Seafood Development Tax. That 1% tax is levied on Prince William Sound and Bristol Bay gillnet fishers. While Chinook salmon are not a primary target in those fisheries, a portion of the salmon that are taken in the GOA trawl fisheries have been traced back to

the third is based on first wholesale value. Aggregated, annual average tax liabilities are presented in order to preserve processor confidentiality.

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. The state shares 50% of tax collected with the incorporated city or organized borough in which the processing took place. If an incorporated city is within an organized borough—such as Kodiak or municipalities within the Aleutians East Borough—the Division divides the 50% shareable amount equally between the incorporated city and the organized borough equally.

   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 2007 and 2016, GOA trawl-caught non-pollock groundfish were delivered to 20 different shore-based processors and five floating processors. During the analyzed period the GOA shore-based processors, in aggregate, paid the State an average of $657,362 per year in Fisheries Business Tax levied on non-pollock groundfish trawl product. Over the same period, the five floating processors paid a combined average of $10,284 per year.

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 Section 210(f) of the American Fisheries Act. The tax is based on the unprocessed value of the resource (ex-vessel value), 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 levied at a rate of 3% of ex-vessel value. Because this action would not directly regulate catcher/processors, no estimate of recently collected Landing Taxes is provided.

3) A **Seafood Marketing Assessment** is levied at a rate of 0.5% of the value of seafood processed products first landed in or exported from Alaska. Taxes collected under this assessment are deposited into the State of Alaska General Fund; the legislature may appropriate funds to the Alaska Seafood Marketing Institute.

   The Seafood Marketing Assessment is based upon the first wholesale value of seafood products, regardless of whether the products were processed at sea or onshore. The first wholesale prices used in this analysis are provided by AKFIN and are based upon COAR data. The action under consideration only affects inshore processing at shore-based plants or on stationary floating processors. From 2007 through 2016, the 25 facilities that processed CV trawl-caught non-pollock groundfish in the GOA collectively paid the State an average of $110,902 per year under the Seafood Marketing Assessment.

4.5.5.3.2 Municipality Raw Fish Taxes

In addition to sharing in the State's Fisheries Business Tax revenues, some municipalities levy raw fish taxes on fish first landed at processing plants located in their community. Municipalities that levied fish taxes and had processors that took deliveries of GOA non-pollock groundfish between 2007 and 2017 are listed in Table 69. The table reports the borough or municipalities' populations, raw fish tax rates, and reported 2017 raw fish tax revenues for all species as reported in the Alaska Department of Commerce,

genetic stocks that return to those areas (refer to Section 3.3.3 of this document for information on the genetic stock of origin for Chinook salmon encountered in GOA trawl fisheries.

Community, and Economic Development's 2017 Municipal Taxation Supplement (DCCED).[38] Estimated raw fish tax revenues from non-pollock trawl fishing are not reported due to confidentiality restrictions, as the number of plants in most of the relevant communities is less than three. General information on the scale and trends of public revenues generated from groundfish landings in Kodiak, Sand Point, and King Cove are discussed below; greater detail is available in Section 5.2 of the Preliminary Social Impact Analysis that was prepared for the development of the GOA Trawl Bycatch Management Program in December 2016.[39]

Table 69 Raw fish taxes levied by GOA groundfish trawl communities in 2017

Municipality	Population	Raw Fish Tax	2017 Raw Fish Tax Revenue
Kodiak Island Borough	13,563	1.075%	$1,306,507
Unalaska	4,448	2.0%	$4,766,264
Aleutians East Borough	3,032	2.0%	$4,714,403
King Cove	923	2.0%	$949,142
Sand Point	943	2.0%	$590,065
Akutan	1,000	1.5%	Not Reported

Raw fish taxes accounted for roughly 7% of the Kodiak Island Borough's local tax revenues in 2017. The Borough collected roughly $15.7 million in local property tax, as well as a 5% bed tax and a motor vehicle flat tax. The City of Kodiak, with a population of 6,124, does not levy its own raw fish tax, but shares in state taxes on fishery activity. Additional information on Kodiak's reliance on fishing for public revenues is provided in Table 70, below.

The $4.8 million in local fish tax collected by Unalaska in 2017 accounted for roughly 20% of local tax revenues. Other taxes included $11.0 in sales tax, $6.2 in local property tax, and $195,000 from 5% local bed tax.

The $950,000 in raw fish taxes collected by King Cove accounted for 56% of the municipality's local tax revenues, with the balance coming from a 6% sales tax. King Cove also collects an additional flat Fisheries Business Impact Tax of $100,000 per year from the processing plant located in the community.

Sand Point's $590,000 in raw fish tax accounted for roughly 44% of 2017 local tax revenues. The balance comes from a 4% sales tax and a 7% bed tax.

DCCED does not report Akutan's revenues from the 1.5% local fish tax in its 2017 Alaska Taxable Supplement, but the department's community profile lists *combined* 2016 revenues from the local tax and a share of the 2% Borough tax at $1.8 million.[40]

While the City of Kodiak does not collect its own municipal raw fish tax, it shares in Borough and State tax levies and those receipts make up a significant portion of public revenues. The SIA that was prepared for the 2017 Central GOA Rockfish Program LAPP Review notes that fish taxes contributed roughly 6% to 8% of the city's general fund in any given year, from 2003 to 2016.[41] The Rockfish Program SIA also

[38] https://www.commerce.alaska.gov/dcra/DCRARepoExt/RepoPubs/Taxable/2017-AlaskaTaxableSupplement.pdf
[39] http://npfmc.legistar.com/gateway.aspx?M=F&ID=e3852a81-a379-4676-a27a-ef2d3938b3e1.pdf
[40] Akutan community profile available at https://www.commerce.alaska.gov/dcra/
[41] See Section 5.2.1.6, at http://npfmc.legistar.com/gateway.aspx?M=F&ID=1c813c58-b346-4cef-aa74-44dbe2a24b42.pdf

notes that Kodiak's boat harbor brings in revenue that is separate from the general fund, but not insignificant, generally totaling between $2.2 to $2.6 million per year from 2009 through 2016.

Table 70 Selected fisheries related revenues (nominal dollars), City of Kodiak, 2003 through 2016

	General Fund Revenue					
	Shared Fisheries Tax Revenue					
Year	Shared Fisheries Business Tax Revenue	Shared Fisheries Resource Landing Tax Revenue	Total Shared Fisheries Tax Revenue	All Other General Fund Revenue	Total General Fund Revenue	Total Shared Fisheries as a Percent of Total General Fund Revenue
2003	$562,000	$65,719	$627,719	$10,246,779	$10,874,498	5.8%
2004	$788,947*	$37,048	$825,995	$10,025,735	$10,851,730	7.6%
2005	$597,723	$45,837	$643,560	$10,654,165	$11,297,725	5.7%
2006	$655,636	$56,788	$712,424	$11,374,385	$12,086,809	5.9%
2007	$760,099	$68,674	$828,773	$12,095,045	$12,923,818	6.4%
2008	$823,097	$62,581	$885,678	$14,498,488	$15,384,166	5.8%
2009	$946,635	$70,855	$1,017,490	$14,303,651	$15,321,141	6.6%
2010	$1,046,010	$68,818	$1,114,828	$14,517,148	$15,631,976	7.1%
2011	$740,229	$87,810	$828,039	$13,883,507	$14,711,546	5.6%
2012	$1,123,205	$120,822	$1,244,027	$15,228,387	$16,472,414	7.6%
2013	$1,252,420	$90,469	$1,342,889	$16,290,881	$17,633,770	7.6%
2014	$1,189,750	$106,436	$1,296,186	$16,802,027	$18,098,213	7.2%
2015	$1,164,404	$90,093	$1,254,497	$18,857,391	$20,111,888	6.2%
2016	$1,021,500	$88,138	$1,109,638	$16,741,076	$17,850,714	6.2%

*Includes revitalization aid.
Source: DCCED 2017

4.5.6 Markets for Alaska Non-Pollock Groundfish Products

This section summarizes market and price trend information for groundfish species that are targeted in the non-pollock GOA trawl CV fisheries. Much of this information is sourced from the Alaska Fisheries Science Center's 2016 Economic SAFE report, which contains a greater level of detail.[42] The Economic SAFE includes market profiles, which are extracted from a more comprehensive document, *Alaska Groundfish Wholesale Market Profiles*, which was published in May 2016.[43]

The U.S., Europe, and Japan are the largest markets for finished products derived from Alaska groundfish and crab, typically accounting for more than 80% of first wholesale value. Approximately one-third of the production volume is reprocessed in China and re-exported to markets in Europe, the U.S., and Japan. A significant percentage of product exported to South Korea is held in cold storage facilities or secondarily processed and re-exported to Japan and Europe. Most species face market competition from fisheries in other countries. The Economic SAFE provides data on Alaska groundfish species' global market share up to 2013; data aggregates both the GOA and BSAI, across all gear types. In 2013 Alaska Pacific cod accounted for 18% of global cod harvest; flatfish had a 32% global market share, rockfish had a 28% market share, and sablefish had 78% market share. The primary markets for Pacific cod, flatfish, and rockfish was China, which functioned mainly as a reprocessing and re-export market (Economic SAFE Table 7.3, p.163). From 2010 through 2014, 12% of the volume of

[42] http://www.afsc.noaa.gov/refm/docs/2017/economic.pdf
[43] (http://www.afsc.noaa.gov/News/pdfs/Wholesale_Market_Profiles_for_
Alaskan_Groundfish_and_Crab_Fisheries.pdf).

Alaska groundfish and crab, in aggregate, were sold directly into the domestic U.S. market. That volume accounted for 26% of the total first wholesale value generated in Alaska groundfish and crab fisheries over that period. Table 71 provides a snapshot of 2014 production by export market on a species basis—again aggregating across the GOA/BSAI and all gear types (adapted from Economic SAFE Table 7.7, p.168). During that year, roughly 23% of wholesale production of the species primarily targeted by GOA non-pollock CVs was sold directly into the U.S. domestic market.

Table 71 Wholesale sales of selected Alaska groundfish (mt), 2014

Species	Wholesale Production	U.S.	Europe	China	Japan	Other	Total Exported
Pacific cod	134,206	30,394	20,975	57,195	16,571	9,071	103,812
Flatfish	167,185	40,045	717	107,486	4,356	13,581	127,140
Rockfish	32192	8,390	58	15,566	6,861	1,317	23,802
Sablefish	6696	593	173	559	4,648	723	6,103
Subtotal	340,279	79,422	21,923	180,806	32,436	24,692	260,857
		23%	6%	53%	10%	7%	77%
Total*	620,134	66,096	159,457	274,903	57,976	61,702	554,038
		11%	26%	44%	9%	10%	89%

*Includes pollock, Atka mackerel, and Pacific halibut.

Prices for Alaska products have been negatively impacted by a stronger U.S. dollar in recent years. The Economic SAFE notes that the magnitude of this shift is unusually large, and that it swiftly altered the bargaining position of Alaska producers. A stronger dollar relative to the currencies of key export markets and competing suppliers makes Alaska seafood more expensive and competing product less expensive from foreign consumers' point of view.

Whitefish, which refers to pollock, cod and flatfish among other species, competes in a global market that includes both wild capture and aquaculture seafood production. Alaska's commercial fisheries produce larger harvests than every other U.S. state combined and 80% of Alaska's harvest volume came from high-volume whitefish fisheries (pollock, cod, and flatfish) in 2013. Despite the impressive scale of its high-volume whitefish fisheries, Alaska is only a fractional part of global whitefish production. In 2013, Alaska production accounted for 13.5% of global wild and farmed whitefish production. As a result, Alaska's groundfish industry is a usually a price taker, where the value of its cod, pollock, and flatfish are impacted by competing suppliers and competing whitefish species. However, low volume Alaska whitefish species like sablefish, rockfish, and halibut have more defined markets where Alaska is the primary export supplier and accounts for a larger percentage of the global supply in niche markets. As a result, species substitution is less common in markets for these species and price is mostly a function of Alaska’s harvest volume.

The 2016 Economic SAFE report makes several notes regarding markets for species that are prosecuted by the GOA non-pollock trawl CV sector and the Central GOA Rockfish Program CV sector. The SAFE notes that Pacific cod had been recently marketed in Europe as a substitute for declining Atlantic cod stocks, but that rebounding Atlantic stocks and protective tariffs combined with unfavorable currency exchange rates have made it more difficult for Pacific cod to compete. Flatfish markets have been negatively affected by the rising strength of the U.S. dollar compared to the Euro, and by increasing re-processing labor costs in China. Rockfish prices from Asia have recently been supported by a reduced supply of Atka mackerel (a substitute), but rebounding Atka mackerel quotas could impact prices for Pacific ocean perch and other rockfish. As with other species, currency exchange rates with the main reprocessing market in China have decreased demand for raw material from Alaska. Finally, sablefish processors have experienced continuing high demand and prices that reflect relatively low TACs compared to historical levels. While sablefish prices peaked in 2011 they remain high; demand has increased in markets outside of Japan, which was the traditional market driver.

The 2016 Economic SAFE also provides information on trends in first wholesale value of key Alaska groundfish species. The SAFE authors use historical data from the Commercial Operators Annual Report (COAR) along with export prices, global estimated catch, and exchange rates to project product values through 2019. These projections do not distinguish between at-sea and shoreside production; nevertheless, this measure reflects the direction in which GOA trawl species' value are expected to move in the future. Values for 2017 (and beyond) are presented as estimates with a 90% confidence interval because COAR data for that year was not finalized at the time that the Economic SAFE was compiled (November 2017).

Readers may find additional market and value information in each chapter of the Groundfish SAFE reports[44] under the heading of "Economic Performance Report." These entries are a new addition to the SAFE document in 2017 and will continue to be developed to provide a time series of market snapshots.

Table 72 Average first wholesale groundfish product price summary and projections (2014 through 2019); 2017 through 2019 projections include 90% confidence interval

Species	Product	2014	2015	2016	2017	2018	2019
Pacific cod	Fillet	2.91	2.65	3.32	3.47	3.49	3.59
					(3.36 - 3.58)	(2.81-4.25)	(2.68-4.72)
	H&G	1.26	1.35	1.28	1.39	1.40	1.41
					(1.31-1.46)	(1.04-1.86)	(0.97-2.03)
	Other	0.78	0.86	0.87	0.88	0.91	0.90
					(0.84-0.93)	(0.72-1.16)	(0.63-1.28)
Sablefish	H&G	6.93	6.95	8.02	8.31	8.38	8.80
					(8.11-8.53)	(7.01-10.00)	(6.90-11.22)
Rockfish	H&G	1.18	1.04	0.93	0.92	0.95	0.97
					(0.85-0.99)	(0.71-1.26)	(0.61-1.47)
Arrowtooth Flounder	H&G	0.70	0.65	0.82	0.74	0.85	0.89
					(0.65-0.84)	(0.53-1.36)	(0.54-1.46)
Flathead Sole	H&G	0.70	0.64	0.77	0.78	0.78	0.76
					(0.74-0.82)	(0.62-0.96)	(0.54-1.05)
Rex Sole GOA	H&G	0.98	0.84	1.01	1.00	0.99	1.00
					(0.95-1.04)	(0.81-1.22)	(0.75-1.30)
Shallow-Water Flatfish GOA	Fillet	1.39	2.37	2.42	2.32	2.24	2.25
					(2.24-2.41)	(1.63-3.17)	(1.51-3.31)

*Source: 2016 Economic SAFE Table 6.1

4.6 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. Historically, most of the subsistence harvest of Chinook occurred in the Yukon and Kuskokwim

[44] https://www.afsc.noaa.gov/refm/stocks/assessments.htm

rivers. In 2010, for example, 86% of the statewide harvest took place in these rivers.[45] However, since 2010, subsistence harvests of Yukon and Kuskokwim river Chinook have declined and accounted for just 55% of the harvest in 2015 (Fall et al. 2018). Predominant gear types in the subsistence fishery include gill nets (drift and set), seines, fish wheels, and long lines. Alaska Department of Fish & Game (ADF&G) reports that harvest by subsistence and personal use fishermen averaged 114,934 Chinook salmon from 2006 through 2015, with 98% of this total taken in subsistence fisheries (Fall et al. 2018). 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 129,721 Chinook salmon per year from 2007 through 2016 (51% taken in Southcentral Alaska; 46% in Southeast Alaska; and 2% 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.[46]

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. After escapement needs, 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.[47]

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, 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.

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.

[45] http://www.adfg.alaska.gov/techpap/TP381.pdf
[46] http://www.adfg.alaska.gov/sf/sportfishingsurvey/index.cfm?ADFG=region.results
[47] http://www.adfg.alaska.gov/index.cfm?adfg=chinook.management

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).

4.6.1 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.[48] Under the Magnuson-Stevens Act, the Federal Government has management authority for the majority of groundfish fisheries, three to two hundred nautical miles offshore, and Pacific halibut fisheries from the shoreline, seaward to 200 nautical miles.

At present, there are no GOA non-pollock groundfish trawl fisheries occurring in state waters that accrue against the State of Alaska’s guideline harvest level (GHL). The only state waters GOA trawl fishery that is managed under the GHL is the Prince William Sound pollock fishery. Other groundfish fisheries that occur in state waters are managed as parallel fisheries, and harvest accrues against the Federal TAC.

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 and economic dependence in the various salmon fisheries. Permits can be freely transferred, bought and sold; thus, new persons have entered into the commercial fishery since the original limitation program was implemented.

Alaska’s commercial salmon fisheries are administered through the use of management areas throughout the state. For information on commercial regulations refer to: http://www.adfg.alaska.gov/index.cfm?adfg=fishregulations.commercial.

The value of the commercial salmon harvest can vary widely dependent on a number of factors including the size of the runs, the size of the fish, international markets, foreign currency exchange rates, world aquaculture production, and economic conditions in our domestic and international markets.

Information on the annual commercial Chinook salmon harvest in Alaska is reported at http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.salmon_grossearnings_byspecies .

Table 73 summarizes commercial Chinook salmon harvest and nominal ex-vessel value (in nominal dollars) from 2003 through 2016.

48 The State of Alaska manages crab under delegated Federal FMP authority, subject to compliance with MSA requirements.

Table 73 Alaska commercial Chinook salmon harvest and ex-vessel value (2003 through 2016)

Year	Number of Fish	Pounds (Million)	Ex-vessel Value (million$)
2003	607,887	10.0	14.0
2004	794,946	12.7	23.7
2005	679,264	10.5	23.0
2006	624,265	9.9	28.8
2007	562,314	8.6	26.8
2008	344,895	5.2	22.3
2009	361,168	5.1	13.9
2010	378,772	5.4	18.6
2011	459,798	6.2	22.1
2012	342,223	4.6	18.0
2013	321,955	4.1	17.2
2014	490,077	6.0	25.4
2015	506,716	6.0	20.7
2016	408,723	4.9	21.6

Source: ADF&G Commercial Fisheries Division:
http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.salmon_grossearnings_byspecies

4.6.2 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 designated 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 consumptive uses within nonsubsistence areas, but such noncommercial harvests do 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.

Since 1994, sockeye salmon have composed a very large portion of personal use salmon harvests in Alaska, about 96%. Chinook salmon made up about 0.8% of the personal use harvest over that time period, about 3,874 fish. In 2015, of a total personal use harvest of 787,053 salmon, 1,817 (0.2%) were Chinook (Fall et al. 2018).

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 that 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 (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 74 reports Alaska's regional and total sport harvest of Chinook salmon for recent years.

Table 74 Statewide sport harvest of Chinook salmon by region, freshwater and saltwater combined, 2007 through 2016

Region	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Southeast	82,848	49,265	69,565	58,503	66,575	46,495	56,392	86,942	79,759	68,347
Southcentral	101,059	77,334	59,855	55,291	57,511	33,348	44,091	43,120	57,811	71,825
Arctic-Yukon-Kuskokwim	8,909	5,658	3,908	3,850	4,021	1,512	602	931	1,356	528
Alaska Total	192,816	132,257	133,328	117,644	128,107	81,355	101,085	130,993	138,926	140,700

Source: http://www.adfg.alaska.gov/sf/sportfishingsurvey/index.cfm?ADFG=region.results

4.6.3 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 of this proposed Chinook PSC action. 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. Also, since 1996, the department has prepared an annual statewide report with summaries of subsistence salmon harvests by management area (e.g. Fall et al. 2018). However, it is important to recognize the challenges associated with the effort to present a comprehensive annual summary of Alaska’s subsistence salmon 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, and other relatively large subsistence fisheries such as Southeast Alaska and the Copper River, through subsistence salmon permits. There is no longer an annual subsistence harvest monitoring program for the Kotzebue Fisheries Management District.
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 District (5 AAC 01.120(b) &(f)), Norton Sound-Port Clarence Area (5 AAC 01.170(b) & (h)), and Yukon 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 no longer 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) Subsistence permits are used as a basis for annual harvest assessments in many areas of the state, but such permits are not required in some areas (such as the Yukon and Kuskokwim river drainages). No subsistence salmon harvest data collection has taken place in the Kotzebue area since 2004, due to a lack of funding.
4) Between management areas, and sometimes between districts within management areas, there are some inconsistencies in how subsistence harvest data are collected, analyzed, and reported, although progress has been made to develop a more uniform system
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 and the annual subsistence harvest report 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. The Alaska Subsistence Salmon Fisheries 2015 Annual Report is not available as of January 2018; the 2014 report is available at http://www.adfg.alaska.gov/techpap/TP427.pdf.

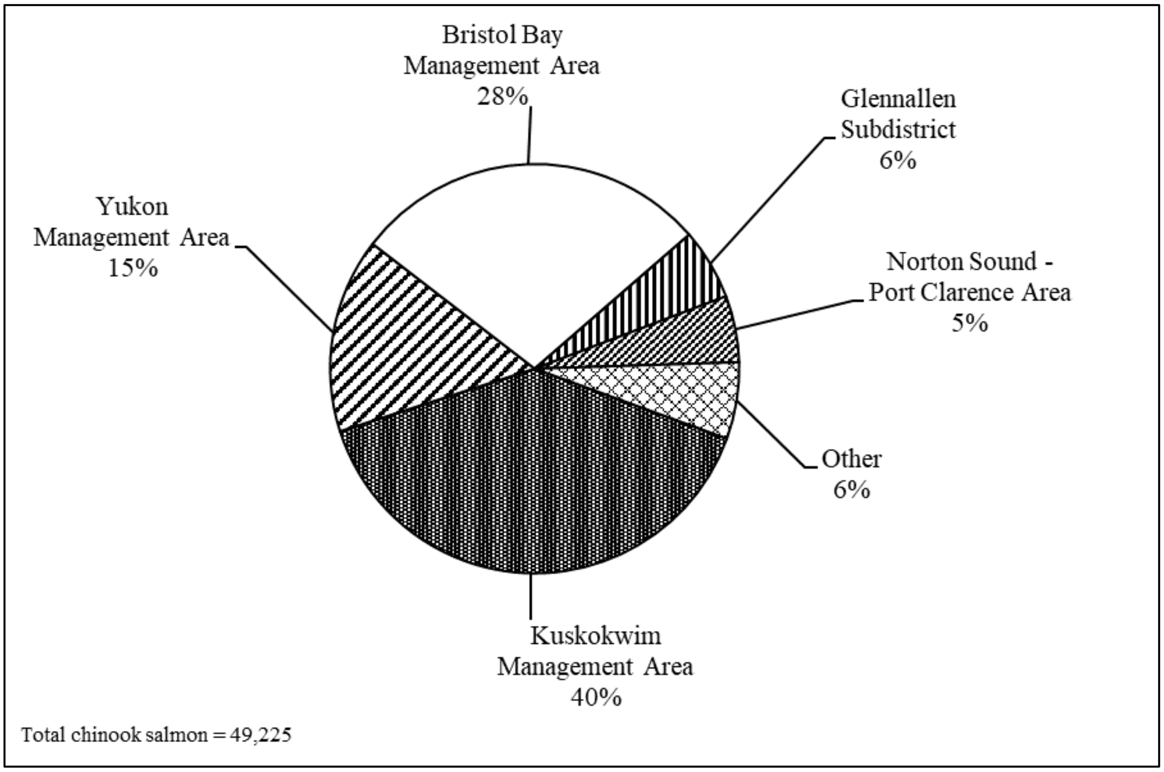
Chinook salmon are the first salmon to arrive in the spring, which is fundamental to their importance for subsistence. In 2015, subsistence take of Chinook salmon was estimated at 49,225 fish (6% of the total 860,809 subsistence salmon harvested). Information on State management of the salmon subsistence fisheries is provided in the Alaska Subsistence Salmon Fisheries 2015 Annual Report, available on the State of Alaska website.[49] This is the most recent publicly available report, published and revised in January 2018.

The amount of Chinook salmon harvested for subsistence use and the portion of subsistence Chinook salmon harvested relative to other species of salmon vary greatly by region and has declined since 2010. Thirteen subsistence fishing areas are defined in the state of Alaska: Arctic-Kotzeube, Norton Sound–Port Clarence, Yukon, Kuskokwim, Bristol Bay, Aleutian Islands, Alaska Peninsula, Chignik, Kodiak, Cook Inlet, Prince William Sound/Copper River, Yakutat, and Southeast.[50] The largest estimated subsistence harvests of Chinook salmon in 2015 occurred in the Kuskokwim Area (19,437 salmon, 40%), followed by the Bristol Bay Area (13,874 salmon; 28%), Yukon Area (7,582 salmon; 15%), the Glennallen Subdistrict of the Upper Copper River District (2,762 salmon; 6%), and the Norton Sound–Port Clarence Area (2,588 salmon; 5%).

For the period 1994 through 2011, subsistence Chinook salmon harvests in the state averaged 157,321 fish for about 16% of the annual subsistence salmon harvest. In contrast, the annual average for 2012–2015 was 62,792 Chinook salmon, or about 7% of the annual subsistence salmon harvest. Large declines in harvests of Chinook salmon in the Yukon and Kuskokwim subsistence fisheries, due to regulatory restrictions in response to conservation concerns, account for most of this change (Fall et al. 2018).

49 http://www.adfg.alaska.gov/techpap/TP373.pdf
50 See Figure 1-1 of the Alaska Subsistence Salmon Fisheries 2015 Annual Report (p. 5) for a map of the Alaska subsistence areas.

Figure 17 Alaska subsistence Chinook salmon harvest by area, 2015



Source: Fall et al. 2018, Figure 2-4.

4.6.4 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 of 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.[51] In 1992, the Secretaries of the Interior and of 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.

[51] 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.

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. Further information on the Federal Subsistence Management Program can be found at https://www.doi.gov/subsistence.

4.6.5 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 (among others) for over a century. Intercepting fisheries were identified through research conducted by the U.S. and Canada 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).
- 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

4.6.6 Summary of Alaska Chinook Salmon Stock Status

Chinook salmon runs in Alaska have been below average since 2007, and management of the fisheries has been conservative in many systems. Implementation of strict fishery management actions has been necessary to meet escapement objectives, and many fisheries have been curtailed to protect Chinook salmon. In the Yukon and Kuskokwim Rivers, weak runs of Chinook salmon resulted in extensive restrictive management actions in the subsistence, sport, personal use, and commercial fisheries by the department.[52]

In 2016, runs improved for the western Alaska stocks (i.e., Yukon, Kuskokwim, and Nushagak) but overall these runs are still below the long-term averages. While also remaining below the long-term averages, runs improved in Kodiak and Cook Inlet in 2016. Unfortunately, Chinook salmon runs from the Copper River to southern Southeast Alaska declined in 2016 and were the lowest on record. It is unclear whether runs will continue to improve over the long term in Kodiak, southcentral, and western Alaska. Runs to the Kenai River were good in 2017, the Copper River run was better than expected, and over 80% of Chinook salmon escapement goals in western Alaska were met in 2017. However, the near-term outlook for southeast Alaska is not positive as very few "jacks," typically a strong indicator of future production, were seen in 2016, and escapements to most systems in 2017 were historically low despite restrictions to fishing.[53] Runs in this region are expected to remain low in 2018.[54]

[52] See http://www.adfg.alaska.gov/index.cfm?adfg=chinookinitiative.main
[53] http://www.adfg.alaska.gov/index.cfm?adfg=pressreleases.pr08072017
[54] http://www.adfg.alaska.gov/index.cfm?adfg=pressreleases.pr12222017

Table 19 in Section 3.3.5.11 of this document identifies stocks that are designated as "stocks of concern" as of 2016. The ADF&G report on 2017 escapement is currently in production and will be included in future versions of this analysis.

4.7 Analysis of Impacts

This section describes the nature of impacts on the GOA trawl CV harvest sector, processors involved in the fishery and, by extension, the communities where those stakeholders reside or contribute to net social and economic benefits through their participation. This section also considers impacts on commercial and non-commercial users of the Chinook salmon resource. The No Action alternative would leave existing PSC limits in place at the level established in GOA Amendment 97, as modified by the flexibility for NMFS to make inseason PSC reallocations established under GOA Amendment 103. Alternatives 2 and 3 are defined as simple linear increases to the existing PSC limits for the non-pollock non-Rockfish Program CV sector and the Rockfish Program CV sector, respectively. Because of that simple construction, this section addresses most of the qualitative description of impacts under Alternative 1 (Section 4.7.1) and approaches the impacts of Alternative 2 and 3 as changes "by degree." Describing the impacts of the action alternatives in qualitative terms is justified by the fact that annual Chinook PSC levels vary widely and without a predictable trend (Table 58), so neither the status quo PSC limits nor the higher limits considered under the action alternatives guarantee that a fishery will be curtailed or fishing behavior will be modified in any year. In other words, the direct effect of the action alternatives is a reduction in the *likelihood*, all else equal, that the GOA non-pollock trawl CV fisheries will be closed by Chinook PSC in any given year.

4.7.1 Alternative 1, No Action

Selecting the No Action alternative would maintain status quo Chinook salmon PSC limits for GOA non-pollock trawl CV fisheries (see Table 1 in Section 2.1). The status quo PSC limits were established in the preferred alternative for GOA Groundfish FMP Amendment 97 (NPFMC 2014). As such, the broad effects of selecting Alternative 1 are similar in nature to the effects described in that analysis. This section considers the potential impacts on GOA non-pollock trawl CV harvesters, processors, and communities as well as the Chinook salmon resource and its users.

Non-pollock trawl CVs are apportioned 3,900 Chinook PSC per year, of which 1,200 is apportioned to the Rockfish Program CV sector. Under Alternative 1, the non-Rockfish Program CV sector would still be eligible to carry an additional 360 Chinook salmon into a year if its PSC level was below 2,340 in the previous year. Both the non-Rockfish Program and the Rockfish Program CV sectors are eligible to receive inseason reallocations of Chinook PSC from other GOA trawl sectors up to a cap of 50% of their base PSC limit – 1,350 Chinook PSC for the non-Rockfish Program sector and 600 Chinook PSC for the Rockfish Program sector. Finally, the non-Rockfish Program sector is eligible to receive a rollover of unused Chinook PSC from the Rockfish Program CV sector on October 1.

All told, the absolute maximum amount of Chinook PSC that each sector affected by this action could use in one year is:

- 4,410 Chinook in the non-Rockfish Program CV sector (2,700 base limit + 360 incentive buffer + 1,350 maximum reapportionments), and
- 1,800 Chinook in the Rockfish Program CV sector (1,200 base limit + 600 maximum reapportionments).

These maximum PSC levels are more theoretical than likely, as they are largely contingent on inseason reallocations of unneeded Chinook PSC in other GOA trawl sectors. The most likely source of inseason reapportionments to the non-pollock CV sectors would be from the pollock fisheries, and NMFS would be cautious about reallocating too much Chinook PSC from the pollock to non-pollock sectors before the pollock C and D seasons occur (August 25 through November 1); historically, Chinook PSC rates in the pollock fishery are highest in October during the D season. Inseason reallocations are most likely to occur late in the year when remaining PSC demand in the pollock fishery can be projected with more precision. In cases when pollock A/B season Chinook PSC rates were significantly lower than historically observed levels, NMFS might use its management expertise to make a moderate PSC reallocation earlier in the year if a non-pollock fishery closure was imminent, but during the development of GOA Amendment 103 the agency cautioned that such actions cannot be counted upon. Making aggressive inseason reallocations from the pollock to the non-pollock fisheries might have a low expected net benefit, since most GOA non-pollock trawl vessels (and processors) actually count on their own participation in the pollock fishery for a significant portion of annual GOA revenues (refer to diversification tables at Table 54 and Table 64).

Under current regulations, the absolute maximum amount of Chinook PSC that can be taken across all sectors of the GOA trawl fishery is 33,340 Chinook salmon. That total includes the base limits defined in Table 1 (32,500 Chinook), plus the incentive buffers for the non-pollock non-Rockfish Program CV sector (360 Chinook) and the GOA trawl CP sector (480 Chinook). As noted above, the mechanism behind the earned incentive buffer ensures that the maximum Chinook salmon PSC that can be taken over any two consecutive years cannot exceed 32,500 Chinook per year. That amount of Chinook salmon PSC is below the maximum allowable level of 40,000 that is defined in the NMFS incidental take statement described in Section 4.5.3.1 of this document.

When establishing the existing GOA non-pollock Chinook PSC limits under Amendment 97, the Council considered levels that would have placed maximum annual removals between 30,000 and 37,500. The rationale for selecting 32,500 is based on the information presented in Section 4.9 of the EA/RIR for Amendment 97 (NPFMC 2014) and is articulated in the Final Rule that implemented the amendment (79 FR 71350, December 2, 2014).[55] Those documents presented the best available information at the time, which included NMFS's Catch Accounting System's estimates of PSC from 2003 to 2012. The Council's rationale for its preferred alternative (the current status quo) was rooted in balancing National Standards 1 (optimum yield), 2 (best available science), 8 (community considerations), and 9 (bycatch minimization). At the time, the Council spoke to its choice of a conservative PSC limit, relative to other alternatives considered, as a necessary response to concern about the status of Chinook salmon stocks. The Council noted that the preferred alternative selected a limit on non-pollock Chinook PSC that was higher than the average over the period considered, but one that would have caused closures during some years if it had been in place. In selecting a relatively conservative limit, the Council noted that it was placing a potentially costly conservation burden on the trawl sector, and that additional management measures to help the trawl sector minimize its PSC more effectively would be developed. From 2013 to 2016 the Council considered a package that would provide the trawl fleet with cooperative management tools and allocations of groundfish and PSC species but has not progressed with that issue since December 2016.

4.7.1.1 Effects on Non-Pollock Trawl CV Harvesters

The most obvious effect of a PSC limit on the GOA non-pollock trawl CV sector is the potential to close a fishery prematurely. An early closure affects vessel revenues and crew compensation in a manner that reverberates throughout stakeholder communities. Hard cap PSC limits are a blunt tool in terms of incentivizing participants to minimize Chinook salmon PSC at all times in the context of a competitive limited access fishery, where actions to avoid salmon—such as standing down, relocating, or employing a net excluder device—are individually costly but benefit the fleet as a whole by decreasing the likelihood

[55] https://www.gpo.gov/fdsys/pkg/FR-2014-12-02/pdf/2014-28096.pdf

of a closure. A sector-wide PSC limit does not, in and of itself, incentivize the fleet to achieve a level of Chinook PSC lower than the cap or—for the non-Rockfish Program CV sector—lower than the incentive buffer threshold.

The Council has set PSC hard caps with dual-objectives in mind: preventing PSC from exceeding established conservation goals and supporting the regulated fishery and its dependent stakeholders at historic levels of participation. An established conservation limit such as the 40,000 Chinook ITS represents an absolute maximum, and the Council can select—and has selected—a lower target in order to promote positive outcomes for Chinook salmon, albeit indirectly. In selecting the status quo PSC limit for the fisheries affected by this action, the Council articulated that it intended to select a limit that supported the non-pollock trawl sector's historical PSC use over an average of years but did not select a level that covered the highest years in order to incentivize bycatch minimization. Under that approach, historical average PSC use is a critical component of selecting the limit that best balances objectives. The purpose and need for this action (Section 1.1) notes that new information from observer coverage that was not available during the years analyzed for Amendment 97 might indicate that estimated Chinook PSC for that segment of the fishery was lower than the actual rate that supported historical harvest levels. Though it is not possible to retrospectively prove or disprove that smaller trawl vessels had been encountering more Chinook salmon than was estimated based on PSC rates extrapolated from larger Western and Central GOA trawl CVs, the marked increase in maximum estimated Chinook PSC for that sector post-restructuring warrants consideration (Table 58).

A hard cap PSC limits is also a blunt tool in terms of its ability to account for natural variations in fisheries (National Standard 6). If the intrinsic rate of PSC encounter increases due to changes in the environment or human-induced external factors, a hard cap will become increasingly constraining over time. Information on the number and trend of Chinook salmon present in the times and areas that the non-pollock trawl fishery operates is not available, and thus the Council has attempted to set hard caps that account for uncertainty. However, the Council has considered, and may continue to consider, changes in observable factors that might contribute to the presence of Chinook in trawl areas, albeit to an unknown extent. Both the EA/RIR prepared for Amendment 97 (NPFMC 2014) and Section 3.3.7 in this document include data on hatchery releases of Chinook that are known to occur in the GOA. Total hatchery releases have not increased from 1999 through 2016, but Alaska hatchery releases in 2016 are at the peak for the period (Table 21 and Table 22).

The trawl CV fleet's greatest motivation to minimize Chinook PSC at all times is uncertainty as to whether a "lightning strike" PSC event could close the fishery unexpectedly, and the seemingly natural annual variability in Chinook PSC encounter levels. In terms of unpredictable high-PSC events, the highest weekly estimated Chinook PSC level from 2007 through 2017 reached 1,302 salmon in the Central GOA, 920 Chinook in the Western GOA, and 899 Chinook in the Rockfish Program CV sector (Section 4.5.1.2). Table 58 in this document illustrates the annual variability in Chinook PSC levels. Since 2007, Central GOA non-Rockfish Program CV PSC has ranged from 412 (2016) to 4,529 (2013); Western GOA non-Rockfish Program CV PSC ranged from zero estimated Chinook in 2010 and one estimated Chinook in 2012 and 2014 to 1,686 (2017); the Rockfish Program CV sector ranged from 158 Chinook (2016) to 1,802 (2015). These peaks and valleys span the years before and after the implementation of the existing Chinook PSC limit (2015) and the expansion of observer coverage to smaller Western GOA trawl CVs (2013). The fact that estimated PSC levels have maintained a high variance throughout the range of analyzed years implies that any behavioral change effected by a hard cap does not result in reliably lower bycatch. Given the potential economic impact of an early fishery closure—as described below in the context of the 2015 analysis for an emergency action to reopen the non-pollock trawl CV fishery—one might assume that fishery participants are operating with all reasonable caution in the context of the status quo management regime, and yet still experiencing wide swings in PSC avoidance success.

The Amendment 97 analysis estimated the likelihood and the impact of an early fishery closure based on typical annual harvest, revenue, and estimated PSC patterns from 2007 through 2011. The quantitative estimates of maximum harvest and revenue effects in that analysis assumed no change in fleet behavior. Section 4.7.1.4.5 of the Amendment 97 RIR examined the maximum potential impact of a PSC limit that was apportioned by CV/CP with a separate PSC limit for the Rockfish Program. The maximum potential impact on the non-Rockfish Program CV sector was associated with a closure in mid-April, completely closing the Pacific cod B season in the Central GOA and the fall flatfish fisheries. Moderate effects projected an October closure that precluded the latter portion of the Pacific cod B season and the fall flatfish fisheries in the Central GOA. Based on characteristic harvest and PSC patterns over the 2007 through 2011 period, a closure would have been projected in one out of five years.

In 2015 NMFS analyzed the potential impact of a May closure of the GOA non-pollock non-Rockfish Program CV trawl sector at nominal values of $4.6 million in ex-vessel revenues and $11.0 million in gross first wholesale revenues, in addition to indirect impacts on local employment, support service businesses, and public revenues.[56] Because the timing of the closure fell after the Pacific cod A season, those effects were deemed most impactful in Central GOA communities such as Kodiak.

This document builds upon those analyses using more recent years of data that reflect the non-pollock fishery as it operates under a PSC hard cap (2015) and increased observer coverage on smaller trawl CVs in the Western GOA (2013). Harvest patterns in more recent years should reflect any fleet behavior change as a result of the hard cap.[57] The monthly distribution of Chinook PSC presented in Table 61 should reflect any effect of expanding observer coverage to smaller trawl CVs in the Western GOA Pacific cod A season.

Based on historical PSC levels dating back to 2003, the existing hard cap is not expected to cause a PSC closure before the end of March. This means that direct harvest and revenue impacts on the non-pollock fishery would not occur in the Western GOA non-pollock CV sector. Note, however, that many Western GOA harvesters also participate in the Central GOA trawl fishery. From 2007 through 2017, 24 CVs made non-pollock landings in both areas.

In general, the impact of a PSC closure hinges on whether or not the Central GOA Pacific cod B season fishery and the late-year Central GOA flatfish fisheries can remain open. Those fisheries account for roughly 23% of harvest and 24% of ex-vessel revenues in the non-pollock non-Rockfish Program CV fisheries (see Table 52 and Figure 13, September through December). An exceptionally early closure occurring in April or May could preclude as much as 60% of average annual harvest and revenue. A closure that occurs during the summer months has a modest marginal impact relative to any other closure that falls after the Pacific cod A season, as only 10% of GOA non-pollock harvest and revenues are generated during June, July, and August.

2013 represents a recent high-Chinook year in which PSC would have closed the non-pollock non-Rockfish Program trawl CV sector in mid-season closure (4,544 Chinook). In that year, the 2,700

[56] RIR for August 2015 Emergency Rule to provide 1,600 Chinook PSC to the non-pollock non-Rockfish Program CV trawl sector (80 FR 47864), available at https://www.gpo.gov/fdsys/pkg/FR-2015-08-10/pdf/2015-19428.pdf

[57] As with any retrospective analysis, harvest and PSC patterns from a small sample of previous years should be considered with the caveat that market and environmental conditions in the fishery are rarely the same from year to year. The 2015 through 2017 period is a small sample of time that includes the 2015 spring/summer closure as well as 2016 and 2017 fisheries that featured historically high pollock TACs, low Pacific cod catch per unit of effort, and relatively low product values on the world market due to a strong U.S. dollar. Nevertheless, these years of data represent the best available information on how the fishery operates under current management, and how it is estimated to perform in terms of PSC under the current observer deployment strategy.

Chinook base PSC limit would have closed the fishery in May. Based on monthly average harvest and revenue distribution during the 2007 through 2017 period, such a closure would have precluded 37% of average annual ex-vessel revenues (approximately $5.9 million); the majority of that value would come from the Central GOA Pacific cod B season (Table 52). If the sector was operating under the incentive buffer PSC limit of 3,060 Chinook, the fishery would have closed in July, precluding approximately 32% of average ex-vessel revenues ($5.1 million). Presuming that a rollover of unused Rockfish Program Chinook PSC or a NMFS inseason PSC reallocation could be executed on October 1, the fishery could have reopened. During the analyzed period, roughly 13% of non-Rockfish Program ex-vessel value was generated after October 1, meaning that the sector might have recovered approximately $2.1 million (or more depending on whether Central GOA Pacific cod markets and catch rates can support a more intensive October harvest after the PSC constraint had been lifted).

The Rockfish Program CV sector has recorded more than its base limit of 1,200 Chinook salmon three times between 2007 and 2017, though the annual average is roughly 850 Chinook. The first two months of the season (May and June) account for 72% of Chinook PSC; that figure would be higher if a notable outlier in November 2015 data were excluded (Table 61). During the analyzed period, May and June activity account for 66% of Rockfish Program CV harvest by weight, and 63% of ex-vessel value (Table 53). Applying the highest single year total of estimated Rockfish Program CV PSC (1,802 Chinook) to the average monthly distribution of PSC over the analyzed period (Table 61), the fishery would have exceeded its PSC limit at the end of June. A July closure would preclude roughly 34% of average harvest (3,640 mt) and 37% of ex-vessel revenue ($2.3 million).

The simple exercise above gives a rough picture of the maximum potential direct effect of an early-season closure on the Rockfish Program CV sector, based on the most recent available data; however, it clearly overstates what a likely outcome and impact would be. The Rockfish Program fishery is cooperatively managed and represents a smaller, more interconnected fleet when compared to the diverse set of non-Rockfish Program CVs that span the Central and Western GOA. Stand-downs or cooperative test-fishing to mitigate and adjust to unexpectedly high PSC rates are easier to coordinate. Moreover, the Rockfish Program fleet carries 100% observer coverage, which lessens – but does not eliminate – the potential for episodic spikes in estimated PSC that sometimes occur when using basket sampling (refer to Section 4.5.1.1.1). The analysts suggest that it is not impossible for the Rockfish Program CV sector to reach its annual PSC limit of 1,200 Chinook, but it is highly improbable for that to occur so early in the season. Moreover, should an unexpected series of events close the Rockfish Program CV sector in June or July, the sector *could* receive up to 600 additional Chinook PSC through inseason reapportionment from another sector. A likely scenario in the event of an early season Rockfish CV closure is that NMFS would consider a reallocation from the pollock sector at some point during mid to late September after inseason managers have a sense of PSC rates in that fishery.

It should be noted that this document does not focus entirely on retrospective estimates of forgone catch and revenue. The most valuable late-year GOA non-pollock fishery—Central GOA Pacific cod—is experiencing a dramatic 80% reduction in harvestable biomass that could persist into the medium term if not the long term. The reduced cod fishery will change the annual time-distribution of harvest and revenue from the fishery. Instead of looking backwards, the relative effects of maintaining status quo PSC limits versus increasing them should be viewed more broadly. The Council should consider whether the likelihood that higher limits materially reduce the impact of unpredictable mid-year closures, as balanced against a marginal increase in the maximum amount of annual Chinook salmon PSC that could possible occur in a year. This is discussed further in Sections 4.7.2 and 4.7.3.

Finally, this analysis incorporates by reference the more extensive discussion in Section 4.7.3 of NPFMC 2014 about the monetary and non-monetary costs (other than forgone harvest) that harvesters incur when fishing under a PSC limit. The existence of a hard cap affects fishing behavior, but the magnitude of those effects vary from year to year and within a year depending on the perceived likelihood of reaching the limit. Individual participants will perceive the potential cost of a closure differently, depending on how much their business plan relies on harvest opportunities that fall later in the calendar year. Vessel operators and crew experience direct costs of salmon avoidance measures. Variable costs might increase as vessels spend time and fuel moving away from areas with high PSC rates. If trips are curtailed by PSC avoidance, vessel crews experience decreased labor productivity. Capital costs might also increase if a vessel makes investments in salmon excluding gear.[58]

4.7.1.2 Effects on Processors and Communities

In addition to any revenue loss associated with forgone non-pollock groundfish harvest, the processing sector might be impacted vis-à-vis its ability to anticipate the need for and utilization of labor, fixed processing costs per unit of production, loss of input supply products to value-added processors in other regions, and fulfillment of output supply contracts.

One of the greatest impacts of hard cap PSC limits on processors is uncertainty about the amount and/or timing of groundfish deliveries. 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. For example, a plant that is not part of a Rockfish Program cooperative or that does not take a significant amount of halibut/sablefish IFQ deliveries might be more impacted by a non-pollock closure that precludes spring and fall flatfish fishing or the Central GOA Pacific cod B season. Processors that derive a greater portion of their revenue from other species such as pollock, salmon, or halibut might be relatively less impacted by a closure.

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 plants with a resident workforce might incur fewer expenses related to housing and feeding employees, they would incur costs associated with keeping quality employees on the job and maintaining workforce morale. In either case—but especially in Kodiak—reduced wages and labor productivity will have negative local multiplier effects and might also lead to negative social outcomes.

Any alteration of delivery patterns throughout the fishing year can impact processor revenues, even if total deliveries are not reduced. An approaching Chinook PSC cap may create incentive for fishermen 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. Concentration of the limited access fishing season could also affect processors' ability to manage input flows in order to focus on higher value product forms. Processors that take more deliveries from vessels prosecuting state-managed fisheries such as salmon or pot cod may be relatively less exposed to Federal groundfish closures, depending on the timing of the closures.

Processing crews are also potentially affected by unpredictable fishery closures. Non-pollock species such as flatfish often serve as a bridge season between the pollock/Pacific cod seasons and salmon processing in the summer. Those fisheries might also be the only source of wages in November and December, after the pollock, cod, and rockfish fisheries are closed by regulation.

[58] Note that salmon excluder gear has primarily been developed for the pollock trawl fishery, and effective use has typically been limited to larger trawl CVs that can tow at a relatively higher rate of speed.

4.7.1.3 Effects on Chinook Salmon Users

Limiting the amount of Chinook salmon PSC taken in non-pollock fisheries provides value to commercial Chinook salmon harvesters and processors, consumers, sport fishermen, charter operators, subsistence users, species that prey upon salmon (including ESA-listed species), and salmon stocks that are protected under the ESA and prioritized for conservation and recovery. Like the groundfish resource, the economic activity generated by salmon harvesting in commercial and non-commercial sectors creates employment and other socioeconomic benefits multipliers throughout coastal communities and the nation.

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. 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 "price" of a fish. Society has invested heavily in their protection, recovery, and enhancement. Public and private entities have devoted expenditures to fish passageway, habitat recovery, migration assistance, and Chinook salmon hatcheries; all clear demonstrations of the value society places on these fish.

The implementation of non-pollock fishery Chinook salmon PSC limits capped the maximum amount of salmon that can be taken in the trawl fishery. While this analysis recognizes that taking fewer Chinook in the trawl fishery represents a benefit to other users of the resource in aggregate, the direct effect of a marginal "saved" Chinook salmon cannot be quantified. Section 3.3.8 in the EA states that 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 the population of Chinook salmon that are taken as PSC. 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. As a result, it is not possible to accurately describe small scale impacts on particular individual stocks. There is no evidence to indicate whether the groundfish fisheries' take of Chinook salmon is, or is not, causing escapement failures in Alaska rivers. The data limitations described in this document also prevent the analysts from estimating the specific impact of the GOA trawl fishery on ESA-listed salmon runs; as noted in Section 4.5.3.1 of this document, the most recent incidental take statements maintain that total Chinook PSC levels of fewer than 40,000 Chinook per year are not likely to jeopardize protected salmon runs.

Section 3.3.3.1 in this document provides the best available information on region of origin for GOA trawl-caught Chinook PSC *that have been sampled*, with the caveat that the majority of genetic samples are taken from the directed pollock fishery where the majority of catch and PSC occurs. The most recent year of published data (2015 samples) show that 51% of sampled Chinook PSC were from British Columbia, 32% were from the U.S. west coast, 14% were from Southeast Alaska, and 3% were from Northwest GOA stocks (Guthrie et al. 2017). Preliminary data for 2016 samples show that these regions continue to make up the vast majority of sampled PSC, with British Columbia and the U.S. west coast each accounting for around 40% of samples. The authors of the GOA genetic sampling analysis studies note that the randomization and time series of sampling studies are not yet sufficient to extrapolate the regional distribution of sampled Chinook to describe the region of origin for all Chinook that are encountered by the GOA trawl fishery.

Section 3.3.8 notes that there is not an adult-equivalent (AEQ) model for GOA trawl-caught PSC, so it is not possible to determine the proportion of PSC Chinook that would have survived natural mortality to spawning age. The most recent available report on Chinook PSC age (size) is based on observer samples collected primarily in the Central GOA pollock trawl fishery from 2002 through 2012. Sampled Chinook averaged between five and nine pounds, which is characteristic of immature Chinook (Section 3.3.2.1). Section 3.3.8 describes the best available process for estimating survivorship in the GOA, applying common age-based mortality rates used by the State of Alaska to specific AEQ multipliers that have been developed for the Southeast Alaska salmon troll fishery. That analogy places the natural mortality rate for 2-year-old Chinook at 23.6% and age 5+ Chinook at 10%.[59]

4.7.1.4 Management Considerations

NMFS manages non-transferable Chinook PSC limits that are applied to a harvesting sector, in aggregate, using inseason assessments of estimated PSC levels, PSC rates, and projected fishing effort. NMFS issues a notice in the Federal Register to close directed fishing when a PSC limit is reached (or might be reached before NMFS can issue a closure) if no PSC reallocation or rollover is available from another GOA trawl sector. 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. NMFS's ability to keep the directed fishery open and manage with inseason measures depends on the amount of available PSC remaining and the amount of effort in the fishery. In the EA/RIR for Amendment 97, NMFS noted that inseason managers would take a precautionary approach when remaining PSC is less than the highest weekly PSC level that has been observed in that sector. During the analyzed period, peak weekly PSC levels – which were outliers from average weekly PSC – were in the neighborhood of 1,000 Chinook salmon for both the non-Rockfish and Rockfish Program CV sectors.

Conservative management can be especially necessary in the non-pollock non-Rockfish Program fishery because it is a competitive limited access fishery that can have high pulses of effort. Furthermore, weekly PSC rate estimates that are derived from extrapolation of observers' at-sea samples onto unobserved fishing effort can have a high variance and might be revised during the course of the season as observers are debriefed. Beginning in 2017, NMFS has flexibility to make inseason reallocations of Chinook PSC to sectors that have a low remaining limit (GOA Amendment 103). As a result, NMFS is more able to avoid situations where extremely conservative closures are necessary. However, the availability of an inseason reallocation from another sector is not guaranteed. Reallocations would likely not be available during years in which PSC levels are high across all sectors (pollock and non-pollock), or early in a year when a sector with remaining PSC is expected to have a high level of effort in later months (e.g. the pollock C/D season).

NMFS works with harvesters and processors when they present plans for an industry-led stand down or catch sharing agreement to harvest remaining TAC near the end of a seasonal quota or under a constraining PSC limit. Records of "PSC stand downs" are not available because NMFS does not track the reason for all inseason cessations in fishing. In some cases, a stand down does not last long enough for inseason managers to verify that it occurred. In other cases, it is not clear whether a stand down was the result of PSC avoidance coordination, weather, or a combination of factors. Anecdotally, however, NMFS noted that the Western GOA trawl fleet stood down for PSC during the week from February 19 through 25, 2017. Efforts to coordinate fishing plans with NMFS in the Central GOA are described in Section 4.5.1.2.1 of this document; most recent voluntary measures in that area occurred in the pollock fishery.

[59] 23.6% = State's assumed 40% mortality rate * 0.59 AEQ multiplier for Age-2 Chinook in the SE troll fishery; 10% = State's assumed 10% mortality rate * 1.00 AEQ multiplier for Age 5+.

4.7.2 Alternative 2, Increase non-pollock non-Rockfish Program CV sector Chinook salmon PSC limit

Alternative 2 would increase the non-pollock non-Rockfish Program CV sector's annual Chinook salmon PSC limit by 1,000 to 3,000 fish. The resulting base PSC limit would increase from 2,700 Chinook to 3,700, 4,700, or 5,700 fish. Table 2 in Section 2.2 shows the maximum possible amount of PSC that could be taken in the sector in a single year, factoring in the application of the incentive buffer established under Amendment 97 and the maximum inseason reallocation from other GOA trawl sectors established in Amendment 103. The highest possible amount of PSC use would be 9,310 (Option 3). Table 3 shows the maximum amount of PSC available if incentive buffer and maximum reapportionment amounts are not affected by this action; the highest possible amount in that case would be 7,410 (Option 3).

It is important to note that the maximum possible single year PSC limits described in those tables overstate the real increase in potential annual Chinook PSC removals on an ongoing basis. The incentive buffer must be earned each year by meeting or outperforming an avoidance threshold in the previous year that equals the size of the buffer. That structure ensures that the incentive buffer represents no increase in Chinook removals on a multiyear basis. Inseason reallocations represent a net-zero increase in allowable Chinook PSC across all GOA trawl fisheries because the reallocated PSC must be taken from another sector. Moreover, NMFS is not obligated to make an inseason reallocation; that ability was established for the expressed purpose of building in flexibility to respond to unintended and unforeseen PSC events. It is possible that the agency would *not* make a reallocation to a sector that was displaying an atypically high Chinook PSC rate without evidence that the sector had a cause to continue fishing beyond its base PSC limit and a plan to minimize bycatch in accordance with the National Standards. In summary, Alternative 2 does not increase the total average annual GOA trawl PSC limit by any more than 1,000, 2,000, or 3,000 Chinook, depending on the option selected.

PSC that is reallocated inseason, however, likely represents an increase in the amount of Chinook that is caught in a given year relative to what would have been caught in the absence of inter-sectoral transfers. Said otherwise, if NMFS is reallocating Chinook PSC from a sector where it is not projected to be needed to a sector where it is, then the likelihood that it will be used to cover Chinook removals increases in the latter sector. The Council weighed this issue when considering Amendment 103, and its rationale for action is described in the Final Rule (81 FR 62659; September 12, 2016).[60] The rationale focuses on providing the fleet and managers with flexibility to continue working towards National Standards 1 (optimum yield), 6 (account for variation), and 8 (minimize impacts on communities) in the context of highly variable annual PSC levels and the decision not to implement a cooperative allocation program for GOA trawl fisheries. The current cap on inseason reallocations to the non-pollock non-Rockfish Program CV sector is 1,350 Chinook PSC. This action could increase that amount to 1,850 (Option 1), 2,350 (Option 2), or 2,850 (Option 3). If the Council determines that increasing the maximum possible reallocation to this sector by up to 1,500 Chinook salmon[61] substantially reduces the incentive to avoid Chinook during high-encounter years, then the Council could move forward considering Alternative 2 with the stipulation that maximum inseason reapportionments remain capped at their current level.

The non-pollock non-Rockfish Program CV sector was apportioned the smallest amount of "head room" in its base PSC limit (2,700) relative to its historical PSC use as analyzed when the Council took action on Amendment 97. PSC estimates for the sector in recent years suggest that the sector's expected annual PSC encounter is even closer to the allotted hard cap of 2,700 Chinook salmon. Since the implementation of Amendment 97 in 2015, the sector has recorded Chinook PSC levels of 2,873, 425, and 2,244 (Table 58). Those widely varying totals, plus the acknowledged risk of a lightning strike PSC event of up to

[60] https://www.gpo.gov/fdsys/pkg/FR-2016-09-12/pdf/2016-21808.pdf
[61] 1,500 Chinook PSC is the difference between the maximum reallocation under Option 3 (2,850) and the status quo (1,350).

1,000 estimated Chinook PSC in a week, illustrate the fact that the sector operates in an unstable setting. The Council has acknowledged this situation by implementing the Rockfish Program rollover provision and the incentive buffer as part of Amendment 97, as well as the flexibility measures in Amendment 103. Nevertheless, the possibility of closure before a rollover is available (October 1) or in a year when other sectors cannot afford to have PSC reallocated from their limits is a constant source of uncertainty.

Increasing the sector's base PSC limit would reduce the likelihood of unpredictable closures, providing security to groundfish harvesters, processors, and communities. That security could allow for better business planning, encourage investment in the affected fishery, stabilize the shoreside and at-sea workforce, and reduce uncertainty in an important source of public revenues. A higher PSC limit would reduce the number of years in which the limit becomes viewed as a looming constraint as the fishery progresses (i.e., years in which PSC levels in the Pacific cod A season and Central GOA spring flatfish fisheries are high). As noted in the previous section, vessels might modify their behavior and race for target species with less regard for PSC minimization when a mid-season closure is perceived as imminent and unavoidable. The benefits of reducing uncertainty and unpredictability in the frequency and timing of PSC closures are likely to be felt more strongly by stakeholders in the Central GOA fishery, where harvest and revenues continue to accrue later in the calendar when closure is more likely.

Given the observed annual variability in Chinook PSC levels, this analysis does not forecast the number of annual closures in future years that would have occurred under the status quo PSC limit but would not occur under Alternative 2. Table 58 shows that the sector recorded PSC levels greater than 4,000 Chinook in two of the 11 years from 2007 through 2017 (2010 and 2013). That amount of PSC would have caused a closure under Alternative 2, Option 1, but not under Options 2 or 3. Based on the information provided in Table 61, a year with around 4,000 Chinook salmon and a typical monthly distribution of PSC accrual would have closed the fishery in October, curtailing part of the Central GOA Pacific cod B season and the late-year flatfish fishery. The fishery also reached 3,500 Chinook in one historical year (2011), placing it within the margin of error for an expected PSC closure.

If one accepts the unproven premise that Chinook PSC was underestimated in the Western GOA non-pollock trawl CV fishery prior to observer program restructuring in 2013, it makes sense to revisit estimated PSC levels for earlier years and examine what they might have been estimated at if 2013 through 2017 levels are a truer reflection of expected PSC in the Western GOA Pacific cod A season. Average PSC in the Western GOA from 2013 through 2017 was 554 Chinook; three of those five years recorded below 15 salmon, while the other two were over 1,000 (1,056 in 2015 and 1,686 in 2017). For the sake of illustration, consider the total GOA non-pollock non-Rockfish Program CV sector PSC levels that could have occurred from 2007 through 2012 if the Western GOA recorded 1,000 Chinook instead of the negligible levels reported in Table 58 (maximum of 107 Chinook in 2008). Average GOA non-pollock non-Rockfish Program PSC would have averaged 3,193 Chinook from 2007 through 2012 (range of 1,749 to 5,161) instead of 2,230 (range of 856 to 4,161). If average PSC from 2007 through 2012 was assumed to be 3,193 and average PSC from 2013 through 2017 is taken at the amounts shown in Table 58, the sector's average PSC for the entire period would have been 2,789. The preceding exercise is not put forth as a model, and the analysts do not mean to imply that PSC estimation for the Western GOA Pacific cod A season fishery was low by 900 to 1,000 fish in every year; nevertheless the notion that expected annual GOA non-pollock non-Rockfish Program could be higher than historical catch accounting data reflect warrants some consideration. If that notion holds some validity, then it follows that the probability of a PSC closure in this sector is higher than what was assumed when the existing hard cap was defined.

As noted in the previous section (Alternative 1), this analysis should also look ahead to the foreseeable future. Based on information available in the GOA Groundfish SAFE, harvest and PSC levels in the non-pollock non-Rockfish Program CV trawl sector will likely look different in 2018 and 2019 due to a significant reduction in available Pacific cod TAC. It is possible that reduced effort in the fishery will naturally pull down expected PSC levels as a function of rates. On the other hand, vessels that would normally focus on Pacific cod might increase their participation in flatfish fisheries, which are observed to have higher Chinook PSC rates (Section 4.5.3.3). The extent to which that target substitution will occur is not forecast in this analysis. The analysts suspect, however, that flatfish will not replace Pacific cod harvest on a pound-for-pound basis due to the lower value and marginal profit in the fishery. As a result, near-term PSC levels might be deflated relative to expectations based on the past. Nevertheless, the Council may wish to consider this action based on potential benefits and costs over the medium- to long-term, at which point there is a non-zero chance that Pacific cod stocks will rebound and restore effort to the levels on which the previous retrospective analyses were based.

The Council should weigh the potential benefits to the trawl sector and its stakeholders against the possibility that higher PSC limits will decrease incentives to avoid Chinook PSC and result in higher bycatch levels relative to the No Action alternative. As described in the previous section, the amount and distribution of benefits from lower Chinook salmon PSC cannot be quantified with the information available. Nevertheless, it should be acknowledged that Chinook salmon provide direct and indirect benefits to a wide range of consumptive and non-consumptive user groups, and that actions that increase Chinook removals represent a marginal adverse impact on those stakeholders.

4.7.3 Alternative 3, Increase Rockfish Program CV sector Chinook salmon PSC limit

Alternative 3 would increase the Rockfish Program CV sector's annual Chinook salmon PSC limit by 300 to 900 fish. The resulting base PSC limit would increase from 1,200 Chinook to 1,500, 1,800, or 2,100 fish. Table 5 in Section 2.3 shows the maximum possible amount of PSC that could be taken in the sector in a single year, factoring in the application of the maximum inseason reallocation from other GOA trawl sectors established by Amendment 103. Depending on whether the considered increase in the sector's base PSC limit would affect its maximum inseason reapportionment, the highest possible amount of PSC use in the fishery would be 2,700 or 3,150 Chinook (Option 3). As noted under Alternative 2, these maximum use cases are very unlikely given the purpose and rationale for implementing Amendment 103.

The Rockfish Program fishery operates under 100% observer coverage. As a result, the variance in PSC estimation is expected to be low, and the annual PSC levels reported in Table 58 are a strong indicator of annual average PSC levels that can be expected in the future. Average Chinook PSC from 2007 through 2017 was 848 fish, with a low of 158 (2016) and a high of 1,802 (2015). The fact that the highest and lowest PSC levels occurred in consecutive years reflects the supposition that Chinook PSC is unpredictable and that hard caps should account for expected variability, even in cooperatively managed fisheries with secure groundfish species allocations that remove the incentive to race for fish. The sector recorded Chinook PSC levels higher than the status quo PSC limit in three of the 11 years since the Pilot Program was implemented. Moreover, even in the context of a full observer coverage fishery, lightning strike PSC events have occurred (albeit in singular end-of-season circumstances described in Section 4.5.3.3).

The estimated maximum potential impacts of a fishery closure under the status quo PSC limit is identified in Section 4.7.1.1. The sector operates under a PSC limit that is high relative to its historical average use, and it has the operational advantages conferred by cooperative management. As a result, the most likely impact of increasing the sector's PSC limit is that the probability of a PSC closure will marginally decrease while the expected amount of the October 1 PSC rollover to the non-Rockfish sector will increase. Because the marginal PSC limit increases under consideration (300 to 900 Chinook) are not larger than the sector's highest recorded weekly PSC level (899), it is not possible to conclude that raising the Rockfish Program CV PSC limit will reduce the probability of a PSC closure to zero. Increasing the expected October 1 rollover to the non-Rockfish CV sector is in accordance with the Council's original intent for apportioning the Rockfish sector with a base PSC limit that exceeded its historical average use. As noted in Section 4.5.2.1, an average of 87% of Rockfish CVs participate in Central GOA Pacific cod and/or flatfish fisheries after October 1 on an annual basis.

As noted in the preceding sections, an action that increases the amount of Chinook PSC available for use in a given year entails potential adverse impacts on direct and indirect users of the Chinook salmon resource. The level and distribution of those impacts are not quantifiable with available information.

4.8 Affected Small Entities

Section 603 of the Regulatory Flexibility Act (RFA) requires that an initial regulatory flexibility analysis (IRFA) be prepared to identify if a proposed action will result in a disproportionate and/or significant adverse economic impact on the directly regulated small entities, and to consider any alternatives that would lessen this adverse economic impact to those small entities. As of January 2017, NMFS Alaska Region will prepare the IRFA in the classification section of the proposed rule for an action. Therefore, the preparation of a separate IRFA is not necessary for the Council to recommend a preferred alternative. This section provides information that NMFS will use to prepare the IRFA for this action, namely a description and estimate of the number of small, directly regulated entities to which the proposed action will apply.

The entities that would be directly regulated under this action are catcher vessels that participate in the GOA trawl non-pollock groundfish fishery. Under the RFA, businesses classified as primarily engaged in commercial fishing are considered small entities if they have combined annual gross receipts not in excess of $11.0 million for all affiliated operations worldwide, regardless of the type of fishing operation (81 FR 4469; January 26, 2016). If a vessel has a known affiliation with other vessels – through a business ownership or through a cooperative – the vessel's gross receipts measured against the small entity threshold based on the total gross revenues of all affiliated vessels. Because public information on business ownership is incomplete, this analysis only considers affiliation in the form of membership in a fishing cooperative. AKFIN has provided data on GOA trawl CVs' total gross revenue across all activities, including fixed-gear and state-managed fisheries (e.g., Pacific cod and salmon). AKFIN applies combined gross revenues at the cooperative level for vessels that participate in the CGOA Rockfish Program, the Bering Sea AFA pollock fishery, or a crab cooperative.

Fifty-six GOA trawl CVs operated in 2016, which is the most recent year for which gross ex-vessel revenue data are available. Twenty-three of those vessels are classified as small entities. The average gross revenue for small entity CVs was $1.02 million, and the median was roughly $990,000. Two of the 23 small entity CVs were affiliated with cooperatives that accumulated a total gross revenue of less than $11 million during the year.

Thirty-three GOA trawl CVs are classified as large entities. No large-entity CV grossed more than $11 million dollars individually; the average revenue was $1.50 million and the median was $1.62 million. All of the large-entity CVs were affiliated with cooperatives that grossed more than $11 million. The lowest cooperative gross revenue was $11.05 million, and the highest was $257.67 million.

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

A qualitative description of each alternative's likely net benefit compared to the No Action baseline will be further developed as the Council identifies a (preliminary) preferred alternative.

Neither the action alternatives nor the No Action alternative would allow annual Chinook salmon PSC levels in the GOA non-pollock trawl CV fisheries to contribute to exceeding a level of total GOA trawl PSC that would jeopardize protected species. Given that starting point, the Council must weigh the relative benefits of reducing the likelihood of unexpected trawl fishery closures against the likelihood that Chinook salmon PSC rises to levels that would not have been permitted under Alternative 1. The direct and indirect stakeholder groups that benefit from the groundfish trawl fishery and the Chinook salmon resource are broad, diverse, and, in some respects, overlapping.

Annual Chinook salmon PSC levels are shown to be highly unpredictable from year to year, and thus forecasts of future PSC levels are not part of this analysis. As a result, the likelihood of a PSC-closure under any of the proposed alternatives can only be quantified in terms of increasing or decreasing relative to the status quo. Alternatives 2 and 3 would reduce the likelihood of a fishery closure, though the probability would not fall to zero. The action alternatives also increase the maximum amount of Chinook salmon that could be taken as PSC in any given year, though historical performance has not indicated that actual PSC levels track at or just-below the imposed limit. Past performance suggests that PSC levels will continue to vary widely—near the limit in some years, and well below it in others. As such, the action alternatives that increase the limit might allow for additional Chinook PSC relative to No Action in some years but would reduce uncertainty in achieving the full socioeconomic benefits of the trawl fishery in all years.

The purpose and need for this action defines an objective of setting a PSC limit that most appropriately balances harvest opportunities, community stability, and bycatch minimization in light of the known variability in PSC rates and the best information currently available (Section 1.1). The timing of a significant increase in estimated Chinook salmon PSC levels in non-pollock fisheries coincided with an expansion of direct observer coverage in the regulated fishery, which at least suggests the possibility that new information is available now compared to what was known when status quo PSC limits were established. As a result, this analysis suggests that the assessment of what constitutes an “appropriate” PSC limit may also have changed. The action alternatives provide a range of options for revising PSC limits to reflect expected use and dependence.

5 Magnuson-Stevens Act and FMP Considerations

5.1 Magnuson-Stevens Act National Standards

Below are the 10 National Standards as contained in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). In recommending a preferred alternative, the Council must consider how to balance the national standards. After the Council completes an initial review of this analysis and potentially designates a preliminary preferred alternative, a brief discussion of how each alternative is consistent with the National Standards will be supplied.

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

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

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

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

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.

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

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

National Standard 8 — Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of National Standard 2, in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

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.

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

The alternatives considered in this action, including the No Action alternative, do not directly or affect the safety of human life at sea. It is conceivable that increasing the Chinook PSC limit for the non-pollock non-Rockfish Program trawl CV fishery could reduce the likelihood that a vessel will operate in unsafe conditions in order to harvest additional groundfish in a competitive fishery before a constraining PSC hard cap is met (Alternative 2). That said, the status quo PSC hard cap (Alternative 1) will not necessarily be a constraint in every year. Increasing the Rockfish Program CV sector's Chinook PSC limit is not expected to affect decisions about when, where, and under what conditions to fish because Rockfish Program CVs operate in cooperatives that receive non-competitive allocations of target species; the perceived constraint of a hard cap in that fishery would not incentivize vessels to "race for fish" prior to a PSC-closure (Alternative 3).

5.2 Section 303(a)(9) Fisheries Impact Statement

Section 303(a)(9) of the Magnuson-Stevens Act requires that a fishery impact statement be prepared for each FMP amendment. A fishery impact statement is required to assess, specify, and analyze the likely effects, if any, including the cumulative conservation, economic, and social impacts, of the conservation and management measures on, and possible mitigation measures for (a) participants in the fisheries and fishing communities affected by the plan amendment; (b) participants in the fisheries conducted in adjacent areas under the authority of another Council; and (c) the safety of human life at sea, including whether and to what extent such measures may affect the safety of participants in the fishery.

The EA/RIR prepared for this plan amendment constitutes the fishery impact statement. The likely effects of the proposed action are analyzed and described throughout the EA/RIR. The effects on participants in the fisheries and fishing communities are analyzed in the RIR (Section 4). The effects of the proposed action on safety of human life at sea are evaluated under National Standard 10 in Section 5.1. Based on the information reported in this section, there is no need to update the Fishery Impact Statement included in the FMP.

The proposed action affects the groundfish fisheries in the EEZ off Alaska, which are under the jurisdiction of the North Pacific Fishery Management Council. Impacts on participants in fisheries conducted in adjacent areas under the jurisdiction of other Councils are not anticipated as a result of this action.

5.3 Council's Ecosystem Vision Statement

In February 2014, the Council adopted, as Council policy, the following:

Ecosystem Approach for the North Pacific Fishery Management Council

Value Statement

The Gulf of Alaska, Bering Sea, and Aleutian Islands are some of the most biologically productive and unique marine ecosystems in the world, supporting globally significant populations of marine mammals, seabirds, fish, and shellfish. This region produces over half the nation's seafood and supports robust fishing communities, recreational fisheries, and a subsistence way of life. The Arctic ecosystem is a dynamic environment that is experiencing an unprecedented rate of loss of sea ice and other effects of climate change, resulting in elevated levels of risk and uncertainty. The North Pacific Fishery Management Council has an important stewardship responsibility for these resources, their productivity, and their sustainability for future generations.

> ***Vision Statement***
>
> The Council envisions sustainable fisheries that provide benefits for harvesters, processors, recreational and subsistence users, and fishing communities, which (1) are maintained by healthy, productive, biodiverse, resilient marine ecosystems that support a range of services; (2) support robust populations of marine species at all trophic levels, including marine mammals and seabirds; and (3) are managed using a precautionary, transparent, and inclusive process that allows for analyses of tradeoffs, accounts for changing conditions, and mitigates threats.
>
> ***Implementation Strategy***
>
> The Council intends that fishery management explicitly take into account environmental variability and uncertainty, changes and trends in climate and oceanographic conditions, fluctuations in productivity for managed species and associated ecosystem components, such as habitats and non-managed species, and relationships between marine species. Implementation will be responsive to changes in the ecosystem and our understanding of those dynamics, incorporate the best available science (including local and traditional knowledge), and engage scientists, managers, and the public.
>
> The vision statement shall be given effect through all of the Council’s work, including long-term planning initiatives, fishery management actions, and science planning to support ecosystem-based fishery management.

In considering this action, the Council is being consistent with its ecosystem approach policy. The Council originally set Chinook salmon PSC limits as a conservation measure to prevent the impact of groundfish fishing on non-target species from reaching scientifically determined thresholds that could jeopardize protected stocks. In doing so, the Council used the best information available at the time to set PSC limits at levels that allowed for groundfish harvest to continue at or near the historical levels that support coastal communities and stakeholders throughout the nation. This action reconsiders the particulars of those limits in light of improved information regarding historical Chinook PSC encounters in the trawl fishery, and the genetic stock composition of Chinook salmon that are encountered in GOA trawl fisheries. Any revision to existing management measures would maintain the Council’s precautionary approach to non-managed species as Chinook salmon PSC limits would not be allowed to exceed critical scientifically determined thresholds and would enhance the benefit that direct and indirect stakeholders in the groundfish fishery are able to receive.

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