DRAFT FOR INITIAL REVIEW
Preliminary Draft Environmental Impact Statement
Bering Sea Chum Salmon Bycatch Management

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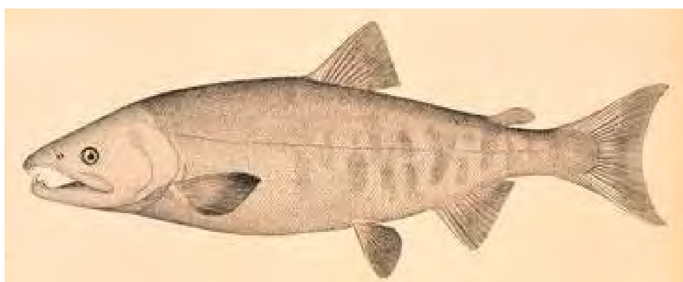

Abstract:

This document is a preliminary Draft Environmental Impact Statement (DEIS) that analyzes proposed management measures to minimize chum salmon (*Oncorhynchus keta*) bycatch in the Bering Sea. The proposed measures would apply exclusively to participants in the Federal Bering Sea pollock (*Gadus chalcogrammus*) fishery which operates in the Bering Sea sub-area of the Bering Sea/Aleutian Islands Groundfish Fishery Management Plan area. The purpose of this action is to minimize chum salmon bycatch, but particularly the bycatch of Western Alaska origin chum salmon, consistent with the Magnuson-Stevens Fishery Management and Conservation Act, its National Standards, and other applicable law.

For definition of acronyms and abbreviations, see online list: https://www.npfmc.org/library/acronyms

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Action Summary

This document is a preliminary Draft Environmental Impact Statement (DEIS) that analyzes proposed management measures to reduce chum salmon (*Oncorhynchus keta, kangitneq, iqalluk, srughot'aye, dog salmon*).[1] prohibited species catch (PSC) in the Bering Sea pollock (*Gadus chalcogrammus*) fishery,[2] consistent with National Standard 9 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and all other National Standards. For catch accounting purposes, the National Marine Fisheries Service (NMFS) monitors salmon bycatch as either "Chinook PSC" or "non-Chinook PSC." Sockeye (*O. nerka)*, coho (*O. kisutch)*, pink (*O. gorbuscha)*, and chum salmon (*O. keta)* are included in the non-Chinook PSC category, but **over 99% of the salmon bycatch in the non-Chinook category are chum salmon** (Table 4-2). Unless explicitly stated that the table of figure is using "chum salmon only," all proceeding tables or figures for "chum salmon" are using counts and information from the non-Chinook category; "chum salmon" is generally used as common language throughout the analysis for ease of the reader.

The proposed action is focused on the Bering Sea pollock fishery because it encounters the majority of chum salmon bycatch in the Bering Sea Aleutian Islands (BSAI) Groundfish Fishery Management Plan (FMP) Area (see also Table 1-1). On average over the last decade (2013-2022), 98.70% of the chum salmon caught as bycatch in the BSAI management area is attributed to this fishery.

[1] Some traditional Alaska Native names for chum salmon are *kangitneq* (Central Yup'ik, used by coastal Kuskokwim communities, refers to migrating chum salmon headed to the headwaters), *iqalluk* (Central Yup'ik, used in lower/middle Kuskokwim communities, referring to adult migrating chum salmon), and *srughot'aye* (Upper Kuskokwim/Dinak'i, used in upper Kuskokwim communities, referring to adult migrating chum salmon). Dog salmon is another English name for chum salmon commonly used by Western Alaska Native peoples. Alaska is home to 229 sovereign Tribal governments and 23 distinct Alaska Native languages, many of which have multiple dialects and all of which are official languages of the state. *Kangitneq, iqalleq*, and *srughot'aye*, shared with Council staff for inclusion in this document by the Kuskokwim River Inter-Tribal Fish Commission through their role as a cooperating agency on this action, are just a few of the traditional names for chum salmon in Alaska. Additional Alaska Native languages' names for chum salmon, or salmon, were not included here because, recognizing the importance of language accuracy to respect culture, language-bearers, and Traditional Knowledge systems, Council and NMFS staff as non-Alaska Native language speakers wished to do no harm to Alaska Native language speakers by attempting to interpret all traditional names for chum salmon. An interested reader could find more information on Alaska Native languages at the Alaska Native Knowledge Network, and on respectfully working with Alaska Native languages in the Alaska Public Interest Research Group's Alaska Native Language Translation Protocols available here.

[2] While "bycatch" and "PSC" are often used interchangeably, these terms do have slightly different meanings. The Magnuson-Stevens Fishery Conservation and Management Act defines bycatch as fish which are harvested in a fishery but are not sold or kept for personal use including regulatory and economic discards. Certain species are designated as "prohibited species" in the Bering Sea Aleutian Island Groundfish Fishery Management Plan because they are the target of other, fully utilized domestic species. PSC species include Pacific halibut, Pacific herring, Pacific salmon, steelhead trout, king crab, and Tanner crab.

Table 1-1 Comparison of the number of chum salmon caught as bycatch in the Bering Sea pollock fishery to the number of chum salmon caught as bycatch in all Bering Sea groundfish fisheries (including the Bering Sea pollock fishery), and Bering Sea pollock chum salmon bycatch as a percent of total, 2013 through 2022

Year	*Bering Sea Pollock Fishery*	*All Bering Sea Groundfish Fisheries*	*Bering Sea Pollock Fishery as % of Total*
2013	125,316	126,463	99.09%
2014	219,442	223,867	98.02%
2015	237,752	241,491	98.45%
2016	343,001	346,000	99.13%
2017	467,678	469,769	99.55%
2018	295,062	307,367	96.01%
2019	347,882	354,681	98.12%
2020	343,625	344,849	99.65%
2021	546,042	548,752	99.51%
2022	242,375	243,695	99.46%
Average	316,835	320,693	98.70%

Source: NMFS Alaska Region Catch Account System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(6-22-2023)

Under the MSA, the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The EEZ lies within federal waters (i.e., those waters 3 to 200 nautical miles from shore). The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in the eight Regional Fishery Management Councils established under the MSA. The North Pacific Fishery Management Council (Council) has the responsibility for preparing FMPs and FMP amendments for the marine fisheries in federal waters off Alaska’s coast 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.

As described in Section 1.1 below, the purpose of this action is to minimize chum salmon bycatch to the extent practicable consistent with the MSA, its National Standards, and other applicable law. The Council has stated a primary goal of this action is to minimize the bycatch of Western Alaska origin chum salmon in particular. The Council is considering this action because any additional chum salmon returning to Alaska river systems could increase escapement which is necessary for the long-term sustainability of chum salmon fisheries.

The purpose of this preliminary DEIS and the accompanying Social Impact Assessment (SIA) is to provide the necessary information for decision-making, which includes an analysis of the potential impacts of the proposed alternatives as well as information for the Council to further refine its alternatives, should it choose to do so.[3] [4] As required by the National Environmental Policy Act (NEPA), the analysis of potential impacts addresses the “human environment” which comprehensively means the natural and physical environment as well as the human dimensions (i.e., communities of people or social dimensions) that interact with that environment (40 CFR 1508.1(m)). When preparing an EIS, decision-makers must consider and analyze the impacts of a reasonable range of alternatives to the proposed action. “Reasonable alternatives” means the range of alternatives are technically and economically feasible and meet the purpose and need for the proposed action (see 40 CFR 1508.1(z)). The alternatives under consideration are different ways to meet the purpose and need statement for the

[3] The preliminary DEIS and the accompanying Social Impact Assessment address the statutory requirements of the MSA, NEPA, Executive Order (E.O.) 12866, E.O. 12898, among others. An interested reader can find more information on the federal policies, treaties, and laws in Appendix 8.
[4] The preliminary DEIS and accompanying Social Impact Assessment were prepared by the Council and the NMFS Alaska Region to provide the analytical information for decision-making. The Alaska Department of Fish & Game (ADF&G) and the Kuskokwim River Inter-Tribal Fish Commission (KRITFC) are cooperating agencies providing special expertise on this action.

action and must include the “No Action” alternative (see 40 CFR 1502.14(d)). For this action, selection of the No Action alternative would result in status quo regulations at 50 CFR 679.21 implementing salmon bycatch management measures in the Bering Sea pollock fishery to remain in place.

The Fiscal Responsibility Act was signed on June 3, 2023, and effective immediately it constrains **the overall timeline for preparing and completing an EIS to two years.** For this action, the two-year time clock started on July 11, 2023, which is the date the Notice of Intent was published. **Interim guidance has been released, and the two-year time clock for this action would end with the publication of the Final EIS by July 11, 2025**. This is a somewhat less conservative time clock than that previously considered by the Council in October 2023. At that time, staff planned for the most conservative timeframe based on the Record of Decision for this action must be signed by July 11, 2025 (i.e., two years from the publication of the Notice of Intent). Figure 1-4 and the accompanying text below describe different timelines for the Council’s consideration. Finally, **the Council and the public can expect the DEIS and Final EIS prepared for the Council and published by the agency to be substantially synthesized from the materials presented at the April 2024 meeting as the EIS will be limited to 150 pages (excluding the Executive Summary and any appendices).**

Description of the Problem Being Addressed

The Bering Sea is undergoing ecological and climatological shifts that are increasingly extreme and difficult to accurately predict. For example, the eastern Bering Sea entered a prolonged warm phase in 2014 with major increases in ocean temperature in 2016 and 2019, although warming conditions appear to have relaxed from fall 2021 through summer 2022 (Siddon 2022). Marine heat waves in the eastern Bering Sea have resulted in reduced sea ice extent, delayed sea ice formation, changes to prey abundance (e.g., a decrease in the availability of large, lipid rich copepods during warm periods), and more (Cheung & Frölicher 2020; Kimmel et al. 2023; Oliver et al. 2019; Reum et al. 2020; Thoman et al. 2020). **These marine heatwaves appear to be strongly and detrimentally influential to the marine and freshwater survival of WAK chum salmon** and have likely contributed to the reduced overall abundance of WAK chum salmon in recent years (Farley et al. 2024).

Chum salmon originating from WAK river systems use the Bering Sea as habitat in their first summer at sea as juveniles and then migrate to the Gulf of Alaska for their first winter at sea. In 2016 and 2019, WAK chum salmon were subject to heat waves in both their major marine habitats (von Biela et al. 2019). The marine heat waves appear to have shifted the base of the food web, altering chum salmon diets. Juvenile chum salmon were observed to consume less diverse and less nutritious foods (e.g., jellyfish) and exhibited significantly lower energy density (stored energy), presumably because of dietary changes and higher metabolisms associated with warmer ocean conditions. Simply put, WAK chum salmon that rear in the Bering Sea had not acquired enough energy stores (i.e., fat) prior to their migration and over wintering in the Gulf of Alaska in the recent warm years (Farley et al. 2024).

Juvenile salmon abundance is linked to adult returns (Farley et al. 2020, 2024; Murphy et al. 2019). For example, a consistent relationship between the proportion of Yukon River fall and summer chum juveniles to fall and summer adults has been shown, indicating that relative adult run strength is determined by the end of a fish’s first summer at sea (in 2003 to 2007 during the study period) (Kondzela et al. 2016). Below-average juvenile abundance is expected to contribute to below-average adult chum salmon returns three to four years in the future (Kondzela et al. 2016). In 2016, this pattern changed as the Bering Sea entered a period of more extreme warming.

In the Bering Sea, some species of Pacific salmon can overlap in their distribution with Bering Sea pollock resulting in their take as incidental bycatch. Of the six Pacific salmon species found in the North Pacific, Chinook salmon and chum are the two species most often encountered as bycatch in the Bering

Sea pollock fishery.[5] Chinook salmon are taken incidentally in both A and B pollock fishing seasons while chum salmon are primarily encountered in the B season (see Table 4-1). Chum salmon and pollock are sometimes found in the same locations in the summer months for a variety of reasons including that they share a preferred habitat, chum salmon migration patterns overlap with where the Bering Sea pollock fishery occurs as chum salmon move from the Bering Sea basin up onto the shelf, and chum salmon feed on age-0 pollock (Murphy and Farley 2012; Murphy et al. 2016). Chinook and chum salmon caught in the pollock fishery are considered bycatch under the MSA and as prohibited species under the BSAI Groundfish FMP and NMFS regulations at 50 CFR 679 because they are the target of other, fully utilized domestic fisheries. Salmon taken as bycatch in the Bering Sea pollock fishery are required to be retained for monitoring purposes, and while salmon bycatch cannot be sold, regulations allow for voluntary processing of salmon bycatch for donation to foodbanks to minimize waste (see 50 CFR 679.26).[6]

Scientists use genetic information collected from samples of chum salmon taken as bycatch in the Bering Sea pollock fishery to estimate the number and proportion of chum salmon originating from six genetic groups: Southeast Asia, Northeast Asia, Coastal Western Alaska (i.e., river systems extending from the Norton Sound region in the north south to Bristol Bay), Upper/Middle Yukon (Yukon River fall chum and some Yukon River summer chum populations), Southwest Alaska, and Eastern Gulf of Alaska/Pacific Northwest. In most years, the majority of chum salmon caught as bycatch is of Asian origin, which is composed of both hatchery and wild fish (Barry et al., 2023).[7] When referring to "WAK chum salmon," the analysis is referring to the combined Coastal Western Alaska and Upper/Middle Yukon reporting groups.

In 2011, NMFS implemented a comprehensive monitoring program to collect salmon bycatch data including an updated genetic sampling protocol that is more representative of the overall bycatch. Since 2011, the annual average level of chum salmon bycatch in the B season pollock fishery has been 280,707. Figure 1-1 below shows the (rounded) average proportion of the genetic stock composition estimates for chum salmon bycatch from 2011-2022. From 2011 through 2022, the average number of chum salmon caught as bycatch attributed to the Coastal Western Alaska (CWAK) genetic stock reporting group during this period was 40,926 fish which accounted for an average proportion of 15.4 % of the total bycatch. The average number of chum salmon caught as bycatch attributed to the Upper/Middle Yukon genetic stock reporting group was 9,028 fish which accounted for an average proportion of 3.9% of the total bycatch. When the CWAK and the Upper/Middle Yukon genetic stock reporting groups are combined, the average number of chum salmon taken as bycatch annually was 49,953, accounting for an average proportion of 19.3% of the total bycatch during this period. However, there is inter-annual variability both in the overall amount of WAK chum salmon taken as bycatch as well as the proportion of the total chum bycatch this represents (see also Table 6-10).

[5] There are five Pacific salmon species found in North America. *O. Masou or* cherry salmon is primarily found in Japan and some parts of Russia.
[6] The Council last received a report from SeaShare, the only organization authorized by the NMFS Alaska Region to retain and distribute incidentally caught salmon and halibut from the BSA and GOA groundfish trawl fisheries, in April 2023. That report is available here.
[7] The Southeast Asia reporting group is primarily composed of hatchery released fish whereas the Northeast Asia reporting group is a mix of hatchery and wild salmon (although the exact proportion of hatchery and wild salmon within the Northeast Asia reporting group is unknown).

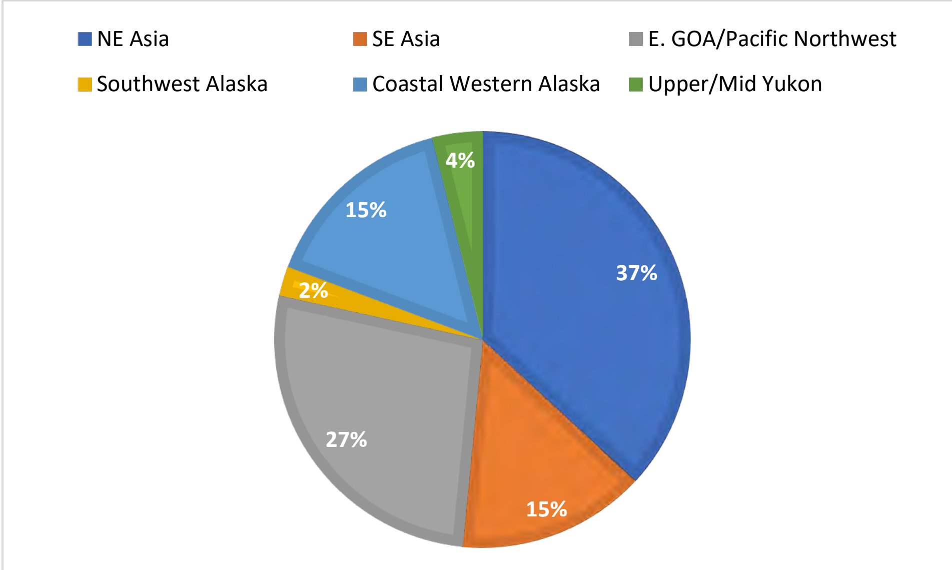

Figure 1-1 Average proportion of genetic stock composition estimates for chum salmon bycatch, 2011 through 2022

The Council is considering this action in light of the ongoing declines in chum salmon run strength across Western and Interior Alaska, and because minimizing chum salmon bycatch in the Bering Sea pollock fishery to the extent practicable could have some positive benefit on the number of chum salmon that return to WAK rivers. In 2020, WAK chum salmon runs began to decline dramatically with run sizes similar to those observed in the previous record poor runs of 2000. In 2020, all management areas across Western and Interior Alaska had chum salmon run sizes below recent year averages and abundance decreased further in 2021. In 2022, most WAK chum salmon abundance indices increased slightly from 2021 but remained below average. However, chum salmon fisheries were again closed in multiple areas including subsistence and commercial fisheries on the Yukon River for both summer and fall chum salmon; commercial chum salmon fishing in the Kuskokwim River and Bay areas; and sport chum salmon fishing on the Kuskokwim River. Subsistence fisheries in the Kuskokwim River and Bay areas were restricted due to conservation concerns for chum salmon for the first time in 2022, following the record low returns in 2021. In contrast to most other areas in WAK, the Kotzebue area had above average abundance and chum salmon fisheries were opened for subsistence and commercial fishing (Section 6.1.2.2).

Chum salmon are an important component of cultural identity and source of food security for many rural and Alaska Native communities across the State of Alaska, and more specifically, Western and Interior Alaska (Ahmasuk et al. 2008; Brown et al. 2023; Raymond-Yakoubian 2013). Additionally, contemporary subsistence uses of salmon across rural Alaska occurs within a mixed economy where communities include both subsistence and cash-based components (Wolfe et al. 1987). Sharing resources is a hallmark of subsistence communities—playing a role in mixed economies and supporting core cultural values— and these exchanges are complex (Wolfe et al. 2010). Harvesting salmon for subsistence is a way for extended families to work together while building and maintaining relationships (Trainor et al. 2021), shape place-based cultural identities (Raymond-Yakoubian 2019), and practice traditional Indigenous stewardship practices and values (e.g., respect, reciprocity, and sharing) encompassed within Traditional Knowledge (TK) systems (Moncrieff and Klein 2003).

Overview of the History of Salmon Bycatch Management in the Bering Sea

This section provides a high-level, chronological overview of salmon bycatch management measures in the Bering Sea as this current action would build on the existing program. **The Council's current salmon**

bycatch management program is designed to minimize salmon bycatch at all levels of salmon and pollock abundance, a goal which may or may not achieve lower salmon bycatch numbers year-after-year. The Council and NMFS have a long history of managing salmon bycatch in the Bering Sea and the management programs have evolved over time.

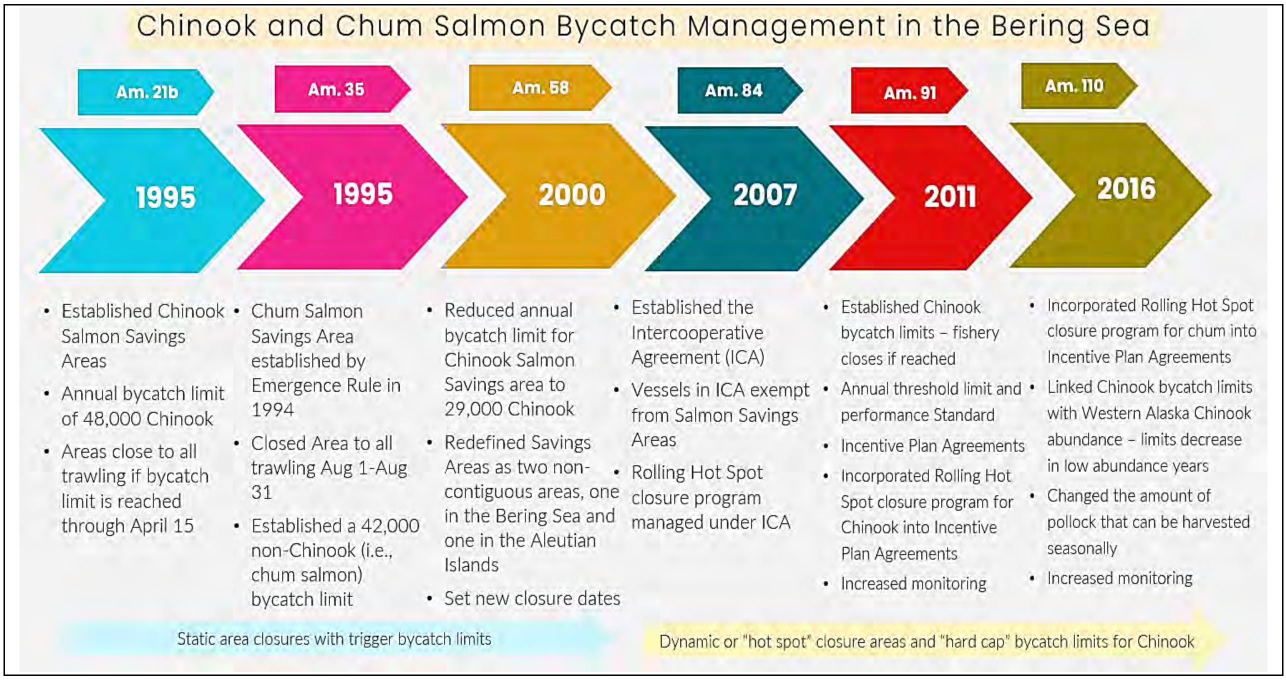

Figure 1-2 Summary of salmon bycatch management measures in the Bering Sea

The Chum Salmon Savings Area is a static area closure in the southeastern Bering Sea within the CVOA. Established in 1994, the Chum Salmon Savings Area was identified as an area with historically high rates of chum salmon bycatch and was closed to all trawling from August 1 through August 31 (the time of year which chum salmon bycatch was historically the highest). The Chum Salmon Savings Area remains closed through October 14 if the bycatch limit of 42,000 non-Chinook (i.e., chum salmon) are caught in the CVOA at any point from August 15 through October 14 (Amendment 35 to the Bering Sea Groundfish FMP).

Chinook Salmon Savings Areas were established in 1995 under BSAI Groundfish FMP Amendment 21b and subsequently revised in 2000 by Amendment 58. Amendment 21b regulations established the Chinook Salmon Savings Areas and prohibited trawling in the Chinook Salmon Savings Areas through April 15 if and when a bycatch limit of 48,000 Chinook salmon was reached (note the Bering Sea pollock A season has a regulatory opening on January 20 each year). Amendment 58 regulations were implemented in 2000, and they incrementally reduced the Chinook salmon bycatch limit from 48,000 to 29,000 fish over a four-year period, implemented year-round accounting of Chinook salmon bycatch in the Bering Sea pollock fishery, revised the boundaries of the Chinook Salmon Savings Areas, and set more restrictive closure dates.

In the early 2000s, information from vessels participating in the CDQ pollock fishery that were not subject to the Salmon Savings Areas mentioned above indicated that the Salmon Savings Areas may be counterproductive because the Chinook and chum salmon bycatch rates were higher outside the closure areas than within. The pollock industry voluntarily implemented a rolling hotspot closure system (RHS) for chum salmon in 2001 and Chinook in 2002 to facilitate sharing real-time salmon bycatch information to avoid areas with high Chinook and chum salmon bycatch rates.

In 2007, Amendment 84 regulations were implemented to address increases in Chinook and chum salmon bycatch that were occurring despite the Chinook and Chum Salmon Savings Areas. Amendment 84 regulations exempted vessels participating in the Bering Sea pollock fishery from the Salmon Savings Area closures if they participated in the RHS managed under an Intercooperative Agreement.[8] The RHS uses real-time catch and observer data to determine areas with higher salmon bycatch rates (i.e., number of salmon per mt of pollock) that would be eligible for potential "hot spot" closures. The Intercooperative Agreement required a third party to compare the salmon bycatch rate of an AFA cooperative to a predetermined salmon bycatch Base Rate.[9] Vessels in a cooperative were assigned to certain tiers based on their bycatch rate compared to the Base Rate. Closures were implemented for vessels in higher tiers associated with higher salmon bycatch rates.

Amendment 84 also required the efficacy of the RHS program and bycatch reduction efforts to be reported to the Council annually. The annual Intercooperative report suggested that the RHS system reduced salmon bycatch rates compared to what they would have been without the program. However, the highest historical Chinook salmon bycatch occurred in 2007 when these regulations were in effect under an exempted fishing permit.[10] Prior to Amendment 84 regulations being implemented in 2007, the Council had begun to work on a comprehensive bycatch management program and analysis for both Chinook and chum salmon. That analysis considered updated closure areas and a range of overall PSC limits by sector and season for Chinook and chum salmon. However, 2007 was the year with the highest historical level of Chinook salmon bycatch which coincided with ongoing observations and concerns about the declining status of WAK Chinook stocks. As such, the Council bifurcated that analysis and prioritized management measures for Chinook salmon bycatch.

The Council adopted Amendment 91 in April 2009 and Federal regulations implementing Amendment 91 came into effect in 2011. Amendment 91 substantially changed how Chinook salmon bycatch is managed in the Bering Sea pollock fishery by creating a Chinook salmon PSC limit or a "hard cap." The Chinook PSC limit requires the pollock fishery to cease fishing if the limit is reached as opposed to being connected with a spatial area closure. The Chinook salmon PSC limit was implemented alongside industry-developed contractual arrangements called Incentive Plan Agreements (IPAs). IPAs are designed to incentivize the pollock industry to minimize their Chinook salmon bycatch at all levels of Chinook salmon abundance. An IPA is the same general concept as the Intercooperative Agreement mentioned above. The primary distinction is that the IPAs are designed to incentivize lower bycatch and participation in the IPA is not limited to AFA cooperatives as it may include individual vessel owners or CDQ groups.

If at least one IPA is approved by NMFS, an overall PSC limit of 60,000 Chinook salmon is implemented. If no IPA is developed and approved by NMFS, a lower limit of 47,591 Chinook salmon is implemented (see 50 CFR 679.21(f)(2)). Three IPAs have been in place since 2010 and all vessels and CDQ groups have participated in the agreements. The three IPAs are: the Inshore Chinook Salmon Savings Incentive Plan Agreement (Inshore SSIP), the Mothership Salmon Savings Incentive Plan Agreement (MSSIP), and the Catcher/processor Chinook Salmon Bycatch Reduction Incentive Plan and Agreement (CP IPA). Either the 60,000 or the 47,591 Chinook PSC limit is allocated among the four

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[8] Amendment 84 also exempted vessels participating in non-pollock trawl fisheries from the Chum Salmon Savings Area closures because these fisheries catch minimal amounts of chum salmon.
[9] Since the inception of AFA cooperatives, Sea State, Inc. has been contracted by the cooperatives to facilitate bycatch avoidance, information sharing, and to provide catch accounting/harvest data for the cooperative annual reports. Sea State works on a data release agreement between the industry and NMFS. NMFS observers sample hauls and estimate PSC. Each vessel electronically transmits its observer data to Sea State, which checks the data and performs statistical extrapolations to factor in any hauls that were not sampled. Position-specific data for each vessel are used to create a chart of vessel-specific bycatch rates that is faxed to participating vessels within 24 hours. Vessels move away from areas with high bycatch rates.
[10] An exempted fishing permit was issued to allow fishing activities to occur that would otherwise be prohibited under Federal regulations and was utilized in 2006 and 2007 to exempt vessels participating in the RHS system from the Salmon Savings Areas closures.

pollock sectors. NMFS further apportions the inshore sector's allocation among the cooperatives and the CDQ sector's allocation among the six CDQ groups. Both PSC limits are divided by the A and B pollock seasons (because Chinook salmon are encountered in both seasons).

In addition to the PSC limits, Amendment 91 established an "annual threshold amount" and a "performance standard." The annual threshold amount is calculated by NMFS and it is the number of Chinook salmon that would be allocated to a sector under the lower limit of 47,591.[11] At the end of each year, NMFS compares each sector's Chinook bycatch performance (i.e., the number of Chinook salmon caught as bycatch) against that sector's annual threshold amount. The performance standard works as follows: if a sector exceeds its annual threshold amount in three out of seven consecutive years (i.e., no more than two times in a seven-year period), it will receive an allocation of the lower limit of 47,591 in all future years. The intent of using a lower PSC limit in conjunction with IPAs, the annual threshold amount, and the performance standard is to ensure the overall limit is not reached.

Following implementation of Amendment 91 in 2011, the Council began to receive annual updates on salmon bycatch numbers, IPA performance, and the genetic stock composition of both Chinook and chum salmon caught as bycatch. In response to continued concerns regarding chum salmon bycatch, widespread concerns over the stock status of WAK Chinook salmon, and indications that vessel-level incentives for Chinook bycatch avoidance could be strengthened (see Stram and Ianelli, 2015), the Council created a comprehensive salmon bycatch avoidance program. Amendment 110 regulations came into effect in 2016 and incorporated chum salmon avoidance measures into the IPAs, modified the requirements for the content of the IPAs to increase incentives for fishermen to avoid Chinook salmon, and provided additional flexibility in the seasonal apportionments of the Bering Sea pollock TAC to allow for more pollock to be harvested if desirable in the A season when Chinook salmon bycatch rates have historically been lower.

Additionally, Amendment 110 regulations reduced the Chinook salmon PSC limit in years when Chinook salmon abundance is determined to be low in WAK based on a Three-river index. The Three-river index used to determine WAK Chinook abundance is based on the sum of the run sizes of the Kuskokwim, Unalakleet, and Upper Yukon River systems. NMFS will determine that it is a low Chinook salmon abundance year when abundance of Chinook salmon in WAK is less than or equal to 250,000 Chinook salmon. By October 1 of each year, the State of Alaska provides to NMFS an estimate of Chinook salmon abundance using this index. In years when Chinook salmon abundance is determined to be low, the overall Chinook PSC limit drops to 45,000 and the lower limit to 33,318 Chinook.

Purpose and Need

The purpose of this action is to minimize the bycatch of WAK chum salmon in the Bering Sea pollock fishery to the extent practicable (National Standard 9 and Section 303(a)(11) of the MSA) while balancing the other National Standards. The Council has further specified that its intent is to balance the National Standards and maintain the objectives of prior salmon bycatch management measures, namely Amendments 91 and 110 to the BSAI Groundfish FMP that established measures to reduce Chinook salmon bycatch (see Section 4.1.3).

The Council is considering this action in light of the ongoing declines in chum salmon run strength across Western and Interior Alaska (see also Section 6.1.2.2). Amidst these changes in chum salmon stock abundance, the Council has received scientific reports outlining the impact of warming ocean conditions on salmon mortality at sea. The Council has also received substantial public comment and input from Western and Interior Alaska Tribes and subsistence salmon fishermen describing the importance of chum salmon for the subsistence way of life, which is integral to Alaska Native peoples' cultural practices, identity, and TK systems. The Council has additionally received public comments and annual

[11] Each sector's annual threshold amount can be found here: https://www.fisheries.noaa.gov/sites/default/files/akro/cas2SalmonPerformanceStandard2023.html

presentations from IPA representatives on the industry's efforts to minimize their bycatch of Chinook and chum salmon. Implementing additional chum salmon bycatch management measures could potentially have some positive benefit on the number of chum salmon that return to Western Alaska rivers. Any additional chum salmon returning to Alaska river systems improves the ability to meet the State's spawning escapement goals which is necessary for the long-term sustainability of chum salmon fisheries.

The Council adopted the following Purpose and Need statement to originate this action on April 8th, 2023.

> *Salmon are an important fishery resource throughout Alaska, and chum salmon that rear in the Bering Sea support subsistence, commercial, sport, and recreational fisheries throughout Western and Interior Alaska. Western and Interior Alaska salmon stocks are undergoing extreme crises and collapses, with long-running stock problems and consecutive years' failures to achieve escapement goals, U.S.-Canada fish passage treaty requirements, and subsistence harvest needs in the Yukon, Kuskokwim, and Norton Sound regions. These multi-salmon species declines have created adverse impacts to culture and food security and have resulted in reduced access to traditional foods and commercial salmon fisheries.*
>
> *The best available science suggests that ecosystem and climate changes are the leading causes of recent chum salmon run failures; however, non-Chinook (primarily chum) salmon are taken in the Eastern Bering Sea pollock trawl fishery which reduces the amount of salmon that return to Western and Interior Alaska rivers and subsistence fisheries. It is important to acknowledge and understand all sources of chum mortality and the cumulative impact of various fishing activities. In light of the critical importance of chum salmon to Western Alaska communities and ecosystems, the Council is considering additional measures to further minimize Western Alaskan chum bycatch in the pollock fishery.*
>
> *The purpose of this proposed action is to develop actions to minimize bycatch of Western Alaska origin chum salmon in the Eastern Bering Sea pollock fishery consistent with the Magnuson-Stevens Act, National Standards, and other applicable law. Consistent, annual genetics stock composition information indicates that the majority of non-Chinook bycatch in the pollock fishery is of Russian/Asian hatchery origin; therefore, alternatives should structure non-Chinook bycatch management measures around improving performance in avoiding Western Alaska chum salmon specifically.*
>
> *The Council intends to consider establishing additional regulatory non-Chinook bycatch management measures that reduce Western Alaska chum bycatch; provide additional opportunities for the pollock trawl fleet to improve performance in avoiding non-Chinook salmon while maintaining the priority of the objectives of the Amendment 91 and Amendment 110 Chinook salmon bycatch avoidance program; meet and balance the requirements of the Magnuson-Stevens Act, particularly to minimize salmon bycatch to the extent practicable under National Standard 9; include the best scientific information available including Local Knowledge and Traditional Knowledge as required by National Standard 2; take into account the importance of fishery resources to fishing communities including those that are dependent on Bering Sea pollock and subsistence salmon fisheries as required under National Standard 8; and to achieve optimum yield in the BSAI groundfish fisheries on a continuing basis, in the groundfish fisheries as required under National Standard 1.*

The Council adopted the following set of alternatives for analysis on October 8th, 2023.

Alternative 1: No Action or Status Quo

All action alternatives apply to the entire Bering Sea pollock B season, the season in which chum salmon are taken as bycatch (prohibited species catch or PSC).

Alternative 2: Overall bycatch (PSC) limit for chum salmon

Option 1: Chum salmon PSC limit based on historical total bycatch numbers: range of 200,000 (~35,400 Western Alaska chum salmon) to 550,000 (~97,350 Western Alaska chum salmon).[12]

Option 2: Chum salmon PSC limit triggered by Western Alaska chum salmon abundance indices based on the prior years' chum salmon abundance. Suboptions below are mutually exclusive.

Suboption 1: Three-area chum salmon index based on Yukon River summer + Yukon River fall run abundance (950,000 + 575,000); Kuskokwim River composed of the Bethel test fishery CPUE (2,800); Norton Sound composed of summed escapement for the Snake, Nome, Eldorado, Kwiniuk, and North Rivers and total Norton Sound harvest (57,000)

If 3/3 areas are above index threshold, no chum salmon PSC limit the following year.

If 2/3 areas are above index threshold, chum salmon PSC limit the following year is X.

If 1 or no areas are above index threshold, chum salmon PSC limit the following year is X.

Suboption 2: Chum salmon index based on Yukon River summer + Yukon River fall run abundance.

Suboption 2a: Yukon River summer chum salmon (950,000)

If index is above threshold, chum salmon PSC limit the following year is X.[13]

If index is below threshold, chum salmon PSC limit the following year is X.

Suboption 2b: Yukon River summer chum salmon (950,000) and fall chum salmon (575,000)

If 2/2 areas are above index threshold, no chum salmon PSC limit the following year.

If 1 or no areas are above index threshold, chum salmon PSC limit the following year is X.

Option 3 (must be selected with Option 1 or 2): PSC limits are apportioned among CDQ, catcher processor, mothership and inshore sectors (using a blended adjusted CDQ bycatch rate as with Amendment 91) based on:

Suboption 1: historical total bycatch by sector using the 3-year average (2020 – 2022)

Suboption 2: historical total bycatch by sector using the 5-year average (2018 – 2022)

Suboption 3: pro rata 25% AFA pollock allocation and 75% historical total bycatch (2020 – 2022)

Suboption 4: pro rata based on AFA apportionment[14]

The sector limits are further apportioned at the cooperative level in proportion to each cooperative's pollock allocation. Chum salmon PSC can be transferred between sectors and among vessels within a cooperative. Reaching a limit closes the pollock fishery sector to which the limit applies.

Alternative 3: Chum salmon PSC limit with an associated Western Alaska chum salmon bycatch annual limit

Establish an annual limit of 40,000 to 53,000 Western Alaska chum salmon PSC based on the 3-year average 2020-2022 range of historical bycatch numbers and an overall chum salmon PSC limit from

[12] The values of 35,400 and 97,350 Western Alaska chum salmon are approximations of the average number of WAK chum salmon that may be encountered by the Bering Sea pollock fishery under the two PSC limits specified in the motion. They are not numerical values for consideration under Alternative 3.
[13] The Council's intent with suboption 2a is that no chum salmon PSC limit would be in place if the summer chum salmon run is above the index threshold. Across all three suboptions, no chum salmon PSC limit would be in place when indices meet their respective threshold(s).
[14] While this is the exact language in the Council's October 2023 motion for suboption 4 of option 3 of Alternative 2, it is staff's understanding that the Council's intent is for staff to look at each sector's AFA pollock allocation.

Alternative 2. Both the overall PSC limit and the Western Alaska chum salmon annual limit will be apportioned according to the options considered under Alternative 2.

Each sector's portion of an overall chum salmon PSC limit of (option 1: 450,000 and option 2: 550,000) is in effect. If a sector exceeds its western AK chum salmon PSC annual limit in any three of seven consecutive years, the sector's portion of an overall chum salmon PSC limit of (option 1: 200,000 and option 2: 300,000) is in effect until Western Alaska chum salmon PSC does not exceed the sector annual limit for three years.

Alternative 4: Additional regulatory requirements for Incentive Plan Agreements (IPAs) to be managed within the IPAs

Option 1: Require a chum salmon reduction plan agreement to prioritize avoidance in genetic cluster areas 1 and 2 for a specified amount of time based on two triggers being met: 1) an established chum salmon incidental catch rate and 2) historical genetic composition (proportion) of Western Alaska chum salmon to non-Western Alaska chum salmon.

Option 2: Additional regulatory provisions requiring Incentive Plan Agreements to utilize the most refined genetics information available to further prioritize avoidance of areas and times of highest proportion of Western Alaska and Upper/Middle Yukon chum salmon stocks.

Industry should submit a detailed proposal of IPA changes under Alternative 4 for inclusion into the Initial Review analysis prior to the February Council meeting. The proposals should consider a process to include local and traditional knowledge from Western and Interior Alaska salmon users in the development of IPA measures. The following is a list of potential measures that could be developed for incorporation into the IPAs and/or through regulation.

- Option 1 trigger 1 and trigger 2 values
- Adjusted base rates to implement a closure
- Adjusted closure area size
- Adjusted closure duration
- Application of the closures to all vessels not just those above the base rate
- Genetic data
- Genetic cluster thresholds
- Additional vessel level incentives/penalties for chum salmon avoidance

Description of Alternatives and Related Considerations

Directly below are high-level descriptions of the alternatives being considered under this action. **At this stage, the Council may choose to refine its alternatives and may wish to consider some of the following information.**

Alternative 1: No Action or Status Quo

There are no decision points for the Council related to refining Alternative 1. Section 0 describes the status quo (or current) regulations at 50 CFR 679.21(f) that manage salmon bycatch in the Bering Sea pollock fishery. Selection of the No Action alternative would result in the existing salmon bycatch regulations remaining in place including the Chum Salmon Savings Area which acts as a backstop measure (see also Section 4.1.1.1), should any vessel or CDQ group not participate in the RHS system for chum salmon avoidance managed under the salmon bycatch IPAs (see also Section 4.1.1.2).

Alternative 2: Overall Chum Salmon PSC Limit

As described in the Council's October 2023 motion, all action alternatives would apply to the B season pollock fishery because the majority of chum salmon are encountered during this season (over 99% on average from 2011-2022; see also Table 4-1). The Bering Sea pollock B season has regulatory dates of

June 10—November 1, but fishing is typically complete by late September to early October because Chinook encounter rates tend to increase towards the fall. Under Alternative 2, an overall chum salmon PSC limit (often referred to as a "hard cap" interchangeably throughout this analysis) would be in place during the B season pollock fishery. "Overall" refers to the fact that all non-Chinook (i.e., chum) salmon caught as bycatch during the B season would accrue to the limit. If or when the overall limit is reached, pollock fishing would be required to cease.

Option 1 of Alternative 2: Overall PSC Limits Selected for Analysis

Option 1 of Alternative 2 specifies the numerical values for overall chum PSC limits selected by the Council for impact analysis, which are summarized in Table 1-2 alongside the Council's rationale.

Table 1-2 Summary of each overall chum salmon PSC limit value selected for analysis and the accompanying Council rationale

Chum Salmon PSC Limit	*Council Rationale*
200,000	Balances public testimony requesting a "very low" or a PSC limit of zero with practicability considerations
300,000	Rounded down from the 10-year average (2013-2022) level of bycatch of 315,449 chum salmon
350,000	Rounded down from the 5-year average (2018-2022) level of bycatch of 354,654 chum salmon
400,000	Rounded up from the 3-year average (2020-2022) level of bycatch of 377,102 chum salmon
450,000	Middle value between 400,00 and 550,000 chum salmon
550,000	Rounded value of the highest level of chum salmon bycatch in the analyzed period (2021 at 545,901 chum salmon)

Option 2 of Alternative 2: Indices for WAK Chum Abundance

Option 2 of Alternative 2 specifies three different indices (suboptions) that could be used to determine WAK chum salmon abundance. Whether an index meets its threshold(s) would determine if an overall chum salmon PSC limit is in place and at what level under the step-down provisions. **A decision point before the Council at this time are the numerical values that would apply as overall chum salmon PSC limits when an index does not meet its threshold value(s).** Strictly for the purpose of analyzing the impacts of this option/Alternative, analytical staff selected 450,000 and 200,000 as the step-down provisions for the overall chum salmon PSC limits that would be in place (see Section 4.2.2).

The three suboptions for indices are mutually exclusive, meaning the Council could only incorporate one index into a Preferred Alternative.[15] **To streamline the analysis, the Council may consider identifying a preferred suboption/index** (see Section 4.2.2). When the Council developed the three options for indices of WAK chum abundance in October 2023 under option 2 of Alternative 2, it requested analytical staff to bring back an analysis of how well the Yukon Area indices based on summer chum (suboption 2a) and summer + fall chum (suboption 2b) trended with the Three-area index (suboption 1). To address this request from the Council, a dynamic factor analysis of the constituent stocks for each area/index identified by the Council was completed to see how well they trend together, and how well the Yukon summer chum (suboption 2a) and Yukon summer + fall chum (suboption 2b) trend with the Three-area index. Appendix 7 contains the full dynamic factor analysis and Section 4.2.2.4 contains additional summary information. **The primary point for the Council to consider, based on this analysis, is that that the Yukon Area indices (suboptions 2a and 2b) are likely to provide a reliable index of the aggregate dynamics of WAK chum salmon stocks. Suboption 2b – an index based on Yukon**

[15] A Preferred Alternative is the selected alternative identified among the set of management measures (alternatives) developed to address the purpose and need statement; the Council typically selects a Preferred Alternative at Final Action but may select a Preliminary Preferred Alternative prior to final action.

summer + fall chum – exhibits a stronger association than suboption 2a (Yukon fall chum only) with the shared dynamic factor analysis trend and the other individual stocks making up the Three-area index (suboption 1).

Option 3 of Alternative 2: Apportioning the Overall Chum PSC Limit

It is the Council's intent that the overall chum PSC limit under consideration in Alternative 2 would be apportioned among the pollock sectors: the Community Development Quota (CDQ) program, the catcher processor (CP) sector, the inshore catcher vessel (CV) sector, and the mothership sector. The Council has further specified the inshore sector's apportionment would be further divided among the inshore cooperatives and the inshore open access fishery in applicable years; the CDQ apportionment would be further divided among the six CDQ groups.

Option 3 of Alternative 2 specifies four different approaches: suboption 1 would apportion the overall chum PSC limit among the sectors based on their historical 3-year average level of bycatch (2020-2022); suboption 2 would apportion the overall chum PSC limit among the sectors based on their historical 5-year average level of bycatch (2018-2022); suboption 3 would apportion the overall chum PSC limit based on a pro-rata approach where the percentage is weighted, 25% to a sector's AFA pollock allocation and 75% to their 3-year historical average level of bycatch; suboption 4 would apportion the overall chum salmon PSC limit based on the sector's AFA pollock allocation.

In October 2023, the Council requested the apportionment percentages be based on an adjusted blend bycatch rate because operational choices are sometimes made at the vessel-level when a vessel is fishing CDQ pollock and how hauls are assigned to CDQ or non-CDQ fishing sectors. Section 4.2.3 provides a detailed description of the approach used to calculate the adjusted blend rate. What is important to note here is that the adjusted blend bycatch rate approach only affects the apportionment percentages for the CDQ and CP sectors (because CDQ pollock has historically been harvested by CPs). Table 1-3 below summarizes the apportionment percentages under consideration that would be used to divide the overall chum PSC limit among the pollock sectors.

Table 1-3 Summary of each sector's apportionment percentages under each suboption

Apportionments	*CDQ*	*CP*	*Inshore*	*Mothership*
Suboption 1: 3-yr avg.	6.1%	21.9%	62.9%	9.1%
Suboption 2: 5-yr avg.	7.1%	25.2%	58.2%	9.5%
Suboption 3: pro-rata	7.1%	25.4%	58.4%	9.1%
Suboption 4: AFA*	10%	36%	45%	9%

*The AFA percentages under suboption 4 – 10% to the CDQ program, 36% to the CP sector, 45% to the inshore sector, and 9% to the mothership sector – reflect the CDQ program's pollock allocation and the AFA sectors' pollock allocation of the directed fishing allowance, the latter of which sets aside the ICA which is used for the incidental catch of pollock in other groundfish fisheries.

If the Council would like to move forward with Alternative 2, it may consider providing input on whether its intent would be to modify existing regulations at 50 CFR 679.22(a)(10) for the Chum Salmon Savings Area by removing this savings area as a backstop measure. If a vessel or CDQ group was not a member to an IPA and participating in the RHS for chum salmon avoidance, the Chum Salmon Savings Area is a static area closure that is triggered by a PSC limit of 42,000 chum salmon (divided by the CDQ program and the AFA sectors). If the Council moves forward with Alternative 2 and recommends an overall chum salmon PSC limit, the 50 CFR 679 regulations would (effectively) have two PSC limits in place for the same fishery. As a point of reference, the Council removed the Chinook Salmon Savings Areas from regulations when it implemented the Chinook salmon PSC limits in 2011 under Amendment 91.

Alternative 3: Annual Western Alaska Chum Salmon Threshold

Under Alternative 3, an annual WAK chum salmon threshold of 40,000 to 53,000 WAK chum would be in place during the B season.[16] The Council chose to set the WAK chum threshold as a range because there is uncertainty around the point estimates for the estimated proportion and number of WAK chum salmon in the overall bycatch (see Table 4-11). The number of WAK chum salmon in the total bycatch estimated using genetic data would accrue to a sector's apportionment of the threshold. Each sector's performance against their WAK chum salmon threshold would be evaluated over time. As described in Section 4.3, Alternative 3 must be implemented in conjunction with Alternative 2.

Under option 1 of Alternative 3, an overall chum PSC limit of 450,000 would be in place and apportioned among the pollock sectors. Alternative 3 includes a performance standard wherein, if a sector exceeded their apportionment of the WAK chum salmon threshold for a third time in any seven-year period, a lower PSC limit of 200,000 chum would apply until the sector had stayed under their apportionment of the WAK threshold for three years, at which point an overall PSC limit of 450,000 would apply again.

Under option 2 of Alternative 3, an overall chum PSC limit of 550,000 would be in place and apportioned among the pollock sectors. If a sector exceeded the performance standard under Alternative 3 and exceeded their apportionment for a third time in any seven-year period, a lower PSC limit of 300,000 chum would apply until the sector had stayed under their apportionment of the WAK threshold for three years, at which point an overall PSC limit of 550,000 would apply again.

The Council included a performance standard under Alternative 3 to incentivize the pollock fleet to avoid WAK chum salmon inseason. **At this stage, a decision before the Council is to determine what would constitute this three-year period.** It is unclear whether the sectors would be required to achieve three consecutive years out of the prior seven years, any three years out of the prior seven years, or three years in an indefinite period to be able to operate under the higher of the two overall PSC limits in the future under option 1 or 2.

There are several other points of consideration for the Council related to implementation under Alternative 3. It is analytical staff's understanding that it is the Council's intent that the WAK chum salmon threshold under Alternative 3 would be implemented as a range. However, NMFS is uncertain how to implement a range of values for a threshold in regulations. With a range of numbers, it is unclear what number NMFS would use to evaluate sectors against a performance standard. For this analysis, staff used the upper bound because it provides the most flexibility in light of the uncertainty and NMFS could use that same approach for implementation of the threshold. **The agency would look for the Council to clarify its implementation intent.**

As currently written and conceptualized, Alternative 3 poses a timing mismatch between the assessment of fishing sectors' performance against the upper bound of the WAK chum salmon threshold and the Council's annually occurring BSAI groundfish harvest specifications process. The genetic data on chum salmon caught as bycatch during the B season fishery will not be available until April of the subsequent year, after NMFS has published the BSAI groundfish harvest specifications in regulation. If the Council would like to move forward with Alternative 3, a possible solution would be to delay the fishing sectors' formal evaluation of performance against the WAK chum salmon threshold by a year (e.g., 2024 B season performance against WAK chum salmon threshold is assessed in October 2025, and the PSC limit in effect would be applied in the 2026 B season fishery; see also Section 4.3.2.1.1).

[16] Note the Council's motion (October 2023) identifies this management alternative as an "annual WAK chum salmon bycatch limit," which is referred to throughout the preliminary DEIS as a "WAK chum threshold." There is no real-time genetic information available to identify WAK chum in the overall bycatch, and an entity's performance against the threshold could not be known until the following year. As such, if the Council moves forward with Alternative 3, at implementation it would not be referred to in regulation as a limit.

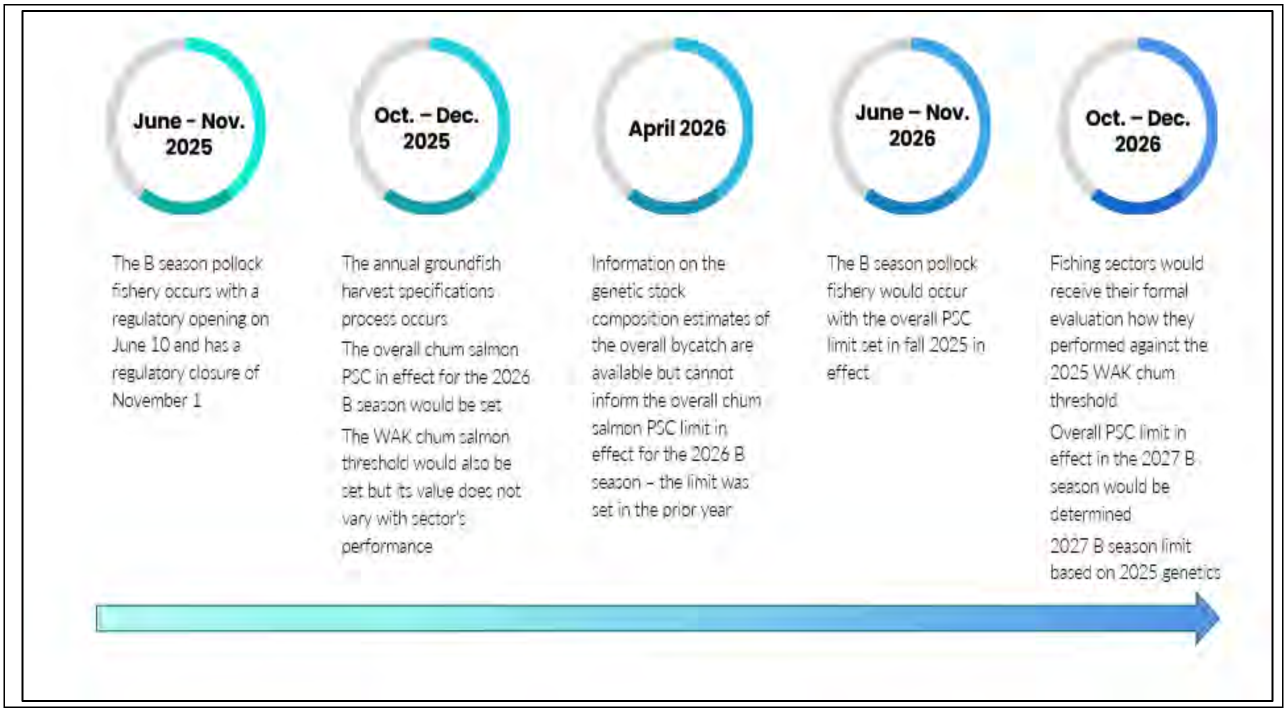

Figure 1-3 Hypothetical timeline that could be used to evaluate genetic information, a sector's performance against the WAK chum salmon threshold, and when sector's performance would have an effect on an overall PSC limit in place

As discussed above, NMFS would perform the catch accounting and retroactively evaluate whether a sector exceeded its apportionment of the WAK chum salmon threshold. The Bering Sea pollock fishery would be unable to know inseason whether they have exceeded the WAK threshold, which raises issues of fairness and whether this approach is legally valid**.**

Table 1-4 below provides new analysis showing estimates of the pollock sector's WAK chum bycatch from 2011-2022. As shown, there are years during the analyzed period where insufficient samples were available to estimate the genetic stock proportions in the overall bycatch for some sectors. If the Council would like to move forward with Alternative 3, it would need to consider its analytical priorities for chum salmon bycatch. The Alaska Fisheries Science Center's Auke Bay Labs can reprioritize sub-sampling strategies to ensure there are sufficient samples for sector-level genetic stock composition estimates. **However, the Council might expect analysis of spatial trends in the overall bycatch to be less available or inferences to be made from a smaller proportion of the overall bycatch** (see Section 4.3.2.1.3).

Table 1-4 Estimated number of WAK chum salmon caught as bycatch by each Bering Sea pollock sector, 2011 through 2022

Year	CDQ	CP	Mothership	Inshore	Total
2011	NA	8,917	4,430	32,444	45,791
2012	NA	NA	NA	3,932	3,932
2013	NA	2,468	801	28,219	31,488
2014	NA	8,715	NA	31,650	40,365
2015	NA	5,133	1,928	36,262	43,323
2016	3,031	21,946	13,758	38,236	76,971
2017	22,674	33,435	4,673	35,288	96,070
2018	6,272	17,644	4,503	30,391	58,810
2019	2,898	5,090	7,637	40,237	55,862
2020	NA	1,926	1,148	25,620	28,694
2021	6,092	7,736	3,447	33,522	50,797
2022	902	8,037	7,891	37,278	54,108
Average	6,978	11,004	5,022	31,090	48,851

Source: NMFS Alaska Region Catch Accounting System.
Notes: These estimates reflect the point estimate of the mean proportion of WAK chum salmon inferred from genetic analysis, multiplied by the sector specific non-Chinook PSC amount. NA denotes insufficient samples were available to estimate genetic stock proportions.

If the Council would like to move forward with Alternative 3, there does not appear to be a benefit—either operationally or for inseason management—to apportioning the annual WAK chum salmon bycatch limit to the inshore cooperative and CDQ group level because there is no real-time genetic information available. **The Council could modify Alternative 3 such that the WAK chum salmon annual bycatch limit would only be apportioned at the sector-level, and that this change would be in line with the Council's original intent of the alternative** (see Section 4.3).

If the Council was interested in including both option 2 of Alternative 2 and Alternative 3 in an eventual Preferred Alternative, it may wish to consider **the numerical value selected for PSC limits under option 2 of Alternative 2 could affect the relative effectiveness of the performance standard under Alternative 3.** Specifically, to maintain the performance standard's, the PSC limits set as step-down provisions under option 2 of Alternative 2 would need to be greater than the lowest applicable PSC limit under Alternative 3 (see Section 4.3.1.1).

Alternative 4: Modifications to the Incentive Plan Agreements (IPAs)

Analytical staff were unable to provide a precise description of how Alternative 4 would work at this time. Appendices 2 and 3 contain the two proposals submitted by IPA representatives prior to the Council's February 2024 meeting for inclusion in the initial review analysis. One proposal contains potential provisions put forward by the CV fleets (Inshore SSIP and MSSIP); the other proposal contains potential provisions from the CP sector (CP IPA). There are differences between how Alternative 4 was written in the Council's October 2023 motion and the provisions or measures for additional WAK chum avoidance in the IPA proposals submitted to staff prior to the Council's February 2024 meeting. These differences should not be understood as the proposals being unresponsive to the Council's request or intention under Alternative 4, which is ultimately to further prioritize avoidance in times and areas when WAK chum are more likely to be present on the pollock grounds. The IPA proposals respond to this intent.

In order to move forward with Alternative 4, the Council would need to add provisions to the existing regulations for the salmon bycatch IPAs at 50 CFR 679.21(f)(12)(iii)(E). At present, the issue at hand is *what* would be contained within these regulatory provisions that the IPAs would be required to respond to. That being said, the IPAs can be formally amended and the measures in place for vessels and

CDQ groups updated at any time. It is analytical staff's understanding that many of the measures and provisions put forward in the IPA proposals would respond to the current regulation at 50 CFR 679.21(f)(12)(iii)(E)(7) requiring each IPA to contain a description of *"how the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's chum salmon bycatch to avoid areas and times where the chum salmon are likely to return to western Alaska."* Therefore, the measures and provisions put forward in these proposals could be incorporated into the IPAs without changes to the implementing regulations for the salmon bycatch IPAs at 50 CFR 679.21(f)(12)(iii)(E). If the Council would like to move forward with Alternative 4 and further develop regulatory provisions, it may wish to consider whether these provisions would be additive to the current provision for WAK chum avoidance or a replacement to them.

Table 1-5 Summary and comparison of the alternatives

Alternative	Chum PSC limit	IPA Requirements	Tools for Western Alaska Chum Avoidance	Is it a Standalone Alternative?
1	PSC limit of 42,000 non-Chinook closes Chum Salmon Savings Area (August 1-31). Pollock fishery is exempt if operating under RHS system in an IPA.	RHS system for chum avoidance operates in the B season.	RHS closure areas are largest East of 168 degrees West Longitude (closer to Alaska Peninsula). Thresholds for implementing closures are lower in June and July when WAK chum encountered in higher proportions.	Yes. Selecting Alt 1 means no additional chum salmon bycatch regulations would be in place.
2.1	Overall chum PSC limit would function as hard cap. All non-Chinook salmon encountered in B season count to the limit. Divided by sector.	Same as Alt 1.	Same as Alt 1.	Yes, but could be adopted with Alt 3 or 4.
2.2	Overall chum PSC limit would function as a hard cap. Only in place if WAK chum fail to meet indices thresholds. Limit value could decrease (step-down) if more thresholds are not met.	Same as Alt 1.	Same as Alt 1.	No. Must be implemented in conjunction with Alt 2 option 1 and 3.
3	Same as Alt 2 and must be implemented in conjunction with Alt 2.	Same as Alt 2.	WAK chum salmon threshold with performance standard. Only WAK chum encountered in the overall bycatch accrue to threshold. Performance assessed retroactively. Divided by sector.	No. Must be implemented in conjunction with Alt 2 option 1 and 3. Does not require implementation alongside WAK indices (option 2 of Alt 2).
4	Same as Alt 1.	Would modify requirements for chum avoidance.	IPA proposals include more targeted (or optimized) closure areas in fishing grounds near Alaska Peninsula.	Yes, but could be adopted with Alt 2 or 3.

Table 1-6 below summarizes the decision points remaining before the Council at this time. These considerations focus both on how the Council may choose to further refine or modify its alternatives, as well as some high-level considerations should it choose to identify a Preliminary Preferred Alternative at this time. Given the timeline imposed by the Fiscal Responsibility Act, in preparing the following table, analytical staff are trying to strike a balance by not presupposing a particular course of action for the Council.

Table 1-6 Summary of Council decision points related to each alternative and option

<table>
<tr><th>Alt/opt.</th><th>Main decision points before the Council at this meeting (April 2024)</th><th>Section for reference</th></tr>
<tr><td>1</td><td>There are no decision points applicable to finalizing Alternative 1 because the existing measures to minimize chum salmon bycatch in the Bering Sea pollock fishery would be retained.</td><td>4.1</td></tr>
<tr><td>2</td><td>Does the Council want to move forward with Alternative 2?
If the Council wanted to move forward with identifying a Preliminary Preferred Alternative at this time, it may wish to consider identifying an overall PSC limit value (option 1) and apportionment approach (option 3). The Council does not need to include an index for WAK chum abundance under option 2 of Alternative 2 in a Preliminary Preferred Alternative, but it may also choose to do so.
Does the Council want to move forward with an index for WAK chum abundance under option 2 of Alternative 2?
If yes, and because the suboptions for indices are mutually exclusive, does the Council wish to select an index to move forward at this time?
If yes, what would be the numerical values for the step-down provisions for the overall chum PSC limits?</td><td>4.2.2</td></tr>
<tr><td>3</td><td>Does the Council want to move forward with Alternative 3?
If the Council wanted to move forward with identifying a Preliminary Preferred Alternative at this time, and wanted to move forward with Alternative 3, it may wish to consider identifying an overall PSC limit under option 1 of Alternative 2 in conjunction with either option 1 or 2 of Alternative 3.
If the Council would like to move forward with Alternative 3, what is its intent for implementing the WAK chum threshold? What numerical value (e.g., upper bound of the apportionment range or another approach) would be used?
If the Council would like to move forward with Alternative 3, what would constitute the 3-year period for a sector to be eligible for the higher overall PSC limit?
If the Council would like to move forward with Alternative 3, would the Council like to modify the alternative such that the WAK chum threshold is apportioned to the sectors but not further among the inshore cooperatives and CDQ groups?</td><td>4.3</td></tr>
<tr><td>4</td><td>Does the Council want to move forward with Alternative 4?
If yes, does the Council wish to add or modify regulatory provisions based on the provisions included in the IPA proposals?</td><td>4.4</td></tr>
</table>

Next Steps for the Council

Figure 1-4 depicts a potential timeline for this action which necessarily includes Council meeting dates for illustration, but there is some flexibility in Council scheduling. **After review of this preliminary DEIS in April 2024, the Council may choose to select a Preliminary Preferred Alternative and recommend the document be released for publication by NMFS as a DEIS. The Council may also choose to schedule a second initial review in 2024 (October or December pending other Council priorities) and could expect final action to occur no later than April 2025.**

Either timeline would be in line with NOAA's interim guidance related to changes in the NEPA process imposed by the Fiscal Responsibility Act. Under either approach, the Council may also choose to modify or refine the alternatives and provide direction on its preference for future work related to this action. However, the second course of action would provide more flexibility for the Council to modify its alternatives at this time, if it feels it is needed. This is due to the fact that NEPA requires that, to the fullest extent possible, a DEIS must meet the requirements established for a Final EIS. If substantial changes to the proposed action relevant to environmental concerns are made, or significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts are presented after the DEIS is published, a supplemental DEIS may be required. However, the Final EIS may be modified from the published DEIS in response to public comments, including modifying alternatives including the proposed action; developing and evaluating alternatives not previously given serious consideration; supplementing, improving, or modifying its analyses; and making factual corrections.

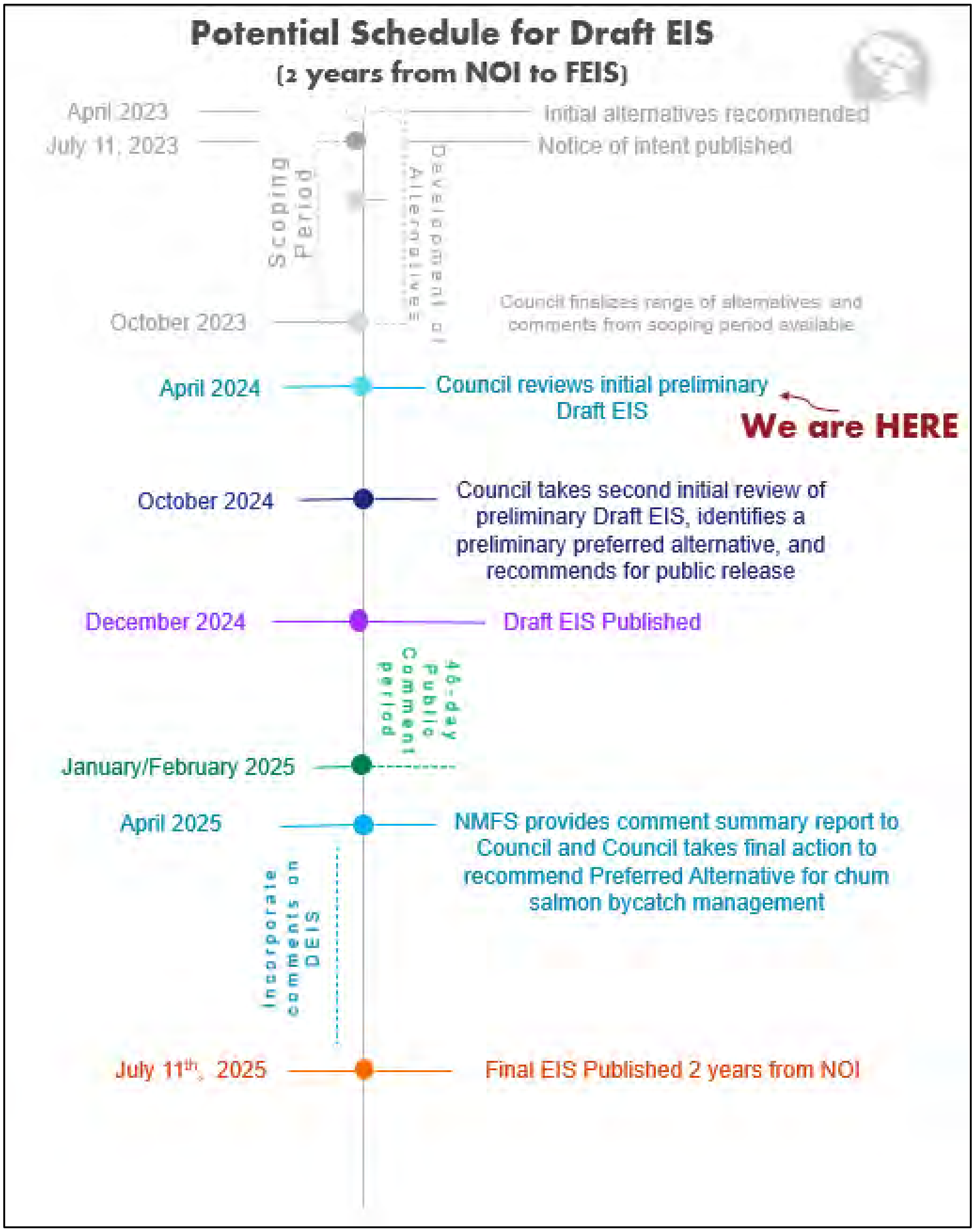

Figure 1-4 Potential Council timeline for decision-making

1 Introduction

This document is a preliminary DEIS analyzing proposed management measures to reduce chum salmon (*Oncorhynchus keta, iqalluk, aluyak, neqepik, srughot'aye*, *dog salmon*) bycatch in the Bering Sea pollock (*Gadus chalcogrammus*) fishery, PSC is also referred to as "bycatch" throughout the preliminary DEIS. For catch accounting purposes, NMFS monitors salmon PSC as either "Chinook PSC" or "non-Chinook PSC." Sockeye (*Oncorhynchus nerka),* coho (*O. kisutch),* pink (*O. gorbuscha),* and chum salmon (*O. keta)* are included in the non-Chinook PSC category, but **over 99% of the salmon bycatch in the non-Chinook category are chum salmon** (see Table 4-2). Thus, unless explicitly stated that the table of figure is using "chum salmon only," all proceeding tables or figures for "chum salmon" are using counts and information from the non-Chinook category.

Under the Magnuson-Stevens Act, the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The EEZ lies within Federal waters (i.e., those waters 3 to 200 nautical miles from shore). The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in the eight Regional Fishery Management Councils. In the Alaska Region, the North Pacific Fishery Management Council (Council) has the responsibility for preparing FMPs and FMP amendments for the marine fisheries that require conservation and management, and for submitting its recommendations to the Secretary. Upon approval by the Secretary, NMFS is charged with carrying out the Federal mandates of the Department of Commerce with regard to marine and anadromous fish.

1.1 Purpose and Need Statement for the Proposed Action

The purpose of this action is to minimize the bycatch of chum salmon in the Bering Sea pollock fishery to the extent practicable (National Standard 9 and Section 303(a)(11) of the Magnuson-Stevens Act) while balancing the other National Standards. The Council has further specified that its intent is to balance the National Standards and maintain the objectives of prior salmon bycatch management measures, namely Amendments 91 and 110 to the BSAI Groundfish FMP that established measures to reduce Chinook salmon bycatch (see Section 4.1.3).

The Council is considering this action in light of the ongoing declines in chum salmon run strength across Western and Interior Alaska. Amidst these changes in chum salmon stock abundance, the Council has received scientific reports outlining the impact of warming ocean conditions on salmon mortality at sea, as well as substantial public comment and input from Western and Interior Alaska Tribes, Tribal Consortia, and subsistence salmon fishermen describing the importance of chum salmon for the subsistence way of life which is integral to Alaska Native peoples' cultural practices, identity, and Traditional Knowledge (TK) systems. The Council has also received public comments and annual presentations from IPA representatives on the industry's efforts to minimize their bycatch of Chinook and chum salmon. Implementing additional chum salmon bycatch management measures could potentially have some positive benefit on the number of chum salmon that return to Western Alaska rivers. Any additional chum salmon returning to Alaska river systems improves the ability to meet the State's spawning escapement goals which is necessary for the long-term sustainability of chum salmon fisheries.

The Council adopted the following Purpose and Need statement to originate this action on April 8th, 2023.

> *Salmon are an important fishery resource throughout Alaska, and chum salmon that rear in the Bering Sea support subsistence, commercial, sport, and recreational fisheries throughout Western and Interior Alaska. Western and Interior Alaska salmon stocks are undergoing extreme crises and collapses, with long-running stock problems and consecutive years' failures to achieve escapement goals, U.S.-Canada fish passage treaty requirements, and subsistence harvest needs in the Yukon, Kuskokwim, and Norton Sound regions. These multi-salmon species declines have*

created adverse impacts to culture and food security and have resulted in reduced access to traditional foods and commercial salmon fisheries.

The best available science suggests that ecosystem and climate changes are the leading causes of recent chum salmon run failures; however, non-Chinook (primarily chum) salmon are taken in the Eastern Bering Sea pollock trawl fishery which reduces the amount of salmon that return to Western and Interior Alaska rivers and subsistence fisheries. It is important to acknowledge and understand all sources of chum mortality and the cumulative impact of various fishing activities. In light of the critical importance of chum salmon to Western Alaska communities and ecosystems, the Council is considering additional measures to further minimize Western Alaskan chum bycatch in the pollock fishery.

The purpose of this proposed action is to develop actions to minimize bycatch of Western Alaska origin chum salmon in the Eastern Bering Sea pollock fishery consistent with the Magnuson-Stevens Act, National Standards, and other applicable law. Consistent, annual genetics stock composition information indicates that the majority of non-Chinook bycatch in the pollock fishery is of Russian/Asian hatchery origin; therefore, alternatives should structure non-Chinook bycatch management measures around improving performance in avoiding Western Alaska chum salmon specifically.

The Council intends to consider establishing additional regulatory non-Chinook bycatch management measures that reduce Western Alaska chum bycatch; provide additional opportunities for the pollock trawl fleet to improve performance in avoiding non-Chinook salmon while maintaining the priority of the objectives of the Amendment 91 and Amendment 110 Chinook salmon bycatch avoidance program; meet and balance the requirements of the Magnuson-Stevens Act, particularly to minimize salmon bycatch to the extent practicable under National Standard 9; include the best scientific information available including Local Knowledge and Traditional Knowledge as required by National Standard 2; take into account the importance of fishery resources to fishing communities including those that are dependent on Bering Sea pollock and subsistence salmon fisheries as required under National Standard 8; and to achieve optimum yield in the BSAI groundfish fisheries on a continuing basis, in the groundfish fisheries as required under National Standard 1.

The Council adopted the following set of alternatives for analysis on October 8th, 2023.

Alternative 1: No Action or Status Quo

All action alternatives apply to the entire Bering Sea pollock B season, the season in which chum salmon are taken as bycatch (prohibited species catch or PSC).

Alternative 2: Overall bycatch (PSC) limit for chum salmon

Option 1: Chum salmon PSC limit based on historical total bycatch numbers: range of 200,000 (~35,400 Western Alaska chum salmon) to 550,000 (~97,350 Western Alaska chum salmon).[17]

Option 2: Chum salmon PSC limit triggered by Western Alaska chum salmon abundance indices based on the prior years' chum salmon abundance. Suboptions below are mutually exclusive.

> Suboption 1: Three-area chum salmon index based on Yukon River summer + Yukon River fall run abundance (950,000 + 575,000); Kuskokwim River composed of the Bethel test fishery CPUE (2,800); Norton Sound composed of summed escapement for the Snake, Nome, Eldorado, Kwiniuk, and North Rivers and total Norton Sound harvest (57,000)

[17] The values of 35,400 and 97,350 Western Alaska chum salmon are approximations of the average number of WAK chum salmon that may be encountered by the Bering Sea pollock fishery under the two PSC limits specified in the motion. They are not numerical values under consideration in Alternative 3.

If 3/3 areas are above index threshold, no chum salmon PSC limit the following year.

If 2/3 areas are above index threshold, chum salmon PSC limit the following year is X.

If 1 or no areas are above index threshold, chum salmon PSC limit the following year is X.

Suboption 2: Chum salmon index based on Yukon River summer + Yukon River fall run abundance.

Suboption 2a: Yukon River summer chum salmon (950,000)

If index is above threshold, chum salmon PSC limit the following year is X.[18]

If index is below threshold, chum salmon PSC limit the following year is X.

Suboption 2b: Yukon River summer chum salmon (950,000) and fall chum salmon (575,000)

If 2/2 areas are above index threshold, no chum salmon PSC limit the following year.

If 1 or no areas are above index threshold, chum salmon PSC limit the following year is X.

Option 3 (must be selected with Option 1 or 2): PSC limits are apportioned among CDQ, catcher processor, mothership and inshore sectors (using a blended adjusted CDQ bycatch rate as with Amendment 91) based on:

Suboption 1: historical total bycatch by sector using the 3-year average (2020 – 2022)

Suboption 2: historical total bycatch by sector using the 5-year average (2018 – 2022)

Suboption 3: pro rata 25% AFA pollock allocation and 75% historical total bycatch (2020 – 2022)

Suboption 4: pro rata based on AFA apportionment[19]

The sector limits are further apportioned at the cooperative level in proportion to each cooperative's pollock allocation. Chum salmon PSC can be transferred between sectors and among vessels within a cooperative. Reaching a limit closes the pollock fishery sector to which the limit applies.

Alternative 3: Chum salmon PSC limit with an associated Western Alaska chum salmon bycatch annual limit

Establish an annual limit of 40,000 to 53,000 Western Alaska chum salmon PSC based on the 3-year average 2020-2022 range of historical bycatch numbers and an overall chum salmon PSC limit from Alternative 2. Both the overall PSC limit and the Western Alaska chum salmon annual limit will be apportioned according to the options considered under Alternative 2.

Each sector's portion of an overall chum salmon PSC limit of (option 1: 450,000 and option 2: 550,000) is in effect. If a sector exceeds its western AK chum salmon PSC annual limit in any three of seven consecutive years, the sector's portion of an overall chum salmon PSC limit of (option 1: 200,000 and option 2: 300,000) is in effect until Western Alaska chum salmon PSC does not exceed the sector annual limit for three years.

Alternative 4: Additional regulatory requirements for Incentive Plan Agreements (IPAs) to be managed within the IPAs

Option 1: Require a chum salmon reduction plan agreement to prioritize avoidance in genetic cluster areas 1 and 2 for a specified amount of time based on two triggers being met: 1) an established chum

[18] The Council's intent with suboption 2a is that no chum salmon PSC limit would be in place if the summer chum salmon run is above the index threshold. Across all three suboptions, no chum salmon PSC limit would be in place when indices meet their respective threshold(s).

[19] While this is the exact language in the Council's October 2023 motion for suboption 4 of option 3 of Alternative 2, it is staff's understanding that the Council's intent is for staff to look at each sector's AFA pollock allocation.

salmon incidental catch rate and 2) historical genetic composition (proportion) of Western Alaska chum salmon to non-Western Alaska chum salmon.

Option 2: Additional regulatory provisions requiring Incentive Plan Agreements to utilize the most refined genetics information available to further prioritize avoidance of areas and times of highest proportion of Western Alaska and Upper/Middle Yukon chum salmon stocks.

Industry should submit a detailed proposal of IPA changes under Alternative 4 for inclusion into the Initial Review analysis prior to the February Council meeting. The proposals should consider a process to include local and traditional knowledge from Western and Interior Alaska salmon users in the development of IPA measures. The following is a list of potential measures that could be developed for incorporation into the IPAs and/or through regulation.

- Option 1 trigger 1 and trigger 2 values
- Adjusted base rates to implement a closure
- Adjusted closure area size
- Adjusted closure duration
- Application of the closures to all vessels not just those above the base rate
- Genetic data
- Genetic cluster thresholds
- Additional vessel level incentives/penalties for chum salmon avoidance

1.2 History of this Action at the Council

The following section provides an overview of the history of this action as it has been developed through the Council's decision-making process.

1.2.1 June 2022

At the June 2022 Council meeting, the Council received a range of scientific and industry reports related to changing ocean and environmental conditions impacting chum salmon survivability, industry performance on salmon bycatch avoidance, and genetic information on the salmon caught as bycatch. The Council also received specific reports on Western Alaska stock status and an updated adult equivalency (AEQ) assessment of the impact of salmon bycatch.[20] [21]

After receiving scientific reports from staff, reports from the Bering Sea pollock industry on their salmon bycatch avoidance performance under the IPAs, the reports from the Scientific and Statistical Committee (SSC) and Advisory Panel (AP), as well as substantial public comment, the Council requested the pollock industry immediately implement additional chum salmon bycatch avoidance measures in the 2022 B season pollock fishery; tasked a discussion paper updating the 2012 analysis of chum salmon bycatch and provided a list of specific information requests to be included in that discussion paper; and initiated a Salmon Bycatch Committee (SBC) composed of Tribal representatives and in-river salmon users as well as representatives from the Bering Sea pollock industry. The SBC's membership was announced following the Council's October 2022 meeting.[22]

1.2.2 December 2022

At the December 2022 Council meeting, the Council received the Report from the State of Alaska Bycatch Review Task Force from ADF&G staff, a presentation from Council staff on the chum salmon

[20] The Council's motion from October 2021 related to salmon bycatch information requests can be found here.
[21] As an accountability measure for the pollock industry, regulations at 50 CFR 679.21(f)(13) require IPA entities to annually report on their efforts to reduce Chinook and chum salmon bycatch, the effect of incentive measures at the individual vessel-level, how incentive measures impact salmon savings beyond current levels, and more.
[22] The Council's motion from the June 2022 meeting related to the salmon reports can be found here.

bycatch discussion paper, and the staff report on the SBC's inaugural meeting held in November 2022.[23] Together, these presentations provided the Council an opportunity to discuss and give direction on its preference for potential future work to minimize chum salmon bycatch in the Bering Sea pollock fishery. After receiving staff presentations, the AP report, and substantial public comment, the Council directed the SBC to develop recommendations for potential chum salmon bycatch management measures, ranging from a hard cap to additional regulatory provisions within the pollock industry's IPAs.[24] The SBC convened for two additional meetings in January 2023 and March 2023 to achieve its goals as directed by the Council.

1.2.3 April 2023

At the April 2023 Council meeting, the Council received its annual update on a range of scientific and industry reports related to salmon bycatch avoidance in the Bering Sea pollock fishery. The Council also received the staff report from the SBC's January 2023 and March 2023 meetings, including the Committee's consensus-based Purpose and Need statement. The staff report also presented the set of conceptual alternatives for chum salmon bycatch management measures developed by the SBC. It is important to note that, while there was consensus among SBC members to bring all conceptual alternatives forward to the Council for the Council's consideration, the SBC did not reach consensus on the alternatives themselves (e.g., not all SBC members supported overall chum salmon PSC limits among other concepts).

After receiving presentations from staff, reports from the Bering Sea pollock industry on their performance to avoid salmon bycatch under the IPAs, the AP report, as well as substantial public comment, the Council adopted a purpose and need statement as well as a set of preliminary alternatives to minimize chum salmon bycatch in the Bering Sea pollock fishery with a particular priority on minimizing the bycatch of WAK origin chum salmon. The Council's supporting rationale clarified its intent to move forward the conceptual alternatives from the SBC and the AP (as presented in the AP report at the April 2023 meeting) which are consistent with the Council's Purpose and Need statement. The Council also clarified that the Preliminary Review analysis was intended to provide the Council and the public with more information to help the Council determine a reasonable range of alternatives.

1.2.4 October 2023

At the October 2023 Council meeting, the Council received a presentation from analytical staff on the Preliminary Review analysis, reports from the Scientific and Statistical Committee and the Advisory Panel, as well as substantial public testimony. Public testimony provided to the Council input on the importance of chum salmon for the subsistence way of life in relation to the cultural and spiritual practices of Tribal members and Alaska Native communities. Public comments also described the importance of the Bering Sea pollock fishery to coastal Western Alaska communities that receive economic and social benefits from processing pollock or through their participation in the Community Development Quota Program. Representatives of the pollock industry described recent and ongoing efforts to avoid WAK chum salmon while fishing for pollock.

After receiving staff presentations, advisory body reports, and public testimony, the Council approved analyzing changes to chum salmon bycatch management measures. The range of alternatives approved for analysis were modified and revised from the preliminary set of alternatives adopted at the April 2023 Council meeting. The finalized set of alternatives approved for analysis of potential environmental, economic, and social impacts in this preliminary DEIS were selected to meet the purpose and need statement. In October, the Council did not modify the purpose and need statement adopted in April 2023.[25]

[23] The State of Alaska Bycatch Review Task Force Report is available here.
[24] The Council's motion from the December 2022 meeting can be found here.
[25] The Council's motion from the October 2023 meeting can be found here.

2 Description of the Bering Sea Pollock Fishery

This chapter provides an overview of the Bering Sea pollock fishery because it is the directly regulated entity under the proposed action. The Bering Sea pollock fishery is prosecuted by vessels using pelagic trawl gear and is managed by regulations that limit seasonal catches of pollock (see 50 CFR 679.23(e)(2)). The NMFS Observer Program provides near real-time catch data during the season and vessels operate within well-defined catch limits. The Bering Sea pollock fishery is the largest U.S. fishery by volume. From 2011 through 2022, the average annual harvest of Bering Sea pollock by all sectors was 1.28 million mt (see Table 2-4). Bering Sea pollock is typically not sold fresh but instead processed into a variety of product forms, the most significant of which are fillets, surimi, and roe. In 2021 and 2022, the total gross first wholesale value of the Bering Sea pollock fishery harvest was $1.5 billion.[26]

2.1 Description of the Action Area

Walleye pollock are a broadly distributed species throughout the North Pacific with the largest concentrations found in the eastern Bering Sea. The action area is the Bering Sea sub-area of the BSAI management area. Within the BSAI management area, pollock is managed as three separate units: the Bering Sea subarea, the Aleutian Islands subarea, and the Bogoslof District. Separate overfishing limits (OFL), acceptable biological catch limits (ABC), and total allowable catch (TAC) limits are specified annually for eastern Bering Sea pollock, Aleutian Islands pollock, and Bogoslof pollock.[27]

The proposed action is solely addressing management of the Bering Sea pollock fishery and would not affect the pollock fishery in the Aleutian Islands sub-area. However, the impacts of the proposed action may also occur outside the action area (i.e., Bering Sea) in the freshwater streams of origin for the chum salmon caught as bycatch, and in the chum salmon migration routes between their streams of origin and the Bering Sea (see

Figure 2-1). Chum salmon caught as bycatch in the Bering Sea pollock fishery originate from Asia, Alaska, Canada, and portions of the Western United States.

[26] Source: NMFS Catch Accounting System, compiled by AKFIN; BS_PLCK_VAL(7-17-23).
[27] Under 50 CFR 679.22(a)(7)(i), directed fishing for pollock is not allowed in the Bogoslof District and the entire TAC is allocated as an incidental catch allowance for pollock harvested in other groundfish directed fisheries that occur in this area.

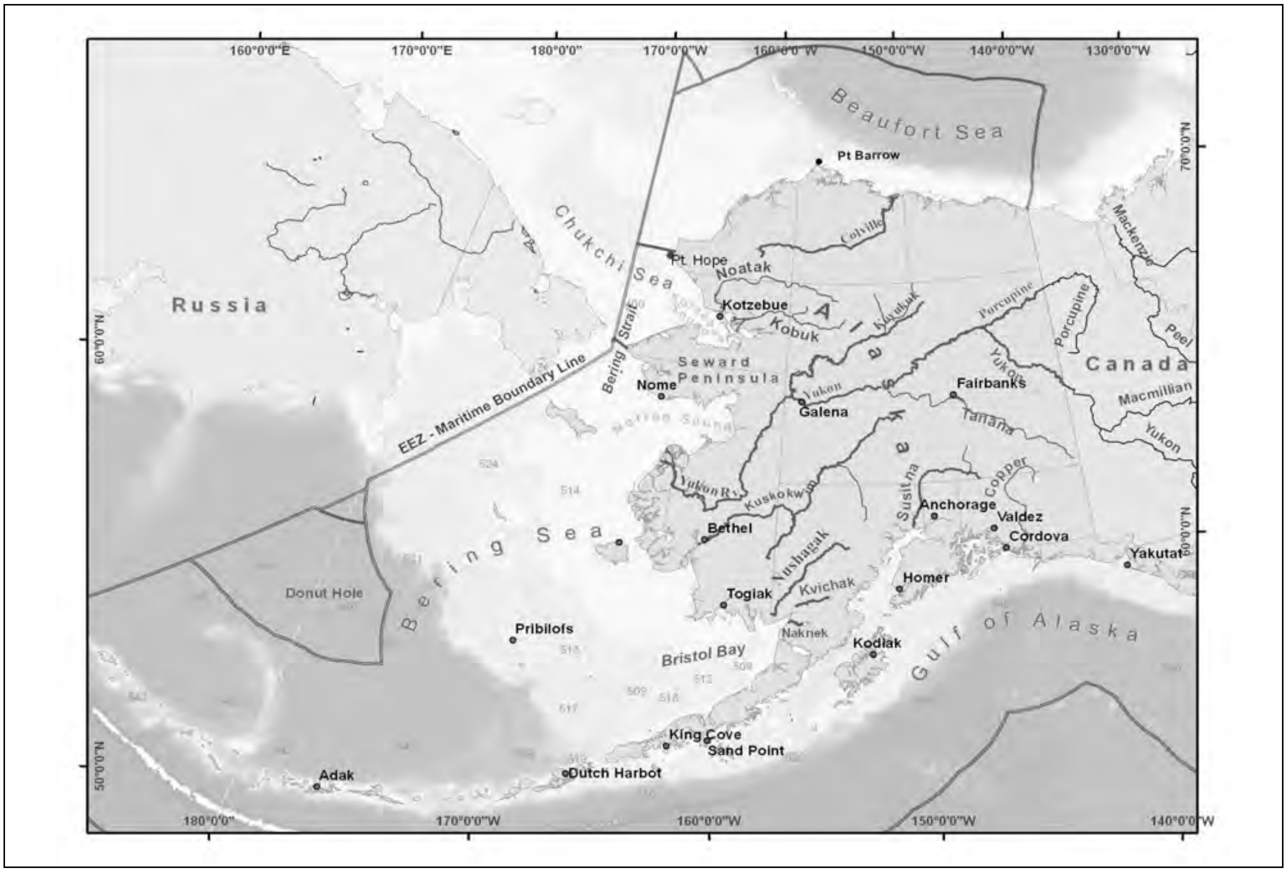

Figure 2-1 Map of the Bering Sea and major salmon producing rivers

2.2 Allocations and Fishing Seasons

The management structure of the Bering Sea pollock fishery substantially changed in 1998 with the passage of the American Fisheries Act (AFA).[28] Prior to the AFA, vessel participation in the Bering Sea pollock fishery was restricted by the existing limited license permit program which endorsed BSAI groundfish licenses by gear type but not by species. Any trawl vessel could enter the pollock fishery if they had a trawl limited license permit. The AFA identified the vessels and processors eligible to participate in the Bering Sea pollock fishery, and it allocated specific percentages of the total allowable catch (TAC) among four different fishery sectors (see sections 206(a) and (b) of the AFA).

Each year, the Bering Sea pollock TAC is set through the Council's harvest specifications process and NMFS allocates the Bering Sea pollock TAC among the four sectors. First, 10% of the TAC is allocated to the CDQ program. After the CDQ pollock allocation is subtracted from the TAC, an amount determined by the Regional Administrator is subtracted from the pollock TAC for the incidental catch of pollock in other groundfish fisheries (this amount is typically around 4% of the TAC). The "directed fishing allowance" is the remaining amount of pollock, and it is allocated to the inshore catcher vessel (CV) sector (50%), the catcher processor (CP) sector (40%), and the mothership sector (10%). The CDQ program's pollock allocation is further apportioned among the six CDQ entities commonly known as

[28] The AFA specified ownership requirements, buyout provisions, eligible participants, fishery cooperatives, excessive shares (i.e., no entity—individual, corporation, through a cooperative, or otherwise—can harvest more than 17.5% of the directed fishing allowance), and sideboard provisions (i.e., protections for other fisheries from potential negative spillover effects of the AFA).

"CDQ groups." The inshore sector's pollock allocation is further apportioned among the cooperatives and in applicable years, the inshore open access fishery.

Before the pollock TAC and subsequent allocations among the four fishery sectors are established, the Council and NMFS consider social and economic factors, management uncertainty, and the overall 2 million mt optimum yield limit on the maximum amount of TAC that can be specified for all BSAI groundfish. NMFS will close the CP or mothership sectors with an inseason management action to ensure sector allocations of pollock are not exceeded. NMFS has not needed to take inseason action to close these sectors, however, because the fishing cooperatives manage their respective allocations and stop fishing before an allocation is reached. Regulations prohibit the CDQ and inshore sector from exceeding their pollock allocation (see 50 CFR 679.7(d)(3)).

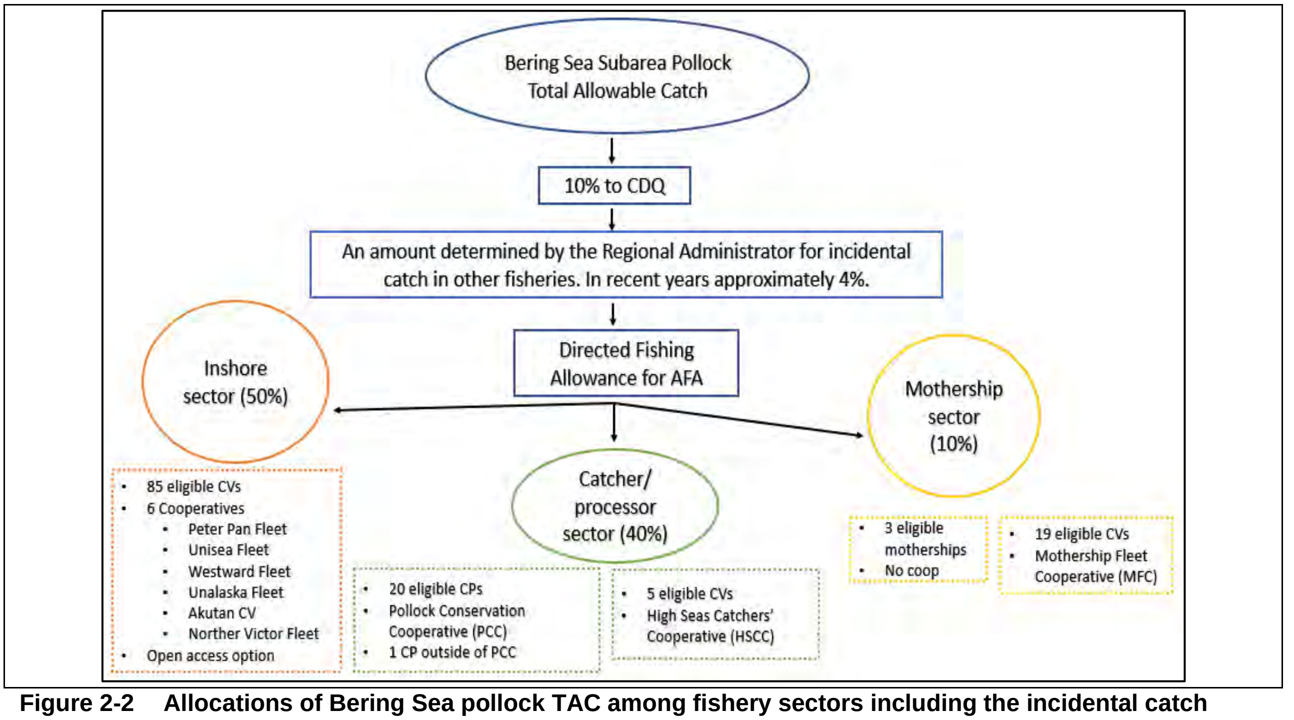

Figure 2-2 Allocations of Bering Sea pollock TAC among fishery sectors including the incidental catch allowance

Notes: Vessel counts are based on 2022 data on AFA vessel eligibility from NMFS Restricted Access Management available at https://www.fisheries.noaa.gov/alaska/commercial-fishing/permits-and-licenses-issued-alaska#american-fisheries-act

The Bering Sea pollock TAC is also apportioned seasonally: 45% to the A season (occurring January 20 to June 10) and 55% to the B season (occurring June 10 to November 1). Prior to Amendment 110 to the BSAI Groundfish FMP, 40% of the Bering Sea pollock TAC was apportioned in the A season and 60% was apportioned in the B season. A purpose of this action was to provide additional flexibility in the seasonal apportionments of the Bering Sea pollock TAC to allow for more pollock to be harvested if desirable in the A season when Chinook salmon bycatch rates have historically been lower.

The Bering Sea pollock fishery targets pre-spawning pollock for their roe in the A season. Fishing typically starts near the regulatory opening and extends into early to mid-April. The B season fishery focuses on targeting pollock for fillet and surimi markets, and the fleet harvests most of the B season TAC during June through early October. Fishing effort in the A season is usually concentrated north and west of Unimak Island, depending on ice conditions and fish distribution. However, there has historically been fishing effort along the Bering Sea shelf edge at the 100-meter depth contour and deeper between Unimak Island and the Pribilof Islands, although the general pattern has varied over time (Ianelli et al., 2022). Fishing effort in the B season is more dispersed with recent years' fishing effort occurring in the southeast portion of the Bering Sea shelf.

Figure 2-3 helps the reader to visualize the location of the Bering Sea pollock fishery from 2011-2022. It does not, however, show the density of pollock harvests by location in each season. The spatial distribution of the A season and B season pollock fisheries is mapped over Alaska Department of Fish and Game (ADF&G) groundfish statistical areas. Those statistical areas where pollock catch was recorded by three or more vessels are highlighted blue. The Catcher Vessel Operational Area (CVOA) is highlighted in red and the 250-meter bathymetry line indicating the Bering Sea shelf edge is shown in a darker blue.[29]

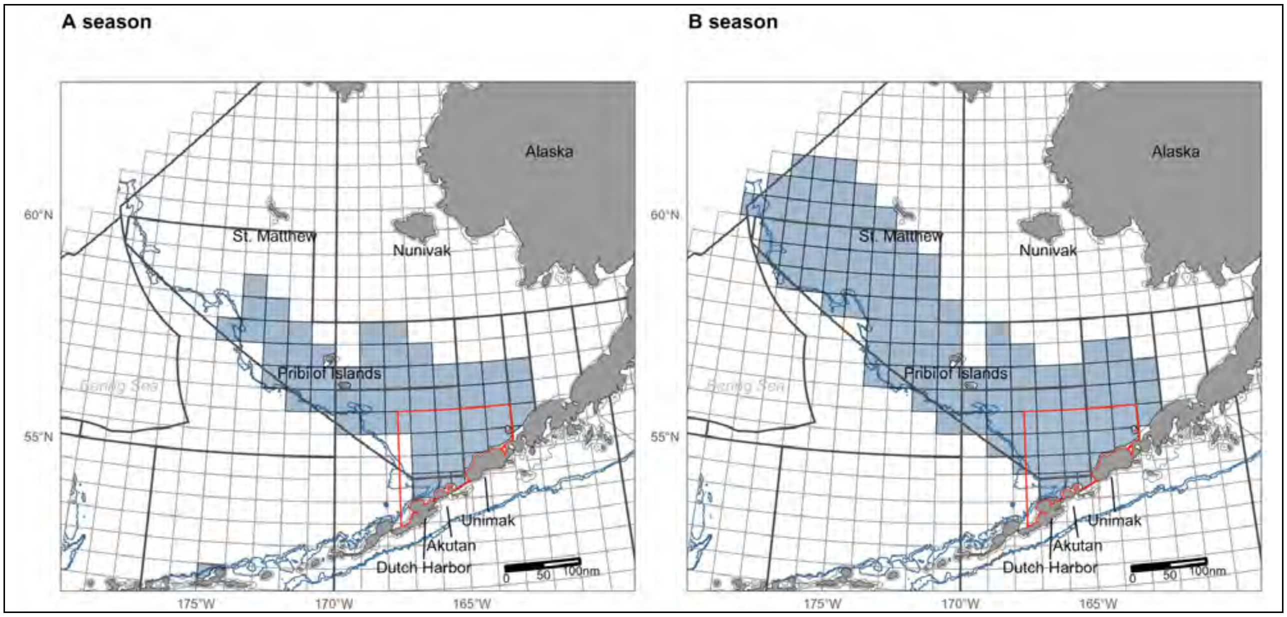

Figure 2-3 Distribution of Bering Sea pollock fishing effort in the A and B seasons, 2011 through 2022

Regulations prohibit reallocations of pollock among the fishery sectors, but NMFS may add any remaining portion of a sector's A season allowance to its B season allowance (see 50 CFR 679.20(a)(5)(i)(B)). This practice is typically referred to as a "rollover." Additionally, regulations at 50 CFR 629.20(a)(5)(iii)(B)(4) allow for the Regional Administrator to reallocate some or all of the projected unused Aleutian Island directed pollock fishery allocation or Aleutian Island CDQ pollock to the Bering Sea subarea directed pollock fishery.

Section 210(e)(1) of the AFA restricts an individual, corporation, or other entity from harvesting more than 17.5% of the pollock available in the directed fishing allowance. This limit is codified at 50 CFR 679.20)(a)(5)(i)(A)(6). Each year, NMFS publishes the limit in the annual harvest specifications. The limit is subject to revision on an in-season basis if NMFS reallocates unharvested amounts of the Bering Sea incidental catch allowance or Aleutian Islands pollock to the directed fishing allowance in the Bering Sea.

As of January 1, 2000, all vessels and processors aiming to participate in the non-CDQ Bering Sea pollock fishery are required to have valid AFA permits on board the vessel or at the processing plant. AFA permits are required even for vessels and processors specifically named in the AFA and are required in addition to any other Federal or State permits. With the exceptions of applications for inshore vessel cooperatives and for replacement vessels, the AFA permit program had a one-time application deadline of December 1, 2000, for AFA vessel and processor permits. Applications for AFA vessel or processor

[29] The CVOA was established under Amendment 18 to the BSAI Groundfish FMP to limit access to pollock within the area to CVs. CPs are prohibited from directed fishing for pollock in the CVOA during B season unless they are participating in the CDQ pollock fishery. The CVOA is defined as the area of the BSAI east of 167° 30' W. longitude, west of 163° W. longitude, south of 56° N. latitude, and north of the Aleutian Islands.

permits were not accepted after this date, and any vessels or processors for which an application had not been received by this date became permanently ineligible to receive AFA permits.

2.3 CDQ Program

The Council established the CDQ Program in 1992 and set the programmatic allocation of Bering Sea pollock was 7.5% of the overall TAC (Amendment 18 to the BSAI Groundfish FMP); the AFA increased the CDQ Program's pollock allocation to 10%. The CDQ Program is an economic development program associated with the Federally managed fisheries in the BSAI Management Area. The purpose of the CDQ Program is to provide eligible communities across coastal Western Alaska opportunities to participate and invest in BSAI Federally managed commercial fisheries, support economic development in these communities, alleviate poverty and provide economic and social benefits for residents across coastal Western Alaska, and to achieve sustainable and diversified local economies in this region. A total of 65 coastal Western Alaska communities participate in the CDQ Program through six nonprofit corporations commonly referred to as "CDQ groups." The CDQ groups are as follows: the Aleutian Pribilof Island Community Development Association (APICDA), the Bristol Bay Economic Development Corporation (BBEDC), the Central Bering Sea Fishermen's Association (CBSFA), the Coastal Villages Region Fund (CVRF), the Norton Sound Economic Development Corporation (NSEDC), and the Yukon Delta Fisheries Development Association (YDFDA).

NMFS apportions the CDQ Program's pollock allocation (10%) among the six CDQ groups. Until 2005, NMFS made allocations among the groups based on recommendations from the State of Alaska. The 2006 revisions to the Magnuson-Stevens Act (see section 305(i)(1)(B)) set the CDQ Program's allocations at the 2005 levels but required the State of Alaska to periodically evaluate the performance (and continued eligibility) of each CDQ group. To harvest their quota, CDQ groups typically sell or lease their pollock to harvesting partners including vessels that may be partially owned by the CDQ group. CDQ groups are not required to partner with AFA-permitted vessels to harvest CDQ pollock, but historically CDQ pollock has been harvested by these vessels. CDQ pollock is primarily harvested by CPs and occasionally by CVs delivering to a mothership.

Table 2-1 CDQ group allocations of Bering Sea (BS) pollock and count of communities

CDQ group	APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFDA	Program total
BS Pollock	14%	21%	5%	24%	22%	14%	100%
Communities	6	17	1	20	15	6	65

Source: https://www.fisheries.noaa.gov/s3/2023-04/2023annualmatrix.pdf
Notes: Unalaska/Dutch Harbor is located in the Aleutians West Census Area, but it was not eligible to be a CDQ community at the start of the program. The city is now an ex officio member of APICDA, and its residents are eligible for training, education, and employment opportunities offered by the group.

2.4 Inshore Sector and Shorebased Processing Component

In 2022, 85 CVs were eligible to participate in the inshore sector and deliver to shorebased processors.[30] The inshore CV sector has the highest number of participants (i.e., vessels), and these vessels are more limited in where they can target pollock. The operating range of an inshore CV is largely determined by their hold capacity, whether the vessel has a refrigerated seawater hold cooling systems, and processor delivery requirements. Processors require CVs to make deliveries within 48 hours of their first tow of fish (i.e., gear deployment) to maintain high quality product. As a result, these vessels will target areas with good pollock catch per unit effort (CPUE) and quality while balancing the need to fish as close to the processing plant as possible (Strong & Criddle 2013).

[30] Each inshore CV must have an AFA permit with an inshore endorsement, an LLP permit authorizing the vessel to engage in trawl fishing for pollock in the Bering Sea, and no sanctions on the AFA license of LLP permit.

As described previously, the pollock sectors are organized under fishing cooperatives. A purpose of these cooperatives is to further subdivide each sector or inshore cooperative's Bering Sea pollock allocation among vessels in the sector through private contractual agreements. The cooperatives manage their pollock allocations to ensure individual vessels and companies do not harvest more than their quota of pollock. The cooperatives also facilitate transfers of pollock among their cooperative members and enforce contract provisions. The AFA (section 210(b)) only allows inshore cooperatives to form if an annual contract is signed by the owners of 80% or more of the inshore CVs that delivered the majority of their pollock for processing to a shorebased processor in the prior year.

Cooperatives operating in the inshore sector are required to submit copies of their contracts to NMFS on December 1 each year before the year in which fishing under the contract will occur. The December 1 deadline is necessary because the inshore sector cooperative allocations must be included in the BSAI interim harvest specifications that are usually published before January 1 each year. This is an important nuance as NMFS makes suballocations of pollock to each inshore cooperative. The cooperative contracts are binding agreements among members that govern allocations of pollock for harvest by members, vessel/license use and transfers, sideboard compliance, and identify the primary shorebased processor that will receive at least 90% of the pollock deliveries from CVs in the cooperative. The intent of allowing inshore processors to partner with a cooperative was to provide a structure for processors to share in the expected economic benefits of the AFA, including shifts to higher value products and improved utilization (Strong & Criddle 2013).

Eight inshore processors met the AFA eligibility criteria, of which six are shorebased processors – UniSea Seafoods, Westward Seafoods, and Alyeska Seafoods in Unalaska/Dutch Harbor; Trident Seafoods in Akutan, Trident Seafoods in Sand Point, and Peter Pan Seafoods in King Cove.[31] Two AFA eligible inshore processors are floating processors—the *Arctic Enterprise* owned by Trident Seafoods, and the *Northern Victor* owned by Westward Seafoods (previously owned by Icicle Seafoods). Since the inshore sector began operating under the cooperative system in 2000, there have been seven inshore cooperatives formed between inshore CVs and their partner processors: the Akutan Catcher Vessel Association, Arctic Enterprise Association, Northern Victor Fleet Cooperative, Peter Pan Fleet Cooperative, Unalaska Fleet Cooperative, UniSea Fleet Cooperative, and the Westward Fleet Cooperative. The Arctic Enterprise Association has not been active since 2008.

[31] Although Trident's Sand Point facility qualified as an AFA inshore processor, it is not partnered with a cooperative. Trident Seafoods' Sand Point Plant has been characterized as more of a "relief valve" for the company's plant in Akutan during the pre-AFA race-for-fish years than as a primary delivery destination for Bering Sea pollock. Despite not being partnered with a cooperative, the plant still has access to up to 10% of the Bering Sea pollock allocated to individual cooperatives, along with Bering Sea pollock harvested in the inshore open access fishery. While it is common for some deliveries of Bering Sea pollock to be made at Trident Seafoods' Sand Point facility, within the analyzed period (2011-2022), no vessels made deliveries of Bering Sea pollock during the B season fishery.

Table 2-2 Summary of information for inshore sector cooperatives based on 2022 information

Inshore Cooperative	Number of member vessels	Bering Sea pollock allocation	Processor name	Processor owner	Processor location
Akutan Catcher Vessel Association	34	33.788%	Trident Seafoods Corp.	Trident Seafoods Corp.	Akutan
Northern Victor Fleet Cooperative	10	10.773%	Northern Victor	Westward Seafoods Inc.	Unalaska/Dutch Harbor
Peter Pan Fleet Cooperative	8	2.512%	Peter Pan Seafoods	Peter Pan Seafoods	King Cove
Unalaska Fleet Cooperative	9	11.454%	Alyeska Seafoods	Alyeska Seafoods Inc.	Unalaska/Dutch Harbor
UniSea Fleet Cooperative	12	22.094%	UniSea Inc.	UniSea Inc.	Unalaska/Dutch Harbor
Westward Fleet Cooperative	9	19.380%	Westward Seafoods	Westward Seafoods Inc.	Unalaska/Dutch Harbor

Source: AFA Cooperative reports are available here; information on AFA permitting and reporting is available from NMFS here; 2022 Bering Sea subarea inshore cooperative pollock allocations are available from NMFS here.

The amount of Bering Sea pollock a cooperative is suballocated by NMFS from the inshore sector's allocation is based on the catch history of the cooperative's member vessels. Under 50 CFR 679.2(a), an inshore cooperative that applies for and receives an AFA inshore cooperative fishing permit under 50 CFR 679.4(1)(6) receives an annual pollock allocation amount based on the two years with the highest levels of non-CDQ pollock landings from 1995 through 1997. Each inshore cooperative is responsible for managing its pollock and PSC allocations such that they are not exceeded.

Inshore CVs are not required to join a cooperative, and those vessels that do not join a cooperative are managed by NMFS under the inshore open access fishery (as will be the case for vessels leaving the Peter Pan Fleet Cooperative in 2024). Vessels that participate in the open access fishery can deliver pollock to the inshore processor of their choice, but they could face a scenario where they race to fish the open access fishery allocation. There was an open access fishery in 2023 (one vessel participating).

An important dynamic to note is that the Peter Pan Fleet Cooperative is included in this analysis because the cooperative operated during the analyzed period constituting the status quo (2011-2022). However, the Peter Pan Fleet Cooperative did not apply for an AFA Inshore Cooperative Permit for the 2024 Bering Sea pollock fishery. As such, this cooperative will not be active in 2024 and potentially future years (although this is uncertain). This means the Peter Pan Fleet Cooperative is included in this analysis as part of the status quo, but the characterization of potential impacts herein may not reflect the reality of the current fishing year (2024) nor future years the fishery could operate under new chum salmon bycatch regulations. It is staff's understanding that the vessels leaving the Peter Pan Fleet Cooperative will fish in the inshore open access fishery in 2024 and transition to a new market and cooperative in 2025. Inshore CVs are free to change cooperatives, but a vessel that wants to do so must fish in the inshore open access fishery for one year before it can join a new cooperative.[32]

[32] Regulations also permit other approaches to switching cooperatives. For example, a cooperative (as a whole) can deliver up to 10% of its pollock to another processor in any year. If the cooperative designates a single vessel to make those deliveries, it is possible that the vessel could deliver the majority of its product to another processor and could switch processors in the following year without having to first participate in the open access fishery (National Marine Fisheries Service 2002).

2.5 Catcher Processor Sector

In 2023, there were 20 CPs eligible to harvest Bering Sea pollock and five CVs were eligible to deliver to these CPs. Under the AFA, the CP sector was allowed to choose one of two options: 1) all participants could form a single cooperative that includes both CPs and CVs delivering to CPs or 2) CPs and CVs could form separate cooperatives and enter into an intercooperative agreement. The latter structure was adopted—the Pollock Conservation Cooperative contains all eligible CPs in the Bering Sea pollock fishery, and the High Seas Catchers' Cooperative contains all CVs eligible to deliver pollock to CPs. The AFA requires NMFS to make a separate allocation of no less than 8.5% of the CP sector's allocation available to CVs delivering to CPs (see also 50 CFR 679.20(a)(5)(i)(A)(*4*)(*ii*)). While CVs formed their own cooperative, it has generally been more profitable for members of the High Seas Catchers' Cooperative to lease or sell their quota to the Pollock Conservation Cooperative and its members (Strong & Criddle 2013).[33]

The AFA listed 20 eligible CPs by name. One CP – the F/V *Ocean Peace* – was not listed in the AFA but met the minimum historical harvest levels to qualify under the AFA. The AFA stipulates that harvests of CPs that are not explicitly listed in the Act (i.e., the *Ocean Peace*) are limited to .5% of the CP sector's allocation. The F/V *Ocean Peace* is not a member of the Pollock Conservation Cooperative but is a member of the CP sector's IPA.

After NMFS allocates the CP sector 40% of the Bering Sea pollock TAC on an annual basis (after allocations to the CDQ program and ICA are made), the Pollock Conservation Cooperative divides the pollock allocations among members as determined by the private contractual agreement. However, NMFS does monitor the pollock harvest by the CP sector and retains the authority to close directed fishing for pollock if vessels in the sector continue to fish once the sector's seasonal allocation of pollock has been harvested.

2.6 Mothership Sector

There are 19 CVs eligible to deliver pollock to motherships under the AFA and have formed a cooperative called the Mothership Fleet Cooperative. Thirteen CVs are "dual qualified" for both the mothership and inshore sector pollock fisheries. These CVs can deliver to an inshore processor or a mothership. The Mothership Fleet Cooperative does not include the owners of the AFA eligible motherships (two motherships operated in the 2022 Bering Sea pollock fishery). Under the contractual terms of the Mothership Fleet Cooperative, CVs can deliver their pollock to any of the eligible motherships, although CV ownership in a particular mothership often dictates where they deliver their harvests.

Like the CP sector, the Mothership Fleet Cooperative subdivides their respective pollock allocations among members, but NMFS monitors the pollock harvest and retains the authority to close directed fishing for pollock by the sector if vessels in that sector continue to fish once the sector's seasonal allocation of pollock has been harvested.

2.7 Summary of Recent Participation in the Bering Sea Pollock Fishery

The following section provides a high-level overview of recent participation levels in the Bering Sea pollock fishery (Table 2-3) and landings (Table 2-4) by sector using fishery dependent data from 2011 through 2022. During this period, the annual average count of vessels participating in the Bering Sea pollock fishery across all sectors is 101, ranging from a high of 107 vessels in 2012 and 2014 to a low of

[33] The PCC and HSCC Joint Annual Report, 2022 is available here: https://www.npfmc.org/wp-content/PDFdocuments/catch_shares/CoopRpts2022/PCC_HSCC_AFA.pdf

94 vessels in 2022. The inshore CV sector has consistently had the greatest number of participating vessels; 74 vessels participating in 2021 and 71 vessels participating in 2022. The CDQ pollock fishery has primarily been harvested by CPs except for 2016 when one CV delivering to a mothership participated in the fishery. The Bering Sea pollock sectors have been able to harvest nearly all the fishery's TAC since 2011 (as well as prior years) (see Table 2-5).

Table 2-3 Number of vessels by sector participating in the Bering Sea pollock fishery, 2011-2022

Year	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***
CDQ	15	16	15	16	16	15	16	15	13	12	11	12
CP	15	14	15	16	14	14	14	14	13	13	13	13
Inshore	80	81	79	78	79	81	77	73	73	76	74	71
Mothership	14	15	14	15	15	15	14	14	15	15	14	13
Total	**104**	**107**	**103**	**107**	**102**	**104**	**103**	**99**	**96**	**98**	**97**	**94**

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA; AFA_Vessels_Landings((12-14-23)
Notes: Vessels counts are not additive. There is overlap between CVs that are dual-qualified to participate in the inshore and mothership sectors, and the CPs harvesting CDQ pollock and AFA pollock.

Table 2-4 Landings (mt) of Bering Sea pollock by sector, 2011-2022

Year	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***
CDQ	118,698	123,150	127,853	130,422	134,115	136,739	137,578	139,080	142,909	129,263	140,436	111,649
CP	440,516	437,924	454,758	454,274	466,048	475,876	481,343	483,713	499,181	477,602	488,653	384,364
Inshore	527,643	534,361	553,412	560,978	579,198	588,342	594,783	603,362	617,573	610,427	602,437	476,048
Mothership	112,220	107,298	111,874	112,025	115,513	117,636	119,302	120,312	124,364	125,017	121,752	95,490
Total	1,199,078	1,202,733	1,247,897	1,257,699	1,294,874	1,318,593	1,333,006	1,346,466	1,384,026	1,342,309	1,353,279	1,067,550

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA; AFA_Vessels_Landings(12-14-23)

Table 2-5 Total Bering Sea pollock harvest (million mt), Bering Sea pollock TAC (million mt), and the percent of TAC utilized, 2011-2022

Year	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***
Harvest	1.20	1.19	1.24	1.25	1.29	1.31	1.33	1.34	1.38	1.34	1.35	1.06
TAC	1.25	1.20	1.25	1.27	1.31	1.34	1.35	1.36	1.40	1.42	1.38	1.1
% Utilized	96%	99%	99%	98%	98%	98%	99%	99%	99%	94%	98%	98%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA; AFA_Vessels_Landings(12-14-23)

Table 2-6 B season pollock harvest (mt), B season pollock allocation, and the percent of B season allocation utilized, 2011-2022

Year	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***
Harvest	681,485	705,761	738,094	747,358	773,077	790,155	755,087	751,131	769,938	702,426	747,818	586,982
Initial B Season Allocation	730,918	700,560	736,920	745,128	757,704	775,056	713,785	724,049	742,764	757,651	729,025	583,825

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA; BS Pollock Allocations
Notes: The initial B season pollock allocation shown above does not include amounts of reallocated pollock from the Bering Sea or Aleutian Islands Incidental Catch Allowances or any rolled over amount of A season pollock.

3 Overview of Chum Salmon Fisheries Management in Alaska

This chapter of the DEIS provides information for the reader on chum salmon fisheries management in Alaska. As stated in the Council's Purpose and Need statement, the Council is considering additional management measures to further minimize Western Alaska chum salmon bycatch in the Bering Sea pollock fishery (see also Section 1.1 above). As such, this chapter provides important context for the reader that is referenced throughout subsequent chapters of this document and the corresponding SIA.

The Council does not hold inseason or in-river management authority for Western Alaska chum salmon fisheries. ADF&G, under the direction of the Alaska Board of Fisheries (BOF), manages subsistence, personal use, sport, and commercial chum salmon harvests in waters within the State of Alaska out to the three-mile limit. ADF&G also manages some commercial and sport fisheries for salmon in the EEZ, in accordance with the Pacific Salmon Treaty and other federal law, where management is either delegated to the state through the FMP or fisheries are not included in the FMP.

Under Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA), the federal government (and rural residents with local knowledge of the region) may (cooperatively) manage rural subsistence salmon fisheries within public lands and waters for the conservation of the fishery and the continuation of opportunity for a subsistence way of life by rural residents (16 U.S.C § 3111). A dual state-federal subsistence salmon management system thus exists in Alaska, including in recent years on the Kuskokwim River (by U.S. Fish and Wildlife Service since 2014, and in cooperation with the Kuskokwim River Inter-Tribal Fish Commission since 2016) and the Yukon River (by U.S. Fish and Wildlife Service in 2023).

The first priority for management is to meet spawning escapement goals in order to sustain salmon resources for future generations. After conservation, the highest priority use under both state and federal law is subsistence. Salmon surplus above escapement needs and subsistence uses are made available for other uses, as discussed below.

3.1 Description of Management for Chum Salmon Stocks

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

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

1. wild salmon stocks and their habitats should be maintained at levels of resource productivity that assure sustained yields;
2. salmon fisheries shall be managed to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning;
3. effective management systems should be established and applied to regulate human activities that affect salmon;
4. public support and involvement for sustained use and protection of salmon resources should be sought and encouraged; and

5. in the face of uncertainty, salmon stocks, fisheries, artificial propagation, and essential habitats shall 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 BOF must review fishery management plans or create new ones. If a salmon stock concern is identified in the course of review, the management plan will contain measures, including needed research, habitat improvements, or new regulations, to address the concern.

A healthy salmon stock is defined as a stock of salmon that has annual runs typically of a size to meet escapement goals and a potential harvestable surplus to support optimum or maximum yield (5 AAC 39.222(f)(16). In contrast, a depleted salmon stock means a salmon stock for which there is a conservation concern (5 AAC 39.222(f)(7). 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)(35)). Yield concerns arise from a chronic inability to maintain expected yields or harvestable surpluses above escapement needs. Management concerns are precipitated by a chronic inability to maintain escapements within the bounds, or above the lower bound of an established goal. A conservation concern may arise from a chronic inability to maintain escapements above a sustained escapement threshold (defined below).

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

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

A **SEG** means a level of escapement, indicated by an index or an escapement estimate, which is known to provide for sustained yield over a five-to-ten-year period. An SEG is used in situations where a BEG cannot be estimated or managed for. The SEG is the primary management objective for the escapement, unless an optimal escapement or in-river run goal has been adopted by the BOF. The SEG will be developed from the best available biological information and should be scientifically defensible on the basis of that information. The SEG will be stated as a range (SEG range) or a lower bound (lower bound SEG) that takes into account data uncertainty. The SEG will be determined by ADF&G and the department will seek to maintain escapements within the bounds of the SEG range or above the level of a lower bound SEG (5 AAC 39.222(f)(36)).

A **SET** means a threshold level of escapement, below which the ability of the salmon stock to sustain itself is jeopardized. In practice, SET can be estimated based on lower ranges of historical escapement levels, for which the salmon stock has consistently demonstrated the ability to sustain itself. The SET is lower than the lower bound of the BEG and also lower than the lower bound of the SEG. The SET is established by ADF&G in consultation with the BOF for salmon stocks of management or conservation concern (5 AAC 39.222(f)(39)).

An **OEG** means a specific management objective for salmon escapement that considers biological and allocative factors and may differ from the SEG or BEG. An OEG will be sustainable and may be expressed as a range with the lower bound above the level of SET. ADF&G will seek to maintain evenly distributed escapements within the bounds of the OEG (5 AAC 39.222(f)(25)).

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

Table 3-1 Arctic-Yukon-Kuskokwim Region chum salmon escapement goals and escapements, 2013 to 2021

	2021 Goal Range			Initial	Escapement								
System	Lower	Upper	Type	Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
CHUM SALMON													
Kuskokwim Area													
Middle Fork Goodnews River	12,000		LB SEG	2005	27,692	11,518	11,475	33,671	44,876	NS	38,072	NS	NS
Kogrukluk River	15,000	49,000	SEG	2005	65,648	30,697	33,091	45,234	85,793	52,937	71,006	19,020	4,153
Yukon River Summer Chum													
Yukon River Drainage[a]	500,000	1,200,000	BEG	2016				1,866,200	2,997,200	1,432,100	1,398,400	705,880	153,120
East Fork Andreafsky River	40,000		LB SEG	2010	61,234	37,793	48,809	50,362	55,532	36,330	49,881	NS	2,531
Anvik River	350,000	700,000	BEG	2005	571,690	399,796	374,968	337,821	415,139	305,098	249,014	NS	18,819
Yukon River Fall Chum													
Yukon River Drainage[a]	300,000	600,000	SEG	2010	854,000	741,000	541,000	832,000	1,706,000	654,000	528,000	194,000	94,525
Delta River	7,000	20,000	SEG	2019	32,000	32,000	33,000	22,000	49,000	40,000	52,000	9,900	1,613
Teedriinjik (Chandalar) River	85,000	234,000	SEG	2019	253,000	221,000	164,000	295,000	509,000	170,000	116,000	NS	21,162
Fishing Branch River (Canada)[b]	22,000	49,000	agreement	2008[c]	25,000	7,000	8,000	29,000	48,000	10,151	18,000	5,000	2,413
Yukon R. Mainstem (Canada)	70,000	104,000	agreement	2010[d]	200,000	156,000	109,000	145,000	401,000	154,000	98,000	23,500	23,170
Norton Sound													
Subdistrict 1 Aggregate	eliminated			2019	108,120	97,234	92,030	60,749	123,794	85,390			
Nome River	1,600	5,300	SEG	2019	4,807	5,589	6,100	7,085	6,321	5,240	3,164	2,822	216
Snake River	2,000	4,200	SEG	2019	2,755	3,982	4,241	3,651	4,759	3,028	2,374	842	2,352
Eldorado River	4,400	14,200	SEG	2019	26,131	27,038	25,549	18,938	73,882	42,361	28,427	11,333	6,283
Kwiniuk River	9,100	32,600	SEG	2019	5,625	39,597	37,663	8,523	32,541	41,620	18,029	4,953	3,862
Tubutulik River	3,100	9,000	SEG	2019	4,532	NS	9,835	NS	NS	NS	NS	NS	NS
Kotzebue Sound													
Noatak and Eli Rivers	43,000	121,000	SEG	2019	NS	490,814	NS	NS	NS	NS	NS	NS	NS
Upper Kobuk w/ Selby River	12,000	32,100	SEG	2019	NS	65,653	NS	NS	NS	NS	NS	NS	NS

Source: Munro and Brenner 2022, http://www.adfg.alaska.gov/FedAidPDFs/FMS22-02.pdf
a A statistical model is used to estimate escapement. All historical escapement estimates are updated annually based on the most recent model run.
b Fishing Branch River fall chum salmon weir assessment project was not operated after 2012. Estimates are based on border sonar estimate minus community harvest with additional information from mark-recapture studies assuming most fish migrate to Fishing Branch River.
c Fishing Branch River fall chum salmon IMEG of 22,000-49,000 was implemented for 2008-2021 by Yukon River Panel.
d Yukon River Mainstem fall chum salmon IMEG of 70,000-104,000 was implemented for 2010-2021 seasons by Yukon River Panel.

3.2 Description of Subsistence Management of Chum Salmon Stocks

3.2.1 State Subsistence Management

The State of Alaska has 84 local fish and game advisory committees that review, make recommendations submit proposals, and testify to the 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(34)).*

Specific to fisheries, under Alaska's subsistence statute (AS 16.05.258), the BOF must:

1. Identify fish stocks that are associated with customary and traditional subsistence fisheries.
2. Determine whether there is a harvestable surplus of these stocks. The harvestable surplus is the amount of fish that can be taken by various uses (subsistence, personal use, commercial) after conservation (escapement) is accounted for.
3. If there is a harvestable surplus of these stocks that have been identified as having been customarily and traditionally used, the BOF must determine the amount of the harvestable surplus that is reasonably necessary for subsistence uses.
4. Then, the BOF must adopt regulations that provide reasonable opportunities for these subsistence uses to take place.

As noted directly above, the BOF is required by the state subsistence statute to provide reasonable opportunities for subsistence uses. A "reasonable opportunity" is defined in statute to mean an opportunity that allows a subsistence user to participate in a subsistence fishery that provides a normally diligent participant with a reasonable expectation of success of taking of fish (AS 16.05.258(f)).

The BOF evaluates whether reasonable opportunities are provided for in the existing or proposed regulations by reviewing harvest estimates relative to the "amount reasonably necessary for subsistence use" (ANS) findings as well as subsistence fishing schedules, gear restrictions, and other management considerations. ANS is typically set (or expressed) as a range but is not a consistent metric across all areas. Some areas like the Yukon and Kuskokwim have species-specific ANS ranges for salmon while others like Norton Sound and Bristol Bay do not. ANS ranges are based on the harvest histories in each area. As a run develops in an area, inseason managers will assess what portion of the run can be harvested (i.e., the amount of harvestable surplus) after conservation (escapement) is accounted for (see Table 3-2).

ANS is not used as an inseason management tool. Harvests within or above the ANS range typically suggest that the regulations do provide reasonable opportunity to harvest a resource for subsistence as long as subsistence patterns have not changed significantly. Subsistence harvests may fall below the lower bound of an ANS range for a number of reasons including shifts in species use (e.g., fewer households owning dog teams) as well as weather conditions or fishing restrictions in a given year. However, a retroactive look at subsistence harvests that fall below the ANS range in a given year or across multiple years can provide additional context to inform understandings of run abundance or stock status. Subsistence harvests below the lower bound of the ANS range may indicate, with other evidence, that there was not reasonable opportunity for subsistence harvests during the season and that subsistence needs may not have been met.

Table 3-2 ANS for Arctic-Yukon-Kuskokwim areas by salmon species

Fisheries Management Area		Year of ANS Finding	Chinook Salmon	Chum Salmon	Summer Chum Salmon	Fall Chum Salmon	Sockeye	Coho	Pink	All Salmon
Kotzebue District		None								
Norton Sound-Port Clarence Area		1998								96,000-160,000
	Subdistrict 1 of Norton Sound District*	1999		3,430-5,716						
Yukon Area		2001	45,500-66,704		83,500-142,192	89,500-167,900		20,500-51,980	2,100-9,700	
Kuskokwim Area		2013								
	Kuskokwim River		67,200-109,800	41,200-116,400			32,200-58,700	27,400-57,600	500-2,000	
	Districts 4 and 5									6,900-17,000
	Remainder of Area									12,500-14,400
Bristol Bay		2001								157,000-172,171
	Kvichak River Drainage						55,000-65,000			
Alaska Peninsula		1998								34,000-56,000

Figure 3-1 below shows the Kuskokwim River post-season chum salmon subsistence harvest estimates from 2000 through 2022. The 2020-2022 average of 15,803 chum salmon was a 73% decline from the 2000-2019 average of 57,741 fish; no estimate is yet available for 2023. Additional information on ANS is available in Section 4.3 of the SIA as well as Appendix 4 which contains information provided by the Yukon River Inter-Tribal Fish Commission.

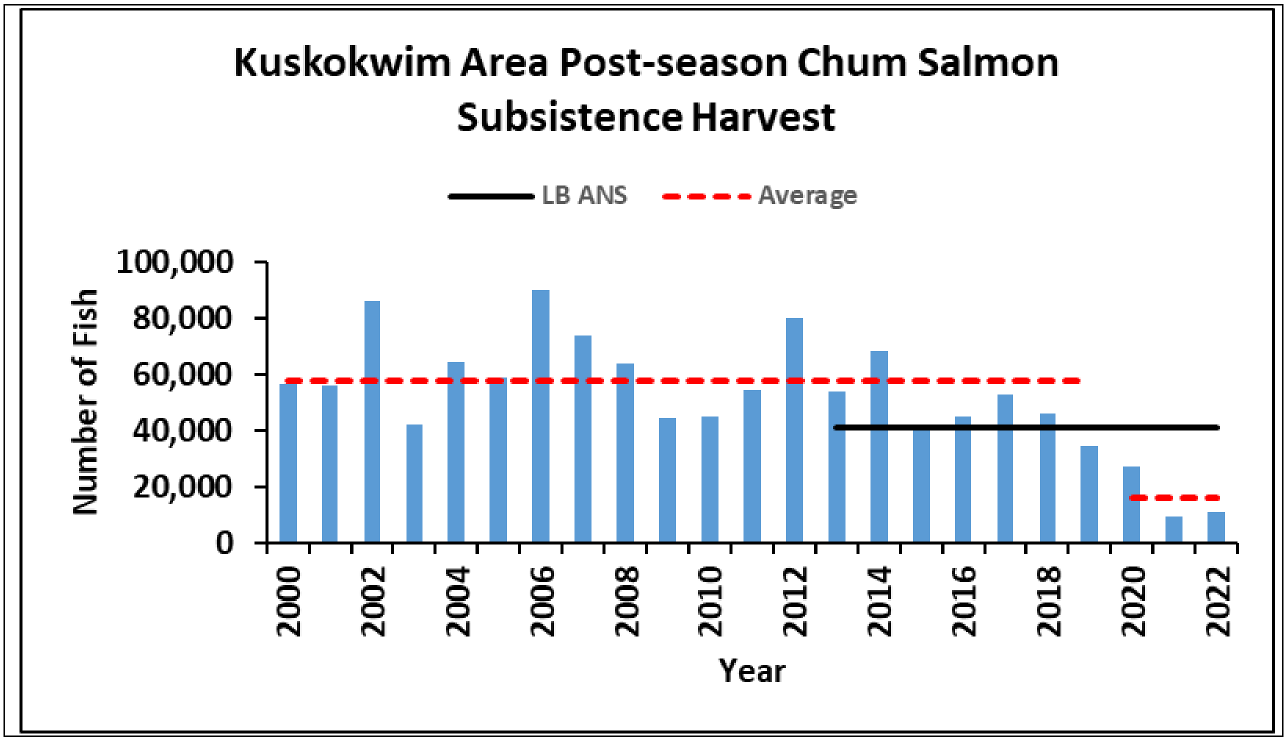

Figure 3-1 Comparison of Amounts Necessary for Subsistence and post-season subsistence harvest, Kuskokwim Area

Source: KRITFC, ADF&G AYK Database https://www.adfg.alaska.gov/CF_R3/external/sites/aykdbms_website/DataSelection.aspx

Whenever it is necessary to restrict harvest, subsistence fisheries have a preference over other consumptive uses of the stock (AS 16.05.258). Subsistence and other uses shall be restricted or closed to provide for sustainability (escapement) based upon the relevant adopted fishery management plans. If the harvestable surplus is within or higher than the ANS range, other nonsubsistence uses, such as commercial or sport fishing, may be allowed. As an example, the management plans for Yukon River fall and summer chum salmon define specific run size and escapement thresholds for determining harvest opportunities in Alaska. A drainage wide escapement goal exists for both stocks (in addition to other escapement goals for tributaries). When the drainage wide run size for summer chum salmon is below 500,000, all directed fisheries for chum salmon are closed. Summer chum salmon opportunities for subsistence may be provided when the run size is above 500,000 fish and commercial opportunities may be provided when the run size is above 650,000 fish (see 5 AAC 05.362). For fall chum salmon, when the drainage wide run size is below 300,000 fish, all directed fall chum salmon fisheries are closed. Fall chum salmon subsistence opportunities may be provided when the run size is above 300,000 and commercial opportunities may be provided when the run size is above 550,000 (see 5 AAC 01.249).

Alaska subsistence fishery regulations do not, in general, permit the sale of resources taken in a subsistence fishery. However, state law does recognize “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 adopted regulatory change proposals to allow customary trade in salmon resources under state subsistence regulations in other areas under consideration in this document.

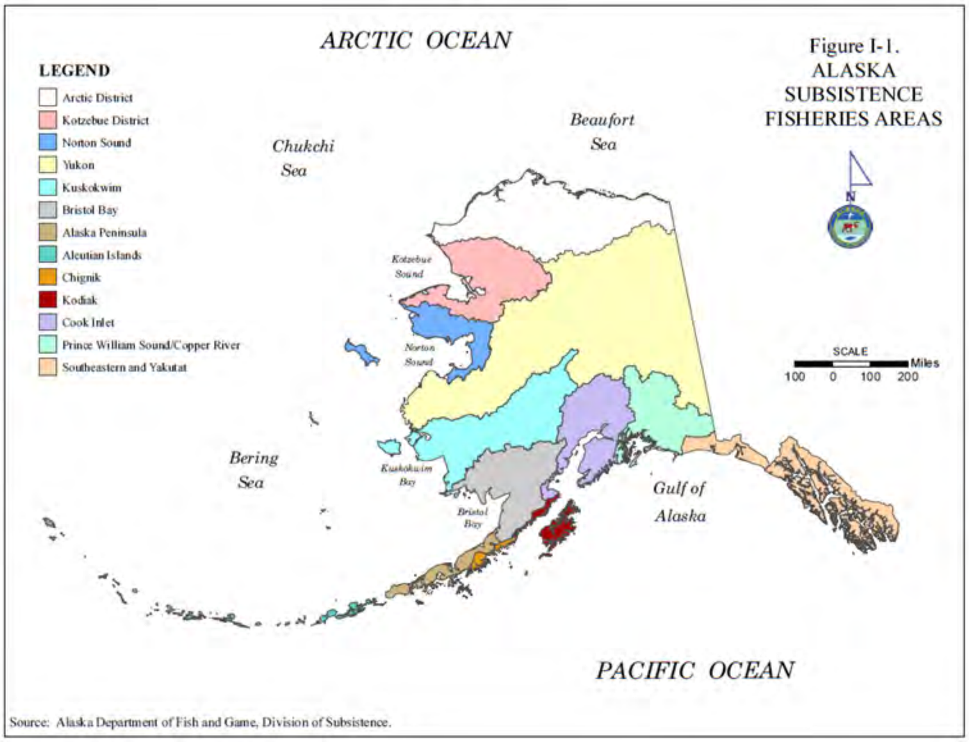

Figure 3-2 Alaska Subsistence Fisheries Areas
Source: ADF&G

3.2.2 Federal Subsistence Management

ANILCA was passed by Congress in 1980. Title VIII of ANILCA mandates that rural residents of Alaska be given a priority opportunity for customary and traditional subsistence uses, among consumptive uses of fish and wildlife, on federal lands (16 U.S.C. 3114). In 1986, Alaska amended its subsistence law to mandate a rural subsistence priority in order to bring the statute 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 (i.e., rural residents) under provisions of the Alaska Constitution. Meanwhile, other federal court cases on the state's administration of Title VIII of ANILCA ruled that the state would not be given deference in interpreting federal statute. These court cases created conflicting rulings and proposed amendments to ANILCA and the Alaska constitution were not adopted to rectify them. As a result, the Secretaries of Interior and Agriculture implemented a parallel regulatory program to assure the rural subsistence priority is applied under ANILCA on federal lands.

As a result, beginning in 1990, both the state and federal governments provide subsistence uses on federal public lands and waters in Alaska. Federal public lands in Alaska encompass approximately 230 million acres (60%) of the land within the state. In 1992, the Secretaries of the Interior and Agriculture established the Federal Subsistence Board (FSB) and ten Regional Advisory Councils (RACs) to administer this responsibility. The FSB's composition includes a chair appointed by the Secretary of the Interior with concurrence of the Secretary of Agriculture; the Alaska Regional Director, U.S. Fish and Wildlife Service; the Alaska Regional Director, National Park Service; the Alaska State Director, Bureau of Land Management; the Alaska Regional Director, Bureau of Indian Affairs; and the Alaska Regional Forester, USDA Forest Service; and two public members representing rural subsistence users.[34]

[34] In February 2024, the Secretary of the Interior announced a proposed rule to revise the regulations concerning the composition of the FSB by adding a third public member nominated or recommended by federally recognized tribal

Through the FSB, these agencies participate in development of regulations which establish the program structure, determine which Alaska residents are eligible to take specific species for subsistence uses, and establish seasons, harvest limits, and methods and means for subsistence take of species in specific federal areas. The RACs provide recommendations and information to the FSB; review proposed regulations, policies, and management plans; and provide a public forum for subsistence issues. Each RAC consists of regional residents representing subsistence, sport, and commercial fishing and hunting interests.

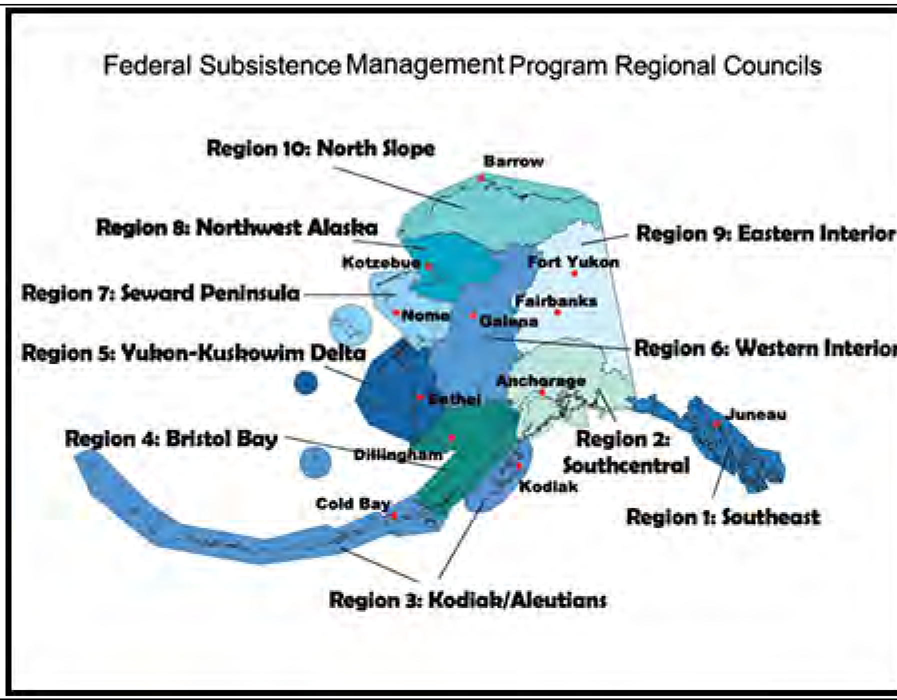

Figure 3-3 Map of areas covered by Alaska Federal Subsistence Management Program Regional Advisory Councils
Source: USDA

The FSB may delegate its management authority to agency field officials (50 CFR Section 100.10(6); 36 CFR Section 242.10(6). This delegation may be initiated by the FSB or requested by a member of the public through a Special Action Request. For instance, on the Kuskokwim, the FSB has delegated its authority for federal management of subsistence salmon fisheries to the U.S. Fish and Wildlife Service – Yukon Delta National Wildlife Refuge Manager, who consults and collaboratively manages these fisheries with KRITFC.

ANILCA is a federal statute that creates a priority for subsistence uses by rural residents over the taking of fish and wildlife for other purposes on public lands and waters, including state subsistence uses by non-rural residents, and it also imposes obligations on federal agencies with respect to decisions affecting the use of public lands and waters to cause the least adverse impact possible on rural residents who depend upon subsistence uses of the resources of such lands (16 U.S.C. 3112). For example, there is a requirement that agencies analyze the effects of those decisions on subsistence uses and needs on federal public lands and waters (16 U.S.C. 3120). ANILCA defines “public lands” as lands situated “in Alaska” which, after December 2, 1980, are federal lands. Exceptions include 1) those lands selected by or granted to the State of Alaska; 2) lands selected by an Alaska Native Corporation under the Alaska Native Claims Settlement Act (ANCSA); 3) and lands referred to in section 19(b) of ANCSA (16 U.S.C. 3102(3)). The

governments, requiring that those nominees have personal knowledge of and direct experience with subsistence uses in rural Alaska including Alaska Native subsistence uses (see FR 89 vol. 38 (February 26, 2024)).

U.S. Supreme Court has ruled that ANILCA's use of "in Alaska" refers to the boundaries of the State of Alaska and concluded that ANILCA does not apply to the outer continental shelf (OCS) region (*Amoco Prod. Co. v. Village of Gambell*, 480 U.S. 531, 546-47 (1987)). The Bering Sea pollock fishery occurs in the Bering Sea subarea of the BSAI Management Area. This management area falls within federal waters under the Council and NMFS's jurisdiction which are those waters 3 to 200 nautical miles from shore. Thus, the waters under the Council and NMFS's jurisdiction are within the OCS region.

3.3 State Management of Personal Use and Sport Salmon Fisheries

The State of Alaska defines personal use fishing as the taking, fishing for, or possession of finfish, shellfish, or other fishery resources, by Alaska residents for personal use and not for sale or barter, with gill or dip net, seine, fish wheel, longline, or other means defined by the BOF (AS 16.05.940(25)). Personal use fisheries are different from subsistence fisheries because they either do not meet the criteria established by the Joint Board of Fisheries and Game (Joint Board) for identifying customary and traditional fisheries (5 AAC 99.010) or because they occur within nonsubsistence areas.

The Joint Board is required to identify 'nonsubsistence areas' using the 13 criteria outlined in statute, 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). In these areas, persons may harvest wild resources for food under personal use or sport fishing regulations; subsistence fisheries are not authorized to occur in nonsubsistence use areas (5 AAC 99.016).

Generally, fish may be taken for personal use purposes only under authority of a permit issued by ADF&G. ADF&G's Division of Commercial Fisheries manages personal use fisheries although some personal use fisheries are managed by the Division of Sport Fish. For more information on state management of personal use fisheries, refer to the ADF&G website: https://www.adfg.alaska.gov/index.cfm?adfg=fishingPersonalUse.main.

The ADF&G Division of Sport Fish also manages the state's recreational fisheries. Alaska statute defines sport fishing as the taking of or attempting to take for personal use, and not for sale or barter, any fresh water, marine, or anadromous fish by hook and line held in the hand, or by hook and line with the line attached to a pole or rod which is held in the hand or closely attended, or by other means defined by the BOF (AS 16.05.940(31)). 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: https://www.adfg.alaska.gov/index.cfm?adfg=fishingSport.main.

Per Alaska regulation (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 (AS 16.05.251). 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 (5 AAC 75.995(a)(42)). Salmon is one of the primary species targeted in the states' recreational fisheries. For further information, refer to the ADF&G website: https://www.adfg.alaska.gov/index.cfm?adfg=SFGuidesLicense.main.

This site contains information important to ADF&G requirements for sport fish charter businesses, sport fish guides, and saltwater charter vessels.

3.4 State Commercial Salmon Fishery Management

Commercial fishing is defined by the State of Alaska as the taking, fishing for, or possession of fish with the intent of disposing of them for profit, or by sale, barter, trade, or in commercial channels (AS 16.05.940 (5)). Commercial fisheries in Alaska fall under a mix of state and federal management jurisdictions. In general, the state has management authority for all salmon, herring, and shellfish fisheries, and for groundfish fisheries within three nautical miles of shore. Under the Magnuson-Stevens Act, the federal government has management authority for the majority of groundfish fisheries three to two hundred nautical miles offshore.

The state manages a large number of commercial salmon fisheries in waters from Southeast Alaska to Kotzebue Sound. Management of the commercial salmon fisheries is the responsibility of the ADF&G Division of Commercial Fisheries, under the direction of the BOF. The salmon fisheries are managed under a limited entry system; participants must hold a limited entry permit for a fishery to fish and the number of permits for each fishery is limited. The state originally issued permits to persons with histories of participation in the various salmon fisheries. Permits can be bought and sold. Thus, since the original limitation program was implemented, new persons have entered into the commercial fishery by buying permits on the open market.

Alaska's commercial salmon fisheries are administered through the use of management areas throughout the state. The value of the commercial salmon harvest varies with the size of the runs, market conditions, and with foreign currency exchange rates. Because of the magnitude of commercial fisheries for salmon, state biologists collect extensive information and statistics to support management decisions. For information on commercial regulations refer to:

https://www.adfg.alaska.gov/index.cfm?adfg=CommercialByFisherySalmon.main.

4 Description of the Management Alternatives

This chapter describes the status quo (or current) regulations for salmon bycatch in the Bering Sea sub-area of the BSAI management area (Alternative 1), as well as the proposed alternatives for new management measures (Alternatives 2-4) and how they would work if put into regulation. These descriptions are a starting point for understanding the potential environmental, economic, and social impacts of these management alternatives which is organized by alternative in Chapter 6.

4.1 Alternative 1: No Action

4.1.1 Chum Salmon Bycatch Management Under the Status Quo

4.1.1.1 Chum Salmon Avoidance Area

Under Alternative 1, the Chum Salmon Savings Area would be retained. The Chum Salmon Savings Area is a time/area closure with fixed spatial boundaries in the southeastern Bering Sea. Established in 1994 by Emergency Rule and implemented by Amendment 35 to the BSAI FMP, the Chum Salmon Savings Area was identified as an area with high rates of chum salmon bycatch in the early 1990s (see Figure 4-1 below). Prior to 2007, the Chum Salmon Savings Area was closed to all trawling from August 1 through August 31 (the time of year when chum salmon bycatch was highest). In 2007, regulations implementing Amendment 84 specified the Chum Salmon Savings Area would only apply to vessels directed fishing for pollock using trawl gear (see 50 CFR 679.22(a)(10)). Additionally, if the bycatch limit of 42,000 non-Chinook (i.e., chum salmon) was reached at any point from August 15 through October 14, the area would remain closed through October 14. Non-Chinook salmon encountered in the CVOA accrued to the 42,000 non-Chinook PSC limit (the CVOA is defined at 50 CFR 679.22(a)(5)).

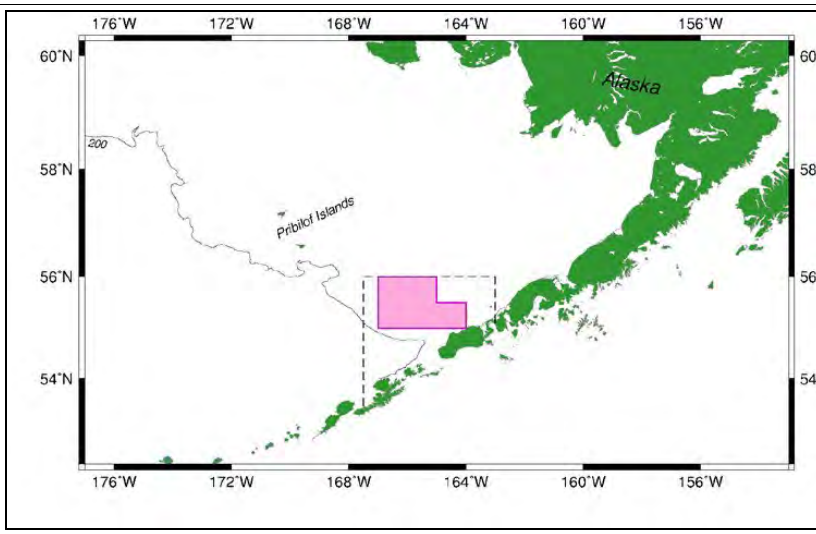

Figure 4-1 Chum Salmon Savings Area, shaded in pink and the Catcher Vessel Operational Area (CVOA), dotted line

4.1.1.2 Rolling Hotspot System for Chum Salmon Avoidance

Alternative 1 would retain regulations that exempt vessels directed fishing for pollock in the Bering Sea, including CDQ pollock, from closures in the Chum Salmon Savings Area if the vessel or CDQ group is governed by an approved Incentive Plan Agreement (IPA) (see 50 CFR 679.21(f)(12). The IPAs are private contractual agreements among parties designed to create incentives for avoiding salmon bycatch. The Rolling Hotspot (RHS) system for chum salmon avoidance is managed under the IPAs and creates an incentive for pollock harvesters to work to keep their bycatch rates low to avoid triggering closure areas that may require them to incur the costs of moving to new areas to target pollock. Section 4.1.1.2 provides more detail on the RHS system for chum salmon avoidance because Alternative 4 proposes changes to the current system (see Section 4.4)

In contrast to the Chum Salmon Savings Area which is a time/area closure with fixed spatial boundaries based on historically high encounters of chum salmon bycatch, the RHS system creates dynamic area closures using near real-time pollock catch and PSC data. A benefit of this management system is in its efficient use of catch data and other information to move the fleet away from known areas of higher salmon bycatch. The RHS system was voluntarily developed by industry under an Intercooperative Agreement in 2001 for chum salmon and 2002 for Chinook salmon avoidance to try and avoid reaching the triggers for the Salmon Savings Areas.[35] The Intercooperative Agreement was a voluntary legal agreement among pollock cooperatives whereby members agreed to supply bycatch information to Sea State Inc. (Sea State) and abide by the rules set out in the agreement each year. The Intercooperative Agreement facilitated sharing real-time salmon bycatch information among the pollock fleet so the cooperatives could better avoid areas with high salmon bycatch rates. The Council developed new regulations in 2007 under Amendment 84 to allow cooperatives exemption from the Salmon Savings Areas if they were members to the Intercooperative Agreement and participating in the RHS system.[36]

Prior to Amendment 84, cooperatives were subject to RHS closures issued by Sea State as well as the Chum and Chinook Salmon Savings Areas, if those closures were issued by NMFS. All AFA vessels participated in the approved Intercooperative Agreement, except for F/V *Ocean Peace* which is not a member of an AFA cooperative. Sea State evaluates potential interactions with other PSC species (e.g., Chinook, chum, and herring) based on observer and catch data and active communication with fishermen, cooperative managers, and IPA representatives.[37] NMFS cannot replicate the RHS system because the boundaries of each RHS closure area are based on weekly or bi-weekly bycatch information from the fleet. In other words, when and where a RHS closure area is implemented are not fixed in regulations. RHS closure areas are more discretely implemented and responsive to changing ocean conditions and fish distributions (both pollock and PSC). This system effects fleet fishing patterns as the closure areas move the fleet away from areas with known high salmon bycatch and redistributes fishing effort elsewhere on the pollock grounds.

The RHS system for chum salmon avoidance operates in the B season while the RHS system for Chinook salmon avoidance operates in the A and B season. In the early 2000s, observer and catch data from vessels participating in the CDQ pollock fishery that were not subject to the Chum Salmon Savings Area closures in the early 2000s indicated the closure areas may be counterproductive. The salmon bycatch rates (number of salmon per mt of pollock) of vessels directed fishing for pollock were higher outside the closure areas than within them.[38]

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[35] While not expanded upon in this analysis because the proposed action alternatives would only affect regulations for chum salmon bycatch management, the Chinook Salmon Savings Areas were established in 1995 under BSAI Groundfish FMP Amendment 21b and subsequently revised in 2000 by Amendment 58. The Chinook Salmon Savings Areas in the Bering Sea were removed from regulation under Amendment 91.

[36] Amendment 84 also exempted vessels participating in non-pollock trawl fisheries from the Chum Salmon Savings Area closures because these fisheries intercept minimal amounts of chum salmon.

[37] Since the inception of AFA cooperatives, Sea State, Inc. has been contracted by the cooperatives to facilitate bycatch avoidance, information sharing, and to provide catch accounting/harvest data for the cooperative annual reports. Sea State works on a data release agreement between the industry and NMFS. NMFS observers sample hauls and estimate PSC. Each vessel electronically transmits its observer data to Sea State, which checks the data and performs statistical extrapolations to factor in any hauls that were not sampled. Position-specific data for each vessel are used to create a chart of vessel-specific bycatch rates that is faxed to participating vessels within 24 hours.

[38] The CDQ groups receive groundfish allocations as well as apportionments of prohibited species quota including Chinook salmon and non-Chinook salmon. In the early 2000s, the non-CDQ apportionment of the Chum Salmon Savings Area non-Chinook PSC limit (89.3%) was reached by the other sectors and thus the closures did not apply to the CDQ groups. More information on CDQ Program quota categories, target and non-target CDQ reserves, allocation percentages, and group quotas is available here.

The RHS system has been modified over time. It is now managed under the pollock industry's IPAs as mentioned above. The salmon bycatch IPAs are legal contracts that members voluntarily agree to and are approved by NMFS under 50 CFR 679.21(f). The IPAs were implemented under Amendment 91 alongside the Chinook PSC limit that requires the pollock fishery to cease fishing when reached. The IPAs establish vessel-level incentives for members to avoid Chinook and chum salmon bycatch while fishing for pollock in the Bering Sea. Implementing a Chinook PSC limit under Amendment 91 without additional tools to incentivize pollock fishermen to avoid Chinook salmon could have created a scenario where vessels would fish pollock at a faster pace because they would be racing against the PSC limit (i.e., to catch their pollock quota prior to the fishery reaching the Chinook PSC limit). In years when bycatch encounters are more difficult to avoid, having additional incentives in place for captains to avoid salmon (which can come at a cost for fuel, overall time at sea, among other considerations) is important to not undermine one of the primary purposes of the AFA in establishing the fishing cooperatives to allow for the orderly harvest of pollock.

All participants in the Bering Sea pollock fishery are members of one of three IPAs approved by NMFS:[39] the Inshore Chinook Salmon Savings Incentive Plan Agreement (Inshore SSIP), the Mothership Salmon Savings Incentive Plan Agreement (MSSIP), and the Catcher/processors Chinook Salmon Bycatch Reductive Incentive Plan Agreement (CP IPA). The IPAs can be revised by submitting amendments to NMFS for approval at any time. However, regulations at 50 CFR 679.21(f)(12)(iii)(E) define 13 topics the IPA must include or address. For example, the IPAs are required by regulation to provide incentives for each member vessel to avoid salmon bycatch under any bycatch rate; the incentive measures must include rewards for salmon bycatch avoidance and/or penalties for failure to avoid salmon bycatch at the vessel-level; and the IPA must specify how those incentives are expected to promote reduction in actual individual vessel bycatch rates relative to what would have occurred in the absence of the incentive program.

4.1.2 Components of the Rolling Hotspot System

Section 4.1.2 describes how the current RHS system for chum salmon avoidance works as managed under the IPAs. To understand the main components of the RHS system for chum salmon avoidance, the analysts relied on qualitative descriptions of the system in prior analyses (e.g., Amendment 84 and Amendment 110); descriptions contained in the IPAs; and conversations with a select number of key informants as directed by the Council in April 2023 prior to the presentation of the Preliminary Review analysis in October 2023.

The starting point for determining whether an area is eligible for a RHS closure is to calculate the **Base Rate**. The calculated Base Rate is a bycatch rate (number of chum salmon per mt of pollock) that provides an index of the pollock fleet's relative chum salmon bycatch encounters. The Base Rate is fixed for the first three weeks of the B season (June 10-June 29) at 0.19 chum salmon per mt of pollock for the inshore and mothership sectors and 0.20 chum salmon per mt of pollock for the CP sector.[40] After this initial start to the fishing season beginning on July 1 each year, the Base Rate is calculated as the ratio of the three-week rolling sum of the total number of chum salmon taken as bycatch to the three-week rolling sum of the total mt of pollock caught in the fishery (in other words, a rolling three-week average). The calculated Base Rate is updated weekly (announced on Thursday). Thus, the calculated Base Rate fluctuates based on the average level of vessel's bycatch performance to reflect the "base" level of chum salmon encounters on the pollock grounds. All IPAs also use a "collar" that prohibits the calculated Base Rate for chum salmon from increasing by more than 20% from one week to the next in June and July. The collar is intended to keep calculated Base Rate low at the start of the fishing season.

[39] The IPAs and amendments can be accessed here.
[40] It is analytical staff's understanding that the current Base Rate floor of 0.20 chum salmon per mt of pollock used in the CP IPA is simply a rounded value of the 0.19 Base Rate floor.

The RHS for chum salmon avoidance also uses a **Base Rate "floor"** that is stair-stepped across the B season. In June and July, the Base Rate floor is either 0.19 for the inshore and mothership sectors and 0.20 chum per mt of pollock for the CP sector.[41] In August, the Base Rate floor is increased to 0.50 chum per mt of pollock for all sectors. In September and October, the Base Rate floor is increased again to 1.00 chum salmon per mt of pollock for all sectors. The in-season adjustment was added to establish a Base Rate based on current conditions on the pollock fishing grounds (NPFMC 2007: 138).

Sea State will use the higher value of either the calculated Base Rate or the applicable Base Rate "floor" to compare against chum salmon bycatch rates at smaller spatial scales. In this way, the Base Rate "floors" mentioned above function as a minimum value used as a starting point for determining RHS closures. It is analytical staff's understanding that the Base Rate "floors" were established to try and avoid unnecessary RHS closures that may not result in additional chum salmon savings but would move the fleet to other areas to target pollock. When the fleet (or a portion of it) is required to move out of an area, it incurs costs and may move to fishing grounds with lower pollock CPUE. Moving the fleet based on very low chum salmon bycatch rates could also be counterproductive for salmon avoidance. At very low bycatch rates, it is possible Sea State would move the fleet to new pollock fishing areas where chum salmon, or other PSC species such as Chinook and herring, bycatch rates are higher.[42]

To determine whether a discrete area on the pollock grounds is eligible for a RHS closure, Sea State calculates **area bycatch rates**. Area bycatch areas are calculated by dividing the number of chum salmon by the mt of pollock caught in the prior week within an ADF&G groundfish statistical area where pollock fishing has occurred each week. For those ADF&G groundfish statistical areas where a "substantial amount" amount of pollock fishing occurred (e.g., at least 2% of the total weekly pollock catch), Sea State compares the area bycatch rate to either the calculated Base Rate or the Base Rate floor, whichever is higher.[43] If the area bycatch rate is greater than the Base Rate value used, then the area may qualify for a closure.

An important component to how the RHS system for chum salmon avoidance functions that is not explicitly specified in the IPAs is fishermen and managers' **Local Knowledge** (LK) of the Bering Sea pollock fishery and fishing grounds. All while the calculations of different bycatch rates are made (as described above), Sea State is actively communicating with fishing cooperative and IPA managers as well as pollock fishermen on the grounds. Managers frequently communicate with fishermen to understand where vessels are encountering good pollock CPUE as well as higher rates of chum salmon, Chinook salmon, herring, among other species. Active communication to understand observations of current conditions on the pollock grounds provides contextual knowledge that can be compared to prior years' genetic information as well as near real-time catch data. This can be a particularly important dynamic for inshore CVs. These vessels make deliveries that include multiple tows, some of which may be made in different ADF&G groundfish statistical areas. Sea State actively communicates with vessel operators to isolate individual tows/areas that may have had higher chum salmon bycatch. In sum, the process of identifying discrete areas for RHS closures is not simply formulaic. Managers also rely on LK of the pollock fishery and the conditions on the fleet's current fishing grounds to determine discrete areas that may need to be closed, as well as identifying the new areas to move the pollock fleet to.

Figure 4-2 provides a snapshot of the bycatch rates that are employed in the RHS for chum salmon avoidance– the calculated Base Rate, the Base Rate "floor," and the area bycatch rates.

[41] It is analytical staff's understanding that the 0.20 bycatch rate used as the June and July Base Rate floor is simply a rounded value from 0.19 (personal communication, A. Estabrooks).
[42] Steve Martell (Sea State), public comment to the Advisory Panel, October 2023.
[43] It is analytical staff's understanding that the 2% minimum harvest rule is enacted to balance the need to focus on concentrated fishing in high bycatch areas with the need to rapidly close an area based on a single haul with high amounts of PSC.

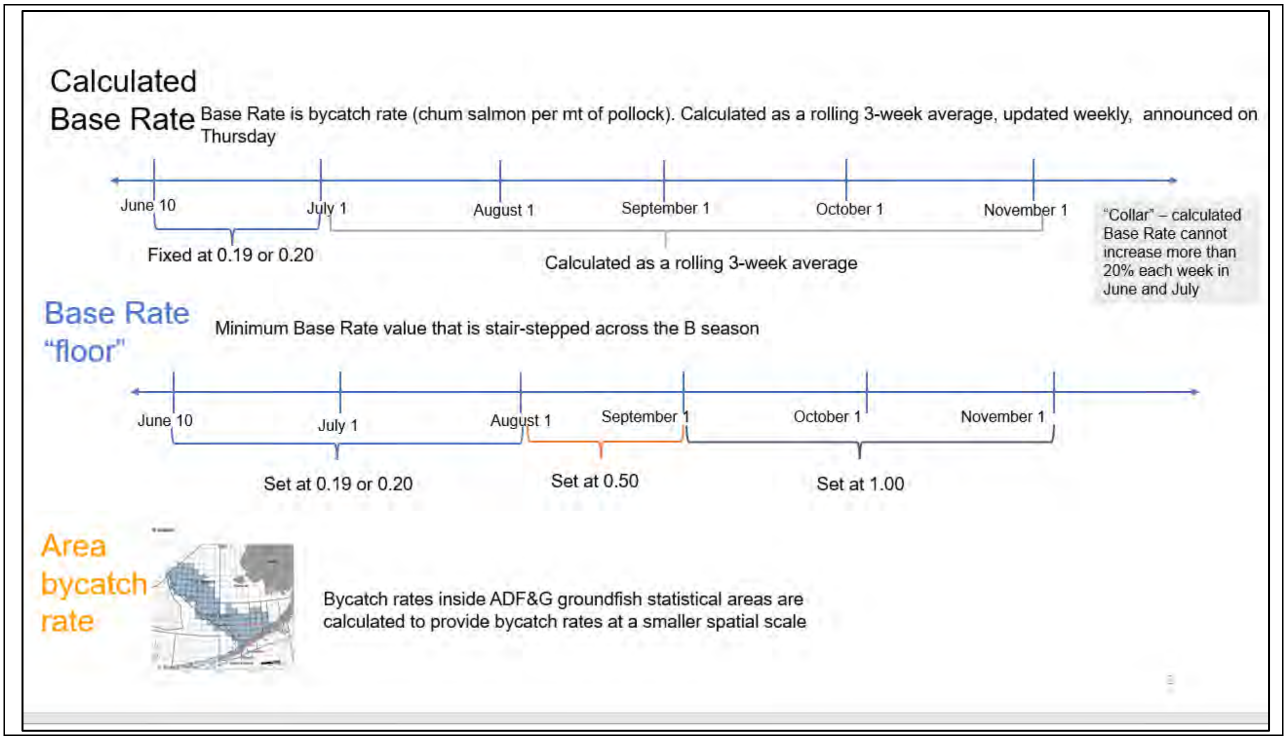

Figure 4-2 Components of the RHS system for chum salmon avoidance

Figure 4-3 illustrates how the calculated Base Rate and the Base Rate "floor" work using a hypothetical calculated Base Rate to help the reader conceptualize how the lower Base Rate floor values in June and July may increase the likelihood that a RHS closure area for chum salmon avoidance would be implemented. Whether or not a closure area is implemented depends on relative fishing effort, fishing location, and encounters of chum salmon the pollock grounds.

- In July, the calculated Base Rate is 0.30 chum salmon per mt of pollock in Week X. A calculated Base Rate of 0.30 chum salmon per mt of pollock is greater than the Base Rate floor of 0.19 or 0.20 chum salmon per mt of pollock in June and July. Therefore, Sea State would use the rate of 0.30 as the starting point for determining eligible RHS closure areas.
- In August, the calculated Base Rate is 0.30 chum salmon per mt of pollock in Week X. A calculated Base Rate of 0. 30 chum salmon per mt of pollock is less than the Base Rate floor of 0.50. Therefore, Sea State would use the rate 0.50 as the starting point for determining eligible RHS closure areas in August.

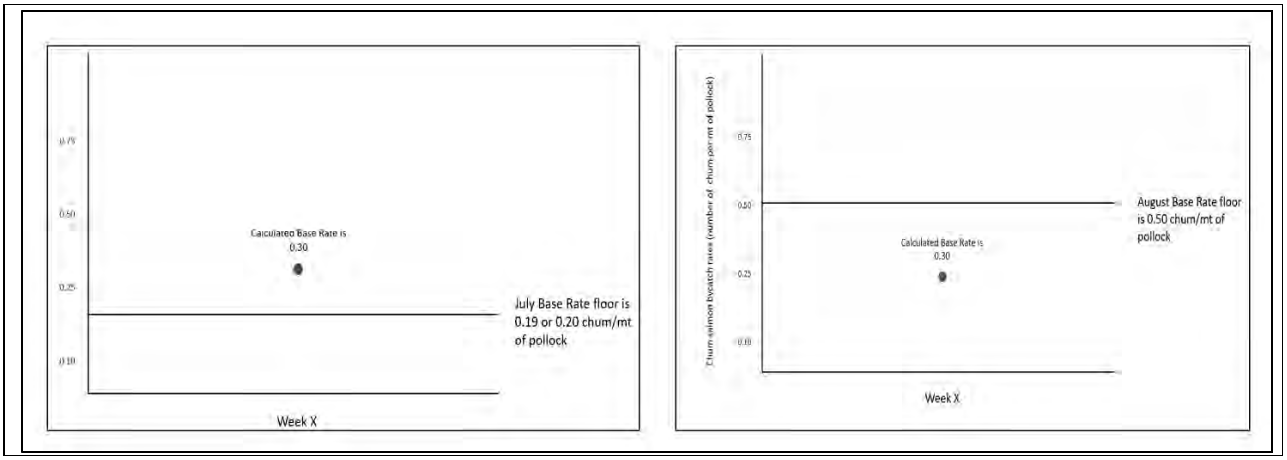

Figure 4-3 Simplified illustration of Base Rate floors as a component of the RHS system for chum salmon avoidance

4.1.2.1 Duration of a RHS Closure

In 2022, the CP sector formally amended their IPA and implemented a new approach to chum salmon "Bycatch Avoidance Areas" (i.e., what this preliminary DEIS refers to as RHS closure areas) that uses a Tuesday to Friday closure. Bi-weekly closures are a more dynamic approach that assesses bycatch more frequently than the previous week-long closures implemented Friday to Friday. Chum salmon can show up on the pollock grounds suddenly and evaluating the data on a bi-weekly basis allows the fleet to be more responsive at avoiding chum salmon on the pollock grounds.[44] RHS closures are implemented on a weekly basis for CVs (inshore and mothership). Chum Salmon Savings Areas (or RHS closure areas) are announced weekly on Thursday and implemented the following Friday-Friday.

4.1.2.2 Application of RHS Closures to Vessels

Not all pollock fishing vessels are prohibited from every RHS closure area. Whether or not pollock vessels are prohibited from fishing in RHS closure areas is based on their bycatch performance. To evaluate **vessel-level bycatch performance**, Sea State calculates the vessel's chum salmon bycatch rate during the prior two weeks. The vessel's bycatch rate is then compared against a standard of better than average performance. What constitutes better than average performance for a vessel is defined in the respective IPAs.

Inder the Inshore SSIP and MSSIP, CVs with bycatch rates less than or equal to the calculated Base Rate are placed in "Tier 1." Tier 1 vessels can fish in the RHS closure areas but Tier 2 vessels that have a bycatch rate greater than the Base Rate cannot.

Under the CP sector's IPA, a vessel's performance is better than average if it has a chum salmon bycatch rate less than 0.75 of the calculated Base Rate. A vessel with a bycatch rate greater than 0.75 of the Base Rate cannot fish in an established closure area for seven days (i.e., the following week). However, if any ADF&G statistical area has an extremely high chum salmon bycatch rate (defined as 5 chum salmon per mt of pollock under the IPA), vessels may not fish in the area regardless of their performance. Additionally, the CP IPA incorporates an "outlier provision" where vessels with bycatch performance greater than 1.5 standard deviations above the average vessel performance are identified. If a vessel is so identified during two consecutive B seasons for chum, then the vessel is designated a poor performer the following season. All vessels designated as poor performers are prohibited from fishing in any chum closure area for the entire season.

[44] Austin Estabrooks, Presentation to the Council, December 2022.

4.1.2.3 Application of Genetic Information

As described in the purpose and need for this action, the Council's intent is to minimize chum salmon bycatch in the Bering Sea pollock fishery with a particular emphasis on the bycatch of WAK origin chum salmon. As such, it is important to note that current regulations at 50 CFR 679.21(f)(12)(iii)(E) require each IPA to include a description of "how the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's chum salmon bycatch to avoid areas and times where the chum salmon are likely to return to Western Alaska." All IPAs incorporate two measures in the RHS system for chum salmon avoidance to meet this regulatory provision.

The first measure is that the combined size limits of RHS closure areas are largest East of 168 degrees West longitude during June and July. This measure aims to implement larger RHS closure areas earlier in the B season, closer to the Alaska Peninsula to match when WAK chum salmon are more likely to be present on the pollock grounds. In June and July, the combined sizes of all chum salmon RHS closure areas east and west of 168 degrees West longitude are limited to 3,000 square miles and 1,000 square miles, respectively. During August, September, and October, the combined sizes of all chum salmon avoidance areas east and west of 168 degrees West longitude are limited to 1,500 square miles and 500 square miles, respectively. At most, four avoidance areas can be identified during any week with a maximum total area of 4,000 square miles in June and July and 2,000 square miles in August-October.

The second measure is the stair-stepped Base Rate floor. The Base Rate floor is lowest (either 0.19 or 0.20 chum salmon per mt of pollock) in June and July when genetic analyses have indicated WAK chum salmon are a higher proportion in the overall bycatch. Recall the Base Rate floor is a minimum value used as a starting point for determining areas that may be eligible for a RHS closure. Because Sea State will use the higher value of either the calculated Base Rate or the applicable Base Rate floor to compare against chum salmon bycatch rates at smaller spatial scales, the lower floor early in the B season (June and July) increases the likelihood that a RHS closure area for chum salmon avoidance would be implemented compared to August and September.

4.1.2.4 Chinook Priority

Finally, the RHS system for chum salmon avoidance is influenced by the **Chinook priority** provision incorporated into the IPAs. Beginning on September 1 for the CP IPA, and at any point during the B season for the Inshore SSIP and MSSIP, whenever a Chinook bycatch rate equal to or greater than .035 Chinook per ton of pollock catch is encountered in any ADF&G statistical area east or west of 168° W longitude, any candidate chum salmon closure area is provided as information only for the remainder of the B season. The Chinook priority effectively eliminates chum salmon avoidance incentives when Chinook abundance on the pollock grounds is determined to be high. Monitoring and enforcement of the chum bycatch agreement is done by Sea State using the Base Rate as a trigger for Savings Area closures and determining the Tier Assignment of the vessel. The Vessel Monitoring System (VMS) is the main tool for monitoring and enforcement. There are VMS requirements and fines for not complying.

4.1.2.5 Other Recent Changes to Fishing Behavior Under the IPAs

In 2022, the Inshore SSIP and MSSIP IPAs were not formally amended as was done by the CP sector. For the mothership sector operating under the MSSIP, one reason is because this IPA has required the rapid dissemination of bycatch information among member vessels. This tool was implemented prior to 2016 when Amendment 110 regulations incorporated the RHS system for chum salmon avoidance into the IPAs. The MSSIP communication protocols require rapid, accurate information sharing (as soon as reasonably possible) for catch data and other information necessary for effective and cooperative fishery management. Daily catch reports by each mothership fleet to all participants in the MSSIP provide a faster turnaround time than the weekly identification of closure areas issued by Sea State. Additionally, if the amount of salmon bycatch (Chinook or chum) is high, each mothership operator notifies the CVs in its fleet as well as the other fleets as soon as possible and without delay. The notifications sent by email, fax, or other mode of communication contains the set and haul time, set and haul location, bottom depth and trawl depth, metric tons of pollock, and the salmon bycatch information of the haul – species, number, and rate per metric ton. The RHS system supplements this rapid dissemination of information.

The Inshore SIP and MSSIP took an experimental approach to implementing additional voluntary avoidance areas apart from the RHS system. The purpose of the additional avoidance areas implemented by the inshore CV and mothership sectors was to use a small amount of fishery dependent data, in combination with fishermen's' and cooperative manager's historical knowledge of areas that may have high chum bycatch rates and implement advisory avoidance areas to mitigate the bycatch peak(s). There were seven chum RHS closures and three chum Advisory Avoidance Areas issued in 2022 for the inshore and mothership sectors. These avoidance areas had 100% compliance in 2022. Bycatch information from vessels in the inshore sector is lagged compared to CPs because the vessel fishes and comes to port to make a delivery at a plant where each salmon is enumerated. For inshore CVs, it can take several days to get information on whether a vessel had high bycatch, meanwhile other CVs may be fishing in the same area. Mothership CVs do not experience the same data lag as inshore CVs as they receive production reports and observer information within hours of their delivery.

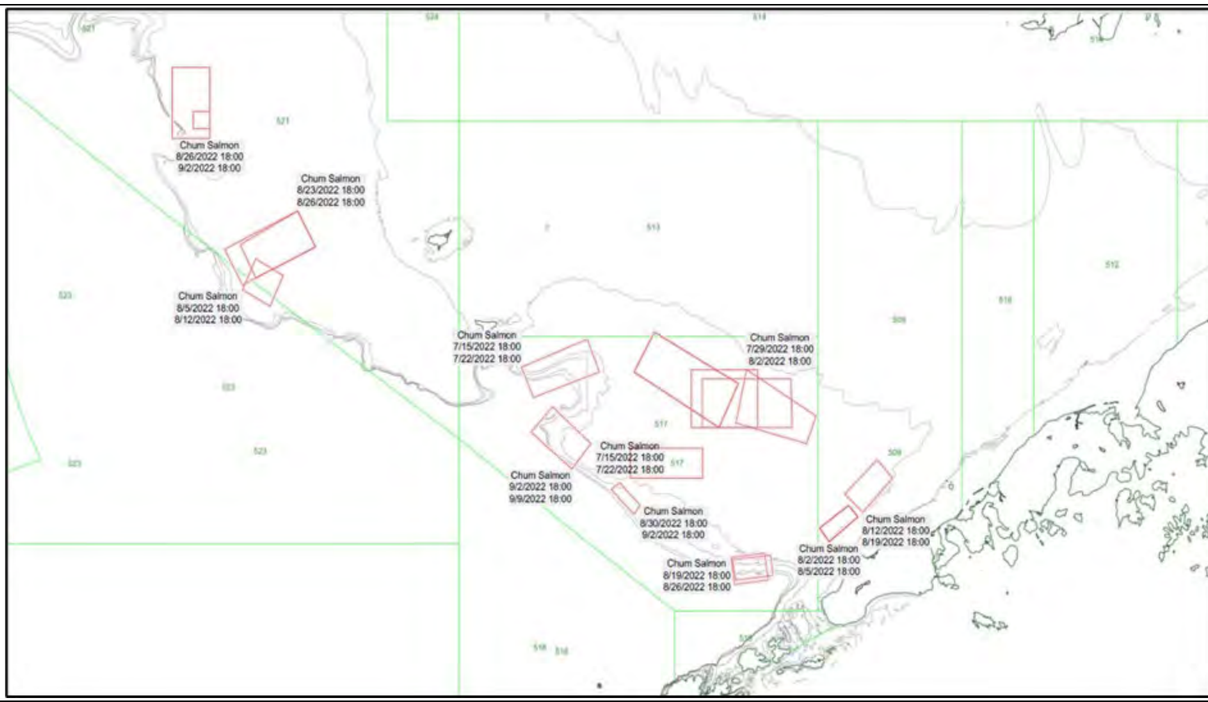

Figure 4-4 Chum RHS closure and chum advisory avoidance areas, CP and mothership sectors, 2022
Source: Sea State, Inc.

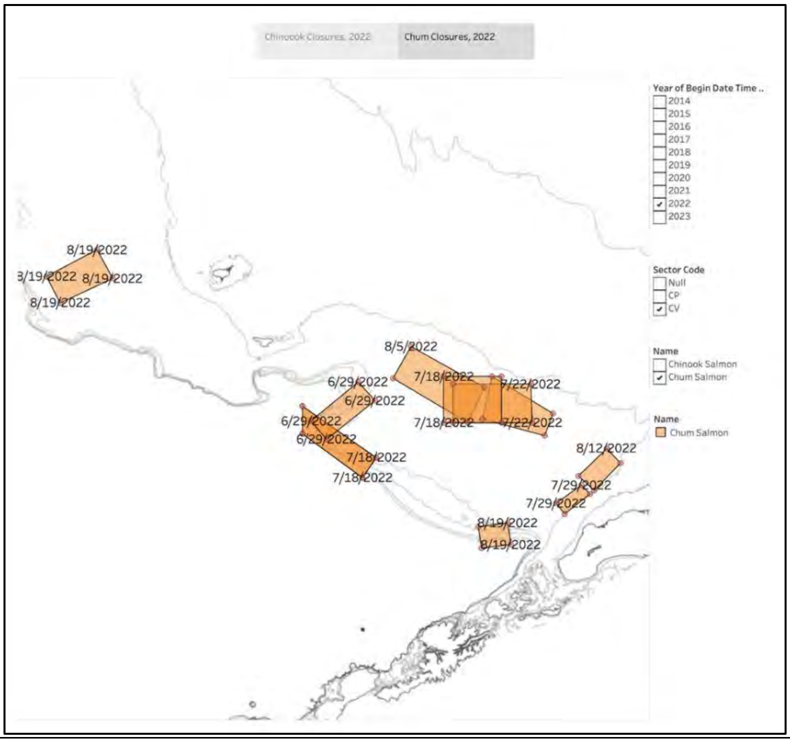

Figure 4-5 Chum RHS closure and chum advisory avoidance areas, inshore CV sector, 2022
Source: Sea State, Inc.

4.1.3 Chinook Salmon PSC Management Under the Status Quo

4.1.3.1 Chinook Salmon PSC Limit

Amendment 91 came into effect in the 2011 Bering Sea pollock fishery (see 75 FR 5306), and it substantially changed how Chinook salmon bycatch is managed by establishing a Chinook PSC limit. The Chinook PSC limit implemented under Amendment 91 is not connected to a spatial closure area but rather requires pollock fishing to cease when an entity reaches their portion of the limit. NMFS apportions an overall PSC limit of 60,000 Chinook salmon among the Bering Sea pollock sectors and further divides the inshore sector's apportionment among the cooperatives as well as the CDQ program's apportionment among the CDQ groups. The Chinook PSC limit is apportioned among the A and B season pollock fishery (70% and 30%, respectively).

The PSC limit of 60,000 Chinook is applied if some or all of the pollock industry is governed by IPAs. While participation in the IPAs is voluntary, the pollock fishing sectors will receive a portion of a lower PSC limit – 47,591 Chinook salmon –if no Chinook salmon bycatch IPA is approved by NMFS or if a sector exceeds its performance standard, the latter of which is discussed more below (50 CFR 679.21(f)(2)(i)).[45] The Council developed two Chinook PSC limits to incentivize the industry to form IPAs to avoid the potential economic impacts of receiving an apportionment under the lower limit.[46]

Amendment 110 regulations came into effect in 2016 and changed the Chinook salmon PSC limits established under Amendment 91 so they fluctuate based on Chinook abundance (i.e., when WAK

[45] 47,591 Chinook salmon is the 10-year average of Chinook salmon bycatch from 1997 to 2006. The Council determined that the 47,591 PSC limit was an appropriate limit on Chinook salmon bycatch in the Bering Sea pollock fishery if no other incentives were operating to minimize bycatch below that level.

[46] If an IPA was formed and an AFA-permitted vessel or CDQ group chose not to participate in an IPA, it would receive a more restrictive allocation referred to as the "opt-out allocation." NMFS would subtract the amount of Chinook salmon PSC from each sector's allocation associated with each vessel not participating in the IPA. The method NMFS would use for sector-specific adjustments can be found at 50 CFR 679.21(f)(4)(ii).

Chinook abundance is low, the Chinook PSC limits are reduced) (see 81 FR 37534). NMFS publishes the applicable Chinook PSC limit in the annual harvest specifications each year after determining if it is a low Chinook salmon abundance year based on information from the State of Alaska. The 3-River index used to determine WAK Chinook abundance is based on the sum of the run sizes of the Kuskokwim, Unalakleet, and Upper Yukon River systems. When this 3-River Index is less than or equal to 250,000 Chinook salmon, the Chinook salmon PSC limits drop to 45,000 and 33,318 Chinook salmon (50 CFR 679.21(f)(2)). NMFS issued apportionments under the 60,000 Chinook salmon PSC limit from 2011-2018 and again in 2020. In 2019, 2021, 2022, and 2023, NMFS issued sector and seasonal apportionments of the 45,000 PSC limit as the 3-River Index determined WAK Chinook salmon abundance to be low.[47]

The pollock industry is also held to a **performance standard** (see 50 CFR 679.21(f)(6)). Prior to each fishing year, NMFS calculates each sector's **annual threshold amount** and publishes it on the NMFS Alaska Region web site (see 50 CFR 679.21(f)(6)(ii)). The annual threshold amount is the annual number of Chinook salmon that would be apportioned to a fishing sector under either the 47,591 or 33,318 Chinook PSC limit depending on the determination of abundance. At the end of each year, NMFS evaluates how many Chinook salmon were caught as bycatch compared to the sector's annual threshold amount. The performance standard requires each sector to not exceed its annual threshold amount in any three of seven years (i.e., no more than two years in a rolling seven-year period). If NMFS determines a sector has exceeded the performance standard, that sector will permanently receive an apportionment of Chinook PSC under the lower limit (either 47,591 or 33,318 Chinook salmon) in all future years.

The Chinook PSC limit, performance standard, and annual threshold amount work together in the Chinook bycatch management program to keep the fishery below the overall cap. This management approach is intended to ensure the individual sectors stay below their actual Chinook PSC apportionments by incentivizing that behavior to receive the highest apportionment of Chinook salmon PSC available each year.

As noted above, NMFS apportions the Chinook PSC limit among the pollock sectors and further divides the inshore sector's apportionment among the cooperatives as well as the CDQ program's apportionment among the CDQ groups. Each sector's apportionment is based on an adjusted five-year (2002-2006) historical average proportion of the Chinook salmon PSC by sector and by season. As such, NMFS manages 15 different Chinook salmon PSC "accounts" each season (and 30 annually).

NMFS issues transferable apportionments of the Chinook PSC limit to inshore cooperatives, the CDQ groups, and an entity representing the mothership and CP sectors (see 50 CFR 679.21(f)(8)). Chinook salmon PSC remaining in an entity's account (e.g., CP sector) can rollover from the A season to the B season, but the entity may only transfer a portion of its PSC apportionment within the same season. Chinook PSC may be transferred between sectors (i.e., inter-sector transfers), between inshore cooperatives (i.e., inter-cooperative transfers), between CDQ groups (i.e., inter-group transfers), and among vessels within a cooperative (i.e., intra-cooperative transfers). Intra-cooperative transfers of Chinook PSC are completed by cooperative/IPA managers. Inter-cooperative, inter-group, and inter-sector transfers of Chinook PSC require NMFS approval of the transfer. Requests for approvals are filed by the entity receiving the transfer (see 50 CFR 679.21(f)(8)(ii)).

Regulations at 50 CFR 679.21(f)(9)(ii) also allow for post-delivery transfers. If the amount of Chinook caught as bycatch exceeds an entity's seasonal apportionment, the entity may receive transfers of Chinook PSC to cover overages for that season. The Council included post-delivery transfers in its Preferred Alternative under Amendment 91 because, if an overage occurs, all vessels fishing on behalf of the entity are allowed to complete the pollock trip that they are on, but the vessels are not allowed to start another fishing trip for the remainder of the season. An entity is allowed to request a transfer to "cover" the

[47] Information on the Chinook PSC limit relative to abundance can be found here: https://www.fisheries.noaa.gov/sites/default/files/akro/cas2SalmonPerformanceStandard2023.html

overage and bring the account balance to zero, but the entity is not allowed to transfer any more PSC than what is required to balance the account to zero.

4.1.3.2 Chinook Rolling Hotspot System

The RHS system for Chinook salmon avoidance is largely the same as that described for chum salmon avoidance. An important difference, however, is that the RHS system for Chinook salmon avoidance operates during both the A and B pollock seasons. The RHS system for Chinook salmon avoidance includes a calculated Base Rate. This calculated Base Rate is updated each week beginning on or near January 28 during the pollock A season and on or near July 1 during the B season. The Base Rate “floor” for Chinook is 0.035 Chinook salmon per mt of pollock, and it is not stair-stepped throughout the fishing seasons. The Base Rate applied by Sea State is the greater value of either the calculated Base Rate or 0.035.

Hot spots are identified by evaluating the Chinook salmon bycatch rates for each ADF&G groundfish statistical area from which a Chinook salmon bycatch report is received, and when feasible, for each lateral half of the statistical area. This step helps to determine Chinook abundance on the pollock fishing grounds in a finer spatial and temporal scale. Area bycatch rates are calculated by dividing the number of Chinook salmon caught incidentally by the pollock fishery during the prior week within an individual ADF&G statistical area by the metric tons of pollock catch from the area during the prior week.

After identifying Chinook Bycatch Hotspots, RHS closure areas for Chinook are established. On January 30 and on each Thursday thereafter for the duration of the A season, and on June 20 and on each Thursday thereafter for the duration of the B season, several criteria are used to provide notice to vessels of identified RHS closure areas for Chinook within which pollock fishing may be restricted.

4.1.4 Status Quo Observer Coverage and Monitoring Requirements

To support the Council’s salmon bycatch management goals, NMFS has implemented a comprehensive monitoring program to collect data on salmon bycatch. This information is used to enumerate how many Chinook and non-Chinook salmon are caught as bycatch from trawl vessels, where those fish came from (i.e., their genetic stock of origin), and whether a potential violation of laws occurred.

Since 1990, all vessels larger than 60’ length overall participating in the groundfish fisheries have been required to have observers on board at least part of the time. Prior to Amendment 91 regulations being implemented in 2011, a rate-based estimation procedure for salmon bycatch in the Bering Sea pollock fishery was used for catch accounting. Observer coverage was required based on vessel length, with 30% coverage required on vessels 60’ to 125’ length overall, 100% observer coverage on vessels larger than 125’, and 100% observer coverage at shoreside processing facilities. Observers would estimate the total weight of the haul, randomly selecting hauls to be sampled – or sample all hauls if feasible – and then determine the species composition of the catch by sampling the entire haul or portions of the haul. Additionally, observers assigned to pollock catcher vessels monitored offloads to collect independent information on the numbers, weights, and biological information of salmon.

However, Amendment 91 placed new constraints on the Bering Sea pollock fishery as each entity that receives an allocation of the Chinook PSC limit is prohibited from exceeding that allocation. If an entity were to reach its allocation of the Chinook PSC limit, they would be required to stop fishing for the remainder of the season. For example, if an entity reached its portion of the Chinook PSC limit in the A season it would be required to stop fishing, although it could fish pollock during the B season. Therefore, Amendment 91 increased the economic incentives to under report or misreport the amount of Chinook salmon bycatch, discard Chinook salmon bycatch, or to hide Chinook salmon before they could be counted by an observer. For these reasons, the monitoring requirements in the Bering Sea pollock fishery changed significantly in 2011 to enable better Chinook (and chum) salmon bycatch accounting.

The monitoring and enforcement provisions were put in place specifically to account for Chinook salmon PSC, but the methods are applied to all salmon species caught as bycatch in the Bering Sea pollock fishery. The monitoring of bycatch of all species of salmon in the Bering Sea pollock fishery is accomplished through requirements for observer coverage for all vessels and processing plants. In the Bering Sea, **CPs and motherships have two fishery observers onboard each vessel** to ensure every haul is monitored, 24 hours a day, every day (because there are two observers onboard, this is sometimes referred to as "200% observer coverage").

There are strict **salmon retention requirements** in place. As the pollock catch comes onboard a CP or mothership, it is immediately dumped from the deck of the boat into tanks and then into the factory. When salmon is encountered by the vessel's crew on the sorting line, it must be immediately put into a salmon bycatch storage bin and kept there until the observer is able to identify, count, weigh, and collect biological information from them. **Video cameras** are placed in the factory to monitor and record the sorting line and the activity of the sorters placing all the salmon into the bin, and to ensure no salmon are removed from the bin. If an observer notices the crew is not following this protocol, they write a statement of potential violation that is forwarded to the NOAA Office of Law Enforcement. Video records may be accessed by the Office of Law Enforcement up to 120 days after fishing.

For every haul, an observer keeps a running total of the salmon in the bin and treats each salmon as its own sampling unit. Every salmon is identified to species, counted, and recorded. In addition, every 10th Chinook salmon and every 30th chum salmon are sampled by the observer for biological information including sex, length, weight, tissues used to determine the stock of origin, a scale to aid in ensuring the species identification, and the snout if the adipose fin is missing to allow the RFID tag to be taken to support tagging studies. Every pollock vessel in the Bering Sea is required to retain all salmon caught as bycatch regardless of species because it is difficult to differentiate Chinook salmon from other species of salmon without direct identification by the observer.

In the Bering Sea pollock fishery, CVs delivering unsorted codends to motherships are not required to have observers onboard when fishing pelagic pollock, since all fish are observed by the two observers on the mothership. **CVs delivering to shoreside processors are required to carry one observer on every trip** (i.e., 100% observer coverage). On shoreside CVs, pollock catches are dumped into tanks below deck which are filled with refrigerated sea water. Once the catch is in the tanks, it is not accessible to people. At-sea discard of any species of salmon is prohibited. If any salmon are discarded at sea, they must be documented, and the observer must notify NMFS. Observers will write a statement of potential violation for the Office of Law Enforcement if salmon are discarded at sea.

In October 2022, the Council took final action to recommend electronic monitoring (EM) on pelagic trawl CVs operating in the Bering Sea and Gulf of Alaska. The trawl EM program only applies to CVs delivering to shoreside processors and does not include unobserved CVs delivering to motherships because they deliver unsorted codends directly to the mothership. This program is designed to use **EM for compliance monitoring**, meaning that EM video does not directly feed into catch accounting or stock assessments. Instead, catch accounting uses a combination of industry reported data which is verified through the EM system and data collected by shoreside observers. Maximized retention ensures that unsorted catch will be delivered and available to be sampled by shoreside observers, allowing for non-biased data to be collected at the trip level by shoreside observers at the processing plant. This improves catch accounting for salmon, could improve cost efficiencies in the Observer Program, and improves monitoring for compliance with discard retention requirements. The trawl EM program has been operating under an exempted fishing permit to evaluate the efficacy of EM systems and shoreside observers since 2020. A proposed rule was published in January, 2024 (89 FR 3902) and implementation of a regulated program is expected to start in 2025.

Regardless of whether a shoreside CV is carrying an observer or using an EM system for compliance monitoring, all salmon bycatch is required to be delivered to a shoreside processor to enable a full accounting of salmon. Every pollock delivery is monitored in its entirety for salmon bycatch. Observers in the processing plant monitor the entire offload and the number of salmon is counted from bins stored at the processing plant. From these storage bins, the observer uses the systematic random sampling design (currently sampling every 10th Chinook and 30th chum salmon) to obtain biological information.

Following the implementation of Amendment 91, NMFS found several issues that affect the observers' ability to ensure all species of salmon are counted. Amendment 110 therefore included some changes to the monitoring requirements established under Amendment 91, but that amendment did not fundamentally restructure the monitoring and catch accounting requirements. Specifically, Amendment 110 revised salmon retention and handling requirements on CVs, improved observer data entry and transmission requirements aboard CVs, clarified the requirements applicable to viewing salmon in a storage bin, and clarified the requirements for the removal of salmon from an observer sampling station at the end of a haul or delivery.

4.2 Alternative 2: Overall Bycatch (PSC limit) for Chum Salmon

Alternative 2 would establish an overall chum salmon PSC limit that would apply to the Bering Sea pollock B season (June 10-November 1). While the Bering Sea pollock fishery operates during the A season (winter months) and B season (summer months), chum salmon are primarily encountered during the B season pollock fishery (see Table 4-1). Any chum salmon encountered by the Bering Sea pollock fishery in the A season would not accrue to the overall chum salmon PSC limit under Alternative 2.

Table 4-1 Total number of non-Chinook bycatch (chum bycatch) in the A and B pollock seasons compared to B season non-Chinook bycatch in the Bering Sea pollock fishery, 2011 through 2022

Year	*B season*	*Total*	*B season as % of total*
2011	191,313	191,435	99.94%
2012	22,172	22,183	99.95%
2013	125,114	125,316	99.84%
2014	218,886	219,442	99.75%
2015	233,085	237,752	98.04%
2016	339,236	343,001	98.90%
2017	465,848	467,678	99.61%
2018	294,675	295,062	99.88%
2019	346,671	347,882	99.69%
2020	343,094	343,625	99.85%
2021	545,901	546,042	99.97%
2022	242,309	242,375	99.97%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(6-22-23)

Under Alternative 2, "overall" refers to the fact that all chum salmon from all genetic stock reporting groups, would accrue to the limit starting on June 10 each year; June 10 is the regulatory opening of the B season. This is in contrast to Alternative 3 which is described in detail in Section 4.3. **However, it is important to be clear that all species of salmon accounted for in the non-Chinook catch accounting category would accrue to the overall chum salmon PSC limit beginning on June 10 each year.** Recall the preliminary DEIS uses "chum salmon" when referring to the non-Chinook catch accounting category for ease of the reader. While sockeye, coho, pink, and chum salmon are included in the non-Chinook PSC category, over 99% of the salmon bycatch in the non-Chinook category are chum salmon (see Table 4-2).

Table 4-2 Annual number of salmon caught as bycatch by species in the non-Chinook catch accounting category, 2011 through 2022

Year	*Sockeye*	*Coho*	*Pink*	*Chum*	*Total*	*% Chum*
2011	27	32	202	191,174	191,435	99.86%
2012	16	9	42	22,116	22,183	99.70%
2013	9	39	94	125,174	125,316	99.89%
2014	22	24	50	219,346	219,442	99.96%
2015	89	37	988	236,638	237,752	99.53%
2016	34	34	144	342,789	343,001	99.86%
2017	150	53	926	466,549	467,678	99.76%
2018	87	9	125	294,841	295,062	99.86%
2019	185	169	1,600	345,928	347,882	99.86%
2020	228	125	385	342,887	343,625	99.79%
2021	48	60	385	545,549	546,042	99.91%
2022	16	34	47	242,278	242,375	99.96%
Average	76	52	416	281,272	281,816	98.83%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(6-22-23)

When the overall chum salmon PSC limit is reached, pollock fishing would cease. The Council has indicated the overall chum salmon PSC limit would be apportioned (divided) among the CDQ program, CP sector, inshore sector, and mothership sector. The CDQ program's apportionment of the chum salmon PSC limit would be further divided among the six CDQ groups. The inshore sector's apportionment of the chum salmon PSC limit would be further divided among the inshore cooperatives and the inshore open access fishery in years when the inshore open access fishery is managed by NMFS. Option 3 of Alternative 2 outlines four different approaches to apportioning the overall chum salmon PSC limit (see Section 4.2.3 for more information).

4.2.1 Option 1: Range of Overall Chum Salmon PSC Limits

Option 1 of Alternative 2 identifies a range of numerical values for analysis as overall chum salmon PSC limits. These values are based on historical chum salmon bycatch levels in the Bering Sea pollock from 2011 through 2022. The Council selected this year set for analysis because it largely aligns with the status quo regulations for salmon bycatch management. Implementing regulations for Amendment 91 establishing the Chinook hard cap and IPAs came into effect in 2011. In response to these regulations, the pollock fleet's fishing behavior changed to avoid Chinook salmon bycatch in response to the new regulations. For example, each sector has reduced its pollock harvests in months (January, February, September, October, and November) that had previously seen high levels of Chinook bycatch and has redistributed fishing effort to times when Chinook bycatch is expected to be lower (see Figure 4-6 and Stram & Ianelli 2015).

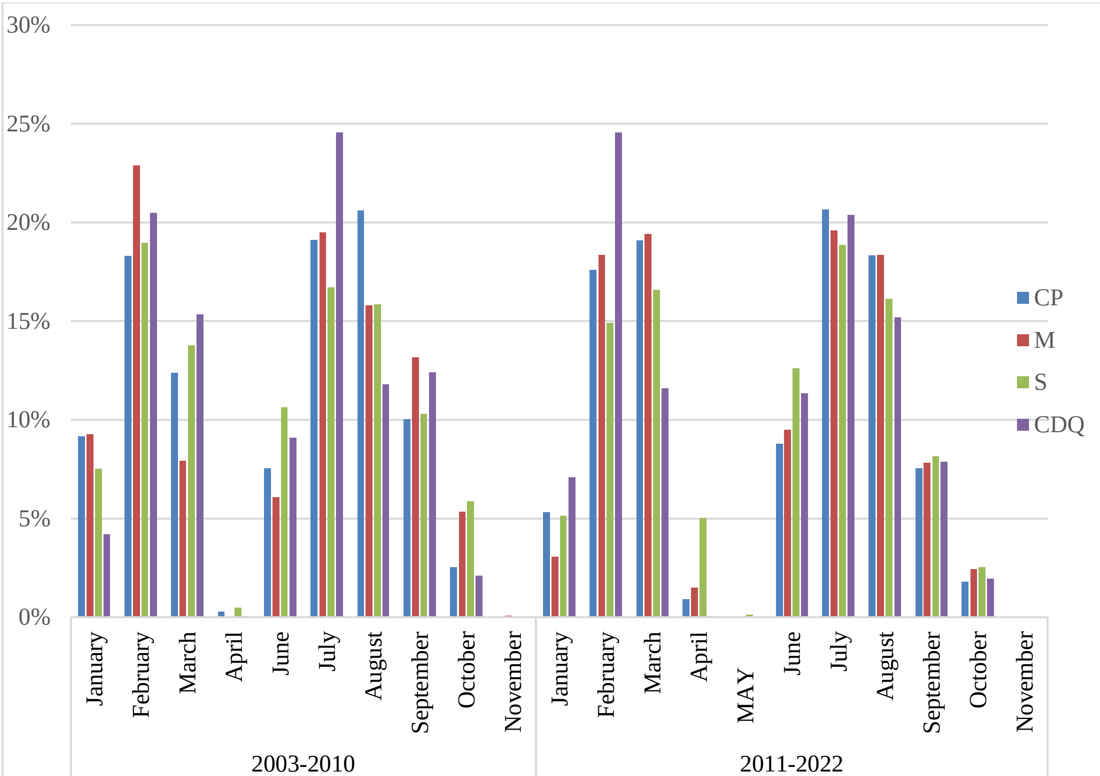

Figure 4-6 Average percent of Bering Sea pollock harvest by month and sector, broken out by pre- and post-implementation of Chinook bycatch limits in 2011 under Amendment 91, 2003 through 2010 and 2011 through 2022

Additionally, NMFS implemented a comprehensive monitoring program to collect data on salmon bycatch to achieve the Council's salmon bycatch management goals. The Observer Program has undertaken systematic genetic sampling of salmon bycatch (1 in 10 Chinook and 1 in 30 chum salmon) since 2011. These observer data are used to determine the genetic stock of origin of the bycatch including WAK chum. Prior to 2011, the genetic sampling of the bycatch did not fully encompass the time and space over which the pollock fishery occurred (i.e., the samples collected were not representative of the overall bycatch). Thus, the genetic data available from 2011 on are considered the best scientific information available to determine the stock of origin of salmon caught as bycatch in the Bering Sea pollock fishery.

The Council selected a range of numerical values for consideration as potential overall chum salmon PSC limits in October 2023. The range of values for potential chum salmon PSC limits and the Council's rationale is provided directly below in Table 4-3. An important thing to note is that, after receiving the staff presentation on the Preliminary Review analysis in October 2023, the Council requested analytical staff prepare an addendum comparing the pollock fishery's historical chum salmon bycatch performance against four different hypothetical PSC limits apportioned using three different approaches. That addendum can be accessed here. Prior to Council deliberations, the Council also asked staff to present an overview of the methods and results of the addendum analysis. In addition to the Preliminary Review analysis, as well as input from the AP and public testimony, that addendum and subsequent presentation informed the Council's decision-making for the recommended range of numerical values to be analyzed as potential chum salmon PSC limits as well as the apportionment suboptions identified for analysis which are described under option 3 of Alternative 2 in Section 4.2.3.

Table 4-3 Summary of chum salmon PSC limits under option 1 of Alternative 2 and the Council's rationale for each value

Chum Salmon PSC Limit	Council Rationale
200,000	Balances public testimony requesting a "very low" or a PSC limit of zero with practicability considerations
300,000	Rounded down from the 10-year average (2013-2022) level of bycatch of 315,449 chum salmon
350,000	Rounded down from the 5-year average (2018-2022) level of bycatch of 354,654 chum salmon
400,000	Rounded up from the 3-year average (2020-2022) level of bycatch of 377,102 chum salmon
450,000	Middle value between 400,00 and 550,000 chum salmon
550,000	Rounded value of the highest level of chum salmon bycatch in the analyzed period (2021 at 545,901 chum salmon)

4.2.2 Option 2: Chum Salmon PSC Limit Triggered by WAK Salmon Abundance Indices

Under option 2 of Alternative 2, an overall chum salmon PSC limit may be in effect during the B season based on an evaluation of indices that represent WAK chum salmon abundance. The overall chum salmon PSC limit would function similarly to what is described under option 1. The main distinction is that, **under option 2 of Alternative 2, the overall chum salmon PSC limit would only be in effect if an index failed to meet its threshold(s). Additionally, the overall chum salmon PSC limit may decrease depending on the number of areas that fail to meet indices thresholds**. Option 2 must be selected in conjunction with option 1 of Alternative 2, but the suboptions of option 2 described below are mutually exclusive.

The Council has not (yet) specified the numerical values for the chum salmon PSC limit that would be in effect when one or more areas fail to meet index thresholds. **This is a decision point for the Council at this stage – what numerical values to select that would apply as step-down provisions**. **For analytical purposes only, the analysis uses chum salmon PSC limits of 450,000 and 200,000 chum salmon to analyze option 2 of Alternative 2.** Analytical staff selected 450,000 and 200,000 chum salmon because numerical values were required for analysis of potential impacts, these PSC limit values are included in the broader range of values identified by the Council for analysis, and these values are the overall chum salmon PSC limit values specified by the Council under option 1 of Alternative 3.

When preparing the Preliminary Analysis for the October 2023 Council meeting, analytical staff worked with ADF&G to assess the relative feasibility of the concept of a Three-area index for WAK chum salmon abundance as requested by the Council in April 2023. The three ADF&G Management Areas selected to represent WAK chum salmon are the Yukon, Kuskokwim, and Norton Sound. As described in the Preliminary Analysis, the use of a Three-area index is feasible if each area is assessed independently. This approach treats each Management Area as its own "test" to determine whether the chum salmon stock's status is at low abundance. The individual test approach is preferable to summing the areas together under one index (as was done for Chinook salmon for the Three-river index (see Section 2.6.4 of Amendment 110 to the BSAI Groundfish FMP, NMFS 2015)). This is because there are limited run reconstructions for chum salmon returning to WAK river systems, and the units of measurement for appropriate estimates of abundance differ between the areas (e.g., full run reconstruction, test fishery, weir count, and others). Additionally, treating each area as an independent test provides some proportionality among the river systems as their run sizes vary substantially.[48]

4.2.2.1 Suboption 1: Three-area Index for WAK Chum Salmon Abundance

Under suboption 1, a Three-area index for WAK chum salmon abundance would be in place. This Three-area index would be based on: a) the sum of the Yukon River run reconstructions for summer and

[48] In October 2023, the SSC agreed that treating each area as an independent test for low abundance would be a reasonable approach. The SSC's final report form October 2023 is available here.

fall chum (1,525,000 chum); b) the cumulative Bethel test fishery CPUE (2,800 chum) for the Kuskokwim River; c) the summed escapement of the Snake, Nome, Eldorado, Kwiniuk, and North Rivers as well as the total Norton Sound harvest (57,000 chum).[49] [50]

The Council's October 2023 motion specified the step-down provisions under suboption 1 as follows:

- If 3/3 areas are above their respective index thresholds, no chum salmon PSC limit would be in place the following year.
- If 2/3 areas are above their respective index thresholds, the chum salmon PSC limit the following year is X.
- If 1 or no areas are above their respective index thresholds, the chum salmon PSC limit the following year is X.

Under suboption 1, the three areas would be weighted equally—no one area's performance against its index threshold would be prioritized over the others.

4.2.2.2 Suboption 2: Chum Salmon Index Based on the Yukon River Chum Salmon Stocks

Under suboption 2, an index of WAK chum abundance would be in place based on Yukon River chum abundance.

Under suboption 2a, the index for WAK chum abundance would be based on the Yukon River summer chum abundance based on the summer chum run reconstruction (950,000 chum). The Council's October 2023 motion specified the step-down provisions under suboption 2a as follows:

- If the Yukon River summer chum run is above the index threshold of 950,000 chum, no chum salmon PSC limit would be in place the following year.[51]
- If the Yukon River summer chum run is below the index threshold of 950,000 chum, the chum salmon PSC limit the following year is X.

Under suboption 2b, an index of WAK chum salmon would be in place based on the Yukon River summer (950,000) and fall chum (575,000) abundance run abundance using run reconstructions.

- If 2/2 areas are above the index thresholds, no chum salmon PSC limit would be in place the following year.
- If 1 or no areas (i.e., only one Yukon River chum salmon run or neither Yukon River chum salmon run) are above their respective index thresholds, the chum salmon PSC limit the following year is X.

Under suboption 2b, "areas" is meant to be understood as the two separate Yukon River chum salmon stocks. Suboption 2b differs from suboption 1 in that evaluation of Yukon River summer (950,000) and fall (575,000) chum salmon are intended to be evaluated separately. The two chum salmon stocks would be weighted equally (i.e., summer chum would not be prioritized over fall and vice versa). The Council included suboption 2 as a way to potentially simplify an abundance-based chum salmon PSC limit, focused on chum salmon stocks where robust run reconstruction data are available.

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[49] The Yukon River summer chum threshold was selected to be 950,000 and the fall chum salmon abundance threshold was selected to be 575,000. The total Yukon River chum salmon abundance is the summation of these stock abundance thresholds.
[50] The Council chose to incorporate both Yukon River summer and fall stocks because summer chum stocks contribute to the Coastal Western Alaska and Upper/Middle genetic reporting groups, while fall stocks contribute only to the Upper/Middle reporting group.
[51] The Council's intent with suboption 2a is that no chum salmon PSC limit would be in place if the summer chum salmon run is above the index threshold, but the exact language in the October 2023 motion indicates the PSC limit would be "X."

4.2.2.3 How Were Index Thresholds Determined?

This section provides information on how the index thresholds were selected. A decision point before the Council when it reviewed the Preliminary Analysis (October 2023) was to select a numerical value for each area (Yukon, Kuskokwim, Norton Sound) that would act as a threshold for determining whether chum salmon abundance is low. Note that for ease of the reader, this analysis uses the terms “low” or “not low,” but the thresholds for all indices represent historically poor years of chum abundance. ADF&G does not use a specific threshold or count of chum salmon that constitutes low abundance for management purposes. As such, this was a choice before the Council. The Council determined the numerical threshold(s) for low chum abundance in each Management Area based on historical chum salmon abundance information; the Council also chose to use whether ANS and escapement goals were met in the area as additional context for selecting these numerical values.

As described in Chapter 3, ANS is a range of harvest that the BOF is required to establish for a fish stock or portion of a stock that has received a positive customary and traditional use finding. How ANS ranges are established can vary widely because they are unique to an area’s historical use patterns for a single or group of fish species. Sometimes the ANS ranges for salmon are not species specific (Norton Sound) but other times they are (Yukon and Kuskokwim rivers). When establishing an ANS range, the BOF is advised to consider harvest histories that exclude years with low run abundance or management restrictions. In this way, ANS ranges should reflect unrestricted customary harvesting patterns.

In October 2023, the SSC asked for information on how to interpret years when subsistence harvests were below the ANS range, within the ANS range, or above the ANS range. Where subsistence harvest levels fall relative to an ANS range is highly contextual. Harvests within or above the ANS range typically suggest that the regulations do provide reasonable opportunity to harvest a resource for subsistence as long as subsistence patterns have not changed significantly. Subsistence harvests may fall below the lower bound of an ANS range for a number of reasons including shifts in species use (e.g., fewer households owning dog teams) as well as weather conditions or fishing restrictions in a given year. However, a retroactive look at subsistence harvests that fall below the ANS range in a given year or across multiple years can provide additional context to inform understandings of run abundance or stock status. Subsistence harvests below the lower bound of the ANS range may indicate, with other evidence, that there was not reasonable opportunity for subsistence harvests during the season and that subsistence needs may not have been met.

All WAK chum salmon escapement goals established by ADF&G are based on the best available data and are consistent with sustained yield principles (see Chapter 3). The lower bound of ADF&G escapement goals are associated with escapement levels that are expected to sustain future harvest and are above levels that would be associated with conservation concerns. Achieving escapement goals for some chum stocks may be impacted by factors other than low total run abundance. For example, error (or uncertainty) in preseason and inseason run assessments can lead to fishery management decisions that harvest too many (or too few) fish relative to the lower (or upper) bound of the escapement goal range.

Table 4-4 provides a summary of available data sources that would be used to determine chum salmon abundance by area. These sources of information informed the Council’s selection of the numerical thresholds used to determine low chum salmon abundance by area (October 2023) and would be the sources of information used by ADF&G on an annual basis to determine whether an area was above or below the Council’s numerical threshold(s).

Table 4-4 Summary of available data sources for determining chum salmon abundance by area and the rationale for using these data sources

Management Area		Available Data	Rationale for Data Use	Applicable suboption(s)
Yukon	**Summer**	Run reconstruction	Reliable run abundance information is available for both Yukon River summer and fall chum salmon as both runs have full run reconstruction information available, meaning there is total accounting of catch and escapement within the drainage	Suboption 1, suboption 2a, suboption 2b
	Fall	Run reconstruction		Suboption 1 and suboption 2b
Kuskokwim		Bethel test fishery cumulative CPUE	Data are readily available and a reliable estimate of run abundance Less impacted by weather conditions (flooding) compared to weir assessment Used by salmon fisheries managers	Suboption 1
Norton Sound		Standardized index of escapements to the Snake, Nome, Eldorado, Kwiniuk, and North Rivers + total Norton Sound Harvest	Representative of chum salmon returns across several management subdistricts across Norton Sound	Suboption 1

Table 4-5 provides a short description of the Council's rationale for each numerical threshold for low chum salmon abundance selected by the Council. In general, the index thresholds are the levels at which there may be some subsistence harvest opportunities but below managers might limit subsistence harvest opportunities to meet escapement goals. However, area escapement goals are not necessarily consistently met when abundance falls below the index thresholds.

Table 4-5 Summary of the Council's rationale for the index threshold values by area

Management area		Index threshold	Council Rationale
Yukon	**Summer**	950,000	Rounded value of the midpoint of Yukon River Drainage escapement goal (500,000-1,200,000) + ANS (83,500-142,192)
	Fall	575,000	Rounded value of the midpoint of Yukon River Drainage escapement goal (300,000-600,000) + ANS (89,500-167,900)
Kuskokwim		2,800	When CPUE is less than 2,300, the run size typically fails to meet ANS (41,200-116,400) and escapement goals; the selected value was also derived by rounding the 25th percentile
Norton Sound		57,000	Rounded from the 25th percentile for the standardized index (57,029)

4.2.2.4 Development of a Shared Index of Run Size for Western Alaska Chum Salmon

When the Council developed the three options for indices of WAK chum abundance in October 2023 under option 2 of Alternative 2, it requested analytical staff to bring back an analysis of how well the Yukon Area indices based on summer chum (suboption 2a) and summer + fall chum (suboption 2b) trended with the Three-area index (suboption 1). To address this request from the Council, a dynamic factor analysis of the constituent stocks for each area/index identified by the Council was completed to see how well they trend together, and how well the Yukon summer chum (suboption 2a) and Yukon summer + fall chum (suboption 2b) trend with the Three-area index.

Appendix 7 contains a full discussion of the development of the shared index using a dynamic factor analysis to combine the indices to a single trend and cross-correlation analysis between indices. A dynamic factor analysis was used to answer the Council's question as it collapses the different time series of data used to inform the Three-area index in suboption 1 into a single time-series. In doing so, the dynamic factor analysis shows how the Three-area index trends with the Yukon summer chum (suboption 2a) and Yukon summer + fall chum (suboption 2b) indices.

A second step was taken to look directly at how the Yukon summer chum and Yukon summer + fall chum indices cross-correlate with the individual time-series that comprise the Three-area index. Cross-correlation analyses indicate that Yukon summer chum (suboption 2a) and Yukon summer + fall chum (suboption 2b) both correlate (moderate to strong correlation) with the Three-area index representing the Kuskokwim (Bethel test fishery CPUE) and the combined indices representing the Norton Sound region. Here, the analysis is comparing the Yukon summer chum index (suboption 2a) and the Yukon summer + fall chum index (suboption 2b) with the Three-area index by evaluating the cross-correlation between the Yukon indices and each individual index (or component) of the Three-area index.

Yukon summer chum (suboption 2a) and Yukon summer + fall chum (suboption 2b) also correlate with the trend derived from the dynamic factor analysis representing shared dynamics among WAK chum salmon in the Three-area index when all individual indices (or components) are collapsed into a single time series trend that describes the shared patterns making up that Three-area index. **The primary point for the Council to consider, based this analysis, is that that the Yukon Area indices (suboption 2a and 2b) are likely to provide a reliable index of the aggregate dynamics of WAK chum salmon stocks. Suboption 2b – an index based on Yukon summer + fall chum – exhibits a stronger association with the shared dynamic factor analysis trend and the other individual stocks making up the Three-area index (suboption 1).**

The panel to the left in Figure 4-7 shows the combined (dynamic factor analysis-derived) shared trend in black as compared to the trend for all four individual indices over the time-series. The factor loading to the right, which are a measure of how well correlated each individual index is with the combined single estimated trend, show the relative comparative correlation of each individual index to the overall shared model trend. Factor loadings indicate that this combined trend was most strongly associated with the Yukon River fall and summer runs, followed by the Kuskokwim River as indexed by the Bethel test fishery CPUE with the Norton Sound abundance time-series exhibiting the weakest association.

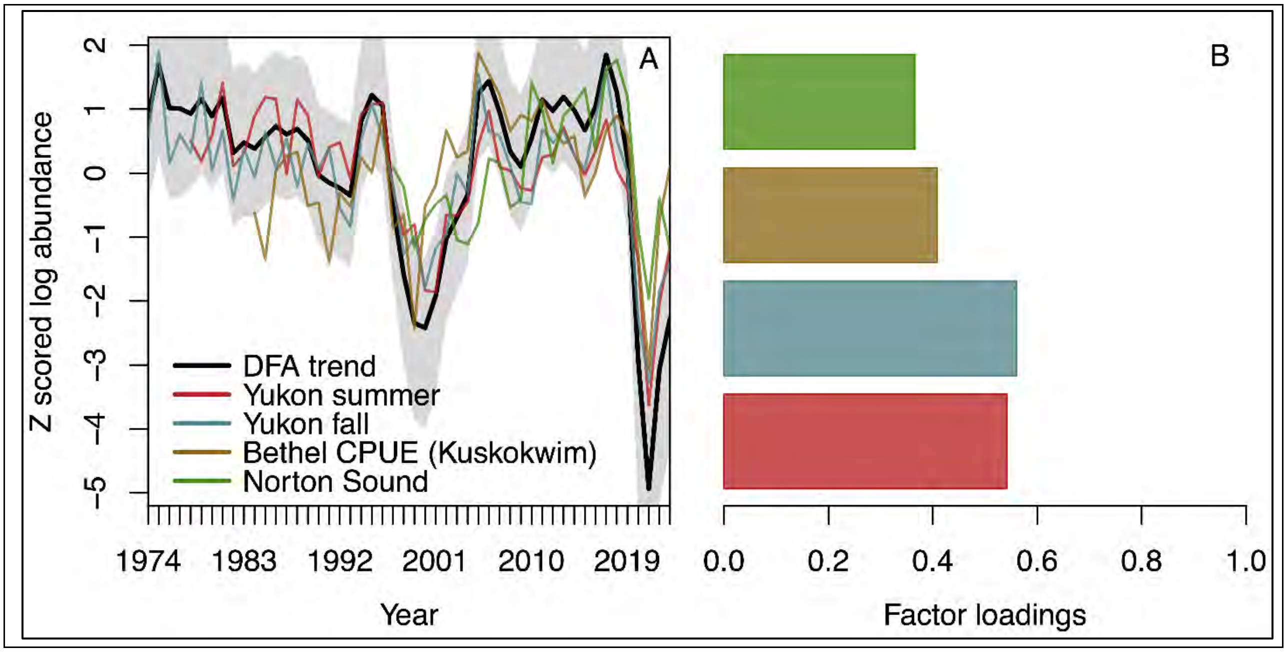

Figure 4-7 Dynamic factor analysis (DFA) derived shared latent trend and factor loadings

4.2.2.5 How Would an Index for WAK Chum Abundance be Implemented?

Each year, ADF&G would evaluate whether index thresholds for "low WAK chum salmon abundance" are met based on area assessments. The information ADF&G would use for area assessments would ultimately depend on the suboption selected. The data sources available for determining whether an area is at a "low" level of historical abundance (i.e., below index thresholds) varies by area (see Table 4-4). Reliable run abundance information is available for both Yukon River summer and fall chum as both runs have full run reconstruction information available. Bethel test fishery CPUE is a readily available and reliable estimate of chum salmon run abundance for the Kuskokwim River that is less impacted by environmental conditions than other methods of assessment. The standardized index of five rivers plus total Norton Sound harvest is a representative approach for the region. The final sport and subsistence harvest numbers from a given year would not be available to accommodate the Council's fall groundfish specification cycle and preliminary estimates would be used for the Norton Sound and Yukon regions (the Bethel test fishery cumulative CPUE does not incorporate harvests). However, because of the run timing for the Yukon River fall chum run, the non-harvest data necessary for run reconstruction estimates will be less complete.

ADF&G would provide NMFS an assessment of area performance against index thresholds by October 1 each year. This timing would accommodate the Council's annual October meeting where preliminary groundfish harvest specifications (including PSC limits) are set. Following Council action in October NMFS would publish a proposed rule for the preliminary groundfish harvest specifications in the BSAI including a chum salmon PSC limit. NMFS would set the overall chum salmon PSC limit (Alternative 2) based on whether the index met its threshold value(s).

4.2.3 Option 3: Apportionment Options Under Consideration

Under option 3 of Alternative 2, the overall chum salmon PSC limit would be apportioned among the CDQ program, the CP sector, the inshore sector, and the mothership sector. Option 3 of Alternative 2 must be selected in conjunction with option 1 or 2 of Alternative 2. The Council selected four different apportionment suboptions for analysis, which are as follows:

- Suboption 1: historical total bycatch by sector using the 3-year average (2020-2022)
- Suboption 2: historical total bycatch by sector using the 5-year average (2018-2022)
- Suboption 3: pro-rata 25% AFA pollock allocation and 75% historical total bycatch (2020-2022)
- Suboption 4: AFA pollock allocation

The Council is considering these suboptions because an apportionment based on average levels of chum salmon bycatch is an approach that considers each sector's historical performance or bycatch encounters (suboption 1 and 2). Analyzing apportionments based on AFA pollock allocations is an approach that considers a level of chum salmon bycatch in proportion to each sector's allocation of the target species (suboption 4). A pro-rata apportionment approach may potentially provide some balance because it is calculated as a weighted average, recognizing pollock sectors have different fishing patterns to harvest their pollock allocations (suboption 3).

In October 2023, the Council specified the apportionment percentages would be calculated by using an "adjusted blend" chum salmon bycatch rate, because operational choices are sometimes made at the vessel-level when a vessel is fishing CDQ pollock and how hauls are assigned to CDQ or non-CDQ fishing sectors. CDQ groups have historically been constrained by multiple hard caps for other groundfish species and prohibited species when the other Bering Sea pollock sectors were not. Some CDQ groups would request that the vessel operators assign the lower bycatch hauls to the CDQ groups and higher bycatch hauls to the non-CDQ pollock fisheries. This would result in it appearing that the vessel(s) fishing on behalf of CDQ groups were achieving lower levels of bycatch in their CDQ pollock hauls versus their non-CDQ pollock hauls. The Council approved this method because chum salmon bycatch history is an important element in the percentage apportionments under suboptions 1-3.

The following paragraphs describe how the adjusted blend bycatch rate was calculated and applied to derive the apportionment percentages for suboptions 1-3. Suboption 4 is not affected by the adjusted blend bycatch rate. The first step was to determine the sectors or vessels harvesting CDQ pollock during the B season in the analyzed period of 2011 through 2022 and catch accounting information showed that CDQ pollock was primarily harvested by CPs harvesting AFA pollock. An exception to this pattern is that CDQ pollock was landed by one CV delivering to a mothership in the 2016 B season. Staff did consider whether to include the CDQ pollock delivered by a single CV to a mothership in the adjusted blend bycatch rate but ultimately decided to exclude it.[52] Staff chose to exclude the mothership sector from the adjusted blend bycatch rate calculation because the entire mothership sector would be included in the blend calculation for 2016 based on a single vessel, and the Council is considering the 3-year and 5-year averages for the apportionment approaches, both of which exclude 2016.

The following steps were taken to calculate the adjusted blend bycatch rate and the adjusted historical averages used in the analysis:[53]

- First, the number of non-Chinook salmon reported as B season bycatch in the CDQ pollock fishery was summed with the number of non-Chinook salmon reported as B season bycatch in the CP sector in each year from 2011 through 2022.
- Second, the B season pollock harvest (mt) for the CDQ pollock fishery and CP sector were summed together in each year from 2011 through 2022.
- Next, the combined pool of B season non-Chinook bycatch was divided by the combined pool of pollock landings to derive an adjusted blend bycatch rate in each year.

[52] To calculate the first approach, the same steps as shown below were taken. The difference is that, under the first approach, the mothership sector's chum salmon bycatch and pollock harvest were included in the respective "combined pools." One additional step was made to multiply the pollock associated with the mothership harvest in each year during the B season only by the average non-Chinook bycatch rate.

[53] This is the same procedure used to calculate the adjusted blend bycatch rate for Chinook salmon used under Amendment 91.

- The adjusted blend bycatch rate was then multiplied by the pollock landings (mt) associated with the CDQ pollock fishery to calculate an “adjusted” number of non-Chinook salmon taken as bycatch in during the B season. The same approach was taken to calculate the “adjusted” number of non-Chinook salmon for the CP sector in each year.

The adjusted blend bycatch rate does not affect the calculation of apportionment percentages for the inshore sector or the mothership sector and are only used to determine apportionment percentages for the CP and CDQ sectors. Each sector’s historical performance against the different numerical values for an overall chum salmon PSC limit is based on “the actual” bycatch levels reported by NMFS observers, which reflects how the sector’s performance against an overall chum PSC limit would be assessed in the future under a regulated program (pending Council action).

Table 4-6 displays the adjusted bycatch levels and apportionments for the CDQ and CP sectors and the reported levels of chum salmon bycatch for the inshore sector. While the mothership sector was not included in the blend rate analysis, the bycatch information for this sector is affected in Table 4-6 because the chum salmon bycatch encountered by a CV while fishing CDQ pollock is attributed to the CDQ and CP sectors. As such, the sector-level bycatch information in Table 4-6 should not be compared against other tables in the preliminary DEIS showing historical levels of reported bycatch.

Table 4-6 3- and 5-year average levels of B season chum salmon bycatch by sector including the adjusted historical blend for the CP and CDQ sectors, 2011 through 2022

Year	*CDQ*	*CP*	*Inshore*	*Mothership*	*Total*
2011	10,033	38,024	118,857	24,399	191,313
2012	475	1,653	19,067	977	22,172
2013	2,403	8,380	110,496	3,835	125,114
2014	14,735	50,742	145,322	8,087	218,886
2015	9,953	34,743	174,343	14,046	233,085
2016	33,654	117,599	144,882	43,101	339,236
2017	64,374	230,039	154,610	16,825	465,848
2018	28,103	97,930	147,369	21,303	294,705
2019	28,309	100,704	172,798	44,860	346,671
2020	17,420	68,299	237,632	19,743	343,095
2021	34,394	119,186	341,779	50,542	545,901
2022	17,618	60,533	131,896	32,262	242,309
3-yr avg.	23,144	82,673	237,102	34,182	377,102
3-yr avg. as % of total	**6.1%**	**21.9%**	**62.9%**	**9.1%**	**100.0%**
5-yr avg.	25,169	89,330	206,295	33,742	354,436
5-yr avg. as % of total	**7.1%**	**25.2%**	**58.2%**	**9.5%**	**100.0%**

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

Table 4-7 provides the reader with a summary of the percentage of the overall chum salmon PSC limit that each Bering Sea pollock sector would receive under each apportionment suboption.

Table 4-7 Summary table for sectors’ apportionment percentages under each suboption

Apportionments	*CDQ*	*CP*	*Inshore*	*Mothership*
Suboption 1: 3-yr avg.	6.1%	21.9%	62.9%	9.1%
Suboption 2: 5-yr avg.	7.1%	25.2%	58.2%	9.5%
Suboption 3: pro-rata	7.1%	25.4%	58.4%	9.1%
Suboption 4: AFA	10%	36%	45%	9%

Notes: The AFA percentages under suboption 4 – 10% to the CDQ program, 36% to the CP sector, 45% to the inshore sector, and 9% to the mothership sector – reflect the CDQ program’s pollock allocation and the AFA sectors’ pollock allocation of the directed fishing allowance, the latter of which sets aside the ICA which is used for the incidental catch of pollock in other groundfish fisheries.

Table 4-8 below shows the number of non-Chinook (read as chum salmon) apportioned to each sector under each suboption for all chum salmon PSC limits under option 1 of Alternative 2 (see Section 4.2.1) using the percentages summarized in Table 4-7 above. These values represent the functional limit that would apply to that sector.

Table 4-8 Number of chum salmon apportioned under each suboption to each Bering Sea pollock sector under each potential value of the overall chum salmon PSC limit identified in option 1 of Alternative 2

PSC limit	*Apportionments*	*CDQ*	*CP*	*Inshore*	*Mothership*
200,000	Suboption 1: 3-yr avg.	12,200	43,800	125,800	18,200
	Suboption 2: 5-yr avg.	14,200	50,400	116,400	19,000
	Suboption 3: Pro-rata	14,200	50,800	116,800	18,200
	Suboption 4: AFA	20,000	72,000	90,000	18,000
300,000	Suboption 1: 3-yr avg.	18,300	65,700	188,700	27,300
	Suboption 2: 5-yr avg.	21,300	75,600	174,600	28,500
	Suboption 3: Pro-rata	21,300	76,200	175,200	27,300
	Suboption 4: AFA	30,000	108,000	135,000	27,000
350,000	Suboption 1: 3-yr avg.	21,350	76,650	220,150	31,850
	Suboption 2: 5-yr avg.	24,850	88,200	203,700	33,250
	Suboption 3: Pro-rata	24,850	88,900	204,400	31,850
	Suboption 4: AFA	35,000	126,000	157,500	31,500
400,000	Suboption 1: 3-yr avg.	24,400	87,600	251,600	36,400
	Suboption 2: 5-yr avg.	28,400	100,800	232,800	38,000
	Suboption 3: Pro-rata	28,400	101,600	233,600	36,400
	Suboption 4: AFA	40,000	144,000	180,000	36,000
450,000	Suboption 1: 3-yr avg.	27,450	98,550	283,050	40,950
	Suboption 2: 5-yr avg.	31,950	113,400	261,900	42,750
	Suboption 3: Pro-rata	31,950	114,300	262,800	40,950
	Suboption 4: AFA	45,000	162,000	202,500	40,500
550,000	Suboption 1: 3-yr avg.	33,550	120,450	345,950	50,050
	Suboption 2: 5-yr avg.	39,050	138,600	320,100	52,250
	Suboption 3: Pro-rata	39,050	139,700	321,200	50,050
	Suboption 4: AFA	55,000	198,000	247,500	49,500

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

4.2.3.1 Dividing the CDQ Program's Apportionment Among the CDQ Groups

NMFS would further divide the CDQ program's apportionment of the overall chum salmon PSC limit among the six CDQ groups in proportion to each CDQ group's pollock allocation. All CDQ group's pollock allocations have been fixed since 2005 as a result of amendments to the MSA. The CDQ group's apportionments of the overall chum salmon PSC limit would be as follows: APICDA 14%, BBEDC, 21%, CBSFA 5%, CVRF 24%, NSEDC 22%, and YDFDA 14%.

Table 4-9 only displays information relevant to the CDQ program and CDQ groups' apportionments of the overall chum salmon PSC limit. A CDQ group's apportionment of the overall chum salmon PSC limit is derived by multiplying their pollock allocation percentage by the CDQ program's apportionment. The number of chum salmon apportioned to each CDQ group under the suboption/chum salmon PSC limit represents the functional limit that would apply to that CDQ group.

Table 4-9 Apportionments of the chum salmon PSC limit to the six CDQ groups based on each CDQ group's pollock allocation

PSC limit	*Apportionment suboption*	*CDQ program*	*14% APICDA*	*21% BBEDC*	*5% CBSFA*	*24% CVRF*	*22% NSEDC*	*14% YDFDA*
200,000	3-yr avg. (6.1%)	12,200	1,708	2,562	610	2,928	2,684	1,708
	5-yr avg. (7.1%)	14,200	1,988	2,982	710	3,408	3,124	1,988
	Pro-rata (7.1%)	14,200	1,988	2,982	710	3,408	3,124	1,988
	AFA (10%)	20,000	2,800	4,200	1,000	4,800	4,400	2,800
300,000	3-yr avg. (6.1%)	18,300	2,562	3,843	915	4,392	4,026	2,562
	5-yr avg. (7.1%)	21,300	2,982	4,473	1,065	5,112	4,686	2,982
	Pro-rata (7.1%)	21,300	2,982	4,473	1,065	5,112	4,686	2,982
	AFA (10%)	30,000	4,200	6,300	1,500	7,200	6,600	4,200
350,000	3-yr avg. (6.1%)	21,350	2,989	4,484	1,068	5,124	4,697	2,989
	5-yr avg. (7.1%)	24,850	3,479	5,219	1,243	5,964	5,467	3,479
	Pro-rata (7.1%)	24,850	3,479	5,219	1,243	5,964	5,467	3,479
	AFA (10%)	35,000	4,900	7,350	1,750	8,400	7,700	4,900
400,000	3-yr avg. (6.1%)	24,400	3,416	5,124	1,220	5,856	5,368	3,416
	5-yr avg. (7.1%)	28,400	3,976	5,964	1,420	6,816	6,248	3,976
	Pro-rata (7.1%)	28,400	3,976	5,964	1,420	6,816	6,248	3,976
	AFA (10%)	40,000	5,600	8,400	2,000	9,600	8,800	5,600
450,000	3-yr avg. (6.1%)	27,450	3,843	5,765	1,373	6,588	6,039	3,843
	5-yr avg. (7.1%)	31,950	4,473	6,710	1,598	7,668	7,029	4,473
	Pro-rata (7.1%)	31,950	4,473	6,710	1,598	7,668	7,029	4,473
	AFA (10%)	45,000	6,300	9,450	2,250	10,800	9,900	6,300
550,000	3-yr avg. (6.1%)	33,550	4,697	7,046	1,678	8,052	7,381	4,697
	5-yr avg. (7.1%)	39,050	5,467	8,201	1,953	9,372	8,591	5,467
	Pro-rata (7.1%)	39,050	5,467	8,201	1,953	9,372	8,591	5,467
	AFA (10%)	55,000	7,700	11,550	2,750	13,200	12,100	7,700

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

4.2.3.2 Dividing the Inshore Sector's Apportionment Among the Cooperatives

NMFS would further divide the inshore sector's apportionment of the chum salmon PSC limit among the inshore cooperatives and the inshore open access fishery (if the inshore open access fishery exists in a particular year).

Each inshore cooperative that received an apportionment of the chum salmon PSC limit would be responsible for managing its apportionment, and the cooperative would be required to stop fishing for pollock once the limit was reached. NMFS would apportion the chum salmon PSC limit to approved inshore cooperatives that filed an application by December 1. The December 1 deadline is necessary because the inshore sector cooperative allocations must be calculated for NMFS to open the Bering Sea pollock fishery in January each year. There have been six inshore cooperatives in recent years, although there are five active cooperatives in 2024 as the Peter Pan Fleet Cooperative did not file an AFA inshore cooperative allocation for the 2024 season. NMFS would apportion the inshore sector's chum salmon PSC limit among the inshore cooperatives and the inshore open access fishery based on the percentage of pollock allocated to each cooperative under 50 CFR 679.62(a). Under 50 CFR 679.26(a), an inshore cooperative that applies for and receives an AFA inshore cooperative fishing permit under 50 CFR 679.4(l)(6) receives an annual pollock allocation amount based on the two years with the highest levels of non-CDQ pollock landings from 1995 through 1997.

If a CV does not join an inshore cooperative it must fish in the inshore open access fishery.[54] The number of CVs that have entered the inshore open access fishery has been consistently small until the 2024 fishing season. In 2024, there are 10 vessels in the inshore open access fishery, in part due to the fact that the Peter Pan Fleet Cooperative did not file an AFA inshore cooperative application for the 2024 season. Prior to 2024, there was an inshore open access fishery in 2023 with one vessel participating and there was an inshore open access fishery in 2015, 2016, and 2018.

To determine the amount of the chum salmon PSC limit that would apply to the inshore open access fishery in years when it exists, NMFS would calculate an amount of chum salmon PSC based on the proportion of the vessel's pollock catch history in the inshore open access. This is the same procedure used for the Chinook PSC limit. NMFS manages the inshore open access fishery in years when it exists, and NMFS would close the fishery once the inshore open access limit is reached.

Analytical staff have considered apportionments to inshore cooperatives based on their 2022 pollock allocations, which is the most recent year analyzed in the status quo period. A single year (2022) was chosen to base the cooperative's apportionments on because the amount of pollock allocated to an inshore cooperative can vary annually as cooperative's allocation of pollock are based on the catch history of the vessels that are members of the cooperative. Table 4-10 displays the number of chum salmon that the inshore sector would be apportioned under each suboption applied to all potential chum salmon PSC limit values identified under option 1 of Alternative 2 (see Section 4.2.1).

[54] Typically, inshore CVs participate in the inshore open access fishery when they wish to leave their cooperative. Alternatively, a cooperative could allow a vessel to deliver more of their pollock quota to the processor of the cooperative the vessel would like to join (see 50 CFR 679.4(l)(6)(ii)(D)(*2*)(*i*)).

Table 4-10 Apportionment suboptions of the chum salmon PSC limit to inshore cooperatives and the inshore open access fishery based on cooperative's 2022 Bering Sea pollock allocations

PSC limit	*Apportionment suboptions*	*Inshore sector*	*(33.778%) Akutan CV Assoc.*	*(0.000%) Arctic Enterprise Assoc.*	*(10.773%) Northern Victor Fleet Coop*	*(2.512%) Peter Pan Fleet Coop.*	*(11.454%) Unalaska Fleet Coop.*	*(22.094%) UniSea Fleet Coop.*	*(19.380%) Westward Fleet Coop.*	*(0.000%) Inshore Open Access*
200,000	3-yr avg. (62.9%)	125,800	42,505	0	13,552	3,160	14,409	27,794	24,380	0
	5-yr avg. (58.4%)	116,400	39,329	0	12,540	2,924	13,332	25,717	22,558	0
	Pro-rata (58.2%)	116,800	39,464	0	12,583	2,934	13,378	25,806	22,636	0
	AFA (45%)	90,000	30,409	0	9,696	2,261	10,309	19,885	17,442	0
300,000	3-yr avg. (62.9%)	188,700	63,758	0	20,329	4,740	21,614	41,691	36,570	0
	5-yr avg. (58.4%)	174,600	58,994	0	18,810	4,386	19,999	38,576	33,837	0
	Pro-rata (58.2%)	175,200	59,197	0	18,874	4,401	20,067	38,709	33,954	0
	AFA (45%)	135,000	45,614	0	14,544	3,391	15,463	29,827	26,163	0
350,000	3-yr avg. (62.9%)	220,150	74,384	0	23,717	5,530	25,216	48,640	42,665	0
	5-yr avg. (58.4%)	203,700	68,826	0	21,945	5,117	23,332	45,005	39,477	0
	Pro-rata (58.2%)	204,400	69,063	0	22,020	5,135	23,412	45,160	39,613	0
	AFA (45%)	157,500	53,216	0	16,967	3,956	18,040	34,798	30,524	0
400,000	3-yr avg. (62.9%)	251,600	85,011	0	27,105	6,320	28,818	55,589	48,760	0
	5-yr avg. (58.4%)	232,800	78,658	0	25,080	5,848	26,665	51,435	45,117	0
	Pro-rata (58.2%)	233,600	78,929	0	25,166	5,868	26,757	51,612	45,272	0
	AFA (45%)	180,000	60,818	0	19,391	4,522	20,617	39,769	34,884	0
500,000	3-yr avg. (62.9%)	283,050	95,637	0	30,493	7,110	32,421	62,537	54,855	0
	5-yr avg. (58.4%)	261,900	88,491	0	28,214	6,579	29,998	57,864	50,756	0
	Pro-rata (58.2%)	262,800	88,795	0	28,311	6,602	30,101	58,063	50,931	0
	AFA (45%)	202,500	68,421	0	21,815	5,087	23,194	44,740	39,245	0
550,000	3-yr avg. (62.9%)	345,950	116,890	0	37,269	8,690	39,625	76,434	67,045	0
	5-yr avg. (58.4%)	320,100	108,155	0	34,484	8,041	36,664	70,723	62,035	0
	Pro-rata (58.2%)	321,200	108,527	0	34,603	8,069	36,790	70,966	62,249	0
	AFA (45%)	247,500	83,625	0	26,663	6,217	28,349	54,683	47,966	0

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

4.2.4 Transfer Provisions

In October 2023, the Council provided direction that chum salmon PSC would be transferable under Alternative 2 (and Alternative 3), and that its intent is to mirror the transfer provisions for Chinook salmon PSC (see 50 CFR 679.21(f)(8)(i)).[55] The Council's rationale for incorporating transfer provisions is that it could provide vessels, cooperatives, and fishing sectors more flexibility to utilize their B season pollock allocation. Transfer provisions for chum salmon PSC would apply under any combination of option or suboption under Alternative 2.

As such, regulations at 50 CFR 679.21 would allow chum salmon PSC to be transferred among sectors (i.e., inter-sector transfers), among inshore cooperatives (i.e., inter-cooperative transfers), among CDQ groups (i.e., inter-group transfers), and among vessels within a single cooperative (i.e., intra-cooperative transfers). Intra-cooperative transfers of chum salmon PSC would be completed by cooperative managers. However, inter-cooperative, inter-CDQ group, and inter-sector transfers of chum salmon PSC would require NMFS approval of the transfer. Requests for approvals would be filed by the entity receiving the transfer (for regulations implementing transfer provisions for Chinook salmon PSC, see 50 CFR 679.21(f)(8)(ii)).

Regulations would also allow for post-delivery transfers of chum salmon PSC. If the amount of chum salmon caught as bycatch in the B season pollock fishery exceeds an entity's apportionment, the entity would be eligible to receive a transfer of chum salmon PSC to cover an overage. If an overage occurs, all vessels fishing on behalf of the entity are allowed to complete the pollock fishing trip that they are on, but the vessels would not be allowed to start another fishing trip. An entity would be allowed to request a transfer to "cover" the overage and bring the allocation account balance to zero, but the entity would not be allowed to transfer any more chum salmon PSC than what is required to balance the account to zero.

Vessels fishing in the inshore open access fishery or under the opt-out allocation fish under specific Chinook PSC allocations that are not transferable (see 50 CFR 679.21(f)(10)). NMFS has indicated it would take the same approach to managing a chum PSC limit for the inshore open access fishery or to vessels that are not members of an IPA (although the latter scenario has never occurred). Chum salmon PSC apportioned to the inshore open access fishery would not be transferable because these vessels are exposed to the risks of open access fishing if there is a scenario where more than one vessel is participating, there is no entity (i.e., cooperative) to represent the vessel to complete a transfer, and NMFS is responsible for managing the inshore open access fishery. NMFS would project when the inshore open access fishery was anticipated to reach its chum PSC apportionment and close the fishery prior to it being reached. The amount of chum salmon PSC that would be apportioned to the inshore open access fishery in a year where the inshore open access fishery occurred would be determined by NMFS after the inshore cooperative permit applications are received by NMFS on December 1.

4.2.5 Monitoring, Inseason Management, and Enforcement

Under Alternative 2, regulations at 50 CFR 679.21 would be modified to incorporate an overall chum salmon PSC limit. **A policy decision before the Council at this point is whether it would like to modify existing regulations at 50 CFR 679.22(a)(10) related to the Chum Salmon Savings Area. As described above, the Chum Salmon Savings Area** currently exists as a backstop measure should vessels or CDQ groups directed fishing for pollock not be governed by an IPA (and thus not participate in the RHS system for chum salmon avoidance). The Chum Salmon Savings Area has not been closed since 2004 and all vessels and CDQ groups have participated in an IPA since 2011. However, the Chum Salmon Savings Area closure is triggered by a non-Chinook salmon PSC limit of 42,000 fish (4,494 fish

[55] Transfers of PSC are not reallocations. Reallocations or transfers of pollock between sectors is prohibited under the AFA. For other groundfish fisheries, reallocations are NMFS inseason management actions, and they typically occur at the end of a fishing season or when a sector has indicated it has completed its fishing season. If there is sufficient projected unused TAC for NMFS to reallocate to another eligible sector, it may do so.

for CDQ groups and 37,506 fish for non-CDQ sectors). Leaving the Chum Salmon Savings Area in regulations would mean two different PSC limits would apply to a vessel or CDQ group that chose not to be governed by, or participate in, the IPAs.

The monitoring to collect data on salmon bycatch under the status quo would remain the same under Alternative 2 and enable a census count of all salmon taken as bycatch in the Bering Sea pollock fishery. PSC apportionments require comprehensive monitoring because of the economic incentives created by this system to under report or misreport catch. NMFS has implemented a comprehensive monitoring program to collect data on salmon bycatch to support the Council's salmon bycatch management goals. The observer and monitoring requirements currently in place to account for Chinook salmon PSC under Amendments 91/110 also enable the same comprehensive monitoring by NMFS to monitor all salmon including non-Chinook PSC.

As such, the Council's consideration of a chum salmon limit does not require additional monitoring and enforcement provisions to ensure accurate and precise accounting of all salmon PSC. These observer and monitoring requirements currently include:

- Full monitoring of all directed pollock fishing with two observers and cameras on CPs and motherships; and either an observer or electronic monitoring system on catcher vessels.
- Strong regulations that require all salmon to be sorted so that all salmon are counted and to enable biological sampling.
- Catcher vessels are required to retain and deliver and deliver all salmon species for enumeration by observers at the dock.
- Catch Monitoring and Control Plans to assist in collection of data from landings and support of the observers.

As noted above, the non-Chinook catch accounting category for salmon PSC includes pink, sockeye, coho, and chum salmon. While the majority (~99%) of salmon in this category are chum salmon, small amounts of pink, sockeye, and coho salmon would also accrue to the overall chum salmon PSC limit under Alternative 2. Since the Council last considered a chum salmon PSC limit in 2011, the catch accounting system has been updated so it would be possible to separate chum salmon from the other three species of salmon in the non-Chinook category. However, this would likely require regulatory changes and redesigning the catch accounting system. As such, it is NMFS's preference that the non-Chinook category be left as is.

The Council has indicated its preference is for the chum salmon PSC limit to be allocated among specific entities within the pollock fishery (i.e., among each sector and further apportioned to the inshore cooperatives and CDQ groups). Under this approach, the PSC allocations made to specific entities would be enforced through regulatory provisions that prohibit the entity from exceeding its PSC allocation. Entity-specific allocations are used for other management programs including the Chinook salmon PSC limit. Entities monitor their Chinook salmon PSC (as does NMFS) relative to their allocation and they are prohibited from exceeding their Chinook salmon PSC allocation. They must stop fishing, and if a PSC limit is exceeded the entity or NMFS would report any overages to NOAA Office of Law Enforcement. An allocation to an entity with prohibition from exceeding the allocation is different from the management approach where NMFS projects when the limit will be reached and issues a fishery closure. The closure would be effective upon filing in the Federal Register which takes multiple days (and the Office of the Federal Register is closed on the weekends and federal holidays). In short, issuing an allocation to a cooperative or CDQ group along with a prohibition to exceed the allocation is timelier because the cooperative or CDQ group can monitor their bycatch in near real-time and cease pollock fishing immediately.

4.3 Alternative 3: Chum Salmon PSC Limit with WAK Chum Threshold

Prior to describing how Alternative 3 would work, staff would note that **the preliminary DEIS refers to "the annual WAK chum salmon bycatch limit" in the Council's October 2023 motion as a "WAK chum threshold."** This is because whether or not a sector reaches their apportionment of the WAK threshold could only be known after the fishing year is complete (i.e., there is no real-time genetic information available). As such, directed fishing would not cease if a sector reached its apportionment and this alternative would not function as a regulatory PSC limit. Additionally, this section of the preliminary DEIS describes how Alternative 3 would function as it was specified in the Council's October 2023 motion and the accompanying rationale. **It does not appear, however, that Alternative 3 could be implemented as the Council originally intended and there are several considerations before the Council related to Alternative 3 at this time**. Staff have summarized these considerations for the Council and the public in Section 4.3.2.

Alternative 3 would establish an annual WAK chum threshold of 40,000 to 53,000 WAK chum salmon.[56] [57] The number of chum salmon caught as bycatch during the B season pollock fishery that are estimated to be WAK chum through genetic sampling analyses would accrue to this threshold amount. Alternative 3 must be implemented in conjunction with the overall chum salmon PSC limit under option 1 of Alternative 2. As such, **Alternative 3 could not be selected or implemented as a standalone management measure.**

The Council chose to set the WAK chum threshold as a range of 40,000 to 53,000 WAK chum salmon because there is uncertainty around the point estimates for the estimated proportion and number of WAK chum salmon in the overall bycatch. To illustrate this point, Table 4-11 provides the average proportional contribution of the WAK genetic stock reporting groups (broken out as Coastal Western Alaska, Upper/Middle Yukon, and Western Alaska combined) over the most recent 3-, 5-, and 10-year averages as well as the 95% credible interval over those averages (2011-2022). The point estimate for the 3-year average (2020-2022) proportion of WAK chum salmon in the overall bycatch is 13.8% (46,150 WAK chum salmon), but the 95% credible interval denotes the uncertainty surrounding the estimated 3-year average proportion of WAK chum salmon, which could range from 12.1% to 15.7% (39,960 to 52,794 WAK chum salmon). In other words, the best estimate is that the Bering Sea pollock fishery caught 46,150 WAK chum salmon, with a 95% probability the true value of WAK chum salmon ranged from 39,96 to 52,794 WAK chum salmon.

As such, it is analytical staff's understanding that Council intends Alternative 3 to would be implemented as a range. However, NMFS is uncertain how to implement a range of values for a threshold in regulations. With a range of numbers, it is unclear what number NMFS would use to evaluate sectors against a performance standard. For this analysis, staff used the upper bound because it provides the most flexibility in light of the uncertainty and NMFS could use that same approach for implementation of the threshold. The agency would look for the Council to clarify its implementation intent.

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[56] The range for the WAK chum threshold of 40,000 to 53,000 is the rounded 3-year average (2020 – 2022) estimated proportion of the WAK combined genetic stock reporting group considered in the Preliminary Analysis (October 2023). This genetic stock reporting group includes the Coastal Western Alaska and Upper/Middle Yukon reporting groups.

[57] The Council considered other approaches to calculating the WAK chum threshold in the Preliminary Analysis (October 2023) including applying the prior year's estimated WAK proportion to the fishery in the upcoming year. For example, if the estimated proportion of WAK chum salmon in the overall bycatch was 18.0% in 2023 and the overall PSC limit was set at 300,000 chum salmon, the WAK chum salmon annual bycatch limit would apply in 2024 is 54,000 WAK chum salmon. Under this approach, industry would have an incentive to stay under the overall limit of 300,000 but not necessarily the WAK proportion in the overall bycatch.

Table 4-11 3-, 5-, and 10-year average (2011-2022) estimated proportion of WAK chum salmon stocks in the overall B season chum salmon bycatch over the most recent 3-, 5-, and 10- year periods as well as the 95% credible interval (CI) over those averages

Time Period		*Coastal Western Alaska*	*Upper Middle Yukon*	*Western Alaska*
3-year avg.	Proportion	12.7%	1.2%	**13.8%**
	95% CI	11.4 - 14.0%	0.7-1.7%	**12.1 - 15.7%**
	Number	42,401	3,748	**46,150**
	95% CI	37,747 - 47,163	2,213 - 5,630	**39,960 - 52,794**
5-year avg.	Proportion	13.9%	1.5%	**15.3%**
	95% CI	12.3 - 15.5%	0.9 - 2.1%	**13.8 - 17.6%**
	Number	45,483	4,455	**49,938**
	95% CI	40,132 - 51,085	2,739 - 6,507	**42,871 - 57,592**
10-year avg.	Proportion	15.4%	3.1%	**18.5%**
	95% CI	13.6 - 17.3%	2.2 - 4.1%	**15.8-21.4%**
	Number	45,668	8961	**54,629**
	95% CI	40,055 - 51,431	6,398 - 11,938	**46,453 - 63,369**

Under Alternative 3, the Council has specified the annual WAK chum salmon threshold would be apportioned among the pollock sectors according to the same suboptions and percentages considered under option 3 of Alternative 2 (see Section 4.2.3). Table 4-12 provides the numerical values for the range of WAK chum salmon each sector would be apportioned under each suboption (3-year historical average, 5-year historical average, pro-rata, and AFA). The apportionment amounts are presented and analyzed as a range to reflect the WAK chum threshold. Each sector's apportionment percentages are provided to the left of the range for ease of the reader.

As the Council's October 2023 motion stated an intent that allocations match those outlined under Alternative 2, which includes CDQ and cooperative-level allocations, Table 4-13 provides information specific to the CDQ program and how the WAK chum salmon threshold would be apportioned among the CDQ groups and in what amount (number of fish). Recall each CDQ group's apportionments of both the overall chum salmon PSC limit (Alternative 2) and the WAK chum salmon threshold (Alternative 3) would be based on their respective allocation amounts of Bering Sea pollock.

Table 4-14 provides information specific to the inshore sector and how the WAK chum salmon threshold would be apportioned among the inshore cooperatives and in what amount (number of fish). It displays the amount of the annual limit (number of fish) each cooperative would receive based on the inshore sector's apportionment of the annual limit. An inshore cooperative's apportionment of both the overall chum salmon PSC limit (Alternative 2) and the WAK chum salmon threshold would be based on their respective pollock allocations.

However, there does not appear to be a benefit—either operationally for pollock vessels or in-season management—to apportioning the WAK chum salmon threshold among the CDQ groups or the inshore cooperatives. This is because there is no real-time genetic information available to allow NMFS, a pollock sector, a CDQ group, or an inshore cooperative to track performance against their apportionment of the threshold inseason. All entities, including NMFS, would know whether an apportionment of the threshold was exceeded the following year as the CAS cannot monitor it to close a sector, and entities receiving an apportionment cannot benchmark their performance against. The Council could modify Alternative 3 such that the WAK chum salmon annual threshold would only be apportioned at the sector-level, and that this change would be in line with the Council's original intent of the alternative.

That being said, the Council may choose to retain the existing language of Alternative 3 such that the WAK threshold would be apportioned among the CDQ groups and inshore cooperatives. If part of the Council’s intent is to monitor individual CDQ group or inshore cooperative performance against their apportionment limit, new and additional genetic analyses would need to be completed for the inshore cooperatives. For this preliminary DEIS geneticists at Alaska Fisheries Science Center’s Auke Bay Labs added new CDQ program and group flags to AKFIN data that allowed genetic stock composition estimates to be broken out at the sector-level. A similar approach would need to be taken to identify inshore cooperatives, and the data would need to be manually updated over time as inshore CVs potentially change cooperatives.

Table 4-12 Amount of the WAK chum threshold (number of fish) each Bering Sea pollock sector would be apportioned under the apportionment suboptions considered under option 3 of Alternative 2

	Apportionment suboptions	*CDQ*			*CP*			*Inshore*			*Mothership*		
40,000 - 53,000 WAK chum	Suboption 1: 3-yr avg.	6.1%	2,440	3,233	21.9%	8,760	11,607	62.9%	25,160	33,337	9.1%	3,640	4,823
	Suboption 2: 5-yr avg.	7.1%	2,840	3,763	25.2%	10,080	13,356	58.2%	23,280	30,846	9.5%	3,800	5,035
	Suboption 3: Pro-rata	7.1%	2,840	3,763	25.4%	10,160	13,462	58.4%	23,360	30,952	9.1%	3,640	4,823
	Suboption 4: AFA	10%	4,000	5,300	36%	14,400	19,080	45%	18,000	23,850	9%	3,600	4,770

Table 4-13 Amount of the WAK chum threshold (number of fish) each CDQ group would receive based of the CDQ Program's apportionment based on the CDQ group's Bering Sea pollock allocation amount (%)

	CDQ program apportionment		*14% APICDA*		*21% BBEDC*		*5% CBSFA*		*24% CVRF*		*22% NSEDC*		*14% YDFDA*	
3-yr avg. (6.1%)	2,440	3,233	342	453	512	679	122	162	586	776	537	711	342	453
5-yr avg. (7.1%)	2,840	3,763	398	527	596	790	142	188	682	903	625	828	398	527
Pro-rata (7.1%)	2,840	3,763	398	527	596	790	142	188	682	903	625	828	398	527
AFA (10%)	4,000	5,300	560	742	840	1,113	200	265	960	1,272	880	1,166	560	742

Table 4-14 Amount of the WAK chum threshold (number of fish) each inshore cooperative would receive based on the inshore sector's apportionment based on the cooperative's 2022 pollock allocation amount (%)

	Inshore apportionment of WAK chum annual limit		*(33.788%) Akutan CV Assoc.*		*0.000% Arctic Enterprise Assoc.*		*10.773% Northern Victor Fleet Coop*		*2.512% Peter Pan Fleet Coop.*		*11.454% Unalaska Fleet Coop.*		*22.094% UniSea Fleet Coop.*		*19.380% Westward Fleet Coop.*		*0.000% Inshore Open Access*	
3-yr avg. (62.9%)	25,160	33,337	8,501	11,264	0	0	2,710	3,591	632	837	2,882	3,818	5,559	7,365	4,876	6,461	0	0
5-yr avg. (58.2%)	23,280	30,846	7,866	10,422	0	0	2,508	3,323	585	775	2,666	3,533	5,143	6,815	4,512	5,978	0	0
Pro-rata (58.4%)	23,360	30,952	7,893	10,458	0	0	2,517	3,334	587	778	2,676	3,545	5,161	6,839	4,527	5,998	0	0
AFA (45%)	18,000	23,850	6,082	8,058	0	0	1,939	2,569	452	599	2,062	2,732	3,977	5,269	3,488	4,622	0	0

4.3.1 WAK Chum Threshold Performance Standard

As noted previously**, the WAK chum threshold under Alternative 3 must be implemented in conjunction with the overall chum salmon PSC limit (Alternative 2).** It is not possible to manage a PSC limit specific to WAK chum salmon bycatch inseason because real-time genetic data are not available. Therefore, the proportion of WAK chum in the overall bycatch is, and would be, assessed after the B season pollock fishery is over. As an example, genetic information on the chum salmon caught as bycatch in the 2024 B season pollock fishery is available in April 2025.

The Council recognized the uncertainty and variability in WAK chum salmon encounters, and that performance against a WAK chum salmon annual bycatch limit could only be assessed retroactively. As a result, **the WAK chum salmon threshold in and of itself would not require a fishing sector to cease if the limit was reached.** However, if a fishing sector were to reach their apportionment of the overall chum salmon PSC limit in a given year, that entity would be required to cease fishing. The Council included a performance standard under Alternative 3 that is intended to incentivize the pollock fleet to avoid WAK chum salmon inseason.

The performance standard would work as follows:

Under option 1 of Alternative 3, the overall chum salmon PSC limit would be 450,000 chum salmon. Operationally, each pollock sector would need to consider its apportionment of the overall chum salmon PSC limit *and* its apportionment of the WAK chum threshold. If the sector reaches its apportionment of the overall limit of 450,000 chum salmon (option 1 of Alternative 3), it must stop fishing inseason. If a sector exceeds its WAK threshold in any three of seven consecutive years, the sector would be penalized by receiving an apportionment of a lower overall chum salmon PSC limit of 200,000 chum salmon. The lower limit of 200,000 would be in effect for the sector(s) that exceeded its WAK threshold until that sector's WAK chum salmon bycatch does not exceed the sector's apportionment of the threshold for three years. Option 2 of Alternative 3 would function similarly to option 1 except an overall chum salmon PSC limit of 550,000 chum salmon would be in effect and would decrease to 300,000 chum salmon if a sector exceeded its apportionment of the WAK chum threshold in any three out of seven years.

At this stage, staff are looking for the Council to provide input on what would constitute this three-year period. Once a sector is at its lower overall chum salmon PSC limit, it is unclear what is required during the three years for it to operate at the higher of the overall PSC limits in the future. As written, the three-year period could be interpreted as a sector needing to remain below the upper bound of the WAK threshold for:

- Three consecutive years out of the prior seven years
- Any three years out of the prior seven years
- Any three years in an indefinite period

Additionally, it is unclear at this time what would happen if a sector failed to achieve that performance (e.g., would the sector operate under the lower PSC limit indefinitely?); it is assumed that a sector would continue to operate under the lower overall PSC limit if the benchmark is three years during an indefinite time period.

A final consideration for the Council is that the performance standard has two functionally different time periods: a rolling seven-year period and a three-year period. This could introduce some instability for industry because of the potential for repeated annual changes in the overall chum PSC limit a sector may operate under. More specifically, the performance standard includes both a retrospective, rolling seven-year period *and* a three-year period. Consider the following hypothetical example, which is intentionally simplified to illustrate the potential instability in a sector's overall chum PSC limit that could result.

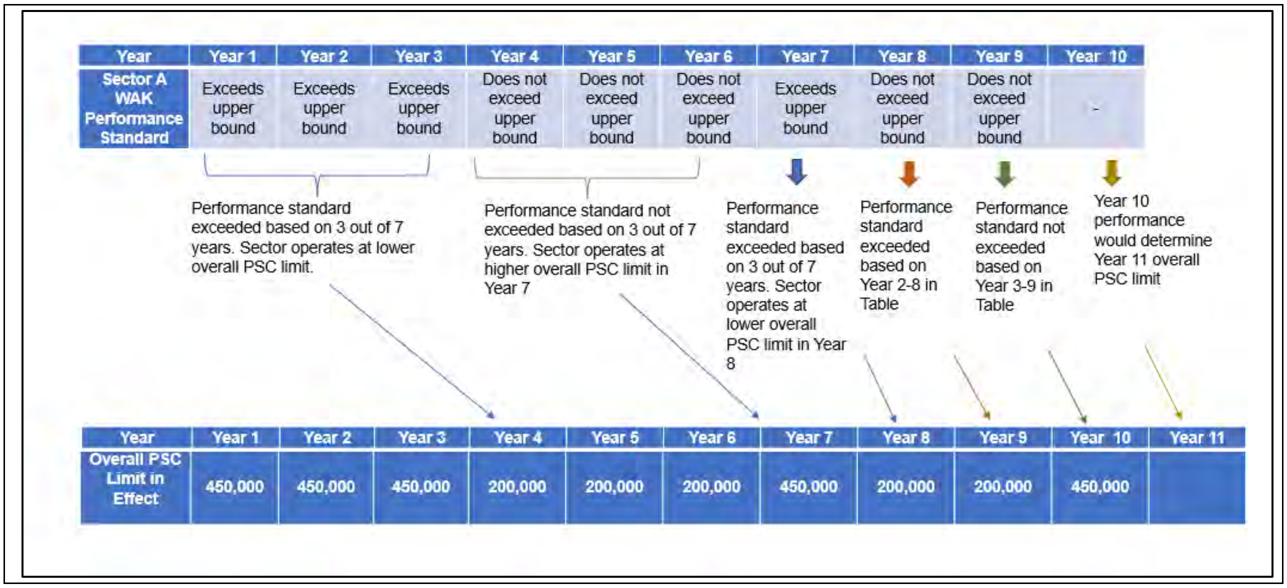

Figure 4-8 Example of the potential instability in the overall PSC limit a sector would operate under based on the performance standard under Alternative 3

The performance standard is intended to account for the unpredictability in WAK chum salmon encounters and the fact that a sector may not be able to avoid exceeding its apportionment of the annual limit as there is no inseason genetic information available. As noted above, in this analysis staff have used the upper bound of the range of threshold values because it provides the most flexibility in light of the uncertainty associated with the point estimates, but NMFS would look for the Council to clarify its implementation intent with the threshold range. Using this approach, a sector's annual level of WAK chum salmon must fall under the upper limit of the range to not exceed the performance standard.

For example, if the WAK chum salmon threshold was apportioned based on each sector's 3-year average level of historical bycatch (suboption 1 of option 3 of Alternative 2), the CDQ Program would be apportioned 6.1% of the annual threshold or 3,223 WAK chum salmon (the upper bound of the range). If vessels fishing CDQ pollock exceeded 3,223 WAK chum salmon in any three out of seven years (i.e., the performance standard is exceeded), the CDQ Program would be apportioned its share of the lower overall chum salmon PSC limit, either 200,000 or 300,000 chum salmon (option 1 and 2, respectively) until its WAK chum salmon bycatch was below 3,223 fish for three years.

Figure 4-9 **is for illustrative purposes only**. It depicts the concept of how the WAK chum threshold, and the performance standard would work in conjunction with an overall chum salmon PSC limit. Analytical staff needed to make several assumptions to depict the relationship between these concepts. For instance, staff selected the overall PSC limits of 450,000 and 200,000 chum salmon under option 1 of Alternative 3. Staff also used the 3-year historical average level of bycatch (suboption1 of option 3, Alternative 2) to be able to depict apportionments of both the overall chum salmon PSC limit and the WAK chum threshold by sector. How to apportion the overall chum salmon PSC limit and the WAK chum threshold are decision points for the Council.

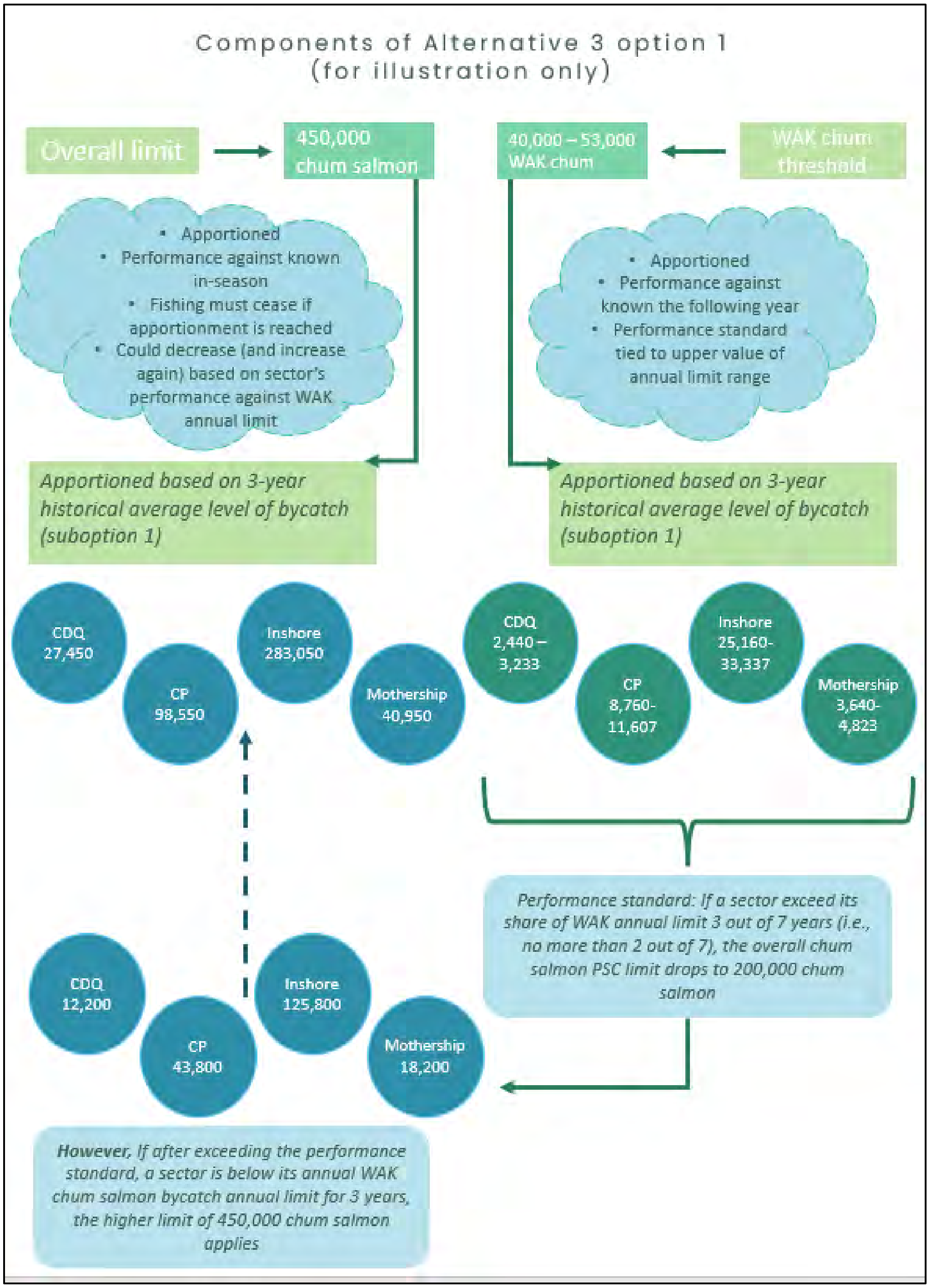

Figure 4-9 Illustration of how the components of option 1 of Alternative 3 would work

Whereas Figure 4-9 illustrates how one apportionment approach applied to option 1 of Alternative 3 would work, Table 4-15 and Table 4-16 provide the Council (and reader) an opportunity to conceptualize sector-level apportionments of the overall chum salmon PSC limits alongside the WAK chum salmon annual bycatch limit for each apportionment approach (suboption 1-4 of Alternative 2) applied to options 1 and 2 of Alternative 3. Table 4-15 provides information specific to option 1 of Alternative 3 (sector-level apportionments of an overall chum salmon PSC limit of 450,000 chum salmon alongside apportionments of the WAK chum salmon bycatch annual limit. The lower portion of Table 4-15 displays the sector-level apportionments that would apply if a sector exceeded the performance standard. Table 4-16 provides the same information but for option 2 of Alternative 3.

Table 4-15 Apportionment of overall chum salmon PSC limits of 450,000 and 200,000 chum salmon as well as the WAK chum threshold among Bering Sea pollock fishing sectors under option 1 of Alternative 3

		CDQ		***CP***		***Inshore***		***Mothership***	
Suboption 1 3-yr avg.	PSC limit of 450,000	27,450		98,550		283,050		40,950	
	Annual WAK threshold	2,440	3,233	8,760	11,607	25,160	33,337	3,640	4,823
Suboption 2 5-yr avg.	PSC limit of 450,000	31,950		113,400		261,900		42,750	
	Annual WAK threshold	2,840	3,763	10,080	13,356	23,280	30,846	3,800	5,035
Suboption 3 Pro-rata	PSC limit of 450,000	31,950		114,300		262,800		40,950	
	Annual WAK threshold	2,840	3,763	10,160	13,462	23,360	30,952	3,640	4,823
Suboption 4 AFA	PSC limit of 450,000	45,000		162,000		202,500		40,500	
	Annual WAK threshold	4,000	5,300	14,400	19,080	18,000	23,850	3,600	4,770
If the performance standard is reached, the overall chum salmon PSC limit would decrease to 200,000 chum salmon but the WAK chum threshold would be the same									
		CDQ		*CP*		*Inshore*		*Mothership*	
Suboption 1 3-yr avg.	PSC limit of 200,000	12,200		43,800		125,800		18,200	
	Annual WAK threshold	2,440	3,233	8,760	11,607	25,160	33,337	3,640	4,823
Suboption 2 5-yr avg.	PSC limit of 200,000	14,200		50,400		116,400		19,000	
	Annual WAK threshold	2,840	3,763	10,080	13,356	23,280	30,846	3,800	5,035
Suboption 3 Pro-rata	PSC limit of 200,000	14,200		50,800		116,800		18,200	
	Annual WAK threshold	2,840	3,763	10,160	13,462	23,360	30,952	3,640	4,823
Suboption 4 AFA	PSC limit of 200,000	20,000		72,000		90,000		18,000	
	Annual WAK threshold	4,000	5,300	14,400	19,080	18,000	23,850	3,600	4,770

Table 4-16 Apportionment of overall chum salmon PSC limits of 550,000 and 300,000 chum salmon as well as the WAK chum threshold among Bering Sea pollock fishing sectors under option 2 of Alternative 3

		CDQ		***CP***		***Inshore***		***Mothership***	
Suboption 1 3-yr avg.	PSC limit of 550,000	33,550		120,450		345,950		50,050	
	Annual WAK threshold	2,440	3,233	8,760	11,607	2,440	3,233	8,760	11,607
Suboption 2 5-yr avg.	PSC limit of 550,000	39,050		138,600		320,100		52,250	
	Annual WAK threshold	2,840	3,763	10,080	13,356	2,840	3,763	10,080	13,356
Suboption 3 Pro-rata	PSC limit of 550,000	39,050		139,700		321,200		50,050	
	Annual WAK threshold	2,840	3,763	10,160	13,462	2,840	3,763	10,160	13,462
Suboption 4 AFA	PSC limit of 550,000	55,000		198,000		247,500		49,500	
	Annual WAK threshold	4,000	5,300	14,400	19,080	4,000	5,300	14,400	19,080
If the performance standard is reached, the overall chum salmon PSC limit would decrease to 300,000 chum salmon but the WAK chum threshold would be the same									
		CDQ		*CP*		*Inshore*		*Mothership*	
Suboption 1 3-yr avg.	PSC limit of 300,000	18,300		65,700		188,700		27,300	
	Annual WAK threshold	2,440	3,233	8,760	11,607	2,440	3,233	8,760	11,607
Suboption 2 5-yr avg.	PSC limit of 300,000	21,300		75,600		174,600		28,500	
	Annual WAK threshold	2,840	3,763	10,080	13,356	2,840	3,763	10,080	13,356
Suboption 3 Pro-rata	PSC limit of 300,000	21,300		76,200		175,200		27,300	
	Annual WAK threshold	2,840	3,763	10,160	13,462	2,840	3,763	10,160	13,462
Suboption 4 AFA	PSC limit of 300,000	30,000		108,000		135,000		27,000	
	Annual WAK threshold	4,000	5,300	14,400	19,080	4,000	5,300	14,400	19,080

4.3.1.1 Interactions Between the Performance Standard and the Indices for Western Alaska Chum Salmon Abundance (Option 2 of Alternative 2)

Recall that option 2 of Alternative 2 includes three mutually exclusive suboptions for indices of WAK chum salmon abundance (see Section 4.2.2). The Council has not (yet) specified values for the overall chum salmon PSC limits that would apply when one or more areas does not meet index threshold(s). For illustrative purposes only, staff selected chum salmon PSC limits of 450,000 and 200,000 as values for the step-down provisions. A decision before the Council at this stage is to select the overall chum salmon PSC limits that would apply as more areas fail to meet index threshold(s).

As the Council considers this decision point, it may also wish to consider how the numerical value selected for PSC limits under option 2 of Alternative 2 (and the corresponding suboptions) could affect the relative effectiveness of the performance standard under Alternative 3. (The following scenario only applies if the Council's Preliminary Preferred Alternative includes option 2 of Alternative 2 and Alternative 3.) Specifically, to maintain the performance standard's incentive (i.e., sectors want to avoid exceeding the WAK chum salmon threshold's performance standard in any given year to not risk fishing under a lower overall PSC limit in the future), the PSC limits set as step-down provisions under the suboptions of option 2 of Alternative 2 would need to be greater than the lowest applicable PSC limit under Alternative 3.

Consider the following scenario for illustrative purposes only. Under suboption 1 of option 2 of Alternative 2 (Three-area index based on Yukon Summer and Fall chum, Kuskokwim, and Norton Sound). If 3/3 areas are above index thresholds, no overall chum salmon PSC limit is in place. If 2/3 areas are above index thresholds, a PSC limit of 450,000 chum salmon would be in place. If 1/3 or no areas are above index thresholds, a PSC limit of 200,000 chum salmon would be in place. In a scenario where the lowest step-down provision for the index that is in effect (i.e., 200,000 chum salmon) is lower than or equal to the lowest applicable PSC limit under Alternative 3 (i.e., 200,000 chum salmon under option 1), the performance standard does not appear to provide an additional incentive as the sector(s) would be operating under the penalty PSC limit they would otherwise be trying to avoid.

4.3.2 Issues Related to Monitoring, Inseason Management, and Enforcement

The following section raises several points for the Council's consideration of potential implementation issues related to Alternative 3.

As described above, the Council may choose to retain the current language and intent of Alternative 3 such that the WAK chum salmon annual bycatch limit would be apportioned among the inshore cooperatives. However, there does not appear to be an operational or inseason management benefit to apportioning this limit among the six CDQ groups and the inshore cooperatives because NMFS and the catch accounting system (CAS) cannot account for WAK chum salmon in the overall bycatch in real-time.

As noted above, NMFS and the CAS cannot account for WAK chum in the overall bycatch in real-time because real-time genetic data are not available. **In general, there are no anticipated changes to monitoring and observer coverage under Alternative 3 compared to the status quo (see Section 4.1.4).** Salmon caught as bycatch would continue to undergo a census count and be identified by NMFS-certified observers onboard vessels or at shoreside processing plants at the species level. Genetic samples would be collected to determine the relative contribution of WAK chum salmon in the overall PSC, but the genetic information would not be available until the following year.

Genetic samples of the salmon caught as bycatch in the Bering Sea pollock fishery are processed by geneticists at Alaska Fisheries Science Center's Auke Bay Lab (ABL). ABL staff prepare and make publicly available preliminary reports on the prior year's salmon bycatch to the Council by April each year. It is important to note the timing of when these genetic reports are presented to the Council could vary slightly annually depending on other Council scheduling priorities and/or staffing resources at ABL.

The genetic reports available in April are labeled as "preliminary" to provide some level of flexibility for editorial changes, completion of complementary analysis, and to allow ADF&G to complete aging for all samples. However, the stock of origin information contained within the April reports are final. ABL geneticists do not rerun analyses on stock of origin information but may add complementary analyses between the period of preliminary and final report posting.

As such, NMFS would use the genetic information from the prior year's B season pollock fishery that is available the next spring (i.e., genetic information on the salmon caught as bycatch in the 2024 B season pollock fishery would be available and assessed in the spring of 2025) to assess the pollock fishery's performance against the WAK threshold. Regulations at 50 CFR 679 would be updated to include the WAK chum salmon threshold.

4.3.2.1.1 Issue 1. Timing Mismatch with the Harvest Specifications Process

As written and currently conceptualized, Alternative 3 poses a timing mismatch between the assessment of fishing sectors' performance against the upper bound of the WAK threshold and the Council and NMFS's annually occurring BSAI groundfish harvest specifications process. **More specifically, the genetic data of chum salmon caught as bycatch from the B season will not be available until April of the subsequent year, after NMFS has published in regulation the BSAI groundfish harvest specifications.**

Establishing harvest specifications is an annual process that determines the target species catch limits and PSC limits. This iterative process begins in the fall and is completed when the final rule is published in the spring.[58] As an example, the proposed 2023 and 2024 harvest specifications for the groundfish fishery of the BSAI were published in the Federal Register on December 14, 2022 (87 FR 76435) and the final 2023 and 2024 harvest specifications for the groundfish fishery of the BSAI were published on March 10, 2023 (88 FR 14926). Currently, PSC apportionments for all federally managed groundfish in the BSAI management area are set within this annual harvest specifications process.

Under Alternative 3, when final harvest specifications are published in spring, the genetic data from the most recent B season would not be available. **If the Council would like to move forward with Alternative 3, NMFS would need to address the mismatch in timing between publishing the final groundfish harvest specifications and when genetic information on salmon bycatch is available.** A possible solution would be to delay the fishing sectors' formal evaluation of performance against the WAK chum threshold by a year and the effect on the overall chum salmon PSC limit in place by two years (Figure 4-10).

[58] The Council and NMFS's process for developing and finalizing the harvest specifications, apportionments, and prohibited species catch allowances for the groundfish fishery of the BSAI management area are outlined in the BSAI Groundfish FMP and its implementing regulations (see: https://www.fisheries.noaa.gov/alaska/sustainable-fisheries/alaska-groundfish-harvest-specifications).

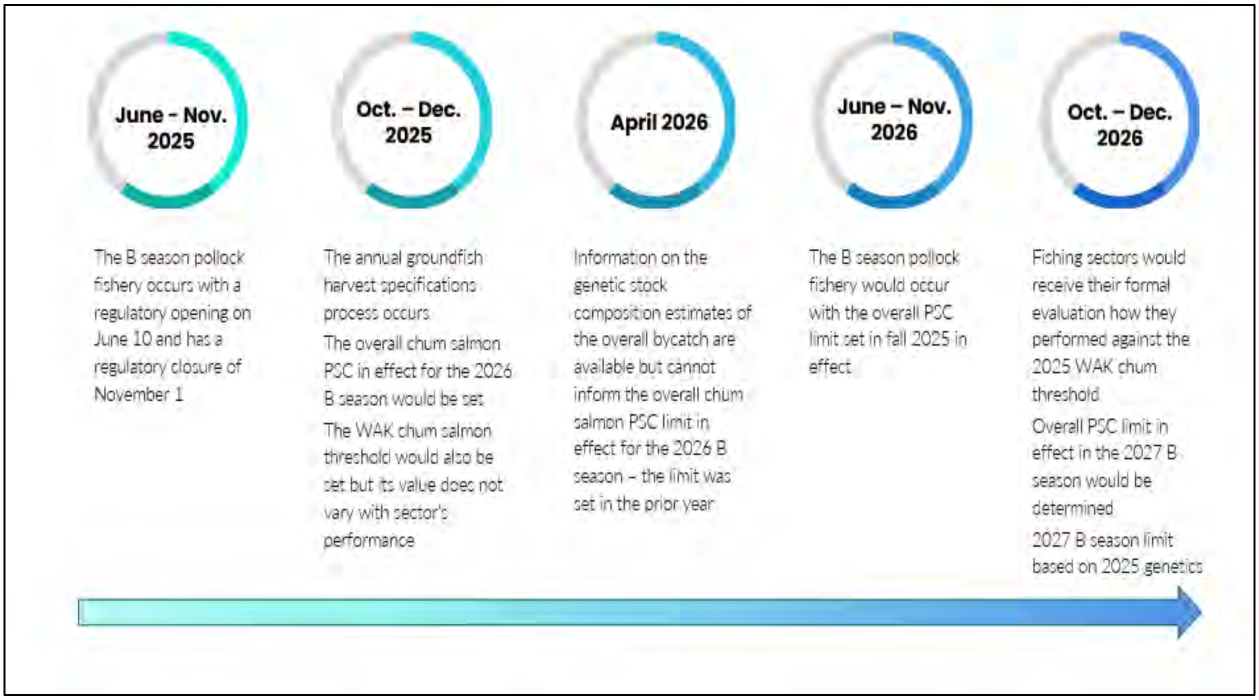

Figure 4-10 Hypothetical timeline that could be used to evaluate genetic information, a sector's performance against the WAK chum salmon threshold, and when sector's performance would have an effect on an overall PSC limit in place

As illustrated in Figure 4-10, there would be a "one year start-up" period before a sector's performance against the WAK chum threshold would officially be known (i.e., 2025 B season – fall 2026 harvest specifications process). As such, the Council, industry, and the public could expect it would take several years before the performance standard could have an effect. Figure 4-11 illustrates the performance standard's "clock" could work if using the hypothetical timeline in Figure 4-10. The analysts want to be clear this figure is not intended to imply or commit NMFS to an implementation timeline – it is only intended to demonstrate the timing of how the components of Alternative 3 would work.

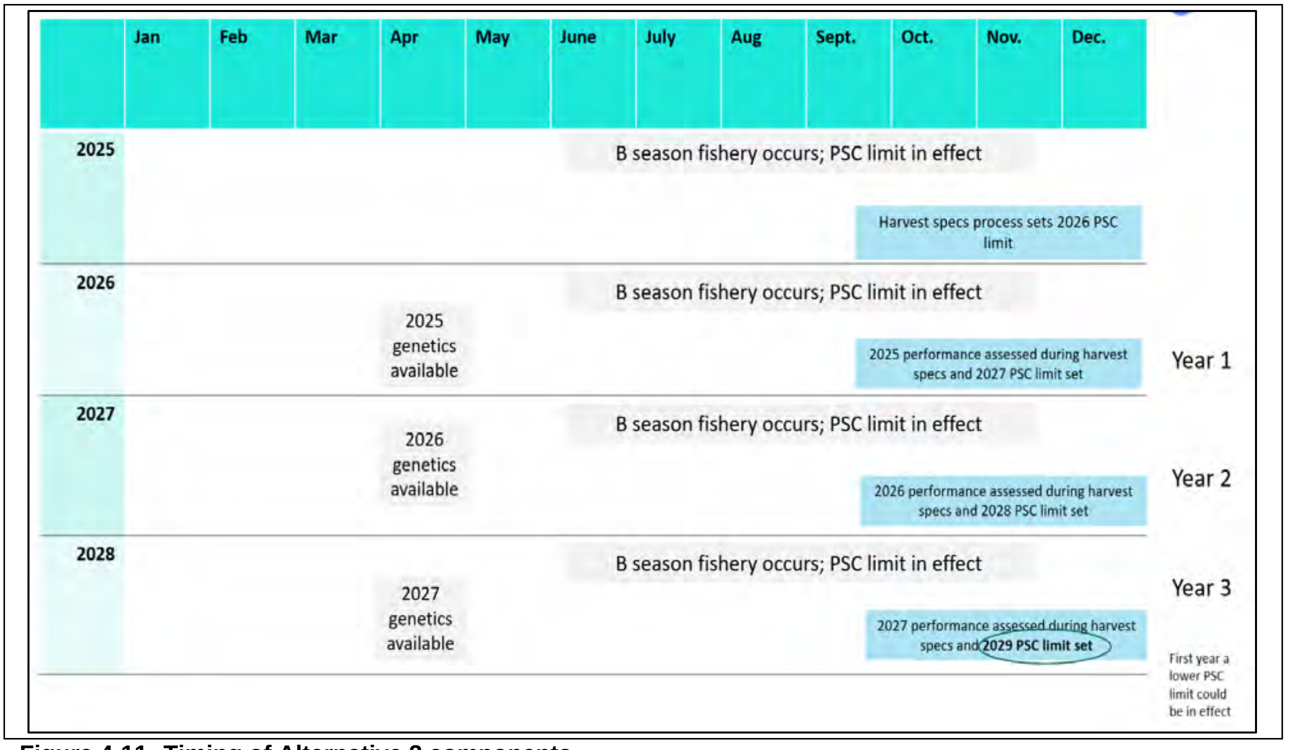

Figure 4-11 Timing of Alternative 3 components

4.3.2.1.2 Issue 2. Having Timely Information Available to the Pollock Fleet

As discussed above, the catch accounting and evaluation of WAK chum bycatch against a sector's apportionment of the WAK chum threshold would occur retroactively. This approach, when combined with the performance standard, does appear to provide industry with an incentive to avoid WAK chum salmon to the extent practicable in the overall bycatch. **However, the fact that the pollock industry would be unable to know inseason whether they have exceeded the WAK threshold could raise issues of fairness.** Unlike many PSC limits (including the overall chum salmon PSC limit considered under Alternative 2), the various sectors cannot know if they are coming close to reaching, or if they have exceeded, the WAK chum threshold during the season. As such, vessels and inseason managers cannot take preventative measures if they are coming close to the WAK threshold in order to avoid a lower PSC limit in the future.

It is possible that a sector could use the prior year's proportion of WAK chum salmon in the overall bycatch, and genetic information on times and areas when WAK chum may be more likely to be encountered on the pollock grounds, to inform inseason behavior. Nevertheless, a fishing sector may exceed the upper bound of the WAK chum salmon threshold and face a reduced overall chum salmon PSC limit in subsequent years, despite taking measures to stay below it. Depending on how the WAK threshold is instituted, this raises issues of fairness and whether the approach is legally valid.

NMFS currently produces weekly inseason reports for the groundfish fisheries and the PSC limits in the groundfish fisheries.[59] Reports are subject to change as data quality checks are conducted and new data enter the catch accounting system. While NMFS cannot provide inseason catch accounting information based on genetic data, it would be possible to provide weekly catch reports related to the WAK threshold, based on determined preseason rates of WAK chum proportions within a sector using historical data. These inseason reports would be for tracking purposes only because the actual data on WAK proportions

[59] Weekly inseason reports are available here.

for that fishing year's B season would not be available until the genetics analysis is complete the following spring. Rates for tracking purposes could be determined prior to the start of the B.

For example, if the Council chose to apportion the WAK chum salmon threshold based on suboption 2 of Alternative 2 (historical 5-year average level of bycatch), then NMFS inseason could provide weekly reports to the fishing sectors using those apportionment percentages (CDQ 7.1%, CP 25.2%, Inshore 58.2%, and Mothership 9.5%). The apportionment percentages could function as WAK chum rates used for inseason tracking and would be applied towards the number of chum bycatch within each sector as data becomes available inseason. However, it is not known how different the estimated number of WAK chum based on historical data would be from the numbers based on genetic samples, so it is hard to predict how useful these data for "tracking purposes" would be for sectors to avoid WAK chum salmon.

4.3.2.1.3 Issue 3. Potential Insufficient Data for Genetics Analysis

There are years during the analyzed period where insufficient samples were available to estimate the genetic stock proportions in the overall bycatch for some sectors. Table 4-17 provides the estimated number of WAK chum salmon caught as bycatch by each sector from 2011-2022.

Table 4-17 Estimated number of WAK chum salmon caught as bycatch by each Bering Sea pollock sector, 2011 through 2022

	CDQ	*CP*	*Mothership*	*Inshore*	*Total*
2011	NA	8,917	4,430	32,444	45,791
2012	NA	NA	NA	3,932	3,932
2013	NA	2,468	801	28,219	31,488
2014	NA	8,715	NA	31,650	40,365
2015	NA	5,133	1,928	36,262	43,323
2016	3,031	21,946	13,758	38,236	76,971
2017	22,674	33,435	4,673	35,288	96,070
2018	6,272	17,644	4,503	30,391	58,810
2019	2,898	5,090	7,637	40,237	55,862
2020	NA	1,926	1,148	25,620	28,694
2021	6,092	7,736	3,447	33,522	50,797
2022	902	8,037	7,891	37,278	54,108
Average	6,978	11,004	5,022	31,090	48,851

Source: NMFS Alaska Region Catch Accounting System.
Notes: These estimates reflect the point estimate of the mean proportion of WAK chum salmon inferred from genetic analysis, multiplied by the sector specific non-Chinook PSC amount. NA denotes insufficient samples were available to estimate genetic stock proportions.

In 2012, the lack of samples was the result of the low level of overall bycatch (22,172 non-Chinook salmon, of which 22,107 were actually chum salmon). Using a systematic and representative sampling protocol, 1 in 30 chum salmon samples were collected by the North Pacific Observer Program (which is administered by the AFSC Fisheries Monitoring and Analysis Division, North Pacific Observer Program). The sampling resulted in approximately 740 samples, of which only 7 were from the CDQ sector, 64 from the CP sector, and 32 from the M sector. Under the current sampling strategy, when there are with low levels of bycatch, there is not enough information to make accurate sector specific estimates cannot be made.

In years where 1 in 30 sampling exceeds the genotyping capacity of the Auke Bay Lab, geneticists will sub-sample using a 1-in-2 to 1-in-5 approach. In some cases, 1 in 30 sampling by observers provide sufficient tissue samples, but because evaluating the CDQ sector was not a priority in previous years geneticists did not prioritize genotyping those samples in order to make an estimate. For instance, in 2020 the total chum bycatch was 342,388, with 11,413 samples expected from 1 in 30 sampling. The CDQ bycatch was 8,579 of which 286 samples would be expected from 1 in 30 sampling by observers. Not all of the 11,413 samples could be processed so the Auke Bay Labs genetics program subsampled the catch 1-in-5, which reduced the CDQ sectors samples below the minimum sample size required for analysis (~100 samples). Going forward, only in years of very low bycatch (where the sectors bycatch does not exceed 3,000 chum salmon) would the genetics program anticipate not being able to estimate a sector specific WAK proportion.

If the Council would like to move forward with Alternative 3, it would need to consider its analytical priorities for chum salmon bycatch. The Council has previously prioritized analyses that provide spatial and temporal trends for the genetic stock composition groups in the overall bycatch. As a result, Auke Bay Labs geneticists have prioritized sub-sampling across the entire B season to maintain representative sampling while increasing sample sizes outside of the representative samples to analyze the genetic cluster areas. Depending on the overall bycatch level, the full collection of genetic samples which are representative of the overall B season bycatch may need to be subsampled at a higher rate while increasing sample sizes for analyses the council might prioritize such as individual sectors. Because of the constraints on the total number of samples that are able to be processed by the lab, there are trade-offs between the number of analyses that may require increasing sample sizes, the representative sampling by FMA, and subsampling by the genetics group.

Auke Bay Lab geneticists can reprioritize sub-sampling strategies to ensure there are sufficient samples for analyses to provide sector-level genetic stock composition estimates. But this effort would need to be prioritized and the Council might expect analysis of spatial trends in the overall bycatch to become less available or inferences might be made from a smaller overall proportion of the bycatch. Genotyping at Auke Bay Laboratory is limited to genotyping approximately 4,000 chum salmon per year, as this is the most fish that can be feasibly ran between when the samples are received (December or early January) and when the results are expected (early April council meeting). Therefore, the laboratory does not have the resources and capacity to consistently analyze sub-samples that would consistently be sufficient for both types of analyses. Substantial additional funding (more personnel and supply money) would be necessary if analyzes were to be expanded.

Even if Auke Bay Labs reprioritized sub-sampling strategies to be able to analyze WAK stock composition estimates at the sector-level, it is still possible that the overall level of bycatch in a sector or the fishery as a whole would be prohibitively low, such that genetic stock composition estimates could not be completed in a given year. Such was the case in 2012 for all sectors except the inshore sector. **At this stage, it is uncertain what would happen if there were insufficient samples to estimate the genetic stock proportions in the overall bycatch by sector.** Potential changes to pollock vessels' fishing behavior are discussed more thoroughly in subsequent chapters that analyze the impacts of the potential action alternatives. However, it is relevant to highlight here that it is anticipated that the overall level of chum salmon bycatch would likely decrease as a result of any action alternative, although the relative magnitude of the reduction varies and is somewhat uncertain. It is not possible to precisely predict an overall level of chum salmon bycatch that would be sufficient to allow for genetic stock proportions to be estimated across all sectors (and considering overall bycatch levels in this way provides a somewhat perverse incentive to catch more bycatch for sampling purposes).

4.4 Alternative 4: Additional Regulatory Provisions for Incentive Plan Agreements

The description of how Alternative 4 would work as a management measure in regulations is uncertain at this time because a decision point before the Council at this meeting is whether, and how, it would like to modify Alternative 4. For this reason, Alternative 4 is written differently from the three preceding alternatives under consideration. In this section, the analysts have described Alternative 4 as written in the Council's October 2023 motion. Appendices 2 and 3 contain the proposals submitted by

IPA representatives in advance of the February 2024 Council meeting, as requested by the Council for inclusion in the initial review draft of the analysis.

The proposals submitted by IPA representatives contain provisions for changes to the salmon bycatch IPAs that are different from the Council's October 2023 motion, although this should not be read as the proposals did not respond to the Council's request. It is analytical staff's understanding that the Council's intent with Alternative 4 was that IPA representatives would put forward ideas on how to better avoid times and areas (or "optimize" avoidance) when WAK chum salmon are more likely to be on the pollock fishing grounds. The proposals respond to this intent.

If the Council would like to move forward with Alternative 4, regardless of how the Council chooses to modify the alternative, this management alternative would add new provisions to the regulations implementing the salmon bycatch IPAs (see 50 CFR 679.21(f)(12)(iii)(E)). The issue at hand is *what* would be contained within these regulatory provisions the IPAs would be required to respond to. The regulations implementing the salmon bycatch IPAs include 13 provisions the IPAs must respond to (Section 4.4.2 contains these provisions as written in regulation). The regulatory provisions specify the Council's intent or objectives related to salmon bycatch management (and reduction) in the Bering Sea pollock fishery. The regulatory provisions are intentionally broad to provide IPA members the flexibility to design measures that respond to the Council's objectives as the IPAs are private contractual agreements that are legally binding among members.

4.4.1 Alternative 4 as Written in the Council's October 2023 Motion

Option 1 of Alternative 4 would require a "chum salmon reduction plan agreement" be implemented during the B season to prioritize chum salmon avoidance in genetic cluster area 1 and 2 when two triggers are met. The two triggers that would be used to determine whether additional measures would be in place are 1) an established chum incidental catch rate (hereafter referred to as a bycatch rate) and 2) the historical genetic composition of WAK chum to non-WAK chum (hereafter referred to as proportion of WAK to non-WAK chum). The Council prioritized genetic cluster areas 1 and 2 because the majority of chum salmon bycatch has historically been encountered in cluster area 1 followed by cluster area 2, and the proportion of WAK chum is typically higher in genetic cluster areas 1 and 2 compared to the other cluster areas (Barry et al. 2023).[60]

Option 2 would add a new provision to the current IPA regulations at 50 CFR 679.21(f)(12)(iii)(E) requiring the IPAs to use the most refined genetics information available to further prioritize avoidance of areas and times of highest proportion of WAK chum stocks. The new regulatory provision added under option 2 would only apply in the B season pollock fishery.

The Council's October 2023 motion states the proposals should consider a process to include local and traditional knowledge from Western and Interior salmon users in the development of IPA measures. The following is a list of potential measures that could be developed for incorporation into the IPAs and/or through regulation:

- Option 1 and 2 trigger values
- Adjusted base rates to implement a closure
- Adjusted closure area size
- Adjusted closure duration
- Application of the closures to all vessels not just those above the base rate
- Genetic data
- Genetic cluster thresholds

[60] The genetic cluster areas were developed by the Alaska Fisheries Science Center's Auke Bay Lab Genetics Program to better understand the spatial distribution of salmon bycatch, and they are based on ADF&G groundfish statistical areas.

- Additional vessel level incentives/penalties for chum salmon avoidance

4.4.2 Monitoring, Inseason Management, and Enforcement

Similar to other alternatives, the monitoring to allow for accurate and precise estimation of all salmon bycatch including chum salmon is currently in place after being implemented in Amendment 91, refined under Amendment 110, and further refined in the pending Trawl EM regulations.

Currently a salmon incentive plan must provide a description of 13 elements specified in regulations at 50 CFR 679.21(f)(12)(iii)(E). As mentioned above, the Council could consider adding new elements to the salmon incentive plans specific to the goals of this action. Note that current elements would continue continued to be required unless modified by this action. The 13 elements currently required in incentive plans include the following information:

(1) The incentive(s) that will be implemented under the IPA for the operator of each vessel participating in the IPA to avoid Chinook salmon and chum salmon bycatch under any condition of pollock and Chinook salmon abundance in all years.
(2) How the incentive(s) to avoid chum salmon do not increase Chinook salmon bycatch.
(3) The rewards for avoiding Chinook salmon, penalties for failure to avoid Chinook salmon at the vessel level, or both.
(4) How the incentive measures in the IPA are expected to promote reductions in a vessel's Chinook salmon and chum salmon bycatch rates relative to what would have occurred in absence of the incentive program.
(5) How the incentive measures in the IPA promote Chinook salmon and chum salmon savings in any condition of pollock abundance or Chinook salmon abundance in a manner that is expected to influence operational decisions by vessel operators to avoid Chinook salmon and chum salmon.
(6) How the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's Chinook salmon bycatch to keep total bycatch below the performance standard described in paragraph (f)(6) of this section for the sector in which the vessel participates.
(7) How the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's chum salmon bycatch to avoid areas and times where the chum salmon are likely to return to western Alaska.
(8) The rolling hot spot program for salmon bycatch avoidance that operates throughout the entire A season and B season and the agreement to provide notifications of closure areas and any violations of the rolling hot spot program to the third-party group.
(9) The restrictions or penalties targeted at vessels that consistently have significantly higher Chinook salmon PSC rates relative to other vessels fishing at the same time.
(10) The requirement for vessels to enter a fishery-wide in-season salmon PSC data sharing agreement.
(11) The requirement for the use of salmon excluder devices, with recognition of contingencies, from January 20 to March 31, and from September 1 until the end of the B season.
(12) The requirement that salmon savings credits are limited to a maximum of three years for IPAs with salmon savings credits.
(13) The restrictions or performance criteria used to ensure that Chinook salmon PSC rates in October are not significantly higher than those achieved in the preceding months.

4.5 Alternatives Considered but Not Analyzed Further

The Council has taken an iterative process to considering management measures to minimize chum salmon bycatch in the Bering Sea pollock fishery. As described throughout Section 1.2, the Council initiated the Salmon Bycatch Committee (SBC) composed of representatives of Tribal governments and in-river salmon users across Western and Interior Alaska as well as representatives of the Bering Sea pollock industry in June 2022. The Council tasked the SBC with developing concepts for management alternatives to minimize chum salmon bycatch (December 2022), and the committee finalized its recommendations in March 2023.[61] To facilitate the committee's finalization of conceptual alternatives, the co-Chairs (Council members Ms. Rachel Baker and Mr. Andy Mezirow) requested committee members put forward proposals for draft Purpose and Need statements as well as concepts for alternatives in advance of the March 2023 committee meeting.[62] The purpose of taking this approach was to allow Council staff to synthesize a draft Purpose and Need statement and organize a list of conceptual alternatives for the committee's review and consideration, prior to the Council's consideration of the committee's recommendation(s).

A conceptual alternative put forward by representatives of Tribal governments and in-river salmon users across Western and Interior Alaska was a chum salmon PSC limit of zero chum salmon, as well as overall chum salmon PSC limits of 22,000 and 54,00**0** (see option 1 of Alternative 2 in the SBC's March 2023 report, pg. 4). Part of the rationale in support of a chum salmon PSC limit of zero was that it would provide an opportunity for staff to analyze the full scope of potential impacts as the Bering Sea pollock industry does not currently operate under a chum salmon PSC limit. In other words, the analysis could consider the potential impacts of zero chum salmon caught as bycatch up to an unlimited number of chum salmon (the highest level of chum salmon bycatch in the analyzed period occurred in 2021 at 545,509 chum salmon). These representatives supported a PSC limit of 22,000 for analysis as it would represent the 10th percentile of chum salmon bycatch, and a PSC limit of 54,000 chum salmon would represent the 25th percentile of chum salmon bycatch, over the historical period of 1991-2022

The SBC agreed to move forward all conceptual alternatives for the Council's consideration, but there was not agreement among members on the details of the chum salmon PSC limit as a conceptual alternative (more information on committee members' rationale is available in the March 2023 report). In April 2023, the Council reviewed the SBC's recommendations for conceptual alternatives to minimize chum salmon bycatch in the Bering Sea pollock fishery. The Council's Advisory Panel supported the SBC's recommended Purpose and Need statement as well as the potential conceptual alternatives for initial analysis.[63]

In April 2023, the Council adopted the Purpose and Need statement developed by the SBC and requested preliminary analysis describing the feasibility of the conceptual alternatives. At that time, the Council did not request analysis of specific values for a chum salmon PSC limit but did request historical chum salmon bycatch information from 2011 through 2022. In October 2023, the Council received a presentation on the Preliminary Analysis and recommended a range of values to be considered as chum salmon PSC limits (see Section 4.2.1). While the Council received public testimony that requested consideration of chum PSC limits between zero and 200,000 at its April and October 2023 meetings, the Council recommended numerical values between 200,000 and 550,000 chum salmon for analysis to balance public testimony requesting a "very low" PSC limit or a PSC limit of zero and the National Standards, particularly National Standard 9 which requires bycatch to be minimized to the extent practicable. Table 4-3 above provides the Council's rationale for each numerical value selected for analysis and is not repeated here. NMFS has prepared a supplement for the overall chum salmon PSC limits recommended by the Council, considering limits below 200,000 and it is incorporated into the preliminary DEIS in Appendix 1.

While certain species like chum salmon are prohibited from harvest in federally managed groundfish fisheries, the purpose of apportioning PSC or PSC limits is because it is recognized that the target species (usually) cannot be harvested without some level of bycatch. NMFS makes an exception to the

[61] The SBC's March 2023 report is available here.
[62] The SBC's March 2023 eAgenda containing committee members' proposals is available here.
[63] The Advisory Panel's April 2023 report is available here.

“prohibition” inherent in the term PSC and sets a limit on that exception, and National Standard 9 requires conservation and management measures shall, to the extent practicable, minimize bycatch.

A second alternative considered but not moved forward for future analysis at this time is a static time/area closure managed by NMFS (see option 1 of Alternative 4 in the Preliminary Analysis). Representatives of Tribal governments and in-river salmon users across Western and Interior Alaska proposed options for PSC limits linked to static time/area closures during the B season in genetic cluster area 1, the area nearest the Aleutian Peninsula (see option 4 of Alternative 2 in the SBC’s March 2023 report, pg. 4). Rationale supporting time/area closures during some or all of the B season included that, historically, a majority of chum salmon bycatch has occurred later in the B season (July and August). Additionally, genetic information on the chum salmon caught as bycatch show the proportion of WAK chum salmon in the overall bycatch is higher in genetic cluster area 1.

The Council considered a “chum salmon reduction plan agreement” to prioritize avoidance of chum salmon bycatch in genetic cluster areas 1 and 2 for a specified amount of time in the October 2023 Preliminary Analysis. That analysis noted these closure areas could be managed by either NMFS or under the IPAs in the RHS system for chum salmon avoidance. As described in the Preliminary Analysis, NMFS would be able to manage static time/area closures and the IPAs are able to manage dynamic area closures. After receiving the presentation on the Preliminary Analysis, reports from advisory bodies, and public comment, the Council determined it would be appropriate and effective for the IPAs to implement additional measures for chum salmon avoidance and, in particular, avoidance of WAK chum salmon on the pollock grounds (October 2023).

The Council’s rationale for this decision was that the IPAs, through the RHS system for chum salmon avoidance described in Section 4.1.1.2, are a more effective management tool than considering a time/area closure with static boundaries. Under the status quo, the RHS system uses near-real time observer and bycatch information to identify discrete areas with higher chum salmon bycatch encounters and move the fleet away from them on a weekly or bi-weekly basis. NMFS would not be able to replicate this dynamic system as the spatial boundaries of the closure area(s) as well as the date(s) the closures could apply would need to be fixed in regulation. In short, because salmon bycatch is dynamic – the level may be influenced by ocean and environmental conditions, the locations with higher encounters can change year-to-year, and year-to-year variations in the timing of the peak(s) of salmon bycatch—the Council concluded that it would be more appropriate to use a dynamic management tool for chum salmon avoidance.

5 Methods Used for Impact Analysis

This chapter provides an overview of the methodologies used to analyze the potential impacts of the proposed alternatives on Bering Sea pollock, chum salmon and other PSC species, as well as the economic impacts. The remaining resource categories analyzed in this document including other groundfish, marine mammals, seabirds, essential fish habitat, and ecosystem relationships are largely based on results and trends from the quantitative analysis.

5.1 Estimating Chum Salmon Bycatch in the Bering Sea Pollock Fishery

Section 4.1.4 describes the observer and monitoring requirements for salmon bycatch in the Bering Sea pollock fishery and is not repeated here. The main point to note is that chum salmon bycatch levels are based on comprehensive observer and electronic monitoring data collected by NMFS-certified observers onboard pollock vessels or at shoreside processing facilities. Observer data are uploaded directly into the Catch Accounting System (CAS) daily. The CAS was developed to receive catch reports from multiple sources, evaluate data for duplication errors, estimate the total catch by species or species category, and determine the appropriate account to attribute the catch. Since 2011, there has been a census count of all salmon caught as bycatch in this fishery and each salmon is identified at the species-level. This information allows for extremely accurate estimation of the overall level of chum salmon bycatch encountered in the pollock fishery. Salmon bycatch data collected by NMFS observers, and imputed into the CAS, was provided by AKFIN for this analysis.

5.2 Estimating Chum Salmon Avoided and Forgone Pollock Under Different PSC Limits

A first step to understanding potential changes in PSC encounters and pollock harvest under Alternative 2 and 3 compared to the status quo (Alternative 1) was to examine the potential amount of chum salmon avoided, forgone pollock harvest, and gross first wholesale and ex-vessel revenues forgone under the different overall chum salmon PSC limits under consideration based on catch in the baseline years. The Council selected 2011 through 2022 as the years for analysis because they capture the years in which status quo salmon bycatch regulations have been in effect (Amendment 91 was implemented in 2011 and Amendment 110 in 2017). These regulations directly impact the pollock fleet and industry has changed fishing behavior in response. Additionally, this period represents the years for which the best genetic information is available to estimate the genetic stock compositions of the overall bycatch.

This preliminary DEIS, as with other analytical documents prepared by analytical staff (e.g., Amendment 91 and 110), is based on a retrospective analysis. **This analysis uses past fleet behavior, pollock catch, and bycatch data as a frame of reference but expects that fishing behavior would change under the action alternatives. The analysis considers operational responses to the alternatives, but it stops short of attempting to quantify changes in vessel-level operations**. It is expected that vessel operators will change their behavior to avoid chum salmon bycatch and the associated potential losses in revenues earned from the pollock fishery (among other potential penalties that may be imposed under the IPAs). However, data were unavailable to accurately predict or quantify the nature of these changes.

The relative magnitude of the potential impacts under the proposed of the action alternatives are uncertain because it is anticipated that the fleet's fishing and PSC avoidance behavior while operating under an overall chum salmon PSC limit under Alternative 2 and 3 would be affected by numerous variables that analytical staff cannot accurately quantify. For example, chum salmon bycatch avoidance behavior may be influenced by the size and operation type of a vessel (e.g., CPs can travel further to target areas with high pollock CPUE while working to avoid chum salmon bycatch compared to inshore CVs), as well as other market, PSC avoidance, and environmental variables.

Under some apportionments and overall chum salmon PSC limits, the retrospective analysis shows the pollock fishery, or individual sectors, would not have closed earlier than actually occurred during these years. In other instances, the apportionments and overall chum salmon PSC limits would have closed pollock fishing earlier than actually occurred, based on historical fishing behavior and bycatch levels (i.e., the retrospective analysis overlays the potential PSC limit and apportionment amount on historical pollock catch and bycatch numbers for each sector and the fleet as a whole). When a PSC limit and/or apportionment would have hypothetically closed a sector or the fishery earlier in the B season, an estimate is made of **1)** the amount of pollock (mt) that would have been left unharvested and **2)**, the reduction in the amount (number of fish) of non-Chinook bycatch which is known to be over 99% chum salmon as a result of the fishery/sector closure. This analysis also provides an estimate of **3)** the reduction in Chinook (number of fish) and herring bycatch (mt). Chinook and herring are incorporated into this quantitative analysis because they are PSC species that have constraining PSC limits for the fleet. The estimate of potentially forgone pollock harvest is also used as the basis for estimating the **4)** potentially forgone gross first wholesale and ex-vessel revenues for the sectors (see Section 5.3 for more information on the methods used to consider revenue impacts).

In an effort to make this analysis more streamlined and accessible, the analysts selected a subset of the overall chum salmon PSC limit values for impact analysis. The Council’s full set of overall PSC limit values, when combined with the four apportionment suboptions (option 3 of Alternative 2) and applied to the four fishing sectors, resulted in 96 different combinations of PSC limits. **The subset of values that were analyzed include overall chum salmon PSC limits of 200,000; 300,000; 450,000; and 550,000.** These values include the upper and lower endpoints of the range, approximate midpoint values, and were identified as the overall chum salmon PSC limit values under options 1 and 2 of Alternative 3 (see Section 4.3). All apportionment suboptions were analyzed.

This analysis used information on PSC encountered and pollock harvested in the B season pollock fishery for each sector from 2011 through 2022. Weekly data from the NMFS Alaska Region were used to approximate when the potential PSC limit would have been reached. The day when the fleet or sector would have closed was estimated by interpolating the statistical week and the week-ending date of the statistical week that bracketed the fleet of sector-specific PSC limit. This date was then used to estimate the total bycatch and pollock harvest that was taken by that date and compared against the total bycatch and pollock harvest by the fleet/sector during the entire B season.

This approach provides an estimate of the relative bycatch avoided by species as well as the potential pollock harvest that would have been forgone when the overall chum salmon PSC limit/apportionment is applied to historical pollock catch and bycatch data. Using an interpolated value for the date a limit would have been reached gives an approximation of the procedure NMFS inseason management uses to notify the fleet of a potential closure resulting from reaching a PSC limit (i.e., the closure would occur after a limit was reached), considers the way chum salmon have historically been encountered on the pollock fishing grounds in pulses where a single high week of bycatch for a sector could exceed an apportionment, and that there is some level of uncertainty in knowing when a limit may have been exceeded. As an example, the inshore sector is affected by a data lag as the census count of salmon bycatch occurs at shoreside plants (i.e., there may be differences between the day a PSC limit was reached and the exact day that information would be known).

With this date, the remaining PSC species and pollock caught by the fleet or a sector was calculated as the sum total from that date until the end of the B season. For example, the expected number of chum salmon saved under a particular PSC limit and apportionment in a given year was calculated using the following approach:

1. Evaluate the daily bycatch records for chum salmon caught by each sector and the fleet during the B season in each year.
2. Identify the statistical week and week-ending date a sector exceeded the apportionment of the PSC limit (e.g., August 15).
3. Calculate the number of chum salmon that the sector caught from the next day (e.g., August 16) through the end of the B season.

Ultimately the estimates of how much chum salmon bycatch (and other PSC species) would have been avoided, based on a retrospective analysis, depends on the overall PSC limit being considered, the numerical value of the apportionment, and the pattern of how the sector/the fleet encountered chum salmon bycatch throughout the season.

An additional, important point to note is that the Council's October 2023 motion did not specify numerical values for overall chum salmon PSC limit values that would be associated with the step-down provisions incorporated under option 2 of Alternative 2 (WAK chum abundance indices). In order to analyze the potential impacts of option 2 of Alternative 2, analytical staff had to assign these values. For analytical purposes only, and again in an effort to make this analysis more streamlined and accessible, staff assigned 450,000 chum salmon 200,000 chum salmon as values when step-down provisions are incorporated into the options and suboptions of Alternative 2. **The numerical values that should be used as step-down provisions associated with the abundance indices is a decision point for the Council at Initial Review.**

Additionally, this analysis does not provide an estimate of PSC avoided or forgone pollock specific to the WAK chum threshold under Alternative 3. The genetic stock composition estimates of the overall bycatch are not available inseason, and as a result, the NMFS and the CAS cannot account for WAK chum salmon bycatch in real-time. Therefore, pollock sectors would not be closed inseason based on their performance against this threshold. Rather, all sectors would know the following year whether their WAK chum salmon bycatch annual limit was exceeded. While it is anticipated that fleet behavior would change to avoid times and areas where WAK chum salmon may more likely be encountered on the pollock grounds under Alternative 3 (and Alternative 4), there is no way to accurately quantify an estimate of the amount of potential PSC avoided or pollock harvest forgone that would result from the WAK chum threshold as a standalone component. It is assumed the primary impacts that would result from this alternative would be driven by the overall chum salmon PSC limit in place which are analyzed in-depth under Alternative 2.

5.2.1 Estimating the Genetic Stock Composition of Chum Salmon Bycatch

Since 2011, the Observer Program has conducted a census of all salmon bycatch in the Bering Sea pollock fishery and has undertaken systematic genetic sampling of all salmon bycatch (1 in 10 Chinook and 1 in 30 chum salmon) since 2011. These observer data were used to determine the genetic stock of origin of the bycatch including WAK chum. Briefly, the Auke Bay Labs genetics program receives shipments of individually labelled paired genetic and scale samples from the FMA division. These samples are inventoried against observers' records within Alaska Fisheries Information Network's database. If the number of samples exceeds the labs capacity a subsampling strategy is determined to maintain representative sampling. Tissue samples are then cut, DNA is extracted, and amplified for the genetic marker panel used for genetic stock identification (prior to 2020 11 microsatellite markers were used, since 2020 84-single nucleotide polymorphisms have been used. Genotyped fish are then arranged into spatial (Bering Sea, CVOA, etc.) and temporal (B season, Early, etc.) mixtures of interest to analyze the stock composition of the bycatch. Genetic stock identification is performed with software that implement a Bayesian mixture model to estimate the proportion of six regional groupings (SE Asia, NE Asia, Coastal Western Alaska, Upper/Middle Yukon, Southwest Alaska, Eastern Gulf of Alaska/Pacific Northwest).

To estimate the number of WAK chum salmon caught as bycatch by sector, the sector-specific annual mean proportion for the WAK regional group (the combined CWAK and Upper/Mid Yukon proportions) was multiplied by the total non-Chinook bycatch that would have been avoided in all statistical weeks after a sector would have reached their apportionment of the limit.

5.3 Consideration of First Wholesale and Ex-vessel Values for Bering Sea Pollock

In this document, Bering Sea pollock catch values are reported as gross first wholesale revenues and ex-vessel revenues for each sector. All prices are real, adjusted to 2022 U.S. dollars.

Gross first wholesale values are derived from prices taken by AKFIN from Commercial Operators Annual Reports (COAR) that are then linked to round weights and product weights by product type and linked to a specific processor by production reports. The first wholesale price is the market price of the primary processed fishery product. This is the value of a processed product when sold by a processor to an entity outside of their affiliate network; it is typically equivalent to the value of product as it leaves Alaska (AFSC 2019).

Gross ex-vessel values for CVs are derived from prices provided by Fisheries Entry Commission (CFEC) from Fish Tickets and adjusted with COAR data. The ex-vessel value is the market price paid to fishermen for their catch when it is delivered to a processor (i.e., the price of pollock multiplied by the weight of landings).

For species harvested by CPs, there is no ex-vessel price generated from the sale of raw fish by a harvester to a primary processor, as the harvester and primary processor are the same entity. However, approximate conversions can be made in order to compare consistent metrics across sectors. In this document, gross ex-vessel values for CPs are estimated using the annual average ex-vessel price paid by shoreside processors accepting deliveries of pollock and applying that price to the round weight of pollock harvested by CPs that year.

Additionally, available values for the mothership sector may be different based on the affiliation the CV has with the mothership vessel. If the CV is affiliated with the mothership vessel through joint ownership or control, a listed ex-vessel value may not be available, or it may not be a comparable metric. If the CV is unaffiliated with the mothership vessel, an ex-vessel value may be in line with the value represented by the shoreside sector.

The analysts acknowledge that the ex-vessel value estimates do not represent the full product values for CPs; and that the Council and the public should consider first wholesale values for CPs if the intent is to characterize the relative value (or revenue dependence) of Bering Sea pollock for CPs. In contrast, the gross ex-vessel value and potential ex-vessel forgone is more appropriate when considering the direct impact to the CV sector. However, the analysts took this approach so the Council and the public could compare the potential revenue impacts of the various action alternatives across sectors in the same metrics. Therefore, while both metrics are provided for cross-sector comparisons, the consideration of impacts within each sector should occur at a different scope for each impacted sector.

5.4 Documents Incorporated by Reference

This preliminary DEIS relies heavily on the information and evaluation contained in prior salmon bycatch actions. These documents are incorporated by reference. The documents listed below contain information about the BSAI ground fisheries, the Bering Sea ecosystem, marine resources, as well as other BSAI groundfish fisheries.

5.4.1 Bering Sea Chum Salmon Bycatch Preliminary Review Analysis

The Bering Sea Chum Salmon Bycatch Preliminary Review Analysis contains relevant background information on the development of alternatives considered in the proposed action. This document is available from: https://meetings.npfmc.org/CommentReview/DownloadFile?p=5b15695d-d544-4385-87cb-b5cdfee54909.pdf&fileName=C4%20Chum%20Salmon%20Bycatch%20Analysis.pdf

5.4.2 Bering Sea Chinook Salmon Bycatch Management Final Environmental Impact Statement/Regulatory Impact Review for Amendment 91 to the FMP for Groundfish of the BSAI

The Bering Sea Chinook Salmon Bycatch Management Final Environmental Impact Statement/Regulatory Impact Review (Chinook EIS/RIR, NPFMC/NMFS 2009) provides decision-makers and the public with an evaluation of the environmental, economic, and social effects of management measures for Chinook salmon bycatch in the BSAI management areas, and it is referenced for an understanding of the impacts on salmon bycatch management in the Bering Sea pollock fishery. The EIS provides examples the effects of different alternatives on target species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationship, and economic aspects of the groundfish fisheries. http://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/feis/.

5.4.3 Environmental Assessment/Regulatory Impact Review for Amendment 110 to the FMP for Groundfish of the BSAI, Bering Sea Chinook and Chum Salmon Bycatch Management Measures

The Environmental Assessment/Regulatory Impact Review for Bering Sea Chinook and Chum Salmon Bycatch Management Measures provides decision-makers and the public with information on the environmental, economic, and social effects of Chinook and chum salmon bycatch management in the Bering Sea pollock fishery.https://www.fisheries.noaa.gov/resource/document/environmental-assessment-regulatory-impact-review-proposed-amendment-110-fmp

5.4.4 Seabird documents

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 2004) provides background on seabirds in the action area and their interactions with the fisheries. This may be accessed at https://alaskafisheries.noaa.gov/sites/default/files/pseis0604-chpt_3_7.pdf.
- Section 6.3 of the PSEIS (NMFS 2015) provides background on seabirds in the action area and their interactions with the fisheries. This may be accessed at https://www.npfmc.org/wpcontent/PDFdocuments/fmp/Final_SIR_2015.pdf.
- The annual Ecosystem Status Reports have a chapter on seabird bycatch: https://www.fisheries.noaa.gov/alaska/ecosystems/ecosystem-status-reports-gulf-alaska-bering-sea-and-aleutian-islands.
- The NMFS Alaska Seabird Bycatch webpage: https://www.fisheries.noaa.gov/alaska/bycatch/seabird-bycatch-alaska.
- 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 https://www.npfmc.org/fisheries-issues/fisheries/bsai-groundfish-fisheries/.
- Washington Sea Grant has several publications on seabird takes, and technologies and practices for reducing them: https://wsg.washington.edu/seabird-bycatch-prevention-in-fisheries/

- The seabird component of the environment affected by the groundfish FMPs is described in detail in Section 3.7 of the PSEIS (NMFS 2004) and updated in the PSEIS Supplemental Information Report (NPFMC and NMFS 2015).
- Seabirds and fishery impacts are also described in Chapter 9 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007).
- U.S. Fish and Wildlife Service (USFWS). 2021. Biological Opinion on the Proposed Modification of the EPA General Permit AKG524000 for Offshore Seafood Processors in Alaska and on the NMFS Groundfish Fishery for the Gulf of Alaska, Bering Sea, and Aleutians Islands. Anchorage, AK: 80 pp. Document available at https://ecos.fws.gov/tails/pub/document/18939343.
- NMFS. 2020. Programmatic Biological Assessment on the Effects of the Fishery Management Plans for Alaska Groundfish Fisheries on the Endangered Short-tailed Albatross, the Threatened Alaska-breeding Population of Steller's Eider, and the Threatened Spectacled Eider (*Polysticta stelleri*). Document available at: https://media.fisheries.noaa.gov/2021-11/AK-Groundfish-Seabird-BA-March-2020.pdf
- Seabird Bycatch and Mitigation Efforts in Alaska Fisheries Summary Report: 2007 through 2015 (Eich et al. 2016). Document available at: https://repository.library.noaa.gov/view/noaa/12695
- Seabird Bycatch Estimates for Alaska Groundfish Fisheries 2016 through 2017 (Eich et al. 2018). Document available at: https://doi.org/10.25923/vb9g-s503.
- Seabird Bycatch Estimates for Alaska Groundfish Fisheries: 2019 (Krieger et al. 2020). Document available at: https://www.fisheries.noaa.gov/national/bycatch/seabirds.
- Seabird Bycatch Estimates for Alaska Groundfish Fisheries Annual Report: 2020 (Krieger and Eich 2021). Document available at: https://repository.library.noaa.gov/view/noaa/32076
- The Alaska Migratory Bird Co-Management Council website, https://www.alaskamigratorybirds.com/index.php.

5.4.5 EFH Documents

This analysis also relies on the information and evaluation contained in EFH 5-year Review documents previously reviewed by the Council, and the BSAI Groundfish and Salmon FMPs. The documents listed below contain information about the EFH 5-year review component evaluations, and the fishery management areas, fisheries, marine resources, ecosystem, social, and economic elements of the fisheries off Alaska.

EA for the EFH Omnibus Amendments Package (NPFMC 2023a)

This EA evaluated the updates adopted by the Council to EFH information in FMPs and environmental impacts from the proposed amendments. The 2023 EFH 5-year Review concluded that no change to the conclusions of the evaluation of fishing effects on EFH is warranted based on new information. None of the FMP amendments require regulatory action.

EFH 5-year Review Summary Report (Harrington et.al, *In prep*)

The EFH 5-year Review summary report contains the updates to new environmental and habitat data, improving the models to map EFH, updating the model to evaluate fishery impacts on EFH, updating the assessment of non-fishing impacts on EFH, and assessing information gaps and research needs.

Fishing Effects Evaluation Discussion Paper (Zaleski et. al, *In prep*)

6 Analysis of Impacts

6.1 Alternative 1: No Action

Alternative 1 is the No Action or status quo alternative. The following sections of the preliminary DEIS provide a comprehensive description of the human environment and the impacts to it occurring under the status quo regulations managing chum salmon bycatch in the Bering Sea pollock fishery. The current management measures described in Section 0 would be retained if the Council chose to take no action.

6.1.1 Description of Groundfish Resources

This section provides an overview of the BSAI groundfish specifications and management process for all managed stocks as they are set during the December Council specifications process as well as stock status for pollock and ecosystem interactions. Details on the how the Bering Sea pollock fishery is managed are contained in Chapter 2.

6.1.1.1 Management of NMFS Groundfish Fisheries

The groundfish fisheries in Federal waters off Alaska are managed under the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP) and the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA FMP). In the BSAI and GOA, groundfish harvests are managed subject to annual limits on the amounts of each groundfish species or species group that may be taken. The annual harvest specifications also set or apportion the PSC limits. The annual limits are referred to as "harvest specifications," and the process of establishing them is referred to as the "harvest specifications process." The intended effect of these actions is to conserve and manage the groundfish resources in the BSAI in accordance with the MSA. The U.S. Secretary of Commerce approves the harvest specifications based on the recommendations of the Council. The goals of the harvest specifications process are to (1) manage fisheries based on the best scientific information available, (2) provide for adequate prior public review and comment on Council recommendations, (3) provide for additional opportunity for Secretarial review, (4) minimize unnecessary disruption to fisheries and public confusion, and (5) promote administrative efficiency.

Groundfish harvest specifications establish an over-fishing level (OFL), acceptable biological catch (ABC), and TAC by species and area in the BSAI. The beginning of the process is to review and determines the Stock Assessment Fishery Evaluation (SAFE) reports for each stock and compile OFL and ABC recommendations by the BSAI Plan Team after which the SSC makes the final recommendations. To set the TAC, the Advisory Panel (AP) first makes recommendations, then the Council considers those recommendations and makes the final recommendations on TAC levels by species. The sum of all TACs in the BSAI cannot exceed the 2 mt optimum yield cap.

BSAI TAC setting is generally driven by tradeoffs among the availability of EBS pollock, BS Pacific cod, key flatfish species and the 2 million mt optimum yield cap. High value, low volume species such as sablefish and rockfish have TACs set equal to ABC while lower value flatfish stocks such as arrowtooth flounder have TACs set well below ABC for both market reasons and expected halibut bycatch rates. At lower levels of pollock ABC (e.g., 2010-2012) the pollock TAC is set equal to the ABC. Since 2012, as the pollock ABC increased, the pollock TAC remained relatively stable thus allowing for higher TACs to be set for other BSAI groundfish species. BS Pacific cod ABC is reduced by the state guideline harvest level (GHL) prior to TAC being established. PSC limits for halibut (for Amendment 80), herring and some crab species are also set and apportioned during the annual specifications process.

As shown in Table 6-1 some species are allocated TAC for the entire BSAI when the population structure indicates a single stock. Others, such as Pollock (EBS, AI and Bogoslof), Pacific cod and sablefish have separate allocations by the BS subarea of the BSAI, and the AI subarea of the BSAI. Additionally, for some rockfish and Atka mackerel, allocations are further specified within regions to avoid localized depletion.

Table 6-1 2023-2025 OFLs, ABCs and TACs for BSAI Groundfish

Species	Area	2023				2024			2025		
		OFL	ABC	TAC	Catch as of 11/25/23	OFL	ABC	TAC	OFL	ABC	TAC
Pollock[4]	BS	3,381,000	1,910,000	1,300,000	1,310,189	3,162,000	2,313,000	1,300,000	3,449,000	2,401,000	1,325,000
	AI	52,383	43,413	19,000	3,706	51,516	42,654	19,000	53,030	43,863	19,000
	Bogoslof	115,146	86,360	300	118	115,146	86,360	250	115,146	86,360	250
Pacific cod[5]	BS	172,495	144,834	127,409	124,413	200,995	167,952	147,753	180,798	150,876	132,726
	AI	18,416	13,812	8,425	3,299	18,416	12,431	8,080	18,416	12,431	8,080
Sablefish[6]	Alaska-wide	47,390	40,502	n/a	n/a	55,084	47,146	n/a	55,317	47,350	n/a
	BS	n/a	8,417	7,996	5,392	n/a	11,450	7,996	n/a	11,499	9,500
	AI	n/a	8,884	8,440	2,384	n/a	13,100	8,440	n/a	13,156	8,440
Yellowfin sole	BSAI	404,882	378,499	230,000	111,638	305,298	265,913	195,000	317,932	276,917	195,000
Greenland turbot	BSAI	4,645	3,960	3,960	1,274	3,705	3,188	3,188	3,185	2,740	2,740
	BS	n/a	3,338	3,338	795	n/a	2,687	2,687	n/a	2,310	2,310
	AI	n/a	622	622	479	n/a	501	501	n/a	430	430
Arrowtooth flounder	BSAI	98,787	83,852	15,000	7,217	103,280	87,690	14,000	104,270	88,548	14,000
Kamchatka flounder	BSAI	8,946	7,579	7,579	6,946	8,850	7,498	7,498	8,687	7,360	7,360
Rock sole[7]	BSAI	166,034	121,719	66,000	27,129	197,828	122,091	66,000	264,789	122,535	66,000
Flathead sole[8]	BSAI	79,256	65,344	35,500	8,946	81,605	67,289	35,500	82,699	68,203	35,500
Alaska plaice	BSAI	40,823	33,946	17,500	15,228	42,695	35,494	21,752	45,182	37,560	20,000
Other flatfish[9]	BSAI	22,919	17,189	4,500	3,019	22,919	17,189	4,500	22,919	17,189	4,500
Pacific ocean perch	BSAI	50,133	42,038	37,703	35,007	49,010	41,096	37,626	48,139	40,366	37,181
	BS	n/a	11,903	11,903	10,196	n/a	11,636	11,636	n/a	11,430	11,430
	EAI	n/a	8,152	8,152	7,544	n/a	7,969	7,969	n/a	7,828	7,828
	CAI	n/a	5,648	5,648	5,460	n/a	5,521	5,521	n/a	5,423	5,423
	WAI	n/a	16,335	12,000	11,807	n/a	15,970	12,500	n/a	15,685	12,500
Northern rockfish	BSAI	22,776	18,687	11,000	10,322	23,556	19,274	16,752	22,838	18,685	15,000
Blackspotted/ Rougheye rockfish[10]	BSAI	703	525	525	529	761	569	569	813	607	607
	BS/EAI	n/a	359	359	213	n/a	388	388	n/a	412	412
	CAI/WAI	n/a	166	166	316	n/a	181	181	n/a	195	195
Shortraker rockfish	BSAI	706	530	530	243	706	530	530	706	530	530
Other rockfish[11]	BSAI	1,680	1,260	1,260	1,188	1,680	1,260	1,260	1,680	1,260	1,260
	BS	n/a	880	880	624	n/a	880	880	n/a	880	880
	AI	n/a	380	380	564	n/a	380	380	n/a	380	380
Atka mackerel	BSAI	118,787	98,588	69,282	65,961	111,684	95,358	72,987	99,723	84,676	66,165
	EAI/BS	n/a	43,281	27,260	24,210	n/a	41,723	32,260	n/a	37,049	30,000
	CAI	n/a	17,351	17,351	17,210	n/a	16,754	16,754	n/a	14,877	14,877
	WAI	n/a	37,956	24,671	24,541	n/a	36,882	23,973	n/a	32,750	21,288
Skates	BSAI	46,220	38,605	27,441	25,183	45,574	37,808	30,519	44,203	36,625	30,361
Sharks	BSAI	689	450	250	321	689	450	400	689	450	400
Octopuses	BSAI	4,769	3,576	400	151	6,080	4,560	400	6,080	4,560	400
TOTAL		4,859,585	3,155,268	2,000,000	1,769,803	4,609,077	3,454,204	2,000,000	4,946,241	3,527,996	2,000,000

6.1.1.2 Status of Groundfish Stocks

In the BSAI groundfish stocks are healthy. All stocks in the BSAI for which information to determine is available were above their target levels in 2023 (indicated by the blue dashed line in Figure 6-1).

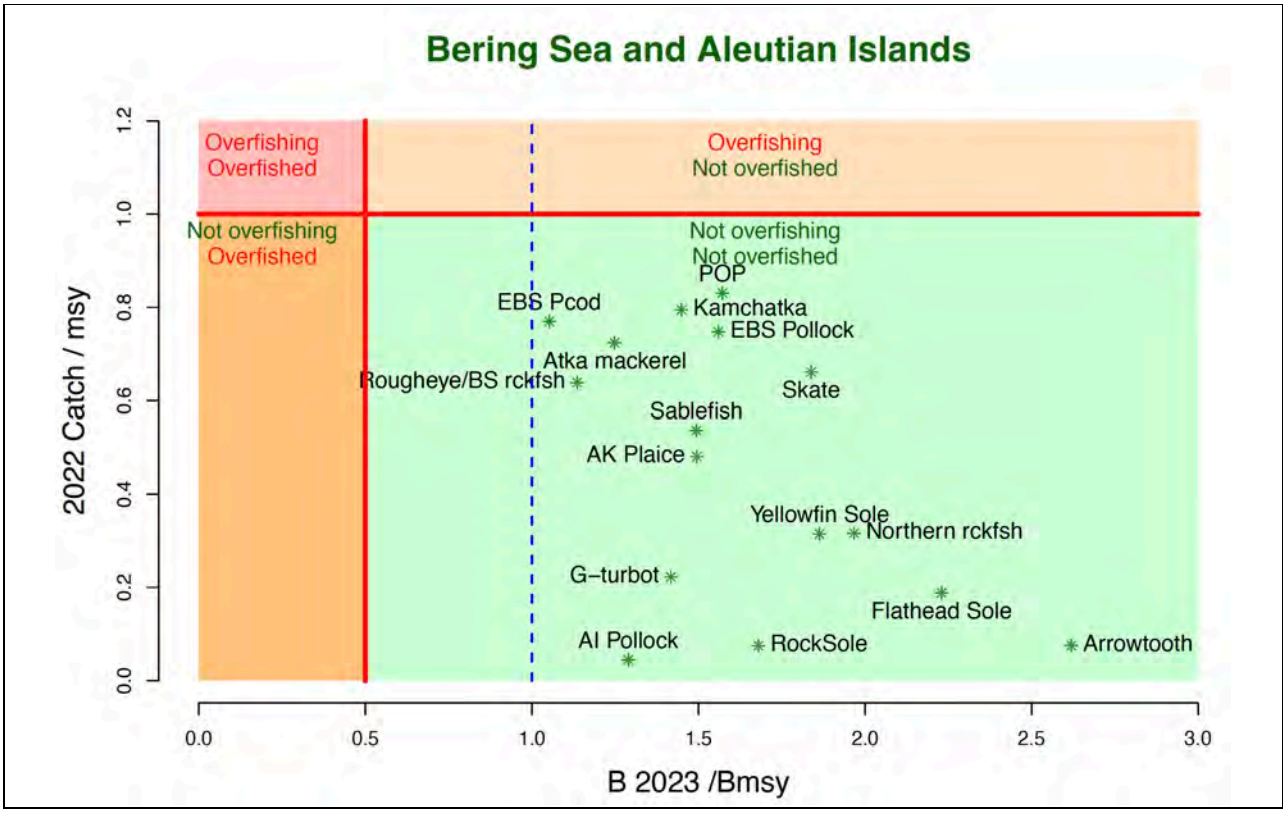

Figure 6-1 Summary of Bering Sea stock status next year (spawning biomass relative to Bmsy; horizontal axis) and current year catch relative to fishing at Fmsy (vertical axis) where FOFL is taken to equal Fmsy.

6.1.1.3 Pollock and Ecosystem Interactions

As shown in Figure 6-1 EBS pollock continues to be at high levels of biomass, well above target levels. For the reasons explained above, when the pollock ABC is high (as it has been for 12 years), the EBS pollock TAC continues to be set well below the ABC with low exploitation compared to target levels. Some environmental interactions and predator/prey information are included below for context.

The following is excerpted from Ianelli et al 2023 and Siddon et all 2023 with respect to juvenile pollock feeding habits and predators on pollock:

*Pollock spawning and feeding habi*ts: In the EBS pollock generally spawn during March-May and in relatively localized regions during specific periods (Bailey (2000)). Generally spawning begins nearshore north of Unimak Island in March and April and later near the Pribilof Islands (Bacheler et al. (2010)). Females are batch spawners with up to 10 batches of eggs per female per year (during the peak spawning period). Eggs and larvae of EBS pollock are planktonic for a period of about 90 days and appear to be sensitive to environmental conditions. These conditions likely affect their dispersal into favorable areas (for subsequent separation from predators) and also affect general food requirements for over-wintering survival (Gann et al. (2015), Heintz et al. (2013), Hunt Jr. et al. (2011), Ciannelli et al. (2004)). Throughout their range juvenile pollock feed on a variety of planktonic crustaceans, including calanoid copepods and euphausiids.

Euphausiids, principally Thysanoessa inermis and T. raschii, are among the most important prey items for pollock in the Bering Sea (Livingston (1991); Lang et al. (2000); Brodeur et al. (2002); Ciannelli et al. (2004); Lang et al. (2005)). Pollock diets become more piscivorous with age, and cannibalism has been commonly observed in this region. However, Buckley et al. (2015) showed spatial patterns of pollock foraging varies by size of predators. For example, the northern part of the shelf region between the 100 and 200 m isobaths (closest to the shelf break) tends to be more piscivorous than pollock found in more near-shore shallow areas.

Predators of pollock: Pollock are cannibalistic and rates of cannibalism might be expected to increase as the biomass of older, larger fish increases (i.e., the aging of the large 2018 year class). In 2023, with an average cold pool extent over the shelf, predation pressure from cannibalism may have been mitigated by this thermal barrier as adult pollock tend to avoid the cold bottom waters. However, the biomass of pelagic foragers, including adult pollock, dropped to their third lowest value over the time series in 2023 (Siddon, 2023). Fur seal consumption of adult pollock generally increases in years when juvenile pollock are less abundant (Kuhn et al., 2019). However, Northern fur seal pup production at St. Paul Island in 2022 continued a declining trend since 1998 that may be partially attributed to low pup growth rates. Other potential predators of juvenile pollock include jellyfish and chum salmon.

6.1.2 Chum Salmon Biology, Status, and Distribution

Chum salmon are the second most numerically abundant salmon species in the North Pacific, after pink salmon (NPAFC 2023; Smirnov 1975; Chereshnev et al. 2002; Makoedov et al. 2009; Ruggerone and Irvine 2018), and are among the most common salmon species in Western and Interior Alaska river systems. Populations are found as far south as the lower Columbia River basin in Washington, U.S., and Honshu, Japan and as far north as the Siberian, Chukchi, and Beaufort Seas (Augerot 2005).

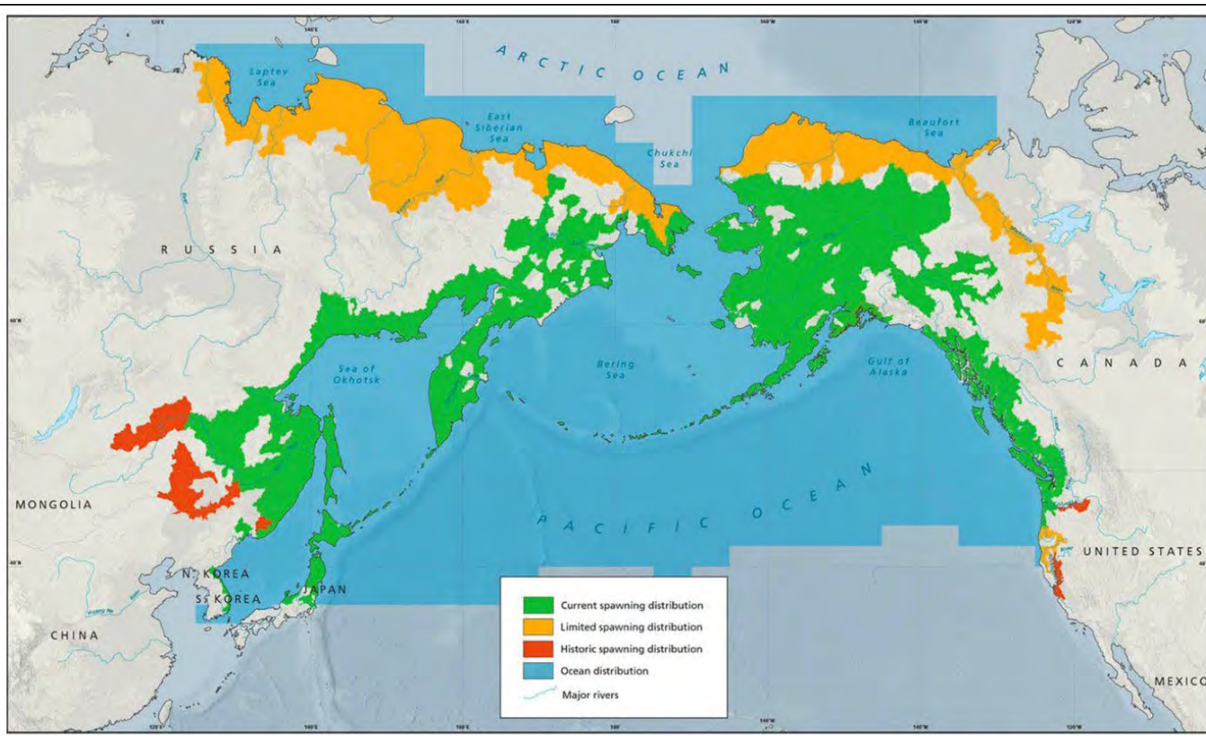

Figure 6-2 Chum salmon distribution. Modified from Atlas of Pacific Salmon (August 2005).

Juvenile chum salmon rear for a relatively short period in freshwater, migrating downstream to the marine ecosystem shortly after they emerge from their spawning gravel. Most chum mature between 3–5 years, although four-year-olds predominate in most areas. Generally, chum salmon that spawn in more northern locations have an older age at maturity compared to more southern locations. At maturity, chum salmon are the second largest Pacific salmon species, after Chinook salmon.

In large river systems, chum salmon often spawn in small side channels and other areas of large rivers where upwelling springs provide excellent conditions for egg survival. They also spawn in many of the same places as do pink salmon (i.e., small streams and intertidal zones). Some chum in the Yukon River travel over 2,000 miles to spawn in the Yukon Territory, Canada. These possess the highest oil content of any chum salmon when they begin their upstream journey. Chum salmon spawning is typical of Pacific salmon with the eggs deposited in redds located primarily in upwelling spring areas of streams.

Chum salmon do not have a year or more of remain in freshwater residence after emergence of the fry as unlike Chinook, coho, and sockeye salmon. Chum salmon fry feed on small insects in the stream and estuary before forming into schools in entering salt water where their diet usually consists of zooplankton and fish. By fall Alaskan chum salmon they move out into the Bering Sea and Gulf of Alaska where they spend two or more of the winters of their three to six year lives. In southeastern Alaska most chum salmon mature at four years of age, although there is considerable variation in age at maturity between streams. There is also a higher percentage of chum salmon chums relative to other Pacific salmon species in the northern areas of the state. Chum salmon vary in size from four to over thirty pounds, but usually range from seven to eighteen pounds, with females generally smaller than males.

6.1.2.1.1 Pacific Rim

6.1.2.1.2 Status Changes Across Pacific Rim

Abundance information for chum salmon is provided by Canada, Japan, the Republic of Korea, Russia, and the U.S. (NPAFC 2023; Appendix B). Some chum salmon stocks are monitored, with and catch, escapement, and return data are available. This is particularly the case in Japan, Russia, and the U.S., where these fisheries have high commercial importance.

Chum salmon populations have shown decline in all regions of the North Pacific within the past three to five years: Canada, Japan, Russia, Korea, United States - Alaska and Pacific Northwest regions (Munro, 2023). In Washington State, chum salmon abundance was negatively correlated with pink salmon *Oncorhynchus gorbuscha* abundance, potentially indicating direct and indirect competitive interactions during marine life stages (Litz et al., 2021). In Japan, declining chum salmon populations are expected due to decreased survival and growth associated with warming coastal waters causing a reduction in coastal zone residency (Kaeriyama, 2023). Khen & Zavolokin (2015) noted a decline in the density of western Bering Sea immature chum salmon during 2007-2011 associated with a change in the Bering Sea cyclonic gyre circulation pattern, which is thought to have shifted distribution and composition of chum salmon prey items. Typical densities of chum were observed after the circulation resumed its normal pattern in 2012. Changes in growth of Japanese chum salmon have been attributed to changes in ecosystem conditions including water temperature and zooplankton density from 1970 – 2000 with the trends expected to continue under the current climate regime (Kishi et al., 2010). Skeena River chum salmon stocks have declined substantially and are now estimated to be 39-52 times lower than in 1916-1919 due to overexploitation, natural life cycle variations, marine climate variability, and loss of critical habitat (Price et al., 2013).

Chum salmon abundances (from 2010–2020) have been mixed in Russia and Japan, ranging from stable to decreasing trends, depending on the area. The Sea of Okhotsk is one area where abundance showed an increasing trend (Table 6-2). Declining abundances of chum salmon in Japan has occurred on the Pacific sides of Hokkaido and Honshu, whereas stable abundance trends occurred in the western and Sea of Okhotsk sides of Japan. In Russia, decreases were focused on the Amur River basin and Sakhalin, and East Kamchatka and Chukotka. In Alaska (U.S.) abundances were relatively stable during this period, while mixed in Canada and Washington (U.S.)— stable in Puget Sound, stable in Hood Canal, and increasing in coastal areas.

From 2018– to 2020, almost all countries and areas showed decreasing chum salmon abundance trends, except for some cases in the U.S. (Washington), where trends increased for some chum salmon populations. Preliminary returns in 2021 trended downward in all countries and areas with some exceptions: increases for some populations in Washington State, and an increase in Russia in the western Bering Sea and Northwest Pacific. Two populations of chum salmon in the U.S. have been listed as endangered (lower Columbia River; and Hood Canal summer-run chum).

Table 6-2 Comparative status across Pacific Rim stocks between 2-16-2020 as compared with 2018-2020 (Source NPAFC Atlas of Pacific Salmon 2023)

Table 2. Summary of chum salmon abundance trends. Abundance includes catch, escapement, and returns, depending on the country, species, and available data. Red arrow indicates decreasing trend, green arrow indicates increasing trend, yellow arrow indicates stable trend. NW = Northwest, W = Western, NE = Northeast, EBS = Eastern Bering Sea, GOA = Gulf of Alaska, SE = Southeast.

	Past 11 years (2010–2020)	Last 3 years (2018–2020)	Preliminary 2021
NW Pacific			
Russia			
W Bering Sea & NW Pacific	⇦⇨	⇩	⇧
Sea of Okhotsk	⇧	⇩	⇩
Primor'e & SW Sakhalin	⇩	⇩	⇩
Japan			
Hokkaido Pacific side	⇩	⇩	⇩
Hokkaido W & Okhotsk sides	⇨	⇩	⇨
Honshu Pacific side	⇩	⇩	⇩
Honshu western side	⇨	⇨	⇩
Korea	⇩	⇩	⇩
NE Pacific			
USA (Alaska)			
Northern EBS	⇦⇨	⇩	⇩
Southern EBS	⇦⇨	⇩	⇩
Western GOA	⇦⇨	⇩	⇩
Northern GOA	⇦⇨	⇩	⇩
Eastern GOA/SE Alaska	⇦⇨	⇩	⇩
Canada			
Northern B.C./Yukon	⇦⇨	⇩	⇩
Southern B.C.	⇦⇨	⇩	⇩
USA (Washington)			
Puget Sound (not ESA listed)	⇩	⇩	⇩
Hood Canal (ESAt listed)	⇦⇨	⇩	⇧
Coast	⇧	⇧	⇧
Lower Columbia River	⇧	⇧	⇧

6.1.2.1.3 Hatchery Releases

Chum salmon hatchery releases by country have been relatively consistent across the past decade with the exception of Russia, which has increased production by an average of ~0.3 billion over the last 3 years, representing an approximately 43% increase over their previous releases. Japan releases the most hatchery fish (10-year average 1.63 billion), followed by Russia (0.78 billion), and the United States (0.73 billion). Canada and Korea each release less than 0.1 billion. Hatchery releases across the Pacific Rim are shown below by species and country from 1952 to 2021 (Figure 6-3and Figure 6-4; NPAFC 2022).

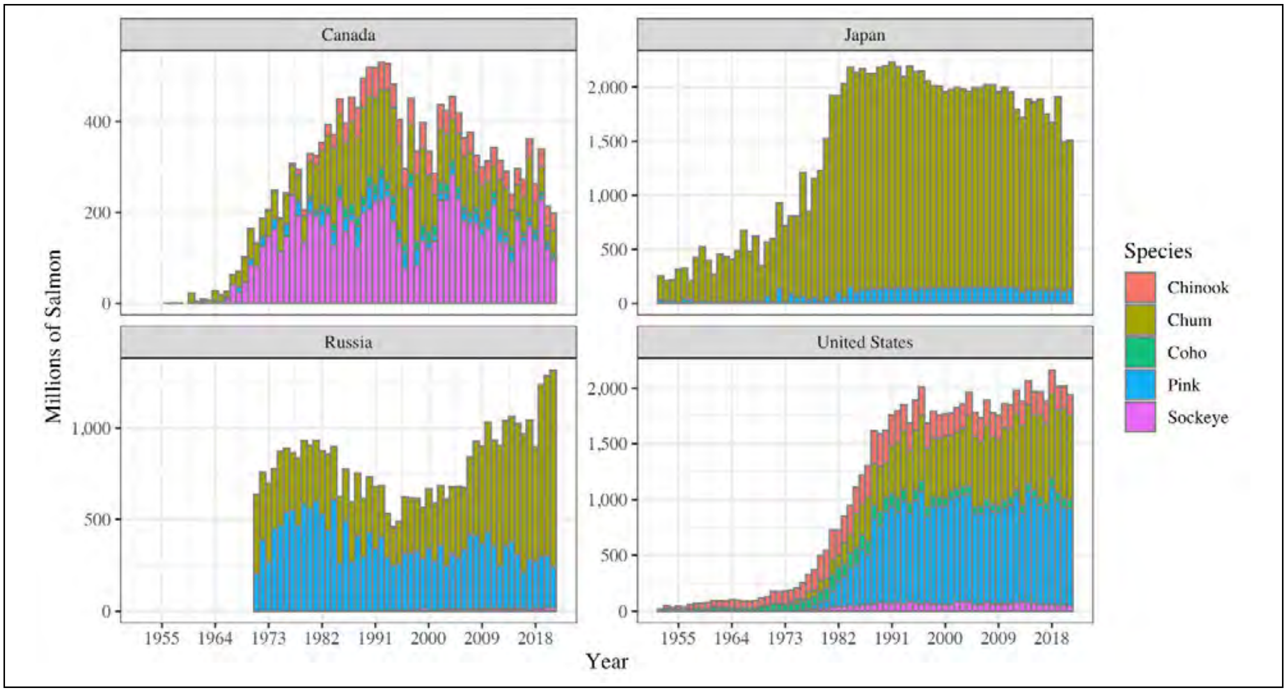

Figure 6-3 Total number of hatchery salmon (all species but omitting cherry and steelhead) by Japan, Russia, United States and Canada from 1952 to 2021

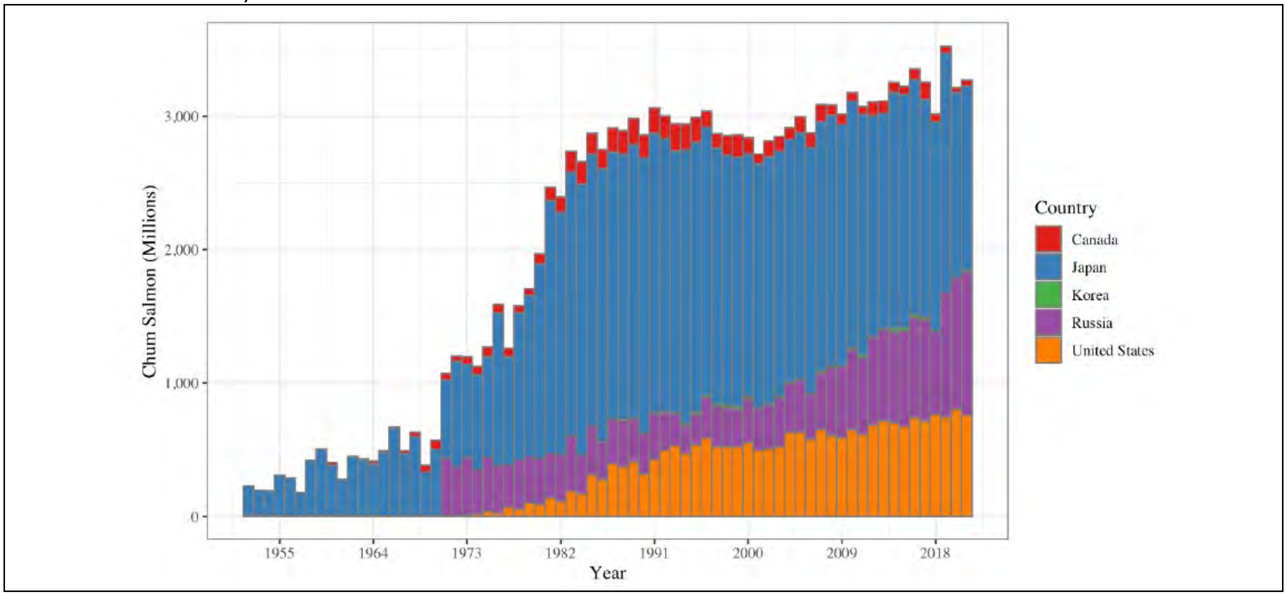

Figure 6-4 Total hatchery chum salmon production around the Pacific rim from 1952 through 2021

6.1.2.2 Western Alaska Chum Stock Status

The following section contains information on the status of Western Alaska chum salmon stocks. The information herein was provided by ADF&G and KRITFC staff through their role as cooperating agencies.

6.1.2.2.1 Current Chum Stock Status

Additional information on chum salmon may be found on ADF&G's website: https://www.adfg.alaska.gov/index.cfm?adfg=chumsalmon.main.

Chum salmon have the widest distribution of all Pacific salmon species and are generally found throughout Alaska. Chum salmon typically spawn in the smaller gravel of side channels, areas of larger rivers where upwellings provide oxygen to support egg survival, and in small streams and some intertidal zones. Unlike some other salmon species, such as Chinook salmon (*O. tshawytscha*), sockeye (*O. nerka*), and coho (*O. kisutch*), juvenile chum salmon spend minimal time in fresh water and migrate downstream to estuaries and the ocean shortly after emerging from the gravel. Juvenile chum salmon tend to feed on small invertebrates while juvenile and immature chum salmon in the marine environment have a more varied diet that may consist of copepods, crustaceans, other species of fish, and soft-bodied animals such as jellyfish and mollusks.

Chum salmon typically spend three to six years in the ocean. For purposes of this document, "Western Alaska chum salmon" refers to those stocks occurring from Bristol Bay north through Kotzebue Sound and includes stocks from Bristol Bay, Kuskokwim, Yukon, Norton Sound, and Kotzebue Sound management areas. Chum salmon originating from WAK river systems use the Bering Sea shelf as habitat in their first summer at sea as juveniles and then migrate between the Gulf of Alaska in winter and southern Bering Sea shelf in summer for 3 – 5 years before returning to their natal stream to spawn (see Figure 2-1 for the map of the Bering Sea and major salmon producing rivers incorporated under the description of the action area).

Chum salmon have historically been abundant throughout Western and Interior Alaska rivers. Chum salmon support regionally important subsistence, commercial, personal use, and sport fisheries. Chum salmon traditionally constitutes the majority of subsistence salmon harvest in the region, providing food for families and; dog teams, which are critical for subsistence and culture. Chum salmon have also supported the most northerly commercial salmon fishery in Alaska, Kotzebue Sound.

Beginning in 2020, Western Alaska chum salmon runs declined dramatically, with run sizes similar to those observed in the previous record poor run of 2000. These run declines resulted in restrictive management actions on commercial, sport, and subsistence harvests of chum salmon. In 2020, all Western Alaska river systems had chum salmon run sizes below recent year averages and in 2021, most run sizes were the lowest in the historical dataset. In 2022 and 2023, abundance increased slightly in most areas, but Western Alaska chum salmon abundance is still very low.

In 2020, commercial chum salmon fisheries were limited for Yukon River summer chum salmon stocks when it became apparent that the run was much poorer than expected; the subsequent Yukon River fall chum salmon commercial fishery was closed (Table 6-3). In the Kuskokwim River, there have not been any processors or registered buyers operating in the commercial salmon fishery since 2016 due to Chinook salmon conservation concerns and an accompanying lack of market interest. In Kuskokwim Bay commercial sockeye salmon fishery, incidental retention of chum salmon was allowed during the 2020 season. Sport fisheries for chum salmon were open in all areas of Western Alaska except for Yukon River fall chum salmon, although sport fisheries in this region generally do not target chum salmon. Subsistence chum salmon fisheries were open in all areas but limited in the Yukon River during both the summer and fall chum salmon runs, when runs failed to materialize.

Table 6-3 Summary of Western Alaska chum salmon stock status, 2020

Stock	Abundance?	Escapement goals met?[a]	Subsistence Fishery?	Commercial Fishery?	Sport Fishery?
Nushagak River	Below average	0 of 1	Yes	Yes	Yes
Kuskokwim Bay	Below average	NS[b]	Yes	Limited	Yes
Kuskokwim River	Below average	1 of 1	Yes	Limited	Yes
Yukon River summer run	Below average	1 of 1	Limited	Limited	Limited
Yukon River fall run	Below average	1 of 4[c]	Limited	No	No
Norton Sound	Below average	2 of 4	Yes	Limited	Yes
Kotzebue	Below average	NS[b]	Yes	Limited	Yes

[a] Includes performance for the subset of goals that were assessed. Some escapement goals were not assessed for various logistical reasons, including funding and weather.
[b] No survey, escapement goal was not assessed.
[c] Includes 2 U.S/Canada goals.

Western Alaska chum salmon abundance decreased further in 2021 (Table 6-4). Indices of chum salmon abundance in Norton Sound, the Yukon River, and the Kuskokwim River were all at the lowest abundance in the time series (Table 6-4). Of the 14 chum salmon escapement goals assessed in the Western Alaska region, only two, both in Norton Sound, were met in 2021. Chum salmon fishing was closed in multiple areas including fall and summer chum salmon commercial, sport, and subsistence on the Yukon River; commercial chum salmon fishing in the Kuskokwim River; and sport chum salmon fishing on the Kuskokwim River. In Kuskokwim Bay, commercial chum salmon harvest was incidental to the sockeye directed fishery.

Table 6-4 Summary of Western Alaska chum salmon stock status, 2021

Stock	Abundance?	Escapement goals met?[a]	Subsistence Fishery?	Commercial Fishery?	Sport Fishery?
Nushagak River	Below average	0 of 1	Yes	Yes	Yes
Kuskokwim Bay	Below average	NS[b]	Yes	No	Yes
Kuskokwim River	Below average	0 of 1	Limited	Limited	No
Yukon River summer run	Below average	0 of 3	No	No	No
Yukon River fall run	Below average	0 of 5[c]	No	No	No
Norton Sound	Below average	2 of 4	Yes	Limited	Yes
Kotzebue	Below average	NS[b]	Yes	Limited	Yes

[a] Includes performance for the subset of goals that were assessed. Some escapement goals were not assessed for various logistical reasons, including funding and weather.
[b] No survey, escapement goal was not assessed.
[c] Includes 2 U.S/Canada goals.

In 2022, most Western Alaska chum salmon abundance indices increased slightly from 2021 however some stocks still showed 2022 as still the second lowest abundance in the time series (e.g. Yukon River, Figure 6-5). Chum salmon fisheries were again closed in multiple areas including subsistence, commercial, and sport fisheries on the Yukon River for both summer and fall chum salmon; commercial chum salmon fishing in the Kuskokwim River and Bay areas; and sport chum salmon fishing on the Kuskokwim River (Table 6-5). In contrast to most other areas in Western Alaska, the Kotzebue area had above average abundance and chum salmon fisheries were opened for subsistence, commercial, and sport fishing.

Table 6-5 Summary of Western Alaska chum salmon stock status, 2022

Stock	Abundance?	Escapement goals met?[a]	Subsistence Fishery?	Commercial Fishery?	Sport Fishery?
Nushagak River	Below average	0 of 1	Yes	Yes	Yes
Kuskokwim Bay	Below average	NS[b]	Yes	No	Yes
Kuskokwim River	Below average	0 of 1	Limited	No	No
Yukon River summer run	Below average	0 of 2	No	No	No
Yukon River fall run	Below average	0 of 5[c]	No	No	No
Norton Sound	Below average	4 of 4	Yes	Limited	Yes
Kotzebue	Above average	NS[b]	Yes	Yes	Yes

[a] Includes performance for the subset of goals that were assessed. Some escapement goals were not assessed for various logistical reasons, including funding and weather.

[b] No survey, escapement goal was not assessed.

[c] Includes 2 U.S/Canada goals.

In 2023, Western Alaska chum salmon abundance indices again increased slightly from the previous year in most areas but remain at very low levels (Figure 6-4, Table 6-6). Escapement goals were met for six of the ten chum salmon escapement goals assessed across the region, but all stocks had below average abundance. Similar to recent years, commercial fisheries for summer chum salmon on the Yukon River were closed; however, there were limited subsistence and sport fishing opportunities for Yukon summer chum salmon which had not occurred since 2020. All fisheries for Yukon River fall chum salmon were closed. Commercial and sport chum salmon fisheries were closed in the Kuskokwim River and Bay areas. Additionally, chum salmon subsistence fisheries were limited in the Kuskokwim River and open in Kuskokwim Bay. In the Kotzebue area, chum salmon fisheries were opened for subsistence, commercial, and sport fishing.

Table 6-6 Summary of Western Alaska chum salmon stock status, 2023

Stock	Abundance?	Escapement goals met?[a]	Subsistence Fishery?	Commercial Fishery?	Sport Fishery?
Nushagak River	Below average	0 of 1	Yes	Yes	Yes
Kuskokwim Bay	Below average	NS[b]	Yes	No	No
Kuskokwim River	Below average	NS[b]	Limited	No	No
Yukon River summer run	Below average	1 of 1	Limited	No	Limited
Yukon River fall run	Below average	3 of 5[c]	No	No	No
Norton Sound	Below average	2 of 3	Yes	Limited	Limited
Kotzebue	Below average	NS[b]	Yes	Yes	Yes

[a] Includes performance for the subset of goals that were assessed. Some escapement goals were not assessed for various logistical reasons, including funding and weather.

[b] No survey, escapement goal was not assessed.

[c] Includes 2 U.S/Canada goals.

Yukon River

In most of Western Alaska, the 2020 through 2023 chum salmon run sizes were the lowest on record. In 2021, both Yukon River summer and fall chum salmon runs were the lowest in the time series 1978-2023, with a combined summer and fall chum salmon run size of 251,000 fish (Figure 6-5). Although run sizes increased in 2023 for both summer and fall chum salmon, they were well below average and still some of the lowest in the timeseries.

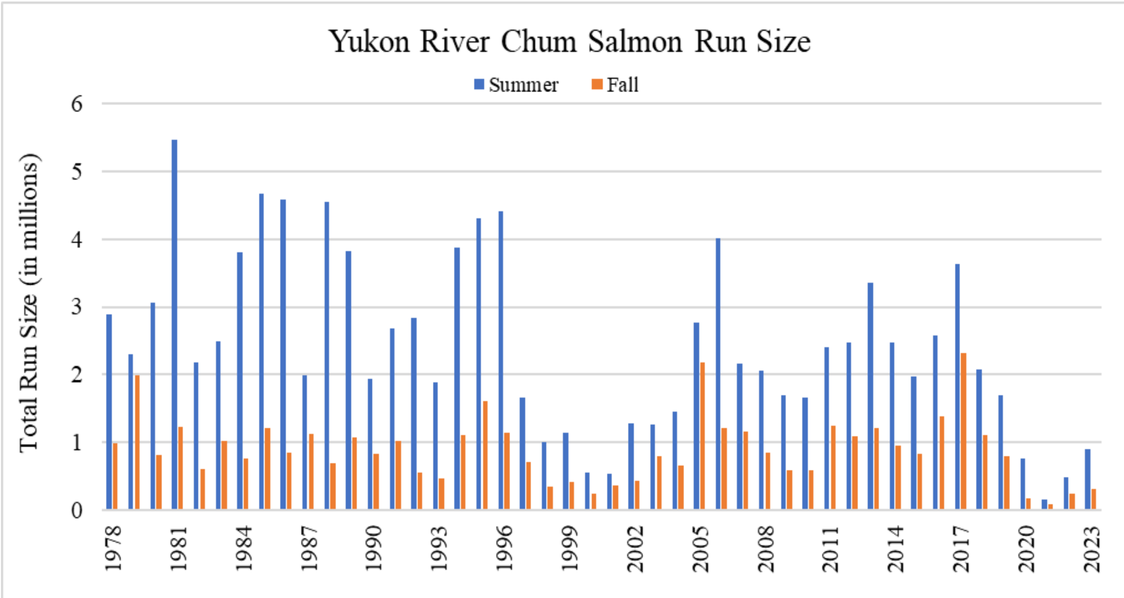

Figure 6-5 Yukon River chum salmon run size, 1978-2023

Kuskokwim Area

While total chum salmon run abundance estimates are not available in the Kuskokwim area, there are relative indices of abundance, including the Bethel Test Fishery in the lower river and the Kogrukluk River weir in the upper river. In 2021, the Bethel Test Fishery cumulative catch per unit effort (CPUE) and the Kogrukluk River weir chum salmon abundance estimates were the lowest in the time series (Figure 6-7). In 2023, the Bethel test fishery CPUE increased significantly but environmental conditions prevented the Kogrukluk River weir from providing reliable estimates of chum salmon escapement. The Kuskokwim area has additional abundance information that can help provide context on the status of chum salmon stocks in the area. These include the Kwethluk River weir, George River weir, Salmon River weir, Takotna River weir, and the Kuskokwim River sonar, which provide indices of abundance with varying levels of reliability and representativeness of the total chum salmon abundance.

In the Kuskokwim Region, LK and TK holders have noted the historically abundant chum salmon throughout the region by their distinct “stink” as their carcasses historically exuded when decomposing by the tens of thousands in tributaries. While total chum salmon run abundance estimates are not available in the Kuskokwim drainage, available data from mainstem enumeration and tributary spawner escapement monitoring projects all show a decline beginning in 2020 compared to the long-term average during the period 2000–2019 (Figure 6-6).

The Bethel Test Fishery is a long-term lower Kuskokwim mainstem enumeration project that provides an index of abundance based on cumulative catch per unit effort (CPUE). The average Bethel Test Fishery CPUE for 2020-2023 shows a 72% decline compared to the 20-year average from 2000 to 2019 (Figure 6-6.1). Similarly, the 2020–2023 average chum salmon escapement past the George River weir in the middle Kuskokwim River region showed a 69% decline from 2000-2019 (Figure 6-6.2). The 2020-2023 chum salmon count at the Bethel Sonar Project, a new mainstem enumeration project, showed a 70% decline compared to the 2019 counts (Figure 6-6.3). The Kogrukluk River weir passed more chum salmon in 2022 than the 2021 record low. However, the 2020–2022 average chum salmon escapement past the Kogrukluk River weir showed an 81% decline from the average for 2000–2019 (Figure 6-6.4).

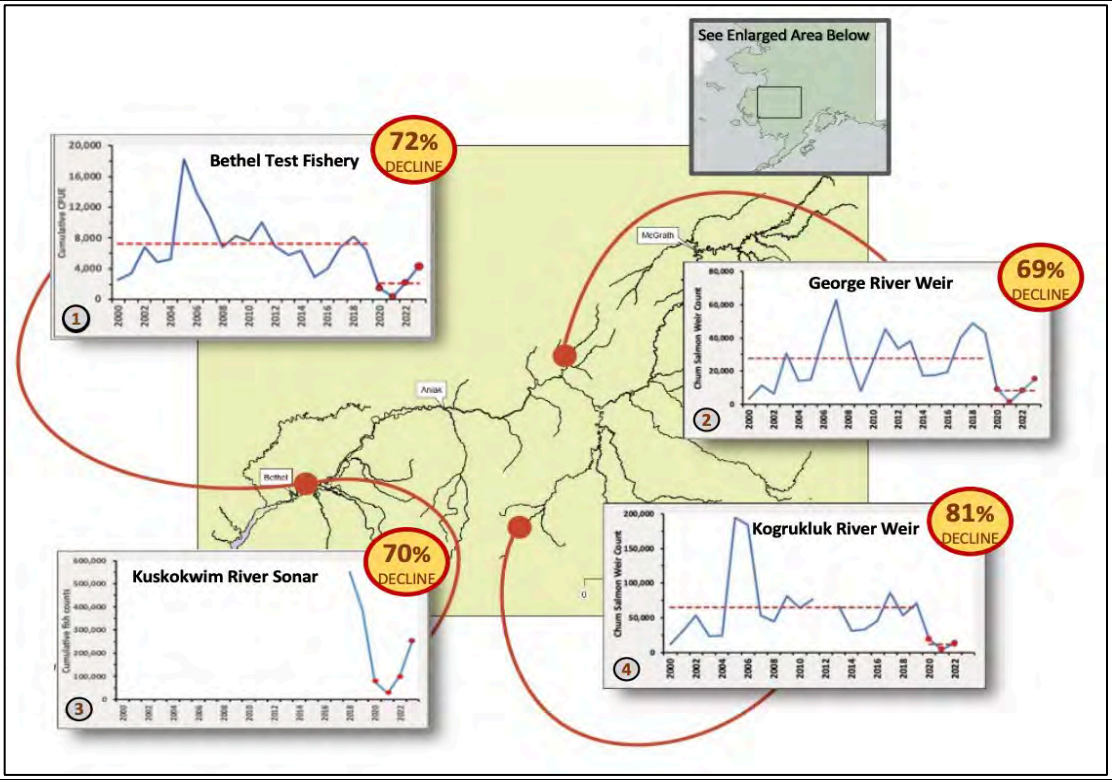

Figure 6-6 Kuskokwim River chum salmon mainstem passage counts and escapements from four stock assessment projects

Source: KRITFC; ADF&G AYK Database Management System, https://www.adfg.alaska.gov/CF_R3/external/sites/aykdbms_website/DataSelection.aspx

B.1: The 2020-2023 cumulative Bethel Test Fishery CPUE index of 2,065 chum salmon shows a 72% decline compared to the than 20-year average of 7,282 fish during the period 2000-2019. **B.2:** The George River weir 2020-2023 average of 8,499 chum salmon showed a 69% decline from the 2000-2019 average of 27,597 fish. **B.3:** The 2020-2023 chum salmon count at the Bethel Sonar Project showed a 70% decline compared to 2019. **B.4:** The Kogrukluk River weir 2020-2022 average of 12,215 chum salmon showed an 81% decline from the 2000-2019 average of 64,572 fish; no estimate is available for 2023.

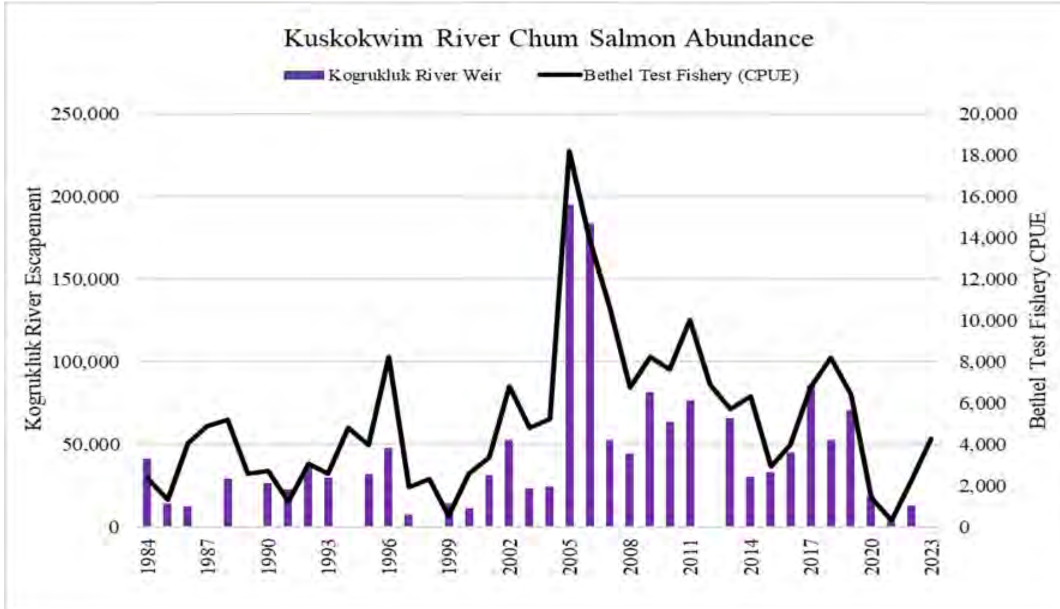

Figure 6-7 Kuskokwim River chum salmon including the Kogrukluk River weir escapement and cumulative CPUE from the in-river Bethel test fishery, 1984-2023

Following marked declines of chum salmon in 2020 and the lowest recorded returns in 2021, federal (USFWS), Tribal (KRITFC), and state (ADF&G) managers[64] on the Kuskokwim have implemented fishery restrictions to conserve chum salmon stocks. Subsistence chum salmon fisheries in the mainstem Kuskokwim were somewhat limited in 2021 (e.g., with a longer period of USFWS/KRITFC management in the lower river, and with ADF&G-mandated live-release from non-gillnet gear in the middle/upper river) and heavily restricted in the lower Kuskokwim in 2022 and 2023 (e.g., limited to short windows and Federally Qualified Subsistence Users [FQSUs; local residents] by USFWS/KRITFC). ADF&G limited subsistence chum salmon fisheries in the Kuskokwim Bay by time (e.g., Sunday fishing closures) and gear (e.g., gillnet length restrictions) in 2022 and 2023.

No commercial chum salmon fisheries have occurred in the mainstem Kuskokwim (District 1) since 2016 due to Chinook salmon conservation concerns, a lack of processors or registered buyers operating in the commercial salmon fishery, and an accompanying lack of market interest. However, due to conservation concerns for chum salmon, ADF&G closed commercial fisheries in District 1 in 2021, 2022, and 2023. In the Kuskokwim Bay (Districts 4 and 5), commercial chum salmon fisheries were opened in 2021 (harvests were lower than average, in part due to reduced participation in the fishery because of processor and buyer limitations); closed in 2022 (due to lack of a buyer and/or processor); and closed in 2023 (due to conservation concerns).

Chum salmon sport fisheries have been closed by ADF&G in the Kuskokwim watershed since 2021, except in the Kanektok River (which feeds into the Kuskokwim Bay), which the Federal Subsistence Board closed to the harvest of chum salmon by non-FQSUs (primarily non-resident sport fishers) starting in 2023.

[64] In times of salmon abundance, ADF&G manages the entirety of the Kuskokwim drainage. In times of salmon declines, USFWS may step in to instate federal jurisdiction of Kuskokwim salmon within the bounds of Yukon Delta National Wildlife Refuge (roughly the "lower Kuskokwim," from the mouth to the community of Aniak) per Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA). KRITFC collaboratively manages salmon with USFWS per Title VIII of ANILCA and their Memorandum of Understanding. Under federal jurisdiction, ADF&G manages non-federal waters of the Kuskokwim (roughly the "middle and upper Kuskokwim," from Aniak to the headwaters, as well as the Kuskokwim Bay). The divide between USFWS/KRITFC and ADF&G management has been in effect for at least some of the salmon fishing season since 2014.

Post-season subsistence harvest estimates in the Kuskokwim River showed subsistence chum salmon harvests in 2020, 2021, and 2022 were well-below long-term averages and failed to meet the Amounts Reasonably Necessary for Subsistence (41,200-116,400 fish) as established by the Alaska Board of Fisheries, with only 38% of chum salmon minimum subsistence needs being met (see Figure 3-1). Local and Traditional Knowledge from the Kuskokwim region confirmed that chum salmon returned in marginally higher abundance in 2023, perhaps aided in their spawning migrations by high and cold waters throughout the summer, but continued low abundance and conservation fishing closures meant subsistence chum salmon harvests still fell far short of meeting subsistence needs in the watershed. Local and Traditional Knowledge holders from the Kuskokwim region note that during their return migrations, chum salmon swim more deeply in the middle of the main river channel, relative to other salmon species concurrently migrating upstream.

Norton Sound

In the Norton Sound area, chum salmon escapement goals were met in two of the four rivers in both 2020 and 2021. All four escapement goals were met in 2022 and at least two of the four were met in 2023. While important chum salmon stocks exist throughout Norton Sound, the only total run size estimate is for Kwiniuk River chum salmon in northern Norton Sound. Unlike most Western Alaska chum salmon stocks, which have been abundant historically, northern Norton Sound chum salmon abundance has been variable with prolonged periods of poor productivity. Compared to other stocks in Norton Sound, the Kwiniuk River is the only stock where chum salmon abundance in 2023 was the poorest in the 1981-2023 time series (Figure 6-8).

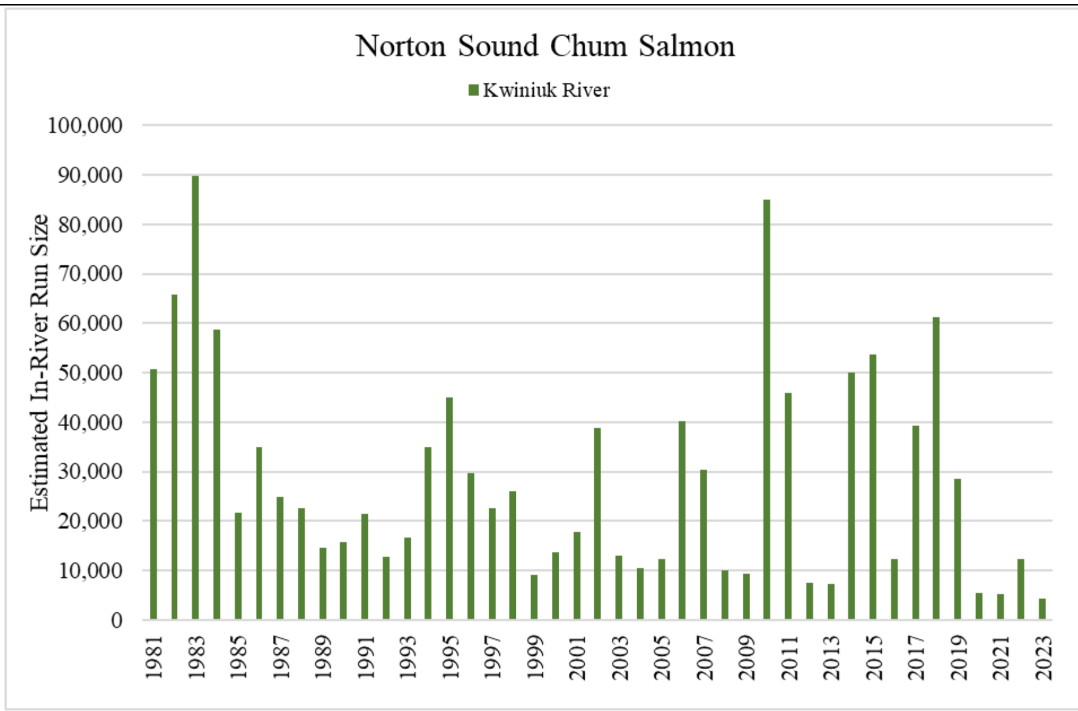

Figure 6-8 Estimated Kwiniuk River chum salmon run size, Norton Sound, 1981-2023

6.1.3 Environmental Factors Related to Chum Salmon Declines

While overall salmon abundance is known to be variable, consistent declines have been observed across WAK including by in-river subsistence fishermen (Brown et al., 2020; Mikow et al., 2019).

Figure 6-9 below shows the life history stages of salmon in the various environments encountered throughout their life cycle as well as the life history stage encountered in the marine environment by the pollock fishery as bycatch. The following sections describe the environmental stressors encountered at various salmon life stages as depicted in Figure 6-9. Generally, chum salmon caught as bycatch tend to be between ages 3-5 consistently (Berry et al., 2023; Section 6.1.4).

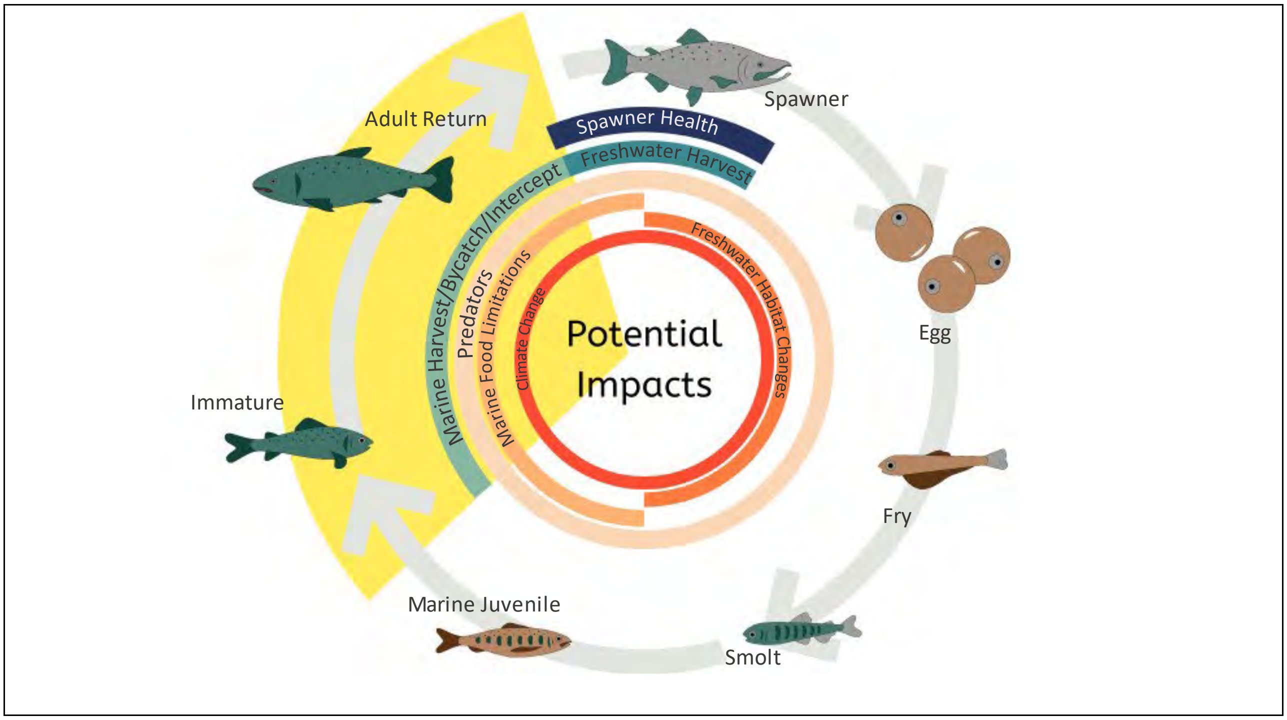

Figure 6-9 Life history cycle of chum salmon (modified from the draft Alaska Salmon Research Taskforce October 2023 report) with yellow shading indicating the ages encountered as bycatch in the pollock fishery.

Declines in chum salmon populations appear to be driven by warmer water temperatures in both the marine and freshwater environments which impact prey availability and quality, metabolism and growth rates, and lower fecundity rates due to chum salmon being younger at maturity (NOAA AFSC, 2022). Inter-annual variations in water temperature within the marine environment are likely to have differing effects on chum salmon from different year classes, however, local populations (i.e., those that return to spawn in the same tributary or river system) from within the same year class are likely to be affected similarly (Goodman, 2004; Kondzela et al., 2016).

Chum salmon originating from WAK river systems use the Bering Sea as habitat in their first summer at sea before migrating to the Gulf of Alaska for their first winter at sea. The early marine phase is a critical time for juvenile salmon when they need to grow quickly to escape predation and build energy reserves to survive their first winter at sea (Beamish and Mahnken 2001, Farley 2007). Early marine survival is known to be positively associated with adult returns (Healey, 1982; Kondzela et al., 2016; Murphy et al., 2019; Farley Jr et al., 2020). For fall chum salmon, this positive association between early marine survival, as measured by juvenile abundance, and adult returns was no longer present starting in 2016, which coincided with the start of marine heatwaves in both the Bering Sea and Gulf of Alaska ecosystems. Marine heatwaves in the Bering Sea and Gulf of Alaska negatively affect chum salmon as their metabolic rate increases, while also shifting the base of the food web which alters chum salmon diets. Juvenile chum salmon energy condition and stomach fullness decreased concomitantly with the start of the marine heatwaves in the Bering Sea[2] like due to decreased prey availability, increased metabolisms, and lower quality prey items (e.g., eating more jellyfish as lipid rich prey items are unavailable; Farley et al, 2024, Deeg et al., 2022; Mustonen & Van Dam, 2021; Myers et al., 2016; Urawa et al., 2016;).

Both early and late marine growth, during first and last marine occupancy seasons, have been correlated to sea surface temperature and changes in the average size of chum salmon at maturity (Oke et al., (2020). Climate change impacts to marine ecosystems such as changes in temperature regimes and salinity may result in a decrease in suitable marine environments (i.e., habitat loss) for chum salmon resulting in potential population declines (Azumaya et al., 2007; Kaeriyama et al., 2012, 2014; Urawa et al., 2018).[65] WAK chum salmon had high marine mortality in years with unusually cold sea surface temperature (SST), however, growth rates could also decline if SST increased by 2ºC above the warmest SST during studies offshore of the Yukon and Kuskokwim rivers during 2002 – 2007 (Farley, 2009). Nonstationarity in SST has been associated with declines in chum salmon productivity in the North Pacific region when comparing pre- and post- 1988/89 eras (Litzow et al., 2019). Malick & Cox (2016) found weak evidence of declines in chum salmon stocks in Alaska with relatively stable productivity from 1980-2000 followed by a steep decline from 2000-2007. Variability in productivity trends was observed in Alaska chum salmon stocks but with widespread declines more evident than with pink salmon (Malick & Cox, 2016).

The distribution, condition, prey availability and quality of prey for chum salmon are impacted by SST (Myers et al., 2016; Urawa et al., 2016). Changes in prey availability due to either mismatches in spatial overlap, declining prey density, lower quality prey items, and/or competition for food have occurred, notably in association with marine heatwaves. The Arctic hyperiid amphipod, *Themisto libellula*, is an important prey species of chum salmon in the eastern Bering Sea, however the availability of this amphipod is largely restricted to the region above the cold pool (Murphy et al., 2016). WAK chum salmon are negatively affected by increases in pink salmon and Asian origin hatchery chum salmon during early marine life and while foraging during summer in the Bering Sea (Minicucci 2018; Ruggerone & Agler, 2008). This competition for resources in conjunction with warming water temperatures may have increased reliance on low-quality prey items such as gelatinous zooplankton. The chum salmon digestive system may decrease dietary competition with other Pacific salmon as they are physiologically able to consume large quantities of low-quality food items in short periods of time due to their high digestion rate and large digestive system volume (Azuma, 1992; Koval', 2006; Urawa et al., 2018). Cnidaria (jellyfish) are an example of a low-caloric content prey species group utilized by chum salmon and they are an important part of the diet of chum salmon in the eastern Bering Sea (Murphy et al., 2016). Prolonged reliance on prey with low nutrient densities, may affect growth, susceptibility to disease and pathogens, reproduction, and mortality. Competition for resources, even with a diet high in plasticity, can affect growth.

Additional potential causes of declines that are broadly attributed to climate change include changes in predator density, pathogen load, and increased interactions with hatchery fish across the North Pacific due to increased hatchery releases (Ahmasuk & Trigg, 2007; Atlas et al., 2022; Barbeaux et al., 2020; Braem et al., 2017; Carey et al., 2021; Cheung & Frölicher, 2020; Crozier et al., 2021; Deeg et al., 2022; Fall et al., 2013; Godduhn et al., 2020; Gorgoglione et al., 2020; KRITFC, 2023; Malick & Cox, 2016; Mikow et al., 2019; Moncrieff et al., 2009; Ruggerone et al., 2010; Suryan et al., 2021; Trainor et al., 2019).

Warming Freshwater Environment:

In addition to the marine environment, climate change impacts the environmental conditions in freshwater environments where chum salmon spawn and migrate. Changing freshwater conditions can alter metabolic needs (i.e., increased in warmer water) and spawning success as water temperatures fluctuate above or below the optimal range (Carey et al., 2021). Changes in stream discharge (i.e., increased turbidity and flow with greater melt off or low flow during times of heat/drought) and oxygen levels (i.e., decreasing) can also negatively affect survival of migrating juveniles and adults (Carey et al., 2021). Changes in turbidity and flow can reduce the suitable habitat in rivers, increase bank erosion, and affect

[65] Urawa et al. (2018) evaluated projected marine changes and found it likely that a 1.5ºC temperature increase and a 0.2 psu salinity decrease would alter habitat suitability for chum salmon, resulting in a decrease of 10% in suitable habitat in the North Pacific during the summer season

survival of eggs and young chum salmon during outmigration (Bash et al., 2001; Beechie et al., 2022; Carey et al., 2021). A large spawning migration mortality event due to warm stream temperatures, hypoxia, and pathogen infections was documented for summer run chum in the Koyukuk River in 2019, largely affecting pre-spawn migrating fish (Westley 2020). Low water levels, warm temperatures, significant algae blooms, and a large quantity of chum salmon migrating decreased dissolved oxygen in the water resulting in a significant die-off in the Kobuk River drainage in 2014 (Braem et al., 2018).

Several other environmental changes have been observed in WAK, although it is not clear how these broader environmental changes may impact WAK chum salmon abundance. For example, communities across Western and Interior Alaska have experienced warmer winter temperatures, increased precipitation, decreased ice thickness, delayed freeze-up, less predictable break-up timing, thawing permafrost, algae blooms, an increase in beaver dam prevalence, increased Northern Pike populations and increased bear populations (Ahmasuk & Trigg, 2007; Braem et al., 2018; Carothers et al., 2019; Carothers et al., 2021; Fall et al., 2013; Godduhn et al., 2020; Mikow et al., 2019; Moncrieff et al., 2009; Mustonen & Van Dam, 2021; Peirce et al., 2013; Raymond-Yakoubian & Raymond-Yakoubian, 2015; Trainor et al., 2019). The timing of ice break-up has been correlated to juvenile salmon outmigration and may result in a mismatch in prey availability during early marine life (Trainor et al., 2019).

Additional resources, databases, and repositories:

The following section describes additional resources, databases, and repositories of information that may provide additional information on chum salmon biology, distribution, and causes of declines.

In December 2022, the Alaska Salmon Research Task Force Act was signed into law by President Biden. The Act is in response to the historic declines of salmon runs specifically on the Yukon and Kuskokwim rivers in Alaska. The Act required the Secretary of Commerce, in consultation with the Governor of Alaska, to form the Alaska Salmon Research Task Force (henceforth, Task Force). The Task Force was convened in June 2023 with the overarching role to identify gaps in data and to produce a coordinated science plan one year after convening. There are four key expectations of the Task Force: to review and report on research about the Pacific salmon in Alaska; to identify applied research needed to increase the understanding of salmon migration and the decline in salmon returns currently being experienced in some regions of Alaska; to form a Yukon and Kuskokwim River work group; and to support sustainable management of salmon. **The Council may want to consider requesting a presentation on findings from the Alaska Research Task Force at the conclusion of its work.**

The Pacific Salmon Commission (Commission) was formed by the governments of Canada and the Unites States with the signing of the Pacific Salmon Treaty in 1985. The Commission represents the interests of commercial and recreational fisheries as well as the Federal, State, and Tribal governments of the two countries. Publications produced by the Commission are available on their website which includes a repository of annual, technical, and special reports as well as other types of files, publications, policy information, endowment fund projects and information, and a full research library which includes historical papers, maps, and photographs. The Chum Technical Committee reports are available through the technical reports section with the most recent report from 2019. Finally, the Commission also hosts informative webinars that can provide additional information on salmon populations in the Pacific region.

The Yukon River Panel was formed from the 2001 Yukon River Salmon Agreement which represents a commitment to restore, conserve, and manage salmon of which communities of the Yukon River depend. Information included on the site ranges from in-season data, funded project locations and descriptions, restoration and enhancement fund call for proposals and funded projects, publications from the Yukon River Joint Technical Committee, news and announcements, fund reports and data sets, and policy information.

The Yukon River Drainage Fisheries Association (YRDFA) was established in 1990 to conserve salmon runs along the Yukon River and coordinate communication between subsistence and commercial fisheries and fishery managers in the region. One part of YRDFA's work has been to document Local and Traditional Knowledge of fishermen and residents across the drainage. The resources available through their site include publications, reports, resolutions, maps, and links to additional resources.

The North Pacific Anadromous Fish Commission was established in 1992 by the Convention for the Conservation of Anadromous Stocks as an inter-governmental organization with the primary objective to promote the conservation of anadromous stocks, namely Pacific salmon. Information available includes reports from committees, annual summary reports, peer-reviewed articles, technical reports, newsletters, and other publications. Technical reports include status and trends in salmon populations, including chum salmon; salmon ocean ecology under changing climate conditions; and other topics. The most recent compilation of statistical information describing Pacific Salmon catch and hatchery release data are available as an online resource. The metadata includes a description of but not quantification of commercial, sport, and recreational catch; hatchery releases; and area-specific information including Alaska. While the publications encompass all salmon species in the North Pacific, specific information within the publications does include chum salmon. Recordings of presentations are available on their site and include chum salmon, changing environmental conditions, and other relevant topics.

Alaska Department of Fish and Game has several resources available. The Salmon Ocean Ecology Program (SOEP) webpage includes a list of publications focused on salmon populations in Alaska. While not solely focused on chum salmon, this website provides resources focused on the Alaska region as a whole. The Western Alaska Salmon Stock Identification Program (WASSIP) directly focuses on the Western Alaska salmon fisheries. Created in 2006, WASSIP aims to better understand the composition of western Alaska fishery harvests and their impacts on salmon stocks of the WAK region. Information available on the WASSIP site includes MOUs, reports, publications, technical documents, meeting minutes and agendas. There are reports and publications focused on chum salmon, however the most recent is 2013, prior to the recent dramatic population declines. These data do, however, provide valuable information that can act as a baseline for knowledge of WAK chum salmon with a strong focus on genetics and stock assessment.

The State of Alaska's Salmon and People (SASAP) project explored the coupling of the human-salmon interface using a holistic, statewide approach to examine the status and characteristics of the relationship. The mission of SASAP is *"to create an equitable decision-making platform for all stakeholders through information synthesis, collaboration, and stakeholder engagement."* Data and information available provide comprehensive regional summaries on salmon-specific topics through an open data portal. Seven key topics were explored including declines in size and age of salmon, the wellbeing of salmon systems, salmon in a changing ocean, community-science engagement, Kenai lowlands, deep time connections, and the public record. Regions encompass all of Alaska and connected drainages within Canada, including the Yukon and Kuskokwim drainages.

The Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative (AYKSSI) was formed "to understand the trends and causes of variation in salmon abundance and fisheries through the assembly of existing information, gaining new information, and improving management and restoration techniques through a collaborative and inclusive process". The AYK SSI 2002-2010 Research and Discovery Report includes information on salmon populations within the AYK region, Bering Sea, Kuskokwim River watershed, Norton Sound, and Yukon River watersheds; Alaska Native science and engineering program; salmon research and restoration plan high priorities, the geographic distribution of funded projects, and AYKSSI accomplishments. The report includes synopses of 55 funded projects from 2002-2010. Additional information including full reports is available via the complete project table in the Projects section of the AYKSSI website, containing 90 total project entries. A comprehensive bibliography is available for five species of Pacific salmon, including chum salmon. The website also includes a draft report focused on the freshwater life cycle of Kuskokwim River chum salmon from October 2004.

Book: Pacific Salmon: Ecology and Management of Western Alaska's Populations, available in print and as a download through the American Fisheries Society Book Store. Published in 2009, the book provides an overview of salmon fisheries in the AYK region, ecological processes that result in changes to salmon populations, human dimensions of salmon populations and fisheries, management in the AYK region, and the links between salmon ecology and management in the AYK region. The table of contents can be accessed online.

6.1.4 Chum Salmon (non-Chinook) Salmon Bycatch

The following section provides an overview of recent non-Chinook salmon bycatch performance. Recall over 99% of the salmon encountered as bycatch in the non-Chinook catch accounting category are chum salmon. The following subsections also contain information on the spatial and temporal patterns of B season chum salmon bycatch as well as genetic information for 2011 through 2022.

6.1.4.1 Chum Salmon Bycatch Historically and by Sector

There is significant interannual variability in the overall number of non-Chinook (i.e., chum salmon) caught as bycatch each year ranging from a low of 22,172 (2012) to a high of 546,901 fish (2021). The annual average level of B season bycatch is 280,707. As shown in Table 6-7, there are differences in the bycatch patterns at the sector-level. The majority of bycatch is attributed to the inshore CV sector (56%), followed by the CP sector (29%), mothership sector (8%) and CDQ pollock fishery (7%).

Table 6-7 B season chum salmon bycatch (number of fish) by Bering Sea pollock fishery sector as well as the 3-, 5-, 10-, and 12-year average levels of bycatch, 2011 through 2022

Year	*CDQ*	*CP*	*Mothership*	*Inshore*	*Total*
2011	3,758	44,299	24,399	118,857	191,313
2012	200	1,928	977	19,067	22,172
2013	554	10,229	3,835	110,496	125,114
2014	2,407	63,066	8,091	145,322	218,886
2015	4,650	40,046	14,046	174,343	233,085
2016	16,342	134,750	43,629	144,882	339,236
2017	87,058	207,355	16,825	154,610	465,848
2018	26,586	99,447	21,303	147,339	294,675
2019	15,726	113,428	44,860	172,798	346,671
2020	8,582	77,138	19,743	237,632	343,094
2021	55,663	97,917	50,542	341,779	545,901
2022	6,365	71,786	32,262	131,896	242,309
3-yr. avg. (2020-2022)	23,537	82,280	34,182	237,102	377,102
5-yr. avg. (2018-2022)	22,584	91,943	33,742	206,295	354,564
10-yr. avg. (2013-2022)	22,393	91,516	25,477	176,113	315,499
12-yr. avg. (2011-2022)	18,991	80,116	23,345	158,255	280,707

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

Sector-level differences in the level of chum salmon bycatch may be attributed to many factors (e.g., fishing behavior, fishing location, environmental conditions, among others). Geneticists have analyzed spatial patterns in the distribution of chum salmon bycatch using biological and catch data systematically collected by NMFS certified observers onboard pollock vessels or at shoreside processing facilities. To evaluate the distribution and variation in the genetic stock composition reporting groups of the chum salmon encountered as bycatch across the pollock fishing grounds, geneticists with the Alaska Fisheries Science Center's Auke Bay Labs developed "genetic cluster areas." The genetic cluster areas group ADF&G groundfish statistical areas together to depict spatial variation in the chum salmon bycatch.

6.1.4.2 Spatial Distribution by Genetic Cluster Area

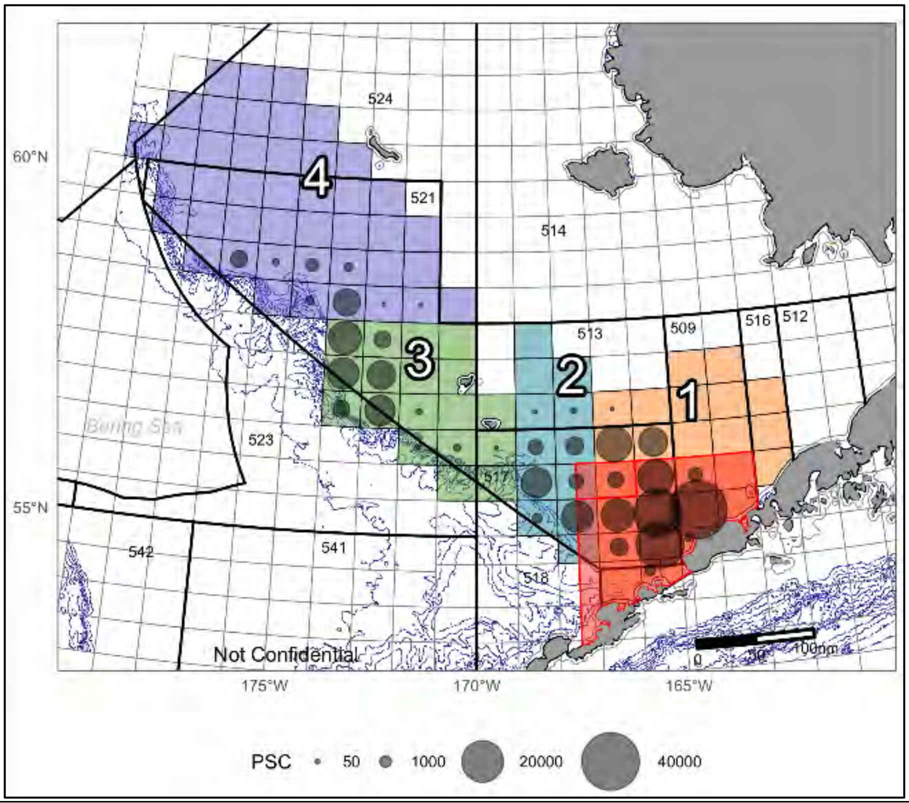

Figure 6-10 Spatial distribution of chum salmon bycatch caught in the 2022 B season pollock fishery by genetic cluster areas 1 through 4 with bathymetry lines and the CVOA highlighted in red

Figure 6-10 shows the spatial distribution of chum salmon bycatch encountered during the 2022 B season pollock fishery by genetic cluster areas (1 through 4). The CVOA is in-laid in red near the Alaska Peninsula. In 2022, the majority of chum salmon bycatch was encountered in genetic cluster area 1 closest to the Alaska Peninsula followed by genetic cluster area 3. The 2022 spatial distribution of the chum salmon bycatch was similar to the average spatial location in prior years (Barry et al., 2023); however, the majority of chum salmon bycatch has historically been encountered in genetic cluster areas 1 and 2.

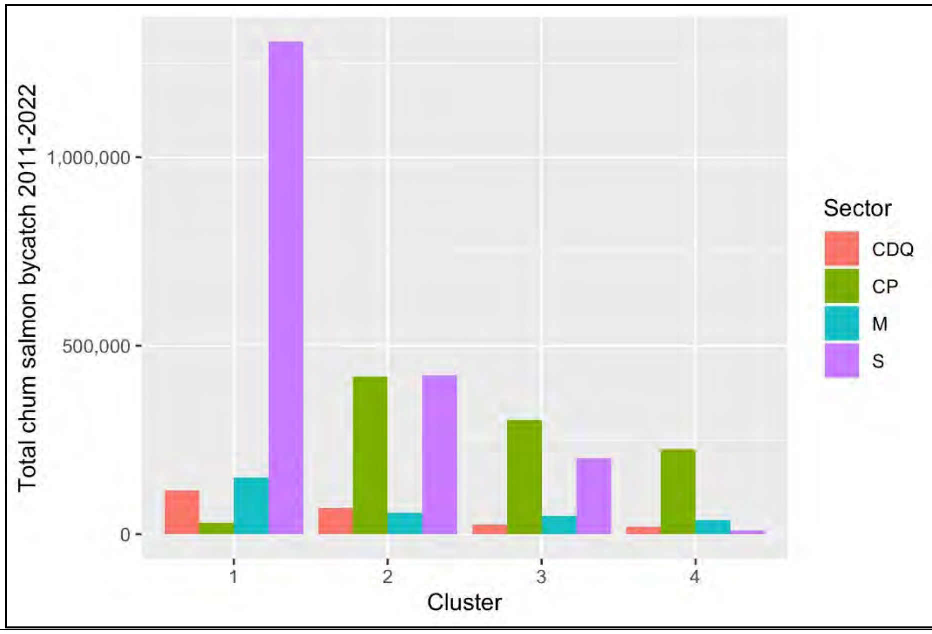

Figure 6-11 Chum salmon encountered by genetic cluster area, 2011-2022

6.1.4.3 Temporal Trends

The timing of chum salmon bycatch within the B season pollock fishery varies annually. To evaluate temporal trends in the chum salmon bycatch, the B season pollock fishery was divided into Early, Middle, and Late periods based on statistical weeks in the calendar year (see Table 6-8**).**

Table 6-8 Summary of statistical weeks and associated week-end calendar dates by analytical period (early, middle, and late) for reference

When Analyzed as Three Distinct Time Periods		
Period	*Statistical Weeks*	*Associated Week-end Calendar Dates*
Early	24-29	June 10-July 29
Middle	30-34	July 29-August 26
Late	35-44	August 26 -November 4
When Analyzed as Two Distinct Time Periods		
Period	*Statistical Weeks*	*Associated Week-end Calendar Dates*
Early	24-32	June 10-August 12
Late	33-44	August 13-November 4

Notes: The associated week-end calendar dates provided here are based on statistical weeks in the 2023 calendar year; there may be some small variation in dates year-to-year.
https://www.adfg.alaska.gov/index.cfm?adfg=CommercialByFisherySalmon.whatisbluesheet#:~:text=The%20first%20statistical%20week%20of,Statistical%20Weeks%2020%20through%2040.

Figure 6-12 shows each sectors annual proportion of chum salmon bycatch, as well as all sectors combined, from early June (statistical week 25 is typically one week into the B season fishery which allows for some bycatch data to have been collected by observers) through November 1 (the regulatory closing date for the B season pollock fishery of November 1 typically falls in statistical week 44 or 45 during a calendar year). As shown, the timing or peaks of chum salmon bycatch vary by year and by sector. In half of the years, the pollock fishery **encountered** the majority of chum salmon bycatch in late July to August (the Middle period). This trend appears to be driven by the inshore sector in most years, e.g., in 2014 when the S sector peaks in the middle period and the CP sector peaks in the late period, the relatively larger overall bycatch of the **inshore** sector determines **all** sectors pattern. In two years, 2017 and 2018, the bycatch occurred early across all sectors. However, it is not uncommon for chum salmon bycatch to be characterized by multiple, and distinct, peaks.

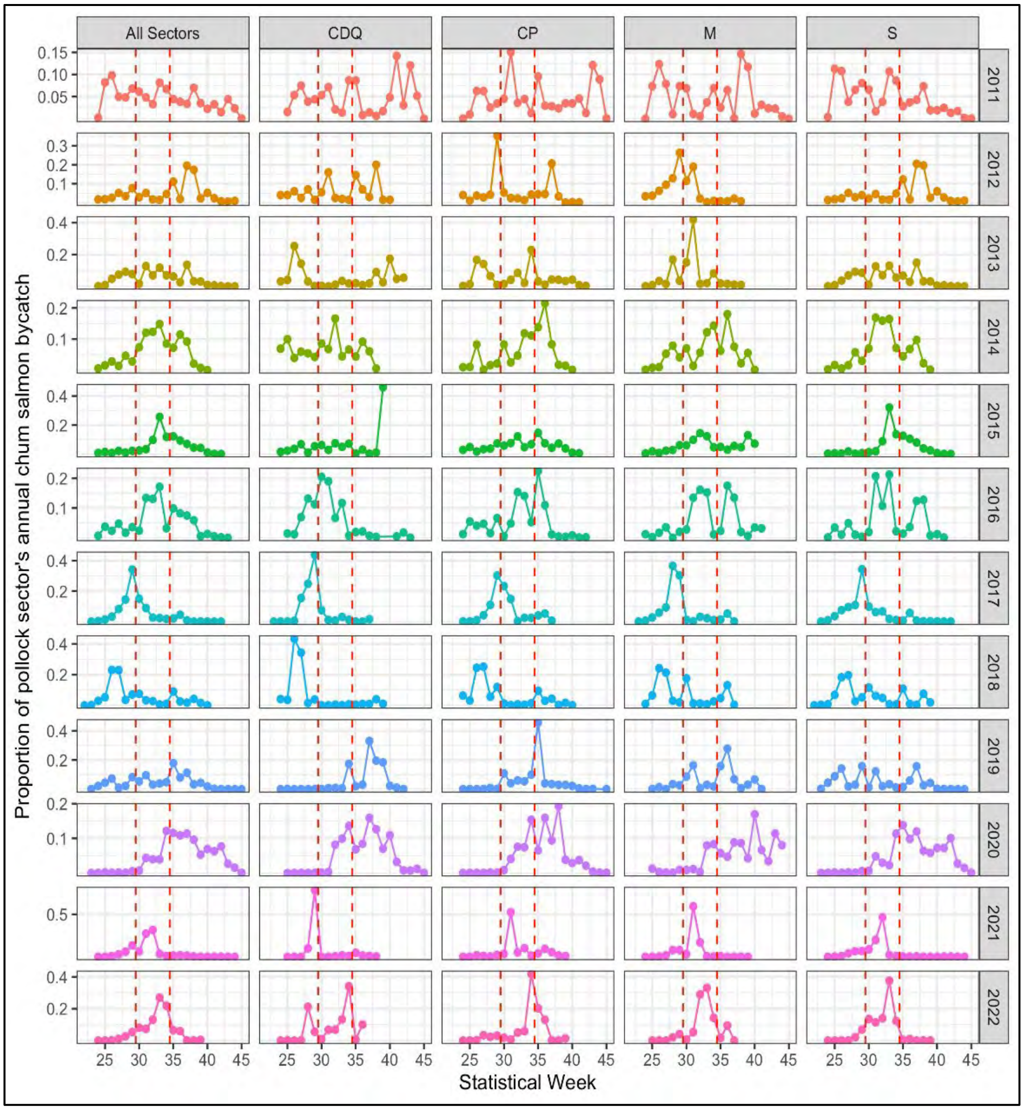

Figure 6-12 Proportion of each pollock sector's annual chum salmon bycatch, and all sectors combined, encountered by statistical week, 2011-2022

Notes: Red vertical lines separate the periods (Early, Middle, or Late) defined in Table 6-8.

6.1.4.4 Genetic Breakouts Including Spatial and Temporal Trends

Not all chum salmon caught as bycatch would return to WAK river systems, and the Council's priority with this action is to minimize the bycatch of WAK origin chum salmon within the overall bycatch. Scientists use biological and genetic information collected from samples of chum salmon taken as bycatch in the Bering Sea pollock fishery to estimate the number and proportion of chum salmon originating from six genetic groups: Southeast Asia, Northeast Asia, Coastal Western Alaska, Upper/Middle Yukon (Yukon River fall chum and some Yukon River summer chum populations), Southwest Alaska, and Eastern Gulf of Alaska/Pacific Northwest.

Table 6-9 provides the annual level of chum salmon bycatch in the Bering Sea pollock B season fishery compared to the estimated mean stock proportion and corresponding estimated number of chum salmon caught as bycatch by the six genetic stock reporting groups. On average, 15.4% of the chum bycatch is attributed to the Coastal Western Alaska genetic stock reporting group and 3.9% is attributed to the Upper/Middle Yukon genetic stock reporting group (2011-2022). The estimated number of combined

WAK chum salmon (i.e., Coastal Western Alaska and Upper/Middle Yukon combined) caught as bycatch ranges from a low of 4,701 fish in 2012 to a high of 93,170 fish in 2017. In most years, the majority of chum salmon bycatch is of Asian origin including both hatchery and wild fish.

Table 6-9 Total chum salmon bycatch in the Bering Sea pollock fishery B season compared to the estimated mean proportion and estimated number of chum salmon (only) caught as bycatch by genetic stock reporting group, 2011 through 2022

	Chum Bycatch	***N.E. Asia***		***S.E. Asia***		***E. GOA/Pacific Northwest***		***Southwest Alaska***		***Coastal Western Alaska***		***Upper/Middle Yukon***		***Western Alaska Combined***	
Year	**Total**	**Mean**	**Est. #**	**Mean**	**Est. #**	**Mean**	**Est. #**	**Mean**	**Est. #**	**Mean**	**Est. #**	**Mean**	**Est. #**	**Mean**	**Est. #**
2011	191,313	18.4%	35,202	17.3%	33,098	37.8%	72,318	1.5%	2,870	16.2%	30,993	8.9%	17,027	25.1%	48,020
2012	22,172	38.9%	8,625	20.3%	4,501	17.6%	3,902	2.0%	443	13.8%	3,060	7.4%	1,641	21.2%	4,701
2013	125,114	44.9%	56,164	14.7%	18,329	14.8%	18,452	1.4%	1,752	18.1%	22,633	6.3%	7,782	24.4%	30,415
2014	218,886	37.4%	81,907	18.5%	40,560	23.6%	51,701	0.7%	1,445	17.7%	38,699	2.1%	4,553	19.8%	43,252
2015	233,085	17.5%	40,790	9.7%	22,609	51.4%	119,806	1.6%	3,729	16.0%	37,294	3.9%	9,090	19.9%	46,384
2016	339,236	30.5%	103,467	8.8%	29,853	34.9%	118,393	1.3%	4,410	19.3%	65,473	5.3%	17,980	24.6%	83,453
2017	465,848	46.1%	214,756	15.7%	73,138	15.0%	69,877	3.2%	14,907	14.0%	65,219	6.0%	27,951	20.0%	93,170
2018	294,675	49.0%	144,405	17.7%	52,163	12.4%	36,543	2.0%	5,894	15.4%	45,385	3.4%	10,020	18.8%	55,405
2019	346,671	39.2%	135,950	18.0%	62,426	22.9%	79,420	3.6%	12,485	15.9%	55,143	0.3%	1,040	16.2%	56,183
2020	343,094	31.9%	109,447	12.7%	43,573	42.5%	145,815	3.8%	13,038	8.0%	27,448	1.1%	3,774	9.1%	31,222
2021	545,901	55.7%	303,903	11.9%	64,695	20.6%	112,615	2.4%	13,176	8.9%	48,658	0.5%	2,854	9.4%	51,512
2022	242,309	32.9%	79,684	10.9%	26,376	29.6%	71,775	3.6%	8,749	21.1%	51,106	1.9%	4,618	23.0%	55,724
Average	280,707	36.9%	109,525	14.7%	39,277	26.9%	75,052	2.3%	6,908	15.4%	40,926	3.9%	9,028	19.3%	49,953

Source: NMFS Alaska Region Catch Accounting System.
Notes: The total chum bycatch column is based on total bycatch in the non-Chinook category and thus includes small amounts of pink, sockeye, and coho. The estimated numbers of chum salmon from each reporting group are inferred by multiplying the mean stock composition estimated using genetic data and the total chum bycatch. The summation of individual stocks deviates from the total chum bycatch due to the rounding of mean estimates.

Table 6-10 contains new analyses estimating the mean number of WAK chum salmon (Coastal Western Alaska + Upper/Mid Yukon) caught as bycatch by pollock fishing sector (with CDQ broken out) in each year, the average level of WAK chum salmon bycatch, as well as the cumulative total (2011-2022). The methods for this analysis can be referenced in Section 5.2.1. The inshore sector consistently encounters the majority of WAK chum salmon year-to-year or approximately 63% of WAK chum salmon encounters from 2011-2022.

Table 6-10 Estimated number of WAK chum salmon caught as bycatch by pollock fishing sector, 2011 through 2022

	CDQ	*CP*	*Mothership*	*Inshore*	*Total*
2011	NA	8,917	4,430	32,444	45,791
2012	NA	NA	NA	3,932	3,932
2013	NA	2,468	801	28,219	31,488
2014	NA	8,715	NA	31,650	40,365
2015	NA	5,133	1,928	36,262	43,323
2016	3,031	21,946	13,758	38,236	76,971
2017	22,674	33,435	4,673	35,288	96,070
2018	6,272	17,644	4,503	30,391	58,810
2019	2,898	5,090	7,637	40,237	55,862
2020	NA	1,926	1,148	25,620	28,694
2021	6,092	7,736	3,447	33,522	50,797
2022	902	8,037	7,891	37,278	54,108
Average	6,978	11,004	5,022	31,090	48,851

Source: NMFS Alaska Region Catch Accounting System.
Notes: NA denotes insufficient samples were available to estimate genetic stock proportions

In terms of timing (Early, Middle, and Late periods), in the 2022 B season pollock fishery, the proportion of WAK chum salmon in the overall bycatch was highest during late July to late August (the Middle period), as show in Figure 6-13 below. The WAK reporting group accounted for 23% of the of the overall bycatch during Middle period. The Upper/Middle Yukon reporting group decreased from the Early and Middle periods (3.6% to 1.9% respectively) to Late (0% of the bycatch after statistical week 34).

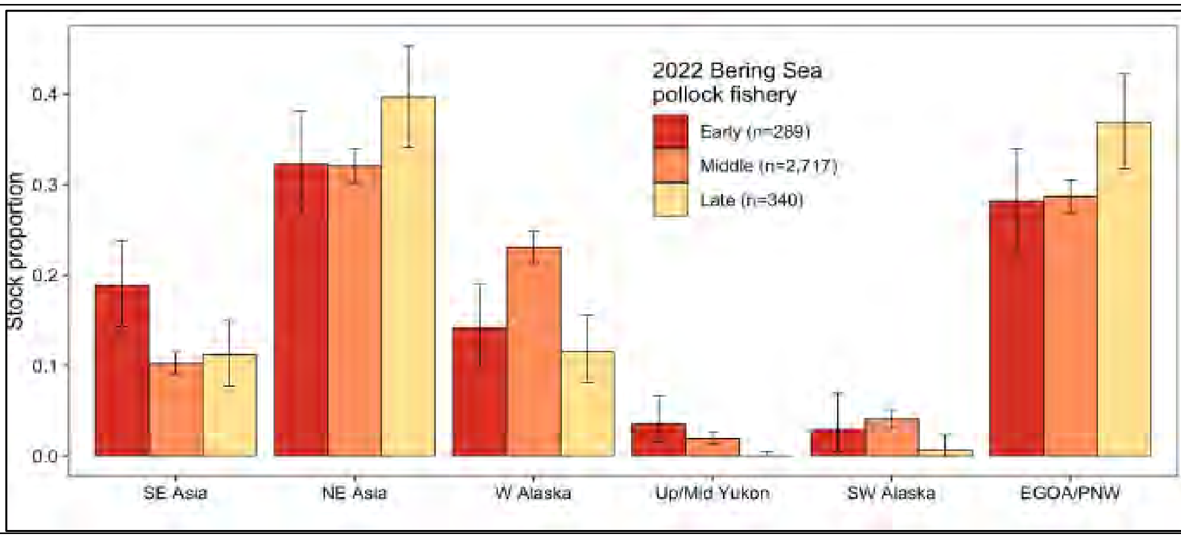

Figure 6-13 Stock composition estimates with 95% credible interval for the chum salmon bycatch from the Early, Middle, and Late periods of the 2022 Bering Sea B season pollock fishery

The temporal trends in the genetic composition of chum salmon bycatch observed in 2022 is fairly typical with patterns observed over the analyzed period (2011-2022). There is interannual variability in the relative proportion of the genetic stock composition estimates across the Early, Middle, and Late periods. However, WAK chum salmon are consistently encountered in higher proportions during the Early and Middle periods (mid-June through late August) compared to the Late period (see Figure 6-14).

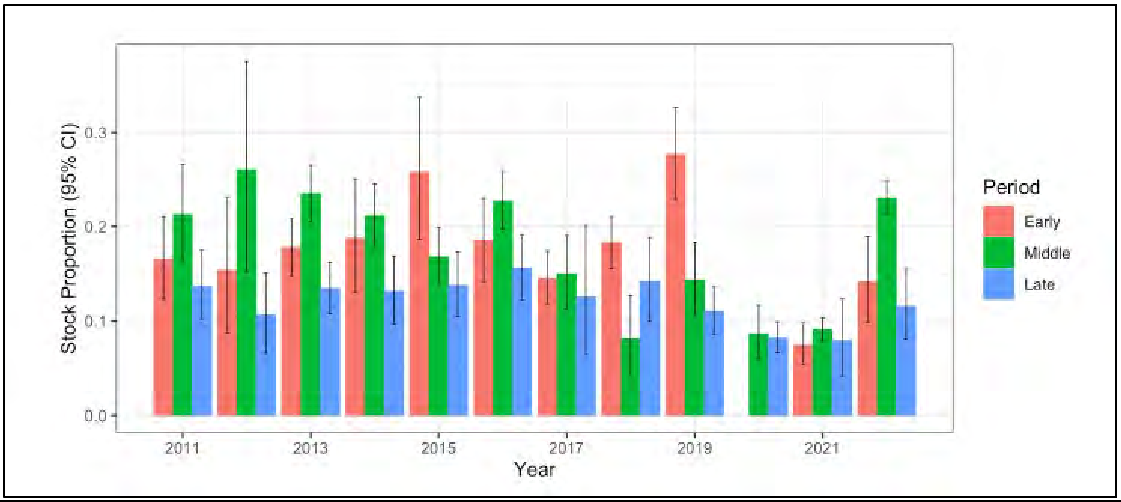

Figure 6-14 Mean stock composition estimates of chum salmon bycatch with 95% credible interval for the WAK reporting group from the Early, Middle, and Late periods from the B season pollock fishery, 2011 through 2022

Figure 6-15 provides the WAK stock composition estimates with the 95% credible interval for all four genetic cluster areas during the Early and Late period from 2011 through 2022. (The Middle period is not considered in the combined spatiotemporal analyses because there are insufficient samples for all three periods in all four cluster areas.) This information depicts the relative consistency in the observed pattern that WAK chum salmon are more likely to be encountered in the Early period (mid-June through mid-August) There is interannual variability in the trend that WAK comprises a larger proportion of the bycatch from genetic cluster area 1. However, in 10 out of 12 years (exceptions include 2014 and 2021), WAK chum comprise a larger portion of the bycatch in cluster area 1 in the Early period. In the Late period, the proportion of WAK chum is highest in genetic cluster area 1 in 11 out of 12 years (2011 is the exception.

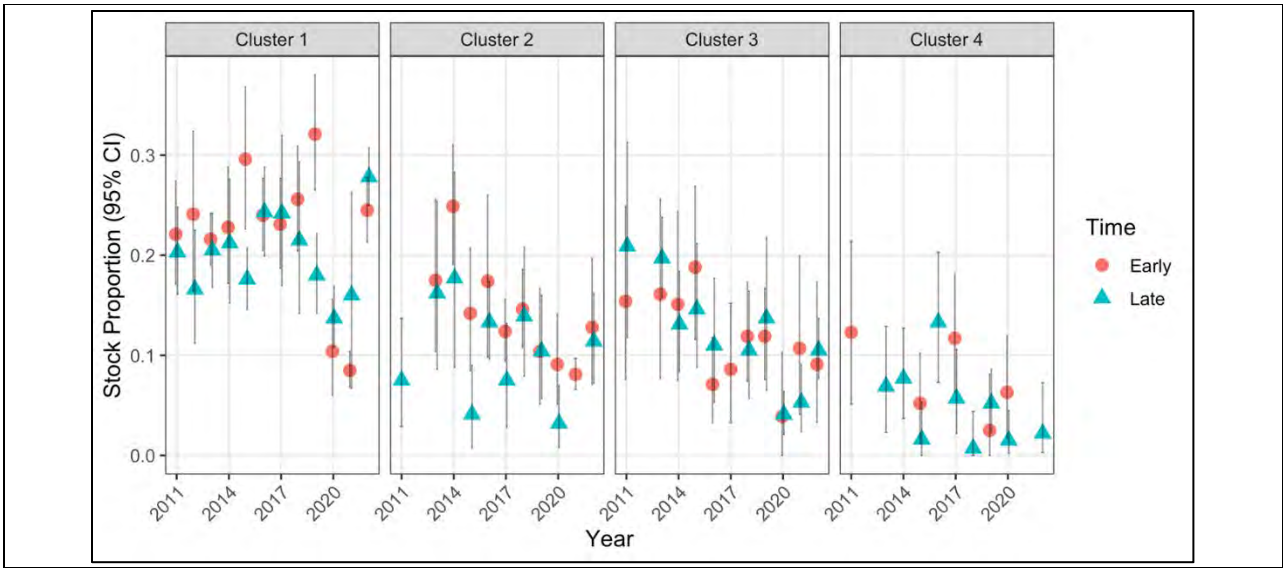

Figure 6-15 WAK stock composition estimates with 95% credible interval from four genetic cluster areas during the Early period (weeks 24-32) and the Late period (weeks 33-43) during the B season pollock fishery, 2011 through 2022

6.1.4.5 Brief overview of 2023 chum salmon bycatch and genetic results

Results of the 2023 chum salmon PSC and genetics are recently available and will be presented to the Council in conjunction with this analysis (see Barry et al., 2024). Non-Chinook salmon PSC in the BSAI pollock fishery in 2023 was 112,303[66]. Of these the mean estimated proportion of CWAK chum was 8.3% (estimated 9,246 fish) while the Upper/Middle Yukon component was 2.3% (estimated 2,540 fish) This represents a drop in the genetics proportion of CWAK from 2022 (CWAK in 2022 was 21.1%) and a slight increase in the Upper/Middle Yukon component (1.9% in 2022)[67].

6.1.4.6 Impact of Alternative 1 on WAK chum salmon bycatch

When considering the impacts of additional bycatch management measures on WAK salmon stocks, it is important to note that bycatch is one of several factors affecting the number of adults returning to WAK river systems (Section 6.1.3). The number of chum salmon caught as bycatch is larger than the number of chum salmon adults that would have returned to Western Alaska rivers because some of those salmon would have died from predation or other types of natural mortality and not all salmon caught as bycatch would have reached maturity and returned in that same year.

To understand the impacts of bycatch on salmon populations, previous Council analyses for Bering Sea salmon bycatch management actions (NPFMC 2016) estimated the number of salmon that would have returned to spawn if not caught as bycatch as a proportion of total salmon returns to WAK river systems. This estimated “impact rate” of bycatch on WAK salmon stocks considers other factors affecting salmon returns and provides the best method using available data to estimate the impacts of bycatch on WAK salmon returns. A recently prepared analysis for Chinook salmon estimated that annual impact rates from 2011 to 2021 averaged 1.9% for the combined coastal western Alaska stocks and 0.6% for the Upper Yukon River stock (NPFMC 2022). This type of analysis requires sufficient information on bycatch and WAK salmon stocks to complete an adult equivalency analysis, or AEQ, that is used to estimate an impact rate of bycatch on annual salmon returns. The following section describes the data limitations related to providing a chum salmon AEQ and impact rate for this analysis.

[66] https://www.fisheries.noaa.gov/sites/default/files/akro/chum_salmon_mortality2024.html

[67] Note that while the mean value for the Upper/Middle Yukon component increased slightly from 2022 to 2023, the 95% confidence intervals for both years overlap substantially (2022: 1.3%-2.6% and 2023: 1.7%-3.0%)

6.1.4.6.1 Estimating the Adult Equivalency for Chum Salmon

A WAK chum salmon AEQ analysis would estimate of the annual number of adult chum salmon that would have returned to Western Alaska rivers if not caught as bycatch in the pollock fishery. An impact rate analysis (chum salmon bycatch/run size) would require an AEQ be applied to an estimate of WAK chum salmon abundance. Because chum salmon caught in the pollock fishery range in age from 3-5 years and chum salmon mature and return to the rivers at multiple ages in a given run year, the AEQ of the bycatch in a given calendar year is spread over multiple run (maturity) years. For example, chum salmon caught as bycatch in 2020 could return to spawn in either 2020 as age-3 fish, 2021 as age-4 fish, 2022 as age-5 fish, or 2023 as age-6 fish. Likewise, bycatch AEQ from multiple calendar year harvests will impact a given run (maturity) year. An AEQ for Western Alaska chum salmon would need to consider (1) the total run size (run reconstruction) of WAK chum salmon stocks in a given year, (2) the number of years that would have occurred between the bycatch event and when those fish would have otherwise matured and returned to the river had they not been caught, and (3) annual natural mortality rates that would have occurred in the year(s) between when they were caught as bycatch and when those fish would have otherwise returned to their natal rivers (Figure 6-16).

Due to a lack of available information, summarized below, neither an AEQ nor an impact rate analysis has been done for this analysis to estimate the impacts of bycatch in the pollock fishery on chum salmon from WAK river systems. Figure 6-17 shows the information necessary to complete an AEQ estimation and the relative availability and reliability of these data.

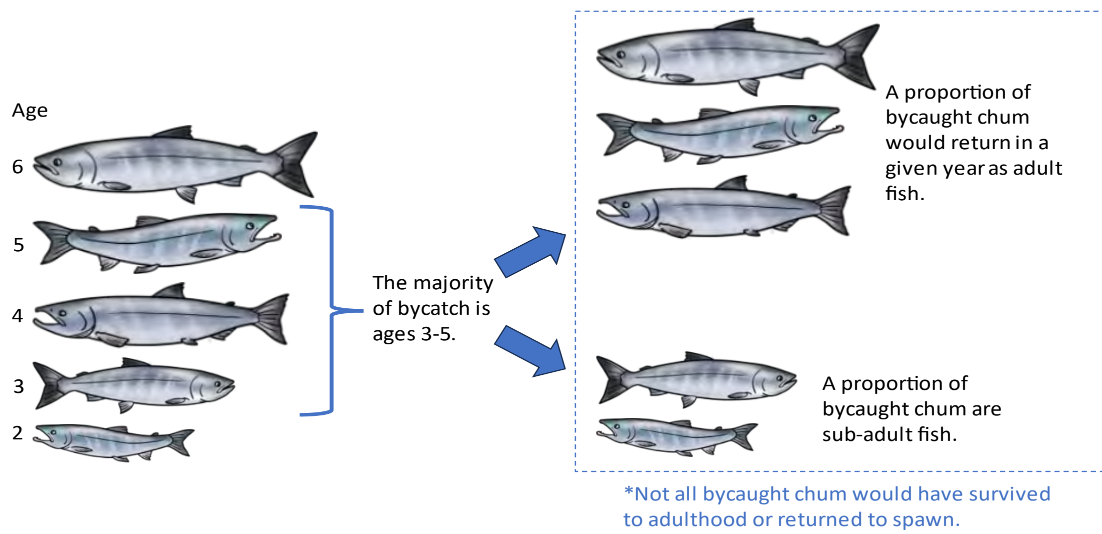

Figure 6-16 Schematic of why not all fish that are caught in a single year would have necessarily returned to individual river systems in that year or subsequent years considering both natural mortality as well as maturation rates by age and river system.

Due to a lack of available information summarized below, an AEQ analysis has not been completed for the consideration of impacts of bycatch on WAK river systems for this current analysis. Nonetheless, it is possible to estimate the number of WAK chum salmon annually removed through bycatch (see Table 6-11). Further, it is reasonable without an AEQ for WAK chum salmon to nonetheless assume some number of these would have returned to WAK as adult spawners, potentially supporting stock abundance. Figure 6-17 shows the information that must be available to complete an AEQ estimation, their sources and the relative availability and reliability of these data.

Data Needed to Estimate Impacts of Bycatch

Data	Source
Number of chum caught in bycatch	NMFS Observers Census of all salmon
Age of chum in bycatch	Scale analysis of ages by Auke Bay Lab (ABL) scientists
Genetic Stock of Origin	Annual analysis by ABL scientists - temporal - spatial - stock specific ages
Maturation rates by river systems	ADF&G
Ocean mortality	Published literature e.g., Beamish et. al 2018 (limited to Asian stocks)

Figure 6-17 Data needed to estimate AEQ shaded by where information is more readily available with less uncertainty (blue) and where higher uncertainty in estimates tends to dominate (red) as well as gradients of more uncertainty in between.

Some of the major considerations that would lead to **high uncertainty** in any WAK chum salmon AEQ or impact rate estimate are summarized below.

1.) Lack of run size reconstructions for estimating an impact rate

Total WAK chum salmon abundance cannot be provided without run reconstructions for large populations of WAK chum salmon. Run reconstructions provide an estimate of total run size and there are limited run reconstructions for chum salmon in Western Alaska that align with the genetically distinguishable stock groupings for stock-specific bycatch estimates. A scientifically defensible run reconstruction includes a thorough estimate of escapement (the number of fish returning to a river system in a given year that are not caught by fisheries and can contribute to the spawning population) and harvest. Run reconstructions are currently only available for Yukon River summer and fall chum salmon and Kwiniuk River chum salmon. This excludes large chum salmon populations in the Kuskokwim River, Bristol Bay, Kotzebue Sound, and Norton Sound.

As partially described in 6.1.2.2 some indices of abundance are available for WAK chum salmon populations without run reconstructions (e.g., aerial surveys, weirs, counting towers, sonars, harvest) but a simple summation of these indices of abundance is not equivalent to a run reconstruction and would not provide a scientifically defensible accounting of the total abundance of chum salmon for the WAK stock reporting group. Indices may only provide a partial accounting, with some unmeasured and uncertain components of the run missing, or they may be designed to only provide relative abundance rather than absolute abundance information. For example, aerial surveys provide a relative index of abundance or escapement because they assess a standardized portion of the in-river spawning area and not the entire spawning area; they do not provide a census or estimate of total abundance. As another example, in large river systems, it may only be possible to operate sonars upriver of important chum salmon spawning habitats, leaving stretches of the population downstream from the sonar entirely unassessed.

Some of these challenges for estimating total run abundance in the many large river systems in Western Alaska have been overcome for Chinook salmon in this region thanks to a tremendous amount of funding and years of effort to create scientifically defensible run reconstructions. Improving and refining these run reconstructions and developing run reconstructions for other species is an ongoing effort, and this work is prioritized based on current information needs for salmon fishery management.

2.) Uncertainty related to natural mortality and age at maturity

The annual natural mortality rate (how many chum salmon would have naturally died in the ocean in a given year) for WAK chum salmon at the age that they are caught as bycatch in the pollock fishery is currently unknown. An AEQ requires an estimate of the annual natural mortality for the stock or stock grouping. An annual natural mortality estimate for WAK chum salmon would be highly uncertain because the data needed to inform an estimate are not available. Uncertainty in any natural mortality estimate would be further compounded by an unknown amount of interannual variability that may exist.

An AEQ also requires unbiased estimates of ages at maturity for each run year because different salmon stocks have different maturity patterns and trends. Unbiased estimates of ages at maturity are provided by run reconstructions, which are not available for all WAK chum salmon stocks. Because WAK-wide run reconstructions for chum salmon are not possible, there are no assessments of the age at maturity for WAK chum salmon stocks overall and considerable uncertainty would occur from assuming ages at maturity for one stock and applying them to the WAK stock group as a whole. Even if an estimate of annual natural mortality was attempted, the number of years to which the natural mortality estimate would apply, equal to the number of years the chum salmon would have remained in the ocean before returning to spawn had it not been caught as bycatch, is also unknown.

3.) Uncertainty related to chum age as it relates to stock specific ages

The number of years an estimated annual natural mortality rate should be applied to is unknown because the ages at which WAK chum salmon are caught as bycatch in the pollock fishery are unknown. Salmon are aged by reading scale patterns and while chum salmon scale samples are individually aged, genetic samples are run in batches, by age, so the proportion of each stock group by age group is provided but not the -age composition for each stock group. This method provides an overall age composition for all chum salmon bycatch in the Bering Sea pollock fishery, but it cannot be presumed that this overall age composition is indicative of the WAK chum salmon age composition, especially when WAK chum salmon comprise a minority of the chum salmon bycatch.

Additional error is associated with aging salmon scales from a wide variety of stocks spanning North America and Asia absent information indicating the stock or stock grouping of origin for the scales. Marks on salmon scales are developed throughout the life of the fish and can vary depending on genetic variation of populations, life history patterns, and environmental variables. Scale age readers are often trained with stock specific scales to account for these differences. Although there are few studies comparing the accuracy of chum salmon scale aging, one recent study found that accuracy was variable among experienced age readers trained on scales from specific chum salmon stocks (Anderson et al., 2023).

6.1.4.7 Summary of Impacts to WAK Chum Salmon Related to Bycatch Under the Status Quo

As a result of the data limitations described above, the retrospective analysis under the hard caps (Alternative 2 and 3) rely on the historical proportion of chum salmon taken in the bycatch from 2011-2022 (See Table 6-7), estimate the amount of chum salmon avoided, and apply the estimated proportion from genetic analysis that comprise the WAK component of those fish (i.e., the estimated proportion of WAK chum is multiplied by the number of non-Chinook salmon saved) to estimate the number of WAK chum salmon that might have been avoided.

The numbers shown below for all years across all sectors represent the estimated number of WAK chum salmon taken as bycatch historically under the current management system. The numbers show should be viewed as the estimated number of fish that originated from that aggregate system understanding that this is not equivalent to the WAK chum salmon that would have returned in that year. Under the status quo, not all of these fish would have returned to natal streams in that year or subsequent years due to predation, natural mortality and age-specific maturation rates as described previously. Analysts are not able to estimate the number of total WAK chum salmon taken as bycatch that would have returned to Western Alaska river systems because neither an AEQ nor an impact rate can be calculated for WAK chum salmon overall or by river system with available data as discussed in Section 6.1.4.6.1. **Although the estimated number of salmon that might have returned to WAK rivers under the status quo, if not taken as bycatch cannot be provided, the number would be less than the total number taken as bycatch due to natural mortality and the variable age composition of bycatch as described above.**

Across the analyzed period, the historical number of total WAK chum salmon encountered as bycatch ranges from 4,710 to 93,170 fish, and the total number that would be expected to return to WAK river systems would be some number below these levels. Which river systems these fish would have returned to and in which years is uncertain due to factors described above, but given the chum salmon life history, it is possible that a fish caught as bycatch could have return to a WAK river system that year or up to three years later (e.g., a WAK chum salmon caught in 2020 could have returned to a WAK river system between 2020 and 2023).

Table 6-11 Genetic composition of the bycatch encountered in the non-Chinook category and the estimated mean proportion for the Coastal Western Alaska (CWAK), Upper/Middle Yukon and combined Western Alaska (CWAK + Upper/Middle Yukon) resulting numbers of fish 2011-2022

	Chum Bycatch	*Coastal Western Alaska*		*Upper/Middle Yukon*		*Western Alaska Combined*	
Year	**Total**	**Mean**	**Est. #**	**Mean**	**Est. #**	**Mean**	**Est. #**
2011	191,313	16.20%	30,993	8.90%	17,027	25.10%	48,020
2012	22,172	13.80%	3,060	7.40%	1,641	21.20%	4,701
2013	125,114	18.10%	22,633	6.30%	7,782	24.40%	30,415
2014	218,886	17.70%	38,699	2.10%	4,553	19.80%	43,252
2015	233,085	16.00%	37,294	3.90%	9,090	19.90%	46,384
2016	339,236	19.30%	65,473	5.30%	17,980	24.60%	83,453
2017	465,848	14.00%	65,219	6.00%	27,951	20.00%	93,170
2018	294,675	15.40%	45,385	3.40%	10,020	18.80%	55,405
2019	346,671	15.90%	55,143	0.30%	1,040	16.20%	56,183
2020	343,094	8.00%	27,448	1.10%	3,774	9.10%	31,222
2021	545,902	8.90%	48,658	0.50%	2,854	9.40%	51,512
2022	242,309	21.10%	51,106	1.90%	4,618	23.00%	55,724

Coastal WAK (CWAK) estimated contribution to the overall chum bycatch ranges from a low of 3,060 in 2012 to a high of 65,473 in 2016. Relative proportions of CWAK stocks to overall bycatch can be highly variable by year, however. For example, in 2021, 545,902 total chum salmon were caught as bycatch, but the proportion of CWAK stocks was 8.90% resulting in a relative number of CWAK chum of 48,658 fish. The following year, in 2022, almost half the total amount of chum salmon was caught (242,309) but the higher proportion of CWAK chum (21.20%) meant a similar number of CWAK chum salmon (51,106) were caught in 2021. While the estimated proportions from the Upper/Middle Yukon reporting groups are variable (ranging from 0.50% to 8.90%), the relative contribution to the overall bycatch tend to be much lower resulting in a range of Upper/Middle Yukon chum taken over this time frame from 1,641 in 2012 to

27,951 in 2017. As described in Section 6.4.1 these proportions are highly influenced by fishing locations annually by sector.

It is important in evaluating potential impacts of chum salmon bycatch on WAK chum salmon returns to understand that WAK salmon populations vary in their productivity and life history characteristics. This variation may contribute to their sustainability as a result of portfolio effects or population viability, which may be important for the resiliency of chum salmon stocks, particularly in the face of climate change. Unfortunately, there is limited information on specific spawning populations of chum salmon, which makes it difficult to understand how each specific population may or may not respond to bycatch and other environmental factors (See Section 6.1.3). For example, data are not available for population-specific abundances, age at maturity patterns (to understand generation time), or population specific relationships between the effective population size and census size to be able gauge if discrete spawning populations have reduced genetic diversity or are approaching their minimum viable population size - which is the population size above which they retain their evolutionary potential.

It is important to recognize that a simple accounting of numbers of fish that would have otherwise returned to rivers had bycatch not occurred (i.e., AEQ and impact rate analyses), may not fully capture the totality of bycatch impacts to salmon populations.[68] Additionally, estimating the effects of bycatch on the likelihood of a population's ability to persist long-term would still require an AEQ to assess the potential number of chum salmon that would have otherwise returned (see above). However, even with an AEQ, the estimated number of returners would have to be analyzed by spawning population based on many assumptions because current genetic data are not able to differentiate spawning populations. Put simply, the data to estimate the impacts of bycatch on specific spawning populations of chum salmon are not available, these data would be extremely difficult to collect, and even if they were available there are many assumptions that would need to be made to estimate impacts. Therefore, probability or magnitude of these other types of impacts cannot be assessed with current information. The Council may still consider, however, that the absolute impact of chum salmon bycatch occurring in the Bering Sea pollock fishery is uncertain. As this discussion highlights, it is possible that removals of relatively small spawning populations may be affected despite the inability to qualify the impacts down to this level.

6.1.5 Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Chum Salmon: Other Major Western Alaska Chum Salmon Removals

This section considers cumulative effects from reasonably foreseeable fishing and non-fishing actions on WAK chum salmon stocks.

In addition to the climate and environmental factors noted in Section 6.1.3 some additional factors may influence chum salmon stock abundances in western Alaska. There are other State managed salmon fisheries that harvest WAK chum salmon outside of the Western Alaska commercial, subsistence and recreational fisheries described in Section 6.1.11 and not repeated here. This section discusses the commercial salmon fishery in the South Alaska Peninsula Management Area and the stock of origin of chum salmon in that fishery as well as summarizes some of the additional cumulative impacts on chum salmon stocks.

The South Alaska Peninsula commercial salmon fishery (commonly called the “Area M” fishery) occurs in the Alaska Peninsula Management Area and pink and sockeye salmon are currently the most abundant

[68] A cooperating agency contributed the following discussion of potential impacts on discrete spawning populations. “Sustained levels of WAK chum salmon removals may have greater negative impacts to viability of discrete spawning populations, or tributary stocks with significant spatial separation such that they may be genetically distinct, at times of low abundance (e.g., in 2020–2023) compared to periods of high abundance. In other words, as chum salmon decline, every salmon that returns becomes biologically more important for the sustainability of its discrete spawning population as well as overall stock abundance.” The analysts are not able to estimate impacts to these levels and await feedback on review of this draft as to the feasibility of including this type of discussion in a future iteration of this document.

salmon species harvested. The fishery also harvests a mixture of local and non-local chum salmon stocks including stocks from the WAK region. These fish, while legally harvested and sold by South Alaska Peninsula commercial fisheries, contribute to cumulative impacts on chum salmon stocks from the WAK region for which this action is focused. The origin of chum salmon stocks harvested in the South Unimak and Shumagin Islands June fishery has been a source of concern among fishermen throughout Western Alaska for several decades. Information about these harvests has been the impetus for several historical studies to investigate the relative composition of chum salmon stocks in the fishery (reviewed in Munro et al. 2012). The most recent and comprehensive study was the Western Alaska Salmon Stock Identification Program (WASSIP). During this study, chum salmon harvests in Western Alaska and the Alaska Peninsula during the 2007–2009 fishing seasons were sampled and analyzed for genetic stock composition (DeCovich et al. 2012; Eggers et al. 2011). On average, between 2007 to 2009, 57% of chum salmon harvest in the South Alaska Peninsula were of CWAK origin.[69] (Munro et al. 2012). In 2022, a *preliminary study* was conducted to estimate harvest rates for western Alaska and Alaska Peninsula stocks in the 2022 South Alaska Peninsula commercial salmon fisheries following the methods of the WASSIP study (Dann et al. 2023 , ADF&G RIR No5J26-02, https://www.adfg.alaska.gov/FedAidPDFs/SP23-07.pdf). Dann et al. (2023) found that the relative proportion of CWAK stocks declined from the WASSIP study findings to 18%, though this varies by time (e.g., more CWAK chum salmon were harvested in June fisheries than July fisheries) and gear type (e.g., more CWAK chum salmon (up to 45% of overall catches) were harvested using gillnet gear than seine gear)

[69] Similar to the genetic stock groupings used in this analysis, CWAK stocks as defined in Munro et al. 2012 and Dann et al. 2023 do not include Upper Yukon chum salmon stocks, which make up a small portion of overall WAK stocks.

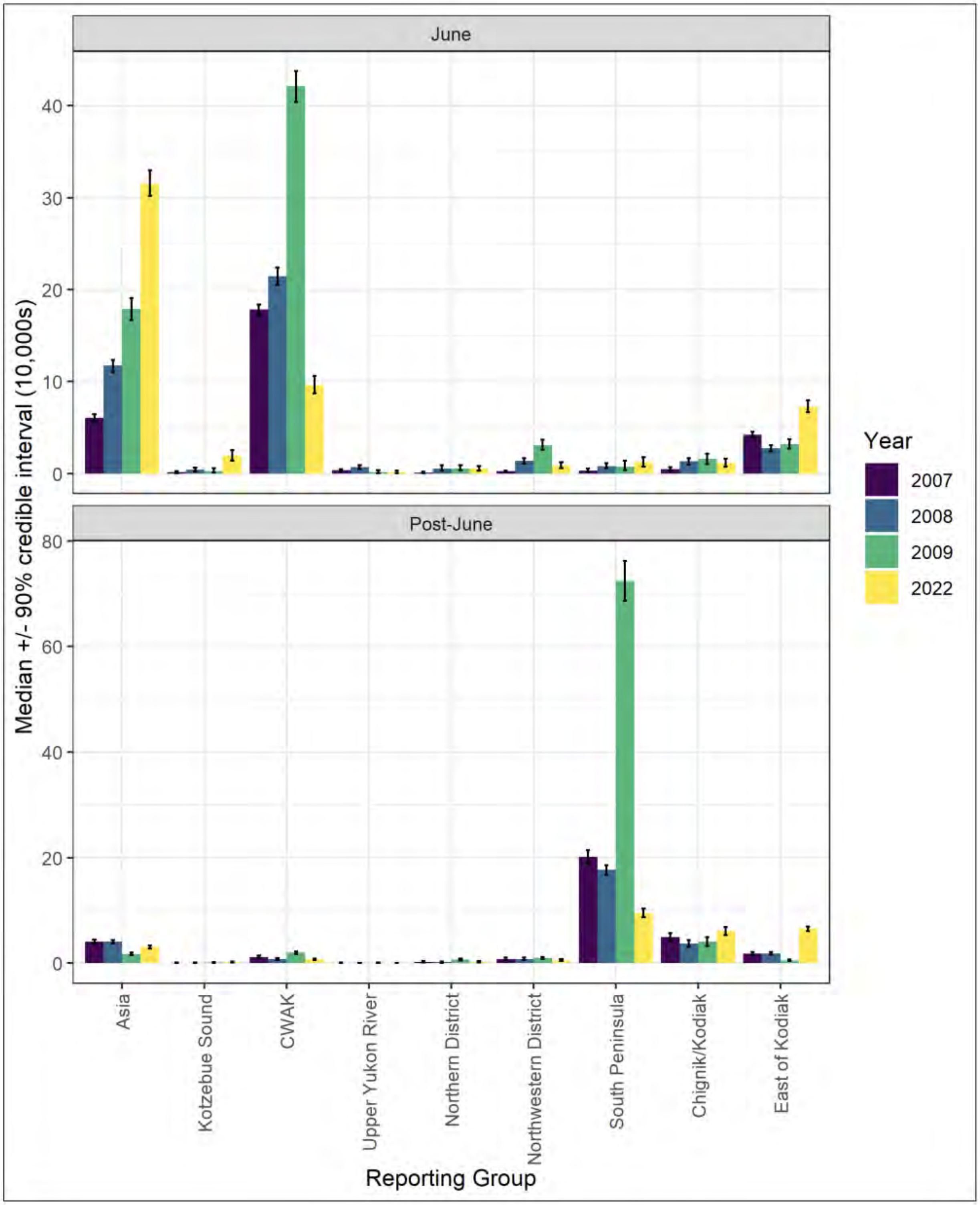

Figure 6-18 Estimates of stock-specific compositions of harvest rate South Alaska Peninsula June and post-June chum salmon harvests, 2022 (source Dann et al. 2023)

Estimated harvest rates from 2022 from that study are shown in Table 6-12 below and were within or lower than the ranges estimated in previous studies. While specific aspects of overall State of Alaska salmon fishery management continue to be modified, it is reasonably foreseeable that this harvest will continue in the future.

The data from that study in 2022 are shown in Table 6-12 below:

Table 6-12 Estimates of stock-specific harvest rate South Alaska Peninsula (source ADF&G RIR No5J26-02)

Table 41.–South Alaska Peninsula area, 2022, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 814,279; 28 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	1.7	0.7	3.1	1.8	0.7
CWAK	5.9	3.3	9.9	6.2	2.0
Upper Yukon	0.6	0.2	1.4	0.7	0.4
Northern Dist.	1.0	0.3	3.9	1.4	1.3
Northwestern Dist.	6.2	1.8	18.9	7.7	5.6
South Peninsula	5.8	1.5	19.2	7.4	6.0
Chignik/Kodiak	3.1	0.9	10.6	4.1	3.3

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 27 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Figure 6-19 below shows the overall South Alaska Peninsula harvest from 2011-2022. For comparison the 2022 harvest was 814,279 fish.

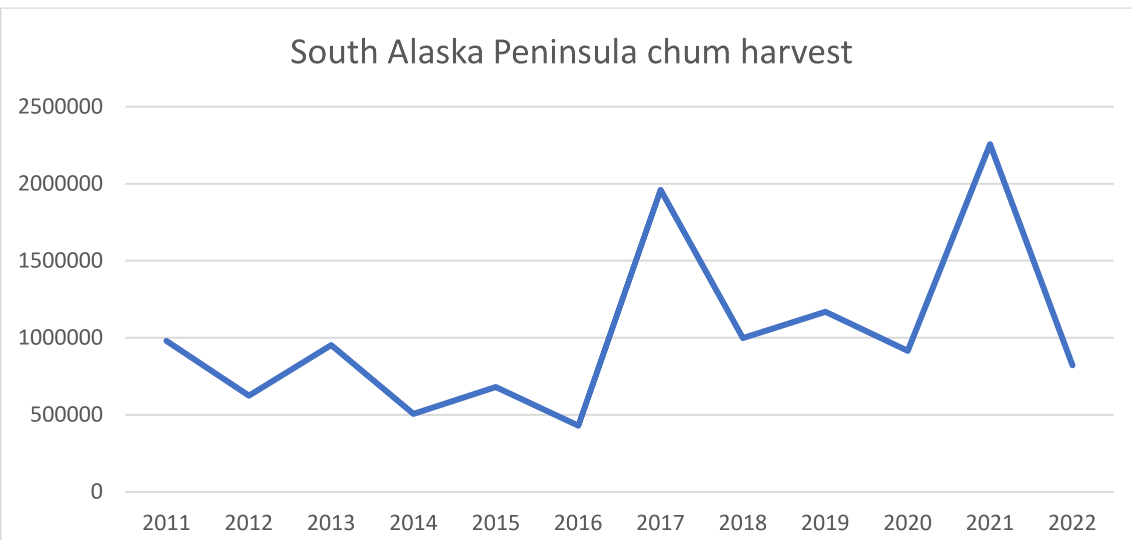

Figure 6-19 South Alaska Peninsula historical harvest of chum salmon 2011-2022

These fish, legally harvested in state-managed commercial fisheries, also originate from the WAK region for which this action is focused. It is reasonably foreseeable that harvest of chum salmon, and WAK chum salmon, will continue in the South Alaska Peninsula fishery in the future.

Some additional considerations for past, present and reasonable foreseeable actions:

Key to understanding the complex and multiple causes of WAK chum salmon stock declines is that, **together and across time, these factors cumulatively contribute to decreases in stock abundance**. Throughout their life history, chum salmon travel thousands of kilometers through multiple freshwater and marine environments, while being exposed to natural and human stressors during each life stage.

Mechanisms may operate independently or interactions may occur among multiple stressors. The relationships between environmental stressors and their effects on chum salmon may vary within a single brood year, across multiple brood years, and among stocks. Most likely, the observed patterns of decline are the result of interactions among multiple variables and possibly within both freshwater and marine phases of their life cycle.

Thus, no single factor can be singled out as the sole driver of WAK chum salmon stock declines; each of the causes, from shifts in marine and freshwater habitats and climates to changes in fishing practices and hatchery releases, work in tandem to contribute to decreased stock abundance. It is therefore important to consider how multiple factors interact to produce cumulative effects that impact chum salmon productivity. Further, these interactions occur and compound over time. For instance, WAK chum salmon removals during one year have cascading impacts to stocks in the following years due to lost potential for successful spawning, which passes genetic diversity and resilience to future generations of chum salmon[70].

6.1.6 Fleet Movement under the RHS for Chum Salmon Avoidance

As described in Section 4.1.2, the Bering Sea pollock fleet uses the RHS system managed under the IPAs to move vessels out of fishing areas with high chum bycatch rates. That discussion and the accompanying figures are not repeated here. However, the analysts would note that it is not possible to accurately calculate the amount of chum salmon saved under the status quo program by vessel movement out of those areas. The RHS system is dynamic, meaning the spatial location of closure areas, the number of closure areas implemented during the B season, the timing of closure implementation, and the relative amount of PSC avoided are not static nor predictable. Figure 6-20 illustrates this point as it shows all RHS chum salmon avoidance areas in genetic cluster area 1 and 2 from 2017-2023. It is anticipated that the number of chum salmon (or WAK chum) saved under the status quo RHS system is greater than what would have been achieved had the vessels not moved. Because it is not possible to accurately quantify the amount of chum salmon saved under these dynamic closure areas, the analysts are similarly limited in providing a quantitative analysis of the marginal differences in PSC avoidance under the proposed action alternatives (2-4) compared to the status quo.

[70] See footnote to section 6.1.4 for additional information and context

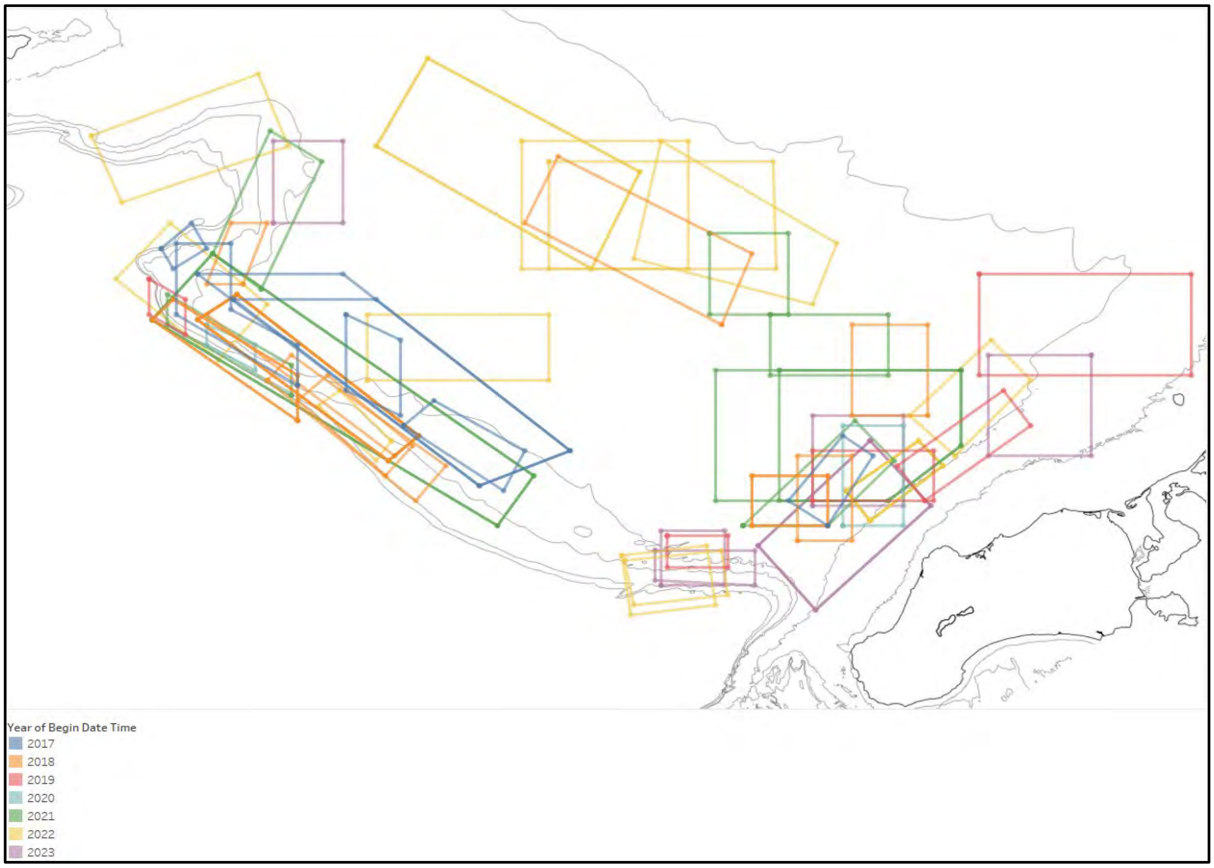

Figure 6-20 All chum salmon bycatch avoidance areas within genetic cluster areas 1 and 2, 2017 through 2023

Source: Sea State; Figure 6. CP IPA Proposal

6.1.7 Pollock stock

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

Pre-spawning aggregations of pollock are the focus of the winter fishery, the “A-season”, which opens on January 20th and extends into early-mid April. During this season the fishery produces highly valued roe which can comprise over 4% of the catch in weight (Ianelli et al., 2023). The summer fishery, or “B-season”, opens on June 10th and extends through late October. Since the closure of the Bogoslof management district (INPFC area 518) to directed pollock fishing in 1992, the A-season pollock fishery on the EBS shelf has been concentrated primarily north and west of Unimak Island (Ianelli *et al.* 2023). Depending on ice conditions and fish distribution, there has also been effort along the 100 m contour (and deeper) between Unimak Island and the Pribilof Islands.

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

6.1.7.1 Impact on the Pollock stock

The effect of the Bering Sea pollock fishery on the pollock stock is assessed annually in the BSAI Groundfish SAFE report (e.g., Ianelli et al., 2023). The pollock stock is neither overfished nor subject to overfishing, and biomass is projected to remain above the target biomass level through 2025. It is estimated that the Bering Sea pollock fishery under the status quo is sustainable for pollock stocks.

6.1.8 Other PSC Species (Chinook salmon, herring)

6.1.8.1 Chinook

The Chinook salmon (*Oncorhynchus tshawytscha*) is the largest of all Pacific salmon species, with weights of individual fish commonly exceeding 30 pounds. In North America, Chinook salmon range from the Monterey Bay area of California to the Chukchi Sea area of Alaska. On the Asian coast, Chinook salmon occur from the Anadyr River area of Siberia southward to Hokkaido, Japan. In Alaska, they are abundant from the southeastern panhandle to the Yukon River. Chinook salmon typically have relatively small spawning populations and the largest river systems tend to have the largest populations. Major populations of Chinook salmon return to the Yukon, Kuskokwim, Nushagak, Susitna, Kenai, Copper, Alsek, Taku, and Stikine rivers with important runs also occurring in many smaller streams.

Like all species of Pacific salmon, Chinook salmon are anadromous. They hatch in fresh water and rear in main-channel river areas for one year, typically. The following spring, Chinook salmon turn into smolt and migrate to the saltwater 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.

6.1.8.2 Impact on Chinook salmon

6.1.8.2.1 Chinook Bycatch Levels

As described in Section 4.1.3, Chinook salmon are caught as bycatch in the EBS pollock fishery and an extensive bycatch management program has been implemented since 2011 with more stringent regulations implemented in 2016. The description of that program is contained in Section 4.1.3 and not repeated here. Trends in Chinook bycatch (total for all sectors) and previous analyses of AEQ for Chinook are summarized below.

Table 6-13 contains the overall Chinook bycatch by EBS pollock fishery (all sectors) since implementation of Amendment 91 (2011) and Amendment 110 (2016). As compared to historical levels, bycatch since 2011 has been substantially lower and well below the PSC limits annually. From 1991-2010, the annual average level of bycatch was 40,976 Chinook, while from 2011-2022 the annual average level of bycatch is 18,864 Chinook (Figure 6-21)

Table 6-13 Chinook PSC in the Bering Sea pollock fishery (all sectors combined) 2011-2022

Year	*Chinook*
2011	25,499
2012	11,351
2013	13,036
2014	15,037
2015	18,329
2016	22,005
2017	30,076
2018	13,731
2019	24,985
2020	32,203
2021	13,784
2022	6,337

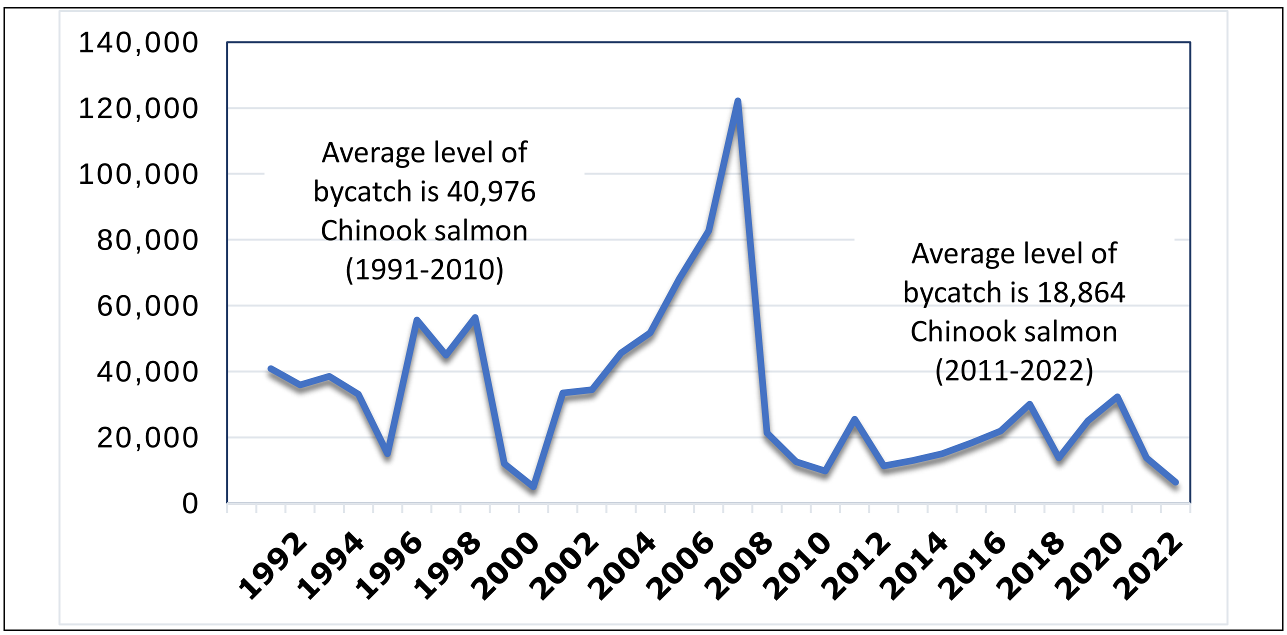

Figure 6-21 Chinook bycatch in the EBS pollock fishery 1991-2022. Note operations under Amendment 91 began in 2011.

6.1.8.2.2 Chinook Stock Composition Estimates

Stock composition estimates for Chinook are available annually as with chum stock composition estimates. Unlike chum, Chinook bycatch tends to be more dominated (49% in 2022) by Western Alaskan stock. Figure 6-22 shows both the stock composition estimates in 2022 as well as the spatial distribution of the bycatch.

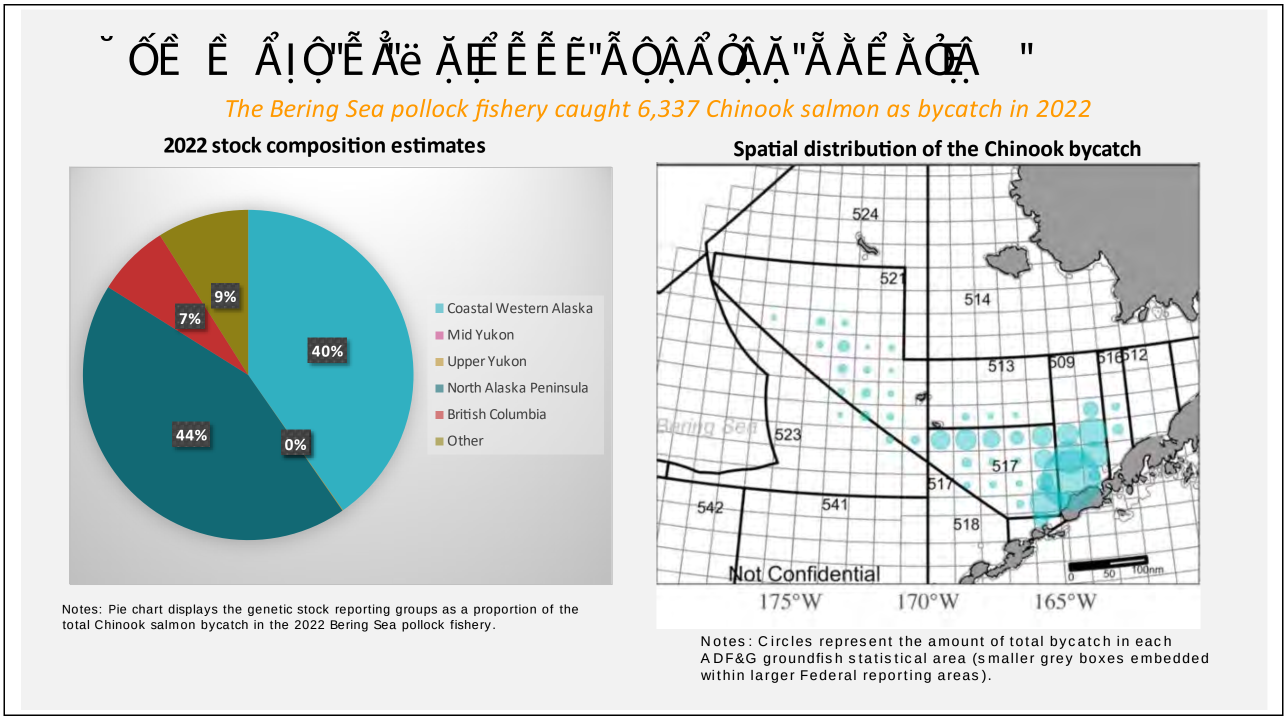

Figure 6-22 Chinook bycatch stock composition estimates and spatial distribution of the bycatch, 2022

6.1.8.2.3 PSC impacts on WAK stocks

Unlike for chum, estimates of the adult equivalence (AEQ) of Chinook salmon that would have returned to river systems had they not been caught as bycatch in the EBS pollock fishery have been provided as part of the Council's bycatch management evaluations. Analyses for Chinook salmon (updated in 2022 through 2021 results; Ianelli 2022) included an estimated adult-equivalent mortality (AEQ; accounting for the lagged effect of when PSC bycatch would have returned) for CWAK stocks and the Upper Yukon (Figure 6-23). When comparing these AEQ estimates with run strengths, impact rates can be estimated (Figure 6-24; Table 6-14). The rates increased in 2020 and 2021 despite low bycatch levels due to lower levels of the estimated run strengths. It should be noted that the estimates of AEQ and impact rate for WAK Chinook required similar assumptions that have been noted as problematic for chum AEQ impacts. For example, the stock composition data are unavailable by age in both cases and maturation rates (age at which salmon return to spawn) vary by system and over time so approximations are used (although for Chinook there is better information on maturation rates by river system allowing in part for run reconstructions for most of the river systems).

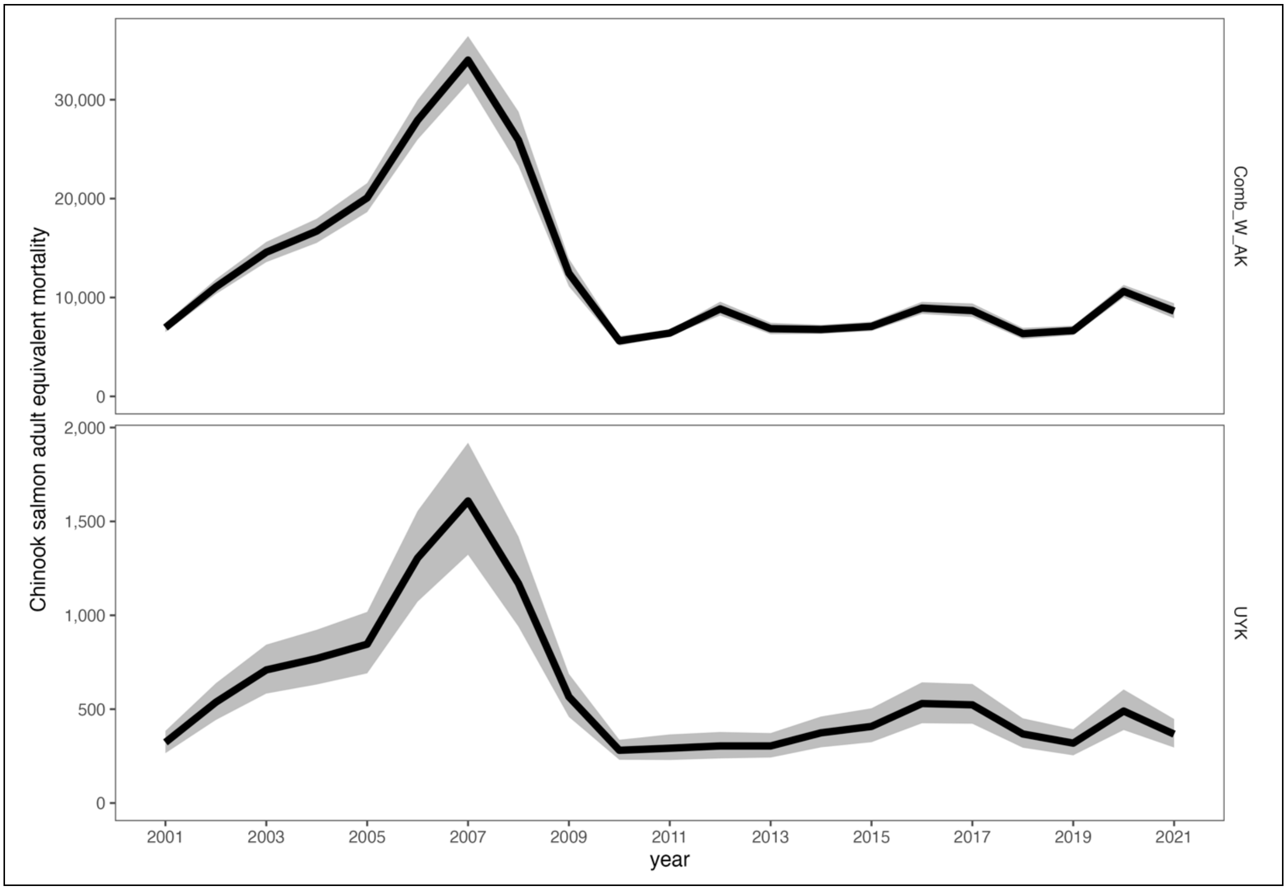

Figure 6-23 Estimated Chinook salmon AEQ mortality (numbers of fish) due to PSC in the AFA pollock fishery, 2001-2021 for Coastal western Alaska (includes middle Yukon; top panel) and for the Upper Yukon (bottom) stock groupings.

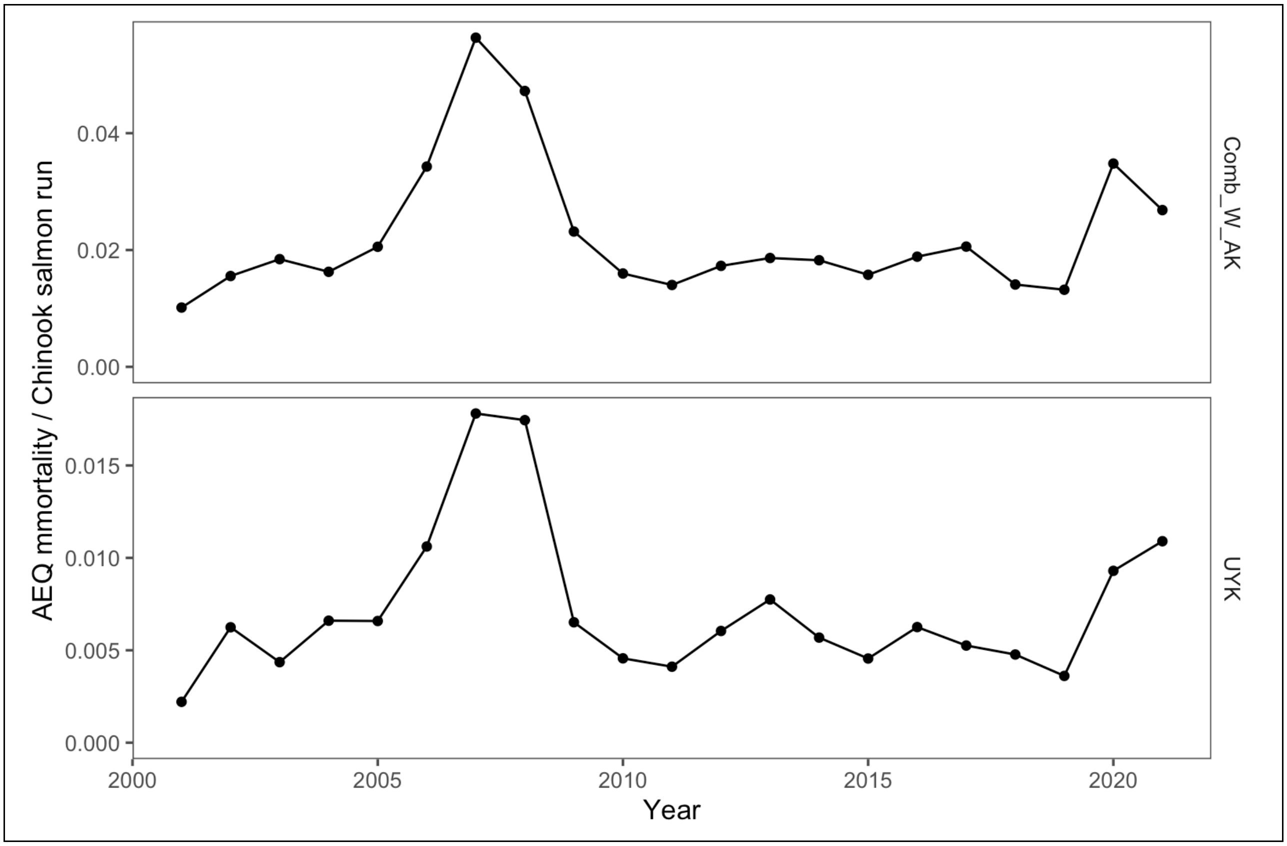

Figure 6-24 Estimated Chinook salmon AEQ mortality impact (ratio of AEQ over run-strength estimates) due to PSC in the AFA pollock fishery, 2001-2021 for Coastal western Alaska (includes middle Yukon; top panel) and for the Upper Yukon (bottom) stock groupings.[71].

Table 6-14 Estimated Chinook salmon AEQ mortality impact %s (ratio of AEQ over run-strength estimates) due to PSC in the AFA pollock fishery, 2001-2021 for Coastal western Alaska (includes middle Yukon; top panel) and for the Upper Yukon (bottom) stock groupings[70]

	CWAK	*Upper Yukon*
Year	PSC mortality rate	PSC mortality rate
2011	1.40%	0.42%
2012	1.72%	0.61%
2013	1.85%	0.78%
2014	1.81%	0.58%
2015	1.57%	0.46%
2016	1.88%	0.63%
2017	2.04%	0.53%
2018	1.41%	0.48%
2019	1.32%	0.37%
2020	3.40%	0.94%
2021	2.64%	1.10%
Mean	1.91%	0.63%

6.1.8.3 Herring

Herring are abundant in Alaska marine waters. Commercial fisheries in the BSAI, mainly for herring roe, exist along the western coast of Alaska from Port Moller north to Norton Sound (Figure 6-25). The

[71] Modified from June Council AEQ report: https://meetings.npfmc.org/CommentReview/DownloadFile?p=c16a58bc-e94e-4fd3-a23f-08909946bf20.pdf&fileName=D1c%20Chinook%20Salmon%20AEQ.pdf

herring fisheries are managed by the Alaska Department of Fish & Game (ADFG) which uses a combination of various types of surveys and population modeling to set catch limits. These fisheries target herring returning to nearshore waters for spawning, with herring in different areas managed as separate stocks. The largest stock in the BSAI spawns in Togiak Bay in northern Bristol Bay; the next largest stock is in Norton Sound (Figure 6-25).

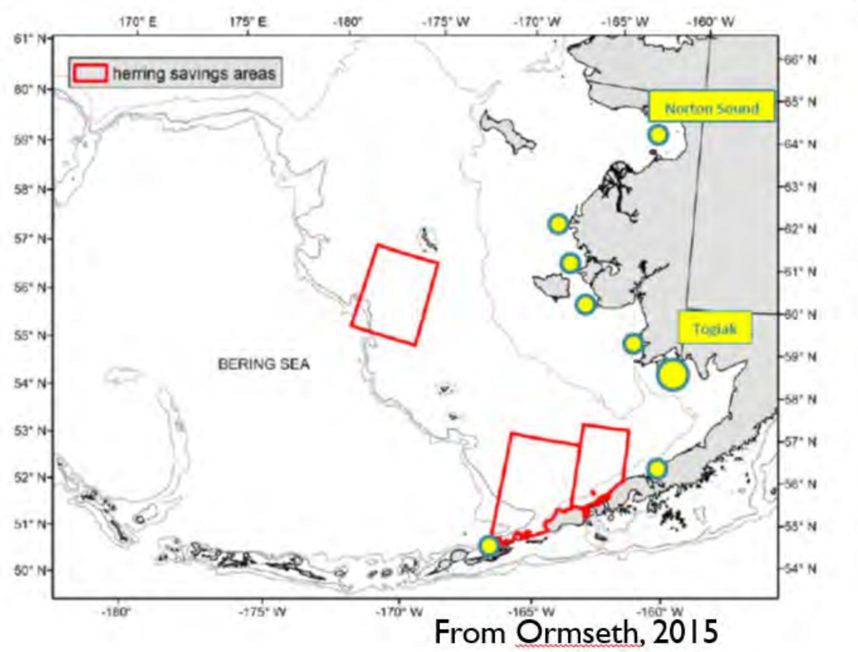

Figure 6-25 Locations of major herring fisheries in the BSAI area (yellow) with Herring Savings Areas (red) (Ormseth, 2015)

Observed herring from surveys by year are shown in Figure 6-26. The spatial distribution of herring in the BSAI described by the bottom trawl survey and the BASIS survey differ and may result from seasonal herring movement (Szuwalski, 2023). Herring are hypothesized to migrate seasonally between their spawning grounds and two overwintering areas in the outer domain of the eastern Bering Sea (EBS) continental shelf (Figure 6-27; Tojo et al. 2007). The bottom trawl survey occurs primarily in June and July and is likely capturing herring that are out-migrating from nearshore spawning areas; the areas of high CPUEs on the southern edge of the EBS and around Nunivak Island are consistent with the movement patterns in (Figure 6-27). Herring density estimates and prevalence display high interannual variability and are both above the long-term mean over this biennial cycle (Szuwalski, 2023).

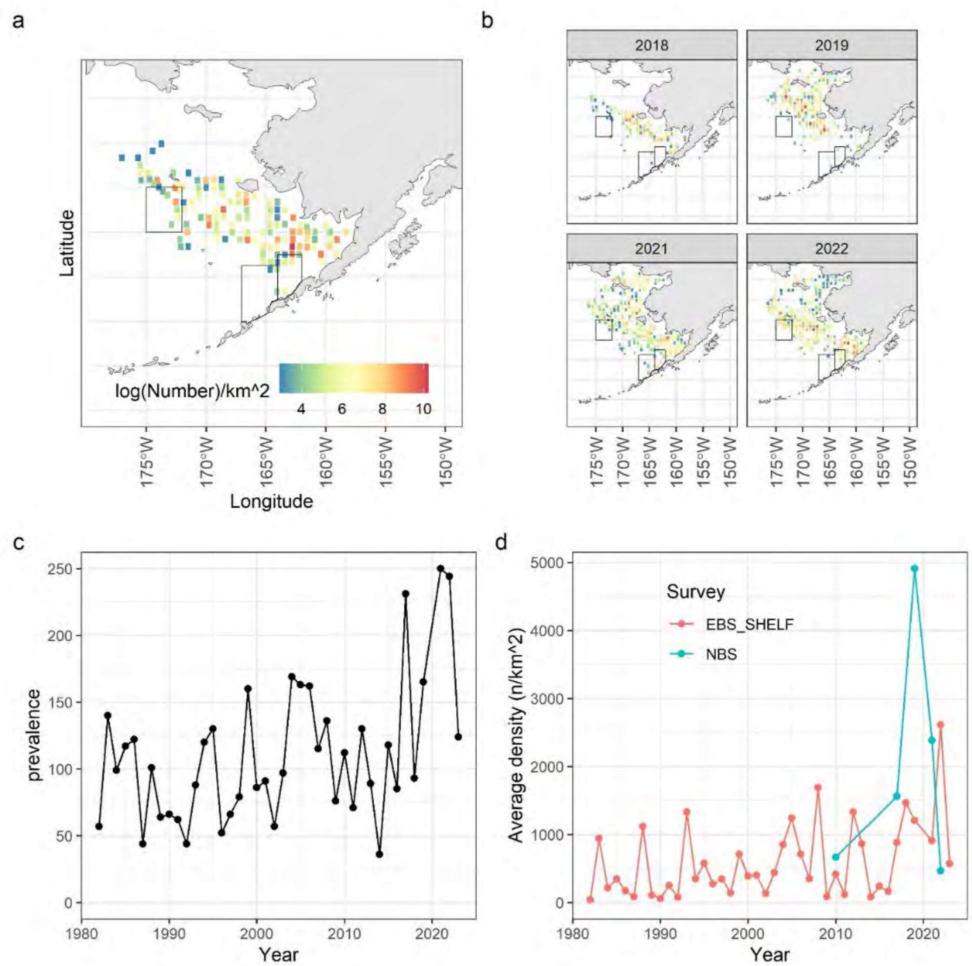

Figure 6-26 BSAI Pacific herring survey data. Spatial density in BSAI surveys (a), spatial densities in the previous four years for which survey data was available (b), prevalence in terms of the number of survey stations that returned positive tows for this species (c), and average densities split by survey location in the BSAI (d) black polygons overlaid on maps represent the herring savings areas (Szuwalski, 2023).

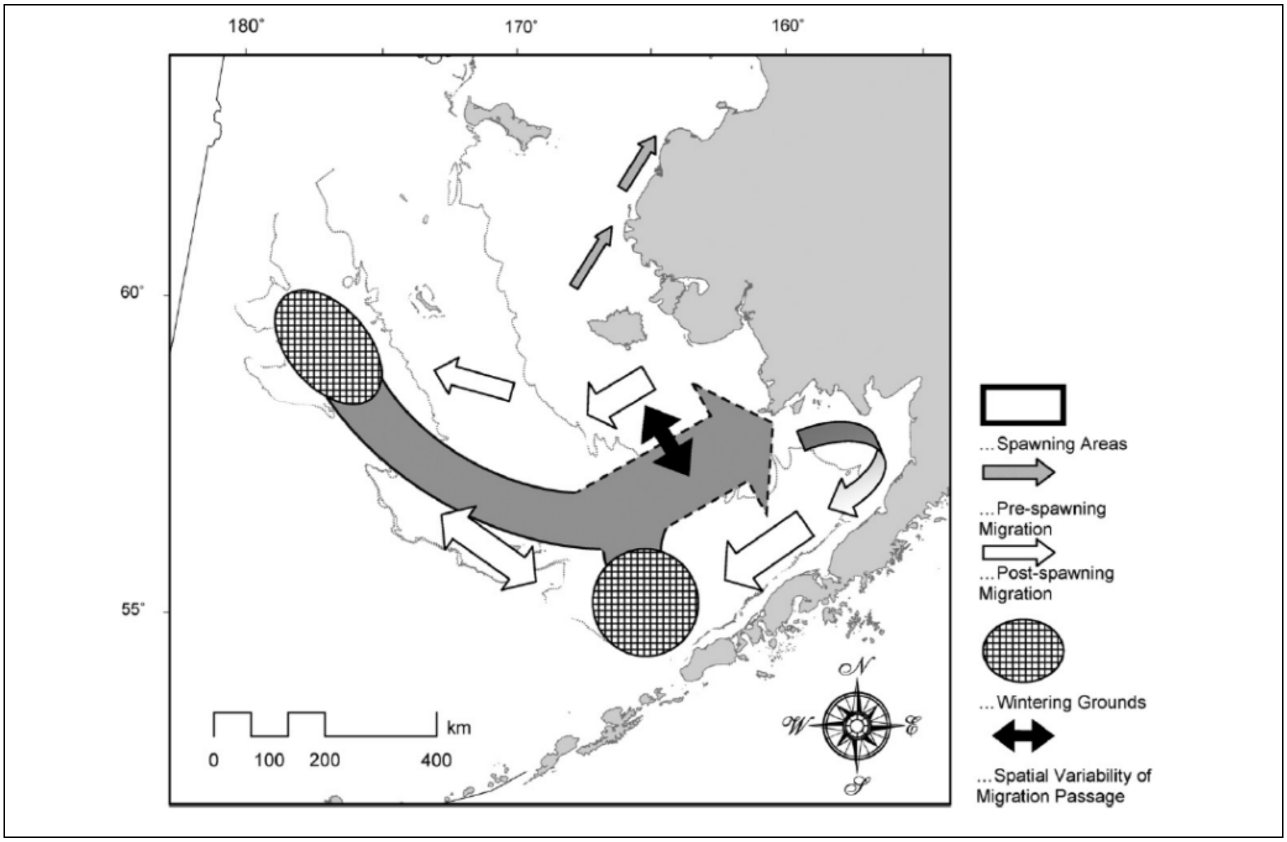

Figure 6-27 Hypothesized migration routes and seasonal distributions of Pacific herring in the eastern Bering

Three Herring Savings Areas (HSAs) were implemented in 1991 (Amendment 16a to the BSAI FMP; NPFMC 1990) and were based upon herring migration data from the 1980s (Figure 6-28). An overall PSC limit for herring is calculated as 1% of the ADF&G estimated annual biomass of herring (Table 6-15) in the eastern Bering Sea.

Table 6-15 Pacific herring mature biomass projections (mt) for spawning aggregations in the eastern Bering Sea, Alaska, provided to the North Pacific Fishery Management Council for the purpose of establishing the 2016–2024 prohibited species catch limits per Amend

Spawning area	2016	2017	2018	2019	2020	2021	2022	2023	2024
Norton Sound	48,794	31,007	31,007	31,007	31,007	31,007	31,007	31,007	31,007
Cape Romanzof	4,366	4,678	4,678	3,300	3,300	3,300	3,300	3,300	3,300
Nunivak Island	140	3,540	3,540	4,464	4,464	4,464	4,464	4,464	4,464
Nelson Island	27,422	4,785	4,785	4,916	4,916	4,916	4,916	4,916	4,917
Cape Avinof	9,456	3,126	3,126	1,890	1,890	1,890	1,890	1,890	1,890
Goodnews Bay	8,263	4,724	4,724	4,724	4,724	4,724	4,724	4,724	4,724
Security Cove	8,540	4,781	4,781	4,762	4,762	4,762	4,762	4,762	4,762
Togiak	147,185	142,453	124,062	197,355	195,793	214,768	324,350	286,853	195,984
Port Moller/ Port Heiden	8,932	2,184	2,268	2,291	2,350	2,449	2,463	2,463	2,463
Total	263,098	201,278	182,971	254,709	253,207	272,281	381,876	344,379	253,511

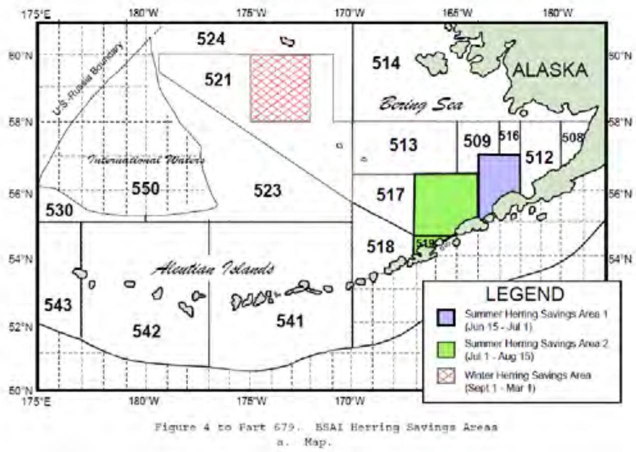

Figure 6-28 BSAI Herring Savings Areas and NMFS management regions

This PSC limit is then apportioned amongst target fisheries during the annual groundfish specifications process (Table 6-16). If the PSC limit is exceeded the responsible target fishery is closed to HSAs based upon the timing of each closure. The majority of the PSC limit is apportioned to the pollock pelagic trawl target.

Table 6-16 2023 herring fishery apportionments, catch and PSC limits (from https://www.fisheries.noaa.gov/sites/default/files/akro/car120_psc_bsai_cdq_only2023.html)

Herring (includes CDQ fisheries)

Trawl Gear

Seasons	Account	Units	Total Catch	Limit	Remaining	% Taken
	Pacific Cod	MT	1	18	17	5%
	Pollock Pelagic	MT	3,059	3,066	7	100%
	Pollock, Atka Mackerel, Other Species	MT	28	41	13	68%
	Rock Sole, Flathead Sole, Other Flatfish	MT	135	99	-36	136%
	Rockfish	MT	2	10	8	21%
	Turbot, Arrowtooth, Kamchatka, Sablefish	MT	0	10	10	5%
	Yellowfin Sole	MT	86	200	114	43%
Total:			**3,312**	**3,444**	**132**	**96%**

Source: https://www.fisheries.noaa.gov/sites/default/files/akro/car120_psc_bsai_cdq_only2023.html

Once triggered the HSAs have specific timings of their closure depending upon at what time of the year the fishery apportioned limit is reached. There is one winter fishery closure (HSA3; September 1-March 1) that is in place if the limit is reached and continues into the subsequent year, and two summer closures if the limit is reached within the season and prior to the timing of (or during) the timing of the closures (HSA1-June 15-July 1; HSA2 July 1-August 15; Figure 6-28). The overall herring PSC limit is apportioned between the Pacific cod, pollock, flatfish and rockfish fisheries (Table 6-16).

6.1.8.3.1 Impacts on herring stocks

Annual PSC limits for the pollock fishery with catch from 2011-2023 are shown in Table 6-17. The majority of herring is taken in the EBS pollock fishery in both A and B seasons with some variability (notably there was more A season catch in 2020) but tends to be more temporally and spatially concentrated in the B season (Figure 6-29). B season catch locations (all sectors combined) tend to be more concentrated in the SE Bering Sea with the exception of 2012 and 2013 (Figure 6-30).

Table 6-17 Pollock fishery annual catch of Herring PSC 2011-2023 with the annual apportionment of the limit to the pollock pelagic trawl target and the percentage of the limit caught in each year. Note red indicates the limit was exceeded in that year triggering additional management measures (closures of HSAs)

Year	Herring PSC (mt)	PSC limit (mt)	% of limit
2011	346	1,737	19.90%
2012	2,167	1,600	135.41%
2013	959	2,165	44.29%
2014	151	1,776	8.52%
2015	1,386	2,242	61.82%
2016	1,425	2,151	66.23%
2017	956	1,800	53.09%
2018	307	1,662	18.49%
2019	1,080	2,313	46.69%
2020	3,720	2,299	161.82%
2021	1,698	2,472	69.00%
2022	1,678	3,400	49.00%
2023	3,059	3,066	99.77%

Source NMFS Alaska Region Catch Account System, data compiled by AKFIN in AFA(2-29-24)

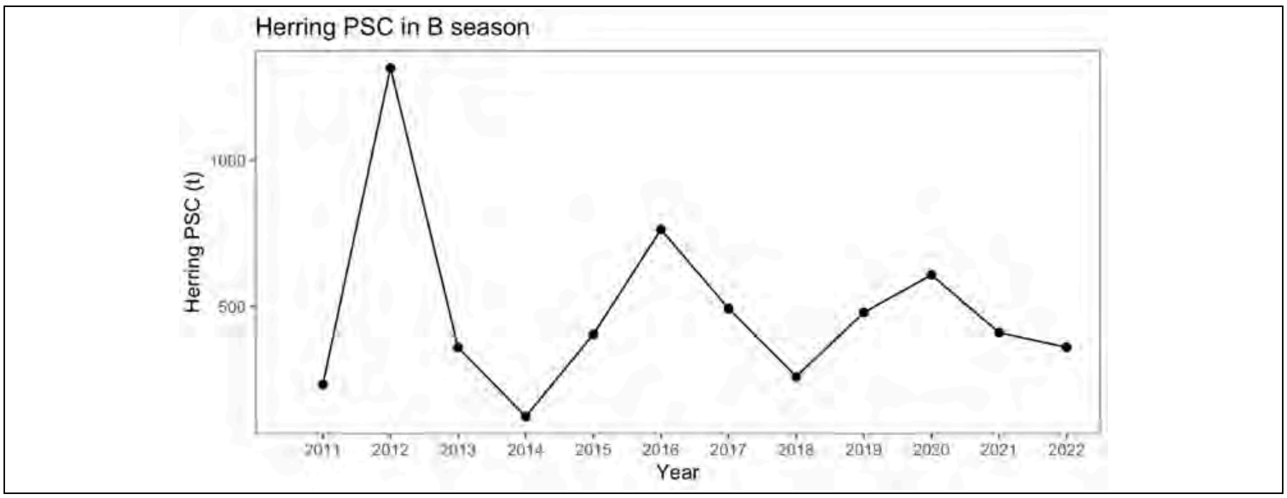

Figure 6-29 Herring PSC (t) taken in the EBS Pollock fishery 2011-2022

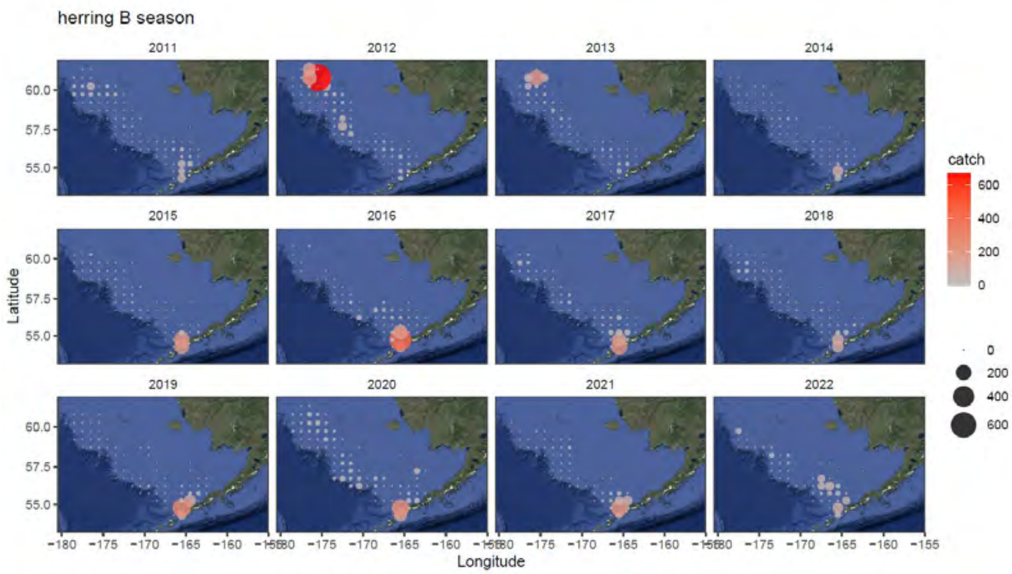

Figure 6-30 Locations of BSAI Herring PSC (t) (all sectors combined) taken in the EBS Pollock fishery, 2011-2022

The PSC limit for the pollock pelagic trawl fishery is not further apportioned between the pollock sectors. Generally, the inshore sector encounters the most herring (Table 6-18) and as noted primarily in the B season but with some seasonal variability (in 2020 all sectors encountered more herring in the A season than the B season). Overall catch by the pollock sector in 2023 (3,059 t) is 0.9% of the overall estimated 2023 biomass of herring in the eastern Bering Sea. Catch locations of herring PSC differ by sector. An example is shown below of catch in both A and B season by two sectors inshore CV (Figure 6-31) and offshore CPs (Figure 6-32) from 2011-2022.

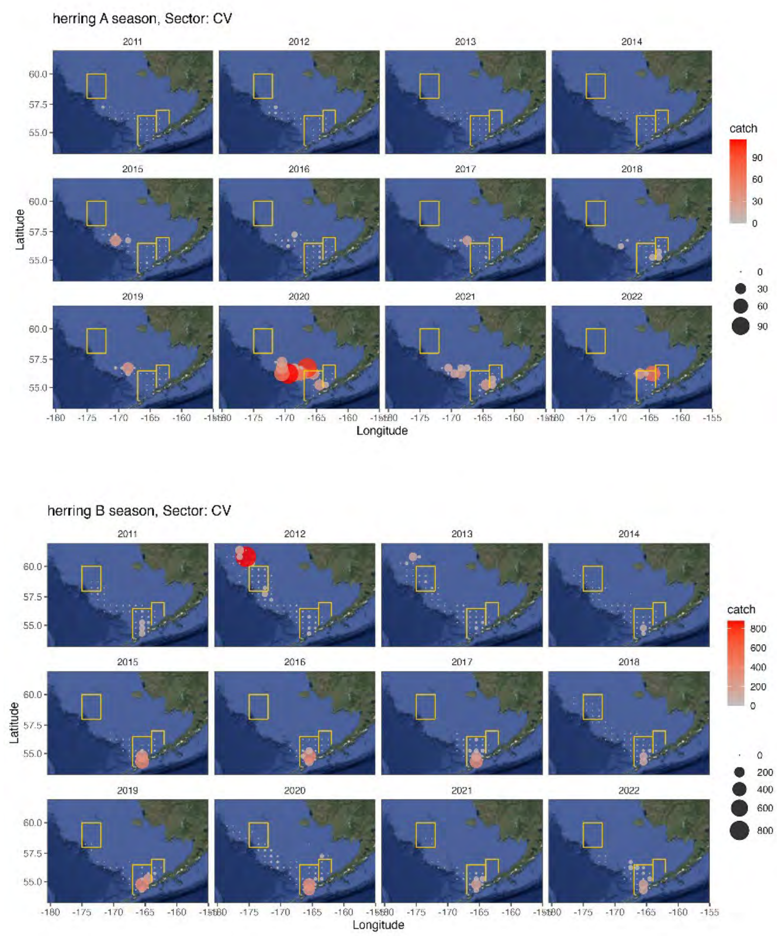

Figure 6-31 Herring PSC (t) by pollock CV sector by A season (upper panel) and B season (lower panel) with HSAs. (2011-2022), Black dots are to show magnitude of catch (in red).

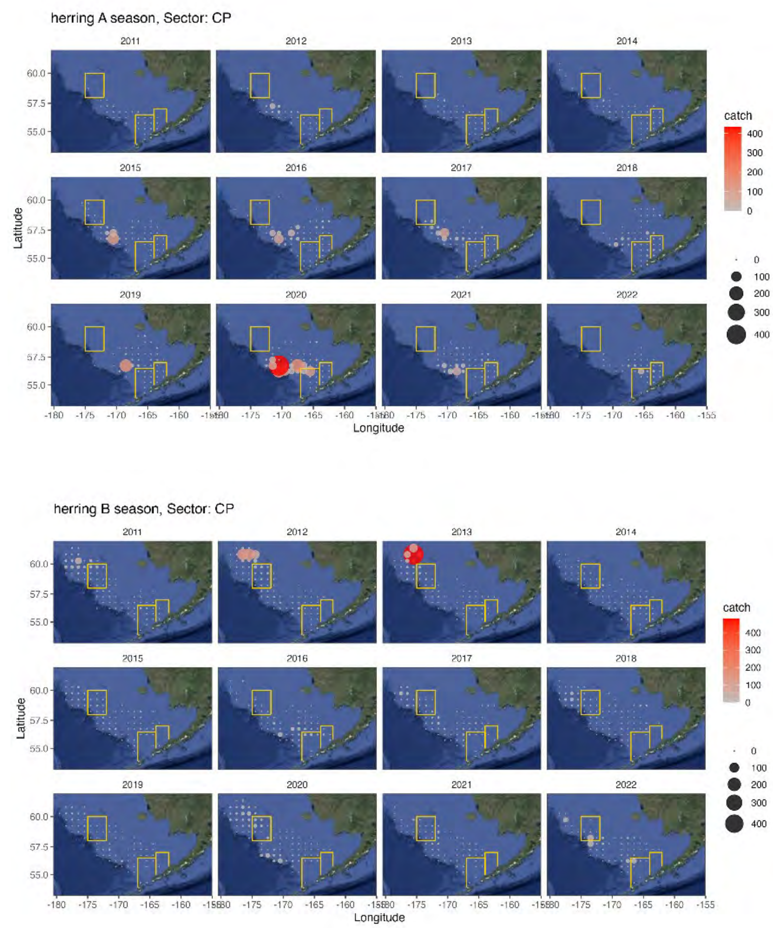

Figure 6-32 Herring PSC (t) by pollock CP sector by A season (upper panel) and B season (lower panel) with HSAs. (2011-2022). Black dots are to show magnitude of catch (in red).

As shown these sectors tend to encounter herring in different areas and the closure of HSAs differentially affect the sectors based on their available seasonal fishing areas. As the limit is not sector apportioned, one sector may impact the others by catching substantial herring PSC in a concentrated area of fishing while other sectors are not encountering herring elsewhere. However, reaching the limit regardless of which sector caught a certain amount causes all 4 sectors to be subject to the HSA closures. The HSA closures may also affect sectors disproportionately with the 2 summer HSAs falling more into fishing grounds for the inshore sector (Figure 6-31) while the winter HSA may more heavily impact available fishing grounds for the CP sector (Figure 6-32). Closure of these areas requires the fleets to move into potentially less productive areas and particularly for the inshore fleet can cause the vessels to “bunch up” outside of the closure to continue to fish the productive grounds (S Martell, pers comm). Additionally, as the inshore sector runs into herring, and it begins to accrue towards the limit, operational decisions must be made to move out of a location (e.g. the horseshoe) and onto the shelf where they would be less likely to encounter herring but more likely to encounter WAK chum (S. Martell, pers comm.). A request for emergency action was submitted in 2020 to suspend the closure of the Winter Herring Savings Area in order to allow the fishery to operate and achieve Optimum Yield rather than be pushed into areas of less productive fishing and potentially higher herring bycatch areas. The summer HSA was re-opened by

NMFS in 2020 as well in order to prevent the underharvest of the 2020 pollock total allowable catch (TAC).[72].

Table 6-18 Herring PSC in the AFA pollock fishery by season and sector 2011-2023

	CP			M			S			CDQ			all sectors
Year	A	B	Total	A	B	Total	A	B	Total	A	B	Total	Total
2011	0	124	124	0	3	3	1	236	238	0	12	12	**377**
2012	122	400	522	0	117	117	3	1,608	1,611	5	103	108	**2,358**
2013	0	763	763	0	4	4	0	191	191	0	1	1	**959**
2014	0	7	7	0	3	3	0	136	136	0	14	14	**159**
2015	358	5	364	9	5	13	45	1,059	1,104	4	1	5	**1,487**
2016	362	47	409	137	14	151	71	654	725	7	139	147	**1,431**
2017	206	27	233	29	25	54	21	646	668	5	3	8	**963**
2018	23	18	42	1	6	7	41	381	422	1	2	3	**473**
2019	160	4	164	0	12	12	45	866	911	5	9	13	**1,100**
2020	1,414	97	1,511	444	36	480	901	822	1,724	139	7	146	**3,861**
2021	131	5	137	51	129	180	384	970	1,354	28	8	36	**1,707**
2022	35	126	161	106	149	255	300	974	1,274	2	12	13	**1,703**
2023	111	256	366	150	632	783	149	1,736	1,885	2	39	41	**3,075**

Biomass estimates across all stocks are provided to the Council annually by ADF&G in order to form the basis of the PSC limit (ADF&G 2023) shown in Table 6-17. Overall herring biomass has been increasing in recent years due to increasing biomass in the Togiak stock (Siddon et al, 2023). Assessment methods for all but the Togiak stock are based on a long-term indication of population sizes (> 30-year medians of sufficiently rated aerial survey biomass estimates; ADF&G 2023). The Togiak stock has been assessed using a statistical catch-at-age (SCAA) model since 1992, however for the first time since 1976 (Funk 1988) there was no commercial gillnet or purse seine sac roe harvest of Togiak herring. Herring samples in the assessment are fishery-dependent and with no fishery conducted in 2023, there were no samples with which to estimate the age, length, and weight compositions of the stock. As no commercial fishery was prosecuted in 2023, the biomass estimate for the Togiak stock in 2024 was based on the median from the most recent decade (2014-2023) of aerial survey biomass estimates and resulted in a much lower overall PSC limit in 2024 than in the previous two years (2,535 t in 2024 as compared with 3,444 t in 2023). Should a commercial fishery continue to be prosecuted in 2024 the assessment will return to previous methods for estimating the 2025 Togiak stock. Nevertheless, all BSAI fisheries subject to an apportionment of the PSC limit including the EBS pollock fishery will operate under a lower limit for the 2024 fishing year. This is likely to result in the limit being more constraining in 2024 for the pollock fishery (the fishery was 7 t under their limit in 2023; Table 6-16).

6.1.9 Other Resources (Seabirds, Marine Mammals, Habitat)

6.1.9.1 Seabirds

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 6-19; 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 6-19; USFWS 2009). Some seabirds and their eggs provide important subsistence foods for Alaska Native communities, including those in coastal Western Alaska (AMBCC 2024).

As noted in the PSEIS (NMFS 2004 and 2015), seabird life history includes low reproductive rates, low adult mortality rates, long life span, and delayed sexual maturity. These traits make seabird populations extremely sensitive to changes in adult survival and less sensitive to fluctuations in reproductive effort.

[72] https://www.fisheries.noaa.gov/resource/document/supplemental-information-nmfss-temporary-rule-and-modification-closure-summer

The problem with attributing population changes to specific impacts is that, because seabirds are long-lived animals, it may take years or decades before relatively small changes in survival rates result in observable impacts on the breeding population.

Table 6-19 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*	
	Short-billed(Mew)*	
	Bonaparte's*	
	Slaty-backed*	
Murres	Common*	
	Thick-billed*	
Jaegers	Long-tailed*	
	Parasitic*	
	Pomarine*	

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

*Seabird species with currently regulated/open subsistence hunting and egging seasons, including in regions of Western Alaska..

6.1.9.1.1 Effects on Seabirds

The PSEIS identifies how the BSAI groundfish fisheries activities may directly or indirectly affect seabird populations (NMFS 2004 and 2015). Direct effects may include incidental take (lethal) 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 on islands, and disposal of plastics, which may be ingested by seabirds. Additionally, seabirds may be vulnerable to climate change and ecosystem variability. They may have unobserved mortality events following marine heat waves, such as might be the case with northern fulmars, a seabird species taken for subsistence.

The impacts of the Alaska groundfish fisheries on seabirds were analyzed in the Harvest Specifications EIS (NMFS 2007) which evaluated the impacts of the alternative harvest strategies on seabird takes, prey availability, and seabird ability to exploit benthic habitat. The focus of this analysis is similar, as any changes to the groundfish fisheries in the BSAI could change the potential for direct take (death) of seabirds. Potential changes in prey availability (seabird prey species caught in the fisheries) and disruption of bottom habitat via the intermittent contact with non-pelagic trawl gear under different levels of harvest are examples of indirect effects on seabirds and are discussed in NMFS (2007). However, prey availability changes could also be closely associated with changes in seabird take levels. Therefore, all impacts to seabirds are addressed by focusing on potential changes in seabird takes (direct effects).

Of particular concern is the impact on seabirds listed under the ESA. Three species of seabirds are currently listed as either threatened or endangered; the short-tailed albatross *Phoebastria albatrus* (endangered), Alaska-breeding population of Steller's eider *Polysticta stelleri* (threatened), and Spectacled eider *Somateria fischeri* (threatened). Two other populations of Steller's eider occur in waters off Alaska but only the Alaska-breeding population is listed under the ESA. The USFWS consulted with NOAA Fisheries Alaska Region under Section 7 of the ESA on the effects of the groundfish fisheries on these species. In its 2021 biological opinion, the USFWS determined the groundfish fisheries off Alaska are likely to adversely affect short-tailed albatross, spectacled eider, and the Alaska-breeding population of Steller's eider, but they are not likely to jeopardize their continued existence (USFWS 2021). It was also determined that the groundfish fisheries off Alaska are not likely to adversely affect designated critical habitat of the Alaska-breeding population of Steller's eider and Spectacled eider. USFWS provides the following incidental take statements for short-tailed albatross, spectacled eider, and threatened Alaska-breeding population of Steller's eider:

- The reported take should not exceed six albatrosses in a floating 2-year period.
- The reported take should not exceed 25 spectacled eiders in a floating 4-year period.
- The reported take should not exceed three Steller's eiders in a floating 4-year period.

6.1.9.1.2 Incidental Take of Seabirds in Trawl Fisheries

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

The average annual estimate of incidental take of birds by pelagic and non-pelagic trawl gear in the BSAI was 764 birds per year from 2011 through 2021 (Tide and Eich 2022). Northern fulmars comprised the majority of this take, with shearwaters and gulls also taken in almost every year. An estimate of 80 Laysan albatross is attributed to the BSAI trawl fisheries in 2018. Storm petrels, murres, auklets, and cormorants were also taken in small numbers in trawling operations in the BSAI from 2011 through 2021. The estimated takes of gulls, fulmars, and shearwaters in the entire BSAI trawl groundfish fisheries are very small percentages of these species' populations, with the exception of a large number of shearwaters incidentally taken in 2019 (1,668 birds; Tide and Eich 2022). The increase in shearwater bycatch was attributed to a shearwater mortality event that occurred throughout Alaska in 2019.

Seabird takes in the BSAI trawl fisheries are relatively low, based on standard observer sampling and NMFS estimation. However, standard species composition sampling of the catch does not account for additional mortality due to gear interactions such as net entanglements or cable strikes. Special data collections of seabird gear interactions have been conducted, and preliminary information indicates that mortalities can be greater than the birds accounted for in the standard species composition sampling (Melvin et al. 2011). The probability of ESA-listed seabird collisions with third wires or other trawl vessel gear in the EEZ off Alaska cannot be assessed; however, given the available observer data and the observed at-sea locations of short-tailed albatrosses relative to trawling effort, the likelihood of ESA-listed seabird collisions are remote, but the possibility of such collisions cannot be completely discounted.

In the Pollock fishery, the estimated total seabird bycatch in Alaska from 2011 through 2021 was 1,278 with an annual average of 116 (Table 6-20, Tide and Eich, 2022).

Table 6-20 Estimated seabird bycatch in Bering Sea and Aleutian Islands pollock trawl fisheries 2011 through 2021.

Species/Species Group	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Grand total	Annual average
Laysan Albatross	0	0	0	0	0	0	0	0	3	8	0	11	1
Northern Fulmar	214	90	123	51	112	84	109	41	105	96	103	1,129	103
Shearwaters	3	12	1	3	6	9	0	0	11	1	7	53	5
Gull	1	0	3	0	0	3	0	0	0	0	0	7	1
Kittiwake	0	0	0	0	0	0	0	0	13	3	7	23	2
Murre	14	0	3	3	0	6	1	0	0	0	0	27	2
Auklets	0	0	4	0	0	0	0	0	0	0	0	4	0
Other Alcid	0	0	0	0	0	0	0	0	6	0	0	6	1
Cormorant	0	0	0	0	3	0	0	0	0	0	0	3	0
Unidentified Birds	0	0	0	0	6	6	0	0	3	0	0	15	1
Total	**232**	**102**	**134**	**57**	**127**	**108**	**110**	**41**	**141**	**108**	**117**	**1,278**	**116**

Source: Tide and Eich, 2022

6.1.9.1.3 Impacts under the Alternatives

Managing the Bering Sea pollock B season at status quo would not be expected to have any change in the minimal impacts to seabirds in the action area. Effects on seabirds under Alternative 1 are therefore not expected to be significant.

Estimated takes in the BSAI trawl groundfish fisheries average 764 birds per year, and in the BSAI demersal longline groundfish and halibut fisheries, 4,638 birds per year; in both, they primarily consist of northern fulmars (Tide and Eich 2022). These seabird take estimates are small in comparison to seabird population estimates, and under the status quo alternative, it is reasonable to conclude that the impacts would continue to be similar. However, observers are not able to monitor all seabird mortality associated with trawl vessels. Several research projects are currently underway to provide more information on these interactions.

6.1.9.1.4 Prey Availability Disturbance

Prey species of seabirds in the EBS are not usually fish that are targeted in the groundfish fisheries (Table 6-21). While not directly targeted by commercial fisheries, age-0 pollock are an important food source for seabirds. On the Pribilof Islands, hatching success and fledgling survival of seabirds has been correlated to the availability of age-0 pollock to nesting birds. However, seabird species may be impacted indirectly by effects of pelagic and nonpelagic trawl fishing gear on the benthic habitat of seabird prey, such as clams, benthic fish, and crab. The EFH EIS provides a description of the effects of the groundfish fisheries on bottom habitat in the appendix (NMFS 2005), including the effects of the commercial fisheries on the EBS slope and shelf.

A description of the effects of prey abundance and availability on seabirds is found in the PSEIS (NMFS 2004 and Supplemental Information Report on the PEIS (2015)) and the Harvest Specifications EIS (NMFS 2007). Detailed conclusions or predictions cannot be made regarding the effects of forage fish bycatch on seabird populations or colonies. NMFS (2007) 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. 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 pelagic or nonpelagic trawl fisheries. There is no directed commercial fishery for those species that compose the forage fish management group, and seabirds typically target juvenile stages rather than adults for commercial target species. Most of the forage fish bycatch is smelt, taken in the pollock fishery, however since detailed conclusions or predictions cannot be made regarding the effects of forage fish bycatch on seabird populations or colonies, the impacts of changes in forage fish bycatch are indeterminate.

Table 6-21 Seabirds in the Bering Sea: 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: Dragoo et al. 2011; NMFS 2022.

6.1.9.1.5 Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Seabirds

This section considers cumulative effects from reasonably foreseeable fishing and non-fishing actions on seabirds in the EBS analysis area.

Reasonably foreseeable future actions for seabirds include ecosystem-sensitive management; rationalization; traditional management tools; actions by other federal, state, Tribal, and international agencies; and private actions, as described in Sections 8.4 and 9.3 of the Harvest Specifications EIS (NMFS 2007). Ecosystem-sensitive management, rationalization, and traditional management tools are likely to increase protection to seabirds by considering these species more in management decisions and by improving the management of fisheries through the restructured Observer Program, catch accounting, seabird avoidance measures, and vessel monitoring systems. 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. 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.

Marine Debris: Plastics are one type of marine debris known to impact seabirds across the Pacific Ocean (Hyrenbach et al. 2020; Padula et al. 2020; Rapp et al. 2017) and within Alaskan waters (Nevins et al. 2005; Padula et al. 2020). Seabirds consume plastics because birds often misidentify plastics as potential food sources. Studies of the effects of marine debris and plastics on seabirds are limited. Padula et al. (2020) examined the impacts of plastics on Aleutian Archipelago seabirds. Phthalates are plastic-derived contaminants and found in 100% of the specimens (n = 115) collected in the study. Differences in concentrations were found between feeding guilds, but not geographically, with diving plankton-feeders with the highest concentrations. Additionally, 36.5% of the randomly sampled seabird stomachs (n = 74) contained plastic particles, identifying ingestion as a mode of phthalate exposure. Nevins et al. (2005) examined dead seabirds from the squid fisheries in British Columbia, Canada. The potential impacts of plastics vary based on species and how they feed. Of the 58 birds and 11 taxa they examined 100% of five surface-feeding species contained plastics while only 50% of the diving species had ingested plastics (Nevins et al. 2005). While there are numerous marine debris cleanup efforts, the continued worldwide use of plastics means that this threat will continue to seabird populations. It is expected that the number of seabird deaths will remain constant at the same levels but may vary as the use of plastic increases or if they are phased out.

Docks, harbors, roads, and bridge construction: Docks, harbors, and other coastal construction projects are commonly permitted in the region and tend to occur along shorelines in sheltered bays which provide feeding habitat for marine birds. Many of these structures, such as docks and piers, often have a positive effect on seabirds as smaller bait fish tend to concentrate around the structure resulting in a higher foraging success. These activities tend not to occur near steep shoreline cliffs, which provide high-density areas for seabird nesting, thus, there are little to no expected effects on seabird nesting habitat. Overall, there is expected to be a negligible effect from these types of projects on seabird populations.

Mining operations: Mining operations tend to occur in the headwater areas of rivers and streams. While these headwater areas provide habitat for some species of seabirds such as loons, ducks, and murrelets, marine birds using this area are at low densities and are expected to move to adjacent habitat; thus, there is expected to be no effect on marine birds from expanded mining operations in the EBS analysis area.

Climate change: The extended increase in sea surface temperature resulted in a shift in prey availability resulting in a mass die-off event in 2014 through 2016 (Piatt et al. 2020). Seabird die-offs in the North Pacific Ocean, Bering Sea, and Chukchi Sea have become more common since 2014. The species which have suffered the largest die-offs, such as the common murre, are considered species of least concern. The die-off events seem to occur in different locations each year and involve different species and or colonies (Kaler and Kuntz 2022). Overall, seabird populations in the BSAI appear to be relatively stable over the long term.

Any action by other entities that may impact seabirds will likely be offset by additional protective measures for the federal fisheries to ensure ESA-listed 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 seabirds.

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 aggregate impacts of the proposed action are determined to be not significant.

6.1.9.2 Habitat

Fishing operations may change the abundance or availability of certain habitat features used by managed fish species to spawn, breed, feed, and grow to maturity. These changes may reduce or alter the abundance, distribution, or productivity of species. The effects of fishing on habitat depend on the intensity of fishing, the distribution of fishing with different gears across habitats, and the sensitivity and recovery rates of specific habitat features.

6.1.9.2.1 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined in the Magnuson-Stevens Act as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.”(50 CFR 600.10) For the purpose of interpreting the definition of essential fish habitat: “waters” includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; “substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities; “necessary” means the habitat required to support a sustainable fishery and a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species’ full life cycle.

In 2005, NMFS and the Council completed the EIS for EFH Identification and Conservation in Alaska (NMFS 2005). The EFH EIS evaluated 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 described 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 concluded 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 concluded 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 indicated 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, NPFMC 2023b, NPFMC 2023c) and (NPFMC and NMFS 2016, NPFMC 2023a). This 5-year review cycle supplemented the 2005 EIS in 2010, and 2017, and 2023 (NPFMC and NMFS 2010, and Simpson et al. 2017, Harrington et al. *In prep*). 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. The updates from the 2023 EFH 5-year Review are summarized in the *Essential Fish Habitat 2023 5-year Review Summary Report* (Harrington et al. *In prep*) and will apply to the FMP for the Salmon Fisheries in the EEZ off Alaska (NPFMC 2021a) and the FMP for Groundfish of the Bering Sea and Aleutian Islands Management Area (NPFMC 2020), as well as three other North Pacific FMPs, with an EFH Omnibus Amendment Package (NPFMC 2023a).

The action area for this EIS is identified as EFH for five species of Pacific salmon (NPFMC 2021a), 26 species of BSAI groundfish (NPFMC 2020), five species of BSAI crabs (NPFMC 2021b), and weathervane scallops (NPFMC 2014). The Pacific salmon species are Chinook, chum, coho, pink, and sockeye salmon. In alphabetical order, the BSAI groundfish species are Alaska plaice, Alaska skate, Aleutian skate, arrowtooth flounder, Atka mackerel, Bering skate, blackspotted rockfish, Dover sole, dusky rockfish, flathead sole, Greenland turbot, Kamchatka flounder, mud skate, northern rock sole, northern rockfish, octopus, Pacific cod, Pacific ocean perch, rex sole, rougheye rockfish, sablefish, shortraker rockfish, shortspine thornyhead rockfish, southern rock sole, walleye pollock, and yellowfin sole. The BSAI crab species are blue king crab, golden king crab, red king crab, snow crab, and Tanner crab.

The EFH information levels for chum salmon include freshwater eggs, freshwater larvae and juveniles, estuarine juveniles, marine juveniles, marine immature and maturing adults, and freshwater adults. General distribution data are available for some or all portions of the geographic range for Chum salmon. Additional detailed information and figures can be found in Appendix A, FMP for the Salmon Fisheries in the EEZ off Alaska (NPFMC 2018) and the revisions to Appendix E (NPFMC 2023c).

The EFH information levels for walleye pollock include eggs, larvae, settled early juveniles, subadults, and adults. General distribution data are available for some or all portions of the geographic range for walleye pollock. Additional detailed information and figures can be found in the revised Appendix E, FMP for Groundfish of the BSAI (NPFMC 2023b).

6.1.9.3 Habitat Description

The Bering Sea is a semi-enclosed, high-latitude sea. Of its total area of 2.3 million sq. km, 44 percent is continental shelf, 13 percent is continental slope, and 43 percent is deep-water basin. Its broad continental shelf is one of the most biologically productive areas of the world. The EBS contains approximately 300 species of fish, 150 species of crustaceans and mollusks, 50 species of seabirds, and 26 species of marine mammals (Livingston and Tjelmeland 2000). However, commercial fish species diversity is lower in the EBS than in the GOA.

A special feature of the EBS is the pack ice that covers most of its eastern and northern continental shelf during winter and spring. The dominant circulation of the water begins with the passage of North Pacific water (the Alaska Stream) into the EBS through the major passes in the AI (Favorite et al. 1976). There is net water transport eastward along the north side of the AI and a turn northward at the continental shelf break and at the eastern perimeter of Bristol Bay. Eventually, EBS water exits northward through the Bering Strait, or westward and south along the Russian coast, entering the western North Pacific via the Kamchatka Strait. Some resident water joins new North Pacific water entering Near Strait, which sustains a permanent cyclonic gyre around the deep basin in the central Bering Sea (BS).

The EBS sediments are a mixture of the major grades representing the full range of potential grain sizes of mud (subgrades clay and silt), sand, and gravel (see Appendix A, Figure 1, FMP for the Salmon Fisheries in the EEZ off Alaska). Sand and silt are the primary components over most of the seafloor, with sand predominating the sediment in waters with a depth less than 60 m. Overall, there is often a tendency of the fraction of finer-grade sediments to increase (and average grain size to decrease) with increasing depth and distance from shore. The distribution of benthic sediment types in the EBS shelf is related to depth (see Appendix A, Figure 2, FMP for the Salmon Fisheries in the EEZ off Alaska).

Additional detailed habitat information can be found in Appendix A of the FMP for the Salmon Fisheries In the EEZ Off Alaska and Appendix D of the FMP for the Groundfish of the BSAI Management Area.

6.1.9.3.1 Habitat Protections and Area Closures

The action area overlaps with several habitat protection areas and time and area closures for fishery management.

6.1.9.3.2 Habitat Conservation Areas

The use of nonpelagic trawl gear is prohibited year-round in the following Habitat Conservation Areas, as described in 50 CFR 679, except for designated areas open to nonpelagic trawl gear. Coordinates can be found in the FMP for the Groundfish of the BSAI Management Area:

- Bering Sea Habitat Conservation Area
- Pribilof Island Habitat Conservation Area
  - This area is also closed to fishing with pot gear year-round.
- St. Matthew Island Habitat Conservation Area
- St. Lawrence Island Habitat Conservation Area
- Nunivak Island, Etolin Strait, and Kuskokwim Bay Habitat Conservation Area

6.1.9.3.3 Habitat Areas of Particular Concern

HAPCs are specific sites within EFH that are of particular ecological importance to the long-term sustainability of managed species, are of a rare type, or are especially susceptible to degradation or development. HAPCs are meant to provide greater focus to conservation and management efforts and may require additional protection from adverse effects. (See the HAPC Process Document for more information.)

The action area has one identified HAPC: Skate Nursery Areas. The Council designated six areas of skate egg concentration as HAPC without any additional associated regulatory measures (Amendment 104 to the FMP for the Groundfish of the BSAI Management Area). The Council did not recommend regulations to limit fishing in the proposed HAPC because there is no evidence of adverse effects from fishing on skate populations within these HAPC that would need to be addressed through regulation.

6.1.9.3.4 Gear, Time, and Area Restrictions

The use of nonpelagic trawl gear in the directed fishery for pollock is prohibited.

The Chum Salmon Savings Area and Red King Crab Savings Area (RKCSA) have gear-specific closures focusing on mitigating impacts to species. The Chum Salmon Savings Area is closed to directed pollock fishing with trawl gear from August 1 to August 31, with caveats (see Section 3.5 in the FMP for the Groundfish of the BSAI Management Area). The RKCSA is closed to nonpelagic trawl fishing year-round. There is also the Nearshore Bristol Bay Trawl Closure Area which is closed to all trawling year round, with a small subarea open seasonally.

Finally, there is the Northern Bering Sea Research Area. The use of nonpelagic trawl gear is prohibited in that area, except as allowed through exempted fishing permits under 50 CFR 679.6 that are consistent with a Council approved research plan to examine the effects of nonpelagic trawling on the management of crab species, marine mammals, ESA-listed species, and subsistence needs for Western Alaska communities.

6.1.9.3.5 Fishing Effects

Fishing gear can impact habitat used by a fish species for the processes of spawning, breeding, feeding, or growth to maturity. The EFH regulations base the evaluation of the adverse effects of fishing regulated under FMPs on EFH on a ‘more than minimal and not temporary’ standard (50 CFR 600.815(a)(2)). 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.

During the 2023 EFH 5-year Review, the fishing effects evaluation modeled habitat disturbance from bottom contact by fishing gear from federally managed fisheries (Zaleski et al. *In prep*). Gear parameters were included in the model to incorporate the nominal width and bottom contact adjustments for different gear types (Appendix 2, Zaleski et al. *In prep*). Model results representing the estimated disturbance of species core EFH areas were provided to stock authors to compare with life history parameters. None of the SAs concluded that fishing effects on their species were more than minimal and not temporary, and therefore no SAs recommended elevating their species to the Plan Teams and the SSC for possible mitigation to reduce fishing effects to EFH. None of the authors recommended any change in management with regards to fishing within EFH at the time of the fishing effects evaluation, and the Council reviewed these results in February 2023 (NPFMC 2023a).

A time series of estimated habitat disturbance from fishing gear was developed from 2003, when widespread VMS data became available, and is available through August 2022. A brief discussion of this ecosystem indicator can be found in the 2023 EBS Ecosystem Status Report (Siddon 2023). In brief, the southern Bering Sea experienced the highest estimated percentages of habitat disturbance compared to the northern Bering Sea, AI, and GOA regions, however the time series showed a decline in disturbance from 2003 (Figure 115, Siddon 2023). This decline could represent gear modifications, shifts in gear types, and changes in effort.

The effects of the federal fisheries gear on salmon EFH was not evaluated during the 2023 EFH 5-year Review. However, following the 2017 EFH 5-year Review, the effects of the fisheries on salmon spawning habitat as well as marine pelagic habitat was considered minimal, temporary in nature, and/or to have no effect on spawning, feeding, and growth to maturity for salmon (Appendix A, FMP for the Salmon Fisheries in the EEZ off Alaska).

6.1.9.3.6 Fishery Interactions

Fisheries can have direct impacts on populations, through both the removal of commercially targeted and bycatch species. Commercial fisheries bycatch includes salmon species and some prey species targeted by salmon in later, marine life history stages including squid, capelin, and herring. Prey species are considered an EFH component and an adverse impact to prey species is an adverse impact to EFH. However, the catch of these prey species is relatively small compared to their overall population sizes, so fishing activities are considered to have minimal and temporary effects on feeding of all salmon species (Appendix A, FMP for the Salmon Fisheries in the EEZ off Alaska).

Fishing activities are considered to have overall minimal and temporary effects on the EFH for all salmon species. Federally managed fishing activities interact with marine salmon habitat, and the concerns about these interactions center on effects on prey availability and bycatch. Additional information on fishing effects and the assessment of non-fishing activities that may adversely affect EFH and the cumulative effects of fishing and non-fishing activities on EFS can be found in Appendix A, FMP for the Salmon Fisheries in the EEZ off Alaska.

6.1.9.3.7 Effects of status quo management

Managing the Bering Sea pollock B season at status quo would not be expected to have any change in the minimal impacts to benthic habitat in the action area. Effects on EFH under Alternative 1 are therefore not expected to be significant.

6.1.9.3.8 Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Habitat

This section considers cumulative effects from reasonably foreseeable fishing and non-fishing actions on habitat in the EBS analysis area.

Vessel noise pollution: Motorized vessels provide a large proportion of anthropogenic noise in marine habitats (Popper and Hawkins 2019). These include fishing vessels, large ships, and personal or recreational craft. Most vessels produce predominantly low frequency sounds from onboard machinery and cavitation at propeller blades (Ellison et al. 2012, Ross 1993). Vessel noise production is increasing with increasing vessel traffic, particularly in busy shipping lanes, and vessel noise can increase the ambient noise levels over wide areas of the ocean (Hildebrand 2009, Ellison et al. 2012). Low frequency noise in fish habitats may cause temporary shifts in behavior (de Jong et al. 2020), though the noise produced does not likely exceed mortality or potential mortal injury thresholds to fish (see Table 2, Popper and Hawkins 2019). Short-term behavioral changes may not lead to long-term impacts to fitness or survival (Bejder et al. 2009, Popper and Hawkins 2019). However, there may be unanticipated localized impacts as vessel use increases in certain high-traffic areas.

Climate change: After an eight year warm period, SST has returned to near average temperatures (based on a 30-year average from 1985-2014), though above average springs over the middle and outer domains and winters across the region were still observed (Siddon 2023). Extended periods of increased SST can lead to marine heat waves (Hobday et al., 2016). Warmer temperatures can alter the ecosystem and have potential to increase open-water phytoplankton blooms and alter the timing of blooms which may result in changes to the food web for pelagic and benthic consumers (Nielsen et al. 2024).

Early season mean ice extent has decreased by 55% over the 1979-2023 period of record. The average sea ice extent from 2022-2023 were considered "low ice stanza" years (Siddon 2023). Salinity in the EBS is linked to sea ice presence, and observations from St. Paul Island indicate that, while salinity had been generally increasing over time until about 2021, it decreased in 2022 (Siddon 2023). Other contributing factors to salinity measurements that are impacted by climate change are precipitation and river discharge, and evaporation or ice advection (Aagaard et al. 2006).

Warmer temperature conditions can be detrimental to salmon survival in freshwater spawning habitats. Warming temperatures can change run timing for salmon which can cause a mismatch on habitat suitability for spawning (Taylor 2008). High instream temperatures can lead to pre-spawning mortality events. It can also exacerbate other stressors such as the spread of disease, stream flow, and hypoxic or anoxic conditions (Belchik et al. 2004, Jones et al. 2020; von Biela et al. 2022).

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 aggregate impacts of the proposed action are determined to be not significant.

6.1.9.3.9 Documents Incorporated by Reference in this Analysis

This analysis relies on the information and evaluation contained in EFH 5-year Review documents previously reviewed by the Council, and the BSAI Groundfish and Salmon FMPs. The documents listed below contain information about the EFH 5-year review component evaluations, and the fishery management areas, fisheries, marine resources, ecosystem, social, and economic elements of the fisheries off Alaska.

EA for the EFH Omnibus Amendments Package (NPFMC 2023a)

This EA evaluated the updates adopted by the Council to EFH information in FMPs and environmental impacts from the proposed amendments. The 2023 EFH 5-year Review concluded that no change to the conclusions of the evaluation of fishing effects on EFH is warranted based on new information. None of the FMP amendments require regulatory action.

EFH 5-year Review Summary Report (Harrington et.al, *In prep*)

The EFH 5-year Review summary report contains the updates to new environmental and habitat data, improving the models to map EFH, updating the model to evaluate fishery impacts on EFH, updating the assessment of non-fishing impacts on EFH, and assessing information gaps and research needs.

Fishing Effects Evaluation Discussion Paper (Zaleski et. al, *In prep*)

This discussion paper reports the methods and results of the FE model and the evaluation of fishing effects on EFH for species of groundfish and crabs, including 27 AI species, 34 EBS species, and 42 GOA Groundfish species.

Final EIS for EFH Identification and Conservation (NMFS, 2005)

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.

FMP for the Salmon Fisheries in the EEZ off Alaska (NPFMC 2021a)

This FMP established the Council's authority over the salmon fisheries in the federal waters off Alaska, from 3 to 200 miles offshore, then known as the U.S. Fishery Conservation Zone. The FMP includes information on EFH and HAPC, and life history and habitat features of the five species of salmonids (pink, chum, sockeye, chinook, and coho).

FMP for the Groundfish of the Bering Sea and Aleutian Islands Management Area (NPFMC 2021b)

This FMP governs groundfish fisheries of the BSAI Management Area. The FMP covers fisheries for all stocks of finfish and marine invertebrates except salmonids, shrimps, scallops, snails, king crab, Tanner crab, Dungeness crab, corals, surf clams, horsehair crab, lyre crab, Pacific halibut, and Pacific herring.

6.1.9.4 Marine Mammals

Information on the status of marine mammal populations in Alaska can be found from multiple published resources. The Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (PSEIS) (NMFS 2004) provides descriptions of the range, habitat, and diet for marine mammals found in waters off Alaska. The 2015 PSEIS Supplemental Information Report (NMFS 2015) provides updates on changes to marine mammal stock or species-related management and status, as well as new information regarding impacts on marine mammal stocks and new methods to assess impacts. In addition, marine mammal stock assessment reports (SARs) are published annually under the authority of the Marine Mammal Protection Act (MMPA) for all stocks that occur in state and federal waters of the Alaska region. Individual SARs provide information on each stock's geographic distribution, population estimates, population trends, and estimates of the Potential Biological Removal[73] levels for each stock. The SARs identify sources of human-caused mortality, including serious injury and mortality in commercial fishery operations, by fishery, and whether the stock has met ZMRG for all fisheries. Lastly, the Alaska Groundfish Harvest Specifications EIS provides information on the effects of the groundfish fisheries on marine mammals (NMFS 2007), and is evaluated annually based on new information with Supplemental Information Reports (SIRs) (NMFS 2023). Information from the PSEIS, SARs, Alaska Groundfish Harvest Specifications and SIRs incorporated by reference. Marine mammal stocks or distinct population segments (DPS)[74], including those currently listed as endangered or threatened under the ESA or depleted or strategic under the MMPA that may be present in the Bering Sea can be found here. ESA section 7 formal and informal consultations with respect to the actions of the Federal groundfish fisheries on ESA-listed species have been completed, either by individual fishery area or by multiple fishery areas (NMFS 2010 and NMFS 2014).

Effects to marine mammals from fisheries can occur from either direct or indirect actions. For the action analyzed here, direct interactions could occur from direct take of marine mammals, whereas indirect effects would mainly occur in the form of prey competition. Table 6-22 shows which marine mammals

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[73] Under the MMPA, the Potential Biological Removal level is the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. The potential biological removal level is the product of the following factors: (A) The minimum population estimate of the stock, (B) One-half the maximum theoretical or estimated net productivity rate of the stock at a small population size, (C) A recovery factor of between 0.1 and 1.0 (50 CFR 229.2). https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act

[74] "Under the Endangered Species Act, a distinct population segment—or DPS—is a vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species." https://www.fisheries.noaa.gov/laws-and-policies/glossary-endangered-species-act

that are known to occur within the action area have experienced either direct or indirect effects from the commercial pollock trawl fishery. The reminder of this section will focus only on those marine mammals for which direct or indirect effects from the Bering Sea commercial pollock trawl fishery have been documented.

Table 6-22 Marine mammals known to occur in the Bering Sea and whether they may be directly (interaction with fishing operation/gear) or indirectly (prey availability) affected by the proposed fishery management alternatives

Infraorder or Superfamily	Species	Potential Impacts	
		Direct	Indirect
Pinnipedia	**Steller sea lion** (*Eumatopias jubatus*), Western DPS	X	X
	Northern fur seal (*Callorhinus ursinus*), Eastern Pacific		X
	Harbor seal (*Phoca vitulina*), Pribilof Islands	X	X
	Harbor seal (*Phoca vitulina*), Bristol Bay	X	X
	Ribbon seal (*Phoca fasciata*), Alaska	X	X
	Bearded seal (*Erignathus barbatus nauticus*), Beringia DPS	X	X
	Spotted seal (*Phoca largha*), Alaska		X
	Ringed seal (*Phoca hispida*), Alaska	X	X
	Pacific Walrus (*Odobenus rosmarus divergens*), Alaska		
Cetacea	**Killer whale** (*Orcinus orca*), Eastern North Pacific Alaska Resident		X
	Killer whale (*Orcinus orca*), Eastern North Pacific GOA, Aleutian Islands, and Bering Sea Transient		
	Killer whale (*Orcinus orca*), Offshore		
	Pacific White-sided dolphin (*Lagenorhynchus obliquidens*), North Pacific	X	X
	Harbor porpoise (*Phocoena phoecena*), Bering Sea	X	
	Dall's porpoise (*Phocoenoides dalli*), Alaska		
	Beluga whale (*Delphinapterus leucas*), Beaufort Sea		X
	Beluga whale (*Delphinapterus leucas*), Eastern Chukchi sea		X
	Beluga whale (*Delphinapterus leucas*), Eastern Bering Sea		X
	Beluga whale (*Delphinapterus leucas*), Bristol Bay		X
	Baird's beaked whale (*Berardius bairdii*), Alaska		
	Stejneger's beaked whale (*Mesoplodon stejnegeri*), Alaska		
	Sperm whale (*Physeter macrocephalus*), North Pacific		
	Bowhead whale (*Balaena mysticetus*), Western Pacific		
	Humpback whale (*Megaptera novaeangliae*), Western North Pacific DPS	X	
	Humpback whale (*Megaptera novaeangliae*), Hawaii DPS	X	
	Humpback whale (*Megaptera novaeangliae*), Mexico DPS	X	
	Fin whale (*Balaenoptera physalus*), Northeast Pacific		
	Minke whale (*Balaenoptera acutorostrata*), Alaska		
	North Pacific right whale (*Eubalaena japonica*), Eastern North Pacific		
	Blue whale (*Balaenoptera musculus*), Eastern North Pacific		
	Gray whale (*Eschrichtius robustus*), Eastern North Pacific DPS		
Mustelidae	**Northern sea otter** (*Enhydra lutris*), Southwest Alaska		
Ursoidea	**Polar Bear** (*Ursus maritimus*), Chukchi/Bering Sea		

Sources: Young et al. 2023; Carretta et al. 2023; Proposed List of Fisheries for 2024 (88 FR 62748, September 13, 2023)

6.1.9.4.1 ESA-listed Marine Mammals

6.1.9.4.1.1 Steller Sea Lions (Western DPS)

On November 26, 1990, NMFS issued the final rule to list the Steller sea lion (*Eumetopias jubatus*) as a threatened species under the ESA (55 FR 49204, *November 26 1990*). In 1997, NMFS reclassified Steller sea lions as two DPSs based on genetic studies and other information (62 FR 24345, *May 5, 1997*); the eastern DPS (EDPS) remained listed as threatened, and the western DPS (WDPS) was reclassified as endangered. On November 4, 2013, the EDPS was removed from the endangered species list (78 FR 66140, *November 4, 2013*). The WDPS remains endangered and is the population potentially affected by the proposed alternatives.

The WDPS of Steller sea lions includes animals born west of Cape Suckling, Alaska (144° W; 62 FR 24345). However, individuals move between rookeries and haul out sites regularly, even over long distances between eastern and western DPS locations (Jemison et al. 2013, Jemison et al. 2018, Hastings et al. 2019). Most adult Steller sea lions occupy rookeries during the summer pupping and breeding season and exhibit a high level of site fidelity (Raum-Suryan et al. 2002, Hastings et al. 2017). During the breeding season, some juveniles and non-breeding adults occur at or near the rookeries, but most are on haulouts (resting sites that provide regular retreat from the water on exposed rocky shoreline, gravel beaches, and wave-cut platforms or ice (Rice 1998, Ban 2005, Call and Loughlin 2005). Steller sea lions disperse widely after the breeding season (late May to July), likely to access seasonally important prey resources. During fall and winter many Stellar sea lions disperse from rookeries and increase use of haulouts, particularly on terrestrial sites but also on sea ice in the Bering Sea (Calkins 1998, Sinclair et al. 2019).

Data from 1978–2022 indicate that WDPS Steller sea lions were at their lowest levels in 2002. Between 2007 to 2022, WDPS non-pup and pup counts increased 1.05% and 0.50% per year, respectively (Sweeney et al. 2023). However, there was high variability among regions. Steller sea lions in the western Aleutian Islands region continued to decline, along with pups in the adjacent central Aleutian Islands region. East of Samalga Pass, Aleutian Islands, pup production slowed or plateaued in the early 2010s, with subsequent non-pup plateauing or declines starting in the late 2010s in all regions (Sweeney et al. 2023). The 2014-2016 North Pacific marine heatwave, one of the most severe heat waves ever recorded, resulted in reduced survival of adult female Steller sea lions in the Gulf of Alaska and reduced survival of adult female and adult male Steller sea lions in Southeast Alaska (Hastings et al. 2022). It appears that adult females may have recovered from the effects of the heatwave, based on recent data (Hastings et al. 2023).

The current minimum population estimate of the U.S. WDPS stock of Stellar sea lions is 49,320 Stellar sea lions; 11,987 pups (95% credible interval of 11,291 – 12,703) and 37,333 non-pups (95% credible interval of 34,274 – 40,245), respectively (Sweeney et al. 2023). The WDPS stock's potential biological removal (PBR)[75] level is 299 Stellar sea lions (Young et al. DRAFT 2023 SAR).

Steller sea lions are predatory and consume a wide range of prey, foraging and feeding primarily at night on over a hundred species of fish and cephalopods. Their diet varies in different parts of their range and at different times of the year, depending on the abundance and distribution of prey species (Gende and Sigler 2006, Womble and Sigler 2006, Womble et al. 2009). Steller sea lions prey on Pacific herring during winter, forage fish spawning aggregations during spring, and migrating salmon species during summer and fall (Womble et al. 2009, Lander et al. 2020).

[75] The Potential Biological Removal level is defined in the MMPA as "the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while still allowing that stock to reach or maintain its optimum sustainable population." For each stock, this level is determined using the product of three factors: 1) the minimum population estimate, 2) one-half the maximum theoretical or estimated net productivity rate of the stock at a small population size, and 3) a recovery factor ranging between 0.1 and 1. The recovery factor for the WDPS Steller sea lion stock is 0.1, the default value for all stocks listed as endangered under the ESA (NMFS 2016)

Steller sea lions are susceptible to a variety of threats including direct interactions with fishery operations and competition with fisheries for preferred prey items. Stellar sea lions were the most commonly reported marine mammal with human-caused injuries and mortalities with 476 interactions, resulting in 429 mortalities/serious injuries (Freed et al. 2023). The minimum estimated mean annual level of human-caused mortality and serious injury for the U.S. Steller sea lions between 2017 and 2021 is 39 Stellar sea lions (Young et al. DRAFT 2023 SAR). All U.S. commercial fishery-related reports of mortality and serious injuries of this stock came from U.S. commercial fishery observer or electronic monitoring data.

Additional information on Steller sea lion biology, status, and threats is available at:

Steller Sea Lion Species Description

Marine Mammal Stock Assessment Reports: Pinnipeds - Otariids

Interactions with Bering Sea Pollock Trawl Fisheries

From 2017 to 2021, 33 Steller sea lion mortalities were attributed to the BSAI pollock trawl fisheries (Freed et al. 2023). The BSAI pollock trawl fisheries may also indirectly affect Steller sea lions through competition for salmon and pollock.

6.1.9.4.1.2 Bearded Seal (Beringia DPS)

Bearded seals (*Erignathus barbatus spp.*) inhabit the seasonally ice-covered seas of the Northern Hemisphere, where they whelp and rear their pups and molt their coats on the ice in the spring and early summer. Bearded seals are boreoarctic species with circumpolar distribution (Fedoseev 1965; Johnson et al. 1966; Burns 1967, 1981; Burns and Frost 1979; Smith 1981; Kelly 1988). Two bearded seal subspecies are widely recognized: *E.b. barbatus* and *E.b. nauticus*, often described as inhabiting the Atlantic sector and the Pacific sector, respectively. Under the ESA, NMFS concluded that the *E. b. nauticus* subspecies consists of two DPSs, the Okhotsk DPS and the Beringia DPS, both of which were listed as threatened on December 28, 2012 (77 FR 76740). The primary threat to these populations is loss of sea-ice cover projected under climate change progression through the 21st century (Cameron et al. 2010). Only the Beringia DPS (which corresponds to the Beringia stock) occurs in US waters.

Bearded seals are strongly associated with sea ice. Male vocalizations have been detected year-round in areas with greater sea ice presence (>50%) (MacIntyre et al. 2013, 2015; Jimbo et al. 2019). In summer, adult bearded seals have been rarely observed hauled out on land and many follow the ice northward. Juveniles will sometimes remain near the coasts of the Bering and Chukchi seas rather than follow the retreating ice (Burns 1967, 1981; Heptner et al. 1976; Nelson 1981; Cameron et al. 2018).

Bearded seals primarily forage for demersal animals (those living on the seafloor) in water less than 650 feet deep. Bearded seals eat a variety of invertebrates (e.g., crab, shrimp, clams, snails) and some fish (e.g., sculpin, flatfish, cod).[76]

A reliable estimate of the entire Bering DPS population is not available. The portion of the population in US waters was estimated to be around 301,836 in 2012 (Conn et al. 2014). The minimum population estimate is 273,676 with a PBR of 8,210 seals. No population trend information is available. The minimum estimated mean annual level of human-caused mortality and serious injury for the portion of the Beringia bearded seal stock in U.S. waters between 2014 and 2018 is 6,709 seals, with just 1.8 seal mortalities or serious injuries per year attributed to U.S. commercial fisheries. The annual rate of 1.8 mortalities or serious injuries is less than 10% of the PBR and therefore can be considered insignificant.

Since 2011, NMFS has declared two unusual mortality events (UMEs) for ice seals in the Bering and Chukchi Seas in Alaska. The first UME (2011-2016) involved all four species of ice seals (bearded seals, as well as ringed, spotted and ribbon seals). The second was declared in 2019 after elevated numbers of

[76] *Bearded Seal (Erignathus barbatus)* (n.d.) Alaska Department of Fish and Game. Retrieved January 2, 2024, from https://www.adfg.alaska.gov/index.cfm?adfg=beardedseal.printerfriendly

stranded bearded seals, along with ringed and spotted seals, were found beginning in June 2018. This UME is no longer active, but remains open.Additional information on bearded seal biology, status, and threats is available at:

Bearded Seal Species Description (NOAA)

Marine Mammal Stock Assessment Reports: Pinnipeds - Phocids

June 1, 2018 Unusual Mortality Event

Interactions with Bering Sea Pollock Trawl Fisheries

From 2017 to 2021, three mortalities or serious injuries were directly attributed to the BSAI pollock trawl fishery (Freed et al. 2023). Further, bearded seals preferentially prey on invertebrates over fish species. As such, concerning levels of prey competition from the BS pollock trawl fishery is not expected.

6.1.9.4.1.3 Ringed Seal (Arctic stock)

Ringed seals (*Pusa hispada*) exhibit a circumpolar distribution and are found in all seasonally ice-covered seas of the Northern hemisphere, as well as certain freshwater lakes (King 1983). Five subspecies of ringed seals are currently recognized, all of which are listed under the ESA: 1) Arctic Ocean and Bering Sea, 2) Sea of Okhotsk and northern Sea of Japan, 3) northern Baltic Sea, 4) Lake Lagoda, Russia, and 5) Lake Saimaa, Finland.

The Arctic subspecies of ringed seal, which is the only ringed seal subspecies found in U.S. waters, was listed as threatened under the ESA on December 28, 2012 (77 FR 76706), and corresponds to the Arctic stock.

Although no accurate population estimate exists for Arctic ringed seals, it is estimated that there are more than 2 million Arctic ringed seals worldwide. The most recent stock assessment suggests a minimum population abundance of 158,507 Arctic ringed seals in US waters and PBR of 4,755 seals. There are no reliable data for trends in abundance.

Ringed seals are strongly associated with sea ice. During winter and early spring, when sea ice is at its maximal extent in Alaskan waters, ringed seals are abundant in the northern Bering Sea, Norton and Kotzebue Sounds, and throughout the Chukchi and Beaufort Seas. In years with extensive ice coverage, ringed seals can be found as far south as Bristol Bay but are generally not abundant south of Norton Sound except in nearshore areas (Frost 1985). However, surveys conducted in the Bering Sea in the spring of 2012 and 2013 documented numerous ringed seals in both nearshore and offshore habitat extending south of Norton Sound (87 FR 19234, *April 1, 2022*). Most ringed seals that winter in the Bering, Chukchi, and Beaufort seas are thought to migrate north in spring as seasonal ice melts and retreats (Burns 1970, Kelly et al. 2010) and spend summers in the northern Chukchi and Beaufort seas where pack ice and some nearshore ice remnants persist (Frost 1985, Kelly et al. 2010). During summer, Arctic ringed seals range hundreds to thousands of kilometers to forage along ice edges or in highly productive open-water areas (Harwood and Stirling 1992, Freitas et al. 2008, Kelly et al. 2010b, Harwood et al. 2015, Quakenbush et al. 2019, Von Duyke et al. 2020).

Ringed seals dive to depths of 150 feet or more while foraging for a wide variety of mostly small prey. While ringed seals are known to predate a wide range of species, typically no more than two to four species are considered important in any geographic location. Fishes of the cod family (including pollock) tend to dominate Arctic ringed seals' diet from late fall through spring, and crustaceans tend to become more important as sea ice recedes into summer.

Ringed seals are dependent on ice availability. Since 2011, NMFS has declared two unusual mortality events (UMEs) for ice seals in the Bering and Chukchi Seas in Alaska. The first UME (2011-2016) involved all four species of ice seals (bearded seals, as well as ringed, spotted and ribbon seals). The second was declared in 2019 after elevated numbers of stranded bearded seals, along with ringed and spotted seals, were found beginning in June 2018. This UME is no longer active, but remains open.

Additional information on ringed seal biology, status, and threats is available at:

Ringed Seal Species Description

Marine Mammal Stock Assessment Reports: Pinnipeds - Phocids

June 1, 2018 Unusual Mortality Event

Interactions with Bering Sea Pollock Trawl Fisheries

Ringed seal mortalities and serious injuries are rarely directly caused by BSAI pollock trawl fisheries. Between 2017 and 2021, one ringed seal mortality was attributed to the BSAI pollock trawl fishery (Freed et al. 2023). However, there is potential for indirect interactions with the fishery as ringed seals are known to prey on young pollock and salmon.

6.1.9.4.1.4 Humpback whale (multiple stocks)

Humpback whales (*Megaptera novaeangliae*) occur worldwide and migrate seasonally from high latitude, subarctic and temperate summering areas to low latitude, subtropical and tropical overwintering areas. Despite their vast migrations, humpback whales exhibit strong maternal site fidelity and therefore maintain genetically distinct population structure. NMFS recognizes 14 DPSs globally, with three of them occurring in the Bering Sea (81 FR 62260, *September 8, 2016*). The three DPSs found in the Bering Sea are 1) Western North Pacific DPS, 2) Hawaii DPS, and 3) Mexico DPS. The most recent SAR lists the Western North Pacific and Mexico DPSs as "endangered" and "threatened" under the ESA, respectively. Whales from these three DPSs overlap on feeding grounds off Alaska, and are visually indistinguishable unless individuals have been photo-identified on breeding grounds and again on feeding grounds. All waters off the coast of Alaska may contain ESA-listed humpbacks.

Between 2004 and 2006, a basin-wide study took place to estimate humpback whale populations. The study, known as SPLASH (Structure, Population Levels, And Status of Humpbacks), delivered abundance estimates of 1,340 for Russia, 7,758 for the Bering Sea and Aleutian Islands, 2,129 for the Gulf of Alaska, 5,890 for Southeast Alaska and northern British Columbia, and 347 for southern British Columbia (Wade et al. 2016, Wade 2021). These estimates are based solely on geography and do not distinguish between the stocks, which are well-known to overlap in these regions. This survey is now more than 15 years old and is a poor determinant of present population abundances. As such, the population trends of all three stocks are unknown. PBRs for the Western North Pacific DPS and Hawaii DPS are 0.2 and 127, respectively. The PBR for the Mexico DPSis unknown.

Humpback whales' primary threats are entanglement in fishing gear and vessel strikes.

Additional information on humpback whale biology, status, and threats is available at:

Humpback Whale Species Description

Marine Mammal Stock Assessment Reports: Cetaceans-Large Whales

Humpback Whale Critical Habitat

Interactions with Bering Sea Pollock Fisheries

Humpback whales have been known to be directly affected by the BSAI pollock trawl fishery. From 2017 to 2021, four humpback whale mortalities were reported in the BSAI pollock trawl fishery (Freed et al. 2023). Of these 4 mortalities, 3 were from the Western North Pacific DPS and 1 was from the Eastern North Pacific Alaska Resident stock. Humpback whales are unlikely to be indirectly affected by the fishery as they consume animals too small to be caught in the nets.

6.1.9.5 Non-ESA Listed Marine Mammals

6.1.9.5.1 Northern fur seal (Alaska stock)

Northern fur seals (*Callorhinus ursinus*) occur from southern California north to the Bering Sea and west to the Sea of Okhotsk and Honshu Island, Japan. During the summer breeding season, most of the worldwide population is found on the Pribilof Islands (St. Paul Island and St. George Island) in the southern Bering Sea with the remaining rookeries being found in Russia, on Bogoslof Island in the southern Bering Sea, on San Miguel Island off southern California (Lander and Kajimura 1982, NMFS 2007), and on the Farallon Islands off central California. Northern fur seals spend the summer and fall foraging within about 230 km (lactating females, Robson et al., 2004) and 360 km (juvenile males, Sterling and Ream 2004) of their breeding islands on the Pribilof Islands. They migrate from their breeding islands in the winter and spend the remainder of the year at sea until returning to their breeding islands. Non-breeding northern fur seals may occasionally haul out on land at other sites in Alaska, British Columbia, and on islets along the west coast of the United States (Fiscus 1983). Two stocks of northern fur seal are recognized within U.S. waters, an Eastern Pacific stock and a California stock. The Eastern Pacific stock occupies the Bering Sea, overlapping with the pollock A and B seasons, while males from all stocks intermix in the Bering Sea and North Pacific during the winter and spring.

The most recent estimate of the Eastern Pacific stock is 626,618 northern fur seals, based on pup production estimates from major rookeries in the eastern Bering Sea. The minimum population estimate is 530,376 northern fur seals. Recent population trends are inferred by opportunistic pup production counts across rookeries (St. Paul, Sea Lion Rock, St. George, and Bogoslof). Temporary increases in the overall stock size are observed when opportunistic estimates are conducted at Bogoslof, but declines at the larger Pribilof colony (specifically St. Paul) continue to drive the overall stock estimate down over time. Recent (20-year and 10-year) trends in pup production were fit using agTrend (Johnson and Fritz 2014). Estimated pup production for the Eastern Pacific stock has been declining at 1.80% (95% CI: -2.36 to -1.19) per year from 1999 to 2019 but only at 0.55% (not significantly different from 0) per year from 2009 to 2019. The PBR for Northern fur seals in Alaska is 11,403 northern fur seals.

Based on currently available data, the minimum estimate of the mean annual U.S.-commercial fishery-related mortality and serious injury for this stock (3.5 northern fur seals) is less than 10% of the calculated PBR (Young et al. 2023).

Northern fur seals are generalist or opportunistic foragers, consuming a wide variety of fish and squid species. Along the Bering Sea shelf, pollock comprise most of the northern fur seal diet. Recent diet studies indicate that fur seals consume both juvenile and mature pollock (Gudmundson et al., 2006; Zeppelin and Ream, 2006; Call and Ream, 2012). During the summer and fall while in the Bering Sea, male and female northern fur seals are central place foragers that segregate their use of marine habitats based on the rookeries where they were born (Robson et al. 2004; Sterling and Ream 2004). Gender and age-structured bioenergetic models found that at a population level, Alaskan northern fur seals consumed 41.4% to 76.5% pollock by weight (McHuron et al. 2020). Furthermore, interannual variation in pollock prey size was driven largely by the availability of juvenile fish. In years with poor age-1 pollock recruitment, up to 81% of pollock biomass in fur seal diet came from mature pollock (age 1+) (McHuron et al. 2020). As they forage off of the shelf, northern fur seals consume greater amounts of oceanic fish and squid species. Other primary prey include Pacific sand lance, Pacific herring, Northern smoothtongue, Atka mackerel, and Pacific salmon. The northern fur seal diet differs depending on geographic area and time of year.

Northern fur seals, like all marine mammals, are protected under the Marine Mammal Protection Act, but have additional protections under the Fur Seal Act. Additional information on fur seal biology, status, and threats is available at:

Northern Fur Seal Species Description

Marine Mammal Stock Assessment Reports: Pinnipeds - Otariids

Interaction with Bering Sea Pollock Trawl Fisheries

While northern fur seals have been observed with significant injuries due to entanglement with unknown discarded fishing gear and marine debris, no mortalities or serious injuries reported between 2017 and 2021 were attributable to the BSAI pollock trawl fishery (Freed et al. 2023). However, because pollock comprises a large portion of the northern fur seal diet, and to a lesser extent Pacific salmon, indirect effects from the pollock trawl fishery could occur.

6.1.9.5.2 Harbor seal (Pribilof Islands and Bristol Bay stocks)

Harbor seals (*Phoca vitulina*) live in coastal and estuarine waters ranging from Baja California north along the coast of North America, into the Bering Sea and north to the Pribilof Islands. Harbor seals are generally non-migratory, moving locally with factors such as tides, weather, season, food availability, and reproduction (Scheffer and Slipp 1944; Fisher 1952; Bigg 1969, 1981; Hastings et al. 2004). Satellite tagging studies in Southeast Alaska, Prince William Sound, Kodiak Island, and Cook Inlet also support the theory that harbor seals are non-migratory (Swain et al. 1996; Lowry et al. 2001; Small et al. 2003; Boveng et al. 2012), though a few studies have found some long distance movements in Alaska (Pitcher and McAllister 1981; Lowry et al. 2001; Small et al. 2003; Womble 2012; Womble and Gende 2013).

Depending on prey availability, harbor seals complete shallow and short dives to forage for fish, shellfish, and crustaceans. Common prey species in Alaska include walleye pollock, Pacific cod, capelin, Pacific herring, sandlance, Pacific salmon, sculpin, flatfish, octopus, and squid.

In 2002, a genomic analysis identified 12 demographically independent clusters of harbor seals within Alaska (Westlake and O'Corry-Crowe 2002). In 2010, NMFS and the Alaska Native Harbor Seal Commission formally identified 12 stocks of harbor seals in Alaska, up from the previously recorded three stocks (Bering Sea, Gulf of Alaska, and Southeast Alaska). Of relevance to this analysis, the stocks that occur in the BS are the Pribilof Islands and Bristol Bay stocks. In 2017, the Bristol Bay stock was estimated to contain 44,781 harbor seals. The current 8-year estimate of the Bristol Bay stock's population trend is +1,127 seals per year, with a low probability of stock decrease, 0.218. In 2018, a survey of Pribilof Islands harbor seals onshore indicated 229 individuals, with no correction factor for seals in the water. The Pribilof Islands population trend is also unknown.

The minimum estimated mean annual level of human-caused mortality and serious injury for all harbor seal stocks between 2013 and 2017 is 1,135 harbor seals: 32 in U.S. commercial fisheries, 0.4 in unknown (commercial, recreational, or subsistence) fisheries, 3.7 due to other causes (illegal shooting, entanglement in ADF&G research trawl gear), and 1,099 in the Alaska Native subsistence harvest. Harbor seals are also taken in Alaska Native subsistence harvest which has been estimated by the Alaska Native Harbor Seal Commission (ANHSC) and the Alaska Department of Fish and Game (ADFG). The most recent 5-years of harvest data (2004-2008) show that no harbor seals were harvested in the Pribilof Islands and 141 seals were harvested in Bristol Bay.

The PBR for the Pribilof Islands and Bristol Bay stocks are 7 seals and 1,607 seals, respectively, and the mean annual level of human-caused mortality and serious injury does not exceed PBR for either stock.

Additional information on harbor seal biology, status, and threats is available at:

Harbor Seal Species Description

Marine Mammal Stock Assessment Reports: Pinnipeds - Phocids

Interactions with Bering Sea Pollock Trawl Fisheries

Between 2013 and 2017, the BSAI pollock trawl caused 1 observed harbor seal mortality (with 98-99% observer coverage each year) and had a mean estimated annual mortality of 0.2. From 2017 to 2021, just one harbor seal mortality was attributed to the BSAI pollock trawl fishery (Freed et al. 2023). Harbor seals also occur closer to shore, reducing the likelihood of directly interacting with the pollock trawl fishery. However, the potential for competition with the BSAI pollock trawl fishery exists as harbor seals often consume pollock and salmon.

6.1.9.5.3 Ribbon seal (Alaska stock)

Ribbon seals (*Histriophoca fasciata*) in Alaska range from the North Pacific ocean and Bering Sea into the Chukchi and western Beaufort Seas. Ribbon seals are ice seals and as such are very rarely seen on shorefast ice or land. From late March to early May, ribbon seals inhabit the Bering Sea ice front (Burns 1970, 1981; Braham et al. 1984). The seals tend to be most abundant in the northern part of the ice front in the central and western parts of the Bering Sea (Burns 1970; Burns et al. 1981). As ice recedes with seasonal warming, ribbon seals move further north, into the Bering Sea, where they haul out on the receding ice edge (Burns 1970, 1981; Burns et al. 1981). As the ice melts further, the seals become more concentrated, with some moving to the Bering Strait and part of the Chukchi Sea.

NMFs considers only the portion of the Arctic ribbon seal stock that inhabits US waters, hereafter referred to as the Alaska stock. The most recent minimum population estimate of Alaskan ribbon seals is 163,086 during the spring season, in US waters. There are no reliable population trend estimates available. The PBR for ribbon seals is 9,785.

Ribbon seals forage for a wide variety of crustaceans (shrimp, mysiids, crabs) and cephalopods (mostly squid) but predominantly consume fish. Prey fish species include walleye pollock, arctic and saffron cod, eelpout, capelin, Greenland halibut, pricklebacks, herring and sandlance[77].

The minimum estimated mean annual level of human-caused mortality and serious injury for the portion of the ribbon seal stock in U.S. waters between 2014 and 2018 is 163 seals: 0.9 in U.S. commercial fisheries and 162 in the Alaska Native subsistence harvest. This mortality rate is much lower than the PBR estimate (9,785 seals) and is therefore not a concern for population persistence.

Ribbon seals have been declared under a UME (along with bearded seals, ringed seals, and spotted seals) since June 1, 2018 when elevated numbers of ice seal strandings were observed. This UME is no longer active but remains open. Additional information on ribbon seal biology, status, and threats is available at:

Ribbon Seal Species Description (NOAA)

Marine Mammal Stock Assessment Reports: Pinnipeds - Phocids

June 1, 2018 Unusual Mortality Event

Interactions with Bering Sea Pollock Trawl Fisheries

The proposed alternatives are not likely to have an effect on direct impacts to ribbon seals, as only one ribbon seal mortality (2014 to 2018) has been attributed to the BSAI pollock trawl fishery. No mortalities or serious injuries to ribbon seals caused by the Bering Sea pollock trawl were reported from 2017 to 2021 (Freed et al. 2021). However, ribbon seals could be indirectly affected by BSAI pollock trawl fisheries through competition for pollock prey.

6.1.9.5.4 Spotted seal (Bering DPS)

Spotted seals (*Phoca largha*) are grouped into three DPSs: 1) the Bering DPS, 2) the Okhotsk DPS, and 3) the Southern DPS. Only the Bering DPS is found within U.S. waters, bounded by the U.S. EEZ. Spotted seals move seasonally according to life-history events. In the late-fall through spring, whelping, nursing, breeding, and molting occur in association with the presence of sea ice on which the seals haul out. When the seasonal ice melts in summer through fall, spotted seals use land for hauling out (Bovenge et al. 2009; Citta et al. 2018). Satellite tagging studies found that seals tagged in the Chukchi Sea moved

[77] *Ribbon Seal* (2008). Alaska Department of Fish and Game. Retrieved January 2, 2024, from https://www.adfg.alaska.gov/static/education/wns/ribbon_seal.pdf

south in October, passing into the Bering Sea sometime in November. Seals overwintered in the Bering Sea, making east-west movements along the ice edge (Lowry et al. 1998). During spring, the seals seem to prefer smaller ice floes and mainly stick to the southern margin of the ice in areas with water depth less than 200 meters, moving to coastal habitats after molting and the retreat of sea ice (Fay 1974; Shaughnessy and Fay 1977; Lowry et al. 2000; Simpkins et al. 2003). Along the western Alaska coast, spotted seals are known to occur around the Pribilof Islands, Bristol Bay, and the eastern Aleutian Islands.

Spotted seals closely resemble harbor seals and the two species are often seen near each other in the southern part of the Bering Sea, though spotted seals are more strongly associated with sea ice.

Spotted seals forage for a variety of crustaceans, cephalopods, and fish with variability according to age, location, and time of year. In the northern Bering Sea, Arctic cod are a large component of spotted seal diet with pollock and capelin becoming more important in the southern Bering Sea.

The minimum population estimate for spotted seals in the U.S. portion of the Bering Sea in spring is 423,237. There is no available data to report a population trend in spotted seals. The minimum estimated mean annual level of human-caused mortality and serious injury for the portion of the Bering Sea stock in U.S. waters between 2014 and 2018 is 5,254 seals, less than the PBR of 25,394 seals. Of those average annual mortalities, just one was attributed to U.S. commercial fisheries.

Elevated numbers of ice seal strandings have occurred in the Bering and Chukchi Seas in Alaska and NMFS declared an UME for bearded seals, ringed seals, and spotted seals from June 1, 2018. Spotted seals are susceptible to climate change-induced long-term habitat loss and modification (Boveng et al. 2009). The 2018 UME is no longer active but remains open.

Additional information on spotted seal biology, status, and threats is available at:

Spotted Seal Species Description

Marine Mammal Stock Assessment Reports: Pinnipeds - Phocids

June 1, 2018 Unusual Mortality Event

Interaction with Bering Sea Pollock Trawl Fisheries

From 2017-2021, no spotted seal mortality or serious injury (M/SI) events have been attributed to the BSAI pollock trawl fishery. However, because pollock comprises a large portion of spotted seal diet in the southern Bering Sea, indirect effects from the pollock trawl fishery could occur.

6.1.9.5.5 Killer whale (multiple stocks)

NMFS recognizes three stocks of killer whales (*Orcinus orca*) occurring in Bering Sea waters: 1) the Eastern North Pacific Alaska Resident; 2) the Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea Transient, and 3) Eastern North Pacific Northern Resident. The most recent SAR acknowledges that NMFS has genetic information suggesting that the current stock structure in Alaska needs to be reassessed (Parsons et al. 2013). This genetic information is under ongoing evaluation, along with other available data to inform whether a stock structure revision is necessary and how that would be implemented.

Population estimates for killer whale stocks in Alaska rely largely on counts on photographically identifiable whales. The minimum population estimates across the stocks are as follows: 1) 1,920 whales in the Eastern North Pacific Alaska Resident stock; 2) 587 whales in the Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock, and 3) 302 whales in the Eastern North Pacific Northern Resident stock. No reliable trend data is available for the Alaska Resident stock or the transient stock. Eastern North Pacific Northern Resident killer whale population growth rates have slowed over the past five census years, from 5.1% in 2014 to -0.3% in 2018 (Fisheries and Oceans Canada 2019). The PBR for the Northern Resident stock is the most sensitive (2.2 whales) while the Alaska Resident stock is the most robust (19 whales). The transient stock PBR is 5.9 whales.

Killer whales occur in a wide range of habitats, in both open seas and coastal waters. Killer whales are highly social, and most live in social groups called pods (groups of maternally related individuals seen together more than half the time). Individual whales tend to stay in their natal pods. Pods typically consist of a few to 20 or more animals, and larger groups sometimes form for temporary social interactions, mating, or seasonal concentrations of prey.

Killer whales rely on underwater sound to feed, communicate, and navigate. Pod members communicate with each other through clicks, whistles, and pulsed calls. Each pod in the eastern North Pacific possesses a unique set of calls that are learned and culturally transmitted among individuals. These calls maintain group cohesion and serve as family badges.

Although the diet of killer whales depends to some extent on what is available where they live, it is primarily determined by the culture (i.e., learned hunting tactics) of each ecotype. For example, one ecotype of killer whales in the U.S. Pacific Northwest (called Residents) exclusively eats fish, mainly salmon, and another ecotype in the same area (Transients or Bigg's killer whales) primarily eat marine mammals and squid. Killer whales often use a coordinated hunting strategy and work as a team to catch prey. They are considered an apex predator, eating at the top of the food web.

Killer whales are vulnerable to entanglement in fishing gear, prey limitations due to habitat loss and overfishing, contaminants such as wastewater treatment plants, sewer outfalls, and pesticide application, oil spills and disturbance from vessels and sound.

Additional information on killer whale biology, status, and threats is available at:

Killer Whale Species Description

Marine Mammal Stock Assessment Reports: Cetaceans-small whales

Interaction with Bering Sea Pollock Fisheries

While the majority (54%) of killer whale serious injury and mortality events are caused by trawl net fisheries, only 1 mortality (Alaska Resident) from 2017 to 2021 was attributed to the BSAI pollock trawl fishery (Bolling et al. 2023). Most recently, one killer whale entanglement (also an Alaska Resident whale) resulting in a serious injury in the summer of 2023[78] was in the BSAI pollock trawl fishery. This take in 2023 did not result in exceedance of the PBR for the Alaskan Resident stock. Killer whales may also indirectly interact with the fishery through competition for preferred salmon prey.

6.1.9.5.6 Pacific white-sided dolphin (North Pacific)

For the MMPA stock assessment reports, Pacific white-sided dolphins within the Pacific U.S. Exclusive Economic Zone are divided into two discrete, non-contiguous areas: 1) waters off California, Oregon and Washington, and 2) Alaskan waters, commonly referred to as the North Pacific stock. This report considers the effects of the proposed alternatives on the North Pacific stock of Pacific white-sided dolphins.

The most recent population estimate of the North Pacific stock is based on surveys conducted during the 1987 to 1990 period. The current abundance estimate of Pacific white-sided dolphins in Alaskan waters is unknown. With no reliable population estimates, there is also no reliable information on trends in abundance. No PBR is available without a minimum population estimate.

Pacific white-sided dolphins forage mostly on small, schooling fish species such as anchovy, herring, and capelin. Squid are also a large component of the Pacific white-sided dolphin diet. Most preferred prey are concentrated in midwater depths, also known as the "deep scattering layer", and are known to use

[78] Press release available at: https://www.fisheries.noaa.gov/feature-story/cause-death-determined-11-killer-whales-incidentally-caught-fishing-gear-alaska-2023

cooperative foraging strategies. Pacific white-sided dolphins are often seen at dawn and dusk, feeding on surface bait balls, often in the company of gulls[79].

Pacific white-sided dolphins have historically been severely threatened by commercial fisheries but changes to fisheries management have dramatically reduced the impacts of fishing efforts on their persistence. There is no subsistence fishery for Pacific white-sided dolphins in Alaska.

Additional information on Pacific white-sided dolphin biology, status, and threats is available at:

Pacific White-sided Dolphin Species Description

Marine Mammal Stock Assessment Reports: Cetaceans-Dolphins

Interactions with the Bering Sea Pollock Fisheries

From 2017 to 2021, two M/SI events of Pacific white-sided dolphins were attributed to thee BSAI pollock trawl fishery (Freed et al. 2023). It is unlikely that Pacific white-sided dolphins would be indirectly affected by the BSAI pollock trawl fishery through prey competition.

6.1.9.5.7 Harbor Porpoise (Bering Sea stock)

Harbor porpoises (*Phocoena phoecena*) in the United States are not endangered or threatened. Harbor porpoises in the eastern North Pacific Ocean range from offshore areas of the Chukchi Sea, along the Alaska coast, and down the west coast of North America to Point Conception, California (Gaskin 1984, Christman and Aerts 2015). The average density of harbor porpoise in Alaska appears to be less than that reported off the west coast of the continental U.S., although areas of high densities do occur in Glacier Bay and the adjacent waters of Icy Strait, Yakutat Bay, the Copper River Delta, Sitkalidak Strait (Dahlheim et al. 2000, 2009, 2015; Hobbs and Waite 2010; Castellote et al. 2015), and lower Cook Inlet (Shelden et al. 2014). In previous SARS, three harbor porpoise stocks were recognized in Alaska: 1) the Southeast Alaska stock, 2) the Gulf of Alaska stock, and 3) the Bering Sea stock. The Bering Sea stock is considered in this report. Recent genomic studies indicate that there are actually several stocks with discrete ranges in Southeast Alaska. The Bering Sea stock remains the same and is the the only stock considered in this report.

The most recent minimum population estimate for the Bering Sea harbor porpoise stock (5,713) is based on a 2008 aerial survey of a small portion of the stock's range. The current stock size and population trend are considered unknown. The PBR is also unknown.

Harbor porpoises feed on schooling fishes such as cod, herring, pollock, sardines, and whiting, as well as squid and octopus. They usually feed individually, consuming approximately 10% of their body weight each day. In general, harbor porpoises are often seen alone, but at times form small groups of less than ten individuals. They are shy animals and rarely show curiosity towards vessels and at times will actively avoid them. The harbor porpoise will occasionally "porpoise" out of the water, but generally they surface to breathe in a slow, gentle roll. Diving for an average of four minutes, they are frequent and shallow divers, although they have been observed diving to depths of up to 200 feet.

Harbor porpoise are mostly found in nearshore areas and inland waters, including bays, tidal areas, and river mouths (Dahlheim et al. 2000, 2009, 2015; Hobbs and Waite 2010). As a result, harbor porpoise are vulnerable to physical modifications of nearshore habitats resulting from urban and industrial development (including waste management and nonpoint source runoff) and activities such as construction of docks and other over-water structures, filling of shallow areas, dredging, and noise (Linnenschmidt et al. 2013). Harbor porpoises are also vulnerable to interactions with fishing gear and

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[79] *Pacific White-sided Dolphin (Lagenorhynchus obliquidens) Species Profile*. (n.d.). Alaska Department of Fish and Game. Retrieved January 31, 2024, from https://www.adfg.alaska.gov/index.cfm?adfg=pacificwhitesideddolphin.main

algal toxins are a growing concern in Alaska marine food webs, in particular the neurotoxins domoic acid and saxitoxin. . Predation by large sharks, dolphins and killer whales is also of concern.

Additional information on harbor porpoise biology, status, and threats is available at:

Harbor Porpoise Species Description

Marine Mammal Stock Assessment Reports: Cetaceans-Porpoises

Interaction with Bering Sea Pollock Fisheries

No (M/SI) events of harbor porpoises were attributed to the BSAIpollock trawl fisheries from 2017 to 2021 (Freed et al. 2023). However, because harbor porpoises are known to feed on pollock, there is some potential for indirect interactions with the BSAI pollock trawl fishery.

6.1.9.5.8 Beluga whale (multiple stocks)

Five stocks of Beluga whales are recognized in Alaska: 1) Cook Inlet (ESA-listed Endangered), 2) Bristol Bay, 3) Eastern Bering Sea, 4) Eastern Chukchi Sea, and 5) Beaufort Sea. Three of the stocks (Beaufort Sea, Eastern Chukchi Sea, Eastern Bering Sea, and Bristol Bay) spend time in the Bering Sea and are considered in this report. These three stocks overwinter in the Bering Sea and summer in the Beaufort Sea (Beaufort Sea and Eastern Chukchi Sea stocks) and Bering Sea (Eastern Bering Sea and Bristol Bay stocks). Genomic analyses indicate minimal mixing between stocks (O'Corry-Crowe et al. 2018).

The sources of information to estimate abundance for beluga whales have included both opportunistic and systematic observations. The minimum population estimates for the three Beluga whale stocks considered in this report are as follows: 1) Beaufort Sea (32,453 whales), 2) Eastern Chukchi Sea (8,875 whales), and 3) Eastern Bering Sea (11,112 whales). However, these population estimates are all over 6 years old and potentially biased by spatial overlap of the stocks. The population trends of these stocks are considered unknown in US stock assessments (link below). The PBR is also unknown.

Beluga whales are harvested by Alaska Natives and Canadian Inuvialit. Threats to Beluga whales include stranding, sea ice entrapment, underwater noise pollution, contaminants, and climate change progression – particularly as it relates to warming and seasonal sea ice.

Beluga whales use their well-developed vision and echolocation to navigate their environment in search of prey[80]. Beluga whales eat a varied diet consisting of octopus, squid, shrimp, clams, snails, and sandworms. They also consume a variety of fish species including salmon, smelt, cod, herring, capelin, and flatfish.

More information on Beluga whale biology, status, and threats is available at:

Beluga Whale Species Description

Marine Mammal Stock Assessment: Cetaceans-Small Whales

Interactions with Bering Sea Pollock Fisheries

No (M/SI) events of beluga whales were attributed to the BSAI pollock trawl fishery from 2017 to 2021 (Freed et al. 2023). However, beluga whales may be indirectly affected by the BSAI pollock trawl fishery through competition for salmon and pollock.

6.1.9.6 Effects of the Alternatives

A complete list of all marine mammals occurring in the Bering Sea and potential for fishery interactions is available in Table 6-22. The subset of marine mammal stocks described above are known to have direct and/or indirect interactions with the BSAI pollock trawl fishery. Direct interactions with the fishery are

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[80] *Beluga Whale (Delphinapterus leucas) Species Profile* (n.d.) Alaska Department of Fish and Game. Retrieved January 2, 2024, from https://www.adfg.alaska.gov/index.cfm?adfg=beluga.main

most commonly in the form of entanglement in fishing gear, whereas indirect interactions are mainly from prey competition.

The BSAI pollock trawl fishery is a 100% observed fishery. As such, there is a high degree of certainty that observed direct interactions of marine mammals with the BSAI pollock trawl fishery are representative of total interactions. Indirect interactions, specifically prey competition are harder to quantify, as indirect interactions can be mediated by other processes (e.g., trophic interactions, population dynamics) and are not so clearly connected to fishing. Reduced food availability could be driven by a range of factors including environmental variability, population dynamics, and fishery competition. Furthermore, most marine mammals occurring in the Bering Sea (Table 6-22) are known to consume a wide variety of prey species.

For purposes of discussing the potential effects of each alternative, we are assuming that increases in fishing effort would have commensurate increases in direct interactions with marine mammals, and similarly decreases in fishing effort would have commensurate decreases in direct interactions with marine mammals. Indirect effects on prey availability for marine mammals with increasing or decreasing fishing levels are not as linear as direct effects, but generally speaking for marine mammals that rely on pollock or chum salmon to meet metabolic needs, large changes in allowed TAC for the BS pollock trawl fishery will affect overall metabolic energy budgets for these marine mammals.

Alternative 1. Managing the Bering Sea pollock B season at status quo would not be expected to change status quo impacts to marine mammals.

6.1.9.6.1 Effects of Reasonably Foreseeable Future Actions

This section considers cumulative effects from reasonably foreseeable fishing and non-fishing actions (RFFAs) on marine mammals in the EBS analysis area.

Effects of Future Fisheries Changes:

Of the federal fisheries operating in the BSAI, the sablefish and turbot fisheries are expected to change in future years. The sablefish fishery has been steadily changing the gear used, as boats have switched from hook-and-line gear to longline pot gear. The Bering Sea Greenland turbot hook-and-line fishery is currently under consideration to allow the use of longline pot gear.[81] While switching the turbot fishery from hook-and-line to longline pot gear is motivated by prolific whale depredation of baited hooks, marine mammals are rarely taken in the fishery; from 2017 to 2021, no (M/SI) events were reported (Freed et al. 2023). Similarly, no marine mammal mortalities were reported under the sablefish hook-and-line fishery and one sperm whale mortality was observed under longline pot gear (2017-2021; Freed et al. 2023). Reduced marine mammal interactions with the sablefish and turbot fisheries are not expected to result in a noticeable decline in (M/SI) events because these fisheries already had very low take rates. Furthermore, these changes are less likely to affect species that remain close to shore as the sablefish and turbot fisheries occur offshore. Generally, as more fisheries change to pot gear it is expected that there will be a slight reduction in the number of marine mammals taken in fisheries as marine mammals interact less with pot gear than hook-and-line gear (Tide and Eich, 2022).

Marine Debris:

The most commonly observed interaction between marine mammals and marine debris is through entanglement, often from packing bands or in remnants of fishing gear that has been discarded or lost. Marine debris may also affect marine mammals through ingestion, but this is less commonly observed as

[81] Advisory Panel. Motions and Rationale, April 5-7, 2023. Available at: https://meetings.npfmc.org/CommentReview/DownloadFile?p=0aec0e2d-5e09-4891-9d47-dcba912e8410.pdf&fileName=C5%20AP%20Report.pdf

without necropsy, this cannot be confirmed. While there are numerous marine debris cleanup efforts, with the continued world wide use of plastics means this threat is likely to persist into the future.

Climate change:

The eastern Bering Sea experienced multi-year periods of warm or cold conditions of varying durations and magnitudes since the year 2000 (Siddon et al. 2023). The recent warm period (2014-2021) was unprecedented in magnitude and duration. There was a near-absence of sea ice during two winters (2017/18 and 2018/19) and dramatically reduced cold pool extent in the subsequent summers (2018 and 2019). Some marine mammals (bearded seals, ringed seals, spotted seals, ribbon seals) are directly impacted by changing temperatures and sea ice extent, while others are indirectly affected, through prey availability. Climatological shifts in the BSAI are also linked to changes in the distribution and abundance of fish and crab stocks. The recent warm period drove increased recruitment in sablefish, herring, and Bristol Bay sockeye salmon and declines in other snow crab, Bristol Bay red king crab, and multiple Western Alaska salmon runs (Siddon et al. 2023). Future warming may negatively affect marine mammals that rely on fish and invertebrates that do not respond well to warming temperatures.

Vessel traffic:

With climate change progression, shipping routes through the Arctic could be accessible for longer periods of time, potentially remaining open through the winter season in some years. These opportunities for global shipping could lead to increased vessel traffic through the Bering Sea.[82] Some marine mammals – for example, large whales – are more prone to vessel strike incidences than other marine mammal species, whereas others are more sensitive to noise or the disturbance caused by passing vessels (ie. hauled out seals).

Harmful Algal Blooms:

Harmful Algal Blooms (HABs) may also become more prevalent as oceanographic conditions in the Bering Sea continue to change. HABs may be caused by a diverse array of organisms including certain phytoplankton species (e.g., *Alexandrium catenella*), cyanobacteria, benthic algae, and macroalgae.[83] Historically, the waters of western and northern Alaska were considered too cold for the germination and growth of harmful algae. With ongoing warming in the Arctic associated with climate change progression, HABs have been documented with increasing frequency and magnitude in Alaskan waters.[84] HABs produce toxins which concentrate in the tissues of lower trophic level organisms like shellfish as they consume the algae. As the toxins travel up the food chain, they may be consumed by marine mammals and humans, causing a fatal condition known as paralytic shellfish poisoning. HABs are expected to become a greater issue in the Bering Sea as conditions continue to warm.[85]

Any or all of these RFFAs may cumulatively lead to declines in marine mammal populations, which could have adverse impacts to subsistence communities reliant upon marine mammals for food, trade, culture, and overall well-being. However, status quo conditions have resulted in marine mammal populations that are, in general, stable to increasing.

Considering the potential 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

[82] Jenessa Duncomb. July 6, 2022. Arctic Shipping Routes are Feeling the Heat. Accessible via: https://eos.org/articles/arctic-shipping-routes-are-feeling-the-heat.
[83] National Ocean Service NOAA. Harmful Algal Blooms. Available at: https://oceanservice.noaa.gov/hazards/hab/
[84] Sea Grant Alaska. Harmful Algal Blooms in Alaska. Available at: https://alaskaseagrant.org/our-work/harmful-algal-blooms/
[85] National Centers for Coastal Ocean Science. New Study Finds Growing Potential for Toxic Algal Blooms in Alaska Arctic. Published October 5, 2021. Available at: https://coastalscience.noaa.gov/news/new-study-finds-growing-potential-for-toxic-algal-blooms-in-the-alaskan-arctic/

the impacts of the RFFAs described in this section, the impacts of the proposed action are determined to be minimal.

6.1.10 Sector Participation and Revenue Dependence on Bering Sea Pollock

Section 2 of this analysis provides an overview of the Bering Sea Pollock fishery, including recent participation by sector (Table 2-3), pollock landing (Table 2-4), prosecution of the TAC (Table 2-5) and B season harvest levels (Table 2-6). In addition, Table 6-23 and Table 6-24 below demonstrate the gross ex-vessel and first wholesale revenue associated with the pollock B season fishery. As explained in Section 5.3, although ex-vessel price (i.e., the market price paid to fishermen for their catch when it is delivered to a processor) is the better metric to use for understanding the impact of the B season fishery for inshore CVs and the first wholesale price (i.e., the market price of the primary processed fishery product when sold by a processor to an entity outside of their affiliate network) is the better metric to understand the full impact of the B season fishery for these entities, this analysis provides both metrics (using the methods described in Section 5.3) in order to allow the reader to compare across sectors. Similar to the values presented in Appendix 6, these values include revenue from any other marketable groundfish species that is caught incidentally to pollock.

Table 6-23 Gross ex-vessel revenue (in millions of 2022 $) for groundfish harvested during the B season pollock fishery by sector, 2011-2022

Year	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*
CDQ	$30.3	$34.3	$31.0	$32.2	$32.0	$29.7	$26.6	$29.7	$28.9	$23.6	$28.3	$27.5
CP	$114.9	$119.3	$108.2	$111.1	$112.0	$104.4	$95.0	$103.6	$103.0	$92.6	$98.2	$94.3
Inshore	$137.8	$149.2	$135.0	$139.2	$140.8	$128.9	$121.3	$134.7	$128.3	$124.1	$125.7	$118.3
Mothership	$30.1	$29.8	$27.2	$27.6	$27.8	$25.6	$23.3	$26.1	$25.4	$25.4	$24.8	$24.0
Total	$313.0	$332.6	$301.4	$310.0	$312.5	$288.6	$266.1	$294.1	$285.7	$265.7	$277.0	$264.1

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

Table 6-24 Gross first wholesale revenue (in millions of 2022 $) for groundfish harvested during the B season pollock fishery by sector, 2011-2022

Year	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*
CDQ	$103.3	$111.6	$95.4	$98.9	$100.8	$104.3	$97.3	$92.6	$103.6	$76.6	$91.1	$85.1
CP	$391.6	$387.7	$333.5	$343.4	$352.2	$366.2	$346.3	$321.5	$366.7	$298.4	$314.7	$291.9
Inshore	$412.7	$441.9	$395.0	$407.1	$381.3	$397.7	$354.3	$387.1	$413.2	$333.7	$352.9	$346.2
Mothership	$102.6	$96.0	$83.8	$85.4	$87.6	$90.3	$85.5	$81.3	$90.1	$81.2	$79.1	$74.5
Total	$1,010.2	$1,037.2	$907.8	$934.8	$922.0	$958.5	$883.3	$882.4	$973.7	$789.9	$837.7	$797.8

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

The remainder of this section provides additional elements of the current economic dynamics that may be relevant for understanding the potential impacts of the action alternatives relative to status quo. Specifically, this section provides additional context on the revenue diversification for the AFA sectors, a description of CDQ investments into AFA vessels, and recent pollock products and market conditions. It concludes with a description of the impacts of status quo for the Bering Sea pollock sector.

6.1.10.1 Revenue Diversification for AFA Sectors

In addition to BS pollock, AFA vessels may rely on a number of other fisheries. An AFA vessel's relative reliance on BS pollock can be meaningful when considering the proposed actions, as some vessels may have a greater opportunity to shift their effort to a different fishery should their B season for pollock be constrained or should the risks associated with chum PSC motivate vessel consolidation.

However, AFA vessels can be constrained in how they are able to diversify. When AFA was implemented, it included a wide array of sideboards. Sideboards are often put in place during the rationalization of a fishery to limit the expansion of the rationalized fleet (which may occur when vessels are ‘freed-up’ due to the consolidated harvest in the rationalized fishery). There is a risk these vessels could move into other unrationalized fisheries, which could otherwise have unintended consequences for the historical participants in the unrationalized fisheries. AFA included sideboards in non-pollock groundfish, crab, and scallop fisheries in the BSAI and GOA that apply to vessels differently based on their previous activity in these non-pollock fisheries. A through illustration of AFA sideboards and trends in participation is included through 2015 in the AFA Program Review (Northern Economics 2017) which is scheduled to be updated for the upcoming program review.

Overall, the AFA CV fleet is more diversified in other fisheries than the CP fleet. However, there is wide variation among vessels from both fleets, in part due to their status relative to the AFA sideboards. Table 6-25 demonstrates the CV sectors’ gross revenue dependence on B season pollock, relative to all other sources of fisheries revenue. On average (2011-2022), 55% of the CVs have generated 40-60% of their total annual fisheries revenue from B season pollock. Some AFA CVs do not participate in the B Season (an average of 9.6 vessels between 2011-2022 earning <0.1% of their total revenue on B season) and very rarely do CVs generate all of their revenue from B season pollock (an average of 0.75 vessels earning 90-100% of their revenue). However, typically about one half of the CVs generate >90% of their annual revenue from AFA pollock fishing (Table 6-26). Of the remaining diversified vessels, there is participation in BSAI Pacific cod trawl fishing (these vessels will be part of the newly implemented Pacific Cod Trawl Cooperative, PCTC Program), the Central GOA Rockfish Program, and other GOA fisheries such as pollock and flatfish. In addition, some of the AFA CVs earn revenue fishing in the U.S. west coast (Washington, Oregon, and California), especially in the Pacific whiting fishery.

Table 6-27 and Table 6-28 demonstrate diversification for the AFA CP vessels. Of the 17 unique CPs that participated during the 2011-2022 time period, 14 earned 80% or more of their fisheries revenue through AFA and CDQ pollock fishing in the BSAI. For the majority of CPs, the B season accounts for 30-50% of their total fisheries revenue. Twelve unique CPs also participated in BSAI Pacific cod or yellowfin sole in this time period and 11 unique CPs earned a portion of their revenue in fisheries off the U.S. west coast.

Table 6-25 CV revenue dependence from B season AFA pollock relative to total fisheries revenue, 2011-2022 (count of vessels)

B Season AFA revenue as a % of total	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2011-2022
<.1%	7	9	9	9	7	11	13	10	9	10	10	12	9.67
.1-10%	3	3	1	1	1	0	2	1	1	4	1	1	1.58
10-20%	9	6	7	3	6	4	5	5	4	3	4	3	4.92
20-30%	5	5	2	8	1	6	0	4	5	2	3	4	3.75
30-40%	4	11	7	7	12	8	8	7	6	7	6	7	7.50
40-50%	14	14	13	14	5	9	16	16	12	29	14	10	13.83
50-60%	33	28	33	33	38	37	35	31	36	25	32	35	33.00
60-70%	11	12	10	7	15	10	6	8	7	5	6	8	8.75
70-80%	0	1	2	1	0	1	1	0	1	0	4	0	0.92
80-90%	0	0	1	0	0	0	0	0	0	0	0	0	0.08
90-100%	0	1	0	3	0	2	0	1	0	0	2	0	0.75
Grand Total	86	90	85	86	85	88	86	83	81	85	82	80	84.75

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

Table 6-26 CV revenue dependence in different fisheries relative to total fisheries revenue, 2011-2022 (count of vessels)

Rev as a % of Total	AFA B Season	AFA	BSAI Pcod	GOA Rockfish Program	Other GOA	WOC
<.1%	5	0	28	75	68	67
.1-10%	8	1	23	13	5	8
10-20%	6	7	16	4	4	8
20-30%	3	6	8	1	4	0
30-40%	9	6	1	0	3	0
40-50%	12	6	1	0	4	1
50-60%	45	1	1	0	2	5
60-70%	5	3	3	0	2	2
70-80%	0	5	2	0	1	2
80-90%	0	15	2	0	0	0
90-100%	0	43	8	0	0	0

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT
Notes: other GOA = GOA fishing outside of the Rockfish Program, primarily GOA pollock and flatfish; WOC = Washington, Oregon, California fisheries

Table 6-27 CP revenue dependence from B season AFA pollock relative to total fisheries revenue, 2011-2022 (count of vessels)

B Season AFA Rev as a % of Total	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2011-2022
<.1%	0	0	1	1	0	0	0	0	0	0	0	0	0.17
.1-10%	1	0	1	1	0	0	0	0	0	0	0	0	0.25
10-20%	0	0	0	0	0	0	1	1	1	0	0	0	0.25
20-30%	1	0	0	0	0	0	0	0	0	3	0	2	0.50
30-40%	6	6	5	6	2	4	4	4	6	5	9	7	5.33
40-50%	4	7	6	7	10	8	9	9	4	3	3	4	6.17
50-60%	3	1	2	1	2	1	0	0	2	2	1	0	1.25
60-70%	0	0	0	0	0	1	0	0	0	0	0	0	0.08
70-80%	0	0	0	0	0	0	0	0	0	0	0	0	0.00
80-90%	0	0	0	0	0	0	0	0	0	0	0	0	0.00
90-100%	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Grand Total	15	14	15	16	14	14	14	14	13	13	13	13	14.00

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

Table 6-28 Catcher Processors Harvesting AFA by Categorical Percent of Total Revenue, 2011-2022 (number of vessels)

Rev as a % of Total	AFA B Season	AFA	B Season CDQ Pollock	CDQ Pollock	AFA + CDQ Pollock	Other BSAI	WOC
<.1%	1	1	2	1	1	5	6
.1-10%	2	2	10	5	2	9	4
10-20%	0	0	2	6	0	0	7
20-30%	1	0	2	2	0	0	0
30-40%	4	0	1	2	0	0	0
40-50%	9	1	0	0	0	0	0
50-60%	0	0	0	1	0	0	0
60-70%	0	3	0	0	0	0	0
70-80%	0	9	0	0	0	0	0
80-90%	0	1	0	0	7	0	0
90-100%	0	0	0	0	7	3	0

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA
Notes: other BSAI = Pacific cod and yellowfin sole; WOC = Washington, Oregon, California fisheries

6.1.10.2 CDQ Revenue Dependence and Investments in AFA Vessels

Section 2.3 of the analysis describes the CDQ Program, the six groups and the apportionment of CDQ pollock to each group established for the CDQ Program. This section describes the relative value that is generated by CDQ species for the groups and also highlights additional investments CDQ groups and their subsidiaries have made in AFA vessel ownership. All CDQ groups are engaged in the Bering Sea pollock fishery either solely through their direct allocation which is typically leased to harvesting partners in the CP sector or also through other investments into the fishery. Thus, this context is useful in understanding the depth in economic impacts that may be incurred from the proposed alternatives should they result in forgone net revenue from reduced pollock harvest or increased costs associated with harvesting. Section 4.2.7 in the SIA provides additional information on the social and economic benefits that have been provided through programs that are funded by the CDQ revenues, including pollock-related investments.

When the CDQ program was originally established in 1992, the programmatic allocation of Bering Sea pollock was set at 7.5% of the TAC. The AFA subsequently increased the CDQ program's Bering Sea pollock allocation to 10%. Since 1992, the CDQ Program has expanded several times and now includes allocations of pollock, halibut, sablefish, crab, all of the remaining groundfish species (cod, Atka mackerel, flatfish, and rockfish), and prohibited species catch (i.e., as bycatch allowances for salmon, halibut, and crab).

The annual CDQ allocations of commercially important federally managed fisheries in the BSAI region provide CDQ groups revenue streams through the direct catch and sale of some species and through leasing quota to various harvesting partners. CDQ groups receive royalty payments on each allocation harvested by a partnering firm. Since the CDQ Program was implemented, the CDQ groups have used these revenues to support sustainable fishery-based economic development in the region and promote infrastructure development, employment, training programs, and other benefits for their regions and communities.

NMFS received detailed reporting information for each CDQ group until 2005. These reports included royalty and revenue information. However, detailed royalty information for the CDQ groups are no longer available because these entities are no longer required to submit such reports to the State or NMFS the reports through which the royalty data previously was collected. Since 2005, NMFS has relied on information from the CDQ groups' publicly available annual reports, which are prepared primarily for residents of the member communities. Some CDQ groups have chosen to present royalty information by species or royalty type. These data are presented in various formats and species groupings; therefore, comparable royalty data are not available across all CDQ groups or in all years.

As a result, it is not possible to quantify CDQ groups' revenues nor is it possible to precisely estimate the relative contribution of royalties earned from Bering Sea pollock to particular programs or benefits the CDQ groups provide to their region and communities. However, AKFIN can provide information on the gross first wholesale values associated with CDQ allocations of federal TAC. This information provides a snapshot of the percent contribution of gross first wholesale values derived from Bering Sea pollock compared to other BSAI fisheries allocations. A caveat to this method is that CDQ groups may choose to lease CDQ out to other harvesting companies, in which case they may receive a fraction of the royalties and not the full value of the harvested species.

Figure 6-33 depicts the average gross first wholesale revenues associated with allocations of Bering Sea pollock, BSAI crab, halibut, Pacific cod, and other groundfish for 2011-2022. During this time period, the CDQ pollock allocation has generated on average approximately $147.5 million in gross first wholesale revenues, accounting for approximately 59% of total revenues from all BSAI fisheries allocations. When compared to 2022, which included crab fishery closures and low crab TACs, the relative proportion of first wholesale revenues derived from Bering Sea pollock increases with the decrease in crab revenues. In this year, pollock CDQ accounted for on $157.3 million and represented 67% of the total revenues from

BSAI allocations. Crab CDQ revenues represented an average of 11% of the potential total CDQ revenues 2011-2022 (Figure 6-33), but in 2022, they represented 4%. Due to confidentiality restrictions, quantitative information for individual CDQ groups cannot be provided. However, on average between 2011-2022, the gross first wholesale revenues earned from the Bering Sea pollock fishery could account for 54-66% of each CDQ groups' total revenues if they received the full value for these quota directly. As such, this analysis considers all CDQ groups and their constituent communities as being engaged in or economically dependent on the Bering Sea pollock fishery, while noting the magnitude may vary.

Figure 6-33 Annual average gross first wholesale revenues (millions of $) associated with CDQ allocations by species, 2011 through 2022

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT; Cdq_activity(11-30-23).

The AFA requirement that vessel-owning entities be at least 75 percent owned and controlled by U.S. citizens resulted in foreign-owned companies divesting majority ownership interests in vessels engaged in BSAI fisheries, which, in turn, provided CDQ groups greater opportunities to acquire equity interests in those entities than would have otherwise been the case. CDQ groups became sought-after business partners for their political capital as well as their CDQ quota, resulting in financing arrangements being extended to CDQ groups that were not previously available to them.

Expanding ownership interests in AFA vessels is one way CDQ groups have worked to meet the economic and social goals of the CDQ Program.[86] Investments in subsidiaries, such as limited liability corporations (LLCs), allow CDQ groups to wholly or partially own vessels directly related to fisheries. Ownership of AFA vessels increase the CDQ group/ subsidiary's holdings of quota in the AFA fishery in addition to providing revenue through the direct catch and sale of pollock.

As of the beginning of 2024, 5 of the 6 CDQ groups had ownership interests in AFA vessels (Table 6-29). These ownership interests are often highlighted in CDQ groups' Annual Reports but are not systematically updated in aggregate through a data source accessible to analysts. These ownership interests were updated with direct input from CDQ representatives and with considerably changes from ownership reported in NMFS CDQ report in 2018. Table 6-29 demonstrates that 3 CDQ groups (BBEDC, CVRF, and NSEDC) currently have full or part ownership in 3 CPs and 5 CDQ groups (BBEDC,

[86] This type of CDQ group ownership investment growth is not unique to the BS pollock fishery managed under the AFA program. For example, it has also been seen in the context of the BSAI crab rationalization program, where CDQ groups have come to have substantial ownership interest in the non-CDQ portion of the fishery, both in terms of crab vessels and crab quota shares, including processor quota shares, with those types of ownership interests increasing over the course of that program. In addition, investments in harvesting and processing capacity provide revenue stream through contractual agreements to harvest other CDQ group's quota, profit sharing, and chartering commercial fishing vessels to government agencies conducting stock assessment surveys.

CBSFA, CVRF, NSEDC, and YDFDA) have full or part ownership in 30 of the AFA CVs that actively fish pollock. Although not included in the table, several CDQ groups have ownership in AFA vessels that are no longer active, but still provide revenue through their access to pollock. One CDQ group (YDFDA) also has an ownership interest in one of the motherships.

Table 6-29 CDQ direct investments in fishery companies and vessels that harvest pollock as of January 2024

CDQ Group	Name of Company	CDQ Ownership	Vessel Name	Vessel Type
BBEDC	Dona Martita	50.0%	Defender	CV
			Alaskan Defender	CV
			Bering Defender	CV
			Northern Defender	CV
	Arctic Storm Holding Company	18.3%	Arctic Fjord	CP
			Neahkahnie	CV
			Arctic Storm	CV
			Sea Storm	CV
CBSFA	St. Paul Fishing Company	75.0%	Starlite	CV
			Starward	CV
		30.0%	Fierce Allegiance	CV
CVRF	Coastal Alaska Premier Seafoods	100.0%	Northern Hawk	CP
	Excellence Seafood LLC	100.0%	California Horizon	CV
			Misty Dawn	CV
			Morning Star	CV
			Papado II	CV
CVRF (50%) / NSEDC (50%)	BSAI Partners	75.0%	Alaska Rose	CV
		75.0%	Bering Rose	CV
		51.0%	Great Pacific	CV
		75.0%	Sea Wolf	CV
	Bering North	75.0%	Progress	CV
			Sunset Bay	CV
			Half Moon Bay	CV
			American Eagle	CV
			Commodore	CV
			Hickory Wind	CV
			Patricia Lee	CV
			Storm Petrel	CV
NSEDC	Glacier Fish Company	37.5%	Alaska Ocean	CP
YDFDA	Nunam Iqua Harvester	100.0%	Aleutian Challenger	CV
	Kotlik Challenger	100.0%	Pacific Challenger	CV
	Alakanuk Beauty	75.0%	American Beauty	CV
	Emmonak Leader	75.0%	Ocean Leader	CV
	Golden Alaska	58.3%	Golden Alaska	MS

Source: Personal communication L. Price 1.12.24; J. Kauffman 1.12.24; P. Peyton 1.19.24; A. Drobnica 1.30.24; P. Wilkins 2.29.24; S. Kinneen 3.8.24.
Note there are some AFA vessels with CDQ ownership not listed that do not actively fish, but the AFA permits are retained and fished on other vessels. This is the case for the Ocean Hope 3 (Bering North; CVRF/NSEDC) as well as Ms. Amy & Messiah and the Destination (BSAIP; CVRF/NSEDC ownership in the associated AFA permits). Ownership of these AFA permits and access to their associated pollock continues to provide royalties to these CDQ groups.

6.1.10.3 Primary Pollock Products and Markets

This section is included in order to highlight the variations in products and values that are derived from Alaska pollock and the role these products play in a global market. This section also includes some high-level discussion of the extraordinary challenges currently confronting the Alaska seafood market. This information is relevant to understanding the conditions under the status quo regulation and although these dynamics are outside of the scope of marginal impacts that may occur *due* to the proposed actions, the effects of the proposed actions could be exacerbated by current market conditions.

Market Profile for Pollock Products

The following section was incorporated from Chapter 8 of the 2022 BSAI Groundfish Economic SAFE (Abelman et al. 2023) which is an excerpt of the Alaska Groundfish Wholesale Market Profiles (forthcoming) prepared by the McKinley Research Group, LLC. Data sources are highlighted in the Economic SAFE, with the most recent year incorporated 2020. See Abelman et al. (2023) for more information on market trends for pollock and other whitefish species in the North Pacific.

Pollock is currently the largest groundfish fishery in the world, by volume harvested, with stocks concentrated in the North Pacific Ocean. Pollock are commercially harvested by several countries, but U.S. (Alaska) and Russia are the largest producers by a wide margin, with U.S. harvests accounting for 42% of global harvests in 2020.

Table 6-30 Summary profile of Alaska pollock wholesale production and markets, 2020

Value and volume		Key products	Fillets	Surimi	Roe	Meal	Other
First wholesale production (mt)	533,530	% of value	37%	34%	8%	11%	10%
% of global pollock harvest	42%	% of first wholesales	16%	31%	22%	21%	7%
First wholesale value ($ millions)	1,416	YoY change	-28%	-13%	-14%	-9%	-2%
% change in value from prior 4-yr avg.	-6%	**Key markets:** Japan, Europe, US, Korea, and China					
% of Alaska groundfish value	67%	**Competing species:** Russian pollock, hake, hoki, tropical surimi, and cod					

Source: Table 8.4 in Chapter 8 of the 2022 BSAI Groundfish Economic SAFE (Abelman et al. 2023)

Alaskan pollock accounted for 39% of total U.S. commercial fishery landings and 13% of wholesale production value in 2020. In 2020, pollock was the single most valuable and plentiful species in Alaska's seafood industry, accounting for 49% of production volume and 39% of first wholesale value. Alaska pollock harvests yielded 533,530 mt of processed product in 2020, with a first wholesale value of $1.42 billion.

Alaska pollock yield five primary product types: surimi, fillets, headed and gutted (H&G) fish, roe, and fish meal/oil. In 2020, of the 533,530 mt of pollock products produced, 33% of that volume was surimi, followed by 29% fillet, 13% fish meal, 7% H&G, 5% roe, and the remainder in other products such as minced meat, fish oil, and organs (Figure 6-34). Fillets typically provide the most revenue of any product type, although surimi is a close second and can top the list some years. Together fillets and surimi accounted for 71 percent of Alaska pollock's first wholesale value in 2020. Although roe was only 5 percent of the production volume, it accounted for 8 percent of the fish's value. Roe used to be a more valuable component when roe prices were higher. Fish meal/oil, minced meat, and other ancillary products account for 17 percent of the value, while H&G production is 3 percent.

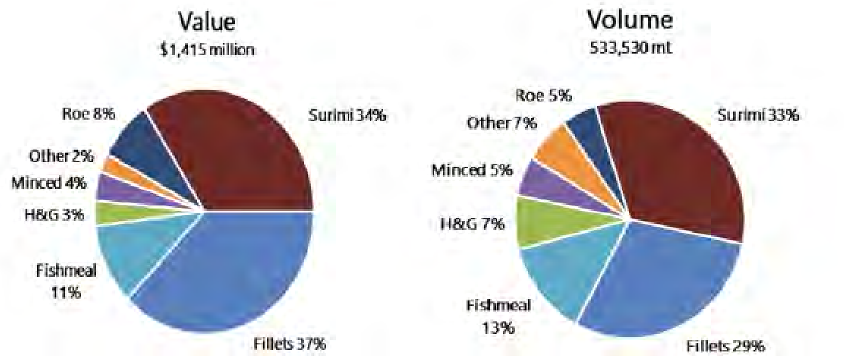

Figure 6-34 Alaska pollock first wholesale production volume and value, by product type, 2020
Source: Figure 8.2 in Chapter 8 of the 2022 BSAI Groundfish Economic SAFE (Abelman et al. 2023)

The AFA A season fishery has historically focused on roe-bearing females. The A season pollock also provides other primary products such as surimi and fillet blocks but yields on those products are lower than in the B season when pollock carry a lower roe content and are thus primarily processed for surimi and fillet blocks.

Europe, Japan, and U.S. are the primary consumer markets for Alaska pollock. For Alaska pollock fillets, more than half of production have recently (2016-200) been sold directly to European markets and about 28% have recently been sold into domestic markets. Almost 90% of Alaska pollock surimi is sold to export markets. In 2020, Japan and South Korea imported just under 70% of all Alaska pollock surimi production. The remaining markets included Europe, U.S., Thailand, and China.

A relatively new domestic market for Alaska pollock fillets is the U.S. Department of Agriculture, which purchases American agricultural products and seafood and distributes them through the National School Lunch Program, food banks, and foreign aid programs among other channels. Domestic opportunities for Alaska pollock producers have increased over the past five years as the federal program has expanded the list of pollock products. USDA pollock purchases hit a record high of more than $76 million in 2019 (about 12% of first wholesale production value for Alaska pollock fillets that year) and averaged more than $30 million per year over the 2020-2021 period. A recent Alaska Seafood Marketing Institute announcement[87] highlighted the USDA's commitment to purchasing 15 million lb of Alaska pollock fish sticks for the National School Lunch Program in 2024.

Competing supply exists both from other countries production of pollock (in particular Russia) but also from other whitefish. Whitefish generally refers to non-oily species, such as cod, pollock, haddock, hake, whiting, and benthic flatfish, such as sole, plaice, flounder, and halibut. Though different perceptions of quality and price premiums exist for this range of species, they are all competitors and may be substituted for each other based on price and availability. Alaska pollock fillets' primary competition comes from Russian-origin twice-frozen pollock fillets. Pollock surimi accounted for about a quarter of the roughly one million metric tons of surimi produced globally in 2021. Most pollock surimi is produced in Alaska (200,000 mt, in 2021), though significant production comes out of Japan (46,000 mt) and Russian processors plan to start producing pollock surimi in significant quantities in the coming years. Tropical surimi dominates the market, accounting more than two-thirds of global production.

[87] Link to press release: https://www.alaskaseafood.org/news/for-release-usda-purchases-wild-alaska-salmon-and-pollock/

Current Alaska Seafood Market Challenges

The current state of extraordinary market challenges across a broad array of Alaska fisheries was recently highlighted by Alaska Seafood Marketing Institute (ASMI) – a public-private partnership between the State of Alaska and the Alaska seafood industry – published a public letter in October 2023 describing.[88]

ASMI states that Alaska seafood is "subject to numerous geopolitical, trade inequity, and economic factors" that are not directly controlled by the participants (harvesters, processors, and distributors) within the state. The letter cites supply and demand imbalances domestically and abroad, large harvests by overseas product competitors with low relative currency valuations (e.g., Russia), and trade conflict with a major U.S. export receiver (China) resulting in a substantial drop in export volume to a traditionally key market. While facing drops in revenue, Alaska processors, exporters, and fishermen are facing higher operating costs due to domestic inflation for labor/materials/shipping/storage, high interest rates, high fuel prices, and labor supply shortfalls. Shipping volume and costs to some traditional Transpacific trading partners remain affected by logistical challenges that stem from the COVID-19 pandemic. U.S. products that are reprocessed internationally before entering the global market as finished goods are being forced to compete directly with seafood products that originate from countries that sell primary seafood products at lower prices and denominated in a weaker currency than the US dollar. High interest rates have affected processors' ability to finance operations and continue needed investment to support vessel fleets and crews. Simultaneously, hold-over product inventories resulting from the supply-demand imbalance has devalued the asset that these Alaska fishery participants are producing. While primary producers are generally receiving lower prices while facing higher costs, retail product prices on the global market remain steady or high which has further affected demand by consumers in inflationary economies – including but not limited to the U.S. – who may be reducing spending in certain categories.

ASMI's letter refers to this constellation of factors as "an economic squeeze not seen for decades or longer". Over the last year, news about Alaska's fishing industry highlights delays in planned capital investments, temporary closures of shoreside processing operations, companies listing assets for sale, among other factors that are driving changes in the business relationships among entities with full or partial ownership in shoreside processors. In short – the analysts can conclude that the BS groundfish markets, including those for pollock face systematic headwinds that leave it presently more vulnerable than usual to marginal changes in operational costs, product quality/value, and net revenue.

6.1.10.4 Summary of Community Engagement and Dependence on the Harvests and Deliveries of AFA and CDQ Pollock

The following section directly corresponds to Section 5.1.1. of the accompanying SIA.

Under Alternative 1, the status quo regulations for salmon bycatch management at 50 CFR 679.21(f) would remain in place. **The effect of these regulations on community participation and dependence on the B season pollock fishery is uncertain** (e.g., it is unclear the extent to which community participation in, or economic dependence on, the B season fishery is affected by the RHS system for chum salmon avoidance), but selection of Alternative 1 would be expected to maintain this level of impact. The following paragraphs summarize some of the trends for community engagement in the B season pollock fishery under the status quo discussed in greater depth in Chapter 4 of the SIA.

From 2011 through 2022, the ownership of vessels engaged in the harvesting and at-sea processing of B season pollock was concentrated in Seattle ("Seattle" refers to the City of Seattle and the Seattle MSA combined).

[88] Accessible at https://www.alaskaseafood.org/news/extraordinary-circumstances/ (Jan. 2024); also published in *National Fisherman Magazine*, Oct. 2023.

- 92.77% of CPs harvesting AFA and CDQ pollock during the B season pollock (see Table 4-1 of the SIA)
- 47.62% of mothership/floating processors (see Table 4-5 of the SIA)
- 80.20% of inshore CVs (see Table 4-10 of the SIA)
- 92.45% of mothership CVs (see Table 4-11 of the SIA)

It is not possible to show the revenue dependence of those CPs and floating processors/motherships on the B season fishery with an ownership address in Seattle due to confidentiality restrictions. However, on average, the B season pollock fishery accounted for 55.27% ($439.22 million) of CPs' gross first wholesale revenues and 58.49% ($107.96 million) of floating processor/motherships' gross first wholesale revenues (2011-2022). For CVs with a Seattle ownership address (both inshore and mothership CVs), the B season pollock fishery accounted for 51.45% ($137.60 million) of total gross ex-vessel revenues (2011-2022).

A central part of Seattle's identity has always been that of a fishing community. The Seattle-based fleet is large and diverse with participants in Alaska groundfish, Pacific Northwest groundfish, and crab fisheries (among others) (see Wise et al. 2023). Likewise, there are distinct areas within Seattle where concentrations of businesses and infrastructure are focused on the area's large and wide-ranging fleet (i.e., support services). From an outside perspective, the Seattle-based fleet(s) and related support operations might be considered as important components to the pollock fishery but not a place-based community. However, from a Seattle-based perspective, it has been and remains a North Pacific fishing community (NOAA 2014).

Kodiak and Newport were also communities identified as having a consistent level of participation in the B season fishery (2011-2022). These communities are affiliated with the CV fleets – from 2011 through 2022, six CVs with a registered ownership address in Kodiak participated in the B season pollock fishery; five of these CVs participated in the inshore sector and one vessel is dual qualified and participated in both the inshore and mothership sectors. During the same period, 10 CVs with a registered ownership address in Newport, Oregon participated in the B season pollock fishery. All Newport CVs were affiliated with the inshore sector. In 2022, three CVs with a registered ownership address in the Anchorage/Wasilla community grouping harvested AFA pollock during the B season and delivered to an inshore processor.

Under the status quo, participation in the shorebased processing component affiliated with the inshore sector was concentrated in Unalaska/Dutch Harbor where four of six physical facilities are located. As described in Section 4.1.4 of the SIA, AFA deliveries of B season pollock were also made in King Cove and Akutan which are each home to a single processing entity. As such, revenue information was aggregated across Unalaska/Dutch Harbor, King Cove, and Akutan for confidentiality. During the analyzed period (2011-2022), these shorebased processing facilities displayed a high degree of economic dependence on the B season pollock fishery. shows shorebased processors within the community grouping of Unalaska/Akutan/King Cove earned $358.3 million in gross first wholesale revenues from B season pollock deliveries, which accounted for 43.72% of these entities' total revenues.

A relatively straight forward benefit to Alaska communities and the State of Alaska are the public revenues generated from direct fishery taxes levied on B season pollock. The total amount of State Fisheries Business Tax (FBT) and Fishery Resource Landing Tax (FRLT) and local taxes levied on B season pollock during the analyzed period were estimated to range between $10.76 million (2017) and $13.20 million (2012) (see Figure 4-14 in the SIA). Figure 4-15 in the SIA provides the estimated amount of State and local tax revenues generated from the B season pollock fishery that have accrued to the City of Unalaska, the City of King Cove, Akutan, and the Aleutians East Borough as a group, and the State of Alaska. The City of Unalaska has received substantial revenues from the B season fishery which ranged between $5.70 million (2012) and $4.46 million (2017). The grouping of King Cove, Akutan, and the Aleutians East Borough also received substantial revenues from the B season pollock fishery which ranged between $2.03 million (2016) and $2.60 million (2019). These tax revenues have a direct effect on public welfare as they are deposited into the city, borough, or state's general fund revenues which are used to provide public goods and services.

As discussed previously in the SIA and the DEIS, shoreside processors and the communities in which they are located are undergoing transition. For example, the Peter Pan Fleet Cooperative did not file an inshore AFA cooperative permit for the 2024 Bering Sea pollock fishery. While some portion of AFA pollock may be delivered to Peter Pan Seafoods facility in the future, the community's continued participation and level of dependence on this fishery is uncertain. Additionally, Trident Seafoods has announced plans to build a "next generation processing plant" to replace its existing facility in Akutan on Unalaska's Captains Bay on property it recently acquired through its subsidiary LFS. The timing of this transition is uncertain but, if or when completed, would change the community footprint of the Bering Sea pollock fishery (including the B season fishery). This information is relevant to understanding the conditions facing some communities under the status quo regulations, although these dynamics are outside of the scope of marginal impacts that may occur *due* to the proposed actions under consideration at this time.

6.1.10.5 Summary of Impacts to Communities Affiliated with CDQ Program

The following section directly corresponds to Section 5.1.2 of the accompanying SIA.

Section 4.1.6 of the SIA and the corresponding subsections provide information on the CDQ regional economies, select demographic and socioeconomic indicators for CDQ communities, and a summary of the programs the CDQ groups provide to their regions and communities. The SIA considers all 65 CDQ communities as indirectly engaged in the Bering Sea pollock fishery to some degree because each CDQ group receives a programmatic allocation of Bering Sea pollock and many have made investments into the AFA fishery (see Section 6.1.10.2). The CDQ groups use the revenues earned from Bering Sea pollock, as well as revenues earned from other fishery allocations and investments to fund programs that support local economies, infrastructure, and wellbeing for their regions and communities (see Section 4.2.7 of the SIA for an extended discussion on this point). At the same time, many communities affiliated with the CDQ program are also engaged in subsistence and commercial chum salmon fisheries including the NSEDC, YDFDA, and CVRF regions. **The effect of the status quo on the CDQ regions and communities is uncertain, but selection of the No Action alternative would be expected to maintain this level of impact.**

6.1.11 Summary of Communities and Regions Engaged in and Dependent on Western Alaska Chum Salmon Fisheries

6.1.11.1 Subsistence Harvests of Chum

The following section directly corresponds to Section 5.1.3.1 of the accompanying SIA.
Under Alternative 1, the status quo regulations for salmon bycatch management at 50 CFR 679.21 would remain in place. **Alternative 1 would not have an effect on the management regulations for subsistence chum salmon fisheries in Western and Interior Alaska (see Chapter 3 of the preliminary DEIS)**. This includes a priority for management to first and foremost meet spawning escapement goals in order to sustain salmon resources for future generations. After conservation (escapement), 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 consumptive uses of the stock, such as commercial fishing.

As discussed in Section 6.1.4 of the preliminary DEIS, the average level of chum salmon bycatch occurring in the Bering Sea pollock fishery has been 280,707 (2011-2022). Chum salmon bycatch is one source of total removals and the estimated level of WAK chum salmon bycatch occurring under the status quo regulations ranged between 4,701fish (2012) and 93,170 fish (2017). Under Alternative 1, the current operations of the Bering Sea pollock fishery would be expected to be maintained, noting fishing behavior could still change into the future under status quo regulations. Under Alternative 1 (and the proposed action alternatives), chum salmon would continue to be caught as bycatch and it is expected that some number of WAK chum would continue to be removed each year. These WAK chum removals may contribute to run size declines and the failure to attain escapement goals, as well as subsequent closures of subsistence (and commercial) fisheries.

The impact of the Bering Sea pollock fishery's chum salmon bycatch occurring under the status quo on adult chum salmon returns to Western and Interior Alaska river systems is uncertain and cannot be quantified with available information (see Section 6.1.4.6). Without the ability to precisely estimate the impact that chum salmon bycatch occurring in the Bering Sea pollock fishery has on adult chum salmon returns, the magnitude of impacts this bycatch may have on WAK chum abundance, and consequently, its impacts on subsistence fishing opportunities is unknown.

Although the impacts of bycatch to rural and Alaska Native communities dependent on chum salmon for subsistence are unable to be quantified, selection of Alternative 1 would be expected to continue this level of impact. It is not anticipated that selection of the No Action alternative would have inherent benefits to the overall health of the resource such that abundance would improve to a level that would allow for increased subsistence fishing opportunities. However, the outcomes for subsistence users under Alternative 1 are ultimately uncertain and affected by a variety of factors external to this marginal impact analysis focused on bycatch reduction measures including climate change, other commercial removals, hatchery releases affecting prey abundance, among others, many of which are addressed in the preliminary DEIS (see Section 6.1.3, Section 6.1.4, and Section 6.1.4.7).

The following paragraphs summarize some of the patterns of subsistence harvest captured throughout Chapter 4 of the SIA. Section 4.3.2.3 of the SIA provides information on subsistence harvests of salmon relevant to the Yukon Area, Section 4.3.3.3 of the SIA provides information for the Kuskokwim Area, and Section 4.3.4.3 of the SIA includes information for the Norton Sound-Port Clarence Districts. This SIA used a longer time series of information on subsistence harvests of chum salmon in each region was provided to better contextualize subsistence harvests over time. **Subsistence harvests of chum salmon have declined across Western and Interior Alaska regions, but patterns of decline vary.**

Households' harvests of salmon vary from one year to the next for many reasons. However, subsistence harvests of chum salmon (and other species of salmon) have declined in light of changing conditions of abundance, particularly as managers implement restrictions on fishing opportunities; because of the patterned use of salmon among households and communities, restrictions on multiple species (i.e., Chinook) also have an effect on chum salmon harvests. Other factors that may influence patterns and trends in subsistence harvests include the fact that households have different abilities and needs for subsistence year-to-year (Magdanz et al. 2005), shifts in species distribution (Carothers et al. 2013), weather conditions combined with the timing of when subsistence fishing may be open (Ikuta et al. 2013), as well as the high prices of gas, equipment, or limitations imposed by wage employment (Raymond-Yakoubian & Raymond-Yakoubian 2015).

In the **Yukon Area**, subsistence harvests of summer chum have ranged between 229,838 (1988) and 1,234 (2021) fish. The most recent 10-year average level of subsistence harvest of summer chum was 77,448 fish (2012-2021). Subsistence harvests of fall chum have ranged between 211,303 (1989) and 705 (2021) fish. In the Yukon Area, subsistence harvests of each chum salmon stock make up a significant portion of households' total subsistence harvests of all species of salmon, although the relative contribution of chum salmon varies by management District across the river as does the stock. For example, in the lower region of the river, where there are generally more subsistence resources available, primarily because of marine mammals, chum salmon tends to contribute a relatively smaller proportion of total subsistence salmon harvests in terms of edible pounds. In the lower region of the Yukon River, summer chum contributes the majority of the subsistence salmon harvest. Moving upriver, salmon, and chum salmon in particular, play an increasingly important role in the subsistence harvest composition of these communities.

In the **Kuskokwim Area**, subsistence harvests of chum salmon have ranged between 157,335 (1990) and 10,690 (2021) fish. The most recent 10-year average level of subsistence harvest of chum salmon was 35,332 fish (2012-2021). In the Kuskokwim Area, residents' dependence on chum salmon as a food source varies, and the relative contribution of chum salmon to total subsistence salmon harvests is influenced by the distribution of chum salmon along the river (see also Figure 4-33 of the SIA). For example, chum salmon return to spawn at the headwaters of the Kuskokwim River whereas other species like sockeye do not. As a percent of total subsistence harvests, chum salmon harvests are highest in Stony River, Lime Village, Sleetmute, Red Devil, Crooked Creek at 14% of the total subsistence harvest (KRITFC Unit 2) and Chuathbaluk, Aniak, Upper Kalskag, and Lower Kalskag at 15% of the total subsistence harvest of all subsistence resources (i.e., fish, mammals, birds, among others) (KRITFC Unit 3).

In the **Norton Sound District**, subsistence harvests of chum salmon have ranged between 43,014 (1995) and 1,681 (2021) fish. The most recent 10-year average level of subsistence harvest of chum salmon in this district was 12,545 fish (2012-2021). The estimated 2021 subsistence harvest is the lowest on record followed by 2020 when subsistence harvests of chum were estimated to be 1,928. In the **Port Clarence District,** subsistence harvests of chum salmon have ranged between 6,886 (2017) and 1,275 (2000) fish. The estimated subsistence harvest of 1,719 chum salmon in 2021 was the second lowest harvest level on record. The most recent 10-year average level of subsistence harvest of chum salmon in this district was 4,774 fish (2012-2022).

Section 4.3.5 of the SIA discusses the role that subsistence plays in the mixed economic and cultural lifeways of rural and Alaska Native communities. Chum salmon are an important source of cultural identity for many Alaska Native communities across Western and Interior Alaska as well as an important component to food security. Reduced opportunities for subsistence fishing have had a negative effect on the ability of households and communities to secure healthy and culturally preferred wild food sources (Ikuta et al. 2013; Moncrieff 2017). As people are able to fish for subsistence less, there are potentially cascading effects among households within and across communities as sharing networks may change over time (Wolfe et al. 1987; Wolfe et al. 2010; Brown and Godduhn 2015; Coleman et al. 2023). At present, families are gathering less to use fish camps as many weigh the costs and benefits of traveling (i.e., the fuel required to get to a fishing site, time away from wage employment, among other considerations) to fish during short windows when all of their needs may not be met (Trainor et al. 2021). Fish camps have long been important places to harvest food, create memories that form one's identity, and share culturally held values and TK across generations (Nadasdy 2007; Gadamus & Raymond-Yakoubian 2015; Brown et al. 2017: 36; Fienup-Riordan 2020).

6.1.11.2 Commercial Harvests of Chum Salmon

The following section directly corresponds to Section 5.1.3.2 of the SIA.

Under Alternative 1 (and the proposed action alternatives), no action, chum salmon would continue to be caught as bycatch and it is likely that some number of WAK chum would continue to be removed each year. These WAK chum removals may contribute to the failure to attain escapement goals and subsequent closures of subsistence (and commercial) fisheries. Alternative 1 would not have an effect on the management regulations for commercial chum salmon fisheries in Western and Interior Alaska. **As such, he commercial chum salmon fisheries described in this section would continue to be managed by the State of Alaska, under the responsibility of the ADF&G Division of Commercial Fisheries and the direction of the Alaska BOF.** This includes a priority for management to first and foremost meet spawning escapement goals in order to sustain salmon resources for future generations. After conservation, 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 consumptive uses of the stock, such as commercial fishing. Under status quo, area managers monitor the run inseason and management measures can be taken to adjust commercial fishing opportunities inseason as more information becomes available.

Section 4.4 of the SIA describes the reliance WAK commercial fisheries have had on chum salmon in recent and historical years, and the restriction resulting from the current stock status. With the exception of the 2022 commercial fishery in Kotzebue, these commercial fisheries all began experiencing lower chum salmon catch rates in 2019. Additional management restrictions and/or closed seasons for chum salmon went into place in 2020 on the Yukon River and 2021 in the Kuskokwim management area. These chum salmon declines under status quo have further exacerbated the economic impacts of Chinook and coho salmon declines that historically have been caught in regional commercial fisheries. These low commercial catch rates and fishery closures have widespread adverse economic implications for the permit holders and communities they are associated with, including adverse impacts to subsistence activities (e.g., financing nets, boats, gas, and other gear used for subsistence) because of the dynamics of mixed economies in this region. As demonstrated in Table 4-57 through Table 4-66 in the SIA, with the exception of Bristol Bay, these are highly local fisheries, and they operate within rural communities that have extremely limited alternative opportunities for generating income.

Without the ability to precisely estimate the impact that chum salmon bycatch occurring in the Bering Sea pollock fishery has on adult chum salmon returns to Western and Interior Alaska river systems, it is not clear the magnitude of impacts this bycatch may have on WAK chum abundance and consequently, its impact on the ability for a commercial fishery to open. **Although impacts under status quo are unable to be quantified, Alternative 1 would be expected to continue this level of impact.**

6.2 Alternative 2 and 3: Overall PSC Limit for Chum Salmon and WAK Chum Salmon Threshold

The following sections analyze the potential impacts of Alternative 2 and 3 together as well as all related options and suboptions. **Alternative 3 must be implemented in conjunction with Alternative 2, and because the overall PSC limit would be included under each alternative, the primary impacts would largely result from this management measure (i.e., the limit). This is not meant to suggest the analysts assume Alternative 3 would not have an effect fishing behavior therefore resulting in somewhat different levels of PSC avoidance and associated costs but rather these marginal differences from Alternative 2 alone cannot be quantified.** The analysts have highlighted the potential differences in the anticipated impacts between Alternative 2 and 3 in the relevant sections related to the resource category, harvesting entities, or communities.

6.2.1 Assessment of Historical Performance Against PSC Limits and Apportionments (Alternative 2)

Alternative 2 would establish an overall chum salmon PSC limit that would apply to the Bering Sea pollock fishery during the entire B season (June 10 – November 1). “Overall” refers to the fact that all non-Chinook salmon (i.e., chum salmon) caught as bycatch from all genetic stock reporting groups would accrue towards the PSC limit starting on June 10. The overall chum salmon PSC limit under would be apportioned among the pollock sectors (as established under option 3 of Alternative 2). The inshore sector’s apportionment would be further subdivided among the inshore cooperatives and inshore open access fishery in relevant years. The CDQ program’s apportionment would be further subdivided among the six CDQ groups. If or when an entity reaches their apportionment of the overall chum salmon PSC limit, that entity would be required to stop pollock fishing. NMFS would report any overages of the allocation to NOAA Office of Law Enforcement for action.

Directly below are a series of figures (see Figure 6-35, Figure 6-36, Figure 6-37, and Figure 6-38) that depict each pollock sector’s historical chum salmon bycatch performance against each apportionment option for overall chum salmon PSC limits of 200,000; 300,000; 450,000; and 550,000. Red cells indicate the years when a sector would have exceeded their apportionment of the PSC limit as well as the years where the fleet would have reached the overall PSC limit.

3-year average	6.1% 12,200	21.9% 43,800	62.9% 125,800	9.1% 18,200	100% 200,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,629	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,675
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

5-year average	7.1% 14,200	25.2% 50,400	58.2% 116,400	9.5% 19,000	100% 200,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,675
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Pro-rata	7.1% 14,200	25.4% 50,800	58.4% 116,800	9.1% 18,200	100% 200,000
Year	CDQ	CP	Inshore	Mothership	Total
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,675
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

AFA	10% 20,000	36% 72,000	45% 90,000	9% 18,000	100% 200,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,675
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Figure 6-35 Historical chum salmon bycatch performance by sector and fishery total compared to the four suboptions for apportioning an overall chum salmon PSC limit of 200,000

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

3-year average	6.1% 18,300	21.9% 65,700	62.9% 188,700	9.1% 27,300	100% 300,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

5-year average	7.1% 21,300	25.2% 75,600	58.2% 174,600	9.5% 28,500	100% 300,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Pro-rata	7.1% 21,300	25.4% 76,200	58.4% 175,200	9.1% 27,300	100% 300,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

AFA	10% 30,000	36% 108,000	45% 135,000	9% 27,000	100% 300,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Figure 6-36 Historical chum salmon bycatch performance by sector and fishery total compared to the four suboptions for apportioning an overall chum salmon PSC limit of 300,000

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

3-year average	6.1% 27,450	21.9% 98,550	62.9% 283,050	9.1% 40,950	100% 450,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

5-year average	7.1% 31,950	25.2% 113,400	58.2% 261,900	9.5% 42,750	100% 450,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Pro-rata	7.1% 31,950	25.4% 114,300	58.4% 262,800	9.1% 40,950	100% 450,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

AFA	10% 45,000	36% 162,000	45% 202,500	9% 40,500	100% 450,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Figure 6-37 Historical chum salmon bycatch performance by sector and fishery total compared to the four suboptions for apportioning an overall
Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN.

3-year average	6.1% 33,550	21.9% 120,450	62.9% 345,950	9.1% 50,050	100% 550,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

5-year average	7.1% 39,050	25.2% 138,600	58.2% 320,100	9.5% 52,250	100% 550,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Pro-rata	7.1% 39,050	25.4% 139,700	58.4% 321,200	9.1% 50,050	100% 550,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

AFA	10% 55,000	36% 198,000	45% 247,500	9% 49,500	100% 550,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Figure 6-38 Historical chum salmon bycatch performance by sector and fishery total compared to the four suboptions for apportioning an overall chum salmon PSC limit of 550,000

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

Table 6-31, Table 6-32, Table 6-33, and Table 6-34 provide the dates when the sectors would have reached an apportionment of the four analyzed PSC limits had those limits been in place historically (and no fishing behavior changes occurred). These dates correspond to the preceding tables indicating when a limit would have been reached.

Table 6-31 Closure dates by sector and apportionment suboption under a chum salmon PSC limit of 200,000

Year	CDQ				CP				Mothership				Inshore			
	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA
2011					10/29				9/17	9/17	9/17	9/17		10/15	10/15	8/27
2012																
2013																9/14
2014					9/6	9/6	9/6						9/6	8/30	8/30	8/9
2015													8/29	8/22	8/22	8/15
2016	8/6	8/13	8/13		8/6	8/6	8/6	8/13	8/13	8/13	8/13	8/13	9/10	9/10	9/10	8/13
2017	7/8	7/15	7/15	7/15	7/22	7/22	7/22	7/22					8/5	7/29	7/29	7/22
2018	6/30	7/7	7/7	7/7	7/7	7/7	7/7	7/21	9/1	9/8	9/1	9/1	9/1	9/1	9/1	7/28
2019	9/21	9/28	9/28		8/31	8/31	8/31	8/31	8/31	8/31	8/31	8/31	9/7	8/17	8/17	7/27
2020					9/5	9/12	9/12	10/3	10/31	10/31	10/31	10/24	9/5	9/5	9/5	8/29
2021	7/17	7/17	7/17	7/17	7/31	7/31	7/31	8/14	7/31	7/31	7/31	7/31	7/31	7/24	7/31	7/24
2022					8/20	8/27	8/27		8/13	8/13	8/13	8/13	8/20	8/13	8/13	8/13

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

Table 6-32 Closure dates by sector and apportionment suboption under a chum salmon PSC limit of 300,000

Year	CDQ				CP				Mothership				Inshore			
	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA
2011																
2012																
2013																
2014																9/13
2015																8/29
2016					8/13	8/13	8/13	8/27	9/3	9/3	9/3	9/3				9/17
2017	7/15	7/15	7/15	7/15	7/22	7/22	7/22	7/29								8/5
2018	7/7	7/7	7/7		7/21	7/21	7/21									9/15
2019					8/31	8/31	8/31	9/28	9/7	9/7	9/7	9/7				9/7
2020					9/19	10/17	10/17						10/3	9/26	9/26	9/12
2021	7/17	7/17	7/17	7/17	8/14	8/14	8/21		7/31	7/31	7/31	7/31	7/31	7/31	7/31	7/31
2022					9/3				8/20	8/20	8/20	8/20				

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

Table 6-33 Closure dates by sector and apportionment suboption under a chum salmon PSC limit of 450,000

Year	CDQ				CP				Mothership				Inshore			
	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA
2011																
2012																
2013																
2014																
2015																
2016					8/27	8/27	8/27		10/1	10/8	10/1	10/1				
2017	7/15	7/15	7/15	7/22	7/29	7/29	7/29	8/5								
2018					9/29											
2019					9/7	10/26			9/28	10/5	9/28	9/28				
2020																10/10
2021	7/17	7/17	7/17	7/17					8/7	8/7	8/7	7/31	8/7	8/7	8/7	7/31
2022																

Source: NMFS Catch Accounting System, data compiled by AKFIN.

Table 6-34 Closure dates by sector and apportionment suboption under a chum salmon PSC limit of 550,000

Year	CDQ				CP				Mothership				Inshore			
	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA	3-year avg.	5-year avg.	Pro-rata	AFA
2011																
2012																
2013																
2014																
2015																
2016					9/3											
2017	7/15	7/22	7/22	7/22	7/29	7/29	7/29	9/9								
2018																
2019																
2020																
2021	7/17	7/17	7/17	9/11					8/28		8/28	8/14		8/7	8/7	8/7
2022																

Source: NMFS Catch Accounting System, data compiled by AKFIN.

6.2.2 Option 2 of Alternative 2: Assessment of WAK Chum Salmon Abundance Indices

The description of the three different indices that are under consideration to be used to determine WAK chum salmon abundance, and synchronicity analysis thereof, can be found in Section 4.2.2. For the impact analysis of the use of these indices in option 2 it is important to know when – or in what years historically— the indices threshold(s) would have resulted in an overall chum salmon PSC limit in place or at what level (step-down provisions under suboptions 1-3).

Under Alternative 2, option 2, suboption 1 the index for WAK chum abundance would be based on three areas:

a) Yukon River chum abundance is based on information provided by the summer and fall chum run reconstructions. If the summed value of Yukon River summer and fall chum salmon is less than 1,525,000 chum, a step-down provision would take effect.
b) Kuskokwim River chum abundance is based on information provided by the Bethel Test Fishery CPUE. If the Bethel Test Fishery CPUE is less than 2,800 chum, a step-down provision would take effect.
c) Norton Sound chum abundance is based on the summed escapement of the Snake, Eldorado, Kwiniuk, and North Rivers as well as total Norton Sound harvest. If the summed value of these sources is less than 57,000 chum, step-down provision would apply.

Table 6-35 below provides information on when the index thresholds would have been reached historically under Alternative 2, option 2, suboption 1.

Table 6-35 Yukon River Summer and Fall indices, the sum of the two Yukon indices, the Kuskokwim (Bethel test fishery) and summed Norton Sound indices (2011-2022). Years shaded in blue indicate when one or more of the indices was below the threshold level indicating a PSC cap would have been implemented in those years.

Year	Yukon River Summer Chum	Yukon River Fall Chum	Yukon River Summer + Fall	Bethel Test Fishery CPUE	Norton Sound Summed
2011	2,406,000	1,244,141	3,650,141	10,028	202,421
2012	2,479,900	1,089,200	3,569,100	6,894	107,359
2013	3,349,600	1,215,809	4,565,409	5,739	188,104
2014	2,467,600	956,669	3,424,269	6,345	215,382
2015	1,978,400	828,453	2,806,853	2,945	259,441
2016	2,581,500	1,390,329	3,971,829	3,998	124,397
2017	3,635,100	2,315,883	5,950,983	6,785	324,148
2018	2,074,700	1,114,684	3,189,384	8,205	363,939
2019	1,689,400	802,964	2,492,364	6,429	234,270
2020	763,200	184,233	947,433	1,443	49,762
2021	156,130	95,249	251,379	327	21,735
2022	478,690	242,465	721,155	2,191	70,702

Source ADF&G.

Based on this information, an overall chum salmon PSC limit would have been in place in the most recent three years for which complete information is available (2020-2022). From 2011-2019, no overall chum salmon PSC limit would have been in place. **A decision point before the Council is to select the step-down provisions that would apply when indices meet their threshold(s).** For analytical purposes only, staff have selected step-down provisions of 450,000 and 200,000 chum salmon. Applying these step-down provisions would have resulted in an overall chum salmon PSC limit of 200,000 in effect in 2020 and 2021. A PSC limit of 450,000 would have been in effect in 2022.

Under Alternative 2, option 2, suboption 2a the index for WAK chum abundance would be based on:

a) Yukon River summer chum salmon abundance, based on whether the run reconstruction is above or below 950,000 chum.
    a. If the Yukon River summer chum run reconstruction is above 950,000 chum, no overall PSC limit would be in place.
    b. If the Yukon River summer chum run reconstruction was below 950,000 chum, a overall PSC limit would be in place.

Table 6-36 below provides information on when the index threshold would have been reached historically under Alternative 2, option 2, suboption 2a.

Table 6-36 Yukon River Summer index (2011-2022). Years shaded in blue indicate when the index was below the threshold level indicating a PSC cap would have been implemented in those years

Year	Yukon River Summer Chum
2011	2,406,000
2012	2,479,900
2013	3,349,600
2014	2,467,600
2015	1,978,400
2016	2,581,500
2017	3,635,100
2018	2,074,700
2019	1,689,400
2020	763,200
2021	156,130
2022	478,690

Source ADF&G.

Based on this information, an overall chum salmon PSC limit would have been in place in the most recent three years for which complete information is available (2020-2022). From 2011-2019, no overall chum salmon PSC limit would have been in place. **A decision point before the Council is to select the step-down provisions that would apply when indices meet their threshold(s).** Using the step-down provisions mentioned previously, an overall chum salmon PSC limit of 450,000 chum would have been in place in 2020, 2021, and 2022.

Under Alternative 2, option 2, suboption 2b the index for WAK chum abundance would be based on:

a) Yukon River summer chum abundance, based on whether the run reconstructions for summer (950,000) and fall chum (575,000).
    a. If the Yukon River summer and fall chum are above the index thresholds of 950,000 and 575,000 chum, no overall PSC limit would be in place.
    b. If either or both summer and fall chum are below index thresholds of 950,000 and 575,000 an overall PSC limit would be in place.

Table 6-37 below provides information on when the index thresholds would have been reached historically under Alternative 2, option 2, suboption 2b.

Table 6-37 Yukon River Summer and Fall indices (2011-2022). Years shaded in blue indicate when one of more of the indices was below the threshold level indicating a PSC limit would have been implemented in those years

Year	Yukon River Summer Chum	Yukon River Fall Chum
2011	2,406,000	1,244,141
2012	2,479,900	1,089,200
2013	3,349,600	1,215,809
2014	2,467,600	956,669
2015	1,978,400	828,453
2016	2,581,500	1,390,329
2017	3,635,100	2,315,883
2018	2,074,700	1,114,684
2019	1,689,400	802,964
2020	763,200	184,233
2021	156,130	95,249
2022	478,690	242,465

Source ADF&G.

Based on this information, an overall chum salmon PSC limit would have been in place in the most recent three years for which complete information is available (2020-2022). From 2011-2019, no overall chum salmon PSC limit would have been in place. **A decision point before the Council is to select the step-down provisions that would apply when indices meet their threshold(s).** Using the step-down provisions mentioned previously, an overall chum salmon PSC limit of 450,000 chum would have been in place in 2020, 2021, and 2022.

6.2.3 Assessment of Performance Against the Annual WAK Chum Salmon Threshold (Alternative 3)

Under Alternative 3, an annual WAK chum salmon threshold of 40,000 to 53,000 WAK chum would be in place during the B season. Only the number of WAK chum salmon estimated using genetic data would accrue to a sector's apportionment of the threshold. Each sector's performance against their WAK chum salmon threshold would be evaluated through time as a performance standard that would have an effect on the sector's overall PSC limit. As described in Section 4.3, Alternative 3 must be implemented in conjunction with Alternative 2.

Under option 1 of Alternative 3, an overall chum PSC limit of 450,000 would be in place and apportioned among the pollock sectors. If a sector exceeded the performance standard under Alternative 3 by exceeding their apportionment for a third time in any seven-year period, a lower PSC limit of 200,000 chum would apply until the sector had stayed under their apportionment of the WAK threshold for three years, at which point an overall PSC limit of 450,000 would apply again.

Under option 2 of Alternative 3, an overall chum PSC limit of 550,000 would be in place and apportioned among the pollock sectors. If a sector exceeded the performance standard under Alternative 3 and exceeded their apportionment for a third time in any seven-year period, a lower PSC limit of 300,000 chum would apply until the sector had stayed under their apportionment of the WAK threshold for three years, at which point an overall PSC limit of 550,000 would apply again.

As discussed in Section 4.3, staff are looking for the Council to provide additional input on what would constitute the three-year period for a sector to be able to operate under the higher overall PSC limit in the future.

The analysis of potential impacts under Alternative 3 is a retrospective analysis as with other portions of this document. As described previously in Section 4.3, there are no real-time genetic information available. Therefore, a sector's performance against the threshold would not be known in season and would be assessed the following year. This dynamic is different from a sector's performance against the overall chum PSC limit under Alternative 2 where inseason managers have the capacity to track daily and weekly performance and close a sector inseason. As such, it is appropriate to evaluate whether a sector's estimated historical B season level of chum and WAK chum bycatch (as identified by genetic analyses) would have exceeded its apportionment of the overall PSC limit had no fishing behavior changes been made.

As discussed in Section 4.3, it is analytical staff's understanding that the Council's intention is that the WAK chum threshold would be implemented as a range to account for uncertainty in the genetic stock composition estimates. **In this retrospective analysis, the analysts assume a sector would be determined to have exceeded its apportionment of the WAK chum threshold if its estimated WAK chum salmon bycatch is greater than the upper bound of the threshold's range.**

Recall the Council's motion (October 2023) specifies the WAK chum threshold would be apportioned according to the four suboptions under option 3 of Alternative 2. Below are four tables that use a retrospective analysis to compare each sector's estimated WAK chum salmon bycatch against the apportionment suboption. Orange cells indicate the years when genetic analyses indicate a sector would have exceeded the upper bound of the apportionment of the WAK chum threshold (which could have an associated management action); yellow cells indicate when the sector would have exceeded the lower bound of the apportionment; gray cells indicate years where the WAK proportion was not able to be estimated for a sector. This provides the Council, industry, and the public with an idea of 1) the number of years when a sector would have exceeded its apportionment historically, and 2) the annual pattern of exceedance to know when or if the performance standard would have been triggered.

Table 6-38 Historical performance against the WAK chum threshold apportioned under Alternative 2, option 3, suboption 1 (3-year historical average level of bycatch), 2011 through 2022

Suboption 1 (3-year average)	6.10% 2,440 - 3,233	21.90% 8,760 - 11,607	9.10% 3,640 - 4,823	62.90% 25,160 - 33,337
Year	**CDQ**	**CP**	**Mothership**	**Inshore**
2011	NA	8,917	4,430	32,444
2012	NA	NA	NA	3,932
2013	NA	2,468	801	28,219
2014	NA	8,715	NA	31,650
2015	NA	5,133	1,928	36,262
2016	3,031	21,946	13,758	38,236
2017	22,674	33,435	4,673	35,288
2018	6,272	17,644	4,503	30,391
2019	2,898	5,090	7,637	40,237
2020	NA	1,926	1,148	25,620
2021	6,092	7,736	3,447	33,522
2022	902	8,037	7,891	37,278

Source: NMFS Alaska Region Catch Accounting System; QuotaGrp_AnnualEst
Notes: NA denotes insufficient samples were available to estimate genetic stock proportions. Orange cells indicate the years when genetic analyses indicate a sector would have exceeded the upper bound of the apportionment of the WAK chum threshold (which could have an associated management action); yellow cells indicate when the sector would have exceeded the lower bound of the apportionment; gray cells indicate years where the WAK proportion was not able to be estimated for a sector.

Table 6-39 Historical performance against the WAK chum threshold apportioned under Alternative 2, option 3, suboption 2 (5-year historical average level of bycatch), 2011 through 2022

Suboption 2 (5-year average)	7.10% 2,840 - 3,763	25.20% 10,080 - 13,356	9.50% 3,800 - 5,035	58.20% 23,280 - 30,846
Year	**CDQ**	**CP**	**Mothership**	**Inshore**
2011	NA	8,917	4,430	32,444
2012	NA	NA	NA	3,932
2013	NA	2,468	801	28,219
2014	NA	8,715	NA	31,650
2015	NA	5,133	1,928	36,262
2016	3,031	21,946	13,758	38,236
2017	22,674	33,435	4,673	35,288
2018	6,272	17,644	4,503	30,391
2019	2,898	5,090	7,637	40,237
2020	NA	1,926	1,148	25,620
2021	6,092	7,736	3,447	33,522
2022	902	8,037	7,891	37,278

Source: NMFS Alaska Region Catch Accounting System; QuotaGrp_AnnualEst
Notes: NA denotes insufficient samples were available to estimate genetic stock proportions. Orange cells indicate the years when genetic analyses indicate a sector would have exceeded the upper bound of the apportionment of the WAK chum threshold (which could have an associated management action); yellow cells indicate when the sector would have exceeded the lower bound of the apportionment; gray cells indicate years where the WAK proportion was not able to be estimated for a sector.

Table 6-40 Historical performance against the WAK chum threshold apportioned under Alternative 2, option 3, suboption 3, (pro-rata with 25% weighted to AFA allocation and 75% weighted to 3-year average), 2011 through 2022

Suboption 3 (Pro-rata)	7.10% 2,840 - 3,763	25.40% 10,160 - 13,462	9.10% 3,640 - 4,823	58.40% 23,360 - 30,952
Year	**CDQ**	**CP**	**Mothership**	**Inshore**
2011	NA	8,917	4,430	32,444
2012	NA	NA	NA	3,932
2013	NA	2,468	801	28,219
2014	NA	8,715	NA	31,650
2015	NA	5,133	1,928	36,262
2016	3,031	21,946	13,758	38,236
2017	22,674	33,435	4,673	35,288
2018	6,272	17,644	4,503	30,391
2019	2,898	5,090	7,637	40,237
2020	NA	1,926	1,148	25,620
2021	6,092	7,736	3,447	33,522
2022	902	8,037	7,891	37,278

Source: NMFS Alaska Region Catch Accounting System; QuotaGrp_AnnualEst
Notes: NA denotes insufficient samples were available to estimate genetic stock proportions. Orange cells indicate the years when genetic analyses indicate a sector would have exceeded the upper bound of the apportionment of the WAK chum threshold (which could have an associated management action); yellow cells indicate when the sector would have exceeded the lower bound of the apportionment; gray cells indicate years where the WAK proportion was not able to be estimated for a sector.

Table 6-41 Historical performance against the WAK chum threshold apportioned under Alternative 2, option 3, suboption 4 (AFA pollock allocations), 2011 through 2022

Suboption 4 (AFA)	10% 4,000 - 5,300	36% 14,400 - 19,080	9% 3,600 - 4,770	45% 18,000 - 23,850
Year	**CDQ**	**CP**	**Mothership**	**Inshore**
2011	NA	8,917	4,430	32,444
2012	NA	NA	NA	3,932
2013	NA	2,468	801	28,219
2014	NA	8,715	NA	31,650
2015	NA	5,133	1,928	36,262
2016	3,031	21,946	13,758	38,236
2017	22,674	33,435	4,673	35,288
2018	6,272	17,644	4,503	30,391
2019	2,898	5,090	7,637	40,237
2020	NA	1,926	1,148	25,620
2021	6,092	7,736	3,447	33,522
2022	902	8,037	7,891	37,278

Source: NMFS Alaska Region Catch Accounting System; QuotaGrp_AnnualEst
Notes: NA denotes insufficient samples were available to estimate genetic stock proportions. Orange cells indicate the years when genetic analyses indicate a sector would have exceeded the upper bound of the apportionment of the WAK chum threshold (which could have an associated management action); yellow cells indicate when the sector would have exceeded the lower bound of the apportionment; gray cells indicate years where the WAK proportion was not able to be estimated for a sector.

CDQ performance against the four apportionment suboptions for the WAK chum threshold cannot be assessed in six out of twelve years (2011 through 2015 and 2020) because there were insufficient samples available (either because of small overall bycatch numbers or subsampling for genetic analysis) to accurately estimate genetic stock compositions of CDQ bycatch. The upper bound of the WAK chum threshold apportionment ranges from a low of 3,233 WAK chum salmon (suboption 1, 3-year average) to a high of 5,300 WAK chum salmon (suboption 4, AFA). Based on the available genetic stock composition estimates, the CDQ program's apportionment would have been exceeded in 2017, 2018, and 2021 under all four apportionment suboptions. Historical performance indicates the CDQ sector would have exceeded the performance standard in recent years (i.e., a seven-year grouping between 2015-2022) and would have operated under a lower overall chum salmon PSC limit of 200,000 or 300,000 chum in future years.

The **CP** sector's performance against the four apportionment suboptions can be assessed in all years except for 2012. The upper bound of the CP sector's apportionment of the WAK chum salmon threshold ranges from a low of 11,607 WAK chum salmon (suboption 1, 3-year average) to a high of 19,080 WAK chum salmon (suboption 4, AFA). **The CP sector would have exceeded their apportionment of the threshold in 2016, 2017, and 2018 under all apportionment suboptions except for suboption 4 when the upper bound of the threshold would have been exceeded in 2016 and 2017.** Under suboptions 1-3, the CP sector would have triggered a lower PSC limit of either 200,000 or 300,000 chum salmon to come into effect in the 2020 B season. This assessment is based on the implementation approach outlined in Section 4.3.2.1.1 wherein the CP sector's performance against the WAK chum threshold in the 2018 B season would have been formally evaluated in the fall 2019 groundfish harvest specifications process and the lower PSC limit implemented in the 2020 B season.

The **mothership** sector's performance against the four apportionment suboptions can be assessed in ten out of twelve years. There were insufficient samples to estimate the stock composition of the mothership sector's chum salmon bycatch in 2012 and 2014. The upper bound of the mothership sector's WAK chum threshold from a low of 4,770 chum salmon (suboption 4, AFA) to a high of 5,035 chum salmon (suboption 2, 5-year average). **Under all four suboptions, the mothership sector would have exceeded its apportionment of the threshold in 2016, 2019, and 2022** and triggered a lower PSC limit of either 200,000 or 300,000 to come into effect in the future.

The **inshore** sector's performance against the four suboptions for apportioning the WAK chum salmon threshold can be assessed in all twelve years. The upper bound of the inshore sector's WAK chum threshold ranges from a low 23,850 chum salmon (suboption 4, AFA) to a high of 33,337 chum salmon (suboption 1, 3-year average). Based on historical performance, **the inshore sector would have exceeded the performance standard under each apportionment suboption during some years but the timing of when a lower PSC limit would come into effect varies.**

6.2.4 Estimates of Overall Chum Salmon and Western Alaska Chum Salmon Avoided Under an Overall Chum Salmon PSC Limit

A direct and positive impact of the proposed action alternatives is a reduction in the overall number of chum salmon caught as bycatch relative to the status quo. The relative degree (or magnitude) of the reduction would depend on the options/alternatives selected and the extent to which pollock harvesters are able to modify their fishing behavior to avoid chum salmon bycatch.

Appendix 6 contains all the individual years and sector allocations under each cap scenario and the salmon saved (chum and Chinook) for each. This analysis uses the cumulative amounts over those years to compare and contrast recognizing the inherent uncertainty in assigning a value judgement to a constraint in an individual year on a sector applied historically. On a broad base, lower caps result in a more likely constraint on some pollock fishing and more likely avoided chum salmon (and Chinook salmon see Section 6.2.5.1) if looked at singularly and without trade-offs on other policy objectives. Apportionment schemes that are more constraining on the shoreside sector, which targets pollock in the fishing grounds closest to the Alaska Peninsula (i.e., Cluster areas 1 and 2 as shown in Section 6.1.4.4) are more likely to result in more WAK chum salmon saved based on their relative distribution. Additionally, application of caps historically does not account for potential behavioral changes so placing too much value on an individual year or allocation scheme within a year would necessarily ignore that uncertainty. **While a summary of estimates of WAK salmon avoided by sector is provided below,**

additional discussion is contained in Section 6.2.4.2 for context in reviewing these results.

Sector level apportionments reflect varying salmon saved due to operational differences and spatial temporal differences amongst the sectors (see 6.1.4.2 through 6.1.4.4), Table 6-42 to Table 6-45 show the cumulative (2011-2022) salmon saved (all chum) by sector, apportionment and cap. For example, looking at Table 6-42, the largest amount of salmon saved (across all alternatives) occurs under for 200,000 cap with the AFA apportionment (suboption 4) because of the disproportionate constraint on the shoreside sector when no bycatch history is taken into account in establishing the apportionment. When looking further by year, the inshore sector is closed early in nearly every year with the exception of 2012 and 2013.

Table 6-42 Pollock forgone, overall chum salmon avoided and % reduction (annual and B season) of each cumulatively (2011-2022) with sector allocations: cap 200,000

If a 200,000 chum PSC limit had been in place 2011-2022:		Sum of Forgone B Season Pollock (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chum Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**1,783,255**	**20.4%**	**11.8%**	**852,347**	**25.3%**	**25.2%**
	CDQ	189,218	21.4%	12.1%	99,035	43.5%	43.2%
	CP	808,749	25.9%	14.9%	347,317	36.1%	35.9%
	Mothership	117,955	14.9%	8.6%	65,310	23.3%	23.2%
	Inshore	667,332	16.9%	9.9%	340,685	17.9%	17.9%
5-year avg. sector apportionment	**Total**	**1,907,248**	**21.8%**	**12.6%**	**994,447**	**29.5%**	**29.4%**
	CDQ	164,173	18.5%	10.5%	63,497	27.9%	27.7%
	CP	785,612	25.1%	14.5%	325,469	33.9%	33.7%
	Mothership	114,457	14.5%	8.4%	62,513	22.3%	22.2%
	Inshore	843,005	21.3%	12.4%	542,968	28.6%	28.5%
Pro-rata sector apportionment	**Total**	**1,889,098**	**21.6%**	**12.5%**	**866,573**	**25.7%**	**25.6%**
	CDQ	164,173	18.5%	10.5%	63,497	27.9%	27.7%
	CP	785,612	25.1%	14.5%	325,469	33.9%	33.7%
	Mothership	117,955	14.9%	8.6%	65,310	23.3%	23.2%
	Inshore	821,358	20.8%	12.1%	412,297	21.7%	21.7%
AFA sector apportionment	**Total**	**2,235,419**	**25.5%**	**14.8%**	**1,092,360**	**32.4%**	**32.3%**
	CDQ	147,739	16.7%	9.5%	61,612	27.0%	26.9%
	CP	621,440	19.9%	11.4%	235,752	24.5%	24.4%
	Mothership	120,149	15.2%	8.8%	66,894	23.9%	23.8%
	Inshore	1,346,090	34.1%	19.9%	728,102	38.3%	38.2%

Table 6-43 Pollock forgone, overall chum salmon avoided and % reduction (annual and B season) of each cumulatively (2011-2022) with sector allocations: cap 300,000

If a 300,000 chum PSC limit had been in place 2011-2022:		Sum of Forgone B Season Pollock (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chum Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**1,071,457**	**12.2%**	**7.1%**	**474,719**	**14.1%**	**14.0%**
	CDQ	147,739	16.7%	9.5%	61,612	27.0%	26.9%
	CP	639,204	20.5%	11.8%	242,239	25.2%	25.0%
	Mothership	69,238	8.8%	5.1%	31,078	11.1%	11.0%
	Inshore	215,277	5.5%	3.2%	139,790	7.4%	7.3%
5-year avg. sector apportionment	**Total**	**1,052,203**	**12.0%**	**7.0%**	**479,507**	**14.2%**	**14.2%**
	CDQ	147,739	16.7%	9.5%	61,612	27.0%	26.9%
	CP	607,007	19.4%	11.2%	231,242	24.1%	23.9%
	Mothership	69,238	8.8%	5.1%	31,078	11.1%	11.0%
	Inshore	228,220	5.8%	3.4%	155,575	8.2%	8.2%
Pro-rata sector apportionment	**Total**	**1,037,812**	**11.9%**	**6.9%**	**478,110**	**14.2%**	**14.1%**
	CDQ	147,739	16.7%	9.5%	61,612	27.0%	26.9%
	CP	592,616	19.0%	10.9%	229,845	23.9%	23.8%
	Mothership	69,238	8.8%	5.1%	31,078	11.1%	11.0%
	Inshore	228,220	5.8%	3.4%	155,575	8.2%	8.2%
AFA sector apportionment	**Total**	**952,571**	**10.9%**	**6.3%**	**460,807**	**13.7%**	**13.6%**
	CDQ	90,104	10.2%	5.8%	57,753	25.3%	25.2%
	CP	231,045	7.4%	4.3%	84,688	8.8%	8.8%
	Mothership	69,238	8.8%	5.1%	31,078	11.1%	11.0%
	Inshore	562,186	14.2%	8.3%	287,288	15.1%	15.1%

Table 6-44 Pollock forgone, overall chum salmon avoided and % reduction (annual and B season) of each cumulatively (2011-2022) with sector allocations: cap 450,000

If a 450,000 chum PSC limit had been in place 2011-2022:		Sum of Forgone B Season Pollock (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chum Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**527,984**	**6.0%**	**3.5%**	**171,870**	**5.1%**	**5.1%**
	CDQ	90,104	10.2%	5.8%	57,753	25.3%	25.2%
	CP	255,325	8.2%	4.7%	95,546	9.9%	9.9%
	Mothership	33,619	4.3%	2.5%	5,518	2.0%	2.0%
	Inshore	148,936	3.8%	2.2%	13,053	0.7%	0.7%
5-year avg. sector apportionment	**Total**	**471,574**	**5.4%**	**3.1%**	**153,079**	**4.5%**	**4.5%**
	CDQ	90,104	10.2%	5.8%	57,753	25.3%	25.2%
	CP	202,042	6.5%	3.7%	81,145	8.4%	8.4%
	Mothership	30,492	3.9%	2.2%	1,128	0.4%	0.4%
	Inshore	148,936	3.8%	2.2%	13,053	0.7%	0.7%
Pro-rata sector apportionment	**Total**	**474,701**	**5.4%**	**3.1%**	**157,469**	**4.7%**	**4.7%**
	CDQ	90,104	10.2%	5.8%	57,753	25.3%	25.2%
	CP	202,042	6.5%	3.7%	81,145	8.4%	8.4%
	Mothership	33,619	4.3%	2.5%	5,518	2.0%	2.0%
	Inshore	148,936	3.8%	2.2%	13,053	0.7%	0.7%
AFA sector apportionment	**Total**	**418,368**	**4.8%**	**2.8%**	**172,531**	**5.1%**	**5.1%**
	CDQ	76,810	8.7%	4.9%	19,679	8.6%	8.6%
	CP	102,579	3.3%	1.9%	31,635	3.3%	3.3%
	Mothership	38,733	4.9%	2.8%	14,154	5.1%	5.0%
	Inshore	200,246	5.1%	3.0%	107,063	5.6%	5.6%

Table 6-45 Pollock forgone, overall chum salmon avoided and % reduction (annual and B season) of each cumulatively (2011-2022) with sector allocations: cap 550,000

If a 550,000 chum PSC limit had been in place 2011-2022:		Sum of Forgone B Season Pollock (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chum Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**274,502**	**3.1%**	**1.8%**	**124,335**	**3.7%**	**3.7%**
	CDQ	90,104	10.2%	5.8%	57,753	25.3%	25.2%
	CP	173,485	5.6%	3.2%	66,382	6.9%	6.9%
	Mothership	10,914	1.4%	0.8%	200	0.1%	0.1%
	Inshore		0.0%	0.0%		0.0%	0.0%
5-year avg. sector apportionment	**Total**	**359,623**	**4.1%**	**2.4%**	**95,095**	**2.8%**	**2.8%**
	CDQ	76,810	8.7%	4.9%	19,679	8.6%	8.6%
	CP	133,877	4.3%	2.5%	62,363	6.5%	6.4%
	Mothership		0.0%	0.0%	13,053	0.0%	0.0%
	Inshore	148,936	3.8%	2.2%		0.7%	0.7%
Pro-rata sector apportionment	**Total**	**370,537**	**4.2%**	**2.5%**	**95,295**	**2.8%**	**2.8%**
	CDQ	76,810	8.7%	4.9%	19,679	8.6%	8.6%
	CP	133,877	4.3%	2.5%	62,363	6.5%	6.4%
	Mothership	10,914	1.4%	0.8%	200	0.1%	0.1%
	Inshore	148,936	3.8%	2.2%	13,053	0.7%	0.7%
AFA sector apportionment	**Total**	**204,635**	**2.3%**	**1.4%**	**28,736**	**0.9%**	**0.8%**
	CDQ	30,507	3.4%	2.0%	13,584	6.0%	5.9%
	CP	2,225	0.1%	0.0%	1,321	0.1%	0.1%
	Mothership	22,968	2.9%	1.7%	778	0.3%	0.3%
	Inshore	148,936	3.8%	2.2%	13,053	0.7%	0.7%
Grand Total		**15,031,214**	**10.7%**	**6.2%**	**6,697,280**	**12.4%**	**12.4%**

In order to look at an interannual scale and show what these allocations could mean for overall WAK salmon saved, a single example (from tables in Appendix 6) using the 200,000 PSC limit cap and 3-yr average apportionment (Option 3, suboption 1) was selected (Table 6-46). While understanding that WAK contribution to bycatch varies both temporally and spatially, information is added to the table as to which time period (Early, Middle, Late) the estimated bycatch would have come from, for context as to the potential number of WAK salmon avoided. Sections 6.1.4.3 and 6.1.4.4 of this analysis provide more information on the spatial, temporal and sector level differences in WAK chum stock composition of the bycatch. Generally speaking (and with some variability across years) the WAK contribution is highest in the Early and Middle season breakout, so all estimates that include retrospective closures in the earlier portion of the B season would be assumed to result in more chum salmon saved but also in a relatively higher WAK contribution among those fish.

As stated previously these tables are illustrative only. The PSC savings are based on assumed pollock fishery closures; however, they do not account for any changes in fishing behavior. An overall chum PSC limit that is constraining on fleet behavior may reduce chum salmon bycatch relative to historical limits, however the direct impact to the catch of WAK chum is more difficult to predict when considering how the fleet may respond to a new PSC limit. While an overall PSC limit will ostensibly set a cap on the maximum number of WAK chum that may be caught, given the large proportion of non-WAK chum typically caught, and the limits considered under Alternative 2, option 1, an overall chum PSC limit on its own may not necessarily achieve the Council's goal of reducing WAK chum bycatch. If the pollock fishery was required to operate under an overall chum salmon PSC limit, it is anticipated that industry would target pollock fishing in areas with lower chum salmon bycatch rates while balancing other considerations (e.g., Chinook avoidance). Reducing the overall level of chum salmon bycatch in response to a PSC limit may not necessarily guarantee a lower proportion of WAK chum in the overall bycatch. For example, in 2021 the pollock fishery caught 545,901 chum salmon as bycatch and the estimated mean stock proportion of WAK chum was 9.4%. In 2022, the pollock fishery caught 242,309 chum salmon as bycatch and the estimated mean stock proportion of WAK chum was 23.0%. Although the overall chum salmon PSC was more than halved between 2021 and 2022, there was an increase in the number of WAK chum salmon caught overall (i.e., an estimated 51,512 chum from WAK in 2021 and an estimated 55,724 chum from WAK in 2022; Table 6-9).

Table 6-46 Annual example of WAK chum salmon saved under a 200,000 PSC limit, suboption 1 (3-yr average). Shown are the allocation, the relative date of closure, what period (Early (E), Middle(M) and Late (L) the chum avoided would have come from and the estimated chum avoided and their relative contribution from WAK as well as the total by sector over all (2011-2022) years.

Sector	Year	Week-end date	what period of time would the remaining chum saved have come from?	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Potential Number of WAK Chum Salmon Avoided in B Season
	Total			**227,891**	**63,497**	
CDQ	2011			3,758		
	2012			200		
	2013			554		
	2014			2,407		
	2015			4,650		
	2016	8/13/2016	M/L	16,342	1,327	601
	2017	7/15/2017	E/M/L	87,058	51,395	19,012
	2018	7/7/2018	E/M/L	26,586	3,859	3,066
	2019	9/28/2019	L	15,726	558	635
	2020			8,582		
	2021	7/17/2021	E/M/L	55,663	6,358	696
	2022			6,365		
	Total			**961,389**	**325,469**	**24,009**
CP	2011		L	44,299		4
	2012			1,928		
	2013			10,229		
	2014	9/6/2014	L	63,066	7,424	1,026
	2015			40,046		
	2016	8/6/2016	M/L	134,750	75,009	12,216
	2017	7/22/2017	E/M/L	207,355	110,576	17,830
	2018	7/7/2018	E/M/L	99,447	40,571	7,198
	2019	8/31/2019	L	113,428	18,785	844
	2020	9/12/2020	L	77,138	24,976	805
	2021	7/31/2021	M/L	97,917	37,412	2,956
	2022	8/27/2022	M/L	71,786	10,716	2,830
	Total			**280,145**	**62,513**	**69,718**
Mothership	2011	9/17/2011	L	24,399	5,176	940
	2012			977		
	2013			3,835		
	2014			8,091		
	2015			14,046		
	2016	8/13/2016	M/L	43,262	18,916	6,016
	2017			16,825		
	2018	9/8/2018	L	21,303	100	612
	2019	8/31/2019	L	44,860	20,379	3,469
	2020	10/31/2020	L	19,743		0
	2021	7/31/2021	L	50,542	9,694	661
	2022	8/13/2022	M/L	32,262	8,248	2,017
	Total			**1,899,055**	**542,968**	**83,434**
Inshore	2011	10/15/2011		118,861		
	2012			19,067		
	2013			110,496		
	2014	8/30/2014	L	145,322	23,714	3,871
	2015	8/22/2015	M/L	174,343	53,326	9,289
	2016	9/10/2016	L	144,882	15,397	796
	2017	7/29/2017	M/L	154,610	32,644	6,076
	2018	9/1/2018	L	147,369	14,956	3,326
	2019	8/17/2019	L	172,798	55,006	9,412
	2020	9/5/2020	L	237,632	111,140	10,518
	2021	7/24/2021	M/L	341,779	225,297	17,535
	2022	8/13/2022	M/L	131,896	10,702	636
	Total			**1,899,055**	**542,182**	**61,460**

In summary, across sectors and years, under a cap of 200,000 chum salmon with the Option 3, suboption 1 apportionment (3-year average), cumulatively across all years 144,893 WAK chum salmon (average of 12,074 per year) would have been saved assuming no change in behavior (Table 6-47).

Table 6-47 Estimated total WAK chum saved by sectors and years under a 200,000 chum salmon PSC limit and suboption 1 (3-year average) apportionment scheme as well as cumulative total across all years (2011-2022) as shown in Table 6-46

Year	CDQ	CP	Mothership	Inshore	Total
2011	0	3	940	0	**943**
2012	0	0	0	0	**0**
2013	0	0	0	0	**0**
2014	0	1,026	0	3,871	**4,897**
2015	0	0	0	9,289	**9,289**
2016	601	12,216	6,016	796	**19,628**
2017	19,012	17,830	0	6,076	**42,918**
2018	3,066	7,198	612	3,326	**14,203**
2019	635	844	3,469	9,412	**14,361**
2020	0	805	0	10,518	**11,323**
2021	696	2,956	661	17,535	**21,848**
2022	0	2,830	2,017	636	**5,484**
Total	**24,009**	**45,708**	**13,716**	**61,460**	**144,893**

6.2.4.1 Additional Considerations Related to Western Alaska Chum Salmon Avoided Under Alternative 3

Alternative 3 imposes the same overall chum PSC limits as Alternative 2 with the additional provision of a WAK performance threshold as described in Section 4.3 of this analysis. While the analysts understand NMFS would likely assess an overage in the subsequent year and impose it the year after (i.e. the sector exceeds the upper bound of its threshold for the third time in 2024, NMFS determines this in 2025, and a lower limit is imposed in 2026), the lack of specificity in the results of retroactively exceeding the WAK threshold mean it is not feasible to estimate the impacts of this alternative separately from those described under Alternative 2 (i.e., the sectors would not know when the threshold had been reached inseason and there is no inseason penalty for doing so). Therefore, the relative impacts under both Alternatives are described below, because it is assumed the impacts of Alternative 2 and 3 on WAK chum salmon would largely be the same, understanding that the penalty for exceeding a WAK threshold is lagged by multiple exceedances and by many years. Nonetheless, it is possible that the despite uncertainty (i.e., a sector would not know its performance against the WAK chum salmon threshold inseason) and the incentive of a lower overall PSC limit taking effect in the future (i.e., if the performance standard was exceeded) Alternative 3 could result in greater WAK chum salmon savings should historical information on spatial and temporal trends in WAK chum on the fishing grounds be useful in avoiding WAK chum in the future.

6.2.4.2 Summary of Impacts Related to Chum Salmon and WAK Chum Salmon Under Alternative 2 and 3

A direct and positive impact of the proposed action alternatives is a reduction in the overall number of chum salmon caught as bycatch relative to the status quo. The relative degree (or magnitude) of the reduction would depend on the options/alternatives selected and the extent to which pollock harvesters are able to modify their fishing behavior to avoid chum salmon bycatch.

A reduction in the number of chum salmon caught as bycatch in the Bering Sea pollock fishery may have a positive and indirect impact on the overall health of the resource as more adult chum salmon may return to their natal streams. The proposed action is focused on reducing WAK chum salmon bycatch in particular, and increased adult chum salmon returns could increase escapement, which may improve run strength and abundance over time. **However, the analysts are unable to quantify the relative magnitude of these potential indirect and positive benefits for at least three primary reasons.**

First, the analysts are unable to determine the absolute impact of chum salmon bycatch occurring in the Bering Sea pollock fishery on chum salmon returns or the overall run size. The genetic component of Western Alaska chum salmon in the overall bycatch includes stocks returning to rivers from a large area spanning from Kotzebue Sound in the north, down through Bristol Bay in the south. Run reconstructions that provide an estimation of total run size are more limited for chum salmon than Chinook salmon for Western Alaska river systems. A scientifically defensible run reconstruction includes fairly thorough estimates of escapements (the number of fish that are not caught by fisheries and contribute to the spawning population) and harvests. Currently, run reconstructions are only available for the Yukon River summer and fall chum salmon as well as the Kwiniuk River chum salmon. This excludes large populations in the Kuskokwim River and throughout Bristol Bay, Kotzebue Sound, and Norton Sound.

The lack of run reconstructions for large portions of WAK chum salmon means an accurate approximation of the total WAK chum salmon abundance cannot be provided. Thus, an estimate of the impact of chum salmon bycatch removals on these total populations cannot be calculated. It is also not possible to precisely estimate the magnitude of the potential benefits of the proposed action alternatives (i.e., the extent to which any level of chum salmon bycatch reduction would lead to improvements in escapement goals being met and subsistence opportunities being less restrictive from the status quo). However, it is possible that the options and suboptions provided in Alternatives 2 and/or 3 would reduce the overall chum salmon bycatch by the pollock fishery and, in turn, reduce the number of chum salmon removed from WAK stocks.

Second, the analysts are unable to break out the WAK genetic stock reporting group (Coastal Western Alaska + Upper/Middle Yukon reporting groups) into smaller river systems or areas because of the current understanding of genetic structure among Western Alaska chum salmon. There is very little genetic differentiation among chum salmon returning to river systems across Western Alaska except for the Yukon River fall chum salmon runs and Kotzebue stocks which are genetically distinct. The current hypotheses explaining such low genetic structure observed is colonization from a single glacial refugia into dynamic watersheds that were transiently interconnected over the last ~1200 generations. Among the large river systems (lower Yukon and Kuskokwim) chum salmon likely formed large metapopulations less affected by the diversifying effect of genetic drift. Despite numerous efforts to identify genetic markers to resolve subregional reporting groups within Western Alaska, geologic history combined with chum salmon life history may constrain population genetic structure in the region. Currently, it is not possible to confer the degree of positive impacts to specific management areas, river systems, or communities. This data limitation may be resolved through genome sequencing (project submitted to AYK Sustainable Salmon Initiative), but this will not happen for at least 3-4 years, and it is still possible that the major river systems will not be able to be differentiated using new techniques.

Third, and related to the points above, there is uncertainty in the level of bycatch reduction that would need to be achieved to result in escapement goals being met or improvements in chum salmon harvest opportunities. Under the current data limitations and uncertainties, it is possible that increased adult chum salmon returns to Western and Interior Alaska river systems achieved through a reduction in bycatch provides the potential for positive impacts on the chum salmon stocks and people across Western and Interior Alaska that depend on them. For stocks that have consistently failed to achieve escapement goals, increased adult returns could increase escapement, which may improve future run sizes over time. For stocks that have only supported limited harvestable surplus, increased adult returns may support cultural practices, identity, food security, and economic opportunities.

6.2.5 Assessment of Other PSC Savings (Chinook salmon and Herring) Under an Overall Chum Salmon PSC Limit

6.2.5.1 Effects on Chinook

As with chum salmon the number of Chinook salmon avoided under each of the alternatives and apportionments was calculated from when each sector would have reached its limit and projecting forward to the number of Chinook salmon that would have been avoided had that sector stopped fishing (assuming no change in behavior). Appendix 6 shows the annual and cumulative Chinook avoided under each alternative and sector. Table 6-48 shows the cumulative Chinook avoided under one cap option (200,000 Chum PSC limit) and all four apportionment suboptions. As Chinook tended to be taken later in the B season it is expected that overall, there would be a high reduction in Chinook which as shown cumulatively ranges from 7.8 to 32.6% (annually) and 20-70% (B-season) depending on the sector and apportionment scheme.

Table 6-48 Cumulative Chinook avoided under a cap of 200,000 chum and 4 sector apportionments (2011-2022)

If a 200,000 chum PSC limit had been in place 2011-2022:		Sum of B Season Chinook Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**32,874**	**39.3%**	**14.5%**
	CDQ	1,441	42.2%	9.6%
	CP	11,277	59.4%	15.6%
	Mothership	3,235	47.8%	21.1%
	Inshore	16,921	31.0%	13.7%
5-year avg. sector apportionment	**Total**	**36,778**	**43.9%**	**16.3%**
	CDQ	1,168	34.2%	7.8%
	CP	11,055	58.2%	15.3%
	Mothership	3,140	46.4%	20.5%
	Inshore	21,415	39.2%	17.3%
Pro-rata sector apportionment	**Total**	**36,835**	**44.0%**	**16.3%**
	CDQ	1,168	34.2%	7.8%
	CP	11,055	58.2%	15.3%
	Mothership	3,235	47.8%	21.1%
	Inshore	21,377	39.2%	17.3%
AFA sector apportionment	**Total**	**54,182**	**64.7%**	**23.9%**
	CDQ	705	20.7%	4.7%
	CP	9,511	50.1%	13.2%
	Mothership	3,553	52.5%	23.1%
	Inshore	40,413	74.1%	32.6%

Looking at an individual apportionment scheme (3-year average) by year shows considerable variability by year (Table 6-49) and across sectors in hypothetical Chinook savings based on closures in the B season. For most sectors the closures would occur later in August and early September but in some years the closures occurred as early as late June (2018 CDQ), and July (2021 Inshore, 2018 CP). In general, any closures even late in the B season have a high likelihood of saving Chinook given the timing of when the pollock fishery tends to run into Chinook bycatch (late August through October). However, as highlighted in Section 6.2.4, the expectation of fleet movement to avoid chum PSC could extend or even prevent the closures represented in these tables. Thus, it is likely that Chinook savings would not be realized in the way they are represented in Table 6-49. Additionally chum avoidance strategies could result in the fleets moving into higher areas of Chinook PSC. While some of these closures could result in Chinook savings it should be weighed against the pollock forgone for a balanced perspective (See Section 6.2.4.2)

Table 6-49 Chinook salmon PSC avoided and % reduction under a 200,000 chum salmon PSC limit and Sector apportionment of Option 3, Suboption 1 (3-year average)

Sector	Year	Week-end date	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Sector	Year	Week-end date	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total
	Total		**3,413**	**1,441**	**42.2%**	**9.6%**		**Total**		**6,774**	**3,235**	**47.8%**	**21.1%**
	2011		334		0.0%	0.0%		2011	9/17/2011	2,426	2,332	96.1%	80.8%
	2012		5		0.0%	0.0%		2012		49		0.0%	0.0%
	2013		48		0.0%	0.0%		2013		48		0.0%	0.0%
	2014		36		0.0%	0.0%		2014		180		0.0%	0.0%
	2015		250		0.0%	0.0%		2015		559		0.0%	0.0%
CDQ	2016	8/6/2016	352	273	77.6%	17.1%	**Mothership**	2016	8/13/2016	366	233	63.7%	16.1%
	2017	7/8/2017	388	224	57.7%	8.9%		2017		476		0.0%	0.0%
	2018	6/30/2018	358	300	83.8%	23.2%		2018	9/1/2018	364	103	28.3%	13.9%
	2019	9/21/2019	719	408	56.7%	17.1%		2019	8/31/2019	538	392	72.9%	26.8%
	2020		557		0.0%	0.0%		2020	10/31/2020	1,472		0.0%	0.0%
	2021	7/17/2021	329	236	71.7%	20.1%		2021	7/31/2021	222	141	63.5%	15.3%
	2022		37		0.0%	0.0%		2022	8/13/2022	74	34	45.9%	10.7%
	Total		**18,989**	**11,277**	**59.4%**	**15.6%**		**Total**		**54,569**	**16,921**	**31.0%**	**13.7%**
	2011	10/29/2011	1,652	31	1.9%	0.9%		2011		13,951		0.0%	0.0%
	2012		92		0.0%	0.0%		2012		3,433		0.0%	0.0%
	2013		448		0.0%	0.0%		2013		4,255		0.0%	0.0%
	2014	9/6/2014	567	252	44.4%	5.6%		2014	9/6/2014	2,718	907	33.4%	9.9%
	2015		2,374		0.0%	0.0%		2015	8/29/2015	2,848	1,519	53.3%	14.3%
CP	2016	8/6/2016	2,403	2,005	83.4%	22.6%	**Inshore**	2016	9/10/2016	1,987	897	45.1%	8.9%
	2017	7/22/2017	1,475	809	54.8%	7.8%		2017	8/5/2017	6,134	2,851	46.5%	18.8%
	2018	7/7/2018	1,259	1,064	84.5%	22.8%		2018	9/1/2018	3,215	773	24.0%	11.0%
	2019	8/31/2019	3,127	2,680	85.7%	26.0%		2019	9/7/2019	4,863	1,257	25.8%	11.6%
	2020	9/5/2020	4,151	3,599	86.7%	31.6%		2020	9/5/2020	7,807	6,726	86.2%	42.4%
	2021	7/31/2021	1,187	775	65.3%	16.5%		2021	7/31/2021	2,571	1,839	71.5%	26.4%
	2022	8/20/2022	254	62	24.4%	3.5%		2022	8/20/2022	787	152	19.3%	4.0%

6.2.5.2 Effects on Herring

In general under Alternatives 2 and 3 estimated cumulative (2011-2022) savings of herring are fairly low (<14% total avoided under the most restrictive PSC cap alternative, Alternative 2, Option 3) with some nuances between sector apportionment sub-options. The actual numbers of herring caught in some years is very low, which makes some reductions look inflated when viewed as a percentile. Option 3, sub-option 4 (AFA pro-rata allocation) tends to provide for higher herring savings by the shoreside sector but this is still highly variable. Looking at a single cap and apportionment options (Table 6-50 below) shows the inter-annual variability in these results likely driven by variability in fishing timing and herring migration pattern more so than by specific PSC cap levels. Here the largest reduction in the shoreside sector occurred in 2021 when 246 t of herring would have been saved by the fishery closing at the end of July (assuming no change in behavior). In general, the number of herring avoided is too small to draw many conclusions about the impacts of a PSC limit for chum salmon in terms of herring savings as behavioral changes to avoid triggering a cap are likely to be a larger factor in herring PSC than the cap itself. However as noted in Section 6.1.8.3 sectors are subject to an aggregate herring PSC limit (not a sector apportioned one), and available fishing locations by sector differentially affected by the HSAs when triggered and thus the fleet must balance herring PSC against considerations of moving operations into areas of higher Chinook salmon or WAK chum salmon (see also Section 6.2.6 on trade-off in fishing operations across PSC species).

Table 6-50 Week-end date, herring bycatch, herring avoided and % of total reduction in herring PSC cumulatively (2011-2022) with sector allocation (Option 3, suboption 1): cap 200,000

Sector	Year	Week-end date	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Sector	Year	Week-end date	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total
CDQ	**Total**		**311**	**3**	**0.96%**	**0.59%**	Mothership	**Total**		**503**	**82**	**16.37%**	**6.43%**
	2011		12		0.00%	0.00%		2011	9/17/2011	3	0	1.51%	1.44%
	2012		103		0.00%	0.00%		2012		117		0.00%	0.00%
	2013		1		0.00%	0.00%		2013		4		0.00%	0.00%
	2014		14		0.00%	0.00%		2014		3		0.00%	0.00%
	2015		1		0.00%	0.00%		2015		5		0.00%	0.00%
	2016	8/6/2016	139	0	0.05%	0.05%		2016	8/13/2016	14	0	2.87%	0.26%
	2017	7/8/2017	3	1	41.53%	17.75%		2017		25		0.00%	0.00%
	2018	6/30/2018	2	0	13.80%	10.30%		2018	9/1/2018	6	1	18.80%	16.50%
	2019	9/21/2019	9	0	0.39%	0.25%		2019	8/31/2019	12	11	91.58%	90.69%
	2020		7		0.00%	0.00%		2020	10/31/2020	36		0.00%	0.00%
	2021	7/17/2021	8	1	14.06%	3.07%		2021	7/31/2021	129	70	53.90%	38.68%
	2022		12		0.00%	0.00%		2022	8/13/2022	149	0	0.10%	0.06%
CP	**Total**		**1,623**	**164**	**10.13%**	**3.71%**	Inshore	**Total**		**8,544**	**475**	**5.56%**	**4.58%**
	2011	10/29/2011	124	0	0.00%	0.00%		2011		236		0.00%	0.00%
	2012		400		0.00%	0.00%		2012		1,608		0.00%	0.00%
	2013		763		0.00%	0.00%		2013		191		0.00%	0.00%
	2014	9/6/2014	7	0	2.38%	2.37%		2014	9/6/2014	136	0	0.00%	0.00%
	2015		5		0.00%	0.00%		2015	8/29/2015	1,059	23	2.15%	2.06%
	2016	8/6/2016	47	14	29.84%	3.40%		2016	9/10/2016	654	0	0.01%	0.01%
	2017	7/22/2017	27	18	68.36%	7.85%		2017	8/5/2017	646	63	9.78%	9.47%
	2018	7/7/2018	18	2	9.18%	4.03%		2018	9/1/2018	381	0	0.02%	0.01%
	2019	8/31/2019	4	2	50.46%	1.17%		2019	9/7/2019	866	93	10.74%	10.21%
	2020	9/5/2020	97	35	36.58%	2.35%		2020	9/5/2020	822	35	4.25%	2.03%
	2021	7/31/2021	5	4	67.65%	2.68%		2021	7/31/2021	970	246	25.34%	18.15%
	2022	8/20/2022	126	89	70.92%	55.50%		2022	8/20/2022	974	15	1.54%	1.18%

6.2.6 Assessment of Other PSC Species Savings and Potential Policy-Level Tradeoffs

The purpose of this action is to minimize WAK chum bycatch in the Bering Sea pollock fishery to the extent practicable (National Standard 9), while balancing all other National Standards and applicable laws. **As the Council considers the proposed action and the current set of alternatives, it may also wish to consider how these alternatives may motivate fleet behavior to avoid chum bycatch (and WAK chum bycatch) while balancing its priorities with PSC avoidance under the current salmon bycatch program established under Amendments 91 and 110 (as noted in the Council's purpose and need statement).** The analysts have summarized some of the main considerations related to PSC directly below, which would apply both under Alternative 2 as well as Alternative 3.

The retrospective analysis prepared by staff is used to estimate a major component of the benefit (PSC avoided) and a major component of the cost (pollock harvest forgone) under a subset of overall chum PSC limits and apportionment suboptions (Alternative 2 and 3. This approach applies the overall chum salmon PSC limit and apportionment amounts to historical catch and bycatch data, depicting when a closure would have been reached. The retrospective tables demonstrate varying estimates of PSC species savings under different PSC limit values that could result from pollock closures in the B season (2011-2022). Table 6-51 provides a summary of the estimated WAK chum (number of fish), total chum (number of fish), Chinook salmon (number of fish), and herring (mt) that would have been avoided under the subset of overall PSC limits selected for analysis; this table also shows an estimate of the amount of B season pollock harvest (mt) that would have been forgone had no fishing behavior changes occurred.

These are cumulative values, meaning they represent an estimated total across all sectors (CDQ, CP, inshore, and mothership) for all years (2011-2022). In general, the retrospective analysis shows that as the overall PSC limit is set at a lower value (e.g., 200,000 chum), the amount of chum bycatch avoided and the potential pollock harvest forgone increase as the overall PSC limit is lower.

Table 6-51 Summary table of WAK chum avoided (number of fish), total chum avoided (number of fish), pollock harvest forgone (mt), Chinook salmon (number of fish) avoided, and herring (mt) avoided under the subset of overall PSC limits and apportionments, 2011-2022

	Apport. Suboption	WAK Chum	Total Chum	Pollock Forgone	Chinook	Herring
200,000	1) 3-yr avg	144,893	852,347	1,783,255	32,874	725
	2) 5-yr avg	147,243	994,447	1,907,248	36,778	890
	3) pro-rata	147,270	866,573	1,889,098	36,835	873
	4) AFA	188,786	1,092,360	2,235,419	54,182	1,216
	Apport. Suboption	WAK Chum	Total Chum	Pollock Forgone	Chinook	Herring
300,000	1) 3-yr avg	60,669	474,719	1,071,457	17,841	488
	2) 5-yr avg	62,127	479,507	1,052,203	15,847	365
	3) pro-rata	62,017	478,110	1,037,812	15,814	365
	4) AFA	75,897	460,807	952,571	19,626	550
	Apport. Suboption	WAK Chum	Total Chum	Pollock Forgone	Chinook	Herring
450,000	1) 3-yr avg	30,821	171,870	527,984	6,891	303
	2) 5-yr avg	29,205	153,079	471,574	4,383	302
	3) pro-rata	30,155	157,469	474,701	4,465	302
	4) AFA	16,483	172,531	418,368	6,595	336
	Apport. Suboption	WAK Chum	Total Chum	Pollock Forgone	Chinook	Herring
550,000	1) 3-yr avg	24,805	124,335	274,502	2,317	30
	2) 5-yr avg	16,145	95,095	359,623	2,800	246
	3) pro-rata	16,159	95,295	370,537	2,872	256
	4) AFA	5,689	28,736	204,635	2,172	280

However, as discussed throughout this analysis, the analysts *do* assume the pollock fleet would change their fishing behavior to prosecute the B season fishery should an overall PSC limit be implemented in the future (Alternative 2 or 3). **The exact magnitude of these behavioral changes (i.e., avoidance strategies), the relative effectiveness of these strategies for avoiding chum or WAK chum bycatch for the fleet or a sector to avoid a potential fishery closure, and the costs associated with these strategies are uncertain.** Nonetheless, as a result of these avoidance strategies, the B season may a) remain open and not result in the potential benefits and costs portrayed in the retrospective tables, and b) the B season may ultimately be prolonged (including Table 6-51 above).

Across all pollock sectors, WAK chum are more prevalent in the "early to middle" portion of the B season (June and July) than the late aspects of the B season (see Section 6.1.4.3). This is a particularly challenging dynamic as the Council considers B season management measures while balancing provisions for Chinook. Chinook bycatch rates tend to increase in September and October (NPFMC 2009; 2015). Increased Chinook bycatch rates prompted additional IPA provisions be added under Amendment 110 which added incentives to the implementing regulations for the salmon bycatch IPAs for vessels to complete fishing prior to late September/October and provided penalties for vessels that fish in those times (NPFMC 2015). The potential for increased Chinook encounters later in the B season was the primary reason the Council decided to table the 2012 Chum Salmon Bycatch analysis.[89] Concerns over

[89] December 2012 Council motion for C2. Prior to the development of Amendment 91, the Council had been considering management measures for both Chinook salmon and chum simultaneously. The measures considered

exacerbating bycatch of chum, Chinook and other PSC species were also noted in discussion for the Council's February 2024 motion for Bristol Bay red king crab area closures as being a reason for not taking further action at this time.[90]

As shown in Figure 6-39 through Figure 6-41, behavioral changes in Chinook avoidance occurred both following implementation of Amendment 91 in 2011 as well as following Amendment 110 implementation in 2016. Chinook rates were consistently higher in September and October prior to Amendment 91 as well as leading up to Amendment 110 (based on individual vessel performance evaluations (see Stram and Ianelli 2014 and NPFMC 2015)). However, Chinook rates in the latter part of the B season have decreased in response to regulations requiring the fleet to incentivize fishing be complete prior to late September/October, as has the overall bycatch of Chinook taken annually (Figure 6-39).

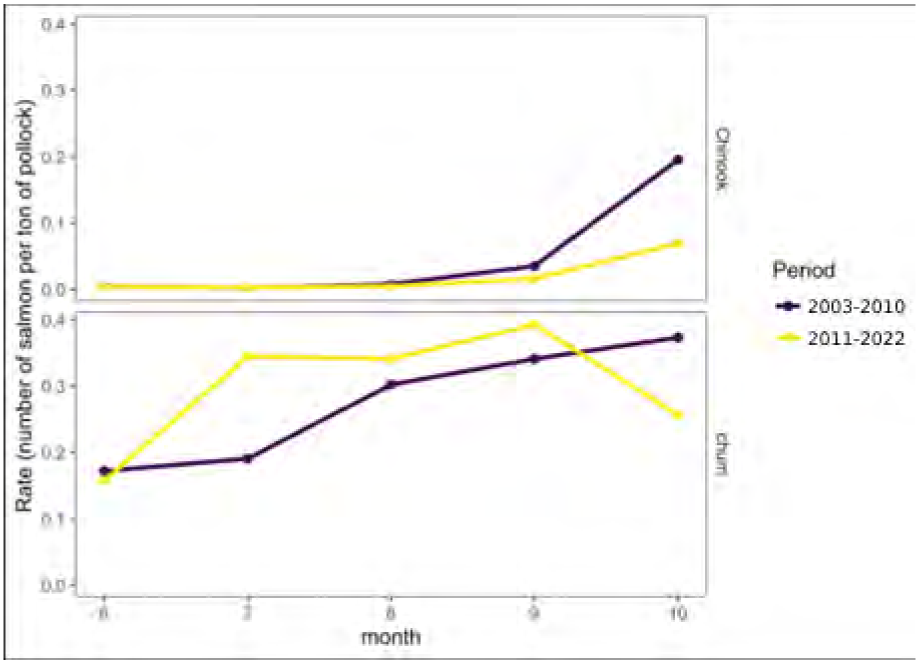

Figure 6-39 Monthly B-season chum and Chinook salmon bycatch rates (number per ton of pollock) by periods pre (2003-2010) and post (2011-2022) implementation of Amendment 91.

However, as shown in Figure 6-39 above, the same behavioral changes are not as apparent in chum rates pre and post implementation of Amendment 91 and Amendment 110 across the B season, and have in fact been higher in the more recent time periods from June to September than pre-2011(Figure 6-39**Error! Reference source not found.**). This trend may be somewhat anticipated because the Council indicated its priority for PSC avoidance was Chinook salmon under Amendments 91 and 110, and the fleet modified its fishing behavior in response to the Chinook hard cap that has the potential to close the fishery and related IPA incentives.

included updated closure areas as well as a range of overall PSC limits by sector, season, and species. Following the 2007 spike in Chinook bycatch, and the continued concerns about the status of Chinook stocks across Western Alaska, the Council split that salmon bycatch analysis with the indication that management measures for Chinook were the priority item. Once Amendment 91 was completed, the Council restarted development of chum bycatch management measures and received an analysis in December 2012 (NPFMC Chum PSC analysis) which evaluated the potential impacts of a suite of alternative measures.

[90] February 2024 Council motion on C2 BBRKC closure areas.

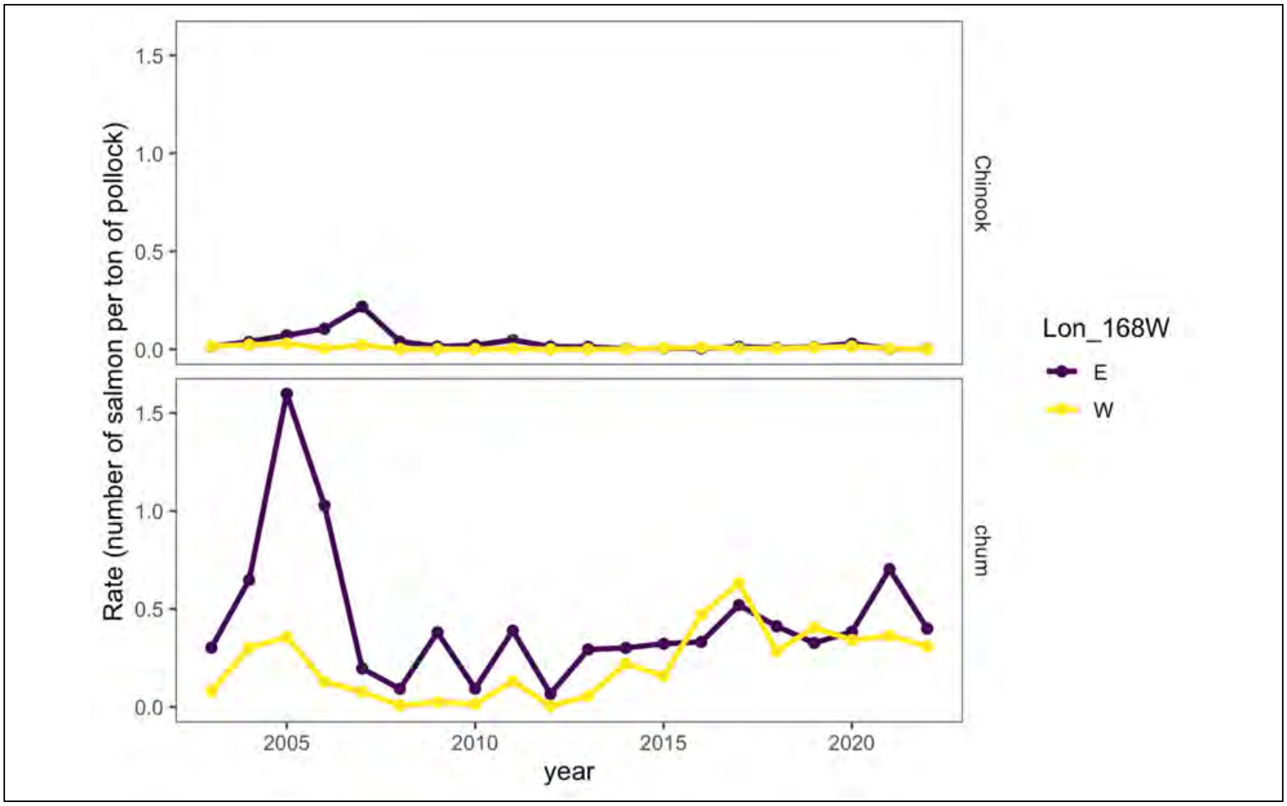

Figure 6-40 B season Chinook salmon and chum bycatch rates (number per ton of pollock) east and west of 168 degrees West longitude.

Given the IPA's operational structure that delineates the pollock fishing grounds between east and west of 168 degrees West longitude (WAK chum salmon are more prevalent on the pollock grounds east of 168 degrees West longitude closer to the Alaska Peninsula), Figure 6-40 shows the historical Chinook salmon and chum bycatch rates broken out by those areas. Also shown are monthly rates by area pre and post implementation of Amendment 91 in 2011 (Figure 6-41). As shown, bycatch rates are consistently higher both east and west of 168 degrees West longitude over the time frame since Amendment 91 for chum, while the bycatch rates for Chinook decreased dramatically, although there has been some observed decrease in chum rates east of 168. Note that these figures show all chum PSC not just WAK chum in order to show the trade-offs in operations across PSC species particularly since implementation of the current salmon bycatch management program.

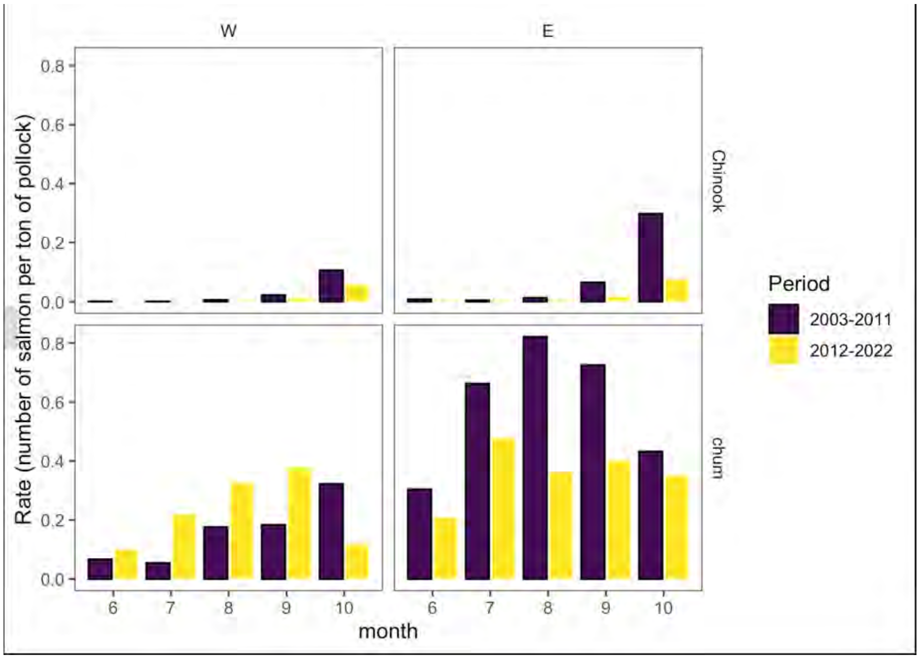

Figure 6-41 Monthly chum and Chinook salmon bycatch rates (number per ton of pollock) east and west of 168W longitude by year, by different periods.

It is possible that implementing an overall PSC limit under Alternative 2 and 3 may result in decreases of chum salmon bycatch rates similar to Chinook measures implemented in Amendment 91 and 110 as it is anticipated the fleet would modify its fishing behavior (noting the degree of magnitude in these changes is uncertain). However, if the Council would like to implement an overall hard cap for chum salmon in the B season, which would require the fleet to balance operations and avoidance under two hard caps during this fishing season (i.e., Chinook salmon and chum salmon)it could expect the fleet to make real-time tradeoffs. Under Alternative 2 or 3, it is anticipated the fleet would continue to balance chum avoidance with other PSC species that can constrain pollock fishing. This means the PSC savings represented in the retrospective tables may manifest, but there may also be an increase in PSC of other species (e.g., Chinook salmon, herring, or WAK chum) relative to the status quo as the fleet implements additional avoidance measures specific to chum.

In this way, the potential for PSC savings and forgone pollock could be conceptualized as a spectrum. If the fishery or a sector is closed for a portion of the remaining B season, pollock harvest may be forgone but the PSC tradeoffs highlighted here would no longer be a consideration because of the closure. A constraining cap may present future scenarios more like the retrospective tables because of the potential of the constraining cap to close a sector or the fishery effectively preventing any additional PSC. However, operational activity prior to a B season closure under a constraining cap could represent a degree of PSC tradeoffs as the cooperatives work stay below its portfolio of PSC constraints. It is also anticipated that what constitutes a “constraining” PSC limit could change over time (i.e., throughout the course of the B season or year-to-year).

While the retrospective tables do not show a significant estimated benefit or harm to herring based on B season chum cap levels, herring PSC is an operational consideration for the fleet given the potential for fleet-wide closures to the HSAs once triggered. As described in Section 6.1.8.3, the herring PSC limit (established as 1% of the estimated biomass of herring in the Bering Sea) is apportioned to fisheries but it is not allocated by sector. Therefore, herring PSC is accrued to the limit across all pollock sectors and once triggered the HSAs apply to all sectors regardless of whether there was disproportionate catch of herring PSC by one sector or another. Closure of the HSAs complicates available fishing opportunities in both A and B season.

Overall, a main point to convey is that there is uncertainty in how the pollock fleet, or individual sectors and cooperatives would respond by layering on a constraining chum PSC limit and this adds uncertainty to the potential effects on other PSC species. At this time, the primary incentives for chum (and WAK chum) avoidance under the IPAs are incorporated into the RHS system and the primary avoidance strategy is fleet movement. The analysts cannot accurately quantify with the available information the potential change in PSC encounters relative to the status quo as a result of fleet behavioral changes. However, it is anticipated that the pollock fleet would carefully balance PSC prioritization in years when encounters of Chinook, chum, and herring are high if operating under three sets of PSC limits, each with associated consequences.

This means that, even if the pollock sectors do not reach their current Chinook PSC limits, with additional chum PSC limits in place, the fleet may catch more Chinook bycatch due to chum avoidance strategies than they may have otherwise. Because the primary tool for PSC avoidance is fleet movement, it is possible that a constraining PSC limit under Alternative 2 and 3 would have the potential to extend the duration of the B season fishery into September and October. Should this transpire, it would be at odds with the current IPA regulations at 50 CFR 679.21(f)(12)(iii)(E)(*2*) that require the IPAs to describe how "measures for chum salmon avoidance do not increase Chinook salmon bycatch," and at 50 CFR 679.21(f)(12)(iii)(E)(*13*) requiring "the restrictions or performance criteria used to ensure that Chinook salmon PSC rates in October are not significantly higher than those achieved in the preceding months."

Ultimately, the analysts are trying to convey that the proposed alternatives may raise some considerations for the Council as it considers its PSC priorities. Table 6-52 **Error! Reference source not found.**below highlights some of the uncertainty surrounding the proposed alternatives by comparing each alternative and the associated management measure to the Council's management objectives relative to the status quo.

Table 6-52 Comparison of alternatives and options in relation to Council management objectives. The symbols convey potential increases, relative neutrality, and potential decreases in relation to status quo, respectively.

Alternative	Measure	Chinook PSC	Chum PSC	WAK Chum PSC	Flexibility for Pollock Fishing
2	Overall chum PSC limit	↑ If B season extends ↔↑ Depending on fleet movement ↓ If sector or fishery is closed	↓ But degree of reduction depends on fishing behavior and the value selected for the overall limit	↔ Expect fleet to target areas with low chum bycatch rates ↓ If sector or fishery is closed or when combined with other incentives	↔ Would anticipate flexibility at higher overall PSC limit values ↓ Flexibility decreases at lower PSC limit values
3	WAK chum threshold (must be combined with Alt 2)	Would anticipate being similar to Alternative 2. Alternative 3 would not require pollock fishing to cease inseason but rather the fishery could operate under a lower overall limit in the future.			
4	Optimize avoidance in shelf edge fishing grounds	↔	↔↓	↔↓	↔
	Bi-weekly closure area consideration	↔	↔↓	↔↓	↔
	Required use of excluder device for duration of B season	↔	↔↓	↔	↔
	Required RHS closure for all vessels regardless of performance when rates are high	↔	↓	↔↓	↔↓

Notes: the measures included under Alternative 4 reflect some of provisions in the IPA proposals which are expanded upon in 6.3.

6.2.7 Assessment of Forgone Pollock and Ecosystem Effects

Over the most restrictive PSC limits and constraints (Alternative 2 200,000 PSC limit) forgone pollock on average in the B season can result in up to 9-14% forgone pollock. The effect of the alternatives in general will likely result in a continuation of pollock catches being well below the TAC (i.e., forgone pollock). Relative to the stock, the near-term expectations would be that projected abundance would be higher than if the full TAC were caught. Beyond the change in near term trend, lower pollock removals would result in the expected long-term biomass to be higher. However, since pollock can be highly cannibalistic, a large adult stock may limit the recruitment due to this predation. We note that this relationship is poorly estimated, and recruitment is typically highly variable, depending on spatial and temporal distributions between adults and juveniles (Ianelli et al. 2023).

Potential Ecosystem Impacts

When thinking about potential ecosystem impacts to under-harvesting pollock TAC, it is important to keep in mind both the immediate and longer-term impacts as well as the direct and indirect impacts.

In the year of implementation, under-harvesting of the pollock TAC would result in additional adult pollock biomass in the area of B season fishing. The direct impacts of under-harvesting pollock TAC may vary depending on the trophic relationship to pollock (i.e., prey or predator).

In subsequent years of continual under-harvesting of the pollock TAC, consideration of stock dynamics and density dependence is important. Some potential considerations include that, as the adult pollock population increases, the average size of pollock may decrease due to prey limitation and density-dependence. Smaller-sized adult pollock may produce fewer age-0 fish, or fewer age-0 fish may survive due to prey limitation, density-dependence, and increased cannibalism. In short, more adult pollock does not necessarily result in more age-0 fish or juvenile recruits.

Prey of pollock includes zooplankton such as euphausiids and copepods as well as zoeal stages of benthic crab species. Under-harvesting of pollock TAC would result in greater biomass of pollock in the short-term (immediate to X numbers of years until stock dynamics and density dependence kick in) and higher predation pressure on zooplankton. This could result in prey depletion - either locally or more globally across the shelf depending on timing (immediate year B season footprint versus X number of years later if the population expands over the shelf).

Predators of pollock include piscivorous seabirds (age-0 and juvenile), larger fish (including adult pollock), and marine mammals such as fur seals (adult pollock). In the immediate timescale, under-harvesting of pollock TAC would result in additional prey availability to predators of adult pollock (e.g., fur seals). Longer-term impacts that depend on stock dynamics and density-dependence are harder to project and do not necessarily result in additional age-0 or juvenile pollock abundance or availability as a prey resource (e.g., seabirds, larger fish, pollock).

Competitors of pollock: Pollock are pelagic foragers and impact the standing stock of zooplankton availability over the shelf (though studies have not demonstrated pollock's ability to locally deplete prey resources). Under-harvesting of pollock TAC would result in greater consumption of zooplankton and therefore fewer krill and copepods available to planktivorous predators. Pelagic planktivorous predators include planktivorous seabirds, herring, and salmon (and maybe young sablefish), baleen whales (e.g., NARW, humpback whales).

Another consideration is what the **indirect impacts might be to the benthic system**. Under-harvesting of pollock TAC would have the immediate impact of increased consumers of pelagic productivity and less production settling to the benthic habitat and available to flatfishes, crabs, etc.

6.2.8 Potential Impacts on Other Resources (Sea Birds, Marine Mammals, Habitat)

6.2.8.1 Seabirds

PSC limits for Alternatives 2 and 3 may result in no change to the status quo or may change fishing patterns to avoid chum salmon PSC. This could result in reduced fishing effort, changes in fishing patterns, or seasonal changes in the timing of the fishing to increase chum salmon avoidance may result in the closure of the pollock fishery if the PSC limit is reached. Alternatively, higher fishing effort may occur if vessels fish areas with less productivity in order to avoid bycatch. If a groundfish fishery reduces fishing effort in specific fisheries to conserve chum salmon PSC, then the incidental take of seabirds may decrease. If a groundfish fishery increases the duration of fishing in areas with lower concentrations of chum salmon, there may be more potential for seabird incidental take, compared to the status quo, if this increased fishing activity overlaps temporally and geographically with areas used by seabirds.

Shifts in the location or timing of fishing may occur as a result of Alternative 2. However, there is already considerable interannual variability in the patterns of fishing across the EBS groundfish sectors, as environmental conditions and avoidance of PSC species have caused vessels to adjust their fishing patterns. Any shift in fishing location or timing is unlikely to occur outside of the existing footprint of the groundfish fisheries. However, shifts in the existing footprint of the groundfish fisheries may change over time due to many factors such as climate change, bycatch avoidance, and shifting fish distributions, making this difficult to assess. Seabird take estimates in the EBS groundfish fisheries are already small, compared to seabird population estimates, and are unlikely to increase to a level that would have a population-level effect on seabird species. The exception to this is incidental take of ESA-listed seabirds, but the take of these species in EBS groundfish fisheries are already closely monitored with respect to the incidental take statements in the 2021 Biological Opinion. Therefore, effects on seabird incidental takes under Alternatives 2 and 3 are not expected to be significant and are not expected to occur beyond the scope analyzed in previous NEPA or ESA documents.

6.2.8.2 Marine Mammals

Chum salmon PSC limits for Alternatives 2 and 3 may result in no change to the status quo or may change fishing patterns to avoid chum salmon PSC. This could result in reduced fishing effort, changes in fishing patterns, or seasonal changes in the timing of the fishing to increase chum salmon avoidance. If a groundfish fishery reduces fishing effort in specific fisheries to conserve chum PSC, then less potential may exist for marine mammal interactions or harvesting of potential prey items of marine mammals. If a groundfish fishery increases the duration of fishing in areas with lower concentrations of chum, there may be more potential for marine mammal interactions, compared to the status quo, if this increased fishing activity overlaps temporally and geographically with areas used by marine mammals. For example, this alternative could become problematic if fishing efforts shift or concentrate to regions closer to known Steller sea lion rookeries or haul outs.

If a groundfish fishery reduces fishing effort in specific fisheries to conserve chum salmon PSC, shifts in the location or timing of fishing may occur as a result of Alternative 2. However, there is already considerable interannual variability in the patterns of fishing across the EBS groundfish sectors, as environmental conditions and avoidance of PSC species have caused vessels to adjust their fishing patterns. Any shift in fishing location or timing is unlikely to occur outside of the existing footprint of the groundfish fisheries. Changes in the interactions with marine mammals would be unlikely as potential changes would be expected to occur within the current boundaries of the fishery. Changes that could occur would be minimal with potential decreases in direct interactions due to associated reduced fishing effort and potential changes in the indirect effects of reduced fishing effort through possible reductions in prey competition. Therefore, effects on marine mammal interactions under Alternatives 2 and 3 are expected to be minimal.

6.2.8.3 Habitat

PSC limits for Alternatives 2 and 3 may result in no change to the status quo, may change fishing patterns to avoid chum salmon PSC, or may result in the closure of the pollock fishery if the PSC limit is reached. This could result in reduced fishing effort, changes in fishing patterns, or seasonal changes in the timing of the fishing to increase chum salmon avoidance. Alternatively, higher fishing effort may occur if vessels fish areas with less productivity in order to avoid bycatch, and higher or lower encounters with other PSC species (e.g., Chinook) may occur if vessels move to areas with higher or lower abundance of nontarget species If a groundfish fishery reduces fishing effort in specific fisheries to conserve chum PSC, the impacts to habitat would be expected to maintain minimal disturbances or to decrease due to reduced fishing effort. If a groundfish fishery increases the duration of fishing in areas with lower concentrations of chum, the impacts to habitat would also be expected to maintain minimal disturbances.

Shifts in the location or timing of fishing may also occur as a result of Alternative 2. However, there is already considerable interannual variability in the patterns of fishing across the BSAI groundfish sectors, as environmental conditions and avoidance of PSC species have caused vessels to adjust their fishing patterns. Any shift in fishing location or timing is unlikely to occur outside of the existing footprint of the groundfish fisheries. However, shifts in the existing footprint of the groundfish fisheries may change over time due to many factors such as climate change, bycatch avoidance, and shifting fish distributions, making this difficult to assess. Therefore, effects on EFH under Alternatives 2 and 3 are not expected to be significant and are not expected to occur beyond the scope analyzed in previous NEPA, EFH, or FMP documents.

6.2.9 Potential Impacts to the AFA Sectors

6.2.9.1 Analysis of Potential Forgone Revenue for Bering Sea Pollock Sectors

This section examines the expected economic effects of the proposed chum salmon PSC limits on the BSAI pollock sector, relative to no action (Alternative 1) as a baseline for comparison. **This analysis considers the application of a chum salmon PSC limit broadly on operational costs and revenues therefore it includes considerations relevant to both Alternative 2 as well as the WAK chum PSC threshold under Alternative 3.**

A thorough consideration of the potential net benefits of the proposed action, as required under E.O. 12866, involves a detailed evaluation of both the expected costs and benefits at a National level, to include both quantifiable and qualitative considerations. Additionally, E.O. 12866, as well as National Standards require consideration of distributional economic and social impacts at a finer scale. This section primarily focuses on the cost categories as well as potentially reduced gross revenue from the possible closure of a fishery or reduced product quality. Potential benefits of the proposed action are primarily described in other sections of the analysis (such as impacts to chum stocks, section 6.2.4, other PSC savings, section 6.2.4.1, and impacts to Western Alaska chum salmon users, section 6.2.10). This section describes costs at a disaggregated level that allows for an understanding of distributional impacts and includes a broader discussion of other impact categories (e.g., employment, regional patterns of spending) which are not included in a net benefit calculation. Economic impacts associated with communities substantially engaged in or dependent on the B season pollock fishery are analyzed in section 6.2.9.2 and CDQ regions and communities in section 6.2.9.3. Net benefits to the Nation will be summarize in Chapter 8 at the time of Council final action.

An appropriate scope for a Benefit-Cost Analysis on the marginal impacts of the proposed alternatives would include the expected impact on net revenue (i.e., profits). This type of analysis requires access to empirical data on cost categories, gross revenue data, and a way to predict the behavioral changes that may influence these variables. The primarily qualitative approach employed in this section is the result of limited available empirical data on cost categories, in addition to the uncertainty of fishing behavior changes in response to new PSC constraints proposed in Alternative 2 and 3. This analysis includes primarily qualitative descriptions of avoidance costs and the expected effect of the proposed Alternatives 2 and 3 on the direction of those costs. While analysts acknowledge the limitations of this approach in providing quantitative information on the magnitude of these marginal changes, which inhibits the ability to calculate expected net benefits, this method was chosen for a number of reasons. The deficiency in operational cost data as well as uncertainty around the specific ways fishing behavior would change means that contextualizing the retrospective harvest patterns and associated gross revenues serve as the best available proxy for impacts on net revenue. Additionally, the qualitative discussion can provide context to the types of impacts that may be expected and the directionality of impacts.

This section first provides a primarily qualitative description of expectations regarding the operational responses to the proposed chum PSC limits, including avoidance costs that would be incurred with a discussion of the potential distributional impacts of those costs.

Next, this section provides an analysis of potentially forgone revenue using the retrospective scope employed in previous sections and considering fishing behavioral changes that may affect the revenue impacts of these measures in future years. **The term 'potentially forgone gross revenue' is defined here as the gross revenue associated with the portion of that B season that hypothetically would have been closed had a PSC limit been in place and no fishing behavior changed. While these tables highlight ranges of revenue associated with a potential closure, the analysis assumes that if these limits were in place in the future, *fishing would be altered* prior to meeting these proposed caps.** There is little data or information available to predict the magnitude of these changes and or how successful they would be in prolonging the pollock season and allowing for the pollock allocation to be caught and revenue generated. The analysis contextualizes the potentially forgone revenue tables with the expectations of future changes in fishing behavior.

This analysis differentiates avoidance costs, which may occur regardless of whether a chum PSC limit is met, from the potentially forgone revenue and implications of a pollock fishery B season closure. Following the forgone revenue analysis is a brief discussion of the broader implications of a fishery closure in the B season. Finally, this section provides a brief discussion of specific considerations for the addition of Alternative 3, a WAK chum threshold adopted jointly with Alternative 2.

6.2.9.1.1 Fleet Operational Effects

Under both Alternative 2 and 3, a chum salmon PSC limit would be chosen and apportioned between the sectors (Alt 2, Option 3). If a hard cap level that has the potential to constrain an AFA sector during the B season is chosen, pollock harvesters would be expected to alter their fishing operations to avoid a closure and to minimize losses associated with potentially forgone gross revenue. Primarily, this strategy includes moving fishing effort to a different area when a certain level of chum is encountered.

The cooperative structure of the AFA pollock fleet in additional to current IPAs equips the fleet with data and communication tools to react quickly and work towards this goal. In considering the operational effects of the proposed actions, it may be helpful to consider the ways in which a chum PSC limit may be similar to the pollock fleet's current Chinook PSC limits, and the ways in which a chum PSC limit may differ.

Chum Encounter Patterns

One way that these PSC limits could differ is in regards to the way chum salmon are encountered relative to Chinook salmon on the fishing grounds. According to industry representatives,[91] Chinook tend to be more intermittent and randomly encountered, whereas chum appear to be encountered in large pulses and can be intermixed with pollock. This may make the potential risk of sudden high chum salmon PSC greater and more difficult to plan for. It may require more conservative fishing practices relative to Chinook management, for instance building in larger buffers under a limit to decrease the likelihood the sector is closed down, or considering proactive measures (e.g., more test tows, consolidation of pollock harvest on more efficient pollock harvesting vessel and/or vessels that have historically had lower chum PSC at the beginning of the B season, etc.) if the risk is perceived to be too great. Depending on how constraining a chum PSC limit is perceived to be, this means that skippers and cooperative managers may consider risk and tradeoffs differently when seeking to avoid chum versus Chinook.

While Alternative 2 and 3 would set an overall chum PSC limit, and NMFS would also apportion this amount down to the sector and cooperative level, the chum PSC limit could be further internally apportioned down to the vessel level, as occurs under the Chinook PSC limits. Section 4.1.3.1 describes the two types of PSC limits in place for Chinook: a hard cap and a lower threshold amount with an associated performance standard. The PSC limits are currently at their lowest level based on the Western Alaska 3-river system index, with the hard cap at 45,000 fish and a threshold amount at 33,318 fish across all sectors and within the cooperatives that would be in effect had the sector exceeded the performance

[91] A. Estabrooks, personal communication.

standard described in this section. The cooperative level IPAs dictate how Chinook is further apportioned down to the vessel level. According to the IPA reports, each sector apportions the threshold limits or a further reduction under that threshold limit to their vessels, rather than the limit itself. This provides a buffer to decrease the likelihood that one vessel exceeding its limit would shut down the fishery for the rest of the sector. For example, the annual Chinook PSC limit for the mothership sector in 2022 was 3,510 Chinook. However, this sector apportioned 2,599 Chinook (the annual apportionment that would be available under the threshold amount that would be in place had the sector triggered the performance standard) among its member vessels in this year. This degree of apportioning and the additional incentives in the IPAs provide vessel-level accountability for Chinook PSC and vessel-level incentives to remain conservatively under their apportioned amount to ensure the opportunity to harvest all of the available pollock catch.

Race for Fish

In a similar way, a chum PSC limit could be internally apportioned to the vessels in order to generate individual accountability and decrease the likelihood that the cooperative as whole would reach its limit. This internal apportionment would need to be accompanied by agreements from associated companies/vessels to adhere to these levels (through IPA agreements, for instance) as they would not be apportioned through regulations. If these internal apportionments were not agreed to with clear and binding penalties, it could create a moral hazard situation where vessels from different companies within a cooperative would be insulated from the risk of closure if they caught their directed fishery allocation quickly (Holland & Jannot 2012). In this way, if vessel apportionments are not paired with binding contractual agreements, it could generate a race to catch pollock prior to the cooperative-level chum PSC limit being met. This would not be desirable at a cooperative-level; therefore, it is expected that IPAs would include binding agreements to maintain vessel-level apportionments.

Vessel Apportionments Under a Low Limit

Internal apportionments of the Chinook PSC limit (down to the vessel level) enforced through the IPAs and paired with the additional incentives in the IPAs and RHS program described in Section 4.1.2, appear to be an effective strategy for managing Chinook PSC to remain under the limits. Additional incentives in the IPAs (e.g., salmon savings plan, outlier provisions, etc.) are designed to motivate minimizing Chinook catch rates, even if the vessel may not be near their individual apportionment. The fleet has remained under the Chinook hard cap limits every year since the limits were implemented in 2011 with Amendment 91. Additionally, no sectors has triggered the performance standard with the CP sector exceeding the threshold amounts once in 2019.

It is difficult to say if the fleet would be as effective at operating under a chum PSC limit while still harvesting the pollock TAC. This will primarily depend on the PSC limit chosen, with lower limits inherently being more likely to constrain a cooperative’s pollock harvest. Considering the layers of PSC apportionment, each with a buffer or insurance pool desirable to reduce the risk of an unexpected closure, a higher cap could potentially provide flexibility for operators to employ chum avoidance techniques while continuing to harvest their pollock allocation. If a “very constraining” chum PSC limit is chosen, it could reduce the vessel’s options for salmon avoidance, while harvesting their pollock allocation.

A “very constraining” chum PSC limit may function differently than the Chinook PSC limit which, to date, appears to provide enough operational flexibility for individual vessel operators to plan avoidance and still harvest their pollock. While some vessels have occasionally reached their individual limit of Chinook and had to stop fishing, as required by their IPA provisions, the pollock TAC is often fully harvested (Table 2-5). If a cap is chosen that is constraining enough that the vessel operator is likely to hit their individual limit during the B season or the risk is perceived to be too great, the cooperative operational strategy may be different than methods employed for Chinook avoidance. For instance, it could result in more proactive measures such as a vessel choosing not to fish the B season, consolidation of pollock on fewer, better performing vessels, or potentially docking for a period of time when chum is encountered. Alternatively, it may be that operations will continue to rely on test tows, communication, and fleet movement.

Alternatively, if a chum PSC limit that is “not constraining” is chosen and is not expected by the AFA sectors to be met in season, the PSC limit on its own may not influence avoidance behavior. However, additional measures implemented within the IPAs, such as those described in Section 4.4, may still result in chum salmon savings. While a lower limit is likely to correspond with a “more constraining” cap as demonstrated through the retrospective tables (Appendix 6), the degree to which a PSC limit may be constraining can be impacted by many external factors (e.g., pollock CPUE, HSA closures, etc.) and could even change inseason.

Transferability

In part because chum PSC is encountered differently than Chinook PSC by the fleet, the proposed chum PSC limits under Alternative 2 and 3 may put more emphasis on the transferable nature of the PSC relative to the practices around Chinook PSC. In particular, this would be the case if a PSC limit is chosen that is deemed by the cooperative to be insufficient or to be too great a risk to support a certain level of pollock harvest. Similar to the Chinook PSC limits, the proposed chum PSC limits includes considerable flexibility in its ability to be transferred, including at the vessel-to-vessel level, within cooperative, between cooperatives and even between sectors. On the surface, one might assume an opportunity for the fleet to coordinate an efficient transfer of chum PSC where it is needed, minimizing the amount of pollock TAC left unharvested. However, there are practical and operational reasons why this quota may not be transferred smoothly and efficiently to the parts of the fleet that may have a demand for additional chum PSC.

First, the highly uncertain and variable nature of chum encounters may result in vessels unwilling to transfer the chum PSC due to associated risk later in the season. Literature suggests that this type of bycatch (i.e., highly uncertain and variable) will generate inefficient markets for PSC that are thin, lumpy and subject to price variability (Holland 2010). In fact, it appears that open markets for Chinook PSC have never developed. Despite the flexibility for transfers, Chinook PSC is typically only transferred as paired transfers with a matching pollock apportionment within cooperatives. Additionally, it may be contract-fished by a vessel outside of the cooperative (under the provisions laid out in Amendment 69); however, the cooperative for which the vessel is contract fishing for must supply both the pollock and the Chinook PSC. A Compensated Transfer Report is part of the reporting requirements under the Amendment 91 Economic Data Reporting (EDRs), which was intended to determine the value of salmon bycatch to the fleet, by asking about price information on arm’s length transfers of Chinook PSC. However, this report has never been completed. During an EDR workshop[92] one industry participant stated that this approach does not align with how the industry operates; they would not assign a monetary value to bycatch and have other procedures for accomplishing a transfer of PSC.

Although this clearly indicates that there is a substantial shadow value associated with Chinook salmon PSC, the analysts expect that when Chinook PSC is transferred along with pollock, it may not extract the full value of the quota. As highlighted for the British Columbia groundfish trawl fishery in Holland (2010), “most quota trading is not done through anonymous arm’s length transactions but between parties that trade with each other frequently and year after year allowing for reciprocity considerations to play a role in the price of trades.” It is expected this is also the case in the AFA fleet, in which transactions are often between parties that trade frequently, and terms of these trades/transfers are complex and built on these relationships.

[92] Report for EDR workshop (November 2020): https://meetings.npfmc.org/CommentReview/DownloadFile?p=63d9cc73-80b1-4d80-8f5c-c277cf63d41e.pdf&fileName=D6%20EDR%20stakeholder%20workshop%20report%20Nov%202020.pdf

In a similar way, although the proposed chum PSC alternatives would allow for extensive transfer flexibility, individual vessels/companies are unlikely to transfer PSC unless they are transferring pollock along with it or if they have completed their fishing season. However, AFA does not allow for pollock to be transferred between sectors or between cooperatives (with the exception of CDQ). This aspect of AFA has been identified to generate economic inefficiencies and reduce potential benefits to all sectors (Strong & Criddle 2013). Because pollock allocations can move easily *within* a cooperative, chum PSC limits may generate more shifting of both pollock and PSC species within a cooperative. However, due to the expectation of a stunted and inefficient "chum PSC market" (if one even develops), a constraining PSC limit may result in instances of stranded pollock between the cooperatives, particularly in the CV sector which includes more cooperatives.

Open Access Fishery

The analysts note that this section has thus far focused on the operational structure of the AFA cooperative. Inshore CVs that do not join a cooperative are managed by NMFS under the inshore open access fishery (as described in Section 4.2.3.2). Vessels that participate in the open access fishery can deliver pollock to the inshore processor of their choice, but they could face a scenario where they race to fish the open access fishery allocation. To determine the amount of the chum salmon PSC limit that would apply to the inshore open access fishery in years when it exists, NMFS would calculate an amount of chum salmon PSC based on the proportion of the vessel's pollock catch history in the inshore open access. Participation in open access has been rare throughout the baseline period (2011-2022); however, one vessel fished in open access in 2023 and in 2024, when the Peter Pan Fleet Cooperative did not file a cooperative application, 10 vessels joined the open access fishery. It is the analysts' understanding that the inter-cooperative manager is assisting this group of CVs to manage their harvest of pollock and PSC through a voluntary cooperative-like structure in 2024.

Based on discussions with the inter-cooperative manager,[93] the analysts expect that the vessels leaving the Peter Pan Fleet Cooperative will fish in the inshore open access fishery in 2024 and transition to a new market and cooperative in 2025. However, they are not required to do so. Moreover, if these or other vessels participate in open access in the future, it is not clear whether they would continue to operate under this cooperative framework or if instead they would instead operate in a competitive manner with one another. If a chum PSC limit was adopted under Alternative 2 or 3, and vessels in the open access sector were operating without voluntary cooperative agreements, this could add another dimension to constraining the catch for other open access vessels.

Cumulative Impacts of Constraining Species

Finally, the proposed chum PSC limits create a different operational structure for the AFA fleets in that they would be additive to the Chinook PSC limits in the B season, as well as other area closures and constraining species (i.e., Chinook and herring). This augments an already complex web of factors that influence fishing behavior and decision making for cooperative managers, Sea State and captains which is discussed more thorough in Section 6.2.6.

6.2.9.1.2 Avoidance Costs

With the risk of having a whole (or portion) of an AFA sector closed for the rest of the B season after a PSC limit is met, the cooperative managers and Sea State would be expected to cautiously monitor the real-time rates of chum PSC and direct vessels to move fishing effort if necessary. However, in doing so, vessels, companies, crew, and in some cases shoreside processors would incur costs associated with this avoidance regardless of whether the overall PSC limit was ever met.

[93] S. Zagorski, personal communication.

The types of avoidance costs that may be incurred are categorized in the following table:

Increased travel costs	Increase in fuel usage and opportunity cost given transit time to move away from chum.
Increased costs (and decreased value) with lower operational efficiency, which may require longer trips/ seasons	Potential to move to areas with potentially lower pollock CPUE or lower quality products. If lower CPUE and time spent moving means longer trips/ seasons- increased costs associated with crew provisions, observer costs, increased Chinook concerns later in the season. Lower compensation for crew that make a share-based wage, unless payment structure specifically designed to insulate them.
Increased costs and risks associated with exploring new fishing areas	Increased use of test tows to identify high pollock CPUE and low chum salmon encounters which could result in greater costs in gear damage. Greater risk for encountering other PSC species.
Potential gear conflicts or safety at sea concerns	Decreased flexibility in time or space for pollock fishing that could possibly contribute to gear conflicts or safety concerns.

Similar types of costs have likely already begun to accrue for the AFA fleet in their recently increased efforts to avoid chum salmon, as well as through their ongoing efforts to avoid other PSC species with limits, such as Chinook and herring. Despite the common occurrence of these types of costs and influence other Council action have likely had on these types of costs (e.g., as predicted in Amendment 91 and Amendment 110), teasing out the precise values associated with avoidance costs under the status quo remains inherently difficult. Moreover, this analysis has the challenge of predicting the *marginal impact* of the additional proposed constraints from the chum PSC chum caps in Alternative 2 and 3, relative to the baseline, on AFA operating costs and production efficiency. While the analysis cannot predict the magnitude of these expected marginal costs, this section provides further description of how these types of costs could manifest under a chum salmon PSC cap and any known nuances that could influence the level of impact.

Increased Travel Costs

One of the primary tools of chum salmon avoidance, imbedded in the RHS program, is moving fishing effort when certain rates of chum salmon bycatch occur. The movement could be relatively small, as in moving to the outside of a closure area or it could result in vessels steaming to an entirely different area of the Bering Sea. When vessels move to avoid salmon or other PSC, they are likely using additional fuel (unless this was an area the vessels would travel regardless) and they may be giving up the opportunity cost of time (the value of the production and income to workers that could have occurred in the time they spent moving).

The fleets have different constraints in their ability to move that would likely result in a different level of impact. For instance, with an industry standard for the shoreside pollock sector of 48 hours between pollock catch and desired delivery in order to produce the freshest quality product, the shoreside fleet is constrained in their distance from port. Thus, depending on the caps and external conditions, the smallest, least mobile vessels could be effectively closed out of the fishery. Even vessels that have the capacity to reach open fishing grounds may incur prohibitively high operating costs (e.g., excessive fuel consumption), increased risk (e.g., should sea or weather conditions change unexpectedly), and reduced product quality (i.e., as hold-time increases). The sectors are also constrained differently through differential area closures, such as the CVOA, which excludes the CP sector except when they are catching CDQ pollock.

Of all the categories of variable costs, fuel ranks at or near the top of the list of operating expenses for the fleets. An Economic Data Report (EDR) was developed under Amendment 91 which requires AFA vessel owners or leaseholders to report on the quantity and cost of all fuel consumed by each AFA vessel harvesting or processing pollock during the calendar year. Table 6-53 demonstrates that for both CVs and CPs, the average rate of fuel burned while fishing has remained relatively consistent over the time series. The CP sector demonstrates much more inter-annual variation in average rate of fuel burned while transiting than the CV sector. Both sectors have variation in total gallons of fuel used annually with a declining trend from 2020- 2022 when considering annual fuel use (both A and B season).

Table 6-53 AFA vessel fuel use and costs, 2012-2022

	Year	Vessels	Annual average fuel consumption rate (gallons per hour), mean (sd)		Annual fuel use, mean (sd)	
			Fishing	Transiting	Gallons (1,000)	Cost ($1,000)
CP	2012	14	284 (40)	255 (59)	1,168 (181)	$5,258 (743)
	2013	15	290 (70)	249 (83)	1,171 (318)	$5,158 (1,308)
	2014	15	277 (61)	249 (79)	1,396 (395)	$5,773 (1,470)
	2015	14	284 (40)	270 (82)	1,438 (368)	$3,942 (856)
	2016	14	297 (32)	282 (85)	1,393 (378)	$3,050 (865)
	2017	14	279 (30)	285 (64)	1,570 (386)	$3,896 (887)
	2018	14	278 (34)	283 (52)	1,522 (306)	$4,523 (907)
	2019	14	278 (34)	284 (54)	1,641 (366)	$4,332 (991)
	2020	14	288 (29)	273 (67)	1,606 (386)	$3,073 (723)
	2021	13	285 (40)	279 (57)	1,252 (278)	$3,237 (725)
	2022	14	297 (47)	256 (47)	1,163 (306)	$4,797 (1,273)
CV	2012	90	75 (38)	51 (30)	163 (98)	$797 (488)
	2013	85	73 (34)	51 (28)	152 (84)	$739 (409)
	2014	85	74 (34)	51 (27)	143 (74)	$661 (342)
	2015	83	76 (36)	52 (29)	131 (52)	$441 (182)
	2016	87	75 (34)	51 (27)	117 (44)	$274 (102)
	2017	84	74 (34)	50 (27)	120 (53)	$312 (131)
	2018	80	75 (35)	51 (27)	139 (65)	$449 (215)
	2019	71	72 (34)	51 (28)	146 (67)	$433 (195)
	2020	79	76 (34)	50 (27)	193 (124)	$390 (176)
	2021	80	76 (35)	52 (30)	131 (67)	$361 (190)
	2022	79	73 (36)	49 (28)	106 (65)	$442 (239)

Source: Amendment 91 EDR fuel survey; sourced by AKFIN and AFSC
Notes: all dollar values are inflation-adjusted to 2022-equivalent values. Data reported for mothership vessels is excluded from the statistics reported in the tables above.

While it is difficult to isolate the impact of PSC avoidance from these values,[94] it is expected that a chum PSC limit that incentivizes avoidance would increase the status quo level of fuel use and fuel costs. This is supported by statements in the Vessel Master Survey, another component of the Amendment 91 EDR. In the 2022 vessel master survey many skippers cited burning more fuel in an effort to avoid Chinook as well as chum salmon.

Decreased Operational Efficiency and Extended Seasons

A redistribution of fishing effort due to increased chum avoidance under Alternative 2 and 3 could move AFA vessels into areas with lower pollock CPUE, lower quality/smaller size, or, for the inshore sector, areas farther from port (which could affect product quality). These changes could also affect the efficiency and net productivity of harvesting and processing operations. Depending on external factors, reduction in harvesting efficiency could extend the season relative to the status quo which, in addition to

[94] This specific type of analysis was conceptualized in the development of the A91 EDR, in that the fuel survey was meant to be pair with modifications of the Daily Fishing Logbook (DFL) for BSAI pollock trawl CVs and CPs. The Council specified modification of the DFL for BSAI pollock trawl CVs and CPs to add a ”checkbox” to the tow-level logbook record, requiring vessel operators to indicate, prior to each tow, instances when a vessel fishing for pollock in the BSAI changed fishing locations for the primary purpose of avoiding Chinook salmon PSC. However, vessel movement data collected to-date from CV's is not captured in an electronic database available to analysts, and data reported by CPs has varied greatly in coverage. Thus, far this data collection component has not be able to be used to the intended effect.

increasing variable harvesting and processing costs, could have ramifications for PSC interactions as highlighted in section 6.2.6.

These types of impacts would not be expected to be uniformly distributed across the fleet and, thus, would carry with them different implications for profitability, economic viability, and sustained participation in these fisheries. Inshore CVs cannot travel far from port and thus are inherently more challenged by additional avoidance. Some CPs are built for higher throughput and would struggle with low catch rates, making it more difficult to offset the high costs of operations. Longer distances and more time in transit mean higher operating costs and less time fishing.

How many additional days may be required would vary by stock and ocean conditions, by rates of success in locating fishable concentrations of the target species in remaining open areas or time periods, by operational mode and capacity, by the level of aggregate effort exerted by the fleet or sub-sector in the remaining open areas, and by other factors. But clearly, if catch per unit effort declines, unless the quality of the product meaningfully increases, cost per unit of catch would increase.

These types of efficiency and product quality tradeoffs are commonly referred to in the Vessel Master Surveys. For instance, in 2022, skippers cite traveling to avoid areas of known bycatch, using more test tows and waiting for reports from others before setting gear. They highlighted the challenge of having to avoid areas where the pollock quality is excellent, for fear of getting Chinook bycatch.

With some exceptions, AFA fishing and processing crew members are generally paid based on shares of an operation's net (or modified gross) revenues. Therefore, the impacts of avoidance costs could be three-fold in how they may affect a crewmember's compensation. Unless the company specifically structures the compensation to insulate the crewmembers from fuel costs,[95] additional movement that is the result of avoidance behavior could decrease payments. If the vessel ends up in an area with pollock that produces a lower quality product, that lower overall value from the resource could decrease share-based payments. Finally, if additional time is spent at sea as a result of these avoidance measures, crew members daily rate of pay would decrease, as they would be earning the same (or potentially less) over a longer season. There may be ways for companies to insulate their crew from some of these distributional impacts (e.g., year-end bonuses, not deducting certain variable costs associated with salmon avoidance prior to calculating crewshares, etc.). In addition, changes in skipper and crew compensation could affect employee retention and impact the level of onboard experience that contributes to safety and productivity. Analysts do not have access to crew compensation data or the details of share-based contracts that may be established, thus it is difficult to estimate the magnitude of these potential effects.

While additional avoidance cost would be primarily imposed on the vessel owners, skippers and crew, processors and communities may experience impacts from avoidance costs in terms of lower quality products which can affect state and local tax revenue (as highlighted further in section 6.2.9.2). Prospecting for harvestable concentrations of pollock then (depending on operating mode) running back to port with raw catch or product would, as previously noted, require increased expenditures of fuel and other consumable inputs, as well as more time on the water (i.e., trips may be longer, and all variable operating costs and wear and tear on equipment and crew would increase). These changes in fleet operating patterns could require a greater total number of days for a given vessel to take its share of the available TAC, other things being equal. Changes in season length or stand-downs in the middle of the season could have mixed impacts on the shoreside processors and communities.

Section 6.1.10.3 highlights the primary products generated from the pollock fishery, with most of the B season value generated from fillet blocks and surimi, but also production of fishmeal, minced fish, and fish oil. There is considerable price variation among different grades of fillet and surimi quality.[96]

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[95] It was highlighted by a skipper in the Vessel Master Surveys that their processor would pay for fuel to search for other areas to fish (2022).
[96] S.Wilt, personal communication.

However, flesh quality for fillets tends to be better in the cold waters of late fall than summer months. Therefore, depending on the products being generated, there could be a mix of impacts on processors and communities from an extended season.

Lower and slower deliveries may not supply sufficient quantities of raw fish for the largest plants to operate profitably. Many plants have been designed, configured, and operated to exploit economies of scale in production. They are designed to move an optimal volume of fish through the processing plant at the most efficient, most cost-effective rate, given the capacity of the facility and expectations of catch and delivery rates from the catcher-vessel fleet. If operated at rates that significantly deviate from those for which the plant was designed, these economies of scale would be lost and a plant could become less profitable to operate.

The marginal effect of a chum salmon PSC cap in contributing to these types of avoidance costs will be highly influenced by other factors that are also difficult to predict. Moreover, the level of avoidance costs may or may not respond in a linear way to a constraining chum PSC limit (Murphy et al. 2021). High pollock CPUE, cooler years in which chum and pollock are less overlapping, a lower amounts of hatchery chum or other constraining species on the fishing grounds, and favorable environmental conditions are all examples of factors that may lead to productive pollock fishing in which caps may not result in any marginal impact on avoidance relative to status quo. However, the inverse could also true (i.e., substantial impacts) in the presence of unfavorable conditions. The large number of factors at play results in uncertainty in the degree of negative impacts on operational efficiency.

Increased Costs and Risks Associated with Exploring New Fishing Area

Public testimony from a cooperative manager to the Council in October 2023.[97] highlighted a perceived shift in her vessels' willingness to take on the risk of exploring new fishing grounds due to an increased risk of encountering a high level of a prohibited or constraining species. Compared to previous eras of fishing in which vessel operators prided themselves in being able to uncover new fishing locations, vessel operators in that cooperative have become more risk averse and would prefer to fish in areas of known encounter rates.

Chum PSC limits established from Alternative 2 or 3 would be additive to a portfolio of other PSC limits (i.e., Chinook, herring, crab), existing area closures, and potentially constraining species (e.g., sablefish and sometimes Pacific Ocean Perch). As vessels are directed to move from areas that have higher chum PSC rates, they may move to areas that result in higher Chinook or herring PSC. As described in section 6.2.6, this analysis does not have a way to quantify the magnitude of that risk. However, with the addition of a constraining chum PSC limit, the cumulative suite of PSC limits and spatial closures may exacerbate avoidance costs (requiring additional movement, longer seasons, etc.) and further decrease potential revenue. Moreover, more test tows and traveling more to avoid chum may result in fishing later into October when Chinook are more present on the fishing grounds.

Possibly Impacts on Gear Conflict or Safety at Sea

With the establishment of cooperatives under the AFA and subsequent lessening of the race-for-fish, AFA vessels can better choose when to fish during the longer fishing season, thereby maximizing safe weather and sea conditions. The extended fishing season has also led to more stable employment, which results in crews that are better trained and more experienced. Further, to the extent that the AFA has helped improve the profitability of fishing operations, vessel owners can perform additional preventive and corrective vessel maintenance that will enhance safety at sea (Hughes and Woodley 2007; Lincoln et al. 2007).

The adoption of a chum PSC limit under Alternative 2 or 3 may create greater risk for safety-at-sea, all other factors held constant. For instance, if a constraining chum PSC limit requires inshore vessels to

[97] Catilyn Yeager, public testimony 10/8/23

travel farther from port than they otherwise would, this would be a concern if a health/safety emergency were to occur. For any operational type, increases in the time spent at sea would increase the length of time fishermen are potentially exposed to accidents. In addition, changes in company-level profitability could lead to a company deferring needed maintenance on vessels and equipment, reduce operating costs by cutting back on safety expenditures, or scale back the size of their crew in order to reduce crew share expenses. Remaining crew would have expanded responsibilities and could risk greater fatigue, increasing the likelihood of accidents. Finally, these operators could decide to fish more aggressively, even in marginal conditions, in an effort to recoup lost gross revenues. Each of the factors described above increases risk. On the other hand, the potential for increased risk may be offset to some extent by changes in fleet behavior as a result of the risk. For example, an increase in risk effectively increases the cost of each additional day of fishing that, in turn, may contribute to reduced levels of participation (e.g., fewer fishing days) by smaller vessels. If this leads to a safety-induced reallocation of harvest from smaller to larger vessels, risk calculations may be affected.

The avoidance techniques that may be employed under a PSC limit, may also result in gear conflicts if trawl vessels are moving more often to avoid chum PSC and the areas they move to overlap with other gear types. Trawl gear, pot gear, and longline gear are incompatible when fished simultaneously in a given area. Gear damage or loss is a common outcome when these competing fishing technologies come into contact with one another on the fishing grounds. Additionally, if the pollock B season is drawn out due to chum salmon avoidance, this could have an impact on gear conflicts. The likelihood of occurrence and magnitude of any such conflict is speculative at this time, as gear conflicts and grounds pre-emption are inherently difficult to monitor.

6.2.9.1.3 Analysis of Potentially Forgone Revenue

This analysis of potentially forgone revenue considers the likelihood and magnitude of reduced direct benefits in the form of gross revenue that may not accrue in the future due to a closure for an AFA pollock sector in the B season under a chum salmon PSC limit. In this case, fish that are not caught and processed do not generate revenue to direct participants. The subsequent section 6.2.5.3 includes a broader discussion of potential indirect impacts of a closure, beyond direct impacts on revenue.

This analysis begins with a retrospective examination of when each pollock sector hypothetically would have hit the various chum salmon PSC limits had the limits been in place in each of the years 2011-2022, not accounting for fishing behavior changes. These tables demonstrate the estimated forgone ex-vessel and first wholesale values associated with this closure,[98] under different PSC limits and apportionment scenarios. Similar to other tables throughout this analysis and highlighted in Appendix 6, these retrospective tables consider the week-end date in which the sectors' limit would have been met, all else equal, and considers all pollock and resulting revenue after that point in the B season forgone.

As stated, the analysts *do assume* that fishing behavior would change in response to a chum salmon limit; therefore, these numbers represent the maximum amount of gross revenue that hypothetically would not have been realized had a chum salmon PSC limit been in place previously (2011-2022). Avoidance techniques may delay or prevent a closure resulting from a chum PSC limit. Chum avoidance techniques could increase the AFA fleets' ability to harvest the pollock TAC and therefore increase the gross revenue attained from the pollock harvested. However, these changes to fishing behavior represent additional costs to certain stakeholders of the fishery as highlighted in previous sections and can add risk in their

[98] Section 5.3 describes the methods for estimating these values and why both types of values are included. In general, in this section the analysis refers to ex-vessel terms for the CVs and wholesale values for the CPs. Ex-vessel prices are the price received by the CVs from delivery of pollock to a shoreside plant or mothership, thus they are the relevant prices in considering the impacts to the CV fleets. First wholesale prices are the prices received by the first level of inshore processors, or by catcher-processors and motherships. They reflect the value added by the initial processor of the raw catch. They are not, therefore, equivalent to ex-vessel prices. They are the relevant value for CPs as there is no ex-vessel value exchanged in these operations. However, both types of values are included so the reader may compare across sectors in order to understand relative impacts under different PSC apportionments.

ability to avoid other priority species. In addition, future conditions that drive the fleets' fishing behavior (e.g., pollock TAC, area CPUE, the presence of chum other constraining species) will likely be different from the conditions of 2011-2022. Therefore, following the hypothetical forgone revenue tables, this analysis includes a discussion of the fleets' future ability to respond to chum PSC limits and additional context for potentially forgone revenue in the future, considering Alternative 2 and 3, relative to no action.

The tables of hypothetically forgone revenue by year from 2011-2022 are included in Appendix 6. The current set of PSC limits identified in Alternative 2, Option 1 (200,000 – 550,000 chum) have been displayed for four benchmark values in this range and the four apportionment options from Alternative 2, Option 3 which result in 16 tables. Table 6-54 and continued onto Table 6-55 is an example of these for a cap of 200,000 chum apportioned across the 4 sectors at the 3-year historical average chum bycatch, 2020-2022 (Alternative 2, Option 3, sub-option 1).

As an example, this table demonstrates that under a 200,000-chum salmon cap, apportioned across sectors by the 3-yr average bycatch rate, the CDQ sector and CP sectors would have seen their maximum reduction in gross revenues in 2018. This would result in a maximum reduction of $77 million in wholesale revenue for the CDQ sector in 2018, which would have represented 83.3% of its B season wholesale revenue and 45.9% of its annual AFA revenue. For the CP sector this apportionment of the 200,000 chum PSC limit would have resulted in a maximum reduction of $267 million in wholesale revenue in 2018, which would have represented 82.9% of its B season wholesale revenue and 45.6% of its annual AFA revenue. For the mothership and the inshore sectors, this apportionment of the 200,000 PSC limit would have resulted in a maximum amount of gross forgone revenue in 2021, which was also the year in the timeseries with the highest level of chum salmon PSC for these sectors. For the CVs in the mothership sector this would have been a maximum of $12 M ex-vessel revenue forgone, which would have represented 48.9% of its B season ex-vessel revenue and 27.1% of its annual AFA revenue. For the CVs delivering shoreside this would have been a maximum of $64 M ex-vessel revenue forgone, which would have represented 50.7% of its B season wholesale revenue and 28.8% of its annual AFA revenue. In this PSC and apportionment scenario, the CDQ sector would have been closed in the B season in 5 of the 12 years, the CP sector would have been closed in 9 of the 12 years, the mothership sector would have been closed in 7 of the 12 years, and the inshore sector would have been closed in 9 of the 12 years.

The sum of the hypothetically forgone revenue from these tables are summarized in cumulative Table 6-56 through Table 6-59. These cumulative tables essentially take the "total" row from each of the annual tables to demonstrate hypothetical values for 2011-2022 combined. As would be expected, based on the PSC apportionment table by sector (Table 4-7), the CDQ and CP sectors would expect the greatest reduction in harvest and corresponding forgone revenue under the 3-year average apportionment. The CV and mothership sectors would see the greatest reduction in harvest and corresponding forgone revenue under the AFA apportionment.

Figure 6-42 visually demonstrates the range of hypothetical reductions in annual gross wholesale revenue that is capture in the Table 6-56 through Table 6-59. Again, while gross wholesale revenue is not best metric for assessing the impacts on the CV fleet, this conversion does allow comparison of potential impacts among the PSC limits and sector apportionments across sectors. In addition, plotting the gross ex-vessel reductions, which are captured in Table 6-56 through Table 6-59, demonstrates the same trends and values within the range of 1.2% - 14% reduction in annual gross ex-vessel revenue. This figure shows a potential for 1.2% – 13.9% reduction in total gross wholesale revenue across all sectors, during the baseline period, relative to revenue accrued during the full pollock season. This figure also demonstrates that there is less variation in impacts from the apportionments for the mothership sector. Conversely, the choice of sector apportionments creates wide variation in revenue impacts for the inshore sector, particularly under lower PSC cap levels (i.e., 200,000 and 300,000). Wide variation is also shown for the CP sector depending on sector apportionment chosen, particularly under a 300,000 PSC limit. Based on

2011-2022 conditions, this represents a difference of between 4.2% and 11.2% decrease in annual gross wholesale revenue from pollock.

Table 6-54 Annual Table: Hypothetical forgone revenue (2011-2022) if a 200,000 chum salmon PSC limit had been in place apportioned to each sector as its 3-year average bycatch (Option 3, sub-option1)

Sector	Year	Week-end date	B Season Pollock Harvested (mt)	B Season Forgone Pollock (mt)	B Season Chum Bycatch (#)	B Season Chum Avoided (#)	B Season Wholesale Value All BSAI Groundfish (real 2022 $)	B Season Wholesale Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total	B Season Ex-Vessel Value All BSAI Groundfish (real 2022 $)	B Season Ex-Vessel Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total
CDQ	**Total**		**884,892**	**189,218**	**227,891**	**99,035**	**1,161M**	**235M**	**20.23%**	**11.48%**	**354M**	**70M**	**19.87%**	**11.29%**
	2011		66,167		3,758		103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		200		112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		554		96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		2,407		99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		4,650		101M		0.00%	0.00%	32M		0.00%	0.00%
	2016	8/6/2016	81,476	14,836	16,342	3,238	104M	19M	18.34%	10.99%	30M	5M	18.34%	11.00%
	2017	7/8/2017	75,419	48,998	87,058	72,998	97M	63M	65.08%	35.91%	27M	17M	65.18%	35.99%
	2018	6/30/2018	76,296	63,534	26,586	12,995	93M	77M	83.33%	45.85%	30M	25M	83.31%	45.90%
	2019	9/21/2019	78,315	13,261	15,726	3,446	104M	18M	17.03%	9.38%	29M	5M	17.13%	9.46%
	2020		63,107		8,582		77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	55,663	6,358	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		6,365		85M		0.00%	0.00%	27M		0.00%	0.00%
CP	**Total**		**3,124,177**	**808,749**	**961,389**	**347,317**	**4,114M**	**1,021M**	**24.81%**	**14.18%**	**1,256M**	**306M**	**24.39%**	**13.92%**
	2011	10/29/2011	250,129	2,073	44,299	18	392M	3M	0.86%	0.50%	115M	1M	0.88%	0.50%
	2012		253,884		1,928		388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		10,229		333M		0.00%	0.00%	108M		0.00%	0.00%
	2014	9/6/2014	267,977	18,825	63,066	7,424	343M	24M	7.05%	4.22%	111M	8M	7.06%	4.20%
	2015		277,192		40,046		352M		0.00%	0.00%	112M		0.00%	0.00%
	2016	8/6/2016	284,065	141,263	134,750	75,009	366M	183M	49.89%	30.20%	104M	52M	50.04%	30.29%
	2017	7/22/2017	266,891	162,802	207,355	110,576	346M	212M	61.17%	34.42%	95M	58M	61.37%	34.61%
	2018	7/7/2018	263,947	218,962	99,447	40,571	321M	267M	82.94%	45.63%	104M	86M	82.83%	45.73%
	2019	8/31/2019	275,173	67,037	113,428	18,785	367M	91M	24.72%	13.83%	103M	26M	24.80%	13.95%
	2020	9/5/2020	245,375	53,883	77,138	32,244	298M	66M	22.27%	11.60%	93M	21M	22.48%	11.78%
	2021	7/31/2021	264,947	125,523	97,917	37,412	315M	149M	47.42%	25.88%	98M	47M	47.44%	25.94%
	2022	8/20/2022	209,668	18,381	71,786	25,278	292M	26M	8.80%	4.82%	94M	8M	8.83%	4.84%

Table 6-55 continued. Annual Table: Hypothetical forgone revenue (2011-2022) if a 200,000 chum salmon PSC limit had been in place apportioned to each sector as its 3-year average bycatch (Option 3, sub-option1)

Sector	Year	Week-end date	B Season Pollock Harvested (mt)	B Season Forgone Pollock (mt)	B Season Chum Bycatch (#)	B Season Chum Avoided (#)	B Season Wholesale Value All BSAI Groundfish (real 2022 $)	B Season Wholesale Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total	B Season Ex-Vessel Value All BSAI Groundfish (real 2022 $)	B Season Ex-Vessel Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total
Mother ship	**Total**		**790,812**	**117,955**	**280,145**	**65,310**	**1,037M**	**154M**	**14.89%**	**8.59%**	**317M**	**46M**	**14.49%**	**8.37%**
	2011	9/17/2011	65,724	16,243	24,399	5,176	103M	26M	25.01%	14.87%	30M	8M	24.98%	14.75%
	2012		63,424		977		96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		3,835		84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		8,091		85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		14,046		88M		0.00%	0.00%	28M		0.00%	0.00%
	2016	8/13/2016	70,599	30,840	43,262	18,916	90M	39M	43.68%	26.27%	26M	11M	43.69%	26.28%
	2017		66,453		16,825		85M		0.00%	0.00%	23M		0.00%	0.00%
	2018	9/1/2018	66,892	5,677	21,303	2,897	81M	7M	8.56%	4.79%	26M	2M	8.52%	4.77%
	2019	8/31/2019	68,066	20,795	44,860	20,379	90M	27M	30.37%	16.80%	25M	8M	30.24%	16.87%
	2020	10/31/2020	66,919		19,743		81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	7/31/2021	66,593	32,775	50,542	9,694	79M	39M	49.16%	27.12%	25M	12M	48.86%	27.09%
	2022	8/13/2022	53,532	11,625	32,262	8,248	75M	16M	21.58%	12.14%	24M	5M	21.68%	12.19%
Inshore	**Total**		**3,949,430**	**667,332**	**1,899,055**	**340,685**	**4,623M**	**719M**	**15.55%**	**9.06%**	**1,583M**	**251M**	**15.83%**	**9.22%**
	2011		299,466		118,861		413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		19,067		442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		110,496		395M		0.00%	0.00%	135M		0.00%	0.00%
	2014	9/6/2014	335,322	25,986	145,322	12,744	407M	32M	7.80%	4.71%	139M	11M	7.62%	4.60%
	2015	8/29/2015	346,959	77,724	174,343	38,094	381M	85M	22.31%	13.60%	141M	31M	21.71%	13.22%
	2016	9/10/2016	354,015	23,825	144,882	15,397	398M	27M	6.72%	4.06%	129M	8M	6.47%	3.91%
	2017	8/5/2017	346,323	123,509	154,610	19,536	354M	127M	35.73%	20.88%	121M	43M	35.19%	20.51%
	2018	9/1/2018	343,996	50,448	147,369	14,956	387M	56M	14.56%	8.39%	135M	19M	14.24%	8.20%
	2019	9/7/2019	348,384	54,020	172,798	32,131	413M	64M	15.45%	8.82%	128M	20M	15.26%	8.65%
	2020	9/5/2020	327,025	114,920	237,632	111,140	334M	118M	35.26%	19.19%	124M	45M	36.17%	19.87%
	2021	7/31/2021	339,546	172,796	341,779	94,626	353M	179M	50.77%	28.77%	126M	64M	50.65%	28.77%
	2022	8/20/2022	262,593	24,105	131,896	2,061	346M	32M	9.21%	5.10%	118M	11M	9.36%	5.20%
Grand Total			**8,749,312**	**1,783,298**	**3,368,480**	**852,347**	**10,936M**	**2,129M**	**19.47%**	**11.22%**	**3,511M**	**673M**	**19.18%**	**11.05%**

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

Table 6-56 Cumulative Table: Hypothetical forgone revenue based on 200,000 chum limit, cumulative for 2011-2022 PSC

If 200,000 chum limit had been in place 2011-2022		Sum of Forgone B Season Pollock (mt)	Sum of B Season Wholesale Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Ex-Vessel Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**1,783,255**	**2,129M**	**19.47%**	**11.22%**	**673M**	**19.18%**	**11.05%**
	CDQ	189,218	235M	20.23%	11.48%	70M	19.87%	11.29%
	CP	808,749	1,021M	24.81%	14.18%	306M	24.39%	13.92%
	Mothership	117,955	154M	14.89%	8.59%	46M	14.49%	8.37%
	Inshore	667,332	719M	15.55%	9.06%	251M	15.83%	9.22%
5-year avg. sector apportionment	**Total**	**1,907,248**	**2,264M**	**20.70%**	**11.93%**	**721M**	**20.54%**	**11.84%**
	CDQ	164,173	203M	17.46%	9.91%	61M	17.26%	9.80%
	CP	785,612	990M	24.06%	13.75%	297M	23.61%	13.47%
	Mothership	114,457	150M	14.48%	8.36%	45M	14.06%	8.12%
	Inshore	843,005	921M	19.93%	11.61%	319M	20.14%	11.73%
Pro-rata sector apportionment	**Total**	**1,889,098**	**2,246M**	**20.54%**	**11.83%**	**715M**	**20.35%**	**11.73%**
	CDQ	164,173	203M	17.46%	9.91%	61M	17.26%	9.80%
	CP	785,612	990M	24.06%	13.75%	297M	23.61%	13.47%
	Mothership	117,955	154M	14.89%	8.59%	46M	14.49%	8.37%
	Inshore	821,358	899M	19.44%	11.33%	311M	19.63%	11.44%
AFA sector apportionment	**Total**	**2,235,419**	**2,638M**	**24.12%**	**13.90%**	**853M**	**24.30%**	**14.00%**
	CDQ	147,739	181M	15.62%	8.86%	55M	15.54%	8.83%
	CP	621,440	786M	19.11%	10.92%	233M	18.52%	10.57%
	Mothership	120,149	157M	15.14%	8.74%	47M	14.75%	8.52%
	Inshore	1,346,090	1,514M	32.74%	19.07%	519M	32.76%	19.08%

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

Table 6-57 Cumulative Table: Hypothetical forgone revenue based on 300,000 chum limit, cumulative for 2011-2022 PSC

If 300,000 chum limit had been in place 2011-2022:		Sum of Forgone B Season Pollock (mt)	Sum of B Season Wholesale Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Ex-Vessel Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**1,071,457**	**1,300M**	**11.88%**	**6.85%**	**402M**	**11.44%**	**6.59%**
	CDQ	147,739	181M	15.62%	8.86%	55M	15.54%	8.83%
	CP	639,204	809M	19.65%	11.23%	240M	19.09%	10.89%
	Mothership	69,238	87M	8.38%	4.84%	26M	8.26%	4.77%
	Inshore	215,277	223M	4.82%	2.81%	81M	5.09%	2.96%
5-year avg. sector apportionment	**Total**	**1,052,203**	**1,273M**	**11.64%**	**6.71%**	**394M**	**11.22%**	**6.47%**
	CDQ	147,739	181M	15.62%	8.86%	55M	15.54%	8.83%
	CP	607,007	768M	18.68%	10.67%	227M	18.08%	10.32%
	Mothership	69,238	87M	8.38%	4.84%	26M	8.26%	4.77%
	Inshore	228,220	236M	5.11%	2.97%	86M	5.40%	3.15%
Pro-rata sector apportionment	**Total**	**1,037,812**	**1,256M**	**11.48%**	**6.62%**	**389M**	**11.07%**	**6.38%**
	CDQ	147,739	181M	15.62%	8.86%	55M	15.54%	8.83%
	CP	592,616	751M	18.26%	10.44%	222M	17.66%	10.08%
	Mothership	69,238	87M	8.38%	4.84%	26M	8.26%	4.77%
	Inshore	228,220	236M	5.11%	2.97%	86M	5.40%	3.15%
AFA sector apportionment	**Total**	**952,571**	**1,097M**	**10.03%**	**5.78%**	**352M**	**10.02%**	**5.77%**
	CDQ	90,104	111M	9.59%	5.44%	33M	9.20%	5.23%
	CP	231,045	301M	7.33%	4.19%	84M	6.71%	3.83%
	Mothership	69,238	87M	8.38%	4.84%	26M	8.26%	4.77%
	Inshore	562,186	598M	12.93%	7.53%	209M	13.18%	7.68%

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

Table 6-58 Cumulative Table: Hypothetical forgone revenue based on 450,000 chum limit, cumulative for 2011-2022 PSC

If 450,000 chum limit had been in place 2011-2022:		Sum of Forgone B Season Pollock (mt)	Sum of B Season Wholesale Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Ex-Vessel Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**527,984**	**640M**	**5.85%**	**3.37%**	**193M**	**5.50%**	**3.17%**
	CDQ	90,104	111M	9.59%	5.44%	33M	9.20%	5.23%
	CP	255,325	334M	8.11%	4.64%	93M	7.44%	4.24%
	Mothership	33,619	41M	3.92%	2.26%	12M	3.91%	2.26%
	Inshore	148,936	154M	3.33%	1.94%	55M	3.46%	2.02%
5-year avg. sector apportionment	**Total**	**471,574**	**564M**	**5.15%**	**2.97%**	**172M**	**4.89%**	**2.82%**
	CDQ	90,104	111M	9.59%	5.44%	33M	9.20%	5.23%
	CP	202,042	261M	6.35%	3.63%	73M	5.81%	3.31%
	Mothership	30,492	37M	3.52%	2.03%	11M	3.55%	2.05%
	Inshore	148,936	154M	3.33%	1.94%	55M	3.46%	2.02%
Pro-rata sector apportionment	**Total**	**474,701**	**568M**	**5.19%**	**2.99%**	**173M**	**4.92%**	**2.84%**
	CDQ	90,104	111M	9.59%	5.44%	33M	9.20%	5.23%
	CP	202,042	261M	6.35%	3.63%	73M	5.81%	3.31%
	Mothership	33,619	41M	3.92%	2.26%	12M	3.91%	2.26%
	Inshore	148,936	154M	3.33%	1.94%	55M	3.46%	2.02%
AFA sector apportionment	**Total**	**418,368**	**482M**	**4.41%**	**2.54%**	**154M**	**4.38%**	**2.52%**
	CDQ	76,810	94M	8.12%	4.61%	28M	7.88%	4.48%
	CP	102,579	133M	3.24%	1.85%	37M	2.93%	1.67%
	Mothership	38,733	47M	4.50%	2.60%	14M	4.51%	2.61%
	Inshore	200,246	207M	4.49%	2.61%	75M	4.72%	2.75%

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

Table 6-59 Cumulative Table: Hypothetical forgone revenue based on 550,000 chum limit, cumulative for 2011-2022 PSC

If 550,000 chum limit had been in place 2011-2022		Sum of Forgone B Season Pollock (mt)	Sum of B Season Wholesale Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Ex-Vessel Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**274,502**	**349M**	**3.19%**	**1.84%**	**99M**	**2.82%**	**1.63%**
	CDQ	90,104	111M	9.59%	5.44%	33M	9.20%	5.23%
	CP	173,485	225M	5.46%	3.12%	62M	4.97%	2.84%
	Mothership	10,914	13M	1.25%	0.72%	4M	1.27%	0.73%
	Inshore			0.00%	0.00%		0.00%	0.00%
5-year avg. sector apportionment	**Total**	**359,623**	**422M**	**3.86%**	**2.23%**	**131M**	**3.72%**	**2.14%**
	CDQ	76,810	94M	8.12%	4.61%	28M	7.88%	4.48%
	CP	133,877	174M	4.23%	2.42%	48M	3.81%	2.18%
	Mothership			0.00%	0.00%		0.00%	0.00%
	Inshore	148,936	154M	3.33%	1.94%	55M	3.46%	2.02%
Pro-rata sector apportionment	**Total**	**370,537**	**435M**	**3.98%**	**2.29%**	**135M**	**3.84%**	**2.21%**
	CDQ	76,810	94M	8.12%	4.61%	28M	7.88%	4.48%
	CP	133,877	174M	4.23%	2.42%	48M	3.81%	2.18%
	Mothership	10,914	13M	1.25%	0.72%	4M	1.27%	0.73%
	Inshore	148,936	154M	3.33%	1.94%	55M	3.46%	2.02%
AFA sector apportionment	**Total**	**204,635**	**224M**	**2.04%**	**1.18%**	**75M**	**2.13%**	**1.23%**
	CDQ	30,507	39M	3.38%	1.92%	11M	3.06%	1.74%
	CP	2,225	3M	0.07%	0.04%	1M	0.06%	0.04%
	Mothership	22,968	27M	2.63%	1.52%	8M	2.67%	1.54%
	Inshore	148,936	154M	3.33%	1.94%	55M	3.46%	2.02%

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

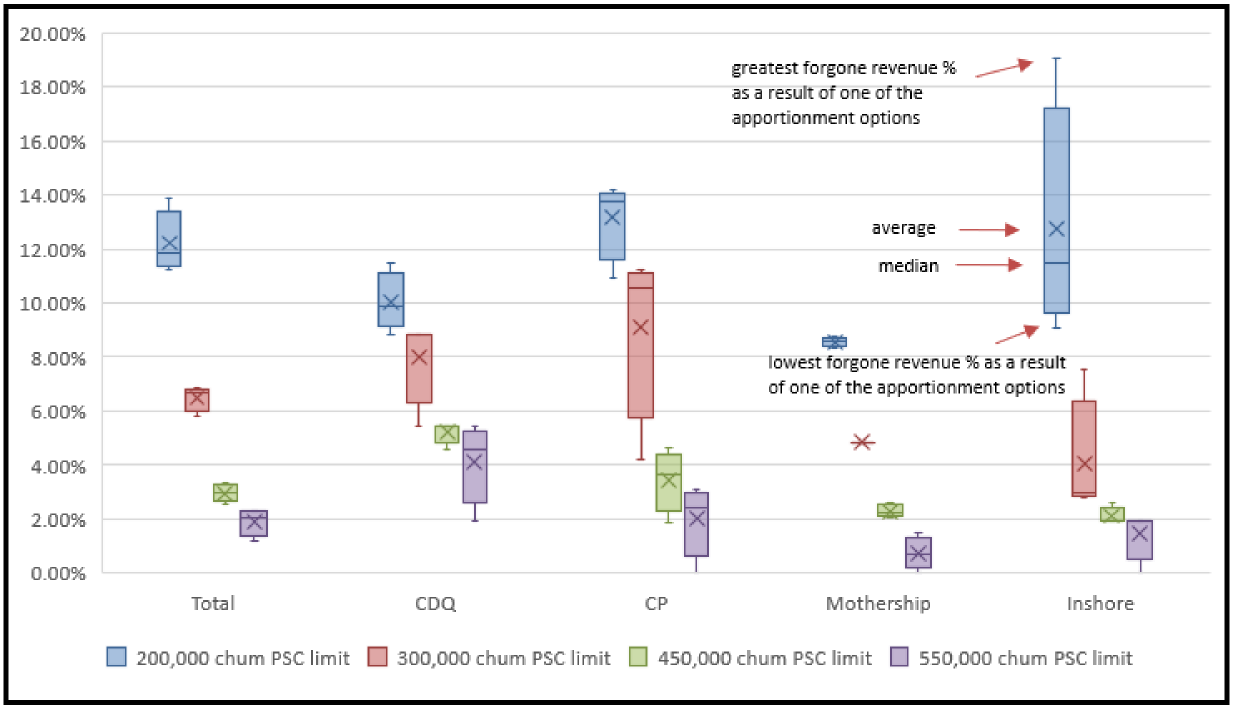

Figure 6-42 Hypothetical reduction in gross wholesale revenue as a percent of annual total pollock wholesale revenue 2011-2022, under four chum PSC limits and four apportionments

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

The tables and figure above are useful for providing a frame of reference for possible future economic impacts related to the chum PSC limits and sector apportionments considered under Alternative 2 and 3. However, these values can only take the reader so far in terms of predicting the future and need to be further contextualized with additional expectations, should chum PSC limits be in place.

As highlighted previously, an evaluation of *gross* revenue does not account for the multitude of costs of production and, thus, does not quantify the net effect of the action. This is expected to be a meaningful distinction, as one of the AFA fleet's primary strategies under a chum PSC cap would likely be increased test tows and movement out of areas with higher bycatch rates, both of which are likely to result in increased costs associated with this avoidance. Section 6.2.9.1.2 qualitatively discusses the types of variable avoidance costs that may increase under the proposed caps.

Alternatively, avoidance behaviors may allow any future AFA B seasons under a chum PSC limit to remain open or open longer than they otherwise would. In this way, the expectation of future forgone gross revenue impacts would not be as great as displayed in Table 6-56– Table 6-59. Moreover, the Council is consideration chum PSC limits that include full transferability between cooperatives and sectors. For the reasons described in Section 6.2.9.1.1, the analysts do not expect that this would occur in an efficient way. However, the ability to transfer chum PSC, may increase the level of pollock TAC able to be harvested.

Finally future variation in ocean conditions and the distribution of pollock/chum/Chinook/other constraining species might render recent history a less representative picture. These conditions could be more or less favorable to pollock fishing and the resulting bycatch. It is important to emphasize the level of uncertainty that exists for future conditions and thus the expectations for marginal impact on forgone revenue and avoidance costs.

6.2.9.1.4 Implications of a B Season Closure

In addition to the direct impacts of possible forgone revenue analyzed in section 6.2.9.1.3, this section highlights the possible economic impacts of a closure within the pollock B season, prior to the full harvest of the TAC. Due to the proposed flexibility in transferability with a chum PSC limit, a constraining chum PSC cap could result in a B season closure at the AFA fleetwide level, if the fleet as a whole reached the cap. However as highlighted in section 6.2.9.1.1, *de facto* closures could also occur within a sector or cooperative, if pockets of pollock are stranded due to a sector or cooperative meeting their sub-apportionment of chum PSC, at which point they would be prohibited from fishing. As previously described, there are reasons to expect chum PSC may not be transferred efficiently throughout whole AFA fleet when there is a demand for it.

The effects of unharvested B season pollock at the cooperative, sector, or AFA fleet-level could demonstrate a clearer retrospective picture of economic impacts than avoidance costs, which appear to be more often imbedded in how a cooperative coordinates harvest. In addition, a B season closure could have wider impacts, extending to processors, communities, markets, and possibly consumers. The likelihood of adverse impacts manifesting, and the magnitude of these effects would greatly depend on the point within the B season that a cooperative, sector, or the AFA fleet reached the limit, with a lesser impact associated with a later closure.

As described through tables in section 6.1.10.1, AFA vessels and companies are not equally reliant on pollock fishing revenue relative to revenue from other fisheries so the marginal impact of the proposed chum PSC limits would fall more heavily on some participants than others. Table 6-25 and Table 6-27 shows that the majority of the CVs rely on B season pollock for 40-60% of their total fisheries gross revenue and the CPs rely on B season pollock for 30-50% of their total fisheries gross revenue (not including revenue from CDQ in the B season, which is demonstrated separately in Table 6-28). Additionally, companies have different cost portfolios that are not available to the analysts. For instance, fixed costs for maintaining and operating a vessel can be high (e.g., debt payments, insurance, property taxes). In the event that total production is lower under Alternative 2 or 3, fixed costs would be distributed across a smaller volume of product output.

If the pollock B season in the BS is shut down early, vessels will have differing abilities to shift effort into other fisheries in order to compensate for this loss of access. Some vessels may increase effort for BSAI yellowfish sole (which does not have sideboards) or Pacific cod (which is rationalized through the PCTC Program) for example, or expand effort in the GOA (e.g., pollock or flatfish). However, as described in section 6.1.10.1 an analysis of potential spillover impacts is inherently complex due to the suite of AFA sideboards that limit participation in other fisheries and vessels have differing “exempt” and “non-exempt” status from these sideboards. Additionally, some vessels will be part of the newly implemented PCTC, but through rationalization the opportunity to expand effort into this fishery is focused through purchasing a trawl license limitation program groundfish license with assigned PCTC quota share or through an annual transfer of quota within a cooperative.

CDQ affiliations add depth and complexity to the consideration of social and economic impacts because these groups have both commercial and community-supporting missions, as well as stakeholder status in groundfish harvesting. As discussed in section 6.1.10.2, recent closures and declining quota in BSAI crab fisheries (i.e., Bristol Bay red king crab and Bering Sea snow (*C. opilio*) crab in particular), have impacted the revenue from both the crab CDQ held by the groups as well as revenues from additional investments in harvesting and processing quota share. In light of these declines, pollock has made up a relatively greater proportion of total revenues in recent years. If chum PSC limits under Alternative 2 or 3 resulted in early closure of the pollock B season, CDQ groups and their subsidiaries would likely have reduced revenues through both their CDQ allocations as well as their direct investments in CDQ vessels (as represented in Table 6-29). However, like other AFA companies, they would still have their immediate fixed costs such as payments for existing debt payments and vessel insurance, etc. Given these factors, a B season closure, depending on the magnitude, could have adverse impacts on a CDQ group's ability to support their community program (as described in section 4.2.7 of the SIA) in the same way that they would under status quo. This potential impact to the communities represented by the CDQ groups is further discussed in Section 6.2.9.3.

A pollock B season closure could result in indirect economic impacts on communities in a number of ways (i.e., as associated with captains/crew, vessel owners, processors, support sectors and CDQ communities). Community engagement and dependence on the B season pollock fishery is described in section 4.1 of the accompanying SIA and Section 6.1.10.4 below describes the expected impacts to these communities from potential forgone harvest and deliveries of B season pollock.

If a constraining chum PSC limit resulted in the AFA pollock fleet or a sector reaching this limit in the B season, this could impact products available for both domestic and export markets. As described in Section 6.1.10.3, the U.S. currently accounts for 42% of the global harvest of pollock, with Russia as its leading competitor. Recent news and markets reports described in Section 6.1.10.3 highlight some current market vulnerabilities, including an expected increase in Russian pollock production in 2024, driving down the price for both surmi and block prices for fillets (Sackton 2024). Harvesters and processors are facing higher operating costs due to domestic inflation for labor/materials/shipping/storage, high interest rates, high fuel prices, and labor supply shortfalls. In addition, there are supply and demand imbalances that have devalued products, geopolitical actions that constraining global market opportunities and impacting competition, as well as the declines in other Alaska species (e.g., BSAI crab) that can decrease the resilience of a processing plant. Given this multitude of challenging global factors in effect for Alaska seafood markets, including pollock, and the lack of processor operating cost data available to analysts, it is unclear what level of unharvested pollock could tip the sustainability of processing operations. However, repeated closures in the B season could exacerbate the current market challenges for existing processors.

Unless repeated B season closures have a more widespread multi-species effect on processing operations, chum PSC limits under Alternative 2 or 3 are unlikely to produce large impact on U.S. consumers. Export markets differ based on the products generated; however, surimi is primarily (70% in 2020) exported to Japan and South Korea and over half of Alaska pollock fillet production (2016-2020) has been sold directly to European markets. Moreover, other whitefish species can be competitors in consumer demand. While export markets remain paramount, domestic opportunities for Alaska pollock fillets have increased in recent years, with new commitments by the U.S. Department of Agriculture (USDA) for purchases of pollock, along with other Alaska seafood for the National School Lunch Program, food banks, and foreign aid programs among other channels (see Section 6.1.10.3).

6.2.9.1.5 Considerations of Operational Effects Under Alternative 3

Alternative 3 adds the additional focus to WAK chum catch by the AFA pollock fleet. As the AFA sectors will not know what their status of WAK chum catch is in season, there may be more of a reliance on historical WAK chum encounter data and any other techniques they may use to try to minimize their harvest of these chum in particular. If this results in more conservative fishing behavior or more targeted avoidance, there may be increase avoidance costs associated with the marginal difference between Alternative 2 and the addition of Alternative 3.

6.2.9.2 Potential Impacts to Communities Engaged in or Dependent on Harvests and Deliveries of AFA and CDQ Pollock

The following section directly corresponds to Section 5.2.1 of the accompany SIA. The following section addresses some of the potential community-level effects of the proposed action alternatives as a group on those communities identified as being substantially engaged in or economically dependent on the B season pollock fishery.

Community engagement in the B season pollock fishery was measured by either a harvesting or at-sea processing vessel's registered ownership address or by the physical location of shorebased processing facilities that accepted deliveries of AFA pollock during the B season from 2011 through 2022. A **community's relative economic dependence** on the B season pollock fishery was measured in terms of the gross revenues earned from B season pollock compared to the gross revenues earned from all other area, species, and gear fisheries harvested or processed by those same entities (see Section 4.1 of the SIA). In this impact analysis, a community's **vulnerability** to the potential adverse effects of the proposed action alternatives is considered in terms of the degree of economic dependence on the directly impacted sector(s), and the community's **resilience** in terms of its economic diversity (e.g., alternative employment opportunities, income, business, public revenues, among others).

It is anticipated the proposed action alternatives could result in indirect and adverse effects on communities affiliated with the harvesting and processing of AFA and CDQ pollock during the B season fishery. From the Pacific Northwest region, it is anticipated the proposed action alternatives would primarily affect the communities of Seattle (WA) and Newport (OR). From Alaska, it is anticipated the proposed action alternatives would primarily affect the communities of Akutan, King Cove, Kodiak, and Unalaska/Dutch Harbor. However, the nature and relative magnitude of these impacts would vary by the option(s)/Alternative(s) under consideration; whether a community is affiliated with a sector harvesting pollock, receiving deliveries of pollock, or both; and the degree to which vessels affiliated with a community change their behavior to avoid chum salmon PSC. In light of this, the discussion on potential community-level impacts has grouped communities (at times) based on some shared characteristics in participation in the fishery as opposed to grouping communities by geographic region.

Section 6.2.9 discusses the potential economic impacts of the proposed action alternatives on participants in the Bering Sea pollock fishery which are not repeated at length here. However, it is important to note the proposed action alternatives could result in different types of economic costs or impacts to the pollock sectors which could in turn impact pollock dependent communities. As discussed previously in this analysis, if the overall chum salmon PSC limit recommended under Alternative 2 and 3 has the potential to constrain a sector during the B season, and pollock harvesters could not alter their fishing behavior to a degree that would avoid reaching the apportionment of the PSC limit, the limit could result in **potentially forgone gross revenue** for those vessels and companies because they would be required to stop fishing.

The proposed action alternatives could also result in **avoidance costs** because it is expected that pollock harvesters would modify their fishing behavior to avoid reaching their apportionment of the PSC limit and minimize losses associated with potentially forgone gross revenues. Primarily, these strategies include moving fishing effort to different areas when a certain level of salmon bycatch is encountered. The cooperative structure of the AFA pollock fleet, in addition to current IPAs, equip the fleet with data and communication tools to work towards this goal. With the risk of having a whole sector closed for the remainder of the B season after the apportionment of the PSC limit was reached, it is anticipated that the cooperative mangers and Sea State (the monitoring agent under the IPAs) would cautiously monitor the real-time rates of chum salmon bycatch and direct vessels to move fishing effort as necessary. In doing so, vessels and companies would incur costs associated with this avoidance regardless of whether the overall PSC limit was met.

The types of avoidance costs addressed in the analysis are centered on fleet movement as a primary strategy. Avoidance costs include increased fuel usage as vessels spend more time prospecting areas with low chum bycatch rates while balancing a need to find areas with high pollock CPUE or areas with the size and quality of pollock to meet the product types they intend to process. Vessels may also use increased test tows to identify these areas which could result in increased costs for fishing gear if damage occurs. Increased travel to pollock grounds and test tows may increase trip lengths (see also work by Murphy Jr. et al. (2021)).

The potential impacts to communities engaged in or dependent on the B season pollock fishery resulting from forgone revenue or avoidance costs are not straightforward. There are extremely limited empirical data on various cost categories, the degree to which these costs can be associated with or attributed to chum PSC avoidance, and the uncertainty of the magnitude of fishing behavior changes in response to new PSC constraints proposed in the alternatives on fishing sectors. Quantitatively linking these costs back to communities affiliated with these harvesting or processing sectors is not possible with the available information and the level of uncertainty. As such, this analysis includes a qualitative description of the impacts on communities affiliated with harvesting and processing B season pollock and the direction of those impacts.

6.2.9.2.1 Potential Impacts to Seattle

From 2011 through 2022, a high degree of AFA vessel ownership was concentrated in Seattle across all potentially affected harvesting and at-sea processing sectors.

- 92.77% of CPs harvesting AFA and CDQ pollock during the B season have a registered ownership address in Seattle.
- 47.62% of mothership/floating processors have a registered ownership address in Seattle.
- 80.20% of inshore CVs have a registered ownership address in Seattle.
- 92.45% of mothership CVs have a registered ownership address in Seattle.

As such, Seattle has a high degree of exposure to the potential adverse effects of a constraining overall chum salmon PSC limit under Alternative 2 and 3, particularly if a sector or cooperative were to close during the B season prior to the pollock TAC being harvested.

As discussed throughout Section 4.1 of the SIA, the B season pollock fishery accounted for a substantial portion of the gross first wholesale and ex-vessel revenues for vessels with a Seattle-based ownership address. Due to confidentiality restrictions, it is not possible to show the gross first wholesale revenues for CPs and floating processor/motherships with a Seattle-based address apart from their community groupings (Seattle/Anchorage and Seattle/Dutch Harbor, respectively). CPs that harvested AFA and CDQ pollock during the B season earned an annual average of $439.22 million in gross first wholesale revenues. The floating processor/motherships earned approximately $107.96 million in gross first wholesale revenues (on average, 2011-2022). CVs with a Seattle-based ownership address that harvested AFA pollock during the B season earned approximately $137.60 million in gross ex-vessel revenues (on average, 2011-2022). This information provides a sense of the relative magnitude of revenues that could be potentially forgone for Seattle-affiliated vessels if the overall chum PSC limit under Alternative 2 and 3 was constraining to a degree that harvesters could not avoid reaching the apportionment of the PSC limit.

The community of Seattle could also be adversely affected if the chum salmon PSC limit was sufficiently constraining under (an ultimately implemented) alternative, such that consolidation would occur within the sector(s). Consolidation could result as firms that are less efficient at addressing chum salmon bycatch incur costs and sell to firms that are more efficient. However, it is challenging to discern the degree to which Seattle would be impacted by potential consolidation because consolidation could occur within Seattle-based firms.

In a scenario where an AFA sector or cooperative reached its apportionment of the overall chum salmon PSC limit (Alternative 2 and 3) prior to the full harvest of its B season pollock allocation, an additional area of potential concern would be the loss of income opportunities for crew that work on these vessels. A fishery closure for a sector or cooperative would impact skipper and crew income. However, as mentioned in Section 6.2.9.1.2, this is in addition to the ways skippers and crew may be impacted by increased chum PSC avoidance costs under all proposed action alternatives. Increased avoidance costs could result in lower compensation for share-based employees (unless companies specifically insult crew from these types of costs). Increased avoidance measures could result in longer fishing trips with crew members spending more time away from home. Longer fishing trips and overall time at sea can have a negative effect on crew morale and job satisfaction (Murphy et al. 2021). Although there are theoretically more alternative employment and income opportunities for workers in a large urban area like Seattle than other community settings, there may not be comparable employment in earning potential or general job satisfaction (Gatewood & McCay 1990).

There is no direct information on the location of AFA vessel purchases of support services, and there is also no readily available information for the community of long-term residences of AFA skippers, crew, and processing workers employed on the vessels affiliated with Seattle. However, Table 6-60 provides some cross-cutting information based on vessel ownership address and homeport information. A vessel's homeport is generally understood to be where the vessel spends a majority of its time throughout the year and generates some related level of economic activity. In this way, communities may be considered as engaged in the relevant Bering Sea pollock sectors in a variety of ways and not in isolation (i.e., a community may have multiple, cross-cutting ties to a fishery).

As shown, all CPs with a registered ownership address in Seattle also list the community as the homeport location. While Table 6-60 only provides a snapshot of information for 2022, this is a consistent trend across all years during the analyzed period. An exception to this trend is that one CP with a registered ownership address in Seattle listed Unalaska/Dutch Harbor as its homeport in 2013 and 2014. CVs (inshore and mothership combined) with a registered ownership address in Seattle show more diversity in their homeport locations, although the majority listed Seattle as their homeport community in 2022. Again, this is a consistent trend over the analyzed period (2011-2022).

Table 6-60 Correspondence of vessels harvesting AFA or CDQ B season pollock with a Seattle or Seattle MSA ownership address and the vessel's listed homeport, 2022

	Vessel Homeport							
Fleet	Anchorage	Unalaska/ Dutch Harbor	Juneau	Kodiak	Neah Bay	Newport	Seattle	Total
CP	-	-	-	-	-	-	12	12
CV	1	7	1	4	1	1	40	55

Source: AKFIN.

While Seattle is the community most substantially engaged in the harvesting and at-sea processing components of the B season pollock fishery, it may also be less economically dependent on the fishery when the revenues earned are compared to the scale, diversity, and general economic resilience of Seattle. Seattle is a large urban metropolitan area and its economic dependence on the B season pollock fishery is relatively small when compared to the scale of the community's economy. (This is not the same as the resiliency of the vessels or companies that are affiliated with Seattle via their ownership address where the potential adverse impacts would be more direct.) Regardless, as mentioned previously, a central part of Seattle's identity as a community has always been that of a fishing community, and there are still distinct areas within the Seattle where concentrations of businesses and infrastructure are focused on the area's large and wide-ranging fleet and the support of that fleet and of the fishing industry in general (NOAA 2014).

6.2.9.2.2 Potential Impacts to Newport and Kodiak

This portion of the analysis provides information on the potential impacts to Newport and Kodiak. As described above, the analysts grouped some communities because of some shared characteristics in terms of participation in the B season pollock fishery which are anticipated to have an effect on the impacts communities would be exposed to. Some specific considerations included that these two communities are affiliated with the CV fleets, are not affiliated with at-sea processing entities, and are not home to an AFA inshore processing facility (the last point being more relevant to Kodiak as an Alaska-based community). In this way, this choice was partially an attempt to minimize redundancy. This is not to suggest there are not important differences in the social and economic characteristics of these communities, which are discussed in the sketches provided for them (see Sections 4.1.53 and 4.1.5.4 of the SIA) and also discussed below.

From 2011-2022, six CVs with a registered ownership address in Kodiak (Kodiak City) participated in the B season pollock fishery. Of these six CVs, five participated in the inshore sector and one vessel is dual qualified and participated in both the inshore and mothership sectors. During the same period, 10 CVs with a registered ownership address in Newport, Oregon participated in the B season pollock fishery. All Newport CVs are affiliated with the inshore sector. Under Alternative 2 and 3, the communities of Kodiak and Newport could be adversely affected if the overall PSC limit was sufficiently constraining, such that a sector or cooperative closed during the B season prior to the pollock TAC being harvested.

On average, Kodiak CVs earned $3.75 million in gross ex-vessel revenues from the B season pollock fishery from 2011 through 2022, which accounted for 2.83% of the community fleet's total gross revenues during the same period (see Table 4-14 of the SIA). These data provide a sense of the relative magnitude of the revenues that could be forgone if the overall chum PSC limit under Alternative 2 and 3 was constraining to a degree that harvesters could not avoid reaching the apportionment of the limit. At the same time, Kodiak is home to a large and diverse community fleet. The Kodiak-based community fleet participates in other groundfish fisheries in the Bering Sea and Gulf of Alaska, halibut IFQ, crab, salmon fisheries, among others. That the B season pollock fishery accounted for 2.83% of the community fleet's total revenues (on average) during the analyzed period might suggest Kodiak is not substantially economically dependent on the B season fishery and thus somewhat insulated from the potential adverse effects of a closure. However, Kodiak is a remote island community accessible by boat or plane. There are limited economic development opportunities and the community's economy has long been anchored in commercial fisheries and government activities (e.g., U.S. Coast Guard base) (McDowell Group 2021).

On average, CVs with based in Newport earned $5.86 million in gross ex-vessel revenues from the B season pollock fishery from 2011 through 2022, which accounted for 20.54% of the community fleet's total gross revenues from the same period (see Table 4-14 of the SIA). These data provide a sense of the relative magnitude of revenues that could be potentially forgone for Newport-based vessels if the overall chum PSC limit under Alternative 2 and 3 was constraining to a degree that harvesters could not avoid reaching the apportionment of the PSC limit. The gross ex-vessel revenues earned from the B season pollock fishery contributed to a large portion to the total revenues earned by the Newport community fleet, suggesting this community may have a higher degree of vulnerability to the adverse effects of a potential fishery closure. At the same time, like Seattle, Newport is a community located in the lower 48 and on the road system. There are more typical commercial development and wage-earning opportunities in Newport which may offset some of the potential adverse effects.

Relevant to both communities, it is possible that a very constraining overall chum salmon PSC limit could encourage these vessels to exit the fishery or lease their quota to other vessels in their cooperative. What constitutes a "very constraining" PSC limit that would result in these effects is uncertain. Should these vessels exit the B season pollock fishery, these operational choices would be anticipated to have adverse effects on crew employment and other community-related revenues associated with participation in the B season fishery. For Kodiak (and the State of Alaska), this likely includes revenues earned from fuel tax, sales tax, harbor fees, among others.

As mentioned above, there is no readily available information on the location of vessel purchases of support services, and there is also no readily available information for the community of long-term residences of skippers, crew, and processing workers participating in the harvesting or processing components of the B season pollock fishery. However, Table 6-61 provides some cross-cutting information based on vessel ownership address and homeport information. A vessel's homeport is generally understood to be where the vessel spends a majority of its time throughout the year and generates some related level of economic activity. In this way, communities may be considered as engaged in the relevant Bering Sea pollock sectors in a variety of ways and not in isolation (i.e., a community may have multiple, cross-cutting ties to a fishery).

As shown, all CVs with a registered ownership address in Kodiak also list the community as the homeport location. While Table 6-61 only provides a snapshot of information for 2022, this is a fairly consistent trend across all years during the analyzed period. However, from 2011 through 2017 one CV with a registered address in Kodiak listed Juneau as its homeport community. CVs with a registered ownership address in Newport show more diversity in their homeport locations which included Alaska and Pacific Northwest communities in 2022.

Table 6-61 Correspondence of vessels harvesting AFA or CDQ B season pollock with a Kodiak or Newport ownership address and the vessel's listed homeport, 2022

Community of Ownership Address	Vessel Homeport				
	Kodiak	Unalaska/ Dutch Harbor	Newport	Portland	Total
Kodiak	3	-	-	-	3
Newport	-	1	2	2	5

Source: AKFIN.

Both Kodiak and Newport are communities that hold a sense of place and identity developed around the commercial fishing industry (Himes-Cornell et al. 2013; Norman et al. 2007). In these communities, fishermen may enter the occupation as a means of making money, because their family or friends are fishermen, or it is a traditional means of employment in the community (Pollnac et al. 2007). Fishermen also find the work satisfying and to be a meaningful component to their wellbeing (Pollnac & Poggie 2006; Pollnac, Seara, & Colburn 2015).

6.2.9.2.3 Potential Impacts to Unalaska/Dutch Harbor

Compared to other Alaska communities, Unalaska/Dutch Harbor has a relatively high degree of vulnerability (which can also be understood as a high degree of dependence) under the proposed action alternatives because the community is the location of four shoreside processing facilities accepting deliveries of B season pollock from multiple cooperatives; the community is the primary location for CP and mothership product transfers; and is listed as the ownership address for two floating processor/motherships during the analyzed period (2011-2022).

In 2022, some 64% of the inshore sector's annual pollock quota was allocated to the cooperative's affiliated with shorebased processing plants in Unalaska/Dutch Harbor. Considering the majority of product transfers from CPs and the mothership sector have been made in Dutch Harbor, this Alaska community is substantially dependent on the Bering Sea pollock fishery. Because of these cross-sector connections, Unalaska/Dutch Harbor derives substantial public benefit from the FRLT, FBT and local raw seafood tax levied on B season pollock. Because of these cross-sector connections, Unalaska/Dutch Harbor derives substantial public benefit from the FRLT, FBT and local raw seafood tax levied on B season pollock. Table 6-62 provides information on the estimated tax revenues the City of Unalaska has derived from the B season pollock fishery (using the methods previously discussed in Section 4.1.6). The information provided in Table 6-62 does not account for revenues derived from taxes and fees from activities in the community that are fishing related or may be paid by AFA vessels companies (e.g., property taxes paid by fisheries businesses, fuel transfer tax revenues, and harbor fees, among others).

The total estimated fishery-related tax revenue derived from the B season pollock fishery ranged between $5.70 million (2012) and $4.46 million (2017). On average, the City of Unalaska earned $5.12 million in revenues from the direct fishery-related tax revenues levied on B season pollock (2011-2022). To put these values into perspective, Table 6-62 also provides the City of Unalaska's General Fund revenues (FY 2011-2021). The total estimated direct fishery-related tax revenue derived from the B season pollock fishery accounted for 15.9% of the City's total general fund revenues, on average (2011-2021). General fund revenues are used to finance the basic operations of a community or borough (e.g., public safety, community development, among others) and thus have a direct effect on public welfare.

Table 6-62 City of Unalaska B season pollock fishery tax estimates compared to all general fund revenue, 2011 through 2022 (millions of real 2022 $)

Year	Estimated Revenues from City Raw Seafood Tax Levied on B Season Pollock	Estimated Revenues from FBT Levied on B Season Pollock	Estimated Revenues from FRLT Levied on B Season Pollock	Total Estimated Revenues from B Season Pollock	City of Unalaska General Fund Revenues	Total B Season Pollock Tax Revenues as % of Total General Fund Revenues
2011	$1,548,563	$1,161,423	$2,628,561	$5,338,547	$29,152,912	18.3%
2012	$1,684,833	$1,263,624	$2,751,920	$5,700,377	$31,634,417	18.0%
2013	$1,582,686	$1,187,014	$2,496,827	$5,266,527	$32,609,892	16.2%
2014	$1,580,252	$1,185,189	$2,563,711	$5,329,152	$34,376,971	15.5%
2015	$1,570,769	$1,178,076	$2,577,507	$5,326,352	$34,525,170	15.4%
2016	$1,386,133	$1,039,599	$2,396,413	$4,822,145	$30,723,626	15.7%
2017	$1,308,772	$981,579	$2,173,292	$4,463,642	$34,371,441	13.0%
2018	$1,767,079	$1,325,309	$2,391,355	$5,483,743	$30,300,957	18.1%
2019	$1,516,279	$1,137,209	$2,360,521	$5,014,009	$36,419,248	13.8%
2020	$1,547,073	$1,160,305	$2,124,581	$4,831,959	$36,478,643	13.2%
2021	$1,602,329	$1,201,747	$2,269,252	$5,073,327	$29,089,571	17.4%
2022	$1,514,463	$1,135,848	$2,187,538	$4,837,850	NA	NA

Source: AKFIN; City of Unalaska, Alaska. Comprehensive Financial Audits, Fiscal Years 2011 through 2021. https://www.commerce.alaska.gov/dcra/admin/Financial Accessed December 18, 2023.
Notes: The Comprehensive City Financial Audits for FY 2022 were not available for the City of Unalaska at the time this analysis was being prepared.

The community of Unalaska/Dutch Harbor would be negatively impacted by Alternative 2 and 3 if the overall chum salmon PSC limits were constraining, such that a sector or a cooperative reached their apportionment and closed during the B season prior to the pollock TAC being harvested. In a scenario where one or more of the inshore cooperatives affiliated with the processing plants in Unalaska/Dutch Harbor, the CP sector, or the mothership sector were to reach their apportionment of the overall chum salmon PSC limit and pollock was left unharvested, the City of Unalaska and the State of Alaska would potentially forgo tax revenues generated by the fishery. These tax revenues are inclusive of, but not limited to, direct-fishery related taxes. The magnitude of these effects would depend on when the limit was reached relative to the amount of remaining B season pollock quota left unharvested and the number of entities that reached their apportionment of the limit.

As described in Section 6.1.10.3, the pollock industry is currently facing market vulnerabilities, including an expected increase in Russian pollock production in 2024, driving down the prices for both surimi and block prices for fillets (Sackton 2024). Harvesters and processors are facing higher operating costs due to domestic inflation for labor/materials/shipping/storage, high interest rates, high fuel prices, and labor supply shortfalls. In addition, there are supply and demand imbalances that have devalued products, geopolitical actions that constraining global market opportunities and impacting competition, as well as the declines in other Alaska species (e.g., BSAI crab) that can decrease the resilience of a processing plant.

Given this multitude of challenging global and domestic factors in effect for Alaska seafood markets, including pollock, and the lack of processor operating cost data available to analysts, it is unclear what level of unharvested pollock resulting from potential B season closures could tip the sustainability of processing operations. However, repeated closures in the B season could exacerbate the current market challenges for existing processors. It is possible that such that consolidation among shoreside processing entities could occur, depending on their ownership structures, market vulnerabilities, and the degree to which harvesting vessels delivering to the processor are able to adapt their fishing behavior under the PSC limit. It is not possible to say with any certainty if or when these transitions would occur and the degree to which a community (like Unalaska/Dutch Harbor) would be affected. These dynamics are not unique to processing facilities in Unalaska/Dutch Harbor but are addressed here first in the SIA.

An inshore processor or the community of Unalaska/Dutch Harbor may also experience negative effects resulting from the proposed action alternatives absent a fishery closure. For example, there is a possibility for there to be stranded pockets of pollock (particularly for the inshore sector where there are more cooperatives) should a cooperative reach their apportionment of the limit and chum PSC was not transferred to facilitate full utilization of the cooperative's B season pollock allocation. Inshore processors and the community may also experience negative impacts if the B season deliveries from harvesters are slower or lower in volume, such that sufficient quantities of raw fish may not be provided for plants to operate profitably. Many plants have been designed to use economies of scale in production and move an optimal volume of fish through the processing plant at the most efficient, and cost-effective rate, given the capacity of the facility and expectations of catch and delivery rates from the catcher-vessel fleet. If operated at rates that significantly deviate from those for which the plant was designed, these economies would be lost, and a plant could become unprofitable to operate. These dynamics are not unique to processing facilities in Unalaska/Dutch Harbor but are addressed here first in the SIA.

It is also worth noting the community's fishery-related tax revenues could be negatively affected under Alternative 2 and 3 even if a cooperative or sector (or multiple) were not required to cease fishing in a given year. Fishery-related tax amounts are affected by the shoreside prices paid for pollock. In a scenario where the harvesters are catching lower quality pollock, or are required to fish in areas that have chum salmon bycatch levels below a certain rate which also have poorer quality pollock that can only be processed into certain product forms (e.g., fishmeal), it is anticipated this would impact the shoreside price paid to harvesters and thus the estimated taxable revenue earned from the B season fishery. (It is also possible that shoreside prices are affected by global market dynamics referenced above, but those dynamics are important context for, yet external to, this marginal impact analysis.) Again, these dynamics are not unique to the processing facilities in Unalaska/Dutch Harbor but are addressed here first in the SIA.

Unalaska/Dutch Harbor plays a role as the major shipping port in the BSAI region. Depending on the degree to which the overall chum salmon PSC limit becomes constraining, it is possible albeit uncertain, there could be spillover effects into other fisheries. The community also has the most developed support service sector capacity in the broader BSAI region because it has multiple marine fueling and provisioning options, substantial cold storage capacity, administrative support services, and multiple electrical, hydraulics, welding, and mechanical service providers. For example, the SIA prepared for the BSAI Halibut ABM action noted that Unalaska/Dutch Harbor accounted for two-thirds of all Amendment 80 Alaska port calls from 2010-2019 (NPFMC 2021).

There could be negative impacts to processing workers as a result of the action alternatives in the form of reduced employment or income opportunities, depending on how the specific plants and the cooperatives delivering to them are able to respond to changing conditions as a result of Alternative 2 or 3. As discussed in Section 4.1.4 of the SIA, the B season pollock fishery contributes a substantial portion of the annual gross revenues for all shorebased processing facilities (those processors in Dutch Harbor cannot be shown apart from the facilities in King Cove and Akutan because the latter are home to one processing entity). Pollock is also an important component to the overall annual cycle of these plants – often times it is the high-volume fisheries like Bering Sea pollock that provide economies of scale helping to facilitate the processing smaller volume fisheries. Unalaska's local small boat fleet has generally participated in halibut and sablefish IFQ, fixed gear groundfish, and local crab fisheries on a relatively small scale

(Downs & Henry 2023). Deliveries from the local small boat fleet may not a major source of income for the plant, but these deliveries have been an important source of income for local fishermen.

Finally, it is also possible that Unalaska/Dutch Harbor could anticipate some positive indirect effects under the proposed action alternatives. If vessels take longer fishing trips, more fishing trips, or a cooperative issued a stand-down because chum salmon bycatch rates were unacceptably high (a scenario that may be more likely under a more constraining overall chum salmon PSC limit), vessels may spend more on fuel or more time in port. In turn, this could generate more fuel and sales tax revenues in addition to any other purchases of goods and services. It is not, however, possible to say whether these positive impacts from a longer season would offset possible adverse impacts for Unalaska (e.g., possible lower tax revenues from a lower value product, etc.) and a longer season may not be net beneficial for people and entities associated with Unalaska (e.g., individual processors, captains and crew).

6.2.9.2.4 Potential Impacts to Akutan and King Cove

Akutan and King Cove are Alaska communities directly engaged in the B season fishery and grouped here in this analysis because the share some characteristics in terms of their participation in the B season pollock fishery. Some specific considerations included that each community is home to a single shorebased processing facility, is located within the Aleutians East Borough (affecting shared tax revenue amounts among other dynamics), and neither community is listed as the ownership address for a vessel that participated in the B season pollock fishery.

In 2022, some 34% of the inshore sector's annual pollock quota was allocated to the cooperative affiliated with Akutan. Behind Unalaska/Dutch Harbor, Akutan received the largest portions of landed pollock. In 2022, some 2.5% of the inshore sector's annual pollock quota was allocated to the cooperative affiliated with King Cove. In 2023, the amount of the inshore sector's annual pollock quota allocated to the cooperative affiliated with King Cove decreased and there is no cooperative affiliated with the Peter Pan Seafoods plant in 2024. Akutan, King Cove, and the Aleutians East Borough derive economic benefits from the local seafood taxes and FBT levied on deliveries of B season pollock to shoreside processors in these communities. As discussed in Section 4.1.6 of the SIA, the estimated revenue derived from direct fishery-related taxes levied on B season pollock ranged between $2.03 million (2016) and $2.60 million (2019) for Akutan, King Cove, and the Aleutians East Borough combined as a grouping for confidentiality. (2011-2022)

Under Alternative 2 and 3, Akutan and King Cove could experience negative economic effects in terms of potentially forgone fishery related tax revenue if the inshore cooperative affiliated with each community/plant reached their apportionment of the overall chum salmon PSC limit prior to their pollock quota being harvested. The magnitude of these effects would depend on when the limit was reached relative to the remaining amount of B season pollock quota. However, as mentioned above, in a scenario where the harvesters are catching lower quality pollock (e.g., because vessels are required to fishing in areas that have chum salmon bycatch levels below a certain rate that also have poorer quality pollock that can only be processed into certain product forms such as fishmeal), it is anticipated this would impact the shoreside price paid to harvesters and thus the estimated taxable revenue earned from the B season fishery.

The Trident Seafoods (Akutan) and Peter Pan Seafoods (King Cove) facilities are multispecies plants like those in Unalaska/Dutch Harbor that have historically taken deliveries of B season pollock. These processors are also engaged in other commercially important fisheries including BSAI crab, other BSAI groundfish, and the commercial salmon fisheries are a significant contributor to the total revenues of the Peter Pan plant. Beyond fishery-related tax revenues, the pollock fishery can play a meaningful role in these communities by supporting the processor’s capacity to engage in other small-scale operations. As an example, the Akutan Trident plant has played a role in supporting the local small boat fleet in Akutan by processing halibut. Halibut deliveries from the local small boat fleet are not a major source of income for the plant, but these deliveries have been an important source of income for local fishermen. While local fishermen are engaged in other means of employment beyond commercial fishing, they do depend to varying degrees on fishing as a part of an integrated, plural employment and income strategy in a community that has relatively limited employment and income opportunities (Downs & Henry 2023).

As mentioned previously in this analysis, the Peter Pan Fleet Cooperative did not apply for an AFA Inshore Cooperative Permit for the 2024 Bering Sea pollock fishery. Consequently, this cooperative will not be active in 2024 and potentially future years. King Cove and the Peter Pan Seafoods facility could receive small amounts of pollock from other cooperatives and thus be considered participants in the B season pollock fishery in the future to a smaller degree (less than 10% of a cooperative's pollock allocation as specified under the AFA). Additionally, and as mentioned previously, Trident Seafoods has announced plans to build a "next generation plant" in Dutch Harbor which would replace its existing facility in Akutan. The timing of this transition is uncertain. As such, there is a degree of uncertainty on the relative impacts these communities may incur as a result of changing the salmon bycatch management regulations as proposed under the action alternatives. These dynamics are important context for consideration, noting that these communities may be affected by a variety of factors external to this marginal impact analysis focused on bycatch reduction measures.

6.2.9.2.5 Additional Considerations Related to Alternative 3

Under Alternative 3, the potential impacts to communities engaged in or economically dependent on the B season pollock fishery are anticipated to largely be the same as those described under Alternative 2. However, as noted above, Alternative 3 would add the annual WAK chum salmon threshold to Alternative 2 which may increase avoidance costs for operators as they work to avoid WAK chum salmon inseason, particularly in light of not knowing their performance against the threshold in real-time. It is possible that increased avoidance costs may impact pollock dependent communities, but the analysts are unable to accurately quantify the degree of impact that Alternative 3 would have on these communities.

6.2.9.3 Potential Impacts to CDQ Regions and Communities

The following section directly corresponds to Section 5.2.2 of the corresponding SIA.

The extent to which the proposed action alternatives would affect the 65 coastal WAK communities participating in the CDQ program is uncertain. However, CDQ groups and their constituent communities could be impacted by potential changes to regulations managing chum salmon bycatch in the Bering Sea pollock fishery in multiple ways, two of which are the most direct. First, all CDQ groups receive programmatic allocations of Bering Sea pollock and would be apportioned an amount of the overall chum salmon PSC limit (Alternative 2 and 3). Second, many CDQ groups have also made additional investments into the AFA sectors (see Section 6.1.10.2). The CDQ groups vary in the number of communities and residents they represent, the composition of their CDQ and non-CDQ quota portfolios, and the relative scale of fishery and non-fishery portions of their local economies, among other attributes.

To the extent that the proposed action alternatives have the potential to reduce royalty and revenue payments by AFA entities to CDQ groups due to increased avoidance costs or closures, CDQ groups and their constituent communities would be at risk of the adverse impacts of the proposed action alternatives. How effectively these risks would be mitigated by adaptive fishing behaviors on part of CDQ partners is unknown and it is not possible to quantify these risks with available data. As discussed in Section 4.2.7 of the SIA, the CDQ groups have used the revenues earned from programmatic allocations of fishery resources such as Bering Sea pollock, as well as revenues earned from other investments, to provide social and economic benefits to their constituent communities.

For example, all CDQ groups have worked to provide various employment opportunities, sometimes these are administrative positions within the CDQ group or its subsidiaries, community liaison roles, or employment on fishing vessels (among other opportunities). The CDQ groups have also made direct investments through community grant programs to support community development and infrastructure. into communities to support infrastructure development. For example, BBEDC has supported the

Community Block Grant Program that provides BBEDC communities an opportunity to fund projects that promote sustainable community and regional economic development. In 2021, the BBEDC Board of Directors allocated $500,000 per BBEDC community (BBEDC 2021). Through this lens of community development and support, all 65 CDQ communities are considered as being indirectly engaged in or economically dependent on the Bering Sea pollock fishery (noting the degree of dependence varies).

The CDQ communities could experience indirect adverse social and economic effects as a result of the proposed action alternatives, although the relative magnitude of these impacts is uncertain. In part, this is because of limitations with using existing data to determine the exact proportion of CDQ groups' revenues and royalties that are derived from the B season pollock fishery.[99] Second, it is not possible to quantify the relative proportion of programmatic funding (compared to staff salaries, for example) that is derived from either the harvest of CDQ pollock or CDQ groups' investments into this fishery. Finally, because CDQ groups have historically leased their Bering Sea pollock allocations to harvesting partners in the AFA CP sector, it is anticipated the potential adverse effects on communities could be mitigated by changes in CDQ partner's fishing behavior. The relative magnitude of these behavioral changes is unknown.

At the same time, many communities affiliated with the CDQ program are also engaged in subsistence and commercial chum salmon fisheries. It is not possible to say, however, whether the potential benefits in terms of increased subsistence of commercial fishing opportunities (depending on conditions of abundance) would offset these impacts for some CDQ communities. The potential impacts of the proposed action alternatives on communities dependent on subsistence and commercial harvests of chum salmon for are discussed directly below.

6.2.10 Potential Impacts to Western and Interior Alaska Chum Salmon Users, Subsistence and Commercial

A potential positive and direct benefit of the proposed action alternatives that would modify the status quo regulations for salmon bycatch would be a reduction in the overall number of chum salmon caught as bycatch below levels occurring under the status quo regulations. The relative magnitude of chum salmon bycatch reduction that could be expected would depend on the option(s)/alternative(s) selected, the extent to which pollock harvesters modify their fishing behavior to avoid chum salmon bycatch, among other factors.

6.2.10.1 Communities and Regions Engaged in or Dependent on Chum Salmon for Subsistence

In light of the data limitations and uncertainties described 6.2.4.2, what follows is a qualitative discussion on the positive and indirect impacts that may result from Alternative 2 and 3 for rural and Alaska Native communities that harvest chum salmon for subsistence. The degree to which the following positive social impacts would be realized depends on whether chum salmon run sizes improve and there are increased returns to a level of abundance that would allow inseason managers to provide less restricted opportunities to harvest chum salmon for subsistence. Less restrictive subsistence opportunities could take on many forms including longer fishing periods or fewer restrictions on eligible gear types. These changes could reduce some of the costs associated with subsistence fishing trips as not all households can afford to take multiple small trips to accommodate short openings when their subsistence needs will not be met. Additional flexibility in when opportunities for chum salmon harvests could be provided may also

[99] Detailed revenue and royalty information was available for the CDQ groups until 2005, but this information is no longer available because the CDQ groups are no longer required to submit such reports to the State of Alaska or NMFS. As such, it is not possible to quantify CDQ groups' total revenues from fishery allocations and other investments, and it is not possible to determine the relative contribution of revenues earned from the Bering Sea pollock fishery (or the B season fishery) to the multiple social and economic programs the groups provide to their communities.

allow fishers to harvest chum salmon when they are in better condition. In the quote below, a fisher from Aniak describes how chum salmon are in better condition earlier in the season (Godduhn et al. 2020: 57).

> *"You can feed your family on an early run of dogs, just as well as kings. If you, if they would let us get them when they are nice and prime at the beginning."*

The weather across WAK turns wet and rainy as the summer months go on. Rainy weather later in the summer can spoil fish drying on racks and flies are more present (Ikuta et al. 2013). These are complicated dynamics, however, because restrictions on target opportunities for chum salmon in June and July may be an effort to conserve Chinook salmon because there is overlap in the runs of these two species in the Kuskokwim River (and in other areas/river systems) (Godduhn et al. 2020). Managers will also aim to provide balanced harvest opportunities across runs temporally.

To the extent that chum salmon abundance improves such that there are more (or less restrictive) subsistence fishing opportunities in the future, it is possible the proposed action alternatives could have a positive indirect effect on the mixed economies in rural and Alaska Native communities. Subsistence "encompasses hunting and gathering activities which have a deep connection to history, culture, and tradition, and which are primarily understood to be separate from commercial activities" (Raymond-Yakoubian, Raymond-Yakoubian, and Moncrieff 2017). However, as discussed at length in this SIA, the cash economy often supports subsistence activities through the purchase of gear, supplies, or other tools forming mixed economies (Wolfe 1982; Reedy Maschner 2009). Within these mixed economies where subsistence plays a critical role, there are extensive non-market sharing and exchange networks. Through sharing, local communities' values are expressed and transmitted across generations. Salmon may be given or shared with other persons without the expectation that something specific will be given in exchange. Fish may be shared with family members or friends, in the region or outside of it. As an example, in the Tanana region "…salmon is given to individual elders, Elders' residences and people who do not have access or ability to fish. Almost all the fishermen interviewed stated that the first salmon caught were given away to share the taste of the first fish and bring luck to the fishermen" (Moncrieff 2007).

Improvements in chum salmon abundance resulting from the proposed action alternatives may have a positive and indirect effect on food security for rural and Alaska Native communities. Subsistence harvests across rural and Alaska Native communities in Western and Interior Alaska account for a significant portion of the foods consumed and fish is a primary food source. Traditional foods are also rich in protein, iron, vitamin B12, polyunsaturated fats, monounsaturated fats, and omega-3 fatty acids (e nutritional value of wild foods cannot be adequately replaced by purchases in stores (Fall 2018). As described in Section 4.3.5.2 of the SIA, however, subsistence harvests that contribute to food security are also affected by conditions beyond the scope of this action including fuel costs, work or personal conflicts, changes in household composition, and more (Ahmasuk et al. 2008; Wolfe et al. 2012).

The proposed action alternatives may also have a positive indirect effect on cultural identity and wellbeing. As described above, salmon and Alaska Natives have been intertwined in close relationships for thousands of years (Carothers et al. 2021; Fienup-Riordan 2020; Raymond-Yakoubian and Angnaboogok 2017). There are multiple dimensions of wellbeing (Donkersloot et al. 2021); specific to this action, communities' wellbeing may be improved as people are able to engage (more) in culturally meaningfully practices. Moncrieff (2017: 41) describes the fishing culture among communities along the Yukon River as:

> *"...Rooted in the activities of eating salmon, sharing salmon, going fishing, cutting fish, and going to fish camp. Fish camp is a place where families come together and teach younger generations their culture and traditions. Participants fished with their relatives – parents, grandparents, uncles, aunts, cousins, and children. It was and still is important to teach their youth how to make fish wheels, cut salmon, hang and dry salmon, run the smokehouse and the myriad of other fish camp activities."*

Retaining a sense of identity and culture based on the act of fishing are difficult to retain without the ability to go fishing. As described in Section 4.3.5.4 of the SIA, when people are working together to harvest, cut, and process fish, they are connected in that moment to each other and their ancestors (see Ikuta et al. 2013; Trainor et al. 2021).

6.2.10.2 Communities and Regions Engaged in or Dependent on Commercial Chum Salmon Fisheries

Although improvements in Western Alaska chum salmon abundance would first and foremost be prioritized for subsistence harvests, the degree of the retuning run size allows the State of Alaska to determine whether there is expected surplus above escapement needs and subsistence to allow for commercial harvesting. **To the extent chum salmon PSC limits proposed in Alternative 2 or 3 result in savings of Western Alaska chum to the river systems of origin, this could have a positive indirect effect on commercial fishing opportunities within these management areas.**

Section 4.4.4 of the SIA emphasizes how cash income is often earned in the commercial harvesting portion of the salmon fishery and used to support subsistence activities. In some cases, especially with the high cost of fuel, subsistence activities may be reduced if commercial harvesting income is lacking. Even a few hundred fish that are made available to commercial harvesters in-river due to “chum salmon savings” under the alternatives in question may provide a family or multiple families with just enough cash income to afford more time at fish camp to meet their subsistence needs for the coming winter. Though it is not possible to quantify exactly what effect the chum salmon savings estimated under the alternatives would have on commercial harvesters in any particular river system it is important to recognize that even a few hundred fish, and a few hundred dollars from those fish, may be critically important in many villages throughout Western and Interior Alaska.

6.2.10.2.1 Additional Considerations Related to Alternative 3

Under Alternative 3, the potential impacts to these regions and communities are anticipated to largely be the same as those described under Alternative 2. Should Alternative 3 result in greater WAK chum salmon savings relative to Alternative 2 alone as pollock operators work to avoid the WAK chum salmon threshold inseason (and presumably over time), there may be some added benefit to subsistence and commercial chum salmon fishers, communities, and tribes across Western and Interior Alaska.

6.3 Alternative 4: Additional Regulatory Requirements for Incentive Plan Agreements

The following section of the analysis provides information related to Alternative 4. In particular, it contains an overview of the proposed measures and provisions in the IPA proposals and staff’s assessment of these measures relative to the status quo. As shown in Appendices 2 and 3, two proposals were submitted by IPA representatives prior to the Council’s February 2024 meeting for inclusion in the initial review analysis. One proposal contains provisions put forward by the CV fleets (Inshore SSIP and MSSIP); the other proposal contains provisions from the CP sector (CP IPA).

In order to move forward with Alternative 4, the Council would need to specify the provisions that would be added to the existing regulations for the salmon bycatch IPAs at 50 CFR 679.21(f)(12)(iii)(E). At present, the issue at hand is *what* would be contained within these regulatory provisions that the IPAs would be required to respond to. It is staff’s understanding that many of the measures and provisions put forward in the IPA proposals would respond to the current regulation at 50 CFR 679.21(f)(12)(iii)(E)(7) which require each IPA to contain a description of *“how the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel’s chum salmon bycatch to avoid areas and times where the chum salmon are likely to return to western Alaska.”* Therefore, the measures and provisions put forward in these proposals could be incorporated into the IPAs at any time without changes to the implementing regulations for the salmon bycatch IPAs at 50 CFR

679.21(f)(12)(iii)(E). If the Council would like to move forward with Alternative 4 and further develop regulatory provisions, it may wish to consider whether these provisions would be additive to the current provision for WAK chum avoidance or a replacement to them.

6.3.1 Common Features in the IPA Proposals and Operational Differences Among the Fleet

Both IPA proposals considered the list of potential measures contained in the Council's October 2023 motion related to Alternative 4 within the context of the sectors' operational dynamics. A primary strategy for salmon bycatch avoidance is fleet movement, and there are important operational differences between the various pollock sectors that influence their avoidance behaviors and the strategies they can use under the IPAs. These operational differences are reflected in the proposals, and where there are commonalities at the provision-level, there may be expected differences in how the IPAs and their member vessels would respond to them.

In terms of operational differences, CPs are able to harvest and process pollock at-sea onboard the same entity which allows these vessels greater flexibility in where they can (and do) target pollock during the B season (i.e., further northwest). Mothership CVs form fleets around the mothership they deliver to because they must coordinate their deliveries – these vessels deliver a single haul (or codend) of pollock at a time. While mothership CVs must fish near their mothership, they have some additional flexibility to travel to different fishing grounds to avoid chum and other PSC. Inshore CVs must stay within a certain proximity to their shoreside processor because of their delivery requirements, meaning they have less flexibility to move to different areas to target pollock. Additionally, as the CV proposal mentions, a trip's worth of catch is typically 2-3 hauls for the inshore CVs, which creates a data lag as salmon caught as bycatch undergo a census count and sampling at the shoreside plant they deliver to (see also Section 4.1.4). Mothership CVs do not experience the same data lag as inshore CVs because they are delivering one haul (or codend) at a time to their mothership with observers onboard.

Both IPA proposals used a scenario planning framework developed by Sea State, the monitoring agent for the IPAs. It is analytical staff's understanding that the scenario planning framework replays the historical fishery from 2011 through 2022 and redistributes fishing effort based on the current features of the current RHS program and in response to potential additional measures that were evaluated. **The key criteria considered in the scenario planning framework and IPA proposals are whether the provisions would minimize chum and WAK chum bycatch with minimum impacts to pollock CPUE. A negative impact on pollock CPUE has the potential to extend the length of the B season, which could increase encounters with Chinook.**

Related to this point, both proposals evaluated the trigger values outlined in option 1 of Alternative 4 as written in the Council's October 2023 motion (i.e., a bycatch rate and proportion of WAK to non-WAK chum). Both proposals considered reducing the Base Rate floor by 25% or 50%. (Recall the Base Rate floors are set in a stair-stepped fashion throughout the B season: 0.19 or 0.20 chum per mt of pollock in June and July, 0.50 chum per mt of pollock in August, and 1.00 chum per mt of pollock in September and October.) **The results from the scenario planning framework demonstrated reducing the Base Rate floor would essentially lower the threshold at which potential RHS closure areas are identified. This measure would make it more likely a closure area for chum salmon avoidance would be implemented, but a tradeoff was that this measure would increase fleet movement with modest WAK chum salmon savings and negative impacts for Chinook**. As such, neither proposal moves this measure or a related provision forward.

Additionally, both proposals considered a proportion of WAK to non-WAK chum that could be used to implement a closure area (trigger 2 specified in option 1 of Alternative 4). However, the proposals do not put forward a threshold for trigger 2 (i.e., a proportion of WAK chum) because there is no inseason genetic data available that could be applied to the haul- or trip-level and this measure would not function effectively at this time.

Both IPA proposals focus on bycatch avoidance measures in fishing grounds areas rather than the genetic cluster areas. Geneticists with Auke Bay Labs have used the fishing grounds distribution as additional information recent years' genetic analyses. As stated in the proposals, the genetic cluster areas are broad aggregations of ADF&G groundfish statistical areas. The fishing grounds areas align with the cluster areas to a degree but allow for bycatch and genetic information to be compared at a finer spatial scale. **The scenario planning framework developed by Sea State demonstrated that the shelf edge and Unimak fishing grounds areas were more likely to have had higher proportions of WAK chum bycatch, and that reducing chum bycatch in the shelf edge area would be more likely to reduce WAK chum bycatch while not extending the B season.** While the Unimak area has historically had the highest proportions of WAK chum salmon in the overall bycatch, it also typically has slightly lower overall bycatch rates due to the higher pollock CPUE in the area in most years.

Figure 6-43 below provides a comparison of the spatial footprint of the genetic cluster areas and the fishing grounds areas for comparison. The CVOA is represented by the ADF&G groundfish statistical areas highlighted in red and the dashed blue line within represents the Chum Salmon Savings Area.

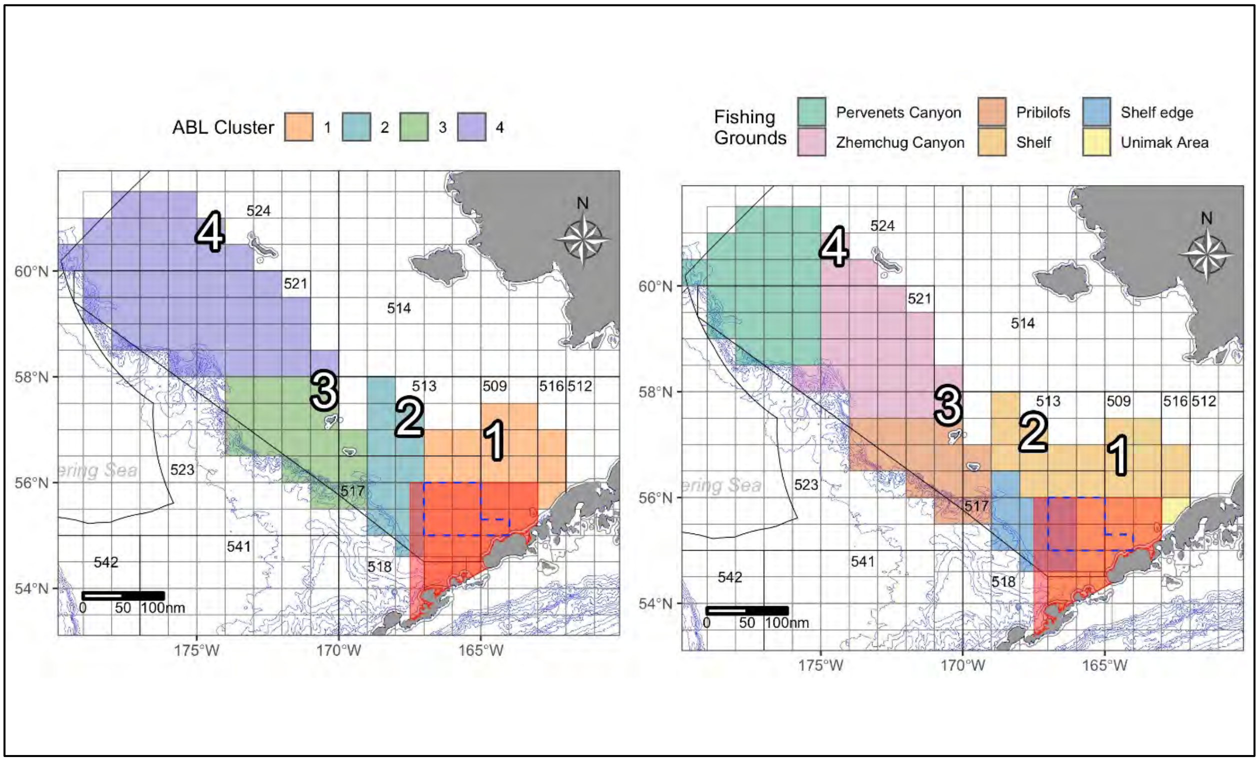

Figure 6-43 Comparison of Auke Bay Labs (ABL) genetic cluster areas to fishing grounds areas for genetic analysis

6.3.2 CV Proposal for Provisions

The CV Fleet proposal contains four provisions or measures that could be incorporated into the IPAs for the Inshore SSIP and MSSIP.

Provision 1. Weekly assessments of the likelihood of WAK chum by statistical area when determining weekly chum closures.

This provision directly responds to the Council's request for the IPAs to consider how genetic information could be used to better inform RHS closures for WAK chum avoidance. Sea State has constructed a chum genetics database (based on genetic information provided by Auke Bay Labs) that pools prior years of data to form maps that depict the likely (or potential) weekly proportions of WAK and non-WAK chum in ADF&G groundfish statistical areas. Using this database, fishery managers can identify the likelihood that an area has higher proportions of WAK chum to non-WAK chum to inform inseason management decisions.

Provision 2. Rolling hotspot closure for all CVs when chum bycatch is 3 times the weekly base rate.

This provision directly responds to the Council's bullet point that the RHS closures would apply to all vessels (not just those above the Base Rate or in Tier 2). Under the status quo RHS system for chum salmon avoidance, Sea State compares the calculated Base Rate to the chum salmon bycatch rate in ADF&G groundfish statistical areas on a weekly basis (the "area bycatch rate" in Figure 4-2). If the bycatch rate in a given ADF&G groundfish statistical area is greater than the weekly calculated Base Rate, the area may be eligible for closure. The status quo program would be modified with this provision such that, if a statistical area has a chum salmon bycatch rate 3 times greater than the weekly calculated Base Rate, the RHS closure overlapping that statistical area will apply to all vessels regardless of their individual chum salmon bycatch rate and tier status.

Provision 3. Monday chum rolling hotspot closures.

This provision responds to the Council's bullet point that the closures would apply to all vessels and adjusted closure duration.[100] Under the status quo program, closures are announced on Thursday and in effect 10:00pm the following Friday and last until 10:00pm the Friday thereafter. Unless provision 2 becomes effective, CVs will receive a tier status as is under the status quo (1 or 2 based on their performance relative to the calculated Base Rate; see also Section 4.1.2.2), and all tier 2 vessels may not fish inside the week-long chum salmon hotspot closure. Provision 3 would modify the status quo program such that any data that is reported over the weekend—includes but is not limited to catch data, fish tickets, accounts from fishermen on the grounds, among others—will be reviewed on Monday. If the weekend data indicates that chum salmon bycatch rates remain high in the closed area, the closure would be in effect for all vessels for the remainder of its duration (until Friday at 10:00pm) to all vessels.

Provision 4. Move Along Rule for CVs.

Provision 4 includes a move along rule, which is an avoidance tool that could be used by an aggregated group of vessels (CVs typically fish in aggregated groupings) at the mothership or inshore cooperative level. A move along rule could be incorporated in the future using haul-by-haul data to calculate a rolling 3-day average bycatch rate to indicate the most recent fishing conditions. As described, the move along rule does not have a defined boundary or duration, and there is some uncertainty on the threshold that would be applied to trigger the move along rule for either the mothership or inshore CVs at this time, but this threshold could be evaluated in the future by the IPAs.

The CV proposal recognizes there are operational differences between the mothership and inshore CVs so two different approaches are described for how the provision would be applied. Mothership CVs deliver one haul at a time to their mothership, and they fish in close proximity to their mothership and each other. Consequently, the catch data of the mothership fleet could be averaged to identify a trend in the catch composition from the area being fished. A move along rule could work to move the individual mothership fleets based on haul-level data in a timely manner and is a potential tool the mothership fleets could develop to avoid chum salmon bycatch, regardless of whether a closure is in place.

Inshore CVs typically deliver 2-3 hauls per trip. After 2-4 days of fishing and transiting, an inshore CV's catch is processed by the plant and the composition is reported. This is a more significant time lag than the mothership CV fleets, so a move along rule would be applied differently. In addition to a 3-day average bycatch rate, the cooperative managers and Sea State would need to actively work with their

[100] An important point to note is that the CV IPAs did consider other tools for modifying the closure area duration, including July closures that would last for two weeks. However, the effects of a longer closure would be highly variable because the relative efficacy of a RHS closure area is based on fishing dynamics (pollock CPUE and bycatch encounter rates) that change more quickly than a two-week period.

fishermen to gain useful haul-by-haul information on where higher chum salmon bycatch was likely to have been encountered.

Proposed Provision	Related Measure Under Current Program	Potential Benefits of Provisions
Weekly use of latest chum genetics, bycatch rate, and CPUE information to assess stat areas historical WAK and non-WAK chum proportions	Genetic information used to inform stair-stepped Base Rate floor and size of closure areas east and west of 168	More timely use of genetic information and genetic information applied at finer spatial scale
Stat area close to all vessels when area rate is 3 times the weekly bycatch rate	ADF&G stat area eligible for RHS closure when area rate is above calculated Base Rate; not applicable to all vessels	Reduce potential for bycatch spikes; known areas of high bycatch are closed to all vessels
Information from weekend fishing evaluated on Monday for potential closure	RHS closures issued weekly (Friday to Friday); Above average vessels (Tier 1) permitted to fish in the closure area	More timely assessment of bycatch and catch data with applied management action; may not necessarily result in a greater number of closures but more vessels (Tier 1) excluded
Move along rules for inshore CV and mothership CV fleets	No move along rule incorporated into Inshore SSIP or MSSIP in current program	More timely assessment of bycatch and catch data; would potentially reduce number of closures as managers and vessels are more responsive to conditions on the fishing grounds

Figure 6-44 Summary of provisions included in the CV Proposal compared to related (or potentially similar) measures under the current program for chum avoidance and the potential benefits of the proposed provisions

6.3.3 CP Proposal for Provisions

The CP IPA was voluntarily amended in 2022 when the Council requested industry take immediate action to reduce chum salmon bycatch in the B season fishery (June 2022). While these amendments were made voluntarily (i.e., not in direct response to changes in federal regulation), they have a legally binding effect on members through civil contracts. The 2022 amendments to the CP IPA included three primary components:

1. Bi-weekly evaluation of chum salmon closure areas (Tuesday to Friday). The intent of this amendment was to reduce the periodic spikes in chum bycatch by evaluating bycatch and catch data more frequently.
2. An outlier provision. The purpose of this amendment was to increase vessel-level accountability by creating incentives for chronic poor chum bycatch performers to improve their chum bycatch rates. This measure identifies vessels with poor bycatch performance by comparing relative vessel performance over several pollock seasons. At the end of each season, vessels with bycatch performance greater than 1.5 standard deviations above the average vessel performance are identified. If a vessel is so identified during two consecutive B seasons for chum (or three consecutive seasons A/B for Chinook), then the vessel is designated a poor performance vessel during the following season. All vessels designated as poor performers are prohibited from fishing in any Chinook or chum closure for the entire season.
3. Areas with very high chum salmon bycatch rates (greater than 5 chum per mt of pollock) close to all vessels regardless of performance. The intent of this amendment was to reduce periodic spikes

in chum bycatch and lightning strike tows of chum by multiple vessels in the same area with known high bycatch rates.

These IPA amendments were included to increase the responsiveness of the IPA when sudden increases of chum encounters occur, restrict fishing effort in very high bycatch areas regardless of vessels performance, and improve vessel-level accountability for chum avoidance. While these measures respond to 50 CFR 679.21(f)(12)(iii)(E)(7) as different ways to ensure that the operator of each vessel governed by the IPA will manage that vessel's chum salmon bycatch to avoid areas and times where the chum salmon are likely to return to western Alaska, the CP IPA's 2022 amendments are not specifically required by this regulation and could be modified at any time.

As stated previously, Council action is not needed to modify IPAs in a way that algins with the goals of current regulations. Thus, in order for the Council to move forward with Alternative 4 as a regulatory action, the existing regulations implementing the salmon bycatch IPAs would need to be modified. The CP IPA proposal puts forward six recommendations for consideration as regulatory provisions, some of which reflect the sector's 2022 IPA amendments. The proposed provisions are listed directly below. The Council may choose to consider this language and/or develop its own regulatory language for provisions. Staff would also note that these provisions respond to the Council's request for the IPAs to consider genetic data, that closures would apply to all vessels not just those above the calculated Base Rate, and additional vessel-level incentives/penalties for chum avoidance.

1. Require IPAs to use the latest chum salmon genetics information, together with in-season chum bycatch rate information, and pollock catch per unit effort information to ***optimize*** prioritization of bycatch avoidance areas.
2. Require IPAs to prohibit fishing in bycatch avoidance areas for all vessels regardless of performance when ADF&G weekly statistical area bycatch rates exceed 5 chum per ton of pollock.
3. Require IPAs to develop and implement chum salmon vessel outlier provisions.
4. Require IPAs to monitor for new candidate chum bycatch avoidance areas on a no less than bi-weekly basis.
5. Require IPA member vessels to utilize salmon excluder devices during the pollock B season.
6. Require IPAs to provide weekly salmon bycatch reports to Western and Interior Alaska salmon users to allow for more transparency in reporting.

Proposed Provision	Related Measure Under Current Program	Potential Benefits of Provisions
Weekly use of latest chum genetics, bycatch rate, and CPUE information to optimize prioritization of closures	Genetic information used to inform stair-stepped Base Rate floor and size of closure areas east and west of 168	More timely use of genetic information and genetic information applied at finer spatial scale
Closure applies to all vessels when weekly stat area bycatch rates are very high	Closures apply when stat area rate is greater than 5 chum per mt of pollock *(2022 amendment)*	Reduce potential for bycatch spikes; known areas of high bycatch are closed to all vessels
Outlier provisions	If a vessel is identified as a poor performer for two consecutive B seasons, it is prohibited from fishing in closure areas for the season *(2022 amendment)*	Vessel-level incentive to keep bycatch low year after year
Bi-weekly assessment of closure areas	Tuesday-Friday, Friday-Tuesday closures *(2022 amendment)*	More timely assessment of bycatch and catch data with applied management action; potential to reduce spikes in bycatch
Use of excluder device for full B season	Excluder devices required September 1 – end of B season	Potentially greater chum escapement from pollock nets
Weekly bycatch reports to Western and Interior Alaska salmon users	Third-party receives reports	Increased transparency and public communication on performance

Figure 6-45 Summary of provisions included in the CP Proposal compared to related (or potentially similar) measures under the current program for chum avoidance and the potential benefits of the proposed provisions

6.3.4 Assessment of Proposals

This section of the analysis contains a high-level assessment of the primary components of the IPA proposals. There are some important points to note before moving forward with this discussion. First, the operational differences between the various pollock sectors highlighted in Section 6.4.1 affect their fishing behavior and the bycatch avoidance strategies they can use. Second, staff are unable to accurately quantify the number of additional RHS closures for chum avoidance that would result from the proposed provisions and measures in the future; staff are also unable to accurately quantify the effect of these provisions in terms of the number of chum, WAK chum, and/or Chinook salmon avoided with the available information. As such, what follows is largely a qualitative description of the potential of the various measures to result in additional PSC avoidance.

In general, it appears the provisions incorporated into the 2022 CP IPA amendments, the additional provisions put forward by the CP IPA, and the measures put forward by the CV fleets would likely result in some additional level of chum savings compared to the status quo RHS program. However, it is somewhat challenging for analytical staff to disentangle the relative effectiveness of the CP IPA provisions in the future from the status quo because some of the proposed provisions were implemented in 2022. In these instances, staff have treated the 2022 provisions as new measures because the IPA was voluntarily amended and could be changed in the future without additional provisions (or specificity) for the salmon bycatch IPAs.

Alternative 4 would provide some operational flexibility to the fleet because there would not be the possibility of a B season fishery closure. (The potential for a B season fishery closure is not a mechanism contained within the current proposals or existing IPAs.) Related, it is assumed the fleet would continue to harvest the full B season TAC and generate the associated revenue, although there would likely be avoidance costs associated with this alternative. However, the avoidance costs, any decrease in pollock CPUE or product quality that may result from additional movement, and risks to extending the B season that are associated with Alternative 4 are assumed to be relatively similar to the status quo (i.e., whatever avoidance costs are associated with the status quo regulations for chum bycatch would largely be the same under Alternative 4).

6.3.4.1 Using Genetic Information in RHS System Closures for Chum Avoidance

A primary change to the current RHS system for chum avoidance incorporated within the IPA proposals would be the increased use of genetic information, primarily proportions of WAK to non-WAK chum, in addition to chum bycatch rates and pollock CPUE data when assessing potential closure areas. The CV proposal indicates this would be accomplished by evaluating the likelihood of WAK to non-WAK proportions in an ADF&G groundfish statistical area by the fishing grounds areas on a weekly basis based on historical genetic information and pollock CPUE data; managers would also closely watch Chinook rates in the potential area closure as well as new areas the fleet moved to. Sea State would use the historical genetic stock composition data to weigh the risks of issuing a dynamic closure area with potentially higher non-WAK chum rates and displace the fishing fleet into areas with potentially higher WAK chum rates. Based on the historical genetic analyses, as well as the scenario planning framework developed by industry in their proposals, WAK chum are encountered in greater proportions in the shelf edge and Unimak areas.

Because the Council's October 2023 motion specified the genetic cluster areas as the spatial units related to the IPAs and the RHS system for chum salmon avoidance, Table 6-63 provides the estimated mean stock proportions for WAK and non-WAK chum salmon by genetic cluster area in the early period and

Table 6-64 provides the same information for the late period. The majority of chum salmon caught as bycatch across all genetic cluster areas are not of WAK origin regardless of where (i.e., cluster area) or when (i.e., early or late period) chum salmon are encountered. However, WAK chum are encountered in similar proportions in genetic cluster area 1 during the early and late periods (the average proportion of WAK chum are 25.8% and 24.1%, respectively). The average proportion of WAK to non-WAK chum is higher in genetic cluster area 1 than genetic cluster area 2 in both the early and late periods.

Table 6-63 Estimated mean proportion of WAK and non-WAK chum bycatch in the early period of the B season fishery by genetic cluster area, 2011 through 2022

Year	Cluster area 1		Cluster area 2		Cluster area 3		Cluster area 4	
	WAK	non-WAK	WAK	non-WAK	WAK	non-WAK	WAK	non-WAK
2011	32.8%	67.2%	-	-	28.8%	71.2%	30.2%	69.9%
2012	26.9%	73.1%	-	-	-	-	-	-
2013	25.8%	74.2%	24.1%	75.9%	-	-	17.6%	82.4%
2014	24.8%	75.2%	25.7%	74.3%	16.1%	83.9%	-	-
2015	32.0%	68.0%	17.2%	82.8%	23.8%	76.2%	11.1%	88.9%
2016	31.1%	68.9%	26.2%	73.8%	10.6%	89.4%	-	-
2017	29.5%	70.5%	18.4%	81.6%	12.8%	87.2%	11.9%	88.1%
2018	32.9%	67.1%	18.1%	81.9%	18.5%	81.5%	-	-
2019	32.9%	67.1%	18.1%	81.9%	18.5%	81.5%	-	-
2020	5.3%	94.8%	9.2%	90.8%	10.3%	89.7%	8.3%	91.8%
2021	9.5%	90.6%	8.4%	91.6%	12.9%	87.1%	-	-
2022	26.5%	73.5%	14.2%	85.8%	9.1%	90.9%	-	-
Avg.	25.8%	74.2%	18.0%	82.0%	16.1%	83.9%	15.82%	84.22%

Notes: Hyphens are used to denote absent values due to non-estimable sample sizes available

Table 6-64 Estimated mean proportion of WAK and non-WAK chum bycatch in the late period of the B season fishery by genetic cluster area, 2011 through 2022

Year	Cluster area 1		Cluster area 2		Cluster area 3		Cluster area 4	
	WAK	**non-WAK**	**WAK**	**non-WAK**	**WAK**	**non-WAK**	**WAK**	**non-WAK**
2011	25.5%	74.5%	7.6%	92.4%	22.1%	77.9%	-	-
2012	23.4%	76.6%	-	-	-	-	-	-
2013	22.1%	77.9%	19.7%	80.3%	29.5%	70.5%	7.7%	92.4%
2014	23.3%	76.7%	19.5%	80.5%	16.1%	83.9%	8.0%	92.0%
2015	22.3%	77.7%	6.5%	93.5%	18.3%	81.7%	3.4%	96.6%
2016	29.0%	71.0%	16.3%	83.7%	18.5%	81.5%	16.7%	83.3%
2017	29.8%	70.2%	10.0%	90.0%	15.0%	85.0%	7.1%	92.9%
2018	25.8%	74.2%	17.3%	82.7%	14.2%	85.8%	1.6%	98.4%
2019	25.8%	74.2%	17.3%	82.7%	14.2%	85.8%	1.6%	98.4%
2020	14.5%	85.5%	3.2%	96.8%	5.1%	94.9%	2.1%	98.0%
2021	17.7%	82.3%	-	-	8.2%	91.8%	-	-
2022	29.9%	70.1%	11.4%	88.7%	12.5%	87.5%	2.2%	97.8%
Avg.	24.1%	75.9%	12.9%	87.1%	15.8%	84.2%	5.6%	94.4%

Notes: Hyphens are used to denote absent values due to non-estimable sample sizes available

Because the IPA proposals have used the fishing grounds areas as the spatial units for consideration when determining RHS closure area implementation, Table 6-65 provides the estimated mean proportion of WAK and non-WAK chum salmon in the Early period of the B season by fishing grounds area and Table 6-66 provides the same information for the Late period of the B season (2011-2022).

Table 6-65 Estimated mean proportion of WAK and non-WAK chum salmon bycatch in the early period of the B season fishery by fishing grounds area, 2011 through 2022

	Unimak Area		Shelf		Shelf edge		Pribilofs		Zhemchug Canyon		Pervenets Canyon	
Year	**WAK**	**Non-WAK**	**WAK**	**Non-WAK**	**WAK**	**Non-WAK**	**WAK**	**Non-WAK**	**WAK**	**Non-WAK**	**WAK**	**Non-WAK**
2011	30.7%	69.3%	-	-	-	-	29.8%	70.2%	28.2%	71.9%	-	-
2012	24.2%	75.8%	-	-	-	-	-	-	-	-	-	-
2013	24.5%	75.5%	30.1%	69.9%	29.4%	70.6%	15.3%	84.7%	-	-	-	-
2014	25.0%	75.0%	-	-	22.3%	77.7%	16.3%	83.8	-	-	-	-
2015	29.6%	70.4%	-	-	19.0%	81.0%	23.9%	76.1%	11.6%	88.4%	-	-
2016	30.1%	69.9%	30.6%	69.5%	27.6%	72.4%	8.8%	91.2%	-	-	-	-
2017	29.0%	71.0%	-	-	20.0%	80.0%	12.0%	88.0%	16.2%	83.8%	-	-
2018	26.3%	73.7%	-	-	17.4%	82.6%	16.4%	83.6%	-	-	-	-
2019	33.6%	66.4%	-	-	11.2%	88.8%	11.2%	88.8%	-	-	-	-
2020	-	-	-	-	6.1%	93.9%	-	-	-	-	-	-
2021	9.3%	90.7%	-	-	8.7%	91.3%	-	-	-	-	-	-
2022	29.2%	70.9%	23.3%	76.7%	16.4%	83.6%	-	-	-	-	-	-
Avg.	26.5%	73.5%	28.0%	72.0%	17.8%	82.2%	16.7%	83.3%	18.7%	81.3%	-	-

Notes: Hyphens are used to denote absent values due to non-estimable sample sizes available

Table 6-66 Estimated mean proportion of WAK and non-WAK chum salmon bycatch in the late period of the B season fishery by fishing grounds area, 2011 through 2022

	Unimak Area		Shelf		Shelf edge		Pribilofs		Zhemchug Canyon		Pervenets Canyon	
Year	WAK	**Non-WAK**	**WAK**	**Non-WAK**	**WAK**	**Non-WAK**	**WAK**	**Non-WAK**	**WAK**	**Non-W-K**	**WAK**	**Non-WAK**
2011	25.9%	74.1%	18.0%	82.0%	8.0%	92.0%	19.0%	81.0%	-	-	-	-
2012	22.5%	77.6%	15.5%	84.6%	-	-	-	-	-	-	-	-
2013	21.5%	78.5%	37.1%	62.9%	21.5%	78.5%	27.3%	72.7%	-	-	7.2%	92.9%
2014	22.6%	77.4%	-	-	19.1%	81.0%	16.7%	83.3%	12.2%	87.8%	7.6%	92.4%
2015	21.7%	78.4%	-	-	10.2%	89.8%	15.5%	84.5%			4.3%	95.7%
2016	29.0%	71.0%	16.7%	83.3%	19.9%	80.1%	16.8%	83.2%	15.4%	84.7%		
2017	26.3%	73.7%	-	-	13.1%	86.9%	-	-	-	-	5.1%	95.0%
2018	22.5%	77.5%	-	-	10.7%	89.3%	12.2%	87.9%	-	-	1. 7%	98.3%
2019	18.5%	81.6%	-	-	11.4%	88.6%	17.9%	82.1%	-	-	5.1%	94.9%
2020	14.1%	85.9%	-	-	7.7%	92.3%	6.4%	93.7%	-	**-**	1.8%	98.2%
2021	13.6%	86.4%	-	-	17.3%	82.7%	7.1%	92.9%	-	-	-	-
2022	31.3%	68.7%	-	-	16.5%	83.5%	12.4%	87.6%	13.5%	86.6%	-	-
Avg.	**22.4%**	**77.6%**	**21.8%**	**78.2%**	**14.1%**	**85.9%**	**15.1%**	**84. 9%**	**13.7%**	**86.3%**	**4.7%**	**95.3%**

Notes: Hyphens are used to denote absent values due to non-estimable sample sizes available

As demonstrated in the series of preceding tables, WAK chum are encountered in higher proportions closer to the Alaska Peninsula and generally decrease further west on the pollock fishing grounds (i.e., WAK chum are encountered in lower proportions near the Pribilof Islands as well as the Zemchung and Pervenets Canyons fishing grounds areas). Therefore, should the IPAs and Sea State use this approach the future, it is possible these closures would contribute to a reduction in WAK chum bycatch. While WAK chum are encountered in the highest proportions in the Unimak area, an emphasis on closures here may result in a longer B season because these fishing grounds have consistently good pollock CPUE and a lower overall chum bycatch rate. Closures in the shelf edge would displace CV and CP fishing effort when the fleets fish in that area during the B season. CPs are only allowed to fish in the CVOA during the B season if they are harvesting CDQ pollock. However, RHS closure areas that apply to CPs are based on fleet-wide data. As a result, any closure that would effectively result from CV fishing would also apply to the CP sector.

6.3.4.2 Required Closures for All Vessels Regardless of Performance if Chum Bycatch are Very High

If the implementing regulations for the salmon bycatch IPAs were modified such that closure areas would be required for all vessels regardless of their performance when chum bycatch rates are very high, it is staff’s understanding that the CP and CV IPAs would address this provision differently (based on the current proposals). The CP IPA would continue to use the 2022 amendment requiring an ADF&G groundfish stat area with a chum bycatch rate of 5 chum per mt of pollock to be closed to all vessels regardless of their performance. In 2022, there was one ADF&G statistical area with a chum bycatch rate greater than 5 chum per mt of pollock (on August 15, 2022, ADF&G statistical area 655500 in the CVOA had a weekly bycatch rate of 5.051 chum salmon per mt of pollock). Implementing a closure area that overlapped this statistical area would likely have reduced a spike in chum bycatch and potentially WAK chum.

The Inshore SSIP and MSSIP would be modified such that a statistical area would be closed to all vessels regardless of performance when the bycatch rate is 3 times the calculated weekly bycatch rate. As described in the CV proposal, the scenario analyses demonstrated that the shelf edge and Unimak fishing grounds areas were more likely to have a higher proportion of WAK chum. That retrospective analysis showed that three out of the four areas that would have been closed to all vessels under this provision fall within these two regions. Therefore, it is possible these closures would have contributed to a reduction in WAK chum bycatch.

6.3.4.3 Use of a Move Along Rule

The CV proposal put forward development and use of move along rule for CVs. It is staff’s understanding that the move along rule is a tool that would be developed and applied regardless of a closure to minimize the risk of increased chum bycatch. Depending on the threshold that is used to determine when a move along rule would take effect (and relative fishing effort), this measure would likely result in less chum salmon bycatch relative to the status quo. It is also possible that addition of this measure may result in fewer closure areas being implemented because managers would be working to move vessels out of an area more quickly to avoid triggering a closure. Operationally, however, a move along rule is similar to implementing a weekly closure if the trigger to move is based on a 3-day rolling average.

6.3.4.4 Bi-weekly Evaluation of Closure Areas

Since 2022, the CP IPA has required inseason managers to evaluate information on a bi-weekly basis to determine whether areas are eligible for RHS closures. The CP IPA evaluates closures on a Tuesday-Friday basis.

Currently, chum closures for CVs are announced on Thursday and in effect until the following Friday. Unless CV provision 2 becomes effective (i.e., all vessels regardless of tier status are closed out of an area with very high bycatch rates), CVs would continue to receive a tier status as normal. All tier 2 vessels would not be allowed to fish inside the week-long chum closure. However, the CV proposal notes the current RHS system for chum avoidance would be modified so that any data that comes in over the weekend will be reviewed on Monday, including catch data, fish tickets, accounts from fishermen on the grounds, among other information. If the weekend data indicates that chum encounters remain high in the closed area and managers deem that area must be avoided, then the chum closure will be effective for all vessels for the remainder of the chum closure's duration (until Friday 10:00 pm).

In general, more timely evaluation of data and closure implementation when warranted has the potential to reduce the spikes in bycatch across the B season because closures would be implemented faster and based on more recent information. Specific to the CV proposal, additional chum avoidance relative to the status quo potentially resulting from this measure would be based on tier 1 vessels no longer being able to fish in the closure area for the remainder of the week (i.e., Tuesday-Friday). This modification to the status quo RHS program would likely reduce the chum bycatch in that area, reducing the total chum bycatch that could have occurred without the addition of Monday Closures.

6.3.4.5 Require the IPAs to Develop Outlier Provisions

The CV proposal does not include a measure or provision that specifies how a vessel outlier would be identified. The 2022 CP IPA was amended to include an outlier provision. This IPA amendment identifies vessels with poor bycatch performance by comparing relative vessel performance over several pollock seasons. At the end of each season, vessels with bycatch performance greater than 1.5 standard deviations above the average vessel performance are identified. If a vessel is so identified during two consecutive B seasons for chum (or three consecutive seasons A/B for Chinook), then the vessel is designated a poor performance vessel during the following season. All vessels designated as poor performers are prohibited from fishing in any Chinook or chum Bycatch Avoidance Area for the entire season. The CP IPA added this measure to increase accountability by creating incentives for chronic poor chum bycatch performers to improve their chum bycatch rates. It is difficult to say how many chum salmon would be avoided as a result of this measure, but it does appear to provide a strong incentive for vessel operators that would presumably want to maintain their operational flexibility.

6.3.4.6 Require the Use of Salmon Excluder Devices Through the B Season

The CP IPA proposal put forward a provision that would require the use of a salmon excluder device throughout the B season. Status quo regulations require the use of salmon excluder devices, with recognition of contingencies, from January 20 to March 31, and from September 1 until the end of the B season 50 CFR 679.21(f)(12)(iii)(E)(11). Adding a provision would require the use of a salmon excluder from June 10 – September 1. The existing regulatory provision was incorporated into the implementing regulations for the salmon bycatch IPAs as a measure for Chinook avoidance. It is possible that requiring the use of a salmon excluder device throughout the entire B season may result in some additional chum salmon avoidance, although the relative magnitude of savings is uncertain. As noted in the EA/RIR prepared for Amendment 110, depending on their design and use, excluder devices can reduce target catch as well as bycatch. This means that it may take more time fishing, which could push more fishing effort into September and October when Chinook bycatch is higher. However, it is unknown how much this could be generalized, and whether a level of bycatch reduction or pollock loss would occur under both high and low bycatch and pollock fishing conditions.

6.3.4.7 Additional Weekly Reporting to Western and Interior Alaska Salmon Users

The CP IPA proposal put forward a provision that would require additional weekly reporting to Western and Interior Alaska salmon users. Regulations at 50 CFR 679.21(f)(12)(iii)(D) require the IPA to identify at least one third party group that "include any entities representing Western Alaskans who depend on salmon and have an interest in salmon bycatch reduction but do not directly fish in a groundfish fishery." It is analytical staff's understanding that Bering Sea Fishermen's Association fulfills this third-party role under the current IPAs. At this time, it is not clear what measures the IPAs would implement to meet this provision, but the intent is to increase public transparency and communication beyond reports currently being distributed to the third-party.

7 Environmental Justice

This chapter will be completed for consideration at the time of Council final action.

This chapter will provide information and analysis required under E.O. 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994).[101] E.O. 12898 was supplemented by E.O. 14096, *Revitalizing Our Nation's Commitment to Environmental Justice for All* (April 26, 2023), in one place for the reader. E.O. 12898 and E.O. 14096 direct federal agencies, as appropriate and consistent with applicable law to identify, analyze, and address disproportionate and adverse human health and environmental effects (including risks) and hazards of federal activities, including those related to climate change and cumulative impacts of environmental and other burdens on communities with environmental justice concerns.

The analysts would reiterate that the reader can find information that is responsive to E.O. 12898 and E.O. 14096 (among others) throughout the accompanying SIA prepared for this action. For example, Section 4.1.5 and the corresponding subsections of the SIA provide demographic and socioeconomic indicators as well as a summary of traditionally used subsistence resources for the subset of communities identified as being substantially dependent on or engaged in the Bering Sea pollock fishery. Section 4.2 and the corresponding subsections of the SIA provide similar information for 65 Western Alaska communities that are eligible for the CDQ program; here the patterns of subsistence resources use are characterized at the regional level. Section 4.3 and the corresponding subsections of the SIA provide detailed information of subsistence harvests of salmon and non-salmon resources for households and communities across Western and Interior Alaska, and Section 4.3.5 provides information on the sociocultural systems of Alaska Native communities that are based on, and informed by, the subsistence way of life.

[101] EPA Region 10 staff provided input that there is flexibility in the way agencies prepare the environmental justice analysis, but they recommended that it exist as a standalone chapter (*personal communication, E. Bitalac)*.

8 Net Benefits to the Nation

This chapter will be prepared for consideration at the time of Council final action.

9 Magnuson-Stevens Act

9.1 Magnuson-Stevens Act National Standards

Below are the 10 National Standards as contained in the MSA. In recommending a preferred alternative, the Council must consider how to balance the national standards.

A brief discussion of this action with respect to each National Standard will be prepared for final action.

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

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 U.S. fishermen, such allocation shall be (A) fair and equitable to all such fishermen, (B) reasonably calculated to promote conservation, and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

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. The analysis should demonstrate that the benefits of fishery regulations are real and substantial relative to the added research, administrative, and enforcement costs, as well as costs to the industry of compliance.

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

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.

9.2 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 or 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 preliminary DEIS, which includes the required elements of an RIR, and the accompanying SIA for this potential plan amendment constitute the fishery impact statement. The likely effects of the proposed action are analyzed and described throughout the preliminary DEIS and SIA.

9.3 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.

Upon selection of a preferred alternative, this section will include the Council's rationale for how any action recommended to the Secretary of Commerce is consistent with this ecosystem approach to policy, and highlight evidence presented for that rationale to the extent that it is available.

10 Preparers and Persons Consulted

This chapter of the preliminary DEIS lists the preparers, contributors, and other persons consulted when preparing the initial review draft for the Council's April 2024 meeting. Council staff would like to recognize and thank the many preparers and contributors who provided special expertise, data, and/or written contributions to assist Council and NMFS staff in preparing this document for initial review.

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Appendix 1 NMFS Supplement of Alternatives Considered but not Moved Forward

Supplement to Section 4.5
Alternatives Considered but Not Included in the
Council's October 2023 Recommendation for Alternatives for Analysis[102]

Background

At the October 2023 meeting of the North Pacific Fishery Management Council (Council), among the alternatives the Council considered to address the purpose and need for this action was an overall PSC limit for chum salmon. In testimony and writing, representatives of Alaska Native tribes and communities shared how chum declines across Western and Interior Alaska are affecting regional economies, cultural identity, food security and traditional diet, and the ability to pass on traditional practices.[103] There was extensive support for analyzing in the Draft Environmental Impact Statement (DEIS) PSC limits below 200,000 chum, including a zero chum PSC limit. In its October motion, the Council included Alternative 2, an overall chum PSC limit, and recommended a PSC limit range of 200,000 to 550,000 chum to be analyzed in the DEIS. The Council's rationale for selecting this range is discussed in section 4.2.1 and presented in Table 4-3 of the DEIS. The Council did not include a zero PSC limit for chum salmon in the alternatives for analysis because it determined that a complete closure of the Bering Sea pollock fishery B season to further minimize chum salmon PSC is not consistent with the purpose and need for this action. In addition, the Council considered the likely underlying cause of declines in chum salmon returns to western Alaska river systems and that the potential savings from a zero PSC limit would not provide a materially different impact on chum salmon returns and opportunities for subsistence harvests throughout Western and Interior Alaska compared to the limits in the Council's alternatives.

This document is a summary review of whether the impacts predicted at a PSC limit of 200,000 chum salmon for the pollock industry, communities whose economies rely on the industry, and users of chum salmon are indicative of the impacts likely to be experienced at lower PSC limits. It supplements section 4.5 of the preliminary DEIS, which discusses alternatives considered but not included in the Council's October 2023 recommendation for alternatives for analysis. At this point in the process of developing the DEIS, the Council may choose to maintain the range of PSC limits, or it may modify the range in the existing alternatives and options or add additional alternatives and options and seek further analysis of PSC limits less than 200,000 chum.

Methods

NMFS performed a retrospective application of PSC limits to estimate a major component of the benefits (chum PSC avoided) and a major component of the costs (pollock harvest forgone), not accounting for any changes in fishing behavior. Only data from the Bering Sea Pollock Fishery B Season was included.[104] NMFS Catch Accounting provided all data. The methods used to assess potential impacts are very similar to those used to generate the retrospective tables in Appendix 6 of the DEIS (described in section 5.2 of the DEIS). For this summary review, NMFS analyzed only one of the four PSC apportionments in the Council's October motion – pro rata (Alternative 2, option 3, suboption 3). To

[102] Prepared by NOAA, National Marine Fishery Service, Alaska Region.
[103] The Yukon River Intertribal Fish Commission provided a summary of the declines and how they have resulted in multiple years of closures of priority state and federal subsistence salmon fisheries, failure to meet escapement goals, and profound impacts on food security (Appendix 5 to the DEIS).
[104] Only the B season was examined because all action alternatives would only apply to the B season fishery. The Council's rationale for this was that the majority of chum PSC has historically been encountered during the B season. For example, between 2011-2022, over 99% of the non-Chinook PSC occurred in the B season. Table 4-1.

evaluate PSC limits within the range of 0 and 200,000 chum, NMFS analyzed PSC limits at 50,000 increments. The sector apportionments at each PSC limit analyzed are shown in Table A-1.

For each PSC limit and year between 2011-2022, daily non-Chinook salmon PSC counts were used to calculate the day of the B season in which each sector would have reached its PSC apportionment.[105] The amount of pollock harvested and chum PSC as of that date were then calculated from catch accounting system records. The amount of forgone pollock harvest was calculated by subtracting the total catch as of the day the sector reached its PSC apportionment from the total B season harvest in that season. Similarly, the difference in chum PSC could be determined by subtracting the chum PSC as of the day the sector reached its PSC apportionment from the total B season chum PSC.[106] In Table A-2, these numbers are represented as cumulative B season pollock forgone and chum PSC avoided from 2011-2022.

To calculate the cumulative gross ex-vessel and first wholesale value of potentially forgone pollock for each sector, each sector's forgone pollock was multiplied by ex-vessel and wholesale prices calculated by the Alaska Fisheries Information Network for each year between 2011 and 2022. For further discussion of the methods used to calculate these prices, see section 5.3 of the DEIS.[107] Each sector's estimated annual values were then summed.

To calculate the estimated avoided chum from the Western Alaska genetic reporting group (WAK), the avoided chum for each PSC limit for each sector, was multiplied by the WAK proportions of B season chum PSC for each year between 2011 and 2022. WAK proportions of B season chum PSC were provided by the Genetics Program at the Alaska Fisheries Science Center. Where empirical data throughout a time period was available for a sector, it was used. In years where sample sizes did not allow for determination of WAK proportions for a sector (e.g., CDQ: 2011-2015, 2020), a mean of the empirical WAK proportions within that sector was used (e.g., CDQ: 2016-2019 and 2021-2022). Each sector's estimated annual values were then summed.

[105] Because over 99% of the non-chinook PSC is chum, all non-chinook salmon will be assumed to be chum (section 4.2 of the DEIS).
[106] Slight differences in pollock forgone, chum PSC and WAK chum PSC saved in this analysis relative to the DEIS are a result of using exact date of closure rather than the week-end date method employed in the DEIS.
[107] As noted in section 5.3, there is no actual ex-vessel price paid for pollock harvested by catcher/processors (CP) as the harvester and processor are the same entity. An approximate conversion was made to generate an ex-vessel price for the CP sector.

Results

The results of this summary review of PSC limits of 200,000 chum and below are summarized in Table A-2. With the exception of a zero PSC limit, the below results are not estimates of actual forgone pollock and associated revenue or avoided chum should any of these PSC limits be adopted. Because this is a retrospective analysis, it does not account for anticipated changes to fishing behavior that could mitigate the risk of potential forgone pollock harvest and increase the potential opportunity for avoided chum.

Impacts on pollock harvest (2011-2022)

The retrospective application of a PSC limit of 200,000 chum resulted in potential cumulative forgone pollock harvest across all sectors from 2011-2022 of 2,068,764 metric tons (mt), which is 24% of the cumulative B season pollock harvest. This amount of pollock has an estimated cumulative gross ex-vessel value of up to $774,000,000 and wholesale value of up to $2,435,000,000.

The retrospective application of a PSC limit of 150,000 chum resulted in potential cumulative forgone pollock harvest across all sectors from 2011-2022 of 2,894,255 mt, which is 33% of the cumulative B season pollock harvest. This amount of pollock has an estimated cumulative gross ex-vessel value of up to $1,095,000,000 and wholesale value of up to $3,423,000,000.

The retrospective application of a PSC limit of 100,000 chum resulted in potential cumulative forgone pollock harvest across all sectors from 2011-2022 of 3,657,087 mt, which is 42% of the cumulative B season pollock harvest. This amount of pollock has an estimated cumulative gross ex-vessel value of up to $1,399,000,000 and wholesale value of up to $4,377,000,000.

The retrospective application of a PSC limit of 50,000 chum resulted in potential cumulative forgone pollock harvest across all sectors from 2011-2022 of 4,658,109 mt, which is 53% of the cumulative B season pollock harvest. This amount of pollock has an estimated cumulative gross ex-vessel value of up to $1,795,000,000 and wholesale value of up to $5,617,000,000.

The retrospective application of a PSC limit of zero chum resulted in potential cumulative forgone pollock harvest across all sectors from 2011-2022 of 8,715,783 mt, which is 100% of the cumulative B season pollock harvest. This amount of pollock has an estimated cumulative gross ex-vessel value of up to $3,462,000,000 and wholesale value of up to $10,779,000,000.

In addition, Table A-2 depicts by PSC limit and sector the mean annual foregone B season pollock.

Impacts on chum PSC (2011-2022)

The retrospective application of a PSC limit of 200,000 chum resulted in a cumulative chum PSC decrease for all sectors between 2011-2022 of 1,203,504 fish, which is 40% of the cumulative B season PSC. The estimated cumulative decrease of WAK chum is 186,339.

The retrospective application of a PSC limit of 150,000 chum resulted in a cumulative chum PSC decrease for all sectors between 2011-2022 of 1,710,185 fish, which is 51% of the cumulative B season PSC. The estimated cumulative decrease of WAK chum is 277,658.

The retrospective application of a PSC limit of 100,000 chum resulted in a cumulative chum PSC decrease for all sectors between 2011-2022 of 2,207,747 fish, which is 66% of the cumulative B season PSC. The estimated cumulative decrease of WAK chum is 371,311.

The retrospective application of a PSC limit of 50,000 chum resulted in a cumulative chum PSC decrease for all sectors between 2011-2022 of 2,742,812 fish, which is 81% of the cumulative B season PSC. The estimated cumulative decrease of WAK chum is 472,310.

The retrospective application of a PSC limit of zero chum resulted in a cumulative chum PSC decrease for all sectors between 2011-2022 of 3,364,568 fish, which is 100% of the cumulative B season PSC. The estimated cumulative decrease in WAK chum is 591,159.

In addition, Table A-2 depicts by PSC limit and sector the mean annual estimated WAK chum avoided.

Discussion

An overall chum PSC limit of zero would effectively close the B season pollock fishery because NMFS could not conservatively manage the fishery against a chum PSC limit of zero wherein no single non-Chinook salmon would be encountered. Thus, it is certain that an overall chum PSC limit of zero would result in a loss of 100% of the ex-vessel and wholesale value generated from the B season, with direct impacts to the pollock industry (e.g., vessels, companies, and sectors) and indirect impacts to the communities and support industries engaged in or dependent on the B season pollock fishery, including coastal Western Alaska communities that benefit from shore-based processing and receive social and economic benefits through the CDQ program.

It is also certain that a zero chum PSC limit, by foreclosing all pollock fishing in the B season, would result in the reduction in chum PSC of all origins, including Western Alaska. There remains significant uncertainty as to the degree to which reduction in chum PSC may result in increased fishing opportunity in the Yukon and Kuskokwim region. That uncertainty, however, does not preclude attempting to evaluate and consider those potential benefits to in-river users, including Alaska Native communities. By the incidental avoidance of other PSC, such as Chinook and herring, a zero PSC limit may also generate additional benefits to Alaska Native communities and the ecosystem.

The impacts of PSC limits less than 200,000 chum may be substantial in terms of both potential forgone pollock and avoided chum. The increase in potential forgone pollock at a PSC limit of 150,000 chum is greater than at a PSC limit of 200,000 chum (33% and 24% proportion of total pollock harvest, respectively). However, the potential increase in avoided chum is also greater (51% and 37% proportion of total chum PSC, respectively).

The results of this summary review, as shown in Table A-2, reflect outcomes had there been no fishing behavioral changes. However, it is expected that the pollock fleet *will* change its behavior and strategies should a chum PSC limit be implemented. The exact magnitude of chum avoidance strategies and their relative effectiveness for the fleet or a sector to avoid a potential fishery closure, and the costs associated with these strategies are uncertain. At PSC limits that allow the fleet opportunity to change fishing behavior, the potential forgone pollock harvest and directly resulting gross revenue shown in Table A-2 likely represent maximum values. Similarly, with changed fishing behavior to avoid the PSC limits, the actual avoided chum numbers may exceed those shown in Table A-2.

However, as PSC limits approach zero it becomes more likely that the fleet may be closed prior to completion of the pollock season, which in turn makes it more likely that pollock harvesters will perceive the risk and cost of operating to be too great and choose not to participate in the B season. In this way, the closer to zero a chum PSC limit is, the more the retrospective results in Table A-2 become representative of future pollock forgone and chum PSC reduction under a chum PSC cap, given the limited opportunity for changes in fishing behavior. The DEIS provides more nuanced discussion to characterize these costs and trade-offs that may occur (see in particular Section 6.2 of the DEIS).

Impacts on pollock harvest (2011-2022)

Between the A and B seasons of the Bering Sea pollock fishery, 45% of the sector's total allowable catch is committed to the A season and 55% is committed to the B season.[108] The total annual Bering Sea pollock harvest (A and B seasons) from 2011-2022 is depicted in Table 2-4 in the DEIS, and amounts to 15,347,510 mt. A reduction of the entire total B season pollock harvest – 8,718,901 mt – is equivalent to 57% of the cumulative pollock harvest over this period.

To some degree, changed fishing behavior will delay or avoid altogether the fishing closures that would give rise to the potential forgone pollock figures in Table A-2. However, as PSC limits and the associated

[108] 50 C.F.R. 679.20(a)(5)(B)(1).

sector-based allocation decrease, the potential for an early pollock fishery closure increases for at least two reasons. The most obvious is that, with lower PSC apportionments, each sector has a greater likelihood of reaching its apportionment before the end of the B season. Another reason relates to the high degree variability in chum that each vessel and sector can encounter daily.[109] Lightning strikes are unpredictable, large PSC events in which, before the fleet can react, large amounts of salmon PSC are harvested. Between 2011 and 2022, multiple lightning strikes occurred. These ranged from daily PSC estimates for one sector of between 8,000 to over 40,000 chum. At lower PSC limits, with accompanying lower sector and vessel apportionments, there is a greater chance that a lightning strike by a single or multiple vessels in a sector will result in an exceedance of a chum PSC apportionment. This possibility may affect the way that a company assesses its financial risk in leaving the dock. If a company sees a risk of being closed prior to recouping its fixed costs, it may choose not to participate in the B season.

As shown in Figure A-1 below, the frequency that each sector's chum salmon PSC would have exceeded the sector's chum PSC apportionment, had a limit been in place and no fishing behavior changed, differs by sector. For example, under a 200,000 PSC limit, the inshore sector had PSC that exceeded what would have been its PSC apportionment in 9 of 12 years. In contrast, the CDQ sector had chum PSC that exceeded what would have been its chum PSC apportionment in 5 of the 12 years.[110]

Even in years in which a sector's chum salmon PSC would have exceeded its PSC apportionment had the limits been in place, the range of forgone pollock as a proportion of total annual harvest varies substantially between years. For example, for the CP sector at a chum PSC limit of 200,000, the range of potential forgone pollock is ~6% of total harvest in 2022 to ~83% in 2018. This reflects a difference in timing of chum PSC during the B season. Because greater overall chum salmon were caught earlier in 2018 than 2022, the CP sector's chum PSC apportionment would have been reached on July 2 in 2018, but not until August 19 in 2022.

In contrast, for the inshore sector, at a chum PSC limit of 200,000 the range of potential forgone pollock is 10% in 2016 to 57% in 2021. Further, at a 200,000 PSC limit, only one out of the twelve years revealed potential forgone B season harvest greater than 50%. At a 150,000 PSC limit, in four of twelve years (1/3) the forgone B season harvest is greater than 50%. At a 100,000 PSC limit, in two of twelve years the forgone B season harvest is greater than 75%.

This interannual variability in the degree of potential forgone pollock results is also revealed in the marginal differences between PSC limits. For example, in 2021, the forgone B season harvest for a PSC limit of 200,000 and 150,000 chum was 55.97% and 61.36% respectively, a difference of 9.39%. In contrast, in 2018, the forgone B season harvest for a PSC limit of 200,000 and 150,000 chum was 19.39% and 56.66% respectively, a difference of 37.27%.

Earlier closures of the Bering Sea pollock B season would potentially result in lost revenue for communities engaged in or economically dependent on the pollock fishery, as well as supporting industries such as fuel, food, transportation. Similarly, should vessels exit the B season fishery, it will have indirect impacts on communities through loss of employment opportunities, fuel taxes, sales tax, shared fish taxes, and harbor fees. As noted in section 6.2.8.2 of the DEIS, communities identified as being substantially engaged in or economically dependent on the B season pollock fishery that could be impacted include Seattle, Kodiak, Newport, Akutan, and Unalaska/Dutch Harbor. King Cove may also be impacted, although quantifying the degree of impact is complicated by the recent change in the financial

[109] This pattern appears in Figure 6-12 of the DEIS (Proportion of each pollock sector's annual chum PSC, and all sectors combined, encountered by statistical week, 2011-2022).
[110] Despite the fact that the CP vessels generally harvest the CDQ TAC, there is inexact alignment in potential forgone pollock between the CDQ and CP sectors. CP operators can select whether to designate a haul as CDQ after determining the species composition. If hauls that have lower amounts of PSC relative to pollock are identified as CDQ hauls, this can create a bias where estimates of potential forgone harvest are different (typically lower) for the CDQ sector than for the CP sector.

viability of Peter Pan Seafoods and its associated AFA pollock inshore cooperative (section 6.2.8.2.4 of the DEIS). The city of Unalaska is particularly vulnerable to decreases in pollock harvest due to its economy and general tax revenue being so closely intertwined with and dependent on the pollock fishery (section 6.2.8.2.43 of the DEIS).

Sixty-five coastal western Alaska CDQ communities could be exposed to economic impacts of early pollock B season closures through both the CP and CDQ sectors. Under a zero chum PSC limit from 2011-2022, the CDQ sector alone would have lost an estimated cumulative ex-vessel revenue of $349,000,000 and an estimated cumulative wholesale revenue of $1,144,000,000. As discussed in section 6.1.10.5 of the DEIS, these are revenues that are otherwise used to invest in BSAI Federally managed commercial fisheries, support economic development in Western Alaska, alleviate poverty and provide economic and social benefits for residents of Western Alaska communities.

Although the pollock fishery may be able to mitigate some of the potential revenue losses through changes in fishing behavior, there are avoidance costs associated with such changes, including increased fuel usage, test tows, and time at sea (section 6.2.8.1.2 of the DEIS). Should these costs become sufficiently high, they could incentivize consolidation within a sector to increase harvest efficiency. Further, if crew must stay at sea longer without additional compensation, that could result in increased crew turnover.

Impacts on chum salmon PSC (2011-2022)

Applying a chum PSC limit of zero chum to the PSC levels for all sectors for the years 2011-2022 reveals a potential reduction in cumulative PSC for all sectors equal to 3,364,426 chum.[111] In most years, the majority of chum PSC is of Asian origin, including both hatchery and wild fish. As discussed in section 6.1.4.4 of the DEIS, genetic testing from 2011-2022 resulted in estimates that WAK chum make up between ~9%-25% of all chum PSC in the pollock fishery. As shown in Table 6-9 of the DEIS, on average between 2011-2022, 15.4% of the chum PSC is attributed to the Coastal Western Alaska genetic stock reporting group and 3.9% is attributed to the Upper/Middle Yukon genetic stock reporting group. Of the cumulative chum PSC between 2011-2012 (3,364,568 chum), it is estimated that 591,159 chum were from the WAK genetic reporting group. Although this reflects a 17.5% proportion, the method used to reach this number was based on sector-specific proportions of WAK for each year between 2011-2022. The average WAK proportion within chum PSC varies between sectors.

Marine heat waves have been shown to have had a strong influence on the marine and freshwater survival of WAK chum, likely contributing to recent chum declines in western Alaska river systems.[112] This means that reducing harvest in the ocean may not lead to future increases in run size. Unlike Chinook salmon, for which scientists have been able to develop methods for estimating adult equivalents (AEQ), that is the number of salmon PSC that would have otherwise matured and attempted to return to natal rivers to spawn, similar methods are not as readily used for chum due to a lack of necessary data (primarily escapement data for many river systems) (section 6.1.4.5.1 of DEIS). Further, it is safe to assume that a portion of mature adult chum caught as PSC would not have reached their natal streams in light of other sources of mortality (e.g., Area M fisheries, predation) (section 6.1.5 of the DEIS).

Any attempt to measure a possible benefit to users of a specific river arising from a reduction in overall chum PSC is further complicated by the limitations of in-river management data and genetic sampling techniques. While additional returns would contribute to overall chum escapement, the Alaska Department of Fish & Game (ADF&G) sets escapement goals by specific river systems. Yet the best

[111] For the reasons discussed in section 6.1.4.5, an increase in avoided chum may not result in a proportional reduction in WAK chum PSC.
[112] NOAA, Alaska Fisheries Science Center, What's Behind Chinook and Chum Salmon Declines in Alaska? (last captured on March 1, 2022) (https://www.fisheries.noaa.gov/feature-story/whats-behind-chinook-and-chum-salmon-declines-alaska#:~:text=Changes%20in%20fish%20metabolism%20and,means%20they%20produce%20fewer%20eggs)

currently available genetic identification tools can determine origin only at the scale of Coastal Western Alaska and Upper/Middle Yukon genetic stock reporting groups, not which salmon are likely to return to specific rivers.

If WAK chum returns were to meet escapement goals and a stock became available for subsistence harvest, there would be wide-ranging benefits for inriver users. As many Alaska Natives from the Yukon Kuskokwim region testified at the October 2023 Council meeting, subsistence harvest allows for opportunities to form intergenerational relationships and pass on traditional practices by working together to catch, process, and store salmon.[113] Subsistence harvests also facilitate food security and food sovereignty and support rural economies. These benefits are discussed in section 4.3.5 of the Social Impact Assessment accompanying this DEIS.

Ecosystem impacts

An analysis of ecosystem impacts of various PSC limits was beyond the scope of this summary review. However, in years where a chum PSC limit would have closed the B season for a pollock sector, fish left unharvested would consist of targeted species (i.e., pollock) and PSC (e.g., chum, Chinook salmon, halibut, herring) (section 6.2.6 of the DEIS). If a sector or vessel chooses to modify its fishing behavior to avoid chum by pausing fishing, effort could shift to later in the B season when Chinook salmon are more likely to be caught. At a certain point, PSC limits would become so constraining that no amount of changed fishing behavior would avoid early closures. In that event, less fishing would occur later in the season, decreasing the likelihood of Chinook encounters.

It is challenging to know the exact ecosystem impacts of unharvested fish due to the complexity of food web dynamics. In general terms, more fish left in the water means more prey species available to higher trophic organisms, such as marine mammals. But it also means more pressure on the lower trophic organisms that make up the diet of the unharvested fish. For example, pollock are known to be generalist eaters with diets ranging from crustaceans to worms to fish, including other pollock.[114] If a zero chum PSC limit had been in place from 2011-2022, there would have been forgone pollock and additional chum and Chinook salmon left annually in the marine environment with differing impacts to the environment. Other fish species may experience increased competition for resources. This could lead to shifts in the abundance and distribution of other commercially and ecologically important fish species in the Bering Sea.[115]

[113] North Pacific Fishery Management Council meetings, starting on October 7 (~6:09) and ending on October 8 (~6:09), 2023; https://www.youtube.com/@npfmclive4407/streams.
[114] Alaska Department of Fish & Game (last visited, March 1, 2024) https://www.adfg.alaska.gov/index.cfm?adfg=walleyepollock.main
[115] Siddon, E. 2023. Ecosystem Status Report 2023: Eastern Bering Sea, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council.

Table A-1 AFA pollock sector apportionments of chum PSC limits under pro rata allocation (Alt. 2, Option 3, suboption 3)

Pro rata allocation						
Sector	**%**	**0**	**50k**	**100k**	**150k**	**200k**
CDQ	7.1	0	3550	7100	10650	14200
CP	2.54	0	12700	25400	38100	50800
Inshore	5.84	0	29200	58400	87600	116800
Mothership	9.1	0	4550	9100	13650	18200

Table A-2 Retrospective analysis of impacts of chum PSC limits on pollock harvest and chum PSC during the 2011 to 2022 pollock fishery B seasons.

Calculated using pro-rata sector apportionment		Sum of Forgone B Season Pollock (mt)	Reduction as % of B Season Total	Mean Annual Forgone B Season Pollock (mt)	Sum of B Season Chum Avoided (#)	Reduction as % of B Season Total	Sum of Estimated WAK Chum Avoided (#)	Mean Annual Estimated WAK Chum Avoided (#)	Sum of B Season Ex-Vessel Value Forgone Pollock (real 2022 $)	Sum of B Season Wholesale Value Forgone Pollock (real 2022 $)
0 chum PSC limit 2011-2022	**Total**	**8,715,783**	**100%**	**726,315**	**3,364,568**	**100%**	**591,159**	**49,263**	**3,462M**	**10,779M**
	CDQ	877,006	99%	73,084	227,068	100%	45,431	3,786	349M	1,144M
	CP	3,119,072	100%	259,923	960,180	100%	121,138	10,095	1,240M	4,053M
	Mothership	783,052	99%	65,254	279,813	100%	51,858	4,322	311M	1,019M
	Inshore	3,936,653	100%	328,054	1,897,507	100%	372,731	31,061	1,562M	4,563M
50,000 chum PSC limit 2011-2022	**Total**	**4,648,109**	**53%**	**447,228**	**2,742,812**	**81%**	**472,310**	**39,359**	**1,795M**	**5,617M**
	CDQ	319,649	36%	35,517	187,146	82%	38,082	3,174	118M	399M
	CP	1,598,394	51%	159,839	812,087	84%	101,532	8,461	614M	2,043M
	Mothership	405,279	51%	40,528	223,404	80%	41,084	3,424	157M	525M
	Inshore	2,324,786	59%	211,344	1,520,175	80%	291,612	24,301	905M	2,651M
100,000 chum PSC limit 2011-2022	**Total**	**3,657,087**	**42%**	**368,553**	**2,207,747**	**66%**	**371,311**	**30,943**	**1,399M**	**4,377M**
	CDQ	241,706	27%	40,284	153,552	67%	31,904	2,659	89M	299M
	CP	1,236,108	40%	123,611	677,563	70%	84,814	7,068	470M	1,568M
	Mothership	323,832	41%	35,981	176,180	63%	32,373	2,698	125M	419M
	Inshore	1,855,441	47%	168,676	1,200,452	63%	222,220	18,518	715M	2,091M
150,000 chum PSC limit 2011-2022	**Total**	**2,894,255**	**33%**	**300,045**	**1,710,185**	**51%**	**277,658**	**23,138**	**1,095M**	**3,423M**
	CDQ	213,554	24%	42,711	139,922	61%	29,103	2,425	79M	264M
	CP	955,942	31%	95,594	547,270	57%	69,140	5,762	357M	1,193M
	Mothership	244,723	31%	27,191	138,456	49%	25,548	2,129	93M	314M
	Inshore	1,480,037	38%	134,549	884,537	47%	153,866	12,822	567M	1,652M
200,000 chum PSC limit 2011-2022	**Total**	**2,068,764**	**24%**	**252,293**	**1,203,504**	**40%**	**186,339**	**15,528**	**774M**	**2,435M**
	CDQ	184,178	21%	36,836	114,078	50%	24,081	2,007	68M	226M
	CP	848,644	27%	106,081	417,007	43%	54,518	4,543	315M	1,055M
	Mothership	134,939	17%	19,277	99,887	36%	18,818	1,568	52M	175M
	Inshore	901,003	23%	90,100	572,532	30%	88,922	7,410	339M	978M

Source: NMFS Catch Accounting
Table notes: there are minor discrepancies between the results shown in Table A-2 and those shown in tables of DEIS (sourced from Appendix 6) for a 200,000 chum PSC limit. This is due to a difference in the date from which forgone pollock and avoided chum was calculated. This review used the date that the PSC apportionment was reached to calculate forgone harvest and PSC. The analysis in the DEIS used the end of the week in which the apportionment was reached to calculate forgone harvest and PSC.

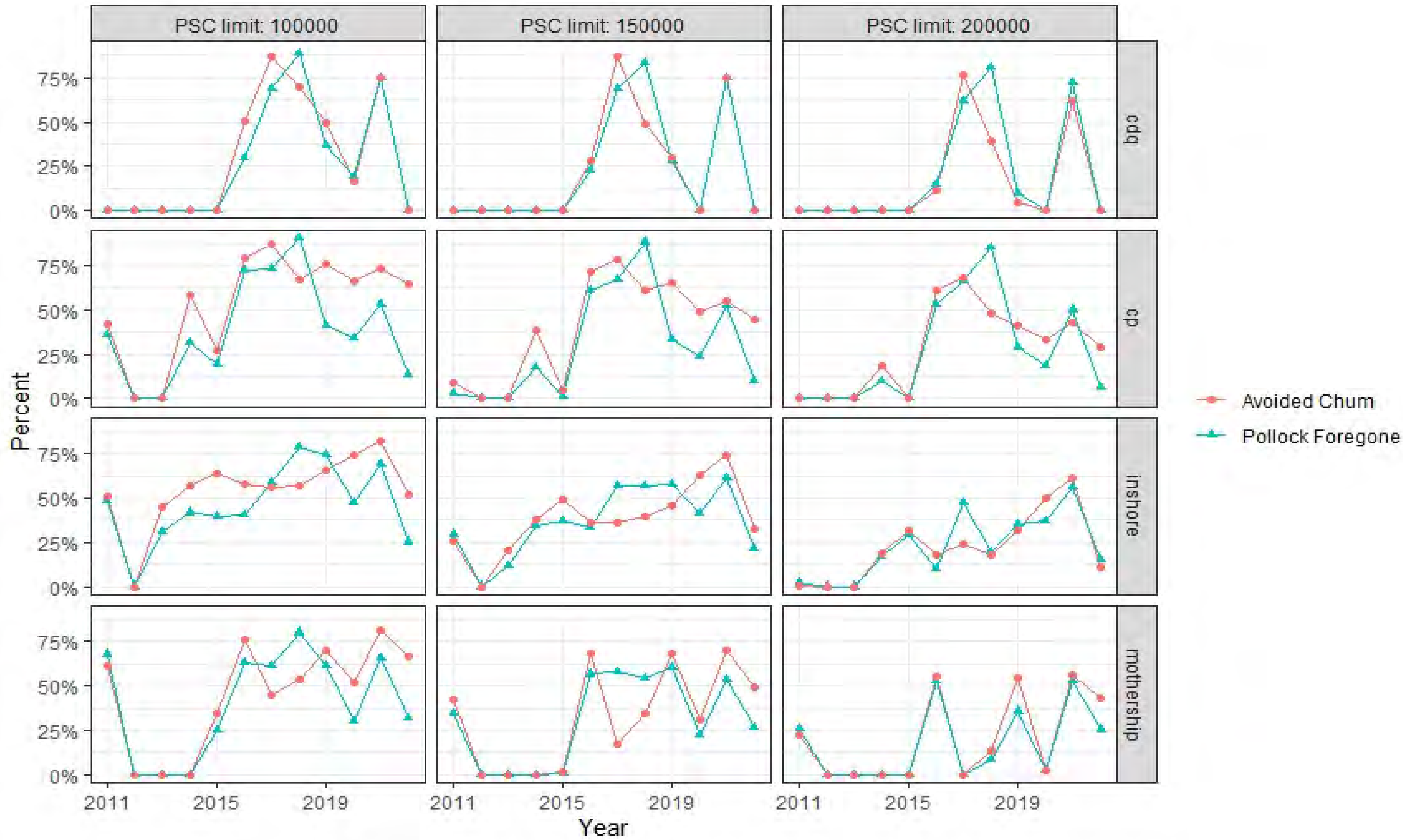


Figure A-1: Pollock forgone as a percent of pollock harvest and chum avoided as a percent of chum encountered by year and sector at 100,000, 150,000, and 200,000 chum PSC limits. Assumes no change in fishing behavior.

Appendix 2 CP IPA Proposal, Alternative 4

POLLOCK CONSERVATION COOPERATIVE

Proposed Alternative 4 Revisions
Western Alaska chum salmon bycatch reduction
February 1, 2024

Executive Summary

The Pollock Conservation Cooperative (PCC) provides scientific guidance to all of the catcher/processors (CPs) active in the Bering Sea pollock fishery. Over the past several months, PCC staff in collaboration with data managers at Sea State and the fleet, explored potential improvements to our existing incentive plan agreements (IPAs) to further minimize bycatch of Western Alaska (WAK) chum salmon.

In addition to assessing the efficacy of the 2022 amendments to our IPA – which were adopted in response to concerns about WAK chum salmon – PCC reviewed over a decade's worth of catch, bycatch, and genetic data to address the North Pacific Fishery Management Council's (Council's) current direction to consider:

- Option 1 trigger 1 and trigger 2 values
- Adjusted base rates to implement a closure
- Adjusted closure area size
- Adjusted closure duration
- Application of the closures to all vessels not just those above the base rate
- Genetic data
- Genetic cluster thresholds
- Additional vessel level incentives/penalties for chum salmon avoidance

We examined expanded closure areas, lower chum salmon base rates for the rolling hot spot program, as well as a range of hypothetical management scenarios in areas of historically higher WAK chum salmon bycatch. Our analysis was designed to explore management improvements that would minimize WAK chum salmon while also minimizing Chinook salmon bycatch.

Our analysis indicated that improving our CP IPA in specific portions of genetic cluster areas 1 and 2 (identified as the "shelf edge" and the "Unimak area" – see Figure 1) would likely result in the greatest potential savings of WAK chum salmon, while also meeting our objective to minimize Chinook salmon bycatch. Because the CP fleet is relatively mobile and fishes in areas of the Bering Sea further north of the shelf edge and Unimak area where lower Western Alaska chum salmon abundance is observed, the potential savings to WAK chum salmon is limited.

Although our existing CP IPA requires that vessel operators manage chum salmon bycatch to avoid areas and times where chum salmon are likely to return to western Alaska, our investigation identified triggered closures in the shelf edge as the CP IPA measure that would likely result in WAK chum salmon savings. Our analysis indicates that the current CP IPA rolling hot spot closures in the shelf edge and Unimak area provide substantial savings to WAK chum salmon.

The 2022 CP IPA provisions adopted by amendment have proven to be effective at avoiding chum salmon and provide the best tools and flexibility to allow the fleet to avoid WAK chums, and minimize

Chinook salmon bycatch, as trend and genetic information becomes available. However, these provisions currently are not required by regulation and can be changed at any time. We recommend the Council establish these changes in regulation and include the following.

1. Require IPAs to use the latest chum salmon genetics information, together with in-season chum bycatch rate information, and pollock catch per unit effort information to ***optimize*** prioritization of bycatch avoidance areas.
2. Require IPAs to prohibit fishing in bycatch avoidance areas for all vessels regardless of performance when ADFG weekly stat area bycatch rates exceed 5 chum per ton of pollock.
3. Require IPAs to develop and implement chum salmon vessel outlier provisions.
4. Require IPAs to monitor for new candidate chum bycatch avoidance areas on a no less than bi-weekly basis.
5. Require IPA member vessels to utilize salmon excluder devices during the pollock B season.
6. Require IPAs to provide weekly salmon bycatch reports to Western and Interior Alaska salmon users to allow for more transparency in reporting.

In addition, given our analysis indicates the shelf edge and Unimak area offer the best opportunity to save WAK chum salmon, there is opportunity for all pollock sectors to establish commensurate protocols while operating in these areas. Chum salmon savings can be maximized by such cumulative efforts.

Background

Differences between in-shore and off-shore fleets

There are significant operational and spatial bycatch differences between the three pollock sectors, especially between the catcher vessel (CV) and catcher processor fleets. The catcher processor fleet generally operates further northwest in genetic clusters 3 and 4 (Figure 1) compared to the CV and mothership fleets which operate more frequently in genetic clusters 1 and 2 (Figure 1). Since 2008, 81% of the AFA CP directed pollock (non-CDQ) catch has occurred in genetic clusters 3 and 4. In addition, the CP fleet is prohibited from fishing in the Catcher Vessel Operational Area (CVOA) during the B season, except when harvesting CDQ quota. As part of our analysis, we examined more refined geographic 'fishing grounds' that better reflect our fishing patterns relative to the more arbitrary genetic cluster spatial areas that were based on equal distribution of genetic samples (see Figure 1B).

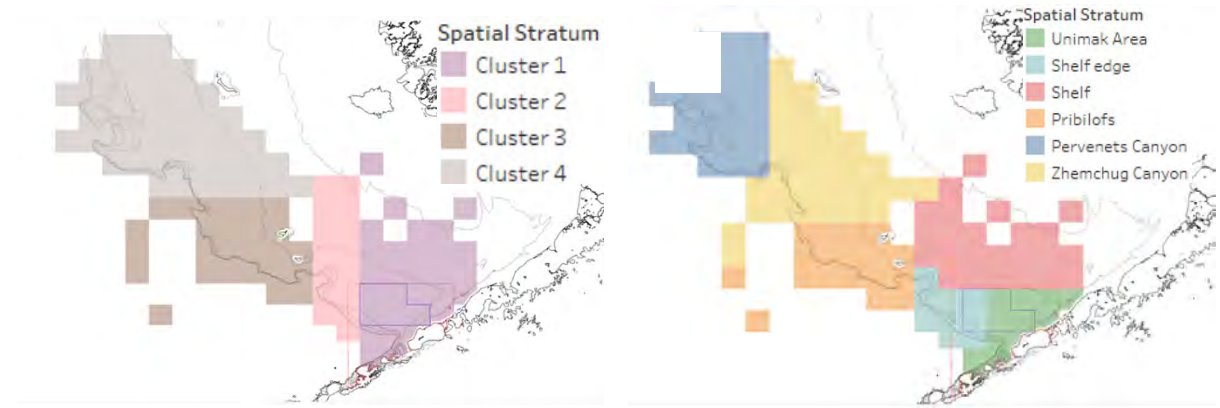


Figure 11-1 Map of genetic clusters (A) and fishing grounds (B). The red box on the map is the CVOA and the blue box is the Chum Salmon Savings Area. (Source: Sea State, Inc.)

Because the CV and CP fleets generally fish in different areas during the B season, and the genetic composition of bycatch is also different between the sectors. These differences directly affect the number of WAK chum taken by each sector.

For instance, based on the most recent year of complete pollock catch and chum salmon bycatch genetics data from NOAA Fisheries in 2022, the catcher processor fleet caught 46% of the directed pollock allocation (491,112 mt of the 1,059,920 mt directed pollock catch) and was responsible for approximately 17% (9,170 of the 54,032) estimated WAK origin chum salmon taken as bycatch in that year. In terms of total chum salmon bycatch, which includes a large proportion of Asian hatchery chum salmon, the CP fleet was responsible for approximately 32% of all chum salmon while harvesting 46% of the directed pollock fishery allocation (Figure 2).

Because of these differences, management strategies that consider the distinct operations of each fleet is the most effective way to address the issue of WAK chum bycatch.

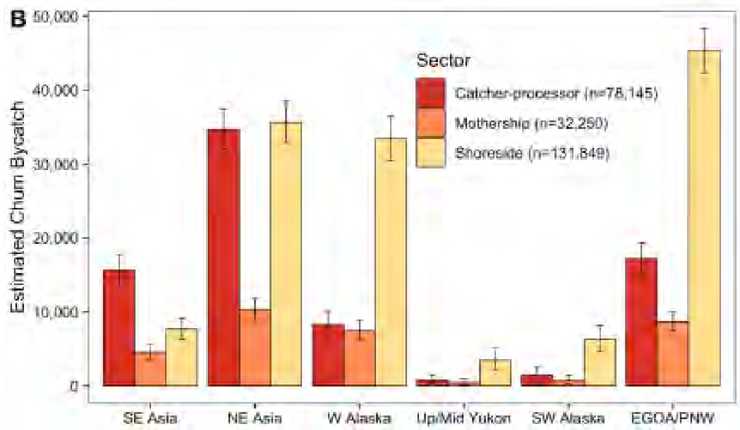


Figure 11-2 2022 Chum Salmon Bycatch Stock ID by pollock sector. (Source: Chum Salmon Genetics Report 2022)

<u>Spatial Distribution of Chum Bycatch</u>

In our analysis of chum salmon bycatch in the pollock fishery, we identified distinct ‘fishing grounds’ where the fleets exhibit consistent fishing patterns. Our analysis showed the two areas that comprised 81% of the total WAK bycatch between 2019 and 2022 were:

1. **Unimak area (Cluster 1):** This area, located entirely within the CVOA, has recorded the highest number of WAK chum bycatch over the time span from 2019 to 2022 (n=101,924).
2. **Shelf edge (Cluster 2):** This area has the second highest total WAK chum bycatch (n=56,716) over the time span from 2019 to 2022.

Analysis of new IPA measures was focused on areas and times when WAK chum encounters have historically been high, in order to develop recommendations to specifically reduce WAK chum bycatch. Figures 3 and 4 provide a visual map of historical genetics data, further illustrating the patterns of WAK chum bycatch.

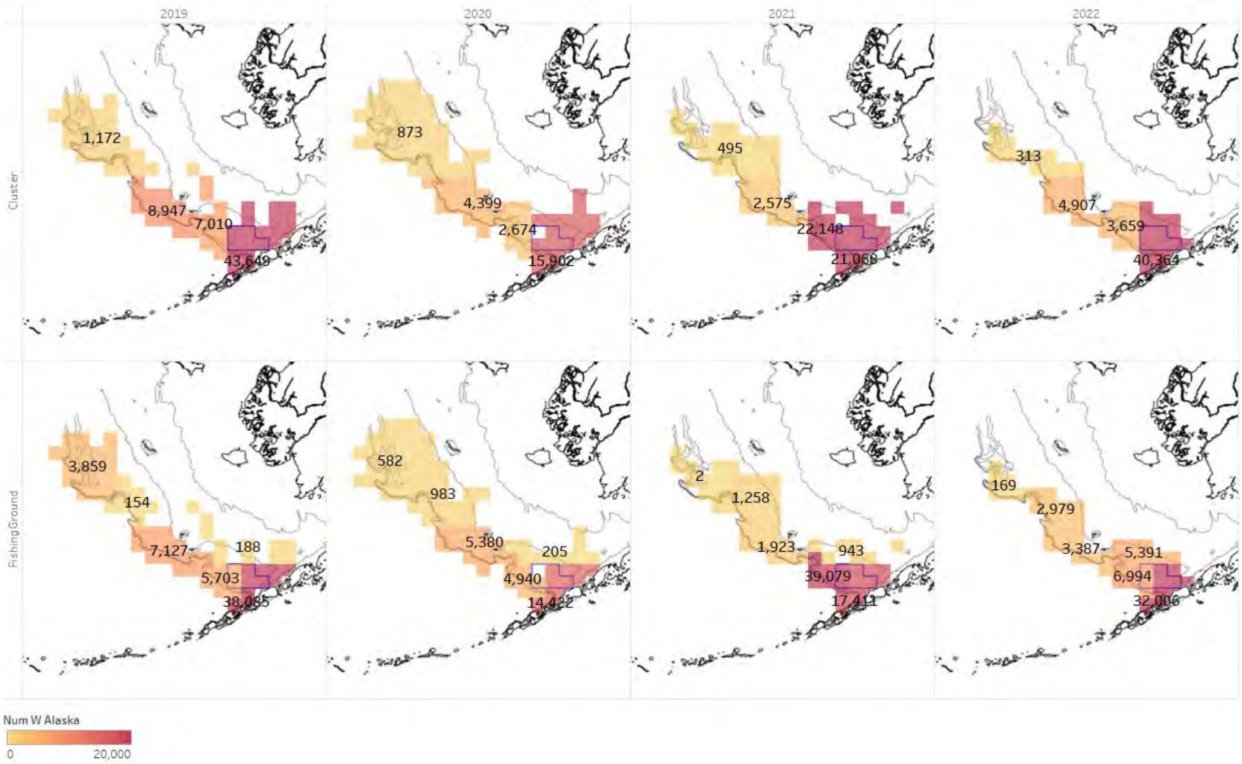


Figure 11-3 Estimated # of WAK chum by Cluster (top) and Fishing Ground (bottom), 2019-2022. (Source; NOAA Auke Bay Lab Genetics Program)

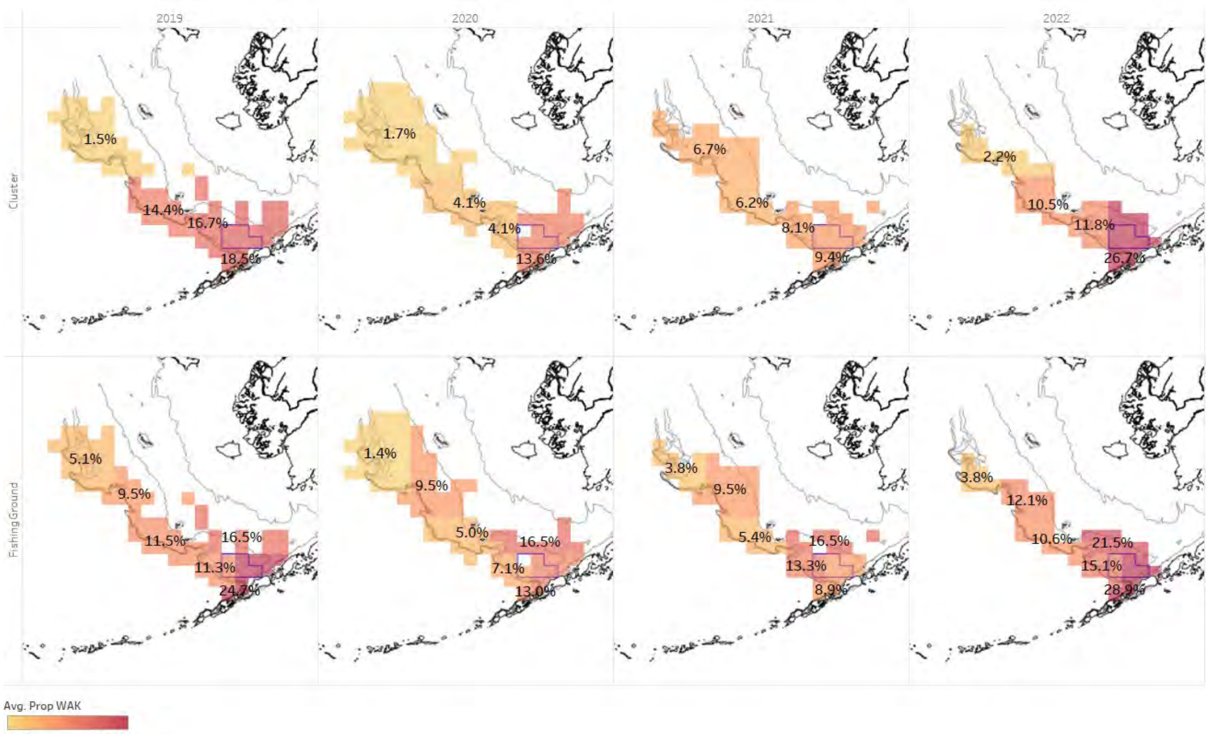
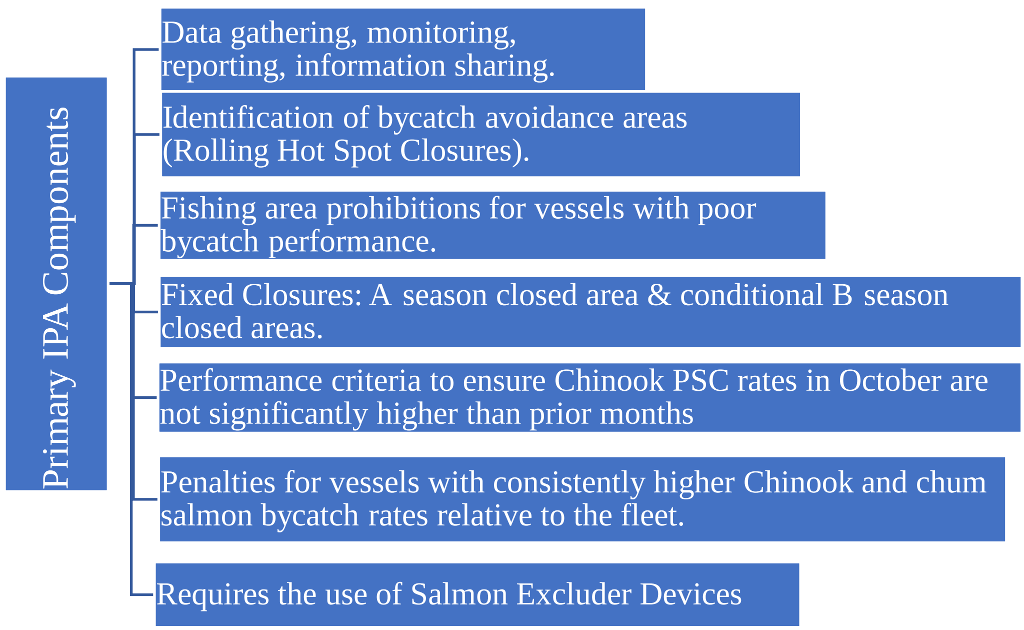


Figure 11-4 Estimated Proportion of WAK chum by Cluster (top) Fishing Ground (bottom), 2019-2022. (Source: NOAA Auke Bay Lab Genetics Program)

IPA Provisions

The Council and NMFS established the Catcher Processor Incentive Plan Agreement (CP IPA) in 2010 following Amendment 91 to the Bering Sea Aleutian Islands Fishery Management Plan. The CP IPA operates on the basic principle of real-time data sharing among all participants in the EBS pollock fishery, which then inform a series of in-season bycatch avoidance areas. Because the CP fleet is relatively small compared to the catcher vessel (CV) fleet, the CP IPA utilizes data from the entire pollock fishery to ensure that all relevant bycatch data is incorporated in the consideration of bycatch avoidance areas. The CP IPA integrates a series of strong incentives to reduce bycatch of salmon at all levels of abundance, with severe financial penalties for non-compliance. The primary incentives and penalties are described below.



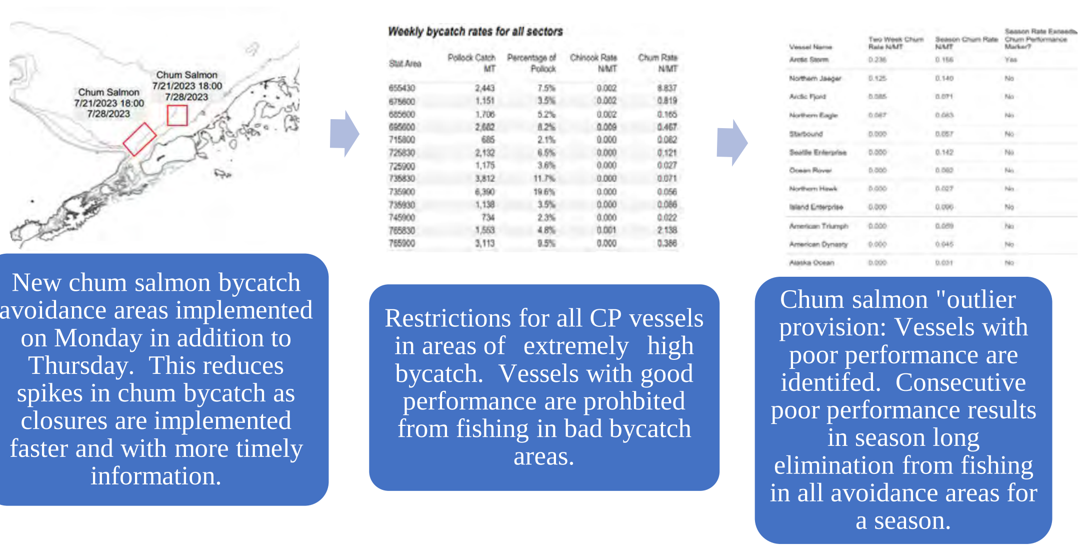
2022 CP IPA revisions

IPAs may voluntarily be amended at any time provided that the amendments are consistent with the IPA regulations, or in response to Council/NMFS changes to the requirements of the IPAs. The CP IPA was amended in 2022 to minimize the incidental catch of WAK chum salmon in response to the collapse of chum salmon runs in the AYK region. While our ability to amend the IPA is voluntary, once the CP IPA is amended, the new revisions are mandatory and binding for all members. The latest CP IPA amendments included measures to:

1.) Increase the responsiveness of the IPA when sudden spikes of chum salmon occur.
2.) Restrict fishing effort in very high bycatch areas regardless of vessel performance.
3.) Improve vessel level accountability by implementing a vessel outlier for chum.

The goal of these amendments was to improve performance of the IPA during times when a high amount of chum salmon are taken in a short period of time and improve vessel level accountability. These amendments are in addition to existing provisions that address the regulatory requirement of the IPA to prioritize avoidance of areas and times where chum salmon are most likely to return to western Alaska. The pollock fleet encounters WAK chum salmon at a higher rate in areas east of 170 degrees West

Longitude (i.e. the Unimak area and shelf edge), therefore existing CP IPA provisions allow larger and more numerous bycatch avoidance areas east of 170 degrees West longitude. Additionally, the "base rate" or bycatch rate threshold at which a bycatch avoidance area is identified is lower in the early B season when WAK chum have historically been more abundant on the fishing grounds.



Efforts to address NPFMC Motion

Several of the bullet points in the Council motion have formally been incorporated in the 2022 CP IPA amendments. For example, the CP IPA has been responsive to:

- '*additional vessel level penalties for chum salmon avoidance*' via implementation of the chum outlier provision,
- '*application of the closures to all vessels, not just those above the base rate'* is currently an element of the CP IPA. All CPs are excluded from high bycatch areas.

While the CP sector currently uses '*genetic data*' to inform the Monday and Thursday closure and avoidance areas, we also contracted Sea State Inc. to investigate two additional pathways to enhance our use of genetic information and further reduce WAK chum salmon bycatch:

1. Increased bycatch avoidance area size in genetic clusters 1 and 2.
2. Reduced base rates in genetic clusters 1 and 2.

First, Sea State Inc. examined the effects of closing entire ADFG statistical areas (much larger closures) in Clusters 1 and 2 when bycatch avoidance areas were identified, instead of the current practice of implementing targeted closures using Vessel Monitoring System (VMS) track data to highlight chum hot spots. This was intended to address the Council motion bullet "*adjusted closure area size*". The performance metrics for the "Stat Area Closure" model were variable across years and did not yield consistent savings of WAK chum, despite the much larger closure area size on average. This is likely because chum salmon often occur in localized areas at very narrow depth ranges that allow for more targeted closures, with larger closures resulting in greater movement of the fleet while achieving no additional salmon savings.

Table 11-1 Performance metric results for "Stat Area Closure" model.

Year	Season duration (Weeks)	WAK chum difference	Proportion WAK % difference	Chinook difference
2018	40	-693	-0.85%	-17
2019	43	-7	-0.21%	-122
2020	44	-240	-7.05%	-53
2021	39	-1,581	-2.59%	-31
2022	39	84	-3.65%	-7
Average	41	-487	-1.08%	-46

Second, the effects of reducing base rates by 25% (75% Base Rate) and 50% (50% Base Rate) in genetic clusters 1 and 2 (where WAK chum predominately occur) were explored, which essentially lowers the threshold at which bycatch avoidance areas are identified, thereby increasing their frequency. This was intended to address the Council motion bullet *adjusted base rates to implement a closure*. Appropriate base rate floors are critical for the effectiveness of the rolling hot spot program, because at a low base rate level, the base rate becomes counterproductive to reducing bycatch because the net result is to constantly move the fleet around: potentially into areas of higher bycatch.

The results shown below under the 75% Base Rate and 50% Base Rate models yield modest WAK chum savings for the CP fleet, while identifying a clear Chinook salmon bycatch tradeoff as base rates for chum salmon are reduced.

Table 11-2 Performance metric results for 75% Base Rate model.

Year	Season duration (Weeks)	WAK chum difference	Proportion WAK % difference	Chinook difference
2018	40	-693	-0.85%	-17
2019	43	-161	-2.52%	126
2020	44	-240	-7.05%	-53
2021	39	-1,581	-2.59%	-31
2022	39	-8	-3.92%	-8
Average	41	-537	-1.68%	3.6

Table 11-3 Performance metric results for 50% Base Rate model.

Year	Season duration (Weeks)	WAK chum difference	Proportion WAK % difference	Chinook difference
2018	40	-693	-0.85%	-17
2019	43	-289	-3.51%	273
2020	44	-240	-7.05%	-53
2021	39	-1,581	-2.59%	-31
2022	39	9	-3.60%	-5
Average	41	-559	-1.85%	34

The base rate reduction and stat area closure model results show relatively small average WAK chum savings over the past 5 years. The results also demonstrate that the existing base rate floors are appropriate and effective at moving the fleet and saving salmon. The base rate floors were established using years of bycatch data prior to the implementation of Amendment 91 and are designed to avoid rolling hot spot closures that only result in closures that shift fishing effort, with no reduction in chum bycatch (Figure 5).

The analysis indicates modifying both base rates and increasing the size of bycatch avoidance areas beyond the existing CP IPA provisions would likely result in increased Chinook bycatch by extending the length of the season or increase chum salmon bycatch by moving vessels to areas that may not provide chum salmon savings. Our assessment is that the existing base rates best balance the need to avoid chum salmon while not increasing Chinook salmon bycatch.

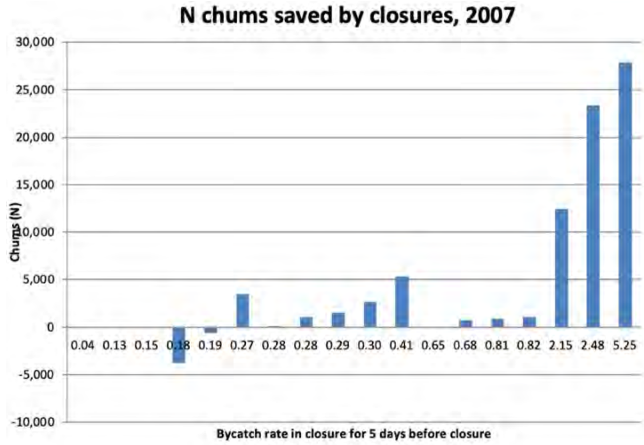


Figure 11-5 Historical Base Rate Floor Evaluation

In addition to evaluating base rates and larger area closures, the CP and CV sectors contracted Sea State, Inc. to evaluate three hypothetical management scenarios relative to the status quo. The management scenarios were intended to explore the effectiveness of various management approaches to reducing WAK chum salmon bycatch. The analysis summarized total and WAK chum catch by area and sector on a weekly basis during the B-season from 2011 to 2022 and redistributed fishing effort based on multiple aspects of fleet dynamics specific to each sector. The model also implements the current IPA rules for salmon bycatch avoidance areas simultaneously for all three pollock sectors.

The key performance criteria estimated by the model under the alternative management scenarios are 1.) the estimated impacts on WAK chum salmon and 2.) the length of the B-season (an outcome of decreased pollock CPUE). The objective was to find a policy that minimizes WAK chum bycatch without increasing the length of the season, which is associated with increased risk of Chinook salmon bycatch later in B-season. The model used in this “scenario planning” analysis is conditioned on historical data; therefore, past performance of each alternative policy does not necessarily predict future performance.

Scenario Planning Results

The existing regulations require that the incentive(s) to avoid chum salmon do not increase Chinook salmon bycatch, therefore any scenario with a “likely” longer B season indicates higher Chinook bycatch and would be inconsistent with current regulations.

The spatial and sector level genetics information presented suggests that the Unimak area and the shelf edge are the primary areas to focus chum salmon avoidance efforts, as these areas have recently comprised approximately 81% of all WAK chum salmon taken in the pollock fishery in the most recent years of relatively higher chum salmon bycatch (2019-2022). The combination of limiting chum salmon bycatch in the CVOA and shifting pollock fishing effort to the northwest Bering Sea is the most obvious management solution to reduce WAK chum salmon bycatch; however, this is not operationally feasible for the catcher vessel fleet and would only serve to extend the pollock season, likely increasing Chinook bycatch.

The modeled management scenario results suggest that **reducing chum salmon catches along the shelf edge fishing area by all pollock sectors results in the most frequent and likely savings of WAK chum** while not extending the season. Focusing on the shelf edge for chum salmon avoidance provides the biggest ‘bang for the buck’ because chum bycatch rates are higher along the shelf edge compared to the Unimak area. The Unimak area has the highest relative WAK chum proportion, but typically experiences slightly lower overall bycatch rates due to higher pollock CPUE in most years.

For the CP fleet, the existing rolling hot spot program already implements targeted shelf edge closures, which are based on catch information from both CV and CP vessels. Therefore, additional chum salmon savings in the shelf edge from the CP fleet may be limited. The CP IPA incorporates catch information from the CV fleet when establishing rate-based avoidance areas. This inclusion provides greater resolution of bycatch information and allows for more informed and strategic closure areas.

The model further highlights that re-distribution of fishing effort to areas of high pollock CPUE, higher WAK chum proportions at lower chum salmon bycatch rates, produces a better result for WAK chum salmon than re-distribution of effort to areas of low pollock CPUE, and lower WAK chum proportions at higher overall chum bycatch rates.

This result is counterintuitive to prioritizing WAK chum salmon bycatch avoidance based solely on avoiding areas with the highest relative proportion of WAK chum in the historical genetics. The most optimal management outcome carefully balances tradeoffs of moving the fleet from one fishing area to another. For instance, if a net positive management outcome is desired for WAK chum salmon, three things must be true when closing area "A" to a fleet of fishing vessels, resulting in movement of the fleet to area "B" (Δ=the relative change between area A and B):

1.) $\Delta Pollock\ CPUE$ must be ≥ 0, unless $\Delta Pollock\ CPUE > \Delta WAK\ chum\ bycatch\ rate$.
2.) $\Delta WAK\ chum\ bycatch\ rate$ must be < 0.
3.) $\Delta Chinook\ bycatch\ rate$ must be ≤ 0.

For example, a temporal pollock fishing closure for the Unimak area (the area with the highest proportion of WAK chum) is estimated to result in higher bycatch of WAK chum salmon. The net result is a longer season, and higher total chum and WAK chum catches. This is because the displaced fishing effort is moved into areas with lower pollock CPUE, and higher chum bycatch rates—at a slightly lower WAK proportion—relative to the Unimak area. Thus, the most intuitive management solution is not optimal.

A temporal pollock fishing closure of the shelf edge displaces both CV and CP fishing effort because both fleets routinely fish in the area during the B season, thereby maximizing the overall chum salmon savings contributions across all sectors.

The scenario planning model results validate the effectiveness of the current CP IPA rolling hot spot program prioritization of chum salmon bycatch avoidance areas on the shelf edge. The shelf edge has been the predominant area for bycatch avoidance areas within cluster 1 and 2 for the CP fleet (Figure 6). The combination of finely tuned base rates and CP rolling hot spot closures that are based on complete pollock fishery data have resulted in targeted closures on the shelf edge at times during high chum salmon bycatch.

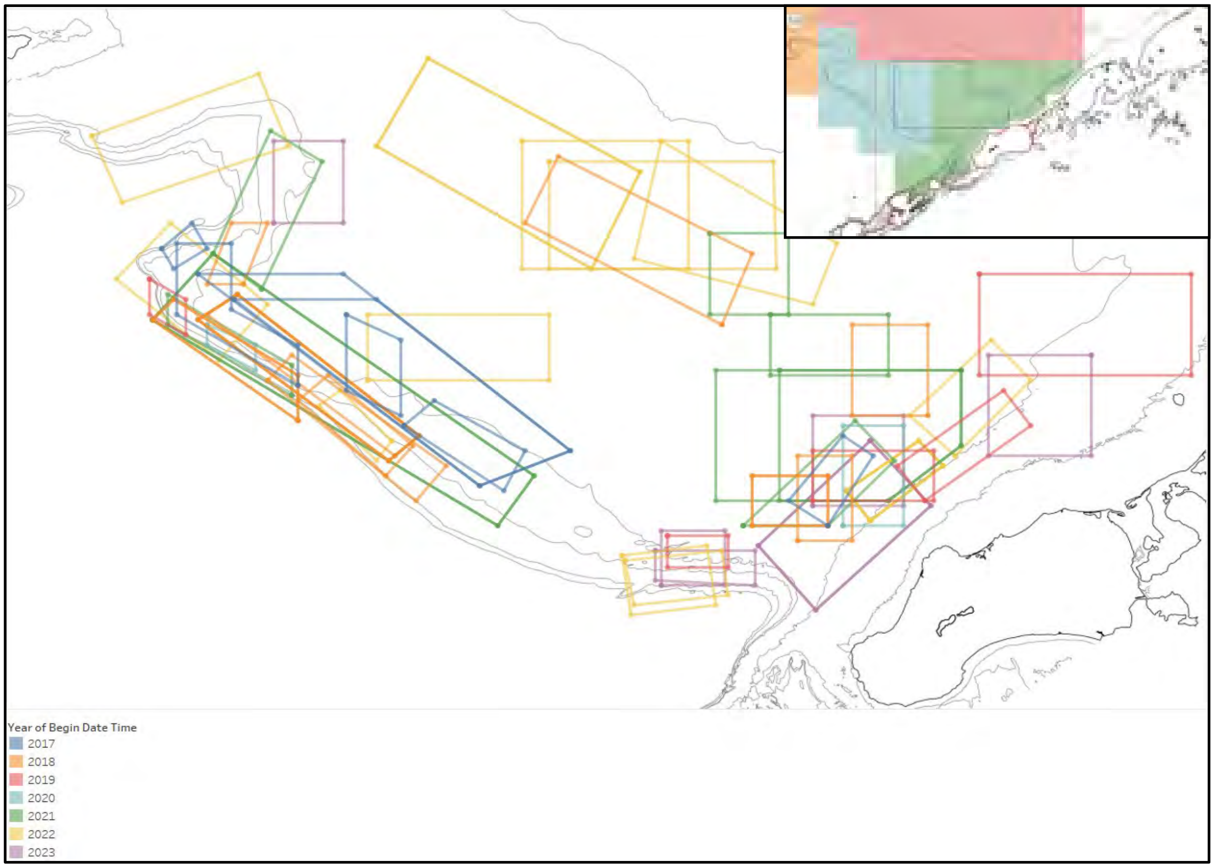


Figure 11-6 All CP Chum salmon Bycatch Avoidance Areas within cluster 1 and 2 2017-2023. (Source: Sea State, Inc.)

<u>Inclusion of Local and Traditional Knowledge</u>

The NPFMC requested that any Alternative 4 proposals should consider a process to include local and traditional knowledge from Western and Interior Alaska salmon users in the development of IPA measures. Our process took two approaches. First, we reviewed the relevant literature from a LKTK search engine query. Review of this information was informative but did not include information on the areas in the Bering Sea where the CP pollock fishery occurs. Second, we reviewed public comment for potential local knowledge suggestions. Our review did identify instances of the public suggesting the pollock fishery create corridors, or closures, during times and areas when WAK chum salmon are transiting the southeastern Bering Sea. Our approach of tuning the rolling hot spot program to implement closures during specific times and areas when WAK chum salmon are encountered is an attempt to be responsive to establishing corridors.

Formal Recommendations

Currently the 2022 CP IPA provisions adopted by amendment have proven to be effective at avoiding chum salmon and provide the best tools and flexibility to allow the fleet to avoid WAK chums as trend and genetic information becomes available. However, these provisions currently are not required by regulation and may be changed at any time. We recommend the Council establish these changes in regulation and include the following.

1. Require IPAs to use the latest chum salmon genetics information, together with in-season chum bycatch rate information, and pollock catch per unit effort information to ***optimize*** prioritization of bycatch avoidance areas.

2. Require IPAs to prohibit fishing in bycatch avoidance areas for all vessels regardless of performance when ADFG weekly stat area bycatch rates exceed 5 chum per ton of pollock.
3. Require IPAs to develop and implement chum salmon vessel outlier provisions.
4. Require IPAs to monitor for new candidate chum bycatch avoidance areas on a no less than bi-weekly basis.
5. Require IPA member vessels to utilize salmon excluder devices during the pollock B season.
6. Require IPAs to provide weekly salmon bycatch reports to Western and Interior Alaska salmon users to allow for more transparency in reporting.

In addition, given our analysis indicates the shelf edge and Unimak area offer the best opportunity to save WAK chum salmon, there is opportunity for all pollock sectors to establish commensurate protocols while operating in these areas. Chum salmon savings can be maximized by such cumulative efforts.

Future Considerations

Climate change poses large risks for all fisheries. Western Alaska chum salmon runs have shown steep declines in the years following an unprecedented lack of sea ice in the Bering Sea during 2018 and 2019. There have been large migrations of Russian and other Asian hatchery chum salmon stocks into the Bering Sea region especially in years when marine heatwaves persisted in the Gulf of Alaska. Spatial and temporal patterns of chum salmon bycatch are highly dependent on cold pool extent in the Bering Sea. Additionally, the spatial and temporal patterns of WAK chum migrations are not well known.

Establishing defined spatial and or temporal closures or bycatch caps based on the patterns of today, ignores the need for flexibility and adaptation moving into an uncertain future. Furthermore, establishing universal incidental chum salmon catch rates coupled with a historical genetic proportion of WAK chum salmon whereby avoidance is triggered, ignores the dynamic in-season data that must be considered to truly “optimize” the movement of a fishing fleet in real-time. IPAs can be modified at any time to adapt to new data and become effective upon NMFS approval. The Council’s innovative IPA management structure is the most effective tool for optimizing bycatch avoidance both now and into an uncertain future.

Appendix 3 Inshore SSIP and MSSIP Proposal, Alternative 4

BSAI Chum Salmon Bycatch October 2023 - Council Motion, Alternative 4

United Catcher Boats (UCB) and Midwater Trawlers Cooperative (MTC) Chum Salmon Bycatch Work Group Proposal, February 1, 2024

Introduction

Of the three sectors that make up the AFA pollock fishery the vessels that belong to the inshore and mothership sectors are catcher vessels. The catcher vessels in the inshore sector deliver their catch from multiple hauls shoreside, and catcher vessels in the mothership sector deliver individual hauls to a mothership. These two sectors operate more similarly to each other than to the catcher processors. Due to operational differences between catcher vessels and catcher processors, two separate work groups were formed to address the council's request for proposals of incentive plan agreement changes.

One of the main operational requirements for catcher vessels is their need to stay within a certain proximity to either their shoreplant or their mothership. The catcher processors are self-contained and not tethered to a processor and can fish much further offshore. Inshore catcher vessels are tethered to their shoreplants which limits the distance the vessel can travel and meet cost effective delivery requirements. The nature of catching a trip's worth of catch, about 2-3 hauls, before delivering to a processor also adds a lag in the data for the inshore catcher vessels. The mothership catcher vessels can, to a degree, move further west but still must stay with the mothership and consider safety for the crew and vessel since they too are smaller vessels. They don't have the same lag in data like the inshore catcher vessels, however they rely on data from multiple catcher vessel at-sea deliveries to inform the mothership of fishing conditions. Catcher vessels are smaller, tend to fish in aggregate, and are not able to redistribute fishing effort west like catcher processors can. Due to these constraints, there is a lag in their data between the time of harvest and when data becomes reportable. Salmon bycatch management measures in the current mothership and inshore salmon savings incentive plan agreements are similar and the two catcher vessel sectors have worked together to analyze data, evaluate measures, and develop potential provisions to their incentive plan agreements.

Sea State Inc., the monitoring agent used to analyze harvest information and implement the rules of the incentive plan agreements (IPAs), developed a "Scenario Planning" framework in which to evaluate potential changes to the business rules in the current incentive plan agreements and the potential changes to impacts on Western Alaska chum salmon bycatch. Key to this framework is an analytical model that replays the historical fishery between 2011 and 2022 and redistributes fishing effort in response to the proposed changes in the incentive plan agreements that are intended to make predictions about the risk of intercepting Western Alaska chum salmon, as well as reduce and/or avoid encounters of Western Alaska chum salmon under each alternative policy. The model also captures the potential tradeoffs associated with extending the season length and the impacts on other prohibited species catch (PSC), including Chinook salmon. Lastly, the model also implements the current incentive plan agreement rules for salmon bycatch avoidance areas simultaneously for all 3 sectors. Sea State then constructed four made-up alternative "Scenarios" and compared the relative impacts on Western Alaska chum salmon and season length in response to alternative policies.

The two work groups defined above, both used the same aforementioned framework developed by Sea State to quantify and attempt to fine tune policies that would minimize the risk to Western Alaska chum salmon with minimum impacts on pollock catch per unit effort (CPUE). The key performance criterion considered in the model for evaluating alternative chum policies are the estimated impacts on Western Alaska chum salmon and the length of the B season. The management objective is to find a policy that minimizes Western Alaska chum bycatch without increasing the length of the season and therefore increasing chinook salmon bycatch. The model used in this "Scenario Planning" framework is conditioned on historical data; therefore, past performance of each alternative policy does not necessarily predict future performance. Nonetheless, the modeling framework was adopted by both work groups as an aid to learn how movement and displacement of effort from specific areas, at specific times, would be expected to impact Western Alaska chum salmon and pollock catch rates.

Catcher Vessel Fleets' Proposal : "Catcher Vessel Chum Reduction Plan"

Industry representatives from the pollock inshore and mothership catcher vessel sectors acknowledge the significance of chum salmon of Western Alaska origin. Recent studies, including a 2022 report by NOAA AFSC[116], indicate that climate change and factors like rising temperatures are contributing to the decline in Western Alaska chum salmon populations. Despite these challenges, catcher vessels are committed to continue minimizing Western Alaska chum bycatch as much as possible. The existing incentives in the incentive plan agreement continue to work at all levels of chum salmon and pollock abundances.

In response to the NPFMC's request outlined in Alternative 4 of their October 2023 Motion, the catcher vessel work group conducted thorough data analysis and evaluated various bycatch avoidance strategies. This proposal details the current chum avoidance measures employed by catcher vessels, insights from the monitoring agent's analysis, and the assessment of multiple strategies, culminating in the recommendation of four specific provisions.

These provisions, intended to be integrated into the catcher vessel incentive plan agreements, were selected based on their compatibility with current fishing operations, effectiveness in reducing or avoiding chum bycatch during the B season, and potential for enhancing avoidance in areas with high estimated Western Alaska chum bycatch.

Current catcher vessel fleet chum avoidance

The catcher vessels in both the mothership sector and the inshore sector operate under salmon savings incentive plan (SSIP) agreements. These are also referred to as the sectors' Incentive Plan Agreements (IPAs). As mentioned, the sectors have slightly different operations, but both inshore and mothership catcher vessel sectors have similar chum avoidance measures. In addition to using salmon excluders, both sectors use a chum rolling hotspot program. The monitoring agent collects and analyzes data, monitors the fleet, and reports necessary information to implement the rolling hotspot salmon closures. A chum rolling hotspot closure is determined by comparing the weekly chum bycatch for ADF&G stat areas against the weekly base rate. The base rate is a threshold bycatch metric which vessels are also incentivized to stay below. To determine the chum base rate for the week, the monitoring agent calculates the average weekly rate of chum salmon bycatch per metric ton of pollock of the sector during the most recent three weeks, as of each Thursday. The chum salmon base rate is the average bycatch rate calculated by the monitoring agent, provided that the base rate cannot be increased by more than twenty percent per week during June and July. The monitoring agent then calculates the chum salmon bycatch rates for each ADF&G stat area, as well as the chum salmon bycatch rate per metric ton of pollock per catcher vessel in each ADF&G area. The monitoring agent thus determines if any areas are appropriate for a chum closure, and assigns a tier status to the catcher vessels, which indicates whether they are subject to the week's chum closure. The chum closure is reported directly to the fleet on Thursday and becomes effective Friday night until the following Friday night.

Fishing for pollock inside the chum closure is not permitted for tier 2 vessels; however, tier 1 vessels are those that earned access to fish pollock inside the chum closure. Catcher vessels receive a weekly tier assignment based on their chum bycatch rate compared to the weekly base rate. A vessel with a chum

[116] NOAA Alaska Fisheries Science Center (2022, August 23). *What's Behind Chinook and Chum Salmon Declines in Alaska?* NOAA Fisheries. Retrieved January 31, 2024 from https://www.fisheries.noaa.gov/feature-story/whats-behind-chinook-and-chum-salmon-declines-alaska#:~:text=Changes%20in%20fish%20metabolism%20and,means%20they%20produce%20fewer%20eggs)

bycatch rate equal to or less than the base rate is assigned to tier 1. Due to operational dynamics, tier assignments in the mothership sector are made at the fleet, rather than the individual processor level.

The incentive for a vessel keeping its chum bycatch relatively low is that it earns access to fish pollock inside the weekly chum closure, whereas tier 2 vessels are subject to the chum closure. Tier 1 vessels sometimes choose to not fish inside a weekly chum closure area even though they are allowed to do so as not to risk increasing their chum bycatch rate. However, there are also times when fishing conditions elsewhere are poor and earning access to a closure area that was producing pollock is important to some.

In 2022 and 2023 B season the catcher vessel managers and the monitoring agent implemented voluntary chum advisory avoidance areas. These advisory avoidance areas utilize historical chum catch and genetic composition data to determine the additional avoidance areas. Rather than including this provision into the salmon savings incentive plan agreement immediately, the advisory avoidance areas remained voluntary so as to gather more data on their effectiveness. The results from the advisory avoidance areas were taken into account when analyzing fishing ground areas and evaluating measures when developing provisions. The 2023 chum bycatch genetics report has not been released prior to this proposal. However, once it is available, the information will be assessed and applied where applicable.

The sectors' salmon savings incentive plan agreements and annual incentive plan agreement reports can be found on the NMFS and NPFMC websites, respectively.

Analyses

To evaluate avoidance measures and develop the proposed provisions below, the catcher vessel representatives used multiple analyses that were made available to their work group. Initially a simulation was built to model the impacts of displacing the catcher vessel fleet in response to adjusted base rate and closure size. Then an additional tool, the "Scenario Planning" framework, was built more specific to evaluating additional spatial and temporal measures. The "Scenario Planning" framework allowed the work group to consider the effects and tradeoffs of closures in certain areas specific to Western Alaska chum. As the development of potential provisions began, some additional analyses were developed around specific design aspects of these provisions. There are some obstacles to modeling displacement effort. Therefore, the results were approximate but relative in addressing key concepts. Modeling fishing effort displacement is based on many assumptions. This is due to fleet behavior, fishing efficiency, and bycatch performance all being highly variable fishing dynamics. The fishery managers can counter some of the highly variable fishing dynamics with a human element that is necessary for salmon bycatch management to function in the pollock fishery.

In order to use these analyses as tools for examining the effects of various measures, the following set of performance metrics was developed: 1) Amount of pollock catch - if pollock catch was lower than the status quo, this would imply a longer season length in order to catch each sectors' annual pollock quota; 2) Number of Chinook caught as bycatch; 3) Total chum bycatch; 4) estimated Western Alaska chum bycatch- this was calculated by applying each year's genetic stock proportions by cluster and time period to the statistical area and time period when the catch would have occurred; 5) Estimated hatchery chum bycatch -this was calculated the same way as the estimated Western Alaska chum bycatch, but assumed hatchery chum were NE Asia, SE Asia, and 50% of SW Alaskan chum; and 6) Redistributed effort, i.e., fishing events (number of fish tickets) for the catcher vessel fleet. Lastly, after measures were evaluated, and provisions were developed, the functionality of the provision in day-to-day fishery management was considered.

Adjusted base rates

The analysis of adjusted base rates in the chum rolling hotspot program were done via a simulation which was based on assumptions of where catcher vessels would have moved to or had been displaced to in response to a chum closure. Adjusting base rates lower are likely to force the fleet to move more which likely leads to highly variable and differential impacts on pollock catch, Western Alaska chum, and Chinook. When the data from 2008-2023 were combined, reducing base rates by 50% resulted in increased redistributed effort, and by extension, increased Western Alaska chum bycatch estimates, and by temporal extension of the pollock fishery, increased chinook bycatch estimates. The results varied year to year. Due to myriad variables related to fishing efficiency and bycatch performance, the effects of an adjusted base rate were not linear.

Adjusted Closure Size

The analysis of adjusting the size of a chum closure was also done via the simulation. Due to highly variable fishing dynamics and annual variability, expanded closure area simulations indicated no clear benefit or impact to Western Alaska chum. However, expansion of closure area size would likely extend the season, resulting in a likely increase of Chinook encounters, and result in forgone pollock. The probable reason for large closure areas to have no clear benefit nor impact on Western Alaska chum is because bycatch encounters aren’t always widespread and are often tightly aggregated.

Adjusted closure duration

Adjusting the duration of the closure was analyzed via an additional analysis. This analysis looked at July closures that would last for 2 weeks. It was again determined that the effects of a longer duration would be highly variable since the efficacy of a chum closure is based on highly variable fishing dynamics. Functionally, a closure can already be extended or re-issued under current management measures by the monitoring agent if appropriate. Weekly data assessment and a one-week duration for closures are appropriate to account for the variable fishing dynamics. In sum, a longer closure duration reduced the adaptive value of the chum rolling hotspot closure without appreciable benefit.

Application of closures to all vessels

Since tier 1 vessels earn access to fish pollock inside the chum closures, the catcher vessel work group considered multiple ways to remove or adjust tier designation. Removing the tier designation entirely was considered first. However, complete removal would likely impact the behavior of the fleet by eliminating an incentive that rewards vessels for good performance. It would also remove the opportunity to conduct infrequent but strategically important test tows inside a closure. Test tows are beneficial in times when the fishing conditions outside the closure are poor or when considering to re-issue the closure. Rather than removing the tiers completely, multiple measures that would result in tier 1 vessels being subject to the closure were considered. This method retains the current incentives but should provide additional incentives for the vessels and the fleet as a whole to keep their chum bycatch relatively low.

Genetic Data

The catcher vessel fleet does not currently have access to in-season genetic testing but supports efforts to develop in-season genetic testing capabilities. When it does become available and reliable, they support the analysis of it as well as when and how it can be used to develop additional Western Alaska chum avoidance measures. The best available genetic data for chum is that from the annual Genetic Stock Composition Analysis of Chum Salmon Prohibited Species Catch provided by the geneticists at the Alaska Fisheries Science Center: Auke Bay Laboratory. The historical genetic composition data was incorporated into the simulation and the scenario analyses. The results from the two analyses were then used to inform the development of new proposed provisions. Proposed provision 1 is responsive to how genetic data can be used in the catcher vessels’ salmon bycatch management.

Genetic cluster thresholds.

While this spatial data is useful, a genetic cluster (Figure 1) is quite broad when applied to finer scale management measures. NMFS geneticists at Auke Bay provided a finer spatial scale, fishing ground areas (Figure 2). The boundaries of the fishing ground areas closely match the common fishing grounds in the Eastern Bering Sea most commonly used by pollock catcher vessels. Both the genetic clusters and the fishing ground areas were incorporated into the simulation and "Scenario Planning" framework to identify potential times and areas to avoid to potentially reduce estimated Western Alaska chum bycatch. The "Scenario Planning" framework revealed that two areas were more likely to have had Western Alaska chum bycatch: the shelf edge and Unimak fishing ground areas.The suite of performance metrics was applied to the results for closures in the shelf edge and Unimak fishing ground areas. The results indicated that chum bycatch avoidance in the shelf edge area is more likely to reduce Western Alaska chum bycatch and not have as much impact on the pollock B season as would a potential closure in the Unimak fishing ground area. The "Scenario Planning" framework results from a potential closure in the Unimak fishing ground area indicated the catcher vessel fleets would potentially experience foregone pollock or longer season length, however, extended season length is often associated with higher Chinook bycatch rates. The importance of these two fishing ground areas, as well as finer spatial bounds, will be incorporated in proposed provision 1 which adds an assessment of the likelihood of Western Alaska chum, spatially and temporally, to the weekly chum rolling hotspot program.

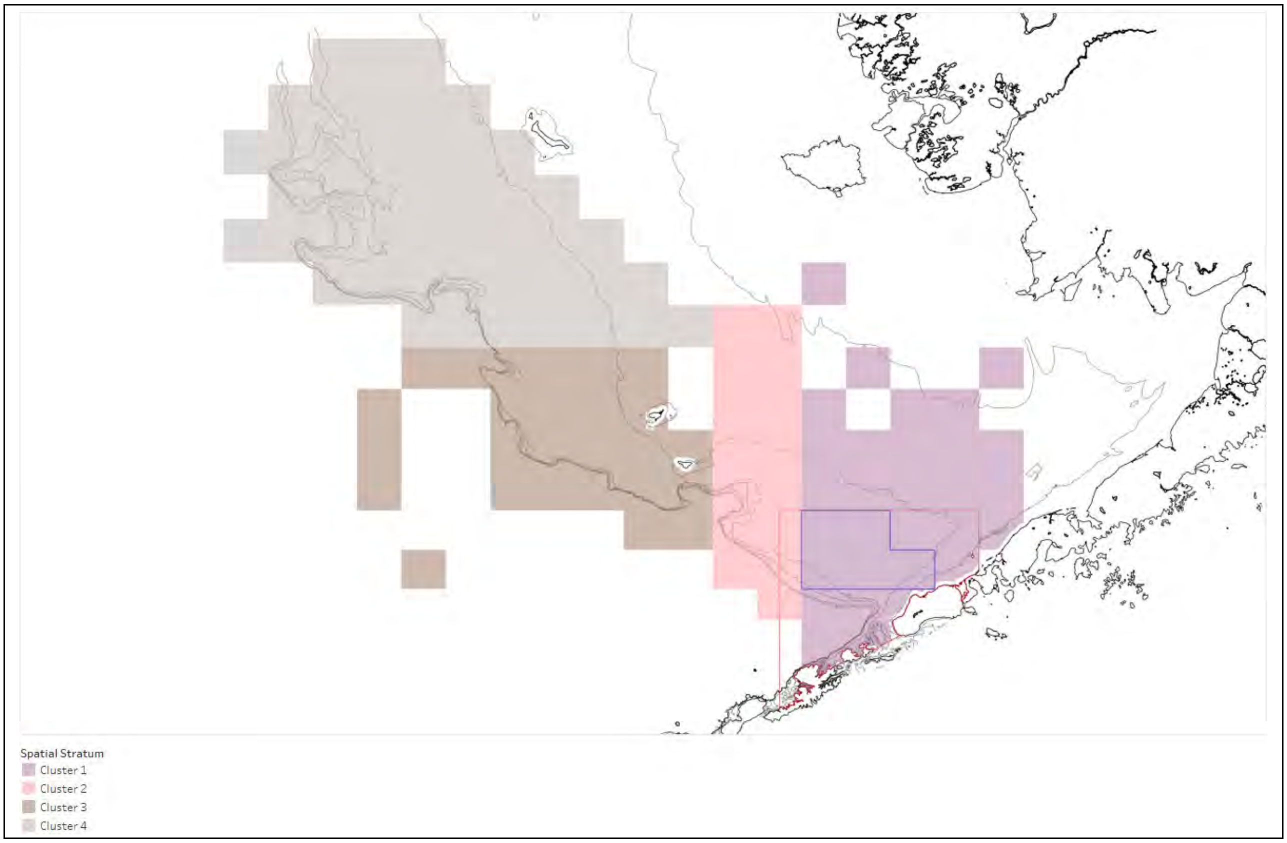


Figure 1 Map of genetic clusters used to estimate genetic stock proportions.

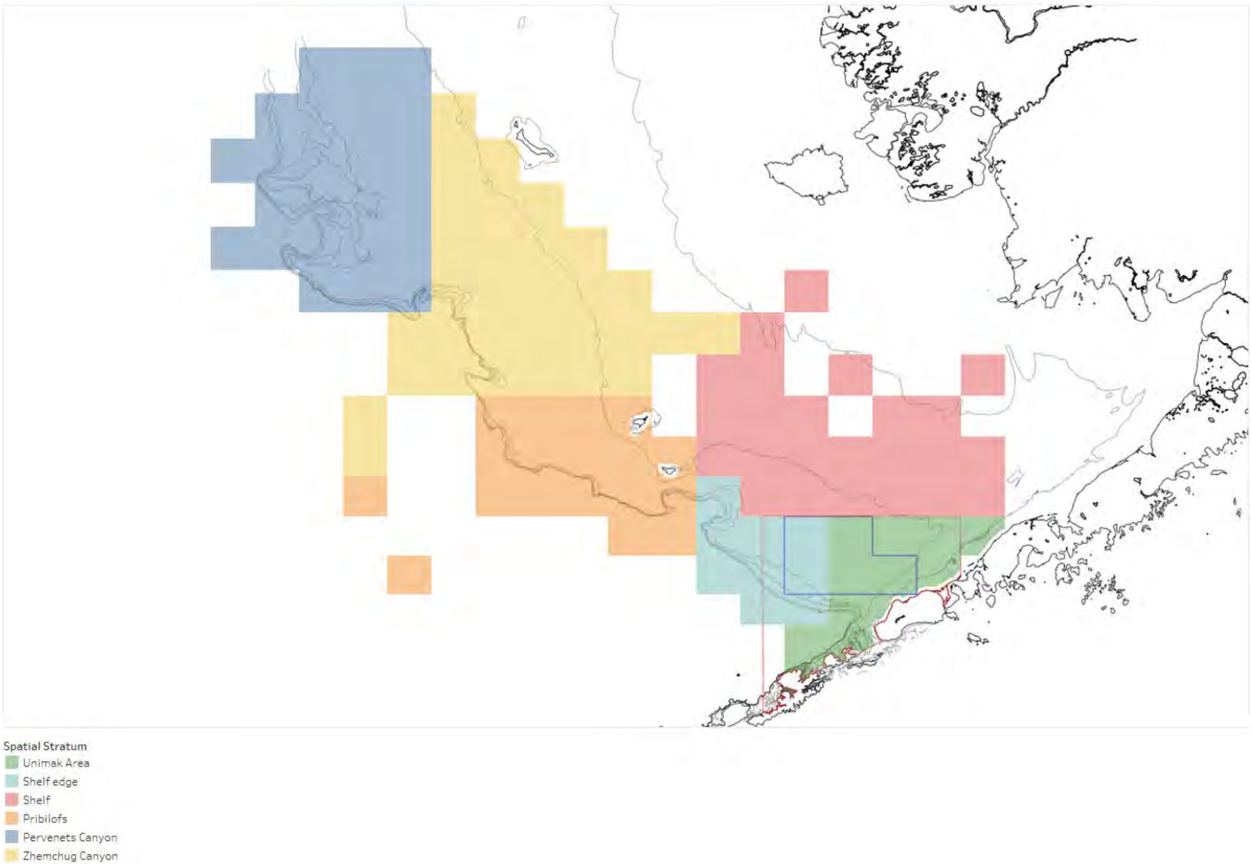


Figure 2 Map of genetic fishing ground areas used to estimate genetic stock proportions.

Additional vessel incentives and penalties

When considering an avoidance measure's functionality and efficacy, managers also consider the associated incentives. Incentives can influence fishing behavior as well as increase accountability when the incentive is at the vessel level (or fleet level in the mothership sector). Multiple proposed provisions will provide an added incentive for the vessels to avoid chum bycatch at all levels of encounters and all levels of pollock abundance.

Alternative 4, Option 1: trigger 1 and trigger 2

Ultimately, there was a lack of data to fully analyze and develop option 1 of Alternative 4. To evaluate and develop this option and its two triggers, results from multiple analyses were considered. Results from evaluating adjusted base rates were considered for trigger 1. The threshold for trigger 2 was able to be determined; however, there are no in-season genetic data, per haul or per trip, that could be applied against the threshold of trigger 2 for it to function effectively. When this option was considered as a component of the simulation, the working group realized that there is a lack of data and Option 1 is not functional at this point in time. The development of Option 1 could not be completed but can be considered when the necessary data to evaluate it are available in the future.

Throughout the process of using multiple analyses to evaluate multiple measures, the catcher vessel fleet developed and proposed four provisions for the inclusion into their chum salmon bycatch management.

Proposed Provisions for the Catcher Vessel Fleet Chum Bycatch Reduction Plan

The current salmon bycatch incentive plan agreements (IPA) regulation at 50 CFR 679.21(f)(12) requires that the sectors' incentive plan agreement must contain a description of "*how the IPA ensures that the operator of each vessel governed by the IPA will manage that vessel's chum salmon bycatch to avoid areas and times where the chum salmon are likely to return to western Alaska.*" (50 CFR 679.21(f)(12)(iii)(E)(*7*)). The catcher vessel fleets of the inshore sector and the mothership sector will continue to address this requirement and the Council's request for a proposal of salmon bycatch incentive plan agreement changes via the following proposed catcher vessel chum salmon avoidance provisions. Both catcher vessel sectors will describe these provisions in their respective salmon saving incentive plan to function with the sector specific available data. Representatives from the catcher fleets thoroughly evaluated multiple analyses and potential provisions to determine that the following four provisions are likely to be the most functional, have the least amount of impacts to the fleet, and likely reduce chum bycatch, specifically Western Alaska origin chum bycatch, to the extent practicable.

1. Weekly assessment of the likelihood of Western Alaska chum by stat area when determining weekly chum closures.

The monitoring agent for the catcher vessel fleets incorporated annual results from the genetic stock composition analysis of chum bycatch in the Bering Sea pollock fishery since 2018. The chum genetics data from each prior fishing year is included in the database that dates back to 2011. The monitoring agent then uses the compiled information pooled from the previous years' genetic sampling to construct maps of where and when Western Alaska chum salmon are more likely to occur than non-Western Alaska chum salmon (e.g., Figure 3). Due to a great deal of Western Alaska and non-Western Alaska chum salmon mixing, relatively low sample rates, and the genetic composition results having been generated from a mixing model, the likelihood of Western Alaska vs non-Western Alaska chum salmon is the best available data. Using this database, fishery managers and the monitoring agent can look for spatial and temporal patterns like weekly genetic chum proportions by ADF&G stat area that can then inform management decisions. The monitoring agent can use the updated historical genetic composition data and maps at a finer resolution to weigh the potential risks of closing a rolling hotspot with potentially higher non-Western Alaska chum rates and displace the fishing fleet into areas with potentially higher Western Alaska chum rates. This is especially useful when multiple areas have been identified as rolling hotspots; deference is given to the area with higher potential of encountering Western Alaska chum, and as a result closed for a week. This process, as well as additional communication among the fleet, managers, and the monitoring agent, is repeated on a weekly basis, each week using the most up to date data and information.

Without in-season genetic testing available at this time, the catcher vessel sectors will continue to use the best scientific information available, including historical genetic composition data, observed patterns, and knowledge from fishermen to enhance the avoidance of areas of high estimated Western Alaska chum salmon abundance, and the management of chum closures. The monitoring agent will use historical genetic data, updated annually or sooner, to construct a tool to estimate spatial (ADF&G stat area) and temporal (weekly) likelihoods of Western Alaska chum relative to non-Western Alaska chum. This tool will be integrated, when applicable, into the catcher vessels' weekly chum rolling hotspot closure program so that the monitoring agent and catcher vessel managers can give protection of Western Alaska chum priority over the protection of non-Western Alaska chum salmon stocks.

The catcher vessels will describe the data and tools that will be used and the time period in which it shall be updated. This provision provides accountability that the catcher vessel managers and monitoring agent will use this tool weekly in the B season chum salmon rolling hotspot closure program. Based on results from the scenarios that were analyzed the managers and monitoring agent can expect to focus on stat areas in the shelf edge and Unimak fishing ground areas.

This provision focuses on the avoidance of Western Alaska chum and can be combined with the other current and proposed provisions to avoid chum salmon. Since chum salmon are primarily encountered in the B season of the pollock fishery, this provision will be implemented only in the B season.

The catcher vessel fleets intend to implement this tool on a weekly basis with the rolling hotspot closures because weekly chum closures informed by estimated weekly spatial and temporal Western Alaska Chum abundance are more adaptive and are less likely to extend the B season than larger and longer time-area closures covering the entire shelf edge or Unimak area as described in the "Scenario Planning" framework. This provision is also less likely to extend B season fishing operations into times when higher Chinook bycatch can be expected relative to the effects of a larger time-area closure.

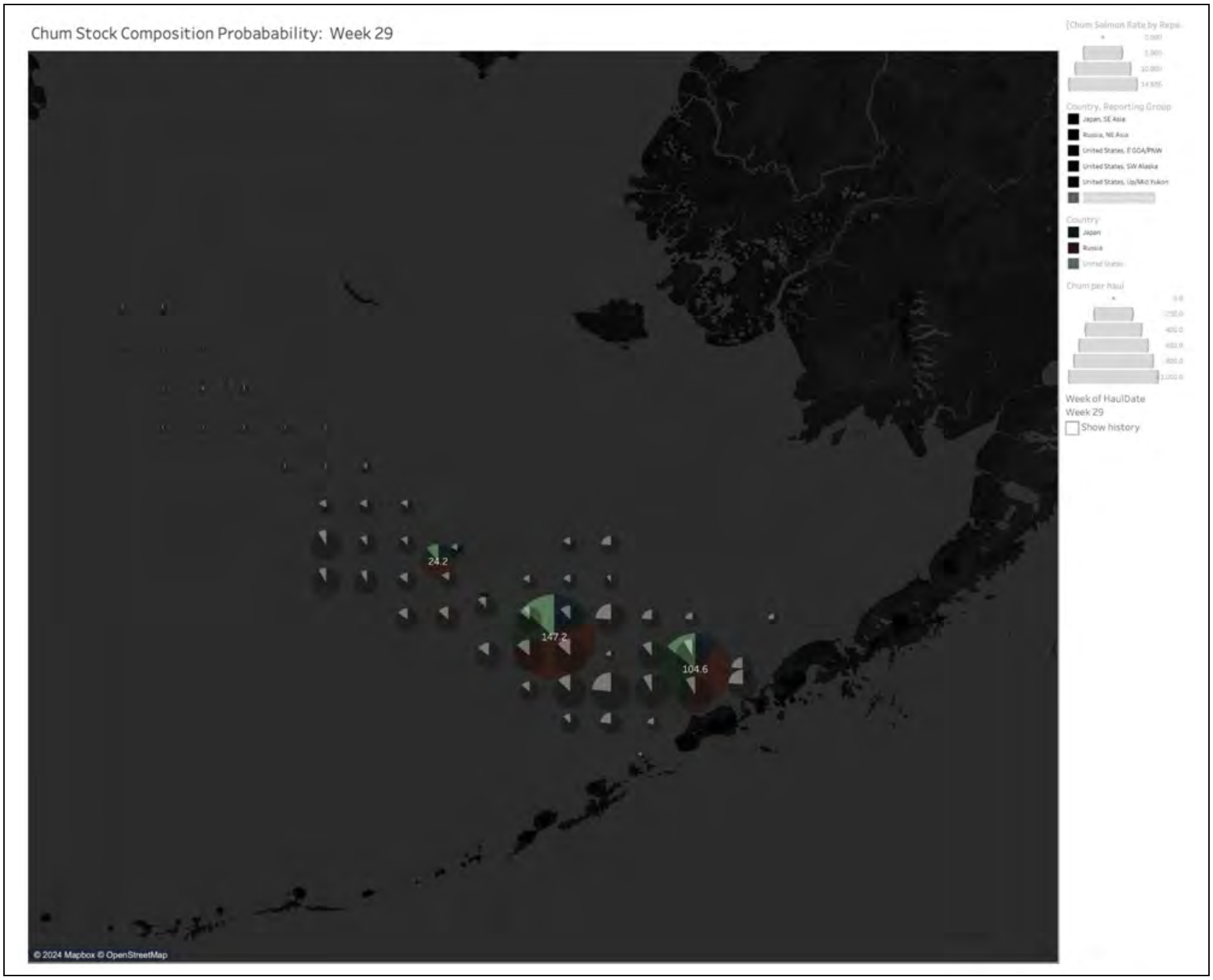


Figure 3 Predicted chum salmon stock composition for week 29 by 4 genetic clusters and each ADF&G statistical area. The proportion of Western Alaska chum in the bycatch is highlighted in each of the pie charts and the size and number in each genetic cluster represents the average number of chum salmon per haul.

<u>Tier Designation</u>

The following two provisions (2 and 3 below) utilize weekly tier designation of catcher vessels as part of the rolling hotspot program. A vessel's (or mothership fleet's) weekly tier status incentivizes fishermen to avoid chum salmon at all levels of encounter, as their tier status depends on their relative bycatch performance. Tier 2 vessels are penalized by being closed out of the rolling hotspot chum closure. Tier 1 vessels earn access to the closure area by keeping their chum bycatch relatively low. Tier designation provides an incentive for catcher vessels to avoid salmon and keep their salmon bycatch relatively low so not to be closed out of an area. The following proposed provisions are intended to reduce any additional chum bycatch that may occur after the weekly chum closure is effective. After reviewing previous years of high chum bycatch, it’s likely that these provisions could reduce the spikes in chum bycatch. In addition to the first proposed catcher vessel provision, it's likely that the catcher vessels can avoid spikes of Western Alaska chum bycatch as well.

2. Rolling Hotspot closure for all catcher vessels when chum bycatch is 3 times the weekly base rate.

Each week, the monitoring agent assesses the weekly base rate and the chum bycatch rate. If the chum bycatch rate reaches three times the weekly base rate, a universal fishing ban in the form of a chum rolling hotspot closure area is imposed on all catcher vessels. This rule applies regardless of each vessel's individual chum bycatch rate or tier status. The chum bycatch rates are determined based on the fishing activities in each ADF&G statistical area from the preceding week.

This provision is designed to be applicable across all genetic clusters and fishing ground areas. Analysis of data from the past three years indicates that employing a multiplier of 3 would have implicated chum closures in the shelf edge, shelf, and Unimak fishing ground areas. Such a measure would have led to the closure of four chum fishing areas for all catcher vessels, potentially reducing the total chum bycatch significantly, especially in 2021.

Scenario analyses have pointed out that the shelf edge and Unimak fishing ground areas are the most prone to higher Western Alaska chum bycatch estimates. Notably, three out of the four areas that would have been closed to all vessels under this provision fall within these two regions. Therefore, it's plausible that such closures would have contributed to a notable reduction in Western Alaska chum bycatch.

Prioritizing fleet-wide measures over the benefits of the tier designation during times of high chum encounters not only increases incentives to keep a vessels’ chum bycatch relatively low, but it increases accountability by ensuring vessels do not fish in areas of high chum even if their relative chum bycatch rate is low. This provision is less impactful to the pollock fleet than removing the tier designation completely for the entire B season. If a rolling hotspot closure area is effective for all vessels and is nearshore in the Unimak area, there is potential that some smaller vessels unable to fish further west could be impacted; however, this is less likely if fishing conditions in the nearshore fishing grounds are good. Other factors vessels will have to consider are weather, fishing conditions outside of the closure, prohibited species catch (PSC) encounters outside the closure, etc. However, this provision is not as likely to significantly extend the fishing season as a large and longer duration time-area closure.

3. Monday chum rolling hotspot closures

Currently, chum closures for the catcher vessels are announced on Thursday, in effect 10:00 pm the following Friday, and last until 10:00pm the Friday thereafter. Unless proposed provision 2 becomes effective, the catcher vessels will receive a tier status, as normal, and all tier 2 vessels may not fish inside the week-long chum closure. This proposed provision adds that any data that comes in over the weekend will be reviewed on Monday. This includes, but is not limited to, catch data, fish tickets, accounts from fishermen on the grounds, etc. If the weekend data indicates that chum encounters remain high in the closed area and the monitoring agent deems that the area must therefore be avoided, then the chum closure will be effective for all tier 1 and tier 2 vessels for the remainder of the chum closure’s duration (until Friday 10:00 pm).

If tier 1 vessels fishing in the chum closure experience increased chum bycatch, or if catch data from the closure area was updated over the weekend, or if any fishermen account of chum bycatch are received, this provision is likely to reduce the continued encounters of chum bycatch in that area, likely reducing the total chum bycatch that could have occurred without the addition of Monday Closures. Similar to proposed provision 2, if the chum closure is in the shelf edge or Unimak fishing ground area and then becomes closed to all catcher vessel fishing effort, it has the potential to reduce Western Alaska chum bycatch as well. Additionally, if fishing conditions are good outside of the closure, there is potential that tier 1 vessels will not fish in the chum closure, so as not to risk increased chum bycatch or closure to all vessels on Monday. In some cases, however, by displacing fishing effort to areas of unknown fishing conditions, there is inherent risk of encountering additional prohibited species catch, whether that be salmon, herring, or sablefish, when diverting fishing effort away from a rolling hotspot closure.

Monday closures pose less risk of extending the duration of the fishery than a larger and longer duration time-area closure but continue to be responsive to chum encounters even after the weekly chum closure is in place. Catcher vessels may be negatively impacted if fishing conditions outside the closure are not good enough to support 100% of the displaced effort. Other factors vessels will have to consider are weather, prohibited species catch encounters outside the closure, how far from their processor they will have to move, and other real-time fishery dynamics.

4. Move Along Rule for catcher vessels

Similar to how tier 1 vessels can choose to stay out of chum closures so not to risk increased chum bycatch, a move along rule can be applied, regardless of a chum closure, to reduce the risk of increased chum bycatch. A move along rule can be a tool used by an aggregated group of vessels to avoid bycatch by using timely haul-by-haul data. Haul-by-haul data can then be calculated to get a 3-day rolling average to indicate the most recent fishing conditions. When a threshold is applied, the fleets can use this tool to determine when they should move away from a certain fishing area. This tool was considered for all the catcher vessels. Due to some slight haul-level operational differences between inshore catcher vessels and mothership catcher vessels the potential development of a move along rule has been described separately.

A mothership catcher vessel delivers its catch one haul at a time to its mothership. The mothership processes the catch upon receiving it, during which time an observer samples the catch. That haul’s catch composition data is then relayed back to that mothership’s catcher vessel fleet. Since the mothership catcher vessels are operationally required to fish in close proximity to the mothership and each other, the catch data of the mothership fleet can be averaged to identify a trend in the catch composition from the area being fished. A move along rule could work well for mothership catcher vessels because they receive their catch data on a haul-by-haul basis, in a timely manner, and they fish in close proximity. Therefore, a move along rule is a potential tool the mothership catcher vessel fleets could develop and use to avoid chum bycatch, regardless of a chum closure in place or not. Such an approach has already been adopted by the Pacific whiting mothership cooperative.

Inshore catcher vessels make about 2-3 hauls a trip. After each haul, the catch is dumped on deck and moved into onboard tanks where it’s retained until they return to their shoreplant for delivery. Their catch composition data is complete after their trip’s catch is delivered and observed at the shoreplant. After about 2-4 days of transiting and fishing, an inshore catcher vessel’s catch is processed by the shoreplant and a trip catch composition is reported. This data has a much more significant lag associated with it than the data from mothership catcher vessels. The inshore catcher vessel catch composition data alone is less likely to be informative to the rest of the fleet, especially after a 3-day average is applied.However, the inshore catcher vessel fleets can work with their fishermen to gain useful haul by haul information. While the information would not necessarily be the observer's catch composition data, it could be useful during times of high chum encounters. A move along rule for the inshore catcher vessels may result in a different design than the motherships, but is a potential tool the coop managers can continue to develop or include in their daily considerations of where their fleet should or should not fish.

Developing a move along rule is a potential tool for the two catcher fleets to develop. Since the inshore catcher vessel fleet faces more challenges to develop a move along rule the same way the motherships could, future developments may result in a different design between the two sectors. Operationally, a move along rule is similar to implementing a weekly closure if the trigger to move is based on a 3-day rolling average. However, the move along rule does not define a boundary, nor does it prevent other platforms or sectors from fishing in the suspected area.

Incorporating the best scientific information available and human elements of salmon bycatch management into the Inshore and Mothership Catcher Vessel Chum Bycatch Reduction Plans

The catcher vessel fleets, their managers, and the monitoring agent will continue to use the best scientific information available to reduce chum bycatch to the extent practicable. The analytical tools used to avoid and reduce chum bycatch are becoming more informed as data continues to accrue. Thanks to the coop structure of the AFA pollock fishery, observer data, fish tickets, and VMS data are communicated in near real-time directly from the fishing grounds to coop managers and Sea State. From the first day of each season and onward, fishermen are incentivized to avoid salmon bycatch at all levels of encounters and all levels of pollock abundance, as a result the catcher vessels are working together to avoid salmon bycatch.

Not only are fishermen communicating, but the managers and monitoring agent continue to share useful information with all participants. At the beginning of B season the catcher vessel fleets will be made aware of the most recent chum genetics report and fishing ground areas more likely to have Western Alaska chum. Avoidance and timely communication will be of the utmost importance, however there are other constraints (e.g., crew safety, avoiding other PSC species) that may not make it feasible to move off the fishing grounds completely. In that case, the proposed provisions along with the current salmon management measures have the potential to effectively reduce chum bycatch to the extent practicable.

Conclusion

The pollock catcher vessel fleets, via their incentive plan agreements and cooperative structure, iteratively adapt their salmon bycatch management as new information becomes available and effectively apply bycatch avoidance measures to minimize or avoid bycatch to the extent practicable. The mothership and inshore catcher vessel fleets intend to continue to use the best science available. Additionally, the pollock industry has been tasked by the NPFMC to propose changes to their incentive plan agreements to minimize the bycatch of Western Alaska chum salmon to the extent practicable. The mothership and inshore catcher vessel sectors worked diligently to be responsive to the Council's request as well as to adapt salmon bycatch management measures and meet Magnuson-Stevens Fishery Conservation and Management Act (MSA) requirements.

The catcher vessel sectors' work incorporated extensive modeling and analysis of which has been informed by the most recent fishery and genetics data available. These models and analyses allowed the work group to focus on salmon bycatch avoidance measures that provide optimal effectiveness in reducing Western Alaska chum salmon. The time and work that went into the development of these provisions also ensured functionality and implementation into pollock fishing behavior. The catcher vessel fleets' proposed provisions, in combination, show significant potential to reduce Western Alaskan chum salmon, eliminate spikes of high chum bycatch, and minimize impacts to the fleets. The catcher vessel cooperatives are eager to continue the discussion with the NPFMC and its staff regarding the implementation of these new, proposed measures into B season pollock fishing.

Appendix 4 Yukon River Chum Salmon Stock Status Overview

YUKON RIVER CHUM SALMON STOCK STATUS OVERVIEW

Submitted Feb. 2, 2024 by the Yukon River Intertribal Fish Commission for inclusion in the Draft Chum Salmon EIS under development by NPFMC staff

All figures are based on data available from ADF&G AYK Database Management System, https://www.adfg.alaska.gov/CF_R3/external/sites/aykdbms_website/DataSelection.aspx

In recent decades, the returns of salmon to the Yukon River have continued to decline and resulted in state and federal fishery disaster declarations and closures to commercial salmon harvests. More recently, the continued collapse of Yukon River Chinook and chum salmon returns have resulted in closures of priority state and federal subsistence salmon fisheries, failure to meet escapement goals, and profound impacts to tribal food security.

Impacts of the Yukon River Chum Salmon Decline:

- No directed Chinook Salmon subsistence gillnet harvest opportunities on the Yukon River for the past three years: 2020-2023
- No directed Summer Chum Salmon subsistence gillnet harvest opportunities on the Yukon River for the past two years: 2021-22.
- No directed fall chum salmon subsistence gillnet harvest opportunities for mainstream Yukon River communities for the past four years: 2020-23.
- Threats to food security due to loss of this important part of the subsistence diet in a region that is highly dependent on subsistence.
- Loss of the opportunity to gather and teach the next generation our cultural, spiritual, and traditional practices.
- A heavy reliance on whitefish, moose, and other subsistence resources, as well as increased dependence on costly store-bought foods of significantly less nutritional and cultural value.

Yukon River Summer Chum Salmon Overview

No directed summer chum salmon subsistence harvest opportunities on the Yukon River for the past two years: 2021-22. Chum salmon subsistence needs, based on “Amounts Reasonably Necessary for Subsistence” as established by the Alaska Board of Fisheries, have not been met since 2018. The 2021 summer chum salmon runs were the lowest on record, and no escapement goals were met in 2021 or 2022. While the drainage wide escapement goal was met, in 2023 other important escapement goals for summer chum salmon including the Anvik River were likely not met and counts at other assessment projects were still well below average.

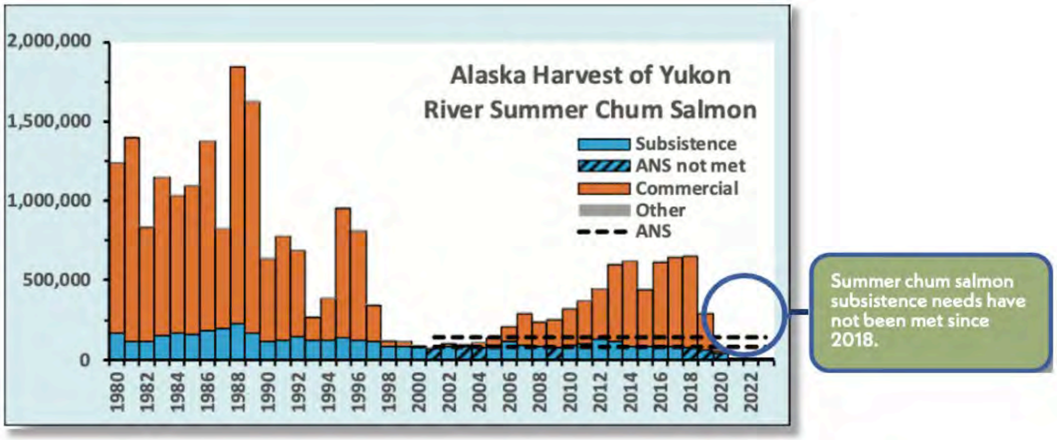


Figure A: Estimates of Yukon River harvest of summer chum by user group 1980-2023. No directed harvest was allowed in 2023, and ANS has not been met since 2018. Source: ADF&G AYK Database Management System, https://www.adfg.alaska.gov/CF_R3/external/sites/aykdbms_website/DataSelection.aspx

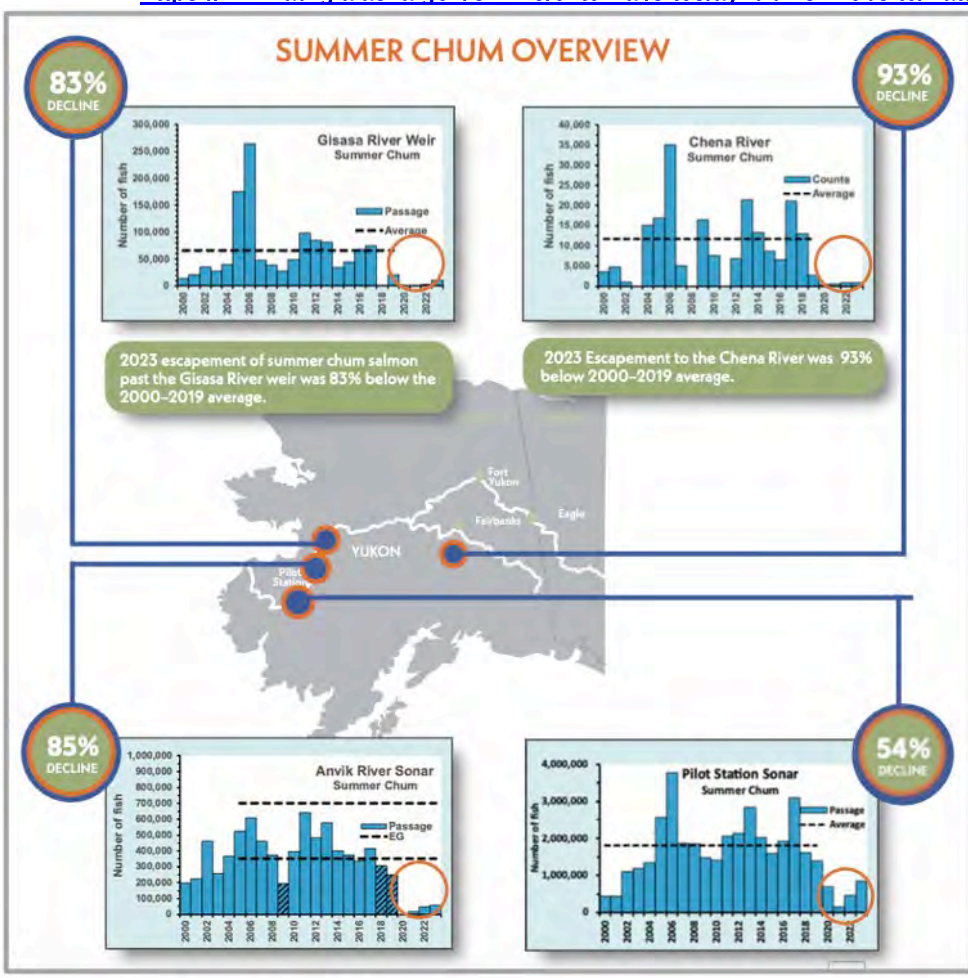


Figure B: Yukon River summer chum escapement estimates 2000-2023 from Gisasa River Weir, Chena River Counting Tower/Sonar, Anvik River Sonar and Pilot Station Sonar, enumeration projects. The percent decline badge above each inset chart shows the percent decline for the period 2020-2023 compared to the 20-year average from 2000 to 2019. Source: ADF&G AYK Database Management System, https://www.adfg.alaska.gov/CF_R3/external/sites/aykdbms_website/DataSelection.aspx

FALL CHUM OVERVIEW

No directed fall chum subsistence salmon harvest opportunities on the Yukon River for the past four years: 2020-23. Passage of fall chum at the Canadian border, as measured by the Eagle sonar and accounting for local harvest, has failed to meet the Canadian Border Passage escapement goal since 2020.

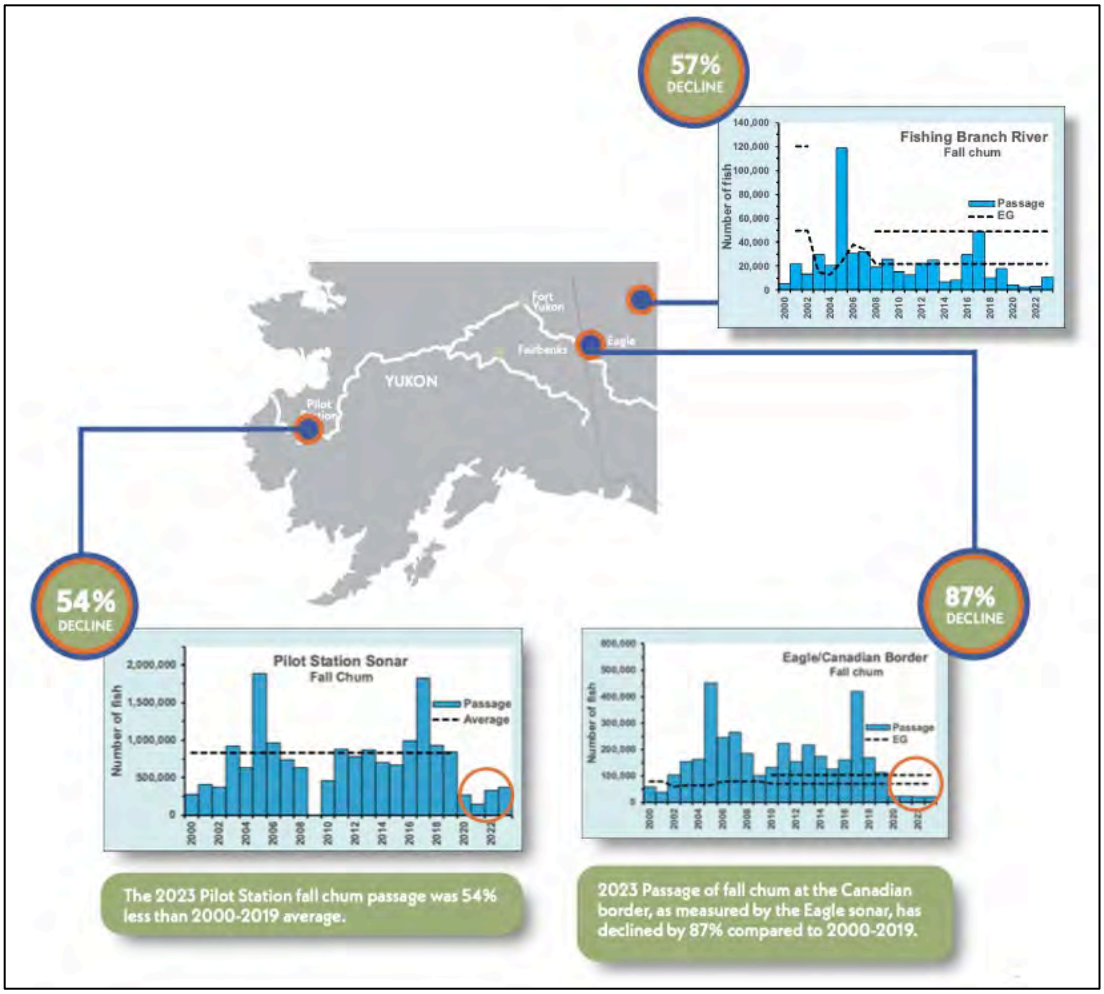


Figure C: **Yukon River fall chum escapement estimates 2000-2023 from Pilot Station Sonar, Eagle/ CAN Border and Fishing Branch River enumeration projects. The percent decline badge above each inset chart shows the percent decline for the period 2020-2023 compared to the 20-year average from 2000 to 2019. Source: ADF&G AYK Database Management System, https://www.adfg.alaska.gov/CF_R3/external/sites/aykdbms_website/DataSelection.aspx**

Appendix 5 Tables of Historical Fishing Performance Against Apportionments of the Overall Chum Salmon PSC Limits

This appendix provides summary tables of each suboption for apportioning the overall chum salmon Prohibited Species Catch (PSC) limit (option 3 of Alternative 2). The overall chum salmon PSC limits considered under option 1 of Alternative 2 are:

- 200,000 chum salmon
- 300,000 chum salmon
- 350,000 chum salmon
- 400,000 chum salmon
- 450,000 chum salmon
- 550,000 chum salmon

The suboptions for apportionment considered are:

- Suboption 1: 3-year historical average level of bycatch (2020-2022)
- Suboption 2: 5-year historical average level of bycatch (2018-2022)
- Suboption 3: Pro-rata with 25% weighted to AFA pollock allocation and 75% to 3-year historical average level of bycatch
- Suboption 4: AFA pollock allocations

Red cells indicate years where a Bering Sea pollock sector or the fishery would have exceeded their apportionment of the overall chum salmon PSC limit in a year.

Historical performance compared to different apportionments of a PSC limit of 200,000 chum salmon:

3-year average	6.1% 12,200	21.9% 43,800	62.9% 125,800	9.1% 18,200	100% 200,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,629	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,675
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

5-year average	7.1% 14,200	25.2% 50,400	58.2% 116,400	9.5% 19,000	100% 200,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,675
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Pro-rata	7.1% 14,200	25.4% 50,800	58.4% 116,800	9.1% 18,200	100% 200,000
Year	CDQ	CP	Inshore	Mothership	Total
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,675
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

AFA	10% 20,000	36% 72,000	45% 90,000	9% 18,000	100% 200,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,675
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Historical performance compared to different apportionments of a PSC limit of 300,000 chum salmon:

3-year average	6.1% 18,300	21.9% 65,700	62.9% 188,700	9.1% 27,300	100% 300,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

5-year average	7.1% 21,300	25.2% 75,600	58.2% 174,600	9.5% 28,500	100% 300,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,094
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Pro-rata	7.1% 21,300	25.4% 76,200	58.4% 175,200	9.1% 27,300	100% 300,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

AFA	10% 30,000	36% 108,000	45% 135,000	9% 27,000	100% 300,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Historical performance compared to different apportionments of a PSC limit of 350,000 chum salmon:

3-year average	6.1% 21,350	21.9% 76,650	62.9% 220,150	9.1% 31,850	100% 350,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

5-year average	7.1% 24,850	25.2% 88,200	58.2% 203,700	9.5% 33,250	100% 350,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Pro-rata	7.1% 24,850	25.4% 88,900	58.4% 204,400	9.1% 31,850	100% 350,00
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

AFA	10% 35,000	36% 126,000	45% 157,500	9% 31,500	100% 350,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Historical performance compared to different apportionments of a PSC limit of 400,000 chum salmon:

3-year average	6.1% 24,400	21.9% 87,600	62.9% 251,600	9.1% 36,400	100% 400,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

5-year average	7.1% 28,400	25.2% 100,800	58.2% 232,800	9.5% 38,000	100% 400,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Pro-rata	7.1% 28,400	25.4% 101,600	58.4% 233,600	9.1% 36,400	100% 400,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

AFA	10% 40,000	36% 144,000	45% 180,000	9% 36,000	100% 400,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Historical performance compared to different apportionments of a PSC limit of 450,000 chum salmon:

3-year average	6.1% 27,450	21.9% 98,550	62.9% 283,050	9.1% 40,950	100% 450,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

5-year average	7.1% 31,950	25.2% 113,400	58.2% 261,900	9.5% 42,750	100% 450,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Pro-rata	7.1% 31,950	25.4% 114,300	58.4% 262,800	9.1% 40,950	100% 450,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

AFA	10% 45,000	36% 162,000	45% 202,500	9% 40,500	100% 450,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Historical performance compared to different apportionments of a PSC limit of 550,000 chum salmon:

3-year average	6.1% 33,550	21.9% 120,450	62.9% 345,950	9.1% 50,050	100% 550,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

5-year average	7.1% 39,050	25.2% 138,600	58.2% 320,100	9.5% 52,250	100% 550,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Pro-rata	7.1% 39,050	25.4% 139,700	58.4% 321,200	9.1% 50,050	100% 550,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

AFA	10% 55,000	36% 198,000	45% 247,500	9% 49,500	100% 550,000
Year	**CDQ**	**CP**	**Inshore**	**Mothership**	**Total**
2011	3,758	44,299	118,857	24,399	191,313
2012	200	1,928	19,067	977	22,172
2013	554	10,229	110,496	3,835	125,114
2014	2,407	63,066	145,322	8,091	218,886
2015	4,650	40,046	174,343	14,046	233,085
2016	16,342	134,750	144,882	43,262	339,236
2017	87,058	207,355	154,610	16,825	465,848
2018	26,586	99,447	147,339	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,671
2020	8,582	77,138	237,632	19,743	343,093
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309

Appendix 6 Historical Tables with Inter-Annual Information on Potentially Forgone Pollock Harvest and Associated Gross Revenues Compared to Avoided Chinook Salmon, Chum, and Herring

Appendix 6 contains the cumulative and inter-annual information on the potential pollock harvest (mt) and associated gross revenues that would have been forgone as well as the Chinook salmon (number of fish), chum (number of fish), and herring (mt) that would have been avoided had the overall chum salmon PSC limits been in place. This is a retrospective analysis based on historical fishing behavior.[117]

[117] Note that there are slight differences between the methods for calculating forgone pollock and associated PSC in these tables and those shown in table A-2 in Appendix 1, which covers a 0 -200,000 chum PSC limit. This is due to a difference in the date from which forgone pollock and avoided chum were calculated/

Table Appendix 6-1 Cumulative amounts of potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 200,000 from 2011-2022

If a 200,000 chum PSC limit had been in place 2011-2022:		Sum of Forgone B Season Pollock (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chum Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chinook Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Herring Avoided (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Wholesale Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Ex-Vessel Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**1,783,255**	**20.4%**	**11.8%**	**852,347**	**25.3%**	**25.2%**	**32,874**	**39.3%**	**14.5%**	**725**	**6.6%**	**4.4%**	**2,129M**	**19.47%**	**11.22%**	**673M**	**19.18%**	**11.05%**
	CDQ	189,218	21.4%	12.1%	99,035	43.5%	43.2%	1,441	42.2%	9.6%	3	1.0%	0.6%	235M	20.23%	11.48%	70M	19.87%	11.29%
	CP	808,749	25.9%	14.9%	347,317	36.1%	35.9%	11,277	59.4%	15.6%	164	10.1%	3.7%	1,021M	24.81%	14.18%	306M	24.39%	13.92%
	Mothership	117,955	14.9%	8.6%	65,310	23.3%	23.2%	3,235	47.8%	21.1%	82	16.4%	6.4%	154M	14.89%	8.59%	46M	14.49%	8.37%
	Inshore	667,332	16.9%	9.9%	340,685	17.9%	17.9%	16,921	31.0%	13.7%	475	5.6%	4.6%	719M	15.55%	9.06%	251M	15.83%	9.22%
5-year avg. sector apportionment	**Total**	**1,907,248**	**21.8%**	**12.6%**	**994,447**	**29.5%**	**29.4%**	**36,778**	**43.9%**	**16.3%**	**890**	**8.1%**	**5.4%**	**2,264M**	**20.70%**	**11.93%**	**721M**	**20.54%**	**11.84%**
	CDQ	164,173	18.5%	10.5%	63,497	27.9%	27.7%	1,168	34.2%	7.8%	2	0.7%	0.4%	203M	17.46%	9.91%	61M	17.26%	9.80%
	CP	785,612	25.1%	14.5%	325,469	33.9%	33.7%	11,055	58.2%	15.3%	163	10.1%	3.7%	990M	24.06%	13.75%	297M	23.61%	13.47%
	Mothership	114,457	14.5%	8.4%	62,513	22.3%	22.2%	3,140	46.4%	20.5%	81	16.1%	6.3%	150M	14.48%	8.36%	45M	14.06%	8.12%
	Inshore	843,005	21.3%	12.4%	542,968	28.6%	28.5%	21,415	39.2%	17.3%	643	7.5%	6.2%	921M	19.93%	11.61%	319M	20.14%	11.73%
Pro-rata sector apportionment	**Total**	**1,889,098**	**21.6%**	**12.5%**	**866,573**	**25.7%**	**25.6%**	**36,835**	**44.0%**	**16.3%**	**873**	**8.0%**	**5.3%**	**2,246M**	**20.54%**	**11.83%**	**715M**	**20.35%**	**11.73%**
	CDQ	164,173	18.5%	10.5%	63,497	27.9%	27.7%	1,168	34.2%	7.8%	2	0.7%	0.4%	203M	17.46%	9.91%	61M	17.26%	9.80%
	CP	785,612	25.1%	14.5%	325,469	33.9%	33.7%	11,055	58.2%	15.3%	163	10.1%	3.7%	990M	24.06%	13.75%	297M	23.61%	13.47%
	Mothership	117,955	14.9%	8.6%	65,310	23.3%	23.2%	3,235	47.8%	21.1%	82	16.4%	6.4%	154M	14.89%	8.59%	46M	14.49%	8.37%
	Inshore	821,358	20.8%	12.1%	412,297	21.7%	21.7%	21,377	39.2%	17.3%	625	7.3%	6.0%	899M	19.44%	11.33%	311M	19.63%	11.44%
AFA sector apportionment	**Total**	**2,235,419**	**25.5%**	**14.8%**	**1,092,360**	**32.4%**	**32.3%**	**54,182**	**64.7%**	**23.9%**	**1,216**	**11.1%**	**7.3%**	**2,638M**	**24.12%**	**13.90%**	**853M**	**24.30%**	**14.00%**
	CDQ	147,739	16.7%	9.5%	61,612	27.0%	26.9%	705	20.7%	4.7%	2	0.7%	0.4%	181M	15.62%	8.86%	55M	15.54%	8.83%
	CP	621,440	19.9%	11.4%	235,752	24.5%	24.4%	9,511	50.1%	13.2%	70	4.3%	1.6%	786M	19.11%	10.92%	233M	18.52%	10.57%
	Mothership	120,149	15.2%	8.8%	66,894	23.9%	23.8%	3,553	52.5%	23.1%	82	16.4%	6.4%	157M	15.14%	8.74%	47M	14.75%	8.52%
	Inshore	1,346,090	34.1%	19.9%	728,102	38.3%	38.2%	40,413	74.1%	32.6%	1,062	12.4%	10.3%	1,514M	32.74%	19.07%	519M	32.76%	19.08%

Table Appendix 6-2 Cumulative amounts of potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 300,000 from 2011-2022

If a 300,000 chum PSC limit had been in place 2011-2022:		Sum of Forgone B Season Pollock (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chum Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chinook Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Herring Avoided (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Wholesale Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Ex-Vessel Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**1,071,457**	**12.2%**	**7.1%**	**474,719**	**14.1%**	**14.0%**	**17,841**	**21.3%**	**7.9%**	**488**	**4.4%**	**2.9%**	**1,300M**	**11.88%**	**6.85%**	**402M**	**11.44%**	**6.59%**
	CDQ	147,739	16.7%	9.5%	61,612	27.0%	26.9%	705	20.7%	4.7%	2	0.7%	0.4%	181M	15.62%	8.86%	55M	15.54%	8.83%
	CP	639,204	20.5%	11.8%	242,239	25.2%	25.0%	10,096	53.2%	14.0%	160	9.8%	3.6%	809M	19.65%	11.23%	240M	19.09%	10.89%
	Mothership	69,238	8.8%	5.1%	31,078	11.1%	11.0%	607	9.0%	4.0%	80	15.9%	6.2%	87M	8.38%	4.84%	26M	8.26%	4.77%
	Inshore	215,277	5.5%	3.2%	139,790	7.4%	7.3%	6,433	11.8%	5.2%	246	2.9%	2.4%	223M	4.82%	2.81%	81M	5.09%	2.96%
5-year avg. sector apportionment	**Total**	**1,052,203**	**12.0%**	**7.0%**	**479,507**	**14.2%**	**14.2%**	**15,847**	**18.9%**	**7.0%**	**365**	**3.3%**	**2.2%**	**1,273M**	**11.64%**	**6.71%**	**394M**	**11.22%**	**6.47%**
	CDQ	147,739	16.7%	9.5%	61,612	27.0%	26.9%	705	20.7%	4.7%	2	0.7%	0.4%	181M	15.62%	8.86%	55M	15.54%	8.83%
	CP	607,007	19.4%	11.2%	231,242	24.1%	23.9%	7,460	39.3%	10.3%	36	2.2%	0.8%	768M	18.68%	10.67%	227M	18.08%	10.32%
	Mothership	69,238	8.8%	5.1%	31,078	11.1%	11.0%	607	9.0%	4.0%	80	15.9%	6.2%	87M	8.38%	4.84%	26M	8.26%	4.77%
	Inshore	228,220	5.8%	3.4%	155,575	8.2%	8.2%	7,075	13.0%	5.7%	247	2.9%	2.4%	236M	5.11%	2.97%	86M	5.40%	3.15%
Pro-rata sector apportionment	**Total**	**1,037,812**	**11.9%**	**6.9%**	**478,110**	**14.2%**	**14.1%**	**15,814**	**18.9%**	**7.0%**	**365**	**3.3%**	**2.2%**	**1,256M**	**11.48%**	**6.62%**	**389M**	**11.07%**	**6.38%**
	CDQ	147,739	16.7%	9.5%	61,612	27.0%	26.9%	705	20.7%	4.7%	2	0.7%	0.4%	181M	15.62%	8.86%	55M	15.54%	8.83%
	CP	592,616	19.0%	10.9%	229,845	23.9%	23.8%	7,427	39.1%	10.3%	36	2.2%	0.8%	751M	18.26%	10.44%	222M	17.66%	10.08%
	Mothership	69,238	8.8%	5.1%	31,078	11.1%	11.0%	607	9.0%	4.0%	80	15.9%	6.2%	87M	8.38%	4.84%	26M	8.26%	4.77%
	Inshore	228,220	5.8%	3.4%	155,575	8.2%	8.2%	7,075	13.0%	5.7%	247	2.9%	2.4%	236M	5.11%	2.97%	86M	5.40%	3.15%
AFA sector apportionment	**Total**	**952,571**	**10.9%**	**6.3%**	**460,807**	**13.7%**	**13.6%**	**19,626**	**23.4%**	**8.7%**	**550**	**5.0%**	**3.3%**	**1,097M**	**10.03%**	**5.78%**	**352M**	**10.02%**	**5.77%**
	CDQ	90,104	10.2%	5.8%	57,753	25.3%	25.2%	430	12.6%	2.9%	2	0.6%	0.4%	111M	9.59%	5.44%	33M	9.20%	5.23%
	CP	231,045	7.4%	4.3%	84,688	8.8%	8.8%	3,446	18.1%	4.8%	20	1.2%	0.4%	301M	7.33%	4.19%	84M	6.71%	3.83%
	Mothership	69,238	8.8%	5.1%	31,078	11.1%	11.0%	607	9.0%	4.0%	80	15.9%	6.2%	87M	8.38%	4.84%	26M	8.26%	4.77%
	Inshore	562,186	14.2%	8.3%	287,288	15.1%	15.1%	15,143	27.8%	12.2%	449	5.3%	4.3%	598M	12.93%	7.53%	209M	13.18%	7.68%

Table Appendix 6-3 Cumulative amounts of potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 450,000 from 2011-2022

If a 450,000 chum PSC limit had been in place 2011-2022:		Sum of Forgone B Season Pollock (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chum Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chinook Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Herring Avoided (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Wholesale Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Ex-Vessel Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**527,984**	**6.0%**	**3.5%**	**171,870**	**5.1%**	**5.1%**	**6,891**	**8.2%**	**3.0%**	**303**	**2.8%**	**1.8%**	**640M**	**5.85%**	**3.37%**	**193M**	**5.50%**	**3.17%**
	CDQ	90,104	10.2%	5.8%	57,753	25.3%	25.2%	430	12.6%	2.9%	2	0.6%	0.4%	111M	9.59%	5.44%	33M	9.20%	5.23%
	CP	255,325	8.2%	4.7%	95,546	9.9%	9.9%	4,417	23.3%	6.1%	20	1.2%	0.5%	334M	8.11%	4.64%	93M	7.44%	4.24%
	Mothership	33,619	4.3%	2.5%	5,518	2.0%	2.0%	250	3.7%	1.6%	56	11.1%	4.3%	41M	3.92%	2.26%	12M	3.91%	2.26%
	Inshore	148,936	3.8%	2.2%	13,053	0.7%	0.7%	1,794	3.3%	1.4%	226	2.6%	2.2%	154M	3.33%	1.94%	55M	3.46%	2.02%
5-year avg. sector apportionment	**Total**	**471,574**	**5.4%**	**3.1%**	**153,079**	**4.5%**	**4.5%**	**4,383**	**5.2%**	**1.9%**	**302**	**2.7%**	**1.8%**	**564M**	**5.15%**	**2.97%**	**172M**	**4.89%**	**2.82%**
	CDQ	90,104	10.2%	5.8%	57,753	25.3%	25.2%	430	12.6%	2.9%	2	0.6%	0.4%	111M	9.59%	5.44%	33M	9.20%	5.23%
	CP	202,042	6.5%	3.7%	81,145	8.4%	8.4%	1,991	10.5%	2.8%	18	1.1%	0.4%	261M	6.35%	3.63%	73M	5.81%	3.31%
	Mothership	30,492	3.9%	2.2%	1,128	0.4%	0.4%	168	2.5%	1.1%	56	11.0%	4.3%	37M	3.52%	2.03%	11M	3.55%	2.05%
	Inshore	148,936	3.8%	2.2%	13,053	0.7%	0.7%	1,794	3.3%	1.4%	226	2.6%	2.2%	154M	3.33%	1.94%	55M	3.46%	2.02%
Pro-rata sector apportionment	**Total**	**474,701**	**5.4%**	**3.1%**	**157,469**	**4.7%**	**4.7%**	**4,465**	**5.3%**	**2.0%**	**302**	**2.7%**	**1.8%**	**568M**	**5.19%**	**2.99%**	**173M**	**4.92%**	**2.84%**
	CDQ	90,104	10.2%	5.8%	57,753	25.3%	25.2%	430	12.6%	2.9%	2	0.6%	0.4%	111M	9.59%	5.44%	33M	9.20%	5.23%
	CP	202,042	6.5%	3.7%	81,145	8.4%	8.4%	1,991	10.5%	2.8%	18	1.1%	0.4%	261M	6.35%	3.63%	73M	5.81%	3.31%
	Mothership	33,619	4.3%	2.5%	5,518	2.0%	2.0%	250	3.7%	1.6%	56	11.1%	4.3%	41M	3.92%	2.26%	12M	3.91%	2.26%
	Inshore	148,936	3.8%	2.2%	13,053	0.7%	0.7%	1,794	3.3%	1.4%	226	2.6%	2.2%	154M	3.33%	1.94%	55M	3.46%	2.02%
AFA sector apportionment	**Total**	**418,368**	**4.8%**	**2.8%**	**172,531**	**5.1%**	**5.1%**	**6,595**	**7.9%**	**2.9%**	**336**	**3.1%**	**2.0%**	**482M**	**4.41%**	**2.54%**	**154M**	**4.38%**	**2.52%**
	CDQ	76,810	8.7%	4.9%	19,679	8.6%	8.6%	419	12.3%	2.8%	2	0.5%	0.3%	94M	8.12%	4.61%	28M	7.88%	4.48%
	CP	102,579	3.3%	1.9%	31,635	3.3%	3.3%	443	2.3%	0.6%	18	1.1%	0.4%	133M	3.24%	1.85%	37M	2.93%	1.67%
	Mothership	38,733	4.9%	2.8%	14,154	5.1%	5.0%	263	3.9%	1.7%	70	13.9%	5.4%	47M	4.50%	2.60%	14M	4.51%	2.61%
	Inshore	200,246	5.1%	3.0%	107,063	5.6%	5.6%	5,470	10.0%	4.4%	246	2.9%	2.4%	207M	4.49%	2.61%	75M	4.72%	2.75%

Table Appendix 6-4 Cumulative amounts of potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 550,000 from 2011-2022

If a 550,000 chum PSC limit had been in place 2011-2022:		Sum of Forgone B Season Pollock (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chum Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Chinook Avoided (#)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Herring Avoided (mt)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Wholesale Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total	Sum of B Season Ex-Vessel Value Forgone All BSAI Groundfish (real 2022 $)	Reduction as % of B Season Total	Reduction as % of Annual Total
3-year avg. sector apportionment	**Total**	**274,502**	**3.1%**	**1.8%**	**124,335**	**3.7%**	**3.7%**	**2,317**	**2.8%**	**1.0%**	**30**	**0.3%**	**0.2%**	**349M**	**3.19%**	**1.84%**	**99M**	**2.82%**	**1.63%**
	CDQ	90,104	10.2%	5.8%	57,753	25.3%	25.2%	430	12.6%	2.9%	2	0.6%	0.4%	111M	9.59%	5.44%	33M	9.20%	5.23%
	CP	173,485	5.6%	3.2%	66,382	6.9%	6.9%	1,815	9.6%	2.5%	18	1.1%	0.4%	225M	5.46%	3.12%	62M	4.97%	2.84%
	Mothership	10,914	1.4%	0.8%	200	0.1%	0.1%	72	1.1%	0.5%	10	2.0%	0.8%	13M	1.25%	0.72%	4M	1.27%	0.73%
	Inshore		0.0%	0.0%		0.0%	0.0%		0.0%	0.0%		0.0%	0.0%		0.00%	0.00%		0.00%	0.00%
5-year avg. sector apportionment	**Total**	**359,623**	**4.1%**	**2.4%**	**95,095**	**2.8%**	**2.8%**	**2,800**	**3.3%**	**1.2%**	**246**	**2.2%**	**1.5%**	**422M**	**3.86%**	**2.23%**	**131M**	**3.72%**	**2.14%**
	CDQ	76,810	8.7%	4.9%	19,679	8.6%	8.6%	419	12.3%	2.8%	2	0.5%	0.3%	94M	8.12%	4.61%	28M	7.88%	4.48%
	CP	133,877	4.3%	2.5%	62,363	6.5%	6.4%	587	3.1%	0.8%	18	1.1%	0.4%	174M	4.23%	2.42%	48M	3.81%	2.18%
	Mothership		0.0%	0.0%	13,053	0.0%	0.0%		0.0%	0.0%		0.0%	0.0%		0.00%	0.00%		0.00%	0.00%
	Inshore	148,936	3.8%	2.2%		0.7%	0.7%	1,794	3.3%	1.4%	226	2.6%	2.2%	154M	3.33%	1.94%	55M	3.46%	2.02%
Pro-rata sector apportionment	**Total**	**370,537**	**4.2%**	**2.5%**	**95,295**	**2.8%**	**2.8%**	**2,872**	**3.4%**	**1.3%**	**256**	**2.3%**	**1.5%**	**435M**	**3.98%**	**2.29%**	**135M**	**3.84%**	**2.21%**
	CDQ	76,810	8.7%	4.9%	19,679	8.6%	8.6%	419	12.3%	2.8%	2	0.5%	0.3%	94M	8.12%	4.61%	28M	7.88%	4.48%
	CP	133,877	4.3%	2.5%	62,363	6.5%	6.4%	587	3.1%	0.8%	18	1.1%	0.4%	174M	4.23%	2.42%	48M	3.81%	2.18%
	Mothership	10,914	1.4%	0.8%	200	0.1%	0.1%	72	1.1%	0.5%	10	2.0%	0.8%	13M	1.25%	0.72%	4M	1.27%	0.73%
	Inshore	148,936	3.8%	2.2%	13,053	0.7%	0.7%	1,794	3.3%	1.4%	226	2.6%	2.2%	154M	3.33%	1.94%	55M	3.46%	2.02%
AFA sector apportionment	**Total**	**204,635**	**2.3%**	**1.4%**	**28,736**	**0.9%**	**0.8%**	**2,172**	**2.6%**	**1.0%**	**280**	**2.6%**	**1.7%**	**224M**	**2.04%**	**1.18%**	**75M**	**2.13%**	**1.23%**
	CDQ	30,507	3.4%	2.0%	13,584	6.0%	5.9%	262	7.7%	1.7%	1	0.2%	0.1%	39M	3.38%	1.92%	11M	3.06%	1.74%
	CP	2,225	0.1%	0.0%	1,321	0.1%	0.1%	8	0.0%	0.0%	1	0.1%	0.0%	3M	0.07%	0.04%	1M	0.06%	0.04%
	Mothership	22,968	2.9%	1.7%	778	0.3%	0.3%	108	1.6%	0.7%	53	10.5%	4.1%	27M	2.63%	1.52%	8M	2.67%	1.54%
	Inshore	148,936	3.8%	2.2%	13,053	0.7%	0.7%	1,794	3.3%	1.4%	226	2.6%	2.2%	154M	3.33%	1.94%	55M	3.46%	2.02%

Table Appendix 6-5 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 200,000 apportioned under suboption 1 (3-year average)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
	Total		**884,892**	**189,218**	**21.4%**	**12.1%**	**227,891**	**99,035**	**43.5%**	**43.2%**	**3,413**	**1,441**	**42.2%**	**9.6%**	**311**	**3**	**0.96%**	**0.59%**	**1,161M**	**235M**	**20.23%**	**11.48%**	**354M**	**70M**	**19.87%**	**11.29%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
CDQ	2016	8/6/2016	81,476	14,836	18.2%	11.0%	16,342	3,238	19.8%	19.3%	352	273	77.6%	17.1%	139	0	0.05%	0.05%	104M	19M	18.34%	10.99%	30M	5M	18.34%	11.00%
	2017	7/8/2017	75,419	48,998	65.0%	35.9%	87,058	72,998	83.8%	83.6%	388	224	57.7%	8.9%	3	1	41.53%	17.75%	97M	63M	65.08%	35.91%	27M	17M	65.18%	35.99%
	2018	6/30/2018	76,296	63,534	83.3%	45.9%	26,586	12,995	48.9%	48.8%	358	300	83.8%	23.2%	2	0	13.80%	10.30%	93M	77M	83.33%	45.85%	30M	25M	83.31%	45.90%
	2019	9/21/2019	78,315	13,261	16.9%	9.4%	15,726	3,446	21.9%	21.8%	719	408	56.7%	17.1%	9	0	0.39%	0.25%	104M	18M	17.03%	9.38%	29M	5M	17.13%	9.46%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
	Total		**3,124,177**	**808,749**	**25.9%**	**14.9%**	**961,389**	**347,317**	**36.1%**	**35.9%**	**18,989**	**11,277**	**59.4%**	**15.6%**	**1,623**	**164**	**10.13%**	**3.71%**	**4,114M**	**1,021M**	**24.81%**	**14.18%**	**1,256M**	**306M**	**24.39%**	**13.92%**
	2011	10/29/2011	250,129	2,073	0.8%	0.5%	44,299	18	0.0%	0.0%	1,652	31	1.9%	0.9%	124	0	0.00%	0.00%	392M	3M	0.86%	0.50%	115M	1M	0.88%	0.50%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014	9/6/2014	267,977	18,825	7.0%	4.2%	63,066	7,424	11.8%	11.7%	567	252	44.4%	5.6%	7	0	2.38%	2.37%	343M	24M	7.05%	4.22%	111M	8M	7.06%	4.20%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
CP	2016	8/6/2016	284,065	141,263	49.7%	30.2%	134,750	75,009	55.7%	54.8%	2,403	2,005	83.4%	22.6%	47	14	29.84%	3.40%	366M	183M	49.89%	30.20%	104M	52M	50.04%	30.29%
	2017	7/22/2017	266,891	162,802	61.0%	34.4%	207,355	110,576	53.3%	53.0%	1,475	809	54.8%	7.8%	27	18	68.36%	7.85%	346M	212M	61.17%	34.42%	95M	58M	61.37%	34.61%
	2018	7/7/2018	263,947	218,962	83.0%	45.8%	99,447	40,571	40.8%	40.7%	1,259	1,064	84.5%	22.8%	18	2	9.18%	4.03%	321M	267M	82.94%	45.63%	104M	86M	82.83%	45.73%
	2019	8/31/2019	275,173	67,037	24.4%	13.7%	113,428	18,785	16.6%	16.5%	3,127	2,680	85.7%	26.0%	4	2	50.46%	1.17%	367M	91M	24.72%	13.83%	103M	26M	24.80%	13.95%
	2020	9/5/2020	245,375	53,883	22.0%	11.5%	77,138	32,244	41.8%	41.6%	4,151	3,599	86.7%	31.6%	97	35	36.58%	2.35%	298M	66M	22.27%	11.60%	93M	21M	22.48%	11.78%
	2021	7/31/2021	264,947	125,523	47.4%	26.1%	97,917	37,412	38.2%	38.2%	1,187	775	65.3%	16.5%	5	4	67.65%	2.68%	315M	149M	47.42%	25.88%	98M	47M	47.44%	25.94%
	2022	8/20/2022	209,668	18,381	8.8%	4.8%	71,786	25,278	35.2%	35.2%	254	62	24.4%	3.5%	126	89	70.92%	55.50%	292M	26M	8.80%	4.82%	94M	8M	8.83%	4.84%
	Total		**790,812**	**117,955**	**14.9%**	**8.6%**	**280,145**	**65,310**	**23.3%**	**23.2%**	**6,774**	**3,235**	**47.8%**	**21.1%**	**503**	**82**	**16.37%**	**6.43%**	**1,037M**	**154M**	**14.89%**	**8.59%**	**317M**	**46M**	**14.49%**	**8.37%**
	2011	9/17/2011	65,724	16,243	24.7%	14.8%	24,399	5,176	21.2%	21.2%	2,426	2,332	96.1%	80.8%	3	0	1.51%	1.44%	103M	26M	25.01%	14.87%	30M	8M	24.98%	14.75%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
Mothership	2016	8/13/2016	70,599	30,840	43.7%	26.3%	43,262	18,916	43.7%	43.6%	366	233	63.7%	16.1%	14	0	2.87%	0.26%	90M	39M	43.68%	26.27%	26M	11M	43.69%	26.28%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018	9/1/2018	66,892	5,677	8.5%	4.8%	21,303	2,897	13.6%	13.6%	364	103	28.3%	13.9%	6	1	18.80%	16.50%	81M	7M	8.56%	4.79%	26M	2M	8.52%	4.77%
	2019	8/31/2019	68,066	20,795	30.6%	17.0%	44,860	20,379	45.4%	44.8%	538	392	72.9%	26.8%	12	11	91.58%	90.69%	90M	27M	30.37%	16.80%	25M	8M	30.24%	16.87%
	2020	10/31/2020	66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	7/31/2021	66,593	32,775	49.2%	27.3%	50,542	9,694	19.2%	19.2%	222	141	63.5%	15.3%	129	70	53.90%	38.68%	79M	39M	49.16%	27.12%	25M	12M	48.86%	27.09%
	2022	8/13/2022	53,532	11,625	21.7%	12.2%	32,262	8,248	25.6%	25.6%	74	34	45.9%	10.7%	149	0	0.10%	0.06%	75M	16M	21.58%	12.14%	24M	5M	21.68%	12.19%
	Total		**3,949,430**	**667,332**	**16.9%**	**9.9%**	**1,899,055**	**340,685**	**17.9%**	**17.9%**	**54,569**	**16,921**	**31.0%**	**13.7%**	**8,544**	**475**	**5.56%**	**4.58%**	**4,623M**	**719M**	**15.55%**	**9.06%**	**1,583M**	**251M**	**15.83%**	**9.22%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014	9/6/2014	335,322	25,986	7.7%	4.7%	145,322	12,744	8.8%	8.7%	2,718	907	33.4%	9.9%	136	0	0.00%	0.00%	407M	32M	7.80%	4.71%	139M	11M	7.62%	4.60%
	2015	8/29/2015	346,959	77,724	22.4%	13.6%	174,343	38,094	21.9%	21.5%	2,848	1,519	53.3%	14.3%	1,059	23	2.15%	2.06%	381M	85M	22.31%	13.60%	141M	31M	21.71%	13.22%
Inshore	2016	9/10/2016	354,015	23,825	6.7%	4.1%	144,882	15,397	10.6%	10.5%	1,987	897	45.1%	8.9%	654	0	0.01%	0.01%	398M	27M	6.72%	4.06%	129M	8M	6.34%	3.91%
	2017	8/5/2017	346,323	123,509	35.7%	20.9%	154,610	19,536	12.6%	12.6%	6,134	2,851	46.5%	18.8%	646	63	9.78%	9.47%	354M	127M	35.73%	20.88%	121M	43M	35.19%	20.51%
	2018	9/1/2018	343,996	50,448	14.7%	8.4%	147,369	14,956	10.1%	10.1%	3,215	773	24.0%	11.0%	381	0	0.02%	0.01%	387M	56M	14.56%	8.39%	135M	19M	14.24%	8.20%
	2019	9/7/2019	348,384	54,020	15.5%	8.8%	172,798	32,131	18.6%	18.6%	4,863	1,257	25.8%	11.6%	866	93	10.74%	10.21%	413M	64M	15.45%	8.82%	128M	20M	15.26%	8.65%
	2020	9/5/2020	327,025	114,920	35.1%	19.2%	237,632	111,140	46.8%	46.7%	7,807	6,726	86.2%	42.4%	822	35	4.25%	2.03%	334M	118M	35.26%	19.19%	124M	45M	36.17%	19.87%
	2021	7/31/2021	339,546	172,796	50.9%	28.9%	341,779	94,626	27.7%	27.7%	2,571	1,839	71.5%	26.4%	970	246	25.34%	18.15%	353M	179M	50.77%	28.77%	126M	64M	50.65%	28.77%
	2022	8/20/2022	262,593	24,105	9.2%	5.1%	131,896	2,061	1.6%	1.6%	787	152	19.3%	4.0%	974	15	1.54%	1.18%	346M	32M	9.21%	5.10%	118M	11M	9.36%	5.20%
Grand Total			**8,749,312**	**1,783,298**	**20.4%**	**11.8%**	**3,368,480**	**852,347**	**25.3%**	**25.2%**	**83,745**	**32,874**	**39.3%**	**14.5%**	**10,980**	**725**	**6.60%**	**4.37%**	**10,936M**	**2,129M**	**19.47%**	**11.22%**	**3,511M**	**673M**	**19.18%**	**11.05%**

Table Appendix 6-6 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 200,000 apportioned under suboption 2 (5-year average)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
CDQ	**Total**		**884,892**	**164,173**	**18.6%**	**10.5%**	**227,891**	**63,497**	**27.9%**	**27.7%**	**3,413**	**1,168**	**34.2%**	**7.8%**	**311**	**2**	**0.67%**	**0.41%**	**1,161M**	**203M**	**17.46%**	**9.91%**	**354M**	**61M**	**17.26%**	**9.80%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
	2016	8/13/2016	81,476	10,195	12.5%	7.5%	16,342	1,327	8.1%	7.9%	352	258	73.3%	16.2%	139	0	0.01%	0.01%	104M	13M	12.60%	7.55%	30M	4M	12.60%	7.55%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.51%
	2018	7/7/2018	76,296	57,635	75.5%	41.7%	26,586	3,859	14.5%	14.5%	358	275	76.8%	21.3%	2	0	9.10%	6.79%	93M	70M	75.58%	41.59%	30M	22M	75.57%	41.64%
	2019	9/28/2019	78,315	6,239	8.0%	4.4%	15,726	558	3.5%	3.5%	719	205	28.5%	8.6%	9	0	0.05%	0.03%	104M	8M	8.03%	4.42%	29M	2M	8.05%	4.45%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	2.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
CP	**Total**		**3,124,177**	**785,612**	**25.1%**	**14.5%**	**961,389**	**325,469**	**33.9%**	**33.7%**	**18,989**	**11,055**	**58.2%**	**15.3%**	**1,623**	**163**	**10.07%**	**3.68%**	**4,114M**	**990M**	**24.06%**	**13.75%**	**1,256M**	**297M**	**23.61%**	**13.47%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014	9/6/2014	267,977	18,825	7.0%	4.2%	63,066	7,424	11.8%	11.7%	567	252	44.4%	5.6%	7	0	2.38%	2.37%	343M	24M	7.05%	4.22%	111M	8M	7.06%	4.20%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
	2016	8/6/2016	284,065	141,263	49.7%	30.2%	134,750	75,009	55.7%	54.8%	2,403	2,005	83.4%	22.6%	47	14	29.84%	3.40%	366M	183M	49.89%	30.20%	104M	52M	50.04%	30.29%
	2017	7/22/2017	266,891	162,802	61.0%	34.4%	207,355	110,576	53.3%	53.0%	1,475	809	54.8%	7.8%	27	18	68.36%	7.85%	346M	212M	61.17%	34.42%	95M	58M	61.37%	34.61%
	2018	7/7/2018	263,947	218,962	83.0%	45.8%	99,447	40,571	40.8%	40.7%	1,259	1,064	84.5%	22.8%	18	2	9.18%	4.03%	321M	267M	82.94%	45.63%	104M	86M	82.83%	45.73%
	2019	8/31/2019	275,173	67,037	24.4%	13.7%	113,428	18,785	16.6%	16.5%	3,127	2,680	85.7%	26.0%	4	2	50.46%	1.17%	367M	91M	24.72%	13.83%	103M	26M	24.80%	13.95%
	2020	9/12/2020	245,375	42,440	17.3%	9.1%	77,138	24,976	32.4%	32.3%	4,151	3,435	82.8%	30.2%	97	34	35.52%	2.28%	298M	52M	17.56%	9.14%	93M	16M	17.73%	9.29%
	2021	7/31/2021	264,947	125,523	47.4%	26.1%	97,917	37,412	38.2%	38.2%	1,187	775	65.3%	16.5%	5	4	67.65%	2.68%	315M	149M	47.42%	25.88%	98M	47M	47.44%	25.94%
	2022	8/27/2022	209,668	8,760	4.2%	2.3%	71,786	10,716	14.9%	14.9%	254	35	13.8%	2.0%	126	89	70.91%	55.49%	292M	12M	4.19%	2.30%	94M	4M	4.21%	2.31%
Mothership	**Total**		**790,812**	**114,457**	**14.5%**	**8.4%**	**280,145**	**62,513**	**22.3%**	**22.2%**	**6,774**	**3,140**	**46.4%**	**20.5%**	**503**	**81**	**16.14%**	**6.34%**	**1,037M**	**150M**	**14.48%**	**8.36%**	**317M**	**45M**	**14.06%**	**8.12%**
	2011	9/17/2011	65,724	16,243	24.7%	14.8%	24,399	5,176	21.2%	21.2%	2,426	2,332	96.1%	80.8%	3	0	1.51%	1.44%	103M	26M	25.01%	14.87%	30M	8M	24.98%	14.75%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
	2016	8/13/2016	70,599	30,840	43.7%	26.3%	43,262	18,916	43.7%	43.6%	366	233	63.7%	16.1%	14	0	2.87%	0.26%	90M	39M	43.68%	26.27%	26M	11M	43.69%	26.28%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018	9/8/2018	66,892	2,179	3.3%	1.8%	21,303	100	0.5%	0.5%	364	8	2.2%	1.1%	6	0	0.00%	0.00%	81M	3M	3.33%	1.86%	26M	1M	3.31%	1.86%
	2019	8/31/2019	68,066	20,795	30.6%	17.0%	44,860	20,379	45.4%	44.8%	538	392	72.9%	26.8%	12	11	91.58%	90.69%	90M	27M	30.37%	16.80%	25M	8M	30.24%	16.87%
	2020	10/31/2020	66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	7/31/2021	66,593	32,775	49.2%	27.3%	50,542	9,694	19.2%	19.2%	222	141	63.5%	15.3%	129	70	53.90%	38.68%	79M	39M	49.16%	27.12%	25M	12M	48.86%	27.09%
	2022	8/13/2022	53,532	11,625	21.7%	12.2%	32,262	8,248	25.6%	25.6%	74	34	45.9%	10.7%	149	0	0.10%	0.06%	75M	16M	21.58%	12.14%	24M	5M	21.68%	12.19%
Inshore	**Total**		**3,949,430**	**843,005**	**21.3%**	**12.4%**	**1,899,055**	**542,968**	**28.6%**	**28.5%**	**54,569**	**21,415**	**39.2%**	**17.3%**	**8,544**	**643**	**7.53%**	**6.21%**	**4,623M**	**921M**	**19.93%**	**11.61%**	**1,583M**	**319M**	**20.14%**	**11.73%**
	2011	10/15/2011	299,466	7,468	2.5%	1.4%	118,861	786	0.7%	0.7%	13,951	2,286	16.4%	12.4%	236	0	0.00%	0.00%	413M	10M	2.54%	1.46%	138M	4M	2.55%	1.47%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014	8/30/2014	335,322	47,726	14.2%	8.6%	145,322	23,714	16.3%	16.3%	2,718	1,452	53.4%	15.9%	136	1	0.42%	0.42%	407M	58M	14.28%	8.63%	139M	20M	14.11%	8.53%
	2015	8/22/2015	346,959	98,950	28.5%	17.3%	174,343	53,326	30.6%	30.1%	2,848	1,648	57.9%	15.5%	1,059	33	3.13%	3.00%	381M	108M	28.39%	17.30%	141M	39M	27.93%	17.01%
	2016	9/10/2016	354,015	23,825	6.7%	4.1%	144,882	15,397	10.6%	10.5%	1,987	897	45.1%	8.9%	654	0	0.01%	0.01%	398M	27M	6.72%	4.06%	129M	8M	6.47%	3.91%
	2017	7/29/2017	346,323	151,531	43.8%	25.7%	154,610	32,644	21.1%	21.1%	6,134	3,412	55.6%	22.5%	646	105	16.29%	15.77%	354M	155M	43.85%	25.63%	121M	53M	43.41%	25.29%
	2018	9/1/2018	343,996	50,448	14.7%	8.4%	147,369	14,956	10.1%	10.1%	3,215	773	24.0%	11.0%	381	0	0.02%	0.01%	387M	56M	14.56%	8.39%	135M	19M	14.24%	8.20%
	2019	8/17/2019	348,384	117,810	33.8%	19.3%	172,798	55,006	31.8%	31.8%	4,863	2,061	42.4%	19.1%	866	98	11.32%	10.77%	413M	139M	33.68%	19.22%	128M	43M	33.68%	19.08%
	2020	9/5/2020	327,025	114,920	35.1%	19.2%	237,632	111,140	46.8%	46.7%	7,807	6,726	86.2%	42.4%	822	35	4.25%	2.03%	334M	118M	35.26%	19.19%	124M	45M	36.17%	19.87%
	2021	7/24/2021	339,546	194,443	57.3%	32.6%	341,779	225,297	65.9%	65.9%	2,571	1,877	73.0%	26.9%	970	264	27.20%	19.48%	353M	202M	57.16%	32.39%	126M	72M	57.02%	32.39%
	2022	8/13/2022	262,593	35,883	13.7%	7.6%	131,896	10,702	8.1%	8.1%	787	283	36.0%	7.4%	974	107	11.02%	8.43%	346M	47M	13.71%	7.60%	118M	16M	13.85%	7.69%
Grand Total			**8,749,312**	**1,907,248**	**21.8%**	**12.6%**	**3,368,480**	**994,447**	**29.5%**	**29.4%**	**83,745**	**36,778**	**43.9%**	**16.3%**	**10,980**	**890**	**8.10%**	**5.37%**	**10,936M**	**2,264M**	**20.70%**	**11.93%**	**3,511M**	**721M**	**20.54%**	**11.84%**

Table Appendix 6-7 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 200,000 apportioned under suboption 3 (pro-rata)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
CDQ	**Total**		**884,892**	**164,173**	**18.6%**	**10.5%**	**227,891**	**63,497**	**27.9%**	**27.7%**	**3,413**	**1,168**	**34.2%**	**7.8%**	**311**	**2**	**0.67%**	**0.41%**	**1,161M**	**203M**	**17.46%**	**9.91%**	**354M**	**61M**	**17.26%**	**9.80%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
	2016	8/13/2016	81,476	10,195	12.5%	7.5%	16,342	1,327	8.1%	7.9%	352	258	73.3%	16.2%	139	0	0.01%	0.01%	104M	13M	12.60%	7.55%	30M	4M	12.60%	7.55%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.51%
	2018	7/7/2018	76,296	57,635	75.5%	41.7%	26,586	3,859	14.5%	14.5%	358	275	76.8%	21.3%	2	0	9.10%	6.79%	93M	70M	75.58%	41.59%	30M	22M	75.57%	41.64%
	2019	9/28/2019	78,315	6,239	8.0%	4.4%	15,726	558	3.5%	3.5%	719	205	28.5%	8.6%	9	0	0.05%	0.03%	104M	8M	8.03%	4.42%	29M	2M	8.05%	4.45%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
CP	**Total**		**3,124,177**	**785,612**	**25.1%**	**14.5%**	**961,389**	**325,469**	**33.9%**	**33.7%**	**18,989**	**11,055**	**58.2%**	**15.3%**	**1,623**	**163**	**10.07%**	**3.68%**	**4,114M**	**990M**	**24.06%**	**13.75%**	**1,256M**	**297M**	**23.61%**	**13.47%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014	9/6/2014	267,977	18,825	7.0%	4.2%	63,066	7,424	11.8%	11.7%	567	252	44.4%	5.6%	7	0	2.38%	2.37%	343M	24M	7.05%	4.22%	111M	8M	7.06%	4.20%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
	2016	8/6/2016	284,065	141,263	49.7%	30.2%	134,750	75,009	55.7%	54.8%	2,403	2,005	83.4%	22.6%	47	14	29.84%	3.40%	366M	183M	49.89%	30.20%	104M	52M	50.04%	30.29%
	2017	7/22/2017	266,891	162,802	61.0%	34.4%	207,355	110,576	53.3%	53.0%	1,475	809	54.8%	7.8%	27	18	68.36%	7.85%	346M	212M	61.17%	34.42%	95M	58M	61.37%	34.61%
	2018	7/7/2018	263,947	218,962	83.0%	45.8%	99,447	40,571	40.8%	40.7%	1,259	1,064	84.5%	22.8%	18	2	9.18%	4.03%	321M	267M	82.94%	45.63%	104M	86M	82.83%	45.73%
	2019	8/31/2019	275,173	67,037	24.4%	13.7%	113,428	18,785	16.6%	16.5%	3,127	2,680	85.7%	26.0%	4	2	50.46%	1.17%	367M	91M	24.72%	13.83%	103M	26M	24.80%	13.95%
	2020	9/12/2020	245,375	42,440	17.3%	9.1%	77,138	24,976	32.4%	32.3%	4,151	3,435	82.8%	30.2%	97	34	35.52%	2.28%	298M	52M	17.56%	9.14%	93M	16M	17.73%	9.29%
	2021	7/31/2021	264,947	125,523	47.4%	26.1%	97,917	37,412	38.2%	38.2%	1,187	775	65.3%	16.5%	5	4	67.65%	2.68%	315M	149M	47.42%	25.88%	98M	47M	47.44%	25.94%
	2022	8/27/2022	209,668	8,760	4.2%	2.3%	71,786	10,716	14.9%	14.9%	254	35	13.8%	2.0%	126	89	70.91%	55.49%	292M	12M	4.19%	2.30%	94M	4M	4.21%	2.31%
Mothership	**Total**		**790,812**	**117,955**	**14.9%**	**8.6%**	**280,145**	**65,310**	**23.3%**	**23.2%**	**6,774**	**3,235**	**47.8%**	**21.1%**	**503**	**82**	**16.37%**	**6.43%**	**1,037M**	**154M**	**14.89%**	**8.59%**	**317M**	**46M**	**14.49%**	**8.37%**
	2011	9/17/2011	65,724	16,243	24.7%	14.8%	24,399	5,176	21.2%	21.2%	2,426	2,332	96.1%	80.8%	3	0	1.51%	1.44%	103M	26M	25.01%	14.87%	30M	8M	24.98%	14.75%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
	2016	8/13/2016	70,599	30,840	43.7%	26.3%	43,262	18,916	43.7%	43.6%	366	233	63.7%	16.1%	14	0	2.87%	0.26%	90M	39M	43.68%	26.27%	26M	11M	43.69%	26.28%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018	9/1/2018	66,892	5,677	8.5%	4.8%	21,303	2,897	13.6%	13.6%	364	103	28.3%	13.9%	6	1	18.80%	16.50%	81M	7M	8.56%	4.79%	26M	2M	8.52%	4.77%
	2019	8/31/2019	68,066	20,795	30.6%	17.0%	44,860	20,379	45.4%	44.8%	538	392	72.9%	26.8%	12	11	91.58%	90.69%	90M	27M	30.37%	16.80%	25M	8M	30.24%	16.87%
	2020	10/31/2020	66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	7/31/2021	66,593	32,775	49.2%	27.3%	50,542	9,694	19.2%	19.2%	222	141	63.5%	15.3%	129	70	53.90%	38.68%	79M	39M	49.16%	27.12%	25M	12M	48.86%	27.09%
	2022	8/13/2022	53,532	11,625	21.7%	12.2%	32,262	8,248	25.6%	25.6%	74	34	45.9%	10.7%	149	0	0.10%	0.06%	75M	16M	21.58%	12.14%	24M	5M	21.68%	12.19%
Inshore	**Total**		**3,949,430**	**821,358**	**20.8%**	**12.1%**	**1,899,055**	**412,297**	**21.7%**	**21.7%**	**54,569**	**21,377**	**39.2%**	**17.3%**	**8,544**	**625**	**7.32%**	**6.04%**	**4,623M**	**899M**	**19.44%**	**11.33%**	**1,583M**	**311M**	**19.63%**	**11.44%**
	2011	10/15/2011	299,466	7,468	2.5%	1.4%	118,861	786	0.7%	0.7%	13,951	2,286	16.4%	12.4%	236	0	0.00%	0.00%	413M	10M	2.54%	1.46%	138M	4M	2.55%	1.47%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014	8/30/2014	335,322	47,726	14.2%	8.6%	145,322	23,714	16.3%	16.3%	2,718	1,452	53.4%	15.9%	136	1	0.42%	0.42%	407M	58M	14.28%	8.63%	139M	20M	14.11%	8.53%
	2015	8/22/2015	346,959	98,950	28.5%	17.3%	174,343	53,326	30.6%	30.1%	2,848	1,648	57.9%	15.5%	1,059	33	3.13%	3.00%	381M	108M	28.39%	17.30%	141M	39M	27.93%	17.01%
	2016	9/10/2016	354,015	23,825	6.7%	4.1%	144,882	15,397	10.6%	10.5%	1,987	897	45.1%	8.9%	654	0	0.01%	0.01%	398M	27M	6.72%	4.06%	129M	8M	6.47%	3.91%
	2017	7/29/2017	346,323	151,531	43.8%	25.7%	154,610	32,644	21.1%	21.1%	6,134	3,412	55.6%	22.5%	646	105	16.29%	15.77%	354M	155M	43.85%	25.63%	121M	53M	43.41%	25.29%
	2018	9/1/2018	343,996	50,448	14.7%	8.4%	147,369	14,956	10.1%	10.1%	3,215	773	24.0%	11.0%	381	0	0.02%	0.01%	387M	56M	14.56%	8.39%	135M	19M	14.24%	8.20%
	2019	8/17/2019	348,384	117,810	33.8%	19.3%	172,798	55,006	31.8%	31.8%	4,863	2,061	42.4%	19.1%	866	98	11.32%	10.77%	413M	139M	33.68%	19.22%	128M	43M	33.68%	19.08%
	2020	9/5/2020	327,025	114,920	35.1%	19.2%	237,632	111,140	46.8%	46.7%	7,807	6,726	86.2%	42.4%	822	35	4.25%	2.03%	334M	118M	35.26%	19.19%	124M	45M	36.17%	19.87%
	2021	7/31/2021	339,546	172,796	50.9%	28.9%	341,779	94,626	27.7%	27.7%	2,571	1,839	71.5%	26.4%	970	246	25.34%	18.15%	353M	179M	50.77%	28.77%	126M	64M	50.65%	28.77%
	2022	8/13/2022	262,593	35,883	13.7%	7.6%	131,896	10,702	8.1%	8.1%	787	283	36.0%	7.4%	974	107	11.02%	8.43%	346M	47M	13.71%	7.60%	118M	16M	13.85%	7.69%
Grand Total			**8,749,312**	**1,889,098**	**21.6%**	**12.5%**	**3,368,480**	**866,573**	**25.7%**	**25.6%**	**83,745**	**36,835**	**44.0%**	**16.3%**	**10,980**	**873**	**7.95%**	**5.27%**	**10,936M**	**2,246M**	**20.54%**	**11.83%**	**3,511M**	**715M**	**20.35%**	**11.73%**

Table Appendix 6-8 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 200,000 apportioned under suboption 4 (AFA)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
	Total		**884,892**	**147,739**	**16.7%**	**9.5%**	**227,891**	**61,612**	**27.0%**	**26.9%**	**3,413**	**705**	**20.7%**	**4.7%**	**311**	**2**	**0.67%**	**0.41%**	**1,161M**	**181M**	**15.62%**	**8.86%**	**354M**	**55M**	**15.54%**	**8.86%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
CDQ	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.45%
	2018	7/7/2018	76,296	57,635	75.5%	41.7%	26,586	3,859	14.5%	14.5%	358	275	76.8%	21.3%	2	0	9.10%	6.79%	93M	70M	75.58%	41.59%	30M	22M	75.57%	41.59%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.74%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
	Total		**3,124,177**	**621,440**	**19.9%**	**11.4%**	**961,389**	**235,752**	**24.5%**	**24.4%**	**18,989**	**9,511**	**50.1%**	**13.2%**	**1,623**	**70**	**4.30%**	**1.57%**	**4,114M**	**786M**	**19.11%**	**10.92%**	**1,256M**	**233M**	**18.52%**	**10.92%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
CP	2016	8/13/2016	284,065	118,751	41.8%	25.4%	134,750	56,071	41.6%	41.0%	2,403	1,789	74.4%	20.2%	47	11	24.00%	2.73%	366M	153M	41.86%	25.34%	104M	44M	42.00%	25.34%
	2017	7/22/2017	266,891	162,802	61.0%	34.4%	207,355	110,576	53.3%	53.0%	1,475	809	54.8%	7.8%	27	18	68.36%	7.85%	346M	212M	61.17%	34.42%	95M	58M	61.37%	34.42%
	2018	7/21/2018	263,947	171,330	64.9%	35.9%	99,447	23,055	23.2%	23.1%	1,259	957	76.0%	20.5%	18	1	6.33%	2.78%	321M	209M	64.99%	35.75%	104M	67M	64.93%	35.75%
	2019	8/31/2019	275,173	67,037	24.4%	13.7%	113,428	18,785	16.6%	16.5%	3,127	2,680	85.7%	26.0%	4	2	50.46%	1.17%	367M	91M	24.72%	13.83%	103M	26M	24.80%	13.83%
	2020	10/3/2020	245,375	19,504	7.9%	4.2%	77,138	4,961	6.4%	6.4%	4,151	2,600	62.6%	22.8%	97	34	34.66%	2.23%	298M	24M	8.02%	4.18%	93M	7M	8.07%	4.18%
	2021	8/14/2021	264,947	82,016	31.0%	17.1%	97,917	22,304	22.8%	22.8%	1,187	676	57.0%	14.4%	5	4	65.50%	2.59%	315M	97M	30.94%	16.89%	98M	30M	30.94%	16.89%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
	Total		**790,812**	**120,149**	**15.2%**	**8.8%**	**280,145**	**66,894**	**23.9%**	**23.8%**	**6,774**	**3,553**	**52.5%**	**23.1%**	**503**	**82**	**16.38%**	**6.43%**	**1,037M**	**157M**	**15.14%**	**8.74%**	**317M**	**47M**	**14.75%**	**8.74%**
	2011	9/17/2011	65,724	16,243	24.7%	14.8%	24,399	5,176	21.2%	21.2%	2,426	2,332	96.1%	80.8%	3	0	1.51%	1.44%	103M	26M	25.01%	14.87%	30M	8M	24.98%	14.87%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
Mothership	2016	8/13/2016	70,599	30,840	43.7%	26.3%	43,262	18,916	43.7%	43.6%	366	233	63.7%	16.1%	14	0	2.87%	0.26%	90M	39M	43.68%	26.27%	26M	11M	43.69%	26.27%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018	9/1/2018	66,892	5,677	8.5%	4.8%	21,303	2,897	13.6%	13.6%	364	103	28.3%	13.9%	6	1	18.80%	16.50%	81M	7M	8.56%	4.79%	26M	2M	8.52%	4.79%
	2019	8/31/2019	68,066	20,795	30.6%	17.0%	44,860	20,379	45.4%	44.8%	538	392	72.9%	26.8%	12	11	91.58%	90.69%	90M	27M	30.37%	16.80%	25M	8M	30.24%	16.80%
	2020	10/24/2020	66,919	2,194	3.3%	1.8%	19,743	1,584	8.0%	8.0%	1,472	318	21.6%	11.7%	36	0	0.07%	0.01%	81M	3M	3.26%	1.79%	25M	1M	3.22%	1.79%
	2021	7/31/2021	66,593	32,775	49.2%	27.3%	50,542	9,694	19.2%	19.2%	222	141	63.5%	15.3%	129	70	53.90%	38.68%	79M	39M	49.16%	27.12%	25M	12M	48.86%	27.12%
	2022	8/13/2022	53,532	11,625	21.7%	12.2%	32,262	8,248	25.6%	25.6%	74	34	45.9%	10.7%	149	0	0.10%	0.06%	75M	16M	21.58%	12.14%	24M	5M	21.68%	12.14%
	Total		**3,949,430**	**1,346,090**	**34.1%**	**19.9%**	**1,899,055**	**728,102**	**38.3%**	**38.2%**	**54,569**	**40,413**	**74.1%**	**32.6%**	**8,544**	**1,062**	**12.43%**	**10.26%**	**4,623M**	**1,514M**	**32.74%**	**19.07%**	**1,583M**	**519M**	**32.76%**	**19.07%**
	2011	8/27/2011	299,466	77,877	26.0%	15.0%	118,861	26,470	22.3%	22.3%	13,951	13,261	95.1%	72.1%	236	4	1.79%	1.78%	413M	108M	26.29%	15.14%	138M	36M	26.25%	15.14%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013	9/14/2013	330,513	24,090	7.3%	4.4%	110,496	5,744	5.2%	5.2%	4,255	2,610	61.3%	33.1%	191	1	0.36%	0.36%	395M	29M	7.37%	4.43%	135M	9M	6.84%	4.43%
	2014	8/9/2014	335,322	114,757	34.2%	20.7%	145,322	54,063	37.2%	37.1%	2,718	2,335	85.9%	25.6%	136	24	17.55%	17.55%	407M	139M	34.25%	20.68%	139M	48M	34.17%	20.68%
	2015	8/15/2015	346,959	121,829	35.1%	21.3%	174,343	76,757	44.0%	43.3%	2,848	1,840	64.6%	17.3%	1,059	58	5.50%	5.28%	381M	133M	34.95%	21.30%	141M	49M	34.62%	21.30%
Inshore	2016	8/13/2016	354,015	106,254	30.0%	18.2%	144,882	47,881	33.0%	32.8%	1,987	1,567	78.9%	15.6%	654	2	0.34%	0.30%	398M	119M	30.00%	18.13%	129M	38M	29.68%	18.13%
	2017	7/22/2017	346,323	178,406	51.5%	30.3%	154,610	40,112	25.9%	25.9%	6,134	3,924	64.0%	25.8%	646	310	47.97%	46.43%	354M	183M	51.64%	30.19%	121M	62M	51.27%	30.19%
	2018	7/28/2018	343,996	169,569	49.3%	28.4%	147,369	43,653	29.6%	29.6%	3,215	1,661	51.7%	23.6%	381	33	8.62%	7.78%	387M	190M	49.16%	28.35%	135M	66M	49.00%	28.35%
	2019	7/27/2019	348,384	193,439	55.5%	31.7%	172,798	66,000	38.2%	38.2%	4,863	4,160	85.5%	38.5%	866	180	20.81%	19.78%	413M	229M	55.34%	31.59%	128M	72M	55.94%	31.59%
	2020	8/29/2020	327,025	129,543	39.6%	21.6%	237,632	131,423	55.3%	55.3%	7,807	6,895	88.3%	43.5%	822	79	9.56%	4.56%	334M	133M	39.79%	21.65%	124M	51M	40.77%	21.65%
	2021	7/24/2021	339,546	194,443	57.3%	32.6%	341,779	225,297	65.9%	65.9%	2,571	1,877	73.0%	26.9%	970	264	27.20%	19.48%	353M	202M	57.16%	32.39%	126M	72M	57.02%	32.39%
	2022	8/13/2022	262,593	35,883	13.7%	7.6%	131,896	10,702	8.1%	8.1%	787	283	36.0%	7.4%	974	107	11.02%	8.43%	346M	47M	13.71%	7.60%	118M	16M	13.85%	7.60%
Grand Total			**8,749,312**	**2,235,419**	**25.5%**	**14.8%**	**3,368,480**	**1,092,360**	**32.4%**	**32.3%**	**83,745**	**54,182**	**64.7%**	**23.9%**	**10,980**	**1,216**	**11.08%**	**7.34%**	**10,936M**	**2,638M**	**24.12%**	**13.90%**	**3,511M**	**853M**	**24.30%**	**13.90%**

Table Appendix 6-9 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 300,000 apportioned under suboption 1 (3-year average)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B	Number of Chinook Salmon Avoided as % of B	Number of Chinook Salmon Avoided as % of Annual	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B	Amount of Herring Bycatch Avoided (mt) as % of	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season	Forgone Ex-Vessel Revenue as % of Annual Total
	Total		**884,892**	**147,739**	**16.7%**	**9.5%**	**227,891**	**61,612**	**27.0%**	**26.9%**	**3,413**	**705**	**20.7%**	**4.7%**	**311**	**2**	**0.67%**	**0.41%**	**1,161M**	**181M**	**15.62%**	**8.86%**	**354M**	**55M**	**15.54%**	**8.83%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
CDQ	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.51%
	2018	7/7/2018	76,296	57,635	75.5%	41.7%	26,586	3,859	14.5%	14.5%	358	275	76.8%	21.3%	2	0	9.10%	6.79%	93M	70M	75.58%	41.59%	30M	22M	75.57%	41.64%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
	Total		**3,124,177**	**639,204**	**20.5%**	**11.8%**	**961,389**	**242,239**	**25.2%**	**25.0%**	**18,989**	**10,096**	**53.2%**	**14.0%**	**1,623**	**160**	**9.85%**	**3.60%**	**4,114M**	**809M**	**19.65%**	**11.23%**	**1,256M**	**240M**	**19.09%**	**10.89%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
CP	2016	8/13/2016	284,065	118,751	41.8%	25.4%	134,750	56,071	41.6%	41.0%	2,403	1,789	74.4%	20.2%	47	11	24.00%	2.73%	366M	153M	41.86%	25.34%	104M	44M	42.00%	25.42%
	2017	7/22/2017	266,891	162,802	61.0%	34.4%	207,355	110,576	53.3%	53.0%	1,475	809	54.8%	7.8%	27	18	68.36%	7.85%	346M	212M	61.17%	34.42%	95M	58M	61.37%	34.61%
	2018	7/21/2018	263,947	171,330	64.9%	35.9%	99,447	23,055	23.2%	23.1%	1,259	957	76.0%	20.5%	18	1	6.33%	2.78%	321M	209M	64.99%	35.75%	104M	67M	64.93%	35.84%
	2019	8/31/2019	275,173	67,037	24.4%	13.7%	113,428	18,785	16.6%	16.5%	3,127	2,680	85.7%	26.0%	4	2	50.46%	1.17%	367M	91M	24.72%	13.83%	103M	26M	24.80%	13.95%
	2020	9/19/2020	245,375	33,633	13.7%	7.2%	77,138	10,131	13.1%	13.1%	4,151	3,155	76.0%	27.7%	97	34	35.48%	2.28%	298M	41M	13.88%	7.23%	93M	13M	13.98%	7.33%
	2021	8/14/2021	264,947	82,016	31.0%	17.1%	97,917	22,304	22.8%	22.8%	1,187	676	57.0%	14.4%	5	4	65.50%	2.59%	315M	97M	30.94%	16.89%	98M	30M	30.94%	16.92%
	2022	9/3/2022	209,668	3,635	1.7%	1.0%	71,786	1,317	1.8%	1.8%	254	30	11.8%	1.7%	126	89	70.88%	55.46%	292M	5M	1.73%	0.95%	94M	2M	1.73%	0.95%
	Total		**790,812**	**69,238**	**8.8%**	**5.1%**	**280,145**	**31,078**	**11.1%**	**11.0%**	**6,774**	**607**	**9.0%**	**4.0%**	**503**	**80**	**15.91%**	**6.25%**	**1,037M**	**87M**	**8.38%**	**4.84%**	**317M**	**26M**	**8.26%**	**4.77%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
Mothership	2016	9/3/2016	70,599	12,787	18.1%	10.9%	43,262	9,836	22.7%	22.7%	366	130	35.5%	9.0%	14	0	0.95%	0.09%	90M	16M	18.12%	10.90%	26M	5M	18.13%	10.91%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019	9/7/2019	68,066	15,157	22.3%	12.4%	44,860	7,917	17.6%	17.4%	538	311	57.8%	21.2%	12	10	84.68%	83.86%	90M	20M	22.09%	12.22%	25M	6M	22.04%	12.29%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	7/31/2021	66,593	32,775	49.2%	27.3%	50,542	9,694	19.2%	19.2%	222	141	63.5%	15.3%	129	70	53.90%	38.68%	79M	39M	49.16%	27.12%	25M	12M	48.86%	27.09%
	2022	8/20/2022	53,532	8,519	15.9%	9.0%	32,262	3,631	11.3%	11.3%	74	25	33.8%	7.9%	149	0	0.10%	0.06%	75M	12M	15.79%	8.88%	24M	4M	15.89%	8.93%
	Total		**3,949,430**	**215,277**	**5.5%**	**3.2%**	**1,899,055**	**139,790**	**7.4%**	**7.3%**	**54,569**	**6,433**	**11.8%**	**5.2%**	**8,544**	**246**	**2.88%**	**2.37%**	**4,623M**	**223M**	**4.82%**	**2.81%**	**1,583M**	**81M**	**5.09%**	**2.96%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
Inshore	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020	10/3/2020	327,025	42,481	13.0%	7.1%	237,632	45,164	19.0%	19.0%	7,807	4,594	58.8%	29.0%	822	0	0.02%	0.01%	334M	44M	13.07%	7.11%	124M	17M	13.59%	7.47%
	2021	7/31/2021	339,546	172,796	50.9%	28.9%	341,779	94,626	27.7%	27.7%	2,571	1,839	71.5%	26.4%	970	246	25.34%	18.15%	353M	179M	50.77%	28.77%	126M	64M	50.65%	28.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**1,071,470**	**12.2%**	**7.1%**	**3,368,480**	**474,719**	**14.1%**	**14.0%**	**83,745**	**17,841**	**21.3%**	**7.9%**	**10,980**	**488**	**4.44%**	**2.94%**	**10,936M**	**1,300M**	**11.88%**	**6.85%**	**3,511M**	**402M**	**11.44%**	**6.59%**

Table Appendix 6-10 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 300,000 apportioned under suboption 2 (5-year average)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
	Total		**884,892**	**147,739**	**16.7%**	**9.5%**	**227,891**	**61,612**	**27.0%**	**26.9%**	**3,413**	**705**	**20.7%**	**4.7%**	**311**	**2**	**0.67%**	**0.41%**	**1,161M**	**181M**	**15.62%**	**8.86%**	**354M**	**55M**	**15.54%**	**8.83%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
CDQ	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.51%
	2018	7/7/2018	76,296	57,635	75.5%	41.7%	26,586	3,859	14.5%	14.5%	358	275	76.8%	21.3%	2	0	9.10%	6.79%	93M	70M	75.58%	41.59%	30M	22M	75.57%	41.64%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
	Total		**3,124,177**	**607,007**	**19.4%**	**11.2%**	**961,389**	**231,242**	**24.1%**	**23.9%**	**18,989**	**7,460**	**39.3%**	**10.3%**	**1,623**	**36**	**2.24%**	**0.82%**	**4,114M**	**768M**	**18.68%**	**10.67%**	**1,256M**	**227M**	**18.08%**	**10.32%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
CP	2016	8/13/2016	284,065	118,751	41.8%	25.4%	134,750	56,071	41.6%	41.0%	2,403	1,789	74.4%	20.2%	47	11	24.00%	2.73%	366M	153M	41.86%	25.34%	104M	44M	42.00%	25.42%
	2017	7/22/2017	266,891	162,802	61.0%	34.4%	207,355	110,576	53.3%	53.0%	1,475	809	54.8%	7.8%	27	18	68.36%	7.85%	346M	212M	61.17%	34.42%	95M	58M	61.37%	34.61%
	2018	7/21/2018	263,947	171,330	64.9%	35.9%	99,447	23,055	23.2%	23.1%	1,259	957	76.0%	20.5%	18	1	6.33%	2.78%	321M	209M	64.99%	35.75%	104M	67M	64.93%	35.84%
	2019	8/31/2019	275,173	67,037	24.4%	13.7%	113,428	18,785	16.6%	16.5%	3,127	2,680	85.7%	26.0%	4	2	50.46%	1.17%	367M	91M	24.72%	13.83%	103M	26M	24.80%	13.95%
	2020	10/17/2020	245,375	5,071	2.1%	1.1%	77,138	451	0.6%	0.6%	4,151	549	13.2%	4.8%	97	0	0.21%	0.01%	298M	6M	2.10%	1.09%	93M	2M	2.10%	1.10%
	2021	8/14/2021	264,947	82,016	31.0%	17.1%	97,917	22,304	22.8%	22.8%	1,187	676	57.0%	14.4%	5	4	65.50%	2.59%	315M	97M	30.94%	16.89%	98M	30M	30.94%	16.92%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
	Total		**790,812**	**69,238**	**8.8%**	**5.1%**	**280,145**	**31,078**	**11.1%**	**11.0%**	**6,774**	**607**	**9.0%**	**4.0%**	**503**	**80**	**15.91%**	**6.25%**	**1,037M**	**87M**	**8.38%**	**4.84%**	**317M**	**26M**	**8.26%**	**4.77%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
Mothership	2016	9/3/2016	70,599	12,787	18.1%	10.9%	43,262	9,836	22.7%	22.7%	366	130	35.5%	9.0%	14	0	0.95%	0.09%	90M	16M	18.12%	10.90%	26M	5M	18.13%	10.91%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019	9/7/2019	68,066	15,157	22.3%	12.4%	44,860	7,917	17.6%	17.4%	538	311	57.8%	21.2%	12	10	84.68%	83.86%	90M	20M	22.09%	12.22%	25M	6M	22.04%	12.29%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	7/31/2021	66,593	32,775	49.2%	27.3%	50,542	9,694	19.2%	19.2%	222	141	63.5%	15.3%	129	70	53.90%	38.68%	79M	39M	49.16%	27.12%	25M	12M	48.86%	27.09%
	2022	8/20/2022	53,532	8,519	15.9%	9.0%	32,262	3,631	11.3%	11.3%	74	25	33.8%	7.9%	149	0	0.10%	0.06%	75M	12M	15.79%	8.88%	24M	4M	15.89%	8.93%
	Total		**3,949,430**	**228,220**	**5.8%**	**3.4%**	**1,899,055**	**155,575**	**8.2%**	**8.2%**	**54,569**	**7,075**	**13.0%**	**5.7%**	**8,544**	**247**	**2.89%**	**2.39%**	**4,623M**	**236M**	**5.11%**	**2.97%**	**1,583M**	**86M**	**5.40%**	**3.15%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
Inshore	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020	9/26/2020	327,025	55,424	16.9%	9.2%	237,632	60,949	25.6%	25.6%	7,807	5,236	67.1%	33.0%	822	1	0.15%	0.07%	334M	57M	17.05%	9.28%	124M	22M	17.62%	9.68%
	2021	7/31/2021	339,546	172,796	50.9%	28.9%	341,779	94,626	27.7%	27.7%	2,571	1,839	71.5%	26.4%	970	246	25.34%	18.15%	353M	179M	50.77%	28.77%	126M	64M	50.65%	28.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**1,052,203**	**12.0%**	**7.0%**	**3,368,480**	**479,507**	**14.2%**	**14.2%**	**83,745**	**15,847**	**18.9%**	**7.0%**	**10,980**	**365**	**3.33%**	**2.20%**	**10,936M**	**1,273M**	**11.64%**	**6.71%**	**3,511M**	**394M**	**11.22%**	**6.47%**

Table Appendix 6-11 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 300,000 apportioned under suboption 3 (pro-rata)

Sector	Year	Date of closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
CDQ	**Total**		**884,892**	**147,739**	**16.7%**	**9.5%**	**227,891**	**61,612**	**27.0%**	**26.9%**	**3,413**	**705**	**20.7%**	**4.7%**	**311**	**2**	**0.67%**	**0.41%**	**1,161M**	**181M**	**15.62%**	**8.86%**	**354M**	**55M**	**15.54%**	**8.83%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.51%
	2018	7/7/2018	76,296	57,635	75.5%	41.7%	26,586	3,859	14.5%	14.5%	358	275	76.8%	21.3%	2	0	9.10%	6.79%	93M	70M	75.58%	41.59%	30M	22M	75.57%	41.64%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
CP	**Total**		**3,124,177**	**592,616**	**19.0%**	**10.9%**	**961,389**	**229,845**	**23.9%**	**23.8%**	**18,989**	**7,427**	**39.1%**	**10.3%**	**1,623**	**36**	**2.23%**	**0.82%**	**4,114M**	**751M**	**18.26%**	**10.44%**	**1,256M**	**222M**	**17.66%**	**10.08%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
	2016	8/13/2016	284,065	118,751	41.8%	25.4%	134,750	56,071	41.6%	41.0%	2,403	1,789	74.4%	20.2%	47	11	24.00%	2.73%	366M	153M	41.86%	25.34%	104M	44M	42.00%	25.42%
	2017	7/22/2017	266,891	162,802	61.0%	34.4%	207,355	110,576	53.3%	53.0%	1,475	809	54.8%	7.8%	27	18	68.36%	7.85%	346M	212M	61.17%	34.42%	95M	58M	61.37%	34.61%
	2018	7/21/2018	263,947	171,330	64.9%	35.9%	99,447	23,055	23.2%	23.1%	1,259	957	76.0%	20.5%	18	1	6.33%	2.78%	321M	209M	64.99%	35.75%	104M	67M	64.93%	35.84%
	2019	8/31/2019	275,173	67,037	24.4%	13.7%	113,428	18,785	16.6%	16.5%	3,127	2,680	85.7%	26.0%	4	2	50.46%	1.17%	367M	91M	24.72%	13.83%	103M	26M	24.80%	13.95%
	2020	10/17/2020	245,375	5,071	2.1%	1.1%	77,138	451	0.6%	0.6%	4,151	549	13.2%	4.8%	97	0	0.21%	0.01%	298M	6M	2.10%	1.09%	93M	2M	2.10%	1.10%
	2021	8/21/2021	264,947	67,626	25.5%	14.1%	97,917	20,907	21.4%	21.3%	1,187	643	54.2%	13.7%	5	3	63.47%	2.51%	315M	80M	25.51%	13.92%	98M	25M	25.52%	13.95%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
Mothership	**Total**		**790,812**	**69,238**	**8.8%**	**5.1%**	**280,145**	**31,078**	**11.1%**	**11.0%**	**6,774**	**607**	**9.0%**	**4.0%**	**503**	**80**	**15.91%**	**6.25%**	**1,037M**	**87M**	**8.38%**	**4.84%**	**317M**	**26M**	**8.26%**	**4.77%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
	2016	9/3/2016	70,599	12,787	18.1%	10.9%	43,262	9,836	22.7%	22.7%	366	130	35.5%	9.0%	14	0	0.95%	0.09%	90M	16M	18.12%	10.90%	26M	5M	18.13%	10.91%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019	9/7/2019	68,066	15,157	22.3%	12.4%	44,860	7,917	17.6%	17.4%	538	311	57.8%	21.2%	12	10	84.68%	83.86%	90M	20M	22.09%	12.22%	25M	6M	22.04%	12.29%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	7/31/2021	66,593	32,775	49.2%	27.3%	50,542	9,694	19.2%	19.2%	222	141	63.5%	15.3%	129	70	53.90%	38.68%	79M	39M	49.16%	27.12%	25M	12M	48.86%	27.09%
	2022	8/20/2022	53,532	8,519	15.9%	9.0%	32,262	3,631	11.3%	11.3%	74	25	33.8%	7.9%	149	0	0.10%	0.06%	75M	12M	15.79%	8.88%	24M	4M	15.89%	8.93%
Inshore	**Total**		**3,949,430**	**228,220**	**5.8%**	**3.4%**	**1,899,055**	**155,575**	**8.2%**	**8.2%**	**54,569**	**7,075**	**13.0%**	**5.7%**	**8,544**	**247**	**2.89%**	**2.39%**	**4,623M**	**236M**	**5.11%**	**2.97%**	**1,583M**	**86M**	**5.40%**	**3.15%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020	9/26/2020	327,025	55,424	16.9%	9.2%	237,632	60,949	25.6%	25.6%	7,807	5,236	67.1%	33.0%	822	1	0.15%	0.07%	334M	57M	17.05%	9.28%	124M	22M	17.62%	9.68%
	2021	7/31/2021	339,546	172,796	50.9%	28.9%	341,779	94,626	27.7%	27.7%	2,571	1,839	71.5%	26.4%	970	246	25.34%	18.15%	353M	179M	50.77%	28.77%	126M	64M	50.65%	28.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**1,037,812**	**11.9%**	**6.9%**	**3,368,480**	**478,110**	**14.2%**	**14.1%**	**83,745**	**15,814**	**18.9%**	**7.0%**	**10,980**	**365**	**3.33%**	**2.20%**	**10,936M**	**1,256M**	**11.48%**	**6.62%**	**3,511M**	**389M**	**11.07%**	**6.38%**

Table Appendix 6-12 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 300,000 apportioned under suboption 4 (AFA)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
CDQ	**Total**		**884,892**	**90,104**	**10.2%**	**5.8%**	**227,891**	**57,753**	**25.3%**	**25.2%**	**3,413**	**430**	**12.6%**	**2.9%**	**311**	**2**	**0.60%**	**0.37%**	**1,161M**	**111M**	**9.59%**	**5.44%**	**354M**	**33M**	**9.20%**	**5.23%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.51%
	2018		76,296		0.0%	0.0%	26,586		0.0%	0.0%	358		0.0%	0.0%	2		0.00%	0.00%	93M		0.00%	0.00%	30M		0.00%	0.00%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
CP	**Total**		**3,124,177**	**231,045**	**7.4%**	**4.3%**	**961,389**	**84,688**	**8.8%**	**8.8%**	**18,989**	**3,446**	**18.1%**	**4.8%**	**1,623**	**20**	**1.21%**	**0.44%**	**4,114M**	**301M**	**7.33%**	**4.19%**	**1,256M**	**84M**	**6.71%**	**3.83%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
	2016	8/27/2016	284,065	68,165	24.0%	14.6%	134,750	18,782	13.9%	13.7%	2,403	1,404	58.4%	15.8%	47	0	0.26%	0.03%	366M	88M	23.91%	14.47%	104M	25M	24.01%	14.53%
	2017	7/29/2017	266,891	133,877	50.2%	28.3%	207,355	62,363	30.1%	29.9%	1,475	587	39.8%	5.7%	27	18	68.09%	7.82%	346M	174M	50.22%	28.25%	95M	48M	50.44%	28.45%
	2018		263,947		0.0%	0.0%	99,447		0.0%	0.0%	1,259		0.0%	0.0%	18		0.00%	0.00%	321M		0.00%	0.00%	104M		0.00%	0.00%
	2019	9/28/2019	275,173	29,002	10.5%	5.9%	113,428	3,543	3.1%	3.1%	3,127	1,455	46.5%	14.1%	4	1	33.77%	0.79%	367M	40M	10.88%	6.09%	103M	11M	10.95%	6.16%
	2020		245,375		0.0%	0.0%	77,138		0.0%	0.0%	4,151		0.0%	0.0%	97		0.00%	0.00%	298M		0.00%	0.00%	93M		0.00%	0.00%
	2021		264,947		0.0%	0.0%	97,917		0.0%	0.0%	1,187		0.0%	0.0%	5		0.00%	0.00%	315M		0.00%	0.00%	98M		0.00%	0.00%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
Mothership	**Total**		**790,812**	**69,238**	**8.8%**	**5.1%**	**280,145**	**31,078**	**11.1%**	**11.0%**	**6,774**	**607**	**9.0%**	**4.0%**	**503**	**80**	**15.91%**	**6.25%**	**1,037M**	**87M**	**8.38%**	**4.84%**	**317M**	**26M**	**8.26%**	**4.77%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
	2016	9/3/2016	70,599	12,787	18.1%	10.9%	43,262	9,836	22.7%	22.7%	366	130	35.5%	9.0%	14	0	0.95%	0.09%	90M	16M	18.12%	10.90%	26M	5M	18.13%	10.91%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019	9/7/2019	68,066	15,157	22.3%	12.4%	44,860	7,917	17.6%	17.4%	538	311	57.8%	21.2%	12	10	84.68%	83.86%	90M	20M	22.09%	12.22%	25M	6M	22.04%	12.29%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	7/31/2021	66,593	32,775	49.2%	27.3%	50,542	9,694	19.2%	19.2%	222	141	63.5%	15.3%	129	70	53.90%	38.68%	79M	39M	49.16%	27.12%	25M	12M	48.86%	27.09%
	2022	8/20/2022	53,532	8,519	15.9%	9.0%	32,262	3,631	11.3%	11.3%	74	25	33.8%	7.9%	149	0	0.10%	0.06%	75M	12M	15.79%	8.88%	24M	4M	15.89%	8.93%
Inshore	**Total**		**3,949,430**	**562,186**	**14.2%**	**8.3%**	**1,899,055**	**287,288**	**15.1%**	**15.1%**	**54,569**	**15,143**	**27.8%**	**12.2%**	**8,544**	**449**	**5.25%**	**4.34%**	**4,623M**	**598M**	**12.93%**	**7.53%**	**1,583M**	**209M**	**13.18%**	**7.68%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014	9/13/2014	335,322	12,817	3.8%	2.3%	145,322	2,891	2.0%	2.0%	2,718	344	12.7%	3.8%	136	0	0.00%	0.00%	407M	16M	3.85%	2.33%	139M	5M	3.69%	2.23%
	2015	8/29/2015	346,959	77,724	22.4%	13.6%	174,343	38,094	21.9%	21.5%	2,848	1,519	53.3%	14.3%	1,059	23	2.15%	2.06%	381M	85M	22.31%	13.60%	141M	31M	21.71%	13.22%
	2016	9/17/2016	354,015	11,149	3.1%	1.9%	144,882	2,189	1.5%	1.5%	1,987	560	28.2%	5.6%	654	0	0.01%	0.01%	398M	13M	3.14%	1.90%	129M	4M	2.93%	1.77%
	2017	8/5/2017	346,323	123,509	35.7%	20.9%	154,610	19,536	12.6%	12.6%	6,134	2,851	46.5%	18.8%	646	63	9.78%	9.47%	354M	127M	35.73%	20.88%	121M	43M	35.19%	20.51%
	2018	9/15/2018	343,996	17,013	4.9%	2.8%	147,369	11,363	7.7%	7.7%	3,215	454	14.1%	6.5%	381	0	0.00%	0.00%	387M	19M	4.93%	2.84%	135M	6M	4.69%	2.70%
	2019	9/7/2019	348,384	54,020	15.5%	8.8%	172,798	32,131	18.6%	18.6%	4,863	1,257	25.8%	11.6%	866	93	10.74%	10.21%	413M	64M	15.45%	8.82%	128M	20M	15.26%	8.65%
	2020	9/12/2020	327,025	93,157	28.5%	15.5%	237,632	86,458	36.4%	36.4%	7,807	6,319	80.9%	39.9%	822	24	2.93%	1.40%	334M	96M	28.66%	15.59%	124M	37M	29.72%	16.33%
	2021	7/31/2021	339,546	172,796	50.9%	28.9%	341,779	94,626	27.7%	27.7%	2,571	1,839	71.5%	26.4%	970	246	25.34%	18.15%	353M	179M	50.77%	28.77%	126M	64M	50.65%	28.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**952,571**	**10.9%**	**6.3%**	**3,368,480**	**460,807**	**13.7%**	**13.6%**	**83,745**	**19,626**	**23.4%**	**8.7%**	**10,980**	**550**	**5.01%**	**3.32%**	**10,936M**	**1,097M**	**10.03%**	**5.78%**	**3,511M**	**352M**	**10.02%**	**5.77%**

Table Appendix 6-13 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 450,000 apportioned under suboption 1 (3-year average)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
CDQ	**Total**		**884,892**	**90,104**	**10.2%**	**5.8%**	**227,891**	**57,753**	**25.3%**	**25.2%**	**3,413**	**430**	**12.6%**	**2.9%**	**311**	**2**	**0.60%**	**0.37%**	**1,161M**	**111M**	**9.59%**	**5.44%**	**354M**	**33M**	**9.20%**	**5.23%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.51%
	2018		76,296		0.0%	0.0%	26,586		0.0%	0.0%	358		0.0%	0.0%	2		0.00%	0.00%	93M		0.00%	0.00%	30M		0.00%	0.00%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
CP	**Total**		**3,124,177**	**255,325**	**8.2%**	**4.7%**	**961,389**	**95,546**	**9.9%**	**9.9%**	**18,989**	**4,417**	**23.3%**	**6.1%**	**1,623**	**20**	**1.24%**	**0.45%**	**4,114M**	**334M**	**8.11%**	**4.64%**	**1,256M**	**93M**	**7.44%**	**4.24%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
	2016	8/27/2016	284,065	68,165	24.0%	14.6%	134,750	18,782	13.9%	13.7%	2,403	1,404	58.4%	15.8%	47	0	0.26%	0.03%	366M	88M	23.91%	14.47%	104M	25M	24.01%	14.53%
	2017	7/29/2017	266,891	133,877	50.2%	28.3%	207,355	62,363	30.1%	29.9%	1,475	587	39.8%	5.7%	27	18	68.09%	7.82%	346M	174M	50.22%	28.25%	95M	48M	50.44%	28.45%
	2018	9/29/2018	263,947	1,116	0.4%	0.2%	99,447	141	0.1%	0.1%	1,259	1	0.1%	0.0%	18	0	0.00%	0.00%	321M	1M	0.43%	0.24%	104M	0M	0.43%	0.24%
	2019	9/7/2019	275,173	52,167	19.0%	10.6%	113,428	14,260	12.6%	12.5%	3,127	2,425	77.6%	23.5%	4	2	47.02%	1.09%	367M	71M	19.31%	10.81%	103M	20M	19.43%	10.93%
	2020		245,375		0.0%	0.0%	77,138		0.0%	0.0%	4,151		0.0%	0.0%	97		0.00%	0.00%	298M		0.00%	0.00%	93M		0.00%	0.00%
	2021		264,947		0.0%	0.0%	97,917		0.0%	0.0%	1,187		0.0%	0.0%	5		0.00%	0.00%	315M		0.00%	0.00%	98M		0.00%	0.00%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
Mothership	**Total**		**790,812**	**33,619**	**4.3%**	**2.5%**	**280,145**	**5,518**	**2.0%**	**2.0%**	**6,774**	**250**	**3.7%**	**1.6%**	**503**	**56**	**11.05%**	**4.34%**	**1,037M**	**41M**	**3.92%**	**2.26%**	**317M**	**12M**	**3.91%**	**2.26%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
	2016	10/1/2016	70,599	893	1.3%	0.8%	43,262	1,374	3.2%	3.2%	366	16	4.4%	1.1%	14	0	0.00%	0.00%	90M	1M	1.26%	0.76%	26M	0M	1.26%	0.76%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019	9/28/2019	68,066	5,066	7.4%	4.1%	44,860	3,086	6.9%	6.8%	538	106	19.7%	7.2%	12	0	0.21%	0.21%	90M	7M	7.41%	4.10%	25M	2M	7.32%	4.08%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	8/7/2021	66,593	27,661	41.5%	23.1%	50,542	1,058	2.1%	2.1%	222	128	57.7%	13.9%	129	56	42.92%	30.80%	79M	33M	41.47%	22.88%	25M	10M	41.18%	22.83%
	2022		53,532		0.0%	0.0%	32,262		0.0%	0.0%	74		0.0%	0.0%	149		0.00%	0.00%	75M		0.00%	0.00%	24M		0.00%	0.00%
Inshore	**Total**		**3,949,430**	**148,936**	**3.8%**	**2.2%**	**1,899,055**	**13,053**	**0.7%**	**0.7%**	**54,569**	**1,794**	**3.3%**	**1.4%**	**8,544**	**226**	**2.64%**	**2.18%**	**4,623M**	**154M**	**3.33%**	**1.94%**	**1,583M**	**55M**	**3.46%**	**2.02%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020		327,025		0.0%	0.0%	237,632		0.0%	0.0%	7,807		0.0%	0.0%	822		0.00%	0.00%	334M		0.00%	0.00%	124M		0.00%	0.00%
	2021	8/7/2021	339,546	148,936	43.9%	24.9%	341,779	13,053	3.8%	3.8%	2,571	1,794	69.8%	25.7%	970	226	23.28%	16.67%	353M	154M	43.69%	24.76%	126M	55M	43.60%	24.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**527,984**	**6.0%**	**3.5%**	**3,368,480**	**171,870**	**5.1%**	**5.1%**	**83,745**	**6,891**	**8.2%**	**3.0%**	**10,980**	**303**	**2.76%**	**1.83%**	**10,936M**	**640M**	**5.85%**	**3.37%**	**3,511M**	**193M**	**5.50%**	**3.17%**

Table Appendix 6-14 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 450,000 apportioned under suboption 2 (5-year average)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
	Total		**884,892**	**90,104**	**10.2%**	**5.8%**	**227,891**	**57,753**	**25.3%**	**25.2%**	**3,413**	**430**	**12.6%**	**2.9%**	**311**	**2**	**0.60%**	**0.37%**	**1,161M**	**111M**	**9.59%**	**5.44%**	**354M**	**33M**	**9.20%**	**5.23%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
CDQ	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.51%
	2018		76,296		0.0%	0.0%	26,586		0.0%	0.0%	358		0.0%	0.0%	2		0.00%	0.00%	93M		0.00%	0.00%	30M		0.00%	0.00%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
	Total		**3,124,177**	**202,042**	**6.5%**	**3.7%**	**961,389**	**81,145**	**8.4%**	**8.4%**	**18,989**	**1,991**	**10.5%**	**2.8%**	**1,623**	**18**	**1.13%**	**0.41%**	**4,114M**	**261M**	**6.35%**	**3.63%**	**1,256M**	**73M**	**5.81%**	**3.31%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
CP	2016	8/27/2016	284,065	68,165	24.0%	14.6%	134,750	18,782	13.9%	13.7%	2,403	1,404	58.4%	15.8%	47	0	0.26%	0.03%	366M	88M	23.91%	14.47%	104M	25M	24.01%	14.53%
	2017	7/29/2017	266,891	133,877	50.2%	28.3%	207,355	62,363	30.1%	29.9%	1,475	587	39.8%	5.7%	27	18	68.09%	7.82%	346M	174M	50.22%	28.25%	95M	48M	50.44%	28.45%
	2018		263,947		0.0%	0.0%	99,447		0.0%	0.0%	1,259		0.0%	0.0%	18		0.00%	0.00%	321M		0.00%	0.00%	104M		0.00%	0.00%
	2019	10/26/2019	275,173		0.0%	0.0%	113,428		0.0%	0.0%	3,127		0.0%	0.0%	4		0.00%	0.00%	367M		0.00%	0.00%	103M		0.00%	0.00%
	2020		245,375		0.0%	0.0%	77,138		0.0%	0.0%	4,151		0.0%	0.0%	97		0.00%	0.00%	298M		0.00%	0.00%	93M		0.00%	0.00%
	2021		264,947		0.0%	0.0%	97,917		0.0%	0.0%	1,187		0.0%	0.0%	5		0.00%	0.00%	315M		0.00%	0.00%	98M		0.00%	0.00%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
	Total		**790,812**	**30,492**	**3.9%**	**2.2%**	**280,145**	**1,128**	**0.4%**	**0.4%**	**6,774**	**168**	**2.5%**	**1.1%**	**503**	**56**	**11.05%**	**4.34%**	**1,037M**	**37M**	**3.52%**	**2.03%**	**317M**	**11M**	**3.55%**	**2.05%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
Mothership	2016	10/8/2016	70,599		0.0%	0.0%	43,262		0.0%	0.0%	366		0.0%	0.0%	14		0.00%	0.00%	90M		0.00%	0.00%	26M		0.00%	0.00%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019	10/5/2019	68,066	2,831	4.2%	2.3%	44,860	70	0.2%	0.2%	538	40	7.4%	2.7%	12	0	0.04%	0.04%	90M	4M	4.14%	2.29%	25M	1M	4.09%	2.28%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	8/7/2021	66,593	27,661	41.5%	23.1%	50,542	1,058	2.1%	2.1%	222	128	57.7%	13.9%	129	56	42.92%	30.80%	79M	33M	41.47%	22.88%	25M	10M	41.18%	22.83%
	2022		53,532		0.0%	0.0%	32,262		0.0%	0.0%	74		0.0%	0.0%	149		0.00%	0.00%	75M		0.00%	0.00%	24M		0.00%	0.00%
	Total		**3,949,430**	**148,936**	**3.8%**	**2.2%**	**1,899,055**	**13,053**	**0.7%**	**0.7%**	**54,569**	**1,794**	**3.3%**	**1.4%**	**8,544**	**226**	**2.64%**	**2.18%**	**4,623M**	**154M**	**3.33%**	**1.94%**	**1,583M**	**55M**	**3.46%**	**2.02%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
Inshore	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020		327,025		0.0%	0.0%	237,632		0.0%	0.0%	7,807		0.0%	0.0%	822		0.00%	0.00%	334M		0.00%	0.00%	124M		0.00%	0.00%
	2021	8/7/2021	339,546	148,936	43.9%	24.9%	341,779	13,053	3.8%	3.8%	2,571	1,794	69.8%	25.7%	970	226	23.28%	16.67%	353M	154M	43.69%	24.76%	126M	55M	43.60%	24.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**471,574**	**5.4%**	**3.1%**	**3,368,480**	**153,079**	**4.5%**	**4.5%**	**83,745**	**4,383**	**5.2%**	**1.9%**	**10,980**	**302**	**2.75%**	**1.82%**	**10,936M**	**564M**	**5.15%**	**2.97%**	**3,511M**	**172M**	**4.89%**	**2.82%**

Table Appendix 6-15 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 450,000 apportioned under suboption 3 (pro-rata)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
	Total		**884,892**	**90,104**	**10.2%**	**5.8%**	**227,891**	**57,753**	**25.3%**	**25.2%**	**3,413**	**430**	**12.6%**	**2.9%**	**311**	**2**	**0.60%**	**0.37%**	**1,161M**	**111M**	**9.59%**	**5.44%**	**354M**	**33M**	**9.20%**	**5.23%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
CDQ	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.51%
	2018		76,296		0.0%	0.0%	26,586		0.0%	0.0%	358		0.0%	0.0%	2		0.00%	0.00%	93M		0.00%	0.00%	30M		0.00%	0.00%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
	Total		**3,124,177**	**202,042**	**6.5%**	**3.7%**	**961,389**	**81,145**	**8.4%**	**8.4%**	**18,989**	**1,991**	**10.5%**	**2.8%**	**1,623**	**18**	**1.13%**	**0.41%**	**4,114M**	**261M**	**6.35%**	**3.63%**	**1,256M**	**73M**	**5.81%**	**3.31%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
CP	2016	8/27/2016	284,065	68,165	24.0%	14.6%	134,750	18,782	13.9%	13.7%	2,403	1,404	58.4%	15.8%	47	0	0.26%	0.03%	366M	88M	23.91%	14.47%	104M	25M	24.01%	14.53%
	2017	7/29/2017	266,891	133,877	50.2%	28.3%	207,355	62,363	30.1%	29.9%	1,475	587	39.8%	5.7%	27	18	68.09%	7.82%	346M	174M	50.22%	28.25%	95M	48M	50.44%	28.45%
	2018		263,947		0.0%	0.0%	99,447		0.0%	0.0%	1,259		0.0%	0.0%	18		0.00%	0.00%	321M		0.00%	0.00%	104M		0.00%	0.00%
	2019		275,173		0.0%	0.0%	113,428		0.0%	0.0%	3,127		0.0%	0.0%	4		0.00%	0.00%	367M		0.00%	0.00%	103M		0.00%	0.00%
	2020		245,375		0.0%	0.0%	77,138		0.0%	0.0%	4,151		0.0%	0.0%	97		0.00%	0.00%	298M		0.00%	0.00%	93M		0.00%	0.00%
	2021		264,947		0.0%	0.0%	97,917		0.0%	0.0%	1,187		0.0%	0.0%	5		0.00%	0.00%	315M		0.00%	0.00%	98M		0.00%	0.00%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
	Total		**790,812**	**33,619**	**4.3%**	**2.5%**	**280,145**	**5,518**	**2.0%**	**2.0%**	**6,774**	**250**	**3.7%**	**1.6%**	**503**	**56**	**11.05%**	**4.34%**	**1,037M**	**41M**	**3.92%**	**2.26%**	**317M**	**12M**	**3.91%**	**2.26%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
Mothership	2016	10/1/2016	70,599	893	1.3%	0.8%	43,262	1,374	3.2%	3.2%	366	16	4.4%	1.1%	14	0	0.00%	0.00%	90M	1M	1.26%	0.76%	26M	0M	1.26%	0.76%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019	9/28/2019	68,066	5,066	7.4%	4.1%	44,860	3,086	6.9%	6.8%	538	106	19.7%	7.2%	12	0	0.21%	0.21%	90M	7M	7.41%	4.10%	25M	2M	7.32%	4.08%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	8/7/2021	66,593	27,661	41.5%	23.1%	50,542	1,058	2.1%	2.1%	222	128	57.7%	13.9%	129	56	42.92%	30.80%	79M	33M	41.47%	22.88%	25M	10M	41.18%	22.83%
	2022		53,532		0.0%	0.0%	32,262		0.0%	0.0%	74		0.0%	0.0%	149		0.00%	0.00%	75M		0.00%	0.00%	24M		0.00%	0.00%
	Total		**3,949,430**	**148,936**	**3.8%**	**2.2%**	**1,899,055**	**13,053**	**0.7%**	**0.7%**	**54,569**	**1,794**	**3.3%**	**1.4%**	**8,544**	**226**	**2.64%**	**2.18%**	**4,623M**	**154M**	**3.33%**	**1.94%**	**1,583M**	**55M**	**3.46%**	**2.02%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
Inshore	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020		327,025		0.0%	0.0%	237,632		0.0%	0.0%	7,807		0.0%	0.0%	822		0.00%	0.00%	334M		0.00%	0.00%	124M		0.00%	0.00%
	2021	8/7/2021	339,546	148,936	43.9%	24.9%	341,779	13,053	3.8%	3.8%	2,571	1,794	69.8%	25.7%	970	226	23.28%	16.67%	353M	154M	43.69%	24.76%	126M	55M	43.60%	24.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**474,701**	**5.4%**	**3.1%**	**3,368,480**	**157,469**	**4.7%**	**4.7%**	**83,745**	**4,465**	**5.3%**	**2.0%**	**10,980**	**302**	**2.75%**	**1.82%**	**10,936M**	**568M**	**5.19%**	**2.99%**	**3,511M**	**173M**	**4.92%**	**2.84%**

Table Appendix 6-16 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 450,000 apportioned under suboption 4(AFA)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
CDQ	**Total**		**884,892**	**76,810**	**8.7%**	**4.9%**	**227,891**	**19,679**	**8.6%**	**8.6%**	**3,413**	**419**	**12.3%**	**2.8%**	**311**	**2**	**0.55%**	**0.34%**	**1,161M**	**94M**	**8.12%**	**4.61%**	**354M**	**28M**	**7.88%**	**4.48%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/22/2017	75,419	28,221	37.4%	20.7%	87,058	13,321	15.3%	15.3%	388	183	47.2%	7.3%	3	1	17.14%	7.33%	97M	37M	37.60%	20.75%	27M	10M	37.62%	20.77%
	2018		76,296		0.0%	0.0%	26,586		0.0%	0.0%	358		0.0%	0.0%	2		0.00%	0.00%	93M		0.00%	0.00%	30M		0.00%	0.00%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
CP	**Total**		**3,124,177**	**102,579**	**3.3%**	**1.9%**	**961,389**	**31,635**	**3.3%**	**3.3%**	**18,989**	**443**	**2.3%**	**0.6%**	**1,623**	**18**	**1.12%**	**0.41%**	**4,114M**	**133M**	**3.24%**	**1.85%**	**1,256M**	**37M**	**2.93%**	**1.67%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
	2016		284,065		0.0%	0.0%	134,750		0.0%	0.0%	2,403		0.0%	0.0%	47		0.00%	0.00%	366M		0.00%	0.00%	104M		0.00%	0.00%
	2017	8/5/2017	266,891	102,579	38.4%	21.7%	207,355	31,635	15.3%	15.2%	1,475	443	30.0%	4.3%	27	18	67.92%	7.80%	346M	133M	38.52%	21.67%	95M	37M	38.73%	21.84%
	2018		263,947		0.0%	0.0%	99,447		0.0%	0.0%	1,259		0.0%	0.0%	18		0.00%	0.00%	321M		0.00%	0.00%	104M		0.00%	0.00%
	2019		275,173		0.0%	0.0%	113,428		0.0%	0.0%	3,127		0.0%	0.0%	4		0.00%	0.00%	367M		0.00%	0.00%	103M		0.00%	0.00%
	2020		245,375		0.0%	0.0%	77,138		0.0%	0.0%	4,151		0.0%	0.0%	97		0.00%	0.00%	298M		0.00%	0.00%	93M		0.00%	0.00%
	2021		264,947		0.0%	0.0%	97,917		0.0%	0.0%	1,187		0.0%	0.0%	5		0.00%	0.00%	315M		0.00%	0.00%	98M		0.00%	0.00%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
Mothership	**Total**		**790,812**	**38,733**	**4.9%**	**2.8%**	**280,145**	**14,154**	**5.1%**	**5.0%**	**6,774**	**263**	**3.9%**	**1.7%**	**503**	**70**	**13.88%**	**5.45%**	**1,037M**	**47M**	**4.50%**	**2.60%**	**317M**	**14M**	**4.51%**	**2.61%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
	2016	10/1/2016	70,599	893	1.3%	0.8%	43,262	1,374	3.2%	3.2%	366	16	4.4%	1.1%	14	0	0.00%	0.00%	90M	1M	1.26%	0.76%	26M	0M	1.26%	0.76%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019	9/28/2019	68,066	5,066	7.4%	4.1%	44,860	3,086	6.9%	6.8%	538	106	19.7%	7.2%	12	0	0.21%	0.21%	90M	7M	7.41%	4.10%	25M	2M	7.32%	4.08%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	7/31/2021	66,593	32,775	49.2%	27.3%	50,542	9,694	19.2%	19.2%	222	141	63.5%	15.3%	129	70	53.90%	38.68%	79M	39M	49.16%	27.12%	25M	12M	48.86%	27.09%
	2022		53,532		0.0%	0.0%	32,262		0.0%	0.0%	74		0.0%	0.0%	149		0.00%	0.00%	75M		0.00%	0.00%	24M		0.00%	0.00%
Inshore	**Total**		**3,949,430**	**200,246**	**5.1%**	**3.0%**	**1,899,055**	**107,063**	**5.6%**	**5.6%**	**54,569**	**5,470**	**10.0%**	**4.4%**	**8,544**	**246**	**2.88%**	**2.37%**	**4,623M**	**207M**	**4.49%**	**2.61%**	**1,583M**	**75M**	**4.72%**	**2.75%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020	10/10/2020	327,025	27,450	8.4%	4.6%	237,632	12,437	5.2%	5.2%	7,807	3,631	46.5%	22.9%	822	0	0.02%	0.01%	334M	28M	8.46%	4.60%	124M	11M	8.86%	4.87%
	2021	7/31/2021	339,546	172,796	50.9%	28.9%	341,779	94,626	27.7%	27.7%	2,571	1,839	71.5%	26.4%	970	246	25.34%	18.15%	353M	179M	50.77%	28.77%	126M	64M	50.65%	28.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**418,368**	**4.8%**	**2.8%**	**3,368,480**	**172,531**	**5.1%**	**5.1%**	**83,745**	**6,595**	**7.9%**	**2.9%**	**10,980**	**336**	**3.06%**	**2.02%**	**10,936M**	**482M**	**4.41%**	**2.54%**	**3,511M**	**154M**	**4.38%**	**2.52%**

Table Appendix 6-17 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 550,000 apportioned under suboption 1 (3-year average)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
CDQ	**Total**		**884,892**	**90,104**	**10.2%**	**5.8%**	**227,891**	**57,753**	**25.3%**	**25.2%**	**3,413**	**430**	**12.6%**	**2.9%**	**311**	**2**	**0.60%**	**0.37%**	**1,161M**	**111M**	**9.59%**	**5.44%**	**354M**	**33M**	**9.20%**	**5.23%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/15/2017	75,419	41,515	55.0%	30.4%	87,058	51,395	59.0%	58.9%	388	194	50.0%	7.7%	3	1	21.69%	9.27%	97M	54M	55.19%	30.45%	27M	15M	55.25%	30.51%
	2018		76,296		0.0%	0.0%	26,586		0.0%	0.0%	358		0.0%	0.0%	2		0.00%	0.00%	93M		0.00%	0.00%	30M		0.00%	0.00%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
CP	**Total**		**3,124,177**	**173,485**	**5.6%**	**3.2%**	**961,389**	**66,382**	**6.9%**	**6.9%**	**18,989**	**1,815**	**9.6%**	**2.5%**	**1,623**	**18**	**1.12%**	**0.41%**	**4,114M**	**225M**	**5.46%**	**3.12%**	**1,256M**	**62M**	**4.97%**	**2.84%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
	2016	9/3/2016	284,065	39,607	13.9%	8.5%	134,750	4,019	3.0%	2.9%	2,403	1,228	51.1%	13.9%	47	0	0.02%	0.00%	366M	51M	13.89%	8.40%	104M	15M	13.95%	8.44%
	2017	7/29/2017	266,891	133,877	50.2%	28.3%	207,355	62,363	30.1%	29.9%	1,475	587	39.8%	5.7%	27	18	68.09%	7.82%	346M	174M	50.22%	28.25%	95M	48M	50.44%	28.45%
	2018		263,947		0.0%	0.0%	99,447		0.0%	0.0%	1,259		0.0%	0.0%	18		0.00%	0.00%	321M		0.00%	0.00%	104M		0.00%	0.00%
	2019		275,173		0.0%	0.0%	113,428		0.0%	0.0%	3,127		0.0%	0.0%	4		0.00%	0.00%	367M		0.00%	0.00%	103M		0.00%	0.00%
	2020		245,375		0.0%	0.0%	77,138		0.0%	0.0%	4,151		0.0%	0.0%	97		0.00%	0.00%	298M		0.00%	0.00%	93M		0.00%	0.00%
	2021		264,947		0.0%	0.0%	97,917		0.0%	0.0%	1,187		0.0%	0.0%	5		0.00%	0.00%	315M		0.00%	0.00%	98M		0.00%	0.00%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
Mothership	**Total**		**790,812**	**10,914**	**1.4%**	**0.8%**	**280,145**	**200**	**0.1%**	**0.1%**	**6,774**	**72**	**1.1%**	**0.5%**	**503**	**10**	**2.02%**	**0.79%**	**1,037M**	**13M**	**1.25%**	**0.72%**	**317M**	**4M**	**1.27%**	**0.73%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
	2016		70,599		0.0%	0.0%	43,262		0.0%	0.0%	366		0.0%	0.0%	14		0.00%	0.00%	90M		0.00%	0.00%	26M		0.00%	0.00%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019		68,066		0.0%	0.0%	44,860		0.0%	0.0%	538		0.0%	0.0%	12		0.00%	0.00%	90M		0.00%	0.00%	25M		0.00%	0.00%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	8/28/2021	66,593	10,914	16.4%	9.1%	50,542	200	0.4%	0.4%	222	72	32.4%	7.8%	129	10	7.85%	5.63%	79M	13M	16.35%	9.02%	25M	4M	16.20%	8.98%
	2022		53,532		0.0%	0.0%	32,262		0.0%	0.0%	74		0.0%	0.0%	149		0.00%	0.00%	75M		0.00%	0.00%	24M		0.00%	0.00%
Inshore	**Total**		**3,949,430**		**0.0%**	**0.0%**	**1,899,055**		**0.0%**	**0.0%**	**54,569**		**0.0%**	**0.0%**	**8,544**		**0.00%**	**0.00%**	**4,623M**		**0.00%**	**0.00%**	**1,583M**		**0.00%**	**0.00%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020		327,025		0.0%	0.0%	237,632		0.0%	0.0%	7,807		0.0%	0.0%	822		0.00%	0.00%	334M		0.00%	0.00%	124M		0.00%	0.00%
	2021		339,546		0.0%	0.0%	341,779		0.0%	0.0%	2,571		0.0%	0.0%	970		0.00%	0.00%	353M		0.00%	0.00%	126M		0.00%	0.00%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**274,502**	**3.1%**	**1.8%**	**3,368,480**	**124,335**	**3.7%**	**3.7%**	**83,745**	**2,317**	**2.8%**	**1.0%**	**10,980**	**30**	**0.28%**	**0.18%**	**10,936M**	**349M**	**3.19%**	**1.84%**	**3,511M**	**99M**	**2.82%**	**1.63%**

Table Appendix 6-18 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 550,000 apportioned under suboption 2 (5-year average)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
	Total		**884,892**	**76,810**	**8.7%**	**4.9%**	**227,891**	**19,679**	**8.6%**	**8.6%**	**3,413**	**419**	**12.3%**	**2.8%**	**311**	**2**	**0.55%**	**0.34%**	**1,161M**	**94M**	**8.12%**	**4.61%**	**354M**	**28M**	**7.88%**	**4.48%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
CDQ	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/22/2017	75,419	28,221	37.4%	20.7%	87,058	13,321	15.3%	15.3%	388	183	47.2%	7.3%	3	1	17.14%	7.33%	97M	37M	37.60%	20.75%	27M	10M	37.62%	20.77%
	2018		76,296		0.0%	0.0%	26,586		0.0%	0.0%	358		0.0%	0.0%	2		0.00%	0.00%	93M		0.00%	0.00%	30M		0.00%	0.00%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
	Total		**3,124,177**	**133,877**	**4.3%**	**2.5%**	**961,389**	**62,363**	**6.5%**	**6.4%**	**18,989**	**587**	**3.1%**	**0.8%**	**1,623**	**18**	**1.12%**	**0.41%**	**4,114M**	**174M**	**4.23%**	**2.42%**	**1,256M**	**48M**	**3.81%**	**2.18%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
CP	2016		284,065		0.0%	0.0%	134,750		0.0%	0.0%	2,403		0.0%	0.0%	47		0.00%	0.00%	366M		0.00%	0.00%	104M		0.00%	0.00%
	2017	7/29/2017	266,891	133,877	50.2%	28.3%	207,355	62,363	30.1%	29.9%	1,475	587	39.8%	5.7%	27	18	68.09%	7.82%	346M	174M	50.22%	28.25%	95M	48M	50.44%	28.45%
	2018		263,947		0.0%	0.0%	99,447		0.0%	0.0%	1,259		0.0%	0.0%	18		0.00%	0.00%	321M		0.00%	0.00%	104M		0.00%	0.00%
	2019		275,173		0.0%	0.0%	113,428		0.0%	0.0%	3,127		0.0%	0.0%	4		0.00%	0.00%	367M		0.00%	0.00%	103M		0.00%	0.00%
	2020		245,375		0.0%	0.0%	77,138		0.0%	0.0%	4,151		0.0%	0.0%	97		0.00%	0.00%	298M		0.00%	0.00%	93M		0.00%	0.00%
	2021		264,947		0.0%	0.0%	97,917		0.0%	0.0%	1,187		0.0%	0.0%	5		0.00%	0.00%	315M		0.00%	0.00%	98M		0.00%	0.00%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
	Total		**790,812**		**0.0%**	**0.0%**	**280,145**		**0.0%**	**0.0%**	**6,774**		**0.0%**	**0.0%**	**503**		**0.00%**	**0.00%**	**1,037M**		**0.00%**	**0.00%**	**317M**		**0.00%**	**0.00%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
Mothership	2016		70,599		0.0%	0.0%	43,262		0.0%	0.0%	366		0.0%	0.0%	14		0.00%	0.00%	90M		0.00%	0.00%	26M		0.00%	0.00%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019		68,066		0.0%	0.0%	44,860		0.0%	0.0%	538		0.0%	0.0%	12		0.00%	0.00%	90M		0.00%	0.00%	25M		0.00%	0.00%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021		66,593		0.0%	0.0%	50,542		0.0%	0.0%	222		0.0%	0.0%	129		0.00%	0.00%	79M		0.00%	0.00%	25M		0.00%	0.00%
	2022		53,532		0.0%	0.0%	32,262		0.0%	0.0%	74		0.0%	0.0%	149		0.00%	0.00%	75M		0.00%	0.00%	24M		0.00%	0.00%
	Total		**3,949,430**	**148,936**	**3.8%**	**2.2%**	**1,899,055**	**13,053**	**0.7%**	**0.7%**	**54,569**	**1,794**	**3.3%**	**1.4%**	**8,544**	**226**	**2.64%**	**2.18%**	**4,623M**	**154M**	**3.33%**	**1.94%**	**1,583M**	**55M**	**3.46%**	**2.02%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
Inshore	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020		327,025		0.0%	0.0%	237,632		0.0%	0.0%	7,807		0.0%	0.0%	822		0.00%	0.00%	334M		0.00%	0.00%	124M		0.00%	0.00%
	2021	8/7/2021	339,546	148,936	43.9%	24.9%	341,779	13,053	3.8%	3.8%	2,571	1,794	69.8%	25.7%	970	226	23.28%	16.67%	353M	154M	43.69%	24.76%	126M	55M	43.60%	24.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**359,623**	**4.1%**	**2.4%**	**3,368,480**	**95,095**	**2.8%**	**2.8%**	**83,745**	**2,800**	**3.3%**	**1.2%**	**10,980**	**246**	**2.24%**	**1.48%**	**10,936M**	**422M**	**3.86%**	**2.23%**	**3,511M**	**131M**	**3.72%**	**2.14%**

Table Appendix 6-19 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 550,000 apportioned under suboption 3 (pro-rata)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
	Total		**884,892**	**76,810**	**8.7%**	**4.9%**	**227,891**	**19,679**	**8.6%**	**8.6%**	**3,413**	**419**	**12.3%**	**2.8%**	**311**	**2**	**0.55%**	**0.34%**	**1,161M**	**94M**	**8.12%**	**4.61%**	**354M**	**28M**	**7.88%**	**4.48%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
CDQ	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/22/2017	75,419	28,221	37.4%	20.7%	87,058	13,321	15.3%	15.3%	388	183	47.2%	7.3%	3	1	17.14%	7.33%	97M	37M	37.60%	20.75%	27M	10M	37.62%	20.77%
	2018		76,296		0.0%	0.0%	26,586		0.0%	0.0%	358		0.0%	0.0%	2		0.00%	0.00%	93M		0.00%	0.00%	30M		0.00%	0.00%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	7/17/2021	76,732	48,589	63.3%	34.9%	55,663	6,358	11.4%	11.4%	329	236	71.7%	20.1%	8	1	14.06%	3.07%	91M	58M	63.33%	34.74%	28M	18M	63.30%	34.75%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
	Total		**3,124,177**	**133,877**	**4.3%**	**2.5%**	**961,389**	**62,363**	**6.5%**	**6.4%**	**18,989**	**587**	**3.1%**	**0.8%**	**1,623**	**18**	**1.12%**	**0.41%**	**4,114M**	**174M**	**4.23%**	**2.42%**	**1,256M**	**48M**	**3.81%**	**2.18%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
CP	2016		284,065		0.0%	0.0%	134,750		0.0%	0.0%	2,403		0.0%	0.0%	47		0.00%	0.00%	366M		0.00%	0.00%	104M		0.00%	0.00%
	2017	7/29/2017	266,891	133,877	50.2%	28.3%	207,355	62,363	30.1%	29.9%	1,475	587	39.8%	5.7%	27	18	68.09%	7.82%	346M	174M	50.22%	28.25%	95M	48M	50.44%	28.45%
	2018		263,947		0.0%	0.0%	99,447		0.0%	0.0%	1,259		0.0%	0.0%	18		0.00%	0.00%	321M		0.00%	0.00%	104M		0.00%	0.00%
	2019		275,173		0.0%	0.0%	113,428		0.0%	0.0%	3,127		0.0%	0.0%	4		0.00%	0.00%	367M		0.00%	0.00%	103M		0.00%	0.00%
	2020		245,375		0.0%	0.0%	77,138		0.0%	0.0%	4,151		0.0%	0.0%	97		0.00%	0.00%	298M		0.00%	0.00%	93M		0.00%	0.00%
	2021		264,947		0.0%	0.0%	97,917		0.0%	0.0%	1,187		0.0%	0.0%	5		0.00%	0.00%	315M		0.00%	0.00%	98M		0.00%	0.00%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
	Total		**790,812**	**10,914**	**1.4%**	**0.8%**	**280,145**	**200**	**0.1%**	**0.1%**	**6,774**	**72**	**1.1%**	**0.5%**	**503**	**10**	**2.02%**	**0.79%**	**1,037M**	**13M**	**1.25%**	**0.72%**	**317M**	**4M**	**1.27%**	**0.73%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
Mothership	2016		70,599		0.0%	0.0%	43,262		0.0%	0.0%	366		0.0%	0.0%	14		0.00%	0.00%	90M		0.00%	0.00%	26M		0.00%	0.00%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019		68,066		0.0%	0.0%	44,860		0.0%	0.0%	538		0.0%	0.0%	12		0.00%	0.00%	90M		0.00%	0.00%	25M		0.00%	0.00%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	8/28/2021	66,593	10,914	16.4%	9.1%	50,542	200	0.4%	0.4%	222	72	32.4%	7.8%	129	10	7.85%	5.63%	79M	13M	16.35%	9.02%	25M	4M	16.20%	8.98%
	2022		53,532		0.0%	0.0%	32,262		0.0%	0.0%	74		0.0%	0.0%	149		0.00%	0.00%	75M		0.00%	0.00%	24M		0.00%	0.00%
	Total		**3,949,430**	**148,936**	**3.8%**	**2.2%**	**1,899,055**	**13,053**	**0.7%**	**0.7%**	**54,569**	**1,794**	**3.3%**	**1.4%**	**8,544**	**226**	**2.64%**	**2.18%**	**4,623M**	**154M**	**3.33%**	**1.94%**	**1,583M**	**55M**	**3.46%**	**2.02%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
Inshore	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020		327,025		0.0%	0.0%	237,632		0.0%	0.0%	7,807		0.0%	0.0%	822		0.00%	0.00%	334M		0.00%	0.00%	124M		0.00%	0.00%
	2021	8/7/2021	339,546	148,936	43.9%	24.9%	341,779	13,053	3.8%	3.8%	2,571	1,794	69.8%	25.7%	970	226	23.28%	16.67%	353M	154M	43.69%	24.76%	126M	55M	43.60%	24.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**370,537**	**4.2%**	**2.5%**	**3,368,480**	**95,295**	**2.8%**	**2.8%**	**83,745**	**2,872**	**3.4%**	**1.3%**	**10,980**	**256**	**2.33%**	**1.54%**	**10,936M**	**435M**	**3.98%**	**2.29%**	**3,511M**	**135M**	**3.84%**	**2.21%**

Table Appendix 6-20 Potentially forgone pollock harvest (mt), gross first wholesale revenue (millions of 2022 real dollars), and gross ex-vessel revenue (millions of 2022 real dollars), and chum salmon avoided (number of fish), Chinook salmon avoided (number of fish), herring bycatch avoided (mt) under a PSC limit of 550,000 apportioned under suboption 4 (AFA)

Sector	Year	Date of Closure	Status Quo B Season Pollock Harvest mt)	Potentially Forgone B Season Pollock Harvest (mt)	Forgone Pollock Harvest as % of B Season Total	Forgone Pollock as % of Annual Total	Status Quo B Season Chum Bycatch (#)	Potential Number of Chum Salmon Avoided in B Season	Number of Chum Salmon Avoided as % of B Season Total	Number of Chum Salmon Avoided % of Annual Total	Status Quo B Season Chinook Bycatch (#)	Potential Number of Chinook Salmon Avoided in B Season	Number of Chinook Salmon Avoided as % of B Season Total	Number of Chinook Salmon Avoided as % of Annual Total	Status Quo B Season Herring Bycatch (mt)	Potential Herring Bycatch Avoided in B Season (mt)	Amount of Herring Bycatch Avoided (mt) as % of B Season Total	Amount of Herring Bycatch Avoided (mt) as % of Annual Total	Status Quo Wholesale Revenue for all BSAI Groundfish in B Season	Potentially Forgone B Season Wholesale Revenue	Forgone Wholesale Revenue as % of B Season Total	Forgone Wholesale Revenue Reduction as % of Annual Total	Status Quo Ex-Vessel Revenue for all BSAI Groundfish in B Season	Potentially Forgone Ex-Vessel Revenue in B Season	Forgone Ex-Vessel Revenue as % of B Season Total	Forgone Ex-Vessel Revenue as % of Annual Total
	Total		**884,892**	**30,507**	**3.4%**	**2.0%**	**227,891**	**13,584**	**6.0%**	**5.9%**	**3,413**	**262**	**7.7%**	**1.7%**	**311**	**1**	**0.19%**	**0.12%**	**1,161M**	**39M**	**3.38%**	**1.92%**	**354M**	**11M**	**3.06%**	**1.74%**
	2011		66,167		0.0%	0.0%	3,758		0.0%	0.0%	334		0.0%	0.0%	12		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		73,163		0.0%	0.0%	200		0.0%	0.0%	5		0.0%	0.0%	103		0.00%	0.00%	112M		0.00%	0.00%	34M		0.00%	0.00%
	2013		75,940		0.0%	0.0%	554		0.0%	0.0%	48		0.0%	0.0%	1		0.00%	0.00%	96M		0.00%	0.00%	31M		0.00%	0.00%
	2014		77,302		0.0%	0.0%	2,407		0.0%	0.0%	36		0.0%	0.0%	14		0.00%	0.00%	99M		0.00%	0.00%	32M		0.00%	0.00%
	2015		79,785		0.0%	0.0%	4,650		0.0%	0.0%	250		0.0%	0.0%	1		0.00%	0.00%	101M		0.00%	0.00%	32M		0.00%	0.00%
CDQ	2016		81,476		0.0%	0.0%	16,342		0.0%	0.0%	352		0.0%	0.0%	139		0.00%	0.00%	104M		0.00%	0.00%	30M		0.00%	0.00%
	2017	7/22/2017	75,419	28,221	37.4%	20.7%	87,058	13,321	15.3%	15.3%	388	183	47.2%	7.3%	3	1	17.14%	7.33%	97M	37M	37.60%	20.75%	27M	10M	37.62%	20.77%
	2018		76,296		0.0%	0.0%	26,586		0.0%	0.0%	358		0.0%	0.0%	2		0.00%	0.00%	93M		0.00%	0.00%	30M		0.00%	0.00%
	2019		78,315		0.0%	0.0%	15,726		0.0%	0.0%	719		0.0%	0.0%	9		0.00%	0.00%	104M		0.00%	0.00%	29M		0.00%	0.00%
	2020		63,107		0.0%	0.0%	8,582		0.0%	0.0%	557		0.0%	0.0%	7		0.00%	0.00%	77M		0.00%	0.00%	24M		0.00%	0.00%
	2021	9/11/2021	76,732	2,286	3.0%	1.6%	55,663	263	0.5%	0.5%	329	79	24.0%	6.7%	8	0	0.12%	0.03%	91M	3M	2.99%	1.64%	28M	1M	2.99%	1.64%
	2022		61,189		0.0%	0.0%	6,365		0.0%	0.0%	37		0.0%	0.0%	12		0.00%	0.00%	85M		0.00%	0.00%	27M		0.00%	0.00%
	Total		**3,124,177**	**2,225**	**0.1%**	**0.0%**	**961,389**	**1,321**	**0.1%**	**0.1%**	**18,989**	**8**	**0.0%**	**0.0%**	**1,623**	**1**	**0.06%**	**0.02%**	**4,114M**	**3M**	**0.07%**	**0.04%**	**1,256M**	**1M**	**0.06%**	**0.04%**
	2011		250,129		0.0%	0.0%	44,299		0.0%	0.0%	1,652		0.0%	0.0%	124		0.00%	0.00%	392M		0.00%	0.00%	115M		0.00%	0.00%
	2012		253,884		0.0%	0.0%	1,928		0.0%	0.0%	92		0.0%	0.0%	400		0.00%	0.00%	388M		0.00%	0.00%	119M		0.00%	0.00%
	2013		264,928		0.0%	0.0%	10,229		0.0%	0.0%	448		0.0%	0.0%	763		0.00%	0.00%	333M		0.00%	0.00%	108M		0.00%	0.00%
	2014		267,977		0.0%	0.0%	63,066		0.0%	0.0%	567		0.0%	0.0%	7		0.00%	0.00%	343M		0.00%	0.00%	111M		0.00%	0.00%
	2015		277,192		0.0%	0.0%	40,046		0.0%	0.0%	2,374		0.0%	0.0%	5		0.00%	0.00%	352M		0.00%	0.00%	112M		0.00%	0.00%
CP	2016		284,065		0.0%	0.0%	134,750		0.0%	0.0%	2,403		0.0%	0.0%	47		0.00%	0.00%	366M		0.00%	0.00%	104M		0.00%	0.00%
	2017	9/9/2017	266,891	2,225	0.8%	0.5%	207,355	1,321	0.6%	0.6%	1,475	8	0.5%	0.1%	27	1	3.61%	0.41%	346M	3M	0.83%	0.47%	95M	1M	0.82%	0.46%
	2018		263,947		0.0%	0.0%	99,447		0.0%	0.0%	1,259		0.0%	0.0%	18		0.00%	0.00%	321M		0.00%	0.00%	104M		0.00%	0.00%
	2019		275,173		0.0%	0.0%	113,428		0.0%	0.0%	3,127		0.0%	0.0%	4		0.00%	0.00%	367M		0.00%	0.00%	103M		0.00%	0.00%
	2020		245,375		0.0%	0.0%	77,138		0.0%	0.0%	4,151		0.0%	0.0%	97		0.00%	0.00%	298M		0.00%	0.00%	93M		0.00%	0.00%
	2021		264,947		0.0%	0.0%	97,917		0.0%	0.0%	1,187		0.0%	0.0%	5		0.00%	0.00%	315M		0.00%	0.00%	98M		0.00%	0.00%
	2022		209,668		0.0%	0.0%	71,786		0.0%	0.0%	254		0.0%	0.0%	126		0.00%	0.00%	292M		0.00%	0.00%	94M		0.00%	0.00%
	Total		**790,812**	**22,968**	**2.9%**	**1.7%**	**280,145**	**778**	**0.3%**	**0.3%**	**6,774**	**108**	**1.6%**	**0.7%**	**503**	**53**	**10.52%**	**4.13%**	**1,037M**	**27M**	**2.63%**	**1.52%**	**317M**	**8M**	**2.67%**	**1.54%**
	2011		65,724		0.0%	0.0%	24,399		0.0%	0.0%	2,426		0.0%	0.0%	3		0.00%	0.00%	103M		0.00%	0.00%	30M		0.00%	0.00%
	2012		63,424		0.0%	0.0%	977		0.0%	0.0%	49		0.0%	0.0%	117		0.00%	0.00%	96M		0.00%	0.00%	30M		0.00%	0.00%
	2013		66,713		0.0%	0.0%	3,835		0.0%	0.0%	48		0.0%	0.0%	4		0.00%	0.00%	84M		0.00%	0.00%	27M		0.00%	0.00%
	2014		66,756		0.0%	0.0%	8,091		0.0%	0.0%	180		0.0%	0.0%	3		0.00%	0.00%	85M		0.00%	0.00%	28M		0.00%	0.00%
	2015		69,141		0.0%	0.0%	14,046		0.0%	0.0%	559		0.0%	0.0%	5		0.00%	0.00%	88M		0.00%	0.00%	28M		0.00%	0.00%
Mothership	2016		70,599		0.0%	0.0%	43,262		0.0%	0.0%	366		0.0%	0.0%	14		0.00%	0.00%	90M		0.00%	0.00%	26M		0.00%	0.00%
	2017		66,453		0.0%	0.0%	16,825		0.0%	0.0%	476		0.0%	0.0%	25		0.00%	0.00%	85M		0.00%	0.00%	23M		0.00%	0.00%
	2018		66,892		0.0%	0.0%	21,303		0.0%	0.0%	364		0.0%	0.0%	6		0.00%	0.00%	81M		0.00%	0.00%	26M		0.00%	0.00%
	2019		68,066		0.0%	0.0%	44,860		0.0%	0.0%	538		0.0%	0.0%	12		0.00%	0.00%	90M		0.00%	0.00%	25M		0.00%	0.00%
	2020		66,919		0.0%	0.0%	19,743		0.0%	0.0%	1,472		0.0%	0.0%	36		0.00%	0.00%	81M		0.00%	0.00%	25M		0.00%	0.00%
	2021	8/14/2021	66,593	22,968	34.5%	19.1%	50,542	778	1.5%	1.5%	222	108	48.6%	11.7%	129	53	40.89%	29.34%	79M	27M	34.43%	19.00%	25M	8M	34.19%	18.96%
	2022		53,532		0.0%	0.0%	32,262		0.0%	0.0%	74		0.0%	0.0%	149		0.00%	0.00%	75M		0.00%	0.00%	24M		0.00%	0.00%
	Total		**3,949,430**	**148,936**	**3.8%**	**2.2%**	**1,899,055**	**13,053**	**0.7%**	**0.7%**	**54,569**	**1,794**	**3.3%**	**1.4%**	**8,544**	**226**	**2.64%**	**2.18%**	**4,623M**	**154M**	**3.33%**	**1.94%**	**1,583M**	**55M**	**3.46%**	**2.02%**
	2011		299,466		0.0%	0.0%	118,861		0.0%	0.0%	13,951		0.0%	0.0%	236		0.00%	0.00%	413M		0.00%	0.00%	138M		0.00%	0.00%
	2012		315,290		0.0%	0.0%	19,067		0.0%	0.0%	3,433		0.0%	0.0%	1,608		0.00%	0.00%	442M		0.00%	0.00%	149M		0.00%	0.00%
	2013		330,513		0.0%	0.0%	110,496		0.0%	0.0%	4,255		0.0%	0.0%	191		0.00%	0.00%	395M		0.00%	0.00%	135M		0.00%	0.00%
	2014		335,322		0.0%	0.0%	145,322		0.0%	0.0%	2,718		0.0%	0.0%	136		0.00%	0.00%	407M		0.00%	0.00%	139M		0.00%	0.00%
	2015		346,959		0.0%	0.0%	174,343		0.0%	0.0%	2,848		0.0%	0.0%	1,059		0.00%	0.00%	381M		0.00%	0.00%	141M		0.00%	0.00%
Inshore	2016		354,015		0.0%	0.0%	144,882		0.0%	0.0%	1,987		0.0%	0.0%	654		0.00%	0.00%	398M		0.00%	0.00%	129M		0.00%	0.00%
	2017		346,323		0.0%	0.0%	154,610		0.0%	0.0%	6,134		0.0%	0.0%	646		0.00%	0.00%	354M		0.00%	0.00%	121M		0.00%	0.00%
	2018		343,996		0.0%	0.0%	147,369		0.0%	0.0%	3,215		0.0%	0.0%	381		0.00%	0.00%	387M		0.00%	0.00%	135M		0.00%	0.00%
	2019		348,384		0.0%	0.0%	172,798		0.0%	0.0%	4,863		0.0%	0.0%	866		0.00%	0.00%	413M		0.00%	0.00%	128M		0.00%	0.00%
	2020		327,025		0.0%	0.0%	237,632		0.0%	0.0%	7,807		0.0%	0.0%	822		0.00%	0.00%	334M		0.00%	0.00%	124M		0.00%	0.00%
	2021	8/7/2021	339,546	148,936	43.9%	24.9%	341,779	13,053	3.8%	3.8%	2,571	1,794	69.8%	25.7%	970	226	23.28%	16.67%	353M	154M	43.69%	24.76%	126M	55M	43.60%	24.77%
	2022		262,593		0.0%	0.0%	131,896		0.0%	0.0%	787		0.0%	0.0%	974		0.00%	0.00%	346M		0.00%	0.00%	118M		0.00%	0.00%
Grand Total			**8,749,312**	**204,635**	**2.3%**	**1.4%**	**3,368,480**	**28,736**	**0.9%**	**0.8%**	**83,745**	**2,172**	**2.6%**	**1.0%**	**10,980**	**280**	**2.55%**	**1.69%**	**10,936M**	**224M**	**2.04%**	**1.18%**	**3,511M**	**75M**	**2.13%**	**1.23%**

Appendix 7 Evaluating Alternative Indices of Run Size for Western Alaska Chum Salmon

Evaluating alternative indices of run size for western Alaska chum salmon

Prepared by: Lukas DeFilippo, Alaska Fisheries Science Center

1. Goals and Overview

This analysis was developed in response to the Council's October 2023 motion and accompanying rationale for evaluating different indices of Western Alaska (WAK) chum salmon abundance. The Council's motion identifies three different indices (or suboptions):

1. Index 1 (corresponds to suboption 1): Three-area chum index based on Yukon River summer + fall run abundance (950,000 + 575,000); Kuskokwim River composed of the Bethel test fishery catch-per-unit-effort (CPUE) (2,800); Norton Sound composed of summed escapement for the Snake, Nome, Eldorado, Kwiniuk, and North Rivers and total Norton Sound harvest (57,000)
2. Index 2 (corresponds to suboption 2a): Yukon River summer chum (950,000)
3. Index 3 (corresponds to suboption 2b): Yukon River summer chum (950,000) and fall chum (575,000)

The Council asked staff to provide a synchronicity analysis to determine how well the Index 2 and 3 focused on the Yukon summer and fall chum runs trend with the Three-area chum index presented in Index 1. This analysis is intended to help the Council in its consideration of the different indices. This analysis is not intended to be used in the future as a management tool, meaning the model presented herein (discussed below) would not be re-run in the future to determine whether WAK chum is above or below abundance thresholds. The Alaska Department of Fish & Game (ADF&G) would use the information sources specified by the Council (discussed below) to determine whether indices were above or below their threshold(s) in the future.

2. Data

Historical estimates of run size for Yukon, Kuskokwim, and Norton Sound chum salmon stocks were provided by ADF&G. The Council's October 2023 motion specified the information sources that would be used for evaluating indices performance against their threshold(s) in the future under a potentially regulated program and are the same information sources used in this analysis. These information sources are as follows:

1. Yukon River summer and fall chum are based on the full run reconstructions for each stock.
2. Kuskokwim River chum abundance is based on the catch-per-unit-effort (CPUE) from the Bethel test fishery.
3. Norton Sound chum abundance was based on the sum of the Snake, Nome Eldorado, Kwiniuk, and North Rivers weir/tower escapements and the total Norton Sound harvest.

In October 2023, the SSC recommended the full time series of information for each area be considered (including 2023 data) to provide the most useful assessment. Further details on data collection and run reconstruction methodology for these stocks can be provided by ADF&G. Table 1 below shows the information provided by ADF&G for this analysis.

Table 1 Estimates of run size indices for individual western Alaska chum salmon stocks

Year	Yukon Summer Chum Run Reconstruction	Yukon Fall Chum Run Reconstruction	Kuskokwim Bethel Test Fishery CPUE	Minimum Standardized Index (Sum of Snake, Nome, Eldorado, North Rivers Weir/Tower/Escapement and Total NS Harvest)
1974		1,150,475		
1875		2,762,062		
1976		884,743		
1977		1,174,618		
1978	2,886,600	984,930		
1979	2,307,000	1,996,377		
1980	3,064,200	810,205		
1981	5,470,200	1,232,293		
1982	2,183,300	607,275		
1983	2,489,400	1,025,266		
1984	3,799,600	763,722	2,391	
1985	4,666,200	1,208,481	1,328	
1986	4,574,900	841,428	4,065	
1987	1,988,700	1,124,565	4,899	
1988	4,554,100	697,147	5,189	
1989	3,818,300	1,074,022	2,605	
1990	1,932,700	835,714	2,722	
1991	2,689,500	1,027,796	1,269	
1992	2,833,600	556,852	3,057	
1993	1,891,700	462,735	2,586	
1994	3,871,700	1,114,772	4,801	
1995	4,300,100	1,614,534	3,986	
1996	4,401,300	1,140,415	8,256	
1997	1,654,300	705,179	1,965	101,934
1998	1,012,700	350,457	2,337	80,966
1999	1,146,500	416,480	549	39,217
2000	552,820	250,242	2,599	55,153
2001	542,190	372,385	3,396	66,123
2002	1,275,200	426,469	6,798	73,710
2003	1,262,200	792,375	4,819	43,407
2004	1,463,000	652,616	5,248	41,270
2005	2,761,400	2,188,488	18,192	53,034
2006	4,019,500	1,213,273	13,927	113,350
2007	2,157,800	1,161,101	10,655	107,719
2008	2,067,500	857,819	6,749	63,806
2009	1,703,700	591,077	8,257	69,906
2010	1,668,300	585,791	7,655	277,401

2011	2,406,000	1,244,141	10,028	202,421
2012	2,479,900	1,089,200	6,894	107,359
2013	3,349,600	1,215,809	5,739	188,104
2014	2,467,600	956,669	6,345	215,382
2015	1,978,400	828,453	2,945	259,441
2016	2,581,500	1,390,329	3,998	124,397
2017	3,635,100	2,315,883	6,785	324,148
2018	2,074,700	1,114,684	8,205	363,939
2019	1,689,400	802,964	6,429	234,270
2020	763,200	184,233	1,443	49,762
2021	156,130	95,249	327	21,735
2022	478,690	242,465	2,191	70,702
2023	896,850	318,687	4,304	38,469

Source: ADF&G

3. Analytical Methods

We address the question of how well indices 2 and 3 represent the Three-area Index (index 1) in two ways. One is by estimating the degree of temporal correlation between indices 2 and 3 and the individual stocks making up the Three-area Index via cross-correlation analysis. The other is to estimate a shared trend among the time-series comprising the Three- area Index via Dynamic Factor Analysis (see below) and examining how well indices 2 and 3 track this shared trend.

3.1. Dynamic factor analysis of the Three-area index

Staff developed an ordination-based shared index for WAK chum abundance using a dynamic factor analysis (DFA) on a time series of the data sources identified in Table 1 representing the Three-area index. The purpose of this approach is to generate a single trend that is representative of the Three-area index (index 1) and compare how well indices 2-3 track this trend. The units of the different indices that make up the Three-area index are not exchangeable, such that it is difficult to summarize the Three-area index as a coherent, single time-series (*i.e.*, by summing the index values across areas). As such, DFA is a useful tool to represent shared variation among the constituent stocks of the Three-area index, and examine how well alternative, simpler indices (*i.e.*, index 2,3) track this variation.

DFA is a time-series ordination technique that describes temporal variation in a set of observed time-series via a reduced set of shared trends and associated loadings. For a complete description of DFA models and applications to fisheries/ecology data, please consult Zuur et al. (2003); a brief description of the model structure is described here. The DFA model consists of two submodels; a process component that describes underlying latent states (shared trends among the input time-series observations), and an observation model linking these latent states to the observed data. For the present analysis, process models followed a multivariate random-walk design of the form:

$$(1)\ \mathbf{x_{t+1}} = \mathbf{x_t} + \mathbf{w_t}$$

$$\mathbf{w_t} \sim \mathrm{MVN}(0, \mathbf{Q}).$$

Where **x** is a matrix dimensioned by the number of years N and the number of latent trends K, and $\mathbf{w_t}$ are multivariate-normally distributed process errors with variance-covariance matrix **Q,** which is assumed to be a $K\ x\ K$ identity matrix.

The observation model linking the latent states **x** to the observed data **y** is specified as:

$$(2)\ \mathbf{y_t} = \mathbf{Z}\mathbf{x_t} + \mathbf{e_t}$$

$$\mathbf{e_t} \sim \mathrm{MVN}(0, \mathbf{R}).$$

Where **Z** is a matrix of estimated loadings with dimensions of P equal to the number of observed time-series, and K equal to the number of latent trends. Residual errors $\mathbf{e_t}$ are multivariate-normally distributed with variance-covariance matrix **R**. The DFA model used here was estimated in a Bayesian context using the stan modeling software, implemented via the *rstan* and *bayesdfa* packages (https://cran.r-project.org/web/packages/bayesdfa/index.html). All input time-series were Z-scored prior to model fitting to ensure a common scale between time-series. While DFA can include any number of latent trends, this analysis only considered one trend as the goal of this exercise was to describe shared variation representative of the Three-area index (Index 1 or suboption 1).

3.2. Index evaluation.

To address the NPFMC's question on how well indices 2 (Yukon summer) and 3 (Yukon summer + fall chum only) tracked variation in index 1 (Three area index), the lag-zero cross correlation coefficient (r_k^{xy}), a metric of correlation between time-series, was calculated between each of these indices and the abundance time-series for each individual stock, as well as the DFA-estimated shared trend:

$$(3)\ r_{k=0}^{xy} = \frac{g_{k=0}^{xy}}{\sqrt{\sigma_x \sigma_y}}$$

where σ_x is the standard deviation of time series x and σ_y is the standard deviation of time-series y, k is the lag at which cross-correlation is computed ($k = 0$ in this application), and g_k^{xy} is the cross-covariance function between the time series x and y at lag k:

$$(4)\ g_k^{xy} = \frac{1}{n}\sum_{t=1}^{n-k}(y_t - \bar{y})(x_{t+k} - \bar{x})$$

Where $\bar{y}$ is the mean of time series y, $\bar{x}$ is the mean of time-series x, and n is the number of years (t) over which cross-covariance is evaluated.

4. Results

4.1. DFA results:

A single trend DFA model was fitted to four time-series of western Alaska chum salmon abundance estimates. The model's single estimated trend corresponded to broad scale temporal variation in the abundance time-series of all western Alaska chum salmon stocks included in this analysis, most notably exhibiting a sharp decline in 2020 and a modest recovery in abundance beginning in 2022 (Figure 1). Factor loadings indicate that this DFA trend was most strongly associated with the Yukon River fall (Z= 0.56) and summer (Z= 0.54) runs, followed by the Kuskokwim River as indexed by the Bethel test fishery CPUE (Z= 0.41) with the Norton Sound abundance time-series exhibiting the weakest loading (Z=0.37) (Figure 1).

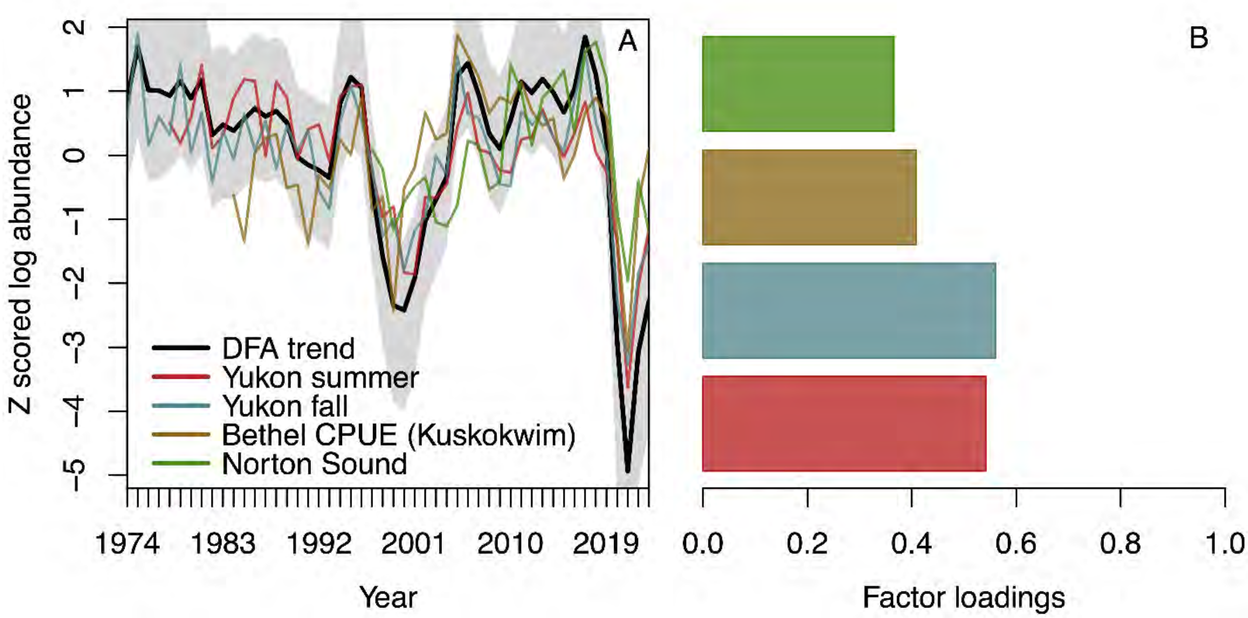


Figure 1 DFA-derived shared latent trend and factor loadings. Panel A. shows the latent state identified by DFA (black) alongside the observed time-series for each data source (coded by color)

4.2. Index performance

To address the NPFMC's question of how well index 2 (Yukon summer chum) and index 3 (Yukon summer + fall chum) track variation in the Three-area index (index 1), cross correlation coefficients were computed between indices 2 and 3, and between indices 2 and 3 and the Three-area index, as represented by the shared DFA trend, as well as the individual stocks comprising the Three-area index. For example, to evaluate how well index 2 (Yukon summer) tracks the Three-area index, the cross-correlation between index 2 (Yukon summer) and the DFA trend, as well as Yukon fall chum abundance, Yukon summer + fall chum abundance, the Bethel CPUE and Norton Sound abundance time series was computed.

4.2.2. Index 2 Performance (Yukon summer chum only)

Index 2, based solely on the Yukon summer run abundance, exhibited moderate cross correlation with the Norton sound abundance time-series (r=0.48) and stronger cross-correlation with the Bethel test fishery CPUE series (r=0.65). Not surprisingly, the Yukon summer run index exhibited a strong correlation with the Yukon fall chum time series (r=0.837) and an identity correlation with the Yukon summer chum time series (r=1). **Index 2 exhibited a strong cross-correlation (r=0.90) with the DFA-estimated shared trend.**

4.2.3. Index 3 Performance (Yukon summer + fall chum)

Index 3 (Yukon summer + fall exhibited a moderate-strong cross-correlation with the Bethel test fishery CPUE time series (r=0.56) and Norton sound abundance time series (r=0.65). Not surprisingly, Index 2 exhibited very strong cross-correlation with the individual summer (r=0.96) and fall (r=0.95) Yukon chum abundance time-series. **Index 3 exhibited a strong cross-correlation with the DFA-estimated shared trend (r = 0.96).**

4. Discussion

Our analysis indicates evidence of synchronous dynamics among WAK chum salmon stocks. The single trend estimated from the DFA model tracked broad sale temporal variation among the constituent stocks and exhibited moderate-strong factor loadings for each contributing time series. Such synchronous dynamics point to the feasibility of using indicator stocks to represent regional dynamics (*i.e.*, index 2, 3). Our results indicate that index 2 (Yukon summer chum) and 3 (Yukon summer + fall chum) exhibit strong cross-correlation with the constituent stocks making up the Three-area Index, as well as the DFA shared trend estimated from the aggregate Three-area index stocks. These results suggest that that indices 2 and 3 are likely to provide a reliable index of the aggregate dynamics of western Alaska chum salmon stocks. While both indices 2 and 3 perform well in this respect, index 3 (Yukon summer + fall) exhibits a stronger association with the shared DFA trend, and the other individual stocks making up the Three-area Index. We recommend periodic re-evaluation of the synchronicity among WAK stocks and the suitability of any indices used for representing aggregate dynamics.

References

Zuur, A. F., Tuck, I. D., & Bailey, N. (2003). Dynamic factor analysis to estimate common trends in fisheries time series. *Canadian journal of fisheries and aquatic sciences*, *60*(5), 542-552.

Appendix 8 Relationship of this Action to Federal Laws, Policies, and Treaties

While NEPA is the primary law directing the preparation of this preliminary DEIS, a variety of other federal laws and policies require environmental, economic, and social analyses or proposed federal actions. This preliminary DEIS and the accompanying SIA contain the required analysis of the proposed federal action and its alternatives to ensure that the action complies with these additional federal laws and executive orders:

National Environmental Policy Act

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

NEPA has two principal purposes:

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

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

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

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

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

NMFS decided to prepare an EIS to assist agency planning and decision-making. The purpose of an EIS is to predict and disclose the impacts of the proposed action and its alternatives on the human environment. NEPA and the Magnuson-Stevens Act requirements for schedule, format, and public participation are compatible and allow one process to fulfill both obligations.

Magnuson-Stevens Fishery Conservation and Management Act

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

The actions under consideration in this preliminary DEIS are management measures to minimize chum salmon bycatch in the Bering Sea pollock fishery. While each FMP amendment must comply with all ten the Magnuson Stevens Act National Standards, national standards, National Standard 9 directly guides this action as it requires that conservation and management measures shall minimize bycatch to the extent practicable while balancing all other National Standards.

Endangered Species Act

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

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

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

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

Formal consultations, resulting in biological opinions, are conducted for federal actions that may have an adverse affect on the listed species. Through the biological opinion, a determination is made about whether the proposed action poses “jeopardy” or “no jeopardy” of extinction or adverse modification or destruction of designated critical habitat for the listed species. If the determination is that the proposed or on-going action will cause jeopardy or adverse modification of critical habitat, reasonable and prudent alternatives may be suggested which, if implemented, would modify the action to no longer pose the jeopardy of extinction or adverse modification to critical habitat for the listed species. These reasonable and prudent alternatives must be incorporated into the federal action if it is to proceed. A biological opinion with the conclusion of no jeopardy or adverse modification of critical habitat may contain conservation recommendations intended to further reduce the negative impacts to the listed species. These recommendations are advisory to the action agency (50 CFR 402.14(j)). If the likelihood exists of any take occurring during promulgation of the action, an incidental take statement may be appended to a biological opinion to provide for the amount of take that is expected to occur from normal promulgation of the action. An incidental take statement is not the equivalent of a permit to take a listed species.

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

Marine Mammal Protection Act

Under the MMPA, NMFS has a responsibility to conserve marine mammals, specifically cetaceans and pinnipeds (other than walrus). The USFWS is responsible for sea otter, walrus, and polar bear. Congress found that certain species and stocks of marine mammals are or may be in danger of extinction or depletion due to human activities. Congress also declared that marine mammals are resources of great international significance. The primary management objective of the MMPA is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. The MMPA is intended to work in concert with the provisions of the ESA. The Secretary is required to consider all factors regarding regulations applicable to the “take” of marine mammals, including the conservation, development, and utilization of fishery resources, and the economic and technological feasibility of implementing the regulations. If a fishery affects a marine mammal population, the Council or NMFS may be requested to consider measures to mitigate adverse impacts.

Administrative Procedure Act

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

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

Regulatory Flexibility Act

The RFA requires federal agencies to consider the economic impact of regulatory proposals on directly regulated small entities, analyze alternatives that minimize adverse economic impacts on this class of small entities, and make their analyses available for public comment. The RFA applies to a wide range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions. The Small Business Administration has established size criteria for all major industry sectors in the United States, including fish harvesting and fish processing businesses. The RFA applies to any regulatory actions for which prior notice and comment is required under the APA. After an agency begins regulatory development and determines that the RFA applies, unless an agency can certify that an action subject to the RFA will not have a significant economic impact on a substantial number of small entities, the agency must prepare an initial regulatory flexibility analysis (IRFA) to accompany a proposed rule. Based upon the IRFA, and received public comment, assuming it is still not possible to certify, the agency must prepare a final regulatory flexibility analysis (FRFA) to accompany the final rule.

Information Quality Act

The IQA directs the OMB to issue government-wide policy and procedural guidance to all federal agencies to ensure and maximize the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies. The OMB’s guidelines require agencies to develop their own guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by the agency. NOAA published its guidelines in September 2002.

Coastal Zone Management Act

The CZMA is designed to encourage and assist states in developing coastal management programs, to coordinate State activities, and to safeguard regional and national interests in the coastal zone. Section 307(C) of the CZMA requires that any federal activity affecting the land or water or uses natural resources of a state’s coastal zone be consistent with the state’s approved coastal management program, to the maximum extent practicable. A proposed fishery management action that requires an FMP amendment or implementing regulations must be assessed to determine whether it directly affects the coastal zone of a state with an approved coastal zone management program. If so, NMFS must provide the state agency having coastal zone management responsibility with a consistency determination for review at least 90 days before final action. Prior to implementation of the proposed action, NMFS will determine whether this action is consistent to the maximum extent practicable with the enforceable policies of the approved coastal management program of the State of Alaska and submit this determination for review by the responsible state agency.

Alaska National Interest Lands Conservation Act

The Alaska National Interest Lands Conservation Act (ANILCA) was passed by Congress in 1980, and it mandates that rural residents of Alaska be given a priority opportunity for customary and traditional subsistence uses, among consumptive uses of fish and wildlife, on federal lands (16 U.S.C. 3114). In 1986, Alaska amended its subsistence law mandating a rural subsistence priority to bring it into compliance with ANILCA. However, in 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. Yet other federal court cases on the state’s administration of Title VIII of ANILCA ruled that the state would not be given deference in interpreting federal statute. Proposed amendments to ANILCA and the Alaska constitution were not adopted to rectify these conflicting rulings, so the Secretaries of Interior and Agriculture implemented a parallel regulatory program to assure the rural subsistence priority is applied under ANILCA on federal lands.

Further, ANILCA provides a mechanism to establish cooperative agreements or otherwise cooperate with Native Corporations, or other appropriate persons or organizations to effectuate the purposes and policies of Title VIII (16 U.S.C. 3119). ANILCA also "...enables rural residents who have personal knowledge of local conditions and requirements to have a meaningful role in the management of fish and wildlife and of subsistence uses on the public lands in Alaska" (16 U.S.C. 3111). These authorities, in addition to executive and secretarial orders, provide the regulatory framework for the salmon co-management structure outlined in the Memorandum of Understanding between the U.S. Fish and Wildlife Service (USFWS) and the Kuskokwim River Inter-Tribal Fish Commission (KRITFC).

While ANILCA creates a priority for subsistence uses by rural residents over the taking of fish and wildlife for other purposes on public lands, it also imposes obligations on federal agencies with respect to decisions affecting the use of public lands, including a requirement that they analyze the effects of those decisions on subsistence uses and needs (16 U.S.C. 3120). ANILCA defines "public lands" as lands situated "in Alaska" which, after December 2, 1980, are federal lands, except those lands selected by or granted to the State of Alaska, lands selected by an Alaska Native Corporation under the Alaska Native Claims Settlement Act (ANCSA), and lands referred to in section 19(b) of ANCSA (16 U.S.C. 3102(3)). The U.S. Supreme Court has ruled that ANILCA's use of "in Alaska" refers to the boundaries of the State of Alaska and concluded that ANILCA does not apply to the outer continental shelf (OCS) region (*Amoco Prod. Co. v. Village of Gambell*, 480 U.S. 531, 546-47 (1987)). Chum salmon bycatch is managed under the BSAI Groundfish Fishery Management Plan specific to federal waters (i.e., those waters that are 3-200 nautical miles from shore). The Bering Sea subarea where the pollock fishery occurs, as well as the BSAI management region, falls within the OCS. Thus, ANILCA Title VIII does not directly apply. Nevertheless, NMFS and the Council aim to protect such uses pursuant to other laws, such as NEPA and the Magnuson-Stevens Act.

American Fisheries Act

The AFA established a cooperative management program for the Bering Sea pollock fisheries. Among the purposes of the AFA was to tighten U.S. vessel ownership standards, and to provide the pollock fleet the opportunity to conduct its fishery in a more economically rational manner, while protecting non-AFA participants in other fisheries. Since the passage of the AFA, the Council has taken an active role in the development of management measures to implement the various provisions of the AFA. The preliminary DEIS contains a detailed discussion of the Bering Sea pollock fishery under the AFA and the relationship between the chum salmon bycatch management and the AFA sectors.

Pacific Salmon Treaty and the Yukon River Agreement

In 2002, the United States and Canada signed the Yukon River Agreement to the Pacific Salmon Treaty. The Yukon River Agreement states that the "Parties shall maintain efforts to increase the in-river run of Yukon River origin salmon by reducing marine catches and by-catches of Yukon River salmon. They shall further identify, quantify and undertake efforts to reduce these catches and by-catches" (Art. XV, Annex IV, Ch. 8, Cl. 12). The Yukon River Agreement also established the Yukon River Panel as an international advisory body to address the conservation, management, and harvest sharing of Canadian-origin salmon between the U.S. and Canada. This proposed action is an element of the Council's efforts to reduce bycatch of salmon in the pollock fishery and ensure compliance with the Agreement.

Executive Order 12866 Regulatory Planning and Review

A purpose of E.O. 12866 is to enhance planning and coordination with respect to new and existing regulations, and to make the regulatory process more accessible and open to the public (58 FR 51735, October 4, 1993). In addition, EO 12866 requires agencies to take a deliberative, analytical approach to rule making, including assessment of costs and benefits of the intended regulations.

E.O. 12866 was amended through E.O. 14094, April 6, 2023 (88 FR 21879). 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 nevertheless 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.

The purpose of an RIR is to assess the potential economic impacts of a proposed regulatory action. As such, it can be used to satisfy NEPA requirements and serve as a basis for determining whether a proposed rule will have a significant impact on a substantial number of small entities under the RFA. The RIR is frequently combined with an EIS and an IRFA in a single document that addresses the analytical requirements of NEPA, RFA, and Executive Order 12866.

E.O. 12866, as amended by E.O. 14094 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 $200 million or more (adjusted every 3 years by the Administrator of OIRA for changes in gross domestic product); or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, territorial, 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 legal or policy issues for which centralized review would meaningfully further the President's priorities or the principles set forth in this Executive order, as specifically authorized in a timely manner by the Administrator of OIRA in each case.

Executive Order 13175 Tribal Consultation and Collaboration

E.O. 13175 of November 6, 2000, Consultation and Coordination with Indian Tribal Governments (see 65 CFR 67429) was promulgated:

"…in order to establish regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates upon Indian tribes."

The Presidential Memorandum of January 26, 2021, Tribal Consultation and Strengthening Nation-to-Nation Relationships (86 FR 7491) affirms a commitment to:

"…honoring Tribal sovereignty and including Tribal voices in policy deliberation that affects Tribal communities. The Federal Government has much to learn from Tribal Nations and strong communication is fundamental to a constructive relationship."

The Presidential Memorandum on Tribal Consultation and Strengthening Nation-to-Nation Relationships does not change the definition of a Federal agency as specified under E.O. 13175. As such, NMFS continues to be the agency responsible for carrying out Tribal Consultations. The Council has previously expressed support for working with NMFS to receive the results of Tribal Consultations and engagement sessions as early as possible in its decision-making process.[118]

[118] For more information see the Council's February 2021 motion related to the Community Engagement Committee here, and the Council's October 2023 motion adopting the LKTKS Protocol and onramp recommendations here.

Executive Order 12898 Environmental Justice

E.O.12898 of February 11, 1994, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 CFR 7629), directs Federal agencies "to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

The E.O. directs the development of agency strategies to include identification of differential patterns of consumption of natural resources among minority populations and low-income populations; Council on Environmental Quality (CEQ) environmental justice guidance under NEPA also specifically calls for consideration of potential disproportionately high and adverse impacts to Indian tribes beyond a more general consideration of potential disproportionately high and adverse impacts to minority populations (Council on Environmental Quality 1997).

Executive Order 13895 Advancing Racial Equity and Support for Underserved Communities Through the Federal Government

E.O. 13985 of January 20, 2021, Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (86 FR 7009; January 25, 2021), addresses issues of equity for Indigenous and Native American persons, persons who live in rural areas, and persons otherwise adversely affected by persistent poverty or inequality, among other groups, as well as underserved communities in general. Specifically, under Section 2, Definitions:

> *For purposes of this order: (a) The term ''equity'' means the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality.*
>
> *(b) The term ''underserved communities'' refers to populations sharing a particular characteristic, as well as geographic communities, that have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life, as exemplified by the list in the preceding definition of "equity."*

Section 8, Engagement with Members of Underserved Communities, specifies that:

> *In carrying out this order, agencies shall consult with members of communities that have been historically underrepresented in the Federal Government and underserved by, or subject to discrimination in, Federal policies and programs.*

Executive Order 14008 Tackling the Climate Crisis at Home and Abroad

E.O. 14008 of January 27, 2021, Tackling the Climate Crisis at Home and Abroad (86 FR 7619; February 1, 2021), under Part II, Taking a Government-Wide Approach to the Climate Crisis, includes language on securing environmental justice and spurring economic opportunity. Specifically, Section 219 states:

> *To secure an equitable economic future, the United States must ensure that environmental and economic justice are key considerations in how we govern. That means investing and building a clean energy economy that creates well-paying union jobs, turning disadvantaged communities—historically marginalized and overburdened—into healthy, thriving communities, and undertaking robust actions to mitigate climate change while preparing for the impacts of climate change across rural, urban, and Tribal areas.*

> *Agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.*[119] [120]

As noted in Section 220, E.O. 14008 also amends Section 1-102 of E.O. 12898 Environmental Justice (Creation of an Interagency Working Group on Environmental Justice), replacing it with the creation, within the Executive Office of the President, a White House Environmental Justice Interagency Council.

[119] In the July 20, 2021 *Interim Implementation Guidance for the Justice40 Initiative,* Memorandum for the Heads of Departments and Agencies (M-21-28, Executive Office of the President, Office of Management and Budget, https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf), an "Interim Definition of Disadvantaged Communities" is provided that includes several variables that may apply singly or in varying combinations to some of the fishing communities that may be directly or indirectly impacted by one or more of the proposed action alternatives or the no action alternative. These include low income, high and/or persistent poverty; high unemployment and underemployment; linguistic isolation; high housing cost burden and substandard housing; high transportation cost burden and/or low transportation access; disproportionate environmental stressor burden and high cumulative impacts; limited water and sanitation access and affordability; disproportionate impacts from climate change; high energy cost burden and low energy access; and access to health care, among others.

[120] In September 2021, the United States Environmental Protection Agency (EPA) published *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts* (EPA 430-R-21-003. www.epa.gov/cira/social-vulnerability-report). As noted on page 4 of that document, however, "due to data limitations, this report does not analyze the impacts of climate change on socially vulnerable populations living in Hawai'i or Alaska." Primary climate change impacts that were analyzed in the document are: air quality and health; extreme temperature and health; extreme temperature and labor; coastal flooding and traffic; coastal flooding and property; inland flooding and property.