DRAFT FOR PRELIMINARY REVIEW
Bering Sea Chum Salmon Bycatch Management

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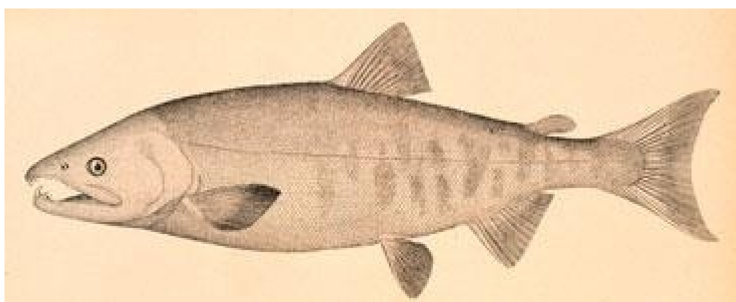

Abstract: This Preliminary Review analysis provides information on the feasibility of proposed alternatives for additional management measures to minimize chum salmon (*Oncorhynchus keta*) bycatch in the Bering Sea. The proposed measures would apply exclusively to participants in the Federal Bering Sea pollock (*Gadus chalcogrammus*) fishery operating 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

Table of Contents

List of Tables

List of Figures

Executive Summary

This Preliminary Review analysis provides information on the relative feasibility of preliminary alternatives for management measures to minimize chum salmon prohibited species catch (PSC) in the Bering Sea. PSC is also referred to as "bycatch" throughout the analysis.[1] For catch accounting purposes, the National Marine Fisheries Service (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 2-5). Thus, the analysis often uses "chum salmon PSC" or "chum salmon bycatch" when referring to the non-Chinook category for ease of the reader.

The proposed management measures would apply exclusively to participants in the Federal Bering Sea pollock (*Gadus chalcogrammus*) fishery operating in the Bering Sea sub-area of the Bering Sea/Aleutian Islands (BSAI) Groundfish Fishery Management Plan (FMP) area. The purpose of this action is to minimize chum salmon bycatch, but particularly the bycatch of chum salmon of Western Alaska (WAK) origin, consistent with the Magnuson-Stevens Fishery Management and Conservation Act (Magnuson-Stevens Act), its National Standards, and other applicable law.

The primary purpose of this document is to help the Council finalize its alternatives for analysis by providing information on how the preliminary set of alternatives adopted by the Council in April 2023 could work.[2] Staff have highlighted Council decision points for the alternatives and options throughout the document. Typically, when the Council adopts a Purpose and Need statement and a set of alternatives, staff analyze the potential environmental, economic, and social impacts of those alternatives in accordance with the National Environmental Policy Act (NEPA), the Magnuson-Stevens Act, and other applicable law. However, at the April 2023 Council meeting, the Council directed analytical staff to bring back additional information to help the Council finalize a reasonable range of alternatives for subsequent impact analysis (see section 1.1.3). When considering a major Federal action, regulations implementing NEPA require a reasonable range of alternatives be analyzed. "Reasonable alternatives" means a range of alternatives that are technically and economically feasible and meet the Purpose and Need for the action. Therefore, finalizing a reasonable range of alternatives is a required step for modifying regulations that manage fisheries in Federal waters under the Council's jurisdiction (i.e., those waters 3 to 200 nautical miles from shore). After review of this analysis, the Council may or may not continue to modify its Purpose and Need statement as well as the alternatives selected to meet that Purpose and Need statement. The Council can also provide direction on its preference for future work related to this action.

However, **which alternatives are ultimately selected will influence the timeline for analysis and implementation**. As the Council increases the complexity of its alternatives, it will take more time (e.g., analytical time, time on the Council meeting agenda, and time invested from the public) to meaningfully assess the potential impacts of these alternatives. Directly related to this point, the Council and the public should be aware of recent statutory changes that pose new constraints for this action. NMFS has determined this action will require an Environmental Impact Statement (EIS), based on uncertainty or

[1] 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.
[2] The Council's April 2023 motion can be found here: https://meetings.npfmc.org/CommentReview/DownloadFile?p=9b5e5f90-f128-4782-a1aa-9efdc5b772e3.pdf&fileName=C2%20MOTION.pdf

disagreement regarding the relevant science. NMFS Alaska Region published a Notice of Intent to prepare an EIS on July 11, 2023. 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. It is not yet clear what the exact end point is. Conservative planning would suggest 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). This timeline would require the Council to take final action on this issue no later than its December 2024 Council meeting. Additionally, **the EIS will be limited to 150 pages** (excluding the Executive Summary and any appendices).

This paper is structured to streamline information and organize it to be most easily understood by the reader. Following the Executive Summary, **Section 1** contains a description of the history of the action, followed by the Purpose and Need statement for this action as well as the preliminary set of alternatives (i.e., the management measures being considered). **Section 2** provides information on the Bering Sea pollock fishery as the directly regulated entity under the Council and NMFS's jurisdiction. **Section 3** provides a detailed description of each preliminary alternative under consideration including the status quo/no action alternative, which the Council is required by law to consider.

Description of the Bering Sea Pollock Fishery

The proposed management measures would apply exclusively to the Bering Sea pollock fishery because the majority of chum salmon bycatch in the Bering Sea is attributed to this fishery. 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 (Table ES 1).

Table ES 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	295,092	307,367	96.01%
2019	348,023	354,681	98.12%
2020	343,626	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)

Pollock are a broadly distributed species throughout the North Pacific with the largest concentrations found in the eastern Bering Sea. In the Bering Sea, pollock are caught with pelagic trawl gear (cone shaped nets towed through the midwater column). This is the largest U.S. fishery by volume—the 2022 and 2023 Bering Sea subarea total allowable catch (TAC) was set at 1.11 million and 1.30 million metric tons (mt), respectively. In 2021 and 2022, the gross first wholesale value of the Bering Sea pollock fishery harvest was $1.5 billion and $1.4 billion, respectively.[3]

The management structure of the Bering Sea pollock fishery substantially changed in 1998 with the passage of the American Fisheries Act (AFA). 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. In contrast, the AFA identified the vessels and processors eligible to participate in the Bering Sea pollock fishery and allocated specific percentages of the TAC among four different fishery sectors.

Each year, the Bering Sea pollock TAC is set through the Council's groundfish harvest specifications process and NMFS allocates the Bering Sea pollock TAC among four sectors. First, 10% of the TAC is allocated to the Community Development Quota (CDQ) Program. After the CDQ pollock allocation is subtracted from the TAC, an amount determined by the Regional Administrator is further subtracted 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 Bering Sea pollock TAC is further divided by two fishing seasons – the A season (January 20 to June 10) and the B season (June 10 to November 1).

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 ES 1 helps the reader to visualize the location of the Bering Sea pollock fishery from 2011-2022. The A season and B season Bering Sea pollock fisheries are mapped by highlighted Alaska Department of Fish and Game (ADF&G) groundfish statistical areas where pollock catch was recorded by three or more vessels. 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 blue.[4]

[3] Source: NMFS Catch Accounting System, compiled by AKFIN; BS_PLCK_VAL(7-17-23).

[4] 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.

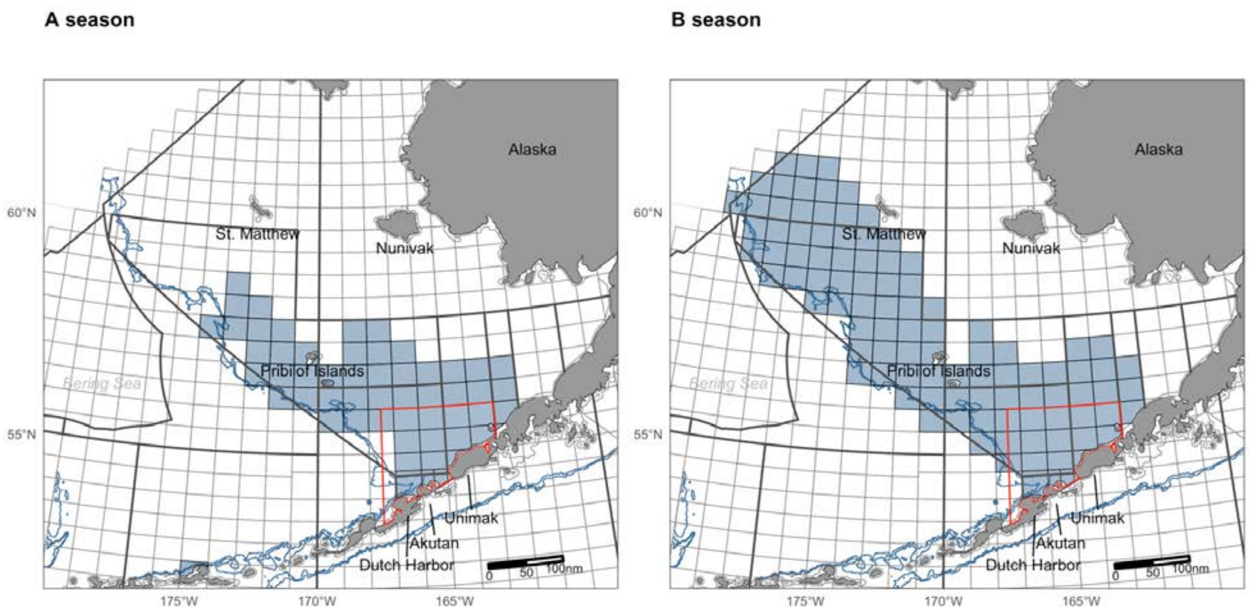

Figure ES 1 Distribution of Bering Sea pollock fishing effort in the A and B seasons, 2011 through 2022

The AFA also allowed the pollock industry to develop fishing cooperatives to help slow the pace of fishing, and ten pollock fishing cooperatives were originally formed as a result: seven inshore cooperatives (although only six are currently active), two cooperatives in the offshore CP sector, and one cooperative in the mothership sector.[5] A purpose of these cooperatives is to further subdivide each sector or inshore cooperative's pollock allocation among vessels in the sector or the cooperatives 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 members and enforce contract provisions.

The different sectors use different strategies to harvest pollock and they operate under different constraints. For example, there are currently 85 CVs eligible to harvest Bering Sea pollock in the inshore sector. These CVs harvest pollock at sea and deliver to shoreside processors. Inshore CVs have less flexibility in where they can fish because they must make deliveries to their processor within 48 hours of their first tow of fish. There are 20 CPs and five CVs that can deliver to CPs that are eligible to participate in this sector. CPs harvest and process pollock on the same vessel and are not as constrained in where they fish compared to the inshore CVs, except they cannot harvest pollock in the CVOA in the B season unless they are participating in the CDQ pollock fishery. However, CPs may face other considerations in a fishing season that influence fishing location such as targeting larger pollock that meet the needs of the at-sea product mixes that they intend to produce. There are three motherships eligible to operate in the Bering Sea pollock fishery and 19 CVs are eligible to harvest pollock under the mothership allocation. There are 13 AFA dual-qualified CVs which means these 13 CVs can deliver to either motherships or shoreside processors.

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

[5] The Arctic Enterprise Association, an inshore CV cooperative, has not been active since 2008.

and 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 survival of WAK chum salmon,**[6] and have likely contributed to the low returns and overall abundance of WAK chum salmon in recent years.

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. 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.

Juvenile salmon abundance is linked to adult returns (Farley et al., 2020; 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.

Beginning in 2020, WAK chum salmon runs declined dramatically with run sizes similar to those observed in the previous record poor runs of 2000. These run declines resulted in restrictive management actions on commercial, recreational, and subsistence harvests of chum salmon. In 2020, all WAK areas had chum salmon run sizes below recent year averages. WAK chum salmon abundance decreased further in 2021. In 2022, most WAK chum salmon indices increased slightly from 2021. However, 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. In contrast to most other areas in WAK, the Kotzebue area had above average abundance and chum salmon fisheries were opened for subsistence, commercial, and sport fishing. (For more information, see Appendix 1 for a salmon stock status overview prepared by ADF&G staff.)

In the Bering Sea, some species of Pacific salmon can at times be in the same locations and depths as pollock resulting in their take as incidental bycatch. Of the six Pacific salmon species found in the North Pacific, Chinook salmon (*Oncorhynchus tshawytscha)* and chum salmon are the two species most often encountered as bycatch in the Bering Sea pollock fishery.[7] 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 2-6). 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 Magnuson-Stevens Act and as prohibited species under the BSAI Groundfish FMP and NMFS regulations at 50 CFR part 679 because they are the target of other, fully utilized domestic fisheries (commercial and

[6] Howard, Kathrine. Western Alaska Chinook and Chum Salmon Marine Research. 2022. Available at: https://meetings.npfmc.org/CommentReview/DownloadFile?p=3a0643f9-e99e-451e-bc4a-96848c3cc26d.pdf&fileName=PPT%20D1a%20WAK%20Chinook%20and%20Chum%20Salmon%20Marine%20Research.pdf

[7] 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.

subsistence). 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).

Chum salmon can show up on the pollock fishing grounds in large pulses that can be difficult to predict and avoid. There is significant inter-annual variability in the amount of chum salmon that have been taken as bycatch in the Bering Sea pollock fishery. Since 1991 when recent recordkeeping for chum salmon bycatch began, the annual level of chum salmon bycatch in the Bering Sea pollock fishery B season ranges from a low of 13,243 chum salmon in 2010 to a high of 702,535 chum salmon in 2005. The annual average level of chum salmon bycatch over this period was 187,501 (1991-2022).

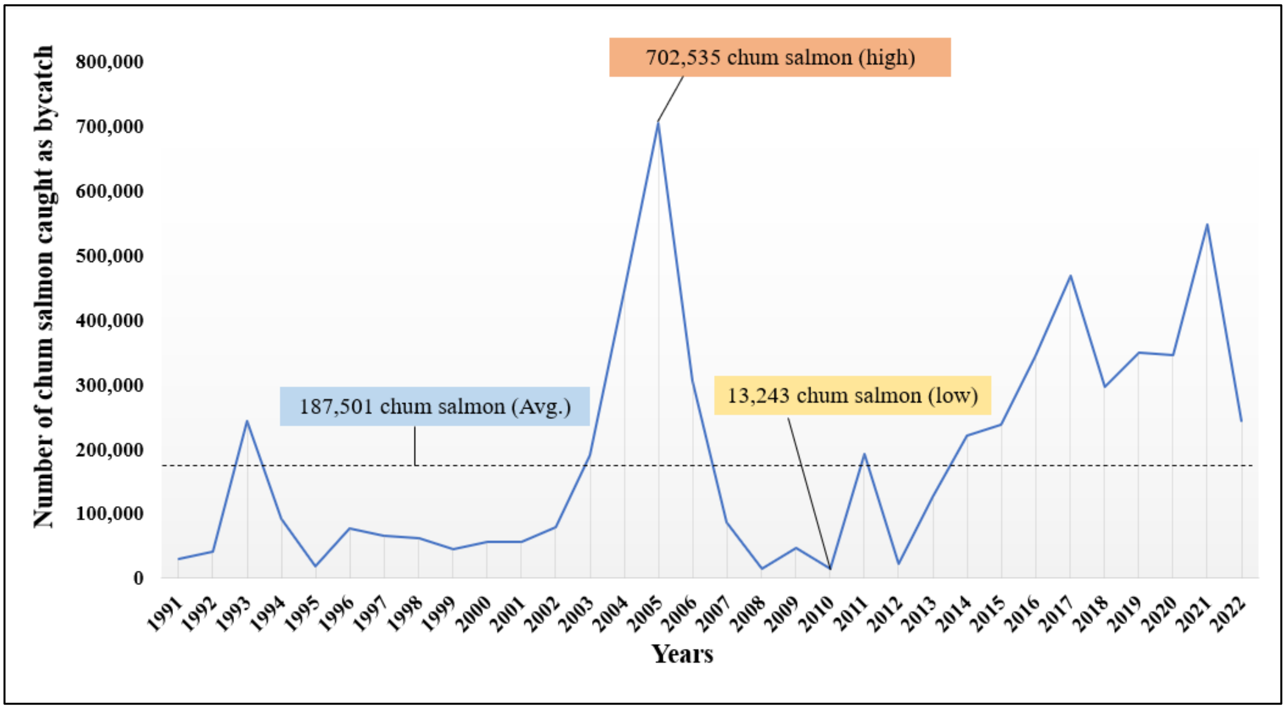

Figure ES 2 Number of chum salmon caught as bycatch in the Bering Sea pollock fishery B season with a callout for the highest level of bycatch (702,535 chum salmon), the lowest level of bycatch (13,243 chum salmon) and the average level of bycatch (187,501 chum salmon) from 1991 through 2022

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

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; see Table 3-15).[8] When referring to “WAK chum salmon,” the analysis is referring to the combined Coastal Western Alaska and Upper/Middle Yukon reporting groups.

[8] 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).

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 was 280,707. From 2011 through 2022, the average number of chum salmon caught as bycatch attributed to the Coastal Western Alaska genetic stock reporting group during this period was 40,892, accounting for an average proportion of 14.5% of the total bycatch. The average number of chum salmon caught as bycatch attributed to the Upper/Middle Yukon genetic stock reporting group was 9,022 chum salmon, accounting for an average proportion of 3.2% of the total bycatch. When the Coastal Western Alaska and the Upper/Middle Yukon genetic stock reporting groups are combined, the average number of chum salmon taken as bycatch annually was 49,914, accounting for an average proportion of 17.7% of the total bycatch during this time period. However, there is considerable 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 Table 3-15).

Chum salmon are an integral part of Alaska Native peoples' subsistence ways of life, food security, social, and spiritual wellbeing (Ahmasuk et al., 2009; Barker 1993; Brown et al., 2017; Raymond-Yakoubian 2013; Wolfe and Spaeder, 2009). Harvesting salmon for subsistence is a way for extended families to work together to catch, process, and store chum salmon for their food security needs (Goddhun et al., 2020). Subsistence harvests of salmon are also a means for practicing traditional Indigenous stewardship practices and values (e.g., respect, reciprocity, and sharing) encompassed within Traditional Knowledge (TK) systems (Moncrieff and Klein 2003). 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 potentially have some positive benefit on the number of chum salmon that return to WAK rivers.

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

This section of the Executive Summary 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.

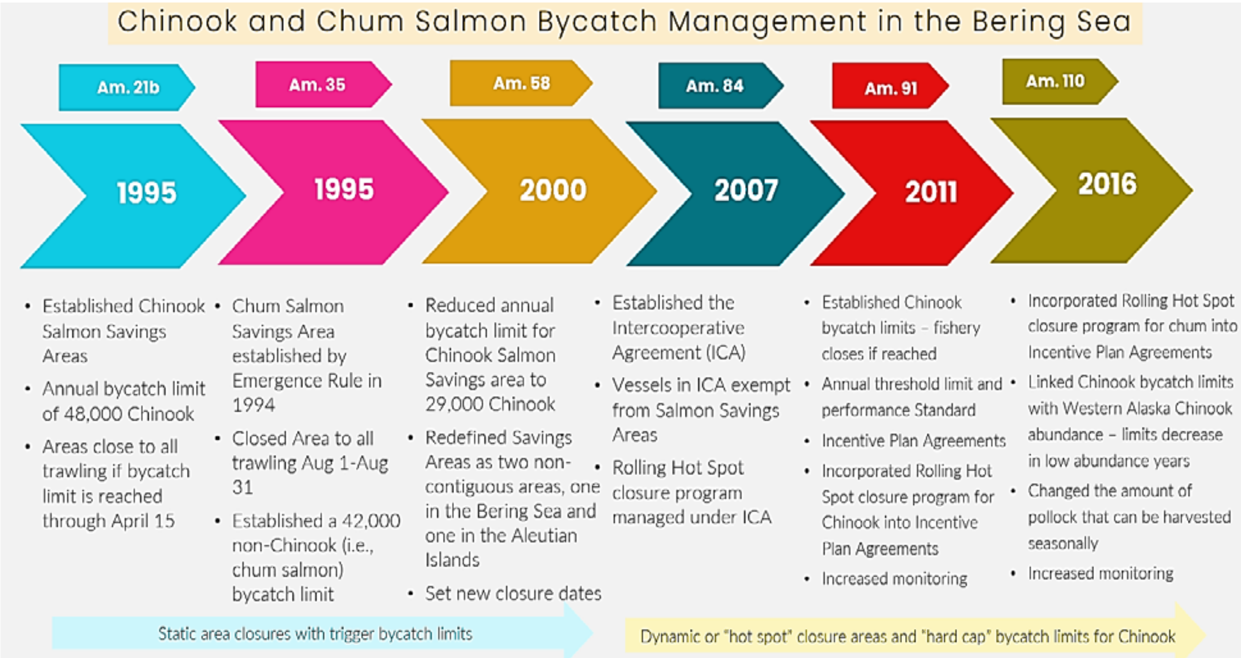

Figure ES 3 Summary of salmon bycatch management measures in the Bering Sea

The Chum Salmon Savings Area is a static area closure in the southeastern Bering Sea within the CVOA Figure ES 3). 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.[9] 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.[10] 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.[11] 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

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[9] 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.

[10] 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.

[11] 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.

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 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).

Bering Sea pollock sector	***Annual threshold amount under the 47,591 PSC limit***
CDQ	3,883 Chinook salmon
CP	13,516 Chinook salmon
Inshore	27,127 Chinook salmon
Mothership	3,707 Chinook salmon

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.[12] 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 origin chum salmon in the Bering Sea pollock fishery to the extent practicable (National Standard 9 and section 303(1)(11) of the Magnuson-Stevens Act) and consistent with the other National Standards. This action would create another layer in the Council's existing salmon bycatch management program. The current salmon bycatch management program is largely formed under Amendments 91 and 110 to the BSAI Groundfish FMP which have established a series of measures to minimize Chinook and chum salmon bycatch in the Bering

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

Sea pollock fishery. In April 2023, the Council stated that its intent with this action is to minimize WAK chum salmon bycatch while balancing the National Standards and maintaining the objectives of salmon bycatch management measures established within the existing program.

The Council has received scientific reports outlining the impact of warming ocean conditions on chum salmon mortality at sea, as well as substantial public comment and input from Western and Interior Alaska Tribes, Tribal Consortia, and subsistence salmon harvesters describing the importance of chum salmon for food security, wellbeing, the continuation of meaningful cultural practices and related TK systems, as well as broader concerns of stewardship practices for salmon resources. The Council has also received public comments and annual presentations from pollock industry representatives on their efforts to minimize Chinook and chum salmon bycatch. Implementing additional chum salmon bycatch management measures could potentially have some positive benefit on the number of chum salmon that return to WAK rivers. Any additional chum salmon returning to Alaska river systems improves the ability to meet the State of Alaska'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 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 preliminary analysis on April 8th, 2023.

Alternative 1: 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.

PSC limits are apportioned among CDQ, catcher processor, mothership and inshore sectors based on historical total bycatch by sector. The inshore limit is further apportioned among the inshore cooperatives. The CDQ limit is further apportioned among the CDQ groups. Reaching a limit closes the pollock fishery to which the limit applies.

Option 2: Weighted, step-down PSC limit triggered by a three-river chum index (Kwiniuk (or index developed for Norton Sound area), Yukon, Kuskokwim) that is linked to prior years' chum abundance/ANS/escapement and weighted to account for variance in stock sizes across river systems.

PSC limits would be triggered and in effect when one or more Western Alaska chum index areas fails to meet index thresholds. As more areas fail to meet index thresholds, chum PSC limits would step-down and become more restrictive. PSC limits are apportioned among CDQ, catcher processor, mothership and inshore sectors. The inshore limit is further apportioned among the inshore cooperatives. The CDQ limit is further apportioned among the CDQ groups. Reaching a limit closes the pollock fishery to which the limit applies.

Alternative 3: Bycatch (PSC) limit for Western Alaska chum salmon

Option 1: Western Alaska chum salmon PSC limit based on historical total bycatch numbers.

PSC limits are apportioned among CDQ, catcher processor, mothership and inshore sectors based on historical total bycatch by sector. The inshore limit is further apportioned among the inshore cooperatives. The CDQ limit is further apportioned among the CDQ groups. Reaching a limit closes the pollock fishery to which the limit applies.

Option 2: Weighted, step-down Western Alaska chum PSC limit triggered by a three-river chum index (Kwiniuk (or index developed for Norton Sound area), Yukon, Kuskokwim) that is linked to prior years' chum abundance/ANS/escapement and weighted to account for variance in stock sizes across river systems.

PSC limits would be triggered and in effect when one or more Western Alaska chum index areas fails to meet index thresholds. As more areas fail to meet index thresholds, chum PSC limits would step-down and become more restrictive. PSC limits are apportioned among CDQ, catcher processor, mothership and inshore sectors. The inshore limit is further apportioned among the inshore cooperatives. The CDQ limit is further apportioned among the CDQ groups. Reaching a limit closes the pollock fishery to which the limit applies.

Alternative 4: Additional regulatory requirements for Incentive Plan Agreements (IPAs) to be managed by either NMFS or 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 stocks.

Description of Alternatives

Prior to describing the preliminary alternatives, it is important to note the Council has specified that **all action alternatives would apply to the entire B season pollock fishery**. As noted previously, chum salmon bycatch primarily occurs in the B season.

Additionally, the Council has selected 2011 through 2022 as years for analysis. Regulations implementing Amendment 91 came into effect in 2011, at which point the pollock fleet's fishing behavior changed to avoid Chinook salmon bycatch. For example, each sector has reduced its pollock harvests in months that had previously seen high levels of Chinook bycatch (January, February, September, October, and November) and instead redistributed fishing effort to times when Chinook bycatch is expected to be lower (Stram and Ianelli 2015; see also Figure 3-5).

As noted previously, NMFS has 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.

Alternative 1: Status Quo (No Action)

Alternative 1 would retain the current management measures to minimize chum salmon bycatch in the Bering Sea pollock fishery, including the Chum Salmon Savings Area closures and the exemption from these closures for vessels that are members to an IPA and participate in the RHS system for chum avoidance (see 50 CFR 679.21(f)). The RHS system operates in lieu of the Chum Salmon Savings Area because it requires the pollock industry to identify "hot spots" – areas with high chum salmon bycatch rates (number of chum salmon per mt of pollock) – and issue closures based on real-time bycatch data to move the fleet to other areas to target pollock.

Alternative 2: Overall Bycatch (PSC) Limit for Chum Salmon

Alternative 2 would establish an overall chum salmon PSC limit for the Bering Sea pollock fishery during the B season. "Overall" refers to the fact that all chum salmon caught as bycatch accrue to the PSC limit regardless of their genetic stock of origin.

The Council has also specified NMFS would allocate an overall chum salmon PSC limit under options 1 and 2 of Alternative 2 among the four pollock sectors, and that the inshore sector and CDQ allocations would be further apportioned by cooperative and CDQ group (see section 3.2.1.2). If or when an entity that is issued a chum PSC allocation reaches their portion of the 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 enforcement action.

Alternative 2 could be implemented in conjunction with Alternative 3 and Alternative 4.

Option 1: Chum Salmon PSC Limit (Range to be Informed by PSC Data)

- ***Council decision point: What is the range of values that should be analyzed as potential chum PSC limits?***

To move forward with Alternative 2, the Council would need to select a range of values for analysis as overall chum PSC limits. The Council directed staff to provide additional information on several components of the chum PSC limit to help make this decision including chum salmon PSC data by year from 2011 through 2022 as well as the 3-, 5-, and 10-year average levels of B season bycatch (see section 3.2.1 for more information).

Future action by the Council to determine a range of values for consideration as chum salmon PSC limits can include a broader range of values than those presented here. In other words, the Council is not limited to only selecting the value represented by the 3-, 5-, or 10-year averages as a range of values for analysis. Some considerations for the Council are as follows.

An overall chum PSC limit may reduce chum bycatch below historical levels, depending on the value selected. For example, a relatively high chum salmon PSC limit may not incentivize industry to minimize chum salmon bycatch beyond current levels in some or most years. Conversely, a relatively low chum salmon PSC limit could reduce chum salmon bycatch below historical levels, but it may also constrain pollock harvests in some (or many) years. Additionally, an overall chum PSC limit may not necessarily achieve the Council's goal of reducing WAK chum bycatch. It is anticipated that industry would target areas of pollock fishing with lower chum salmon bycatch rates while trying to avoid other prohibited species (among other considerations). Reducing the overall level of chum bycatch in response to a PSC limit would not necessarily guarantee a lower proportion of WAK chum in the overall bycatch. This possibility would be explored more extensively in a future analysis of the potential impacts of the alternatives.

Table ES 2 below provides the annual level of B season chum salmon bycatch by sector as well as the 3-, 5-, and 10-year average levels of bycatch (2011-2022).

Table ES 2 Annual level of B season chum salmon bycatch (number of chum salmon) as well as the 3-, 5-, and 10-year average level of bycatch by pollock sector and fishery total (all sectors combined), 2011 through 2022

Year	*CDQ*	*CP*	*Inshore*	*Mothership*	*Total*
2011	3,758	44,299	118,861	24,399	191,317
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	147,369	21,303	294,705
2019	15,726	113,428	172,798	44,860	346,812
2020	8,582	77,138	237,632	19,743	343,095
2021	55,663	97,917	341,779	50,542	545,901
2022	6,365	71,786	131,896	32,262	242,309
3-year Avg. (2020-2022)	23,537	82,280	237,102	34,182	377,102
5-year Avg. (2018-2022)	22,584	91,943	206,295	33,742	354,564
10-year Avg. (2013-2022)	22,393	91,516	176,113	25,447	315,449

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

Ocean temperature and chum salmon bycatch levels:

- ***Council decision points: Does the Council want to link chum salmon bycatch management measures to ocean temperature data?***
    - ***If so, what measure of ocean temperature (sea surface or bottom) would be used, what would be the associated management measures, and what would be the numerical threshold for determining a warm or cold year?***

The Council also directed staff to provide "potential ranges for average PSC levels during warm/cold years from 2011 through 2022" (April 2023). In general, this information could help determine whether there is a relationship between the magnitude of chum salmon bycatch and ocean temperature. Section 3.2.1.1 provides the reader with information on the average levels of chum salmon bycatch compared to different ranges of sea surface and bottom temperatures in the Bering Sea (2011-2022). There does not appear to be a strong relationship between the annual average sea surface temperature and the annual level of B season chum salmon bycatch. However, the level of chum salmon bycatch does appear to increase in years with warmer bottom temperatures. This could be due to shifts in how chum salmon are distributed in the Bering Sea, resulting in greater overlap with the distribution of pollock.

If the Council would like to link chum salmon bycatch management measures to ocean temperature, the Council would need to select a measure of ocean temperature. As stated above, bottom temperature appears to be a better indicator of the level of chum salmon bycatch. However, bottom temperature data is collected during the bottom trawl survey which occurs during the summer months (June-August) to measure the extent of the cold pool in the eastern Bering Sea (among other things).[13] Bottom trawl survey

[13] The cold pool is an area of the eastern Bering Sea survey where bottom temperatures are less than or equal to 2°C. The size and the location of the cold pool can change year to year, but it can influence the distribution fish and crabs, and it can act as a boundary separating Arctic species from subarctic species like pollock. More information on

data are not available until September, meanwhile the B season pollock fishery opens on June 10 each year. As such, the relationship between bottom temperature and the overall level chum salmon bycatch would need to be evaluated retroactively. This means in-season management measures linked to current bottom temperature would not be possible. Additionally, to move forward with this approach, the Council would need to determine a threshold for what constitutes a warm or cold year. However, as the Bering Sea continues to undergo climatological shifts, what is determined to be a warm year currently could be a cooler year in the future.

Allocating a chum salmon PSC limit:

- ***Council decision point: What allocation approaches should be analyzed (i.e., using historical bycatch numbers, AFA pollock allocation percentages, a pro rata approach, or some other option)?***

Under Alternative 2 (or Alternative 3), NMFS would issue allocations of the chum salmon PSC limit to the CP, mothership, inshore, and CDQ sectors. NMFS would further apportion the CDQ sector's allocation of the chum salmon PSC limit among the CDQ groups and the inshore sector's allocation among the cooperatives. Section 3.2.1.2 describes how sector-level allocations could work. The allocations of the chum salmon PSC limit among fishery sectors could be based on historical bycatch numbers, and Council dialogue also directed staff to provide information on other approaches to allocating a chum salmon PSC limit including allocation percentages based on AFA pollock allocations by sector.

If the Council allocated a chum PSC limit based on the 3-, 5-, or 10-year average levels of bycatch, the following allocation percentages would be applied:

a) 3-year average (2020-2022): 6% to the CDQ sector, 63% to the inshore CV sector, 9% to the mothership sector, and 22% to the CP sector
b) 5-year average (2018-2022): 6% to the CDQ sector, 58% to the inshore CV sector, 10% to the mothership sector, and 26% to the CP sector
c) 10-year average (2013-2022): 7% to the CDQ sector, 56% to the inshore CV sector, 8% to the mothership sector, and 29% to the CP sector

If the Council allocated a chum PSC limit based on the sector's percentage allocations for pollock, the following allocation percentages would be applied:

a) 10% to the CDQ sector
b) 45% to the inshore sector
c) 9% to the mothership sector
d) 36% to the CP sector

Table ES 2 **is for illustrative purposes only.** It depicts four different approaches to allocating a chum salmon PSC limit among the four sectors: allocating the chum salmon PSC limit in proportion to each sector's AFA pollock allocation or based on each sector's 3-, 5-, and 10-year average level of historical chum salmon bycatch based on a hypothetical cap of 350,000 chum salmon (350,000 chum salmon is the rounded 5-year average level of B season bycatch). To help the reader compare each approach, each sector's B season chum salmon bycatch is provided for 2020, 2021, and 2022. It is important to be clear that the analysts are not recommending a PSC limit but are instead providing the Council and the public

temperature anomalies and the Bering Sea cold pool estimates can be found here: https://www.fisheries.noaa.gov/alaska/science-data/temperature-anomalies-and-cold-pool-estimates-bering-sea-bottom-trawl-surveys-2023#:~:text=The%20cold%20pool%20index%20is,square%20kilometers%20(km2).

an opportunity to conceptualize how a chum salmon PSC limit would be allocated at the sector-level and in what amount.

Table ES 3 Potential chum salmon PSC limit allocation percentages for each sector based on their AFA pollock allocation and 3-, 5-, and 10-year average historical level of chum salmon bycatch based on a hypothetical cap of 350,000 chum salmon compared to each sector's 2020, 2021, and 2022 B season chum salmon bycatch

Allocation approach	*CDQ*	*Inshore*	*Mothership*	*CP*
AFA	10% 35,000	45% 157,500	9% 31,500	36% 126,000
3-year avg.	6% 21,000	63% 220,500	9% 31,500	22% 77,000
5-year avg.	6% 21,000	58% 203,000	10% 35,000	5% 91,000
10-year avg.	7% 24,500	56% 196,000	8% 28,000	29% 101,500
2020 B season bycatch	8,582	237,632	19,743	77,138
2021 B season bycatch	55,663	341,779	50,542	97,917
2022 B season bycatch	6,365	131,896	32,262	71,786

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(3-8-23)

Finally, the Council could consider using a pro-rata approach to allocating the chum salmon PSC limit. This approach would weight each sector's AFA pollock allocation and their historical average level of bycatch. The Council could make any determination of pro-rata combinations it wants, but a starting point for consideration could be a) 25% weighted to AFA allocation and 75% to weighted to historical bycatch numbers; b) 50% weighted to AFA allocation and 50% weighted to historical bycatch numbers; c) 75% weighted to AFA allocation and 25% weighted to historical bycatch numbers. To analyze this approach, staff would need to know the average level of bycatch that would be used and the weighting combination(s) the Council would like to see analyzed. (For example, 25% weighted to AFA allocation and 75% to the 5-year average level of bycatch.)

Transferability:

❖ ***Council decision point: Would the overall chum PSC limit allocations be transferable?***

The Council's April 2023 motion did not direct whether chum PSC allocations to each sector, inshore cooperative, or CDQ group would be transferable. **The Council may want to consider transferability which could be included under Alternative 2 or 3.** Allowing for allocations of the chum PSC limit to be transferable would provide vessels, cooperatives, and fishing sectors more flexibility in utilizing their pollock allocations.

Option 2: Weighted, Step-down PSC Limit Triggered by a Three-area Chum Index

The range of values the Council selects to be analyzed as an overall chum salmon PSC limit would be the same under option 1 and 2 of Alternative 2. Under option 1 of Alternative 2, the overall chum salmon PSC limit would be in place each B season. Under option 2 of Alternative 2, a chum PSC limit would only be in place, and potentially step-down (i.e., decrease), based on considerations of stock status for three WAK chum salmon river systems (hereinafter referred to as "areas"). The three systems that correspond with ADF&G salmon management areas evaluated under this option are Norton Sound, Yukon, and Kuskokwim. For this reason, the analysis hereafter refers to the index as a "3-area index."

The Council indicated that an index would be weighted to account for variance in chum salmon stock sizes across these river systems, and that their performance (i.e., the stock status for chum salmon) would be linked to 1) overall abundance, 2) whether Amounts Reasonably Necessary for Subsistence (ANS) are met, and 3) whether escapement goals for chum salmon are met. However, the Council also requested that analytical staff work with ADF&G to determine the feasibility of this concept, and to provide suggestions for how best to weight or consider the three systems in conjunction with each other.

Assessment of feasibility:

Use of a 3-area chum index appears to be feasible if the Council chooses to assess these areas independently. Each area would be treated as an individual "test" to determine whether the chum salmon stock's status is at low abundance. The corresponding management action in the pollock fishery's B season (i.e., step down provisions) would scale to the number of areas that meet each area's low abundance criteria. 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)) as there are limited run reconstructions for chum salmon 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.

Data available by river system/management area:

- ❖ ***Council decision point: Would Yukon River fall and summer chum be included in the Yukon portion of the 3-area index?***

Yukon River: Reliable run abundance information is available for both the Yukon River summer and fall chum salmon components as both runs have full run reconstruction information available. The Council would need to decide if they want to include both summer and fall stocks in this portion of the 3-area index. 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. A revised genetic baseline now enables all summer stocks to be included in the Coastal Western Alaska reporting group (which also includes non-Yukon stocks) and a standalone fall chum reporting group – this more closely aligns with how stocks are assessed and the abundance indices available. It is recommended that the full run reconstructions (total accounting of catch and escapement within the drainage) for these respective stocks be used. Similar to the use of run reconstruction datasets for Chinook salmon under the Three-river index under Amendment 110, preliminary estimates may be available in early fall following the salmon season. These preliminary estimates of Yukon River summer and fall chum run reconstructions include best estimates of subsistence harvest before the final subsistence harvest analysis is completed in late winter/early spring of the following year.

Kuskokwim River: Reliable relative abundance information is available for total Kuskokwim River chum salmon stocks using the Bethel Test Fishery catch per unit effort (CPUE). Other sources of information are available to determine chum run abundance, but the Bethel Test Fishery CPUE data are the most reliable for several reasons. These data are the only readily available information on total run abundance, and the Bethel Test Fishery CPUE data are less impacted by weather conditions (i.e., flooding) compared to weir assessment data. These data have also been independently confirmed through various assessments to provide a consistent indicator of relative run abundance, are used by salmon fisheries managers, and are readily publicly available. It is recommended to use the annual cumulative CPUE data from the Bethel Test Fishery for the Kuskokwim portion of the 3-area index. These data are preliminarily available in-season on the ADF&G website with a final version available shortly after the salmon season in various ADF&G published reports and online. Because of the location of this test fishery, harvest does not substantially impact this index and the timing of subsistence harvest estimate availability would not be a limiting factor in reporting the cumulative CPUE.

Norton Sound: The Kwiniuk River run reconstruction data are available through 2019 and could be used as an indicator of abundance for the Norton Sound region. However, it is only one of many Norton Sound rivers with a chum salmon run and a run reconstruction from this single system may not be a consistently reliable indicator for the whole Norton Sound region. Additionally, the Kwiniuk River chum run reconstruction is not currently used by ADF&G for management so ADF&G staff would have to conduct this analysis specifically to meet this request of the Council's.

An alternative for the Norton Sound region would be to use a standardized index constructed of escapements to five rivers in the area (Snake, Nome, Eldorado, Kwiniuk and North) that are consistently enumerated each year through weirs or counting towers as well as adding in the total Norton Sound harvest (commercial, sport and subsistence). Using a standardized index for the Norton Sound region based on these five rivers would be an approach that is more representative of the chum salmon returns across several management subdistricts within the Norton Sound region. Under this approach, 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.

Other WAK chum areas: ADF&G staff do not recommend the inclusion of additional stocks for consideration of WAK chum indices for a variety of reasons. For example, Kotzebue chum salmon, while genetically distinguishable, lacks consistent escapement information; thus, the best indicator for these stocks is generally considered to be commercial harvest data. Bristol Bay chum salmon are primarily harvested incidental to the large sockeye fishery and as such escapements are not as diligently assessed across this broad system. Any index of Bristol Bay chum salmon would be largely based on commercial harvest data. Other chum assessment projects exist such as for the Solomon and Unalakleet mainstem but those projects have short datasets and thus are not appropriate for use in assessing longer term escapement trends.

- ***Council decision point: How does the Council want to define low chum salmon abundance for each area?***

To move forward with option 2 of Alternative 2, the Council would need to provide input on several components related to establishing the 3-area index.

First, the Council would need to establish criteria to determine low chum salmon abundance in each area. It is recommended that an overall determination for what constitutes low chum salmon abundance for each area be defined based on the available data for each area as indicated above. The Council has indicated it may be interested in considering additional criteria such as whether Amounts Reasonably Necessary for Subsistence (ANS) and escapement goals are met. These additional criteria could provide context to help the Council determine the thresholds they would like to use for each area to define low abundance, but it is not recommended the other criteria be used in isolation.

Historical abundance:

> ❖ ***Council decision point: If the Council would like to use historical chum abundance information for each area to determine low abundance, what year set would be used for each area to determine a numerical threshold?***

If the Council would like the 3-area index to be based on historical chum abundance in each management area, the Council would need to define a threshold (i.e., number of chum salmon) for each area that defines low abundance. ADF&G does not have a specific threshold or count for chum salmon in each of the three management areas being considered that constitutes low abundance. As such, this is a determination for the Council. However, as noted above, it is recommended that a determination on historical abundance for each area be made using the sources of available data for historical levels of chum abundance previously identified. The Council would need to define the years for which average abundance would be estimated. Selecting the years will influence perceptions of what constitutes low and high levels of chum abundance and change into the future as more data are included in the time series.

Area	Summary of available chum salmon abundance data
Yukon	Full run reconstruction for summer and fall chum
Kuskokwim	Bethel Test Fishery CPUE
Norton Sound	Standardized index of escapements to the Snake, Nome, Eldorado, Kwiniuk and North Rivers + total Norton Sound harvest

Amounts Reasonably Necessary for Subsistence (ANS):

> ❖ ***Council decision point: Does the Council want to include other criteria (ANS and escapement goals) to determine low abundance?***

ANS is a range of harvest that the Alaska Board of Fisheries (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, as in the case of Norton Sound, an ANS range was established for all salmon, while on the Yukon and Kuskokwim rivers, there are chum salmon specific ANS ranges. 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. Established ANS ranges can reflect nuanced understandings of harvest patterns or may simply reflect the highest and lowest recorded harvests through time. Achieving minimum ANS may be impacted by factors other than low total chum salmon run abundance, such as personal decisions to participate in subsistence fishing opportunities or poor fishing conditions. As such, there are years when ANS are not met but abundance levels were adequate to support more subsistence harvest (and vice versa) which could provide helpful context as the Council determines levels of WAK chum abundance.

Escapement goals:

All WAK chum salmon escapement goals established by ADF&G are based on the best available data and are consistent with sustained yield principles. 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. Additionally, there are two Yukon River fall chum salmon escapement goals associated with the Pacific Salmon Treaty, which do not necessarily conform to the same criteria that are used in establishing other chum salmon escapement goals throughout the AYK region.

Assessment:

- ***Council decision point: If the Council would like to include additional criteria to determine low chum abundance, what method for assessment does the Council want to use?***

If the Council would like to use ANS and escapement goal criteria in addition to a numerical determination of low historic abundance, the Council would need to explicitly define how they are used. These indices could provide additional context to help determine what constitutes low or high chum salmon abundance by area. However, using these criteria in isolation is not recommended. This is because ANS and escapement goals may sometimes be influenced by factors other than chum salmon abundance in a given year or area.

This determination would need to be reached annually, in conjunction with the annual harvest specifications process. There are a couple of different methods which could be used. One approach is to use a risk table similar to that which is used for groundfish stock assessments. Another is for the Council to establish explicit criteria by which the ANS and escapement goals are assessed annually (i.e. 'if ANS is not met, then…' or 'if all escapement goals are not met, then…') such that ADF&G would provide an annual letter determining if the criteria by region was met (similar to the determination of the three area index number annually for Chinook salmon in October).

Relative weighting of the river systems:

- ***Council decision point: Does the Council want to "weight" (i.e., prioritize) the areas or consider them equally?***

As noted above, the Council could use a 3-area chum index if the areas are assessed independently such that each area would be treated as an individual test for low abundance. **The Council would need to consider whether each area would be treated equally (i.e., assessed as independent tests but weighted equally) or if the Council would prefer to prioritize measures of low abundance by area.** Under the first approach, if any one area is determined to be at low abundance, then a step-down provision(s) would be implemented. Under the second approach, the Council could determine an area of priority. Step-down provisions would only start to be implemented if the priority area was determined to be at low abundance.

Step-down provisions according to stock status from chum indices:

- ***Council decision point: What would be the step-down provisions and associated chum PSC limits?***

As indicated in the Council's motion, the chum PSC limit would be triggered by, and linked with, step-down provisions when one or more of the three areas representative of WAK chum salmon abundance fail to meet the thresholds specified for the index. As more areas fail to meet index thresholds, the chum PSC limit would become more restrictive in the B season. **The Council would need to determine what the step-down provisions would be (i.e., the value of the overall chum salmon PSC limit associated with each step-down provision).**

The Council could consider the step-down provisions in a manner as shown below (note this assumes assessment of each system is weighted equally). Under the first scenario, there would not be a chum PSC limit in place in the B season pollock fishery when conditions are such that all three areas are determined to be above their specified threshold. Under the second scenario, if one area fails to meet its threshold (while the other two areas are above theirs), the overall chum salmon PSC limit (based on a range of values determined under option 1) would be triggered. As more systems fail to meet their thresholds (scenarios 3 and 4 below), the limit would be progressively more restrictive. The Council would need to determine what the appropriate PSC limit associated with each 'step' would be. An example is shown below:

a) if 3/3 areas are above index thresholds, no chum PSC limit would be implemented.
b) if 2/3 areas are above index thresholds, the high point of the chum PSC limit values would be implemented.
c) if 1/3 areas are above index thresholds, the midpoint of the chum PSC limit values would be implemented.
d) If 0/3 areas are above index thresholds, the low point of the chum PSC limit values would be implemented.

Again, this example assumes that each area is equally weighted in terms of whether they meet their respective thresholds. If the Council would like to weight river systems differentially then the criteria associated with the step-down provisions would need to be explicit by river system (i.e. 'If the Kuskokwim and the Yukon systems are above their index thresholds but the Norton Sound is below, then…').

Alternative 3: Bycatch (PSC) Limit for Western Alaska Chum Salmon

The Council's intent with Alternative 3 is that it would establish a PSC limit specifically for WAK chum salmon, as identified through genetic sampling. This is in contrast with Alternative 2 which considers an overall chum salmon PSC limit. Alternative 3 would be similar to Alternative 2 in that it would only apply to the Bering Sea pollock fishery in the B season. However, **it is important to note Alternative 3 could not work as intended in the Council's motion. It is not possible to manage a PSC limit specific to only WAK chum in-season because real-time genetic data are not available, therefore pollock fishing would not cease if the limit was reached.** The proportion of WAK chum in the overall bycatch is, and would be, assessed after the B season pollock fishery is over and reported to the Council in April of the following year (i.e., genetic stock reporting data from salmon caught as bycatch in the 2024 Bering Sea pollock fishery will be available in April 2025).This is discussed in more detail below as are two different approaches the Council could consider.

Approaches for a "WAK chum performance threshold":

- ***Council decision point: Would the Council want to consider a standalone WAK chum performance threshold or one that is linked to an overall chum salmon PSC limit?***

The Council's goal is to minimize WAK chum salmon bycatch and staff considered two approaches for meeting this goal under Alternative 3 given the limitations on the availability of real-time genetic information. Under both approaches considered by staff, any WAK chum PSC limit (which is hereafter referred to as a "WAK chum performance threshold)" considered by the Council in and of itself would not require directed fishing for pollock to cease.

1) The Council could establish a stand-alone WAK chum performance threshold. To do this, the Council would need to determine the value of the WAK chum performance threshold (i.e., the number of WAK chum salmon not to be reached/exceeded). This value could be based on

historical proportions of WAK chum PSC (i.e., 3-, 5-, or 10-year average) or some other approach.

2) The Council could link the WAK chum performance threshold to an overall chum PSC limit (as in Alternative 2). The Council would need to determine the numerical value of the WAK chum threshold as in the first option. If the overall chum PSC limit were to be reached, directed pollock fishing must cease in-season as a result of that limit.

Under both approaches identified above, the pollock fishery's performance against the WAK chum performance threshold would be assessed the subsequent year, and only WAK chum salmon bycatch would accrue to the performance threshold. Both approaches could provide an opportunity for the Council, NMFS, the pollock industry, and the public to assess the pollock industry's performance at minimizing WAK chum in the overall bycatch. **If the Council would like to move forward with either approach, it would need to determine the numerical value of a WAK chum performance threshold, whether or not the WAK chum performance threshold would be linked to a management measure(s), and if so, what those management measures would be.**

Management measures:

- ***Council decision points: Does the Council want to link the WAK chum performance threshold with management measures?***
  - ***If so, what would those management measures be?***

If the Council would like to link management measures with the WAK chum performance threshold, those measures would be implemented retroactively when genetic analyses are available. However, the Council has indicated that, if the WAK chum performance threshold (referred to in the motion as a PSC limit) was exceeded for a number of consecutive years (e.g., 2 out of 5 years, 3 out of 7 years), the WAK chum performance threshold could be reduced in subsequent years. This type of approach may be feasible, but at this stage, the Council has not identified in-season management measures that would be aligned with exceeding the WAK chum performance threshold. As such, it is not clear what repercussions (if any) would be imposed if it was consecutively exceeded (annually, in 2 out of 5 years, etc.). If the Council intends the WAK chum performance threshold to incentivize pollock fishermen to avoid WAK chum salmon, the Council would need to determine what those management measures would be to reduce the number of WAK chum caught per year to remain under the WAK performance threshold.

Calculating the WAK chum performance threshold:

- ***Council decision points: What would be the numerical threshold for the WAK chum performance threshold?***
  - ***How does the Council want to use genetic information to determine values for a WAK chum performance threshold (i.e., based on the prior year, an average over a defined year set, or a rolling average)?***
  - ***How would the uncertainty in the point estimate or the average over a number of years be treated?***

To calculate a WAK chum performance threshold from existing genetic proportions, some assumptions must be made about the relative expected proportion of WAK chum annually in the overall chum salmon bycatch. The proportional contribution of WAK chum in the total bycatch is variable by year, and this point estimate has uncertainty surrounding it within each year that must also be considered (see Table ES 4)

Table ES 4 Average proportional contribution of WAK chum stocks 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	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	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	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**

The Council could take two different approaches to calculating a numerical value for a WAK chum performance threshold. One approach is to select an average proportion of WAK chum based on genetic information and annually assess whether that proportion was exceeded. The second approach is to use the most recent proportion from the previous year to inform the performance threshold for the subsequent year (i.e., the proportion of WAK chum in the 2024 B season pollock fishery would inform the 2025 WAK chum performance threshold value). This second approach would likely introduce substantial inter-annual variability in the calculated threshold.

Table ES 4 **is for illustrative purposes only**. It depicts the second approach to calculating a WAK chum performance threshold based on a hypothetical overall chum PSC limit of 240,000 (the rounded value of the 2022 chum salmon bycatch), and it demonstrates the inter-annual variability in the numerical value of a WAK chum performance threshold that could be expected under the second approach (ranging from a low of 21,840 WAK Chum salmon in 2021 to a high of 60,240 WAK chum salmon in 2012).

Table ES 5 Mean proportion of the WAK chum contribution to the overall genetic composition in the bycatch by year and a calculated WAK fishery performance threshold based on the previous season's mean proportion (e.g., 2011 mean proportion used to calculate the 2012 WAK threshold) based upon an illustrative overall cap of 240,000 chum salmon PSC

Year	*Mean WAK proportion*	*WAK threshold*
2011	25.10%	n/a
2012	21.20%	60,240
2013	24.40%	50,880
2014	19.80%	58,560
2015	19.90%	47,520
2016	24.60%	47,760
2017	20.00%	59,040
2018	18.80%	48,000
2019	16.20%	45,120
2020	9.10%	38,880
2021	9.40%	21,840
2022	23.00%	22,560
2023	n/a	55,200

One way to stabilize the WAK chum performance threshold annually is to select a range of years over which the proportion would be averaged. For example, as shown in Table 3-16, a 3-year (13.8%), 5-year (15.3%) or 10-year (18.5%) average would result in a static threshold of 33,120, 36,936 and 44,400, respectively (noting that this does not accommodate the uncertainty in the estimate). The proportion could also be calculated on a rolling year basis, but this might provide some perverse incentives to drive up the contribution from WAK rather than incentivize the fleet to decrease it.

Some considerations for the Council are as follows. If the set proportion of WAK chum is established as 20%, based on either an average proportion over a set number of years (approach 1) or the previous year's estimate (approach 2), and the overall chum PSC limit is 240,000 (the rounded value of the 2022 chum salmon bycatch), then no more than 48,000 WAK chum would be expected to be taken. However, in a scenario where 230,000 chum salmon were taken in the total bycatch (thus the cap of 240,000 was not reached), but the realized proportion of WAK chum was actually 25% in that year, then the realized WAK chum taken in that B season would have been 57,500 fish. In this scenario, the WAK chum performance threshold of 48,000 would have been exceeded. As noted above, the Council would need to determine what, if any, the management measures would be and how they would be applied retroactively to the Bering Sea pollock fishery.

In addition, option 2 of Alternative 3 includes consideration of a weighted, step-down framework that is triggered by a 3-area chum index. As described in this section, the possibilities for instituting a WAK-specific limit would be to allocate a WAK chum performance threshold either as a standalone measure or as a measure implemented in proportion to an overall chum PSC limit. Therefore, similar to option 2 of Alternative 2, the WAK chum performance threshold would decrease in size in a stepwise fashion if the Council were to choose an option for step-down provisions based on the stock status for three Western Alaska chum salmon systems. If the Council chose to include both an overall chum PSC limit and a WAK chum performance threshold within a step-down framework, the Council would need to identify both types of values for each step. Additionally, based on the Council's current motion, it is staff's understanding that the WAK chum performance threshold would be allocated to different entities (i.e., fishery sectors, CDQ groups, and inshore cooperatives).

Alternative 4: Additional Regulatory Requirements for IPAs to be Managed by Either NMFS or Within the IPAs

Alternative 4 would establish new regulatory measures to prioritize avoidance of WAK chum, which could be managed by either by NMFS or under the IPAs. Options 1 and 2 under Alternative 4 are not mutually exclusive to one another, and both options could be implemented in conjunction with Alternative 2 or Alternative 3.

Option 1: Require a Chum Salmon Reduction Plan Agreement

Option 1 of Alternative 4 would require a "chum salmon reduction plan agreement" be implemented in the B season pollock fishery to prioritize avoidance in genetic cluster areas 1 and 2 for a specified amount of time 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 genetic cluster area 1 (followed by genetic cluster area 3), 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).[14]

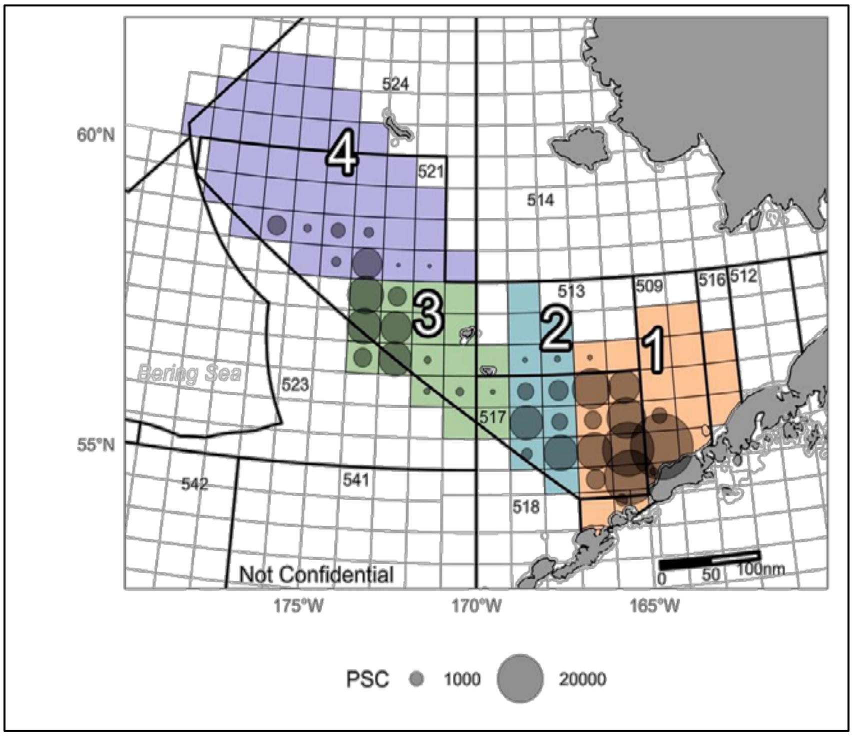


Figure ES 4 Spatial distribution of the chum salmon bycatch by genetic cluster areas (1 through 4) in the 2022 B season pollock fishery

Source: Barry et al., 2023. Genetic Stock Composition Analysis of Chum Salmon from the Prohibited Species Catch of the 2022 Bering Sea Walleye Pollock Trawl Fishery, Preliminary Report

[14] 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.

Managing entity:

- ***Council decision point: What entity would be responsible for managing the measures implemented under a chum salmon reduction plan agreement, either NMFS or the IPAs?***

The main decision point that determines how option 1 of Alternative 4 would work is whether the additional management measures under a chum salmon reduction plan agreement would be managed by NMFS or under the IPAs. "Avoidance" is understood to imply some form of area closure to redistribute pollock fishing effort away from genetic cluster areas 1 and 2 when chum salmon bycatch rates are high and the proportion of WAK chum is also estimated to be high. NMFS and the IPAs would be able to "prioritize avoidance" in genetic cluster areas 1 and 2 using very different approaches, namely static versus dynamic area closures.

If the Council determines the additional measures to prioritize avoidance of WAK chum in genetic cluster areas 1 and 2 would be managed under the IPAs, then a new provision would be added to regulations at 50 CFR 679.21(f)(12)(iii)(E) for the salmon bycatch IPAs. The IPAs would be required to implement measures that meet the Council's intent for a chum salmon reduction plan agreement. As a result of the Council's request (April 2023), industry and IPA representatives have put forward two potential measures that could be implemented when both triggers are met. These measures would modify the current RHS system (the current RHS program for chum salmon avoidance is described in detail in section 3.1.1.1).

One potential measure that could be implemented under the IPAs (when both triggers are met) to further emphasize chum salmon avoidance is to lower the Base Rate "floor." The Base Rate is a chum salmon bycatch rate (number of chum salmon per mt of pollock) that is used as a starting point to determine candidacy for a RHS area closure. The Base Rate fluctuates throughout the B season – it is set at 0.19 or 0.20 from June 10 through June 29 (i.e., the first three weeks of the season). Thereafter, the Base Rate is updated weekly based on a rolling three-week average chum salmon bycatch rate. The Base Rate "floor" is a minimum value that also varies throughout the B season – it is set at 0.19 for the inshore and mothership sectors and 0.20 for the CP sector during the months of June and July, at 0.50 in August, and 1.00 in September and October. The Base Rates are important components for determining whether an area may qualify for a RHS closure (along with other criteria).

A second potential measure that could be implemented under the IPAs (when both triggers are met) is to increase the size of RHS closure areas for chum avoidance East of 168 degrees West longitude. Under the status quo, the combined sizes of all chum salmon closure areas East and West of 168 are limited to 3,000 square miles and 1,000 square miles in June and July, respectively. During August, September, and October, the combined sizes of all chum salmon avoidance areas east and west of 168 are limited to 1,500 square miles and 500 square miles, respectively. It is unlikely that increasing the number of closures that could be issued during any week would lead to additional WAK chum avoidance (currently the IPAs have a limit of four area closures not to exceed 4,000 square miles in June and July and 2,000 square miles in August-October). This is because it is very uncommon for four or more ADF&G statistical areas to be above the Base Rate during any week, unless vessels are fishing at the intersection of the four statistical areas. In this scenario, one closure could be issued over four statistical areas (*Sea State, personal communication*).

In contrast to how the IPAs could issue dynamic closure areas via the RHS system, NMFS could manage static area closures. This is because NMFS must post a notice in the Federal Register to open or close a fishing area. This process typically takes seven days, but it can be slower as the Federal Register is not open on weekends or holidays. Prior to the notice of issuing an opening or closure, the documents submitted by NMFS inseason branch must also be reviewed by NOAA General Counsel NOAA Headquarters. Chum salmon bycatch rates could substantially change on the pollock fishing grounds in the time it takes NMFS to issue a management action to open and close specific fishing areas.

If the Council were to prefer NMFS to manage the additional measures under a chum salmon reduction plan agreement, it is not clear what the measure(s) would be, and the Council would need to provide input on its preference for additional measures. It is not possible for NMFS to manage the additional measures put forward by IPA representatives, and NMFS would not be able to replicate this program as NMFS does not, and would not, be able to manage dynamic area closures.

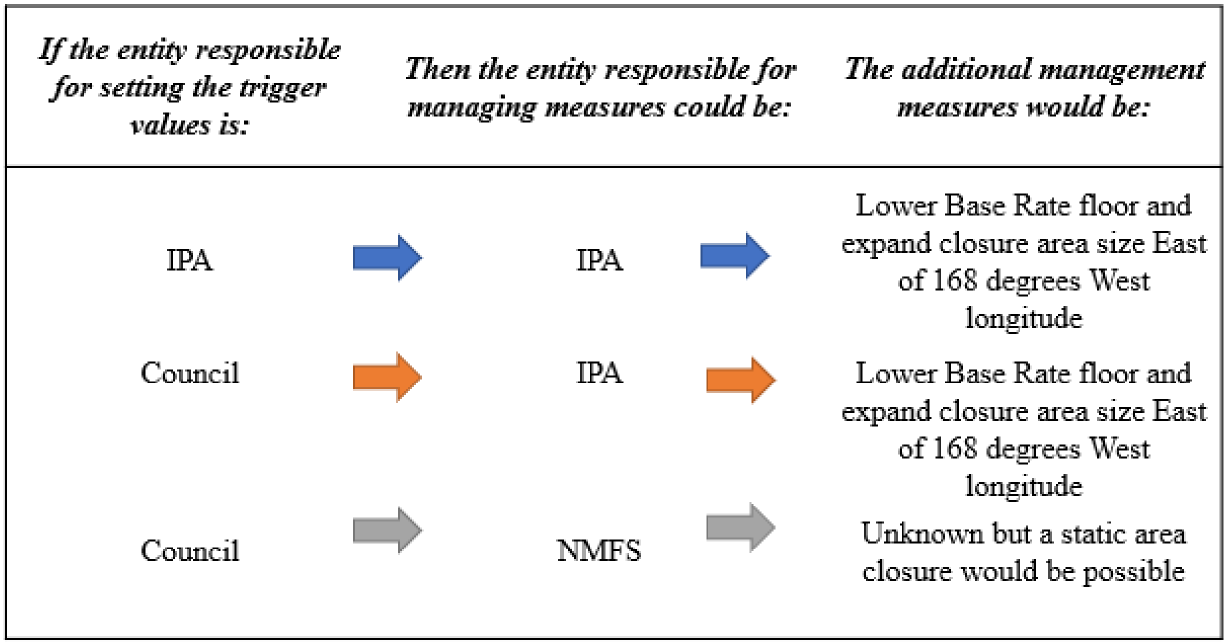


Figure ES 5 Summary of options for the entity determining trigger values and responsible for implementing management measures under a chum salmon reduction plan agreement as well as potential additional measures

Entity determining the triggers:

- ***Council decision points: Who determines the trigger values, either the Council or the IPAs?***
    - ***If the Council would like to determine the trigger values, what would be the temporal and spatial scale of the triggers?***
    - ***Would the triggers be assessed individually for genetic cluster area 1 and 2 or be combined?***

To move forward with option 1 of Alternative 4, the Council would also need to determine the entity responsible for setting the trigger values, either the Council or the IPAs. The Council would need to specify numerical values for each trigger if it decides NMFS would manage additional measures to prioritize WAK chum avoidance. The Council is not required to determine the numerical values for each trigger if the IPAs would manage additional measures to prioritize WAK chum avoidance, although it could choose to do so. The RHS system is an industry-led program managed under private contractual agreements. Thus, it would be consistent with previous decisions for the Council to decide how the IPAs could determine the numerical values for each trigger.

If the Council determines the trigger values for the IPAs, the numerical values would be set in regulations. Establishing the trigger values in regulation might give the Council, NMFS, and the public more assurance in how the chum salmon reduction plan agreement would work. However, adding specificity to the provisions in Federal regulation provides very little flexibility for IPA participants to revise contract provisions to respond to new information or consider better methods on an annual basis to minimize bycatch without a regulatory amendment. It is difficult to define exactly what the line is between providing necessary detail in regulations to ensure the IPAs meet the Council's objectives while providing the IPAs enough flexibility to make improvements without requiring regulatory amendments. If the Council would like to set the trigger values, further information is provided in section 3.4.1.2.

Option 2: Additional Regulatory Provisions Requiring Incentive Plan Agreements to Utilize the Most Refined Genetics Information Available

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.

Regulations require the IPAs to include a description of how the agreement "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" (see 50 CFR 679.21(f)(12)(iii)(E)(*7*)). The IPAs currently comply with this regulatory requirement using different tools in the RHS system for chum salmon avoidance. Specific details on how the IPAs could respond to additional regulatory requirements to use the most refined genetic information available were not provided at this time.

Alternative 4, option 2 is not substantially different from the status quo except that it would implement additional regulatory requirements for IPAs to currently (and in the future) utilize the most refined genetic information to avoid WAK chum salmon bycatch.

Summary of Decision Points Before the Council

As stated previously, the Council is finalizing alternatives for future impact analysis. Each of the preliminary action alternatives and options has several decision points for the Council to consider, which staff have summarized as questions for consideration in Table ES 6. Additionally, the Council may wish to consider the level of complexity associated with each alternative/option. While determining the level of complexity of a given alternative or option is a subjective assessment, it could be conceptualized in terms of the time it would take to meaningfully analyze and consider them (i.e., analytical time, Council agenda time at future meetings, and time invested from the public to understand these alternatives). In short, the overall amount of time associated with this particular action increases as the level of complexity of the alternatives and options does.

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

Alt/opt.	Decision points before the Council at this meeting to finalize the alternatives	Section for reference
1 (Status quo)	• Not applicable; the existing management measures under the status quo to minimize chum salmon bycatch in the Bering Sea pollock fishery would be retained	3.1
2.1 (Overall chum salmon PSC limit)	• What is the range of values that should be analyzed as potential chum PSC limits? • Does the Council want to link chum salmon bycatch management measures to ocean temperature data? ◦ If so, what would be the temperature measure (sea surface or bottom), the threshold for determining a warm or cold year, and the associated management measures? • What allocation approaches should be analyzed (i.e., using historical bycatch numbers, AFA allocation, a pro rata approach, or some other option)? • Would the chum PSC limit allocations be transferable?	3.2
2.2/3.2 (3-area index for WAK chum abundance)	• Would Yukon River fall and summer chum be included in the Yukon portion of the 3-area index? • How does the Council want to define low chum abundance for each area (i.e., Yukon, Kuskokwim, Norton Sound)? • If the Council would like to use historical chum abundance information for each area to determine low abundance, what year set would be used for each area to determine the numerical threshold? • Does the Council want to include other criteria (ANS and escapement goals) to determine low abundance? ◦ If yes, what method for assessment does the Council want to use? • Does the Council want to "weight" (i.e., prioritize) the areas or consider them equally? • What would be the step-down provisions and associated chum PSC limits?	3.2.2

3.1 (WAK PSC limit)	• Would the Council want to consider a standalone WAK chum performance threshold or one that is linked to an overall chum PSC limit?
	• What would be the numerical value of the WAK chum performance threshold?
	  ◦ How does the Council want to use genetic information to determine values for a WAK chum performance threshold (i.e., based on the prior year, an average over a defined year set, or a rolling average)?
	  ◦ How would the uncertainty in the point estimate or average be treated?
	• Does the Council want to link the WAK chum performance threshold with management measures?
	  ◦ If yes, what would those measures be?
		3.3

Alt/opt.	Decision points before the Council at this meeting to finalize the alternatives	Section for reference
4.1 (Additional regulatory provisions for WAK chum avoidance)	• What entity would be responsible for managing the measures implemented under a chum salmon reduction plan (i.e., NMFS or the IPAs)? • Who determines the trigger values (i.e., the Council or IPAs)? ◦ If the Council would like to determine the trigger values, what would be the temporal (i.e., rates and proportions based annual, early/late period, or some other approach) and spatial scale (i.e., rates and proportions based on grounds-wide information or only that from genetic cluster area 1 and 2) of the triggers? • Would the triggers be assessed individually for genetic cluster area 1 and 2 or be combined?	3.4.1

1 Introduction

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 History of this Action at the Council

1.1.1 June 2022

At the June 2022 Council meeting, the Council received a range of scientific and industry reports related to salmon bycatch avoidance, genetics, and management. In addition to the genetics and pollock industry salmon avoidance reports that are presented annually, the Council also received specific reports on stock status and bycatch impact assessment.[15]

The reports presented in June included:

a) an Alaska Department of Fish and Game (ADF&G) presentation on salmon stock and research updates,
b) a series of genetics reports on stock of origin of Chinook and chum salmon available for the 2020 (Chinook) and 2020 and 2021 (chum) for the Bering Sea pollock fishery, as well as some Gulf of Alaska fisheries, [16]
c) an updated bycatch impact (adult equivalency or AEQ) analysis for Chinook salmon bycatch, and staff report with interagency staff recommendations regarding currently available data on assessing chum salmon bycatch impacts and potential analyses that could be conducted, and
d) a series of industry reports including a salmon excluder exempted fishing permit report, a report from SeaShare on the Prohibited Species Donation Program efforts to provide donated fish to food donations programs, and the IPA annual reports. 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.

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:[17]

[15] The Council's motion from October 2021 related to salmon bycatch information requests can be found here: https://meetings.npfmc.org/CommentReview/DownloadFile?p=01eef937-8ca9-4187-a27e-b7730af04699.pdf&fileName=E1%20Motion%20-%20Salmon%20Bycatch.pdf

[16] Typically, the Council receives the annual reports and updates on salmon bycatch avoidance and genetic information at its April meeting. In 2022, the Council received the salmon reports in June so that geneticists at Auke Bay Lab could provide the most recent and up-to-date information for Chinook *and* chum salmon bycatch. This provided the Council and the public the most up-to-date information on the relative impacts of salmon bycatch in terms of the stock of origin in recent years.

[17] The Council's motion from the June 2022 meeting related to the salmon reports can be found here: https://meetings.npfmc.org/CommentReview/DownloadFile?p=0bcfb6f4-a3a8-4670-97fe-e9404f430e43.pdf&fileName=D1%20Council%20Motion.pdf

a) requested the pollock industry immediately implement additional chum salmon bycatch avoidance measures in the 2022 B season pollock fishery.
b) 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.
c) 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 next meeting in October.

1.1.2 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 bycatch discussion paper, and the staff report on the SBC's inaugural meeting held in November 2022.[18] 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.[19] The SBC convened for two additional meetings in January 2023 and March 2023 to achieve its goals as directed by the Council.

1.1.3 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.

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 alternatives to minimize chum salmon bycatch in the Bering Sea pollock fishery with a particular priority of minimizing Western Alaska chum salmon bycatch. 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 this Preliminary Review analysis is intended to provide the Council and the public with more information to help the Council determine a reasonable range of alternatives.**

1.2 Purpose and Need

The purpose of this action is to minimize the bycatch of WAK origin chum salmon in the Bering Sea pollock fishery to the extent practicable (National Standard 9 and section 303(1)(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

[18] The State of Alaska Bycatch Review Task Force Report is available here: https://www.adfg.alaska.gov/static/fishing/PDFs/bycatchtaskforce/abrt_final_report.pdf
[19] The Council's motion from the December 2022 meeting related to the chum salmon bycatch discussion paper and SBC can be found here: https://meetings.npfmc.org/CommentReview/DownloadFile?p=3f466f72-7d09-4dda-a442-50d53b5206ec.pdf&fileName=D1%20Council%20Motion%20Salmon%20Bycatch%20FINAL.pdf

management measures, namely Amendments 91 and 110 to the BSAI Groundfish FMP that established measures to reduce Chinook salmon bycatch.

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 food security, wellbeing, and the continuation of meaningful cultural practices and related 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 April 8th, 2023.

Alternative 1: 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.

PSC limits are apportioned among CDQ, catcher processor, mothership and inshore sectors based on historical total bycatch by sector. The inshore limit is further apportioned among the inshore cooperatives. The CDQ limit is further apportioned among the CDQ groups. Reaching a limit closes the pollock fishery to which the limit applies.

Option 2: Weighted, step-down PSC limit triggered by a three-river chum index (Kwiniuk (or index developed for Norton Sound area), Yukon, Kuskokwim) that is linked to prior years' chum abundance/ANS/escapement and weighted to account for variance in stock sizes across river systems.

PSC limits would be triggered and in effect when one or more Western Alaska chum index areas fails to meet index thresholds. As more areas fail to meet index thresholds, chum PSC limits would step-down and become more restrictive. PSC limits are apportioned among CDQ, catcher processor, mothership and inshore sectors. The inshore limit is further apportioned among the inshore cooperatives. The CDQ limit is further apportioned among the CDQ groups. Reaching a limit closes the pollock fishery to which the limit applies.

Alternative 3: Bycatch (PSC) limit for Western Alaska chum salmon

Option 1: Western Alaska chum salmon PSC limit based on historical total bycatch numbers.

PSC limits are apportioned among CDQ, catcher processor, mothership and inshore sectors based on historical total bycatch by sector. The inshore limit is further apportioned among the inshore cooperatives. The CDQ limit is further apportioned among the CDQ groups. Reaching a limit closes the pollock fishery to which the limit applies.

Option 2: Weighted, step-down Western Alaska chum PSC limit triggered by a three-river chum index (Kwiniuk (or index developed for Norton Sound area), Yukon, Kuskokwim) that is linked to prior years' chum abundance/ANS/escapement and weighted to account for variance in stock sizes across river systems.

PSC limits would be triggered and in effect when one or more Western Alaska chum index areas fails to meet index thresholds. As more areas fail to meet index thresholds, chum PSC limits would step-down and become more restrictive. PSC limits are apportioned among CDQ, catcher processor, mothership and inshore sectors. The inshore limit is further apportioned among the inshore cooperatives. The CDQ limit is further apportioned among the CDQ groups. Reaching a limit closes the pollock fishery to which the limit applies.

Alternative 4: Additional regulatory requirements for Incentive Plan Agreements (IPAs) to be managed by either NMFS or 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 stocks.

1.3 Action Area

The Bering Sea sub-area of the BSAI management area is the area in which this action occurs (see Figure 1-1). 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.[20] 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.

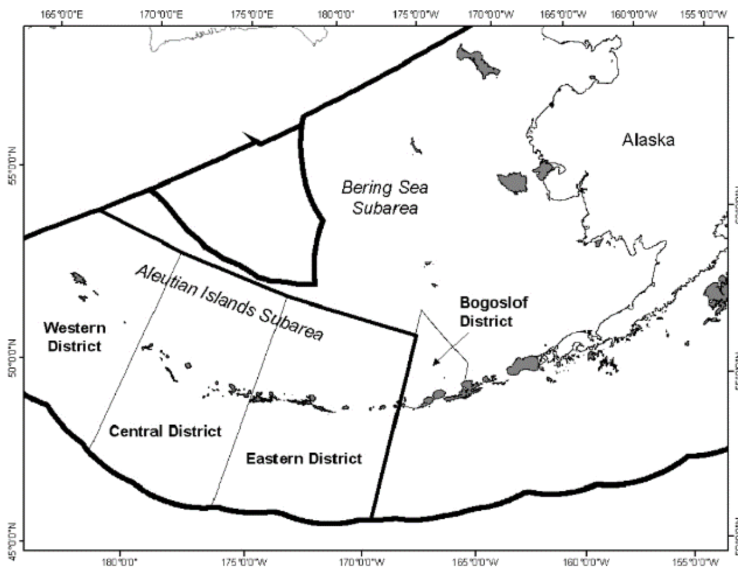


Figure 1-1 Bering Sea Aleutian Islands management sub-areas

[20] 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.

2 Description of the Bering Sea Pollock Fishery

Walleye pollock are a broadly distributed species throughout the North Pacific with the largest concentrations found in the eastern Bering Sea. 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. From 2011 through 2022, the average annual harvest of Bering Sea pollock was 1.26 million mt.[21]

The Bering Sea pollock fishery is the largest U.S. fishery by volume. 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 and $1.4 billion, respectively.[22]

2.1 Bering Sea Pollock 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).[23] 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 sector's allocation is further apportioned among the CDQ groups and the inshore sector's allocation is further apportioned among the cooperatives and the inshore open access fishery in applicable years (see 432.2 and 2.3.1 for more detail).

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, as the 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)).

[21] Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA; AFA_Vessels_Landings(3-24-23)2.
[22] Source: NMFS Catch Accounting System, compiled by AKFIN; BS_PLCK_VAL(7-17-23).
[23] The AFA also specifies ownership requirements, buyout provisions and 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).

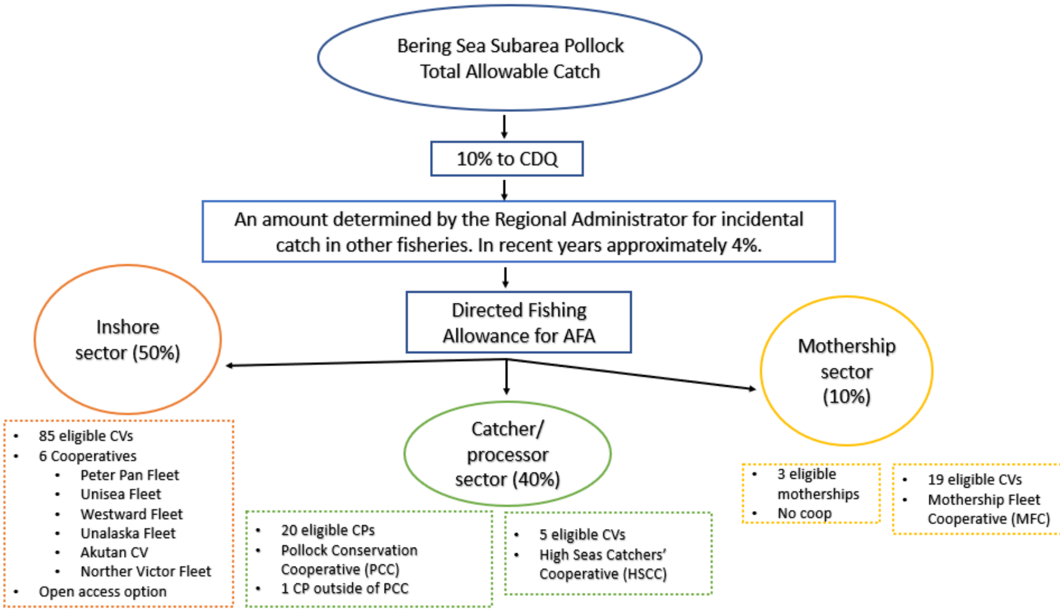


Figure 2-1 Allocations of Bering Sea pollock TAC among fishery sectors including the incidental catch allowance

Notes: Vessel counts are based on 2023 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, 40% of the Bering Sea pollock TAC was apportioned in the A season and 60% was apportioned in the B season. This action was intended 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.

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(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(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 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.

2.2 CDQ Program

The Council established the CDQ Program in 1992 to provide eligible coastal Western Alaska communities an opportunity to participate and invest in Federal fisheries in the BSAI Management Area. When the CDQ Program was first implemented, the programmatic allocation of Bering Sea pollock was 7.5% of the overall TAC. However, the AFA set 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 WAK communities the opportunity to participate and invest in BSAI fisheries, to support economic development in WAK, to alleviate poverty and provide economic and social benefits for residents of WAK, and to achieve sustainable and diversified local economies in WAK. A total of 65 communities participate in the CDQ Program through six nonprofit corporations commonly referred to as "CDQ groups." The CDQ groups are as follows:

Aleutian Pribilof Island Community Development Association (APICDA): APICDA represents six communities within the Aleutians East Borough (three communities) and Aleutians West Census Area (three communities). [24]

Bristol Bay Economic Development Corporation (BBEDC): BBEDC represents 17 coastal communities across the Bristol Bay region.

Central Bering Sea Fishermen's Association (CBSFA): CBSFA represents the community of St. Paul, the only community on St. Paul Island.

Coastal Villages Region Fund (CVRF): CVRF represents 20 communities. Of these communities, 17 coastal communities are located in the Bethel Census area and three are located in the Southwest portion of the Kusilvak Census Area.

Norton Sound Economic Development Corporation (NSEDC): NSEDC represents 15 communities along the Bering Sea Coast of the Nome Census area.

Yukon Delta Fisheries Development Association (YDFDA): YDFDA represents six communities at the mouth of the Yukon River plus the community of Grayling.

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.

[24] 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 this CDQ group, and its residents are eligible for training, education, and employment opportunities offered by the group.

Table 2-1 CDQ group allocations of Bering Sea pollock, 2023

Fishery	Group Allocation (as a % of program allocation)						Program allocation (% of TAC)
	APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFDA	
BS Pollock	14%	21%	5%	24%	22%	14%	100%
AI Pollock	14%	21%	5%	24%	22%	14%	100%
Fishery	**Group Allocation (in mt based on the 2023 TAC)**						**Total mt**
	APICDA	**BBEDC**	**CBSFA**	**CVRF**	**NSEDC**	**YDFDA**	
BS Pollock	18,200	27,300	6,500	31,200	28,600	18,200	130,000
AI Pollock	266	399	95	456	418	266	1,900

Source: https://www.fisheries.noaa.gov/s3/2023-04/2023annualmatrix.pdf
Notes: The AI pollock CDQ reserve of 1,900 mt was reallocated to BS pollock. CDQ Bering Sea Pollock TAC after reallocation was 131,900 mt.

2.3 Non-CDQ Sectors

2.3.1 Inshore Sector

In 2023, there were 85 CVs eligible to harvest Bering Sea pollock and deliver to inshore processors. The AFA set up a structure for the formation of fishing cooperatives to help slow the pace of pollock fishing. Since 2000, there have been seven cooperatives formed by inshore CVs and their partner inshore processor: Northern Victor Fleet Cooperative, Peter Pan Fleet Cooperative, Unalaska Fleet Cooperative, UniSea Fleet Cooperative, Akutan Catcher Vessel Association, Arctic Enterprise Association, and Westward Fleet Cooperative. The Arctic Enterprise Association has not been active since 2008. Each CV in a cooperative 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.

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 inshore 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 and Criddle 2013).

The amount of pollock an inshore cooperative is suballocated by NMFS from the inshore sector's allocation is based on member vessel's catch history. 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; those that do not join are managed by NMFS under the "inshore open access fishery." Inshore CVs participating 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 is an open access fishery in 2023, and prior to that there has not been an open access fishery since 2011. Inshore CVs are also 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. 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).

The operating range of an inshore CV is largely determined by their hold capacity and whether the vessel has a refrigerated seawater hold cooling systems. 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, shoreside CV operations are limited in where they target pollock and generally fish as close to the processing plant as possible (Strong and Criddle 2013).

2.3.2 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 and Criddle 2013).[25]

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, 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.

2.3.3 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 three AFA eligible motherships. 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

[25] 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

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.

2.4 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 2-2) and landings (Table 2-3) by sector using fishery dependent data from 2011 through 2022. From 2011 through 2022, the annual average count of vessels participating in the Bering Sea pollock fishery across sectors is 99, ranging from a high of 105 vessels in 2012 to a low of 93 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 2-4).

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

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
CP	15	14	15	16	14	14	14	14	13	13	13	13
Inshore	80	81	79	78	79	81	77	73	72	76	74	71
Mothership	14	15	14	15	15	15	14	14	15	15	14	13
CDQ	15	16	15	16	16	15	16	15	13	12	11	12
Total	**101**	**105**	**100**	**103**	**101**	**102**	**102**	**98**	**95**	**98**	**95**	**93**

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA; AFA_Vessels_Landings(3-24-23)2

Notes: Vessels counts between the mothership and inshore sector are not additive, as there is overlap between CVs that are dual-qualified to participate in the inshore and mothership sectors.

Table 2-3 Landings (mt) of Bering Sea pollock by sector, 2011 through 2022

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
CP	423,653	423,129	440,489	445,178	457,648	467,914	472,736	477,712	490,084	468,610	480,179	380,089
Inshore	518,951	525,127	548,262	555,518	570,888	584,617	589,722	597,052	610,726	599,621	596,952	473,790
Mothership	109,849	105,384	110,018	111,009	114,394	117,051	118,181	119,402	122,491	122,394	120,002	95,008
CDQ	117,053	121,928	126,548	128,637	132,891	135,705	136,450	138,293	141,609	127,974	139,330	111,033

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA; AFA_Vessels_Landings(3-24-23)

Table 2-4 Total landings (million mt) in the Bering Sea pollock fishery compared to the Bering Sea pollock TAC (million mt) and the percent utilized, 2011 through 2022

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Landings	1.17	1.18	1.22	1.24	1.26	1.31	1.32	1.33	1.36	1.32	1.34	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	93%	98%	98%	98%	97%	97%	98%	98%	98%	93%	97%	95%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA; AFA_Vessels_Landings(3-24-23)

2.5 Chum Salmon Bycatch Performance in the Bering Sea Pollock Fishery

For catch accounting purposes, NMFS monitors salmon PSC as either “Chinook PSC” or “non-Chinook PSC.” Sockeye, coho, pink, and chum salmon 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 2-5). As noted previously, it is for this reason that the analysis uses “chum salmon bycatch” or “chum salmon PSC” for ease of the reader.

Table 2-5 Annual composition of species in the non-Chinook catch accounting category (number of fish), 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	99	342,422	342,589	99.95%
2017	150	53	926	466,549	467,678	99.76%
2018	90	10	138	294,841	295,079	99.92%
2019	181	170	1,586	345,928	347,865	99.44%
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%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(5-8-23)

Table 2-6 provides information on the total number of chum salmon caught as bycatch each year (A and B pollock seasons) compared to only those chum salmon caught in the B season. Over 99% of the chum salmon caught as bycatch occur during the B season from 2011 through 2022.

Table 2-6 Annual total chum salmon bycatch (A and B pollock seasons) compared to the chum salmon bycatch in the B season Bering Sea pollock fishery, 2011 through 2022

Year	*Annual Total*	*B season total*	*B season as % of total*
2011	191,435	191,317	99.94%
2012	22,183	22,172	99.95%
2013	125,316	125,114	99.84%
2014	219,442	218,886	99.75%
2015	237,752	233,085	98.04%
2016	342,589	339,236	99.02%
2017	467,678	465,848	99.61%
2018	295,079	294,705	99.87%
2019	347,865	346,812	99.70%
2020	343,625	343,095	99.85%
2021	546,042	545,901	99.97%
2022	242,375	242,309	99.97%

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

Table 2-7 provides the number of vessels participating in the B season pollock fishery (all sectors), the annual B season landings of pollock (mt), and the amount of B season chum salmon bycatch from 2011 through 2022. During this period, an average of 90 vessels participated in the B season pollock fishery harvesting 729,092 mt of pollock. The total number of chum salmon taken as bycatch in the B season pollock fishery ranges from a low of 22,172 in 2012 to a high of 545,901 fish in 2021.

Table 2-7 Number of vessels participating in the B season Bering Sea pollock fishery, B season pollock landings (mt), B season chum salmon bycatch (number of fish), 2011 through 2022

Year	*Vessels*	*Landings (mt)*	*Chum bycatch*
2011	94	681,343	191,317
2012	96	705,728	22,172
2013	90	738,094	125,114
2014	92	747,358	218,886
2015	94	773,077	233,085
2016	91	790,151	339,236
2017	89	755,087	465,848
2018	88	751,020	294,705
2019	86	769,907	346,812
2020	88	702,378	343,095
2021	85	747,743	545,901
2022	81	586,982	242,309
Average	90	729,072	280,707

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; AFA_VESSELS_landings(6-14-23) and salmon_PSC(6-22-23)

3 Description of Alternatives

This section and the corresponding subsections provide detailed descriptions of how each alternative and option could work and what input is required from the Council to move forward. The Council is finalizing alternatives at this stage, so it may choose to refine or restructure these alternatives. Analytical staff would incorporate any changes to these alternatives in the next iteration of the analysis.

3.1 Alternative 1, No Action/Status Quo

The description of the status quo alternative provides a comprehensive overview of the current management measures used to minimize chum and Chinook salmon bycatch. While this current action is specific to chum salmon bycatch, the analysis includes a description of Chinook salmon bycatch management measures because any additional measures resulting from this action would be layered onto the existing programs for both species. The current management measures would be retained if the Council chose to take no action. The Council is required to consider the no action/status quo alternative under NEPA. Future iterations of the analysis will compare the impacts of the action alternatives against the status quo.

3.1.1 Current Measures to Reduce Chum Salmon PSC Under the Status Quo

The Chum Salmon Savings Area would be retained under Alternative 1. The Chum Salmon Savings Area is a static area closure in the southeastern Bering Sea. 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 when chum salmon bycatch was highest). It would remain closed through October 14 if the bycatch limit of 42,000 non-Chinook (i.e., chum salmon) was reached at any point from August 15 through October 14. Non-Chinook salmon encountered in the CVOA accrued to the 42,000 non-Chinook PSC limit (see Figure 3-1); the CVOA is defined at 50 CFR 679.22(a)(5)).

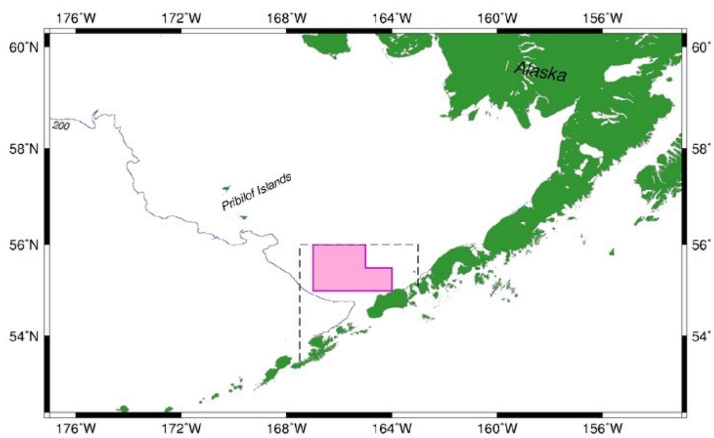


Figure 3-1 Chum Salmon Savings Area, shaded in pink and the Catcher Vessel Operational Area (CVOA), dotted line

3.1.1.1 Rolling Hotspot System (RHS) for Chum Salmon

Alternative 1 would retain the existing RHS system used to avoid chum salmon bycatch. 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 (and the Chinook Salmon Savings Areas) indicated the closure areas may be counterproductive as salmon bycatch rates (number of salmon per mt of pollock) were higher outside the closure areas than within them.[26] The pollock industry voluntarily implemented a RHS system for chum salmon in 2001 and Chinook salmon in 2002 under an Intercooperative Agreement to try and avoid reaching the triggers for the Salmon Savings Areas.

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 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.[27] 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.

In contrast to the Chum Salmon Savings Area, which is a static area closure, the RHS system creates dynamic area closures based on real-time catch data. The benefit of this management tool is in its efficient use of catch data and other information to move the fleet away from known areas of higher Chinook and chum bycatch to a degree that could not be replicated by NMFS inseason management. This system effects fleet fishing patterns through the RHS area closures as well by as establishing a flow of bycatch information communication with fishermen.

The RHS system has been modified over time including that it is now managed under the pollock industry's Incentive Plan Agreements (IPAs). The salmon bycatch IPAs are legal contracts that members voluntarily agree to and are approved by NMFS under 50 CFR 679.21(1). 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. The possibility of triggering an area closure under the RHS system is an example of an incentive for bycatch avoidance under the IPAs – pollock fishermen 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.

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 current participants in the Bering Sea pollock fishery are members to one of three IPAs approved by NMFS:[28] 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

[26] The Chinook Salmon Savings Areas were established under BSAI Groundfish FMP Amendment 21b and are described in the Executive Summary.
[27] 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.
[28] The IPAs and amendments can be accessed here: https://www.fisheries.noaa.gov/alaska/bycatch/chinook-salmon-bycatch-management-alaska.

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.

The following paragraphs describe how the current RHS program for chum salmon avoidance works as managed under the IPAs. The RHS system for chum salmon avoidance operates in the pollock B season when chum salmon are more prevalent on the pollock grounds.

The starting point for determining eligibility for a RHS closure area is to calculate the **Base Rate**. The Base Rate is a bycatch rate that provides an index of relative chum salmon bycatch encounters, and it fluctuates based in the average level of vessel's bycatch performance to reflect the "base" level of chum salmon encounters on the pollock grounds. 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. After this initial start to the fishing season (beginning on July 1), 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). The calculated Base Rate for chum salmon is not allowed to increase by more than 20% from one week to the next in June and July (this is sometimes referred to as a "collar").

The IPAs also use a Base Rate "floor" that varies across the B season. In June and July, the Base Rate floor is 0.19 or 0.20 chum per mt of pollock for the respective sectors. In August, the Base Rate floor is increased to 0.50 chum per mt of pollock. In September and October, the Base Rate floor increases to 1.00 chum salmon per mt of pollock. The in-season adjustment was added to establish a Base Rate based on current conditions on the pollock fishing grounds (NPFMC 2007, 138).

Next, Sea State evaluates the bycatch rates in ADF&G groundfish statistical areas which provides salmon bycatch rates at a smaller spatial scale. The salmon bycatch rate in an ADF&G groundfish statistical area is called an "area bycatch rate." Area bycatch rates are calculated by dividing the number of chum salmon by the mt of pollock caught in the prior week within the area.

For those ADF&G groundfish statistical areas where a "substantial amount" amount of pollock fishing occurred (e.g., a minimum of 500 mt of pollock and at least 2% of the total weekly pollock catch), Sea State will compare the area bycatch rate to either the calculated Base Rate or the Base Rate floor, whichever is higher. If the area bycatch rate is greater than the Base Rate value used, then the area qualifies for a closure.

Whether or not vessels are prohibited from fishing in RHS closure areas based on their bycatch performance. To evaluate a vessel's bycatch performance, Sea State calculates the vessel's chum salmon bycatch rates. This is the relative bycatch performance of a vessel during the prior two weeks which is then compared to a standard of better than average performance.

a) For CPs, a vessel is considered better than average if it has a bycatch rate less than 0.75 of the Base Rate. A vessel with a bycatch rate greater than 0.75 of the Base Rate cannot fish in an established avoidance area for seven days (i.e., the following week). However, if an ADF&G statistical area has an extremely high chum rate (5 chum salmon per mt of pollock) vessels may not fish in the area regardless of their performance. CPs can also be excluded for two weeks from an avoidance area if their vessel-level bycatch rate is above average.

b) CVs with bycatch rates less than or equal to the 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.

The Council's primary intent with this current action is to further minimize 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." Two management measures are incorporated into the current RHS system to meet this regulatory provision.

The first is that the combined size limits of RHS closure areas are largest East of 168 degrees West longitude during June and July to match when WAK are more likely to be present on the pollock grounds. In June and July, the combined sizes of all chum salmon avoidance areas east and west of 168 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 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 management measure that responds to the regulatory requirement to avoid areas and times where chum salmon are likely to return to WAK 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.

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.

3.1.1.2 Recent Changes to Incentive Plan Agreements for Chum Salmon Avoidance

Following the spike in chum salmon bycatch in 2021, the Council requested the pollock industry immediately implement additional chum salmon bycatch avoidance measures in the 2022 B season pollock fishery.

In 2022, the CP IPA was amended to include three primary changes. First, the CP sector implemented a new approach to chum salmon "Bycatch Avoidance Areas" (i.e., RHS closure areas) by using a Tuesday to Friday closure. This is 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 (hours or days) and evaluating the data on a bi-weekly basis allows the fleet to be more responsive at avoiding chum salmon on the pollock grounds. There were 14 Bycatch Avoidance Areas implemented in 2022 for the CP sector along with one advisory avoidance area. The total number of chum salmon Bycatch Avoidance Areas increased in 2022 compared to prior years due to amendments to the CP IPA for the 2022 B season to allow Bycatch Avoidance Areas to be identified twice weekly instead of weekly.

The second CP IPA amendment implemented restrictions for all vessels fishing in known areas of extremely high chum bycatch (defined as 5 chum salmon per mt of pollock). This amendment is intended to reduce periodic spikes in chum salmon bycatch and lightning strike tows of chum salmon by multiple vessels in areas with known high bycatch rates. The 2022 chum bycatch rates were relatively low across all weeks of the B season for the CP sector. 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 had a weekly bycatch rate of 5.051 chum salmon per mt of pollock); however, this statistical area is in the CVOA where CPs are not allowed to fish, unless participating in the CDQ fishery.

The third CP IPA amendment adds chum salmon to the "outlier provision'" (similar to what the sector implemented in 2015 for Chinook). This IPA amendment increases accountability by creating incentives for chronic poor chum bycatch performers to improve their chum bycatch rates. This incentive 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.

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.

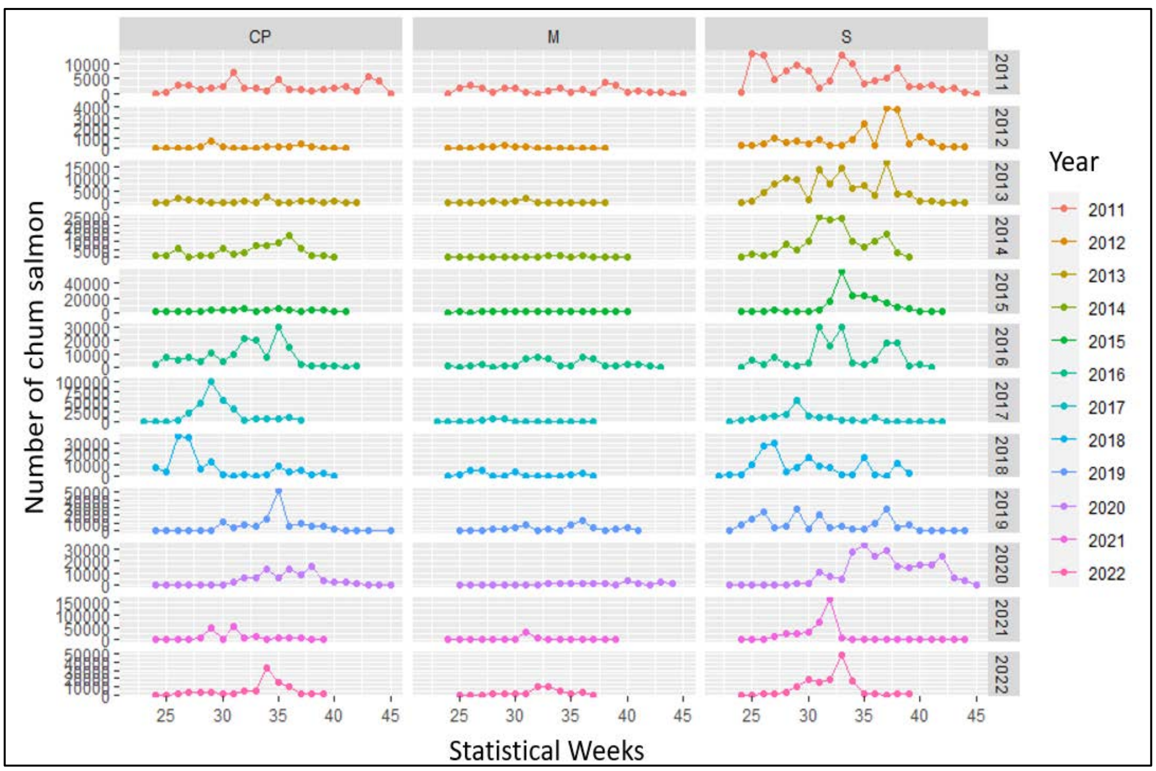


Figure 3-2 Number of chum salmon caught as bycatch by pollock sector over statistical weeks 25 through 45, 2011 through 2022

The Inshore SIP and MSSIP took an experimental approach to implementing additional voluntary avoidance areas apart from the RHS system. These avoidance areas had 100% compliance in 2022. The B season chum salmon bycatch can be characterized by a single major peak with a gradual increase and decrease on either side (see Figure 3-2). 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. 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. There was a total of seven chum RHS closures and three chum Advisory Avoidance Areas issued in 2022 for the inshore and mothership sectors.

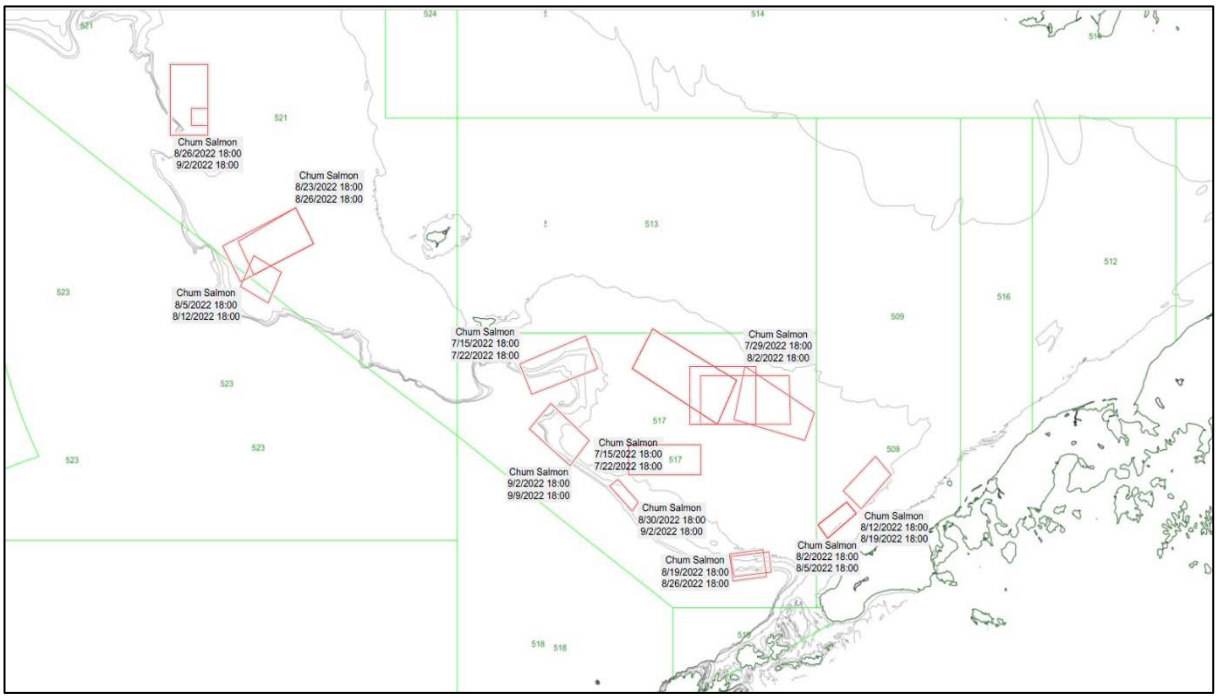


Figure 3-3 Chum bycatch avoidance areas for the CP and mothership sectors, 2022
Source: Sea State, Inc.

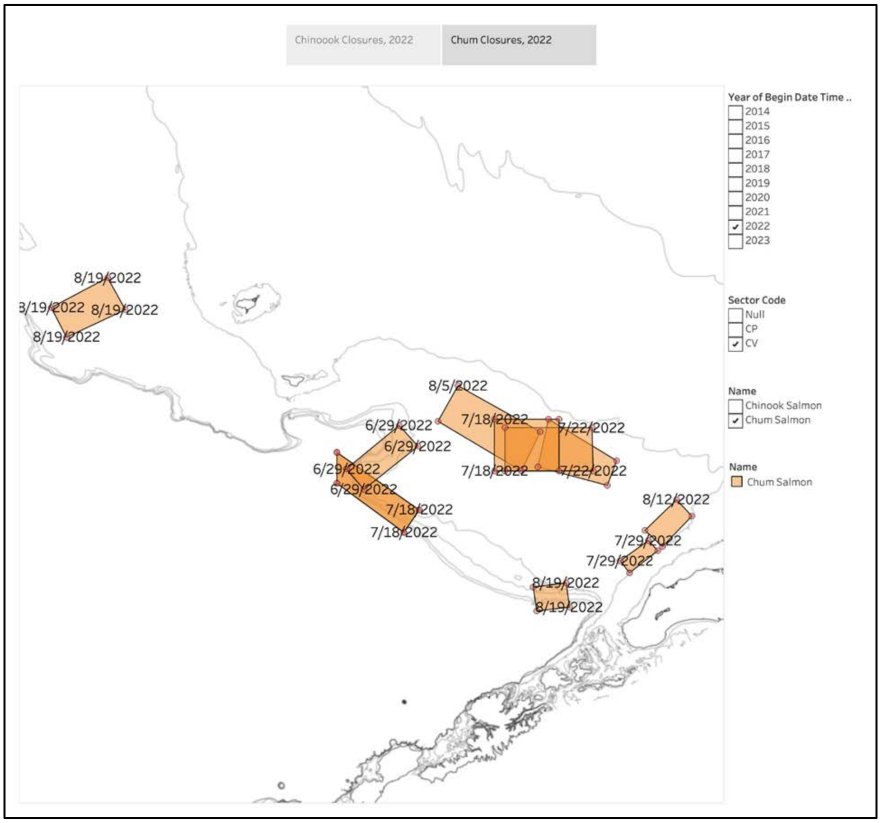


Figure 3-4 Chum RHS Closure and Chum Advisory Avoidance Areas, inshore CV sector, 2022
Source: Sea State, Inc. Prepared for Inshore Salmon Savings Incentive Plan Agreement, Annual Report 2022.

3.1.2 Chinook Salmon PSC Management Under the Status Quo

3.1.2.1 Chinook Salmon PSC Limit

Amendment 91 came into effect in the 2011 Bering Sea pollock fishery (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 allocates an overall PSC limit of 60,000 Chinook among the Bering Sea pollock sectors and further apportions the inshore sector's allocation among the cooperatives as well as the CDQ sector's allocation 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 participates in IPAs that establish incentives for pollock fishermen to avoid Chinook on the pollock grounds at all levels of encounter rates. Participation in an IPA is voluntary. However, the pollock 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)).[29] The Council developed two Chinook PSC limits to incentivize the industry to

[29] 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.

form IPAs to avoid the potential economic impacts of receiving an allocation under the lower limit.[30]

Amendment 110 came into effect in 2016 and it changed the Chinook salmon PSC limits established under Amendment 91 to fluctuate based on Chinook abundance (i.e., when WAK 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 Chinook salmon and 33,318 Chinook (50 CFR 679.21(f)(2)). NMFS issued allocations under the 60,000 PSC limit from 2011-2018 and again in 2020. In 2019, 2021, 2022, and 2023, NMFS issued sector and seasonal proportions of the 45,000 PSC limit as the 3-River Index determined WAK Chinook salmon abundance to be low.[31]

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 allocated to a fishing sector under either the 47,591 or 33,318 Chinook PSC limit depending on a 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 allocation 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 ensures the inshore CV, CP, mothership, and CDQ fishery sectors stay below their actual Chinook PSC allocation because of the incentive to receive the highest PSC allocation available each year.

As noted above, NMFS allocates the Chinook PSC limit among the pollock sectors and further apportions the inshore sector's allocation among the cooperatives as well as the CDQ allocation among the CDQ groups. Each sector's allocation 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 Chinook PSC limits 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 allocation 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)).

[30] 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).

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

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 allocation, 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 overage and bring the allocation 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.

3.1.2.2 Chinook Rolling Hotspot System

The RHS system for Chinook salmon avoidance is largely the same as that described for chum salmon in section 3.1.1.1. An important difference, however, is that the RHS system for Chinook salmon operates in the A and B pollock seasons. The Chinook Base Rate is calculated each week beginning on or near January 28th during the pollock A season and on or about July 1 during the B season. The Chinook Base Rate is determined to be the greater value of either 1) the average bycatch rate or 2) the rate of .035 Chinook salmon per mt of pollock. Preliminary data are used at the start of each fishing season (e.g., January 20 through January 29 in the A season) to determine the location and concentration of Chinook salmon, and to determine the initial Base Rate.

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 mt of pollock catch from the area during the prior week.

After identifying Chinook Bycatch Hotspots, RHS closure areas for Chinook 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.

3.1.3 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 vessels 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 industry reported data that 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.

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 10^{th} Chinook and 30^{th} 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.

3.2 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 fishery during the entire B season. "Overall" means chum salmon caught as bycatch from all genetic stock reporting groups would accrue to towards the limit starting on June 10.

The Council has indicated that its intent is for NMFS to allocate an overall chum salmon PSC limit under Alternative 2 option 1 and option 2 among the pollock sectors; the inshore sector's allocation would be further apportioned by cooperative and CDQ allocation among the CDQ groups (see 3.2.1.2). If or when an entity that receives a chum PSC allocation reaches their portion of the 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 enforcement action.

Option 2 of Alternative 2 is discussed in detail in section 3.2.2. Under option 2, the range of PSC limit values considered for analysis would be the same as those considered under option. However, a primary difference between option 1 and 2 of Alternative 2 is that an overall chum salmon PSC limit would be in place each year in the B season under option 1. Under option 2, an overall chum salmon PSC limit would only be in place, and potentially step-down (i.e., decrease), based on considerations of stock status for three WAK chum salmon river systems.

3.2.1 Option 1: Chum PSC Limit (Range to be Informed by PSC Data)

The Council directed staff to provide additional information to help it select a range of values for analysis as potential chum salmon PSC limits including chum salmon bycatch data by year from 2011 through 2022 as well as the 3-, 5-, and 10-year average levels of bycatch. The Council selected 2011-2022 as years for analysis because implementing regulations for Amendment 91 came into effect in 2011, at which point the pollock fleet's fishing behavior changed to further avoid salmon bycatch to respond 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 instead redistributed fishing effort to times when Chinook bycatch is expected to be lower (Stram and Ianelli 2015).

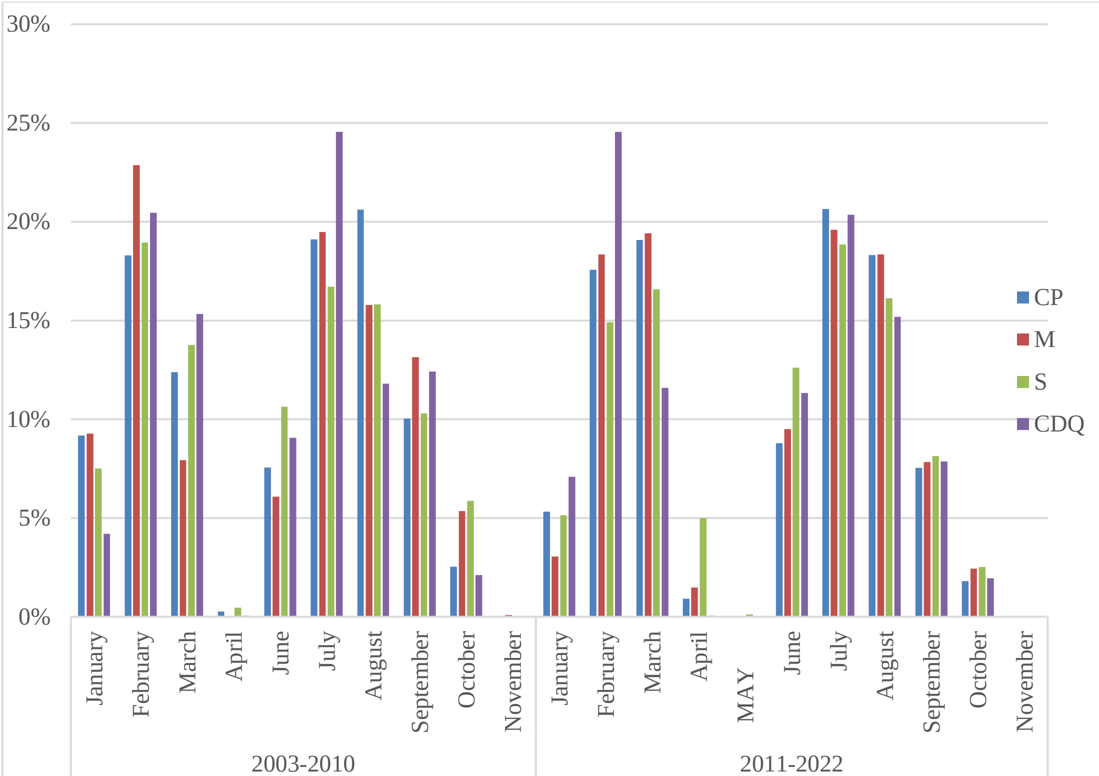


Figure 3-5 Average percent of Bering Sea pollock harvest by month and sector, broken out by pre- and post-implementation of Chinook bycatch limits in 2011 under Am. 91, 2003 through 2010 and 2011 through 2022

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.Table 3-1 provides the number of chum salmon caught as bycatch by each sector as well as the total number of chum salmon bycatch annually (2011-2022).

Table 3-1 B season chum salmon bycatch (number of chum salmon) by Bering Sea pollock fishery sector, 2011 through 2022

Year	*CDQ*	*CP*	*Mothership*	*Inshore*	*Total*
2011	3,758	44,299	24,399	118,861	191,317
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	43,262	144,882	339,236
2017	87,058	207,355	16,825	154,610	465,848
2018	26,586	99,447	21,303	147,369	294,705
2019	15,726	113,428	44,860	172,798	346,812
2020	8,582	77,138	19,743	237,632	343,095
2021	55,663	97,917	50,542	341,779	545,901
2022	6,365	71,786	32,262	131,896	242,309
Average	18,991	80,116	23,345	158,255	280,707

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(3-8-23)

Table 3-2 provides the 3-, 5-, and 10-year average levels of bycatch by sector as well as total (i.e., all sectors combined).

Table 3-2 3-, 5-, and 10-year average levels of B season chum salmon bycatch (number of chum salmon) by pollock sector, 2011 through 2022

Sector	*3- year avg. (2020-2022)*	*5-year avg. (2018-2022)*	*10-year avg. (2013-2022)*
CDQ	23,537	22,584	22,393
CP	82,280	91,943	91,516
Mothership	34,182	33,742	25447
Inshore	237,102	206,295	176,113
Total	377,102	354,564	315,449

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(3-8-23)

Future action by the Council to determine a range of numbers for analysis as chum salmon PSC limits can include a broader range of values than the 3-, 5-, or 10-year average values. Some considerations for the Council are as follows. An overall chum PSC limit may reduce chum salmon bycatch below historical levels, depending on the value(s) selected. For example, a relatively high PSC limit may not incentivize industry to minimize chum salmon bycatch below current levels in some (or many) years. On the other hand, a relatively low PSC limit could reduce chum salmon bycatch below historical levels, but it may also constrain pollock harvests in some (or many) years.

Additionally, an overall chum PSC limit 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%.

Table 3-3 provides the Council with a summary range of the bycatch levels in the B season pollock fishery. The values include the highest level of bycatch in 2021, the lowest level of bycatch in 2012, as well as the 3-, 5-, 10-, and 12-year average levels of bycatch.

Table 3-3 Summary range of B season chum salmon bycatch levels (number of chum salmon) in the Bering Sea pollock fishery B season, 2011 through 2022

Highest level of bycatch (2021)	545,901
3-year average (2020-2022)	377,102
5-year average (2018-2022)	354,564
10-year average (2013-2022)	315,449
12-year average (2011-2022)	280,707
Lowest level of bycatch (2012)	22,172

3.2.1.1 Ocean Temperature and Chum Salmon Bycatch Levels

The Council also directed staff to provide "potential ranges for average PSC levels during warm/cold years from 2011 through 2022" (April 2023). In general, this information could help determine whether there is a relationship between the magnitude of chum salmon bycatch and ocean temperature.[32] Changes in ocean temperatures may influence the spatial distribution of groundfish species like pollock as well as the distribution of chum salmon as they follow prey, typically up onto the Bering Sea shelf.

Table 3-4 provides the reader with a summary of the annual average sea surface temperature, bottom temperature, and the level of B season chum salmon bycatch (2011-2022, except for 2020 for bottom temperature data). Sea surface temperature data is collected by satellites. The data is linked to spatial management regions and provided by AKFIN (see Watson and Callahan (2021) for a comprehensive review of the methods used to automate operational access to sea surface temperature data). The NOAA-AFSC bottom trawl survey measures bottom temperature to determine the extent of the cold pool (bottom water temperature less than 2ºC).

Table 3-4 Number of chum salmon caught as B season bycatch, Bering Sea annual average sea surface temperature (degrees Celsius), and Bering Sea bottom temperature (degrees Celsius), 2011 through 2022

Year	*Chum salmon bycatch*	*Avg. Sea surface temp*	*Avg. Bottom temp*
2011	191,317	5.19	2.31
2012	22,172	4.30	0.83
2013	125,114	4.93	1.64
2014	218,886	6.67	3.02
2015	233,085	6.36	3.13
2016	339,236	7.74	4.21
2017	465,848	6.18	3.14
2018	294,705	6.85	4.15
2019	346,812	7.63	4.73
2020	343,095	6.34	No survey
2021	545,901	6.01	3.54
2022	242,309	5.29	2.9
Average	280,706	6.12	3.05

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(3-8-23), Chum_PSC_SST(5-22-23), NOAA-AFSC bottom trawl survey

[32] Other work demonstrates a relationship between where chum salmon bycatch occurs and sea surface temperature. In years with lower sea surface temperatures, the centroid of the mothership and inshore CV sector are further northeast in the Bering Sea on the shelf (Barry et al., 2023).

To analyze the relationship between the overall and average levels of B season chum salmon bycatch and ocean temperature, staff calculated the 25th, 50th, 75th, and 100th percentiles for the annual average sea surface and bottom temperatures in the eastern Bering Sea (2011-2022).[33] Staff then organized the sea surface and bottom temperature percentile values into ranges (25th, 25-50th, 50-75th, and 75-100th) to provide a way for the reader to compare the annual and average levels of bycatch that occurred within those temperature ranges. For example, the 25th percentile for annual average sea surface temperature is 5.26 ºC meaning there were three years or (i.e., 25% of the values) where the sea surface temperature was below 5.26 ºC. When the annual average sea surface temperature was at 5.26 ºC or lower, the average level of B season chum salmon bycatch was 112,868 fish and the overall level of bycatch ranged from 22,172 to 191,317 chum salmon.

Table 3-5 provides the percentile ranges of annual average sea surface temperature in the eastern Bering Sea, the corresponding level of B season chum salmon bycatch, the average level of B season chum salmon bycatch, and the associated years. Table 3-6 provides the same information for bottom temperature in the eastern Bering Sea.

Table 3-5 Percentile ranges of annual average sea surface temperature (25th, 25-50th, 50-75th, and 75-100th) and the corresponding range of B season chum salmon bycatch

Percentiles	*Sea surface temp (degrees Celsius)*	*Range of B season chum bycatch*	*Average level of chum bycatch*	*Years*
25%	5.26	22,172 - 191,317	112,868	2011, 2012, 2013
25-50%	5.26-6.30	242,309 - 545,901	418,019	2017, 2021, 2022
50-75%	6.30-6.71	218,886 - 343,095	265,022	2014, 2015, 2020
75-100%	6.71-7.74	294,705 - 346,812	326,918	2016, 2018, 2019

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(3-8-23), Chum_PSC_SST(5-22-23)

Table 3-6 Percentile ranges of annual average bottom temperature (25th, 25-50th, 50-75th, and 75-100th) and the corresponding range of B season chum salmon bycatch

Percentiles	*Bottom temp (degrees Celsius)*	*Range of B season chum bycatch*	*Average level of chum bycatch*	*Years*
25%	2.6	22,172 - 191,317	112,868	2011, 2012, 2013
25-50%	2.6-3.13	218,886 - 242,309	231,427	2014, 2015, 2022
50-75%	3.13-3.85	465,848 - 545,901	326,918	2017 and 2021
75-100%	3.85-4.73	294,705 - 346,812	505,875	2016, 2018, 2019

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(3-8-23), Chum_PSC_SST(5-22-23)

During the analyzed period, there does not appear to be a strong relationship between sea surface temperature and the level of B season chum salmon bycatch. Chum salmon bycatch was lowest during the years with the lowest annual average sea surface temperature (2011-2013). However, above 5.26ºC (i.e., the 25th percentile), the relationship is highly variable. For example, 2021 had the highest level of B season bycatch at 545,901 chum salmon but the annual average sea surface temperature was 6.01ºC. Conversely, B season bycatch levels were lower in 2014 and 2015 at the start of the marine heat wave

[33] A percentile is a number where a certain percentage of scores in a given range fall below that number. For example, the 25th percentile is the value at which 25% of the values in the range are below.

(218,886 and 233,085 chum salmon, respectively) while the annual average sea surface temperatures were above average at 6.67 ºC and 6.36ºC. 2016 and 2019 were the warmest years in the analyzed period with recorded temperatures of 7.74º and 7.63ºC but are not the years with the highest levels of bycatch.Figure 3-6 depicts the variable relationship between annual average sea surface temperature in the eastern Bering Sea and the corresponding level of B season chum salmon bycatch. B season bycatch is organized in ascending order from top to bottom (i.e., lowest level of bycatch to highest), and the corresponding annual average sea surface temperature is displayed to the right. The annual average sea surface temperature is color coded by percentile.

Year	Chum salmon bycatch	Annual average sea surface temperature
2012	22,172	4.30
2013	125,114	4.93
2011	191,317	5.19
2014	218,886	6.67
2015	233,085	6.36
2022	242,309	5.29
2018	294,705	6.85
2016	339,236	7.74
2020	343,095	6.34
2019	346,812	7.63
2017	465,848	6.18
2021	545,901	6.01

25th percentile

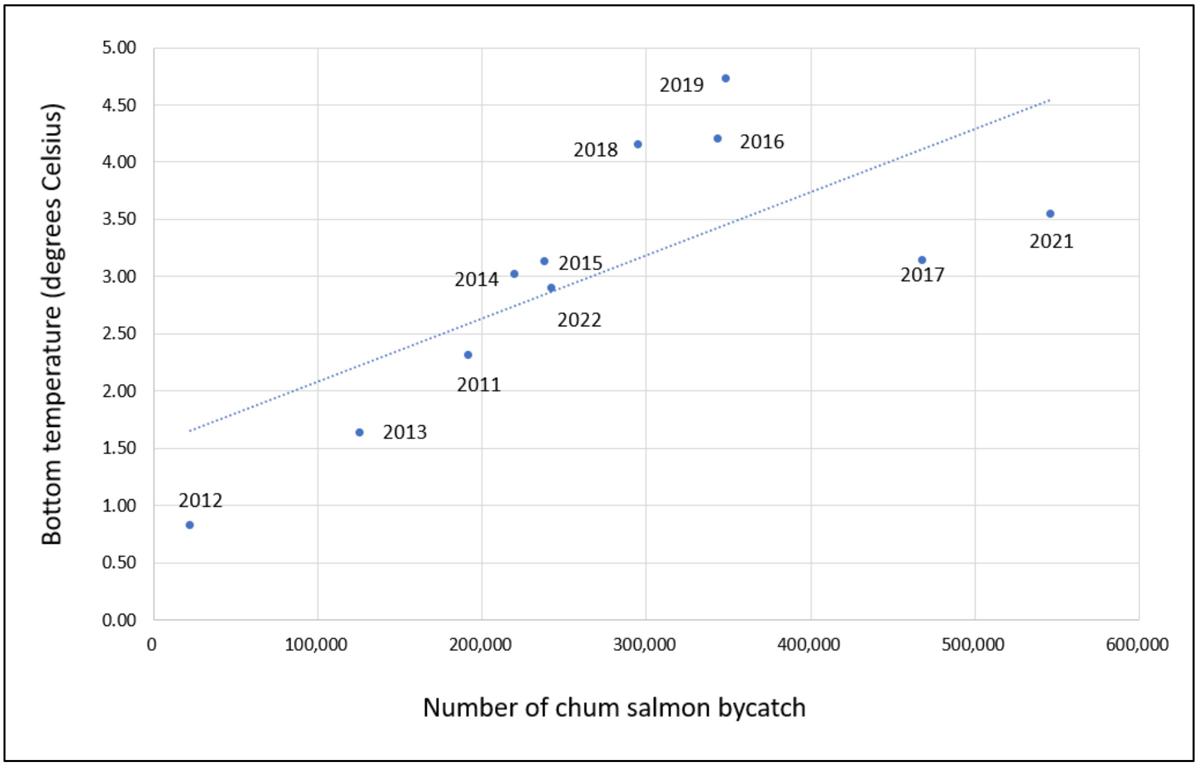
25-50th percentile

50-75th percentile

75-100th percentile

Figure 3-6 B season chum salmon bycatch in ascending order (low to high) compared to percentile ranges of annual average sea surface temperature (degrees Celsius), 2011-2022

In general, there appears to be a **positive linear relationship between the level of chum salmon bycatch encountered by the pollock fishery in the B season and the annual average bottom temperature**. Figure 3-7 captures this trend by showing the rate of B season chum salmon bycatch (number of chum salmon per 1,000 mt of pollock) against the annual average bottom temperature for each year from 2011 through 2022. In years with warmer bottom temperature, the level of chum salmon bycatch tends to be slightly higher. This could be due to chum salmon distribution shifts that result in greater overlap with the distribution of pollock (*J. Ianelli, personal communication*).



From 2011 through 2022 (excluding 2020 due to a lack of bottom trawl survey data), the annual average bottom temperature was 3.05ºC, ranging from a low of 0.83 ºC in 2012 to a high of 4.73 ºC in 2019.

Figure 3-7 **Number of chum salmon bycatch plotted against annual average bottom temperature in the eastern Bering Sea, 2011-2022**

Chum salmon bycatch levels increase under warmer conditions compared to colder conditions, although 2017 and 2021 had the highest level of bycatch but were not years with the warmest bottom temperature (Figure 3-8).

Year	Chum salmon bycatch	Annual Average bottom temperature
2012	22,172	0.83
2013	125,114	1.64
2011	191,317	2.31
2014	218,886	3.02
2015	233,085	3.13
2022	242,309	2.9
2018	294,705	4.15
2016	339,236	4.21
2019	346,812	4.73
2017	465,848	3.14
2021	545,901	3.54

25th percentile

25-50th percentile

50-75th percentile

75-100th percentile

Figure 3-8 B season chum salmon bycatch in ascending order (low to high) compared to percentile ranges of annual average bottom temperature (degrees Celsius), 2011 through 2022 except for 2020

If the Council would like to link chum salmon bycatch measures to ocean temperature, there are several related decision points to consider. Bottom temperature appears to be a better indicator of chum salmon bycatch levels year to year. However, the bottom trawl survey data used to collect bottom temperature data occurs during the summer months (June-August) and data is typically not available until September. There is a mismatch in the timing of when bottom temperature data would be available and the start of the B season pollock fishery which opens on June 10 each year. For management purposes, the relationship between bottom temperature and B season chum salmon bycatch could only be evaluated retroactively, and in-season management measures to minimize chum salmon bycatch would not be possible. Additionally, to move this forward, would require the Council to determine a threshold for what constitutes a warm or cold year. The relationship between the level of B season chum salmon bycatch and bottom temperature is driven by early years (2011-2013) in the analyzed period substantially which had substantially lower temperatures than other years. The Bering Sea is undergoing climatological shifts that are increasingly extreme and difficult to accurately predict, and what is determined to be a warm year currently could be a cooler year in the future. This dynamic could make it challenging to identify what would be an appropriate temperature threshold to use for management purposes.

3.2.1.2 Allocating the Chum Salmon PSC Limit

Under Alternative 2 (or Alternative 3), NMFS would issue allocations of the chum salmon PSC limit to the CP, mothership, inshore, and CDQ sectors. NMFS would further apportion the CDQ sector's allocation of the chum salmon PSC limit among the CDQ groups and the inshore sector's allocation among the cooperatives. The Council's April 2023 motion indicates that allocations of the chum salmon PSC limit could be based on historical bycatch numbers, but subsequent dialogue directed staff to also provide information on additional ways to allocate a chum salmon PSC limit including allocation percentages based on AFA pollock allocations by sector.

Allocating based on historical bycatch:

The chum salmon PSC limit could be allocated among each sector based on their historical levels of bycatch. For example, the Council could allocate the overall chum PSC limit based on each sector's 3-, 5-, and 10-year average level of bycatch (or some other approach using historical bycatch information).

If the Council allocated a chum PSC limit based on the 3-, 5-, or 10-year average levels of bycatch, the following allocation percentages would be applied:

a) 3-year average (2020-2022): 6% to the CDQ sector, 63% to the inshore sector, 9% to the mothership sector, and 22% to the CP sector.
b) 5-year average (2018-2022): 6% to the CDQ sector, 58% to the inshore sector, 10% to the mothership sector, and 26% to the CP sector.
c) 10-year average (2013-2022): 7% to the CDQ sector, 56% to the inshore sector, 8% to the mothership sector, and 29% to the CP sector.

Allocating based on AFA pollock allocations:

The Council could also allocate the chum PSC limit based on each sector's percentage allocation of pollock. Under this approach, 10% of the chum PSC limit would be allocated to the CDQ sector, 45% to the inshore CV sector, 9% to the mothership sector, and 36% to the offshore CP sector. (These pollock allocation percentages reflect the amount of pollock each sector is allocated of the directed fishing allowance.)

Table 3-7 **is for illustrative purposes only.** It depicts four different approaches to allocating a chum salmon PSC limit: allocating the limit in proportion to each sector's AFA pollock allocation, or based on each sector's 3-, 5-, and 10-year average historical level of bycatch. Table 3-7 provides the percent of the chum salmon PSC limit each sector would be allocated under the four approaches and the corresponding amount of chum salmon PSC based on a hypothetical PSC limit of 350,000 chum salmon; 350,000 chum salmon is the rounded 5-year average level of B season bycatch. To help the reader compare the four approaches, each sector's B season chum salmon bycatch is provided for 2020, 2021, and 2022. It is important to be clear that the analysts are not recommending a cap level but are instead providing the Council and the public an opportunity to conceptualize how a chum salmon PSC limit would be allocated at the sector-level and in what amount.

Table 3-7 Potential chum salmon PSC limit allocation percentages for each sector based on their AFA pollock allocation and 3-, 5-, and 10-year average historical level of chum salmon bycatch based on a hypothetical cap of 350,000 chum salmon compared to each sector's 2020, 2021, and 2022 B season chum salmon bycatch

Allocation approach	*CDQ*	*Inshore*	*Mothership*	*CP*
AFA	10% 35,000	45% 157,500	9% 31,500	36% 126,000
3-year avg.	6% 21,000	63% 220,500	9% 31,500	22% 77,000
5-year avg.	6% 21,000	58% 203,000	10% 35,000	5% 91,000
10-year avg.	7% 24,500	56% 196,000	8% 28,000	29% 101,500
2020 B season bycatch	8,582	237,632	19,743	77,138
2021 B season bycatch	55,663	341,779	50,542	97,917
2022 B season bycatch	6,365	131,896	32,262	71,786

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC; salmon_PSC(3-8-23)

Allocating using a pro-rata approach:

The Council could also consider allocating a chum salmon PSC limit using a pro rata approach that weights each sector's AFA pollock allocation and their historical average level of bycatch. The Council could make any determination of pro-rata combinations it wants, but a starting point for consideration could be a) 25% weighted to AFA allocation and 75% weighted to historical bycatch numbers; b) 50% weighted to AFA allocation and 50% weighted to historical bycatch numbers; or c) 75% weighted to AFA allocation and 25% weighted to historical bycatch numbers. A pro-rata approach could provide some balance, recognizing that different sectors have different fishing patterns and needs to harvest their AFA pollock allocation. To analyze this approach, staff would need to know the average level of bycatch that would be used and the weighting combination(s) the Council would like to see analyzed. (For example, 25% weighted to AFA allocation and 75% to the 5-year average level of bycatch.)

3.2.1.2.1 Apportioning the Chum Salmon PSC Limit Among Cooperatives and CDQ Groups

The Council has indicated its preference for NMFS to further apportion the CDQ sector's chum salmon PSC limit among the CDQ groups and the inshore sector's allocation among the cooperatives. **In addition to determining how to allocate the chum PSC limit among sectors (i.e., based on historical bycatch numbers, AFA pollock allocations, or some other approach), the Council would need to specify its preference for how NMFS would further apportion the PSC limit among the inshore cooperatives and the CDQ groups**. The Council is not limited in using the same approaches taken under Amendment 91 that established the Chinook PSC limit, but the analysis provides those apportionment methods directly below for the Council to consider.

Inshore cooperative 2022 pollock allocations
Akutan Catcher Vessel Assoc. (33.788%)
Arctic Enterprise Assoc. (0.000%)
Northern Victor Fleet Cooperative (10.773%)
Peter Pan Fleet Cooperative (2.512%)
Unalaska Fleet Cooperative (11.454%)
UniSea Fleet Cooperative (22.094%)
Westward Fleet Cooperative (19.380%)
Inshore Open Access (0.000%)

NMFS apportions the inshore sector's Chinook salmon PSC allocation among the inshore cooperatives and the inshore open access fishery based on the percentage allocations of pollock to each cooperative under 50 CFR 679.2(a). 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.

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 opening the fishery in January. There have been six inshore cooperatives in recent years. However, if a CV does not join an inshore cooperative it must fish in the inshore open access fishery. Additionally, CVs are free to change cooperatives, but a vessel may have to fish in the open access fishery to do so. 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*)). The number of CVs that have entered the inshore open access fishery has been consistently small, although there is an inshore open access fishery in 2023 with one CV participating (prior to 2023 the inshore open access fishery has not been open since 2011).

Under Amendment 91, NMFS allocates the CDQ group's Chinook salmon PSC allocation in proportion to their pollock allocation. The CDQ group's allocations have been in effect since 2005 as a result of amendments to the Magnuson-Stevens Act. The CDQ group's apportionments of the Chinook PSC limit are as follows: APICDA 14%, BBEDC, 21%, CBSFA 5%, CVRF 24%, NSEDC 22%, and YDFDA 14%.[34]

3.2.1.3 Transferability

The Council's April 2023 motion did not direct whether chum PSC allocations to each sector, inshore cooperative, or CDQ group would be transferable. Allowing chum PSC allocations to be transferable would provide vessels, cooperatives, and fishing sectors more flexibility to utilize their B season pollock allocation. The ability to transfer chum salmon PSC allocations could be implemented as part of either Alternative 2 or 3. As noted previously, the Council is not required to mirror prior approaches to establishing PSC limits, but it is worth noting that NMFS issues transferable Chinook PSC allocations to inshore cooperatives, CDQ groups, the CP sector, and mothership sector (see 50 CFR 679.21(f)(8)(i)). Chinook PSC can be transferred between sectors (i.e., inter-sector transfers) and among vessels within a cooperative (i.e., intra-cooperative transfers). To transfer Chinook PSC between sectors or between inshore cooperatives, an entity must submit a transfer request to NMFS either online via secure website or by paper filing. More information on how transfers of Chinook PSC work was provided in section 3.1.2.1.

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 prefer to 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. The amount of chum salmon PSC that would be allocated to each inshore cooperative, or open access fishery if applicable, would be determined each year after the inshore cooperative permit applications are received by NMFS on December 1.

3.2.2 Option 2: Weighted, Step-down PSC Limit Triggered by a Three-area Chum Index

The range of values the Council selects to be analyzed as an overall chum salmon PSC limit would be the same under option 1 and 2 of Alternative 2. As noted above, under option 1 of Alternative 2, the chum PSC limit would be in place each B season. Under option 2 of Alternative 2, a chum PSC limit would only be in place, and potentially step-down (i.e., decrease), based on considerations of stock status for three Western Alaska chum salmon river systems. The three systems that correspond with ADF&G salmon management areas evaluated under this option are Norton Sound, Yukon, and Kuskokwim. For this reason, the analysis hereafter refers to the index as a "3-area index."

The Council indicated that an index would be weighted to account for variance in chum salmon stock sizes across these river systems, and that their performance (i.e., the stock status for chum salmon) would be linked to **1)** overall abundance, **2)** whether Amounts Reasonably Necessary for Subsistence (ANS) are met, and **3)** whether escapement goals for chum salmon are met. The Council also requested that analytical staff work with ADF&G to determine the feasibility of this concept, and to provide suggestions for how best to weight or consider the three systems in conjunction with each other. The substance of those conversations and suggestions is captured below.

The following section of the analysis provides a consideration of the feasibility of option 2 Alternative 2, an overview of the information available that could be used to determine each river system's stock status (i.e., whether chum salmon returns are estimated to be a low or high abundance), and an estimate of when the data used to estimate WAK chum abundance in each area would be available because the Council would need to consider it in conjunction with its annual harvest specification process. An example of

[34] More information on the 2023 CDQ Program quota categories, target and non-target CDQ reserves, allocation percentages, and group quotas can be found here: https://www.fisheries.noaa.gov/s3/2023-04/2023annualmatrix.pdf

step-down PSC provisions based upon reaching identified thresholds by river system is also provided to illustrate how this index could be applied to a chum salmon PSC limit.

3.2.2.1 Feasibility of Concept and Data Availability

Use of a 3-area chum index appears to be feasible if the Council chooses to assess these areas independently. Each area would be treated as an individual “test” to determine whether chum salmon stock status is at low abundance. The corresponding management action in the pollock fishery’s B season (i.e., the step-down provisions) would scale to the number of areas that meet a threshold for low abundance. The individual test approach is preferable to summing the areas together under one index (as was done for Chinook salmon under the Three-river index (see Section 2.6.4 of Amendment 110 to the BSAI Groundfish FMP, NMFS 2015) for two primary reasons. First, there are limited run reconstructions for chum salmon 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). Second, treating each area as an independent test provides some proportionality among the river systems as their run sizes vary substantially. Each river system is described below with the relative information available for each system.

Yukon River: 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 (Table 3-8 and Table 3-9; Figure 3-9). The Council would need to decide whether to include both summer and fall stocks in the Yukon area’s portion of the 3-area index. 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. A revised genetic baseline now enables all Yukon summer stocks to be included in the Coastal Western Alaska reporting group and a standalone Yukon River fall chum reporting group. This approach to genetic differentiation more closely aligns with how these stocks are assessed and the estimates of abundance that are available.

It is recommended that the full run reconstructions for both the Yukon summer and fall chum runs be used. Similar to the use of run reconstruction datasets for Chinook salmon under the three-river index under Amendment 110, preliminary estimates may be available in early fall following the salmon season. These preliminary estimates include best estimates of subsistence harvest before the final subsistence harvest analysis is completed in late winter/early spring of the following year.

Table 3-8 Yukon River chum salmon summer run reconstruction index and whether ANS and escapement goals were met,1992 through 2022

Year	Yukon Summer Index (run reconstruction)	Currently established ANS Met (83,500–142,192)	Met or Exceeded All Current EGs(Anvik, EF Andreafsky and Drainagewide; based on currently used EG range)
1992	2,707,800	YES	100%
1993	1,786,500	YES	100%
1994	3,670,100	YES	100%
1995	4,295,000	YES	100%
1996	4,219,600	YES	100%
1997	1,654,200	YES	100%
1998	1,012,700	YES	100%
1999	1,142,800	YES	67%
2000	552,470	NO	0%
2001	541,970	NO	0%
2002	1,273,400	YES	100%
2003	1,259,000	NO	33%
2004	1,462,500	NO	100%
2005	2,760,000	YES	67%
2006	4,012,700	YES	100%
2007	2,154,700	YES	100%
2008	2,065,100	YES	100%
2009	1,698,400	NO	33%
2010	1,664,800	YES	100%
2011	2,405,800	YES	100%
2012	2,478,400	YES	100%
2013	3,346,100	YES	100%
2014	2,463,900	YES	67%
2015	1,974,300	YES	100%
2016	2,578,100	YES	67%
2017	3,627,300	YES	100%
2018	2,070,000	NO	33%
2019	1,682,200	NO	67%
2020	762,520	NO	100%
2021	154,370	NO	0%
2022	478,130	NO	0%

Sources: https://www.adfg.alaska.gov/FedAidPDFs/SP22-20.pdf https://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareayukon.subsistence_salmon_harvest https://www.adfg.alaska.gov/FedAidPDFs/SP22-20.pdf
Jallen, D. M., C. M. Gleason, B. M. Borba, F. W. West, S. K. S. Decker, and S. R. Ransbury. 2022. Yukon River salmon stock status and salmon fisheries, 2022: A report to the Alaska Board of Fisheries, January 2023. Alaska Department of Fish and Game, Special Publication No 22, Anchorage https://www.adfg.alaska.gov/FedAidPDFs/SP22-20.pdf

Table 3-9 Yukon River chum salmon fall run reconstruction index and whether ANS and escapement goals were met, 1992 through 2022

Yukon Fall Index (run reconstruction)	Currently established ANS Met (89,500–167,900)	Met or Exceeded All Current EGs(Drainagewide, Delta, Chandalar, Fishing Branch CA, Yukon Mainstem CA; based on currently used EG range)
568,652	YES	75%
473,535	NO	75%
1,109,572	YES	100%
1,611,534	YES	100%
1,141,115	YES	100%
707,279	YES	100%
351,957	NO	40%
419,480	YES	40%
252,942	NO	40%
374,885	NO	60%
427,969	NO	80%
792,025	NO	100%
653,216	NO	80%
2,180,488	YES	100%
1,211,273	NO	100%
1,160,101	YES	100%
857,269	NO	80%
598,277	NO	100%
587,091	NO	80%
1,238,091	NO	80%
1,085,700	YES	100%
1,211,909	YES	100%
954,769	YES	80%
823,653	NO	80%
1,389,062	NO	100%
2,288,383	NO	100%
1,112,834	NO	80%
801,614	NO	80%
184,233	NO	25%
95,249	NO	0%
242,480	NO	0%

Sources: https://www.adfg.alaska.gov/FedAidPDFs/SP22-20.pdf https://www.adfg.alaska.gov/CF_R3/external/sites/aykdbms_website/DataSelection.aspx https://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareayukon.subsistence_salmon_harvest https://www.adfg.alaska.gov/FedAidPDFs/SP22-20.pdf
Jallen, D. M., C. M. Gleason, B. M. Borba, F. W. West, S. K. S. Decker, and S. R. Ransbury. 2022. Yukon River salmon stock status and salmon fisheries, 2022: A report to the Alaska Board of Fisheries, January 2023. Alaska Department of Fish and Game, Special Publication No 22, Anchorage https://www.adfg.alaska.gov/FedAidPDFs/SP22-20.pdf

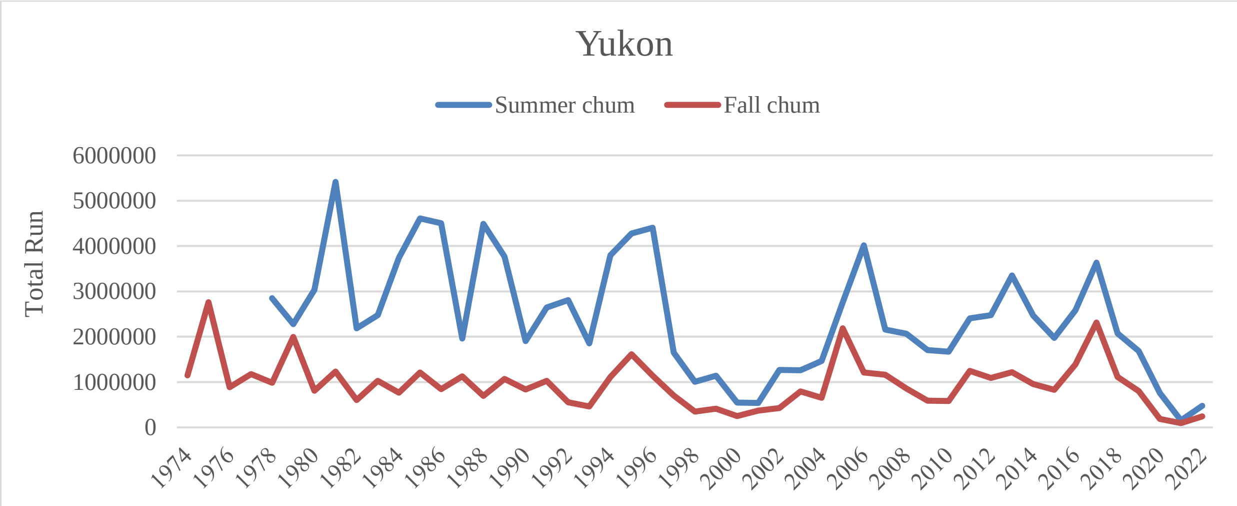


Figure 3-9 Yukon River summer and fall chum run reconstruction, 1974 through 2022

Kuskokwim River: **It is recommended to use the annual cumulative CPUE data from the Bethel Test Fishery for the Kuskokwim portion of the 3-area index because these data provide a reliable estimate of run abundance** (Table 3-10). Other sources of information are available to determine run abundance, but the Bethel Test Fishery CPUE data are more reliable for several reasons. These data are the only readily available information on total run abundance, and the Bethel Test Fishery CPUE data are less impacted by weather conditions (e.g., flooding) compared to weir assessment data. These data have also been independently confirmed through various assessments to provide a consistent indicator of relative run abundance. Bethel Test Fishery CPUE data are also used by salmon fisheries managers and the data is readily available to the public. Preliminary data from the Bethel Test Fishery CPUE is available in-season on the ADF&G website with a final version available shortly after the salmon season in various ADF&G published reports and online. This timing would align with the Council's consideration of the 3-area index in conjunction with its annual harvest specifications process each fall.

Table 3-10 Kuskokwim River chum Bethel test fishery CPUE and whether ANS and escapement goals were met, 1992 through 2022

Year	Bethel Test Fishery CPUE	Currently established ANS Met (41,200-116,400)	Met or Exceeded All Current Egs (Kogrukluk River; based on currently used EG range)
1992	3,057	YES	YES
1993	2,586	YES	YES
1994	4,801	YES	
1995	3,986	YES	YES
1996	8,256	YES	YES
1997	1,965	NO	NO
1998	2,337	YES	
1999	549	YES	NO
2000	2,599	YES	NO
2001	3,396	YES	YES
2002	6,798	YES	YES
2003	4,819	YES	YES
2004	5,248	YES	YES
2005	18,192	YES	YES
2006	13,927	YES	YES
2007	10,655	YES	YES
2008	6,749	YES	YES
2009	8,257	YES	YES
2010	7,655	YES	YES
2011	10,028	YES	YES
2012	6,894	YES	
2013	5,739	YES	YES
2014	6,345	YES	YES
2015	2,945	NO	YES
2016	3,998	YES	YES
2017	6,785	YES	YES
2018	8,205	YES	YES
2019	6,429	NO	YES
2020	1,443	NO	YES
2021	327	NO	NO
2022	2,191	NO	NO

Source: https://www.adfg.alaska.gov/FedAidPDFs/SP22-19.pdf
https://www.adfg.alaska.gov/FedAidPDFs/SP22-19.pdf

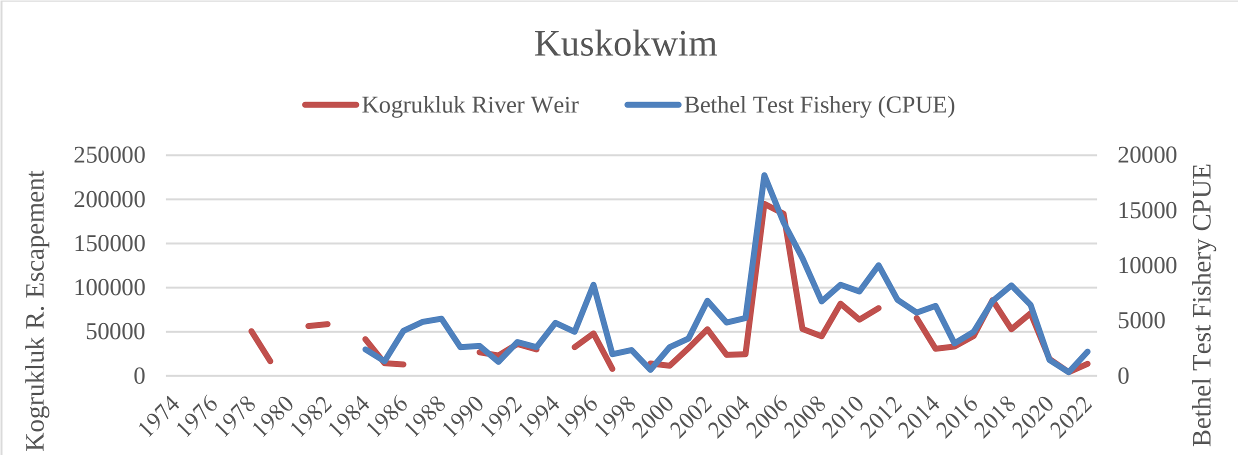


Figure 3-10 Kuskokwim River chum salmon: Bethel Test Fishery catch per unit effort (CPUE) and Kogrukluk River Weir

Norton Sound: The Council's April 2023 motion identified the Kwiniuk River as a candidate system to determine chum abundance for the Norton Sound region. Run reconstruction data are available for the Kwiniuk River through 2019 and could be used as an indicator of abundance for the Norton Sound region. However, the Kwiniuk River is only one of many Norton Sound rivers with a chum salmon run, and a run reconstruction from this single system may not be a consistently reliable indicator for the whole Norton Sound region. Additionally, the Kwiniuk River chum run reconstruction is not currently used by ADF&G for management, so ADF&G staff would have to conduct this analysis specifically to meet this request for the Council.

An alternative would be to use a standardized index constructed of escapements to five rivers in the area (Snake, Nome, Eldorado, Kwiniuk and North) that are consistently enumerated each year through weirs or counting towers as well as adding in the total Norton Sound harvest (commercial, sport and subsistence) (Table 3-11; Figure 3-11). Using a standardized index for the Norton Sound region based on these five rivers would be an approach that is more representative of the chum salmon returns across several management subdistricts within the Norton Sound region. Under this approach, the tributary escapements, commercial, sport, and subsistence harvest would be preliminary (not the final) estimates used to accommodate the Council's fall specification cycle. Preliminary escapement would be based on the total estimated chum salmon passage at each tributary assessment project, and the very small annual harvest that occurs upriver from the assessment locations would be ignored. Preliminary harvest would be informed by commercial fish tickets and ADF&G management staff expectation of subsistence and sport harvest based, in part, on historical trends, amounts of fishing opportunity provided, and observations of fishery participation. These preliminary data are available shortly after the salmon season, with final estimates for all components published in Annual Management Reports. Some consideration should be given to addressing missing data (such as recent 3 or 5-year average proportional contributions) should data to inform the index not be consistently available.

Table 3-11 Index of the sum of five Norton Sound Rivers Snake, Nome, Eldorado, Kwiniuk and North river weirs/towers escapement and total harvest) and whether ANS and escapement goals were met, 1997 through 2022 (data are incomplete for recent years)

Year	Minimum Standardized Index (Sum of Snake, Nome, Eldorado, Kwiniuk, North rivers weir/tower escapement and Total NS Harvest)	Kwiniuk River Run Reconstruction	Met or Exceeded Current EGs (Snake, Nome, Eldorado, Kwiniuk; based on currently used EG range - excludes Tubutulik because that system is rarely assessed)
1997	101,934	22,493	100%
1998	80,966	26,091	100%
1999	39,217	9,135	0%
2000	55,153	13,733	75%
2001	66,123	17,789	75%
2002	73,710	38,721	100%
2003	43,407	12,969	75%
2004	41,270	10,450	75%
2005	53,034	12,330	100%
2006	113,350	40,114	100%
2007	107,719	30,406	100%
2008	63,806	10,051	75%
2009	69,906	9,415	25%
2010	277,401	84,941	100%
2011	202,421	45,874	100%
2012	107,359	7,596	50%
2013	188,104	7,159	75%
2014	215,382	50,115	100%
2015	259,441	53,671	100%
2016	124,397	12,305	75%
2017	324,148	39,191	100%
2018	363,939	61,225	100%
2019	234,270	28,579	100%
2020	49,762	5,436	50%
2021	21,632	5,201	50%
2022	62,657	12,300	100%

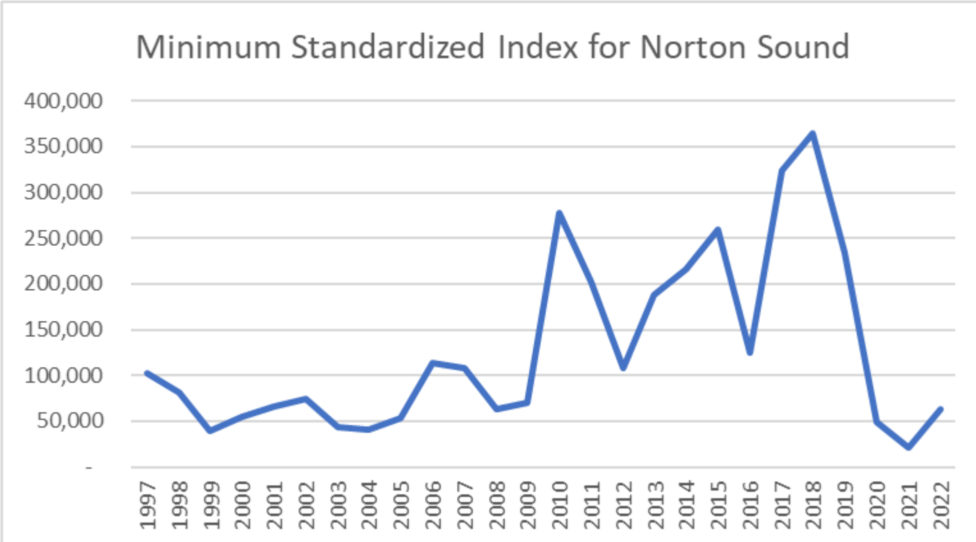


Figure 3-11 Minimum Standardized Index for the Norton Sound chum region (Sum of Snake, Nome, Eldorado, Kwiniuk, North rivers weir/tower counts and Total Norton Sound Harvest)

Other Western Alaska chum areas: **ADF&G staff do not recommend the inclusion of additional stocks for consideration of western Alaskan chum indices** for a variety of reasons. For example, Kotzebue chum salmon, while genetically distinguishable, lacks consistent escapement information; thus, the best indicator for these stocks is generally considered to be commercial harvest data. Bristol Bay chum salmon are primarily harvested incidental to the large sockeye fishery and as such escapements are not as diligently assessed across this broad system. Any index of Bristol Bay chum salmon would be largely based on commercial harvest data.

3.2.2.2 Criteria to Define Low Chum Abundance by Area

To move forward with option 2 of Alternative 2, the Council would need to provide input on several components related to establishing the 3-area index. **Specifically, the Council would need to establish the criteria that would be used to determine (or define) what constitutes low abundance in each area.** It is recommended that an overall determination for what constitutes low chum salmon abundance for each area be defined based on the available data for each area as indicated above. The Council has indicated it may be interested in considering additional criteria such as whether ANS or escapement goals are met. These additional criteria could provide additional context to help the Council determine the numerical thresholds they would like to use for each area, but it is not recommended the other criteria be used in isolation.

Historical abundance:

If the Council would like the 3-area index to be based on historical chum abundance in each management area, the Council would need to define a threshold – a number of chum salmon – for each area that defines low abundance. ADF&G does not have a specific number of chum salmon in each of the three management areas being considered that constitutes low abundance. As such, this is a determination for the Council. However, as noted above, it is recommended that a determination on historical chum abundance in each area be made using the sources of available data previously identified (e.g., full run reconstruction for Yukon River fall and summer chum, Bethel Test Fishery CPUE, and a standardized index of five rivers in the Norton Sound region).

To develop the criterion of low abundance, the Council would need to define the years from which average chum abundance would be estimated. The selection of the year set will greatly influence perceptions of what constitutes low and high chum abundance, and these perceptions of abundance may change into the future as more data are included in the time series. As the Council considers how to define the years to use for each area, it is important to note there may be different time series of information available by area. For example, the 15th percentile of one dataset may align well with how managers and stakeholders view a low abundance run in one area but may not align well with that perspective in another area - because the spread, historical patterns, and units of measure differ between the areas.

Amounts Reasonably Necessary for Subsistence:

ANS is a threshold for levels of harvest deemed reasonably necessary to support subsistence needs in a particular area (Table 3-12). The Board of Fisheries and Board of Game use Customary and Traditional Use Worksheets to determine whether a stock or population has been customarily and traditionally used in an area. If the Board gives a positive finding that a resource is customarily and traditionally used, an ANS amount is established, and management decisions as well as harvest opportunities are made with that range in mind. The ANS amount is set keeping in mind the sustained yield principle, and the amounts do not include salmon harvested from personal use permits or salmon retained from commercial fisheries for personal use. The Board of Fisheries has made positive ANS findings for chum salmon throughout the three areas being considered in this index (Table 3-13).

However, ANS is not a consistent metric across all areas. For example, the ANS determination for the Norton Sound region is based on all salmon and not chum salmon alone. Subsistence harvest data for some chum salmon stocks may be impacted by factors other than low run abundance in some years. For example, the Yukon River fall chum data shown in Table 3-9 demonstrate that there are years, such as 2017, with a relatively high level of chum returns (based on full reconstructions) for which ANS was not met. These patterns occur for a variety of reasons including ADFG’s historical management practices, nuances of the Pacific Salmon Treaty as it includes some negotiated escapement goals, changes in cultural and traditional use of salmon, among others.

Table 3-12 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

Escapement goals:

Table 3-13 provides a summary of chum salmon escapement goals for river systems across the Arctic-Yukon-Kuskokwim region. Achieving escapement goals for some chum stocks may be impacted by factors other than low abundance in some years. For example, again using the Yukon River fall chum data, two escapement goals on this system are associated with the Pacific Salmon Treaty and are therefore negotiated goals. These two goals are based on the best available data and consistent with sustained yield principles, but they do not necessarily conform to the same criteria that are used in establishing other escapement goals in this system. Escapements to the Fishing Branch on the Porcupine River (Canadian Yukon) have chronically been below what has been defined in treaty as an escapement objective, even when abundance for the rest of the fall chum salmon population is high. Additionally, some areas have more escapement goals than others – a criterion based only on escapement goals would lead to areas with fewer escapement goals to be more heavily influenced by one goal being met/not met. Generally, escapement goals across the AYK region are based on different criteria depending on data quality and type of goal (Sustainable Escapement Goal, Biological Escapement Goal, and Optimal Escapement Goals when established by the BOF).[35] As such, interpreting escapement goal performance requires context.

[35] More information on ADF&G's escapement goals can be found here: https://www.adfg.alaska.gov/index.cfm?adfg=sonar.escapementgoals#:~:text=Biological%20Escapement%20Goals%20(BEGs)%20and,sustained%20yields%20in%20the%20future.

Table 3-13 Chum salmon escapement goals and escapements for Arctic-Yukon-Kuskokwim Region (where applicable), 2012 through 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

Note: NA = data not available; NS = no survey; LB SEG = lower-bound SEG.

[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

[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.

Table 3-14 provides an overall summary of the types of available information by river system that could be considered to determine whether each area in the 3-area index is at low abundance.

Table 3-14 Summary of available information by area

	Yukon	Kuskokwim	Norton Sound
River systems included by area	Yukon River	Kuskokwim River	Standardized index for Snake, Nome, Eldorado, Kwiniuk, and North Rivers + total Norton Sound harvest
Historical abundance indices	Run reconstruction for fall and summer chum – total accounting of catch and escapement in the drainage	Bethel Test Fishery annual CPUE	Sport, subsistence and commercial harvests; select weirs, and counting towers.
ANS	Subsistence harvest information based on ANS Summer chum: 83,500-142,192 Fall chum: 89,500-167,900	Subsistence harvest information based on ANS Chum: 41,20-116,400	Subsistence harvest information based on ANS All salmon: 96,000-160,000
Escapement Goals	Summer chum: 3 escapement goals Fall chum: 5 escapement goals, 2 based on Pacific Salmon Treaty	2 chum escapement goals	5 chum escapement goals (1 per river system)

3.2.2.3 Council Considerations for Refining Alternative 2, Option 2, 3-area Index:

If the Council would like to move forward with using the 3-area index, it would need to provide input on several components prior to staff being able to conduct additional analysis. Staff have summarized the decision points before the Council at this stage below.

The Council would need to define a threshold (i.e., number of chum salmon) for each area that defines low abundance. Using the available information sources identified above – full run reconstruction estimates for summer and fall chum on the Yukon River, Bethel Test Fishery CPUE, and a standardized index from five rivers in the Norton Sound Area—the Council could determine a numerical value for chum salmon abundance. The Council would need to select a range of years and percentiles of average historical abundance for consideration. Potential year sets are provided directly below, and they are based on the information provided in Table 3-8 for Yukon River summer chum, Table 3-9 for Yukon River fall chum, Table 3-10 for chum salmon estimates from the Bethel Test Fishery CPUE, and Table 3-11 for chum estimates based on a standardized index of five rivers in the Norton Sound region. It is recommended the Council consider using a longer year set to determine historical abundance of chum salmon than that used for chum salmon PSC because 2011 through 2022 would be a short period to consider chum life history (chum salmon typically have a 5-year lifespan).

- Yukon summer and fall: 1978-2022 (Note that fall summer chum data is available from 1974 on, but as these seasonal runs would be summed together and summer chum run data is only available from 1978 on.)

- Kuskokwim: 1984-2022 (Bethel test fishery CPUE only)
- Norton Sound: 1997-2022 (Minimum Standardized Index (Sum of Snake, Nome, Eldorado, Kwiniuk, North rivers weir/tower escapement and Total NS Harvest)

In addition to a numerical value for historical chum salmon abundance, the Council could consider whether ANS and escapement goals are met as additional criteria to define low abundance for each area (as mentioned above). If the Council would like to use ANS and escapement goals as additional criteria, these indices could provide additional context to help determine what constitutes low or high chum salmon abundance by area. However, using these criteria in isolation is not recommended. This is because ANS and escapement goals may sometimes be influenced by factors other than chum salmon abundance in a given year or area.

If the Council would like to use ANS and escapement goals as criteria to provide additional context, it is important to note that evaluating whether or not ANS and escapement goals have been met would be relatively straight forward. However, it is less clear how the Council would use these criteria in addition to historical abundance indices for each area as they do not track well together. In other words, historical abundance indices for an area may be low (e.g., below average) but ANS and escapement goals are met. Thus, using the combined approach that considers ANS and escapement goals as criteria may provide additional context for decision-making, but determining the numerical threshold for each area that constitutes low chum abundance would be a somewhat subjective decision for the Council.

Some methods could be used to consider these potentially differentially trending information sources, one would be to use a risk table similar to that which is used for groundfish stock assessments in which considerations are scored separately within each category (e.g., stock assessment, fishery performance, …) with an overall score reflecting the scores across all individual categories. The second is that the Council could establish explicit criteria by which the ANS and escapement goals are assessed annually (i.e. ‘if ANS is not met, then…’ or ‘if all escapement goals are not met, then…’) such that ADF&G would provide an annual letter determining if the criteria by region was met (similar to the determination of the three-river index number annually for Chinook in October). The use of these additional criteria would need to be explicitly defined by the Council in refining this alternative for further analysis.

As noted above, the Council could use a 3-area chum index if the areas are assessed independently such that each area would be treated as an individual test for low abundance. **The Council would need to consider whether each area would be treated equally (i.e., assessed independently but weighted equivalently) or if the Council would prefer to prioritize modifying management measures due to low abundance by area.** Under the first approach, if any one area is determined to be at low abundance, then a step-down provision(s) would be implemented. Under the second approach, the Council could determine an area of priority whereby step-down provisions would only start to be implemented if the priority area was determined to be at low abundance.

As noted above, the allocation and apportionment considerations described under option 1 of Alternative 2 would apply under option 2 of Alternative 2 and are not repeated here. The range of values for consideration and analysis as chum salmon PSC limits would also be the same as those specified under option 1 of Alternative 2. However, the Council has indicated that under option 2 of Alternative 2, the chum PSC limit would be triggered by, and linked with, step-down provisions when one or more of the three areas representative of WAK chum salmon abundance (i.e., Yukon, Kuskokwim, or Norton Sound) fail to meet the thresholds specified for the index. As more areas fail to meet index thresholds, the chum PSC limit would become more restrictive in the B season.

To move forward with option 2 of Alternative 2, the Council would also need to consider what the step-down provisions would be. An example of how the chum salmon PSC limit could be triggered, and the associated step-down provisions, could work is shown below. It is important to note this example assumes each of the three areas are weighted equally, but this is a policy consideration for the Council. As more areas fail to meet their thresholds, the chum PSC limit would be progressively more restrictive, and the Council would need to determine what the appropriate PSC limit associated with each "step" would be.

a) if 3/3 areas are above index thresholds, no chum PSC limit implemented.
b) if 2/3 area are above index thresholds, the high point of the chum PSC limit values would be implemented.
c) if 1/3 areas are above index thresholds, the midpoint of the chum PSC limit values would be implemented.
d) if 0/3 areas are above index thresholds, the low point of the chum PSC limit would be implemented.

Again, this example assumes that each area is equally weighted in terms of whether they meet their respective thresholds. If the Council would like to weight river systems differentially then the criteria associated with the step-down provisions would need to be explicit by river system (i.e., 'if the Kuskokwim and the Yukon systems are above their thresholds but the Norton Sound does not, then…'). The Council must also determine the value of the PSC limit associated with each step of the step-down provision.

3.2.3 Observer Coverage, Monitoring Requirements, and Inseason Management

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. As mentioned in Section 3.1.3, PSC allocations 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 Amendment 91 also enable the same comprehensive monitoring by NMFS to monitor all salmon including non-Chinook PSC.

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. Additionally, while it would be difficult for an observer to intentionally misidentify a species of salmon as they collect scales for verification, a chum-only PSC limit could place additional pressure on observers working on a vessel or at a shoreside plant. As such, it is NMFS 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 OLE. 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.

3.3 Alternative 3 Bycatch (PSC) Limit for Western Alaska Chum Salmon

The Council's intent with Alternative 3 is that it would establish a PSC limit specifically for WAK chum salmon, as identified through genetic sampling. This is in contrast with Alternative 2 which considers an "overall" chum PSC limit to which all chum salmon bycatch would accrue. Alternative 3 would be similar to Alternative 2 in that it would apply to the Bering Sea pollock fishery in the B season. However, **Alternative 3 could not work as intended in the Council's motion in that pollock fishing would not cease if a PSC limit based on WAK chum was reached. It is not possible to manage a PSC limit specific to only WAK chum in-season 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 and reported to the Council in April of the following year (i.e., genetic stock reporting data from salmon caught as bycatch in the 2024 Bering Sea pollock fishery will be available in April 2025). This is discussed in detail below as are two different approaches the Council could consider to potentially reduce WAK chum bycatch with some kind of a "limit or threshold.

Under option 1 of Alternative 3, the values for the overall chum PSC limit and the allocation options to the individual pollock sectors would be the same as those described under Alternative 2, if the Council links the WAK chum salmon limit to the overall chum salmon PSC limit (this approach is described in detail below). That information is not included again here to streamline the analysis for the reader. Likewise, under option 2 of Alternative 3, the step-down provisions based on considerations of the stock status for three WAK chum salmon systems (Yukon, Kuskokwim, and Norton Sound) would be the same as option 2 of Alternative 2 and are not repeated here.

The genetic information used to determine the relative contribution of WAK chum in the total bycatch caught by the pollock fleet is annually estimated and presented to the Council each April (Barry et al. 2023).[36] 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, 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 bycatch is of Asian origin including both hatchery and wild fish.

Specific to the B season, the annual average chum salmon bycatch is 280,707 fish (2011-2022). On average over this period, 14.5% of the B season chum bycatch is attributed to the Coastal Western Alaska genetic stock reporting group and 3.2% is attributed to the Upper/Middle Yukon genetic stock reporting group (2011-2022). The 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 93,154 fish in 2017.

[36] Information on genetics research at the Alaska Fisheries Science Center and the salmon bycatch reports are available here: https://www.fisheries.noaa.gov/alaska/science-data/genetics-research-alaska-fisheries-science-center

Table 3-15 Total Chum salmon bycatch PSC in the Bering Sea pollock fishery B season compared to mean proportion and estimated number of chum salmon species (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	191,317	18.4%	35,169	17.3%	33,067	37.8%	72,250	1.5%	2,867	16.2%	30,964	8.9%	17,011	25.1%	47,975
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%	56,158	14.7%	18,327	14.8%	18,452	1.4%	1,751	18.1%	22,631	6.3%	7,781	24.4%	30,412
2014	218,886	37.4%	81,899	18.5%	40,556	23.6%	51,696	0.7%	1,445	17.7%	38,695	2.1%	4,552	19.8%	43,247
2015	233,085	17.5%	40,774	9.7%	22,601	51.4%	119,760	1.6%	3,728	16.0%	37,279	3.9%	9,087	19.9%	46,366
2016	339,236	30.5%	103,425	8.8%	29,841	34.9%	118,345	1.3%	4,408	19.3%	65,446	5.3%	17,972	24.6%	83,418
2017	465,848	46.1%	214,721	15.7%	73,126	15.0%	69,866	3.2%	14,905	14.0%	65,208	6.0%	27,946	20.0%	93,154
2018	294,705	49.0%	143,993	17.7%	52,014	12.4%	36,439	2.0%	5,877	15.4%	45,255	3.4%	9,991	18.8%	55,246
2019	346,812	39.2%	135,492	18.0%	62,216	22.9%	79,152	3.6%	12,443	15.9%	54,957	0.3%	1,037	16.2%	55,994
2020	343,095	31.9%	109,421	12.7%	43,563	42.5%	145,781	3.8%	13,035	8.0%	27,441	1.1%	3,773	9.1%	31,214
2021	545,901	55.7%	303,893	11.9%	64,692	20.6%	112,611	2.4%	13,176	8.9%	48,657	0.5%	2,854	9.4%	51,511
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	38.9%	109,438	13.9%	39,240	26.7%	75,002	2.4%	6,902	14.5%	40,892	3.2%	9,022	17.7%	49,914

Source: NMFS Alaska Region Catch Accounting System; Chum_BSAIBseason_2011_2022
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. For this reason, the sum of the estimated number of fish across columns is slightly less than the total bycatch column. It is not possible for geneticists to sample and identify stocks of origin for species other than chum in the non-Chinook category.

It is not currently possible for NMFS to manage a PSC limit that would only be specific to WAK chum bycatch in-season. NMFS and the catch accounting system cannot differentiate WAK chum from other genetic stock reporting groups and thus account for it because real-time genetic data are not available. However, the Council's goal is to minimize WAK chum salmon bycatch and staff considered two approaches for meeting this goal under Alternative 3 given the limitations for real-time genetic information availability.

Under both approaches considered by staff, any WAK chum PSC limit –hereafter referred to as a "WAK chum performance threshold"— considered by the Council in and of itself would not require directed fishing for pollock to cease in-season. Analytical staff intentionally chose to use the naming convention of a "performance threshold" opposed to a "PSC limit" for this reason, and because the pollock fishery's performance against the threshold could only be assessed retroactively.

1) Under the first approach, the Council could establish a stand-alone WAK chum performance threshold. To do this, the Council would need to determine the value of the WAK chum performance threshold (i.e., the number of WAK chum salmon not to be reached/exceeded). This value could be based on historical proportions of WAK chum PSC (i.e., 3-, 5-, or 10-year average) or some other approach.
2) Under the second approach, the Council could link the WAK chum performance threshold to an overall chum PSC limit (as in Alternative 2). The Council would need to determine the numerical value of the WAK chum threshold as in the first option. If the overall chum PSC limit were to be reached, directed pollock fishing must cease in-season as a result of that limit.

Under both approaches identified above, the pollock fishery's performance against the WAK chum performance threshold would be assessed the subsequent year, and only WAK chum salmon bycatch would accrue towards it. Both approaches could provide an opportunity for the Council, NMFS, the pollock industry, and the public to assess the pollock industry's performance at minimizing WAK chum in the overall bycatch. **If the Council would like to move forward with either approach, there are three primary decision points – What would be the numerical value of the WAK chum performance threshold? Does the Council want to link the WAK chum performance threshold to a management measure(s)? What would the management measure(s) be?**

3.3.1 Management Measures

If the Council would like to link management measures with the WAK chum performance threshold, those measures would be implemented retroactively when genetic analyses are available. The Council has indicated that, if the WAK chum performance threshold (referred to in the motion as a PSC limit) was exceeded for a number of consecutive years (e.g., 2 out of 5 years, 3 out of 7 years), the WAK chum performance threshold could be reduced in subsequent years. This type of approach may be feasible, but at this stage, the Council has not identified in-season management measures that would be aligned with exceeding the WAK chum performance threshold. As such, it is not clear what repercussions (if any) would be imposed if it was consecutively exceeded (annually, in 2 out of 5 years, etc.). If the Council intends the WAK chum performance threshold to incentivize pollock fishermen to avoid WAK chum salmon, the Council would need to determine what those management measures would be to reduce the number of WAK chum caught per year to remain under the WAK performance threshold.

3.3.2 Calculating a WAK Chum Performance Threshold

To calculate a WAK chum performance threshold from existing genetic proportions, some assumptions must be made about the relative expected proportion of WAK chum annually in the overall bycatch and the estimated uncertainty around those point estimates. The proportion of WAK chum is annually variable, and this point estimate has uncertainty surrounding it within each year that must also be considered. To illustrate this point, Table 3-16 provides the average proportional contribution of WAK chum stocks over the most recent 3-, 5-, and 10-year periods as well as the 95% credible interval over these average point estimates.

Table 3-16 Average proportional contribution of WAK chum stocks 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	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	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	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**

The Council could take two different approaches to calculating a WAK chum performance threshold. One approach is to select an average proportion of WAK chum based on genetic information and annually assess whether that proportion was exceeded. The second approach is to use the most recent proportion from the previous year to inform the performance threshold for the subsequent year (i.e., the proportion of WAK chum in the 2024 pollock fishery informs the 2025 WAK chum performance threshold). This second approach would likely introduce substantial inter-annual variability in the calculated threshold.

Table 3-17 is for illustrative purposes only. It depicts the second approach to calculating a WAK chum performance threshold based on a hypothetical overall chum PSC limit of 240,000 (the rounded value of the 2022 chum salmon bycatch). It demonstrates the inter-annual variability in the numerical value of a WAK chum performance threshold that could be expected under the second approach as the WAK chum performance threshold would have ranged from a low of 21,840 WAK chum in 2021 to a high of 60,240 WAK chum in 2012.

Table 3-17 Mean proportion of the WAK contribution to the overall genetic composition in the bycatch by year and a calculated WAK fishery performance threshold based on the previous season's mean proportion (e.g., 2011 mean proportion used to calculate the 2012 WAK threshold) based upon an illustrative overall cap of 240,000 chum salmon PSC

Year	*Mean WAK proportion*	*WAK threshold*
2011	25.10%	n/a
2012	21.20%	60,240
2013	24.40%	50,880
2014	19.80%	58,560
2015	19.90%	47,520
2016	24.60%	47,760
2017	20.00%	59,040
2018	18.80%	48,000
2019	16.20%	45,120
2020	9.10%	38,880
2021	9.40%	21,840
2022	23.00%	22,560
2023	n/a	55,200

One way to stabilize the threshold annually is to select a range of years over which the proportion would be averaged. For example, as shown in Table 3-16, a 3-year (13.8%), 5-year (15.3%) or 10-year (18.5%) average would result in a static threshold of 33,120, 36,936 and 44,400, respectively (noting that this does not accommodate the uncertainty in the estimate). The WAK chum proportion could also be calculated on a rolling year basis, but this might provide some perverse incentives to drive up the contribution from WAK rather than incentivize the fleet to decrease it.

Some considerations for the Council are as follows. If the set proportion of WAK chum is established as 20%, based on either an average proportion over a set number of years (e.g. Table 3-16) or the previous year's estimate (e.g. Table 3-17) and the overall chum PSC limit is 240,000 (the rounded value of the 2022 chum salmon bycatch), then no more than 48,000 WAK chum would be expected to be. If, however, 230,000 overall chum PSC were taken (thus the overall chum PSC limit of 240,000 was not reached) but the realized proportion of WAK chum was actually 25% in that year, then the realized WAK chum taken in that B season would have been 57,500 fish. In this scenario, the WAK chum performance threshold would have been exceeded but not the overall chum PSC limit. As noted above, the Council would need to determine what, if any, the management measures would be and how they would be applied to the Bering Sea pollock fishery.

In sum, decisions for the Council related to establishing a WAK threshold include a) whether the WAK chum performance threshold would exist as a standalone measure or be linked with an overall chum salmon PSC limit; b) what the WAK chum performance threshold would be based on (i.e., whether to use a single point estimate or to smooth the variability by using an average over a range of years); c) how the uncertainty in the point estimate or the average over a number of years would be treated; and d) what (if any) consequences there would be for exceeding the WAK chum performance threshold in a given year (or over a range of years), including when (if implemented) the overall chum salmon PSC limit was not reached.

In addition, option 2 of Alternative 3 includes consideration of a weighted, step-down framework that is triggered by a 3-area chum index. As described in this section, the possibilities for instituting a WAK-specific limit would be to allocate a WAK chum performance threshold either as a standalone measure or as a measure implemented in proportion to an overall chum PSC limit. Therefore, similar to option 2 of Alternative 2, the WAK chum performance threshold would decrease in size in a stepwise fashion if the Council were to choose an option for step-down provisions based on the stock status for three Western Alaska chum salmon systems. If the Council chose to include both an overall chum PSC limit and a WAK chum performance threshold within a step-down framework, the Council would need to identify both types of values for each step. Additionally, based on the Council's current motion, it is staff's understanding that the WAK chum performance threshold would be allocated to different entities (i.e., fishery sectors, CDQ groups, and inshore cooperatives).

3.3.3 Observer Coverage, Monitoring Requirements, and Inseason Management

As noted above, NMFS and the catch accounting system cannot account for WAK chum in the total chum salmon bycatch in real-time because real-time genetic data are not available. Therefore, the monitoring to collect data on salmon bycatch under status quo would remain the same under Alternative 3 and enable the census count of all salmon taken as bycatch in the Bering Sea pollock fishery. Salmon would be counted and identified by observers onboard vessels or at shoreside processing plants at the species level. Genetic samples would be collected to determine the relative contribution of Western Alaskan chum PSC. But the genetic information would not be available until after the fact.

3.4 Alternative 4 Additional Regulatory Requirements for IPAs to be Managed by either NMFS or the IPAs

Alternative 4 would establish new regulatory measures to prioritize avoidance of WAK chum, which could be managed by either NMFS or under the IPAs. Options 1 and 2 under Alternative 4 are not mutually exclusive to one another, and both options could be implemented in conjunction with Alternative 2 or Alternative 3.

Option 1 of Alternative 4 would require a "chum salmon reduction plan agreement" be implemented in the B season to prioritize avoidance in genetic cluster areas 1 and 2 for a specified amount of time when two triggers are met. The two triggers that would be used to determine whether additional measures to prioritize avoidance of WAK chum 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).

Option 2 of Alternative 4 would require the IPAs to use the most refined genetics information available to further prioritize avoidance of areas and times with the highest proportion of WAK chum.[37] Option 2 would add a new provision to the current salmon bycatch IPA regulations at 50 CFR

[37] The Council's motion states, "Western Alaska chum and Upper/Middle Yukon chum stocks," but as stated earlier in this analysis, the combined WAK reporting group includes Coastal Western Alaska and Upper/Middle Yukon chum stocks.

679.21(f)(12)(iii)(E) and the IPAs would be required to implement measures that meet the intent of the provision.

The Council directed staff to work with industry and IPA representatives to compile ideas for additional management measures that could be implemented under the IPAs for option 1 and 2 of Alternative 4. The substance of staff's conversations with industry and IPA representatives is captured in the text below.

3.4.1 Option 1: Require a Chum Salmon Reduction Plan Agreement

The Council prioritized avoidance in genetic cluster areas 1 and 2 because the majority of chum salmon bycatch has historically been encountered in genetic cluster area 1 (followed by genetic cluster area 3), and the proportion of WAK chum in the overall bycatch has historically been higher in genetic cluster areas 1 and 2 compared to other areas (Barry et al., 2023). Figure 3-12 shows the spatial distribution of chum salmon bycatch in the 2022 B season pollock fishery. ADF&G groundfish statistical areas are represented by smaller boxes which are highlighted by genetic cluster area and embedded within the larger NMFS reporting areas. The total salmon bycatch is denoted with circles overlapping ADF&G groundfish statistical areas, and the size of the bycatch is relative to the overall size of the circle. In 2022, 63% of the total B season chum salmon bycatch was caught in genetic cluster area 1, 12% in genetic cluster area 2, 19% in genetic cluster area 3, and 6% in genetic cluster area 4; the highest bycatch is denoted by the largest circle and is attributed to ADF&G statistical area 645501. The spatial distribution of the 2022 B season bycatch is fairly typical with observed spatial patterns in prior years.

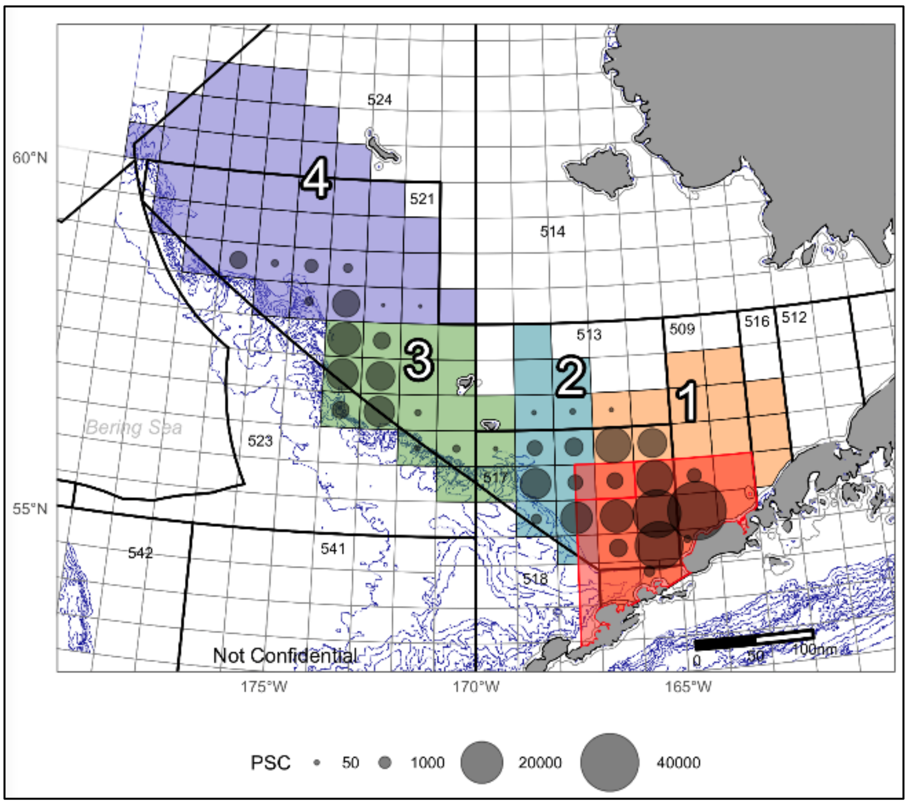


Figure 3-12 Spatial distribution of chum salmon bycatch caught in the 2022 B season pollock fishery by genetic cluster areas 1 through 4 with bathymetry lines and the CVOA highlighted in red

Figure 3-13 shows the genetic stock proportions of the chum salmon bycatch encountered in the 2022 Bering Sea pollock fishery East and West of 170 degrees Longitude. Chum salmon from the Northeast (NE) Asia and Southeast (SE) Asia reporting groups are encountered in larger proportions West of 170 degrees West longitude (i.e., genetic cluster areas 3 and 4) compared to WAK chum salmon which are encountered in higher proportions East of 170 degrees West Longitude (i.e., genetic cluster areas 1 and 2). This is a consistent pattern observed in the chum salmon bycatch over time.

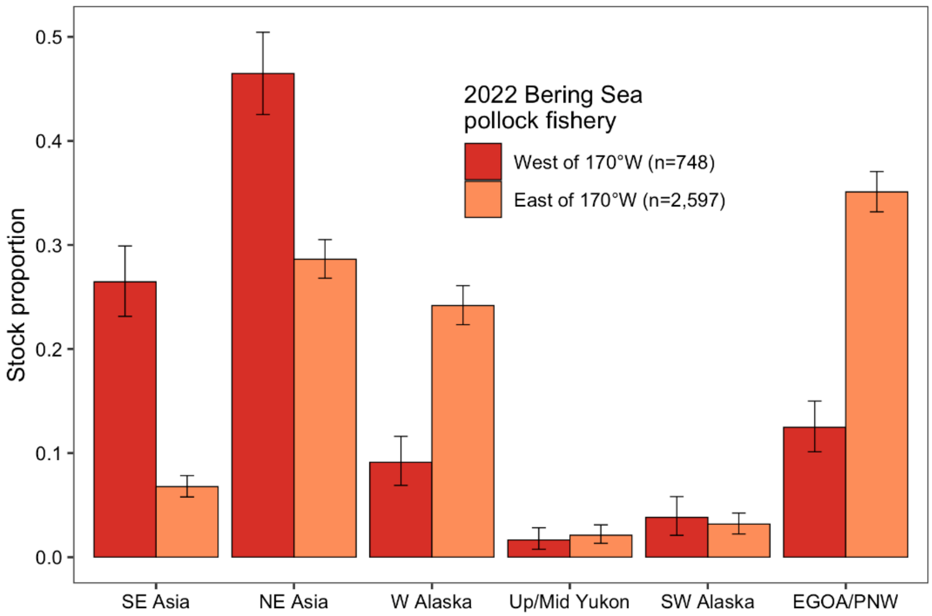


Figure 3-13 Proportions of the genetic stock reporting groups East and West of 170 degrees West longitude in the 2022 chum salmon bycatch

Source: Barry et al., 2023. Genetic Stock Composition Analysis of Chum Salmon from the Prohibited Species Catch of the 2022 Bering Sea Walleye Pollock Trawl Fishery, Preliminary Report**.**

3.4.1.1 Determining the Managing Entity

At this stage, the main decision point that determines how option 1 of Alternative 4 would work is whether the additional management measures under a chum salmon reduction plan agreement would be managed by NMFS or under the IPAs. "Avoidance" is understood to imply some form of area closure to redistribute pollock fishing effort away from genetic cluster areas 1 and 2 when chum salmon bycatch rates are determined to be high as is the proportion of WAK chum salmon. NMFS and the IPAs would be able to "prioritize avoidance" in genetic cluster areas 1 and 2 using very different approaches, namely static versus dynamic area closures.

If the Council determines the additional chum avoidance measures under option 1 of Alternative 4 should be managed by the IPAs, a new regulatory provision would be added to implementing regulations at 50 CFR 679.21(f)(12)(iii)(E) for the salmon bycatch IPAs. The IPAs would be required to implement measures that meet the Council's intent as (would be) specified in regulations. As a result of the Council's request (April 2023), industry and IPA representatives have put forward two potential measures that could be implemented when both triggers are met. These two measures would modify the current RHS system for chum salmon, which is described in detail in section 3.1.1.1.

One potential measure that could be implemented under the IPAs (when both triggers are met) to further emphasize chum salmon avoidance is to lower the Base Rate floor. The Base Rate is a chum salmon bycatch rate (number of chum salmon per mt of pollock) that is used as a starting point to determine candidacy for a RHS area closure. The Base Rate fluctuates throughout the B season – it is set at 0.19 or 0.20 for the first three weeks of the B season. Thereafter, the Base Rate is updated weekly based on a rolling three-week average chum salmon bycatch rate. The Base Rate floor is a minimum value that also varies throughout the B season – it is set at 0.19 or 0.20 during the months of June and July, at 0.50 in August, and 1.00 in September and October. Sea State will compare the bycatch rate of an ADF&G statistical area to either the calculated Base Rate or the Base Rate floor to determine candidacy area closures.

Some considerations for the Council related to this first potential measure are as follows. Lowering the Base Rate floor could increase the likelihood that a RHS closure area for chum avoidance would be implemented (although it would depend on relative fishing effort, fishing location, and chum salmon abundance/encounters on the pollock grounds). However, catching more chum salmon (or having a higher chum salmon bycatch rate) does not necessarily mean the proportion of WAK chum in the overall bycatch is higher (and vice versa). For example, in 2021, the B season chum salmon bycatch was 545,901 fish and in 2022 it was 242,309 fish. The estimated mean proportion of the 2021 bycatch attributed to the WAK stock reporting group was 9.4% (51,511) whereas the 2022 estimated mean proportion attributed to the WAK stock reporting group was 23.0% (55,724). Additionally, moving the fleet to avoid chum salmon could cause more spatial overlap with other bycatch species such as Chinook salmon. Moving the fleet to areas that may have lower pollock catches could mean it would take the fleet longer to harvest their allocations and extend the B season later in the year when Chinook have historically been more prevalent on the grounds.

A second potential measure that could be implemented under the IPAs (when both triggers are met) is to increase the size of RHS closure areas East of 168 degrees West longitude. Under the status quo, the combined sizes of all chum salmon closure areas East and West of 168 are limited to 3,000 square miles and 1,000 square miles in June and July, respectively. During August, September, and October, the combined sizes of all chum salmon avoidance areas east and west of 168 are limited to 1,500 square miles and 500 square miles, respectively. It is unlikely that increasing the count of closures that could be issued during any week would lead to additional WAK chum avoidance (currently the IPAs have a limit of four area closures not to exceed 4,000 square miles in June and July and 2,000 square miles in August-October). This is because it is very uncommon for four or more ADF&G statistical areas to be above the Base Rate during any week, unless vessels are fishing at the intersection of the four statistical areas. In this scenario, one closure could be issued over four statistical areas (*Sea State, personal communication*).

In contrast to how the IPAs could manage dynamic closure areas under the RHS system, NMFS must post a notice in the Federal Register to open or close a fishing area. This process typically takes seven days, but it can be slower as the Federal Register is not open on weekends or holidays. Prior to the notice of issuing an opening or closure, the documents submitted by NMFS inseason branch must also be reviewed by NOAA General Counsel NOAA Headquarters. Chum salmon bycatch rates could substantially change on the pollock fishing grounds in the time it takes NMFS to issue a management action to open and close specific fishing areas.

If the Council were to prefer NMFS to manage the additional measures under a chum salmon reduction plan agreement, it is not clear what the measure(s) would be, and the Council would need to provide input on its preference for additional measures. It would be not possible for NMFS to manage the additional measures put forward by IPA representatives as NMFS would not be able to replicate RHS system as NMFS does not, and would not, be able to manage dynamic area closures. However, some type of a static area closure in genetic cluster area 1 or 2 to prioritize avoidance of WAK chum may be feasible.

If the entity responsible for setting the trigger values is:	*Then the entity responsible for managing measures could be:*	*The additional management measures would be:*
IPA	IPA	Lower Base Rate floor and expand closure area size East of 168 degrees West longitude
Council	IPA	Lower Base Rate floor and expand closure area size East of 168 degrees West longitude
Council	NMFS	Unknown but a static area closure would be possible

Figure 3-14 Summary of options for the entity determining trigger values and responsible for implementing management measures under a chum salmon reduction plan agreement as well as potential additional measures

3.4.1.2 Determining the Triggers for a Chum Salmon Reduction Plan Agreement

To move forward with option 1 of Alternative 4, the Council would also need to determine the entity responsible for setting the trigger values, either the Council or the IPAs. If the Council would like NMFS to manage additional measures to prioritize WAK chum avoidance, the Council would need to determine what the numerical values for each trigger would be.

If the Council determines the IPAs should manage the additional avoidance measures under a chum salmon reduction plan agreement, the Council is not required to determine the numerical trigger values that the IPAs would use. The RHS system is an industry-led program managed under private contractual agreements. The Council did not establish the Base Rate floors or determine how the Base Rate would be calculated. Rather, those rates were agreed upon by parties to a private contract. Thus, it would be consistent with previous decisions for the Council to decide the IPAs could determine the numerical values for each trigger.

However, the Council can decide it would like to set the numerical values for the triggers, and have the IPAs manage the additional measures to prioritize avoidance of WAK chum salmon. In this case, the numerical values for the triggers would be incorporated as a provision in regulations at 50 CFR 679.21(f)(12)(iii)(E). This approach might give the Council, NMFS, and the public some assurance in how a chum salmon reduction plan agreement would work. However, adding specificity to the provisions in Federal regulation provides very little flexibility for IPA participants to revise contract provisions to respond to new information or consider better methods on an annual basis to minimize bycatch without a regulatory amendment. It is difficult to define exactly what the line is between providing necessary detail in regulations to ensure the IPAs meet the Council's objectives while providing the IPAs enough flexibility to make improvements the programs and incentives without requiring regulatory amendments.

The Council has specified **the first trigger** would be an established bycatch rate. Table 3-18 provides an overview of the historical chum salmon bycatch rates in the B season by sector as well as the bycatch rates for the fishery as a whole (i.e., all sectors combined). The average B season chum salmon bycatch rate for the pollock fishery is 0.38 chum per mt of pollock. In most years, the inshore sector has the highest B season bycatch rates (exceptions include 2016 and 2017).[38]

Table 3-18 Chum salmon bycatch rate (number of chum salmon per mt of pollock) in the B season pollock fishery by sector and fishery total for all sectors combined, 2011 through 2022

Year	CP	Mothership	Inshore	Total
2011	0.22	0.37	0.40	0.28
2012	0.01	0.02	0.06	0.03
2013	0.04	0.06	0.33	0.17
2014	0.21	0.12	0.43	0.29
2015	0.15	0.20	0.50	0.30
2016	0.49	0.61	0.41	0.43
2017	0.65	0.25	0.45	0.62
2018	0.35	0.32	0.43	0.39
2019	0.45	0.66	0.50	0.45
2020	0.31	0.30	0.73	0.49
2021	0.43	0.76	1.01	0.73
2022	0.38	0.60	0.50	0.41
Avg.	0.31	0.36	0.48	0.38

Source: NMFS Alaska Region Catch Accounting System; bycatchrate_sector_period

Table 3-19 provides information on the chum salmon bycatch rates by genetic cluster area in the early and late period of the B season pollock fishery (2011-2022). The early period includes all statistical weeks less than or equal to calendar week 33 and the late period includes all weeks after week 33. The average bycatch rate is highest in genetic cluster area 2 during the late period at 0.90 chum per mt of pollock, followed by genetic cluster area 3 during the late period at 0.61 chum per mt of pollock (see Table 3-19). Overall, bycatch rates tend to be higher in the late period across all genetic cluster areas.

An explanation for this pattern is the decrease in pollock fishing effort during the late period, meanwhile the number of chum salmon caught as bycatch is relatively similar in the early and late period across genetic cluster areas. For example, in 2022, the pollock fishery caught 77,393 chum salmon as bycatch in genetic cluster area 1 and 635,292 mt of pollock in the early period (the bycatch rate is 0.122 chum per mt of pollock); in the same year/genetic cluster area, the pollock fishery caught 74,960 chum salmon as bycatch and 62,178 mt of pollock in the late period (the bycatch rate is 1.205 chum per mt of pollock). One notable exception to this trend occurs in the early period in genetic cluster area 2 in 2021 which is the highest bycatch rate in the analyzed period at 2.281 chum per mt of pollock (270,760 chum/118,680 mt pollock).

[38] CDQ and CP sectors are combined.

Table 3-19 Chum salmon bycatch rates (chum per mt of pollock) by genetic cluster area in the early and late period B season pollock fishery, 2011 through 2022

	Cluster area 1		*Cluster area 2*		*Cluster area 3*		*Cluster area 4*	
	Early	**Late**	**Early**	**Late**	**Early**	**Late**	**Early**	**Late**
2011	0.15	0.58	0.07	0.35	0.08	0.25	0.13	0.07
2012	0.02	0.27	0.00	0.14	0.00	0.11	0.00	0.00
2013	0.24	0.84	0.04	0.47	0.01	1.17	0.01	0.03
2014	0.09	0.51	0.34	1.10	0.10	0.44	0.04	0.41
2015	0.11	0.95	0.04	0.70	0.05	1.05	0.04	0.12
2016	0.18	0.53	0.09	0.68	0.23	0.40	0.05	0.81
2017	0.23	0.15	0.95	0.48	0.31	0.24	0.26	0.41
2018	0.12	0.18	0.92	1.82	0.80	0.64	0.01	0.05
2019	0.11	0.48	0.27	0.65	0.89	0.19	0.02	0.87
2020	0.02	0.73	0.16	2.14	0.03	1.39	0.05	0.38
2021	0.38	0.08	2.28	0.25	0.06	0.61	0.01	0.06
2022	0.12	1.21	0.10	1.98	0.04	0.78	0.02	0.92
Avg.	0.15	0.54	0.44	0.90	0.22	0.61	0.05	0.34

Source: NMFS Alaska Region Catch Accounting System; ChumRates_YrTempGrp

The Council has specified **the second trigger** is a proportion of WAK to non-WAK chum salmon. Table 3-20 provides the estimated mean stock proportions for WAK and non-WAK chum salmon by genetic cluster area in the early period and Table 3-21 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 3-20 Estimated mean proportion of WAK and non-WAK chum salmon bycatch in the early period of the B season Bering Sea pollock 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%	0.0%	-
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%	0.0%	-
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%	15.0%	68.4%	13.4%	69.9%	6.6%	35.1%

Source: NMFS Alaska Region Catch Accounting System; SpatioTemp_Chum_prelim2011-2014_pub2015-2021)2022unpub-2
Notes: Hyphens are used to denote absent values due to non-estimable sample sizes available.

Table 3-21 Estimated mean proportion of WAK and non-WAK chum salmon bycatch in the late period of the B season Bering Sea pollock 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%	10.7%	72.6%	14.5%	77.2%	4.2%	70.8%

Source: NMFS Alaska Region Catch Accounting System; SpatioTemp_Chum_prelim2011-2014_pub2015-2021)2022unpub-2
Notes: Hyphens are used to denote absent values due to non-estimable sample sizes available.

3.4.1.3 Applying the Triggers

How the triggers would be applied depends on whether additional measures prioritizing WAK chum avoidance in genetic cluster areas 1 and 2 would be managed under the IPAs or by NMFS. An example of how the triggers would be applied under the IPAs to determine whether the additional measures would be implemented is as follows.

In the 2025 B season, IPA managers would monitor chum salmon bycatch rates (as done under the status quo) in an area (e.g., cluster area 1 and 2).

- Did the chum salmon bycatch rate in the area exceed the numerical value set for trigger 1?
  - If yes, then IPA managers would look at whether the genetic proportion of WAK chum in that area exceeded the numerical value of trigger 2 in the 2024 B season.
- Did the proportion of WAK chum in the 2024 B season in the area exceed the numerical value set for trigger 2?
  - If yes, then additional chum salmon avoidance measures would be in place.
  - If no, then no additional avoidance measures in place, but the RHS system under the status quo would be in place.

While the prior year's genetic stock composition may not be a perfect indicator of where WAK chum will be the next year, the historical genetic information that is updated annually is currently the best information available to estimate where WAK chum may show up on the pollock fishing grounds. Thus, the intent is for industry to prioritize WAK chum avoidance each year while working with the constraints of having genetic data that is lagged by a year.

Staff are unable to provide a clear example of how the triggers could be applied if the additional measures were to be managed by NMFS (because staff does not know what these measures would be). In general, the triggers would not be applied by NMFS in the same way as the IPAs as NMFS would not be able to issue dynamic area closures.

3.4.1.4 Additional Information Required to Analyze Changes to the IPAs

The Council asked staff to provide a summary of the additional information necessary to analyze the IPAs. The information needed to qualitatively analyze the additional management measures that would be implemented under the IPAs for a chum salmon reduction plan agreement, regardless of whether the IPAs or the Council determine the trigger values, is as follows. Staff would need to know the bycatch rate that would be used (trigger 1), the proportion of WAK to non-WAK chum salmon that would be used (trigger 2), the new Base Rate floor, the new size of the spatial area closures East of 168 degrees West Longitude, whether bycatch performance against the triggers would be assessed in genetic cluster area 1 and 2 as individual areas (i.e., treated as spatially separate) or together, and the specified amount of time these new measures would be in place.

If the Council decides the trigger values should be set by the IPAs, staff are looking for the Council to provide additional direction on how this information should be provided. The Council could either a) direct staff to work with industry and IPA representatives to describe these elements of the chum salmon reduction plan agreement and qualitatively analyze their impacts in the Initial Review Analysis, or b) direct industry to provide a proposal to the Council outlining these elements of the chum salmon reduction plan agreement prior to Initial Review or at Initial Review. If the Council were to direct industry to provide a proposal to the Council prior to Initial Review, analytical staff would need the proposal at least one Council meeting in advance of Initial Review (e.g., no later than the February 2024 Council meeting if Initial Review is scheduled for the April 2024 Council meeting) to analyze the proposal.

Staff would be limited to a qualitative analysis of the measures put forward by the IPAs for a chum salmon reduction plan agreement because it is not possible for staff to simulate the closures implemented by Sea State with the same level of sophistication. Sea State uses VMS data to identify where the pollock fleet is fishing as well as which hauls have high level of bycatch. At the same time, Sea State is actively communicating with the fleet while they are on the fishing grounds (*Sea State, personal communication*). CVs make multiple hauls in a single trip and Sea State is able to work with captains to isolate the haul(s) in a trip which was likely to have higher bycatch. Sea State is able to isolate areas at a finer spatial scale than ADF&G statistical areas to implement a closure based on haul-level data. RHS closures involve active communication with the fleet and subjective decision-making to a degree that staff would not be able to replicate. Staff would qualitatively analyze and describe the potential impacts in terms of WAK chum salmon avoidance, potential interactions with Chinook, and fleet behavior.

3.4.2 Option 2: Utilizing Refined Genetics Information to Avoid WAK Chum

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.

Regulations require the IPAs to include a description of how the agreement “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” (see 50 CFR 679.21(f)(12)(iii)(E)(*7*)). The IPAs currently comply with this regulatory requirement using different tools in the RHS system for chum salmon avoidance. For example, larger closure areas may be implemented East of 168 West Longitude (up to 3,000 sq. nm) during the months of June and July and the Base Rate is lowest in June and July to match patterns of when and where WAK chum salmon are more likely to be on the pollock grounds, based on historical genetic information. Specific details on how the IPAs could respond to additional regulatory requirements to use the most refined genetic information available were not provided at this time.

Alternative 4, option 2 is not substantially different from the status quo except that it would implement additional regulatory requirements for IPAs to currently (and in the future) utilize the most refined genetic information to avoid WAK chum salmon bycatch.

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Appendix 1 Western Alaska Chum Salmon Stock Status

The following chum salmon stock status overview was prepared by ADF&G staff. 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 and other areas of larger rivers where upwellings provide oxygen to support egg survival as well as in small streams and some intertidal zones. Unlike some other salmon species, such as Chinook, sockeye (*Oncorhynchus nerka)*, or coho (*Oncorhynchus kisutch)*, juvenile chum salmon spend minimal time in fresh water and migrate downstream to estuaries and the ocean shortly after emerging. Juvenile chum salmon tend to feed on small invertebrates while immature chum salmon 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 before returning to their natal stream to spawn, with longer times spent in the ocean being more common in northern populations.

Chum salmon have historically been abundant throughout Western Alaska rivers. 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 support regionally important commercial, sport and subsistence fisheries although chum salmon are typically not targeted in this region's sport fisheries. Chum salmon traditionally constitute the majority of subsistence salmon harvest in the region and have supported the most northerly commercial salmon fishery in Alaska, Kotzebue Sound. In the more interior communities of the larger river systems, Chinook, coho, and chum salmon are the only salmon species available.

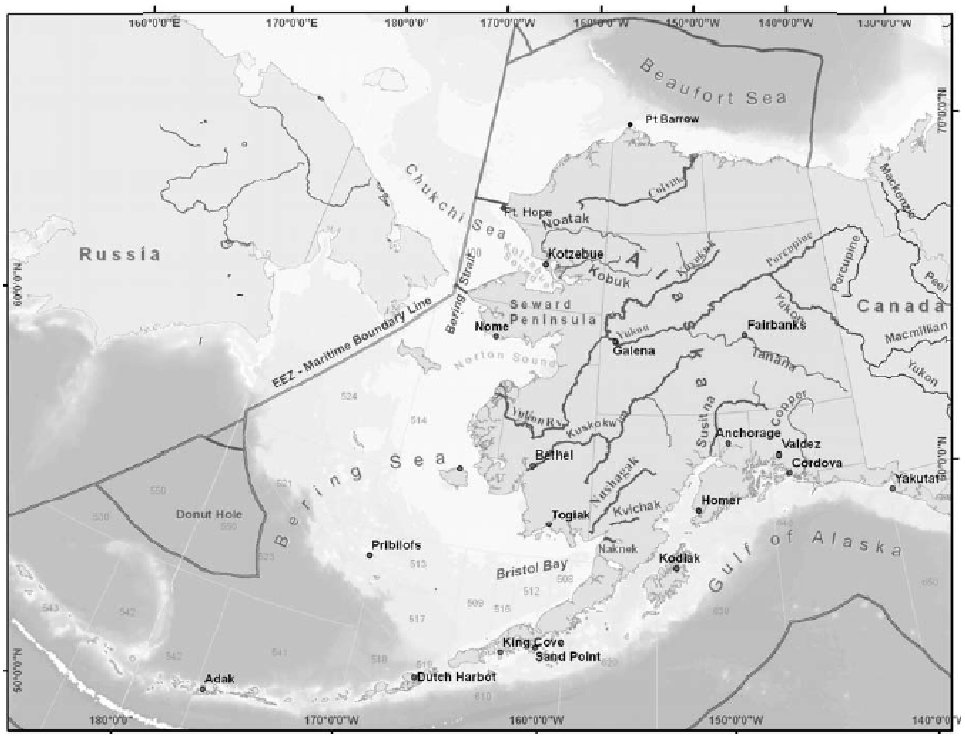

Figure A1 1 Map of the Bering Sea and major salmon producing rivers

Western Alaska Chum Salmon

Beginning in 2020, Western Alaska chum salmon runs declined dramatically, with run sizes similar to those observed in the previous record poor runs of 2000. These run declines have resulted in restrictive management actions on commercial, recreational, and subsistence harvests of chum salmon. In 2020, all Western Alaska areas had chum salmon run sizes below recent year averages and many were some of the lowest in the historical dataset (Table A1 1). 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. 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 the 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.

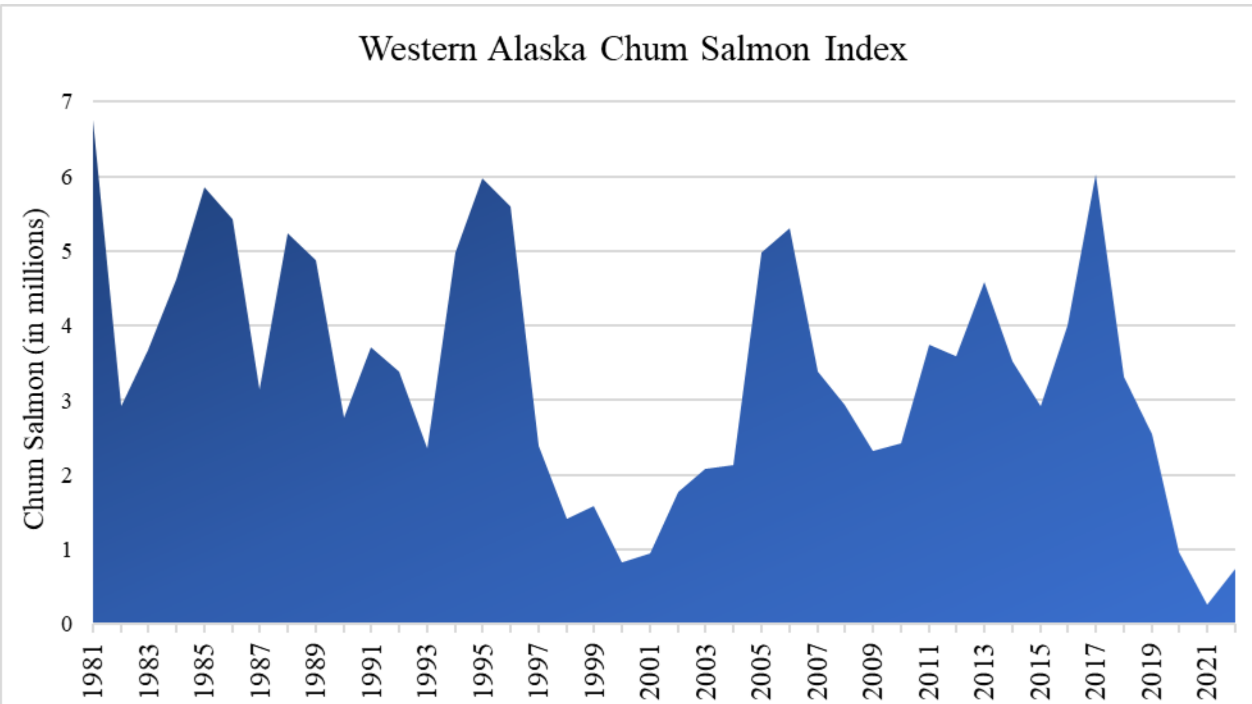

Figure A1 2 Chum salmon index abundance estimates for Western Alaska stocks

Notes: This is a summed index of abundance for those WAK stocks where the abundance is consistently measured across the time series. This index includes Yukon River summer and fall chum salmon, Kogrukluk River Weir, and Kwiniuk River information.

Western Alaska chum salmon abundance decreased further in 2021 across all areas (Table A1 2). An index of Western Alaska chum salmon abundance indicates the 2021 run size was roughly one-third as large as the previous record poor abundance observed in 2000, by far the poorest abundance in the time series. 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 Bay areas; and sport chum salmon fishing on the Kuskokwim River.

In 2022, most Western Alaska chum salmon abundance indices increased slightly from 2021 but an index of Western Alaska chum salmon abundance shows 2022 was still the second lowest abundance in the time series. 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 A1 3). 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.

Western Alaska chum salmon abundance information for 2023 is still preliminary as fisheries and run assessment projects are ongoing. In-season information on the 2023 Yukon River summer chum salmon run indicates that it is larger than the 2021 and 2022 runs, which allowed for limited subsistence fishing opportunities.

Table A1 1Summary 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	No	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.

Table A1 2 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	No	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.

Table A1 3 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[d]	Yes
Kuskokwim River	Below average	1 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.

[d] No processor operating in the area.

In most of Western Alaska, the 2020 through 2022 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, 1978-2022, with a combined summer and fall chum salmon run size under 250,000 fish.

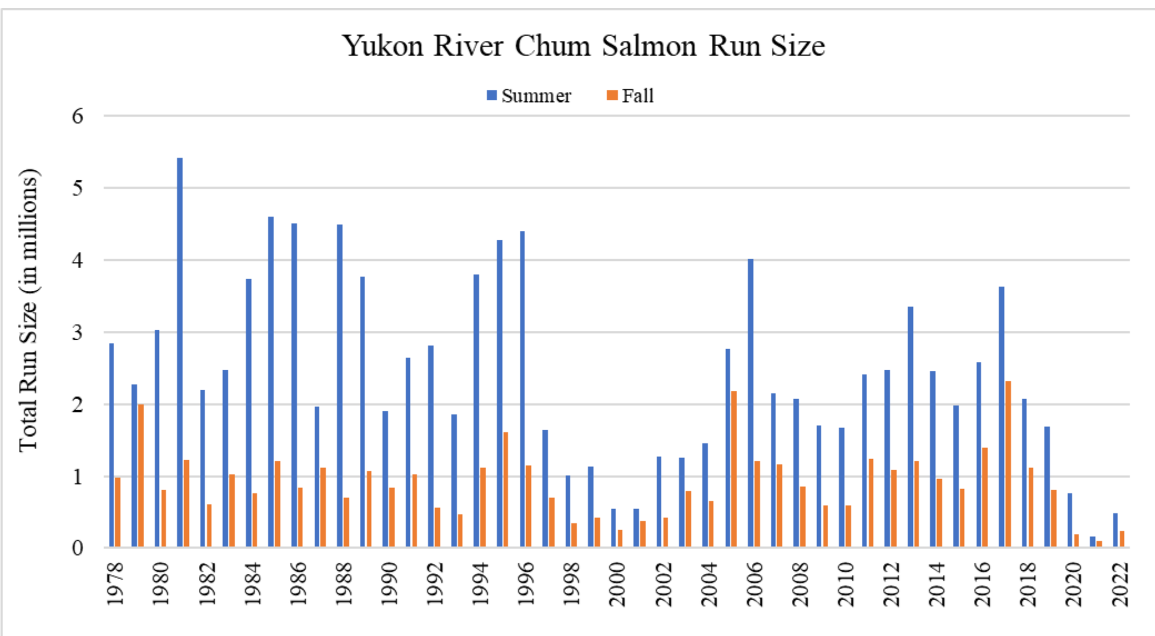

Figure A1 3 Yukon River chum salmon run size, 1978-2022. Source: Bayesian run reconstructions provided by ADF&G on August 4, 2023

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.

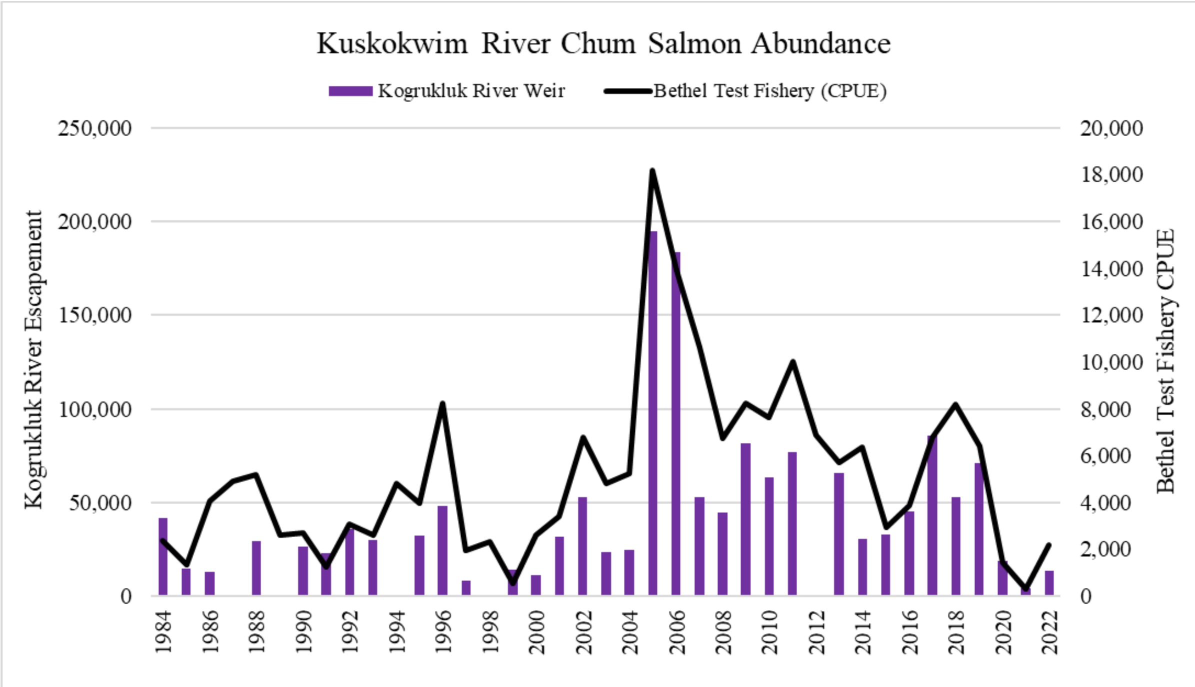

Figure A1 4 Kuskokwim River chum salmon. Kogrukluk River weir escapement and cumulative CPUE from the in-river Bethel test fishery, 1984-2022

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. In 2020, escapement goals were met on the Eldorado River and the Nome River. In 2021, escapement goals were met on the Snake River and Eldorado River; no escapement estimate was made for the Nome River. 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. Despite this different historical trend, the estimated 2021 Kwiniuk River chum salmon abundance was the poorest in the 1981-2022 time series (Figure A1 5).

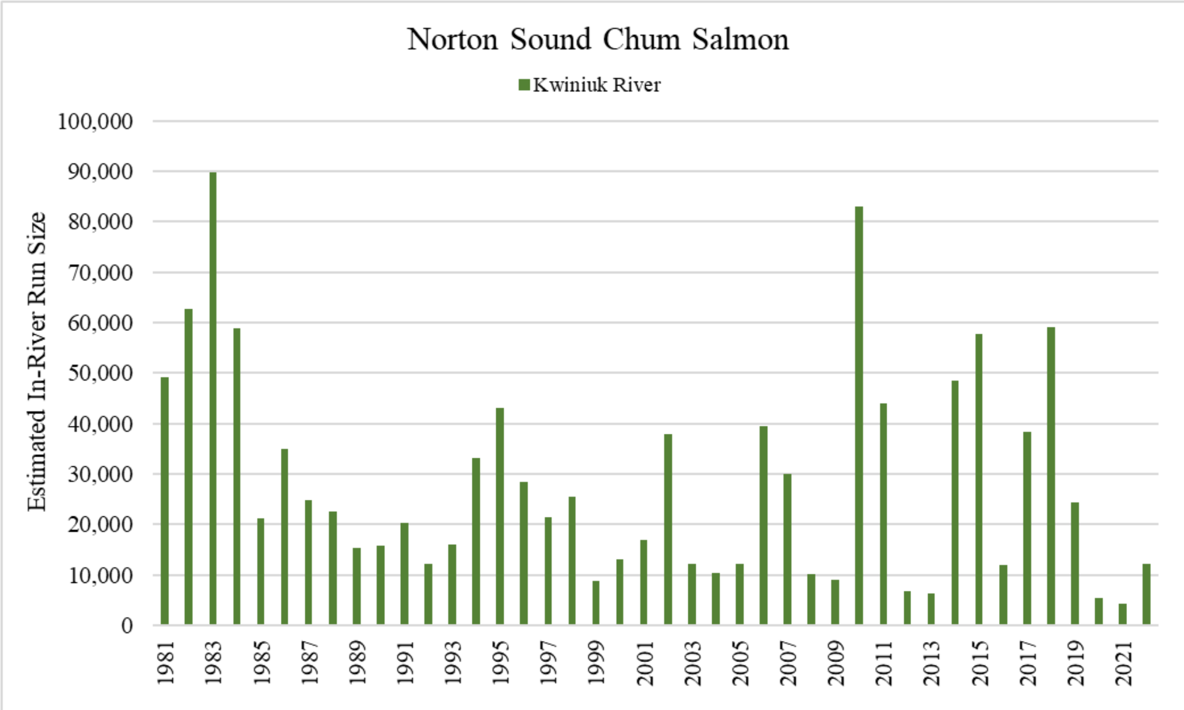

Figure A1 5 Estimated Kwiniuk River chum salmon run size, Norton Sound, 1981-2022

Appendix 2 Causes of Chum Salmon Decline

The Council requested staff provide "a summary of research and Traditional Knowledge (TK) that can be gathered to understand all of the causes of the population decline" (April 2023). Because this information request was made in conjunction with the Council adopting a Purpose and Need statement and an initial set of alternatives to minimize WAK chum bycatch, staff have focused on summarizing available research and TK related to chum salmon declines across WAK. However, it is worth noting that chum salmon populations have shown decline in all regions of the North Pacific within the past three to five years including Canada, Japan, Russia, Korea, Alaska, and across the Pacific Northwest (Munro, 2023).

Approach

Staff used multiple data bases to identify sources of western scientific information including Scopus, Web of Science, Google Scholar, and various websites focused on Pacific salmon to collect relevant sources of information. The search terms "decline western Alaska chum salmon," "decline salmon Alaska," "decline chum salmon" were used to generate results. Book chapters, reports, and bulletins were also reviewed.

Staff also used the Local Knowledge (LK), Traditional Knowledge (TK), and Subsistence (collectively LKTKS) search engine to identify sources of social science information based on LK and TK with a focus on WAK chum salmon. This search engine contains scientific articles in peer-reviewed journals, white papers, archival references, and other sources of information related to LK, TK, the social science of LK and TK, and subsistence information. Analytical staff prepared a compendium of sources on the social science of LK and TK in response to the Salmon Bycatch Committee's request for information at its March 2023 meeting. That Compendium is not reiterated here but is available to the Council and the public here.

As noted above, the information sources compiled for this paper are primarily focused on WAK origin chum salmon. It is important to note there are a relatively limited number of written sources of western scientific information and the social science of TK to explain the causes of chum salmon declines across WAK, specifically. In part, this may be explained by a greater prioritization on research funding to understand the causes in Chinook salmon declines across WAK (and elsewhere) due to Pacific Salmon Treaty obligations. Additionally, TK is most often shared orally and an absence of written sources of information based on TK does not mean it does not exist (for example, the Council may receive LK or TK in public testimony describing the causes of WAK chum declines).

Summary of Causes of Chum Salmon Stock 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). 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. Early marine survival is known to be critical and positively associated with growth and adult returns (Healey, 1982; Kondzela et al., 2016; Murphy et al., 2019; Farley Jr et al., 2020). 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. Decreased prey availability, and lower quality prey items (e.g., eating more jellyfish as lipid rich prey items are unavailable), negatively impact WAK chum salmon that rear in the Bering Sea (Deeg et al., 2022; Mustonen & Van Dam, 2021; Myers et al., 2016; Urawa et al., 2016;)[39].

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).[40] WAK chum salmon had high marine mortality in years with unusually cold 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 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 n 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 has 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.

Estuarine early-life is a critical period and **size-specific predation** is thought to be a contributor to high natural mortality during this time. Mortality during early estuarine life is high and appears size dependent, indicative of an ontological shift from shallow, nearshore habitat to pelagic, food limitations, and size-selective predation (Healey, 1982; Helle & Hoffman, 1995; Hillgruber & Zimmerman, 2009). In the AYK region, Chum salmon juveniles are found in estuaries from approximately early May through September during which their diet is variable but often consisting of epibenthic and neustonic prey in estuarine habitat then switching to pelagic prey once migrating out to more open water or waters with higher salinity (Hillgruber & Zimmerman, 2009). Differences in diet during this early marine life varies by location and size of fish with juveniles consuming calanoid and harpacticoid copepods, neustonic prey such as winged

[39] Howard, Kathrine. Western Alaska Chinook and Chum Salmon Marine Research. 2022. Available at: https://meetings.npfmc.org/CommentReview/DownloadFile?p=3a0643f9-e99e-451e-bc4a-96848c3cc26d.pdf&fileName=PPT%20D1a%20WAK%20Chinook%20and%20Chum%20Salmon%20Marine%20Research.pdf

[40] 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

insects, mysids, chironomid larvae, and terrestrial insects (Hillgruber & Zimmerman, 2009). Changes to nearshore ecosystems may occur due to climate change. Environmental and ecosystem changes may have dramatic effects on juvenile survival in the early marine life stage (Hillgruber & Zimmerman, 2009).

Additional 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 survival of eggs and young chum 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 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 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 along rivers, 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 in 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).

Declines in Other Regions:

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 both freshwater and 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. Typical densities of chum were observed after the circulation resumed its normal pattern in 2012. This change in circulation is thought to have shifted distribution and composition of chum salmon prey items (Khen & Zavolokin, 2015). 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).

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 overarching role of the Task Force is 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) includes a list of publications focused on salmon populations in Alaska. While not solely focused on Chum salmon, this 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 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.

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Appendix 3 Chum Salmon 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 1.629 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 (NPAFC, 2022).

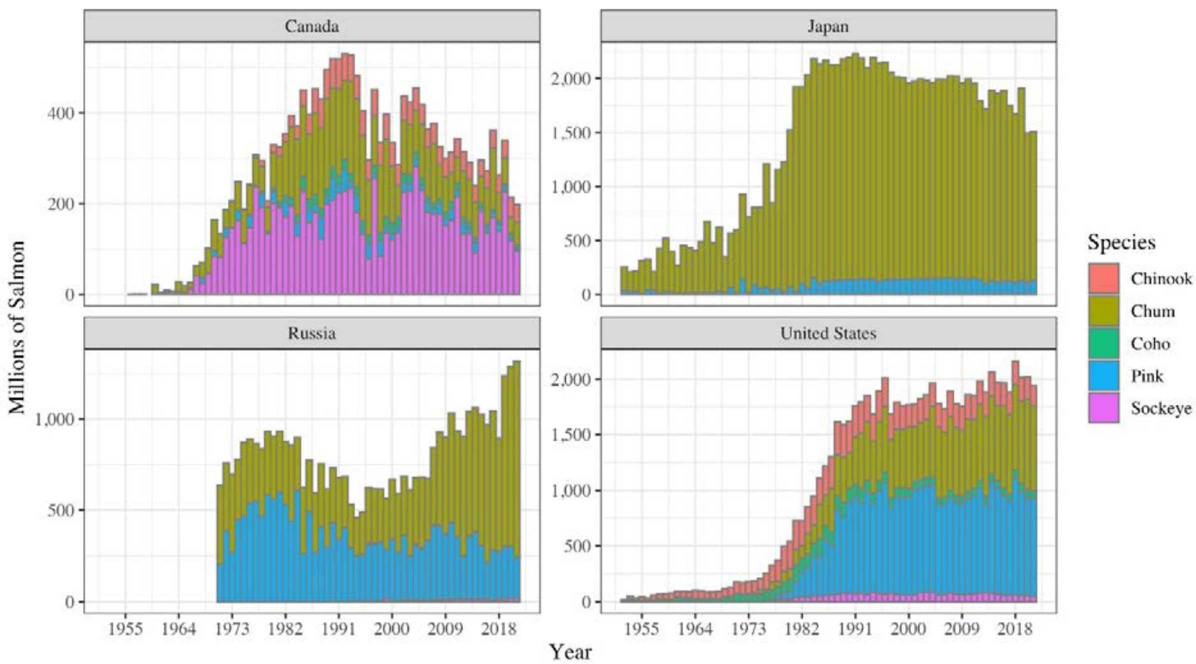

Figure A3 1 Total number of hatchery salmon (omitting cherry and steelhead) by Japan, Russia, United States and Canada from 1952 to 2021

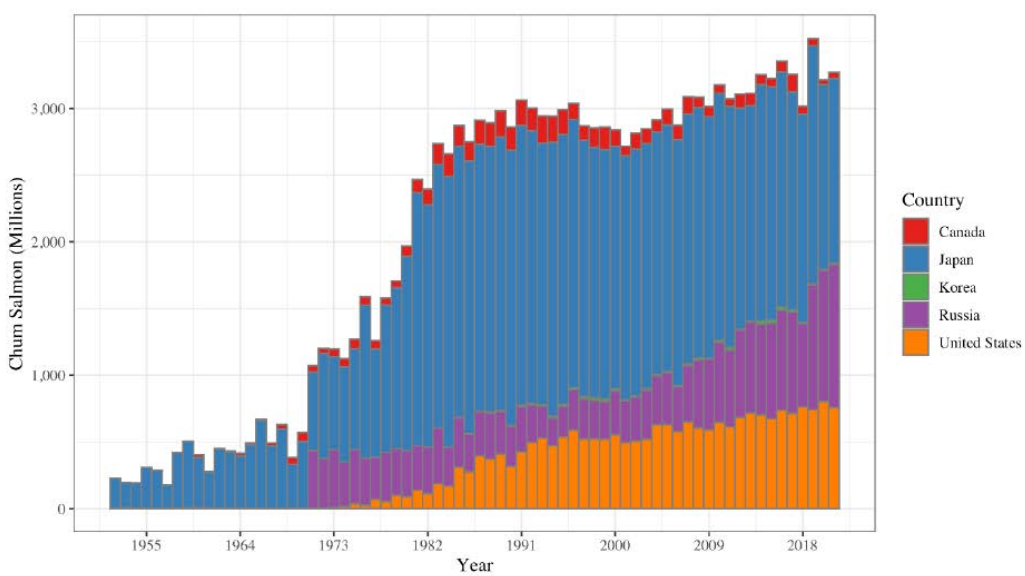

Figure A3 2 Total hatchery chum salmon production around the Pacific rim from 1952 through 2021