DRAFT FOR INITIAL REVIEW

Preliminary Draft Environmental Impact Statement
for Proposed Amendment
to the Fishery Management Plan for Groundfish of the Bering Sea/Aleutian Islands Management Area

Bering Sea Chum Salmon Bycatch Management
December 20, 2024

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Cooperating Agencies: State of Alaska Department of Fish and Game

Kuskokwim River Inter-Tribal Fish Commission

Tanana Chiefs Conference

Abstract: This preliminary Draft Environmental Impact Statement analyzes proposed management measures to minimize chum salmon (*Oncorhynchus keta*) bycatch in the Bering Sea pollock (*Gadus chalcogrammus*) fishery. The purpose of this action is to minimize chum salmon bycatch in the Bering Sea pollock fishery, with a particular focus on chum salmon of Western Alaska origin, consistent with the Magnuson-Stevens Fishery Management and Conservation Act, its National Standards, and other applicable law. The management measures being considered include limits or "caps" on the number of chum salmon that may be caught in the pollock fishery and closure of all or part of the Bering Sea to pollock fishing once the limit is reached. This document addresses the requirements of the National Environmental Policy Act and other applicable federal law.

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

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Executive Summary

This executive summary outlines the Bering Sea chum salmon bycatch preliminary Draft Environmental Impact Statement (DEIS). This preliminary DEIS provides decision-makers and the public with an evaluation of the predicted environmental, economic, and social effects of alternative management measures being considered to minimize non-Chinook salmon prohibited species catch (PSC)[1] in the Bering Sea pollock (*Gadus chalcogrammus*) fishery.

"Non-Chinook" is a category in the National Marine Fisheries Service's (NMFS) Catch Accounting System (CAS). This category includes chum salmon (*Oncorhynchus keta, kangitneq, iqalluk, srughot'aye, dog salmon*)[2], sockeye salmon (*O. nerka),* coho salmon (*O. kisutch)*, and pink salmon (*O. gorbuscha).* Over 99% of the salmon bycatch in the non-Chinook catch accounting category are chum salmon (see Table 6-2). For this reason, the preliminary DEIS primarily uses "chum salmon" in reference to the non-chinook salmon category for ease of the reader.

The proposed management action would amend the Fishery Management Plan (FMP) for the Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI) and federal regulations to establish new measures to minimize chum salmon bycatch in the Bering Sea pollock fishery, consistent with National Standard 9 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and all other National Standards. Bering Sea pollock fishery participants are the entities that would be directly affected by any of the proposed changes to the current regulations managing chum salmon bycatch. Participants in this fishery catch up to 99% of the chum salmon taken incidentally in all BSAI groundfish fisheries (see also Table 3-9).

Lead and Cooperating Agencies

NMFS is the lead federal agency preparing this preliminary DEIS. Three tribal and state entities are participating as cooperating agencies under 40 CFR 1501.8 and 1508.1(g)[3]:

- Alaska Department of Fish and Game (ADF&G)
- Kuskokwim River Inter-Tribal Fish Commission (KRITFC)
- The Tanana Chiefs Conference (TCC)

[1] 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 and include Pacific halibut, Pacific herring, Pacific salmon, steelhead trout, king crab, and Tanner crab. While bycatch is therefore a broader term, in this document both terms are used to refer to the catch of chum salmon in the pollock fishery.
[2] Traditional names for chum salmon in the Yukon and Kuskokwim regions include iqalleq (Central Yup'ik), nalay (Deg Xinag and Holikachuk), srughot'aye (Upper Kuskokwim Athabascan), nulaga (Koyukon), nuleghi (Middle Tanana), and khii (Gwich'in). These names were shared with Council staff for inclusion in this document by the Kuskokwim River Inter-Tribal Fish Commission and Tanana Chiefs Conference, and additional traditional names for chum salmon provided by these entities can be found in Appendix 7 and Appendix 8. However, Alaska is home to 229 sovereign Tribal governments and 23 distinct Alaska Native languages, many of which have multiple dialects and all of which are official languages of the state. Additional Alaska Native languages' names for chum salmon were not included here because, recognizing the importance of language accuracy to respect culture, language-bearers, and Traditional Knowledge systems, Council and NMFS staff as non-Alaska Native language speakers sought to do no harm by attempting to interpret all traditional names for chum salmon. More information on Alaska Native languages is available at the Alaska Native Knowledge Network, and on respectfully working with Alaska Native languages in the Alaska Public Interest Research Group's Alaska Native Language Translation Protocols available here.
[3] This preliminary DEIS cites to the NEPA regulations issued by the Council on Environmental Quality ("CEQ") at 40 CFR Ch.V, subch. A. The recent decision by the D.C. Circuit in *Marin Audubon Soc. v. FAA,* No. 23-1067, 2024 WL 4745055 (D.C. Cir. Nov. 12, 2024), ruled that CEQ lacks the authority to issue binding regulations on NEPA compliance. No other circuit has issued a similar ruling invalidating CEQ's NEPA regulations. This preliminary DEIS refers to and follows the CEQ regulations as advisory, if not binding. This document is also consistent with the statutory requirements under NEPA and does not depend on the validity of the regulations issued by the CEQ.

The MSA is the primary law governing federal fisheries management. The management of marine fishery resources within the nation's Exclusive Economic Zone (EEZ) in federal waters 3 to 200 nautical miles from shore is vested in the Secretary of Commerce (Secretary) and in eight Regional Fishery Management Councils. In the Alaska Region, the North Pacific Fishery Management Council (Council) is responsible for preparing FMPs and FMP amendments, such as the one being considered in this preliminary DEIS for chum salmon bycatch management. The Council is not a federal agency but submits its management and conservation recommendations to the Secretary. If the recommendations are approved by the Secretary, NMFS is the federal agency charged with carrying out the mandates of the Department of Commerce with regard to marine and anadromous fish.

Bering Sea Pollock Fishery

Pollock are a species of fish broadly distributed throughout the North Pacific with the largest concentrations found in the eastern Bering Sea. The Bering Sea pollock fishery is the largest U.S. fishery by volume—the 2024 and 2025 Bering Sea subarea total allowable catch (TAC) was set at 1.30 million and 1.375 million metric tons (mt), respectively. The TAC is set annually 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.[4] After the CDQ pollock allocation is subtracted from the TAC, an amount determined by the NMFS 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 pollock industry is organized under fishing cooperatives, and a purpose of these cooperatives is to further subdivide each sector's pollock allocation among member vessels 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, facilitate transfers of pollock among members, and enforce contract provisions. Ten fishing cooperatives were originally formed: seven inshore cooperatives (although only five are currently active[5]), two cooperatives in the offshore CP sector, and one cooperative in the mothership sector. There were eight cooperatives active in 2024.

Salmon Bycatch in the Pollock Fishery

Pacific salmon are caught incidentally in the pollock fishery. Pollock are caught using pelagic trawl gear which are cone-shaped nets towed through the mid-water column. Salmon in the Bering Sea exist in the same times, locations, and depths as pollock and are thus caught in the nets of fishermen targeting pollock. Of the five species of Pacific salmon found in Alaska's waters, Chinook salmon and chum salmon are most often encountered in the BSAI groundfish fisheries and primarily by the Bering Sea pollock fishery.

NMFS manages all species of salmon as prohibited species in the BSAI groundfish fisheries because they are not the target species and fully allocated for other uses including subsistence, commercial, and recreational fisheries in and off Alaska and Canada. As prohibited species catch, salmon must be avoided as bycatch. NMFS-certified observers are onboard pollock vessels or stationed at shore-based processing plants accepting Bering Sea pollock deliveries. After an observer has identified the species of salmon and

[4] The CDQ Program was established in 1992 to provide economic development opportunities to communities across Western Alaska by facilitating their participation in the BSAI fisheries.
[5] The Arctic Enterprise Association is a cooperative that has not been active since 2008. The Peter Pan Fleet Cooperative was not active in 2024.

collected any scientific data or biological samples, the salmon must be discarded or donated to the Prohibited Species Donation Program (see 50 CFR 679.21(a)(2)(ii)).

The proposed action is focused on minimizing chum salmon bycatch to the extent practicable, but there are several types of management measures currently used to reduce salmon bycatch in the Bering Sea pollock fishery. The Chum Salmon Savings Area is a time/area closure in the southeastern Bering Sea encompassed within the Catcher Vessel Operational Area (CVOA).[6] The boundaries of this time/area closure were based on historically high rates of chum salmon bycatch (i.e., number of chum salmon caught incidentally per mt of pollock). The Chum Salmon Savings Area would close to all trawl fisheries from August 1 through August 31 and remain closed through October 14 if the area-specific cap of 42,000 non-Chinook (i.e., chum salmon) were caught inside the CVOA at any point from August 15 through October 14.[7]

After several amendments to the management measure since 1994, the existing regulations exempt pollock vessels from the restrictions in the Chum Salmon Savings Area if they participate in the Rolling Hotspot System (RHS) for chum salmon avoidance. The pollock fleet voluntarily developed the RHS program for chum salmon in 2001 and it was managed under an Inter-cooperative Agreement. Contrary to the original intent of the Chum Salmon Savings Area closure, chum salmon bycatch rates appeared to be higher outside the area than inside. The RHS program is a bycatch avoidance program whereby area closures are designated in the Bering Sea based upon recent observations of high bycatch. Once areas with high salmon bycatch rates are identified, closures are established by a third-party entity, Sea State, for a period of time and vessels are moved to new fishing grounds. The RHS program for chum salmon avoidance operates during the B season when the fleet encounters the vast majority of chum salmon bycatch (see Figure 1-1). The program is intended to increase the ability of fishery participants to minimize salmon bycatch by giving them more flexibility to move fishing operations to avoid areas where they experience high rates of salmon bycatch.

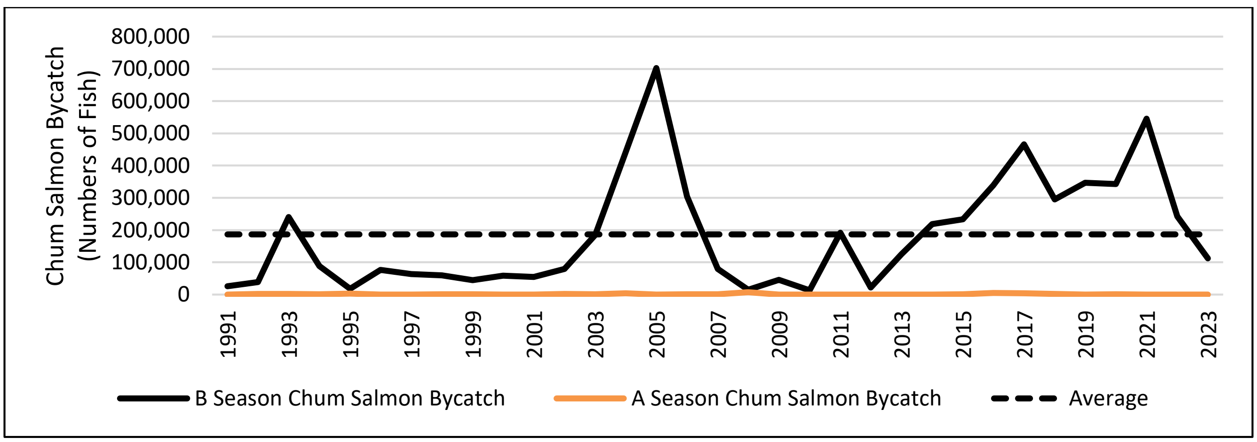

Figure 1-1 Chum salmon bycatch in the Bering Sea pollock fishery for the A season (orange), B season chum salmon bycatch (black), and the annual average level of bycatch (dashed), 1991–2023

Source: NMFS Alaska Region CAS, data compiled by AFKIN.

The RHS program for chum salmon avoidance is now managed under the salmon bycatch Incentive Plan Agreements (IPAs). The IPAs are legally binding civil contracts that establish incentives and penalties for pollock vessels and CDQ groups governed by the contract to avoid Chinook salmon and chum salmon while fishing for pollock. The IPAs were implemented voluntarily in 2010 alongside the Chinook salmon

[6] See 50 CFR 679.22(a)(5). A CP vessel authorized to fish BSAI pollock is prohibited from directed fishing for pollock in the CVOA during the B season, unless it is directed fishing for CDQ pollock.

[7] The non-Chinook salmon PSC limit of 42,000 fish is apportioned among the CDQ and non-CDQ fisheries but not further divided among the sectors.

PSC limit (often referred to as "Amendment 91"). The Chinook salmon PSC limit is a hard cap that requires pollock fishing to cease if the limit is reached. The Chinook salmon PSC limit is divided across the A and B seasons and apportioned among the four sectors. If at least one IPA is approved by NMFS, a PSC limit of 60,000 Chinook salmon is in place. If an IPA is not developed and approved by NMFS, a lower limit of 47,591 Chinook salmon is implemented (see 50 CFR 679.21(f)(2)). These caps decrease in times of low Western Alaska Chinook salmon abundance to 45,000 and 33,318 Chinook salmon, respectively. The Chinook salmon PSC limits also include a performance standard. If a sector exceeds its apportionment of the lower limit for a third year in any seven-year period, it must operate under the lower limit in the future.

Three IPAs have been in place since 2010 and all vessels and CDQ groups have participated in the agreements: the Catcher Processor IPA, Inshore Salmon Savings Incentive Program (Inshore SSIP); and Mothership Salmon Savings Incentive Program (MSSIP). The existing IPA regulations specify 13 different provisions written in broad language to provide IPA members the flexibility to design incentive measures that are responsive to the regulations but work for the unique circumstances of vessels governed by the contract. The IPAs must meet all 13 regulatory provisions, are reviewed by NMFS, and approved after review. As an accountability measure, 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. The written annual reports are made available to the Council, NMFS, and the public prior to March 15 each year.[8]

The Council and NMFS started considering revisions to existing chum salmon bycatch management measures in 2022 following the high bycatch year in 2021. In the 2021 B season, the pollock fleet caught 545,901 chum salmon as bycatch. Compared to the most recent 10-year average (2011–2020) of 258,009 chum salmon, this represented a 112% increase in chum salmon bycatch. Following that high bycatch year, the 2022 B season bycatch was substantially lower at 242,309 fish; the 2023 B season chum salmon bycatch was 111,843 fish; the 2024 B season bycatch was 35,125 fish.[9] The recent decreases in chum salmon bycatch are likely the result of fleet behavioral changes to take additional steps to avoid chum salmon, as well as changes in the distribution and abundance of chum salmon and pollock.

Western Alaska Chum Salmon

The proposed regulatory changes for chum salmon bycatch management in the Bering Sea pollock fishery are being considered in light of the recent declines in chum salmon abundance across Western and Interior Alaska. A general overview of Western Alaska (WAK) chum salmon stock status is provided in Section 3.2.3.1 of this preliminary DEIS. Figure 1-2 provides an index of chum salmon abundance in the Yukon, Kuskokwim, and Norton Sound regions. Abundance levels are standardized and shown as a percentage deviation from the historical average in each area because the unit of measurement for chum salmon abundance is different. Positive percentage deviations indicate years where abundance was above average whereas negative percentage deviations indicate years with below average abundance. As shown, chum salmon abundance was very low across all indices and areas during two distinct periods from 1997–2002 and 2020–present (yellow), indicating that all areas exhibit similar trends during periods of very low abundance.[10] From 2020–2023, Yukon summer and fall chum salmon abundance was 63%–94% below the historical average whereas Yukon fall chum salmon abundance was 74%–90% below average. Chum

[8] IPA annual reports are available on the Council's website.
[9] PSC data are available from the NMFS Alaska Region's Fisheries Catch and Landings Report webpage. Target species catch and PSC data were not finalized for the 2024 fishing year at the time this preliminary DEIS was published. The analysts have included 2024 B season data when relevant for comparison with recent years, based on numbers retrieved on December 8, 2024.
[10] The causes of chum salmon decline in this earlier period are not fully known. In response to these declines, and to improve monitoring and enforcement efforts, the North Pacific Anadromous Fish Commission (NPAFC) scientists developed the Bering-Aleutian International Survey (BASIS) during 2002. BASIS was recently expanded to include other large marine ecosystems in the North Pacific and was renamed the Bering Arctic Subarctic Integrated Survey.

salmon abundance in the Kuskokwim area was 16%–94% below average, and 44%–83% in the Norton Sound region.

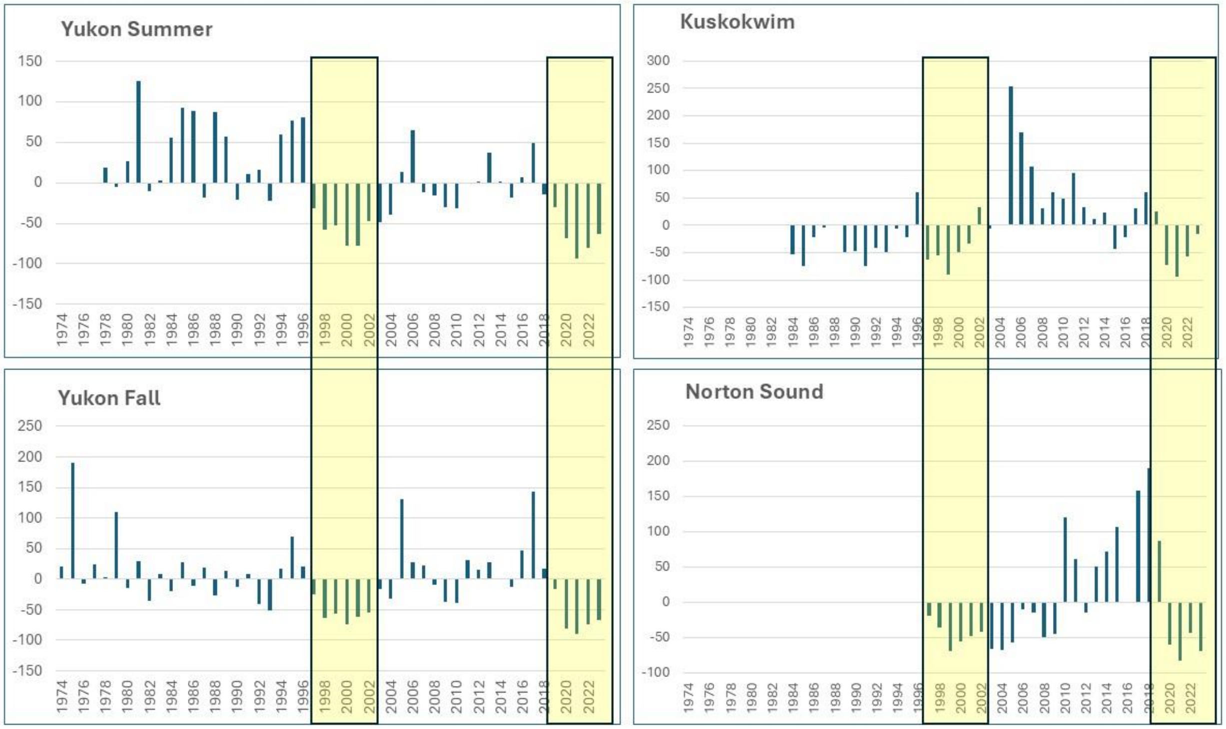

Figure 1-2 Chum salmon abundance in the Yukon, Kuskokwim, and Norton Sound areas measured as a percentage deviation from the historical average level of abundance based on Yukon summer and fall chum salmon run reconstructions, the cumulative catch per unit effort (CPUE) from the Kuskokwim Bethel Test Fishery, and a standardized index of escapements in the Norton Sound region plus total harvest

Source: ADF&G

Chum salmon are harvested for subsistence and non-subsistence uses across Western and Interior Alaska. Many Tribal Nations in these regions have historically relied on chum salmon as an integral component of the subsistence way of life. ADF&G manages subsistence, commercial, personal use and sport salmon fisheries. Subsistence salmon fisheries are managed under a dual state and federal system. This management structure includes a priority for management to first and foremost meet spawning escapement goals in order to sustain salmon resources for future generations. After conservation (escapement), the highest priority use is for subsistence under both state and federal law. Salmon surplus above escapement needs and subsistence uses are made available for other consumptive uses of the stock, such as commercial and sport fishing.

The best available science suggests ecosystem and climate changes are the leading causes of recent chum salmon declines (Farley et al., 2024). Chum salmon originating from WAK river systems spend their first summer in the Bering Sea as juveniles and migrate into the Gulf of Alaska in late fall for their first winter at sea; chum salmon then spend 1–4 more years migrating between the Bering Sea (summer) and Gulf of Alaska (winter) (Myers et al., 2009). In 2016 and 2019, WAK chum salmon were subject to heat waves in both their major marine habitats, which shifted the food web and altered chum salmon diets (von Biela et al., 2019). 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. 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, and juvenile salmon abundance has been linked with adult returns (Farley et al., 2024).

Chum salmon taken as bycatch in the Bering Sea pollock fishery reduces the amount of chum salmon that may return to Western and Interior Alaska river systems. As noted above, the proposed regulatory changes are being considered in light of recent declines in WAK chum salmon abundance and the critical importance of chum salmon to Western and Interior Alaska communities and ecosystems (see Section 1.1). The purpose of the proposed action is to reduce chum salmon bycatch in the pollock fishery to the extent practicable with a particular focus on minimizing the bycatch of WAK origin chum salmon.

The chum salmon taken as bycatch in the pollock fishery originate from countries across the North Pacific Rim. Genetic analyses of the chum salmon caught as bycatch organize populations into six genetic stock composition reporting groups: Southeast Asia, Northeast Asia[11], Coastal Western Alaska (CWAK)[12], Upper/Middle Yukon (includes Yukon River fall chum and some Yukon River summer chum salmon populations), Southwest Alaska, and Eastern Gulf of Alaska/Pacific Northwest. The combined WAK chum salmon reporting group includes chum salmon populations in the CWAK and Upper/Middle Yukon reporting groups.

While the exact estimates vary each year, the majority of chum salmon bycatch is attributed to the Northeast and Southeast Asia reporting groups. On average from 2011–2023, approximately 53% of the chum salmon caught as bycatch originate from Northeast and Southeast Asia river systems compared to approximately 19% of the chum salmon bycatch which originates from WAK river systems (see also Table 3-12). Figure 1-3 provides a snapshot of the genetic stock composition estimates for the 2023 B season which is currently the most recent year chum salmon bycatch genetic analyses are available. The 2023 B season bycatch was 111,843 fish, of which 10.6% (11,492 chum salmon) originated from WAK river systems.

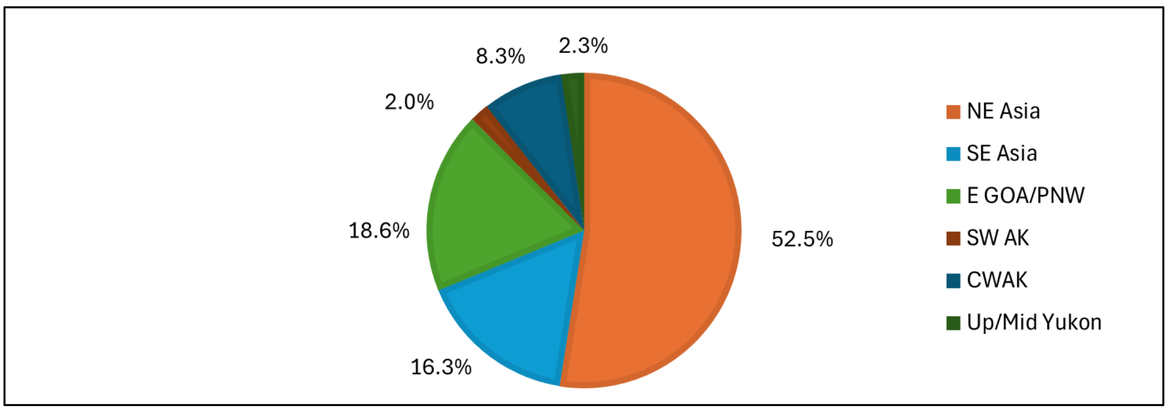

Figure 1-3 Genetic stock composition estimates for chum salmon bycatch in the 2023 B season pollock fishery

Alternatives

The Council recommended the following revised alternatives for analysis in April 2024. Most of the action alternatives (Alternative 2-5) are not mutually exclusive and may be adopted in combination with one another.

Alternative 1: No Action

[11] 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.

[12] CWAK reporting group includes river systems extending from the Norton Sound region in the north south to Bristol Bay.

The National Environmental Policy Act (NEPA) requires a “No Action” alternative be considered. Under the No Action alternative, all regulations and FMP language related to chum salmon bycatch management in the Bering Sea pollock fishery would remain intact. Those regulations include 50 CFR 679.22(a)(10) for the Chum Salmon Savings Area and 50 CFR 679.21(f)(12)(iii)(E) for the salmon bycatch IPAs. Vessels and CDQ groups that are governed by an IPA are exempt from the time/area closure associated with the Chum Salmon Savings Area.

Alternative 2: Overall Chum Salmon PSC Limit

Alternative 2 would establish regulations for an overall chum salmon PSC limit (also referred to as a hard cap) during the B season. Alternative 2 contains different components and options to **1)** determine the total amount of the chum salmon PSC limit and **2)** how to apportion it among the fishing sectors. The PSC limit amount would be chosen from a range of 100,000–550,000 chum salmon (see Table 1-1).

Table 1-1 Range of chum salmon PSC limits in numbers of fish and the Council’s rationale

Cap level	Council rationale
100,000	Lower limit added in April 2024 to expand the range of analyzed overall PSC limits
200,000	Rounded up from historical average (1991–2023) intended to balance public testimony requesting a “very low” limit with practicability considerations
300,000	Rounded down from the 10-year average level of bycatch (2013–2022)
350,000	Rounded down from the 5-year average level of bycatch (2018–2022)
400,000	Rounded up from the 3-year average level of bycatch (2020–2022)
450,000	Value between 400,00 and 550,000 chum salmon included in October 2023 addendum
550,000	Rounded value of the highest level of chum salmon bycatch in the analyzed period

The chum salmon PSC limit would be apportioned among the CDQ, CP, inshore, and mothership sectors based upon one of four different approaches: Option 1: 3-year historical average level of chum salmon bycatch; Option 2: 5-year historical average level of chum salmon bycatch; Option 3: a pro-rata approach that weights the amount 25% to the sector’s AFA pollock allocation and 75% to the sector’s 3-year historical average level of chum salmon bycatch; Option 4: the sector’s AFA pollock allocation. Table 1-2 provides the proportion of the cap each sector could expect to receive, based on the four different approaches being considered. The inshore sector’s apportionment would be further divided among the inshore cooperatives and open access fishery, when applicable. The CDQ apportionment would be further divided among the six CDQ groups. If a sector reaches its apportionment, it must stop fishing for the remainder of the B season.

Table 1-2 Apportionment percentages for each option by sector

Apportionment options	CDQ	CP	Mothership	Inshore
Sector Apportionment 1, 3-yr avg.	6.1%	21.9%	9.1%	62.9%
Sector Apportionment 2, 5-yr avg.	7.1%	25.2%	9.5%	58.2%
Sector Apportionment 3, pro rata	7.1%	25.4%	9.1%	58.4%
Sector Apportionment 4, AFA	10%	36%	9%	45%

To provide fishing sectors and cooperatives more opportunity to fully harvest their pollock allocations, Alternative 2 would include the ability to transfer chum salmon PSC among sectors and cooperatives, as is allowed under the Chinook salmon PSC limit. A sector would be able to request NMFS move a specific amount of chum salmon PSC from one entity’s account to another’s during a fishing season. Apportionments of chum salmon PSC do not constitute a “use privilege.”

Alternative 3: Overall Chum Salmon PSC Limit With Abundance Indices

Alternative 3 would establish an overall chum salmon PSC limit during the B season based on indices of the prior year's chum salmon abundance. The index framework under Alternative 3 means a chum salmon PSC limit *may* be in place during the B season whereas Alternative 2 includes a chum salmon PSC limit during each B season. The chum salmon PSC limit amount under Alternative 3 could also decrease, depending on the number of thresholds that are not met in a given year. The apportionment options and transferability provisions for Alternative 3 are the same as Alternative 2 and not repeated here. Alternative 3 contains two mutually exclusive options for abundance indices.

Option 1 would implement a Three-area chum salmon index based on the Yukon, Kuskokwim, and Norton Sound regions. The potential management actions are tied to whether the number of chum salmon returning to an area are above or below the threshold. To meet its threshold:

- The Yukon Area needs to have more than 1,713,300 or 2,718,400 combined Yukon summer and fall chum salmon return based on full run reconstructions.
- The Bethel test fishery cumulative CPUE in the Kuskokwim Area needs to be more than 2,800 or 5,200.
- The Norton Sound Area needs to have more than 57,300 or 91,500 chum salmon return based on the sum of the Snake, Nome, Eldorado, Kwiniuk, and North River escapements plus total chum salmon harvests for the region.

At this time, each index has two threshold amounts that represent the 25^{th} or 50^{th} percentile of abundance for each area based on historical data. At implementation, only one threshold would be in effect.

- If all three areas (3 of 3) have returns above their thresholds, a chum salmon PSC limit **<u>would not</u>** be in effect.
- If two areas (2 of 3) have returns above their thresholds, a chum salmon PSC limit **<u>would</u>** be in effect the following year. The amount would be between 100,000–550,000 chum salmon.
- If 1 or 0 (1 of 3 or 0 of 3) have returns above their thresholds, a chum salmon PSC limit **<u>would</u>** be in effect the following year. The amount would be set at 75% of the level selected for when one area (2 of 3) has returns above their thresholds.

Option 2 would implement a hard cap based on indices for Yukon summer and fall chum salmon.

To meet its threshold, the Yukon would need to have:

- More than 1,268,700 or 1,978,400 summer chum salmon return based on the full run reconstruction.
- More than 444,600 or 803,000 fall chum salmon return based on the full run reconstruction.

If both stocks (2 of 2) are above their thresholds, a chum salmon PSC limit **<u>would not</u>** be in effect the following year. If 1 or 0 stocks are above the threshold, a chum salmon PSC limit **<u>would</u>** be in effect the following year. The amount would be between 100,000–550,000 chum salmon.

Alternative 4: Additional Regulatory Requirements for IPAs

Alternative 4 would modify the regulations at 50 CFR 679.21(f)(12)(iii)(E) to include six additional provisions for the salmon bycatch IPAs. The proposed provisions are as follows:

1. Require the pollock sectors to describe in their IPA how historical genetic stock composition data are included in chum salmon avoidance measures.
2. Require the pollock sectors to describe in their IPAs how they monitor for potential chum salmon avoidance closures more than once per week.

3. Require the use of salmon excluders for the duration of A and B season.
4. Require the pollock sectors to develop chum salmon vessel outlier provisions and implement within their IPA.
5. Require IPAs to provide weekly salmon bycatch reports to Western and Interior Alaska salmon users to allow for more transparency in reporting.
6. Require the pollock sector IPAs to prohibit fishing in bycatch avoidance areas for all vessels regardless of performance when ADFG weekly stat area bycatch rates exceed 5 chum per ton of pollock for the CP IPA and 3 times base rate for the Inshore SSIP and MSSIP.

The Council requested the pollock industry to take immediate steps to avoid chum salmon during the 2022 B season. In response, all sectors either made formal amendments or informal agreements to immediately increase chum salmon avoidance efforts. Members of the CP IPA formally amended the contract with new chum salmon avoidance measures in 2022. Members of the Inshore SSIP and MSSIP implemented voluntary measures in 2022 and formally amended their respective IPAs prior to the 2024 B season. The six provisions under Alternative 4 are generally aligned with current fishing operations and reflect the measures incorporated within each recently amended IPA.

Alternative 5: Inseason Corridor Caps

Alternative 5 would establish inseason corridors that would close to a sector if a corridor-specific chum salmon PSC limit is met. Only chum salmon PSC caught inside the corridor from June 10 to August 31 would count towards the cap. Three corridor options are being considered but only one could be selected for implementation (Figure 1-4).

- Option 1: Cluster Area 1 with cap levels ranging from 50,000–200,000 chum salmon
- Option 2: Unimak Area with cap levels ranging from 50,000–200,000 chum salmon
- Option 3: Cluster Area 2 with a cap level of either 50,000–100,000 chum salmon

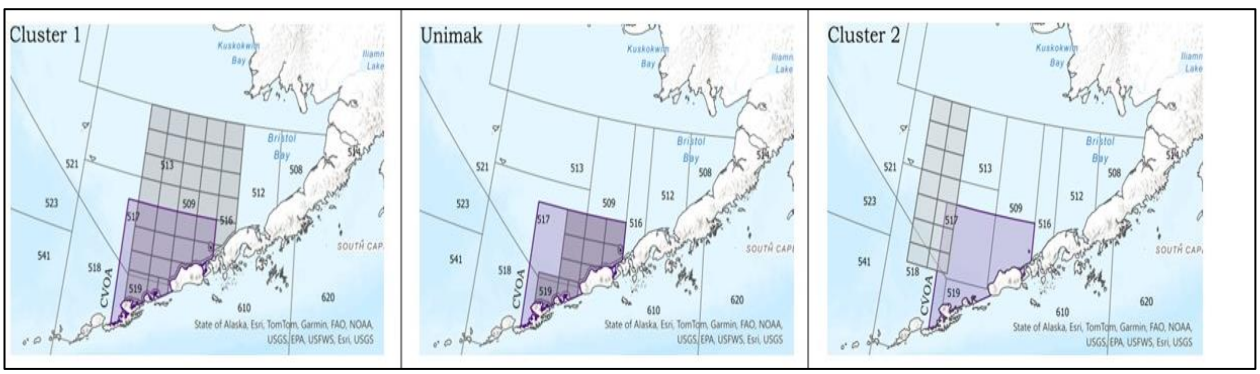

Figure 1-4 Inseason corridor areas under consideration in Alternative 5 (gray) and CVOA (purple)

The apportionment options and transferability provisions are the same as Alternative 2 and 3. Table 2-10 in Chapter 2 provides the apportionment percentages for each sector and inseason corridor based upon each sector's historical chum salmon PSC within the corridor (2011–2023). If a sector reached their apportionment of the cap between June 10 to August 31, the corridor area would immediately close and remain closed until August 31. On September 1, a sector closed out of the corridor area could return and target pollock in the area. The inseason corridors would be managed by NMFS.

Comparison of Alternatives

Table 1-3 below provides a summary and comparison of the primary management features for each proposed alternative.

Table 1-3 Comparison of the primary management tools for each proposed alternative

Alternative	Chum salmon PSC limit	IPA requirements	Western Alaska chum avoidance	Is it a standalone Alternative?
1	Cap of 42,000 non-Chinook closes the Chum Salmon Savings Area (August 1 –31) Vessels and CDQ groups are exempt from the closure if governed by an IPA	RHS system for chum avoidance operates in the B season	RHS closure areas are largest East of 168 degrees West Longitude (closer to Alaska Peninsula) Thresholds for implementing closures are lower in June and July when WAK chum encountered in higher proportions	Yes
2	Hard cap of 100,000 to 550,000 chum salmon closes the fishery if it is met All non-Chinook salmon encountered in B season count to the cap	Same as Alt 1	Same as Alt 1	Yes Could be implemented with Alt. 4 and 5 Could not be implemented with Alt. 3
3	Hard cap in place if one or more Management Areas in Western Alaska are at low abundance Cap level could decrease as more areas fail to meet abundance thresholds	Same as Alt 1	Same as Alt 1	Yes Could be implemented with Alt. 4 and 5 Could not be implemented with Alt. 2
4	Same as Alt 1	Add six provisions with more specificity to existing IPA regulations	RHS closures assessed for the likelihood of the area having higher proportions of Western Alaska chum salmon	Yes Could be adopted with any other action Alternative
5	Cap of 50,000–200,000 chum salmon close corridors when cap is reached	Same as Alt 1	Corridors are in areas where Western Alaska chum salmon have historically been encountered in higher proportions	Yes Could be adopted with any other action Alternative

Impact Analysis

Background

A purpose of this preliminary DEIS is to characterize the conditions that have existed while the current chum salmon bycatch regulations have been in place and to evaluate expected changes due to the proposed alternatives. In this analysis, the terms "baseline," "status quo," and "current" are often used interchangeably to describe this period. The analytical baseline informs decision-makers of the state-of-the-world as it is today, and what could be expected to continue if Alternative 1, No Action is selected. This assessment does not mean the conditions are static; they can always change moving forward.

The analytical baseline is the benchmark used to compare the relative differences in the alternatives, as well as their implications as either positive or negative and their magnitude, against. The analysis must provide an assessment of the direct, indirect, and cumulative effects of the proposed alternatives. Below are definitions for these three categories of effects to provide the reader the appropriate context for understanding how the analysts have characterized the potential impacts (see 40 CFR 1508.1).

- **Direct effects:** impacts caused by the action and occur at the same time and place;
- **Indirect effects:** impacts caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable; and
- **Cumulative effects:** impacts that result from the incremental effects of the action when added to effects of other past, present, and reasonably foreseeable actions regardless of what agency or person is undertaking those other actions.

Chapter 3 of this preliminary DEIS analyzes the potentially affected environment and the degree of the impacts of the alternatives on the various resource components. Since the primary regulatory changes being considered here are management alternatives to reduce chum salmon bycatch in the pollock fishery to the extent practicable, with a particular focus on reducing the bycatch of WAK origin chum salmon, this preliminary DEIS is particularly focused on the effects of the proposed alternatives to chum salmon. The potential impacts to Chinook salmon PSC, herring PSC, eastern Bering Sea pollock, marine mammals, seabirds, habitat, and the ecosystem are also evaluated.

Chapter 4 analyzes the potential economic and social impacts of the proposed alternatives on participants in the Bering Sea pollock fishery, as well as communities and Tribes that rely on WAK chum salmon fisheries for economic wellbeing, food security, and the subsistence way of life. Fisheries management and enforcement as it relates to the pollock fishery was also evaluated (see Chapter 6).

The proposed alternatives create different incentives for chum salmon avoidance. Considering the incentives created by the alternatives, and how the pollock industry may respond to them, is an important component to this analysis. The potential future behavior changes would influence the magnitude of bycatch reductions as well as the potential for unintended, adverse effects. Compared to the status quo, chum and WAK chum salmon bycatch reductions could result from either an early B season closure that would ensure no additional PSC was removed in that year (**Alternatives 2 and 3**), behavior changes to stay below the overall PSC limits (**Alternatives 2, 3, and 5**), and/or fleet movement away from areas with high chum salmon bycatch rates or encounters (**Alternatives 4 and 5**). As the pollock industry works to avoid chum and WAK chum salmon bycatch in response to one or more of the alternatives, there could be interactions with other PSC species like Chinook salmon and herring. Figure 1-5 shows the incentive structures around each of the proposed alternatives.

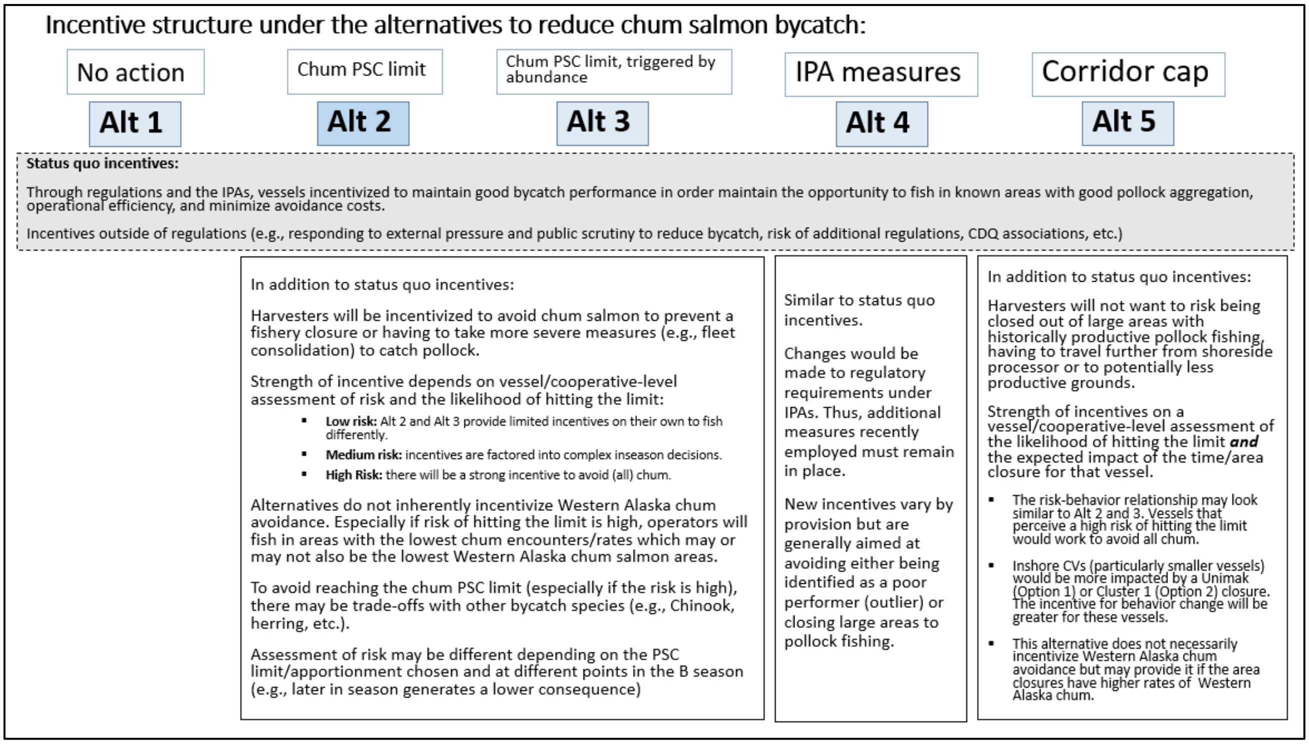

Figure 1-5 Incentive structure under each alternative

Pollock Stock

The eastern Bering Sea pollock is currently managed to account for the capacity of the stock to yield sustainable biomass on a continuing basis, and this stock is not overfished nor approaching an overfished condition (Section 3.1.1.1). Analysis of Alternatives 2, 3, and 5 indicates these alternatives could make it more challenging to catch the full B season TAC and thus reduce the impact of fishing on the pollock stock. However, these alternatives are likely to result in fishermen shifting where they fish for pollock to avoid chum salmon bycatch. Changes in where pollock fishing would occur is likely to be within the historical footprint of the fishery. As such, the proposed alternatives would be expected to have a neutral effect on the Bering Sea pollock stock when compared to the status quo.

Chum Salmon

Alternative 1 would not change the regulations managing chum salmon bycatch in the Bering Sea pollock fishery (see Section 2.2), nor would this alternative modify any regulation for Chinook salmon bycatch under the current bycatch management program (see Appendix 2). From 2011–2023, an average of 267,704 chum salmon were caught as bycatch in the B season pollock fishery, ranging from a low of 111,843 fish in 2023 to a high of 545,901 fish in 2021. The 2024 B season bycatch of 35,125 chum salmon was well below average (2011–2023).

Not all chum salmon caught as bycatch originate from WAK river systems. WAK chum salmon populations are organized into two genetic reporting groups, CWAK and Upper/Middle Yukon. As noted above, the CWAK reporting group includes chum salmon returning to natal river systems from Kotzebue Sound to Bristol Bay whereas the Upper/Middle Yukon reporting group largely aligns with the fall chum salmon stock. The proportion of the total bycatch attributed to WAK chum salmon stocks (CWAK + Upper/Middle Yukon) ranged from 9.1% of the total in 2020 to 24.6% of the total in 2016. On average, chum salmon originating from WAK river systems accounted for 18.6% of the total bycatch (2011–2023).

While the proportion of WAK chum salmon in the total bycatch varies each year, there are some spatial and temporal patterns that indicate when and where WAK chum salmon are more likely to be encountered on the pollock fishing grounds. Figure 1-6 shows "cluster areas" used by geneticists at the Alaska Fisheries Science Center's (AFSC) Auke Bay Labs (ABL) to show spatial variation in the genetic stock composition estimates for chum salmon bycatch. The cluster areas are simply groupings of ADF&G groundfish statistical areas (stat areas), into four larger clusters. Historical genetic analyses indicate WAK chum are more likely to be encountered in higher proportions near the Alaska Peninsula (Cluster 1 in orange) compared to fishing grounds further northwest and during June to August relative to later months during the B season.

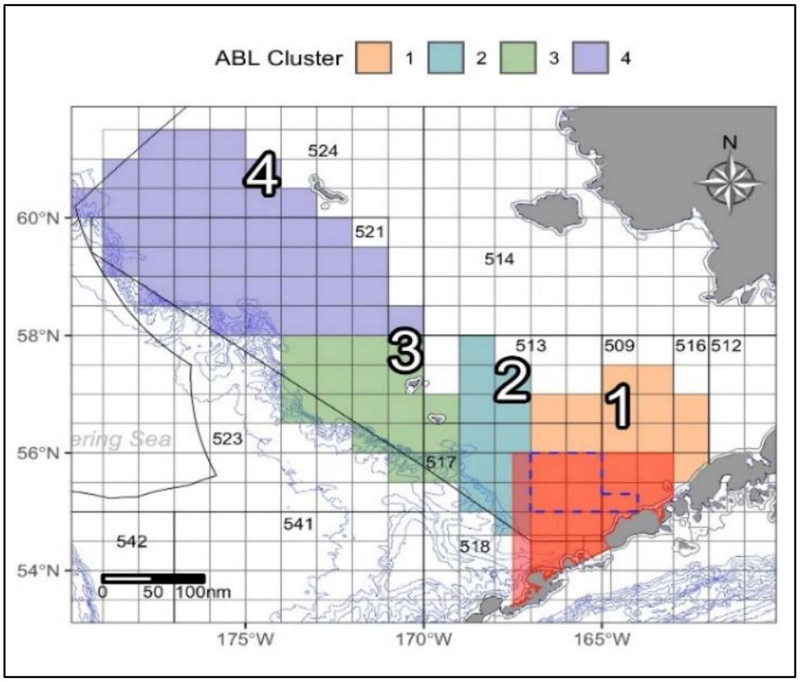

Figure 1-6 Map of four genetic cluster areas as well as the CVOA (red) and Chum Salmon Savings Area (blue dotted line)

Chum salmon bycatch genetics data were combined with data on the ages of chum salmon taken by the pollock fishery to provide annual estimates on the numbers of chum salmon that would have otherwise survived the marine environment and returned to natal river systems to spawn or be caught in a directed fishery (referred to as an adult equivalency analysis or AEQ[13]). The adult equivalency analysis was completed for the CWAK and Upper/Middle Yukon reporting groups using data from 2011–2022.[14] Estimates on the number of AEQ CWAK chum salmon in the bycatch ranged from 11,608 fish in 2012 to 69,445 fish in 2017 and estimates on the number of AEQ Upper/Middle Yukon chum salmon ranged from 2,124 fish in 2020 to 16,429 fish in 2017.

An adult equivalency analysis for chum salmon caught as bycatch is not a complete impact analysis, which requires an estimate of total run size to determine the potential effects of bycatch on these populations. Run reconstructions for all major salmon producing river systems across coastal WAK are not available. Nevertheless, the estimates of the number of AEQ CWAK chum can be compared to total removals of subsistence and commercial chum salmon harvests in the Kotzebue, Norton Sound, Yukon summer chum, Kuskokwim, and Bristol Bay areas. On average from 2011–2019, bycatch removals of

[13] While an AEQ analysis can provide a more accurate representation of the actual impact that chum salmon bycatch in the pollock fishery may have on total run size, it may not capture the relative importance of a small number of fish for Western and Interior Alaska ecosystems, and the fishermen, communities, and Tribes that depend on chum salmon, as noted in Appendix 7 and 8 provided by KRITFC and TCC, respectively.

[14] Age data are not available for the 2023 chum salmon bycatch.

AEQ CWAK chum salmon in the pollock fishery accounted for 1.4% of total removals of CWAK chum salmon. Removals of AEQ CWAK chum salmon due to bycatch represented a higher proportion of total removals in recent years of low abundance at 5.7% from 2020–2022, on average.

The Upper/Middle Yukon reporting group aligns with the Yukon fall chum salmon run, which is a genetically distinguishable stock for which a run reconstruction is available. The impact rate of bycatch on the Upper/Middle Yukon reporting group fluctuated annually from 2011–2022 averaging 1%. The largest impact was observed in 2021 at close to 5%.

For **Alternative 2 and 3,** estimates on the potential number of chum salmon saved under each alternative compared to Alternative 1 (status quo) are made based upon catch and bycatch data from 2011–2023. Catch data are compared to the details of the alternative and option to determine when a cap would have been met and triggered a closure. Based on that date, an estimate was made on the amount of pollock (mt) that would have been unharvested ("forgone pollock") and the reduction in the amount of chum salmon bycatch ("salmon savings").

A subset of three hard caps were used to display estimates throughout the analysis. These amounts represent the upper and lower endpoints of the range as well as one equidistant point: 100,000 chum salmon; 325,000 chum salmon; and 550,000 chum salmon. A 75,000-chum salmon PSC limit was also included for the analysis of Alternative 3, Option 1 because it is the lowest possible cap amount under consideration (Alternative 3, Option 1 when fewer than two areas have returns above threshold values). This approach provides an analysis of the full range of potential impacts that could result from selecting a PSC limit under Alternative 2 or 3. However, the Council may recommend a chum salmon PSC limit anywhere within the range specified (100,000–550,000 chum salmon).

For Alternatives 2 and 3, all options under consideration could reduce chum salmon PSC compared to Alternative 1. However, the caps being considered for Alternative 2 would have little potential to impact annual bycatch amounts in years with low historical bycatch. The lowest year of bycatch in the analyzed period was 2012, and all analyzed caps were estimated to have had no effect on PSC reductions compared to status quo. On the other hand, estimates on the number of chum salmon saved are high in some years and vary by sector. For instance, the highest potential for chum salmon bycatch reductions to accrue from a single year and sector would have occurred in 2021 under a 100,000-chum salmon PSC limit using the AFA apportionment. This could have resulted in 289,446 chum salmon not caught by the inshore sector.

A PSC limit of 100,000 chum salmon would have closed fishing for all sectors in a varying number of years depending on the apportionment used. This cap would have ended the B season early for the CDQ sector in 5–6 years, in 10–11 years for the CP sector, and in 10 and 12 years for the mothership and inshore sectors, respectively. The highest chum salmon PSC reductions from the pollock fleet were estimated under a 100,000-chum salmon PSC limit using the pro-rata apportionment for Alternative 2. In percentage terms, this cap amount and apportionment were estimated to reduced fleet-wide chum salmon PSC by 56.4% across all years.

As the PSC limit is increased to 325,000 fish, the estimates on PSC reductions are lower than those predicted at a limit of 100,000 chum salmon, and the cap halts operations in fewer years for all sectors (see Figure 1-7). Across all years, at a 325,000-chum salmon PSC limit, the highest fleet-wide chum salmon PSC savings would occur under the 3-year average apportionment This cap amount and apportionment represented a 12.4% reduction from status quo across all years. Higher savings are estimated from the 3-year average apportionment under a 325,000-chum salmon PSC limit because the CP and CDQ sectors had higher bycatch in some years (e.g., 2017) and the 3-year average apportionment option is the most restrictive for these sectors (compared to other apportionment). Similar trends are observed as the PSC limit increases to 550,000 chum salmon.

The salmon savings estimates shown in Figure 1-7 do not account for oceanic mortality and varying age at maturity and thus represent chum salmon that would not be caught as bycatch, but not necessarily fish that would return to their regions of origin.

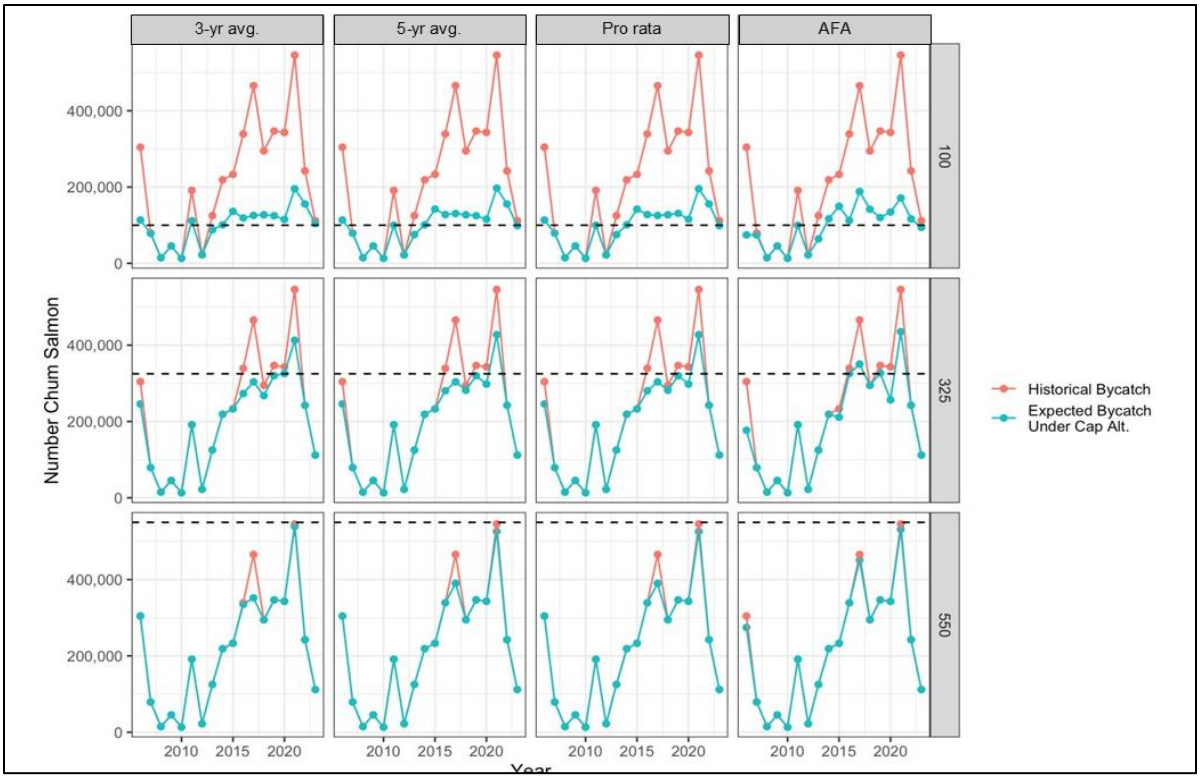

Figure 1-7 Historical B season chum salmon bycatch (red line) compared to estimated chum salmon bycatch under Alternative 2 PSC limit amounts (blue line) ranging from 100,000–550,000 chum salmon (black dotted line) and all apportionment options

Note: estimated bycatch values above the black dotted line are due to the retrospective method used to estimate early closures.

Since all options being considered under Alternative 2 could reduce chum salmon PSC, they could also increase returns of adult salmon to their regions of origin. The largest AEQ savings from both reporting groups was estimated to occur under a 100,000-chum salmon PSC limit using the pro-rata apportionment. This would have increased returns to CWAK by an average of 21,678 fish and an average of 3,435 fish to the Upper/Middle Yukon. The highest single year of reductions was estimated to occur in 2017 under a 100,000-chum salmon PSC limit using the 3-year average apportionment at 47,862 fish from the CWAK reporting group and 11,553 fish from the Upper/Middle Yukon reporting group.

Alternative 2 and 3 are mutually exclusive, so only one alternative could be selected for implementation. **The potential year-over-year savings for Alternative 3, Option 1 or 2 are less than what would be expected for Alternative 2 but would still be a decrease in bycatch from status quo.** Under this management framework, a PSC limit would have been in place in either 3 or 6 years under Alternative 3, Option 1 (Three-area index) and either 4 or 5 years under Alternative 3, Option 2 (indices based on Yukon summer and fall chum salmon). In years when a chum salmon PSC limit would not have been in place, the potential impacts to chum salmon PSC are best approximated by the status quo. However, a 75,000-chum salmon PSC limit could have been in effect under Alternative 3, Option 1 in 2021, 2022, and 2023 as more than two areas had run sizes that failed to meet their thresholds in the prior year. In these three years, for most sectors and apportionments, the potential chum salmon PSC reductions were estimated to be marginally greater than what could be expected in the same years under Alternative 2.

However, there is a degree of uncertainty in whether WAK chum salmon PSC would be reduced under the hard caps being considered under Alternatives 2 and 3. The analysis expects pollock fishermen would go to areas with good pollock aggregations and low chum salmon bycatch rates while balancing other considerations to avoid reaching the overall cap. The fleet may be able to use different strategies to stay below an overall cap, such as increased movement, communication, or test tows, but this would not necessarily result in lower WAK chum salmon bycatch. As an example, the 2022 B season bycatch of 242,309 chum salmon was a 55% reduction from the 2021 B season bycatch of 545,901 chum salmon. Despite this decrease in the overall bycatch in 2022, the estimated number of WAK chum salmon caught as bycatch in the 2022 B season was 55,724 chum salmon compared to 51,512 WAK chum salmon in the 2021 B season. This represented an 8% increase in WAK chum salmon bycatch. Reducing chum salmon bycatch to the lowest levels observed in the time series could reduce the number WAK chum salmon caught as bycatch in the pollock fishery (e.g., 2012, 2013, and 2023), but the proportion of WAK chum salmon in the total bycatch would still be variable. Potential reductions in WAK chum salmon bycatch would also depend on fishing behavior, overall chum salmon bycatch encounters, and the proportion of WAK chum salmon encountered in a given year.

The provisions being considered under **Alternative 4** were evaluated for its likelihood to reduce chum salmon and WAK chum salmon PSC in Section 3.2.4.3. The voluntary amendments to the IPAs have coincided with lower levels of chum salmon PSC in recent years. Compared to the 2021 level of bycatch of 545,901 chum salmon, the 2022 B season bycatch was a 55% reduction, the 2023 B season an 80% reduction, and the 2024 B season was a 94% reduction. The analysis cannot quantify and attribute the PSC reductions that may have been achieved by the IPAs incorporating measures that reflect these proposed provisions in recent years. However, without modifying the existing regulations to require these measures continue to be used in the future, it would be possible for the contracts to be modified such that less stringent avoidance efforts are taken.

Alternative 5 includes three different options for inseason corridors that would close to a sector if the corridor-specific PSC limit was met at any point between June 10 through August 31. The timing and location of these corridors was informed by historical salmon bycatch genetic analyses indicating WAK chum salmon are more likely to be encountered in higher proportions during earlier in the B season and closer to the Alaska Peninsula. In the most recent five years (2019–2023), the average proportion of WAK chum salmon in the total bycatch during June to mid-August (referred to as “Early period”) was approximately 19%, 22%, and 11% in Cluster 1, Unimak, and Cluster 2, respectively. The average proportion of WAK chum during mid-August to November 1 (referred to as “Late period”) in the corridors was approximately 19%, 18%, and 10% in Cluster 1, Unimak, and Cluster 2, respectively.

The impacts to chum and WAK chum salmon bycatch due to a corridor closure are uncertain because this alternative would displace fishing effort to outside locations and there are inherent limitations to predicting where pollock fishermen would go. The magnitude of potential bycatch reductions under each corridor and cap are based on each sector’s historical bycatch inside the corridor, as well as what the bycatch encounters outside the corridors where fishermen move to may be. For instance, the average chum salmon bycatch rate in June and July inside Cluster 2 was 1.92 chum/mt of pollock compared to 0.42 chum/mt of pollock in Cluster 1 and 0.55 chum/mt of pollock in Unimak (2019–2023).

Each pollock sector has different fishing history inside these corridors. The inshore sector, and to a lesser degree the mothership sector, has a high degree of reliance on the Cluster 1 and Unimak corridors. In some years and at lower corridor cap amounts, these corridor closures could displace ~200,000 mt of inshore sector pollock catch. These vessels are limited in how far they can travel to find productive fishing grounds with low bycatch rates due to their processors’ delivery requirements among other factors. Many inshore CVs displaced from Cluster 1 and Unimak would likely first move to Cluster 2 which is immediately northwest of these corridors. Some of the larger CVs may travel further. A scenario that concentrates pollock fishing in areas like Cluster 2 with high chum salmon bycatch rates could result in much higher chum salmon bycatch numbers compared to status quo, which could also increase WAK chum salmon bycatch numbers despite a lower proportion of WAK chum salmon in the total bycatch in these areas.

On the other hand, because overall chum and WAK chum salmon bycatch tends to be higher in Cluster 1 or Unimak, if vessels continue to fish in these areas and are able to successfully minimize bycatch compared to status quo, there could be a substantial reduction in chum salmon and WAK chum salmon bycatch. This scenario would have the greatest potential for chum and WAK chum salmon bycatch reductions, but it also has a high risk that those benefits will not be realized and an increase in chum salmon bycatch if vessels are incentivized or required to move into Cluster 2.

When the corridor areas are compared to one another, the analysis indicates implementing a Cluster 2 corridor poses the least risk to creating adverse outcomes for chum and WAK chum salmon bycatch. This outcome is counterintuitive when considering historical chum salmon bycatch genetics data which indicate WAK chum salmon are encountered in higher proportions in the Cluster 1 and Unimak corridors. However, these outcomes are driven by the alternative structure that displaces pollock fishing when the corridor closed, the high amount of pollock harvest that has occurred inside Cluster 1 and Unimak, and the high chum salmon bycatch rates inside Cluster 2.

Table 1-4 Simplified comparison of the potential risks and benefits for chum and WAK chum salmon bycatch associated with Alternative 5

Cap / Corridor	Cluster 1	Unimak	Cluster 2
200,000	Moderate Benefit/Low Risk	Moderate Benefit/Lower Risk (compared to Cluster 1)	N/A
100,000	Moderate Benefit/Moderate Risk	Moderate Benefit/Lower Risk (compared to Cluster 1)	Moderate Benefit/Low Risk
50,000	High Risk/High Benefit ***if cap not met***	High Risk/High Benefit ***if cap not met***	High Benefit/Low Risk

Western and Interior Alaska Chum Salmon Fisheries

The proposed action is being considered in light of the recent and ongoing declines in WAK chum salmon abundance and the critical importance of chum salmon for Western and Interior Alaska ecosystems, communities and Tribes. Recent declines in chum salmon abundance were described above and are not repeated here. **Alternative 1** represents no change to the current chum salmon bycatch regulations and therefore does not have inherent benefits to Western and Interior Alaska ecosystems, subsistence and commercial fishermen, communities and Tribes beyond the status quo.

Subsistence harvests of chum salmon can be affected by conservation efforts for Chinook salmon and other species, weather patterns, households' needs in a given year, and abundance levels. Similarly, commercial chum salmon fisheries participation can be affected by a processor closing or the lack of a buyer as well as abundance. Coinciding with the recent period of decline, subsistence harvests of chum salmon across Western and Interior Alaska have been dramatically low in recent years, and commercial chum salmon fisheries within the Western and Interior Alaska management areas have experienced either closures or declining commercial chum salmon harvest trends in recent years.

Annual average subsistence harvests of chum salmon in the most recent three years (2020–2022) were 72% below the historical average in the Norton Sound region (1994–2019), 97% below the historical average for Yukon fall chum and 84% below the historical average for Yukon summer chum (1988–2019), and 76% below the historical average in the Kuskokwim region (1989–2022). Commercial chum salmon restrictions have been in place for Kuskokwim Bay, Kuskokwim River, Norton Sound, and Kotzebue (2020–2023). Closures have been in place for Yukon River summer chum since 2021 and for the fall run since 2022. The lack of commercial chum harvest in recent years is a stark contrast to commercial harvests of 576,700 summer chum salmon in 2018 and 489,702 fall chum salmon on the Yukon in 2017.

Declines in chum salmon abundance have had broad and severe implications for Western and Interior Alaska ecosystems, communities, and Tribes. These declines have coincided with declines in Chinook salmon runs and represent a significant loss for many rural and Indigenous communities' ways of life, cultural traditions, and spiritual wellbeing (see Section 4.3.3.2). Families are currently gathering less to use fish camps as many weigh the costs and benefits of traveling to fish during short windows when all of their needs may not be met (Trainor et al. 2021). It is at fish camp that core values like sharing, respect, not wasting, and the kinship relationships with salmon, are passed down to Alaska Native youth of the Yukon and Kuskokwim regions (see Section 4.3.3.2). Reduced opportunities for subsistence and commercial fishing have had a negative effect on households' ability to secure healthy and culturally preferred wild foods with broader effects within and across sharing networks and mixed economies for rural and Alaska Native communities (Wolfe 1982).

All of the proposed action alternatives are different measures to reduce chum salmon bycatch in the pollock fishery to the extent practicable. Relative to status quo, there could be positive and indirect impacts to Western and Interior Alaska chum salmon users. The degree to which the proposed alternatives being considered in this action could indirectly affect Western and Interior Alaska chum salmon users depends on the pollock industry's ability to reduce WAK chum salmon bycatch.

Under Alternative 2, the highest estimate on AEQ chum salmon savings from the Upper/Middle Yukon reporting group would have occurred in 2017 at 11,553 fish. The 2017 Yukon fall chum salmon run was 2,315,583 fish which was well above the drainage wide escapement goal of 300,000–600,000 fish. In 2017, limited subsistence fishing opportunities were provided due to Chinook salmon conservation measures. The lowest year of return for Yukon fall chum salmon was 2021 at 95,249 fish. In 2021, the highest estimate for AEQ Upper/ Middle Yukon savings would have occurred in 2021 under a 100,000-chum salmon cap and the AFA apportionment at 3,255 fish. These estimates indicate the alternative and options may not have changed the outcome for directed fishing opportunities in these years but could have resulted in more chum salmon returning to the river system and generally improved conservation towards meeting escapement goals.

An overall chum salmon PSC limit is expected to motivate changes in fishing behavior prior to a limit being reached, to the extent the sector is able. As such, these values may not represent an upper bound of potential overall savings. An AEQ analysis may also not capture the relative importance of a small number of fish for Western and Interior Alaska ecosystems, and the fishermen, communities, and Tribes that depend on chum salmon, as described in Appendix 7 and 8 provided by KRITFC and TCC. For many Indigenous communities across Western and Interior Alaska hold, their wellbeing is wholistically bound to salmon fishing (see Section 4.3.3.2 and Section 4.4.5.3.3).

Recent reductions in B season chum salmon bycatch have coincided with the implementation of measures in the IPAs aligned with the provisions proposed under **Alternative 4**. The degree to which Alternative 4 could have positive and indirect effects for Western and Interior Alaska chum salmon users depends on industry's ability to avoid WAK chum salmon in the overall bycatch. The individual provisions of Alternative 4 are analyzed in Section 3.2.4.3. Some provisions have the potential to reduce WAK chum salmon bycatch from current levels given the explicit focus on prioritizing hot spot closures when areas are more likely to have higher proportions of WAK chum salmon bycatch.

Alternative 5 could result in varied outcomes for Western and Interior Alaska chum salmon users. When the corridors are compared against one another, prioritizing chum salmon avoidance in Cluster 2 poses the least risk to creating adverse outcomes for chum and WAK chum salmon bycatch as well as Chinook salmon bycatch. It is possible that prioritizing avoidance in the Cluster 1 and Unimak corridors could have the greatest potential for chum and WAK chum salmon bycatch reductions, if vessels continue to fish in these areas and are able to successfully minimize bycatch compared to status quo. There is also a high risk that those benefits for WAK chum salmon will not be realized if effort is displaced outside these areas. If the corridor caps result in a longer season for the pollock sector, this could also risk increasing Chinook salmon bycatch relative to status quo levels.

To the extent that any proposed alternative reduces WAK chum salmon bycatch from current levels, the management change could increase the likelihood that WAK chum salmon return to their regions of origin with positive impacts towards conservation. Over time, higher abundance could provide more harvest opportunities. Additional flexibility in the timing and duration of subsistence harvesting opportunities could support traditional practices of fishing for chum salmon when they present themselves (see Section 4.3.3.2.1). This may also be more aligned with when fish are in better condition. More broadly, additional opportunities for subsistence fishing would make it more likely that households' harvest goals are met, that Tribal food sovereignty and security is supported, potentially restoring human-salmon-ecosystem relationships (see Section 4.3.3.2.2).

Chinook Salmon PSC

The number of Chinook salmon encountered as bycatch in the pollock fishery varies each year, but bycatch levels have decreased substantially since the hard caps took effect in 2011. From 1991–2010, the annual average Chinook salmon bycatch was 40,876 Chinook compared to 18,325 from 2011–2023. Since 2011, annual Chinook salmon bycatch levels have ranged from 6,337 fish in 2022 to 32,200 fish in 2020. The proportion of coastal Western Alaska Chinook salmon in the total bycatch has decreased from a high of 68.0% in 2011 to a low of 23.7% in 2017 and has since fluctuated around 47% since 2020.

AEQ and impact rate analyses were prepared to estimate the effect of Chinook salmon bycatch removals in the pollock fishery on the Upper Yukon and coastal WAK reporting groups. Bycatch removals of Upper/Middle Yukon AEQ Chinook was estimated to be less than 1% in all years from 2011–2023, except for 2022 when the impact rate was estimated at 1.1% of the total run size. The impact rate for the CWAK reporting group ranged from 1.2% to 3.6% (2011–2023).

The proposed management alternatives to reduce chum salmon bycatch in the pollock fishery would affect fishing behavior, and there could be a wide range of potential interactions with Chinook salmon. The pollock fishery catches both chum salmon and Chinook salmon bycatch during the B season. The timing of this catch is dissimilar amongst the two species, with Chinook salmon caught in the latter part of the B season and chum salmon caught throughout the B season. Additionally, WAK chum salmon bycatch is encountered in higher proportions from June to August compared to the later aspects of the B season (see Section 3.2.4.1.3). Similar trends were also observed inside the corridor areas under consideration Alternative 5.

The salmon bycatch IPA regulations require the IPAs to create incentives to ensure the Chinook salmon PSC rates in October are not significantly higher than those achieved in preceding months (50 CFR 679.21(f)(12)(iii)(E)(*13*)). As such, policy decisions for alternative management measure for chum salmon bycatch must also consider the potential impact on Chinook salmon PSC. A consideration of policy decisions for Chinook salmon bycatch are less relevant for Alternative 4. The pollock fleet has operated under the IPAs since 2010, and the provisions under Alternative 4 largely reflect current operations and thus Alternative 4 is not expected to have adverse impacts on Chinook salmon PSC.

The overall caps under **Alternatives 2 and 3** could close the B season earlier and thus reduce Chinook salmon PSC. A 100,000-chum salmon cap was estimated to reduce Chinook salmon bycatch by an average of 5,404 fish (2011–2023). Caps analyzed at higher amounts within the range for Alternatives 2 and 3 would result in marginal changes to Chinook salmon PSC compared to status quo. At higher cap amounts, there is less potential for early B season closures and the fleet would have greater operational flexibility to avoid Chinook and chum salmon PSC.

If a chum salmon PSC limit slowed the pace of the pollock fishery, it could increase divert pollock catch to later in the B season. This would likely increase Chinook salmon PSC. Chinook salmon bycatch rates increase as the B season goes on, such that the highest Chinook salmon bycatch rates have occurred in October (NMFS 2009, 2016). As shown in Figure 1-8, the average Chinook salmon bycatch rate in October (statistical weeks 41–44) was 0.10 Chinook/per mt of pollock compared to the average in prior B season weeks at 0.01 Chinook/mt of pollock.

Although the analysis expects the industry would carefully balance operations to avoid Chinook and chum salmon bycatch, adding a second hard cap to the B season would limit operational flexibility. In a scenario where fishermen cannot find consistently good pollock catch rates and lower chum salmon bycatch rates after moving or slowing their operations, Chinook salmon bycatch would likely increase in the later portion of the B season. All other factors being equal (environmental conditions, pollock aggregations, among other factors), this outcome becomes more likely for chum salmon PSC limits analyzed at lower amounts which are inherently more constraining.

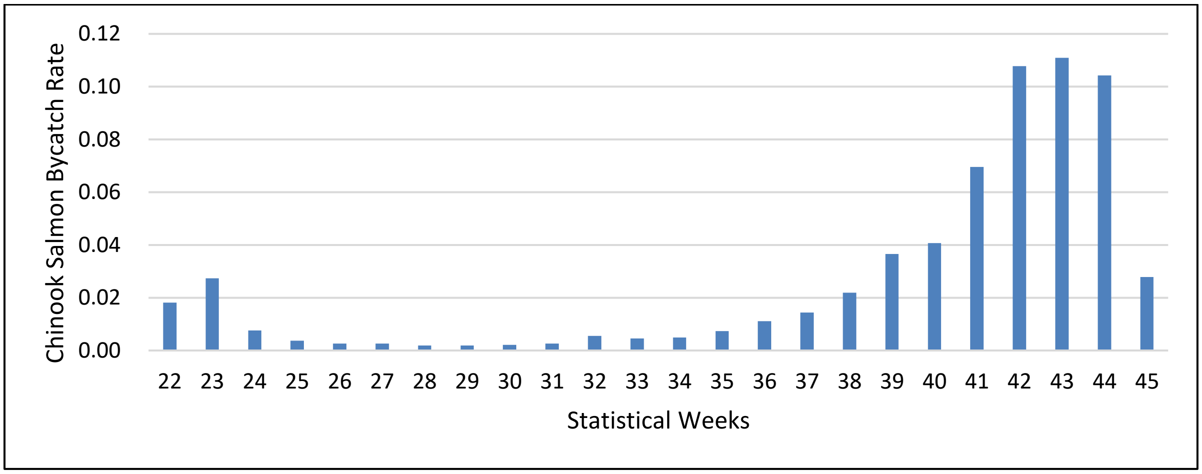

Figure 1-8 Distribution of the average weekly Chinook salmon bycatch rate in the B season pollock fishery, 2011–2023

Notes: Statistical weeks 41–44 typically align with the month of October in a given calendar year.

Chinook salmon bycatch could be reduced under **Alternative 5**, if a sector closed out of fishing in a corridor moved to new fishing grounds with good pollock aggregations that could sustain fishing or production *and* had lower chum and Chinook salmon PSC rates. Chinook salmon bycatch would likely increase if B season pollock catch is moved to areas with lower aggregations of pollock and catch rates. This scenario is more likely to occur if chum salmon avoidance is prioritized in Cluster 1, and to a lesser degree the Unimak corridor because of the substantial pollock harvest that has historically occurred in these areas. Prioritizing chum salmon avoidance in Cluster 2 appears to have the least potential for increases in Chinook salmon bycatch due to the comparatively lower amounts of pollock catch that could be displaced.

Herring PSC

Herring bycatch in the BSAI groundfish fisheries is managed under timed area closures called "Herring Savings Areas". The Herring Savings Areas close when the PSC limit is met which is set at 1% of the herring spawning biomass on an annual basis and apportioned among the trawl fisheries (see 50 CFR 679.21(e)(3)(iv)(B) through (F)). Herring PSC accrues towards the PSC limit on the basis of a fishing year (January 1 to December 31). If the PSC limit is met, the applicable Herring Savings Area will close to the relevant fishery.

From 2011–2023, herring PSC (mt) in the pollock fishery has ranged from 151 (mt) in 2014 to 3,720 (mt) in 2020. Herring PSC tends to be higher during the B season fishery rather than the A season, but the 2020 A season was a notable exception to this trend. The potential impacts to herring bycatch under Alternative 4 are expected to be marginal compared to the status quo. Alternative 2 and 3 could close the fishery earlier in the B season and thus could reduce herring bycatch. A 100,000-chum salmon PSC limit under Alternative 2 was estimated to reduce herring bycatch by an average of 235 mt due to early B season closures (2011–2023). The estimates on herring PSC reductions were substantially less under hard caps analyzed at the higher end of the range.

A primary point for consideration under Alternatives 2, 3, and 5 are the operational trade-offs that may present themselves inseason as pollock fishermen work to avoid chum salmon, Chinook salmon, and herring PSC. As an example, an inseason corridor under Alternative 5 would reduce the pollock fleet's operational flexibility to avoid herring bycatch to some degree. Herring bycatch was higher inside the Unimak corridor s and chum salmon bycatch rates were highest inside Cluster 2. Prioritizing chum salmon avoidance in Cluster 2 could encourage inshore CVs to target pollock inside Unimak and Cluster 1 and where herring bycatch was higher in recent years (2021–2023). Prioritizing chum salmon avoidance in Cluster 1 or Unimak could potentially reduce herring bycatch but it would also likely produce worse outcomes for chum and WAK chum salmon bycatch compared to status quo.

Overall, the different bycatch regulations and the fleet's behavioral responses to them create a high degree of uncertainty in the direction and magnitude of the potential impacts to chum and WAK chum salmon, Chinook salmon, and herring PSC as compared to Alternative 1.

Table 1-5 Summary of alternatives and options in relation to different PSC species and Council management objectives. The symbols ↑, ↔, ↓reflect improvements, relative neutrality, and potential negative effects all compared to status quo/Alternative 1, respectively

Alt/Opt.	Measure	Chum salmon PSC	WAK chum salmon PSC	Chinook PSC	Herring PSC
2/3	100,000-chum salmon PSC limit	↑	↑	↑↓	↑↓
2/3	550,000-chum salmon PSC limit	↔	↔	↔	↔
4.1	Use historical genetic data to inform likelihood of WAK chum salmon	↑↔	↑↔	↔	↔
4.2	Monitor RHS closures more than once per week	↑	↑↔	↔	↔
4.3	Required use of excluder device for duration of B season	↔	↔	↔	↔
4.4	Develop outlier provision	↑↔	↔	↔	↔
4.5	Weekly reporting to WAK chum salmon users	↔	↔	↔	↔
4.6	Closures when rates are very high	↑↔	↑↔	↔	↔
5.1	Cluster 1 corridor	↓↔	↓↔	↔	↔
5.2	Unimak corridor	↓↔	↓↔	↔	↔
5.3	Cluster 2 corridor	↑↔	↑↔	↔	↔

Bering Sea Pollock Fishery

The proposed changes to the current chum salmon bycatch regulations would apply to participants in the Bering Sea pollock fishery during the B season. From 2011–2023, the number of fishery participants include: 83 inshore CVs and the 6 shore-based processors these vessels deliver to; 16 CPs and 4 motherships that accept deliveries from 18 mothership CVs at-sea, as well as the communities these vessels are registered to and the shore-based processors are located within; the 65 coastal Western Alaska communities that participate in the CDQ program are also engaged in and dependent upon the Bering Sea pollock fishery. Continued management under **Alternative 1** would result in the current social and economic conditions at the local, regional, and state level continuing along current trends. Table 1-6 provides a fisheries engagement matrix for the sectors and communities participating in the pollock fishery.

Alternative 4 is similarly addressed here because it likely to have neutral or slightly increase operating costs for pollock harvesters relative to Alternative 1. The potential for adverse impacts to pollock fishery participants is substantially less under Alternative 4 compared to Alternatives 2, 3, and 5 because this alternative would add six new provisions into Federal regulations and essentially codify operational changes the fleet has adopted in recent years, with some new additions.

Table 1-6 Engagement matrix for communities engaged in or dependent on B season pollock by vessel's registered ownership address, location of shore-based processing facility (2011–2023), CDQ group affiliation, and indicators for community size, minority percentage population, and low-income population (referred to as "Environmental Justice indicators")

Community	CDQ group	Community size (number of persons)	Minority percentage population	Low-income percentage population	CP ownership	Mothership ownership	Inshore CV ownership	Mothership CV ownership	Shore-based processor location	CP product transfer location
Akutan	APICDA	1,589	90.8%	29.9%	NA	NA	NA	NA	1 facility (2011–2023)	NA
King Cove	NA	757	72.5%	16.4%	NA	NA	NA	NA	1 facility (2011–2023)	NA
Kodiak City	NA	5,581	67.8%	10.7%	NA	NA	4.2 CVs at 6.23% of total (2011–2023)	0.8 CVs at 5.92% of total (2011–2023)	NA	NA
Newport	NA	10,256	29.7%	20.4%	NA	NA	4.7 CVs at 7.04% of total (2011–2023)	NA	NA	NA
Seattle MSA	NA	4,018,762	41.2%	11.0%	12.7 vessels at 92.70% of all CPs (2011 –2023)	1.6 motherships at 47.73% of total (2011–2023)	53.5 CVs at 80.16% of total (2011–2023)	12.0 CVs at 92.31% of total (2011–2023)	NA	NA
Unalaska	APICDA	4,254	68.8%	13.2%	NA	1.8 motherships at 52.27% of total (2011–2023)	NA	NA	3 facilities (2011 –2016) 4 facilities (2017–2023)	Location of both CP and mothership product transfers

Notes: Community population (or size) data are based upon the 2020 U.S. Census. The minority percentage population and low-income percentage population are based upon the 2022 American Community Survey estimates. Color shading is provided for contrast. Blue denotes a CDQ community, purple denotes environmental justice indicators, and green denotes community participation in the pollock fishery through vessel ownership address or the location of a shore-based processor. Darker shading within a category indicates higher values.

A chum PSC limit under **Alternative 2 or 3** is expected to motivate changes in fishing behavior if there is a perceived risk of a B season closure. Pollock fishermen would be expected to alter their behavior, to the extent they are able, to avoid a closure and minimize losses associated revenue losses. However, altering harvest strategies may increase avoidance costs. Avoidance of chum PSC would likely decrease harvesting operational efficiency in several ways, which may carry different implications for economic viability and sustained participation across the fleet. Greater sensitivity to chum PSC rates means vessels may need to move more often, conduct more test tows, or fish further from port. It may mean they need to move from areas of good pollock aggregation and/or size/flesh quality to less desirable fishing areas. Increased travel time/movement would increase fuel costs, which could result in increased cost per unit of catch. Decreased operational efficiency could also contribute to a longer B season, which would increase a suite of other variable costs and risk increased Chinook PSC.

Avoidance techniques may delay or prevent a closure resulting from a chum salmon PSC limit. If the sector is unsuccessful, and they are closed early there may be forgone revenue associated with that unharvested pollock. The analysis of potentially forgone gross revenue uses a retrospective examination of when each pollock sector hypothetically would have hit the various chum salmon PSC limits had the limits been in place in each of the years 2011-2023. Estimates on the amount of potentially forgone gross revenue are intended to provide an upper bound for decision-makers to consider the potential direct revenue impacts and are a way for the alternatives and options to be compared against one another.

The retrospective analysis indicates a 100,000-chum salmon PSC limit would be more constraining for the pollock industry compared to higher cap amounts (Table 1-7). Of the 13 years analyzed, a 100,000-chum salmon PSC limit could have ended B season fishing early for the CDQ sector in 5 or 6 years, 10 or 11 years for the CP sector, 12 years for the inshore sector, and 10 years for the mothership sector. Under this lowest cap, without additional changes in fishing behavior, each sector could have seen an average reduction of 19%-47% in their B season gross revenue. In comparison, a 550,000-chum salmon PSC limit could have potentially ended the B season early for all sectors in 0 to 2 years, depending on the apportionment. This would likely lead to minimal or no forgone revenue at the sector-level. However, the analysis also highlights adverse impacts that may occur at the vessel- company- or cooperative-level from dynamics created from the PSC limits, even if the sector is able to harvest its full apportionment of pollock.

The cap amounts being considered under Alternative 3, Option 2 are the same as Alternative 2 and thus the potential for adverse impacts are expected to be similar in years when a cap is in place. When a chum salmon PSC limit would not be in effect, the impacts to the pollock industry would be similar to status quo. A 75,000-chum salmon cap is possible under Alternative 3, Option 1, if the cap set when one area fails to meet its threshold is 100,000 chum salmon. In the limited number of years that a 75,000-chum salmon PSC limit could have been in effect, the potential impacts to the pollock industry would be greater in magnitude. The analysis indicates that all sectors would have exceeded their apportionment under this cap amount in 2021, the highest bycatch year analyzed. In this year, CDQ, inshore, and mothership sectors would have left more than 60% of their B season pollock allocation unharvested, without additional changes in fishing.

Table 1-7 Summary of the number of years when closures potentially could have occurred and potential reductions in gross first wholesale revenue had chum salmon PSC limits been in place, 2011–2023

Sector	Apportionment	100,000 PSC limit			325,000 PSC limit			550,000 PSC limit		
		Number of years closed (out of 13)	Average forgone revenue (million of 2022$)	% reduction in average B season forgone revenue	Number of years closed (out of 13)	Average forgone revenue (million of 2022$)	% reduction in average B season forgone revenue	Number of years closed (out of 13)	Average forgone revenue (million of 2022$)	% reduction in average B season forgone revenue
CDQ	Least adverse: AFA	5	$18.3	19%	2	$8.6	9%	2	$3.0	3%
	Most adverse: 3-yr avg	6	$21.3	23%	3	$13.9	15%	2	$8.6	9%
CP	Least adverse: AFA	10	$85.7	25%	2	$17.3	5%	1	$17.3	0%
	Most adverse: 3-yr avg	11	$121.4	35%	6	$60.5	18%	2	$60.5	5%
Inshore	Least adverse: 3-yr avg	12	$153.5	40%	2	$15.9	5%	0	$11.8	0%
	Most adverse: AFA	12	$181.8	47%	5	$31.5	9%	1	$11.8	3%
Mothership	Least adverse: 5-yr avg	10	$32.2	38%	4	$38.8	7%	0	$0.0	0%
	Most adverse: AFA	10	$33.6	39%	4	$38.8	7%	1	$2.1	3%

Notes: forgone revenue values are gross first wholesale values for all sectors. For the stake of comparison across alternatives, the analysis also demonstrates forgone gross ex vessel revenue as well, estimated for the offshore sectors that do not generate an ex-vessel price.

An early B season closure could have widespread implications for fisherman, processing crew members, shore-based processors and communities. However, the potential adverse effects would not be experienced evenly throughout the fleet. Reduced revenue could impact companies' ability to immediately cover fixed and variable operational costs. Some AFA vessels and companies are more diversified across other fisheries (e.g., participation in other Bering Sea, Gulf of Alaska, and West Coast groundfish fisheries), which may help them balance potential inter-annual reductions in B season pollock revenue. In general, AFA CPs and CVs are limited in the scope of other federally managed fisheries they could participate in because many are managed under rationalized programs, sideboard limitations that constrain AFA vessels from participating in other Bering Sea and Gulf of Alaska fisheries, and current market conditions.

Harvesting and Processing Crew. Early B season closures could reduce crew members' compensation and/or there is a potential for job losses. An average of approximately 2,300 crew members have been employed on AFA vessels and 1,700 shoreside processing workers have been affiliated with the B season fishery (2014–2023). Separate from an early closure, increased avoidance costs and decreased operational efficiency may also result in additional impacts to harvesting and processing crew. For instance, many crewmembers are compensated through a share-based wage, therefore increased vessel costs, decreased revenue and longer trips could all contributed to a lower pay-per-day for crew members. It is expected that efforts to avoid reaching a chum salmon PSC limit may increase uncertainty among captains and crew regarding employment in the fishery as longer B seasons and time away from home and/or lower pay would affect crew morale and retention which may also have implications for at-sea safety and productivity.

Shore-based Processors. Compared to other sectors, the inshore CVs are more limited in the chum salmon avoidance strategies they can use. The shore-based processors they deliver to have requirements to ensure a fresh, high-quality product that limit how far these vessels can travel to find new fishing grounds with high pollock catch rates and low PSC. There is diversity in the size, capacity and horsepower of vessels within the inshore CV sector and smaller, lower capacity CVs may be disproportionate challenged in where they can fish. The potential impacts to shore-based processors are inherently connected to the bycatch performance of the CVs that deliver to them.

B season pollock accounted for an annual average of 43.82% ($374.21 million) of these processors' gross revenue. This suggests these processors have a high degree of dependency on the B season fishery. More broadly, early B season closures or lower and slower deliveries from inshore CVs could destabilize processing operations which would impact the other fisheries—Pacific cod, crab, halibut, salmon, sablefish among others—that these processors participate in. Pollock is a high-volume fishery that allows these processors to operate at a cost-effective rate, given the capacity of the facility and the expectations for the catch and delivery rates of the inshore CVs. Slower or interrupted delivers could limit these companies' ability to continue participating in other fisheries, including other facilities in non-pollock dependent communities, that may be of critical importance to the fishermen and communities that rely on them.

Pollock Dependent Communities. The Seattle Metropolitan Statistical Area[15] (MSA), Newport, Kodiak City, Unalaska, Akutan, and King Cove are communities substantially engaged in or dependent upon the B season fishery. Unalaska is an Alaska community uniquely affiliated with all sectors, and so is the Pacific Northwest community of Seattle MSA. All of these communities hold identities as "fishing communities" in some form. Early closures and/or high avoidance costs could have far-reaching economic and social implications.

Unalaska, Akutan, and King Cove could experience direct and adverse impacts through reduced fishery-related tax revenues, a loss of jobs within the community, and reduced spending at support sector businesses. Unalaska earned an average of $5.30 million in direct fishery-related tax revenue from B

[15] The Seattle MSA is composed of King, Snohomish, and Pierce counties in Washington State.

season pollock (2011–2022). This represented 16.50% of the City's total general fund revenue and provides a sense of scale for the potential economic impacts to the community. It is worth noting that shore-based processors and their communities could also experience adverse impacts apart from an early closure if the processor(s) receives lower wholesale prices because the pollock delivered is of lower quality. This scenario would reduce processors' gross revenue as well as the revenue earned from the State's Fisheries Business Tax.[16]

The potential impacts to Kodiak City and Newport are somewhat different in their nature and scope. The B season pollock fishery accounted for an average of 25.57% ($3.55 million) and 36.84% ($5.93 million) of the gross revenue CVs affiliated with Kodiak City and Newport (respectively) earned from all fisheries (2011–2023). Early B season closures or high avoidance costs would have an adverse impact on these vessels, their crew, and by extension the communities they are affiliated with in terms of reduced income and economic activity (for instance, harbor fees or spending at gear shops). The B season fishery plays a meaningful role in these vessels' business plans and the opportunities to participate in other fisheries are limited, but pollock has also provided a sense of stability. As younger fishermen weigh the many trade-offs of entering the industry, the possibility of a constraining hard cap or the observance of an early closure could discourage fishermen from buying into the industry in the future.

Seafood Markets. Alaska's seafood industry is currently facing a variety of challenges – record-low seafood prices, inflation, increased transportation costs, increased competition from foreign producers, among others. These are cross-cutting issues that are largely external to the regulatory changes being considered in this preliminary DEIS, but theses dynamics could make pollock fishery participants more vulnerable to the potential adverse economic effects from a B season closure. For instance, frequent or erratic closures in the B season may make it more difficult to maintain new or existing markets with other external pressures.

CDQ Groups and Communities. The overall caps being considered under Alternative 2 and 3 have the potential to reduce CDQ revenue through their direct allocation of pollock and investments in the AFA fisheries. The CDQ groups receive an allocation of pollock and five of the six groups also have ownership or partnerships in AFA companies that could be impacted by the proposed PSC limits. CDQ pollock has typically been harvested on CPs and for many groups this involves leasing the quota to an AFA company. Since all CDQ groups are focused on supporting their regions and communities, both the groups and their communities may experience adverse impacts from an overall hard cap both through their allocations of CDQ pollock and their AFA investments. Direct CDQ pollock allocations typically make up a large and stable portion of group revenues from CDQ species (~70% in 2023). Between the pollock quota for CDQ and AFA, CDQ groups have connections to ~29% of the total directed Bering Sea pollock fishery.

These connections to the pollock fishery provide a primary and important source of revenue for the groups with which to support their mission of providing economic and social benefits to the communities they represent. Each CDQ group supports diverse programs for their respective regions and communities, including employment opportunities, shore-based fisheries development, in-community infrastructure projects, educational scholarships, and financial support for local participation in small boat fisheries and subsistence activities. Changes in net revenues could impact the CDQ groups' ability to continue supporting these types of programs, depending on the magnitude of overall decreases or variability in revenue.

Alternative 5 would not inherently result in forgone revenue for the industry but could lead to increased avoidance costs and decreased operational efficiency, similar to Alternative 2 and 3. Vessels displaced from a corridor closure could continue fishing outside the area until September 1st and return to fishing inside if it is beneficial for them to do so. Since the risk and consequence of corridor closures are different across sectors and the corridor considered, the impacts are considered by sector separately. Similarly, the

[16] The Fisheries Business Tax is typically paid by the first processor of fish, or the exporter of unprocessed fish, on the raw fish landed in the state.

analysis suggests there would be differential changes in fishing behavior among the sectors. The degree of anticipated operational response based on the potential risk and consequence by sector is summarized in Table 1-8.

Table 1-8 Summary of sector-level reliance on the corridors and potential operational responses to avoid the consequence of reaching corridor caps under Alternative 5

Corridor	Sector	Reliance on corridor	Potential operational response*
Cluster 1	CDQ/ CP	Moderate	Variable based on the conditions of that year
	Mothership	Moderate	Variable based on the conditions of that year
	Inshore	High	Broad strategic changes in fishing at the beginning and throughout the B season
Unimak	CDQ/ CP	Low	Limited operational changes
	Mothership	Moderate	Variable based on the conditions of that year
	Inshore	High	Broad strategic changes in fishing at the beginning and throughout the B season
Cluster 2	CDQ/ CP	Moderate	Variable based on the conditions of that year
	Mothership	Low	Limited operational changes
	Inshore	Moderate	Variable based on the conditions of that year

*Depending on cap level and apportionment chosen.

The analysis indicates not all corridor caps would impact all sectors. The mothership sector relied on Cluster 2 for its pollock harvests to varying degrees and would have been moved out of that corridor in 1–2 of the 13 analyzed years. CP pollock (and CDQ) has primarily been caught outside of Cluster 1 with very little dependency on the Unimak corridor because it is fully encompassed within the CVOA. Corridor cap apportionments are based on a sector's historical PSC inside the corridor, so with a small amount of the total cap the risk of a Cluster 1 closure could be high for either sector. However, the consequence of a temporary closure may not be very high and thus not motivate changes in fishing behavior.

The inshore sector would be most impacted by a Cluster 1 corridor and the Unimak corridor to a lesser degree. In the most recent five years (2011–2023), 42% to 98% of the inshore sector's B season pollock was harvested in Cluster 1 and to 35% to 86% in the Unimak corridor. The inshore sector has relied on the fishing grounds in these corridor areas because they have historically had good aggregations of pollock that can sustain fishing, but also because of their processors' delivery requirements which are less costly to fulfill when pollock is caught closer to port. A temporary closure of either corridor would likely move these vessels to outside areas to continue fishing, to the extent they are able to do so. The analysis indicates a Cluster 1 corridor closure would have put $0–$36.2 million in gross ex vessel revenue "at risk," depending on the PSC limit and apportionment for a Cluster 1 corridor (2011–2023).

Depending on the corridor-cap amount, the inshore sector could respond to the risk of losing access to the Cluster 1 and Unimak corridors with different strategies to avoid that cap. Cooperative manages could carefully monitor chum salmon bycatch inside the corridor and move vessels more frequently (i.e., have a lower threshold for when movement needs to be considered or occur). Cooperatives may also send larger vessels with greater capability to fish further away from port and outside of the corridor because chum salmon PSC caught outside the corridor would not accrue toward the cap. As such, smaller inshore vessels with lower capacity may be disproportionately constrained by the inseason corridor cap.

The potential impacts to shore-based processors and pollock dependent communities would be similar in nature to those summarized for Alternative 2 and 3, but the magnitude under Alternative 5 would generally be less. An exception to this could arise from a scenario where a Cluster 1 or Unimak corridor cap was very constraining for one or more inshore cooperatives such that shore-based processors' operations were substantially disrupted.

Comparison of Impacts of the Alternatives

This part of the Executive Summary provides a high-level, quantitative overview of the potential impacts to different resource categories. The important context and uncertainties associated with these estimates have been described qualitatively and at length throughout the Executive Summary and preliminary DEIS.

Table 1-9 Summary of impacts of the alternatives to minimize chum salmon PSC in the Bering Sea pollock fishery

Category	Alternative 2 and 3	Alternative 4	Alternative 5
Description of Alt.	*Alt 2.* Hard cap 100,000-550,000 chum salmon; four options for sector apportionments and options for transfers. *Alt 3.* Hard cap of 75,000-550,000 (opt. 1) or 100,00-550,000 chum salmon (opt. 2). Cap is only in place when indices fail to meet thresholds, either the Three-area index (opt. 1) or Yukon area index (opt. 2); apportionment and transferability provisions are the same as Alt. 2.	Modify salmon bycatch IPA regulations to include six additional provisions for chum and WAK chum salmon avoidance.	Inseason corridor in place from June 10 to Aug. 31. Corridor closure triggered by corridor caps of 50,000-200,000 in Cluster 1 and Unimak and 50,000 or 100,000 in Cluster 2. Apportionment and transferability provisions are the same as Alt. 2 and 3.
Chum salmon			
Total chum salmon PSC reductions	*Alt 2.* Chum salmon PSC reduced by an average of 2,210 (550K cap, AFA) to 150,936 fish (100K cap, pro rata). *Alt 3.* Total PSC reductions are less than what is anticipated across years under Alternative 2. Avg. reductions from 75K cap ranged from 178,317 (AFA) to 200,731 (3-yr avg.) in limited years.	Similar to status quo with increased potential for lower chum salmon PSC. Recent IPA changes have coincided with increasingly lower overall levels of chum salmon PSC, 2022 PSC was a 55% reduction, 2023 PSC an 80% reduction, and 2024 a 94% reduction from 2021 level.	2019–2023 avg. weekly chum bycatch rate peaks at 4.0 chum/mt pollock in Cluster 2 compared to 0.93 and 1.05 chum/mt pollock in Cluster 1 and Unimak respectively. Prioritizing chum salmon avoidance in Cluster 2 presents the lowest risk of creating adverse outcomes for chum salmon PSC. Highest potential savings and risk result from prioritizing avoidance in Cluster 1.
WAK chum salmon PSC reductions (AEQ)	*Alt 2.* CWAK AEQ reduced by an average of 564 (550K cap, AFA) to 21,678 fish (100K cap, pro rata). Highest single year of savings estimated to occur in 2017 at 47,862 fish. Upper/Middle Yukon AEQ reduced by an average of 101 (550K cap, AFA) to 3,435 fish (100K cap, pro rata). Highest single year of savings estimated to occur in 2017 at 11,553 fish. *Alt 3.* Highest single year of CWAK AEQ savings estimated in 2022 at 35,318 fish (75K cap, 3-year avg.); highest single year of Upper/Middle Yukon savings estimated in 2021 at 3,627 fish (75K cap, 3-year avg.).	Similar to status quo with increased potential for lower WAK chum salmon PSC.	2019 –2023 avg. WAK chum proportions in Early period were ~19% in Cluster 1, 22% in Unimak, and 11% in Cluster 2. Late period proportions were ~19% Cluster 1, 18% in Unimak, and 10% in Cluster 2. WAK chum PSC rates highest in Cluster 2. Despite lower historical proportions of WAK chum in Cluster 2, adverse impacts to WAK chum PSC expected if pollock catch was moved to Cluster 2.
Chinook salmon			
Chinook salmon PSC	Variable impacts to Chinook salmon PSC but constrained by existing PSC limits and not expected to jeopardize sustainability of stocks. *Alt 2.* Annual avg. Chinook PSC reductions range from 773 fish (550K cap, AFA) to 5,448 (100K cap, AFA). Potential PSC increases not quantified. Later fishing in the B season when Chinook rates are highest would increase Chinook PSC compared to status quo; scenario more likely at lower chum cap amounts.	Likely similar to status quo.	Avg. Chinook PSC rates highest in Cluster 1 and Unimak for CP/CDQ and Mothership in October and Cluster 2 for shoreside. Prioritizing chum salmon avoidance in Cluster 1 has the greatest potential for adverse impacts to Chinook PSC. Similar to Alt 2 and 3, impacts would be constrained by existing PSC limits.

Pollock			
Pollock stock	Potential for reduced catches. Not expected to impact the productivity of the pollock resource.	Likely similar to status quo. Not expected to impact the productivity of the pollock resource.	Potential for reduced catches but less likely than Alternative 2 or 3. Catch location could move but would occur within historical footprint of the fishery. Not expected to impact the productivity of the pollock resource.
Pollock catch	*Alt 2.* Avg. *f*orgone pollock catch ranged from 15,741 mt (550K cap, AFA) to 272,620 mt (100K cap 3-year avg.). CP and CDQ most constrained by 3-year avg. apportionment and least constrained by AFA. Mothership most constrained by AFA and least constrained by 5-year avg. Inshore most constrained by AFA and least constrained by 3-year avg.	Likely similar to status quo.	*Opt. 1, Cluster 1:* avg. pollock catch displaced ranged from 4,846 mt (200K cap, 5-year avg.) to 106,383 mt (50K cap, AFA). *Opt. 2, Unimak:* avg. pollock catch displaced ranged from 0 mt (200K cap, 3-, 5-year, and pro rata) to 89,005 mt (50K AFA). *Opt. 3, Cluster 2:* avg. pollock catch displaced ranged from 9,091 mt (50K cap, AFA) to 16,927 mt (100K cap, 3-year avg.) Inshore sector more impacted by Cluster 1 compared to other areas; mothership CVs would be impacted by Cluster 1/Unimak; CP/CDQ primarily affected by Cluster 2.

Next Steps

The Council will review this preliminary DEIS at its February 2025 meeting. At that time, the Council may choose to modify the proposed alternatives and/or recommend a Preliminary Preferred Alternative (PPA). The Council may recommend the preliminary DEIS be revised and published by NMFS. The Council is not required to identify a PPA prior to recommending the agency publish the DEIS, but a benefit of doing so is that it provides an opportunity for more focused public comment and input to be received on the published DEIS.

To move this action and the current set of alternatives forward, there are several points for consideration that need to be addressed and are outlined in Table 1-10 below. Each point for consideration is written to convey what decisions the Council may want to make now as well as those that must eventually be made in a final recommendation to move that alternative forward.

Table 1-10 Points for consideration to further develop the proposed alternatives

Alternative/Option	Points for Consideration
Alt 1. No Action	No additional points for consideration. Selecting Alternative 1 would retain the current regulations for chum salmon bycatch management in the Bering Sea.
Alt 2. Hard Cap	o Does the Council want to continue its consideration of Alternative 2 at this time? o If yes, it may identify a cap amount and apportionment approach to include in a PPA. The Council is not required to do so, but these components would need to be included in a final recommendation.
Alt 3. Hard Cap with Index	o Does the Council want to continue its consideration of Alternative 3 at this time? o If yes, it may identify a cap amount and apportionment approach to include in a PPA. The Council is not required to do so, but these components would need to be included in a final recommendation. o If yes, the Council may also identify one index for WAK chum salmon abundance to include. The two options for indices are mutually exclusive and one would need to be included in a final recommendation. o If yes, the Council may also identify one threshold amount for WAK chum salmon abundance to be used. Only one threshold amount would be included in a final recommendation.
Alt 4. Modifications to the IPAs	o Does the Council want to continue its consideration of Alternative 4 at this time? o If yes, the six provisions may be individually selected, or all could be included in the Alternative. No provisions are mutually exclusive.
Alt 5. Inseason Corridors Closed by a Cap	o Does the Council want to continue its consideration of Alternative 5 at this time? o If yes, the Council may identify one corridor, cap amount, and apportionment to include in a PPA. It is not required do to so, but these components would need to be included in a final recommendation. The three inseason corridors being considered are mutually exclusive and only one could be included in a final recommendation.

1 Introduction

This preliminary DEIS analyzes proposed alternatives for managing chum salmon prohibited species catch (PSC) or bycatch in the Bering Sea pollock fishery. The North Pacific Fishery Management Council (Council) is considering a range of PSC limits or "caps" on the number of chum salmon that may be caught in the Bering Sea pollock fishery and closure of all or part of the Bering Sea to pollock fishing once the limit is reached. This preliminary DEIS provides an assessment of the environmental, economic, and social impacts of the proposed action alternatives and their distribution. This analysis addresses the statutory requirements of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the National Environmental Policy Act (NEPA), and Presidential Executive Order 12866.

This preliminary DEIS is a document prepared by the Council and the National Marine Fisheries Service (NMFS) Alaska Region, and it provides information for decision-makers and the public to understand a) the need for changing the current management approach for chum salmon bycatch; b) the purpose and objectives being pursued under each of the proposed management and regulatory changes c) the range of management alternatives being considered; d) relative implications ("adverse" or "beneficial") of adopting each alternative, compared with taking no management action.

Under the MSA, the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The management of marine fishery resources within the nation's EEZ in federal waters 3 to 200 nautical miles from shore is vested in the Secretary of Commerce (Secretary) and in eight Regional Fishery Management Councils. In the Alaska Region, the Council is responsible for preparing Fishery Management Plans (FMPs) and FMP amendments for marine fisheries requiring 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.

This preliminary DEIS is being prepared using the 2020 Council on Environmental Quality (CEQ) NEPA Regulations. NEPA requires that an EIS be prepared on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment (40 CFR 1502.3). Additionally, EISs are prepared when the proposed action is novel, when there is controversy in the underlying science used to understand the impacts of the alternatives, or when the potential impacts are unknown. A Notice of Intent to publish an EIS for the proposed management measures was published in the Federal Register on July 11th, 2023.

1.1 Purpose and Need

The Council recommended 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.

1.2 Affected Environment

The environment that is the subject of this action is the Bering Sea sub-area of the BSAI management area. Pollock is managed as three separate units within the BSAI management area: 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.[17] The proposed action would not affect the pollock fishery in the Aleutian Islands or other Bering Sea groundfish fisheries (Figure 1-1).

All proposed regulatory changes would solely affect the participants in the Bering Sea pollock fishery as the directly regulated entities, but the indirect impacts of the proposed action could beyond the action area to the freshwater streams of origin for the chum salmon caught as bycatch which originate from stocks across Asia, Alaska, Canada, and portions of the contiguous Western United States. For the purpose of this NEPA analysis, this larger area is the affected environment. See 40 CFR 1502.15.

[17] Under 50 CFR 679.22(a)(7)(i), directed fishing for pollock is not allowed in the Bogoslof District and the entire TAC is allocated as an incidental catch allowance for pollock harvested in other groundfish directed fisheries that occur in this area.

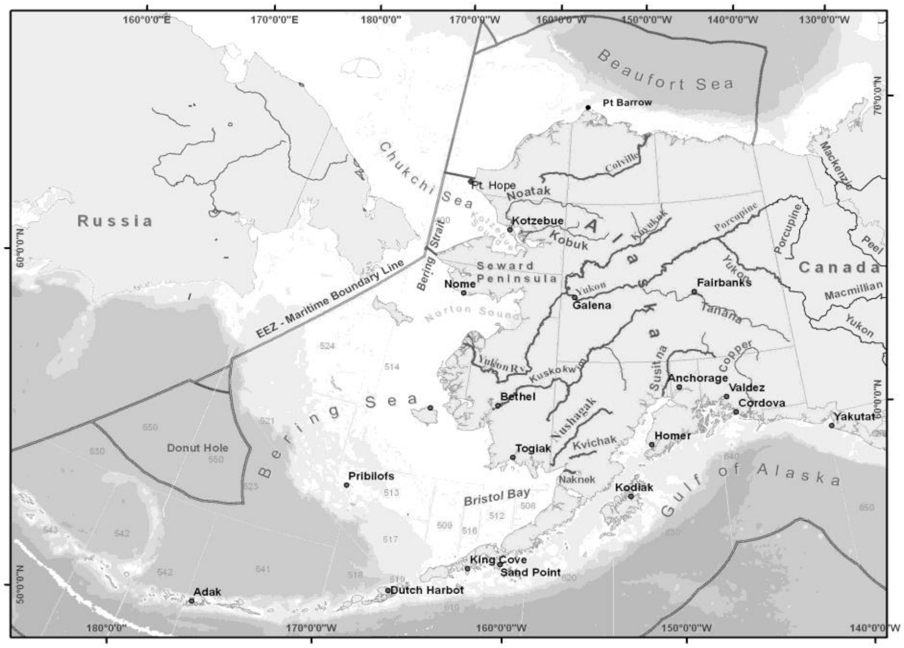

Figure 1-1 Map of the Bering Sea and salmon producing rivers

1.3 Consultation and Engagement with Tribes and Alaska Native Claims Settlement Act Regional and Village Corporations

Pursuant to Executive Order (EO) 13175 and subsequent Presidential memoranda, NOAA must have an accountable process to ensure meaningful and timely input from Tribal officials in the development of Federal policies with Tribal implications. Consistent with NOAA's Tribal Consultation Handbook, NMFS consults with Tribal officials from Alaska Native Tribes on a government-to-government basis.[18] In addition, because Congress required Federal agencies to consult with Alaska Native corporations on the same basis as Federally recognized Tribes, NMFS engages in consultations with Alaska Native Claims Settlement Act corporations.[19] The Tribal consultation policies of the Department of Commerce[20] and NOAA[21] identify the need for Federal agencies such as NMFS to consult and work with Federally recognized Tribal governments when developing "regulations, legislative comments or proposed legislation, and other policy statements or actions that have substantial direct effects on one or more Tribes".[22] NMFS may also conduct Tribal consultation for actions that do not fit within the definition under EO 13175.

Consistent with its commitment to an improved consultation process, on December 3, 2024, NMFS Alaska Region posted its Tribal Consultation Protocol (Protocol) in accordance with Department of Commerce and NOAA policies on government-to-government consultation, related executive orders, and the Alaska Implementation Plan for the NMFS Equity and Environmental Justice Strategy. The Protocol includes an introduction, NOAA's definitions of engagement and consultation, an overview of the roles and responsibilities of the NMFS Alaska Region, the Alaska Fisheries Science Center, and the Council, and specifics on the tribal consultation process. To address questions about the Protocol, virtual

[18] NOAA Procedures for Government-to-Government Consultation.
[19] Public Law (P.L.) 108-199, 118 Stat. 452, as amended by P.L.108-447, 118 Stat. 3267. NOAA interprets the term "Alaska Native corporations" to mean "Native corporation[s]" as that term is defined under the Alaska Native Claims Settlement Act (ANCSA) of 1971 (43 U.S.C. § 1602).
[20] Department of Commerce DAO 281-8 (Consultation And Coordination With Indian Tribal Governments).
[21] NOAA Tribal Resources can be accessed at this webpage: https://www.noaa.gov/legislative-and-intergovernmental-affairs/noaa-tribal-resources/information-documents
[22] From the definition of "Policies that have Tribal implementations" in Section 1 of E.O. 13175.

engagement sessions with Federally recognized Tribes and representatives were scheduled for January 7 and 8, 2025. The Protocol can be found at the NFMS Alaska Region webpage on *Tribal Consultations and Engagements in Alaska*.

As described below, NMFS's engagement and consultation with Tribes to address chum salmon bycatch in the Bering Sea pollock fishery began in early 2022.[23] NMFS issued a notice of intent to develop an EIS on July 11, 2023. NMFS has continued to engage and consult with Tribes as the Council has analyzed and further refined the alternatives under consideration. Additional opportunities for Tribal engagement and consultation during the development of the EIS are outlined below (section 1.3.3).

Throughout this action, NMFS identified ways to improve Tribal participation in the Council process. Starting in October 2022, NMFS began preparing and circulating prior to each Council meeting a Tribal newsletter that provides, among other information, notice of the upcoming agenda items. Also prior to each Council meeting, NMFS circulates an invitation to request consultation on any of the upcoming agenda items that may affect Tribes. Starting in March 2024, NMFS began regularly holding a Tribal engagement session two to three weeks before each Council meeting. These engagement sessions provide an overview of the upcoming Council actions, a space for building relationships, and an opportunity for Tribes to ask questions of NMFS and Council staff.

1.3.1 Tribal Engagements and Consultations

At the following Tribal engagement sessions and formal consultations, the topic of chum salmon bycatch in the Bering Sea pollock fishery was discussed.

On **January 11, 2022**, NMFS conducted a virtual Tribal listening session attended by approximately 80 people, the Assistant Regional Administrator, and several NMFS staff. The purpose of this meeting was to allow earlier participation in the development of a management measure to address salmon bycatch in the Bering Sea pollock fishery.[24] Tribal representatives expressed concerns about Chinook and chum salmon bycatch in the Bering Sea pollock fishery and the State of Alaska managed Area M salmon fishery amid declines in salmon runs. These run declines and accompanying State and Federal (Department of Interior) restrictions on subsistence fishing affect Tribal food security, culture, spiritual and sacred connections with salmon, the intergenerational passing on of the Tribal way of life, and the health and wellness of Tribal children and elderly. Poor salmon runs also have ecosystem impacts by reducing the transport of marine nutrients. The fractured management system between state and Federal entities makes it difficult to protect the Tribes' subsistence way of life. Participants also expressed a feeling of inequity as they are at risk of being arrested for continuing their traditions and feeding their communities while pollock vessels are permitted to continue fishing.

Proposed solutions to addressing inequity included having Tribal seats on the Council, requiring the use of longline gear instead of trawl nets, closing the Bering Sea to trawl fishing and creating a Federal bycatch committee. Tribal participants asked for a stand down of pollock fishing, at least temporarily, to allow salmon to come back.

The importance of government-to-government consultation and the Federal-Tribal trust responsibility were highlighted. Tribal participants requested that NMFS proactively consult with Tribes and visit affected communities. NMFS shared its extensive research program to better understand Chinook and chum salmon bycatch. NMFS explained the current measures to reduce salmon bycatch in the pollock fishery. NMFS noted that it encourages the reduction of bycatch, but also that the management process can be slow and frustrating.

[23] Summaries of consultations and engagements for salmon bycatch can be found at https://www.fisheries.noaa.gov/alaska/consultations/alaska-fisheries-tribal-consultation-documents-and-workgroup#salmon-bycatch
[24] A summary of this meeting can be found at https://media.fisheries.noaa.gov/2022-02/tanana-chiefs-consultation-summary.pdf

On **January 21, 2022**, NMFS held a virtual consultation with the Tanana Chiefs Conference (TCC), attended by the Acting Regional Administrator and numerous NMFS staff. TCC initiated this consultation to discuss concerns about Chinook and chum salmon bycatch.[25] Specific topics discussed included: the Tribal request for an emergency action to eliminate Chinook salmon bycatch; a cap on chum salmon bycatch in the Bering Sea pollock trawl fishery; NMFS disaster declaration process; and Tribal food security.

At the **June 2022 Council meeting**, after receiving information on the current amount chum salmon bycatch, the Council requested that its staff prepare a discussion paper and formed a Salmon Bycatch Committee (SBC) composed of Tribal representatives, in-river salmon users, and representatives from the Bering Sea pollock fishery.[26] At the **December 2022 Council meeting**, the Council requested that the SBC develop recommendations for potential chum salmon bycatch management alternatives.[27]

On **February 3, 2023**, NMFS held a virtual Tribal consultation with the Kuskokwim River Intertribal Fish Commission (KRITFC), Association of Village Council Presidents (ACVP), TCC, Mountain Village, and the Bering Sea Fishermen's Association (BSFA). This consultation was in response to a request by these Tribal organizations to discuss the upcoming Bering Sea Aleutian Island harvest specifications. Tribal representatives shared concerns about declining salmon runs and how they believed that salmon bycatch in the Bering Sea was contributing. They also expressed a desire for greater government- to-government consultation and more meaningful opportunities for Tribal perspectives to be incorporated into management actions. They further asked that Tribes be cooperating agencies on the development of a programmatic supplement environmental impact statement. NMFS responded that it hears and empathizes with the impacts of salmon declines on Tribal communities and shares the goal of bringing salmon back.

On **February 15, 2023**, NMFS held a virtual Tribal consultation with the Aleut Community of St. Paul Island (ACSPI), Orutsaramiut Native Council, Kawerak, Inc., TCC, Yukon River Inter-Tribal Fish Commission (YRITFC), AVCP, KRITFC, Bering Sea Elders Group (BSEG), and Native American Rights Fund. The meeting focused on overall improvements for Tribal consultation and increased communication and transparency with Tribal partners.[28]

At the **April 2023 Council meeting**, the Council received a staff report on the SBC's findings, adopted a purpose and need statement for a management measure to reduce chum salmon bycatch in the Bering Sea pollock fishery, and requested a preliminary review analysis of four alternatives. A number of Tribal representatives and Tribal organizations provided written public comments and oral public testimony on the proposed alternatives.

On **April 18-19, 2023**, to improve knowledge of Tribal issues and engagement strategies for staff across the region, NMFS and NOAA General Counsel Alaska staff participated in the First Alaskans Institute training on Alaska Native Governance and Protocols.

On **July 11, 2023**, NMFS issued its notice of intent to prepare an EIS and associated 60-day comment period.[29] NMFS notified Alaska Tribal governments, Alaska Native corporations, and related organizations about the proposed action and EIS process and invited their comments and participation in the Council process. During the comment period, NMFS received 11 submissions with 87 distinct comments. Submissions were received on behalf of six Tribal coalitions, an association of Tribal fishing communities in Alaska, two nonprofits who represent Tribal interests in Alaska, and an Alaska Native

[25] A summary of this consultation can be found at https://media.fisheries.noaa.gov/2022-02/tanana-chiefs-consultation-summary.pdf
[26] For additional information about this meeting, see 2.1.1.
[27] For additional information about this meeting, see Section 2.1.2.
[28] By letter dated June 1, 2023, NMFS provided to the meeting attendees additional information about its efforts to improve its engagement and consultation process.
[29]The Notice of Intent to Prepare an Environmental Impact Statement can be accessed at: https://www.federalregister.gov/documents/2023/07/11/2023-14581/notice-of-intent-to-prepare-an-environmental-impact-statement-for-minimizing-non-chinook-salmon

Corporation. NMFS summarized and included all comments into a scoping report (i.e., a summary of the public input received on the scope of alternatives the Council should analyze), which it then presented to the Council at the October 2023 Council meeting. A copy of the scoping report is attached in Appendix 1.

On **August 16, 2024**, NMFS sent an invitation for Tribal consultation for upcoming 2023 October Council action items. No response was received from Tribal partners to consult on chum salmon bycatch at that time.

At the **October 2023 Council meeting**, the Council received the NMFS scoping report and heard from a number of Tribal representatives and Tribal organizations through written public comments and oral public testimony on the proposed alternatives. The Council then revised the proposed scope of alternatives and requested staff prepare a preliminary DEIS to be presented at the April 2024 Council meeting.

After the meeting, AVCP and TCC requested a consultation on chum salmon bycatch. NMFS staff, including the Deputy Regional Administrator, made multiple good faith attempts to contact AVCP and TCC, but received no response, and so the scheduling of this consultation on chum salmon bycatch was unsuccessful.

On **November 14, 2023**. Kawerak, Inc., KRITFC, and BSEG submitted a letter to NMFS expressing concerns with PSC limits being analyzed under Alternative 2 as well as the methods for a low abundance trigger of PSC limits under Alternative 3. These Tribal coalitions also requested that NMFS initiate engagements and consultations with all affected Tribes. By letter dated November 28, 2023, NMFS stated that it would continue to engage and consult with Tribes on this topic, including by providing regular invitations to consult and timely responding to Tribal requests for consultation.

On **January 24, February 14 and March 5, 2024**, NMFS held engagement sessions attended by Kawerak Inc., KRITFC, BSEG, TCC, ACSPI, AVCP, YRITFC, Arctic-Yukon-Kuskokwim Tribal Consortium (AYKTC), and BSFA. A summary of the input received at these meetings is included in the following subsection.

On **March 5, 2024**, NMFS invited requests for Tribal consultation on April 2024 Council agenda items. No requests for Tribal consultation were received.

On **March 19, 2024**, NMFS held a Tribal informational session at which Council and NMFS staff provided information about the alternatives that would be discussed with the Council at the April 2024 meeting and answered questions. Concerns that Tribal participants expressed included: the analyses put a dollar value on Tribal subsistence; the inshore sector seems to be catching more chum salmon than other fishing sectors; the current range of alternatives presented is insufficient and time and area closures are omitted; and industry self-management of rolling hotspot closures. Tribes also expressed an interest in contributing information about how chum salmon declines are having social and economic effects on their communities and information about baseline harvest.

At the **April 2024 Council meeting**, numerous Tribal representatives and Tribal organizations provided written public comments and oral public testimony on the proposed management alternatives.

1.3.2 Input from Tribes and Tribal coalitions

The following is a summary of Tribal input that NMFS has received since October 2023, when the Council requested the preparation of the first version of the preliminary DEIS.

Chum salmon PSC limits (Alternative 2, option 1, overall PSC limits). Many Tribes and Tribal coalitions, including Kawerak, Inc., KRITFC, and BSEG, notified NMFS that they felt that the PSC limits in the October 2023 motion (200,000-550,000 chum salmon) did not constitute a reasonable range for analysis. They requested that the Council analyze PSC limits below 200,000 chum salmon, including a PSC limit of zero chum salmon.

In response, NMFS supplemented the March 2024 preliminary DEIS (Appendix 1) to review whether the impacts predicted at a PSC limit of 200,000 chum salmon for the pollock industry, communities whose economies rely on the industry, and users of chum salmon are indicative of the impacts likely to be experienced at lower PSC limits. In its April 2024 motion, the Council expanded the lower end of PSC limits under analysis to 100,000 chum salmon.[30]

By letter to NMFS on October 4, 2024, Kawerak, Inc., TCC, Native People's Action (NPA), YRITFC, Yukon River Drainage Fisheries Association (YRDFA), and AVCP expressed concerns with the alternatives in the Council's April 2024 motion. They felt that the high end of the range of PSC limits under consideration (550,000 chum salmon) need to be reduced to closer to the average bycatch that industry has achieved since 2011 (~280,000 chum salmon).[31]

Chum salmon abundance indices (Alternative 2, option 2; abundance-based overall PSC limits). Abundance indices that solely used spawner metrics from the Yukon River were described as insufficiently representative of salmon abundance throughout the Yukon-Kuskokwim Region. It was also expressed that the abundance thresholds that would trigger the application of a PSC limit were too low. In its April 2024 motion, the Council increased the upper end of the range of the abundance thresholds.[32]

In their October 4, 2024, letter, Kawerak, Inc., TCC, NPA, YRITFC, YRDFA, and AVCP expressed: that the 25th and 50th percentile numbers used as abundance thresholds continued to be too low to achieve a conservation benefit; the PSC limits (including no cap when the abundance threshold is met) are too high and do not meet the goal of minimizing bycatch in all times of abundance; and, the Yukon-River only approach to an index in Option 2 is insufficient.[33]

Alternative 4 - modifications to the Incentive Plan Agreements. Leading up to the April 2024 Council meeting, representatives of several Tribal coalitions shared that they felt that Alternative 4 would not be sufficient to minimize bycatch. Concerns included that this alternative (as described in the October 2023 Council motion) would effectively leave the solution to industry and that the language in Alternative 4 that provided for industry proposals to "consider a process to include local and traditional knowledge from Western and Interior Alaska salmon users in the development of IPA measures" was inappropriate and inconsistent with the Council's LKTK Protocol (March 17, 2023).

Although the Council's April 2024 motion includes a refined version of Alternative 4, it no longer contains the LKTK provision to which the Tribes objected.[34]

Alternative 5. In their October 4, 2024 letter, Kawerak, Inc., TCC, NPA, YRITFC, YRDFA, and AVCP expressed that the closure area chum salmon PSC limits are too high and, as designed, the mutually-exclusive closure areas do not achieve the purpose of a conservation corridor. Tribal participants suggested consideration of an alternative that includes the following elements: 1) the development of a conservation corridor that includes all three areas proposed under Alternative 5 and is combined with a bycatch limit well below the historic average; 2) IPA modifications that encourage working towards the goal of real-time genetics; and 3) a program review after a specific number of years or metrics that are not achieved. They also asked for an investigation into a framework that could facilitate further bycatch avoidance measures without triggering another EIS.[35] YRITFC also asked for consideration of an alternative that includes a salmon migration corridor (i.e., a time/area closure) that is combined with an overall chum salmon PSC limit.

Tribal engagement. Tribes have requested better timing, more proactive engagement, meaningful Tribal consultations, and greater accessibility for people who live in rural areas. KRITFC asked NMFS to do

30 See Section 2.7 - Alternatives Analyzed but Not Considered Further.
31 See Tribal Coalitions letter to NMFS (October 4, 2024), Appendix 1.
32 See section 2.4 - Alternative 3: PSC Limit with Abundance Indices.
33 See Tribal Coalitions letter to NMFS (October 4, 2024), Appendix 1.
34 See section 2.5 - Alternative 4: Additional Regulatory Requirements for Incentive Plan Agreements
35 See Tribal Coalitions letter to NMFS (October 4, 2024), Appendix 1.

more to reach out to Tribes that are not represented by them, as a Tribal cooperating agency. In response, NMFS held multiple engagement sessions in early 2024 with numerous Tribal coalitions and began holding engagement sessions prior to every Council meeting, as described above. Future opportunities for input on this action, including through NMFS engagement and consultation, are described below.

NMFS recognizes the importance of holding and attending in-person meetings to hear from people in rural communities. At the suggestion of some commenters from Tribal organizations at the October 2024 Council meeting, NMFS staff attended the Alaska Federation of Natives Workshop on Subsistence Issues and subsequent Subsistence Panel. Regional Administrator Kurland accompanied several Council members to the Tanana Chiefs Conference fall special convention in Fairbanks, on November 13, 2024. NMFS understands that there is interest in Council members and NMFS staff attending the Alaska Subsistence Regional Advisory Council meetings in February and March 2025. While noting that all travel is dependent on staff capacity and funding, NMFS will attempt to attend these meetings, along with any others to which it is invited.

Inclusion of Indigenous Knowledge (IK). There have been requests for NMFS to do more to include IK, including Traditional Knowledge (TK), from all Tribal entities. As described further below, NMFS is working with two Tribal cooperating agencies (as that term is defined under the National Environmental Policy Act (40 CFR 1508.1(g)), KRITFC and TCC, to incorporate Tribal information and expertise, including TK. KRITFC and TCC represent 25 and 37 federally recognized Tribes respectively. These Tribal cooperating agencies are the primary authors of preliminary DEIS Sections 3.2.3.1.1.1(Traditional Knowledge of Chum Salmon Declines), 4.3.3.2 (Importance of Chum Salmon for Indigenous Peoples in the Yukon and Kuskokwim Regions), 4.4.1.1 (Subsistence Chum Salmon Users), and 4.4.5.3.3 (Potential Benefits of the Proposed Action to Yukon and Kuskokwim Indigenous Ways of Life). They also submitted materials that include TK from their members. See Appendices 7 and 8.

However, these cooperating agencies have emphasized that they cannot provide information and TK on behalf of affected communities who are not their members. Therefore, on July 11, 2024, by letter NMFS invited all Tribes to submit information and TK that would be included in an appendix to the preliminary DEIS. In response to this invitation, on October 4, 2024, NMFS received two documents, both of which are attached in their original form in Appendix 1. YRITFC submitted a letter to NMFS regarding the historical context of commercial fisheries and salmon declines and impacts to salmon users on the Yukon.[36] YRITFC explained that impacts of salmon declines on the Yukon River system are multidecadal in nature and have been documented with both western science and traditional and local knowledge.

The other submission was the October 4 letter from Kawerak, Inc., TCC, NPA, YRITFC, YRDFA, and AVCP. These coalitions did not include TK in their letter, but rather expressed a number of concerns with the form of and timing of NMFS's request for information and TK. NMFS acknowledged the validity of these concerns and provided more context for the request.[37]

NMFS is committed to continue to work with Tribes to identify opportunities for the inclusion of TK in this action and all others that affect Tribes. However, any requests for inclusion of TK must be balanced by staff capacity and time constraints.

Co-Stewardship/Co-Management of Salmon in the Marine Environment. Many Tribal organizations have expressed a desire to develop a co-stewardship or co-management relationship with NMFS related to managing salmon in the marine environment. Tribal partners have told NMFS that an ecosystem approach to salmon management is needed and have asked NMFS, under its government-to-government relationship, to help Tribes be more involved. The Department of Interior's Gravel-to-Gravel Initiative, which involves USFWS, has been identified as an example of co-management.

[36] YRITFC letter to NMFS (October 4, 2024) is attached at Appendix 1.
[37] NMFS letter to Kawerak et al. (October 18, 2024), copy attached in Appendix 1.

NMFS has noted that, with respect to the Gravel-to-Gravel Initiative, USFWS has different authority and jurisdiction over salmon management. NMFS is committed to continuing to talk with Tribes about co-management opportunities within the scope of its existing authorities.

More Time to Review Material Prior to Council Meetings. The time between the production of the preliminary DEIS and the April 2024 Council meeting was described as insufficient for many Tribal representatives, including elders, to be prepared to meaningfully participate in the Council process. In response, Council staff worked diligently to try to post the preliminary DEIS on its webpage much farther in advance of the February 2025 Council meeting.

Production of an impact rate. In their October 4, 2024, letter, the Tribal coalitions expressed that an impact rate would fail to account for: the waste of sentient species with whom Indigenous communities have formed reciprocal relationships; the loss of thousands of eggs with each adult chum salmon that fails return to spawn; the impacts of bycatch on discreet spawning populations during low abundance; the cumulative impacts of bycatch on the marine ecosystem under climate change; and, the significance of even relatively small numbers of fish to Tribal food sovereignty and security. See Tribal Coalitions letter (October 4, 2024), Appendix 1.

1.3.3 Future Opportunities for Tribal Input

In addition to the Tribal engagements and consultations that have preceded the preparation of this preliminary DEIS, as the Council and NMFS further develop the EIS and NMFS conducts the rulemaking associated with any recommended fishery management measure, there will be the following opportunities for input.

- <u>NMFS engagement and consultation prior to February 2025 Council meeting</u>. NMFS will host both a virtual engagement session and a virtual consultation prior to the February Council meeting, likely in the third or fourth week of January. At the engagement session, Tribes can ask Council and NMFS staff questions about this preliminary DEIS and what decisions the Council plans to make at the February Council meeting.

  At the consultation session, Tribes may share anything they feel is important for NMFS to understand about chum salmon bycatch in the Bering Sea pollock fishery, including any concerns regarding the scope of management alternatives being considered. This will be a good opportunity to bring new information or positions to NMFS that are not described in this Section, or the letters that are attached at Appendix 1.

- <u>February Council meeting</u>. To review this preliminary DEIS, the Council will meet from February 3-10, 2025, at the Egan Center in Anchorage, Alaska. Written comments can be submitted directly to the Council on the preliminary DEIS. To allow the Council to review them prior to the meeting, written comments should be submitted to the Council website by noon on Friday, January 31, 2025 (www.npfmc.org/public-comment-policy/). There will also be an opportunity to provide oral and written testimony at the Council meeting.

- <u>DEIS public comment period (date tbd)</u>. If the Council decides the proposed action is ready to move to the next stage, all information and deliberations at the February Council meeting will be incorporated, as appropriate, into NMFS's DEIS, which we will publish for public comment. A public comment period of a minimum of 45 days will follow during which Tribes can provide additional information and knowledge to NMFS. The publication of the DEIS will be accompanied by additional Tribal engagement and consultation opportunities.

- <u>(if needed) Council meeting to review modified alternatives</u>. If, at the February Council meeting, the Council makes further substantive modifications to the alternatives that require staff analysis, a future Council meeting will be scheduled to review another (third) version of the preliminary DEIS. It is likely that the earliest that meeting could occur would be October 2025. Written input can be submitted on the Council webpage prior to the meeting and oral and written testimony can be provided at the Council meeting. (www.npfmc.org/public-comment-policy/)

- Council meeting for final action (tbd). If, at the February Council meeting, the Council recommends to publish the DEIS, and NMFS agrees, a future Council meeting will be scheduled to review the public comments received on the DEIS. It is likely that the earliest that meeting could occur would be October 2025. Written input can be submitted on the Council webpage prior to the meeting and oral and written testimony can be provided at the Council meeting. (www.npfmc.org/public-comment-policy/)
- Final EIS, record of decision, fishery management plan (FMP) amendment and rulemaking process. Once the Council takes final action, NMFS begins the process under the MSA to review the Council recommendation and decide to approve, partially approve, or disapprove the FMP amendment and implement the action in Federal regulations. The MSA and Administrative Procedures Act provide opportunities for comment during the FMP amendment decision and rulemaking process. NMFS will also complete the EIS process by issuing a Final EIS and a Record of Decision. NMFS accompanies the rulemaking process with Tribal engagement and consultation opportunities and will notify Tribes and Tribal organizations at each key step.

1.3.4 Lead and Cooperating Agencies

NMFS is the lead agency for this EIS. Three tribal and state entities are participating as cooperating agencies under 40 CFR 1501.8 and 1508.1(g).

- Alaska Department of Fish and Game (ADF&G) provided special expertise related to management of salmon fisheries in State waters and inland rivers as well as impacts of salmon bycatch.
- Kuskokwim River Inter-Tribal Fish Commission (KRTIFC) provided special expertise related to salmon fisheries management on the Kuskokwim River and tributaries, salmon life cycles, subsistence and commercial fisheries in the area, as well as regionally specific LK and TK.
- Tanana Chiefs Conference (TCC) provided special expertise related to chum salmon stock status in the Yukon River and tributaries, subsistence harvests of chum salmon, as well as regionally specific LK and TK.

Between June and October 2024, NMFS facilitated four joint cooperating agency meetings, at which ADF&G, KRITFC, and TCC representatives attended. Agenda topics included coordination on Tribal contributions, abundance metrics under Alternative 3, and opportunities for Western and Interior Tribes to receive inseason reports from industry on salmon bycatch data under Alternative 4.

1.4 Laws, Treaties, and Policies

In implementing new regulations for chum salmon bycatch management, NMFS would comply with applicable international agreements; federal, state, and local laws and regulations, and executive orders (EOs).

The current regulations managing chum salmon bycatch in the pollock fishery, and the proposed actions under consideration in this preliminary DEIS are in accordance with the **Magnuson-Stevens Conservation and Fishery Management Act of 1976 and all National Standards**.

This preliminary DEIS was developed by the National Marine Fisheries Service as the lead agency to address the effects of proposed alternatives to change chum salmon bycatch regulations in the Bering Sea pollock fishery, in accordance with the **National Environmental Policy Act (NEPA) of 1969**. NEPA requires federal agencies to evaluate the potential environmental effects of any major planned federal action, and to promote public awareness of the potential impacts at the earliest planning stages of these actions, by preparing a detailed analysis of proposed actions that would affect the quality of the human environment.

NOAA Administrative Order 216-6 describes NOAA's policies, requirements, and procedures for complying with NEPA and the implementing regulations issued by the Council on Environmental Quality (CEQ)[38]. This Administrative Order provides comprehensive and specific procedural guidance to NMFS and the Council for preparing and adopting FMPs. Federal fishery management actions subject to NEPA requirements include the approval of FMPs, FMP amendments, and regulations implementing FMPs.

This preliminary DEIS was also prepared in response to a variety of other law, treaties, and EOs including:

The **American Fisheries Act (AFA)** substantially changed the management structure of the Bering Sea pollock fishery by identifying the vessels and shore-based processors eligible to participate in the Bering Sea pollock fishery, allocating specific percentages of the TAC among the fishing sectors, establishing cooperatives, among other provisions.

The **Endangered Species Act** (ESA) designed to conserve endangered and threatened species. The Act is jointly administered by NMFS and the US Fish and Wildlife Service (USFWS). With some exceptions, NMFS oversees cetaceans, seals and sea lions, marine and anadromous fish species, and marine plant species. USFWS oversees walrus, sea otter, seabird species, and terrestrial and freshwater wildlife and plant species.

The **Marine Mammal Protection Act** aims to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the marine habitat. NMFS has a responsibility to conserve marine mammals, specifically cetaceans and pinnipeds (other than walrus). The USFWS is responsible for sea otter, walrus, and polar bear.

The **Pacific Salmon Treaty and the Yukon River Agreement** requiring the United States and Canada to "maintain efforts to increase the in-river run of Yukon River origin salmon by reducing marine catches and by-catches of Yukon River salmon. They shall further identify, quantify and undertake efforts to reduce these catches and by-catches" (Art. XV, Annex IV, Ch. 8, Cl. 12).

The **Administrative Procedure Act** requiring federal agencies to notify the public before rule making and provide an opportunity to comment on the rules.

The **Regulatory Flexibility Act** requiring federal agencies to consider the economic impact of regulatory proposals on directly regulated small entities, analyze alternatives that minimize adverse economic impacts on this class of small entities, and make their analyses available for public comment. This analysis is typically prepared in advance of the Council's final action.

The **Information Quality Act** directing the Office of Management and Budget (OMB) to issue government-wide policy and procedural guidance to all federal agencies to ensure and maximize the quality, objectivity, utility, and integrity of information disseminated by federal agencies.

E.O. 12866, *Regulatory Planning and Review*, **t**hat requires federal agencies to take a deliberative approach to rule making, including an assessment of the costs and benefits of the intended regulations (58 FR 51735, October 4, 1993). EO 12866 was amended through **E.O. 14094** on April 6, 2023 (88 FR 21879). EO 12866, as amended by EO 14094, requires the OMB to review proposed regulatory programs that are considered to be significant.

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[38] The CEQ has issued NEPA regulations at 40 CFR Ch.V, subch. A. The recent decision by the D.C. Circuit in *Marin Audubon Soc. v. FAA*, No. 23-1067, 2024 WL 4745055 (D.C. Cir. Nov. 12, 2024), ruled that CEQ lacks the authority to issue binding regulations on NEPA compliance. No other circuit has issued a similar ruling invalidating CEQ's NEPA regulations. This preliminary DEIS refers to and follows the CEQ regulations as advisory, if not binding. This document is also consistent with the statutory requirements under NEPA and does not depend on the validity of the regulations issued by the CEQ.

E.O. 13175, *Consultation and Coordination with Indian Tribal Governments* (65 FR 67249) and **Presidential Memorandum of January 26, 2021, *Tribal Consultation and Strengthening Nation-to-Nation Relationships (***86 FR 7491). NMFS is the federal agency responsible for carrying out Tribal Consultations.

E.O. 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629), directs federal agencies to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. EO 12898 was amended by **E.O. 14906**, *Revitalizing Our Nation's Commitment to Environmental Justice for All* (88 FR 25251). Information relevant to environmental justice populations and effects can be found in Chapter 4.

E.O. 13985, *Advancing Racial Equity and Support for Underserved Communities Through the Federal Government* (88 FR 10825) addresses issues of equity for Indigenous and Native American persons, persons who live in rural areas, and persons otherwise adversely affected by persistent poverty or inequality, among other groups, as well as underserved communities in general.

E.O. 14008, *Tacking the Climate Crisis at Home and Abroad* (86 FR 7619), places climate change at the forefront of foreign policy and national security planning and includes language on securing environmental justice and spurring economic opportunities for marginalized and over-burdened communities.

The **Ocean Justice Strategy** is a report from the Ocean Policy Committee (the latter established by EO 13840) that articulates a vision for ocean justice that builds on previously specified ideas and definitions of equity and environmental justice.[39]

[39] *As noted in the Ocean Justice Strategy,* Ocean Justice "…focuses on addressing environmental justice concerns related to the use of the ocean for economic, cultural, spiritual, and recreational purposes, and food security. Ocean justice provides the opportunity to work towards repairing past harms and a lens through which to think through past, current, or future impacts to the ocean. It also provides a framework with which to improve the well-being of people in coastal communities and other communities connected to and dependent on the ocean."

2 Description of Alternatives

2.1 Alternative Development

The Council and NMFS have taken an iterative approach to develop the Purpose and Need statement for the proposed action, as well as the range of alternatives considered to meet its specified objectives. Council meetings, and the meetings of its advisory bodies, are open to the public to participate in virtually or in-person. Written public testimony can be provided to the Council and its advisory bodies in advance of the meeting and oral testimony may be provided remotely or in-person at each meeting. The Council meets five times per year for approximately 7 to 10 days in communities across Alaska, Washington, and Oregon.

2.1.1 June 2022

The Council's June 2022 meeting was held in Sitka, Alaska. The Council received a) scientific reports on changing ocean conditions having an impact on chum salmon survivability, b) a report on Western Alaska salmon stock status, c) an updated adult equivalents analysis for Chinook salmon caught as bycatch in the Bering Sea pollock fishery, d) reports from the pollock industry on their recent bycatch performance under the IPAs, and e) annual reports on the stock composition estimates for the salmon caught as bycatch. Some of these information reports are part of the Council's annual cycle while others were specifically requested by the Council at its October 2021 meeting in Anchorage, Alaska.[40]

After receiving these reports, input from the Scientific and Statistical Committee (SSC) and Advisory Panel (AP), as well as substantial public comment, the Council a) requested the Bering Sea pollock industry immediately implement additional chum salmon bycatch avoidance measures; 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; and c) initiated a Salmon Bycatch Committee (SBC) composed of Tribal representatives, in-river salmon users, and representatives from the Bering Sea pollock industry.[41]

2.1.2 December 2022

The Council's December 2022 meeting was held in Anchorage, Alaska. The Council received a) the State of Alaska Bycatch Review Task Force report from ADF&G staff, b) a presentation on the chum salmon bycatch discussion paper prepared by staff, and c) the staff report on the SBC's first meeting in November 2022.[42] 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 alternatives, ranging from a hard cap to additional regulatory provisions within the pollock industry's IPAs.[43] The SBC convened for two additional meetings in January 2023 and March 2023 to achieve its goals, as directed by the Council.

2.1.3 April 2023

The Council's April 2023 meeting was held in Anchorage, Alaska. The Council received a) annual reports on salmon bycatch genetics, b) reports from the Bering Sea pollock industry on the prior year's salmon bycatch avoidance and performance, c) and the staff report from the SBC's January 2023 and March 2023 meetings. The SBC report included the committee's recommended Purpose and Need

[40] The Council's October 2021 motion on salmon bycatch information requests can be found here.
[41] The Council's June 2022 motion related to the salmon reports can be found here.
[42] The State of Alaska Bycatch Review Task Force Report is available here.
[43] The Council's December 2022 motion related to salmon bycatch can be found here.

statement and concepts for management alternatives to meet the objectives of that statement. There was consensus to bring all concepts for alternatives forward to the Council for consideration, but the SBC did not reach consensus on the alternatives themselves. Following these reports, input from the AP, and substantial public comment, the Council adopted the committee's Purpose and Need statement and a set of preliminary alternatives. The Council requested a "Preliminary Review" analysis to provide the Council and the public with more information on how the preliminary alternatives would work.

2.1.4 October 2023

The Council's October 2023 meeting was held in Anchorage, Alaska. The Council received the Preliminary Review analysis, reports from the SSC and AP, as well as substantial public testimony. After receiving staff presentations, advisory body reports, and public testimony, the Council approved analyzing changes to chum salmon bycatch management measures. The range of alternatives approved for analysis were modified and revised from the preliminary set of alternatives adopted at the April 2023 Council meeting. The finalized set of alternatives approved for analysis of potential environmental, economic, and social impacts in this preliminary DEIS were selected to meet the purpose and need statement.[44]

2.1.5 April 2024

The Council's April 2024 meeting was held in Anchorage, Alaska. The Council received a) a preliminary DEIS and a Social Impact Assessment (SIA) analyzing the potential impacts of the proposed alternatives, b) scientific reports on salmon bycatch genetics, c) reports from the pollock industry on the prior year's salmon bycatch avoidance and performances, as well as d) presentations from IPA representatives on proposals for changes under Alternative 4, as requested by the Council. After receiving these reports, as well as input from the SSC, AP, and substantial public comment, the Council modified the proposed alternatives to better align with the purpose and need statement and requested further analysis.

2.2 Alternative 1: No Action

Alternative 1 is the No Action alternative and retains the existing chum salmon PSC regulations.

2.2.1 Salmon Bycatch Incentive Plan Agreements

The current regulations managing chum salmon bycatch in the Bering Sea pollock fishery include the required elements and approval process for the salmon bycatch Incentive Plan Agreements (IPAs). The IPAs are civil legal contracts that create incentives and penalties for vessels and CDQ groups that are members of the agreement to avoid Chinook salmon and chum salmon while fishing for pollock. Three IPAs have been in place since 2010: the Catcher Processor IPA (CP IPA), Inshore Salmon Savings Incentive Program (Inshore SSIP); and Mothership Salmon Savings Incentive Program (MSSIP).

Federal regulations include 13 provisions that specify the goals of the current salmon bycatch avoidance program (see 50 CFR 679.21(f)(12)(iii)(E)). Some provisions are specific to Chinook salmon and others are specific to chum salmon. Each IPA is required to address all 13 provisions for the contract to be approved by NMFS. These provisions apply equally to all IPAs, are written in broad language, and may be met in a variety of ways. The regulations do not explicitly dictate how the provisions are to be addressed but the accompanying regulations at 50 CFR 679.21(f)(13) do specify the content that must be submitted in a written annual report to the Council prior to March 15 each year. Among other topics, the written annual reports must describe (see 50 CFR 679.21(f)(12)(iii)(E)(*1*) through *(13))*:

- The incentives that will be implemented for each vessel operator to avoid Chinook salmon and chum salmon bycatch under all levels of Chinook salmon and pollock abundance, in a manner

[44] The Council's October 2023 motion can be found here.

that is expected to affect individual vessel's operational choices to avoid Chinook salmon and chum salmon (Provision 1 and 5).

- The rewards for vessels avoiding Chinook salmon and penalties for not doing so (Provision 3).
- How the incentive measures in the IPA are expected to promote reductions in a vessel's Chinook salmon and chum salmon bycatch compared to what would have occurred absent the incentive program (Provision 4).
- The RHS program for salmon bycatch that operates throughout the entire A season and B season and the agreement to provide notifications of closure areas and any violations of the RHS program (Provision 8).
- 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 (Provision 7).

2.2.1.1 Rolling Hotspot Program for Chum Salmon Avoidance

The RHS program for chum salmon avoidance operates during the B season and has been designed by IPA members to respond to Provisions 4, 5, 7, and 8 specified in the current regulations. For example, the program works by identifying "hot spots" on the pollock fishing grounds with high chum salmon PSC rates (chum salmon per metric ton (mt) of pollock). Hot spots are closed for a period of time by a private company, Sea State, Inc., and vessels are moved to new areas to fish for pollock. Vessel operators' decisions to avoid chum salmon are influenced by the risk of losing access to fishing grounds with high pollock catch rates and do not want to incur the costs of moving to new areas with potentially higher salmon bycatch rates or rates of other PSC species.

The components of how the RHS program should work are not specified in regulations and have been designed by industry in concert with Sea State, Inc. Sea State has been contracted by AFA cooperatives to facilitate bycatch avoidance, information and data sharing, and to provide catch accounting and harvest data for the cooperative's annual reports. This management is in addition to, not supplementary of, NMFS inseason management of the fishery. The starting point for identifying a hot spot is a base chum salmon PSC rate, which is referred to in this analysis as the **"Base Rate."** The Base Rate is fixed at either 0.19 or 0.20 chum salmon per mt of pollock for the first three weeks of the B season (from June 10 to July 1) until there are three weeks of fishery dependent data that can be used to calculate the Base Rate. From July 1 until the end of the B season, the Base Rate is calculated as the rolling three-week average chum salmon bycatch rate. The Base Rate is updated weekly and shared with the fleet each Thursday.[45]

The fleet's weekly Base Rate is compared to the **"Base Rate floor."** The Base Rate floors are fixed rates that are stair-stepped throughout the B season. It functions as a minimum value that can be used to determine whether an area is eligible to be closed.

- June and July: The Base Rate floor is 0.19 for the inshore and mothership sectors and 0.20 chum per mt of pollock for the CP sector.
    - August: The Base Rate floor is 0.50 chum per mt of pollock for all sectors.
        - September and October: The Base Rate floor is 1.00 chum salmon per mt of pollock for all sectors.

[45] A "collar" is used by all IPAs to prohibit the Base Rate from increasing by more than 20% from one week to the next throughout June and July.

In any given week, Sea State will compare the calculated Base Rate to the fixed Base Rate floor that applies and select the higher of the two values. For example, if the calculated Base Rate was 0.65 during the first week of August, that calculated rate would be applied rather than the August floor rate of 0.50.[46]

The second step is to calculate the chum salmon PSC rate at smaller spatial scales. This is referred to as the **"Area Bycatch Rate,"** which is the calculated chum salmon PSC rate in each statistical area (referred to as "stat areas") where a substantial amount of pollock fishing occurred. A substantial amount of pollock fishing is defined by the IPAs as a stat area where a minimum of 500 mt of pollock and at least 2% of the week's pollock catch was harvested. If an Area Bycatch Rate is greater than the Base Rate that is used (either that which is calculated or the fixed floor), it might qualify for a closure.[47] It is not common practice for the boundaries of a RHS closure area to encompass an entire statistical area, although a single closure might overlap several.

When a hotspot is identified, not all vessels are prohibited from fishing in it that week. Under the CP IPA, a vessel's bycatch rate must be less than 75% of the calculated Base Rate for it to maintain unrestricted access to the fishing grounds and not prohibited from hotspots. Under the Inshore SSIP and MSSIP, vessels with bycatch rates less than or equal to the calculated Base Rate are placed in "Tier 1". Tier 2 are vessels have a bycatch rate above the week's calculated Base Rate. Tier 1 vessels are allowed to fish in the RHS closure areas, but Tier 2 vessels are not.

As mentioned previously, part of the RHS program for chum salmon avoidance has been designed under the IPAs in part to respond to Provision 7, which requires each IPA to describe "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." There are two measures incorporated into each IPA in response to Provision 7:

1. The size limits of area closures are largest nearer to the Alaska Peninsula (east of 168 degrees West longitude), and the combined size of closure areas is largest during June and July. No more than four closure areas can be identified in any week with a maximum of 4,000 square miles in June and July and 2,000 square miles in August to October.
2. The Base Rate floor is fixed at its lowest value in June and July when Western Alaska chum salmon are encountered in higher proportions on the pollock fishing grounds.

An important component of the RHS program that is not specified in regulations, or in the IPAs, is the Local Knowledge of pollock fishermen and program managers. Particularly for inshore CVs where a trip's worth of catch may come from two or three tows in multiple stat areas, vessel operators and program managers work cooperatively to isolate tows and areas with higher bycatch to identify the boundaries of the hotspot. Discrete areas can be identified based on the depths, times, and areas where pollock and salmon bycatch have historically occurred.

Beginning on September 1 for the CP IPA, and at any point during the B season for the Inshore SSIP and MSSIP, when Chinook salmon bycatch rates are equal to or greater than 0.035 in any ADF&G statistical area, any candidate chum salmon closure area is provided as information only for the remainder of the B season. The Chinook priority provision effectively eliminates chum salmon avoidance incentives when Chinook abundance on the pollock grounds is determined to be high. This component of the RHS program for chum salmon avoidance responds to Provision 2 in the current regulations, which requires IPAs to describe "how the incentive(s) to avoid chum salmon do not increase Chinook salmon bycatch."

[46]The stair-stepped floor values were established by industry to try and avoid unnecessary closures that may not result in additional salmon savings. Moving the fleet based on very low chum salmon bycatch rates could also be counterproductive for salmon avoidance. At very low bycatch rates, it is possible Sea State would move the fleet to new pollock fishing areas where chum salmon, or other PSC species such as Chinook and herring, bycatch rates are higher (NPFMC 2007:138).

[47] The 2% minimum harvest rule is enacted to balance the need to focus on concentrated fishing in high bycatch areas with the need to rapidly close an area based on a single haul with high amounts of PSC.

2.2.2 Chum Salmon Savings Area

Alternative 1 would retain the Chum Salmon Savings Area (see 50 CFR 679.22(a)(10)), which is a fixed time and area closure in the southeastern Bering Sea. It exists as a backstop regulatory measure, should a vessel choose not to be governed by an IPA (see 50 CFR 679.22(a)(10)). This scenario has never occurred since the IPAs took effect in 2010.

2.3 Alternative 2: Overall Chum Salmon PSC Limit

Alternative 2 would include an overall chum salmon PSC limit. The PSC limit would only be in effect during the B season pollock fishery which opens on June 10 and closes on November 1. The PSC limit amounts being considered are based on historical chum PSC levels from 2011–2022 and range from 100,000 to 550,000 chum salmon.[48] This is a hard cap, so pollock fishing must cease if the PSC limit is reached. All salmon PSC caught by the pollock fishery during the B season and accounted for under the "non-Chinook" catch accounting category, would accrue to the chum salmon PSC limit. The non-Chinook catch accounting category includes sockeye, pink, coho, and chum salmon but over 99% are chum salmon (Table 6-2).

The PSC limit would be apportioned among the CDQ, CP, inshore, and mothership sectors. Amounts of chum salmon PSC apportioned to a sector could be transferred. Transferability provisions are described in Section 3286.1.6 and not repeated here. Four different options are being considered for apportioning the cap and only one could be selected for implementation: **Option 1** based on a sector's 3-year historical average level of bycatch (2020–2022); **Option 2** based on a sector's 5-year historical average level of bycatch (2018–2022); **Option 3** would use a pro-rata apportionment with 25% weighted to the sector's AFA pollock allocation and 75% weighted to the sector's 3-year historical average pollock allocation (2020–2022); **Option 4** based on a sector's AFA pollock allocation amount.

Table 2-1 Chum salmon PSC amounts used to set the apportionment percentages for each sector where amounts are based on either historical PSC numbers or a blended bycatch rate for the CDQ and CP sectors, used to set apportionment percentages 2011-2022

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

Source: NMFS Alaska Region CAS, data compiled by AKFIN

[48] The Council selected 2011–2022 as the baseline or status quo period because Amendment 91 regulations implementing the Chinook salmon hard cap took effect in 2011. Pollock harvester's fishing behavior changed in response to the hard cap and incentives to avoid bycatch. Observer and monitoring requirements for the fleet were also modified at that time. These changes included a systematic genetic sampling protocol to identify stocks of origin of the salmon caught as bycatch in the Bering Sea pollock fishery (see Section 6.1 for more information).

Table 2-2 Summary of apportionment percentages by option and sector

Apportionment options	CDQ	CP	Mothership	Inshore
Sector Apportionment 1, 3-yr avg.	6.1%	21.9%	9.1%	62.9%
Sector Apportionment 2, 5-yr avg.	7.1%	25.2%	9.5%	58.2%
Sector Apportionment 3, pro rata	7.1%	25.4%	9.1%	58.4%
Sector Apportionment 4, AFA	10%	36%	9%	45%

Notes: The AFA percentages under Option 4 reflect the CDQ program's pollock allocation and the AFA sectors' pollock allocation of the directed fishing allowance, the latter of which sets aside the ICA which is used for the incidental catch of pollock in other groundfish fisheries.

The CDQ apportionment would be further divided among the six CDQ groups based on each group's pollock allocation amount which has been fixed since 2005 due to amendments to the MSA. The inshore sector's apportionment would be further divided among the inshore cooperatives and the inshore open access fishery in applicable years. Only inshore cooperatives that filed an application by December 1 each year and is approved by NMFS would receive a pollock allocation and an amount of the chum salmon PSC limit. There have been six inshore cooperatives in recent years, but five were active in 2024. The Peter Pan Fleet Cooperative did not file an AFA inshore cooperative allocation for the 2024 season.

If an inshore CV does not join a cooperative, it must fish in the inshore open access fishery.[49] The number of CVs that have entered the inshore open access fishery has been consistently small until the 2024 fishing season. In 2024, 10 vessels were in the inshore open access fishery. Prior to 2024, there was an inshore open access fishery in 2023 with one vessel participating and there was an inshore open access fishery in 2015, 2016, and 2018. A cooperative's 2022 pollock allocation was used to calculate its apportionment, but these amounts.[50]

[49] CVs typically participate in the inshore open access fishery when they wish to leave their co-op, but a co-op could allow a vessel to deliver more of their pollock quota to the processor of the co-op the vessel would like to join (see 50 CFR 679.4(l)(6)(ii)(D)(*2*)(*i*)).
[50] NMFS would apportion the chum salmon PSC limit among the inshore co-ops and the inshore open access fishery based on the percentage of pollock allocated to each co-op under 50 CFR 679.62(a). The amount of pollock an inshore co-op receives is based on the catch history of member vessels. Under 50 CFR 679.26(a), an inshore cooperative that applies for and receives an AFA inshore co-op fishing permit under 50 CFR 679.4(l)(6) receives an annual pollock allocation amount based on the two years with the highest levels of non-CDQ pollock landings from 1995 through 1997.

Table 2-3 Number of chum salmon apportioned to each pollock fishing sector under all PSC limit amounts and apportionment options under consideration in Alternative 2

PSC limit	Apportionment	CDQ	CP	Inshore	Mothership
100,000	3-year avg.	6,100	21,900	62,900	9,100
	5-year avg.	7,100	25,200	58,200	9,500
	Pro-rata	7,100	25,400	58,400	9,100
	AFA	10,000	36,000	45,000	9,000
200,000	3-year avg.	12,200	43,800	125,800	18,200
	5-year avg.	14,200	50,400	116,400	19,000
	Pro-rata	14,200	50,800	116,800	18,200
	AFA	20,000	72,000	90,000	18,000
300,000	3-year avg.	18,300	65,700	188,700	27,300
	5-year avg.	21,300	75,600	174,600	28,500
	Pro-rata	21,300	76,200	175,200	27,300
	AFA	30,000	108,000	135,000	27,000
350,000	3-year avg.	21,350	76,650	220,150	31,850
	5-year avg.	24,850	88,200	203,700	33,250
	Pro-rata	24,850	88,900	204,400	31,850
	AFA	35,000	126,000	157,500	31,500
400,000	3-year avg.	24,400	87,600	251,600	36,400
	5-year avg.	28,400	100,800	232,800	38,000
	Pro-rata	28,400	101,600	233,600	36,400
	AFA	40,000	144,000	180,000	36,000
450,000	3-year avg.	27,450	98,550	283,050	40,950
	5-year avg.	31,950	113,400	261,900	42,750
	Pro-rata	31,950	114,300	262,800	40,950
	AFA	45,000	162,000	202,500	40,500
550,000	3-year avg.	33,550	120,450	345,950	50,050
	5-year avg.	39,050	138,600	320,100	52,250
	Pro-rata	39,050	139,700	321,200	50,050
	AFA	55,000	198,000	247,500	49,500

Source: NMFS catch accounting system, data compiled by AKFIN

Table 2-4 Number of chum salmon apportioned to the CDQ groups under all PSC limit amounts and apportionment options under Alternative 2

PSC limit	Apportionment	CDQ	14% APICDA	21% BBEDC	5% CBSFA	24% CVRF	22% NSEDC	14% YDFDA
100,000	3-yr avg. (6.1%)	6,100	854	1,281	305	1,464	1,342	854
	5-yr avg. (7.1%)	7,100	994	1,491	355	1,704	1,562	994
	Pro-rata (7.1%)	7,100	994	1,491	355	1,704	1,562	994
	AFA (10%)	10,000	1,400	2,100	500	2,400	2,200	1,400
200,000	3-yr avg. (6.1%)	12,200	1,708	2,562	610	2,928	2,684	1,708
	5-yr avg. (7.1%)	14,200	1,988	2,982	710	3,408	3,124	1,988
	Pro-rata (7.1%)	14,200	1,988	2,982	710	3,408	3,124	1,988
	AFA (10%)	20,000	2,800	4,200	1,000	4,800	4,400	2,800
300,000	3-yr avg. (6.1%)	18,300	2,562	3,843	915	4,392	4,026	2,562
	5-yr avg. (7.1%)	21,300	2,982	4,473	1,065	5,112	4,686	2,982
	Pro-rata (7.1%)	21,300	2,982	4,473	1,065	5,112	4,686	2,982
	AFA (10%)	30,000	4,200	6,300	1,500	7,200	6,600	4,200
350,000	3-yr avg. (6.1%)	21,350	2,989	4,484	1,068	5,124	4,697	2,989
	5-yr avg. (7.1%)	24,850	3,479	5,219	1,243	5,964	5,467	3,479
	Pro-rata (7.1%)	24,850	3,479	5,219	1,243	5,964	5,467	3,479
	AFA (10%)	35,000	4,900	7,350	1,750	8,400	7,700	4,900
400,000	3-yr avg. (6.1%)	24,400	3,416	5,124	1,220	5,856	5,368	3,416
	5-yr avg. (7.1%)	28,400	3,976	5,964	1,420	6,816	6,248	3,976
	Pro-rata (7.1%)	28,400	3,976	5,964	1,420	6,816	6,248	3,976
	AFA (10%)	40,000	5,600	8,400	2,000	9,600	8,800	5,600
450,000	3-yr avg. (6.1%)	27,450	3,843	5,765	1,373	6,588	6,039	3,843
	5-yr avg. (7.1%)	31,950	4,473	6,710	1,598	7,668	7,029	4,473
	Pro-rata (7.1%)	31,950	4,473	6,710	1,598	7,668	7,029	4,473
	AFA (10%)	45,000	6,300	9,450	2,250	10,800	9,900	6,300
550,000	3-yr avg. (6.1%)	33,550	4,697	7,046	1,678	8,052	7,381	4,697
	5-yr avg. (7.1%)	39,050	5,467	8,201	1,953	9,372	8,591	5,467
	Pro-rata (7.1%)	39,050	5,467	8,201	1,953	9,372	8,591	5,467
	AFA (10%)	55,000	7,700	11,550	2,750	13,200	12,100	7,700

Source: NMFS catch accounting system, data compiled by AKFIN

Table 2-5 Number of chum salmon apportioned to each inshore cooperative and inshore open access fishery under all PSC limit amounts and apportionment options under Alternative 2

PSC limit	Apportionment	Inshore	(33.788%) Akutan CV Assoc.	(0.000%) Arctic Enterprise Assoc.	(10.773%) Northern Victor Fleet Coop	(2.512%) Peter Pan Fleet Coop.	(11.454%) Unalaska Fleet Coop.	(22.094%) UniSea Fleet Coop.	(19.380%) Westward Fleet Coop.	(0.000%) Inshore Open Access
100,000	3-yr avg. (62.9%)	62,900	21,253	0	6,776	1,580	7,205	13,897	12,190	0
	5-yr avg. (58.2%)	58,200	19,665	0	6,270	1,462	6,666	12,859	11,279	0
	Pro-rata (58.4%)	58,400	19,732	0	6,291	1,467	6,689	12,903	11,318	0
	AFA (45%)	45,000	15,205	0	4,848	1,130	5,154	9,942	8,721	0
200,000	3-yr avg. (62.9%)	125,800	42,505	0	13,552	3,160	14,409	27,794	24,380	0
	5-yr avg. (58.2%)	116,400	39,329	0	12,540	2,924	13,332	25,717	22,558	0
	Pro-rata (58.4%)	116,800	39,464	0	12,583	2,934	13,378	25,806	22,636	0
	AFA (45%)	90,000	30,409	0	9,696	2,261	10,309	19,885	17,442	0
300,000	3-yr avg. (62.9%)	188,700	63,758	0	20,329	4,740	21,614	41,691	36,570	0
	5-yr avg. (58.2%)	174,600	58,994	0	18,810	4,386	19,999	38,576	33,837	0
	Pro-rata (58.4%)	175,200	59,197	0	18,874	4,401	20,067	38,709	33,954	0
	AFA (45%)	135,000	45,614	0	14,544	3,391	15,463	29,827	26,163	0
350,000	3-yr avg. (62.9%)	220,150	74,384	0	23,717	5,530	25,216	48,640	42,665	0
	5-yr avg. (58.2%)	203,700	68,826	0	21,945	5,117	23,332	45,005	39,477	0
	Pro-rata (58.4%)	204,400	69,063	0	22,020	5,135	23,412	45,160	39,613	0
	AFA (45%)	157,500	53,216	0	16,967	3,956	18,040	34,798	30,524	0
400,000	3-yr avg. (62.9%)	251,600	85,011	0	27,105	6,320	28,818	55,589	48,760	0
	5-yr avg. (58.2%)	232,800	78,658	0	25,080	5,848	26,665	51,435	45,117	0
	Pro-rata (58.4%)	233,600	78,929	0	25,166	5,868	26,757	51,612	45,272	0
	AFA (45%)	180,000	60,818	0	19,391	4,522	20,617	39,769	34,884	0
450,000	3-yr avg. (62.9%)	283,050	95,637	0	30,493	7,110	32,421	62,537	54,855	0
	5-yr avg. (58.2%)	261,900	88,491	0	28,214	6,579	29,998	57,864	50,756	0
	Pro-rata (58.4%)	262,800	88,795	0	28,311	6,602	30,101	58,063	50,931	0
	AFA (45%)	202,500	68,421	0	21,815	5,087	23,194	44,740	39,245	0
550,000	3-yr avg. (62.9%)	345,950	116,890	0	37,269	8,690	39,625	76,434	67,045	0
	5-yr avg. (58.2%)	320,100	108,155	0	34,484	8,041	36,664	70,723	62,035	0
	Pro-rata (58.4%)	321,200	108,527	0	34,603	8,069	36,790	70,966	62,249	0
	AFA (45%)	247,500	83,625	0	26,663	6,217	28,349	54,683	47,966	0

Source: NMFS catch accounting system, data compiled by AKFIN. 2022 Inshore cooperative apportionments available at: https://media.fisheries.noaa.gov/2022-01/afa-inshore-allocations-2022.pdf

2.4 Alternative 3: Overall Chum Salmon PSC Limit with Abundance Indices

Alternative 3 would include an overall chum salmon PSC limit during the B season pollock fishery with an index of the prior year's chum salmon abundance. Two options for indices are being considered at this time but only one index could be selected for implementation. Under Alternative 3, an overall chum salmon PSC limit *may* be in place depending on whether or not the chum salmon returns in an area are above index thresholds. The chum salmon PSC limit amount under Alternative 3 could also decrease, depending on the number of thresholds that are not met in a given year. The apportionment options and transferability provisions for Alternative 3 are the same as Alternative 2 and not repeated here.

2.4.1 Option 1: Three-area Chum Salmon Index

Alternative 3, Option 1 includes a Three-area chum salmon index based on the Yukon, Kuskokwim, and Norton Sound areas. To meet its threshold:

- The Yukon Area needs to have more than 1,713,300 or 2,718,400 combined summer and fall chum salmon returns based on run reconstructions.
- The Bethel test fishery cumulative CPUE in the Kuskokwim Area needs to be more than 2,800 or 5,200.
- The Norton Sound Area needs to have more than 57,300 or 91,500 chum salmon return based on the sum of the Snake, Nome, Eldorado, Kwiniuk, and North River escapements plus total chum salmon harvests for the region.

At this time, each index has two threshold amounts that represent the 25th or 50th percentile of abundance for each management area based on historically available data from 1992–2022 for the Kuskokwim and Yukon areas and 1997–2022 for the Norton Sound region. Only one value could be selected for implementation. The Council considered available data for each area in the Preliminary Review Analysis presented in October 2023. However, new information from ADF&G indicates that funding to operate the Bethel Test Fishery is uncertain beginning in 2025 and these data may not be available for use in Alternative 3, Option 1, in the future. Therefore, the Council should consider other data sources for indexing adult chum salmon abundance to the Kuskokwim River. Additional information on other sources of information for indexing adult chum salmon abundance to the Kuskokwim River is available in Appendix 2.

Each threshold would function as an independent test to determine whether the area is at a state of low or high chum salmon abundance. This approach is preferable to summing the thresholds for each area together under a single index for Western Alaska Chinook salmon for several reasons. First, there are limited run reconstructions for chum salmon returning to Western Alaska river systems. Second, the units of measurement for appropriate estimates of abundance differ between the areas (e.g., full run reconstruction, test fishery, weir count, among others), and this approach provides some proportionality among the river systems as their run sizes vary substantially.[51]

Whether a chum salmon PSC limit would be in effect during a B season, and at what amount, would depend on how many Management Areas meet their threshold.

- If all areas (3 of 3) have returns above their thresholds, a chum salmon PSC limit **would not** be in effect the following year.
- If two areas (2 of 3) have returns above their thresholds, a chum salmon PSC limit **would** be in place the following year. The amount would be between 100,000 and 550,000 chum salmon.

[51] In October 2023, the SSC recommended treating each area as an independent test for low abundance; the SSC's final report from October 2023 is available here.

- If 1 or 0 areas (1 of 3 or 0 of 3) have returns above their thresholds, a chum salmon PSC limit **would** be in effect the following year. The amount would be set at 75% of the level selected for when two areas (2 of 3) have returns above their thresholds.

Under Option 1 of Alternative 3, it is possible for a 75,000-chum salmon PSC limit to be in effect if 1 or 0 areas have returns above their thresholds and the PSC limit set when 2 of 3 areas have returns above their thresholds is 100,000 chum salmon. Table 2-6 through Table 2-8 provide the number of chum salmon that would be apportioned to each sector, CDQ group, and inshore cooperative under all cap amounts that are 75% of caps set between 100,000 and 550,000 chum salmon.

Table 2-6 Number of chum salmon apportioned to each sector under all PSC limit amounts when two or more areas fail to meet their abundance thresholds under Alternative 3, Option 1

PSC limit	Apportionment	CDQ	CP	Mothership	Inshore
75,000	3-year avg.	4,575	16,425	6,825	47,175
	5-year avg.	5,325	18,900	7,125	43,650
	Pro-rata	5,325	19,050	6,825	43,800
	AFA	7,500	27,000	6,750	33,750
150,000	3-year avg.	9,150	32,850	13,650	94,350
	5-year avg.	10,650	37,800	14,250	87,300
	Pro-rata	10,650	38,100	13,650	87,600
	AFA	15,000	54,000	13,500	67,500
225,000	3-year avg.	13,725	49,275	20,475	141,525
	5-year avg.	15,975	56,700	21,375	130,950
	Pro-rata	15,975	57,150	20,475	131,400
	AFA	22,500	81,000	20,250	101,250
262,500	3-year avg.	16,013	57,488	23,888	165,113
	5-year avg.	18,638	66,150	24,938	152,775
	Pro-rata	18,638	66,675	23,888	153,300
	AFA	26,250	94,500	23,625	118,125
300,000	3-year avg.	18,300	65,700	27,300	188,700
	5-year avg.	21,300	75,600	28,500	174,600
	Pro-rata	21,300	76,200	27,300	175,200
	AFA	30,000	108,000	27,000	135,000
337,500	3-year avg.	20,588	73,913	30,713	212,288
	5-year avg.	23,963	85,050	32,063	196,425
	Pro-rata	23,963	85,725	30,713	197,100
	AFA	33,750	121,500	30,375	151,875
412,500	3-year avg.	25,163	90,338	37,538	259,463
	5-year avg.	29,288	103,950	39,188	240,075
	Pro-rata	29,288	104,775	37,538	240,900
	AFA	41,250	148,500	37,125	185,625

Table 2-7 Number of chum salmon apportioned to each CDQ group under all PSC limits when two or more areas fail to meet abundance thresholds under Alternative 3, Option 1

PSC limit	Apportionment	CDQ	14% APICDA	21% BBEDC	5% CBSFA	24% CVRF	22% NSEDC	14% YDFDA
75,000	3-yr avg. (6.1%)	4,575	641	961	229	1,098	1,007	641
	5-yr avg. (7.1%)	5,325	746	1,118	266	1,278	1,172	746
	Pro-rata (7.1%)	5,325	746	1,118	266	1,278	1,172	746
	AFA (10%)	7,500	1,050	1,575	375	1,800	1,650	1,050
150,000	3-yr avg. (6.1%)	9,150	1,281	1,922	458	2,196	2,013	1,281
	5-yr avg. (7.1%)	10,650	1,491	2,237	533	2,556	2,343	1,491
	Pro-rata (7.1%)	10,650	1,491	2,237	533	2,556	2,343	1,491
	AFA (10%)	15,000	2,100	3,150	750	3,600	3,300	2,100
225,000	3-yr avg. (6.1%)	13,725	1,922	2,882	686	3,294	3,020	1,922
	5-yr avg. (7.1%)	15,975	2,237	3,355	799	3,834	3,515	2,237
	Pro-rata (7.1%)	15,975	2,237	3,355	799	3,834	3,515	2,237
	AFA (10%)	22,500	3,150	4,725	1,125	5,400	4,950	3,150
262,500	3-yr avg. (6.1%)	16,013	2,242	3,363	801	3,843	3,523	2,242
	5-yr avg. (7.1%)	18,638	2,609	3,914	932	4,473	4,100	2,609
	Pro-rata (7.1%)	18,638	2,609	3,914	932	4,473	4,100	2,609
	AFA (10%)	26,250	3,675	5,513	1,313	6,300	5,775	3,675
300,000	3-yr avg. (6.1%)	18,300	2,562	3,843	915	4,392	4,026	2,562
	5-yr avg. (7.1%)	21,300	2,982	4,473	1,065	5,112	4,686	2,982
	Pro-rata (7.1%)	21,300	2,982	4,473	1,065	5,112	4,686	2,982
	AFA (10%)	30,000	4,200	6,300	1,500	7,200	6,600	4,200
337,500	3-yr avg. (6.1%)	20,588	2,882	4,323	1,029	4,941	4,529	2,882
	5-yr avg. (7.1%)	23,963	3,355	5,032	1,198	5,751	5,272	3,355
	Pro-rata (7.1%)	23,963	3,355	5,032	1,198	5,751	5,272	3,355
	AFA (10%)	33,750	4,725	7,088	1,688	8,100	7,425	4,725
412,500	3-yr avg. (6.1%)	25,163	3,523	5,284	1,258	6,039	5,536	3,523
	5-yr avg. (7.1%)	29,288	4,100	6,150	1,464	7,029	6,443	4,100
	Pro-rata (7.1%)	29,288	4,100	6,150	1,464	7,029	6,443	4,100
	AFA (10%)	41,250	5,775	8,663	2,063	9,900	9,075	5,775

Source: NMFS catch accounting system, data compiled by AKFIN.

Table 2-8 Number of chum salmon apportioned to each inshore cooperative and the inshore open access fishery when two or more areas fail to meet their abundance thresholds under Alternative 3, Option 1

PSC limit	Apportionment	Inshore sector	(33.788%) Akutan CV Assoc.	(0.000%) Arctic Enterprise Assoc.	(10.773%) Northern Victor Fleet Coop	(2.512%) Peter Pan Fleet Coop.	(11.454%) Unalaska Fleet Coop.	(22.094%) UniSea Fleet Coop.	(19.380%) Westward Fleet Coop.	(0.000%) Inshore Open Access
75,000	3-yr avg. (62.9%)	47,175	15,939	0	5,082	1,185	5,403	10,423	9,143	0
	5-yr avg. (58.2%)	43,650	14,748	0	4,702	1,096	5,000	9,644	8,459	0
	Pro-rata (58.4%)	43,800	14,799	0	4,719	1,100	5,017	9,677	8,488	0
	AFA (45%)	33,750	11,403	0	3,636	848	3,866	7,457	6,541	0
150,000	3-yr avg. (62.9%)	94,350	31,879	0	10,164	2,370	10,807	20,846	18,285	0
	5-yr avg. (58.2%)	87,300	29,497	0	9,405	2,193	9,999	19,288	16,919	0
	Pro-rata (58.4%)	87,600	29,598	0	9,437	2,201	10,034	19,354	16,977	0
	AFA (45%)	67,500	22,807	0	7,272	1,696	7,731	14,913	13,082	0
225,000	3-yr avg. (62.9%)	141,525	47,818	0	15,246	3,555	16,210	31,269	27,428	0
	5-yr avg. (58.2%)	130,950	44,245	0	14,107	3,289	14,999	28,932	25,378	0
	Pro-rata (58.4%)	131,400	44,397	0	14,156	3,301	15,051	29,032	25,465	0
	AFA (45%)	101,250	34,210	0	10,908	2,543	11,597	22,370	19,622	0
262,500	3-yr avg. (62.9%)	165,113	55,788	0	17,788	4,148	18,912	36,480	31,999	0
	5-yr avg. (58.2%)	152,775	51,620	0	16,458	3,838	17,499	33,754	29,608	0
	Pro-rata (58.4%)	153,300	51,797	0	16,515	3,851	17,559	33,870	29,710	0
	AFA (45%)	118,125	39,912	0	12,726	2,967	13,530	26,099	22,893	0
300,000	3-yr avg. (62.9%)	188,700	63,758	0	20,329	4,740	21,614	41,691	36,570	0
	5-yr avg. (58.2%)	174,600	58,994	0	18,810	4,386	19,999	38,576	33,837	0
	Pro-rata (58.4%)	175,200	59,197	0	18,874	4,401	20,067	38,709	33,954	0
	AFA (45%)	135,000	45,614	0	14,544	3,391	15,463	29,827	26,163	0
337,500	3-yr avg. (62.9%)	212,288	71,728	0	22,870	5,333	24,315	46,903	41,141	0
	5-yr avg. (58.2%)	196,425	66,368	0	21,161	4,934	22,499	43,398	38,067	0
	Pro-rata (58.4%)	197,100	66,596	0	21,234	4,951	22,576	43,547	38,198	0
	AFA (45%)	151,875	51,316	0	16,361	3,815	17,396	33,555	29,433	0
412,500	3-yr avg. (62.9%)	259,463	87,667	0	27,952	6,518	29,719	57,326	50,284	0
	5-yr avg. (58.2%)	240,075	81,117	0	25,863	6,031	27,498	53,042	46,527	0
	Pro-rata (58.4%)	240,900	81,395	0	25,952	6,051	27,593	53,224	46,686	0
	AFA (45%)	185,625	62,719	0	19,997	4,663	21,261	41,012	35,974	0

Source: NMFS catch accounting system, data compiled by AKFIN. 2022 Inshore cooperative apportionments.

2.4.2 Option 2: Yukon Area Index

Option 2 of Alternative 3 would implement an index based on Yukon River summer and fall chum salmon returns. The abundance thresholds for Yukon summer chum salmon are either 1,268,700 or 1,978,400 fish. The abundance thresholds for Yukon fall chum are either 444,600 or 803,000 fish.

If both stocks (2/2) have returns above the threshold, a chum salmon PSC limit **would not** in effect the following year. If one or neither stock (1/2 or 0/2) has returns above the threshold, a chum salmon PSC limit **would** be in effect the year, set an amount between 100,000 and 550,000 chum salmon.

In April 2024, the Council received a synchronicity analysis that was used to determine how well the Yukon summer and fall chum runs trend with the Three-area index under Option 1 (see Appendix 7 of the April 2024 preliminary DEIS). The Three-area index was used as a baseline for WAK chum salmon abundance, because there is uncertainty in the run size estimates for areas apart from the Yukon. The synchronicity analysis demonstrated the Yukon summer and fall chum salmon stocks are likely to provide a reliable index of the aggregate dynamics of Western Alaska chum salmon stocks. The SSC recommended the Council could consider Option 2 as a way to establish a simpler index.[52]

2.5 Alternative 4: Additional Regulatory Requirements for Incentive Plan Agreements

The IPAs establish incentives and penalties for vessel operators to avoid Chinook and chum salmon while fishing for pollock. The incentives and penalties are determined by parties to the contract, but all IPAs must respond to 13 provisions specified in regulations. Alternative 4 would modify the regulations at 50 CFR 679.21(f)(12)(iii)(E) to include six additional provisions. The Council has thus far considered the provisions as a package, but the provisions may be adopted or implemented individually. The annual reporting requirements for the IPAs at 50 CFR 679.21(f)(13) would still apply.

1. Require the pollock sectors to describe in their IPA how historical genetic stock composition data are included in chum salmon avoidance measures.
2. Require the pollock sectors to describe in their IPAs how they monitor for potential chum salmon avoidance closures more than once per week.
3. Require the use of salmon excluders for the duration of A and B season.
4. Require the pollock sectors to develop chum salmon vessel outlier provisions and implement within their IPA.
5. Require IPAs to provide weekly salmon bycatch reports to Western and Interior Alaska salmon users to allow for more transparency in reporting.
6. Require the pollock sector IPAs to prohibit fishing in bycatch avoidance areas for all vessels regardless of performance when ADFG weekly stat area bycatch rates exceed 5 chum per ton of pollock (CP) and 3 times base rate (CV and MS).

These provisions would modify regulations at 50 CFR 679.21(f)(12)(iii)(E) such that the IPAs must contain a description of how vessels and CDQ groups governed by the contract are implementing more strict measures to avoid chum salmon PSC (e.g., proposed Provision 2, 4, and 6 under Alternative 4) and improve efforts to avoid areas and times WAK chum salmon are more likely to be encountered on the fishing grounds (Provision 1 under Alternative 4). These provisions would apply equally across the IPAs, may be met by the individual IPAs in a variety of ways, and the explicit manner in which they are addressed within IPAs is not specified. Just as it is with the current IPA regulations, the IPA submitted to NMFS for approval would be required include a description of how these provisions are met by the IPA.

[52] SSC minutes on C2 Draft EIS April 2024.

Following the high chum salmon bycatch year in 2021, the Council requested industry to take immediate steps to avoid chum salmon in the 2022 B season. In response to this request, members of the CP IPA agreed to formally amend the contract with new chum salmon avoidance measures. The Inshore SSIP was amended to incorporate new avoidance measures prior to the 2024 B season, and MSSIP members agreed to adopt all additional chum salmon bycatch avoidance measures incorporated into the Inshore SSIP. The six provisions under Alternative 4 align with current operational strategies and reflect each recently amended IPA. While these provisions reflect current operations, without modifying the IPA regulations, the contracts could be amended such that the following measures are no longer taken. A primary function of Alternative 4 is to modify regulations at 50 CFR 679.21(f)(12)(iii)(E) to ensure the IPAs could not use less stringent avoidance strategies in the future.

2.6 Alternative 5: Inseason Corridor Cap

Alternative 5 includes inseason corridors (areas) on the pollock fishing grounds that would close for a period of time during the B season, if or when a corridor-specific chum salmon PSC limit is met. Only the chum salmon PSC taken inside the corridor from June 10 to August 31 would count towards the corridor limit. Alternative 5 may be implemented in conjunction with Alternative 2 and 3. In this scenario, the chum salmon PSC caught inside the corridor would also accrue to the overall chum salmon PSC limit. If a sector reached its apportionment of the corridor cap, the area would immediately close to that sector. However, on September 1 vessels could fish in the corridor again if they so choose.

The corridor closures would be managed by NMFS. The Council is considering three different corridor options that are mutually exclusive. Option 1: Cluster Area 1: 50,000 to 200,000 chum salmon; Option 2: Unimak Area: 50,000 to 200,000 chum salmon; Option 3: Cluster Area 2: 50,000 or 100,000 chum salmon.

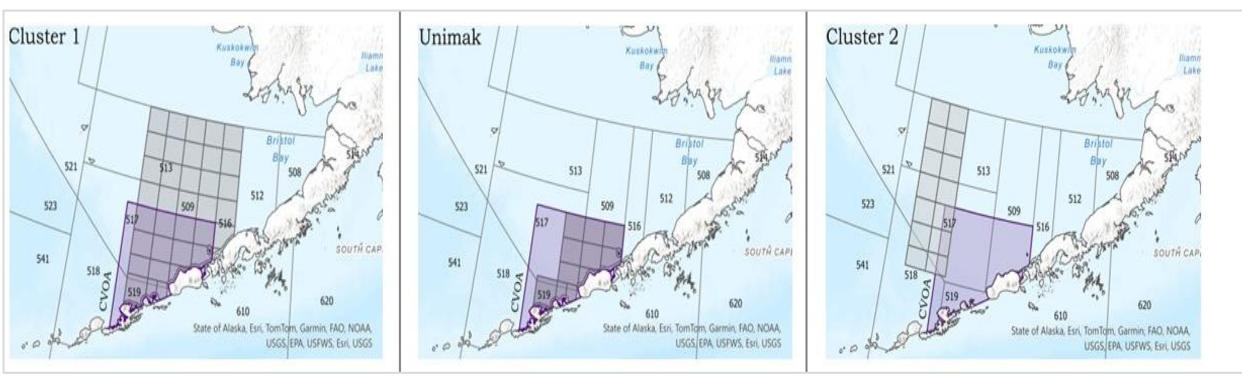

Figure 2-1 Corridor areas under consideration in Alternative shown in gray and CVOA shown in purple

The chum salmon PSC limits under Alternative 5 would be apportioned using the same options as Alternative 2 and 3 and would be transferable. Three options for corridor areas are being considered, but only one could be selected at implementation. Table 2-9 provides each sector's historical chum salmon PSC in each corridor from June 10 to August 31 (2011–2022) which are the basis for the apportionment amounts.[53] Table 2-10 through Table 2-13 provide the amount of the corridor chum salmon PSC limit that would be apportioned to each sector under the range of limits being considered. Additional information on the apportionments to the CDQ groups and inshore cooperatives for each corridor and cap level can be found in Appendix 2.

[53] Estimates of PSC for the inshore sector are lagged because these vessels make delivers to shoreside plants where salmon undergo a census count by NMFS certified observers. Analytical staff calculated the inshore sector's apportionments using the catch activity date in CAS. This approach provides the best information for the historical chum salmon bycatch that occurred in each area from June 10 to August 31 to set apportionment amounts, although the actual delivery date when the trip's PSC is known might occur after August 31.

Table 2-9 Pollock fishing sector's chum salmon PSC inside each corridor option under Alternative 5 from June 10 through August 31, 2011-2022

Corridor	Sector	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	3-Yr Avg.	5-Yr. Avg
Cluster 1	CDQ	782	10	0	248	29	13,524	31,493	7,730	0	0	49,239	722	16,654	11,538
	CP	2,335	58	1,201	22	2	19,378	843	3,462	0	0	24	1,998	674	1,097
	Mothership	9,048	793	1,129	1,174	986	26,711	14,431	7,113	1,676	298	16,010	23,742	13,350	9,768
	Inshore	78,436	7,967	66,665	55,511	121,608	93,609	114,133	68,154	84,642	21,894	150,817	123,489	98,733	89,799
Unimak	CDQ	740	9	0	246	29	9,375	146	4,607	0	0	48,473	0	16,158	10,616
	CP	0	0	0	0	0	18	6	0	0	0	0	0	0	0
	Mothership	8,254	732	751	1,146	754	11,167	5,396	4,685	1,501	287	11,370	12,952	8,203	6,159
	Inshore	64,341	7,405	56,397	30,990	108,531	47,754	79,529	51,330	82,491	20,680	126,117	97,119	81,305	75,547
Cluster 2	CDQ	47	8	1	210	213	1,351	53,283	5,817	76	0	276	1,920	732	1,618
	CP	2,491	561	1,831	5,384	5,112	54,952	149,637	29,960	25,917	4,821	55,239	22,999	27,686	27,787
	Mothership	504	35	1,650	493	277	2,232	626	5,967	210	0	34,264	297	11,520	8,148
	Inshore	5,110	370	14,278	48,235	1,970	10,186	30,730	62,160	4,792	31,369	181,469	5,282	72,707	57,014

Source: NMFS catch accounting system, data compiled by AKFIN.

Table 2-10 Sector- and corridor-specific apportionment percentages under Alternative 5

Corridor	Apportionment	CDQ	CP	Mothership	Inshore
Cluster 1	3-Yr avg.	12.9%	0.5%	10.3%	76.3%
	5-Yr avg.	10.3%	1.0%	8.7%	80.0%
	Pro-rata	12.2%	9.4%	10.0%	68.5%
	AFA	10.0%	36.0%	9.0%	45.0%
Unimak	3-Yr avg.	15.3%	0.0%	7.8%	76.9%
	5-Yr avg.	11.5%	0.0%	6.7%	81.8%
	Pro-rata	14.0%	9.0%	8.1%	68.9%
	AFA	10.0%	36.0%	9.0%	45.0%
Cluster 2	3-Yr avg.	0.6%	24.6%	10.2%	64.5%
	5-Yr avg.	1.7%	29.4%	8.6%	60.3%
	Pro-rata	3.0%	27.4%	9.9%	59.7%
	AFA	10.0%	36.0%	9.0%	45.0%

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

Table 2-11 Apportionments of the corridor-specific PSC limit for Cluster Area 1 under Alternative 5, Option 1

PSC limit	Apportionment	CDQ	CP	Mothership	Inshore
50,000	3-Yr avg.	6,450	250	5,150	38,150
	5-Yr avg.	5,150	500	4,350	40,000
	Pro-rata	6,088	4,688	4,988	34,238
	AFA	5,000	18,000	4,500	22,500
100,000	3-Yr avg.	12,900	500	10,300	76,300
	5-Yr avg.	10,300	1,000	8,700	80,000
	Pro-rata	12,175	9,375	9,975	68,475
	AFA	10,000	36,000	9,000	45,000
150,000	3-Yr avg.	19,350	750	15,450	114,450
	5-Yr avg.	15,450	1,500	13,050	120,000
	Pro-rata	18,263	14,063	14,963	102,713
	AFA	15,000	54,000	13,500	67,500
200,000	3-Yr avg.	25,800	1,000	20,600	152,600
	5-Yr avg.	20,600	2,000	17,400	160,000
	Pro-rata	24,350	18,750	19,950	136,950
	AFA	20,000	72,000	18,000	90,000

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

Table 2-12 Apportionments of the corridor-specific PSC limit for Unimak Area under Alternative 5, Option 2

PSC limit	Apportionment	CDQ	CP	Mothership	Inshore
50,000	3-Yr avg.	7,650	0	3,900	38,450
	5-Yr avg.	5,750	0	3,350	40,900
	Pro-rata	6,988	4,500	4,050	34,463
	AFA	5,000	18,000	4,500	22,500
100,000	3-Yr avg.	15,300	0	7,800	76,900
	5-Yr avg.	11,500	0	6,700	81,800
	Pro-rata	13,975	9,000	8,100	68,925
	AFA	10,000	36,000	9,000	45,000
150,000	3-Yr avg.	22,950	0	11,700	115,350
	5-Yr avg.	17,250	0	10,050	122,700
	Pro-rata	20,963	13,500	12,150	103,388
	AFA	15,000	54,000	13,500	67,500
200,000	3-Yr avg.	30,600	0	15,600	153,800
	5-Yr avg.	23,000	0	13,400	163,600
	Pro-rata	27,950	18,000	16,200	137,850
	AFA	20,000	72,000	18,000	90,000

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

Table 2-13 Apportionments of the corridor-specific PSC limit for Cluster Area 2 under Alternative 5, Option 3

PSC limit	Apportionment	CDQ	CP	Mothership	Inshore
50,000	3-Yr avg.	325	12,289	5,114	32,272
	5-Yr avg.	855	14,692	4,308	30,145
	Pro-rata	1,494	13,717	4,960	29,829
	AFA	5,000	18,000	4,500	22,500
100,000	3-Yr avg.	650	24,578	10,227	64,545
	5-Yr avg.	1,711	29,384	8,616	60,290
	Pro-rata	2,987	27,434	9,920	59,659
	AFA	10,000	36,000	9,000	45,000

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

2.7 Alternatives Considered but not Analyzed Further

The following section discusses the alternatives previously considered by the Council but have not been analyzed further.

PSC limits below 100,000: The Council has previously considered chum salmon PSC limits below 100,000 chum salmon through recommendations from the Salmon Bycatch Committee[54] and a supplement prepared by NMFS. The NMFS supplement was prepared for the Council's April 2024 meeting and provided estimates of forgone pollock (mt), gross ex-vessel and first wholesale revenues, and chum salmon PSC reductions for caps of 150,000, 100,000, 50,000, and 0 chum salmon. In April 2024, the Council lowered the range of PSC limits in response to public testimony and the supplement to include a cap level of 100,000 chum salmon.[55] However, the Council is not considering caps below 100,000 chum salmon under Alternative 2 in light of its consideration of the National Standards. The Council is required to balance all National Standards when selecting and recommending a management alternative to the Secretary, including National Standard 9 which requires conservation and management measures shall, to the extent practicable, minimize bycatch.

Western Alaska Chum Salmon Performance Threshold: The Council previously considered an alternative to establish a performance threshold for WAK chum salmon. The threshold would have been implemented in conjunction with an overall PSC limit. A fishing sector would have been required to balance its performance against an overall cap as well as the WAK chum salmon performance threshold. Only those salmon caught as bycatch during the B season *and* identified as being of Western Alaska origin would accrue towards the threshold. If a sector exceeded its apportionment of the threshold three times in any seven-year period, it would be required to operate under a lower chum salmon PSC limit.

The Council determined the WAK chum salmon performance threshold was not a feasible management alternative to analyze further, because it intended to use each fishing sector's actual WAK chum salmon bycatch to compare against the threshold. Real-time genetic data for the salmon caught as bycatch in the pollock fishery are currently not available. Further, the percentage of chum bycatch consisting of WAK chum fluctuates significantly each year. Therefore, neither individual boats nor sectors of the pollock fleet would know if they had exceeded the threshold, which could result in lower caps in future years. This raised equity concerns.

This determination was reached after considering different ways of setting the threshold including using a rolling average as well as the prior year's estimated proportion of WAK chum salmon. Both of these approaches would allow each fishing sector to know their apportionment of the threshold prior to the fishing season so their performance could be assessed against it in real-time. However, these approaches provide a perverse incentive for the pollock fleet to attempt to increase their WAK chum over a period of years or in the prior year salmon bycatch to achieve a higher proportion against which their future performance would be measured of a period of years or in the prior year. Additionally, the staff presentation in April 2024 clarified that it was not clear what management action would occur if a sector appeared to stay below the threshold inseason, but it later became known that the sector's bycatch was in fact above the threshold.

[54] The SBC's March 2023 report is available here.
[55] The letter from NMFS is available here.

3 Environmental Assessment

Chapter 3 evaluates the potentially affected environment and the degree of the direct and indirect impacts of the alternatives and options on the various resource components. Recent and relevant information necessary to understand the affected environment for each resource component is summarized in the corresponding section below. Table 3-1 provides the initial scan used to consider the potential impacts of the proposed action alternatives on the components of the human environment and whether the proposed action has the potential to impact each resource component. The potential socio-economic impacts of the proposed alternatives are evaluated in Chapter 4.

Environmental Scan

The resource components addressed in this preliminary DEIS are chum salmon PSC, Chinook salmon PSC, herring PSC, marine mammals, seabirds, habitat, as well as ecosystem and climate. The analysts considered crab PSC encountered by the Bering Sea pollock fishery at the species level with a particular focus on Tanner crab, snow crab and red king crab (all red king crab combined not specific to Bristol Bay) from 2011–2023. Estimates on red king crab PSC ranged between 0–23 animals over that time frame while Tanner crab PSC ranged from approximately 92–4,900 and snow crab PSC ranged from 21–4,700. These numbers are low at the aggregated species level so as to be seen minimal in terms of relative impacts to crab PSC and the alternatives included under consideration are not anticipated to have any impact on the relative crab PSC taken in the pollock fishery.

Table 3-1 Resources potentially affected by the proposed action and alternatives

	Potentially affected resource component							
Eastern Bering Sea Pollock	**Salmon**	**Herring PSC**	**Marine Mammals**	**Seabirds**	**Habitat**	**Crab PSC**	**Ecosystem and Climate Change**	**Economic, Community, and Tribal**
Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

N = no impact anticipated by each alternative on the component.
Y = an impact is possible if each alternative is implemented.

Overview of a Cumulative Effects Analysis

In addition to an analysis on the potential direct and indirect effects, NEPA requires an analysis of the potential cumulative effects of a proposed Federal action and its alternatives. Cumulative effects are the "effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (see 40 CFR 1508.1(i)(3)). Cumulative effects can result from actions with individually minor but collectively significant effects taking place over a period of time. A cumulative effects analysis is intended to capture the total effects of many actions over time that would be missed if each action was individually evaluated.

Based on the resource components in Table 3-1, the cumulative effects analysis focuses on the resources that may be affected by the proposed action are eastern Bering Sea pollock, salmon, herring, marine mammals, seabirds, habitat, ecosystem and climate change as well as the human dimensions. In this preliminary DEIS, the past and present actions related to the relevant environmental components are identified and integrated in the appropriate sub-sections of Chapter 3 and 4. The cumulative effects on many of these environmental components have been analyzed in 2004 Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (2004 PEIS) and Supplemental Information Report (NMFS 2015).

The CEQ regulations include a consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. Reasonably Foreseeable Actions (RFA) are interpreted as indicating actions that are more than merely possible or speculative. Actions are considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or the publication of a proposed rule. Actions simply “under consideration” have not generally been included because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen.

Actions are understood to be human actions (e.g., a proposed rule to designate northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). Concurrently, the CEQ guidelines recognize that it is most practical to focus cumulative effects analysis on only those effects that are truly meaningful. Therefore, this is not intended to be an exhaustive list of all external factors influencing each resource category, but rather focus on those reasonably foreseeable human actions that could interact with the proposed alternatives.

Some RFAs are expected to impact and interact with all resource components: the continued authorization of the Bering Sea pollock fishery through the annual harvest specifications process, prosecution of the Bering Sea pollock fishery, and climate change. These RFAs are cross-cutting for the resource components evaluated and therefore described here.

Authorization of Bering Sea Pollock Fishery. The continued setting of controls and limits for the Bering Sea pollock fishery under the annual harvest specifications process constitutes an RFA. Annual TAC specifications limit each year’s harvest within sustainable bounds. The overall OY limits on harvests in the BSAI constrain overall harvest of all species. Each year, the Council recommends, and NMFS approves of OFLs, ABCs, and TACs for two years, as described in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007b).

Prosecution of the Bering Sea Pollock Fishery. Annual Bering Sea pollock harvest is an RFA that is conducted by private actors and affects many resource categories. The ongoing effects of the pollock fishery on the sustainability of pollock is considered annually through the stock assessment process (Ianelli et al. 2024).

Additionally, documents incorporated by reference, Appendix 7 (prepared by KRITFC) and Appendix 8 (prepared by TCC), and sections throughout this analysis highlight potential impacts and interactions of the prosecution of this fishery on all other resource components analyzed here. This includes bycatch of chum and WAK chum salmon (Section 3.2.3.1.1.1, Sections 3.2.4, as well as through information provided by cooperating agencies in Section 5.B of Appendix 7 and Appendix 8), bycatch of other species (Section 3.3 for Chinook and Section for 3.4 herring), marine mammals (Section 3.6) , seabirds (Section 3.7.1), habitat impacts (Section 3.8), broader ecosystem considerations (Section 3.9, Section 4.3.3.2.3, Section 5.B in Appendix 7, and Section 7-4 in Appendix 8); as well as extensive information on the human dynamics associated with this fishery (Section 4.1) and indirectly impacted by this fishery (i.e., throughout Section 4.3 and throughout Appendix 7 and 8). In general, these levels of impact are expected to continue. Analyses of the proposed action inherently considers the continuation of the pollock fishery in combination with the proposed alternatives.

Climate Change. Climate change has ecosystem-level effects, including changes in habitat, prey species, and food availability. The Council annual receives Ecosystem Status Reports as it considers setting the upcoming year’s catch and PSC limits (this is referred to as “harvest specifications”). The 2023 ESR (Siddon et al., 2023) is cited and incorporated by reference throughout this preliminary DEIS. The relationship between climate change and recent chum salmon declines is discussed at length in Section 3.2.3.1.1 as well as in Appendix 7 (prepared by KRITFC) and Appendix 8 (prepared by TCC) and throughout the analysis related to other resource components. For example, climate shifts in the BSAI region, including the recent marine heat waves (Siddon et al., 2023) have been linked to:

- Climate shifts in the BSAI region, including the recent marine heat waves (Siddon et al., 2023) have been linked to low prey quality and survival at sea for juvenile WAK chum salmon (Farley et al., 2024);

- increased open-water phytoplankton blooms have been observed with potential effects to the food web for chum salmon (Nielsen et al. 2023);[56]
- some marine mammals, like ice seals (bearded seals, ringed seals, spotted seals, ribbon seals), are directly impacted by changing temperatures and sea ice extent, while others are indirectly affected, through prey availability (Edwards and Richardson 2004);
- extended increases in sea surface temperature resulted in a shift in prey availability resulting in a mass seabird die-off event from 2014 to 2016 (Piatt et al. 2020).

Commercially managed stocks are experiencing variable impacts related to climate change. For instance, in addition to many salmon stocks, there have been recent declines in snow crab, and Bristol Bay red king crab (Siddon et al. 2023). Conversely, there has been increased recruitment in sablefish, herring, and Bristol Bay sockeye salmon and increased reproductive success and recruitment for the 2018-year class of pollock.

Additional RFAs are identified within each associated sub-sections in Chapter 3 and 4 and are then considered cumulatively alongside the proposed actions.

3.1 Overview of BSAI Groundfish and Stock Status

The Council recommends annual catch limits, allocations, and PSC limits for the federally managed commercial groundfish fisheries in the BSAI. Those stocks that are commercially important and for which an annual catch limit is established include: walleye pollock, Pacific cod, sablefish, yellowfin sole, Greenland turbot, arrowtooth and Kamchatka flounders, northern rock sole, flathead sole, Alaska plaice, and "other flatfish", Pacific ocean perch, northern rockfish, shortraker and rougheye rockfish, "other rockfish, Atka mackerel, shark, octopus, sculpin, skate, and squid (see also the BSAI Groundfish FMP). Authorized gear types are trawls, hook-and-line, pots, jigs, and other gear as defined in regulations. Participants in the Bering Sea pollock fishery would be directly regulated by the proposed action and is managed under the BSAI Groundfish FMP.

The annual BSAI Groundfish Stock Assessment and Fishery Evaluation (SAFE) Report is considered by the Council annually at its December meeting when recommending biennial harvest specifications. The SAFE Report provides a detailed discussion on the status of individual groundfish stocks. The Council also receives an Ecosystem Status Report (ESR) on an annual basis in conjunction with setting harvest specifications. The goals of the harvest specifications process are to 1) manage fisheries based on the best scientific information available, 2) provide for adequate prior public review and comment on Council recommendations, 3) provide for additional opportunity for Secretarial review, 4) minimize unnecessary disruption to fisheries and public confusion, and 5) promote administrative efficiency. This portion of the analysis relies on the 2024 BSAI Groundfish SAFE and ESR.

Across all gear types and sectors, total commercial groundfish TAC levels in the BSAI are capped at 2 million mt each year. This cap corresponds to the upper limit on the optimum yield in the BSAI FMP and in Pub. L. No. 108-199. The 2 million mt cap is a harvest constraint set well below the sum of Acceptable Biological Catch (ABC) levels, which represent the overfishing level adjusted for uncertainty, for the FMP groundfish species mentioned above. For example, the sum of the 2024 groundfish FMP species' ABCs is 3,476,800 mt. The 2024 TAC was set at 2,000,000 mt.

BSAI TAC setting is generally driven by tradeoffs among the availability of eastern Bering Sea pollock, Bering Sea Pacific cod, key flatfish species and the 2 million mt optimum yield cap. High value, low volume species such as sablefish and rockfish have TACs set equal to ABC while lower value flatfish stocks such as arrowtooth flounder have TACs set well below ABC for both market reasons and expected

[56] Salmon EFH includes both the marine environment and freshwater anadromous streams used during their egg, larval, juvenile, and spawning adult life history stages (NPFMC 2024).

halibut bycatch rates. At lower levels of pollock ABC (e.g., 2010 to 2012) the pollock TAC is set equal to the ABC. Since 2012, as the pollock ABC increased, the pollock TAC remained relatively stable thus allowing for higher TACs to be set for other BSAI groundfish species.

As shown in Appendix 3, FMP groundfish species TACs are allocated for the entire BSAI when the population structure indicates a single stock. Others, such as Pollock, Pacific cod and sablefish have separate allocations by the Bering Sea and Aleutian Islands subareas of the BSAI. Additionally, for some rockfish and Atka mackerel, allocations are further specified within regions to avoid localized depletion.

3.1.1 Bering Sea Pollock

Walleye pollock (*Gadus chalcogrammus*; hereafter referred to as pollock) are a semidemersal, schooling species that are generally found at depths from 30 to 300 meters but have been recorded at depths as low as 950 meters (Mecklenburg et al. 2002). Pollock are usually concentrated on the outer shelf and slope of coastal waters but may utilize a wide variety of habitats (Sogard and Olla 1993). Pollock are broadly distributed throughout the North Pacific with the largest concentrations found in the Bering Sea. For management purposes, pollock in the U.S. waters of the Bering Sea are divided into three stocks: the eastern Bering Sea stock, the Aleutian Islands stock, and the Central Bering Sea-Bogoslof Island stock. General migratory movements of adult pollock on and off the eastern Bering Sea shelf tend to follow a pattern of movement to the outer shelf edge and deep water in the winter months, to spawning areas in the springtime, and to the outer and central shelf during the summer months to feed (Smith 1981).

Prosecution of the Pollock Fishery

Bering Sea pollock is the largest U.S. fishery by volume—the 2024 and 2025 Bering Sea subarea total allowable catch (TAC) was set at 1.30 million and 1.375 million metric tons (mt), respectively. Also marketed under the name “Alaska pollock,” this fishery represents over 40% of the global whitefish production with the market disposition split fairly evenly between fillets, whole (headed and gutted), and surimi. An important component of commercial production is the sale of roe from pre-spawning pollock, which are the focus of the winter fishery (“A season” from January 20th to June 10th). During this season the fishery produces highly valued roe which can comprise over 4% of the catch in weight (Ianelli et al., 2024). The summer (“B season”) opens on June 10th and fishing extends through November 1.

The A-season fishery concentrates primarily north and west of Unimak Island depending on ice conditions and fish distribution. There has also been effort along the 100m depth contour (and deeper) between Unimak Island and the Pribilof Islands. The general pattern by season (and area) has varied over time with recent B-season catches occurring in the southeast portion of the shelf.

Figure 3-1 Bering Sea pollock harvest (mt) by sector and fishing season (A and B), 2011–2023

Year	CDQ		CP		Mothership		Inshore		Total
	A season	B season	A season	B season	A season	B season	A season	B season	
2011	50,886	66,167	173,550	250,129	44,125	65,724	228,167	299,466	1,178,214
2012	48,766	73,163	169,284	253,884	45,547	63,424	219,776	315,290	1,189,133
2013	50,607	75,940	175,665	264,928	48,135	66,713	227,664	330,513	1,240,165
2014	51,334	77,302	177,201	267,977	53,178	66,756	228,945	335,322	1,258,016
2015	53,106	79,785	180,456	277,192	50,827	69,141	232,596	346,959	1,290,061
2016	54,229	81,476	183,852	284,065	55,682	70,599	239,764	354,015	1,323,682
2017	61,031	75,419	205,845	266,891	59,501	66,453	252,573	346,323	1,334,036
2018	61,997	76,296	213,813	263,947	64,085	66,892	261,483	343,996	1,352,509
2019	63,294	78,315	214,942	275,173	68,733	68,066	272,701	348,384	1,389,608
2020	64,867	63,107	223,283	245,375	58,483	66,919	281,741	327,025	1,330,801
2021	62,597	76,732	215,232	264,947	60,550	66,593	266,499	339,546	1,352,696
2022	49,844	61,189	170,421	209,668	44,873	53,532	219,213	262,593	1,071,334
2023	58,945	72,842	201,052	250,632	50,281	62,413	248,015	325,217	1,269,397

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

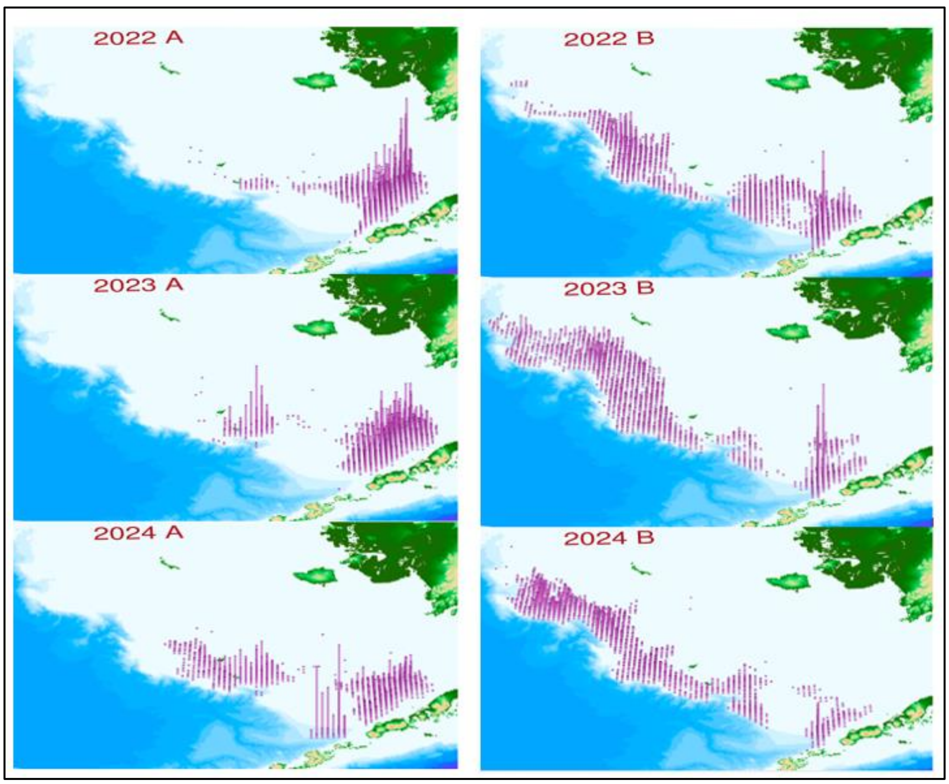

Figure 3-2 Eastern Bering Sea pollock catch distribution during the A season (left) and B season fishery from 2022–2024. Column height is proportional to catch.

Source Ianelli et al., 2024

3.1.1.1 Effects of the Alternatives on the Pollock Stock

3.1.1.2 Alternative 1

Presently the pollock stock is managed based on science covering a wide variety of factors including the capacity of the stock to yield sustainable biomass on a continuing basis. Spatial and temporal distribution changes are closely monitored by scientifically trained at-sea observers. These changes are reflected in the annual stock assessments and in consideration of fishing conditions. The present bycatch management system neither significantly affects the distribution of the stock spatially and temporally, nor is it reasonably expected to jeopardize the capacity of the stock productivity on a continuing basis. Thus Alternative 1 is not expected to have adverse effects on the pollock stock as evidenced by the capacity to yield sustainable biomass on a continuing basis and the ability of the stock to sustain itself regardless of any minor modifications in the stock distribution as a result of the fishery (see also Appendix 3).

3.1.1.3 Alternatives 2 and 3

The amount of pollock catch that would have been forgone under **Alternative 2 and 3** was compared with the total actual B season pollock catch in each year to evaluate the impact of different hard caps and apportionments. **This method ignores the fact that the fleet would likely have taken measures to avoid reaching a cap in any given year.** The day a sector would have closed was estimated by interpolating the statistical week and the week-ending date of that week that bracketed the specific PSC limit. This methodology is the same as that which was used in the April 2024 preliminary DEIS.

The amount of hypothetical forgone pollock varies considerably over the years and sectors (see Table 3-2). In general, the amount of forgone pollock is greater when the cap was met earlier in the B season. For instance, the CP sector would have reached a cap of 100,000 chum salmon using the 3-year average on June 30, 2018, which was estimated to result in 236,646 mt of potentially forgone catch. Under the same cap amount and apportionment, the CP sector would have met the cap on August 10th, 2019. This was estimated to result in 117,701 mt of potentially forgone pollock catch for this sector. The annual TAC and fishing conditions in that year (e.g., how much pollock quota was caught by the date a cap was met) are also important factors for determining the magnitude of the estimates on potentially forgone pollock catch.

A 75,000-chum salmon PSC limit is included in the cap range under Alternative 3, Option 1. Section 3.2.4.2.4 provides implications specific to Alternative 3 which are not reiterated here, but it is important to note that a PSC limit would not have been in effect in each year retrospectively under Alternative 3 as would be the case for Alternative 2 (see Table 3-23 and Table 3-24). An overall chum salmon PSC limit would have been in effect in 3 or 6 years under Alternative 3, Option 1 and in 4 or 5 years under Alternative 3, Option 2. A 75,000-chum salmon PSC limit under Alternative 3, Option 1 would have been possible in 2021, 2022, and 2023. A 75,000-chum salmon PSC limit would have been more constraining for the sectors in the years that it was met; in 2023, the CDQ sector would not have reached any apportionment, and the CP sector would not have reached its AFA apportionment.

Table 3-2 Week-ending date that analyzed chum salmon PSC limits and apportionments would have been met under Alternative 2, 2011–2023

Year	100,000				325,000				550,000			
	CDQ	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**
Sector apportionment 1, 3-year average												
2011		27-Aug	23-Jul	6-Aug								
2012												
2013				17-Aug								
2014		16-Aug		2-Aug								
2015		22-Aug	29-Aug	15-Aug								
2016	23-Jul	9-Jul	30-Jul	6-Aug		13-Aug	3-Sep			3-Sep		
2017	8-Jul	15-Jul	15-Jul	15-Jul	15-Jul	22-Jul			15-Jul	29-Jul		
2018	30-Jun	30-Jun	7-Jul	7-Jul	7-Jul	21-Jul						
2019	14-Sep	10-Aug	3-Aug	13-Jul		31-Aug	7-Sep					
2020	19-Sep	22-Aug	19-Sep	22-Aug		3-Oct		10-Oct				
2021	17-Jul	31-Jul	17-Jul	17-Jul	17-Jul	14-Aug	31-Jul	31-Jul	17-Jul		28-Aug	
2022	3-Sep	20-Aug	6-Aug	6-Aug			3-Sep					
2023		9-Sep	26-Aug	2-Sep								
Sector apportionment 2, 5-year average												
2011		27-Aug	23-Jul	30-Jul								
2012												
2013				10-Aug								
2014		16-Aug		2-Aug								
2015		29-Aug	5-Sep	15-Aug								
2016	23-Jul	16-Jul	30-Jul	6-Aug		20-Aug	3-Sep					
2017	8-Jul	15-Jul	22-Jul	15-Jul	15-Jul	22-Jul			22-Jul	29-Jul		
2018	30-Jun	30-Jun	7-Jul	7-Jul	14-Jul	1-Sep						
2019	14-Sep	10-Aug	3-Aug	13-Jul		31-Aug	7-Sep					
2020	26-Sep	22-Aug	19-Sep	22-Aug				3-Oct				
2021	17-Jul	31-Jul	24-Jul	17-Jul	17-Jul	4-Sep	31-Jul	31-Jul	17-Jul			7-Aug
2022		20-Aug	6-Aug	6-Aug			3-Sep					
2023			26-Aug	26-Aug								
Sector apportionment 3, pro rata												
2011		27-Aug	23-Jul	30-Jul								
2012												
2013				10-Aug								
2014		16-Aug		2-Aug								
2015		29-Aug	29-Aug	15-Aug								
2016	23-Jul	16-Jul	30-Jul	6-Aug		20-Aug	3-Sep					
2017	8-Jul	15-Jul	15-Jul	15-Jul	15-Jul	22-Jul			22-Jul	29-Jul		
2018	30-Jun	30-Jun	7-Jul	7-Jul	14-Jul	1-Sep						
2019	14-Sep	17-Aug	3-Aug	13-Jul		31-Aug	7-Sep					
2020	26-Sep	22-Aug	19-Sep	22-Aug				3-Oct				
2021	17-Jul	31-Jul	17-Jul	17-Jul	17-Jul	4-Sep	31-Jul	31-Jul	17-Jul		28-Aug	7-Aug
2022		20-Aug	6-Aug	6-Aug			3-Sep					
2023			26-Aug	26-Aug								
Sector apportionment 4, AFA												
2011		22-Oct	23-Jul	9-Jul								
2012												
2013				3-Aug								
2014		30-Aug		2-Aug								
2015		19-Sep	29-Aug	15-Aug				5-Sep				
2016	30-Jul	30-Jul	30-Jul	30-Jul		3-Sep	3-Sep					
2017	8-Jul	22-Jul	15-Jul	15-Jul	15-Jul	29-Jul		9-Sep	22-Jul	9-Sep		
2018	30-Jun	7-Jul	7-Jul	30-Jun				29-Sep				
2019	21-Sep	24-Aug	3-Aug	29-Jun			7-Sep	14-Sep				
2020		5-Sep	19-Sep	22-Aug				12-Sep				
2021	17-Jul	31-Jul	17-Jul	10-Jul	17-Jul		31-Jul	31-Jul	11-Sep		14-Aug	7-Aug
2022		20-Aug	6-Aug	30-Jul			3-Sep					
2023			26-Aug	19-Aug								

Table 3-3 Estimates on the amount of potentially forgone B season pollock harvest (mt) under all analyzed PSC limits and apportionments for Alternative 2, 2011–2023

	100,000				325,000				550,000			
Year	**CDQ**	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**
Sector apportionment 1, 3-year average												
2011		89,307	39,459	118,722								
2012												
2013				83,516								
2014		84,042		135,459								
2015		64,924	15,877	121,829								
2016	22,468	221,815	42,404	130,249		118,751	12,787			39,607		
2017	48,998	183,204	40,749	204,500	41,515	162,802			41,515	133,877		
2018	63,534	236,646	52,088	249,756	57,635	171,330						
2019	26,313	117,701	39,597	248,376		67,037	15,157					
2020	15,662	80,883	20,163	142,044		19,504		27,450				
2021	48,589	125,523	43,980	217,587	48,589	82,016	32,775	172,796	48,589		10,914	
2022		18,381	15,107	55,312			138					
2023		2,272	29,787	47,240								
Sector apportionment 2, 5-year average												
2011		89,307	39,459	135,011								
2012												
2013				101,755								
2014		84,042		135,459								
2015		43,904	12,547	121,829								
2016	22,468	199,965	42,404	130,249		91,600	12,787					
2017	48,998	183,204	34,882	204,500	41,515	162,802			28,221	133,877		
2018	63,534	236,646	52,088	249,756	53,133	28,419						
2019	26,313	117,701	39,597	248,376		67,037	15,157					
2020	12,181	80,883	20,163	142,044				42,481				
2021	48,589	125,523	38,483	217,587	48,589	33,327	32,775	172,796	48,589			148,936
2022		18,381	15,107	55,312			138					
2023			29,787	66,304								
Sector apportionment 3, pro rata												
2011		89,307	39,459	135,011								
2012												
2013				101,755								
2014		84,042		135,459								
2015		43,904	15,877	121,829								
2016	22,468	199,965	42,404	130,249		91,600	12,787					
2017	49,998	183,204	40,749	204,500		162,802			28,221	133,877		
2018	63,534	236,646	52,088	249,756	41,515	28,419						
2019	26,313	100,774	39,597	248,376	53,133	67,037	15,157					
2020	12,181	80,883	20,163	142,044				42,481				
2021	48,589	125,523	43,980	217,587		33,327	32,775	172,796	48,589		10,914	148,936
2022		18,381	15,107	55,312	48,589		138					
2023			29,787	66,304								
Sector apportionment 4, AFA												
2011		7,379	39,459	196,087								
2012												
2013				125,947								
2014		38,220		135,459								
2015		5,176	15,877	121,829				59,215				
2016	17,433	165,915	42,404	157,984		39,607	12,787					
2017	48,998	162,802	40,749	204,500	41,515	133,877		26,033	28,221	2,225		
2018	63,534	218,962	52,088	272,819								
2019	13,261	82,845	39,597	291,563			15,157	36,895				
2020		53,883	20,163	142,044				93,157				
2021	48,589	125,523	43,980	242,240	48,589		32,775	172,796	2,286		22,968	148,936
2022		18,381	15,107	78,690			138					
2023			29,787	85,628								

Table 3-4 Estimates on the amount of potentially forgone pollock harvest (mt) represented as a percent of total B season under all analyzed PSC limit and apportionments for Alternative 2, 2011–2023

Year	100,000				325,000				550,000			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
Sector apportionment 1, 3-year average												
2011		35.7%	60.0%	39.6%								
2012												
2013				25.3%								
2014		31.4%		40.4%								
2015		23.4%	23.0%	35.1%								
2016	27.6%	78.1%	60.1%	36.8%		41.8%	18.1%			13.9%		
2017	65.0%	68.6%	61.3%	59.0%	55.0%	61.0%			55.0%	50.2%		
2018	83.3%	89.7%	77.9%	72.6%	75.5%	64.9%						
2019	33.6%	42.8%	58.2%	71.3%		24.4%	22.3%					
2020	24.8%	33.0%	30.1%	43.4%		7.9%		8.4%				
2021	63.3%	47.4%	66.0%	64.1%	63.3%	31.0%	49.2%	50.9%	63.3%		16.4%	
2022		8.8%	28.2%	21.1%			0.3%					
2023		0.9%	47.7%	14.5%								
Sector apportionment 2, 5-year average												
2011		35.7%	60.0%	45.1%								
2012												
2013				30.8%								
2014		31.4%		40.4%								
2015		15.8%	18.1%	35.1%								
2016	27.6%	70.4%	60.1%	36.8%		32.2%	18.1%					
2017	65.0%	68.6%	52.5%	59.0%	55.0%	61.0%			37.4%	50.2%		
2018	83.3%	89.7%	77.9%	72.6%	69.6%	10.8%						
2019	33.6%	42.8%	58.2%	71.3%		24.4%	22.3%					
2020	19.3%	33.0%	30.1%	43.4%				13.0%				
2021	63.3%	47.4%	57.8%	64.1%	63.3%	12.6%	49.2%	50.9%	63.3%			43.9%
2022		8.8%	28.2%	21.1%			0.3%					
2023			47.7%	20.4%								
Sector apportionment 3, pro rata												
2011		35.7%	60.0%	45.1%								
2012												
2013				30.8%								
2014		31.4%		40.4%								
2015		15.8%	23.0%	35.1%								
2016	27.6%	70.4%	60.1%	36.8%		32.2%	18.1%					
2017	65.0%	68.6%	61.3%	59.0%	55.0%	61.0%			37.4%	50.2%		
2018	83.3%	89.7%	77.9%	72.6%	69.6%							
2019	33.6%	36.6%	58.2%	71.3%		24.4%	22.3%					
2020	19.3%	33.0%	30.1%	43.4%				13.0%				
2021	63.3%	47.4%	66.0%	64.1%	63.3%	12.6%	49.2%	50.9%	63.3%		16.4%	43.9%
2022		8.8%	28.2%	21.1%			0.3%					
2023			47.7%	20.4%								
Sector apportionment 4, AFA												
2011		3.0%	60.0%	65.5%								
2012												
2013				38.1%								
2014		14.3%		40.4%								
2015		1.9%	23.0%	35.1%				17.1%				
2016	21.4%	58.4%	60.1%	44.6%		13.9%	18.1%					
2017	65.0%	61.0%	61.3%	59.0%	55.0%	50.2%		7.5%	37.4%	0.8%		
2018	83.3%	83.0%	77.9%	79.3%								
2019	16.9%	30.1%	58.2%	83.7%			22.3%	10.6%				
2020		22.0%	30.1%	43.4%				28.5%				
2021	63.3%	47.4%	66.0%	71.3%	63.3%		49.2%	50.9%	3.0%		34.5%	43.9%
2022		8.8%	28.2%	30.0%			0.3%					
2023			47.7%	26.3%								

Table 3-5 Date of B season closures under a PSC limit of 75,000-chum salmon under Alternative 3, Option 1

Sector	CDQ			
Apportionment	**3-year avg.**	**5-year avg.**	**Pro rata**	**AFA**
2021	10-Jul	10-Jul	10-Jul	17-Jul
2022	20-Aug	20-Aug	20-Aug	
2023				
Sector	**CP**			
Apportionment	**3-year avg.**	**5-year avg.**	**Pro rata**	**AFA**
2021	31-Jul	31-Jul	31-Jul	31-Jul
2022	13-Aug	20-Aug	20-Aug	20-Aug
2023	26-Aug	2-Sep	2-Sep	
Sector	**Mothership**			
Apportionment	**3-year avg.**	**5-year avg.**	**Pro rata**	**AFA**
2021	17-Jul	17-Jul	17-Jul	17-Jul
2022	6-Aug	6-Aug	6-Aug	6-Aug
2023	19-Aug	19-Aug	19-Aug	19-Aug
Sector	**Inshore**			
Apportionment	**3-year avg.**	**5-year avg.**	**Pro rata**	**AFA**
2021	10-Jul	10-Jul	10-Jul	10-Jul
2022	30-Jul	30-Jul	30-Jul	23-Jul
2023	19-Aug	19-Aug	19-Aug	19-Aug

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

Table 3-6 Estimates on the amount of potentially forgone B season pollock harvest (mt) and the amount of forgone harvest represented as a percent of B season total for Alternative 3, Option 1 under a 75,000-chum salmon PSC limit, 2021 –2023

Year	CDQ		CP		M		CV	
	Pollock harvest (mt)	A % of B season total	Pollock harvest (mt)	As % of B season total	Pollock harvest (mt)	As % of B season total	Pollock harvest (mt)	As % of B season total
Sector apportionment 1, 3-year average								
2021	59,756	77.9%	125,523	47.4	43,980	66.00%	242,240	71.3%
2022	579	0.9%	34,084	16.3%	15,107	28.2%	78,690	30.0%
2023			26,751	10.7%	33,315	53.4%	85,628	26.3%
Sector apportionment 2, 5-year average								
2021	59,756	77.9%	125,523	47.4%	43,980	66.0%	242,240	71.3%
2022	579	0.9%	18,381	8.8%	15,107	28.2%	78,690	30.0%
2023			13,570	5.4%	33,315	53.4%	85,628	26.3%
Sector apportionment 3, pro rata								
2021	59,756	77.9%	125,523	47.4%	43,980	66.0%	242,240	71.3%
2022	579	0.9%	18,381	8.8%	15,107	28.2%	78,690	8.8%
2023			13,570	5.4%	33,315	53.4%	85,628	5.4%
Sector apportionment 4, AFA								
2021	48,589	63.3%	125,523	47.4%	43,980	66.0%	242,240	71.3%
2022			18,381	8.8%	15,107	28.2%	104,821	39.9%
2023					33,315	53.4 %	85,628	26.3%

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

Alternatives 2 or 3 would make it more challenging for fishermen to catch the full B season TAC without changing their fishing behavior to avoid chum salmon PSC during the B season. If the pollock TAC was not fully harvested under Alternatives 2 or 3, fishing would have less of an impact on the stock compared to status quo. As such, these chum salmon PSC management measures are not expected to result in adverse impacts to the pollock stock in terms of total removals by the fishery.

However, reducing catches below the pollock TAC could result in higher adult pollock biomass in the areas fished during the B season. The direct impacts of lower catches would vary depending on the trophic relationship to pollock (i.e., prey or predator). Future impacts of reduced fishing could affect stock dynamics and density dependence processes, if there were large and consistent reductions in pollock harvest. For example, higher stock sizes could affect the average size of pollock due to prey limitation (and hence density-dependent reductions in somatic growth). Smaller-sized adult pollock may have lower reproductive potential yet cause higher density-dependent mortality and increased cannibalism. Higher levels of adult pollock biomass have historically resulted in lower levels of recruitment. Any changes to prosecution rates in the Bering Sea pollock fishery would be accounted for in the stock assessment as well as any impacts on size-composition of the pollock stock that was detectable in the EBS trawl survey.

3.1.1.4 Alternative 4

Alternative 4 would not result in adverse impacts to the pollock stock. The pollock fleet has operated under the salmon bycatch IPAs since 2010, and the provisions under Alternative 4 largely reflect the fleet's operations in recent years.

3.1.1.5 Alternative 5

A triggered corridor closure under Alternative 5 would require a sector to stop fishing inside the area from the date the limit was reached until September 1, but fishing could continue outside the corridor. In general, it is assumed that a sector displaced from a corridor would continue to fish outside the area if they are able to do so to fully utilize its pollock allocation. As such, Alternative 5 does not have the same implications for the stock as Alternatives 2 or 3. Fleet movement under Alternative 5 is addressed in depth in (Section 3.2.4.4). As noted there, the analysis expects displaced pollock catch would occur within the historical footprint of the fishery. Thus Alternative 5 is not expected to have adverse effects on the pollock stock given the ability of the stock to sustain itself regardless of any minor modifications in the distribution of the fishery.

Alternatives 2, 3, and 5 could result in pollock catch being diverted to later in the B season compared to status quo. A temporal shift in pollock catch is expected if the fleet must operate at a slower pace to carefully account for the chum salmon PSC in each haul or shoreside delivery, or if equally good catch rates cannot be realized after vessels have moved from an area. These changes could affect the temporal and spatial distribution of the fishery, but not to a greater degree than what has been observed under status quo.

3.1.1.6 Cumulative Effects on Pollock

Past and present human action impacting EBS pollock have been highlighted in documents incorporated by reference including Chapter 4 and 5 of the Harvest Specifications EIS, the 2024 EBS pollock SAFE, and AFA Program Review (Ianelli 2024; NMFS 2007; NPFMC 2017), some of which are summarized in Section 3.1.1. In particular, past and present human actions include the annual harvest specifications process, the allowance of the directed and incidental take of pollock, the implementation of AFA and associated rules and restrictions, and the assignment of seasonal apportionments.

RFAs that may have a cumulative impact with the proposed actions include authorization and prosecution of the Bering Sea pollock fishery and climate change, described at the beginning of Chapter 3.

Cumulative Effects of the Proposed Actions with RFAs: This section inherently considers the cumulative effects of the proposed alternatives with the assumption that the pollock fishery and associated management structure, as well as climate change impacts (the identified RFAs), would continue. The proposed action alternatives are not anticipated to substantially redistribute fishing effort in time or space outside of the range of what is possible under Alternative 1. It is possible that under a chum salmon PSC limit (Alternative 2 or 3) or potentially under a Cluster 1 corridor cap (Alternative 5) some amount of pollock TAC may be left unharvested relative to no action. However, annual harvest specifications limit each year's harvest within sustainable bounds and total removals are accounted for each year in the stock assessment. The overall optimum yield limits on harvests in the BSAI constrain harvest of all species. Each year, OFLs, ABCs, and TACs are specified for two years at a time, as described above. Thus, the potential for additional adverse effects on the eastern Bering pollock stock is expected to be minimal.

3.2 Chum Salmon

3.2.1 Biology and Distribution

Chum salmon are the most widely distributed of the Pacific salmon. In North America, chum salmon are distributed from Yaquina Bay, Oregon in the south to the Mackenzie River, Canada in the north. In Asia their distribution extends from Kyushu Island, Japan north to the Chukchi Peninsula and as far west as the Lena River, Russia (Salo 1991).

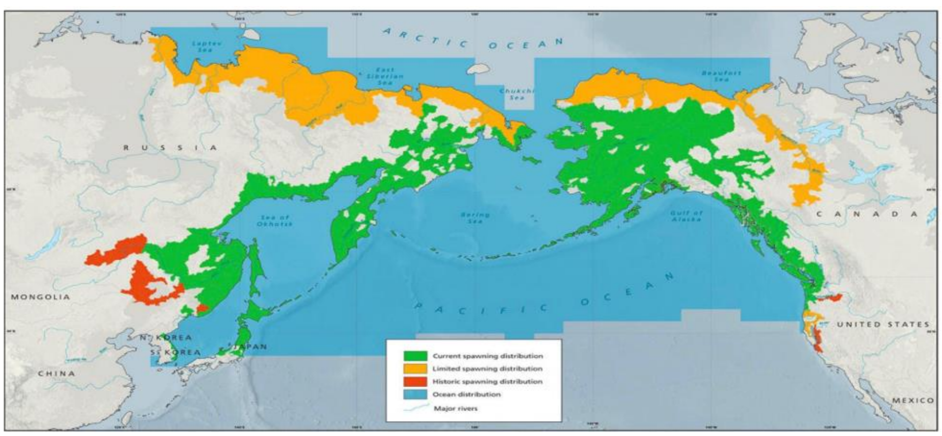

Figure 3-3 Chum salmon distribution. Modified from Atlas of Pacific Salmon (August 2005).

Across their geographic distribution, return timing of chum salmon populations to their natal streams is variable with two distinct seasonal lineages (Summer and Fall runs; Salo 1991). Within Alaska, summer run populations return to freshwater from May to September while Fall run populations return from July to November. Chum salmon use a diverse array of spawning habitat which range from the intertidal and mainstems in the lower portion of river systems (similar to pink salmon), to up to 2,800 km up large rivers such as the Yukon and Mackenzie. Fall run spawning habitat is often associated with upwelling where warmer spring water is favorable for development. In addition to spawn timing and water temperature, numerous environmental factors can influence incubation and emergence timing including stream flow, dissolved oxygen levels, gravel composition, and population specific genetic variation for development. Shortly after emergence, chum salmon fry begin their downstream migration.

Unlike coho, sockeye and Chinook salmon which can spend up to two years rearing in freshwater habitats, chum salmon typically complete their migration to nearshore estuarine habitat, where they spend their first couple months, within 30 days. Within Alaska, movement offshore occurs by fall when schools of juvenile chum salmon move into the Bering Sea and Gulf of Alaska where they spend two or more winters. There is substantial mixing of stocks in the marine environment as they move seasonally between the Bering Sea and Gulf of Alaska. Age at maturity is typically between two and six years of age but varies by latitude where southern origin chum salmon typically mature at an earlier age.[57]

3.2.2 Abundance and Status Changes Across the North Pacific

Chum salmon are the second most numerically abundant salmon species in the North Pacific, after pink salmon. Abundance information for chum salmon from available catch, escapement, and return data, is provided by countries around the North Pacific including Japan, the Republic of Korea, Russia, Canada, and the United States. From severely declining to moderately increasing, trends in population abundance are diverse throughout their geographic range. Trends in chum salmon abundances from 2010–2020 were mixed in Russia and Japan, ranging from stable to decreasing. In Alaska and Canada, abundance was relatively stable from 2010–2020 but mixed in Washington (U.S.) where chum salmon abundance decreased in Puget Sound, was stable in Hood Canal, and increased in coastal areas (NPAFMC 2023). Over the past three to five years, however, chum salmon populations have shown decline in all regions of the North Pacific with few exceptions (see also Appendix 3).

3.2.2.1 Hatchery Releases of Pacific Salmon from Countries Around the North Pacific

Total hatchery releases of Pacific salmon have been relatively consistent across the past decade (2014–2023). Although Russia has increased its total hatchery production in recent years, Japan has decreased its production (Figure 3-4). In 2023, Russia's hatchery production of Pacific salmon was ~1.6 billion fish which is approximately a 35% increase from the most recent five-year (2018–2022) average of ~1.2 billion fish (Figure 3-4). Notably, across all countries, hatchery releases of chum salmon have ranged between 1.1 and 1.3 billion fish from 2020–2023 which represents a ~51%–78% increase from the most recent 10-year average of 0.73 billion chum salmon (2011–2020). The majority of chum salmon hatchery production is attributed to Japan (10-year average of 1.54 billion), followed by Russia (0.88 billion) and the United States (0.76 billion).

[57] Some prior research provides qualitative information on the distribution of WAK chum salmon. A new project is underway to develop comprehensive models for the distribution of WAK chum salmon in the marine ecosystems that integrates environmental variables (PI: Dr. Curry Cunningham).

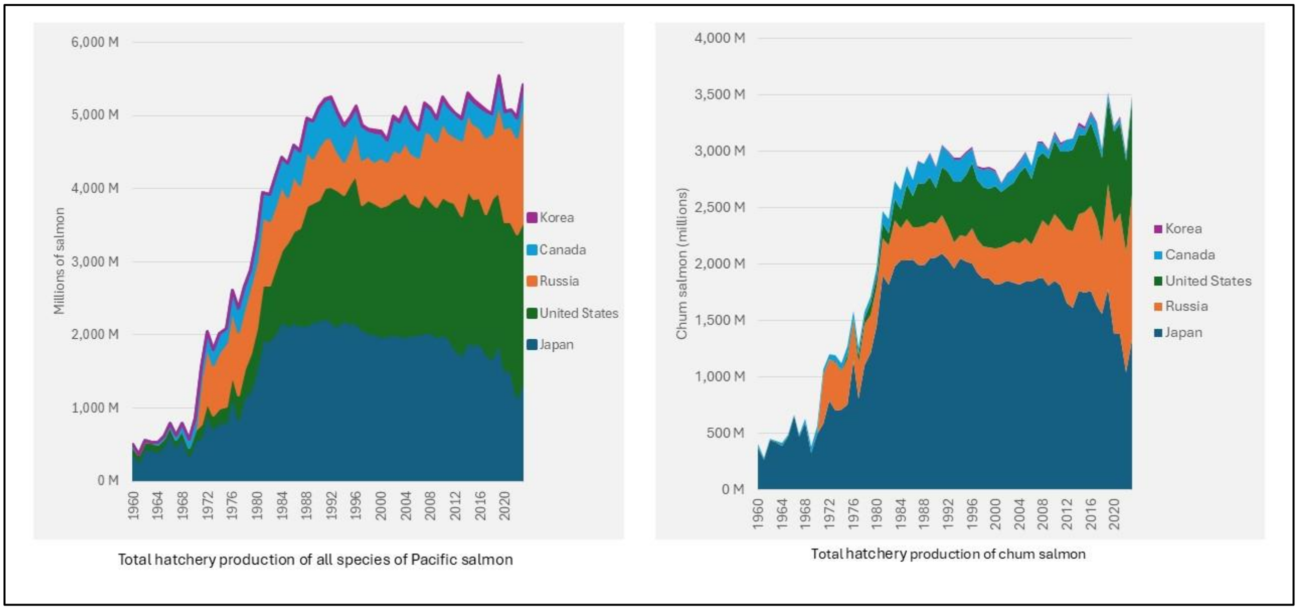

Figure 3-4 Total hatchery salmon production (left) and total hatchery production of chum salmon (right) from countries around the North Pacific rim 1960 – 2023

Source: NPAFC Hatchery Statistics. 2024. Accessed November 2024. Available: https://www.npafc.org.

The magnitude of hatchery releases of chum salmon is relevant to this analysis because the proposed action aims to reduce chum salmon PSC in the pollock fishery to the extent practicable, particularly the bycatch of WAK origin chum salmon. However, the majority of chum caught as bycatch in the pollock fishery are commonly estimated to be of Asian origin (Southeast and Northeast Asia reporting groups). The Southeast Asia reporting group is largely composed of hatchery released fish whereas both wild and hatchery fish, in unknown proportions, comprise the Northeast Asia reporting group. From 2011–2023, approximately 30%–55% of the chum salmon bycatch caught by the pollock fishery was attributed to the Northeast Asia reporting group, except for 2011 and 2015 when lower proportions were observed. The Southeast Asia reporting group has accounted for approximately 9%–20% of the total bycatch. The highest numbers of Asia origin chum salmon occurred in 2017 and 2021 coinciding with the highest years of total chum salmon PSC. Stock composition estimates for the chum salmon caught as bycatch in the pollock fishery are provided with greater detail in Section 3.2.4.1.3 below.

3.2.3 Alaska Salmon Fisheries Management and Western Alaska Stock Status

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

The first priority for management is for conservation or to meet spawning escapement goals in order to sustain salmon resources for future generations. The Alaska State Constitution, Article VII, Section 4, states that “Fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial users.” In 2000, the BOF adopted the Sustainable Salmon Fisheries Policy (SSFP; 5 AAC 39.222), which defines sustained yield to mean an average annual yield that results from a level of salmon escapement that can be maintained on a continuing basis; a wide range of average annual yield levels is sustainable, and a wide range of annual escapement levels can produce sustained yields (5 AAC 39.222(f)(38)).

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

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

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

The key definitions contained in the SSFP with regard to scientifically defensible escapement goals and resulting management actions are biological escapement goal (BEG), an optimal escapement goal (OEG), sustainable escapement goal (SEG), and sustained escapement threshold (SET). The definitions of BEG, OEG, and SEGs and their use in chum salmon fisheries management are summarized in Appendix 2.

3.2.3.1 Western Alaska Chum Salmon Stock Status

This section provides information on the status of Western Alaska chum salmon stocks. 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. Further information on subsistence and commercial chum salmon harvests is provided in Sections 4.3.3 and 4.3.3.2.[58]

Chum salmon have historically been abundant throughout Western and Interior Alaska rivers. In the Kuskokwim Region, LK and TK holders have noted the historically abundant chum salmon throughout the region by their distinct "stink" as their carcasses historically exuded when decomposing by the tens of thousands in tributaries. However, beginning in **2020**, WAK chum salmon runs declined dramatically and nearly all river systems had chum salmon run sizes below recent year averages with run sizes similar to those observed in the previous record poor run of 2000. In **2021**, indices of chum salmon abundance in Norton Sound, the Yukon River, and the Kuskokwim River were all at the lowest abundance in the time series. Of the 13 chum salmon escapement goals assessed in the Western Alaska region, only two were met in 2021 (both in Norton Sound). In **2022**, most Western Alaska chum salmon abundance indices increased slightly from 2021 however abundance indices for some stocks were the second lowest in the time series (*e.g.*, Yukon River). In **2023**, Western Alaska chum salmon abundance indices again increased slightly from the previous year in most areas but remain at very low levels. Escapement goals were met for five of the ten chum salmon stocks assessed across the region, but all stocks had below average abundance.

[58] Additional data is not included on personal use or sport fishing for Western Alaska chum salmon because extremely limited effort occurs through these methods of harvesting; however, Table 3-7 highlights years where opportunities were provided.

Yukon Area: Total summer and fall chum salmon abundance estimates are available based on full run reconstructions for each stock. In 2021, both Yukon River summer and fall chum salmon runs were the lowest in the time series 1978–2023, with a combined summer and fall chum salmon run size of 251,000 fish. Although run sizes increased in 2023 for both summer and fall chum salmon, they were well below average and still some of the lowest in the time series.

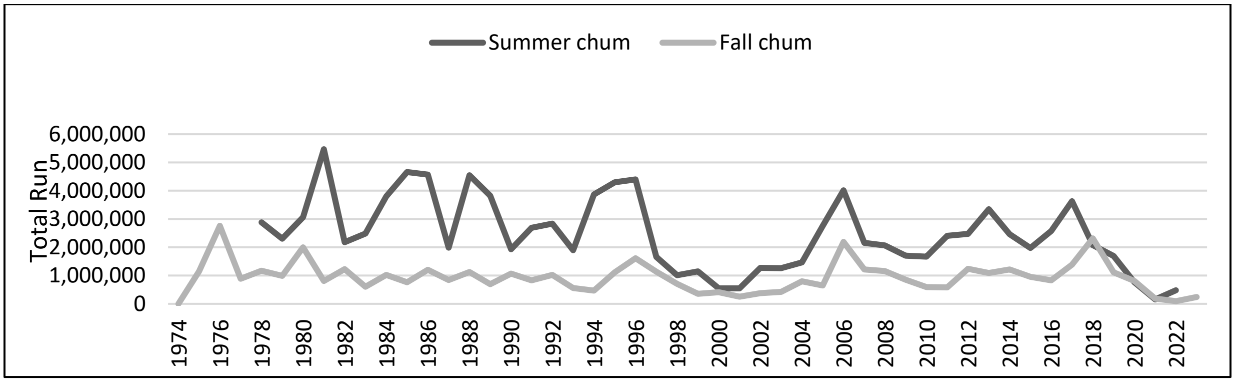

Figure 3-5 Yukon River chum salmon run size, 1978–2023 Source: ADF&G.

Kuskokwim Area: While total chum salmon run abundance estimates are not available in the Kuskokwim area, there are relative indices of abundance, including the Bethel Test Fishery in the lower river and the Kogrukluk River weir in the upper river. Available data from mainstem enumeration and tributary spawner escapement monitoring projects all show a decline beginning in 2020. 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. In 2023, the Bethel test fishery CPUE increased significantly but environmental conditions prevented the Kogrukluk River weir from providing reliable estimates of chum salmon escapement. The Kuskokwim area has additional abundance information that can help provide context on the status of chum salmon stocks in the area. These include the Kwethluk River weir, George River weir, Salmon River weir, Takotna River weir, and the Kuskokwim River sonar, which provide indices of abundance with varying levels of reliability and representativeness of the total chum salmon abundance.

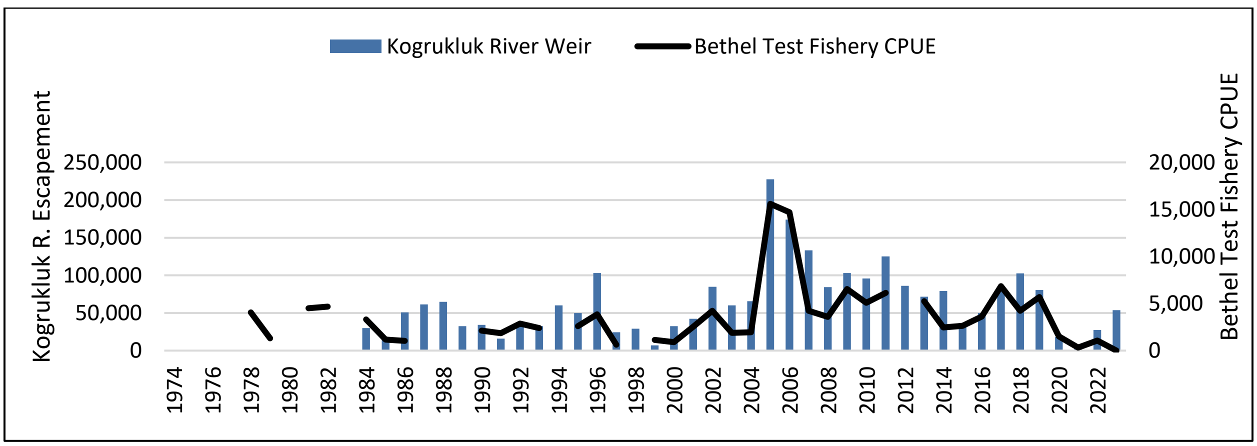

Figure 3-6 Kuskokwim River chum salmon including the Kogrukluk River Weir escapement and cumulative CPUE from the in-river Bethel test fishery, 1984–2023

Source: ADF&G.

Norton Sound Area: In the Norton Sound area, chum salmon escapement goals were met in two of the four rivers in both 2020 and 2021. All four escapement goals were met in 2022 and at least two of the four were met in 2023. 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. 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. However, a run reconstruction from this single system may not be a consistently reliable indicator for the whole Norton Sound region. Figure 3-7 shows chum salmon abundance trends for the Norton Sound region (1997–2023) based on a standardized minimum index of the Snake, Nome, Eldorado, and North Rivers as well as total harvests. approach that is more representative of the chum salmon returns across several management subdistricts within the Norton Sound region.

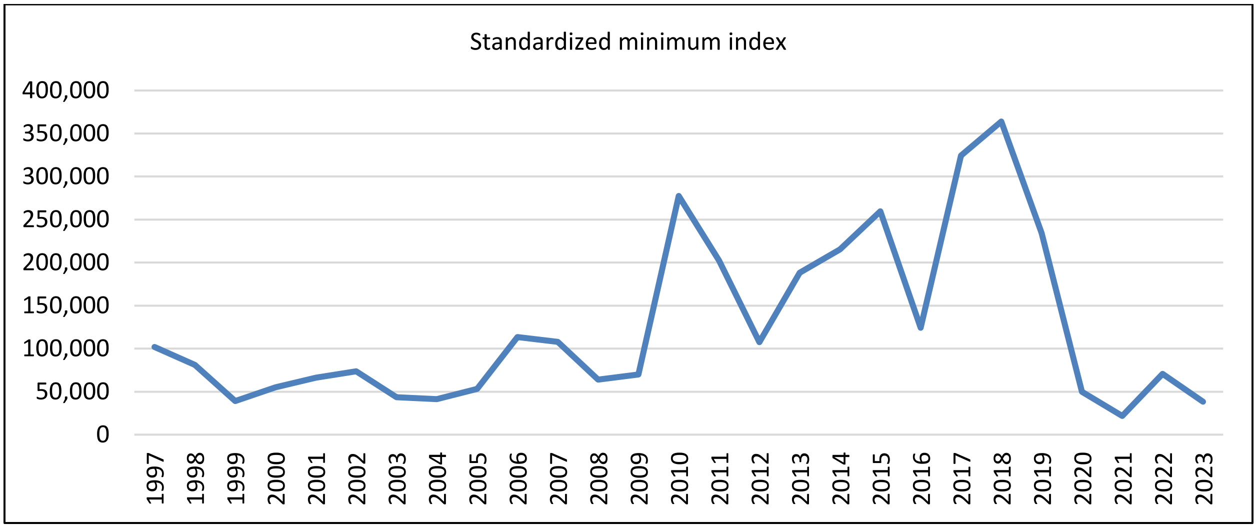

Figure 3-7 Standardized minimum index composed of the sum of the Snake, Nome, Eldorado, North Rivers Weir/Tower/Escapement and total Norton Sound harvests, 1997–2023

Source: ADF&G.

Chum salmon support regionally important subsistence, commercial, personal use, and sport fisheries. However, the chum salmon run declines in recent years have resulted in some management areas not meeting some or all escapement goals as well as restrictive management actions on commercial, sport, and subsistence harvests of chum salmon (see Table 3-7).

Table 3-7 Summary of Western Alaska chum salmon stock status, 2020 to 2023

Stock	Abundance	Escapement met 2020 to 2023?[a]	Restrictions Imposed on harvests 2020 to 2023?		
			Subsistence	Commercial	Sport
Nushagak	Below average (all years)	0 of 1 (all years)	No (all years)	No (all years)	No (all years)
Kuskokwim Bay	Below average (all years)	NS (all years)[b]	No (all years)	Yes (all years)	No (except 2023)
Kuskokwim River	Below average (all years)	1 of 1 (2020) 0 of 1 (2021, 2022) NS (2023)	Yes, limited (except 2020)	Limited (2020, 2021) No (2022, 2023)	Yes (except 2020)
Yukon River Summer Run	Below average (all years)	1 of 1 (2020) 0 of 3 (2021) 0 of 2 (2022) 1 of 1 (2023)	Limited (2020, 2023); yes (2021, 2022)	Limited (2020); yes (2021, 2022, 2023)	Limited 2020, 2023; no fishery 2021, 2022
Yukon River Fall Run	Below average (all years)	1 of 4 (2020)[c] 0 of 5 (2021, 2022) 3 of 5 (2023)	Limited (2020); yes (2021, 2022, 2023)	Yes (all years)	Yes (all years)
Norton Sound	Below average (all years)	2 of 4 (2020, 2021) 4 of 4 (2022) 2 of 3 (2023)	No (all years)	Limited (all years)	No in 2020, 2021, 2022 Limited in 2023
Kotzebue	Below average (except 2022)	NS (all years)[b]	No (all years)	Limited (all years)	No (all years)

[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] NS = No survey, escapement goal was not assessed.
[c] Includes 2 U.S./Canada escapement goals for the Yukon fall run in all years.

3.2.3.1.1 Environmental Factors Related to Western Alaska Chum Salmon Declines

This section provides information on the different factors linked to Western and Interior Alaska chum salmon declines organized by the environmental stressors chum salmon encounter at different life stages as depicted in Figure 3-8.

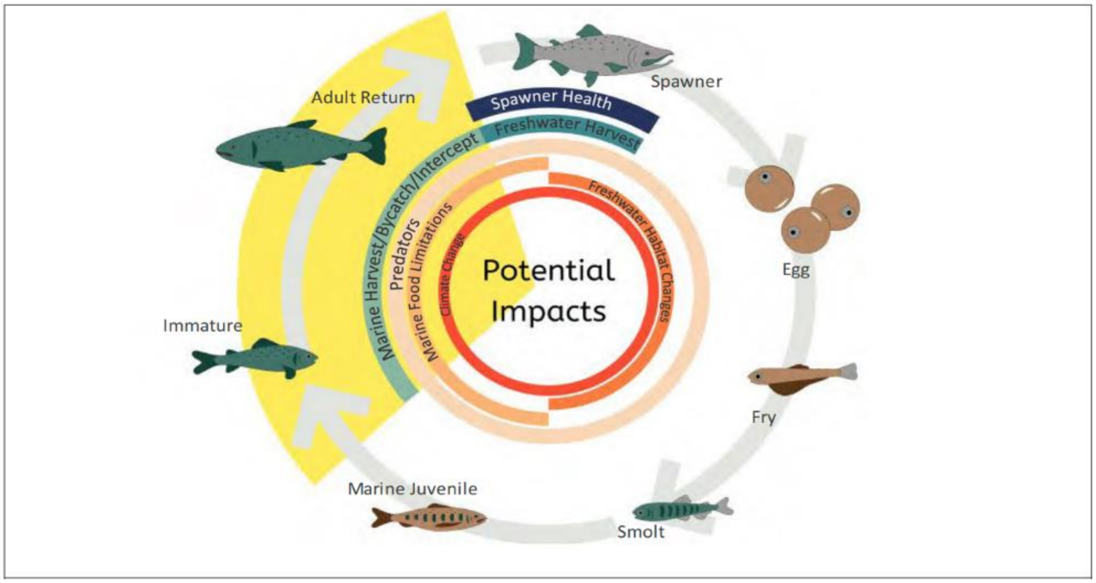

Figure 3-8 Life history cycle of chum salmon (modified from the draft Alaska Salmon Research Taskforce October 2023 report) with yellow shading indicating the ages encountered as bycatch in the pollock fishery

Western and Interior Alaska chum salmon eggs, fry, and smolt are susceptible to freshwater climate and environmental changes. Changes in oxygen levels, turbidity and flow, the timing of ice break-up, and bank erosion can affect survival of eggs and chum salmon fry during outmigration and may result in a mismatch in prey availability during early marine life (Bash et al., 2001; Beechie et al., 2022; Carey et al., 2021).

Chum salmon originating from Western and Interior Alaska river systems use the Bering Sea as habitat in their first summer before migrating to the Gulf of Alaska their first winter. The early marine phase is a critical time for juvenile salmon because they need to grow quickly to escape predation and build energy reserves to survive their first winter at sea (Farley 2009). Early marine survival is generally positively associated with adult returns (Kondzela et al., 2016). However, this positive association between early marine survival (as measured by juvenile abundance) and adult returns was not observed for fall chum salmon starting in 2016, which coincided with the start of marine heatwaves in both the Bering Sea and Gulf of Alaska ecosystems (Farley et al., 2024).

The recent marine heatwaves in the were found to increase chum salmon metabolic rates while simultaneously destabilizing the base of the marine food web. At the same time, juvenile chum salmon energy condition and stomach fullness decreased, likely due to decreased prey availability, increased metabolisms, and lower quality prey items (e.g., eating more jellyfish as lipid rich prey items were unavailable; see Farley et al., 2024).

In the marine environment, WAK chum salmon are also 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 (Ruggerone & Agler 2008). This competition for resources in conjunction with warming water temperatures may have increased reliance on low-quality prey items such as gelatinous zooplankton. Prolonged reliance on prey with low nutrient densities can affect growth, susceptibility to disease and pathogens, reproduction, and mortality.

Both Western scientific research (e.g., Oke et al. 2020) and LK/TK indicate that chum salmon spawners today are smaller than in decades prior. Smaller salmon, impacted by poor marine feeding conditions and climate change, exhibit reduced fecundity (egg production/reproductive capacity). Fewer eggs translates into fewer juvenile salmon entering the life cycle, reinforcing population declines (see Section 4.3.3.2.3,

Appendix 8-4). Sea surface temperature has been correlated with the average size of chum salmon at maturity, as well as with both early and late marine growth during first and last marine occupancy seasons (Oke et al., 2020). WAK chum salmon had high marine mortality in years with unusually cold sea surface temperature, however, growth rates also declined when sea surface temperature increased by 2ºC above the warmest sea surface temperature during studies offshore of the Yukon and Kuskokwim rivers during 2002–2007 (Farley 2009).

Additional factors affecting juvenile chum salmon that can be broadly attributed to climate change include changes in predator density, and increased pathogen load (Yasumiishi et al., 2020). For instance, the presence of parasites, such as *Ichthyophonus*, has been linked to mortality in Yukon River Chinook salmon, and likely has similar effects on chum salmon, especially when environmental conditions favor parasite outbreaks. Warmer waters and changing ecological interactions due to climate change are likely contributing to increased disease prevalence (Zuray et al., 2012).

Western and Interior Alaska chum salmon again face freshwater climate and environmental changes when they return to river systems as adult spawners. Water above or below the optimal range can alter metabolic needs and spawning success and changes in stream discharge or oxygen levels can negatively affect survival of migrating adults (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 salmon in the Koyukuk River in 2019, largely affecting pre-spawn migrating fish (Westley 2020). Low water levels, warm temperatures, significant algae blooms, and a large quantity of chum salmon migrating decreased dissolved oxygen in the water, resulting in a significant die-off in the Kobuk River drainage in 2014 (Braem et al., 2018).

Many other environmental changes have been observed across Western and Interior Alaska, but it is not clear how they may impact chum salmon abundance. For example, communities across the region have experienced warmer winter temperatures, increased precipitation, decreased ice thickness, delayed freeze-up, less predictable break-up timing, thawing permafrost, algae blooms, an increase in beaver dam prevalence, increased Northern pike populations and increased bear populations (Ahmasuk & Trigg, 2007; Braem et al., 2018; Godduhn et al., 2020; Mikow et al., 2019).

3.2.3.1.1.1 Traditional Knowledge of Chum Salmon Declines

The following section provides information on factors leading to chum salmon declines, based on TK held by residents of the Yukon and Kuskokwim regions. It was prepared by TCC and KRITFC. Additional, related information can be found in Appendices 7 and 8. It specifically covers the Yukon and Kuskokwim regions in which TCC and KRITFC respectively have special expertise, though information may also be relevant to other regions of Western and Interior Alaska dependent upon chum salmon and impacted by this action.

Yukon and Kuskokwim region TK holders share that traditional foods are sentient and respond to the behaviors and needs of people. When an animal or plant appears to a person, it is willingly offering itself to be taken and used for food, medicine, clothing, or other materials. To not take the being when it appears offends it, and it might not return to that person or place again because it feels it is no longer needed. In the words of one Yup’ik Elder:

> *“You know in the old days, the uses [of chum salmon] were multifold. We ate them and our dogs ate them. In the old days, they were used a lot. And I still think of what the old people say: you use them, they will come back in numbers. It’s just like I see the muskrats now. We quit hunting them and they’re disappearing.” – Robert Lekander, July 2023, KRITFC archives*

Contemporary salmon fishery management aims to conserve salmon spawners by allowing spawning salmon to pass through. However, a management approach that dictates when, where, and how people can fish contradicts Indigenous stewardship principles (Voinot-Baron 2019). With guidance from Elders, people take only what was needed at the time it was meant to be taken and without wasting it. To not be able to take salmon when salmon are in the river—when it is time to take salmon—poses a threat to food and cultural security and offends the salmon such that they may not return.

TK says salmon, once harvested, must be attentively monitored while drying and smoking to ensure it dries properly without flies/maggots or rot. Workspaces for processing fish must be cleaned so as to respect fish to come, and bones and scraps are to be properly disposed of; in Yup'ik communities of the lower Kuskokwim, traditional disposal is burial in the ground (Fienup-Riordan et al. 2020). The failure to adhere to these practices of care, and instead to disrespect and waste salmon, contributes to salmon declines. As noted in Fienup-Riordan et al. 2020:

> *Such careless treatment [of bones, scraps, and food], many believe, will cause the animals and plants to dwindle. Annie [Nelson] (March 2017:66) concluded: 'Because food is stepped on, some fish are declining in numbers…'" (Fienup-Riordan et al. 2020:78).*

TK holders additionally hold that salmon bycatch, as a form of wasteful and careless treatment of salmon—as a spiritual and physical offense to these fish—contributes to chum salmon declines. Similarly, TK holders from the Kuskokwim have expressed that catch-and-release sport fishing also disrespects salmon by playing with food, thus contributing to salmon declines.

Declines in salmon and at times the criminalization of traditional hunting and fishing practices have disrupted the spiritual relationship of salmon and people (Stevens & Black 2019), as well as the Elder-youth interactions that often occurred at fish camp (see Section 4.4.3.2). The dissolution of these relationships has also contributed to salmon declines: "The root cause of the decline of fish is that young people are no longer instructed… Along with lack of instruction, the decline of fish is believed to be a product of discord and lack of consensus among people" (Fienup-Riordan 2020:109).

The Council must balance the National Standards when making management recommendations to NMFS. Underpinning the Council's decision-making process are values that are reflected in management objectives. For instance, National Standard 1 requires "conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the U.S. fishing industry." A concept like "optimum yield" is commonplace in federal fisheries management but may not align with TK and Indigenous value systems, as described in Appendices 7 and 8. Rather, traditional fishery stewardship has been guided by Elders' TK is centered around the values of sharing, avoiding waste, taking only what is needed in the season it appears, and carefully attending to fish from gravel to table. TK from these regions holds that, in addition to the environmental factors described above, the anthropogenic factors discussed here accumulate over time and have contributed to the recent declines (see Appendices 7 and 8; KRITFC 2021).

3.2.4 Effects of the Alternatives on Chum Salmon

3.2.4.1 Alternative 1

Alternative 1 would retain the current regulations for chum salmon bycatch management which includes the Chum Salmon Savings Area as a backstop measure and the RHS program for chum salmon avoidance (see Section 2.2). The proposed action is focused on the Bering Sea pollock fishery because it has encountered the majority of chum salmon PSC compared to all other BSAI groundfish fisheries. Additionally, approximately 99% of the pollock fishery's chum salmon bycatch was encountered during the B season (see Table 3-8).

Table 3-8 Chum salmon PSC (numbers of fish) in all BSAI groundfish fisheries compared to the Bering Sea pollock fishery and pollock fishery chum salmon PSC as percent of total, 2011–2023

Year	Chum salmon PSC in all BSAI groundfish fisheries	Annual chum salmon PSC in the pollock fishery	Chum salmon PSC in the pollock fishery as percent of total chum salmon PSC in all BSAI groundfish fisheries	B season chum salmon PSC in the pollock fishery	B season chum salmon PSC in the pollock fishery as percent of annual total
2011	194,783	191,435	98.3%	191,313	99.9%
2012	23,138	22,183	95.9%	22,172	99.9%
2013	126,463	125,316	99.1%	125,114	99.8%
2014	223,867	219,442	98.0%	218,886	99.7%
2015	241,491	237,752	98.5%	233,085	98.0%
2016	346,000	343,001	99.1%	339,236	98.9%
2017	469,769	467,678	99.6%	465,848	99.6%
2018	307,367	295,062	96.0%	294,675	99.9%
2019	354,681	347,882	98.1%	346,671	99.7%
2020	344,849	343,625	99.6%	343,094	99.8%
2021	548,752	546,042	99.5%	545,901	99.9%
2022	243,695	242,375	99.5%	242,309	99.9%
2023	113,478	112,294	99.0%	111,843	99.6%
Average	**272,179**	**268,776**	**98.5%**	**267,704**	**99.6%**

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

3.2.4.1.1 RHS Program for Chum Salmon Avoidance

The RHS program identifies hot spots on the pollock fishing grounds where salmon bycatch rates are observed to be higher and closes these areas to pollock fishing for a period of time. The thresholds for hot spot closures are set in the IPAs. The program is designed to create incentives for pollock fishermen to keep their bycatch rates low to not risk losing access to good fishing grounds in a given week. A CP representative reported in the 2020 Vessel Master Survey that "…during the B season, there were areas that had a lot of chum salmon we tried to avoid or had to move out."[59] The exact timing and location of RHS closure areas vary year-to-year because they are based on inseason bycatch rates, but it is common for closures to be implemented near the Alaska Peninsula and northwest of Unimak Pass (Figure 3-9).

[59] The Amendment 91 Chinook Economic Data Report (EDR) has three reporting requirements, which include a mandatory census survey of the vessel masters. The Vessel Master Survey contains information reported by the vessel master on how the IPA incentives affected vessel behavior, Chinook salmon bycatch conditions compared to the last two years, if/how fishing trips were affected by Chinook salmon PSC, among other factors.

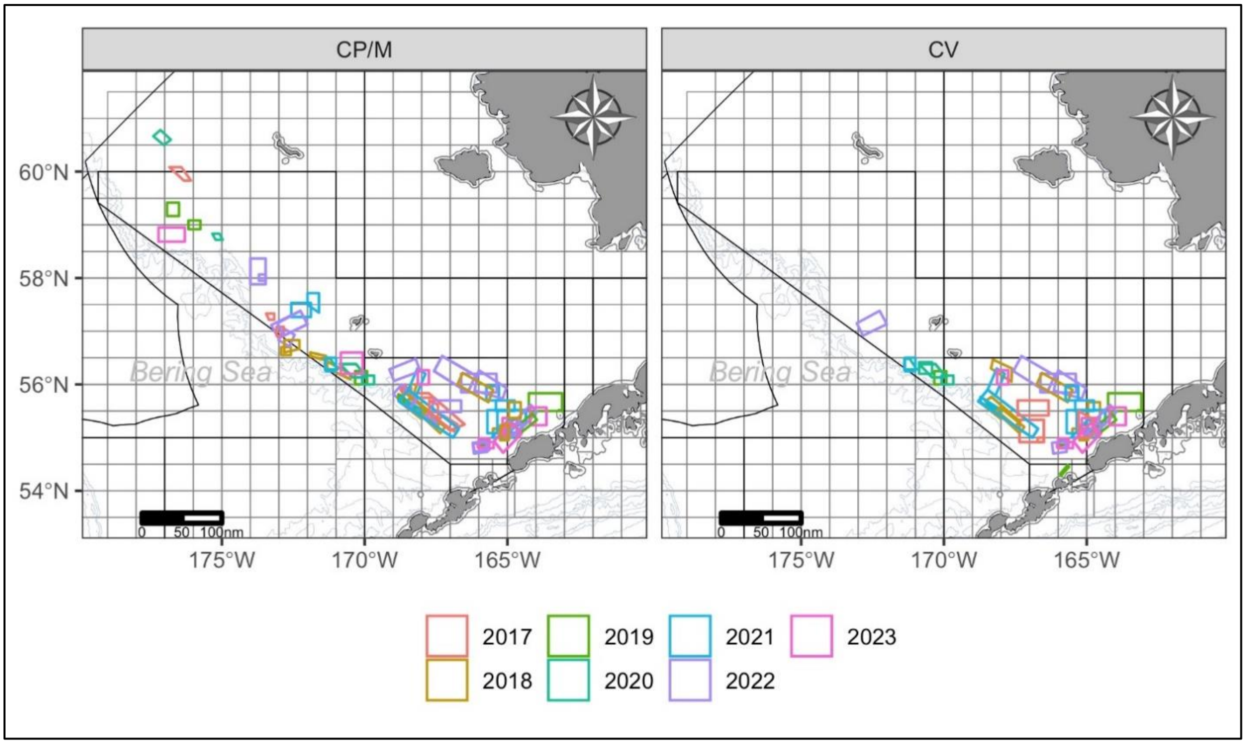

Figure 3-9 Rolling hotspot closure areas for chum salmon avoidance, 2017–2023

Source: Sea State.

Table 3-9 and Table 3-10 provide the dates RHS closures took effect, the size of the closure area in square miles, and the number of vessels that were excluded from the area for the inshore and offshore components from 2018–2023 which are the years comparable data were available. As shown, RHS closures for chum salmon avoidance were most frequently implemented in July, and it was common for multiple closures to be in effect during the same week. The size of the RHS closure areas varied depending on when and where the closure area was implemented. Closure areas are largest East of 168 degrees West longitude in June and July to match the time and areas when Western Alaska chum salmon are more likely to be encountered (see Section 2.2.1.1).

During the analyzed period, 47 RHS closures were implemented for the inshore sector and 77 RHS closures applied to the CP and mothership sectors. The CP and mothership sectors were subject to a higher number of closure areas because their IPAs require the use of fleet-wide data, so hotspots identified for the inshore sector also apply to CPs and motherships if they are fishing in similar areas. The average size of a RHS closure for the inshore sector was 803 sq. miles in June and July compared to 759 sq. miles in August and September. The average size of a closure area for the CP and mothership sectors was 783 sq. miles in July and July compared to 709 sq. miles in August and September (2018–2023). No RHS closure areas for chum salmon avoidance applied to any sector in the month of October during the analyzed period.

Regulations at 50 CFR 679.21(f)(12)(iii)(E)(*8*) require IPAs representatives to report program violations. There were no reported instances of vessels governed by the IPAs and excluded from the RHS closures fishing inside of them. The Vessel Master Survey also indicates it has not been common practice for vessels that are allowed to fish inside a closure based on their tier status to do so. For example, a CV representative reported "even if we are Tier 1, we still generally avoid salmon closures and don't even fish around the perimeter of them. Every once in a while, we will be tempted to fish in a closure if we are Tier 1 if we have a very reliable source that it is clean again" in the 2020 survey.

Table 3-9 Date of chum salmon RHS closure implementation, size of closure area in square miles (sq. mi), and the number of vessels excluded from the closure area (Tier 2 vessels) for the inshore sector, 2018–2023

2018	Date	1-Jul	6-Jul	6-Jul	13-Jul	20-Jul	27-Jul	3-Aug	10-Aug	28-Sep	
	Area Closed (sq. mi)	576	392	1,384	713	455	657	816	816	321	
	Vessels Excluded	0	50	50	48	44	28	26	32	21	
2019	Date	1-Jul	5-Jul	19-Jul	19-Jul	13-Sep	13-Sep				
	Area Closed (sq. mi)	1,782	512	490	485	165	75				
	Vessels Excluded	0	20	13	13	4	4				
2020	Date	3-Jul	31-Jul	7-Aug	21-Aug	28-Aug	4-Sep	11-Sep	18-Sep		
	Area Closed (sq. mi)	459	512	94	135	326	628	628	291		
	Vessels Excluded	2	19	24	21	26	18	15	19		
2021	Date	2-Jul	2-Jul	9-Jul	16-Jul	23-Jul	30-Jul	6-Aug	6-Aug	13-Aug	13-Aug
	Area Closed (sq. mi)	600	432	597	1,828	2,529	320	2,520	534	689	2,520
	Vessels Excluded	35	35	36	36	41	33	26	26	23	23
2022	Date	22-Jul	29-Jul	29-Jul	5-Aug	12-Aug	19-Aug	19-Aug			
	Area Closed (sq. mi)	2,013	1,474	276	2,128	534	1,183	440			
	Vessels Excluded	16	33	33	17	15	24	24			
2023	Date	21-Jul	21-Jul	28-Jul	28-Jul	25-Aug	25-Aug	1-Sep			
	Area Closed (sq. mi)	866	1,149	276	1,149	477	297	691			
	Vessels Excluded	21	21	31	31	14	14	12			

Source: Sea State

Table 3-10 Date of chum salmon RHS closure implementation, size of closure area in square miles (sq. mi), and the number of vessels excluded from the closure area for the CP and mothership sectors, 2018–2023

2018	Date	29-Jun	29-Jun	3-Jul	6-Jul	6-Jul	6-Jul	6-Jul	10-Jul	13-Jul	17-Jul	20-Jul	24-Jul	27-Jul	3-Aug	7-Aug	10-Aug	14-Aug	4-Sep	25-Sep	28-Sep
	Area Closed (sq. mi)	187	576	195	195	505	1,384	392	449	449	382	455	455	657	816	643	816	816	237	321	321
	Vessels Excluded	8	8	8	7	7	7	7	7	10	10	7	7	5	1	1	1	1	0	1	1
2019	Date	2-Jul	5-Jul	19-Jul	19-Jul	2-Aug	2-Aug	23-Aug	30-Aug	13-Sep											
	Area Closed (sq. mi)	1,782	512	490	485	490	109	331	496	165											
	Vessels Excluded	0	0	0	0	4	4	5	11	1											
2020	Date	31-Jul	7-Aug	14-Aug	21-Aug	28-Aug	4-Sep	11-Sep	18-Sep												
	Area Closed (sq. mi)	512	94	139	398	326	628	628	291												
	Vessels Excluded	2	2	3	8	7	2	3	4												
2021	Date	2-Jul	2-Jul	9-Jul	16-Jul	23-Jul	30-Jul	6-Aug	6-Aug	13-Aug	13-Aug	27-Aug	10-Sep								
	Area Closed (sq. mi)	600	432	597	1,828	2,529	320	534	2,520	689	2,520	551	862								
	Vessels Excluded	2	2	2	6	7	6	4	4	2	2	4	2								
2022	Date	15-Jul	15-Jul	22-Jul	26-Jul	29-Jul	29-Jul	2-Aug	2-Aug	5-Aug	5-Aug	12-Aug	16-Aug	19-Aug	19-Aug	23-Aug	23-Aug	26-Aug	30-Aug	2-Sep	
	Area Closed (sq. mi)	1,008	1,115	2,013	276	1,474	276	2,128	276	495	2,128	534	129	1,183	440	1,519	371	1,223	163	825	
	Vessels Excluded	2	2	4	4	2	2	2	2	2	2	1	1	2	2	4	4	4	6	5	
2023	Date	7-Jul	21-Jul	21-Jul	28-Jul	28-Jul	25-Aug	25-Aug	25-Aug	1-Sep											
	Area Closed (sq. mi)	1,444	866	1,149	276	1,149	1,165	297	477	691											
	Vessels Excluded	2	0	0	2	2	0	0	0	1											

Source: Sea State

3.2.4.1.2 Chum Salmon Bycatch Levels and Trends Under Status Quo

From 2011–2023, an average of 267,704 chum salmon were caught during the B season pollock fishery. During the same period, the majority of chum salmon PSC was encountered by the inshore sector (56%) followed by the CP sector (28%), mothership sector (9%), and CDQ (7%).

Table 3-11 Chum salmon bycatch (number of fish) during the B season pollock fishery broken out by sector and fleet total, 2011–2023

Year	CDQ	CP	Mothership	Inshore	Total
2011	3,758	44,299	24,399	118,857	191,313
2012	200	1,928	977	19,067	22,172
2013	554	10,229	3,835	110,496	125,114
2014	2,407	63,066	8,091	145,322	218,886
2015	4,650	40,046	14,046	174,343	233,085
2016	15,975	134,750	43,629	144,882	339,236
2017	87,058	207,355	16,825	154,610	465,848
2018	26,586	99,447	21,303	147,339	294,675
2019	15,726	113,287	44,860	172,798	346,671
2020	8,582	77,137	19,743	237,632	343,094
2021	55,663	97,917	50,542	341,779	545,901
2022	6,365	71,786	32,262	131,896	242,309
2023	3,358	22,499	19,099	66,887	111,843
Average	**17,760**	**75,673**	**23,047**	**151,224**	**267,704**

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

Figure 3-9 be shows the spatial distribution of the pollock fleet’s chum salmon bycatch in recent years (2019–2023) broken out by monthly periods during the B season: June and July, August, and September to November 1. Chum salmon are typically encountered in higher numbers in the eastern portion of the pollock fishing grounds near the Alaska Peninsula. This aligns with the hotspot closure areas portrayed in Figure 3-9 above. Additionally, chum salmon bycatch levels were typically highest in August, but higher bycatch also occurred in June and July in 2021.

Figure 3-11 shows each pollock sector’s B season bycatch by genetic cluster area from 2011–2023. A map of the genetic cluster areas is available in Figure 1-6 for reference. Geneticists at the Alaska Fisheries Science Center’s Auke Bay Lab use the genetic “cluster areas,” based on an analysis of the environmental and economic drivers of the pollock fishery by Haynie & Pfeiffer (2013), to show spatial variation in the genetic stock composition estimates of chum salmon caught as bycatch during the B season. The ordering of areas increases sequentially, moving from east to west (i.e., Cluster 1 is closest to the Alaska Peninsula and Cluster 4 is furthest northwest.

In Cluster 1, the majority of chum salmon bycatch is encountered by the inshore sector (purple). In some years (2017 and 2021), CPs encountered higher bycatch levels in Cluster 1, but typically this sector’s bycatch was encountered in Clusters 2, 3, and 4. There are operational differences among the sectors that influence their bycatch avoidance strategies. For instance, the vertical integration of CPs affords them greater flexibility in where they target pollock during the B season. Mothership CVs deliver one haul at a time to the mothership and must coordinate their deliveries. Inshore CVs are limited in how far they can travel to find good fishing grounds and/or avoid different PSC because their shore-based processors have a 48-hour delivery requirement. The operating range of these vessels is largely determined by their hold capacity, whether the vessel has a refrigerated seawater hold cooling systems, and horsepower.

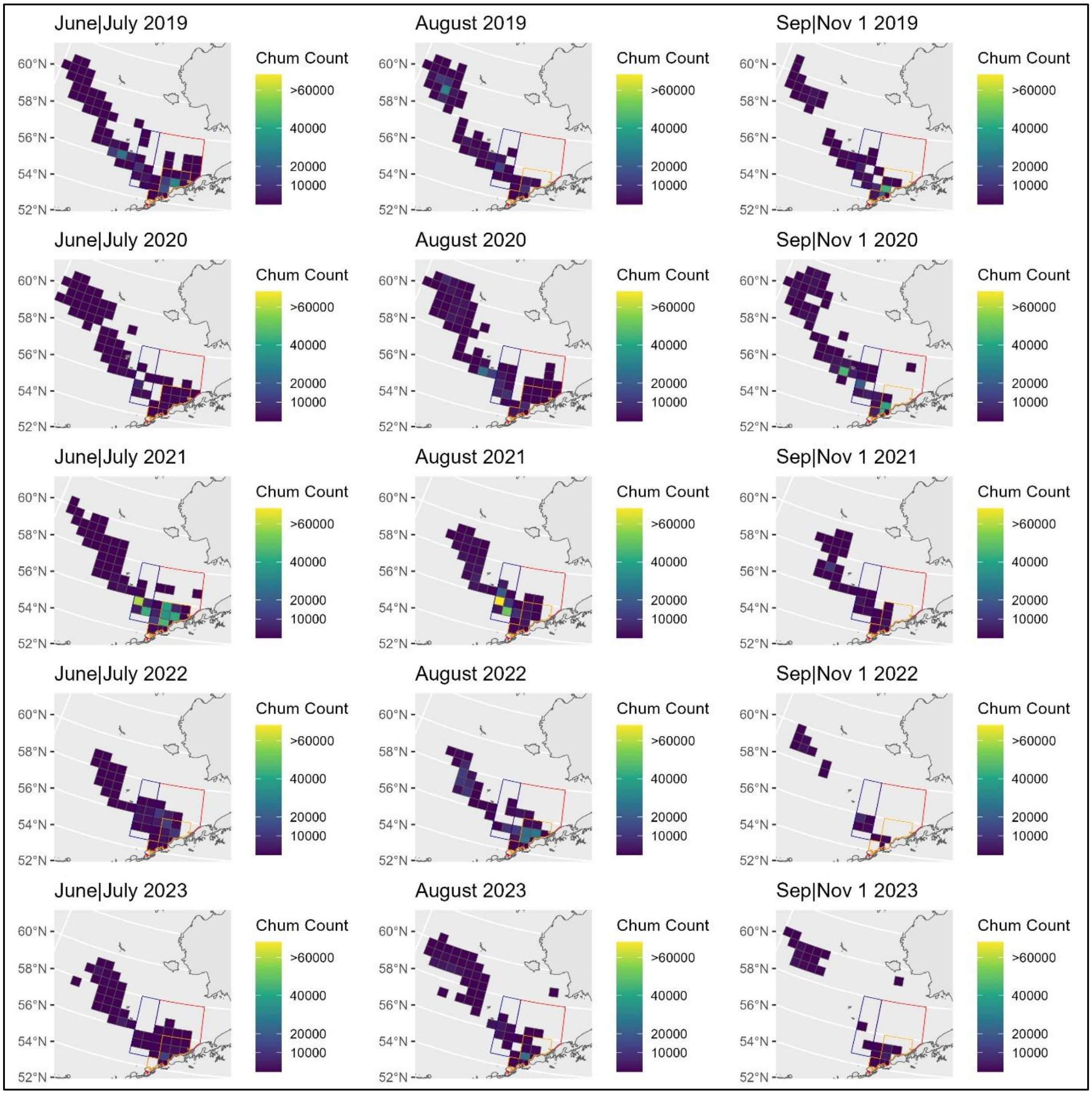

Figure 3-10 Spatial distribution of B season chum salmon bycatch (numbers of fish) in the Bering Sea pollock fishery during June and July, August, and September to November 1 from 2019–2023. Cluster 1 is shown in red, Unimak area in yellow, and Cluster 2 in blue.

Source: NMFS Alaska Region CAS.

Figure 3-11 Pollock sector's B season chum salmon bycatch (numbers of fish) by Cluster Area, 2011–2023

3.2.4.1.3 Chum Salmon Genetic Stock Composition Estimates

The chum salmon taken as bycatch in the pollock fishery originate from Alaska, the Pacific Northwest, Canada, and Asian countries along the Pacific Rim. NMFS-certified observers onboard each pollock vessel or stationed at a shore-based processing facility collect biological samples from the salmon taken as bycatch to determine the stock of origin (1 in 10 Chinook salmon and 1 in 30 chum salmon). Six genetic reporting groups are used to determine where the chum caught as bycatch in the pollock fishery originate from: Southeast Asia, Northeast Asia[60], Coastal Western Alaska (CWAK)[61], Upper/Middle Yukon (includes Yukon River fall chum and some Yukon River summer chum populations), Southwest Alaska, and Eastern Gulf of Alaska/Pacific Northwest. WAK chum salmon" refers to the combined Coastal Western Alaska and Upper/Middle Yukon reporting groups.

Chum salmon attributed to the Northeast and Southeast Asia reporting groups were encountered in higher proportions in most years. On average, the chum salmon caught as bycatch from the CWAK and Upper/Middle Yukon reporting groups accounted for 14.8% and 3.8% of the B season, respectively. WAK chum salmon accounted for 18.6% of the B season bycatch (on average), ranging from a low of 4,701 fish in 2012 to a high of 93,170 fish in 2017 (see Table 3-12).

[60] 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.
[61] CWAK reporting group includes river systems extending from the Norton Sound region in the north south to Bristol Bay.

Table 3-12 Estimated mean proportion and number of chum salmon caught as bycatch from each genetic stock reporting group compared to the total B season chum salmon bycatch (number of fish), 2011–2023

Year	Total B season chum salmon PSC	N.E. Asia		S.E. Asia		E. GOA/Pacific Northwest		Southwest Alaska		Coastal Western Alaska		Upper/Middle Yukon		Western Alaska Combined	
		Mean	Est. #	Mean	Est. #	Mean	Est. #	Mean	Est. #	Mean	Est. #	Mean	Est. #	Mean	Est. #
2011	191,313	18.4%	35,202	17.3%	33,098	37.8%	72,318	1.5%	2,870	16.2%	30,993	8.9%	17,027	25.1%	48,020
2012	22,172	38.9%	8,625	20.3%	4,501	17.6%	3,902	2.0%	443	13.8%	3,060	7.4%	1,641	21.2%	4,701
2013	125,114	44.9%	56,164	14.7%	18,329	14.8%	18,452	1.4%	1,752	18.1%	22,633	6.3%	7,782	24.4%	30,415
2014	218,886	37.4%	81,907	18.5%	40,560	23.6%	51,701	0.7%	1,445	17.7%	38,699	2.1%	4,553	19.8%	43,252
2015	233,085	17.5%	40,790	9.7%	22,609	51.4%	119,806	1.6%	3,729	16.0%	37,294	3.9%	9,090	19.9%	46,384
2016	339,236	30.5%	103,467	8.8%	29,853	34.9%	118,393	1.3%	4,410	19.3%	65,473	5.3%	17,980	24.6%	83,453
2017	465,848	46.1%	214,756	15.7%	73,138	15.0%	69,877	3.2%	14,907	14.0%	65,219	6.0%	27,951	20.0%	93,170
2018	294,675	49.0%	144,405	17.7%	52,163	12.4%	36,543	2.0%	5,894	15.4%	45,385	3.4%	10,020	18.8%	55,405
2019	346,671	39.2%	135,950	18.0%	62,426	22.9%	79,420	3.6%	12,485	15.9%	55,143	0.3%	1,040	16.2%	56,183
2020	343,094	31.9%	109,447	12.7%	43,573	42.5%	145,815	3.8%	13,038	8.0%	27,448	1.1%	3,774	9.1%	31,222
2021	545,901	55.7%	303,903	11.9%	64,695	20.6%	112,615	2.4%	13,176	8.9%	48,658	0.5%	2,854	9.4%	51,512
2022	242,309	32.9%	79,684	10.9%	26,376	29.6%	71,775	3.6%	8,749	21.1%	51,106	1.9%	4,618	23.0%	55,724
2023	111,843	52.5%	58,064	16.3%	18,221	18.7%	20,893	2.0%	2,245	8.3%	9,246	2.3%	2,540	10.6%	11,491
Avg.	267,704	38.1%	105,566	14.8%	37,657	26.3%	70,885	2.2%	6,549	14.8%	38,489	3.8%	8,528	18.6%	46,995

WAK chum salmon have typically been encountered in higher numbers and proportions in Cluster Area 1, which is nearest to the Alaska Peninsula followed by Cluster 2 (Figure 3-12). The majority of WAK chum salmon PSC is attributed to the inshore sector, a pattern that likely reflects the fishing behavior and location of inshore CVs given their processor's locations and delivery requirements (Table 3-13).

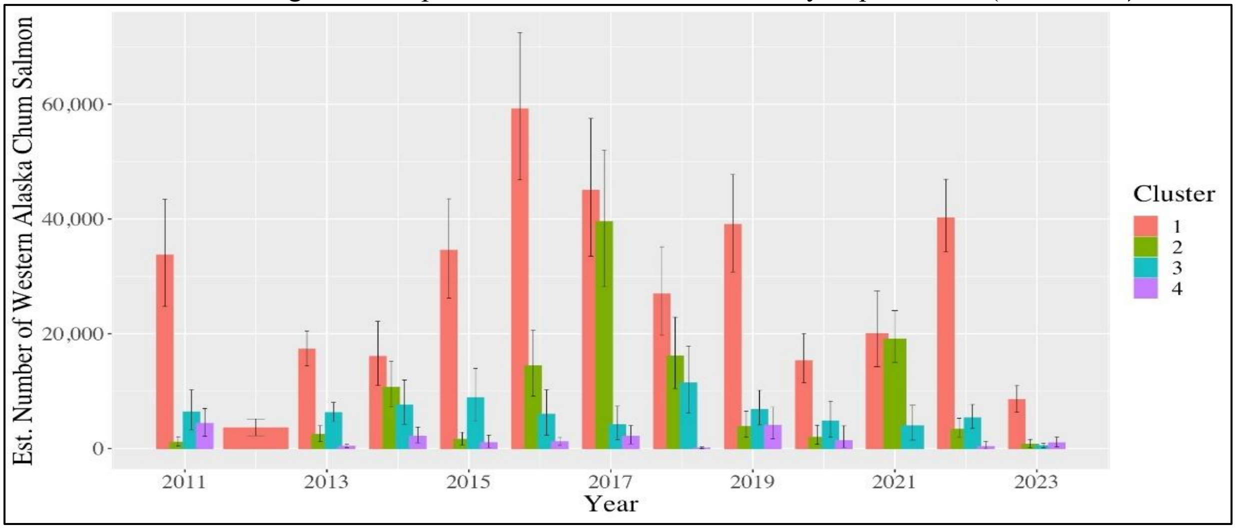

Figure 3-12 Estimated number of Western Alaska chum salmon caught as bycatch in each genetic cluster area, 2011–2023

Table 3-13 Estimated number of Western Alaska chum salmon caught as bycatch by sector, 2011–2023

Year	CDQ	CP	Mothership	Inshore
2011	-	8,911	4,426	32,391
2012	-	-	-	3,922
2013	-	2,467	801	28,188
2014	-	8,714	-	31,636
2015	-	4,528	1,963	34,903
2016	3,140	21,074	13,731	37,768
2017	22,672	33,429	4,562	35,172
2018	6,271	17,640	4,482	30,385
2019	2,894	5,087	7,575	40,049
2020	-	1,925	1,143	25,557
2021	6,091	7,734	3,442	33,488
2022	902	8,036	7,888	37,265
2023	86	965	979	9,735

Source: NMFS Alaska Region CAS.
Notes: Hyphens denote insufficient samples were available to estimate genetic stock proportions

The stock composition of the bycatch also varies temporally. WAK chum salmon make up a greater percentage of the total bycatch during the Early and Middle periods of the B season, which is also when the majority of the total chum bycatch is encountered (Figure 3-13). While the point estimate is often largest for the Middle period (9 of 12 comparisons), the credible intervals, or uncertainty in the estimate, overlap in all but one. Among all years analyzed, the Late period estimate was never the largest and in only two years did its credible interval overlap with the largest estimate (2020 and 2021).

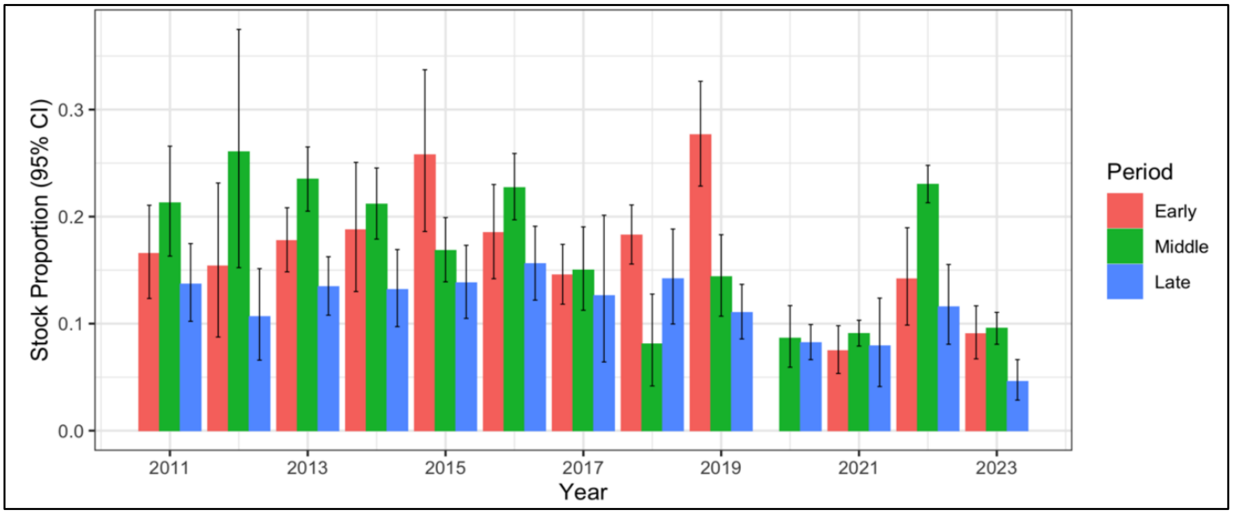

Figure 3-13 Mean stock composition estimates for the Western Alaska reporting group from the Early, Middle, and Late time periods from the 2011 to 2023 B season pollock fishery

Source: Barry et al. (2024)

Notes: Early period corresponds to June and July, Middle period to August, and Late period to September to November 1.

Table 3-14 provides the estimated proportion of WAK chum salmon in the Early and Late period by cluster area from 2011 to 2023. There are insufficient sample sizes to estimate the stock composition of the bycatch at finer temporal *and* spatial scales. As shown, WAK chum salmon have been encountered in higher proportions in Cluster Area 1 in the Early and Late periods compared with other cluster areas. In addition, WAK chum have been encountered in higher proportions during the Early period in Cluster 1.

Table 3-14 Estimated mean proportion of Western Alaska chum salmon in the overall bycatch in the Early and Late periods of the B season by genetic cluster area, 2011–2023

	Cluster Area 1		Cluster Area 2		Cluster Area 3		Cluster Area 4	
Year	**Early**	**Late**	**Early**	**Late**	**Early**	**Late**	**Early**	**Late**
2011	32.8%	25.5%	-	7.6%	28.7%	22.2%	30.1%	-
2012	26.9%	23.5%	-	-	-	-	-	-
2013	25.8%	22.1%	24.1%	19.7%	17.7%	29.5%	-	7.6%
2014	24.9%	23.3%	25.8%	19.5%	16.1%	16.1%	-	8.0%
2015	32.0%	22.3%	17.2%	6.5%	23.8%	18.3%	11.1%	3.4%
2016	31.1%	29.0%	26.2%	16.3%	10.6%	18.5%	-	16.7%
2017	29.5%	29.8%	18.4%	10.0%	12.9%	-	11.9%	7.1%
2018	31.8%	22.1%	16.8%	17.3%	16.0%	13.1%	-	0.9%
2019	33.6%	18.5%	10.5%	17.3%	11.9%	18.5%	4.5%	5.2%
2020	10.5%	14.4%	9.2%	3.2%	10.3%	5.2%	8.3%	2.0%
2021	9.4%	17.7%	8.4%	-	12.9%	8.2%	-	-
2022	26.5%	29.9%	14.2%	11.4%	9.1%	12.4%	-	2.2%
2023	16.3%	14.3%	10.3%	9.6%	6.1%	22.2%	4.0%	2.2%

Notes: Hyphens are used to denote absent values (non-estimable proportions) due to sample size limitations.

3.2.4.1.4 Estimates of Chum Salmon Adult Equivalents

The overall goal of an adult equivalency (AEQ) analysis for salmon is to estimate the number and impact (proportion of a total run size) of bycaught salmon that may have otherwise survived the marine environment and returned to natal streams. A major point of consideration and discussion for this analysis has been the uncertainties associated with performing an AEQ analysis for chum salmon which have thus far precluded the analysts from providing one for the chum salmon PSC in the pollock fishery. There are many sources of uncertainty in an AEQ model related to the conditions of oceanic maturity, survival, in-river age composition, and estimates of stock of origin.

Based upon the SSC's Minutes from April 2024, as well as requests from the Council and public, a "simplified AEQ" chum salmon analysis has been completed so decision-makers and the public can consider the relative effect of chum salmon bycatch. Given the considerable uncertainty associated with all relevant parameters for a chum salmon AEQ estimate, this naming convention is used to distinguish it from the AEQ estimates produced for Chinook salmon bycatch. However, "AEQ" is also used for shorthand, particularly in subsequent tables and figures, to reduce confusion. **Due to the uncertainties associated with an AEQ analysis for chum salmon, the estimates presented should be taken within the context of the levels of associated uncertainty with the calculations and assumptions.**

The considerations associated with calculating an AEQ include: 1) the genetic composition of the bycaught salmon, 2) the number and relative ages of salmon caught in the bycatch (i.e., the age composition of chum salmon bycatch), 3) the unspecified oceanic natural mortality (i.e., from predation, starvation, disease, etc.), and 4) the relative maturation by age class to the age composition of the mature population that enters natal rivers and is then the subject of in-river mortality (natural or by fishery) and/or contribute to escapement. Together, these data provide a way to estimate the annual natural mortality rates that would have occurred in the year(s) between when they were caught as bycatch and when those fish would have otherwise returned to their natal rivers. Thus, the AEQ analysis provides a means to answer: *"how many and in what year would the salmon have returned had they not been taken as bycatch"?*

Genetic composition of the bycaught chum salmon. A new aggregation of populations in the chum salmon genetic baseline was used solely for the purposes of the simplified AEQ analysis, the reporting groups used by US Fish and Wildlife Service and ADF&G for management are the Coastal Western Alaska – Summer and Yukon River – Fall Run. These are nearly identical to the CWAK and Upper/Middle Yukon reporting groups used in historical genetic analyses, but the primary difference is the grouping of a handful of populations in the middle river. For each dataset, the baseline that has been used in the past was reorganized to match the run timing groups prior to estimating the age-specific stock compositions. The analysis continues to use "CWAK" and "Upper/Middle Yukon" for ease of the reader and to minimize public confusion with two different naming conventions for relatively similar reporting group analyses.[62]

Ages of the salmon caught as bycatch. The Council and its advisory bodies periodically receive AEQ and impact rate analyses for the Chinook salmon caught as bycatch in the pollock fishery, but there are important differences between the relative proportion of the ages of the Chinook salmon caught as bycatch as compared to chum salmon. For instance, the Chinook salmon caught in the pollock fishery primarily range from 3- to 6-years old with a small component of 2- and 7-year-olds caught in any one year. This is represented by the far left and far right aggregations of fish by age in Figure 3-14. However, a small proportion of the chum salmon caught as bycatch in the pollock fishery are 2-, 6-, or 7-year-olds. Rather, the majority of the bycaught chum is between the ages of 3- to 5-years. More information on age composition data are available in Appendices 4 and 5.

Figure 3-14 shows a generic model of the various aspects of salmon life cycle in the open ocean subject to oceanic natural mortality (from predation, competition for food resources, etc.), bycatch (by the pollock fishery), and relative maturation by age class leading overall to the proportion of the mature population that is then the subject of in-river mortality (natural or by fishery) and/or contributes to escapement.

[62] Current research underway at AFSC in collaboration with ADFG (PI: Dr. Wes Larson) is developing a new genetic marker panel with low coverage whole genome sequencing for WAK chum salmon to improve the resolution of stock structure. This project could allow for more precise estimation of the relative effect of bycatch on WAK chum salmon populations, but results are not yet available for this preliminary DEIS.

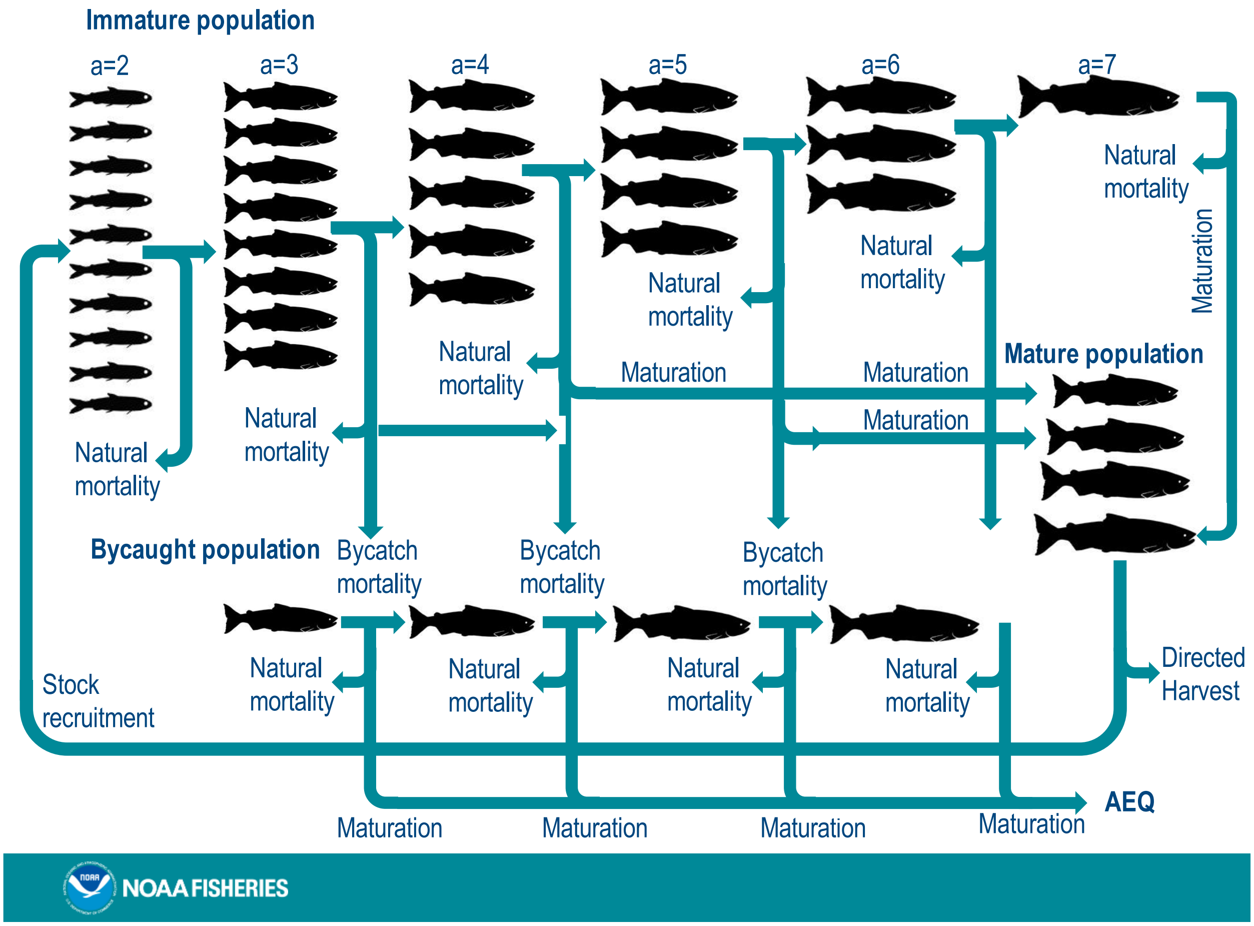

Figure 3-14 Generalized model of the relative relationship of oceanic growth of salmon by age as compared to mortality (natural mortality, predation, food limitation, and bycatch mortality) and to maturation by age to calculate an adult equivalent estimate for the relative proportion caught as bycatch.

Source: DeFillipo et al., in prep.

Because chum salmon caught in the pollock fishery generally range in age from 3- to 5-years old, and chum salmon mature and return to the rivers at multiple ages, the effect of adult equivalents caught as bycatch in a given calendar year is spread over multiple return (maturity) years. For example, a 3-year old chum salmon caught as bycatch in 2020 could return to spawn in either 2020 as age-3 fish, 2021 as age-4 fish (given it survived in the ocean from age 3 to age 4), 2022 as age-5 fish (given it survived from age 3 to 4 and 4 to 5), 2023 as age-6 fish, or 2024 as age-7 fish (all fish of age 7 mature in a given year. In a year where the bycatch had a high number and proportion of age-3 fish (and other ages), the removals of those fish can have an effect on the AEQ estimates in subsequent years. **This is the “propagation effect” of the bycatch removals of adult equivalents in the pollock fishery on current and future years’ runs.**

Unspecified oceanic mortality, natural mortality, and age at maturation. For both Chinook and chum salmon, natural mortality in the marine environment varies by age, but it is extremely difficult to quantify age- and species-specific natural mortality in the ocean for these species. The age at which Chinook and chum salmon reach sexual maturity (maturation age) and are ready to spawn varies by natal stream, while available data on the in-river age composition of salmon in natal streams varies widely by species and region. Stock composition estimates for WAK Chinook and chum salmon bycatch are estimated at the aggregate level due to the genetic limitations with the exception of the Upper Yukon (Chinook) and the Yukon fall run chum salmon stock. Even when age-specific maturation may be well estimated by river for runs where a full run reconstruction is available (e.g., for Yukon Chinook salmon and Yukon fall chum salmon), some aggregation of maturation data must be done to account for a range across river systems when a single maturation rate is applied to estimate an aggregate AEQ at the stock composition level. Additionally, while a large proportion of the variance in age at maturity can be explained by genetics, it is still affected by the environment such that maturity can vary within a stream among years.

An AEQ analysis applies the assumed maturation rate (averaged over yeas and/or populations) to the aggregate stock composition by age to estimate the proportion of fish that will mature in a given year versus remaining in the ocean another year where those fish will be subject to oceanic mortality, or live to mature the following (or even subsequent) year. In each year, some salmon remain in the ocean, some mature and return to rivers and some are caught as bycatch. For the AEQ estimate, the application of the relative mortalities (natural and bycatch) compared to relative proportion mature is made for each age. In this way, from a given year of bycatch mortality, an estimate of the AEQ by brood year is made to result in (estimate) the proportion of bycaught fish in a given year that would have returned to a natal stream in Western Alaska.

3.2.4.1.4.1 Calculating a Chum Salmon Adult Equivalency Analysis

The steps were used to calculate AEQ chum salmon caught as bycatch in the pollock fishery. Some of the major considerations that lead to **high uncertainty** in any AEQ analysis for WAK chum salmon or impact rate estimate are summarized below to provide a relative understanding of the uncertainty associated at each step, and therefore cumulatively on the resulting AEQ estimates provided in this analysis)[63]. Note steps 1-3 are used to estimate the age composition of the WAK genetic stock composition group while step 4 related to the calculation of the AEQ.

1. Estimate the annual age-specific stock compositions for chum salmon from 2005–2022[64] for the frequent age classes. This range of years encompasses the removals of infrequent age classes, for which stock composition estimates could not be made due to low sample sizes (e.g., 2, 6, and 7) the closest age class was applied (age 3 estimates applied to age 2, and age 5 estimates applied to age 6 and 7).
2. Estimate the total number of chum salmon of each age by multiplying the annual age composition of the bycatch by the total bycatch.
3. Estimate the number of chum salmon for each genetic group by multiplying the total number of each age (step 2) by the age-specific stock compositions (step 1).
4. Calculate the AEQ using the stock specific estimate for each age, with some assumptions (see below) about natural mortality, maturation, and oceanic maturity. This is done by iteratively calculating for each age the proposition of fish that die, the proportion of fish of each age that mature to return to their natal rivers, and the proportion of remaining fish that will survive to the next year (Figure 3-14). As discussed below there is considerable uncertainty associated with the assumption about pertaining to these parameters as well as uncertainty associated with the stock composition estimates, particularly those prior to 2011, and the assignment to ages.

Uncertainty related to natural mortality. The annual age-specific natural mortality rate (how many chum salmon would have naturally died in the ocean at a given age in a given year) for WAK chum salmon at the age that they are caught as bycatch in the pollock fishery is currently unknown. Few estimates of chum salmon oceanic mortality exist for populations across the Pacific Rim. Fukuwaka and Suzuki (2000) produced some estimates based on work from 1992–1997 summarizing a mark-recapture study on hatchery released chum. Their results indicated that early sea mortality during coastal life (~ 99.1%) was much higher than successive mortality during offshore life (~0.6%). No mortality estimates are available

[63] See Appendix 4 for specific details on the calculations employed and parameter estimates involved in this calculation
[64] Note that prior to 2011, bycatch samples were not sampled systematically and biases in the age-specific stock compositions from non-representative spatial and temporal sampling.

for WAK chum stocks. An AEQ requires an estimate of the annual natural mortality for the stock or stock grouping. Uncertainty in any natural mortality estimate would be further compounded by an unknown amount of interannual variability that may exist.

For purposes of this analysis (and consistent with the 2012 chum analysis), a mortality estimate by age was assumed to be varying from 0.3 for age 2 to 0.0 to age 7. As noted, however, there is considerable uncertainty surrounding these estimates.

Uncertainty related to age at maturity. An AEQ also requires unbiased estimates of ages at maturity for each run year because different salmon stocks have different maturity patterns and trends. Unbiased estimates of ages at maturity are provided by run reconstructions, which are not available for all WAK chum salmon stocks. Run reconstruction data are available for the Yukon Fall run stock and the most recent 5 years of available data (2014–2018)[65] were used to calculate an average estimate of the age at maturity for this stock. However similar age at maturity data were not available for other coastal western Alaska stocks, therefore information from 6 river systems within the Kuskokwim[66] were used to estimate an average in river age composition that was then applied to the entire CWAK stock. For these, the following sources were employed: Goodnews (middle fork), Kaneketok, Salmon River Aniak, George River, Tatlawiksuk, Kogrukluk. To be most reflective of recent maturity estimates, the most recent five years (2014–2018 for most, 2002–2015 for Kaneketok (Table 1)) were selected. As noted in Table 1 not all Kuskokwim weirs were operational or had sampling issues which precluded the estimation of age, sex, and length for all years, and are annotated appropriately. With caveats on the data sources and sampling issues, these data may be appropriate for estimation of the in-river ages of the Kuskokwim stocks, considerable uncertainty can occur from assuming ages at maturity for one stock and applying them to the CWAK stock group as a whole.

Table 3-15 In-river data sources from six systems along the Kuskokwim used to estimate in-river age composition data for the simplified AEQ chum salmon analysis

Source	Years	Issues noted with data available
Goodnews (middle fork)	2014-2018	In 2018 the weir did not operate
Kanektok	2002-2015	Sampling issues in 2014; weird did not operate from 2016 on
Salmon River Aniak	2014-2018	Sampling issues in 2014, 2016
George River	2014-2018	
Tatlawiksuk	2014-2018	2018 weir did not operate for most of season; data from observed escapement counts
Kogrukluk	2014-2018	Sampling issue in 2017

Uncertainty related to bycaught chum age. The stock specific ages at which WAK chum salmon are caught as bycatch in the pollock fishery have considerable uncertainty associated with them. Salmon are aged by reading scale patterns and while chum salmon scale samples are individually aged, genetic samples are run in batches, by primary age class, so the proportion of each stock group by age group is provided but not the -age composition for each stock group. If all individuals of known age could be assigned to a stock group with high accuracy (individual assignment), one could estimate the age composition of each stock group by dividing the number of fish in each age class by the sum over age classes. For instance, the proportion age-2 individuals within the WAK group would be:

#Age2/(#Age2+#Age3+#Age4+#Age5+#Age6+#Age7

[65] Yukon JTC, 2024, Yukon River Salmon 2023 Season Summary and 2024 Season Outlook
[66] ADF&G 2021, Regional Information Report 3A21-03

To infer the total number of each age from a given reporting group, these proportions are then multiplied by the B season estimate of total number of fish for the reporting group (with its uncertainty).

This would provide more accurate estimates for infrequent age class proportions (ages 2, 6, and 7), as they would be analyzed and assigned to a reporting group, and likely more precise estimates because the B season estimates have substantially more samples than each age-specific analysis. Additional error is associated with aging salmon scales from a wide variety of stocks spanning North America and Asia absent information indicating the stock or stock grouping of origin for the scales. Marks on salmon scales are developed throughout the life of the fish and can vary depending on genetic variation of populations, life history patterns, and environmental variables. Scale age readers are often trained with stock specific scales to account for these differences. Although there are few studies comparing the accuracy of chum salmon scale aging, one recent study found that accuracy and precision was variable among experienced age readers trained on scales from specific chum salmon stocks (Anderson et al., 2023).

Lack of run size reconstructions for impact rate estimation. An AEQ estimate does not account for any associated mortalities (natural mortality or direct or indirect fishing mortality) that may accrue within river. An AEQ is only an estimate of those fish that, had they not been caught as bycatch in the ocean, may have made it to their regions of origin. Because reconstructions for all major chum salmon producing systems across WAK are not available, an impact rate cannot be provided. Run reconstructions provide an estimate of total run size and there are limited run reconstructions for chum salmon in Western Alaska that align with the genetically distinguishable stock groupings for stock-specific bycatch estimates. A scientifically defensible run reconstruction includes a thorough estimate of escapement (the number of fish returning to a river system in a given year that are not caught by fisheries and can contribute to the spawning population) and harvest. Run reconstructions are currently only available for Yukon River summer and fall run chum salmon and Kwiniuk River chum salmon. This excludes large chum salmon populations in the Kuskokwim River, Bristol Bay, Kotzebue Sound, and Norton Sound.

Some indices of abundance are available for WAK chum salmon populations without run reconstructions (e.g., aerial surveys, weirs, counting towers, sonars, harvest), but a simple summation of these indices of abundance is not equivalent to a run reconstruction and would not provide a scientifically defensible accounting of the total abundance of chum salmon for the WAK reporting group. Indices may only provide a partial accounting, with some unmeasured and uncertain components of the run missing, or they may be designed to only provide relative abundance rather than absolute abundance information. For example, aerial surveys provide a relative index of abundance or escapement because they assess a standardized portion of the in-river spawning area and not the entire spawning area; they do not provide a census or estimate of total abundance.

3.2.4.1.4.2 Simplified AEQ and Region of Origin Impacts Under Alternative 1

Figure 3-15 compares estimates on the number of chum salmon caught as bycatch from the CWAK (WAK-Summer) and Upper/Middle Yukon (Yukon-Fall) reporting groups to each reporting group’s AEQ estimate from 2011–2022. The results indicate that, on average, of 38,162 AEQ CWAK chum salmon and 6,074 AEQ Upper/Middle Yukon chum salmon were removed due to bycatch in the B season pollock fishery. The estimated number of AEQ CWAK chum salmon ranged from a low of 11,608 fish in 2012 to a high of 69,445 fish in 2017. The estimated number of AEQ Upper/Middle Yukon chum salmon ranged from a low of 2,124 fish in 2020 to a high of 16,429 fish in 2017.

Estimates on CWAK AEQ chum salmon were often lower than the CWAK stock-specific bycatch estimate in a given year, except for 2012 and 2018. The CWAK AEQ estimate exceeds the reported bycatch in 2012 because the total PSC was substantially lower in 2012 compared to prior years. Chum salmon caught as bycatch in prior years contributed to the 2012 AEQ estimates (e.g., age-3 fish caught in 2011 that would have survived and likely matured as age-4 fish in 2012). In 2018, this pattern was also due to higher levels of chum salmon bycatch in 2016 and 2017 that would have likely matured in 2018, combined with a reduction in the overall bycatch in 2018 compared to 2016 and 2017.

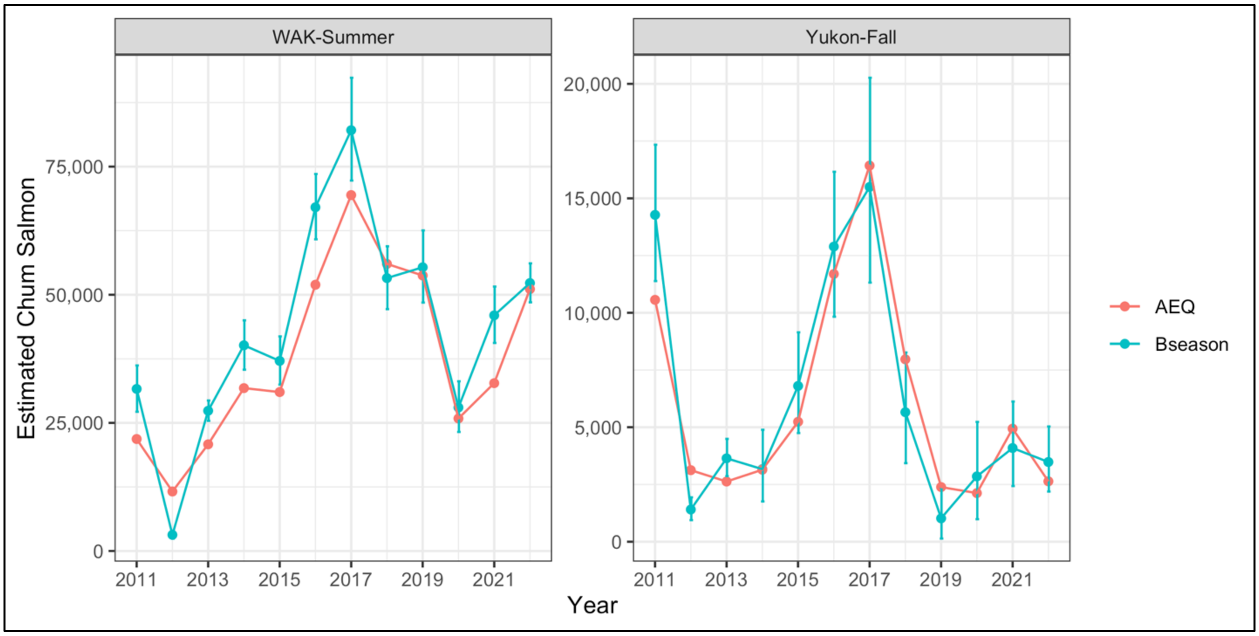

Figure 3-15 AEQ estimates (number of chum salmon that may have returned to streams after discounting natural mortality and accounting for age at maturity) for CWAK (WAK-Summer) and Upper/Middle Yukon (Yukon-Fall) genetic reporting groups compared with the estimated level of B season bycatch for each reporting group, 2011–2022

An AEQ analysis is not a complete assessment on the potential impact bycatch removals of chum salmon may have on WAK chum salmon populations. This requires an estimate of the total run size which is not available for all stocks encompassed within the CWAK reporting group.[67] As such, this analysis provides information to scale PSC removals from the CWAK reporting group under the status quo in response to requests from the SSC, Council, and members of the public. **The data provided are only meant to contextualize the magnitude of PSC removals of chum salmon attributed to the CWAK reporting group, and these data should not be used in lieu of an impact rate or as a determinant of annual run sizes**. A full run reconstruction is available for Yukon fall chum salmon and an impact rate for that stock is presented below, but trends for Yukon fall chum salmon abundance and/or the impact rate of PSC removals on this singular stock may not reflect overall trends across all WAK stocks.

Figure 3-16 provides the estimated number of AEQ CWAK chum salmon compared to subsistence and commercial chum salmon harvests from 2011–2022. The subsistence and commercial harvest data were provided by ADF&G's Division of Subsistence and the Annual Management Reports or Summaries from the Commercial Fisheries Division. These are the same data used throughout Chapter 4. Data are provided for the Kotzebue, Norton Sound-Port Clarence, Yukon (summer chum harvest data only), Kuskokwim and Bristol Bay areas. It is assumed that all subsistence harvests represent removals of adult fish as they are returning to spawn and a similar assumption is made regarding the ages of chum in commercial fisheries harvest. This approach is somewhat limited because directed fisheries harvests do not perfectly represent abundance (and are not intended to in this analysis), but chum salmon harvests are fully assessed. The analysts acknowledge some proportion of the chum salmon caught in the South Alaska Peninsula (Area M) fishery originate from CWAK stocks. ADF&G has raised concerns that comparable data are not available, both in terms of annual genetic stock composition estimates and AEQ estimates of those fish. The Area M fishery is described separately in Section 4.3.4.2.

[67] In their October 4, 2024, letter to NMFS, Kawerak, Inc., AVCP, YRITFC, TCC, NPA, and YRDFA expressed several concerns with the use of an impact rate which is available in Appendix 1.

From 2011–2019, the simplified AEQ estimates of CWAK chum accounted for an average of 1.4% of total removals compared to 5.7% of total removals from 2020–2022. As shown in Figure 3-16 below, the majority of CWAK chum salmon removals have been attributed to commercial fisheries harvests, and the proportion of total removals represented by estimates of AEQ CWAK chum salmon are low relative to commercial harvests. The proportion of total removals that bycatch in the pollock fishery represents increased in years when abundance declined and directed fisheries opportunities have been limited.

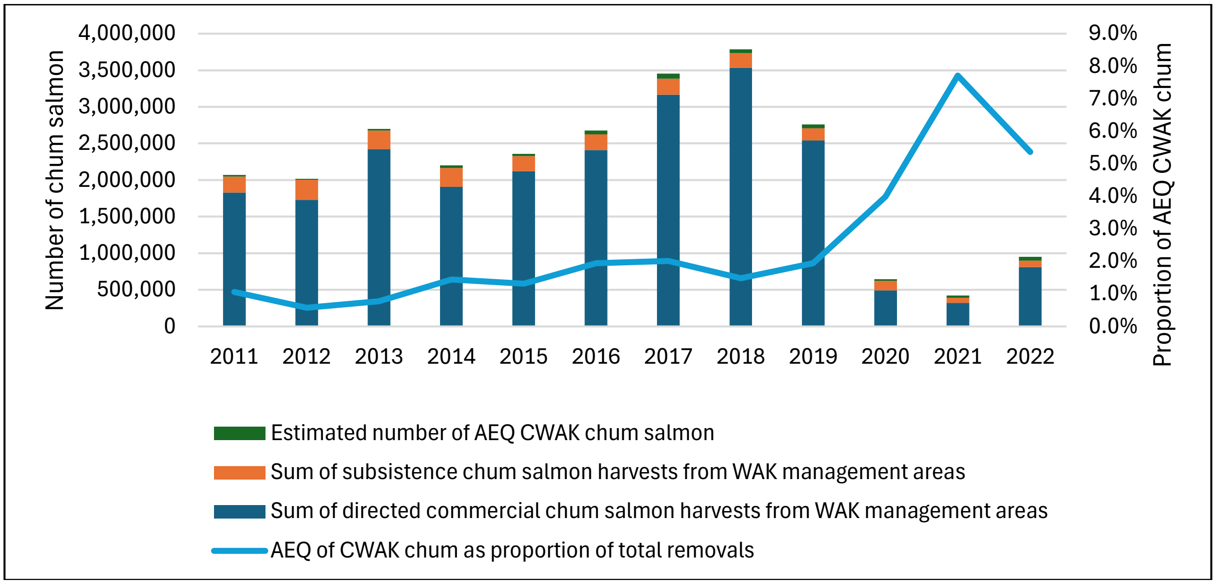

Figure 3-16 Comparison of simplified AEQ CWAK chum salmon estimates to subsistence and commercial harvests of WAK chum, 2011–2022

Table 3-7 provides an impact rate for PSC removals of AEQ Yukon fall chum salmon based on the Upper/Middle Yukon reporting group estimates. As noted above, this analysis is possible because it is a genetically distinguishable stock with existing estimates of total run size. In most years from 2011-2022, the impact of bycatch removals of Upper/Middle Yukon chum salmon was less than 1% of the total run size. Bycatch of AEQ chum salmon was estimated to be highest in 2017, which coincided with the largest run size during this time frame, so the estimated impact rate was still relatively low 0.70%. In recent the most recent three years for which data are available, the Yukon fall chum salmon run sizes have been smaller and thus the relative impact of bycatch has been higher. The lowest fall chum salmon run was observed in 2021 at 95,249 fish and the estimated AEQ bycatch was approximately 5,000 fish. The impact of bycatch in years with lower returns was greater at 4.93%

Table 3-16 Estimated impact rate for Yukon River fall chum salmon based on the simplified AEQ estimates of Upper/Middle Yukon bycatch, 2011–2022

Year	AEQ Upper/Middle Yukon bycatch	Fall chum run size	Impact rate for fall chum salmon bycatch
2011	10,565	1,244,141	0.84%
2012	3,126	1,089,200	0.29%
2013	2,629	1,215,809	0.22%
2014	3,145	956,669	0.33%
2015	5,239	828,453	0.63%
2016	11,695	1,390,329	0.83%
2017	16,429	2,315,883	0.70%
2018	7,967	1,114,684	0.71%
2019	2,387	802,964	0.30%
2020	2,124	184,233	1.14%
2021	4,939	95,249	4.93%
2022	2,638	242,465	1.08%

3.2.4.2 Alternatives 2 and 3

Alternative 2 would include an overall chum salmon PSC limit of 100,000 to 550,000 chum salmon. This PSC limit would be in place during every B season (June 10 to November 1), apportioned among the sectors, and fishing must stop if the cap is reached. Alternative 3 would also include an overall chum salmon PSC limit similar to Alternative 2, except the PSC limit under this alternative *may* be in place depending on whether certain areas in Western Alaska meet their abundance thresholds (see Section 2.4). Additionally, the Alternative 3 hard cap may decrease as more areas fall below their abundance thresholds under Option 1. The range of possible PSC limits under Alternative 3, Option 1 is 75,000 to 550,000 chum salmon. The range of possible PSC limits under Alternative 3, Option 2 is 100,000 to 550,000 chum salmon and thus the same as the range being considered for Alternative 2.

This analysis uses fisheries-dependent data and is a retrospective evaluation of when a PSC limit may have been met. This is a useful and necessary approach to quantify potential chum salmon and WAK chum salmon PSC reductions, as if these PSC limits had been in place in previous years and without changes in fleet behavior. **This provides the best quantitative benchmark for potential savings, and it allows for a comparison to be made among the alternatives, cap amounts, and apportionments. However, this approach does not account for the likely future changes in fishing behavior.** The expected operational changes are described further in Section 3.2.4.2.5.

The degree to which fishermen change their behavior to avoid reaching the cap would depend on the degree of risk the cap poses, their ability to modify their behavior, and a consideration of how costly those changes may be. While lower PSC limits are inherently more likely to become a binding constraint, perceptions of risk are expected to influence harvesters' behavior and be informed by pollock aggregations, environmental conditions, and the levels of other constraining PSC species. If fishermen are successful at remaining below the hard cap, it is possible the overall chum salmon savings would be greater than the retrospective estimates. The same logic does not inherently apply to WAK chum salmon PSC reductions which is addressed below.

For Alternative 2 and 3, estimates on the potential number of chum salmon saved are compared to Alternative 1 (status quo), and based on the details of the alternative and option to determine when a cap would have been met and triggered a closure. Based on that date, an estimate was made of the amount of pollock (mt) that would have been left unharvested and the reduction in the number of chum salmon taken as bycatch. This methodology is the same as that which was used in the April 2024 preliminary DEIS.

3.2.4.2.1 Overall Chum Salmon Savings for Alternative 2

A subset of three PSC limits was used for the analysis of Alternative 2 and Alternative 3, Option 2: 100,000 chum salmon, 325,000 chum salmon, and 550,000 chum salmon. The implications specific to Alternative 3 are addressed separately below. The subsequent analysis provides estimates on the overall chum salmon savings which do not account for genetic stock of origin and AEQ. Next, estimates on WAK chum salmon savings are provided which account for the genetic stock of origin but not AEQ. The estimates on AEQ chum salmon savings for the CWAK and Upper/Middle Yukon reporting groups are then provided.

Table 3-17 shows estimates on the potential number of chum salmon saved under the analyzed cap amounts and apportionments. Cells without numerical values indicate a sector did not meet a given cap in that year. There are some years when the estimated savings exceeds the cap, and occasionally by a substantial amount (e.g., 2021 with a 100,000-chum salmon PSC limit). This is due to the fact that this is a retrospective analysis, the weekly bycatch patterns of the fleet are highly varied during the analyzed period, and there is a lag between deliveries to shoreside processing facilities and the availability of observer data. In the future, the analysts expect fishing behavior would change to stay below the cap to the extent practicable. NMFS and cooperative managers would also closely monitor vessel’s chum salmon bycatch prior to the limit being reached.

A PSC limit of 100,000 chum salmon would have been a binding constraint for all sectors in a varying number of years depending on the apportionment used. The cap would have been a binding constraint for the CDQ sector in 5–6 years, in 10–11 years for the CP sector, and in 10 and 12 years for the mothership and inshore sectors, respectively. As the cap amount increases, sectors were less likely to be affected by an early closure.

Compared to Alternative 1, the numbers of chum salmon saved are high in some years and vary by sector. Typically, greater reductions were estimated to accrue from the inshore sector (CV). Exceptions to this trend include 2016 and 2017. The highest potential for chum salmon savings to accrue from a single year and sector would have occurred in 2021 under a 100,000-chum salmon PSC limit using the AFA apportionment at 289,446 chum salmon from the inshore sector. This represented an 84.69% reduction from the sector’s status quo bycatch in 2021. On the other hand, the caps under consideration for Alternative 2 would have minimal potential to impact annual bycatch amounts in years with low historical bycatch; all cap amounts under consideration would have had no effect on PSC reductions compared to Alternative 1 in 2012, which was the lowest bycatch year analyzed.

Across all years, at a 100,000-chum salmon PSC limit, the highest fleet-wide chum salmon PSC savings would occur under the pro-rata apportionment. In percentage terms, summing the savings under this cap amount and apportionment would have reduced fleet-wide chum salmon bycatch by 56.4% across all years. As the cap increased to 325,000 fish, the estimates of salmon savings are lower than those predicted at a limit of 100,000 chum salmon, and the cap is a binding constraint in fewer years for all sectors (see Figure 1-7). **Across all years, a 325,000-chum salmon PSC limit, the highest fleet-wide chum salmon PSC savings would occur under the 3-year average apportionment.** This cap amount and apportionment represented a 12.4% reduction from status quo across all years. Higher savings are estimated from the 3-year average apportionment under a 325,000-chum salmon PSC limit because the CP and CDQ sectors had higher bycatch in some years (e.g., 2017) and the 3-year average apportionment option is the most restrictive for these sectors (compared to other apportionment). Similar trends are observed as the PSC limit increases to 550,000 chum salmon**.**

Table 3-17 Estimates on the number of total chum salmon saved as if the analyzed PSC limits and sector apportionments were in place from 2011–2023 for Alternative 2

Year	100,000				325,000				550,000			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
Sector apportionment 1, 3-year average												
2011		18,605	13,950	46,993								
2012												
2013				37,151								
2014		36,702		81,273								
2015		15,601	4,696	76,757								
2016	7,434	111,826	32,492	68,533		56,071	9,836			4,019		
2017	72,998	173,273	7,534	86,531	51,395	110,576			51,395	62,363		
2018	12,995	65,623	9,976	78,910	3,859	23,055						
2019	6,522	88,183	30,062	97,213		18,785	7,917					
2020	2,054	49,565	10,003	166,392		4,961		12,437				
2021	6,358	37,412	41,389	265,246	6,358	22,304	9,694	94,626	6,358		200	
2022		25,278	18,921	42,505			27					
2023		221	5,407	2,025								
Sector apportionment 2, 5-year average												
2011		18,605	13,950	58,971								
2012												
2013				49,747								
2014		36,702		81,273								
2015		9,729	4,273	76,757								
2016	7,434	102,929	32,492	68,533		48,996	9,836					
2017	72,998	173,273	2,444	86,531	51,395	110,576			13,321	62,363		
2018	12,995	65,623	9,976	78,910	3,434	9,445						
2019	6,522	88,183	30,062	97,213		18,785	7,917					
2020	1,453	49,565	10,003	166,392				45,164				
2021	6,358	37,412	39,786	265,246	6,358	7,726	9,694	94,626	6,358			13,053
2022		25,278	18,921	42,505			27					
2023			5,407	7,729								
Sector apportionment 3, pro rata												
2011		18,605	13,950	58,971								
2012												
2013				49,747								
2014		36,702		81,273								
2015		9,729	4,696	76,757								
2016	7,434	102,929	32,492	68,533		48,996	9,836					
2017	72,998	173,273	7,534	86,531	51,395	110,576			13,321	62,363		
2018	12,995	65,623	9,976	78,910	3,434	9,445						
2019	6,522	82,005	30,062	97,213		18,785	7,917					
2020	1,453	49,565	10,003	166,392				45,164				
2021	6,358	37,412	41,389	265,246	6,358	7,726	9,694	94,626	6,358		200	13,053
2022		25,278	18,921	42,505			27					
2023			5,407	7,729								
Sector apportionment 4, AFA												
2011		3,963	13,950	73,762								
2012												
2013				60,923								
2014		20,942		81,273								
2015		2,128	4,696	76,757				21,994				
2016	4,327	95,698	32,492	94,233	51,395	4,019	9,836					
2017	72,998	110,576	7,534	86,531		62,363		1,782	13,321	1,321		
2018	12,995	40,571	9,976	89,373								
2019	3,446	70,565	30,062	122,723			7,917	12,055				
2020	1,453	32,244	10,003	166,392	6,358			86,458				
2021	6,358	37,412	41,389	289,446			9,694	94,626	263		778	13,053
2022		25,278	18,921	81,764			27					
2023			5,407	12,176								

Table 3-18 Estimates on the number of total chum salmon saved represented as a percent of total B season bycatch under all analyzed PSC limits and apportionments for Alternative 2, 2011–2023

Sector apportionment 1, 3-year average

	100,000				325,000				550,000			
Year	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2011		42.00%	57.17%	39.54%								
2012												
2013				33.62%								
2014		58.20%		55.93%								
2015		38.96%	33.43%	44.03%								
2016	45.49%	82.99%	75.11%	47.30%		41.61%	22.74%			2.98%		
2017	83.85%	83.56%	44.78%	55.97%	59.04%	53.33%			59.04%	30.08%		
2018	48.88%	65.99%	46.83%	53.55%	14.52%	23.18%						
2019	41.47%	77.74%	67.01%	56.26%		16.56%	17.65%					
2020	23.93%	64.25%	50.67%	70.02%		6.43%		5.23%				
2021	11.42%	38.21%	81.89%	77.61%	11.42%	22.78%	19.18%	27.69%	11.42%		0.40%	
2022		35.21%	58.65%	32.23%			0.08%					
2023		0.98%	28.31%	3.03%								

Sector apportionment 2, 5-year average

	100,000				325,000				550,000			
Year	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2011		42.00%	57.17%	49.61%								
2012												
2013				45.02%								
2014		58.20%		55.93%								
2015		24.29%	30.42%	44.03%								
2016	45.49%	76.39%	75.11%	47.30%		36.36%	22.74%					
2017	83.85%	83.56%	14.53%	55.97%	59.04%	53.33%			15.30%	30.08%		
2018	48.88%	65.99%	46.83%	53.55%	12.92%	9.50%						
2019	41.47%	77.74%	67.01%	56.26%		16.56%	17.65%					
2020	16.93%	64.25%	50.67%	70.02%				19.01%				
2021	11.42%	38.21%	78.72%	77.61%	11.42%	7.89%	19.18%	27.69%	11.42%			3.82%
2022		35.21%	58.65%	32.23%			0.08%					
2023			28.31%	11.55%								

Sector apportionment 3, pro rata

	100,000				325,000				550,000			
Year	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2011		42.00%	57.17%	49.61%								
2012												
2013				45.02%								
2014		58.20%		55.93%								
2015		24.29%	33.43%	44.03%								
2016	45.49%	76.39%	75.11%	47.30%		36.36%	22.74%					
2017	83.85%	83.56%	44.78%	55.97%	59.04%	53.33%			15.30%	30.08%		
2018	48.88%	65.99%	46.83%	53.55%	12.92%	9.50%						
2019	41.47%	72.30%	67.01%	56.26%	0.00%	16.56%	17.65%					
2020	16.93%	64.25%	50.67%	70.02%	0.00%	0.00%	0.00%	19.01%				
2021	11.42%	38.21%	81.89%	77.61%	11.42%	7.89%	19.18%	27.69%	11.42%		0.40%	3.82%
2022		35.21%	58.65%	32.23%			0.08%					
2023			28.31%	11.55%								

Sector apportionment 4, AFA

	100,000				325,000				550,000			
Year	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
2011		8.95%	57.17%	62.06%								
2012												
2013				55.14%								
2014		33.21%		55.93%								
2015		5.31%	33.43%	44.03%				12.62%				
2016	26.48%	71.02%	75.11%	65.04%		2.98%	22.74%					
2017	83.85%	53.33%	44.78%	55.97%	59.04%	30.08%		1.15%	15.30%	0.64%		
2018	48.88%	40.80%	46.83%	60.65%								
2019	21.91%	62.21%	67.01%	71.02%			17.65%	6.98%				
2020		41.80%	50.67%	70.02%				36.38%				
2021	11.42%	38.21%	81.89%	84.69%	11.42%		19.18%	27.69%	0.47%		1.54%	3.82%
2022		35.21%	58.65%	61.99%			0.08%					
2023			28.31%	18.20%								

Table 3-19 Estimates on the number of total chum salmon saved shown as a percent reduction as if the PSC limits and sector apportionments had been in place from 2011 –2023 under Alternative 2

Year	100,000				325,000				550,000			
	CDQ	CP	M	CV	CDQ	CP	M	CV	CDQ	CP	M	CV
Sector Apportionment 1, 3-year average												
2011		3,745	2,533	12,828								
2012												
2013				9,488								
2014		5,072		17,701								
2015		1,768	669	15,424								
2016	1,429	17,493	10,327	17,873		8,771	3,126			629		
2017	19,012	27,939	2,092	19,750	13,386	17,830			13,386	10,056		
2018	3,066	11,643	2,109	16,276	910	4,090						
2019	1,202	3,962	5,118	22,636		844	1,348					
2020	NA	1,238	582	17,939		124		1,341				
2021	696	2,956	2,823	26,016	696	1,762	661	9,281	696		14	
2022		2,830	4,628	12,013			7					
2023		9	277	295								
Sector Apportionment 2, 5-year average												
2011		3,745	2,533	16,097								
2012												
2013				12,705								
2014		5,072		17,701								
2015		1,103	609	15,424		7,665						
2016	1,429	16,101	10,327	17,873		17,830	3,126					
2017	19,012	27,939	679	19,750	13,386	1,676			3,469	10,056		
2018	3,066	11,643	2,109	16,276	810	844						
2019	1,202	3,962	5,118	22,636			1,348					
2020	NA	1,238	582	17,939		610						
2021	696	2,956	2,714	26,016	696		661	9,281	696			1,280
2022		2,830	4,628	12,013			7					
2023			277	1,127								
Sector Apportionment 3, pro rata												
2011		3,745	2,533	16,097								
2012												
2013				12,705								
2014		5,072		17,701								
2015		1,103	669	15,424								
2016	1,429	16,101	10,327	17,873		7,665	3,126					
2017	19,012	27,939	2,092	19,750	13,386	17,830			3,469	10,056		
2018	3,066	11,643	2,109	16,276	810	1,676						
2019	1,202	3,684	5,118	22,636		844	1,348					
2020	NA	1,238	582	17,939				4,869				
2021	696	2,956	2,823	26,016	696	610	661	9,281	696		14	1,280
2022		2,830	4,628	12,013			7					
2023			277	1,127								
Sector Apportionment 4, AFA												
2011		798	2,533	20,135								
2012												
2013				15,559								
2014		2,894		17,701								
2015		241	669	15,424				4,419				
2016	832	14,970	10,327	24,576		629	3,126					
2017	19,012	17,830	2,092	19,750	13,386	10,056		407	3,469	213		
2018	3,066	7,198	2,109	18,435								
2019	635	3,170	5,118	28,576			1,348	2,807				
2020	NA	805	582	17,939			NA	9,321				
2021	696	2,956	2,823	28,389	696		661	9,281	29		53	1,280
2022		2,830	4,628	23,109			7					
2023			277	1,775								

3.2.4.2.2 Estimates of Western Alaska Chum Salmon Savings Under Alternative 2

	100,000				325,000				550,000			
Year	**CDQ**	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**
Sector Apportionment 1, 3-year average												
2011		3,745	2,533	12,828								
2012												
2013				9,488								
2014		5,072		17,701								
2015		1,768	669	15,424								
2016	1,429	17,493	10,327	17,873		8,771	3,126			629		
2017	19,012	27,939	2,092	19,750	13,386	17,830			13,386	10,056		
2018	3,066	11,643	2,109	16,276	910	4,090						
2019	1,202	3,962	5,118	22,636		844	1,348					
2020	NA	1,238	582	17,939		124		1,341				
2021	696	2,956	2,823	26,016	696	1,762	661	9,281	696		14	
2022		2,830	4,628	12,013			7					
2023		9	277	295								
Sector Apportionment 2, 5-year average												
2011		3,745	2,533	16,097								
2012												
2013				12,705								
2014		5,072		17,701								
2015		1,103	609	15,424		7,665						
2016	1,429	16,101	10,327	17,873		17,830	3,126					
2017	19,012	27,939	679	19,750	13,386	1,676			3,469	10,056		
2018	3,066	11,643	2,109	16,276	810	844						
2019	1,202	3,962	5,118	22,636			1,348					
2020	NA	1,238	582	17,939		610						
2021	696	2,956	2,714	26,016	696		661	9,281	696			1,280
2022		2,830	4,628	12,013			7					
2023			277	1,127								
Sector Apportionment 3, pro rata												
2011		3,745	2,533	16,097								
2012												
2013				12,705								
2014		5,072		17,701								
2015		1,103	669	15,424								
2016	1,429	16,101	10,327	17,873		7,665	3,126					
2017	19,012	27,939	2,092	19,750	13,386	17,830			3,469	10,056		
2018	3,066	11,643	2,109	16,276	810	1,676						
2019	1,202	3,684	5,118	22,636		844	1,348					
2020	NA	1,238	582	17,939				4,869				
2021	696	2,956	2,823	26,016	696	610	661	9,281	696		14	1,280
2022		2,830	4,628	12,013			7					
2023			277	1,127								
Sector Apportionment 4, AFA												
2011		798	2,533	20,135								
2012												
2013				15,559								
2014		2,894		17,701								
2015		241	669	15,424				4,419				
2016	832	14,970	10,327	24,576		629	3,126					
2017	19,012	17,830	2,092	19,750	13,386	10,056		407	3,469	213		
2018	3,066	7,198	2,109	18,435								
2019	635	3,170	5,118	28,576			1,348	2,807				
2020	NA	805	582	17,939			NA	9,321				
2021	696	2,956	2,823	28,389	696		661	9,281	29		53	1,280
2022		2,830	4,628	23,109			7					
2023			277	1,775								

Not all of the estimates on chum salmon savings represent WAK fish. Table 3-20

Table 3-20 provides the estimated number of WAK chum salmon (CWAK + Upper/Middle Yukon reporting groups) under the analyzed cap amounts and sector apportionments for Alternative 2 (2011–2023). Estimates are provided in each year the cap was met retrospectively by a sector. Cells without a numerical value indicate years when a sector did not meet a given cap. “NA” denotes a year when a sector would have met the cap but there were insufficient sample sizes to estimate the potential WAK chum savings for the sector.

Under the analyzed options for hard caps and sector apportionments, the numbers of WAK chum salmon saved are substantially less than the estimates on total chum salmon savings presented above. **The retrospective analysis indicates the highest potential reductions in WAK chum salmon PSC from the pollock fleet under a 100,000-chum salmon PSC limit using the AFA apportionment for Alternative 2.** Under this cap amount and apportionment, the highest PSC reductions accrue from the inshore sector in all years. Across all years and sectors, the highest estimate for WAK chum salmon savings was estimated to occur in 2019 from the inshore sector at 28,567 fish under the AFA apportionment for a 100,000 cap.

In 2017, the highest WAK chum salmon savings was estimated to accrue from the CP sector at 27,939 fish under a 100,000-chum salmon PSC limit and all apportionments *except* the AFA split. From 2011–2023, the highest WAK chum salmon bycatch was observed in 2017 at 93,170 fish and the CP sector’s historical WAK chum salmon bycatch in that year was 33,429 fish (see Table 3-13).

There are temporal and spatial dynamics associated with WAK chum salmon PSC encounters that would affect the potential for future savings. For instance, the WAK component of the total chum salmon bycatch is highest in the Early and Middle periods of the B season. A closure earlier in the B season may result in greater chum salmon savings (because fishing is curtailed, and no additional number of chum salmon could be caught) *and* greater WAK chum salmon PSC reductions as compared to an early closure in the later aspects of the B season.

As the analyzed cap increases to 325,000 and 550,000 chum salmon, the estimates on WAK chum salmon PSC reductions decrease compared to the lower limit of 100,000 chum salmon. **Similar to the trends observed for total chum salmon savings, at 325,000- and 550,000-chum salmon PSC limits, the highest fleet-wide WAK chum salmon PSC savings across all years would occur under the 3-year average apportionment.**

Table 3-20 Estimates on the number of WAK chum salmon saved as if the analyzed PSC limits and sector apportionments were in place from 2011–2023 for Alternative 2

	100,000				325,000				550,000			
Year	**CDQ**	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**
Sector Apportionment 1, 3-year average												
2011		3,745	2,533	12,828								
2012												
2013				9,488								
2014		5,072		17,701								
2015		1,768	669	15,424								
2016	1,429	17,493	10,327	17,873		8,771	3,126			629		
2017	19,012	27,939	2,092	19,750	13,386	17,830			13,386	10,056		
2018	3,066	11,643	2,109	16,276	910	4,090						
2019	1,202	3,962	5,118	22,636		844	1,348					
2020	NA	1,238	582	17,939		124		1,341				
2021	696	2,956	2,823	26,016	696	1,762	661	9,281	696		14	
2022		2,830	4,628	12,013			7					
2023		9	277	295								
Sector Apportionment 2, 5-year average												
2011		3,745	2,533	16,097								
2012												
2013				12,705								
2014		5,072		17,701								
2015		1,103	609	15,424		7,665						
2016	1,429	16,101	10,327	17,873		17,830	3,126					
2017	19,012	27,939	679	19,750	13,386	1,676			3,469	10,056		
2018	3,066	11,643	2,109	16,276	810	844						
2019	1,202	3,962	5,118	22,636			1,348					
2020	NA	1,238	582	17,939		610						
2021	696	2,956	2,714	26,016	696		661	9,281	696			1,280
2022		2,830	4,628	12,013			7					
2023			277	1,127								
Sector Apportionment 3, pro rata												
2011		3,745	2,533	16,097								
2012												
2013				12,705								
2014		5,072		17,701								
2015		1,103	669	15,424								
2016	1,429	16,101	10,327	17,873		7,665	3,126					
2017	19,012	27,939	2,092	19,750	13,386	17,830			3,469	10,056		
2018	3,066	11,643	2,109	16,276	810	1,676						
2019	1,202	3,684	5,118	22,636		844	1,348					
2020	NA	1,238	582	17,939				4,869				
2021	696	2,956	2,823	26,016	696	610	661	9,281	696		14	1,280
2022		2,830	4,628	12,013			7					
2023			277	1,127								
Sector Apportionment 4, AFA												
2011		798	2,533	20,135								
2012												
2013				15,559								
2014		2,894		17,701								
2015		241	669	15,424				4,419				
2016	832	14,970	10,327	24,576		629	3,126					
2017	19,012	17,830	2,092	19,750	13,386	10,056		407	3,469	213		
2018	3,066	7,198	2,109	18,435								
2019	635	3,170	5,118	28,576			1,348	2,807				
2020	NA	805	582	17,939			NA	9,321				
2021	696	2,956	2,823	28,389	696		661	9,281	29		53	1,280
2022		2,830	4,628	23,109			7					
2023			277	1,775								

Note: “NA” denotes insufficient sample sizes. Blank cells indicate years where the chum salmon PSC limit was not met by a sector.

3.2.4.2.3 Simplified Adult Equivalent Chum Salmon Savings Under Alternative 2

This section provides estimates on the potential savings of AEQ fish from the CWAK and Upper/Middle Yukon reporting groups under all analyzed caps and apportionment options for Alternative 2 (see Table 3-21 and Table 3-22). Estimates are provided for each year the cap was met retrospectively. Cells without numerical values indicate a sector did not meet a given cap in that year.

The analysis indicates the largest reductions in AEQ chum salmon from both the CWAK and Upper/Middle Yukon reporting groups would occur under a 100,000-chum salmon PSC limit using the pro-rata apportionment. This would have increased returns to CWAK by an average of 21,678 fish and an average of 3,435 fish to the Upper/Middle Yukon (2011–2022).

The highest single year of AEQ reductions was estimated to occur in 2017 under a 100,000-chum salmon PSC limit using the 3-year average apportionment at 47,862 fish from the CWAK reporting group and 11,553 fish from the Upper/Middle Yukon reporting group. This pattern is due to 2016 and 2017 bycatch years having a relatively large component of WAK chum salmon and a large number of age-4 fish. The maturity schedule used in the simplified AEQ model accounted for a large proportion of those fish maturing at age-4 and age-5.

For Alternative 2, all options under consideration would reduce chum salmon PSC and consequently increase returns of adult salmon to their regions of origin. As discussed above, an impact rate for CWAK is not possible. The impact rate of bycatch on the Upper/Middle Yukon reporting group ranged from 0.22% in 2013 to 4.93% in 2021, averaging 1.0% over the time period (2011–2022). An impact rate reduction was not calculated for this reporting group due to the uncertainty in the parameters for the AEQ calculation. However, all estimated reductions due to Alternative 2 (or 3 as discussed below) can be considered in the context of the status quo impact rate.

Table 3-21 Estimates on the number of AEQ chum salmon saved from the CWAK reporting group for all analyzed PSC limits and apportionment options under Alternative 2, 2011–2022

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
100,000, 3-year avg.	8,564	3,946	5,962	14,651	14,501	30,571	47,862	36,365	33,606	16,440	21,226	24,877
100,000, 5-year avg.	9,854	4,540	7,895	15,626	14,211	29,274	46,722	35,986	33,544	16,429	21,150	24,816
100,000, pro rata	9,854	4,540	7,895	15,626	14,239	29,296	47,214	36,276	33,059	16,115	21,158	24,866
100,000, AFA	9,870	4,548	9,547	14,917	12,823	30,389	42,069	31,555	32,434	16,234	21,591	29,978
325,000, 3-year avg.						7,192	19,595	12,221	5,846	2,000	5,594	4,604
325,000, 5-year avg.						6,420	19,151	10,911	4,993	2,193	5,842	4,520
325,000, pro rata						6,420	19,151	10,911	4,993	2,193	5,842	4,520
325,000, AFA					1,461	2,668	12,232	6,724	3,074	2,199	6,670	4,848
550,000, 3-year avg.						439	11,109	6,510	1,296	69	240	214
550,000, 5-year avg.							7,223	4,306	861	46	710	634
550,000, pro rata							7,223	4,306	861	46	717	641
550,000, AFA							1,398	833	166	9	515	460

Notes: Blank cells indicate years where the chum salmon PSC limit was not met by a sector.

Table 3-22 Estimates on the number of AEQ chum salmon saved from the Upper/Middle Yukon reporting group for all analyzed PSC limits and apportionment options under Alternative 2, 2011–2022

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
100,000, 3-year avg.	4,263	985	705	1,337	2,280	6,999	11,553	5,079	1,431	1,379	3,207	1,374
100,000, 5-year avg.	4,905	1,134	925	1,474	2,196	6,696	11,308	5,031	1,427	1,376	3,195	1,370
100,000, pro rata	4,905	1,134	925	1,474	2,203	6,701	11,441	5,065	1,425	1,369	3,203	1,374
100,000, AFA	4,913	1,136	1,108	1,470	2,020	7,019	9,969	4,451	1,306	1,289	3,255	1,594
325,000, 3-year avg.						1,759	4,969	1,588	296	131	867	300
325,000, 5-year avg.						1,570	4,888	1,373	212	238	916	295
325,000, pro rata						1,570	4,888	1,373	212	238	916	295
325,000, AFA					375	602	3,208	805	96	395	1,069	318
550,000, 3-year avg.						108	3,009	777	77	3	38	14
550,000, 5-year avg.							1,971	513	51	2	113	42
550,000, pro rata							1,971	513	51	2	114	42
550,000, AFA							382	99	10	1	82	30

Notes: Blank cells indicate years where the chum salmon PSC limit was not met by a sector.

3.2.4.2.4 Implications Specific to Alternative 3

Under Alternative 3, the PSC limit would be explicitly established in times of low WAK chum salmon abundance. An overall PSC limit would be in place when an index of WAK chum salmon abundance failed to meet one or more of its abundance thresholds in the prior year. There are two options for abundance indices included in Alternative 3, but only one could be selected for implementation.

Alternative 3, Option 1 would include a Three-area index composed of the sum of the Yukon area's summer and fall chum salmon runs as well as returns to the Kuskokwim and Norton Sound areas. **Alternative 3, Option 2** would include an index based on the Yukon Area's summer and fall chum salmon runs. Option 2 is a simplified index based on the analysis prepared in the April 2024 preliminary DEIS that showed the Yukon Area, and in particular the Yukon summer + fall chum salmon runs, was a reliable index for the aggregate dynamics of WAK chum salmon stocks, as measured by the Three-area index (see also the SSC's Minutes from April 2024).

The index thresholds for each area represent either the 25th or 50th percentile of historical run abundance in an area (1992–2022 for the Yukon and Kuskokwim Areas and 1997–2022 for the Norton Sound region, see Appendix 3). The threshold for each Management Area would function as an independent test to determine whether the area is at a state of low or high chum salmon abundance.

Under **Alternative 3, Option 1, t**he Yukon Area needs to have more than 1,713,300 or 2,718,400 combined Yukon summer and fall chum salmon return based on their respective run reconstructions; the Bethel test fishery cumulative CPUE in the Kuskokwim Area needs to be more than 2,800 or 5,200; the Norton Sound Area needs to have more than 57,300 or 91,500 chum salmon return based on the sum of the Snake, Nome, Eldorado, Kwiniuk, and North River escapements plus total chum salmon harvests for the region. If all three areas (3 of 3) have returns above their thresholds, a chum salmon PSC limit **would not** be in effect during the upcoming B season. If two areas (2 of 3) have returns above their thresholds, a chum salmon PSC limit **would** be in effect the following year. The amount would be between 100,000–550,000 chum salmon. If 1 or 0 (1 of 3 or 0 of 3) have returns above their thresholds, a chum salmon PSC limit **would** be in effect the following year. The amount would be set at 75% of the level selected for when one area (2 of 3) has returns above their thresholds

Under **Alternative 3, Option 2,** the Yukon summer chum salmon run would need to be above 1,268,700 or 1,978,700 fish to meet its threshold and the fall chum run having more than 444,600 or 803,000 chum salmon return to meet its threshold. If both stocks (2/2) have returns above the threshold, a chum salmon PSC limit **would not** in effect the following year. If one or neither stock (1/2 or 0/2) has returns above the threshold, a chum salmon PSC limit **would** be in effect the year, set an amount between 100,000 and 550,000 chum salmon. Option 2 does not include step-down provisions for the hard cap amount.

Table 3-23 shows the number of years where historical abundance fell below the 25th percentile in each area (2011–2023), compared with the number of areas that were above the threshold, whether a cap would have been in effect, and at what amount under Alternative 3, Option 2. Table 3-24 provides the same information evaluated at the 50th percentile for each area.

Table 3-23 Years when historical abundance fell below the 25th percentile for each area (gray), compared to a notation of the number of areas that were above the threshold evaluated, whether a chum salmon PSC limit would have been in effect, and at what amount under Alternative 3, Option 1, 2011–2023

Year	Yukon (sum of summer and fall chum run)	Kuskokwim (Bethel Test Fishery)	Norton Sound (Index + Total Harvest)	3 of 3 areas above threshold?	2 of 3 areas above threshold?	1 or 0 areas above threshold?	PSC limit in effect?	PSC limit amount
2011	3,650,141	10,028	202,421	Y	Y	Y	N	
2012	3,569,100	6,894	107,359	Y	Y	Y	N	
2013	4,565,409	5,739	188,104	Y	Y	Y	N	
2014	3,424,269	6,345	215,382	Y	Y	Y	N	
2015	2,806,853	2,945	259,441	Y	Y	Y	N	
2016	3,971,829	3,998	124,397	Y	Y	Y	N	
2017	5,950,983	6,785	324,148	Y	Y	Y	N	
2018	3,189,384	8,205	363,939	Y	Y	Y	N	
2019	2,492,364	6,429	234,270	Y	Y	Y	N	
2020	947,433	1,443	49,762	**N**	**N**	**N**	N	
2021	251,379	327	21,735	**N**	**N**	**N**	**Y**	75% of 100-550k
2022	721,155	2,191	70,702	**N**	**N**	**N**	**Y**	75% of 100-550k
2023	1,215,537	4,304	38,469	**N**	**N**	**Y**	**Y**	75% of 100-550k
25th percentile	**1,713,000**	**2,800**	**57,300**	-	-	-	-	-

Notes: Gray highlighting indicates values below the25th percentile of historical abundance.

Table 3-24 Years when historical abundance fell below the 50th percentile for each area (gray), compared to a notation of the number of areas that were above the threshold evaluated, whether a chum salmon PSC limit would have been in effect, and at what amount under Alternative 3, Option 1, 2011–2023

Year	Yukon (sum of summer and fall chum run)	Kuskokwim (Bethel Test Fishery)	Norton Sound (Index + Total Harvest)	3 of 3 areas above threshold?	2 of 3 areas above threshold?	1 or 0 areas above threshold?	PSC limit in effect?	PSC limit amount
2011	3,650,141	10,028	202,421	Y	Y	Y	N	
2012	3,569,100	6,894	107,359	Y	Y	Y	N	
2013	4,565,409	5,739	188,104	Y	Y	Y	N	
2014	3,424,269	6,345	215,382	Y	Y	Y	N	
2015	2,806,853	2,945	259,441	**N**	Y	Y	N	
2016	3,971,829	3,998	124,397	**N**	Y	Y	**Y**	100-550K
2017	5,950,983	6,785	324,148	Y	Y	Y	**Y**	100-550K
2018	3,189,384	8,205	363,939	Y	Y	Y	N	
2019	2,492,364	6,429	234,270	**N**	Y	Y	N	
2020	947,433	1,443	49,762	**N**	**N**	**N**	**Y**	100-550K
2021	251,379	327	21,735	**N**	**N**	**N**	**Y**	75% of 100-550k
2022	721,155	2,191	70,702	**N**	**N**	**N**	**Y**	75% of 100-550k
2023	1,215,537	4,304	38,469	**N**	N	N	**Y**	75% of 100-550k
50th percentile	**2,718,400**	**5,200**	**91,500**	-	-	-	-	-

Notes: Gray highlighting indicates values below the 50th percentile of historical abundance.

Table 3-25 shows the number of years where historical abundance fell below the 25th percentile each stock compared with a notation of whether a cap would have been in effect, and at what amount under Alternative 3, Option 2. Table 3-26 provides the same information evaluated at the 50th percentile for Yukon summer and fall chum salmon stocks.

Table 3-25 Years when historical abundance fell below the 25th percentile for either the Yukon summer or fall chum salmon run (gray) compared to a notation of whether a cap would have been in effect and at what amount under Alternative 3, Option 2, 2011–2023

Year	Yukon		Did one fail to meet threshold?	Cap?	Cap Amount
	Summer	Fall			
2011	2,406,000	1,244,141	N	N	
2012	2,479,900	1,089,200	N	N	
2013	3,349,600	1,215,809	N	N	
2014	2,467,600	956,669	N	N	
2015	1,978,400	828,453	N	N	
2016	2,581,500	1,390,329	N	N	
2017	3,635,100	2,315,883	N	N	
2018	2,074,700	1,114,684	N	N	
2019	1,689,400	802,964	**Y**	N	
2020	763,200	184,233	**Y**	**Y**	100,00 to 550,000
2021	156,130	95,249	**Y**	**Y**	100,00 to 550,000
2022	478,690	242,465	**Y**	**Y**	100,00 to 550,000
2023	896,850	318,687	**Y**	**Y**	100,00 to 550,000
25th percentile	**1,268,700**	**444,600**	**-**	**-**	-

Notes: Grey highlighting indicates values below the 25th percentile of historical abundance.

Table 3-26 Years when historical abundance fell below the 50th percentile for either the Yukon summer or fall chum salmon run compared with a notation of whether a cap would have been in effect and at what amount under Alternative 3, Option 2, 2011–2022

Year	Yukon		Did one fail to meet threshold?	Cap?	Cap Amount
	Summer	Fall			
2011	2,406,000	1,244,141	N	N	
2012	2,479,900	1,089,200	N	N	
2013	3,349,600	1,215,809	N	N	
2014	2,467,600	956,669	N	N	
2015	1,978,400	828,453	**Y**	N	
2016	2,581,500	1,390,329	N	**Y**	100,00 to 550,000
2017	3,635,100	2,315,883	N	N	
2018	2,074,700	1,114,684	N	N	
2019	1,689,400	802,964	**Y**	N	
2020	763,200	184,233	**Y**	**Y**	100,00 to 550,000
2021	156,130	95,249	**Y**	**Y**	100,00 to 550,000
2022	478,690	242,465	**Y**	**Y**	100,00 to 550,000
2023	896,850	318,687	**Y**	**Y**	100,00 to 550,000
50th percentile	**1,978,700**	**803,000**	**-**	**-**	**-**

Notes: Grey highlighting indicates values below the 50th percentile of historical abundance.

As shown in the preceding tables, there is an inherent lag in the timing of when an overall chum salmon PSC limit would be implemented under Alternative 3. A PSC limit would have been in effect in 3 or 6 years retrospectively under Alternative 3, Option 1 and in 4 or 5 years under Alternative 3, Option 2. At these thresholds, an overall chum salmon PSC limit would not have been in effect year-to-year until there was a consistent decline in abundance, as observed from 2020–2023, and would not be in effect during the first year of a consistent decline.

For instance, the recent period of decline began in 2019 for the Yukon summer and fall chum salmon stocks and persisted through 2023. In 2020, run abundance was very low and a cap would have been implemented under all scenarios, except for Alternative 3, Option 1 when abundance is evaluated based 25th percentile. However, when the 50th percentile was used to evaluate indices, a chum salmon PSC limit of 100,000–550,000 chum salmon would have been in effect in 2016, 2017, and 2020 because one area fell below its threshold. **Abundances evaluated by the higher thresholds at the 50th percentile may detect a decline earlier.**

The methods used to evaluate the potential for chum salmon savings under Alternative 3 are the same as Alternative 2. Additionally, the range of overall chum salmon PSC limits under Alternative 3, Option 2 is the same as that under Alternative 2 (i.e., 100,000–550,00 chum salmon). However, these alternatives are mutually exclusive and a primary difference between them is that a cap would not necessarily be in effect during each B season under Alternative 3. Years where a chum salmon PSC limit would not have been in effect are expected to be best approximated by status quo. However, in 2021, 2022, and 2023 the chum salmon PSC limit in effect under Alternative 3, Option 1 would have been 75% of 100,000–550,000 chum salmon. As stated above, the analysts selected a 75,000-chum salmon PSC limit for analysis of Alternative 3, Option 1 because it uniquely falls outside of the range considered for Alternative 2 and is the lowest hard cap amount being considered.

Table 3-27 provides estimates of chum salmon PSC reductions for a 75,000-chum salmon PSC limit under Alternative 3, Option 1. Estimates are provided for all apportionment options, sectors, and years when a 75,000-chum salmon PSC limit would have been possible based on the current alternative structure. This table uses a 75,000-chum salmon cap which would only be applicable under Alternative 3, Option 1 and demonstrated on the historical years where it may have applied.

	CDQ	CP	M	CV
Sector Apportionment 1, 3-yr avg.				
2021	5,487	2,956	2,823	28,389
2022	98	6,190	4,628	23,109
2023		182	551	1,775
Sector Apportionment 2, 5-yr avg.				
2021	5,487	2,956	2,823	28,389
2022	98	2,830	4,628	23,109
2023		121	551	1,775
Sector Apportionment 3, pro-rata				
2021	5,487	2,956	2,823	28,389
2022	98	2,830	4,628	23,109
2023		121	551	1,775
Sector Apportionment 4, AFA				
2021	696	2,956	2,823	28,389
2022		2,830	4,628	26,349
2023			551	1,775

Table 3-29 provides estimates of WAK chum salmon PSC reductions, and Table 3-29 provides AEQ CWAK and Upper/Middle Yukon chum salmon savings for the 2021 and 2022 B seasons.

Table 3-27 Estimated chum salmon savings under a 75,000-chum salmon-PSC limit for Alternative 3, Option 1, 2021–2023

	CDQ	CP	M	CV
Sector Apportionment 1, 3-yr avg.				
2021	50,134	37,412	41,389	289,446
2022	689	55,285	18,921	81,764
2023		4,234	10,744	12,176
Sector Apportionment 2, 5-yr avg.				
2021	50,134	37,412	41,389	289,446
2022	689	25,278	18,921	81,764
2023		2,822	10,744	12,176
Sector Apportionment 3, pro-rata				
2021	50,134	37,412	41,389	289,446
2022	689	25,278	18,921	93,226
2023			10,744	12,176
Sector Apportionment 4, AFA				
2021	6,358	37,412	41,389	289,446
2022		25,278	18,921	93,226
2023			10,744	12,176

Table 3-28 Estimated WAK chum salmon savings under a 75,000-chum salmon PSC limit for Alternative 3, Option 1, 2021–2023

	CDQ	CP	M	CV
Sector Apportionment 1, 3-yr avg.				
2021	5,487	2,956	2,823	28,389
2022	98	6,190	4,628	23,109
2023		182	551	1,775
Sector Apportionment 2, 5-yr avg.				
2021	5,487	2,956	2,823	28,389
2022	98	2,830	4,628	23,109
2023		121	551	1,775
Sector Apportionment 3, pro-rata				
2021	5,487	2,956	2,823	28,389
2022	98	2,830	4,628	23,109
2023		121	551	1,775
Sector Apportionment 4, AFA				
2021	696	2,956	2,823	28,389
2022		2,830	4,628	26,349
2023			551	1,775

Table 3-29 Estimate of AEQ chum salmon savings from the CWAK and Upper/Middle Yukon reporting groups under a 75,000-chum salmon PSC limit for Alternative 3, Option 1 in 2021 and 2022

Genetic reporting group	Year	Sector apportionment 1, 3-year avg.	Sector apportionment 2, 5-yr avg.	Sector apportionment 3, Pro rata	Sector apportionment 4, AFA
CWAK	2021	24,124	24,068	24,068	23,260
	2022	35,318	31,813	31,813	32,055
Upper/Mid Yukon	2021	3,627	3,625	3,625	3,512
	2022	1,854	1,711	1,711	1,697

3.2.4.2.5 Uncertainty in the Potential Benefits for WAK Chum Salmon Savings

It is uncertain whether overall hard caps would reduce WAK chum salmon bycatch compared to Alternative 1. Pollock fishermen would target areas with good pollock aggregations and low chum salmon bycatch rates while balancing other considerations to stay below the cap. The fleet may be able to use different strategies, such as increased movement, communication, or test tows, but this would not necessarily result in lower WAK chum salmon bycatch (Figure 3-17).

As an example, 2022 B season bycatch of 242,309 chum salmon was a 55% reduction from the 2021 B season bycatch of 545,901 chum salmon. Despite this decrease in the overall bycatch in 2022, the estimated number of WAK chum salmon caught as bycatch in the 2022 B season was 55,724 chum salmon s compared to 51,512 WAK chum salmon in the 2021 B season. This represented an 8% increase in WAK chum salmon bycatch. Reducing chum salmon bycatch to the lowest levels observed in the time series could reduce the number WAK chum salmon caught as bycatch in the pollock fishery (e.g., 2012, 2013, and 2023), but the proportion of WAK chum salmon in the total bycatch would still be expected to be variable. Moreover, the potential benefits would depend on fishing behavior, chum salmon bycatch encounters, and the proportion of WAK chum salmon encountered in the total bycatch in a given year.

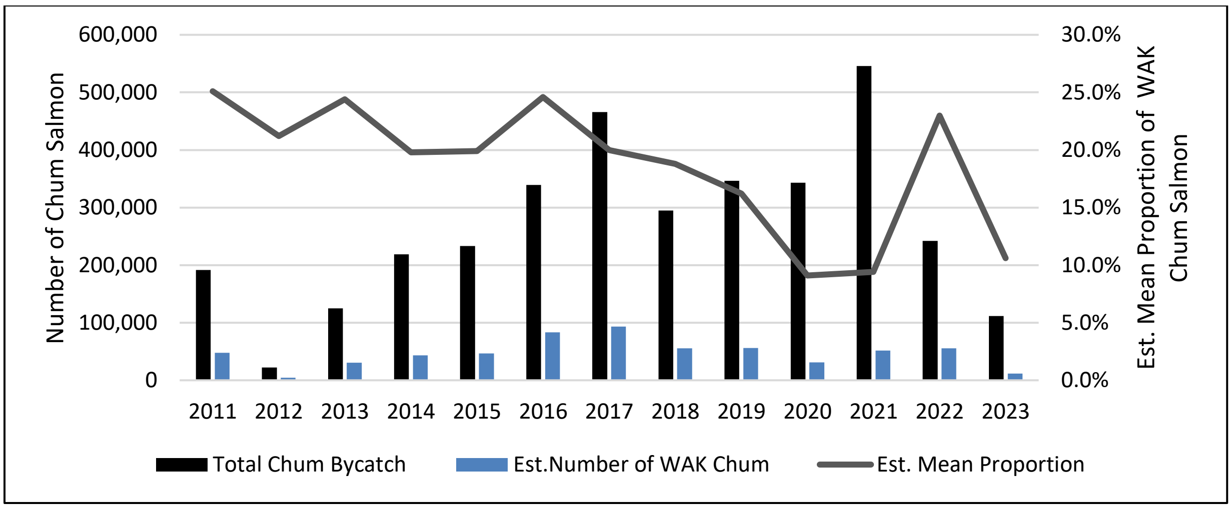

Figure 3-17 Comparison of the total B season chum salmon bycatch, estimated number of WAK chum salmon, and estimated mean proportion of WAK chum salmon in the overall bycatch from 2011–2023

3.2.4.2.6 Operational Considerations for Chum Salmon Avoidance

As noted previously, the analysts expect fishing behavior would change if the pollock fleet was required to operate under a chum salmon PSC limit (Alternative 2 or 3) in the future. The magnitude of these behavior changes would likely reflect the degree to which harvesters see the PSC limit as a risk. The fleet currently uses a variety of strategies to avoid chum salmon PSC on the fishing grounds – frequent communication among the fleet and cooperative managers, the RHS program that requires vessels to move to new areas when bycatch rates are unacceptably high, excluder devices, among others. This section addresses some of the additional tools that could be available to the fleet based on a comparison of the current Chinook program.

That being said, industry representatives have conveyed chum salmon PSC is encountered on the pollock fishing grounds differently than Chinook. Whereas Chinook encounters are more intermittent, chum salmon can be encountered in large pulses and intermixed with pollock. These differences in how the two species are encountered may diminish the utility of some comparisons, but it also highlights a challenge the industry will need to address if it is required to operate under a constraining chum cap. Specifically, the more dynamic nature of historical chum salmon PSC encounters may make the potential risk of a sudden high PSC event (i.e., haul or trip) greater and more difficult to plan for. It is expected the fleet may need to use more conservative fishing practices relative to the strategies used to avoid Chinook salmon PSC, such as building in larger buffers under the limit to decrease the likelihood the sector is closed down, or considering proactive measures (e.g., more test tows, consolidation of pollock harvest on more efficient pollock harvesting vessel and/or vessels that have historically had lower chum salmon PSC at the beginning of the B season, etc.) if the risk is perceived to be too great.

In addition to more conservative fishing practices, the cooperatives or IPAs may choose to apportion the chum salmon PSC limit to individual vessels (i.e., "vessel-level" apportionments). As described in Chapter 2, the chum salmon PSC limit would be apportioned among the sectors and further divided among the CDQ groups and inshore sectors by NMFS. Vessel-level apportionments would not be set in federal regulations but rather handled internally. This is how the IPAs currently manage individual vessels under the Chinook salmon PSC limit to create greater individual accountability and reduce the likelihood a sector would reach that cap. The IPAs also create different buffers to ensure member vessels stay below the Chinook salmon PSC limit, including dividing the lower PSC limit (i.e., threshold amount) among members or deducting an "insurance pool" off the top to reduce the risk of reaching the cap (see Appendix 1). Internal apportionments would need to be accompanied by agreements from associated companies/vessels to adhere to these levels (through IPA agreements, for instance). If these internal apportionments were not agreed to with clear and binding penalties, it could create a moral hazard situation where vessels from different companies within a cooperative would be insulated from the risk of closure if they caught their directed fishery allocation quickly (Holland & Jannot 2012).

These strategies appear to have been an effective strategy for the Chinook salmon PSC limit when paired with the Chinook RHS program and additional incentives specified in the IPAs (see Appendix 1). The fleet has remained under the Chinook hard cap limits every year since the limits were implemented in 2011 with Amendment 91, and no sector has triggered the performance standard. Only once has the CP sector exceeded the threshold amount (i.e., lower of the two Chinook salmon PSC limits) in 2019. However, it is challenging to say if the pollock fleet would be as effective at operating under a chum salmon PSC limit while still harvesting the pollock TAC which would depend on the PSC limit amount, apportionment approach, pollock aggregations, and how harvesters manage interactions with multiple PSC species with constraining limits.

Similar to the Chinook salmon PSC limits, the proposed chum salmon PSC limits would be transferable at the vessel-to-vessel level, within cooperative, between cooperatives and even between sectors. Given that chum salmon PSC is encountered differently than Chinook, harvesters and cooperative managers may place greater emphasis on the transferability provisions. This would be the case if a chum salmon PSC limit is chosen that is seen as insufficient or too great a risk to support a certain level of pollock harvest. While it might be assumed the transferability provisions will create an opportunity for the fleet to coordinate an efficient transfer of chum salmon PSC where it is needed, minimizing the amount of pollock TAC left unharvested, there are practical and operational reasons why this quota may not be transferred smoothly and efficiently to the parts of the fleet that may have a demand for additional chum salmon PSC.

The highly uncertain and variable nature of chum encounters may result in vessels unwilling to transfer the chum salmon PSC due to associated risk later in the season. Bycatch encounters that are highly uncertain and variable are likely to generate inefficient markets for PSC that are thin, lumpy and subject to price variability (Holland 2010). In fact, it appears that open markets for Chinook salmon PSC have never developed. Despite the flexibility for transfers, Chinook salmon PSC is typically only transferred as paired transfers with a matching pollock apportionment within cooperatives. Additionally, it may be contract-fished by a vessel outside of the cooperative (under the provisions laid out in Amendment 69); however, the cooperative for which the vessel is contract fishing for must supply both the pollock and the Chinook salmon PSC.

Finally, the analysts note this section has thus far focused on the operational structure of the AFA cooperative and IPAs which are largely formed around the cooperatives. Exceptions include CDQ groups that are members to applicable IPAs. Inshore CVs that do not join a cooperative are managed by NMFS under the inshore open access fishery (as described in Section 2.3). Vessels that participate in the open access fishery can deliver pollock to the inshore processor of their choice, but they could face a scenario where they race to fish the open access fishery allocation. To determine the amount of the chum salmon PSC limit that would apply to the inshore open access fishery in years when it exists, NMFS would calculate an amount of chum salmon PSC based on the proportion of the vessel's pollock catch history in the inshore open access.

From 2011-2023, participation in the open access fishery has been rare. In 2024, the Peter Pan Fleet Cooperative did not file an AFA cooperative application, and 10 vessels joined the open access fishery. Although the inter-cooperative manager helped to facilitate pollock harvests and PSC management among open access CVs in 2024,[68] this type of scenario could present itself in the future. It is not clear if vessels would continue to (or again) operate under this cooperative framework. If a chum salmon PSC limit was adopted under Alternative 2 or 3, and vessels in the open access sector were operating without voluntary cooperative agreements, this could add another dimension to constraining the catch for other open access vessels.

3.2.4.3 Alternative 4

Alternative 4 would increase the provisions to reduce chum salmon bycatch under the IPAs and are discussed in order below. The proposed provisions reflect the recommendations for alternatives proposed by the Salmon Bycatch Committee and brought forward to the Council in April 2023. The Council requested IPA representatives provide proposals on how the IPAs would respond to the proposed regulatory measures under Alternative 4 in advance of the April 2024 Council meeting. The subsequent analysis is based on the content of those proposals.[69] It is also worth noting that industry has been proactive at responding to these provisions, and each IPA has been recently amended to include measures that generally align with these provisions for the 2022, 2023, and/or 2024 B seasons.

The provisions analyzed under Alternative 4 are intended to reduce chum salmon PSC, particularly WAK chum salmon PSC, within the IPAs. It is not possible to quantify the potential reductions in salmon bycatch for each provision relative to status quo. Nevertheless, each alternative is analyzed for its potential to reduce chum and WAK chum salmon bycatch, and the analysis indicates Alternative 4 would likely reduce chum and WAK chum salmon bycatch compared to status quo.

3.2.4.3.1 Provision 1: Describe the Use of Historical Genetic Information for Avoidance Areas

The IPAs have indicated they would respond to Provision 1 by using historical salmon bycatch genetics data to determine when and where WAK chum salmon are more likely to be encountered on the pollock grounds. This evaluation would be completed on a weekly basis for ADF&G stat areas. **A benefit of incorporating this measure within the IPAs is that it explicitly evaluates whether areas may be more likely to have higher proportions of WAK chum salmon, and its prioritization of greater WAK chum avoidance, particularly when multiple areas have been identified as hotspots**. When this scenario occurs, deference would be given to the area(s) with higher potential for encountering WAK chum salmon. That being said, it is less likely that there would be a need to prioritize hotspot areas when chum salmon bycatch rates are below RHS program thresholds such that closures are not needed in a given week, fewer than four hotspots are identified in a given week, and/or managers are weighing the tradeoffs between implementing a closure with very different historical estimates on WAK chum salmon proportions (e.g., choosing between a hotspot in Pervents or Unimak).

[68] S. Zagorski, personal communication.
[69] The IPA proposals are available in Appendices 3 and 4 of the April 2024 preliminary DEIS.

Although historical genetic stock composition estimates are not currently available by week or groundfish stat area, estimates on the proportion of WAK chum salmon in the total bycatch are available for larger time periods and spatial areas. These data can be used to inform fleet movement at these smaller scales. Table 3-30 provides the estimated proportion of WAK chum salmon bycatch by fishing grounds area during the Early and Late periods of the B season (2019–2023). The fishing grounds areas were developed by Sea State to inform RHS program management and shown in Figure 3-18. There is some alignment with the cluster areas used by ABL geneticists, but the fishing grounds are slightly smaller and more closely align with how the fleet is moved under the program inseason.

WAK chum salmon have been encountered in higher proportions in the Unimak fishing grounds in both the Early and Late periods compared to other fishing grounds. The estimated proportion of WAK chum salmon was typically higher in Unimak during the Early period compared to the Late period. Higher proportions of WAK chum salmon were also encountered in the Shelf Edge, although the proportion has been slightly greater during the Late period.

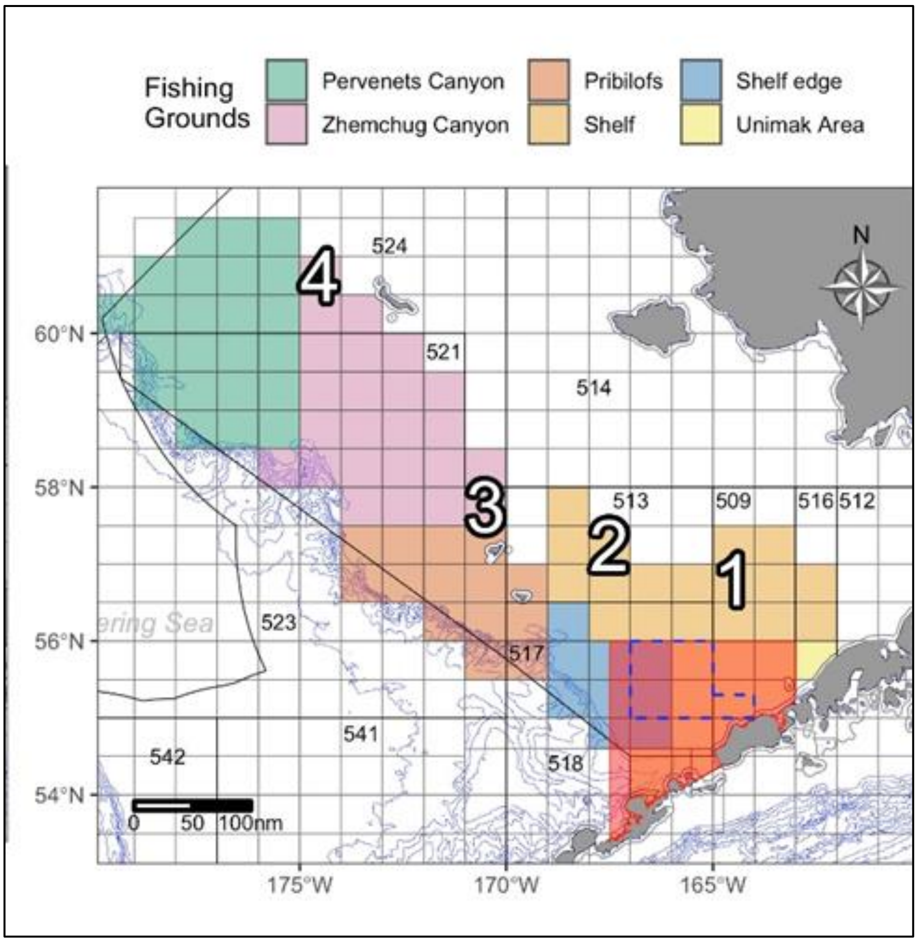

Figure 3-18 Map of fishing grounds areas developed by Sea State as well as the CVOA (red) and Chum Salmon Savings Area (blue dashed line)

Source: Sea State.

Table 3-30 Estimated mean proportion of WAK chum salmon bycatch during the Early and Late periods by fishing grounds area

	Unimak		Shelf		Shelf Edge		Pribilofs		Zemchung		Pervents	
Year	**Early**	**Late**	**Early**	**Late**	**Early**	**Late**	**Early**	**Late**	**Early**	**Late**	**Early**	**Late**
2019	33.6	18.5	-	-	11.2	11.4	11.2	17.9	-	-	-	5.1
2020	-	14.1	-	-	6.1	7.7	-	6.4	-	-	-	1.7
2021	9.3	13.6	-	-	8.7	17.3	-	7.1	-	-	-	-
2022	29.2	31.3	23.3	-	16.4	16.5	-	12.4	-	-	-	-
2023	15.8	14.6	-	-	12.3	12.5	5.2	11.9	4.9	6.9	-	-

Notes: Hyphens denote insufficient sample sizes.

It is expected the fleet would carefully balance prioritizing WAK chum salmon avoidance with other considerations, such as moving vessels out of areas with good pollock CPUE to other fishing grounds where the bycatch rates and aggregations of pollock are uncertain. Moving the fleet to areas with lower pollock catch rates increases the likelihood the B season would extend later in the year. To illustrate some of these potential tradeoffs, Table 3-31 shows the number of chum salmon caught as bycatch, the pollock harvest (mt), and bycatch rate in each fishing grounds area for the 2021 and 2022 B seasons.

Table 3-31 Number of chum salmon caught as bycatch, B season pollock catch (mt), and bycatch rate in each fishing grounds area for 2021 and 2022

Fishing grounds	2021			2022		
	Chum salmon PSC	**Pollock (mt)**	**Rate**	**Chum salmon PSC**	**Pollock (mt)**	**Rate**
Unimak	193,969	356,108	0.54	110,795	247,880	0.44
Shelf Edge	296,967	99,437	2.98	46,160	79,877	0.57
Shelf	5,738	2,070	2.77	24,272	67,652	0.35
Pervents	35,686	72,975	0.48	31,972	97,756	0.32
Pribilofs	61	9,220	0.01	4,487	4,969	0.90
Zemchung	13,480	213,722	0.54	24,623	90,779	0.27

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

In 2021, the pollock fishery was widely distributed across the grounds but the majority of pollock was harvested in Unimak (47% of total). The highest level of bycatch and bycatch rate occurred in the Shelf Edge. These total chum salmon bycatch data, combined with historical genetic information, indicate moving the fleet out of the Unimak and Shelf Edge fishing grounds may be an effective strategy to prioritize WAK chum salmon avoidance. However, this would likely pose a tradeoff for the CV fleet. Many vessels are limited in their ability to move further northwest. This point is addressed in greater detail under the analysis of Alternative 5 which includes larger time/area closures in similar areas.

The 2022 B season pollock harvest was lower than 2021 but fishing was again widely distributed across the grounds and the majority of pollock was harvested in Unimak (42% of total) followed Pervents (17% of total). The B season bycatch rate was highest in the Pribilofs (0.90 chum salmon per mt of pollock), but this rate was substantially lower than the highest rate observed in 2021 (2.98 chum salmon per mt of pollock). Notably, the amount of pollock harvested in the Shelf fishing grounds increased in 2022 as compared to 2021.

The fleet implemented new chum salmon avoidance measures in 2022 in response to the Council's request for the pollock industry to take immediate steps to reduce bycatch following the high bycatch year in 2021. The CV fleet implemented Advisory Avoidance areas based on small amounts of inseason data and historical knowledge of where high chum salmon PSC rates occurred. The first Advisory Avoidance area went into effect on June 29 and remained in place until July 30. Two more areas were identified on July 19, one of which was extended and remained in effect until August 15 (Figure 3-19). These Advisory Avoidance Areas align with the Shelf Edge where chum salmon bycatch rates were very high in 2021.

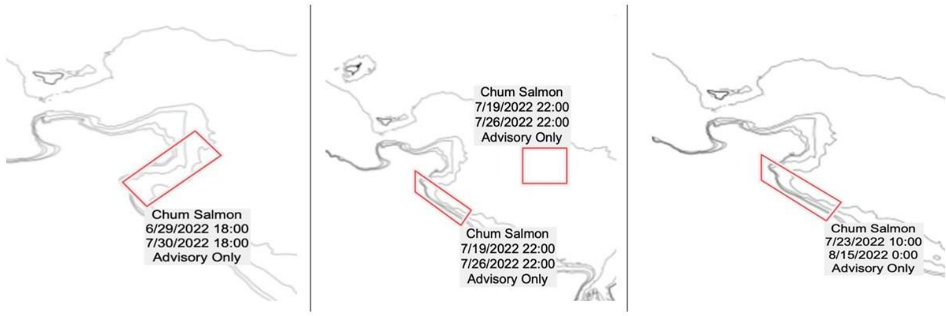

Figure 3-19 2022 B season chum salmon advisory avoidance areas for the CV fleets
Source: Sea State

The pollock fleet was able to achieve a lower level of bycatch in 2022 (242,309 fish) at least in part by proactively moving the fleet away from areas with historically high bycatch rates, in addition to operating the RHS program as normal. Potentially in response to these areas coming into effect, there was an increase in fishing effort further east in the Shelf grounds. The estimated proportion of WAK chum salmon in the overall bycatch substantially increased from 9.3% in 2021 to 23.0% in 2022.

Comparing the 2021 and 2022 B seasons shows the inherent challenge of reducing WAK chum salmon *and* total chum salmon bycatch, but also the reality that each fishing year is slightly different. These differences could be due to where good aggregations of pollock are, how long aggregations of pollock can sustain fishing, the costs associated with traveling to new fishing grounds, efforts to avoid other PSC species, among many other factors. However, additional chum salmon bycatch genetics data are available each year and can be incorporated into the RHS program's likelihood analysis, and each year of fishing presents new information that can be used to enhance tools for WAK chum salmon avoidance. For instance, an estimate of the proportion of WAK chum salmon encountered in the Shelf fishing grounds are only available for the 2022 B season in recent years. It is expected that RHS program managers would use these data in the future to help inform or prioritize hotspots for WAK chum salmon avoidance.

3.2.4.3.2 Provision 2: Evaluate Closures More Than Once Per Week

Provision 2 would modify regulations to require the IPAs to describe how potential chum salmon avoidance closures would be evaluated more than once per week. The current program implements hotspots on a weekly basis where the new weekly Base Rate and any applicable hotspot closures are announced on Thursday evenings and take effect the next day (i.e., Friday to Friday closures). Under Provision 2, this practice would continue, *and* relevant pollock catch and bycatch data would be evaluated on Monday for potential Tuesday to Friday closures. The CP IPA has required bi-weekly evaluation of hotspot closures since 2022. The Inshore SSIP and MSSIP added a similar measure which took effect for the first time in the 2024 B season.

A primary benefit of incorporating this measure within the IPAs is that it requires relevant data to be evaluated more frequently, which has the potential to reduce chum salmon bycatch compared to status quo. Whether chum bycatch numbers or bycatch rates are increasing compared to prior days of fishing is only known after the fact. This measure reduces the possibility that bycatch rates would increase without a reaction from the fleet to avoid these areas. Program managers would weigh the tradeoffs of **not** advising or requiring the fleet to move after a Monday evaluation of data because there could be a risk of allowing the fleet to continue fishing in the area until the upcoming Friday. These dynamics are an important nuance to this measure because its effectiveness would likely not be detectable based on the number of Tuesday closures implemented in the future. The relative effectiveness of this measure may be able to be "seen" in retrospective data by a reduction in the weekly bycatch rates and peaks.

To illustrate this, the weekly bycatch rate and chum bycatch numbers were pulled for the CP sector in 2021, 2022, and 2023. As shown in Figure 3-20 and Figure 3-21, the peak bycatch rate and level have decreased over time in line with what would be expected. For instance, the bycatch rate in statistical week 36 in 2022 was 1.77, slightly below the weekly peak in 2021 at 1.99 chum salmon. However, the overall number of chum salmon bycatch that these rates reflect are substantially different. In 2021, 51,406 chum salmon were caught as bycatch in statistical week 31 when the rate was 1.99 chum salmon per mt of pollock compared to 2022 when 10,044 chum salmon caught as bycatch in statistical week 36.

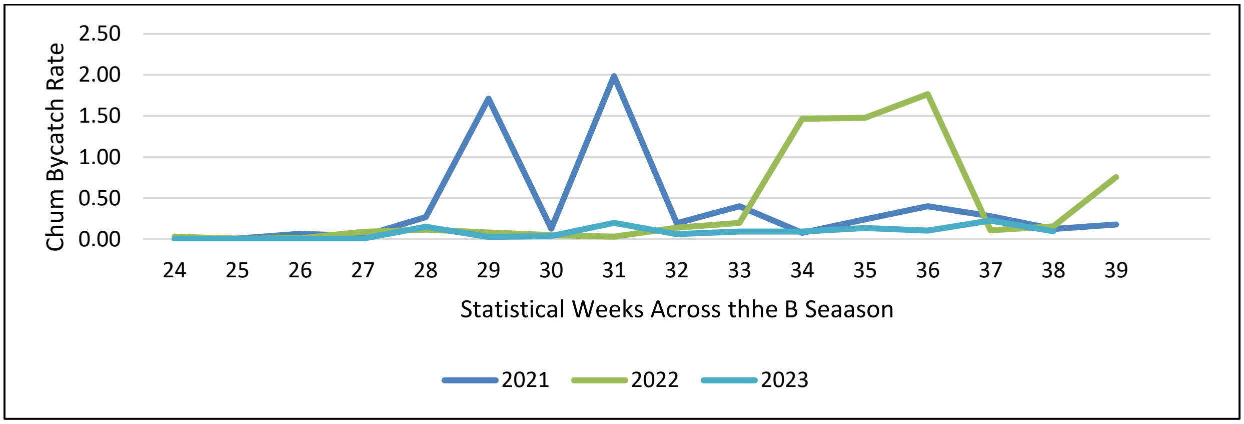

Figure 3-20 Weekly B season chum salmon bycatch rate for the CP sector in 2021, 2022, and 2023
Source: NMFS Alaska Region CAS, data compiled by AKFIN.

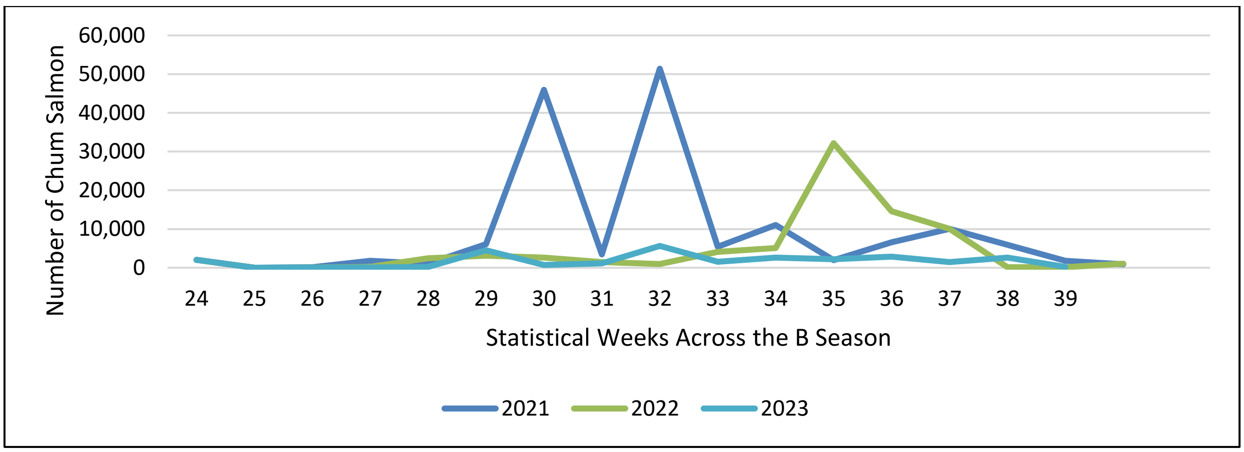

Figure 3-21 Weekly B season chum salmon bycatch for the CP sector in 2021, 2022, and 2023
Source: NMFS Alaska Region CAS, data compiled by AKFIN.

3.2.4.3.3 Provision 3: Require an Excluder Device for the Duration of the B Season

Provision 3 would modify regulations to require vessel operators governed by the IPAs to use salmon excluder devices for the full duration of the A and B pollock fishing seasons. Salmon excluders are bycatch reduction devices that allow for salmon to escape the pelagic trawl net with minimal losses to pollock catch. The general concept for excluder devices is that they have large escapement portal(s) to allow salmon to escape from the retentive section of the trawl net. The designs are based on salmon being much stronger swimmers than pollock; salmon can make their way forward in a pollock trawl net and react to changes in water flow and oncoming pollock whereas pollock are not able to swim forward and react to eddies or lees in the net created by the excluder device (EFP 2018-03 Final Report).

Existing regulations require the use of salmon excluder devices, with recognition of contingencies, from January 20 to March 31, and from September 1 until the end of the B season (see 50 CFR 679.21(f)(12)(iii)(E)(11). Any additional salmon savings compared to status quo would result from the required use of an excluder device from June 10 to September 1. Vessels typically leave a salmon excluder device in the trawl net for the duration of the B season, even though it is not currently required by regulation, because the device provides an opportunity for salmon to escape the trawl net, and it is a significant effort to change fishing gear midseason. As such, **Provision 4 would not have an additional effect on the current practices of pollock fishing vessels in terms of salmon excluder use, but the status quo regulations would be modified to align with current practices as discussed below.**

The **CP IPA** currently requires the use of a salmon excluder device during trawls made during the A season and the end of the B season (September 1 onward) in accordance with existing regulations, but it is common practice for all CPs to leave the excluder device in the net during the entire B season. The **MSSIP** currently requires member vessels to use salmon excluders at all times when fishing in the mothership sector. If a contingency arises (e.g., a torn net) that would prohibit a vessel from using the excluder device, the vessel must report to the IPA representative the circumstances of why the excluder was not used. Based on recent MSSIP reports, no contingencies have resulted in vessels temporarily not using a salmon excluder device (2019 –2023).

The **Inshore SSIP** requires all A season tows be made with a salmon excluder and all B season tows after August 31st as well, but it is common practice for CVs to leave the excluder device in the net during the entire B season. In 2023 (as with other recent years), recognizing certain contingencies, there were two vessels that did not use a salmon excluder device during fishing operations. These two vessels operated trawl nets that utilize fish pumps to get the fish aboard rather than hauling the codend up a stern ramp. The type of net associated with a fish pump does not support the use of an effective excluder at this time (2023 Inshore SSIP).

In addition to excluder devices, live feed camera systems are used by all CPs and six CVs. These camera systems were originally used during the development of salmon excluders to ensure the device was taking its proper shape. These cameras provide a front facing view of the composition of the catch entering the codend. The camera system itself is not a tool that improves bycatch avoidance (compared to an excluder device for example), but it can inform a skipper's decision to stop a tow and haul the net back early because the composition of pollock and salmon in the net is perceived to be too high (2023 CP IPA). These camera systems are cost prohibitive for many vessels at approximately $500,000. However, vessels equipped with live feed systems communicate what the skipper is seeing in terms of catch composition on the camera with cooperative managers and vessels fishing nearby.[70]

3.2.4.3.4 Provision 4: Require Outlier Provisions

Provision 4 would require the pollock sectors to develop measures to identify outliers for chum salmon bycatch performers and implement those measures within their IPA. **A primary purpose of Provision 4 is to reduce the potential for a vessel to consistently maintain higher chum salmon bycatch rates compared to other vessels fishing at the same time (i.e., an outlier). Restrictions or penalties targeted at outliers can induce changes in fishing behavior and are a way for the IPAs to improve individual vessel behavior.** Changes in fishing patterns can involve several different behaviors: avoiding areas that recently had high bycatch rates, using and sharing information on high bycatch areas; and moving vessels immediately once a high bycatch area has been identified.

[70] Personal communication, S. Zagorski and H. Berns, United Catcher Boats.

To be effective, the outlier provision would need to provide operators an incentive to change where they fish to avoid chum salmon bycatch. All other factors being equal, it is anticipated vessels would fish in an area with high pollock catch rates and that other vessels might choose to move to that area if they are able to. Any incentive that would increase the cost of catching chum salmon would reduce the likelihood that vessels would fish in areas with the highest bycatch rates, even if pollock catch rates are very good.

The definition of an "outlier" – how far above average a vessel can be without incurring a penalty –would be defined by the respective IPAs as would the penalty for any vessel identified as an outlier. The CP IPA incorporated an outlier provision for chum salmon in 2022. Under this IPA, a vessel is identified as an outlier when their chum salmon bycatch rate is more than 1.5 standard deviations above the sector's average bycatch rate. A vessel identified as an outlier for two consecutive B seasons is prohibited from fishing in any hotspot closure the following year. Had this measure been incorporated within the IPA in prior years (2019–2023), four CPs would have been identified as having chum salmon bycatch rates greater than 1.5 standard deviations from the mean. Of these four CPs, two would have been identified as an outlier for two consecutive B seasons and incurred the penalty the following year.

Basing the penalty on two consecutive seasons of high chum bycatch allows vessels one fishing season to adjust their behavior following one poor performing season/year and reduces the likelihood of situations where vessels have high bycatch for sustained periods of time. A CP's primary incentive to maintain good chum salmon bycatch performance is to avoid the penalty of losing the ability to fish inside a closure area the following year. The strength of the incentive depends on how often a vessel uses the flexibility afforded by its performance to fish inside a hotspot area, or the relative importance of maintaining this operational flexibility even if it is not used.

It is staff's understanding that the CV fleet intended to begin developing an outlier provision during the 2024 B season with the goal of using inseason experience and information to craft the measure.

3.2.4.3.5 Provision 5: Require IPAs to Provide Weekly Reports to Western and Interior Alaska Salmon Users

Provision 5 would require the IPAs to provide weekly reports to Western and Interior Alaska salmon users. The current regulations at 50 CFR 679.21(f)(12)(iii)(D) require the IPA to identify at least one third party group that "include any entities representing Western Alaskans who depend on salmon and have an interest in salmon bycatch reduction but do not directly fish in a groundfish fishery." Bering Sea Fishermen's Association fulfills this third-party role under the current IPAs. At this time, it is not clear what measures the IPAs would implement to meet this provision, but the intent is to increase public transparency and communication beyond reports currently being distributed to the third-party.

3.2.4.3.6 Provision 6: Require IPAs to Prohibit Fishing in Areas with Very High Bycatch Rates

Provision 6 would require the IPAs to prohibit all vessels from pollock fishing in ADF&G groundfish statistical areas that have a very high weekly bycatch rate. The CP IPA incorporated this measure in 2022; they defined a very high weekly bycatch rate as greater than 5 chum/mt of pollock. The Inshore SSIP and MSSIP have defined an area with very high bycatch rates as a stat area with a weekly bycatch rate greater than 3 times the Base Rate. **A primary benefit of this provision is that it would close areas where bycatch rates are determined to be very high, likely resulting in some level of salmon savings as vessels are required to avoid the entire statistical area regardless of their performance. These larger closures would occur in addition to any RHS closures.**

The analysis evaluates the number and location of ADF&G groundfish stat areas that would have met the CP sector's threshold in 2022 and 2023 when this measure was in place. Three stat areas had a weekly bycatch rate above 5 chum/mt of pollock in 2022 and four stat areas were above that threshold in 2023 (see Table 3-32). Closing stat areas with very high chum salmon bycatch rates would likely reduce chum salmon bycatch, but the potential for WAK chum salmon savings would depend on where the closed stat area is located, when the rates were identified as being very high and thus were closed during the B season, how much effort is displaced from the area, and ultimately where vessels move to.

For instance, in 2022, closing stat area 765900 in the Pervents fishing grounds would be unlikely to result in WAK chum salmon savings because the Late period proportions have historically been low or non-estimable because of insufficient sample sizes (see Table 3-30). However, closing statistical area 715630 in the Pribilofs fishing grounds in 2023 during the Late period could have resulted in WAK chum salmon savings, depending on where vessels moved to. The estimated proportion of WAK chum salmon in the Pribilofs fishing grounds during the Late period was 11.9% in 2023.

Unique to the CP IPA, the potential for chum salmon savings would also be affected by whether an area was closed due to CP rates or CV rates because the sector uses fleet-wide data to inform its hotspot program. Statistical areas 655500, 645434, and 644501 are located inside the Unimak fishing grounds which historically has had a higher proportion of WAK chum salmon in the Late period, compared with other fishing grounds. WAK chum salmon savings could have resulted from closing these areas to CPs if they intended to harvest CDQ pollock. These two stat areas are located inside the CVOA where CPs are prohibited from harvesting AFA pollock.

Table 3-32 ADF&G groundfish statistical areas where the weekly chum salmon bycatch rate for CPs exceeded 5 chum salmon per mt of pollock (Provision 6 of Alternative 4) in 2022 and 2023

Year	Statistical area	Fishing grounds	Statistical week during the B season	Weekly rate in the area
2022	765900	Pervents	36	6.3
	655500	Unimak	33	5.4
	645434	Unimak	33	5.5
2023	715630	Pribilofs	33	6.1
	655500	Unimak	33	11.4
	655430	Unimak	33	5.1
	645501	Unimak	33	11.4

3.2.4.4 Alternative 5

Alternative 5 includes three different options for inseason corridors. Only one corridor option could be selected and recommended for implementation. These corridors are defined areas in the Bering Sea that would close to pollock fishing if or when a sector met the corridor-specific chum salmon PSC limit. Only chum salmon caught inside the corridor from June 10 to August 31 would count towards the cap. If a corridor closed to a sector at any point between June 10 to August 31, the sector could continue fishing outside of that area until September 1. From September 1 onward, a sector previously closed out of the corridor could return to fishing inside.

- Option 1: Cluster Area 1. Cap amounts range from 50,000 to 200,000 chum salmon.
- Option 2: Unimak Area. Cap amounts range from 50,000 to 200,000 chum salmon.
- Option 3: Cluster Area 2. Cap amounts range from 50,000 or 100,000 chum salmon

While other portions of this analysis have largely provided an impact analysis that focuses on grounds-wide data (e.g., levels of bycatch during the B season), the impact analysis for Alternative 5 is based upon comparison with the current B season bycatch and pollock catch by sector inside these corridors. The potential benefits of this alternative in terms of chum salmon savings could result from a closure that prohibits a sector from fishing inside a corridor for a period of time, theoretically redistributing fishing to areas with lower chum salmon encounters. Savings could also be realized by vessel operators changing their behavior to stay below the cap. However, there is a high degree of uncertainty in whether these corridor closures will result in chum salmon savings compared to Alternative 1 (status quo). Whether chum salmon savings or WAK chum salmon savings could result from a corridor in a given year would depend on the fishing conditions, the bycatch rates where vessels moved to, and the proportion of WAK chum salmon in those new areas which would only be known the following year**.**

The Council added Alternative 5 for consideration in April 2024 and thus the analysis provides more detail on the methods, assumptions, and results for consideration because it is new information.

3.2.4.4.1 Methods Used to Analyze Alternative 5

3.2.4.4.1.1 Fleet Movement Model

To provide decision-makers estimates on the potential chum salmon PSC reductions under Alternative 5, the analysts built a "Fleet Movement Model" that displaces B season pollock catch (mt) and chum salmon PSC from a corridor when a sector would have reached its apportionment of a corridor cap. **More specifically, the model was developed to aid decision-makers in comparing three different, and mutually exclusive, corridors. After developing the model, it was apparent there are several limitations to the model and the ability for model results to predict future fishing behavior based on prior fisheries-dependent data.**

At the outset of model development, the analysts reviewed the SSC's minutes and recommendations from June 2023 and February 2024 on the recent Bristol Bay Red King Crab (BBRKC) EA/RIR, and considered both the available data, as well as time and resources needed to build the model, compared with those that were available[71]. The Fleet Movement Model uses a "proportional approach" to redistribute pollock catch (mt), chum salmon PSC, and Chinook salmon PSC from a corridor that closed to a sector to all ADF&G statistical areas (or "stat areas") outside the corridor that had catch, in proportion to the catch that occurred. The final results of the model include an estimated net change in PSC to occur within the closure window.

Estimates of pollock catch and chum and Chinook salmon PSC from 2011–2023 were obtained from NMFS's CAS. This model used a spatial resolution similar to how salmon are accounted for in CAS. Haul-level PSC accounting was maintained when haul-specific data were available from at-sea observers for CPs and motherships. Inshore CV's PSC used the spatial resolution of the stat areas associated with pollock landings and census counts of salmon that occur at delivery.

The data were evaluated for each corridor-specific PSC limit and apportionment method being considered to determine when the corridor would have closed for a given sector and year. The model redistributed pollock catch and salmon bycatch on a weekly basis to the areas where catch occurred outside of the corridor through August 31. Weekly runs were chosen because chum salmon PSC encounters, bycatch rates, and pollock fishing locations are variable throughout the B season. For each week that a closure would have occurred, the sum of the pollock catch inside the closed corridor that occurred in that week was proportionally dispersed to the stat areas that had catch outside the corridor based on the proportion of outside pollock catch in that week. For example, if there were two stat areas outside the corridor each had the same amount of the pollock catch that week, a displacement of 100 mt from inside the corridor would result in each stat area receiving 50 mt of pollock catch. Next, the mean PSC rates (weekly number of chum salmon PSC per weekly mt of pollock) was applied to the estimated catch of pollock for each outside stat area to derive new estimates of PSC by stat area. Finally, the amount of PSC in each week inside the closed corridor was subtracted from the sum of the new estimates of PSC catch to derive a net change estimate.

The proportional approach to moving the closed sector(s) catch and bycatch to other areas does not reflect the effects of pollock quality, travel costs, and other factors that drive vessel's decisions and are not incorporated into the model. The model does not carry forward redistribution from September 1 to the end of the season. A sector may choose to target pollock inside the corridor after August 31, if it is beneficial

[71] For more information on the SSC's review of fleet redistribution models used in the BBRKC analysis, see section below on Alternative Approaches Considered.

for them to do so. It was assumed that, if a sector had historical pollock catch inside the corridor after August 31, that was likely due to good pollock catch inside the corridor or that fishing in that area provided some operational efficiency, while balancing other considerations like avoiding Chinook salmon bycatch or other PSC. Thus, the model essentially stops redistributing effort after August 31.

Outliers and Assumptions

The analysts applied two methods to trim the dataset and remove outliers. When the initial model run occurred, analysts noted that there were issues with the redistribution of catch because there were a few instances of low catch and high PSC rates. First, hauls less than 10 mt in pollock catch were dropped because this threshold was determined to be a lower bound where a small amount of fishing or a test tow occurred. Second, analysts utilized the local outlier factor (LOF) method which identifies outliers in a dataset by reviewing rate and catch for the data. This method looked at 500 nearest neighbors for each haul and assumed that 1% of the data would be an outlier. Each row was ranked based on LOF ranking and a total of seven rows were removed (these hauls represented catch rate outliers).

There are several aspects of the Fleet Movement model that need to be considered when interpreting model results (listed in no particular order):

- The model was built to analyze Alternative 5 exclusively and was not combined with any other alternatives.
- The model assumed the processing sector was CP for all CDQ landings for coding simplicity. In reality, a small amount of CDQ pollock has been landed during the B season by Motherships as well.
- The model assumed that corridor options considered under Alternative 5 would not close the B season for a sector that reached its apportionment of the cap. In other words, if a sector was closed out of the corridor, the model allows the sector to continue fishing outside of the closed corridor until August 31 and no stand down occurs. This does not apply to cases when there is not pollock harvest occurring outside of a closed corridor since the model has nowhere to move catch to.
- The model does not capture if the fleet would have harvested the full amount with a corridor closure. There were weeks when the corridor closed and there was no pollock harvest outside of the corridor area. In these cases, the model had nowhere to move catch to. There were enough weeks that this occurred (Table 3-33) to reduce the amount that would have been harvested annually with corridor closures. This is an unrealistic scenario because the fleet is likely to adapt with corridor closures. Additionally, the amount of adaption is not captured. For example, a sector would be unable to travel to new fishing grounds or unable to find areas with equally good fishing with a corridor closure; the full amount of pollock harvested is unlikely to be the same as without a closure. In reality with a corridor closure, the sectors will have an incentive to find ways to make up their catch, whether that is through changing the timing or location of their fishing as they are able.
- The model does not account for vessel capacity (fish hold, fuel tanks) and horsepower, which are particularly important considerations for inshore CVs. Smaller vessels are more limited by speed, travel distance, and hold capacity to meet delivery requirements – while balancing operational costs and safety – than larger vessels. These dynamics are addressed qualitatively in Section 4.2.4 relative to pollock fishery impacts.

Other Modeling Approaches Considered

The analysts considered two other methods for building the Fleet Movement Model.

The first approach that was considered would have used historical chum salmon bycatch rates to determine where pollock catch and chum salmon bycatch moved out of each closed corridor would go. Pollock catch and chum salmon bycatch that occurred inside a corridor would have been moved to stat areas where the sector had achieved the lowest chum salmon bycatch rates. The analysts did not use this approach because it relies on an unlikely assumption that pollock harvesters prioritize minimizing chum salmon bycatch, such that other considerations like pollock CPUE and the financial cost of moving to these areas are under emphasized (see also the SSC's minutes from June 2023).

The second approach that was considered would have used pollock CPUE to determine where pollock catch and chum salmon bycatch moved out of each closed corridor would go. The analysts considered the SSC's minutes from June 2023 and February 2024 when they reviewed a similar fleet redistribution model used to evaluate potential closure areas to protect Bristol Bay Red King Crab. The SSC discussed a CPUE-based model compared to a PSC rate allocation approach, and while the SSC did note that a CPUE approach might provide a better approximation of fleet behavior and include some consideration of operational efficiency, they concluded that, in general, the two models (PSC rate and CPUE) showed similar outcomes. They also noted that both approaches had limitations and the potential to produce biased PSC estimates.

After reviewing the SSC's February 2024 Minutes, the analysts decided not to use the CPUE approach for two additional reasons. First, building a model that displaced the fleet to locations based on CPUE would have required the analysts to exclude CVs carrying trawl EM gear and this would have created a large data gap in the model starting in 2020. Vessels that carry trawl EM for compliance do not carry at-sea observers and therefore observers do not collect data on the amount of time gear was fishing nor the spatial distribution of fishing effort (i.e. where trawl gear is deployed for fishing).[72] Instead, observers are located at the processing plant, and they conduct salmon counts and collect biological samples during the offload. NMFS is working on ways to incorporate haul-specific locations from Trawl EM vessels into the CAS and Catch-In-Areas database in the future.

At present, NMFS does not have a way to include the haul locations and haul duration times from CVs in the trawl EM program. The Trawl EM program has been expanding since the program started under an Exempted Fishing Permit (EFP) in 2020. In 2020, 28% of the pollock trawl CVs participated in the trawl EM program, the proportion of vessels in trawl EM grew to 57% in 2021, 66% in 2022, 67% in 2023 and by 2024, 64 CVs participated in the trawl EM program and only two vessels elected to carry at-sea observers. So, excluding CVs in the trawl EM program would have excluded the majority of this fleet in recent years and created an inconsistency across the analyzed time series. Consequently, as a result of this data limitation, the analysts made the decision to spatially redistribute catch and bycatch using the proportion of pollock catch.

Second, a CPUE model approach would redistribute effort (minutes of pollock fishing) to areas outside of a closed corridor. Areas outside a closed corridor sometimes have lower CPUE. While this approach would account for the difference in CPUE, which is likely to occur in reality, it presents challenges for the objective of estimating changes in salmon PSC. For example, this method would result in lower total pollock catch and assumes the sector (or fleet) would not harvest their full allocation if they could not find areas of equally good CPUE outside the closed corridor. This would artificially reduce PSC rates and may not reflect reality.

3.2.4.4.1.2 Fleet Movement Model Results

As with other parts of this preliminary DEIS, the Fleet Movement Model is a retrospective analysis. This is a useful and necessary approach to assess the baseline of where catch occurred and the magnitude of pollock and PSC that were caught in an area. However, a retrospective analysis does not account for the

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[72] While NMFS does have VMS information that shows vessel tracks, it does not indicate when fishing starts and stops and therefore doesn't provide haul-specific locations and times.

likely and anticipated future changes in fishing behavior. The model moved the fleet to stat areas outside the closed corridor where pollock fishing historically occurred, but any mechanism for redistributing the effort (in proportion to pollock harvest, PSC rates, or CPUE) presented a challenge that cannot be reconciled by using a different method available to analysts because **there were weeks where a sector did not have any history fishing outside the corridor after a closure would have occurred for a given year**. **For these years, corridors, and sectors, the model has nowhere to move pollock catch and PSC to since the model relies on historical pollock catch and PSC**.

Table 3-33 provides the proportion of weeks where a sector did not have any fishing history outside of a corridor after a closure would have occurred until the end of the closure window (August 31); cells marked with a "-" indicate there was no closure for that given year, corridor, and sector. Cells marked with a "0%" indicate that fishing in some weeks occurred both inside and outside of the corridor. Cells marked with a percentage greater than zero indicate that fishing in some weeks only occurred inside the corridor and there was no fishing outside of the corridor. These values are based on the sum of total weeks where fishing only occurred inside the corridor after a cap was met, and the sum of weeks when fishing occurred after a cap was met regardless of fishing location (i.e., inside the corridor or not). For instance, in 2016, there were 42 weeks (summed across caps and apportionments) when the inshore sector only fished inside the corridor after the cap was met and a closure occurred. There were 51 weeks (summed across caps and apportionments) when the inshore sector fished inside and outside of Cluster 1 and after the corridor would have closed to the sector. This means the model had nowhere to move this sector in this year in 82% of cases (i.e., weeks when fishing did occur).

Table 3-33 Proportion of weeks where a sector did not have any fishing history outside of a corridor after a closure would have occurred in each year, 2011–2023

Year	Cluster 1			Unimak			Cluster 2		
	CP/CDQ	M	Inshore	CP/CDQ	M	Inshore	CP/CDQ	M	Inshore
2011	0%	0%	13%	-	0%	0%	-	-	-
2012	-	-	-	-	-	-	-	-	-
2013	0%	-	0%	-	-	0%	-	-	-
2014	-	-	0%	-	-	0%	-	-	0%
2015	-	-	3%	-	-	0%	-	-	-
2016	10%	82%	82%	0%	72%	5%	0%	-	-
2017	0%	30%	64%	-	30%	8%	0%	-	0%
2018	0%	0%	0%	-	0%	0%	0%	0%	0%
2019	-	-	44%	-	-	0%	-	-	-
2020	-	-	-	-	-	-	-	-	0%
2021	0%	74%	18%	-	45%	18%	0%	0%	0%
2022	0%	100%	56%	-	0%	30%	0%	-	-
2023	-	-	0%	-	-	0%	-	-	-

Source: NMFS Alaska Region CAS.

The issue of pollock catch not occurring in stat areas outside of a closed corridor for a given sector and year was most prevalent for the inshore sector in Cluster 1, followed by the mothership sector. This was less of an issue for Unimak and not an issue for Cluster 2. In part, this scenario was more common in the analysis of the Cluster 1 and Unimak corridors because the inshore sector has heavily relied on the pollock fishing grounds inside Cluster 1 and the Unimak corridor is fully encompassed within Cluster 1. **In these instances, the results from a model that relies on retrospective data cannot be used as a predictor of where the fleet may shift effort to. Because the model calculated net change within the closure windows, these weeks would be equivalent to those with no change.**

In some years, the model estimated significant increases in chum salmon bycatch resulting from one or more sectors being moved out of a corridor. Consider the following example from 2019. The inshore sector's historical bycatch was 86,504 chum salmon in Cluster 1 from June 10-August 31 in 2019. The sector would have hit a 50,000-chum salmon PSC limit under all four apportionments in 2019 and reached the cap on June 29 under three of four apportionment suboptions (all but AFA; Apportionment 4). The model estimates the inshore sector would have caught 207,785 *more* chum salmon by being displaced from Cluster 1 from June 30 to August 31 in 2019. The substantial increase in chum bycatch estimated for the inshore sector in 2019 was driven by a single week. During the week of July 27, the model estimates bycatch would increase by 191,175 chum salmon had Cluster 1 closed.

Table 3-34 Estimated net change in chum salmon PSC for the inshore sector in Cluster 1, 2019

Week	Historical chum salmon PSC in Cluster 1	New chum salmon PSC estimate	Net estimate of chum salmon PSC change
6/29/2019	2,061	374	-1,687
7/6/2019	1,599	589	-1,010
7/13/2019	10,267	18,425	8,158
7/27/2019	3,748	195,722	191,975
8/10/2019	7,149	16,713	9,564
8/17/2019	1,875	2,659	784
Total	**26,699**	**234,484**	**207,785**

Source: NMFS Alaska Region CAS.
In 2019, the inshore sector did not harvest pollock in any stat areas outside of Cluster 1 during the weeks of July 10 and August 3. The model ignores these weeks in the B season because there is “nowhere” to displace the sector’s catch to outside of the corridor. This means the estimate of 207,785 additional chum salmon does not include these weeks of data.

The increase in chum bycatch during the week of July 27 resulted from moving the sector from areas inside Cluster 1 with low bycatch rates to stat areas outside with very high rates. The average chum bycatch rate inside Cluster 1 in this week was 0.72, compared with the average rate outside the corridor at 8.57. The sector caught 24,806 mt of pollock inside Cluster 1 in that week, which was moved to statistical areas outside the corridor in proportion to the amount of pollock catch in those outside areas (Table 3-35).

Table 3-35 Chum salmon bycatch (number of fish), pollock catch (mt), and chum salmon bycatch rates for the inshore sector in stat areas inside Cluster 1 during the week of July 27, 2019

Areas inside Cluster 1 where fishing occurred	Number of chum salmon	Pollock catch (mt)	Chum bycatch rate (No. of chum salmon/mt of pollock)
655409	1,164	5,246	0.22
655430	1,993	17,736	0.11
665430	15	292	0.05
655500	21	14	1.49
645501	17	13	1.28
665401	88	348	0.25
655410	392	1,138	0.34
655600	61	32	1.9
635504	0	1	0
Total	**3,748**	**24,806**	**0.72(avg. rate)**

Source: NMFS Alaska Region CAS.

For this inshore example in 2019, Table 3-36 shows the historical number of chum salmon caught as bycatch, pollock catch, bycatch rate, and the proportion of pollock harvest that occurred in each stat area outside Cluster 1. The added amount of pollock catch displaced from Cluster 1 and the estimated change in chum bycatch are also provided. As shown, 35.1% of the sector’s catch that week (8,696 mt) was moved to statistical area 705600 outside Cluster 1. This area had a bycatch rate of 11.52. Additionally, 21.9% of the sector’s catch that week (5,431 mt) was moved to statistical area 695600 outside Cluster 1. This area had a bycatch rate of 10.31. As a result, the model predicts the inshore sector would have caught 100,078 more chum salmon in statistical area 705600 and 56,031 more chum salmon in statistical area 695600.

Table 3-36 Chum salmon bycatch, pollock catch (mt), and chum salmon bycatch rate for the inshore sector in stat areas outside of Cluster 1 during the week of July 27, 2019

Stat areas outside Cluster 1	Average chum salmon PSC	Average pollock catch (mt)	Average chum salmon PSC rate	Proportion of catch moved to area	Displaced pollock catch added to area	New chum salmon PSC estimate
675430	664	96	6.90	4.2%	1,044	7,214.
675500	171	10	17.09	0.4%	109	1,858
685500	1	231	0.004	10.2%	2,519	11
685530	104	144	0.72	18.9%	4,694	3,390
695600	1,719	166	10.31	21.9%	5,431	56,031
705600	1,842	160	11.50	35.1%	8,696	100,078
715600	1,034	84	12.25	7.4%	1,833	22,469
725630	430	44	9.71	1.9%	481	4,672
Total	5,965	937	-	-	24,806	195,723

Source: NMFS Alaska Region CAS.

It is also unlikely these estimates are an accurate representation of what would occur in the future in terms of the magnitude of potential additional chum salmon caught. The inshore sector was moved from areas inside the corridor with lower bycatch to areas outside with higher bycatch rates. While this general trend could occur from displaced effort, it is the magnitude of change in bycatch that is unlikely. If increased higher chum salmon PSC rates occurred after vessels moved, it is expected the RHS program and particularly the use of new bi-weekly closures or closing stat areas with very high bycatch rates as well as fleet communication would move vessels away from very high bycatch rate areas.

For these reasons, the analysts decided against providing the full quantitative results of the Fleet Movement Model as they are not a likely depiction of future outcomes for fleet behavior, PSC savings, or PSC increases. The potential impacts of closures and shifts in effort must be considered qualitatively, outside of the model results. Although the same issue is not prevalent in Cluster 2, there are not comparable results from Cluster 1 and Unimak areas to compare with the Cluster 2 analysis. This represents another limitation of the model and, as noted above, a key reason for developing the Fleet Movement Model was to provide decision-makers a way to compare the potential impacts of three different, and mutually exclusive, corridor options.

3.2.4.4.1.3 Other Approaches to Analyzing Alternative 5

In light of the limitations of the Fleet Movement Model, the analysts have used a different approach to provide decision-makers a way to compare the spatial, temporal, and sector-level effects of each corridor option under Alternative 5. Similar to an overall chum salmon PSC limit under Alternative 2 or 3, the potential for chum salmon bycatch reductions under Alternative 5 would be influenced by changes in fishing behavior. The consequence of a corridor closure varies by sector based on the relative importance of that area in a given year in terms of fishing conditions and/or PSC encounters.

Table 3-37 shows the proportion of each sector's B season pollock harvest taken inside the corridor during the closure window (June 10 to August 31) from 2011 to 2023. The inshore sector is heavily reliant on Cluster 1 given 41.98% –92.65% of the sector's pollock was caught in this area during the analyzed timeframe. The mothership sector is also more reliant on Cluster 1 for its pollock harvest compared to the Cluster 2 and Unimak corridors. The CP/CDQ sectors are more reliant on Cluster 2 which can likely be explained by the high degree of overlap for the Cluster 1 and Unimak corridors with the CVOA.

Table 3-37 Proportion of each sector's B season pollock harvest taken inside the corridor area during the closure window (June 10 to August 31), 2011–2023

Year	Cluster 1			Unimak			Cluster 2		
	CP/CDQ	Mothership	Inshore	CP/CDQ	Mothership	Inshore	CP/CDQ	Mothership	Inshore
2011	3.33%	42.36%	69.64%	1.95%	38.21%	62.81%	12.41%	9.27%	9.69%
2012	2.55%	35.76%	41.98%	0.22%	24.40%	34.57%	7.30%	14.48%	9.20%
2013	0.43%	11.60%	47.01%	0.02%	8.05%	38.06%	3.96%	17.97%	20.71%
2014	3.55%	17.26%	69.42%	3.39%	15.56%	58.39%	10.99%	9.17%	12.05%
2015	0.52%	11.97%	87.38%	0.49%	8.79%	77.07%	13.56%	13.89%	9.06%
2016	35.56%	89.94%	98.34%	13.70%	58.38%	79.24%	35.18%	10.06%	1.66%
2017	10.78%	70.70%	89.78%	3.29%	55.07%	80.33%	48.69%	12.73%	10.22%
2018	7.59%	25.91%	80.36%	6.62%	23.01%	75.22%	14.84%	8.89%	14.55%
2019	7.86%	42.09%	91.18%	5.50%	35.02%	85.50%	16.57%	6.54%	3.29%
2020	0.01%	33.49%	63.72%	0.00%	32.15%	60.39%	5.75%	3.11%	8.49%
2021	3.47%	82.90%	90.25%	3.30%	76.43%	85.14%	15.36%	8.49%	6.61%
2022	4.26%	73.40%	92.65%	0.00%	56.55%	82.04%	29.25%	7.82%	6.33%
2023	1.92%	65.42%	67.70%	0.45%	61.08%	59.45%	4.82%	1.85%	6.03%

Source: NMFS Alaska Region CAS.

Alternative 5 differs from Alternatives 2 and 3 in that it would not inherently halt fishing. If a corridor closed to a sector for a period of time, the total area where fishing could occur would be reduced but vessels could fish outside of the closed corridor until September 1. The analysis assumes vessels would fish outside the closed corridor if they are able to do so. **Thus, a key consideration for Alternative 5 are the historical levels of pollock catch inside each corridor and the relative effect on bycatch levels of displacing that catch temporally and/or spatially.**

Table 3-38 compares the pollock fleet's pollock catch (mt), chum salmon PSC (numbers of fish), and chum salmon bycatch rate in each corridor area by periods for June and July, August, and September through November 1 (2019–2023). Conditional formatting (i.e., varying the color of the cells based on value) was added so the differences in areas and periods could be more easily compared within and across years. Darker color saturation indicates higher values whereas lower saturation indicates lower values. As shown, pollock catch was concentrated in Cluster 1 and Unimak. Typically, greater harvests occurred in June and July in these areas compared to Cluster 2, except for 2020. Different trends are observed in the distribution of historical chum salmon bycatch rates which are typically higher in Cluster 2 compared to Cluster 1 and Unimak. While the overall number of chum salmon caught as bycatch tends to be higher in Cluster 1 (2021 was a notable exception to this trend with a total of 274,805 chum in Cluster 2 relative to 221,859 chum salmon in Cluster 1), the rates are lower because of the substantial pollock caught in the area.

Table 3-38 Comparison of pollock catch (mt), chum salmon PSC (number of fish), and PSC rate during June and July, August, and September to November 1 in each corridor area, 2019-2023

Category	Year	Cluster Area 1			Unimak			Cluster Area 2		
		June | July	Aug	Sep | Nov	June | July	Aug	Sep | Nov	June | July	Aug	Sep | Nov
Pollock	2019	132,998	131,409	114,612	129,590	127,878	88,296	24,968	8,206	42,559
	2020	36,976	71,607	127,079	36,651	64,714	122,547	6,484	24,404	17,638
	2021	190,748	102,482	83,084	183,349	97,763	74,997	21,918	11,325	47,985
	2022	208,839	70,337	16,025	169,179	63,857	14,844	90,268	3,538	6,403
	2023	160,372	30,769	77,587	134,365	29,146	74,932	14,088	21,814	462
Chum salmon PSC	2019	72,056	16,932	75,659	70,713	16,138	68,106	14,573	16,420	11,322
	2020	4,017	17,609	96,770	3,977	16,743	91,278	5,201	30,988	28,223
	2021	208,666	7,404	5,789	182,557	6,191	5,221	181,884	87,961	4,960
	2022	52,465	96,143	1,697	28,628	80,517	1,650	11,608	10,008	9,306
	2023	19,768	29,173	8,056	19,427	29,026	8,010	1,407	7,081	257
Chum salmon PSC Rate	2019	0.54	0.13	0.66	0.55	0.13	0.77	0.58	2.00	0.27
	2020	0.11	0.25	0.76	0.11	0.26	0.74	0.80	1.27	1.6
	2021	1.09	0.07	0.07	1.00	0.06	0.07	8.3	7.77	0.10
	2022	0.25	1.37	0.11	0.17	1.26	0.11	0.13	2.83	1.45
	2023	0.12	0.95	0.10	0.14	1.00	0.11	0.10	0.32	0.56

Source: NMFS Alaska Region CAS.

Table 3-39 provides the amount of pollock catch (mt) that would have been displaced from the Cluster 1 and Unimak corridors based upon retrospective estimates on when a sector would have reached the highest and lowest corridor-specific cap amounts of 50,000 and 200,000 chum salmon (2019–2023). Table 3-40 provides the same information for Cluster 2 at cap amounts of 50,000 and 100,000 chum salmon.

The analysis indicates the Unimak corridor would not constrain the CDQ and CP sectors. CP AFA pollock catch would not have been moved from the Unimak corridor in any year due to a closure because the corridor is fully encompassed within the CVOA, and CPs are restricted from fishing inside the CVOA during the B season. These sectors would have been constrained by a Cluster 1 corridor in a limited number of years at the low cap amount, and the CP sector would have been constrained in 2022 under 200,000 chum salmon cap using the 3-year average apportionment. Cluster 2 would have been a constraint for these sectors in a limited number of years under both the high and low cap.

The Cluster 1 and Unimak corridors would have constrained the inshore and mothership sector at the low cap amount. The inshore sector is most affected by Cluster 1 and would have reached all apportionments of a 50,000-chum salmon cap in all years, except 2020 (Table 3-39). In 2020, more pollock was harvested during September through November 1 compared to earlier months. **A 50,000-chum salmon cap in either Cluster 1 or Unimak would have moved a substantial amount of the inshore sector's catch, either 198,221 or 202,785 mt in 2019 under all apportionments, except AFA. The amount of amount of pollock catch moved outside is greater under the AFA apportionment in both corridors but higher in Cluster 1 at 217,504 mt compared to Unimak at 212,677 mt.** In this year, the inshore sector would have reached the Cluster 1 cap on June 29 under all apportionments except for AFA. The AFA apportionment was met on June 22.

Table 3-39 Estimated pollock harvest (mt) displaced from Cluster 1 and Unimak based on corridor-specific PSC limits of 50,000 and 200,000 chum for all sectors and apportionment methods, 2019–2023

Cluster 1								
Limit	**50,000**				**200,000**			
Sector	**CDQ**	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**
Sector Apportionment 1, 3-yr avg								
2019				202,785				
2020								
2021			31,271	149,319				
2022		4,491	4,288	67,109		4,491	805	
2023				12,236				
Sector Apportionment 2, 5-yr avg								
2019				202,785				
2020								
2021	10,322		35,791	149,319				
2022		4,491	4,288	67,109			805	
2023				12,236				
Sector Apportionment 3, pro rata								
2019				202,785				
2020								
2021			31,271	149,319				
2022			4,288	88,803			805	88,730
2023				12,236				
Sector Apportionment 4, AFA								
2019				217,504				
2020								
2021	10,322		35,791	173,975				103,845
2022			4,288	88,803			805	27,017
2023				16,796				

Unimak								
	50,000				**200,000**			
	CDQ	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**
Sector Apportionment 1, 3-yr avg								
2019				198,221				
2020								
2021			33,263	139,022				
2022			1,749	40,881				
2023				12,046				
Sector Apportionment 1, 3-yr avg								
2019				198,221				
2020								
2021			33,263	139,022				
2022			1,749	40,881				
2023				12,046				
Sector Apportionment 1, 3-yr avg								
2019				198,221				
2020								
2021			33,263	139,022				
2022			1,749	40,881				
2023				12,046				
Sector Apportionment 4, AFA								
2019				212,677				
2020								
2021			33,263	162,727				96,537
2022			1,749	76,431				15,690
2023				12,046				

Table 3-40 Estimated pollock harvest (mt) displaced from Cluster 2 based on corridor specific PSC limits of 50,000 or 100,000 chum salmon for all sectors and apportionment methods, 2019–2023

Cluster 2								
Limit	**50,000**				**100,000**			
Sector	**CDQ**	**CP**	**M**	**CV**	**CDQ**	**CP**	**M**	**CV**
Sector Apportionment 1, 3-yr avg								
2019								
2020								
2021		3,139	973	9,459		3,139	973	9,459
2022	5,236	3,366			5,236			
2023								
Sector Apportionment 2, 5-yr avg								
2019								
2020								
2021		3,139	973	9,459		3,139	973	9,459
2022	5,236	3,366						
2023								
Sector Apportionment 3, pro rata								
2019								
2020				1,545				
2021		3,139	973	9,459		3,139	973	9,459
2022		3,366						
2023								
Sector Apportionment 4, AFA								
2019								
2020				1,545				
2021		3,139	973	9,459		3,139	973	9,459
2022								
2023								

The spatial and temporal displacement of pollock catch outside of a corridor once it closed to a sector are key considerations under Alternative 5. Figure 3-22 compares the average weekly chum salmon bycatch rate, WAK chum salmon bycatch rate, and pollock catch (mt) for each sector within the three corridors (2019–2023). As a point of reference, the closure window of June 10 to August 31 is generally aligned with statistical weeks 24–35 during the B season.

The estimate on each sector's WAK chum bycatch rate was calculated by multiplying the estimated proportion of WAK chum salmon in a corridor during either the Early or Late period by a sector's weekly chum salmon bycatch in the corridor; this approach assumes all sectors have the same genetic stock group proportions for a given location and time. For instance, the inshore sector's chum PSC in the Unimak closure in statistical week 28 in 2021 was multiplied by the Early period proportion of WAK chum in Unimak in 2021 (inclusive of all sectors). This is a necessary approach because sufficient data were not available to determine the estimated proportion of WAK chum in the total bycatch by sector, period, and corridor; however, stock compositions of WAK chum salmon PSC does not vary greatly week to week for WAK chum salmon and thus this represents a reasonable estimate.

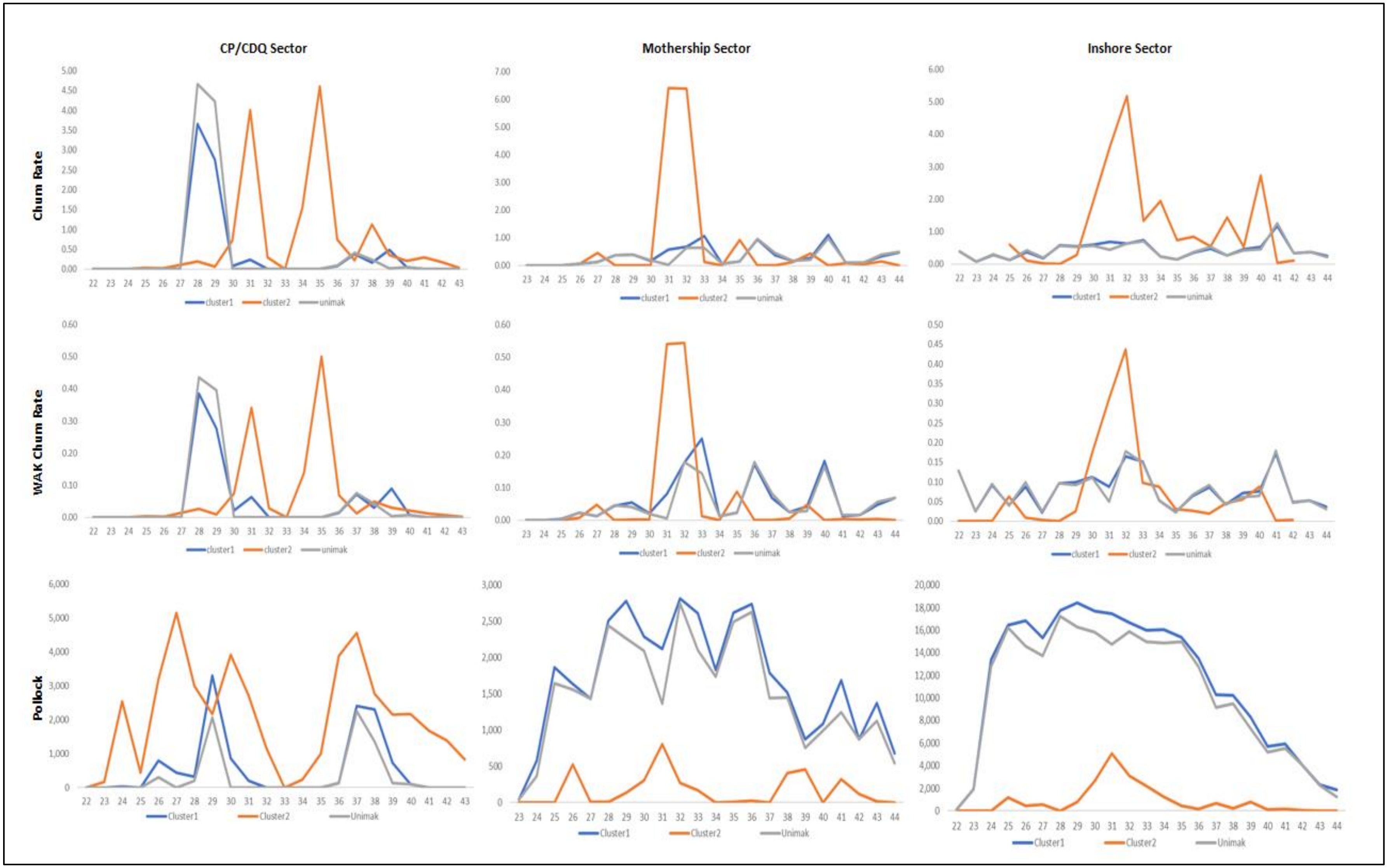

Figure 3-22 Comparison of the weekly average WAK chum salmon rates, chum salmon PSC rates, and pollock harvest (mt) by sector and corridor under Alternative 5, 2019–2023

Notes: CP and CDQ are combined.

The weekly chum and WAK chum salmon bycatch rates were relatively low for all sectors inside Cluster 1 and Unimak compared to Cluster 2, although the CP/CDQ sector's rate was higher in statistical week 28 in Cluster 1. This appears to be driven by higher bycatch rates inside the area in 2021. The weekly pollock catch for the CV sectors was noticeably greater in Cluster 1 and Unimak compared to Cluster 2. The CP/CDQ sector's pollock catch was more variable across the corridors.

Cluster 1 and Unimak Corridors

CPs are restricted from harvesting AFA pollock inside the CVOA during the B season, which has constrained CP's AFA pollock harvest inside Unimak and to a lesser degree in Cluster 1. Relatively small amounts of CDQ pollock have been harvested in both corridors. Since these sectors have relatively little fishing history inside these corridors, prioritizing chum salmon avoidance by implementing a Cluster 1 or Unimak corridor may not have a large effect on their fishing/chum salmon avoidance behavior. The amount of pollock catch that could be moved from Cluster 1 or Unimak was also not estimated to be substantial. This reduces the risk associated with moving a large amount of catch from an area with lower bycatch rates to areas with unknown or higher rates.

The inshore and mothership CVs have heavily relied on the fishing grounds encompassed within the Cluster 1 and Unimak corridors for their pollock catch during the analyzed period. This reliance may be driven by many factors, but it suggests these sectors would likely modify their fishing behavior to the extent practicable to not risk losing access to these historically productive fishing grounds. Additionally, while the amount of pollock varies for each CV sector and there are differences in the temporal distribution across weeks, a general trend for both the inshore and mothership CVs is that pollock catch was high during statistical weeks 24–35. These weeks align with the closure window for Alternative 5.

In 2019, under a cap of 50,000 chum salmon in Cluster 1, the inshore CVs would have been moved out of the corridor on June 22 or June 29 (depending on the apportionment). In this scenario, ~200,000 mt of inshore CV pollock catch would have been moved from Cluster 1 (blue) during statistical weeks 26–35 in 2019. **Moving high amounts of pollock catch outside of Cluster 1 (and Unimak) would result in very different, but not necessarily positive, outcomes for chum and WAK chum salmon PSC**.

If the Unimak corridor closed to inshore CVs, most vessels would likely move northwest into a portion of Cluster 1 and then into Cluster 2 (all other factors being equal). If the Cluster 1 corridor closed to the inshore sector, many CVs would move to the fishing grounds in Cluster 2. In both scenarios, some larger CVs with greater capacity may travel further northwest from Cluster 2 (all other factors being equal). This assessment is informed by existing regulatory and environmental restrictions. No pollock sector can fish farther east due to the Nearshore Bristol Bay Trawl Closure. Pollock vessels cannot fish around the Pribilof Islands which are encompassed in the Pribilof Islands Habitat Conservation Zone, and the fleet would not fish further directly west off of the "shelf edge" where there is break in the continental shelf (see Figure 3-23).

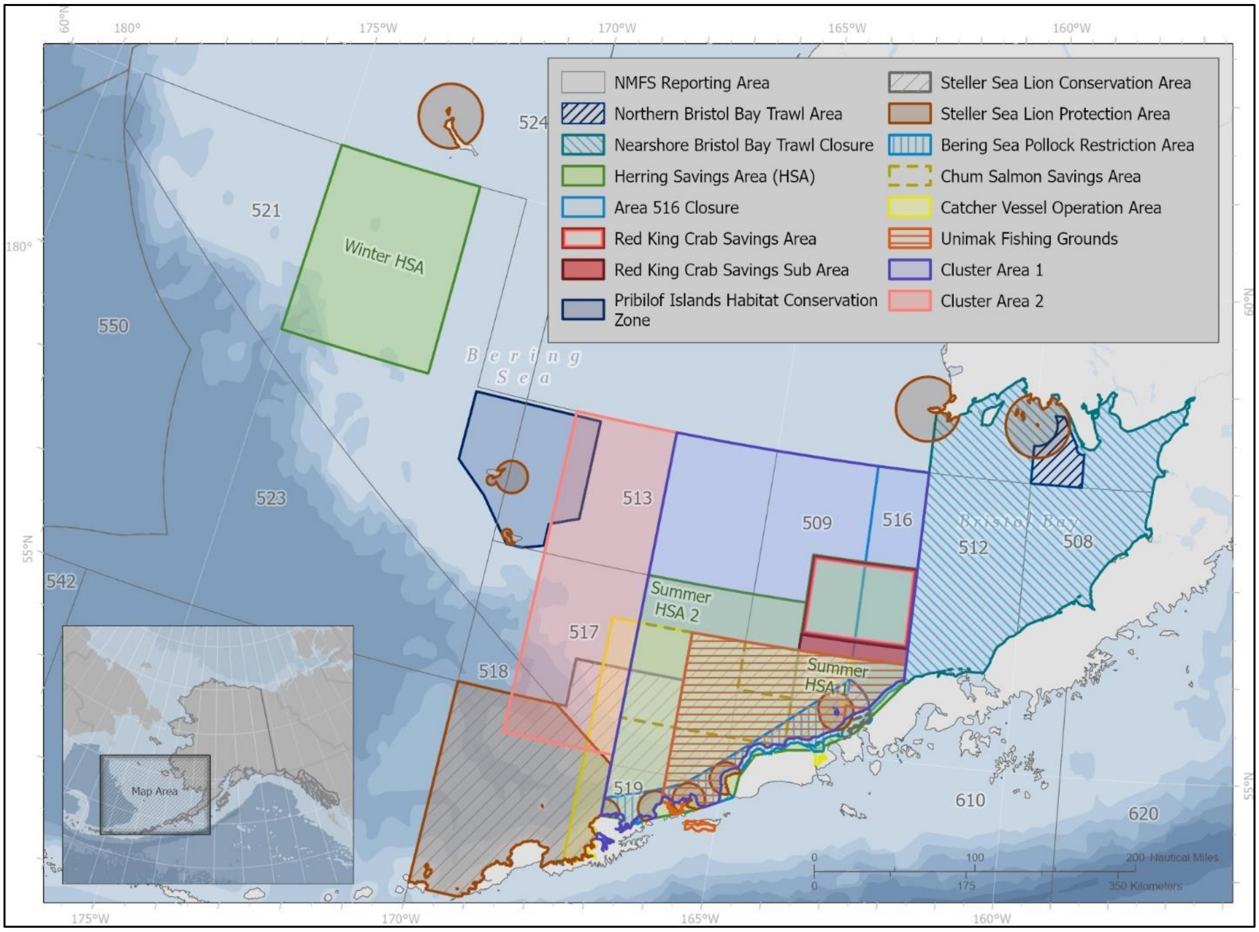

Figure 3-23 Inseason corridor areas under Alternative 5 and other relevant groundfish management boundaries in the Bering Sea

Given these constraints– regulatory, environmental, vessel capacity, among others– moving CV pollock catch from Cluster 1 or Unimak to Cluster 2 or some areas further northwest would result in increased chum and WAK chum salmon PSC. This is because the chum salmon bycatch rates have typically been much higher in Cluster 2. The potential for adverse impacts would be exacerbated by a corridor closure occurring earlier in the window, as would have been the case in 2019 for the inshore sector. While the proportion of WAK chum salmon is greater in Cluster 1 and Unimak compared to Cluster 2 or further northwest on the pollock fishing grounds, substantially increasing the overall bycatch in Cluster 2 could result in an opposite outcome from what was observed in the 2021 and 2022 B seasons. Namely, that despite fishing in an area with a possibly lower rate of WAK chum salmon caught, the actual number of WAK chum salmon caught would increase because the total bycatch would increase substantially due to higher PSC rates.

That being said, the CV sectors have a high degree of reliance on the fishing grounds encompassed within these corridors. To avoid being moved out of these fishing grounds (i.e., corridors), vessels may change their fishing behavior which could have varied outcomes for chum salmon PSC. One strategy that could be used to stay below the corridor cap is to encourage larger CVs that are capable of fishing further northwest to do so. Any chum salmon caught by these vessels would not accrue to the corridor cap. However, given the general trend that chum salmon bycatch rates are higher in Cluster 2, chum salmon bycatch could increase relative to status quo even if either corridor did not close. Whether larger CVs fish outside the corridor or not, another possibility is that the inshore CVs continue to fish inside Cluster 1 or Unimak. While doing so, chum salmon bycatch rates would be closely monitored and vessels would respond to these rates inside the corridor. These changes in fishing and chum salmon avoidance behavior *could* reduce chum and WAK chum salmon PSC compared to status quo if the cap is not met and/or a large amount of pollock catch is not moved to outside areas.

In sum, the Cluster 1 and Unimak corridors could result in chum and WAK chum salmon savings compared to status quo. These reductions would primarily accrue from the inshore and mothership CV sectors. Prioritizing chum salmon avoidance in these areas would also pose a high risk for creating an adverse outcome for chum and WAK chum salmon PSC if the cap is met and a substantial amount of pollock catch is moved to areas with historically higher chum salmon bycatch rates. This latter scenario was more likely in the retrospective analysis at low corridor cap amounts of 50,000 chum salmon.

Cluster 2

All sectors rely on Cluster 2 for their pollock harvest to some degree and could be affected by a Cluster 2 corridor. The CP and CDQ sectors' reliance on the fishing grounds encompassed within Cluster 2 was variable, ranging from 3.96% to 48.69% in 2013 and 2017 respectively. CPs have greater operational flexibility to move to new areas with better pollock catch rates or lower PSC. The CV sectors have also relied on Cluster 2 to vary degrees, ranging from 1.66% in 2016 to 20.71% in 2013 for the inshore CVs and 1.85% to 17.97% in 2023 and 2013 for the mothership CVs. Given the variable fishing history and reliance on Cluster 2, it is possible that prioritizing chum salmon avoidance in Cluster 2 may not motivate large changes in fishing/chum salmon avoidance behavior.

However, maintaining operational flexibility is a primary incentive embedded with the RHS program. While all sectors may not heavily rely on the fishing grounds encompassed within this corridor, the analysis assumes a similar incentive to the RHS program would also be relevant if chum salmon avoidance was prioritized in Cluster 2. Fishermen would likely be proactive at avoiding fishing in Cluster 2, to the extent practicable, because historical data indicates the potential for high chum salmon bycatch rates. Reaching a Cluster 2 cap would result in that sector losing the operational flexibility those fishing grounds may provide in a given year. Compared to status quo, the potential for chum salmon savings would result from all sectors proactively avoiding the corridor or carefully monitoring PSC against the chum cap. Encountering higher bycatch rates inside Cluster 2 would pose a greater risk of losing important operational flexibility later on.

The retrospective analysis indicates lower amounts of pollock catch would be moved from Cluster 2 compared to Cluster 1 and Unimak. This poses less risk to creating adverse outcomes for chum and WAK chum salmon PSC. If Cluster 2 closed to the CP and CDQ sectors, these vessels would likely move further northwest towards Cluster 3 and 4. The CV sectors would likely move to the historically productive fishing grounds inside Cluster 1 and Unimak.

3.2.4.5 Cumulative Effects on Chum Salmon

Past and present human action impacting chum salmon and Western Alaska chum salmon stocks have been highlighted in numerous documents (e.g., Farley et al., 2024; Whitworth et al. 2023), in Section 3.2.1 through Section 3.2.4 in this Preliminary DEIS as well as Appendices provided by cooperating agencies (i.e., Appendix 7 from KRITFC, Appendix 8 from TCC). In particular, past and present human actions that may affect Western Alaska chum salmon include bycatch in the Bering Sea pollock fishery and associated avoidance techniques, bycatch in the state-managed Area M fishery, directed catch from commercial salmon fisheries in river and in the ocean, competition from hatchery releases, and environmental factors associated with climate change.

RFAs that may have a cumulative impact with the proposed actions include authorization and prosecution of the Bering Sea pollock fishery and climate change, described at the beginning of Chapter 3. In addition, chum salmon may be affected by:

Bycatch management tools and WAK chum salmon research. Although previously established in Federal regulation, the continued use of bycatch management tools may constitute an RFA. Gear modifications are one way to reduce salmon bycatch in the pollock fisheries. Salmon excluder devices for pollock trawl gear may result in reductions of salmon bycatch, potentially reducing the adverse effects of incidental bycatch of salmon in the pollock fishery. Salmon excluder devices have been successful in reducing Chinook salmon bycatch and modifications are being tested to improve its effectiveness for reducing chum salmon bycatch.

Additionally, current work underway by researchers at (1) NOAA’s Auke Bay Lab to explore whole genome sequencing of WAK chum salmon; (2) the University of Alaska Fairbanks to produce distributive models of WAK chum salmon; and (3) the Bristol Bay Science and Research Institute to investigate in-season genetic analysis of chum salmon bycatch in the inshore pollock sector. This research could aid the pollock sectors in efforts to minimize WAK chum salmon bycatch, as well as providing greater resolution for genetic information in understanding the impacts of bycatch (see Appendix 7, Attachments 1-3).

South Alaska Peninsula Management Area (Area M). Some amount of Western Alaska WAK chum salmon is also caught in the South Alaska Peninsula Management Area (Area M) commercial salmon fisheries. Section 4.3.4.2 provides information on commercial chum salmon fisheries across Western and Interior Alaska. The Area M fishery is proximate to the action area, and while specific aspects of overall State of Alaska salmon fishery management continue to be modified, it is reasonably foreseeable that this fishery will continue in the future.

Hatchery Releases of Chum Salmon. Hatcheries produce salmon fry and release these small salmon into the ocean to grow and mature before returning as adults to the hatchery or local rivers and streams for harvest or breeding. Hatchery production is generally thought to increase the number of salmon in the ocean beyond what is produced by the natural system, but some research posits that hatcheries may have actually replaced natural production rather than added on to it (Amoroso, Tillotson & Hillborn 2017). Hatchery adults also stray into streams where wild stocks are spawning and have been known to intermingle with those stocks potentially reducing genetic diversity, reproductive success, and resilience to climate variability and change. A number of hatcheries produce salmon in Korea, Japan, Russia, the US, and Canada. The North Pacific Anadromous Fish Commission summarizes information on hatchery releases, by country and by area, where available. It is reasonably foreseeable the hatchery production will continue at a similar level into the future.

Subsistence and Commercial Chum Fisheries. ADF&G is responsible for managing commercial, subsistence, sport, and personal use salmon fisheries, as described in Section 3.2.3. Additionally, within federal waters of the Kuskokwim and during periods of conservation concern, USFWS and KRITFC are responsible for co-managing rural subsistence salmon fisheries (see Appendix 6.3.C). While specific aspects of salmon fishery management continue to be modified, it is reasonably foreseeable that the current management systems for salmon fisheries will continue into the future. In addition, if ADF&G determines there is surplus fish beyond escapement needs within Western and Interior river systems and opens subsistence fisheries or other directed fisheries, a reasonably foreseeable action may be the prosecution of those fisheries (State management thresholds and past prosecution of these fisheries are further described in Section 4.3.3). As described in Table 3-7, many of these river systems have seen limitations or closures of commercial and subsistence opportunities in recent years, including the Yukon and Kuskokwim Rivers.

Cumulative Effects of the Proposed Actions with RFAs: The cumulative effect of the RFAs and proposed alternatives are inherently considered throughout this section in the analysis of impacts on chum salmon. For instance, the expected impacts of a chum PSC limit on chum salmon, fundamentally presumes that pollock fishing would continue, Area M fishing would continue, hatchery releases of chum salmon, and climate change impacts would continue into the future. Any impacts on chum savings from pollock fishery incentives or restrictions created from the proposed alternatives may be offset if adverse impacts on chum from other human actions increase. Conversely, if future external human impacts on chum are less adverse, the overall impacts of chum salmon savings may be enhanced.

3.3 Chinook Salmon

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

Like all species of Pacific salmon, Chinook salmon are anadromous. They hatch in fresh water and rear in main-channel river areas for one year. The following spring, Chinook salmon smoltify and migrate to the saltwater estuary. They spend anywhere from one to five years feeding in the ocean, then return to spawn in fresh water. All Chinook salmon die after spawning. Chinook salmon may become sexually mature from their second through seventh year, and as a result, fish in any spawning run may vary greatly in size. Females tend to be older than males at maturity. In many spawning runs, males outnumber females in all but the 6- and 7-year age groups. Small Chinook salmon that mature after spending only one winter in the ocean are commonly referred to as “jacks” and are usually males. Alaska streams normally receive a single run of Chinook salmon in the period from May through July.

Chinook salmon often make extensive freshwater spawning migrations to reach their home streams on some of the larger river systems. Yukon River spawners bound for the headwaters in Yukon Territory, Canada will travel more than 2,000 river miles during a 60-day period. Chinook salmon do not feed during the freshwater spawning migration, so their condition deteriorates gradually during the spawning run as they use stored body materials for energy and gonad development.

Each female deposits between 3,000 and 14,000 eggs in several gravel nests, or redds, which she excavates in relatively deep, fast-moving water. In Alaska, the eggs usually hatch in the late winter or early spring, depending on time of spawning and water temperature. The newly hatched fish, called alevins, live in the gravel for several weeks until they gradually absorb the food in an attached yolk sac. These juveniles, called fry, wiggle up through the gravel by early spring. In Alaska, most juvenile Chinook salmon remain in fresh water until the following spring when they migrate to the ocean as smolt in their second year. Juvenile Chinook salmon in freshwater feed on plankton and then later eat insects. In the ocean, they eat a variety of organisms including herring, pilchard, sand lance, squid, and crustaceans. Effects of the Alternatives on Chinook Salmon

3.3.1 Alternative 1

Alternative 1 would not change the existing regulations for Chinook salmon PSC, including the Chinook salmon hard caps established under Amendment 91 to the BSAI Groundfish FMP in 2011 and more stringent regulations in 2016 under Amendment 110 (see 50 CFR 679.21(f)(12)(iii)(E)(2).[73] While the exact number of Chinook salmon encountered varies each year, bycatch levels have decreased substantially since the hard caps took effect in 2011. From 1991–2010, the annual average Chinook salmon bycatch was 40,876 fish compared to 18,325 Chinook from 2011–2023 (Figure 3-24).

[73] See Appendix 2 for additional information on current Chinook salmon PSC management measures in the BSAI.

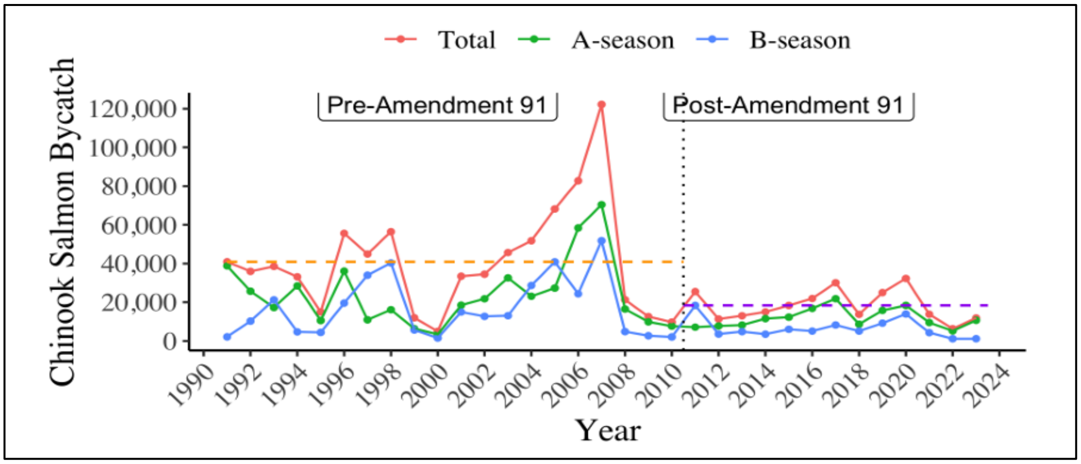

Figure 3-24 Chinook salmon for the Bering Sea pollock trawl fishery for the A, B, and both seasons. Horizontal dashed lines represent the mean bycatch pre- and post-Amendment 91, 1991–2023

Source: Barry et al. (2024)

Since 2011, annual Chinook salmon bycatch levels have ranged from 6,337 fish in 2022 to 32,200 fish in 2020. Chinook salmon bycatch tends to be higher during the A season as compared to the B season and encountered in greater numbers by the inshore sector.

Table 3-41 Number of Chinook salmon caught as bycatch during the pollock fishery's A and B season by sector and fleet total, 2011–2023

Year	CDQ			CP			Mothership			Inshore			Total
	A	B	Subtotal	A	B	Subtotal	A	B	Subtotal	A	B	Subtotal	Total
2011	430	334	764	1,806	1,652	3,458	459	2,426	2,885	4,441	13,951	18,392	25,499
2012	344	5	349	2,484	92	2,576	312	49	361	4,624	3,433	8,057	11,343
2013	472	48	520	3,566	448	4,014	557	48	605	3,622	4,255	7,877	13,016
2014	692	36	728	3,961	567	4,528	463	180	643	6,420	2,718	9,138	15,037
2015	781	250	1,031	3,039	2,374	5,413	689	559	1,248	7,789	2,848	10,637	18,329
2016	1,245	141	1,386	6,456	2,403	8,859	1,077	577	1,654	8,040	1,987	10,027	21,926
2017	2,116	388	2,504	8,900	1,475	10,375	1,530	476	2,006	9,057	6,134	15,191	30,076
2018	933	358	1,291	3,411	1,259	4,670	375	361	736	3,816	3,213	7,029	13,726
2019	1,661	719	2,380	7,196	3,126	10,322	927	538	1,465	5,954	4,863	10,817	24,984
2020	1,692	557	2,249	7,238	4,148	11,386	1,242	1,472	2,714	8,044	7,807	15,851	32,200
2021	848	329	1,177	3,520	1,187	4,707	700	222	922	4,407	2,571	6,978	13,784
2022	392	37	429	1,519	254	1,773	243	74	317	3,031	787	3,818	6,337
2023	1,151	20	1,171	4,364	161	4,525	735	183	918	4,359	882	5,241	11,855

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

Figure 3-25 shows the spatial distribution of Chinook salmon bycatch by genetic cluster area. Chinook salmon bycatch was higher in Cluster 1 in all years compared to other areas (see Figure 3-25). During the A season, Chinook salmon are typically encountered within and just outside of the eastern portion of the CVOA, but bycatch encounters are more distributed across the Bering Sea shelf during the B season (see Figure 3-26).

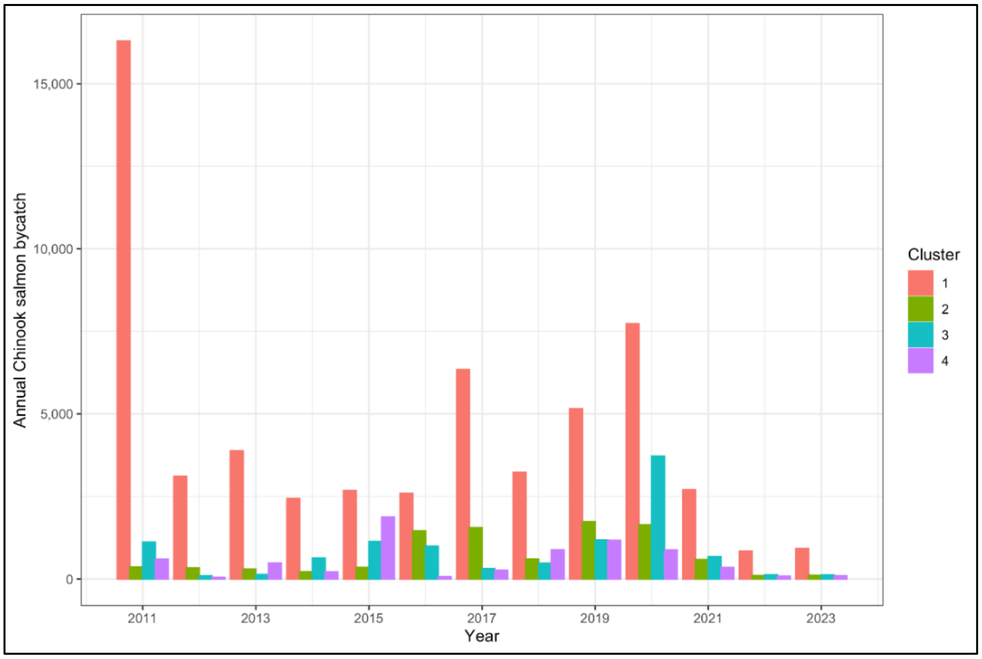

Figure 3-25 Spatial distribution of Chinook salmon bycatch (numbers of fish) by genetic cluster area, 2011–2023

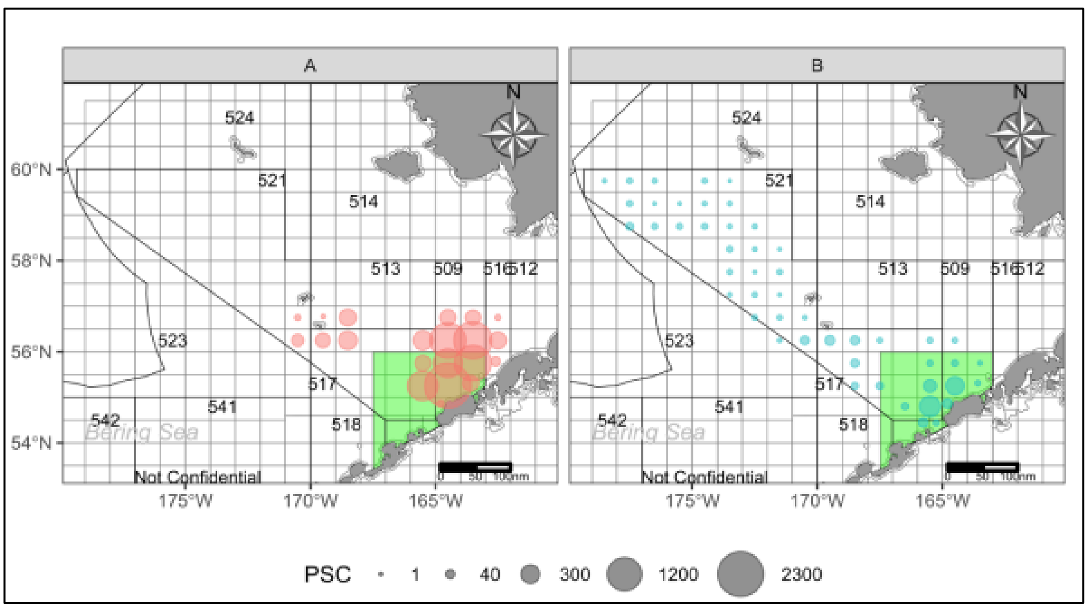

Figure 3-26 Location and timing of Chinook salmon PSC in the Bering Sea pollock A and B season (2023) by NMFS management areas (black) and ADF&G stat areas (gray) where circles represent the total amount of bycatch and the CVOA is shaded green

Source: Barry et al. (2024)

3.3.1.1 Chinook Salmon Stock Composition Estimates

Chinook salmon caught as bycatch in the Bering Sea pollock fishery originate from river systems in Russia, Asia, across Alaska, and the Pacific Northwest. For Chinook salmon, the contribution of 11 regional stock groups is estimated: Russia, Coastal Western Alaska, Middle Yukon, Upper Yukon, North Alaska Peninsula, Northwest Gulf of Alaska, Copper River, Northeast Gulf of Alaska, Coastal Southeast

Alaska, British Columbia, and West Coast United States. The coastal western Alaska genetic stock reporting group includes all major river systems in western Alaska from the Kotzebue region in the north to the Bristol Bay region in the south excluding the middle and Upper Yukon River.

Figure 3-27 provides the annual stock composition estimates (top panel) and the estimated number of Chinook salmon (bottom panel) caught as bycatch from 2011–2023. The proportion of coastal Western Alaska (Coast WAK) has decreased from a high of 68.0% in 2011 to a low of 23.7% in 2017 and has fluctuated around ~47% since 2020 (see Figure 3-27). The proportion of Chinook salmon PSC from the North Alaska Peninsula (NAK Pen) reporting group has increased in recent years, averaging 13.5% between 2011–2020 and 31.9% since. Despite the increase in the relative proportion for this group, because of the overall decline in Chinook salmon bycatch numbers, the number of Chinook salmon caught in this reporting group has remained consistent, averaging 3,160 fish (2011–2023).

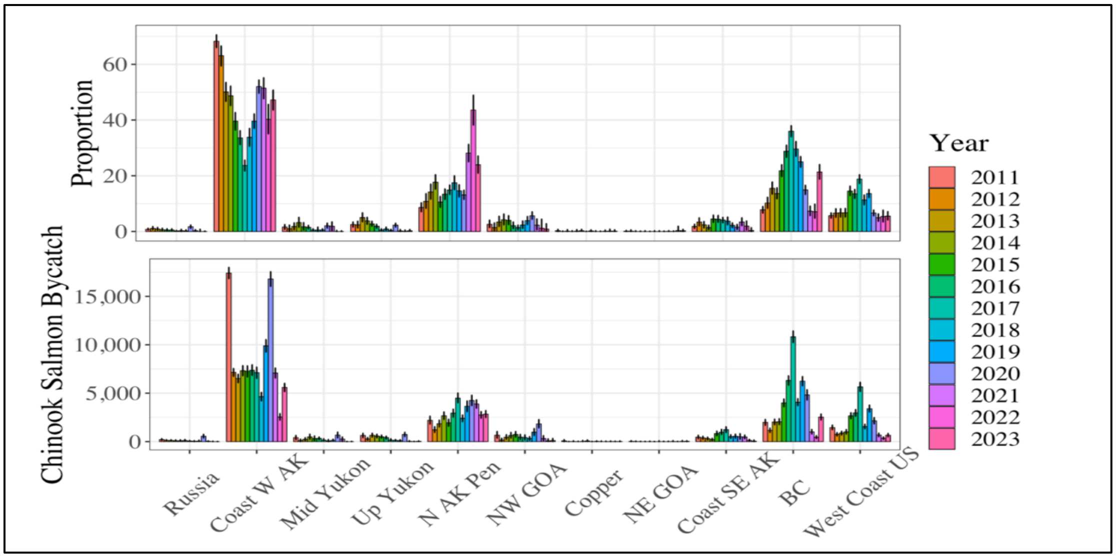

Figure 3-27 Annual stock composition estimates (top) and estimated number of Chinook salmon bycatch (bottom) with their 95% credible intervals (black line) in the Bering Sea pollock fishery, 2011–2023

Source: Barry et al. (2024)

3.3.1.2 Chinook Salmon AEQ and Impact Rate

An AEQ model was developed for use in the Amendment 91 Chinook EIS/RIR (NPFMC/NMFS 2009; Ianelli & Stram 2014) to understand the effects of removals of Chinook salmon due to bycatch in the pollock fishery impact Chinook salmon populations. This required a method be developed to estimate how the different bycatch numbers would propagate to adult equivalent spawning salmon which are distinguished from the annual bycatch numbers recorded by observers each year for management purposes. The Chinook salmon caught in the pollock fishery range in age-2 to age-7 with the majority being 3-6-year-olds. The impacts of bycatch in any one year may be lagged by several years. Analyses for Chinook salmon have included an estimated AEQ mortality for the Upper Yukon and combined Western Alaska stocks (Figure 3-28). As shown, adult equivalents from each reporting group have declined since historically high levels in 2007 with an increase in 2020.

To estimate the impact of bycatch in the pollock fishery on these aggregate stock groupings, the AEQ estimates provided in Figure 3-28 were compared to run-size information assembled for two regional stock groupings (aggregate coastal Western Alaska including the Middle Yukon and the Upper Yukon, Canadian-origin fish). Table 3-42 provides the estimated impact rates of the pollock fishery bycatch for these two regional stock groupings alongside the lower and upper bound of confidence intervals. The impact rate for the Upper Yukon reporting group was less than 1% in all years from 2011 –2023, except for 2022 when the impact rate was estimated at 1.1% of the total run size. The impact rate for the CWAK reporting group ranged from 1.2%–3.6% (2011–2023). The impact rate in 2022 for Upper Yukon reporting group declined after a slight increase in 2021 while rates for the Combined WAK have steadily declined since 2020.

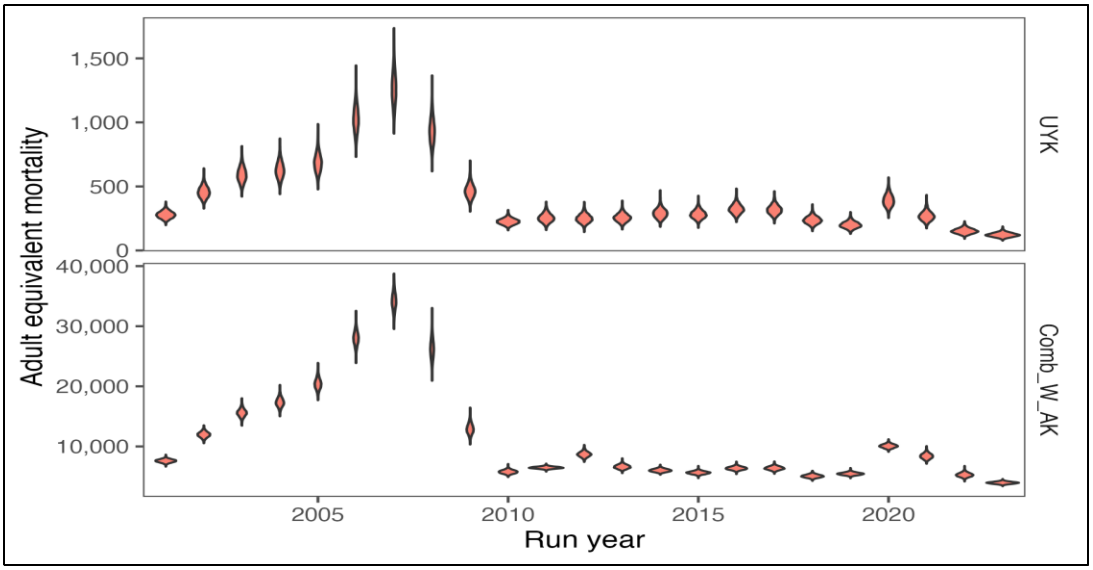

Figure 3-28 Chinook salmon PSC adult equivalent mortality by run year for the Upper Yukon stock (upper panel) and the combined Western Alaska (coastal Western Alaska and Middle Yukon) stocks (lower panel)

Table 3-42 Estimated impact (median and lower and upper 95% confidence intervals) for combined western Alaska stocks and Upper Yukon impact estimates by year of return (run-year), 2011–2023

Year	Upper Yukon	CWAK
2011	0.4% (0.3% - 0.5%)	1.7% (1.6% - 1.8%)
2012	0.5% (0.4% - 0.6%)	2.5% (2.3% - 2.8%)
2013	0.6% (0.5% - 0.8%)	2.3% (2.1% - 2.6%)
2014	0.4% (0.3% - 0.6%)	2.2% (2.0% - 2.4%)
2015	0.3% (0.3% - 0.4%)	1.4% (1.2% - 1.5%)
2016	0.4% (0.3% - 0.5%)	1.6% (1.5% - 1.7%)
2017	0.3% (0.3% - 0.4%)	1.6% (1.5% - 1.8%)
2018	0.3% (0.2% - 0.4%)	1.4% (1.2% - 1.5%)
2019	0.2% (0.2% - 0.3%)	1.2% (1.1% - 1.3%)
2020	0.7% (0.6% - 0.9%)	3.6% (3.4% - 3.8%)
2021	0.8% (0.6% - 1.0%)	3.0% (2.8% - 3.4%)
2022	1.1% (0.9% - 1.5%)	2.1% (1.8% - 2.3%)
2023	0.8% (0.6% - 1.0%)	1.7% (1.6% - 1.9%)

Notes: The 2023 estimates are based on a projection and have a higher degree of uncertainty associated with them. The 2023 estimates will be revised following genetics information from the 2023 fishery.

The current Chinook salmon bycatch management program was extensively evaluated in the FEIS prepared for Amendment 91 (NMFS 2009) and the EA/RIR prepared for Amendment 110 (NMFS 2016), in addition to what is presented here, and is not expected to have adverse impacts to Chinook salmon.

3.3.2 Alternatives 2 and 3

The alternatives are analyzed against the status quo bycatch levels to estimate the potential impacts of additional chum salmon PSC regulations. The proposed management alternatives to reduce chum salmon bycatch in the pollock fishery would affect fishing behavior, and there could be a wide range of potential interactions with Chinook salmon.

Compared to Alternative 1, Chinook salmon bycatch could decrease under the chum salmon PSC limits being considered under Alternatives 2 and 3. An average of 5,448 Chinook salmon were estimated to be saved under a 100,000-chum salmon PSC limit using the pro rata apportionment. The potential for Chinook salmon savings decreases as the PSC limit increases. At a 550,000 cap, an average of 772 Chinook salmon were estimated to be saved using the 3-year apportionment compared to 1,436 under the AFA apportionment. **These estimates do not account for likely future behavior changes.**

Table 3-43 Estimates on fleet-wide Chinook salmon PSC reductions (number of fish) as if the chum salmon PSC limits and apportionment had been in place from 2011 –2023 under Alternative 2

Cap	100,000				325,000				550,00			
Split	3-year avg.	5-year avg.	Pro rata	AFA	3-year avg.	5-year avg.	Pro rata	AFA	3-year avg.	5-year avg.	Pro rata	AFA
2011	17,407	17,479	17,479	16,754								
2012												
2013	3,544	3,626	3,626	3,762								
2014	2,834	2,834	2,834	2,720								
2015	3,293	3,057	3,093	2,270				1,392				
2016	4,503	4,467	4,467	4,394	1,919	1,733	1,733	1,358	1,228			
2017	5,781	5,749	5,781	5,539	1,003	1,003	1,003	1,913	781	770	660	191
2018	3,658	3,658	3,658	3,788	1,232	789	789				2,102	
2019	8,270	8,270	8,253	8,041	2,991	2,991	2,991	1,196				
2020	12,191	12,154	12,154	11,796	6,231	4,594	4,594	6,319				
2021	3,098	3,089	3,098	3,173	2,892	2,760	2,760	2,216	308	2,030	1,981	1,981
2022	441	441	441	522	0	0	0	0				
2023	381	494	494	544								

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

The pollock fishery catches both chum salmon and Chinook salmon bycatch during the B season. The timing of this catch is dissimilar amongst the two species, with Chinook salmon caught in the latter part of the B season and chum salmon caught throughout the B season. Additionally, WAK chum salmon bycatch is encountered in higher proportions from June to August compared to the later aspects of the B season (see Section 3.2.4.1.3). Similar trends were also observed inside the corridor areas under consideration Alternative 5.

As a chum hard cap becomes more constraining, pollock fishing would slow down to account for the chum salmon bycatch in each haul or delivery to a shore-based processor. As pollock catch is diverted later in the B season, Chinook salmon PSC would increase from status quo. Chinook salmon bycatch rates increase in October, as illustrated by Figure 3-29 that compares the fleet's average weekly chum salmon PSC rate (black), Chinook salmon PSC rate (gray), and pollock harvest (blue) during the B season, 2011–2023. While providing average values over the status quo period may dampen interannual variability, a consistent trend in Chinook salmon bycatch is that the rates tend to increase in September and October (NMFS 2009 and 2016).

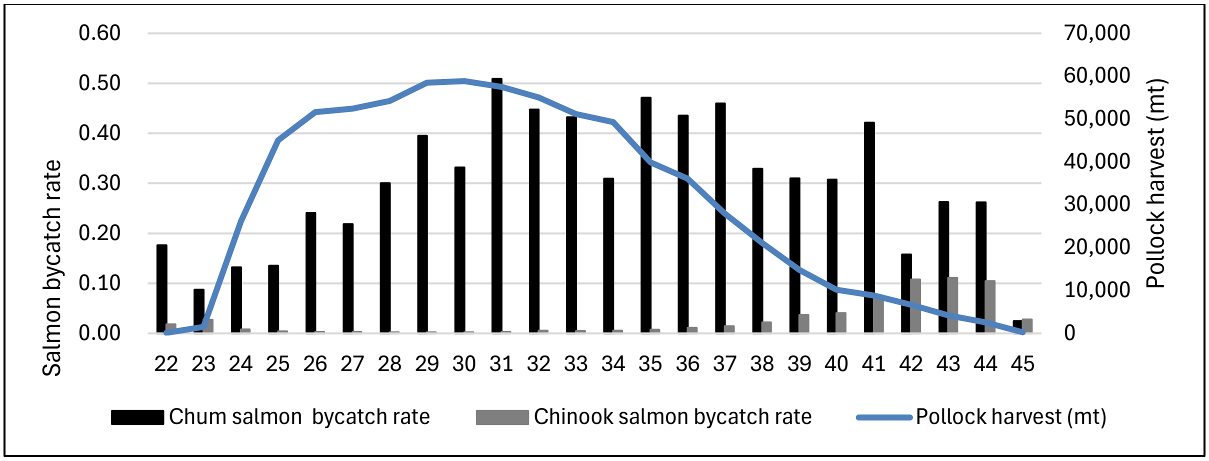

Figure 3-29 Comparison of the weekly fleet-wide weekly average chum salmon bycatch rate, Chinook salmon bycatch rate, and pollock harvest (mt), 2011–2023

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

There is a clear trend that Chinook salmon PSC rates increase during September and October where October generally aligns with statistical weeks 41–44. To avoid chum salmon, fishermen could move more frequently, use a lower threshold to advise vessels move out of areas prior to a hotspot closure being implemented under the RHS program, and/or slow the pace of pollock fishing to carefully monitor chum salmon PSC against the remaining cap amount. If fishermen cannot find equally good catch rates after moving to avoid chum salmon, and/or or the pace of fishing significantly slows down, some pollock catch would be displaced to later weeks with adverse effects to Chinook salmon PSC. This scenario would be more likely under lower chum salmon PSC limits which are inherently more constraining.

The implications for Chinook salmon PSC under Alternative 3 are similar to Alternative 2. When considered across multiple years, the magnitude for either Chinook salmon PSC reductions due to an early closure or increases due to a B season extension are less under Alternative 3 as compared to Alternative 2**.** This is simply because an overall chum salmon PSC limit would not have been in effect in all 13 years. A chum salmon PSC limit would have been in effect in either 3 or 6 years under Alternative 3, Option 1 and 4 or 5 years under Alternative 3, Option 2.

While Chinook salmon PSC could increase under Alternatives 2 and 3, a scenario that becomes more likely as pollock catch is diverted later in the B season, the estimated impacts would not diminish the protections afforded to Chinook salmon under the provisions of Amendment 91 and the more stringent regulations implemented under Amendment 110.

3.3.3 Alternative 4

Alternative 4 would not result in adverse impacts to Chinook salmon PSC. The pollock fleet has operated under the IPAs since 2010, and the provisions under Alternative 4 largely reflect operations in recent years. Additionally, the IPAs would retain the priority for Chinook salmon closures that is intended to ensure Chinook salmon PSC is minimized. The Chinook threshold provides a benchmark whereby chum salmon closures cease once the threshold for the Chinook rate (0.035 Chinook/mt pollock) is reached. This restrains fleet movement under chum salmon closures to avoid any exacerbation of Chinook salmon PSC.

3.3.4 Alternative 5

Alternative 5 would include inseason corridors triggered by area-specific chum salmon PSC limits. The subsequent analysis of potential impacts to Chinook salmon PSC builds on that which was provided in Section 3.2.4.4.1.3 related to chum and WAK chum salmon PSC. The operational considerations are the same and not repeated here. Table 3-44 compares the pollock harvest (mt), Chinook salmon PSC (numbers of fish), and Chinook salmon PSC rate during June and July, August, and September through November 1 in each corridor (2019–2023). As shown, the levels of encounters and Chinook salmon bycatch rates were highest in all corridors during the later aspect of the B season (i.e., September to November 1) compared to earlier periods.

Table 3-44 Comparison of pollock harvest (mt), Chinook salmon PSC (number of fish), and Chinook salmon PSC rate during June and July, August, and September–November 1, 2019–2023

Category	Year	Cluster Area 1			Unimak			Cluster Area 2		
		June | July	Aug	Sep | Nov	June | July	Aug	Sep | Nov	June | July	Aug	Sep | Nov
Pollock	2019	132,998	131,409	114,612	129,590	127,878	88,296	24,968	8,206	42,559
	2020	36,976	71,607	127,079	36,651	64,714	122,547	6,484	24,404	17,638
	2021	190,748	102,482	83,084	183,349	97,763	74,997	21,918	11,325	47,985
	2022	208,839	70,337	16,025	169,179	63,857	14,844	90,268	3,538	6,403
	2023	160,372	30,769	77,587	134,365	29,146	74,932	14,088	21,814	462
Chinook PSC	2019	2,626	591	1,914	580	2,589	1504	25	73	1,662
	2020	255	390	7,071	388	240	6,711	75	12	1,558
	2021	348	757	1,589	729	333	1,511	13	111	459
	2022	343	394	99	328	331	93	3	89	12
	2023	36	433	453	419	33	439	43	63	3
Chinook salmon PSC rate	2019	0.020	0.004	0.017	0.004	0.020	0.017	0.001	0.009	0.039
	2020	0.007	0.005	0.056	0.011	0.004	0.055	0.012	0.000	0.088
	2021	0.002	0.007	0.019	0.004	0.003	0.020	0.001	0.010	0.010
	2022	0.002	0.006	0.006	0.002	0.005	0.006	0.000	0.025	0.002
	2023	0.000	0.014	0.006	0.003	0.001	0.006	0.003	0.003	0.006

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

Figure 3-30 below shows the weekly chum salmon PSC rate, Chinook salmon PSC rate, and pollock harvest (mt) for each corridor area by sector (2019–2023). Chinook salmon bycatch rates vary by sector and corridor but clearly increase during late September through October which generally aligns with weeks 39–44. It is possible that a corridor closure could reduce Chinook salmon PSC if a sector moved out of that area was able to find good pollock catch rates, as well as lower chum and Chinook salmon bycatch rates outside the corridor. However, given that Chinook salmon bycatch rates remain relatively low for all sectors and areas the spatial displacement of pollock catch may present less potential for adverse impacts to Chinook compared to the temporal displacement of catch.

Similar to Alternatives 2 or 3, there is a risk that inseason corridors could increase Chinook salmon PSC if one or more sectors fish later into the B season due pollock fishing being displaced outside of the corridor. Since the highest amount of pollock catch moved out of the corridors would come from closing Cluster 1 or Unimak to the CV sectors, prioritizing chum salmon avoidance in these corridors would be more likely to result in adverse impact to Chinook salmon bycatch (see Table 3-39 and Table 3-40). Pollock vessels are constrained by other regulations and environmental conditions in where they can move to target pollock. In a year like 2019, the inshore sector would have needed to find equally good fishing grounds outside of Cluster 1 from June 29 to September 1 to not risk displacing some amount of the 200,000 mt of catch later in the B season or have found substantially higher catch rates.

P and CDQ sectors have not relied on Cluster 1 or Unimak for their B season pollock harvest compared to Cluster 2 and other fishing grounds. The highest amount of pollock catch displaced from Cluster 2 under a corridor cap of 50,000-chum salmon was ~9,500 mt from the inshore sector in 2021. A Cluster 2 corridor closure could move CPs further northwest, and the inshore and mothership CVs would move to historically productive fishing grounds in Cluster 1 and Unimak (all other considerations being equal). Thus, the retrospective analysis shows Cluster 2 could result in neutral impacts to Chinook salmon based on temporal displacement of pollock catch.

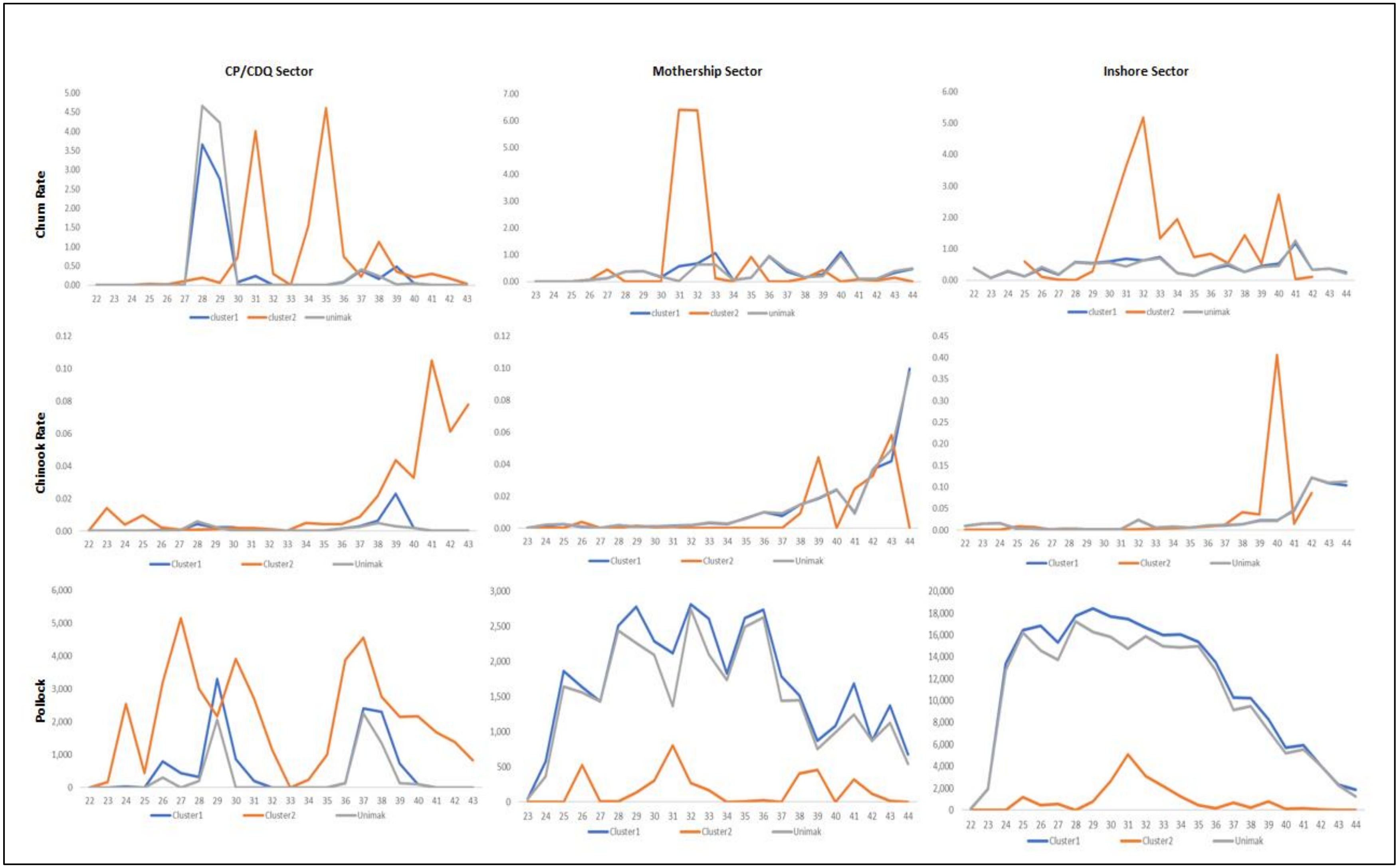

Figure 3-30 Distribution of the average weekly chum salmon PSC rate, Chinook salmon PSC rate, and pollock harvest (mt) for each corridor area by sector, 2019–2023

3.3.5 Cumulative Effects on Chinook

Past and present human actions associated with Chinook salmon are described throughout this section and in numerous other documents including the 2004 Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement and Supplemental Information Report (NMFS 2004; NMFS 2015). This includes climate change impacts, subsistence, sport, personal use, and commercial fisheries that have occurred in the past and/or continue to occur for Chinook, implementation of CDQ and AFA, as well as bycatch in the Bering Sea pollock fishery and bycatch management actions that have previously occurred.

RFAs that may have a cumulative impact with the proposed actions include authorization and prosecution of the Bering Sea pollock fishery and climate change, described at the beginning of Chapter 3. In addition, Chinook salmon may be affected by:

Bycatch management tools. Although previously established in Federal regulation, the continued use of Chinook bycatch management tools in the Bering Sea pollock fishery may constitute an RFA. For instance, Federal regulations at 50 CFR 679.21(f)(12)(iii)(E)(*11*) currently require for the use of salmon excluder devices, (with recognition of contingencies), in the A season for reducing Chinook bycatch. It is also common practice for vessels to continue to use an excluder in the B season.

The implementation of Chinook salmon PSC limits constitutes a past action; however, the industry-established process for ensuring catch of Chinook remains under these limits and the methods used to address the IPA requirements, may be considered action(s) that would be reasonably foreseeable in the future as well. For instance, this includes use of the RHS program and data sharing agreement through Sea State to generate a system to incentivize the avoidance of Chinook salmon at all levels of abundance.

Subsistence and commercial Chinook salmon fisheries. A broad RFA for Chinook includes the continued management of commercial, subsistence, sport, and personal use salmon fisheries, as described in Section 3.2.3. Chinook salmon runs in Western Alaska have seen substantial declines over the past decade. Chinook salmon runs on the Kuskokwim River were the lowest on record from 2012 through 2014 and have remained below the historical average, resulting in restrictions to subsistence fisheries. Subsistence harvests of Chinook salmon on the Yukon River have declined since 2007 and commercial and sport harvests have declined since 1998. Commercial Chinook fisheries on the Yukon have seen tight restrictions and closures since 2008. On April 1, 2024, ADF&G and the Department of Fisheries and Oceans Canada signed a seven-year agreement to suspend commercial, sport, domestic and personal use fishing for Chinook on the Yukon River and Canadian tributaries. This means future in river removals will be limited to ceremonial subsistence use and the transmission of cultural knowledge until 2030, unless in-river abundance of Canadian-origin Chinook salmon is bilaterally projected to exceed 71,000 at the U.S./Canada border.

<u>Cumulative Effects of the Proposed Actions with RFAs:</u> The cumulative effect of the RFAs and proposed alternatives are inherently considered in this section through the analysis of impacts on Chinook salmon and Section 3.5 on policy-level tradeoffs). For instance, the expected impacts of a chum PSC limit on Chinook includes an assumption that the Bering Sea pollock fishery would be authorized and continue to be prosecuted, that existing bycatch management tools would continue included the required use of excluders during the A season, overall Chinook PSC limits, IPA requirements, and the use of the RHS system for in season avoidance.

As described throughout this section, potential impacts on Chinook PSC from the Alternative 2, 3 and 5 are unknown both in terms of magnitude and direction. For instance, effects on Chinook PSC may vary based on the chum PSC limit amount, apportionment method, and pollock harvester’s operational strategies.

There is a potential under Alternative 2, 3 or 5 that Chinook PSC may increase relative to Alternative 1, if reaching a chum PSC limit (Alternative 2 or 3) or the corridor cap (Alternative 5) is perceived to be a greater risk than reaching one of the other PSC limits. Chinook PSC may also increase relative to status quo if a pollock sector's operations are less efficient to the extent that it drives harvesting later in the B season, as this correlates with higher Chinook PSC. Due to the incentives created from the overall Chinook PSC and performance standard, paired with the IPA's internal management of this limit, it is not expected that Chinook PSC would increase to a level where the overall sector limit is met. However, Chinook PSC may increase relative to what it would have been in the absence of Alternative 2, 3, or 5.

There are also scenarios under any of the action alternatives in which Chinook PSC may be reduced relative to status quo levels. For instance, this could be the case if a sector is closed early due to reaching a chum PSC limit. Chinook that may have been caught as PSC later in the season would be left in the water. When paired with other RFAs, such as the seven-year agreement on the Yukon River, if the action alternatives are able to reduce Chinook PSC relative to status quo, this may enhance the success of these in river effort to conserve the Chinook runs.

3.4 Herring

Herring are abundant in Alaska marine waters and commercial fisheries exist throughout State waters in both the BSAI and GOA, primarily for herring roe with smaller fisheries for food and bait. These fisheries target herring returning to nearshore waters for spawning. Herring in different areas are managed as separate stocks. The largest stock in the BSAI spawns in Togiak Bay in northern Bristol Bay and the next largest stock is in Norton Sound. ADF&G uses a combination of different types of surveys and population modeling to set catch limits.

Herring are widely distributed throughout the North Pacific, and herring that spawn along the eastern shore of the Bering Sea are thought to migrate seasonally between their spawning groups and wintering areas near the western edge of the Bering Sea continental shelf, north and west of the Pribilof Islands (Tojo et al., 2007). Figure 3-31 shows the spatial distribution of herring in the BSAI region captured by the bottom trawl survey and the BASIS survey are different and may result from the seasonal movement of herring (Vollenwider et al. 2024). The bottom trawl survey occurs primarily in June and July and is likely capturing herring that are out-migrating from nearshore spawning areas.

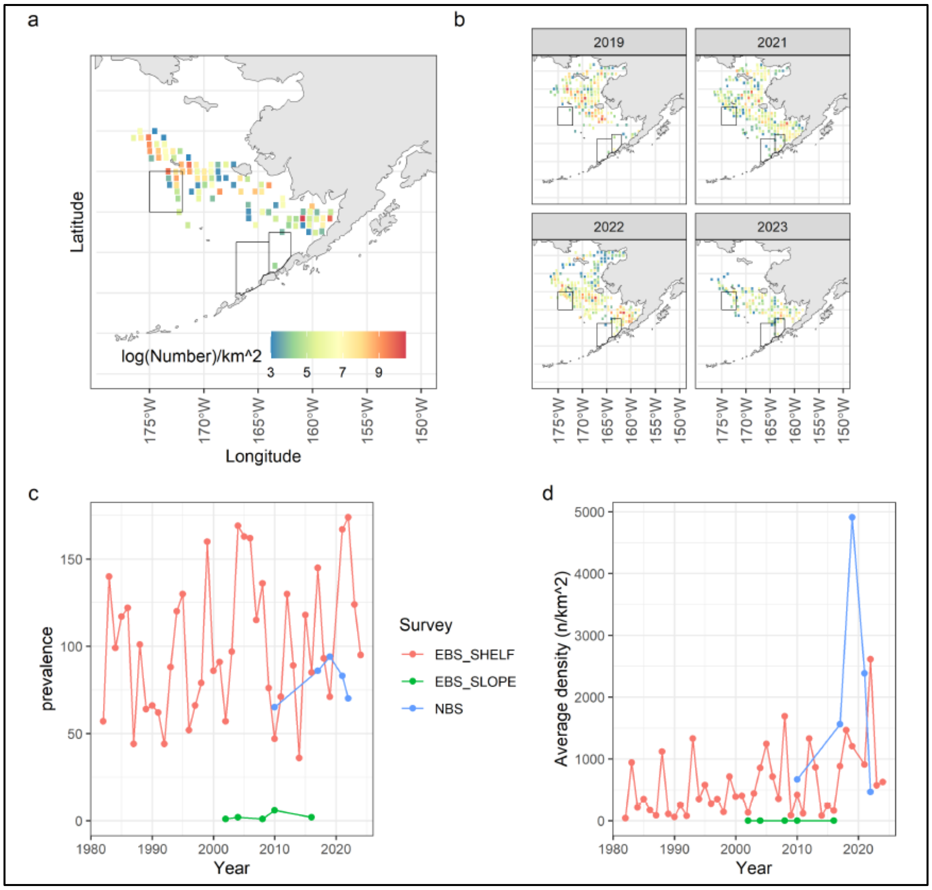

Figure 3-31 Spatial density of BSAI Pacific herring survey data from Vollenweider et al. (2024).

Notes: Spatial density in BSAI surveys (a), spatial densities in the previous four years for which survey data was available (b), prevalence in terms of the number of survey stations that returned positive tows for this species (c), and average densities split by survey location in the BSAI (d).

3.4.1 Effects of the Alternatives on Herring

3.4.1.1 Alternative 1

The existing management measures for herring PSC in the BSAI groundfish trawl fisheries include the Herring Savings Areas (HSAs) and a PSC limit framework established under Amendment 16a to the BSAI Groundfish FMP. The HSAs are triggered time and area closures based on the PSC limit which is set annually at 1% of the herring spawning biomass. The three areas and their timed closures are shown in Figure 3-32. The herring PSC limit is published in the annual harvest specifications and apportioned to the trawl directed fishing categories (see 50 CFR 679.21(e)(3)(iv)(B) through (F)). Attainment of any apportionment triggers the HSA to close to that fishery based upon the timing of each area closure. A fishery is accountable for its herring PSC on the basis of a fishing year (January 1 to December 31). Once a fishery has reached its annual herring PSC allowance, further fishing in the Summer and Winter HSAs would be prohibited during that year. However, the Winter HSA would be in place if the herring PSC limit is reached during September 1-March 1 and continues into the subsequent year.

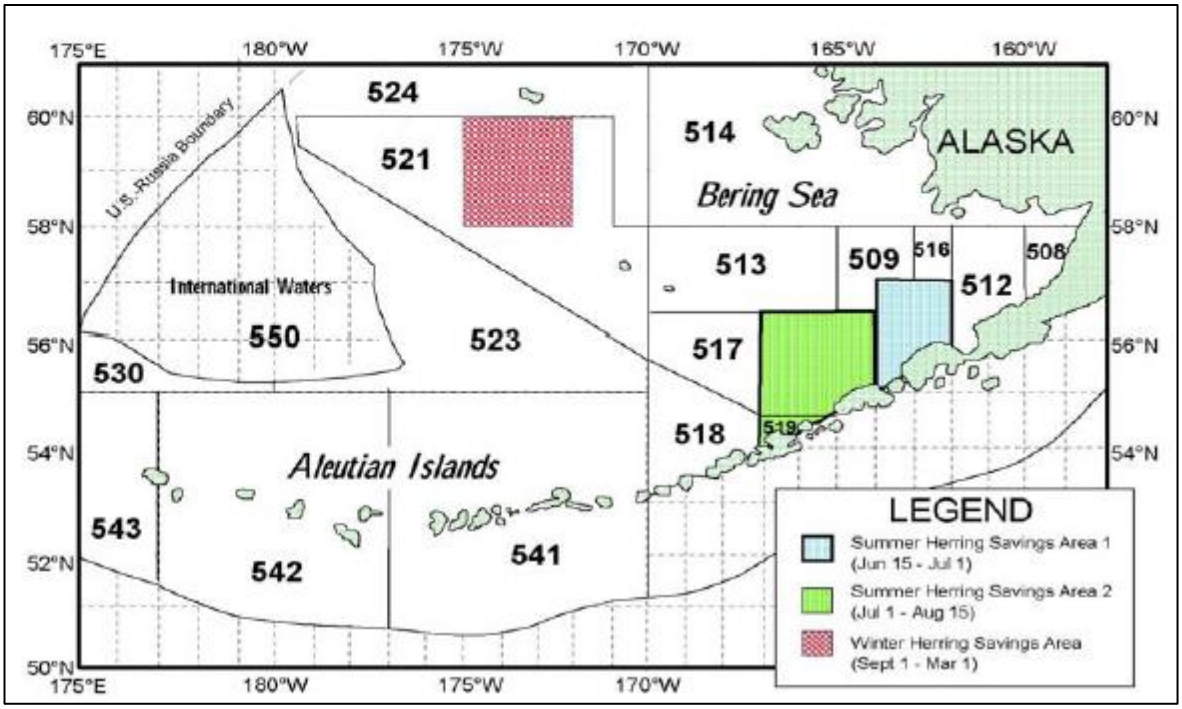

Figure 3-32 Herring Savings Areas

Note: The locations of the HSAs were based upon available herring migration data in the 1980s.

Table 3-45 compares the pelagic pollock trawl fishery's herring PSC (mt) to the amount of the annual herring PSC limit it is apportioned and the percent of the PSC limit caught each year from 2011–2023. As shown, the annual amount of herring PSC (mt) caught by the pelagic pollock fishery ranged from 151 (mt) in 2014 to 3,720 (mt) in 2020; the fishery exceeded its apportionment of the limit in 2012 and 2020.[74] While herring are encountered by the fishery in both the A and B seasons, bycatch tends to be higher during the B season. The 2020 A season was an exception to this trend.

Togiak herring biomass has been increasing in recent years as a result of strong 2016- and 2017-year classes that have also contributed to higher PSC in the pollock fishery in recent years (Joy et al., 2023). The 2017-year class is now approaching full size and maturity and should begin to age out of the population as natural mortality accrues in coming years. However, changing spatial distributions of herring biomass and/or changes in the distributions of directed pollock and flatfish fisheries could result in exceeding PSC limits when and if exceptionally large year classes occur in the future (Joy, et al. 2023).

The amount of herring PSC encountered by the pollock fishery is less than that of all groundfish fisheries combined and below 1% of the estimated herring biomass and thus Alternative 1 is not expected to have adverse impacts to herring PSC.

[74] A request for emergency action was submitted in 2020 to suspend the closure of the Winter Herring Savings Area in order to allow the fishery to operate and achieve Optimum Yield rather than be pushed into areas of less productive fishing and potentially higher herring bycatch areas. The summer HSA was re-opened by NMFS in 2020 as well to prevent the underharvest of the 2020 pollock TAC.

Table 3-45 Pollock fishery herring PSC (mt) compared to the fishery's apportionment of the limit (mt) and percent of the limit caught

Year	Herring PSC (mt)	PSC limit (mt)	% of limit
2011	346	1,737	19.9%
2012	2,167	1,600	135.4%
2013	959	2,165	44.3%
2014	151	1,776	8.5%
2015	1,386	2,242	61.8%
2016	1,425	2,151	66.2%
2017	956	1,800	53.1%
2018	307	1,662	18.5%
2019	1,080	2,313	46.7%
2020	3,720	2,299	161.8%
2021	1,698	2,472	69.0%
2022	1,678	3,400	49.0%
2023	3,059	3,066	99.7%

Source: NMFS Inseason. https://www.fisheries.noaa.gov/alaska/commercial-fishing/fisheries-catch-and-landings-reports-alaska

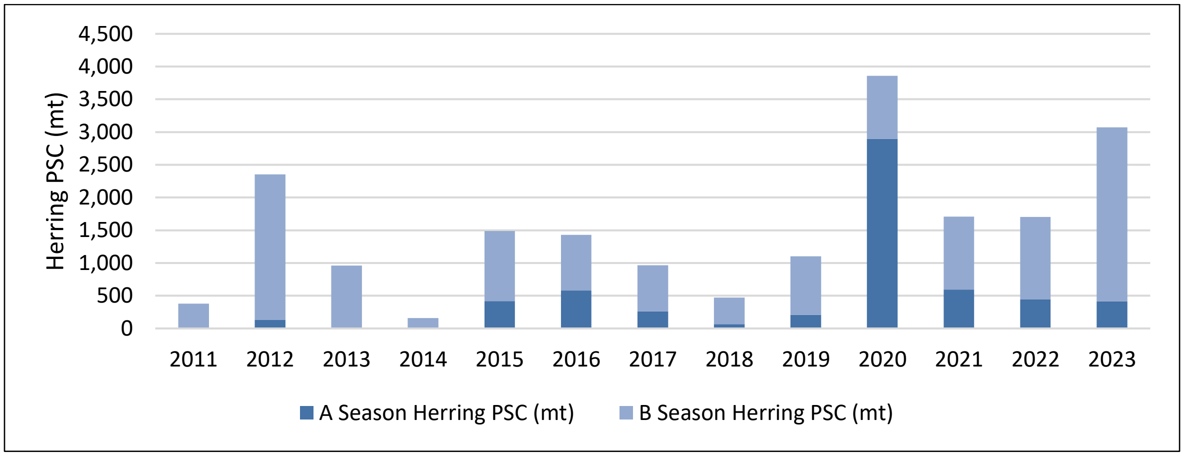

Figure 3-33 Comparison of Herring PSC (mt) during the A and B season pollock fishery, 2011–2023
Source: NMFS Alaska Region CAS, data compiled by AKFIN.

3.4.1.2 Alternatives 2 and 3

The alternatives are analyzed against the status quo levels of herring PSC to estimate the potential impacts of additional chum salmon bycatch regulations. The proposed management alternatives to reduce chum salmon bycatch in the pollock fishery would affect fishing behavior, and there could be a wide range of potential interactions with herring. While herring PSC could increase under these proposed regulatory changes for chum salmon bycatch, the estimated impacts would not diminish the protections afforded by the existing PSC limit.

An early B season closure would result in some herring PSC (mt) savings compared to status quo. Under a 100,000-chum salmon PSC limit the estimates on potential reductions ranged from an average of 223 mt to 259 mt depending on the apportionment; estimates on potential herring savings substantially decrease as the chum salmon PSC limit increases. **However, the pollock fleet is likely to change is fishing behavior in response to a chum salmon hard cap which could increase herring PSC prior to or regardless of that hard cap being met (see Section 3.2.4.2.5).**

Alternative 2 and 3 would require the pollock industry to operate under two hard caps during the B season fishery, one for Chinook salmon and the other for chum salmon PSC. The annual herring PSC limit would also be in place. It is assumed the fleet would not want to incur the cost of an early B season closure due to reaching either the Chinook or (potential) chum salmon PSC cap, nor would fishermen want to lose access to the fishing grounds encompassed within the HSAs by triggering their closure. The pollock industry would take measures to avoid all PSC to the extent practicable under this regulatory scenario, although it inherently limits the operational flexibility afforded to the fleet to avoid PSC.

The pollock fleet would need to make inseason management choices on how to carefully balance their operations against these constraining limits. For instance, if a sector was encountering higher herring PSC, operational choices may need to be made on where to move vessels to avoid further herring while also maintaining low chum salmon PSC. Fleet managers have shared that the CV sectors could be moved onto the shelf where herring bycatch has recently been less likely to be encountered, but chum salmon and WAK chum salmon may be more prevalent (see Table 3-30).[75]

Conversely, there could be a scenario where the fleet balances its chum salmon PSC against the overall cap, and their operational choices inadvertently result in the fishery reaching the herring PSC limit. Closing the summer HSAs (because the herring PSC limit was met) would require vessels to move out of the area which encompasses historically productive fishing grounds. Vessels may concentrate their effort on the edge of the closure to continue fishing the most productive grounds and closer to port. This proximity is particularly important for the inshore sector. Based on the location of the summer HSAs, a closure would likely move most CVs into Cluster 2 if the pollock aggregations were good and could sustain fishing. Some vessels would go also go further northwest as able. However, increased fishing inside Cluster 2 poses the risk these CVs would have higher chum salmon bycatch.

CPs are more affected by the Winter HSA. In some recent years, herring bycatch has been higher outside of the Winter HSA compared to within it (Table 3-46). If the pollock fishery exceeded the herring PSC limit while balancing its chum salmon PSC against the overall cap, an unintended consequence may occur as vessels are moved to new grounds with potentially higher herring PSC.

Table 3-46 Comparison of herring PSC rates inside the Winter HSA, HSA1, HSA2, and all outside areas (remainder) during the B season pollock fishery, 2019–2023

Year	Herring PSC rate inside Winter HSA	Herring PSC rate inside HSA1	Herring PSC rate inside HSA2	Herring PSC rate in remainder
2019	0.02	1.82	2.23	0.12
2020	0.39	1.19	3.67	0.38
2021	0.02	15.03	3.02	0.05
2022	1.97	0.02	3.26	0.94
2023	0.53	0.44	8.64	1.47

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

The implications for herring PSC under Alternative 3 are similar to Alternative 2. When considered across multiple years, the magnitude for herring PSC savings under Alternative 3 is less than what is expected under Alternative 2 because a chum salmon PSC limit would not be in effect during each B season. If the hard cap set when one area fails to meet its abundance thresholds is 100,000 chum salmon, a 75,000-chum salmon PSC limit could be in effect in a B season when two or more areas failed to meet their thresholds. In the years where a hard cap of 75,000 chum salmon is in effect, there is greater potential for adverse effects to herring PSC because this cap amount is more constraining for the fleet compared to caps analyzed at higher amounts.

Overall, these dynamics make the potential impacts to herring uncertain, both in their direction and magnitude, particularly at lower chum salmon hard cap amounts. Operational choices would be made by the fleet on a season-by-season basis which would affect the potential outcomes.

[75] Personal communication, S. Martell.

3.4.1.3 Alternative 4

Alternative 4 is not expected to result in adverse impacts to herring. The pollock fleet has operated under the IPAs since 2010 and the proposed provisions largely reflect recent fishing behavior.

3.4.1.4 Alternative 5

The analysis of potential impacts to herring PSC under Alternative 5 is focused on the operational tradeoffs that may present themselves if the industry was required to operate under two different PSC limits that trigger time and area closures, one for herring and the other for chum salmon. The analysis presents information from the most 2021–2023 which represent the most recent three years of available fisheries-dependent data. Each sector's reliance on the inseason corridors for their pollock harvest is the same as that which is described in Section 3.2.4.4.1.3 and not repeated here. Figure 3-34 shows the spatial distribution of herring PSC (top panel) and chum salmon PSC (bottom panel) in June and July, August, and September to November 1 from 2021 to 2023. The spatial distributions are depicted along with the boundaries of the three corridors under consideration in Alternative 5 and the summer HSAs (purple). Herring bycatch is generally higher during June and July compared to later months during the B season, but the spatial distribution of herring PSC is variable.

In **2021**, In 2021, at the low cap amount of 50,000 chum salmon, the Cluster 1 and Unimak corridors would have closed to the CDQ, inshore, and mothership sectors under all apportionments. The cap would have been met in both areas at variable dates between July 3 and July 17 (see Appendix 3). While the CDQ sector met the Cluster 1 and Unimak cap, no pollock catch was moved from the areas because the sector did not continue fishing inside the corridor after that week. In 2021, at the low cap of 50,000 chum salmon, all sectors except CDQ met the cap on July 31 across all apportionments. Corridor caps at 200,000 chum salmon would have been met by in a variable number of years and apportionments.

If the CV sectors responded to a Cluster 1 or Unimak closure in 2021, many vessels may move to Cluster 2 and then further northwest as able. In the 2021 B season, this movement scenario may have reduced herring bycatch to a degree because PSC was higher in the Unimak corridor in June and July compared to Cluster 2. On the other hand, this movement scenario could have had adverse impacts to chum and WAK chum salmon PSC compared to status quo. The chum PSC rates were higher in Cluster 2 at 8.30 chum/mt of pollock compared to Cluster 1 and Unimak at approximately 1.0 chum/mt of pollock and high in most stat areas where fishing occurred (see Table 3-35).

Conversely, if the CV sectors had responded to a Cluster 2 closure in 2021, most vessels would likely move to the historically productive pollock fishing grounds inside the Cluster 1 and Unimak corridors (all other factors being equal). This "movement scenario" approximates the 2021 B season. In this year, the majority of pollock was caught inside Cluster 1 and Unimak in 2021 from June to August. However, a Cluster 2 closure would have limited the fleet's operational flexibility to move to new areas where lower catches of herring could be realized.

In **2022**, the CP, mothership, and inshore sectors would have met the low cap amount in Cluster 1. The dates the sectors met these caps were variable as were the apportionments, but the corridor would have closed in mid-July to the first week of August. Similar trends for the inshore and mothership sectors were observed in Unimak. In 2022, the CDQ sector would have met the low cap amount of 50,000 chum salmon in Cluster 2 under the 3-year and 5-year average apportionments; the CP sector would have met all apportionments on August 27 at the low cap amount, except for AFA when the sector did not reach that apportionment of a 50,000-chum salmon cap.

If the CV sectors had responded to a Cluster 1 or Unimak closure in 2022, it is again assumed most vessels would move northwest into Cluster 2 and then further northwest as able. Depending on if or where effort moved to in Cluster 2, this movement scenario could have increased herring PSC. Some stat areas inside Cluster 2 were observed to have high herring bycatch in June and July during the 2022 B season. If the CP sector had responded to a Cluster 2 corridor on August 27, it is assumed these vessels would have moved further northwest as able. This approximates the status quo and would be unlikely to have substantially changed herring or chum salmon PSC in this timeframe. Higher herring bycatch was observed inside a discrete number of stat areas inside the Unimak corridor in August during the 2022 B season.

In **2023**, the inshore sector would have met a cap of 50,000 chum salmon in the Cluster 1 and Unimak corridors in mid-August. The mothership sector would have reached a 50,000-chum salmon cap in Unimak apportioned using the 5-year average on August 19. No sector met the higher cap amount of 200,000 chum salmon in 2023 in these corridors. Compared to prior years, the chum salmon bycatch rates observed in 2023 were low across all corridors and monthly periods. If the CV sectors responded to a mid-August closure in Cluster 1 or Unimak, these vessels would likely move northwest where they would potentially fish in Cluster 2. In 2023, the average chum salmon bycatch rate was lower in Cluster 2 at 0.32 chum/mt of pollock compared to that observed in Unimak at 0.95 chum/mt pollock and Cluster 1 at 1.0 chum/mt of pollock. In this year, it is possible that some chum salmon savings could have been realized by moving the CV sectors out of these areas without creating adverse impacts to herring PSC.

An analysis of recent years' data highlights the interannual variability in herring and chum salmon PSC encounters. Based on these data and analysis, the inseason corridor options under Alternative 5 could produce variable outcomes for herring PSC. Similar to Alternatives 2 and 3, the pollock industry would make operational choices on a season-by-season basis to balance their operations against different regulations to constrain PSC. The choices made in response to the regulations would impact the outcomes for herring PSC. All corridor options under Alternative 5 would limit the pollock fleet's operational flexibility to avoid herring PSC to some degree but this may be more acutely experienced by the inshore sector that would have been more constrained by corridor caps especially at lower amounts.

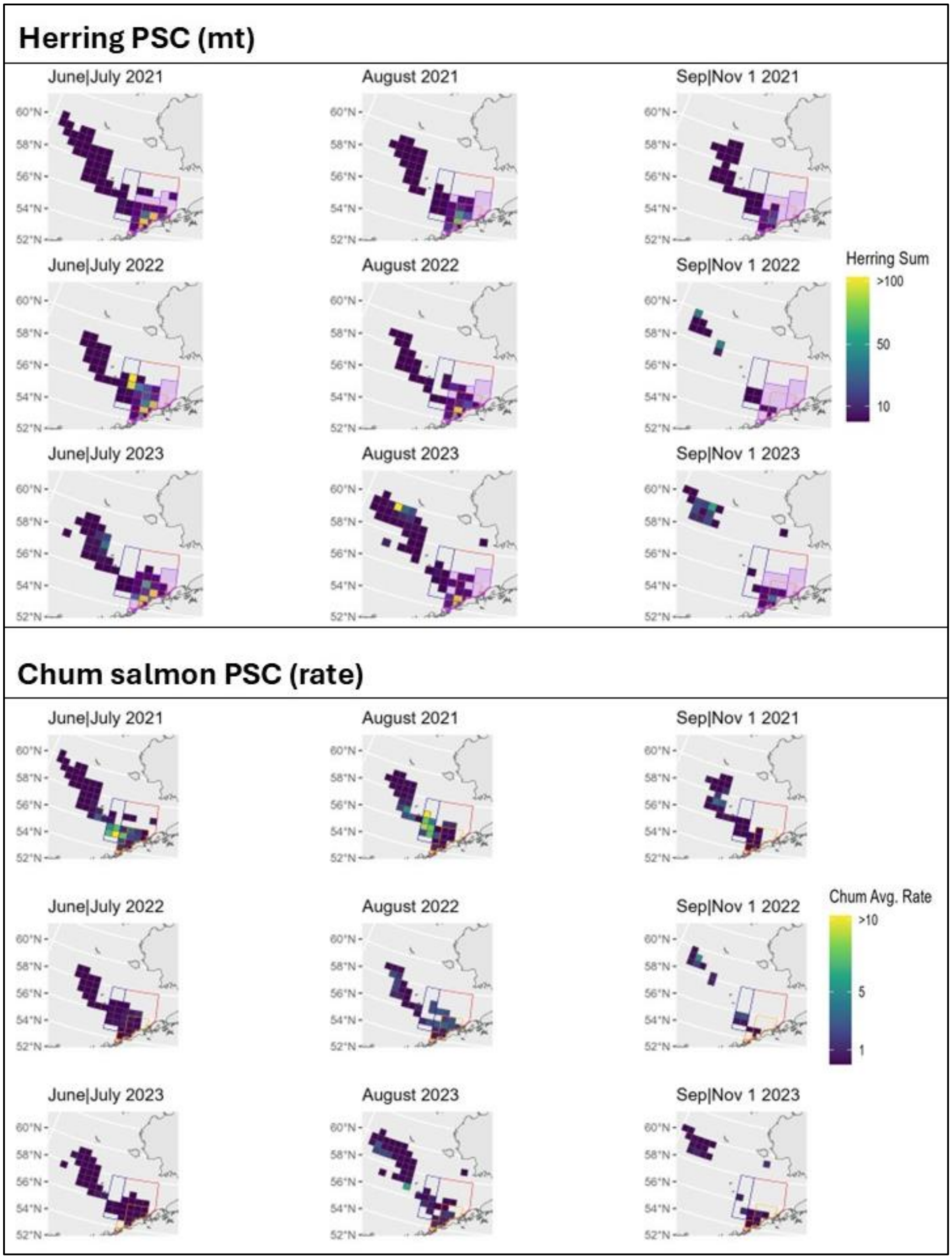

Figure 3-34 Distribution of herring PSC during June and July, August, and September–November compared to the distribution of chum salmon PSC during the same periods, 2021–2023

Notes: Cluster 1 is shown in red, Unimak in orange, and Cluster 2 in Blue. Purple shading denotes the summer HSAs.

3.4.1.5 Cumulative Effects on Herring

The past and present human actions associated with Pacific herring are described in throughout this section and in numerous other documents including the 2004 Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement and Supplemental Information Report (NMFS 2004; NMFS 2015). This includes directed commercial fisheries that have occurred in the past and/or continue to occur for herring, as well as bycatch in the Bering Sea pollock fishery and implementation of herring PSC limits and time/area closures.

RFAs that may have a cumulative impact with the proposed actions include authorization and prosecution of the Bering Sea pollock fishery and climate change, described at the beginning of Chapter 3.

Cumulative Effects of the Proposed Actions with RFAs: The cumulative effect of the RFAs and proposed alternatives are inherently considered in the analysis of impacts on herring throughout this section and 3.5 on policy-level tradeoffs below. The potential impacts to herring PSC under Alternatives 2, 3, or 5 are uncertain in both magnitude and direction. While a directed fishery for Togiak herring (and thus information to inform an age-structured assessment) have not been available in recent years, the best information available indicates that the herring population in the eastern Bering Sea is increasing.[76] Thus, concerns for the cumulative impacts on herring as a result of the alternatives in the herring population are limited and best estimated by the impacts of status quo.

3.5 Policy-Level Considerations for Potential PSC Tradeoffs

Alternatives 2 and 3 under consideration in this action would modify regulations such that the pollock industry would be required to operate under two hard caps during the B season fishery, one for Chinook salmon and the other for chum salmon PSC. The annual herring PSC limit discussed above would also be in place. All regulatory PSC limits present different incentives for bycatch avoidance. It is assumed the pollock industry would not want to risk an early B season closure due to reaching a chum salmon hard cap (Alternatives 2 and 3), increase their Chinook salmon PSC compared to status quo and/or risk meeting the existing Chinook hard cap, and pollock fishermen would not want to lose access to the fishing grounds encompassed within the HSAs by triggering their closure. It is possible for Alternative 2 or 3 to be implemented in conjunction with Alternative 5, and this would result in the fishery being required to operate under four different constraining PSC limits during the B season.

The pollock industry would take measures to avoid all PSC to the extent practicable under this regulatory scenario, although it inherently limits the operational flexibility afforded to the fleet to avoid PSC. **The analysis must call attention to these dynamics because, outside of any methodological or data limitations, they create uncertainty in the direction and magnitude for the potential impacts to different PSC species compared to Alternative 1.** This section addresses some of operational trade-offs that may present themselves as well as policy-level considerations, but the analysis is not implying what the pollock industry would do.

The retrospective analysis prepared for Alternatives 2 and 3 indicates the highest chum salmon savings would occur under the lowest cap amounts. The retrospective estimates on overall chum salmon PSC reductions do not inherently represent an upper bound on total chum salmon savings under a hard cap (see Section 3.2.4.2.5). As pollock fishermen avoid chum salmon PSC, and the degree to which they are able to stay below a hard cap, greater chum salmon PSC reductions could be realized. However, there will be associated costs that could limit the ability of harvesters to stay well below the PSC limit (see Chapter 4).

The potential for Alternatives 2 and 3 to result in WAK chum salmon PSC savings compared to status quo is uncertain because WAK chum salmon are encountered in variable numbers and proportions in the total bycatch each year. However, reducing total chum salmon PSC to the lowest levels observed during the analyzed period could result reduce the number of WAK chum salmon caught as bycatch but not necessarily the proportion of the total bycatch these fish represent.

The proposed management alternatives to reduce chum salmon bycatch in the pollock fishery would affect fishing behavior, and there could be a wide range of potential interactions with Chinook salmon and herring. The pollock fishery catches both chum salmon and Chinook salmon bycatch during the B

[76] Letter from ADF&G to the Council on mature biomass of Pacific herring (11/24).

season. The timing of this catch is dissimilar amongst the two species, with Chinook salmon caught in the latter part of the B season and chum salmon caught throughout the B season. Additionally, WAK chum salmon bycatch is encountered in higher proportions from June to August compared to the later aspects of the B season (see Section 3.2.4.1.3). Similar trends were also observed inside the corridor areas under consideration Alternative 5.

Vessels would change their fishing behavior as chum salmon PSC limits become more constraining. Some known behavior changes include moving to new areas with lower chum salmon bycatch rates, using more frequent test tows, and/or slowing the pace of fishing to account for each haul or offload at a shore-based processor. It is also possible a cooperative may issue a stand down for a period of time. All of these behavior changes have the potential to divert pollock catch to later weeks in the B season. Chinook salmon bycatch would increase compared to status quo if greater pollock catch is diverted to later in the B season. This scenario would be more likely under the low hard cap amounts for Alternatives 2 and 3 which are inherently more constraining as well as prioritizing chum salmon avoidance in Cluster 1.

The salmon bycatch IPA regulations require the IPAs to create incentives to ensure the Chinook salmon PSC rates in October are not significantly higher than those achieved in preceding months (50 CFR 679.21(f)(12)(iii)(E)(*13*)). **As such, policy decisions for alternative management measure for chum salmon bycatch must also consider the potential impact on Chinook salmon PSC**. A consideration of policy decisions for Chinook salmon bycatch are less relevant for Alternative 4. The pollock fleet has operated under the IPAs since 2010, and the provisions under Alternative 4 largely reflect current operations and thus Alternative 4 is not expected to have adverse impacts on Chinook salmon PSC.

Herring PSC presents different operational tradeoffs. Namely, if a chum salmon hard caps being considered under Alternatives 2 or 3 as well as a corridor-caps under Alternative 5 are constraining a sector, and inseason data indicate lower chum salmon PSC could be realized in another area *but* that area has higher herring PSC and that limit is also likely to become a constraint, cooperative managers may need to prioritize one PSC species over another. The analysis cannot say what choices would be made. Nevertheless, policy decisions for alternative management measures for chum salmon bycatch also need to consider the tradeoffs that may be presented as the industry would need to carefully balance its operations inseason.

3.6 Marine Mammals

Information on the status of marine mammal populations in Alaska can be found from multiple published resources. The Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (PSEIS) (NMFS 2004) provides descriptions of the range, habitat, and diet for marine mammals found in waters off Alaska. The 2015 PSEIS Supplemental Information Report (NMFS 2015) provides updates on changes to marine mammal stock or species-related management and status, as well as new information regarding impacts on marine mammal stocks and new methods to assess impacts. In addition, marine mammal stock assessment reports (SARs) are published annually under the authority of the Marine Mammal Protection Act (MMPA) for all stocks that occur in state and federal waters of the Alaska region. Individual SARs provide information on each stock's geographic distribution, population status and trends, and estimates of human-caused mortality and serious injury (M/SI). The MMPA also provides guidance for the List of Fisheries (LOF), an annually updated table which classifies federally-managed commercial fisheries according to observed levels of M/SI. The BSAI pollock fishery is a Category II fishery. More information on that basis of this determination can be found here.

Lastly, the 2007 Alaska Groundfish Harvest Specifications Environmental Impact Statement provides information on the effects of the groundfish fisheries on marine mammals (NMFS 2007), and is evaluated annually based on new information with Supplemental Information Reports (SIRs) (NMFS 2023). Information from the PSEIS, SARs, Alaska Groundfish Harvest Specifications, and SIRs are incorporated by reference. Marine mammal stocks or distinct population segments (DPS)[77], including those currently listed as endangered or threatened under the ESA or depleted or strategic under the MMPA that may be present in the Bering Sea can be found here. ESA section 7 formal and informal consultations with respect to the actions of the Federal groundfish fisheries on ESA-listed species have been completed, either by individual fishery areas or by multiple fishery areas (NMFS 2010 and NMFS 2014).

Effects to marine mammals from fisheries can occur from either direct or indirect interactions. For the action analyzed here, direct interactions are observable M/SI, whereas indirect effects would primarily occur in the form of competition for preferred prey (e.g., herring, pollock). Indirect interactions occur over protracted periods and are often difficult to attribute to any single cause. Table 3-47 shows a list of marine mammal DPS known to occur within the affected environment. Table 3-48 shows only the marine mammal DPS which are known to interact (directly or indirectly) with the BSAI pollock trawl fishery and includes the most recently reported information on each DPS's minimum population abundance and trend (increasing/decreasing), collected from SARs. For species that are listed to have indirect interactions with the BSAI pollock fishery, Table 3-48 also lists prey preferences.

For more information on critical habitat designations, population statuses including years used in evaluation, and prey preferences, please refer to Appendix 3.

[77] Under the Endangered Species Act, a distinct population segment—or DPS—is a vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species." (50 CFR 424.02)

Table 3-47 Marine Mammals known to occur in the BSAI and whether may be directly or indirectly (interaction with fishing operation/gear) or indirectly (competition for prey abundance) affected by the proposed fishery management alternatives

In order or Superfamily	Species	Potential Impacts	
		Direct	Indirect
Pinnipedia	**Steller sea lion** (*Eumatopias jubatus*), Western DPS	X	X
	Northern fur seal (*Callorhinus ursinus*), Eastern Pacific		X
	Harbor seal (*Phoca vitulina*), Pribilof Islands	X	X
	Harbor seal (*Phoca vitulina*), Bristol Bay	X	X
	Ribbon seal (*Phoca fasciata*), Alaska	X	X
	Bearded seal (*Erignathus barbatus nauticus*), Beringia DPS	X	X
	Spotted seal (*Phoca largha*), Alaska		X
	Ringed seal (*Phoca hispida*), Alaska	X	X
	Pacific Walrus (*Odobenus rosmarus divergens*), Alaska		
Cetacea	**Killer whale** (*Orcinus orca*), Eastern North Pacific Alaska Resident		X
	Killer whale (*Orcinus orca*), Eastern North Pacific GOA, Aleutian Islands, and Bering Sea Transient		
	Killer whale (*Orcinus orca*), Offshore		
	Pacific White-sided dolphin (*Lagenorhynchus obliquidens*), North Pacific	X	X
	Harbor porpoise (*Phocoena phoecena*), Bering Sea	X	
	Dall's porpoise (*Phocoenoides dalli*), Alaska		
	Beluga whale (*Delphinapterus leucas*), Beaufort Sea		X
	Beluga whale (*Delphinapterus leucas*), Eastern Chukchi Sea		X
	Beluga whale (*Delphinapterus leucas*), Eastern Bering Sea		X
	Beluga whale (*Delphinapterus leucas*), Bristol Bay		X
	Baird's beaked whale (*Berardius bairdii*), Alaska		
	Stejneger's beaked whale (*Mesoplodon stejnegeri*), Alaska		
	Sperm whale (*Physeter macrocephalus*), North Pacific		
	Bowhead whale (*Balaena mysticetus*), Western Pacific		
	Humpback whale (*Megaptera novaeangliae*), Western North Pacific DPS	X	
	Humpback whale (*Megaptera novaeangliae*), Hawaii DPS	X	
	Humpback whale (*Megaptera novaeangliae*), Mexico DPS	X	
	Fin whale (*Balaenoptera physalus*), Northeast Pacific		
	Minke whale (*Balaenoptera acutorostrata*), Alaska		
	North Pacific right whale (*Eubalaena japonica*), Eastern North Pacific		
	Blue whale (*Balaenoptera musculus*), Eastern North Pacific		
	Gray whale (*Eschrichtius robustus*), Eastern North Pacific DPS		
Mustelidae	**Northern sea otter** (*Enhydra lutris*), Southwest Alaska		
Ursoidea	**Polar Bear** (*Ursus maritimus*), Chukchi/Bering Sea		

Table 3-48 Marine mammals known to interact (directly or indirectly) with the BSAI pollock fishery. Minimum population estimates, trends and most recently available counts of M/SI caused by the BSAI pollock trawl fishery are reported from the most recently available SARs. Pre preferences are reported for stocks indirectly affected by the proposed fishery management plan.

Species	Potential Impacts		Population		Prey groups affected by the BSAI pollock trawl fishery	M/SI count (5-year range)
	Direct	Indirect	Minimum Population Estimate	Trend		
Steller sea lion (Eumatopias jubatus), Western DPS	X	X	49,837	variable by region	salmon, pollock	33 (2017 - 2021)
Northern fur seal (Callorhinus ursinus), Eastern Pacific		X	628,616	neutral	salmon, pollock	0 (2017 - 2021)
Harbor seal (Phoca vitulina), Pribilof Islands	X	X	229	unknown	salmon, pollock	0 (2013 - 2017)
Harbor seal (Phoca vitulina), Bristol Bay	X	X	44,781	increasing	salmon, pollock	1 (2013 - 2017)
Ribbon seal (Phoca fasciata), Alaska	X	X	163,086	unknown	pollock, herring	1 (2014 - 2018)
Bearded seal (Erignathus barbatus nauticus), Beringia DPS	X	X	273,676	unknown	capelin	3 (2017 - 2021)
Spotted seal (Phoca largha), Alaska		X	5,254	unknown	pollock	0 (2017 - 2021)
Ringed seal (Phoca hispida), Alaska	X	X	158,507	unknown	salmon, pollock	1 (2017 - 2021)
Killer whale (Orcinus orca), Eastern North Pacific Alaska Resident		X	302	neutral	salmon	1 (2017 - 2021)
Pacific White-sided dolphin (Lagenorhynchus obliquidens), North Pacific	X	X	unknown	unknown	herring	2 (2017 - 2021)
Harbor porpoise (Phocoena phoecena), Bering Sea	X		5,713	unknown		0 (2017 - 2021)
Beluga whale (Delphinapterus leucas), Beaufort Sea		X	32,453	unknown	salmon, forage fish	0 (2017 - 2021)
Beluga whale (Delphinapterus leucas), Eastern Chukchi Sea		X	8,875	unknown	salmon, forage fish	0 (2017 - 2021)
Beluga whale (Delphinapterus leucas), Eastern Bering Sea		X	11,112	unknown	salmon, forage fish	0 (2017 - 2021)
Beluga whale (Delphinapterus leucas), Bristol Bay		X	1,645	neutral	salmon, forage fish	0 (2017 - 2021)
Humpback whale (Megaptera novaeangliae), Western North Pacific DPS	X		1,084	unknown		3 (2017 - 2021)
Humpback whale (Megaptera novaeangliae), Hawaii DPS	X		11,278	unknown		0 (2017 - 2021)
Humpback whale (Megaptera novaeangliae), Mexico DPS	X		unknown	unknown		1 (2017 - 2021)

Source: Young et al. 2023; Carretta et al. 2023; Proposed List of Fisheries for 2024 (88 FR 62748, September 13, 2023).
Notes: Further details on the information presented here is available in Appendix 3.

3.6.1 Effects of the Alternatives on Marine Mammals

Table 3-49 Summary of effects on ESA-listed marine mammals in the Action Area

Alternative	Management Measure	Direct and Indirect effects on Marine Mammals
Alternative 1	Status quo	Present levels of marine mammal M/SI are considered minimal.
Alternative 2	Overall bycatch (PSC) limit for chum salmon	Potential effects may be no change from status quo or may be an increase or decrease in interactions with marine mammals, depending on how fishing patterns change (spatially, temporally).
Alternative 3	Chum salmon PSC limit with an associated Western Alaska chum salmon bycatch annual limit	Adverse effects of Alternative 3 are expected to be similar to those from Alternative 2 (see above).
Alternative 4	Additional regulatory requirements for Incentive Plan Agreements (IPAs) to be managed within the IPAs	No changes relative to the status quo would be expected.
Alternative 5	Corridors that would close through August 31 if associated caps are reached	Potential increases/decreases to marine mammal interactions if fishing effort extends later into the season.

A complete list of all marine mammals occurring in the Bering Sea and potential for fishery interactions is available in Table 3-48. The subset of marine mammal stocks described above are known to have direct and/or indirect interactions with the BSAI pollock trawl fishery. Direct interactions with the fishery are most commonly in the form of entanglement in fishing gear, whereas indirect interactions are mainly from prey competition.

The BSAI pollock trawl fishery is a 100% observed fishery. As such, there is a high degree of certainty that observed direct interactions of marine mammals with the BSAI pollock trawl fishery are representative of total interactions. The indirect effects of prey competition are hard to quantify and may be mediated by other processes (e.g., trophic interactions, population dynamics) that are influenced by a numerous factors including environmental variability, population dynamics, and fishery competition. Further, most marine mammals occurring in the Bering Sea (Table 3-47) are known to consume a wide variety of prey species.

For purposes of discussing the potential effects of each alternative, we assume that increases in fishing effort would have commensurate increases in direct interactions with marine mammals, and similarly decreases in fishing effort would have commensurate decreases in direct interactions with marine mammals. However, if fishing effort moved to areas with fewer preferred prey species (e.g., pollock, salmon, or herring), fewer marine mammals may also be present. Indirect effects on prey availability for marine mammals with increasing or decreasing fishing levels are not as linear as direct effects, but generally speaking for marine mammals that rely on pollock or chum salmon to meet metabolic needs, large changes in total pollock catch will affect overall metabolic energy budgets for these marine mammals.

3.6.1.1.1 Alternative 1 (Status Quo)

Under the status quo, chum salmon bycatch would continue to be managed under the IPAs, as described in Section 2.2. No shift of effort beyond the status quo inter-annual variability, which is influenced by many factors, including the presence and timing of pollock and PSC on the fishing grounds, would be expected. The status quo direct and indirect impacts on marine mammals in the Bering Sea are described under the subheading titled "Interaction with Bring Sea Pollock Fisheries" for each species in Appendix 3. Managing the Bering Sea pollock B season under Alternative 1 is not expected to change the effects of the status quo fishery on marine mammals.

3.6.1.1.2 Alternatives 2 and 3

Chum salmon PSC limits for Alternatives 2 and 3 may result in no change to the status quo or may change fishing patterns to avoid chum salmon PSC. This could result in reduced fishing effort, changes in fishing patterns, or seasonal changes in the timing of the fishing to increase chum salmon avoidance. If a groundfish fishery reduces total fishing effort in specific fisheries to conserve chum salmon PSC, then less potential may exist for marine mammal interactions or harvesting of potential prey items of marine mammals. If a groundfish fishery increases the duration of fishing in areas with lower concentrations of chum and equivalent or greater concentrations of marine mammals species, there may be more potential for marine mammal interactions, compared to the status quo, if this increased fishing activity overlaps temporally and geographically with areas used by marine mammals. For example, this alternative could result in additional direct and indirect effects if fishing efforts shift or concentrate to regions closer to known Steller sea lion rookeries or haul outs. However, it is assumed that existing habitat protections for ESA-listed species such as Steller sea lions would help mitigate the risk of increased interactions.

If a groundfish fishery reduces fishing effort in specific fisheries to conserve chum salmon PSC, shifts in the location or timing of fishing may occur. However, there is already considerable interannual variability in the patterns of fishing across the EBS groundfish sectors, as environmental conditions and avoidance of PSC species have caused vessels to adjust their fishing patterns. Due the fleet's preference to fish in familiar locations, any shift in fishing location or timing is unlikely to occur outside of the existing footprint of the groundfish fisheries. Because we expect that any geographic or temporal changes to fishing effort would occur within the current boundaries of the fishery, increased direct interactions with marine mammals would be unlikely.

If there were reduced fishing effort due to an early closure of the fishery to one or more cooperatives or CDQ groups, there would be potential decreases in direct interactions with marine mammals. Further, there may be decreased competition between the fisheries and marine mammals that feed on pollock. However, shifts in effort that result in greater herring bycatch would increase competition with marine mammals that feed on herring. Absent a substantial reduction in total pollock catch or increase in herring bycatch, changes in the indirect effects on marine mammals under Alternatives 2 and 3 are expected to be minimal.

3.6.1.1.3 Alternative 4

Under Alternative 4, no significant geographic or temporal changes in fishing effort are expected. Therefore, if Alternative 4 were adopted, no changes to the effects on marine mammals relative to the status quo would be expected.

3.6.1.1.4 Alternative 5

Under Alternative 5, when the corridor cap is met, said corridor closes until September 1, after which fishing to reach TAC may continue until November 1, the end of the B season (50 CFR 679.23(e)(2)). A temporary closure may extend fishing later into the B season, which may affect marine mammals present in the fishing area during late fall. As with Alternatives 2 and 5, under Alternative 5 the analysts expect geographic changes to fishing effort would likely occur within the historic fishery footprint. Whether displaced effort within the historic fishery footprint would affect interactions with migratory marine mammals is indeterminable given the spatial and temporal resolutions of available information on observed animal movements and uncertainty about precisely where any displaced fishing effort would occur. As is true of Alternatives 2 and 3, this alternative could result in additional direct and indirect effects if fishing effort shifts to or concentrates in regions closer to known Steller sea lion rookeries or haul outs. However, it is assumed that existing habitat protections for ESA-listed species such as Steller sea lions would help mitigate the risk of increased interactions.

Potential changes to direct interactions with marine mammals due to temporal shifts in fishing effort are possible but not easily predicted with available information. An area closure could reduce the risk of marine mammal direct interactions with the BSAI groundfish pollock fishery earlier in the season by effectively pausing fishing effort within the corridor until September 1 once the cap is reached. A temporary area closure may also decrease adverse indirect effects of reduction of harvest of marine mammal prey. Therefore, effects on marine mammal interactions under Alternative 5 are expected to be minimal.

3.6.1.1.5 Cumulative Effects on Marine Mammals

Past and present actions that have had effects on marine mammals populations are the same types of actions as discussed in the 2004 PEIS (section 3.8-2) and include direct interactions (e.g., commercial harvests, customary and traditional hunting, incidental takes in commercial fisheries through entanglement with gear during fishing and after abandonment) and indirect interactions (e.g., trophic interactions affecting prey availability, physiological stressors affecting overall health) which may be driven by a variety of processes including climate change, oil spills, and fishing gear avoidance.

RFAs that may have a cumulative impact with the proposed actions include authorization and prosecution of the Bering Sea pollock fishery and climate change, described at the beginning of Chapter 3. In addition, marine mammals may be affected by:

Fisheries Management Changes. Of the federal fisheries operating in the BSAI, the sablefish and turbot fisheries are expected to change in future years. The sablefish fishery has been steadily changing the gear used, as boats have switched from hook-and-line gear to longline pot gear. The Bering Sea Greenland turbot hook-and-line fishery is currently under consideration to allow the use of longline pot gear. While switching the turbot fishery from hook-and-line to longline pot gear is motivated by prolific whale depredation of baited hooks in the HAL Greenland turbot fishery, marine mammals are rarely taken in the fishery; from 2017 to 2021, no M/SI events were reported (Freed et al. 2023). Similarly, no marine mammal mortalities were reported under the sablefish hook-and-line fishery and one sperm whale mortality was observed under longline pot gear (2017-2021; Freed et al. 2023). *Reduced* marine mammal interactions with the sablefish and turbot fisheries are not expected to result in a noticeable decline in M/SI events because these fisheries already have very low take rates. Furthermore, these changes are less likely to affect species that remain close to shore as the sablefish and turbot fisheries occur offshore. Generally, as more fisheries change to pot gear it is expected that there will be a slight reduction in the number of marine mammals taken in fisheries as marine mammals interact less with pot gear than hook-and-line gear (NMFS 2022).

Marine Debris. The most commonly observed interaction between marine mammals and marine debris is through entanglement, often from packing bands or in remnants of fishing gear that has been discarded or lost. Marine debris may also affect marine mammals through ingestion, but this is less commonly observed as without necropsy, this cannot be confirmed. While there are numerous marine debris cleanup efforts, the continued ubiquity of plastics means this threat is likely to persist into the future.

Alaska Native Subsistence Hunting**.** Section 119 of the MMPA allows NMFS and the US Fish and Wildlife Service to establish co-management agreements with Alaska Native Organizations (ANOs) and tribally authorized co-management bodies. Methods for determining harvest allocations are based on population viabilities and are not expected to change.

Vessel Traffic. With climate change progression, shipping routes through the Arctic could be accessible for longer periods of time, potentially remaining open through the winter season in some years. These opportunities for global shipping could lead to increased vessel traffic through the Bering Sea. Some marine mammals (i.e., large whales) are more prone to vessel strike incidences than other marine mammal species, whereas others are more sensitive to noise, or the disturbance caused by passing vessels (i.e., hauled out seals).

Any or all of these RFAs may cumulatively lead to declines in marine mammal populations, which could have adverse impacts to subsistence communities reliant upon marine mammals for food, trade, culture, and overall well-being. However, status quo conditions have resulted in marine mammal populations that are, in general, stable to increasing.

***Ice Seal Critical Habitat*.** Section 4(b)(6)(C) of the ESA requires the Secretary to designate critical habitat concurrently with listing a species as threatened or endangered unless it is not determinable at that time. At the time of ESA listings for the arctic ringed seal stock and the Beringia DPS of bearded seal, NMFS announced intent to designate critical habitat in separate rulemakings, as the respective critical habitats were not then determinable. On May 2, 2022, NMFS issued a final rule to designate an area in the Bering, Chukchi, and Beaufort seas as critical habitat for both populations (87 FR 19180). On September 26, 2024, this habitat designation was vacated by the U.S. District Court for the District of Alaska (*Decision & Order*, State of Alaska v. NMFS, Case No. 3:23-cv-00032-SLG (D. Court of Alaska). Given that the ESA requires a critical habitat designation for all listed species, it is reasonable to assume that NMFS will propose new critical habitat in the future. It is possible that designation of ice seal critical habitat could mitigate negative impacts of the abovementioned climate change-driven increased vessel traffic and sea ice reductions. However, the relative magnitudes of any such mitigation are not presently known.

<u>Cumulative Effects of the Proposed Actions with RFAs:</u> This section considers the RFAs in tandem with the potential impacts of the proposed actions relative to marine mammals. Under the more constraining chum salmon PSC limits analyzed under Alternatives 2, 3 and 5, to avoid triggering a closure, the fleet may shift more effort later in the season and/or to different parts of the fishing grounds. In that event, there is potential for either an increase or decrease in marine mammal interactions. It is not expected that there will be marginal cumulative effects from shifting to pot gear for the Greenland turbot fishery or designation of sea ice critical habitat for fur seals in the combination with the proposed actions.

3.7 Seabirds

Alaska's waters support extremely large concentrations of seabirds. Over 80 million seabirds are estimated to occur in Alaska annually, including 40 million to 50 million individuals from the numerous species that breed in Alaska (Table 6-19; USFWS 2009). An additional 40 million to 50 million individuals do not breed in Alaska but spend part of their life cycle there. These include short-tailed and sooty shearwaters and three albatross species: the black-footed albatross, the Laysan albatross, and the endangered short-tailed albatross (Table 6-19; USFWS 2009). Some seabirds and their eggs provide important subsistence foods for Alaska Native communities, including those in coastal Western Alaska (AMBCC 2024).

As noted in the PSEIS (NMFS 2004, 2015), seabird life history includes low reproductive rates, low adult mortality rates, long life span, and delayed sexual maturity. These traits make seabird populations extremely sensitive to changes in adult survival and less sensitive to fluctuations in reproductive effort. The problem with attributing population changes to specific impacts is that, because seabirds are long-lived animals, it may take years or decades before relatively small changes in survival rates result in observable impacts on the breeding population.

Seabirds may be vulnerable to climate change and ecosystem variability. There may have been unobserved mortality events (UME) following marine heat waves, such as might be the case with northern fulmars, a seabird species taken for subsistence. Since 2015, those UMEs include:

- 2015: 470,000–1,030,000 common murres in Gulf of Alaska; the 2014 –2016 marine heat wave drove anomalous ocean conditions and ecosystem-level impacts on forage fish.
- 2019: 10,000 short-tailed shearwaters washed ashore in southeastern Bering Sea. Starvation appears to be the proximate cause of mortality.

UMEs are of concern for coastal communities that rely on ocean resources for their nutritional, cultural, and economic well-being and can also signal issues with the state of subarctic and Arctic oceans (Kaler and Kuntz 2022).

Seabirds are indicators of secondary productivity and shifts in prey availability that may similarly affect commercial fish populations. Trends in seabird reproductive success were mixed on the Pribilof Islands in 2023, with higher reproductive success for both fish-eating and plankton-eating species on St. George Island than on St. Paul Island. Species that experienced recent population losses (least auklets and common murres) do not appear to be rebounding to historic numbers. On St. Paul Island common and thick-billed murres had very low egg abundance early in the season, therefore no subsistence harvest took place in 2023. Community observations throughout the summer reported eventually seeing “a lot” of murre eggs, though murres seemed to experience nest failure later in the summer. Overall, reproductive success was mixed across species, but generally higher for species on St. George Island. This may indicate differences in local availability of zooplankton and small schooling forage fish in feeding areas utilized by seabirds of each island. No major seabird die-off events were observed in 2023 (Siddon 2023).

3.7.1 Effects of the Alternatives on Seabirds

Table 3-50 Summary of the effects of the on seabirds

Alternative	Management Measure	Impact to Seabirds
Alternative 1	Status quo	Reported mortalities by gear and wire interactions in the Bering Sea pollock fishery are small. Indirect effects (e.g., prey reduction or prey habitat disturbance) are not measurable.
Alternative 2	Overall bycatch (PSC) limit for chum salmon	An early closure of the season that results in less fishing effort throughout the season would likely decrease gear entanglement and wire collisions and thus have a beneficial effect. PSC limits that result in substantial physical or temporal shifts in fishing effort may result in an increase or decrease in gear entanglement and wire collisions. Given the relatively small amount of reported mortalities resulting from gear entanglement, any resulting increase in mortalities relative to the status quo is likely to be small.
Alternative 3	Chum salmon PSC limit with an associated Western Alaska chum salmon bycatch annual limit	Adverse effects of Alternative 3 are expected to be similar to those from Alternative 2 (see above).
Alternative 4	Additional regulatory requirements for Incentive Plan Agreements (IPAs) to be managed within the IPAs	No change in effects relative to the status quo.
Alternative 5	Corridors that would close through August 31 if associated caps are reached	Constraining caps that result in substantial shifts in the location of effort on the fishing grounds may result in an increase or decrease in the number of interactions with seabirds. Information is unavailable to predict the magnitude or directional change of this possible effect.

This proposed action involves management of and analysis of direct and indirect effects on seabird bycatch in the Bering Sea pollock fishery, which used pelagic trawl gear. However, much of the available scientific information on seabird bycatch in the Bering Sea commercial fisheries includes all groundfish fisheries in the Bering Sea and Aleutian Islands. In addition to the pelagic trawl gear used by the Bering Sea pollock fishery, these fisheries include a variety of gear types, including non-pelagic trawl, pot, and hook-and-line.

The effects of all BSAI groundfish fisheries on seabirds was previously analyzed in the 2004 PSEIS and 2015 SIR (NMFS 2015) and 2007 Harvest Specifications EIS (NMFS 2007), which are incorporated by reference. In 2015, an expert panel reviewed the conclusions in the 2004 PEIS and concluded that no new information was presented that would modify the 2004 conclusion that the effects of the groundfish fisheries on seabirds was insignificant. The expert review of conclusions in the 2004 PEIS can be found in Appendix 4 to the 2015 SIR (NMFS 2015, 106).

The 2007 Harvest Specifications EIS evaluated the impacts of the alternative harvest strategies on seabird takes, prey availability, and seabird ability to exploit benthic habitat. The focus of this analysis is similar, as any changes to the BSAI pollock fishery could change the status quo potential for direct take (mortality) of seabirds. However, prey availability changes could also be closely associated with changes in seabird take levels. In other words, if seabirds taken in BSAI pollock fisheries decrease year over year, greater prey may be available, and the opposite would also be true. Therefore, for the purpose of this analysis, all indirect effects on seabirds will be addressed by focusing the analysis on potential changes in seabird takes (direct effects).

3.7.1.1 Alternative 1

Direct Effects: Gear and Vessel Interactions

Direct effects may include incidental take (lethal) in fishing gear and vessel strikes. Seabirds can interact with trawl fishing vessels in several ways. Birds foraging at the water surface or in the water column are sometimes caught in the trawl net as it is brought back on board. In addition to getting caught in the fishing nets of trawl vessels, some species strike cables attached to the infrastructure of vessels or collide with the infrastructure itself. Indirect takes may occur if seabirds ingest and become entangled in marine plastics, become oiled during oil spills caused by marine accidents, or their colonies are predated by invasive mammals introduced by accident (the Norway rat is a particular concern) (NMFS 2007).

Under the status quo, direct effects may include incidental take (lethal) in fishing gear and vessel strikes. Seabirds can interact with trawling in several ways. Birds foraging at the water surface or in the water column are sometimes caught in the trawl net as it is brought back on board. In addition, to capture in trawl nets, some species strike cables attached to nets during active fishing or collide with the vessel itself. Trawling vessels may indirectly affect seabirds through competition for bycaught forage fish (e.g., herring, capelin), entanglement in lost or abandoned nets, ingesting marine plastics, and oil spills.

Implementation of a restructured observer program in 2013 has allowed for the collection of data on incidental takes (NMFS 2015). All seabird take values included in this section are reported as estimates and are not actual numbers of seabirds. For a detailed explanation of seabird bycatch estimation procedures please refer to Seabird Bycatch Estimates for Alaskan Groundfish Fisheries (NMFS 2020).

The average annual estimate of incidental take of seabirds by pelagic and non-pelagic trawl gear in the BSAI was 764 birds per year from 2011 through 2021 (NMFS Tech Memo 2024). Northern fulmars comprised the majority of this take, with shearwaters and gulls also taken in almost every year. Observers have recorded no short-tailed albatross or black-footed albatross takes in BSAI trawl gear but have observed Laysan albatross mortalities. In 2018, 80 Laysan albatross were recorded in the BSAI trawl fisheries, but none were recorded in the pollock trawl fishery (NMFS 2021). Storm petrels, murres, auklets, and cormorants were also taken in small numbers in BSAI trawl operations from 2011 –2021 (NMFS 2021). The estimated total seabird bycatch in the BSAI pollock trawl fishery (2011 –2023) was 1,359 with an annual average of 115 seabirds (see Table 3-51).

However, these estimates are for birds brought up in trawl nets and do not account for mortality by net entanglements or cable strikes. Trawl-cable strikes are most likely to result in mortalities of large-winged birds such as albatrosses. Seabird mortality from interactions with gear may exceed those measured in the standard observer sampling (Melvin et al. 2011). The probability of seabird collisions with third wires or other trawl vessel gear in the EEZ off Alaska cannot be assessed. Staff are currently using the vessel collision information component of observer notes to summarize interactions by species, regions, and other factors (NMFS 2024).

Table 3-51 Estimated seabird bycatch in the BSAI pollock trawl fishery based on observer standard species composition sampling, 2011 –2023

Species/ Species Group	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total	Annual avg.
Laysan Albatross	0	0	0	0	0	0	0	0	3	8	0	0	0	11	1
Short-tailed Albatross	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Black-footed Albatross	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Northern Fulmar	214	90	123	51	112	84	109	41	105	96	103	128	56	1,185	101
Shearwaters	3	12	1	3	6	9	0	0	11	1	7	12	3	68	5
Gull	1	0	3	0	0	3	0	0	0	0	0	0	0	7	1
Kittiwake	0	0	0	0	0	0	0	0	13	3	7	0	3	26	2
Murre	14	0	3	3	0	6	1	0	0	0	0	0	0	27	2
Auklets	0	0	4	0	0	0	0	0	0	0	0	4	0	8	1
Other Alcid	0	0	0	0	0	0	0	0	6	0	0	0	0	6	1
Cormorant	0	0	0	0	3	0	0	0	0	0	0	0	0	3	0
Storm Petrels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unidentified Birds	0	0	0	0	6	6	0	0	3	0	0	0	3	18	1
Total	**232**	**102**	**134**	**57**	**127**	**108**	**110**	**41**	**141**	**108**	**117**	**144**	**65**	**1,359**	**115**

Notes: Does not include mortalities by cable strikes.

Indirect Effects: Disturbing Prey Availability

Under the status quo, indirect effects of the Bering Sea pollock fishery on seabirds may include reductions in prey (seabird prey, such as forage fish, caught in nets) abundance and availability, discharge of processing waste and offal, contamination by oil spills, presence of nest predators on islands, and disposal of plastics, which may be ingested by seabirds (NMFS 2007). It can also disturb the benthic habitat of seabird prey species, such as clams, benthic fish, and crab. The 2005 Essential Fish Habitat EIS provides a description of the effects of the groundfish fisheries on bottom habitat in the appendix (NMFS 2005), including the effects of the commercial fisheries on the eastern Bering Sea slope and shelf.

A description of the effects of prey abundance and availability on seabirds is found in the PSEIS (NMFS 2004 and Supplemental Information Report on the PEIS (NMFS 2004 and 2015)) and the Harvest Specifications EIS (NMFS 2007). As noted in the 2007 Groundfish Harvest Specifications EIS, in addition to benthic habitat disturbance, trawl fisheries may reduce, or disperse, the biomass of prey species available to seabird populations. Vessel activity may also displace or interfere with normal seabird foraging. This may be a particular concern when both birds and vessels are attracted by particular "hot spots" such as sites of upwelling, fronts, and shelf breaks. Detailed conclusions or predictions cannot be made regarding the effects of forage fish bycatch on seabird populations or colonies. The 2007 Groundfish Harvest Specifications EIS also found that, due to little or no overlap between the fisheries and foraging seabirds, based on either prey size, dispersed foraging locations, or different prey, the potential impact of the entire groundfish fisheries on seabird prey availability was limited (NMFS 2007). Vessels may also create seabird feeding opportunities by the discard of fish or fish processing wastes (offal) (NMFS 2007; Bicknell et al. 2013).

Table 3-52 Seabirds in the Bering Sea: foraging habitats and common prey species

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

Source: Dragoo et al. 2011; NMFS 2022.

Most of the pollock fishery's bycatch of forage fish is smelt, for which there is a ban on directed fishing. The pollock fishery also catches Pacific herring, a species that some seabirds feed on and for which there is a PSC limit that prevents substantive reductions in herring biomass. Detailed conclusions or predictions cannot be made regarding the effects of forage fish bycatch in the Bering Sea pollock fishery.

Effects of BSAI Groundfish Fisheries on ESA-listed Seabirds

The impact of Alaska's groundfish fisheries (federal and state), including the BSAI pollock fishery, on ESA-listed seabirds was analyzed in a 2021 USFWS biological opinion. Three species of seabirds are currently listed as either threatened or endangered; the short-tailed albatross *Phoebastria albatrus* (endangered), Alaska-breeding population of Steller's eider *Polysticta stelleri* (threatened), and Spectacled eider *Somateria fischeri* (threatened). Two other populations of Steller's eider occur in waters off Alaska, but only the Alaska-breeding population is listed under the ESA.

Table 3-53 Seabirds that NMFS monitors for interactions with the BSAI pollock fishery and their status (whether they are listed as either “endangered” or “threatened)

Type	Common name	ESA Status
Albatross	Black-footed	
	Short-tailed	Endangered
	Laysan	
Fulmar	Northern fulmar*	
Shearwater	Short-tailed	
	Sooty	
Storm petrel	Leach’s	
	Fork-tailed	
Cormorants	Pelagic	
	Red-faced	
	Double-crested	
Gull	Glaucous-winged*	
	Glaucous*	
	Herring*	
	Short-billed(Mew)*	
	Bonaparte’s*	
	Slaty-backed*	
Murre	Common*	
	Thick-billed*	
Jaeger	Long-tailed*	
	Parasitic*	
	Pomarine*	

Type	Common name	ESA Status
Guillemot	Black*	
	Pigeon*	
Eider	Common	
	King	
	Spectacled	Threatened
	Steller’s	Threatened
Murrelet	Marbled	
	Kittlitz’s	
	Ancient	
Kittiwake	Black-legged*	
	Red-legged*	
Auklet	Cassin’s*	
	Parakeet*	
	Least*	
	Whiskered*	
	Crested*	
Tern	Arctic*	
Puffin	Horned*	
	Tufted*	

The USFWS consulted with NOAA Fisheries Alaska Region under Section 7 of the ESA on the effects of the groundfish fisheries on these species. In its 2021 ESA Biological Opinion, USFWS determined the groundfish fisheries off Alaska are likely to adversely affect short-tailed albatross, Spectacled eider, and the Alaska-breeding population of Steller’s eider, but they are not likely to jeopardize their continued existence (USFWS 2021). It was also determined that the groundfish fisheries off Alaska are not likely to adversely affect designated critical habitat of the Alaska-breeding population of Steller’s eider and Spectacled eider. USFWS provides the following incidental total take in the BSAI groundfish fisheries for short-tailed albatross, Spectacled eider, and threatened Alaska-breeding population of Steller’s eider:

- The reported take should not exceed six albatrosses in a floating 2-year period.
- The reported take should not exceed 25 Spectacled eiders in a floating 4-year period.
- The reported take should not exceed three Steller’s eiders in a floating 4-year period.

If any of these takes were to be exceeded, NMFS is required to contact USFWS and reinitiate formal consultation.

Managing the Bering Sea pollock B season at status quo under Alternative 1 would not be expected to have any change in the minimal impacts of the pollock trawl fishery on seabirds in the action area. The BSAI pollock fishery's estimated total seabird bycatch was 1,359 with an annual average of 115 seabirds from 2011–2023 (see Table 3-51). These seabird take estimates are small in comparison to seabird population estimates, and under the status quo alternative, it is reasonable to conclude that the impacts would continue to be similar. Effects on seabirds under Alternative 1 are therefore not expected to increase or decrease outside of recently observed ranges. However, observers are not able to monitor all seabird mortality associated with trawl vessels. Research projects are currently underway to provide more information on these interactions.

3.7.1.2 Alternatives 2 and 3

PSC limits for Alternatives 2 and 3 may result in no change to the status quo or may change fishing patterns to avoid chum salmon PSC. This could result in reduced fishing effort, changes in fishing patterns, or seasonal changes in the timing of the fishing to increase chum salmon avoidance to reduce the risk of reaching the PSC limit and triggering a fishery closure. Alternatively, higher fishing effort may occur if vessels fish areas with less productivity in order to avoid bycatch. If a groundfish fishery reduces fishing effort in specific fisheries to conserve chum salmon PSC, then the incidental take of seabirds may decrease. If a groundfish fishery increases the duration of fishing in areas with lower concentrations of chum salmon, there may be more potential for seabird incidental take, compared to the status quo, if this increased fishing activity overlaps temporally and geographically with areas used by seabirds. Conversely, if there is increased fishing effort in lower productivity areas as a result of this action, there may also be fewer seabirds present, and the rate of seabird interactions could decrease.

Shifts in the location or timing of fishing may occur as a result of Alternative 2. However, there is already considerable interannual variability in the patterns of fishing across the EBS groundfish sectors, as environmental conditions and avoidance of PSC species have caused vessels to adjust their fishing patterns. Any shift in fishing location or timing is unlikely to occur outside of the existing footprint of the groundfish fisheries. However, shifts in the existing footprint of the groundfish fisheries may change over time due to many factors such as climate change, bycatch avoidance, and shifting fish distributions, making this difficult to assess.

Seabird take estimates in the EBS groundfish fisheries are already small, compared to seabird population estimates, and are unlikely to increase to a level that would have a population-level effect on seabird species. The exception to this is the incidental take of ESA-listed species of seabirds. But the take of ESA-listed seabird species in EBS groundfish fisheries are the subject of incidental take statements in the 2021 Biological Opinion and, therefore, are already closely monitored. Therefore, effects on seabird incidental takes under Alternatives 2 and 3 are not expected to occur beyond the scope analyzed in previous NEPA or ESA documents.

3.7.1.3 Alternative 4

Under Alternative 4, no significant geographic or temporal changes in fishing effort are expected. Therefore, if Alternative 4 were adopted, no changes to the status quo effects on seabirds would be expected.

3.7.1.4 Alternative 5

Similar to Alternatives 2 and 3, PSC limits associated with Alternative 5 may result in no change to the status quo (Alternative 1) or may change fishing patterns to avoid chum salmon PSC. This could result in changes in fishing locations or changes in the timing of fishing within the season. However, it is unknown how closure areas will spatially or temporarily shift the fleet. If a closure were to result in lower CPUE, then more tows could occur. Substantially increased tows may increase the risk of greater seabird bycatch.

Due to changes in seabird distributions, it is not possible to predict how a possible shift of fishing effort to later in the B season may impact the potential for incidental takes of seabirds. Based on low estimates of observed seabird mortalities, displaced fishing effort within the historical fishery footprint is unlikely to result in changes to the status quo effects on seabird populations. The proposed action does not change the regulated gear use in the fishery (i.e., pelagic trawl) so the rate of take is expected to remain the same, but total take may be different depending on how the length of the fishing season (i.e., fishing effort) is changed by this action in any given year. Due to the absence of information, analysts are unable to evaluate the effects of these alternatives on incidental takes by cable strikes.

There are two potential effects on ESA-listed seabird species of a significant shift of fishing effort northward. As noted in the 2007 Harvest Specifications EIS, large numbers of short-tailed albatross have been observed on the northwestern Bering Sea shelf break, near the border with Russia. The 2021 USFWS Biological Opinion contains a number of conservation recommendations for vessels operating in areas within which a short-tailed albatross is in the vicinity (USFWS 2021). No short-tailed albatross interactions with the pollock fishery have been recorded over the last 13 years (see Table 3-51).

Further, shifts of the fleet northward in response to a closure could increase the potential for interaction with the threatened Spectacled eider. Spectacled eider annually migrate from their summer range (generally north of 65º N, or near Norton Sound) to areas south of St. Lawrence Island in the fall to overwinter. There has been no recorded interaction between pollock trawl vessels and the Spectacled eider over the last 13 years (see Table 3-51). However, in late summer/fall the eiders are very patchy in distribution. Most of the population may occur in less than 5% of the critical habitat area at any given time. Thus, when a flock is encountered it may be very large and any interaction could disproportionately affect large numbers (USFWS 2021). The 2021 USFWS Biological Opinion contains a number of conservation recommendations for groundfish vessels operating in areas that are traversing in or near critical habitat of Spectacled eiders (USFWS 2021). Historically, the critical habitat of Spectacled eiders and the pollock fishing grounds have had little to no overlap.

3.7.1.5 Cumulative Effects on Seabirds

As noted in the 2004 PEIS and throughout this section, past and present actions that have had effects on seabird populations include commercial harvests (e.g., harvest of short-tail albatross colonies in Japan), incidental catch in fisheries operations, vessel strikes, subsistence harvest, changes in prey availability, ingestion of fish processing waste and discards, oil spills (e.g., Exxon Valdez), and introduction of mammalian predators (e.g., arctic fox and rats) and ingestible plastics (e.g., pellets and fragments) into seabird habitat. In addition, since 2015, there have been multiple unusual mortality events of seabirds, the causes of which are uncertain, but may relate to changes in prey availability or biotoxins associated with warming waters (Kaler and Kuntz 2022).

RFAs that may have a cumulative impact with the proposed actions include authorization and prosecution of the Bering Sea pollock fishery and climate change, described at the beginning of Chapter 3. In addition, seabirds may be affected by:

Fishing Management Measures. Reasonably foreseeable actions within NMFS jurisdiction that may affect seabirds include ecosystem-sensitive management; fisheries rationalization; traditional management tools; and private actions, such as those described in Sections 8.4 and 9.3 of the Harvest Specifications EIS (NMFS 2007). Ecosystem-sensitive management, rationalization, and traditional management tools are likely to *increase protection* to seabirds by evaluating the potential effects of proposed actions to these species more in management decisions and by improving the management of fisheries through the restructured Observer Program, catch accounting, seabird avoidance measures, and vessel monitoring systems. Changes in the status of species listed under the ESA, the addition of new listed species or critical habitat, and results of future Section 7 consultations may require modifications to groundfish fishing practices to reduce the impacts of these fisheries on listed species and critical habitat. Additionally, since future BSAI groundfish TACs will be set with existing or enhanced protection measures, we expect that the effects of the fishery on the harvest of prey species and disturbance will not increase significantly in future years.

Reasonably foreseeable actions by other federal agencies, state agencies, and persons that may result in adverse or beneficial effects on seabirds include the following.

***Marine Debris*.** Plastics are one type of marine debris known to impact seabirds across the Pacific Ocean (Hyrenbach et al. 2020; Padula et al. 2020; Rapp et al. 2017) and within Alaskan waters (Nevins et al. 2005; Padula et al. 2020). Seabirds consume plastics because birds often misidentify plastics as potential food sources. While there are numerous marine debris cleanup efforts, the continued worldwide use of plastics means that this threat will continue to seabird populations.

***Pink salmon competition for seabird prey*.** In years of great abundance, salmon may exploit prey resources more efficiently than their competitors. In odd years when pink salmon are most abundant due in large part to hatchery production, they can initiate cascading effects on the pelagic marine food web (Batten et al., 2018), which may negatively impact salmonids, forage fishes, whales and seabirds (Ruggerone et al., 2023). Least auklets consume greater amounts of copepod prey and tufted puffins eggs hatching timing shifts in odd years, when pink salmon are in greater abundance (Ruggerone et al., 2023). A biennial pattern in seabird reproductive success has been also attributed to a negative relationship with years of high pink salmon abundance (Springer and van Vliet, 2014) (NMFS 2023).

Pink salmon populations are widely distributed throughout epipelagic waters across the North Pacific Ocean and may be interacting with GOA and Bering Sea species. Overall abundance has increased since the 1970s, reaching unprecedented levels during 2005-2021. Approximately 82 million adult pink salmon annually originated from hatcheries between 2005-2015 (Ruggerone et al., 2023).

***Docks, harbors, roads, and bridge construction*.** Docks, harbors, and other coastal construction projects are commonly permitted in the region and tend to occur along shorelines in sheltered bays which provide feeding habitat for marine birds. Many of these structures, such as docks and piers, often have a positive effect on seabirds as smaller bait fish tend to concentrate around the structure resulting in a higher foraging success. These activities tend not to occur near steep shoreline cliffs, which provide high-density areas for seabird nesting, thus, there are little to no expected effects on seabird nesting habitat. Overall, there is expected to be a negligible effect from these types of projects on seabird populations.

***Mining operations*.** Mining operations tend to occur in the headwater areas of rivers and streams. While these headwater areas provide habitat for some species of seabirds such as loons, ducks, and murrelets, marine birds using this area are at low densities and are expected to move to adjacent habitat; thus, there is expected to be no effect on marine birds from expanded mining operations in the EBS analysis area.

Subsistence harvest. Direct mortality by subsistence harvest is likely to continue, but these harvests are tracked and considered in the assessment of seabirds. For more information on the co-management of subsistence harvest of seabirds by the Alaska Migratory Bird Co-Management Council, see www.alaskamigratorybirds.com.

Increased marine traffic. Increased marine traffic could affect short-tailed albatrosses, Spectacled eiders, and Steller's eiders through disturbance, collisions, and more significantly from accidental fuel spills. In the Chukchi and Beaufort Seas, decline in the extent of Arctic sea-ice in the summer and increase in the length of the ice-free season has prompted interest in shipping within and through Arctic waters via the Northwest Passage. Ships operating, or that could operate in the action area, include military vessels, pleasure craft, cruise ships, barges, scientific research vessels, and vessels related to oil, gas, or mineral development. Thousands of vessels transit the Great Circle Route through the Aleutian Islands each year and the level of use is expected to double in the next several decades. The risk of oil spills in the Bering and Chukchi Seas is also increasing. As sea-ice recedes due to climate change, the potential for increases in Arctic shipping continues to grow. (USFWS 2021).

Cumulative Effects of the Proposed Actions with RFAs: Generally, Bering Sea seabird populations remain stable, although mass mortality events caused by the effects of climate change on seabird prey may continue for some species. The likelihood and degree of spatial and temporal shifts in fishing effort in response to the proposed alternatives is unknown. However, it is unlikely that fishing effort would be uniformly redistributed into areas with different average seabird abundances or densities. Therefore, the potential for an additional adverse effect on seabird populations as a result of any of the alternatives is low.

3.8 Habitat

Fishing operations may change the abundance or availability of certain habitat features used by managed fish species to spawn, breed, feed, or grow to maturity. These changes may reduce or alter the abundance, distribution, or productivity of species. The effects of fishing on habitat depend on the intensity of fishing, the distribution of fishing with different gears across habitats, and the sensitivity and recovery rates of specific habitat features.

A description of the Bering Sea habitat dynamics and a list of habitat protection and closures areas is provided below. Briefly, the Bering Sea is a high-latitude sea made up of the outer, middle, and inner shelf based on bathymetric contours. The benthic habitat is diverse though most of the seafloor is made up of sand and silt.

Description

The Bering Sea is a semi-enclosed, high-latitude sea. Three fronts, the outer shelf, mid-shelf, and inner shelf, follow along the 200-, 100-, and 50-m bathymetric contours, respectively (Stabeno et al., 2016). This creates four oceanographic domains: the deep water (more than 200 m), the outer shelf (200 to 100 m), the mid-shelf (100 to 50 m), and the inner shelf (less than 50 m). The Bering Sea broad continental shelf, making up 44 percent of the total 2.3 million sq. km area, is one of the most biologically productive areas of the world (NPFMC 2024b). The eastern Bering Sea (EBS) contains approximately 300 species of fish, 150 species of crustaceans and mollusks, 50 species of seabirds, and 25 species of marine mammals (Livingston & Tjelmeland 2000).

The large spatial scale and relatively flat bathymetry affect the current patterns across the EBS. The main sources of water flow from the North Pacific onto the EBS through Unimak Pass and Bering Slope water via canyons (Stabeno et al. 2016). There is net water transport eastward along the north of the Aleutian Island chain and a turn northward at the continental shelf break and at the eastern perimeter of Bristol Bay. Eventually, EBS water exits northward through the Bering Strait, or westward and south along the Russian coast, entering the western North Pacific via the Kamchatka Strait. A typical water transit time from Unimak Pass to Bering Strait is >13 months (Stabeno et al. 2016).

The EBS encompasses a diverse variety of benthic (i.e., on the seafloor) habitats. Much of the continental shelf is shallow, flat, and composed of soft, unconsolidated sediments (Smith and McConnaughy 1999, Rooper et al. 2016). The sediments are a mixture of the major grades representing the full range of potential grain sizes of mud (subgrades clay and silt), sand, and gravel (see Appendix A, Table 1 and Figure 1, Salmon FMP). Sand and silt are the primary components over most of the seafloor, with sand predominating the sediment in waters with a depth less than 60 m. Overall, there is often a tendency of the fraction of finer-grade sediments to increase (and average grain size to decrease) with increasing depth and distance from shore. The distribution of benthic sediment types in the EBS shelf is related to depth (see Appendix A, Figure 2, Salmon FMP).

Detailed habitat information can be found in Appendix A of the FMP for the Salmon Fisheries In the EEZ Off Alaska (Salmon FMP, NPFMC 2024a) and Appendix D of the FMP for the Groundfish of the BSAI Management Area (BSAI Groundfish FMP, NPFMC 2024b).

Essential Fish Habitat

Essential fish habitat (EFH) is defined in the Magnuson-Stevens Act as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.”(50 CFR 600.10) For the purpose of interpreting the definition of essential fish habitat: “waters” includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; “substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities; “necessary” means the habitat required to support a sustainable fishery and a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species’ full life cycle.

In 2005, NMFS and the Council completed the EIS for EFH Identification and Conservation in Alaska (NMFS 2005). The EFH EIS evaluated the long-term effects of fishing on benthic habitat features, as well as the likely consequences of those habitat changes for each managed stock, based on the best available scientific information. The EFH EIS also described the importance of benthic habitat to different groundfish species and the past and present effects of different types of fishing gear on EFH. The Council and NMFS updated the available habitat information, and their understanding of the impacts of fishing on habitat, through periodic 5-year reviews of the EFH components in the Council fishery management plans (NMFS 2012, NMFS 2024). The iterative 5-year review cycle supplemented the 2005 EIS with reviews in 2010, 2017, and 2023 (NMFS 2012, Simpson et al. 2017, Harrington et al. 2024).These 5-year reviews have not indicated findings different from those in the 2005 EFH EIS with respect to fishing effects on habitat, although new and more recent information has led to the refinement of EFH for a subset of Council-managed species. Maps and descriptions of EFH for groundfish species are available in the applicable FMPs. The updates from the 2023 EFH 5-year Review are summarized in the *Essential Fish Habitat 2023 5-year Review Summary Report* (Harrington et al. 2024) and are implemented in the Salmon FMP and the BSAI Groundfish FMP, as well as three other North Pacific FMPs, with an EFH Omnibus Amendment package (NMFS 2024).

The Action Area for this EIS is identified as EFH for five species of Pacific salmon (NPFMC 2024a), 26 species of BSAI groundfish (NPFMC 2024b), five species of BSAI crabs (NPFMC 202d), and weathervane scallops (NPFMC 2024e). The Pacific salmon species are Chinook, chum, coho, pink, and sockeye salmon. In alphabetical order, the BSAI groundfish species are Alaska plaice, Alaska skate, Aleutian skate, arrowtooth flounder, Atka mackerel, Bering skate, blackspotted rockfish, Dover sole, dusky rockfish, flathead sole, Greenland turbot, Kamchatka flounder, mud skate, northern rock sole, northern rockfish, octopus, Pacific cod, Pacific ocean perch, rex sole, rougheye rockfish, sablefish, shortraker rockfish, shortspine thornyhead rockfish, southern rock sole, walleye pollock, and yellowfin sole. The BSAI crab species are blue king crab, golden king crab, red king crab, snow crab, and Tanner crab.

The EFH information levels for Pacific salmon species are Level 1, meaning general distribution data are available for some or all portions of the geographic range. Level 1 EFH information is available for all freshwater and marine life history stages of chum salmon: eggs, larvae, freshwater and estuarine juveniles, marine juveniles, immature and mature marine adults, and freshwater adults. Habitat associations are also included in EFH descriptions and include diet and prey, locations, bottom types, and oceanographic features. For example, maturing marine adult chum salmon diets include fish, squid, euphausiids, amphipods, copepods, and gelatinous zooplankton (NPFMC 2024a). Additional detailed information and figures can be found in Appendix A of the Salmon FMP.

Habitat Protections and Closure Areas

The action area overlaps with several habitat protection and areas and other time/area closures for fisheries management.

Except for designated areas, the use of nonpelagic trawl gear is prohibited year-round in the following Habitat Conservation Areas, as described in 50 CFR 679.22 (coordinates can be found in the BSAI Groundfish FMP):Bering Sea Habitat Conservation Area; Pribilof Island Habitat Conservation Area (also closed to fishing with pot gear); St. Matthew Island Habitat Conservation Area; St. Lawrence Island Habitat Conservation Area; and the Nunivak Island, Etolin Strait, and Kuskokwim Bay Habitat Conservation Area.

Habitat Areas of Particular Concern (HPACs)

HAPCs are specific sites within EFH that are of particular ecological importance to the long-term sustainability of managed species, are of a rare type, or are especially susceptible to degradation or development. HAPCs are meant to provide greater focus to conservation and management efforts and may require additional protection from adverse effects.[78]

The action area has one identified HAPC: Skate Nursery Areas. In 2015, through Amendment 104 of the BSAI Groundfish FMP, NMFS designated six areas of skate egg concentration as HAPC without any additional associated regulatory measures. Per the final rule, these areas encompass approximately 82 square nautical miles of habitat, or less than 0.1% of the total area of the BSAI. The Council did not recommend regulations to limit fishing in the proposed HAPC because there was no evidence of adverse effects from fishing on skate populations within Skate Nursery Areas that would need to be addressed through regulation.[79]

Gear, Time, and Area Restrictions

The use of nonpelagic trawl gear in the directed fishery for pollock is prohibited (see 50 CFR 679.24(b)(4)). The Chum Salmon Savings Area and Red King Crab Savings Area (RKCSA) have gear-specific closures focusing on mitigating impacts to species. The Chum Salmon Savings Area is closed to directed pollock fishing with trawl gear from August 1 to August 31, with caveats (see Section 3.5 in the BSAI Groundfish FMP). Even when a Chum Salmon Savings Area is triggered, it only applies to vessels who choose not to participate in an IPA and has not applied in recent years (see Section 2.2). The RKCSA is closed to nonpelagic trawl fishing year-round. There is also the Nearshore Bristol Bay Trawl Closure Area which is closed to all trawling year round, with a small subarea open seasonally.

Finally, there is the Northern Bering Sea Research Area. The use of nonpelagic trawl gear is prohibited in that area, except as allowed through exempted fishing permits under 50 CFR 679.6 that are consistent with a Council approved research plan to examine the effects of nonpelagic trawling on the management of crab species, marine mammals, ESA-listed species, and subsistence needs for Western Alaska communities.

3.8.1 Effects of the Alternatives on Habitat

The direct effects of the alternatives described below are the estimated benthic habitat disturbance under the fishing effects model (Zaleski et al., 2024). Therefore, for each alternative, the analyst evaluated for a new estimate of the amount of benthic habitat disturbance using the fishing effects model. Because such information is unavailable, a qualitative description of how the alternative may result in changes to benthic disturbance relative to the status quo is provided.

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[78] HAPC Process: https://www.npfmc.org/wp-content/uploads/hapc_process092010.pdf

[79] www.federalregister.gov/documents/2015/01/09/2015-00170/fisheries-of-the-exclusive-economic-zone-off-alaska-skates-management-in-the-bering-sea-and-aleutian#p-1 (last visited Nov. 13. 2024)

Table 3-54 Summary of the effects on essential fish habitat

Alternative	Management Measure	Impact to EFH in the Bering Sea
Alternative 1	Status quo	No changes to the current effects of the pollock trawl fishery on benthic habitat in the Bering Sea would be expected. Prosecuted under status quo, the impacts of the pollock fishery on EFH are estimated to be minimal and temporary
Alternative 2	Overall bycatch (PSC) limit for chum salmon	Effects are dependent on the type of change, if any, to fishing activity in response to exceeding PSC limits. Shorter fishing seasons can reduce the estimated habitat disturbance from fishing gear bottom contact. Increased fishing in different areas due to spatial shifts can increase the estimated benthic habitat disturbance from fishing gear.
Alternative 3	Chum salmon PSC limit with an associated Western Alaska chum salmon bycatch annual limit	Similar to Alternative 2.
Alternative 4	Regulatory requirement to added up to six additional chum salmon bycatch provisions in Incentive Plan Agreements (IPAs) to further prioritize WAK salmon bycatch reduction	No changes to the effects relative to the status quo would be expected since they align with current operational strategies.
Alternative 5	Corridors that would close through August 31 if associated caps are reached.	Alternative 5 was qualitatively evaluated because a full quantitative estimate of habitat disturbance requires vessel track information to pair with location-based habitat information. However, that information is not available. The qualitative assessment assumes similar estimates of bottom contact would occur if fishing effort shifted spatially but not temporally in response to corridor closures. Similar to Alternatives 2 and 3, if an Alternative 5 option results in increases to the duration of fishing, that would increase estimates of bottom contact.

3.8.1.1 Alternative 1

Managing the Bering Sea pollock B season at *status quo* would not be expected to have any change in the fisheries effects on benthic habitat in the action area. Effects on EFH under Alternative 1 are outlined below under the current management strategy.

Fishing Effects

Fishing gear can impact habitat used by a fish species for the processes of spawning, breeding, feeding, or growth to maturity. The EFH regulations base the evaluation of the adverse effects of fishing regulated under FMPs on EFH on a 'more than minimal and not temporary' standard (see 50 CFR 600.815(a)(2)(ii)). The effects of fishing on habitat depend on the intensity of fishing, the distribution of fishing with different gears across habitats, and the sensitivity and recovery rates of specific habitat features.

During the 2023 EFH 5-year Review, the fishing effects evaluation modeled habitat disturbance from bottom contact by fishing gear from federally managed fisheries (Zaleski et al. 2024). This represents the impacts from fishing under status quo management. Gear parameters were included in the model to incorporate the nominal width and bottom contact adjustments for different gear types (Appendix 2, Zaleski et al. 2024). Model results representing the estimated disturbance of species core EFH areas were provided to groundfish and crab stock assessment authors (SAs) for all FMP species in the BSAI Groundfish FMP, the GOA Groundfish FMP (NPFMC 2024c), and the BSAI Crab FMP (NPFMC 2024d) to compare with life history parameters. None of the SAs concluded that fishing effects on their species were more than minimal and not temporary, and therefore no SAs recommended elevating their species to the plan teams and the SSC for possible mitigation to reduce fishing effects to EFH. None of the SAs recommended any change in management with regards to fishing within EFH at the time of the fishing effects evaluation, and the Council reviewed these results in February 2023 (Zaleski et al. 2024).

A time series of estimated habitat disturbance from fishing gear was developed from 2003, when widespread VMS data became available, and is available through August 2022. A brief discussion of this ecosystem indicator can be found in the 2023 EBS Ecosystem Status Report (Siddon 2023). In brief, the southern Bering Sea experienced the highest estimated percentages of habitat disturbance compared to the northern Bering Sea, Aleutian Island, and GOA regions, however the time series showed a decline in disturbance from 2003 (Figure 115, Siddon 2023). This decline could represent gear modifications, shifts in gear types, and changes in effort.

The effects of the federal fisheries gear on salmon EFH were not evaluated during the 2023 EFH 5-year Review. However, following the 2017 EFH 5-year Review, the effects of the fisheries on salmon spawning habitat as well as marine pelagic habitat was considered minimal, temporary in nature, and/or to have no effect on spawning, feeding, and growth to maturity for salmon (Appendix A, Salmon FMP).

In sum, the annual harvest activity in the Bering Sea pollock fishery with pelagic trawl gear is expected to continue to result in bottom contact and benthic habitat disturbance in the Bering Sea to the same or similar minimal degree currently estimated. Section 3.8.1.1 describes the fishing effects to benthic habitat under the status quo, though the fishing effects evaluation performed for the 2023 EFH 5-year Review is a comprehensive analysis looking at impacts of all gear types in a region to ensure cumulative impacts from multiple fishing trips are considered. A time series of estimates of disturbance was calculated for the EBS using the fishing effects model and reported in the 2023 EBS Ecosystem Status Report (ESR, Siddon et al. 2023). It showed a declining trend in estimates of disturbance from about 2009–2022 (see Figure 115 of the ESR). That decline could represent gear modifications, shifts in gear types, and changes in effort and is discussed further in the ESR. If the trajectory of gear impacts on benthic habitat stays consistent, it could imply that estimates of overall disturbance would decrease or maintain minimal effects over time.

Fishery-Prey Interactions

Fisheries can have direct impacts on populations, through both the removal of commercially targeted and bycatch species. Commercial fisheries bycatch includes salmon species, and some prey species targeted by salmon in later, marine life history stages including squid, capelin, and herring. Prey species are considered an EFH component and an adverse impact to prey species is an adverse impact to EFH. However, the catch of these prey species is relatively small compared to their overall population sizes (see Fisheries Catch and Landings reports for Forage Fish, Grenadier, and Squid).

3.8.1.2 Alternatives 2 and 3

PSC limits for Alternatives 2 and 3 may result in no change to the status quo, changes in the location or timing of fishing patterns to avoid chum salmon PSC or may result in the closure of the pollock fishery if the PSC limit is reached. Greater fishing effort may occur if vessels fish areas with less productivity in order to avoid bycatch, and higher or lower encounters with other PSC species (e.g., Chinook) may occur if vessels move to areas with higher or lower abundance of nontarget species.

If the pollock fishery reduces fishing effort to conserve chum salmon PSC, the estimated minimal impacts to benthic habitat from gear contact under the fishing effects model would be expected to stay the same or decrease. However, if the pollock fishery increases the duration of fishing in areas with lower concentrations of chum salmon, the impacts to habitat would be expected to increase due to greater overlapping instances of bottom contact, though the susceptibility and recovery rates of the geological and biological habitat features influence the overall estimates of disturbance (see Appendix 3, Zaleski et al., 2024).

Shifts in the location or timing of fishing may also occur as a result of Alternatives 2 and 3. However, there is already considerable interannual variability in the patterns of fishing across the BSAI groundfish sectors, as environmental conditions and avoidance of PSC species have caused vessels to adjust their fishing patterns. Any shift in fishing location or timing outside of the existing footprint of the groundfish fisheries will be analyzed in Alternative 5. Similar to the status quo, Alternative 1, shifts in the existing footprint of the groundfish fisheries may change over time due to many factors such as climate change, bycatch avoidance, and shifting fish distributions, making this difficult to assess. Therefore, effects on EFH under Alternatives 2 and 3 are expected to be minimal and temporary in nature and not expected to occur beyond the scope analyzed in previous NEPA, EFH, or FMP documents.

Alternatives 2 and 3 may change the interactions of fisheries with salmon prey species. Similar to the anticipated changes in estimates of habitat disturbance, longer fishing seasons may result in more prey species removals while shorter seasons may lead to less interactions. This is dependent on where fishing effort may shift in order to avoid chum salmon bycatch and is difficult to predict. Nevertheless, the rate of bycatch in the pollock fishery is relatively small and not likely to be the source of an adverse impact to the prey component of salmon EFH.

3.8.1.3 Alternative 4

Managing the Bering Sea pollock B season with additional regulatory requirements for IPAs would not be expected to have any change in the estimated effects of pollock trawl gear on benthic habitat since they largely align with current operational strategies. The amount of estimated contact would stay the same as status quo (Alternative 1), being minimal and temporary in nature and interactions with salmon prey species is expected to be the same.

3.8.1.4 Alternative 5

Implementing corridor caps and closures may result in a change in fishing timing and location, and with greater fishing occurring outside the selected corridor. The Alternative 5 retrospective analysis indicates where fishing effort has historically occurred outside of the proposed corridors. If in response to a closure vessels moved effort to solely those historic locations, that would be expected to increase benthic disturbance in those areas while decreasing the estimated disturbance from pollock trawl gear in the corridors. However, it is not expected that the fleet would only fish in the historic fishing areas outside of the closed area; it is expected that fishing effort would shift to areas that currently have higher pollock CPUE and lower PSC. Without such information, vessel tracks of shifting behavior cannot be predicted, which is needed to quantify estimates of habitat disturbance using the fishing effects model (a qualitative evaluation could assume, if fishing effort shifts spatially but not temporally, similar estimates of bottom contact would occur).

As with the effects of Alternatives 2 and 3, if an Alternative 5 option causes an increase in the duration of fishing, that would increase the estimates of bottom contact under the fishing effects model. Again, the susceptibility and recovery rates of the geological and biological habitat features influence the overall estimates of disturbance (Zaleski et al. 2024). Without projections of vessel tracks, the analysts are unable to estimate the degree to which habitat disturbance may change under Alternative 5 using the fishing effects model. Qualitatively, effects on EFH from prosecuting the pollock fishery under Alternative 5 are expected to be minimal and temporary in nature to the effects of fishing under the status quo.

3.8.1.5 Cumulative Effects on Habitat

Past and present actions that have had effects on EFH include vessel noise pollution, domestic and transboundary mining operations, fishing gear contact with benthic habitat, fishery removals of prey species, regime shifts as a result of climate change (Eisner et al. 2014), and changes to water quality as a result of climate change.

RFAs that may have a cumulative impact with the proposed actions include authorization and prosecution of the Bering Sea pollock fishery and climate change, described at the beginning of Chapter 3. In addition, habitat may be affected by:

***Vessel noise pollution*.** Motorized vessels provide a large proportion of anthropogenic noise in marine habitats (Popper and Hawkins 2019). These include fishing vessels, large ships, and personal or recreational craft. Most vessels produce predominantly low frequency sounds from onboard machinery and cavitation at propeller blades (Ellison et al. 2012, Ross 1993). Vessel noise production is increasing with increasing vessel traffic, particularly in busy shipping lanes, and vessel noise can increase the ambient noise levels over wide areas of the ocean (Hildebrand 2009, Ellison et al. 2012). Low frequency noise in fish habitats may cause temporary shifts in behavior (de Jong et al. 2020), though low frequency noise, in of itself, has not been shown to result in fish mortality (see Table 2 for noise thresholds, Popper and Hawkins 2019). Short-term behavioral changes may not lead to long-term impacts to fitness or survival (Bejder et al. 2009; Popper and Hawkins 2019). However, there may be unanticipated localized impacts as vessel use increases in certain high-traffic areas.

***Domestic and transboundary mining operations*.** Current and proposed mining operations in Alaska and the Yukon can adversely impact downstream nearshore and marine EFH. When considering mining operations, it is important to note that immediate freshwater impacts can cause downstream impacts to nearshore marine habitats. Impacts from mining include heavy metal contaminants, stream dynamic changes, and permanent habitat loss (Limpinsel et al. 2023). One transboundary mine example is the Eagle Gold Mine in the Yukon that experienced a heap leach facility failure on June 24, 2024, with cyanide introduced into the Yukon River watershed which drains into the Bering Sea (https://yukon.ca/en/victoria-gold-updates).

Cumulative Effects of the Proposed Actions with RFAs: Considering the direct and indirect effects of the proposed alternatives on EFH when added to the impacts of past and present actions and the effects of the RFAs listed above, the cumulative effects of the proposed action are expected to be minimal. This is because, as described above, any anticipated changes in estimated disturbance to EFH from the pollock fishery prosecuted under the *status quo* is little, though changes in estimated disturbance that may be observed after the action depends on the location of fishing effort shifts.

3.9 Ecosystem and Climate

When preparing this section, the analysts considered the potential effects the proposed action would have on *the ecosystem*. Similar to other parts of this analysis, the focus is on how the alternatives could result in changes from the status quo conditions, but unlike other portions of this analysis focused on specific environmental or resource categories, this assessment is evaluating changes *at the ecosystem-level.* This analysis is thus of a different scale than other portions of this preliminary DEIS that discuss individual resource categories.

Broader ecosystem changes in the Bering Sea where the pollock fishery operates as a result of this action are possible compared to status quo, because there is the potential for lower realized catches of pollock during the B season. This scenario is most likely under Alternative 2 or 3 that have the potential to curtail the B season fishery. The proposed alternatives could also indirectly affect Western and Interior Alaska ecosystems in terms of reduced chum and WAK chum salmon bycatch (see Section 4.4.5.3.2).

3.9.1 Effects of the Alternatives on the Ecosystem

3.9.1.1 Alternative 1

Alternative 1 would retain current chum salmon PSC regulations. Under Alternative 1, it is expected the Bering Sea pollock fishery would continue to operate within the parameters observed under status quo (e.g., gear, timing of the fishery, spatial distribution, among other factors). No change in how this fishery is prosecuted beyond the status quo inter-annual variability, which is influenced by many environmental conditions, would be expected. For more information on the status of the Bering Sea ecosystem, see the 2023 Ecosystem Status Report.

3.9.1.2 Alternatives 2 and 3

Alternative 2 and 3 would include an overall limit on chum salmon PSC. If the limit (cap) was reached, pollock fishing must cease. **When thinking about potential ecosystem impacts to fishing below the pollock TAC, it is important to keep in mind both the immediate and longer-term impacts as well as the direct and indirect impacts.**

Immediate impacts of reducing catches below the pollock TAC could result in higher adult pollock biomass in the areas fished during the B season. The direct impacts of lower pollock catches would vary depending on the trophic relationship to pollock (i.e., prey or predator), and be influenced by the amount of B season TAC left unharvested. Also, the current season structure would shift the catches to earlier in the B-season—a period when the fish size tends to be smaller and have lower yields per fish (low recovery rates).

Future impacts of reduced fishing could affect stock dynamics and density dependence processes. For example, higher stock sizes could affect the average size of pollock due to prey limitation (and hence density-dependent reductions in somatic growth). Smaller-sized adult pollock may have lower reproductive potential yet cause higher density-dependent mortality and increased cannibalism. Higher levels of adult pollock biomass have historically resulted in lower levels of recruitment. Following the 2014-2021 warm period, the balance of the EBS ecosystem has shifted and there is increased variability on conditions leading to recruitment success for pollock. However, pollock have been shown to be adaptable to changing conditions and remain at a high stock status. There may be some competition on pelagic and zooplankton productivity from increasing pollock biomass which may prove to be a competitive advantage over other pelagic considers such as salmon.

Prey of pollock includes zooplankton such as euphausiids and copepods as well as zoeal stages of benthic crab species. An increased biomass of pollock in the short-term (immediate to X numbers of years until stock dynamics and density dependence kick in) would result in higher predation pressure on zooplankton. This could result in prey depletion - either locally or more broadly across the shelf depending on timing (immediate year B season footprint versus X number of years later if the population expands over the shelf).

Predators of pollock include piscivorous seabirds (age-0 and juvenile), larger fish (including adult pollock), and marine mammals such as fur seals (adult pollock). Near-term impacts of lower catches could result in additional prey availability to predators of adult pollock (e.g., fur seals). Longer-term impacts will depend on stock dynamics and density-dependence and are harder to predict. Historical patterns suggest that higher levels of adult biomass may not increase the abundance of juvenile pollock as a prey resource for seabirds and other ecosystem components.

Competitors of pollock: Pollock are pelagic foragers and likely impact the standing stock of zooplankton availability over the shelf. Higher pollock biomass due to lower fishing could result in greater consumption of zooplankton and therefore reduce krill and copepods available to planktivorous predators.

Pelagic planktivorous predators include planktivorous seabirds, herring, salmon (and maybe young sablefish), and baleen whales (e.g., NARW, humpback whales).

Another consideration is what the **indirect impacts might be to the benthic components of the ecosystem**. Higher pollock biomass could increase consumption in the pelagic zone and hence result in less production settling to the benthic habitat and available to flatfishes, crabs, etc.

3.9.1.3 Alternative 4

Alternative 4 would include additional regulatory provisions for the salmon bycatch IPAs related to chum salmon avoidance with an emphasis on WAK chum salmon avoidance. It has been previously discussed throughout this preliminary DEIS that these regulatory provisions largely reflect industry current operations and thus are not anticipated to have effects on the ecosystem relative to Alternative 1.

3.9.1.4 Alternative 5

It is not anticipated that Alternative 5 would result in different impacts on the ecosystem than what is currently observed for the status quo. Alternative 5 would include inseason corridors (time and area closures) triggered by area-specific chum salmon PSC caps. Depending on the corridor and PSC limit chosen. If a sector reached its amount of the cap between June 10 to August 31, the corridor would close to that sector until September 1. Alternative 5 has some similarities to Alternatives 2 and 3 in that a cap on chum salmon PSC is included, but it is dissimilar in that the B season fishery would not close to a sector.

As such, some amount of fishing effort may be redistributed for a period of time, but it is not expected that pollock fishing would cease as a result of any option under Alternative 5. Analysts expect the pollock TAC to be harvested outside of the area closure, expect possibly in the case of an early B Season closure for a Cluster 1 or Unimak corridor for the inshore CV sector. Given the magnitude of pollock that is typically harvested in these areas, as well as the requirement to deliver to port, there is a possibly that this action could result in unharvested TAC for this sector. Although more effort may shift outside of the corridor area prior to and after a closure the footprint of the B season pollock fishery would not be expected to substantially change under Alternative 5, because the fleet would continue to target good aggregations of pollock in historically common locations and other regulatory closure areas limit where vessels could shift effort to.

3.9.2 Effects of the Alternative on Climate Change

The alternatives being considered for this action are expected to have minimal impacts on climate change in terms of greenhouse gas emissions. Humans are increasing atmospheric concentrations of planet-warming gasses, including the three main greenhouse gasses produced by human activities: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide. Since 1850, atmospheric concentrations of carbon dioxide have increased by more than 47%, nitrous oxide by 23%, and methane by more than 156%. Methane is a more potent greenhouse gas than CO_2 but is shorter-lived and present in lower concentrations than CO_2. Nitrous oxide is both long-lived and more potent, but its concentrations are also lower than CO_2. The evidence for warming across multiple aspects of the Earth system is incontrovertible, and the science is unequivocal that increases in atmospheric greenhouse gasses are driving many observed trends and changes. The concentrations of greenhouse gasses in the atmosphere continue to increase primarily because humans have burned and continue to burn fossil fuels for transportation and energy generation. In addition, industrial processes, deforestation, and agricultural practices also increase greenhouse gasses in the atmosphere. As a result of increases in the atmospheric concentrations of these heat-trapping gasses, the planet is on average about 2°F (1.1°C) warmer than it was in the late 1800s (USGCRP 2023).

The pollock fishery can contribute to greenhouse gas emissions either directly or indirectly in the following ways: emissions from fishing vessels; emissions from processing facilities; emissions from transportation of processed fish; emissions from vessel maintenance and repairs; emissions related to traveling to and from fishing vessels; emissions related to vessel supplies.

Greenhouse gas emissions associated with the operation of pollock fisheries are, in the short term, expected to remain similar to current levels at current harvest levels. Alternatives 1–5 would not increase the amount of harvest above the TAC, the intensity of harvest, or the location of harvest; therefore, those alternatives are presumed to not increase the impacts of the fishery to various prey items eaten by chum salmon (forage fish, zooplankton, squid, etc.) nor increase greenhouse gas emissions above current levels. Should the fishery close before reaching the TAC as is possible under Alternatives 2 and 3, any contribution to greenhouse gas emissions would decrease by the closure of the fishery.

The effects of Alternative 1–5 on the climate would be minimal. For example, there is no evidence to suggest that these Alternatives would result in substantial changes to the amount of greenhouse gasses in the atmosphere as emissions from the pollock fishery and associated transportation and processing are extremely small relative to global emissions. There is also no evidence to suggest that these alternatives would exacerbate any associated effects of climate change. However, climate change and associated effects are likely already affecting both salmon and pollock throughout the North Pacific, and climate change effects pose a substantial threat to salmon as these effects intensify in the future.

Alternative 5 may cause the pollock fleet to move more to avoid corridor closures than alternatives 1 through 4. If this is the case and vessels are required to move further to continue fishing this could increase the greenhouse gas emissions due to an increase in fuel usage from these vessels.

3.9.3 Cumulative Effects

While the effects of climate change on the ecosystem are expected to continue, considering the direct and indirect impacts of Alternatives 1 through 5 discussed in this section, when added to the impacts of past and present actions and the impacts of the reasonably foreseeable future actions listed above, the impacts of Alternatives 1 through 5 on the ecosystem and climate are determined to be negligible as the pollock fisheries are not expected to dramatically increase fossil fuel emissions from current levels, and direct impacts from the fishery on the ecosystem are not anticipated as the fishery impacts to benthos or other incidentally caught species are not expected to increase.

4 Economic and Social Assessment

This chapter analyzes the potential impacts of the proposed alternatives on the Bering Sea pollock industry, including communities identified as being substantially engaged in or dependent on the B season pollock fishery. Chapter 4 also evaluates the potential effects for fishermen, communities, and Tribes across Western and Interior Alaska that are engaged in or dependent on chum salmon fisheries and may indirectly benefit from the proposed alternatives. The April 2024 preliminary DEIS and SIA are incorporated here by reference and summary.

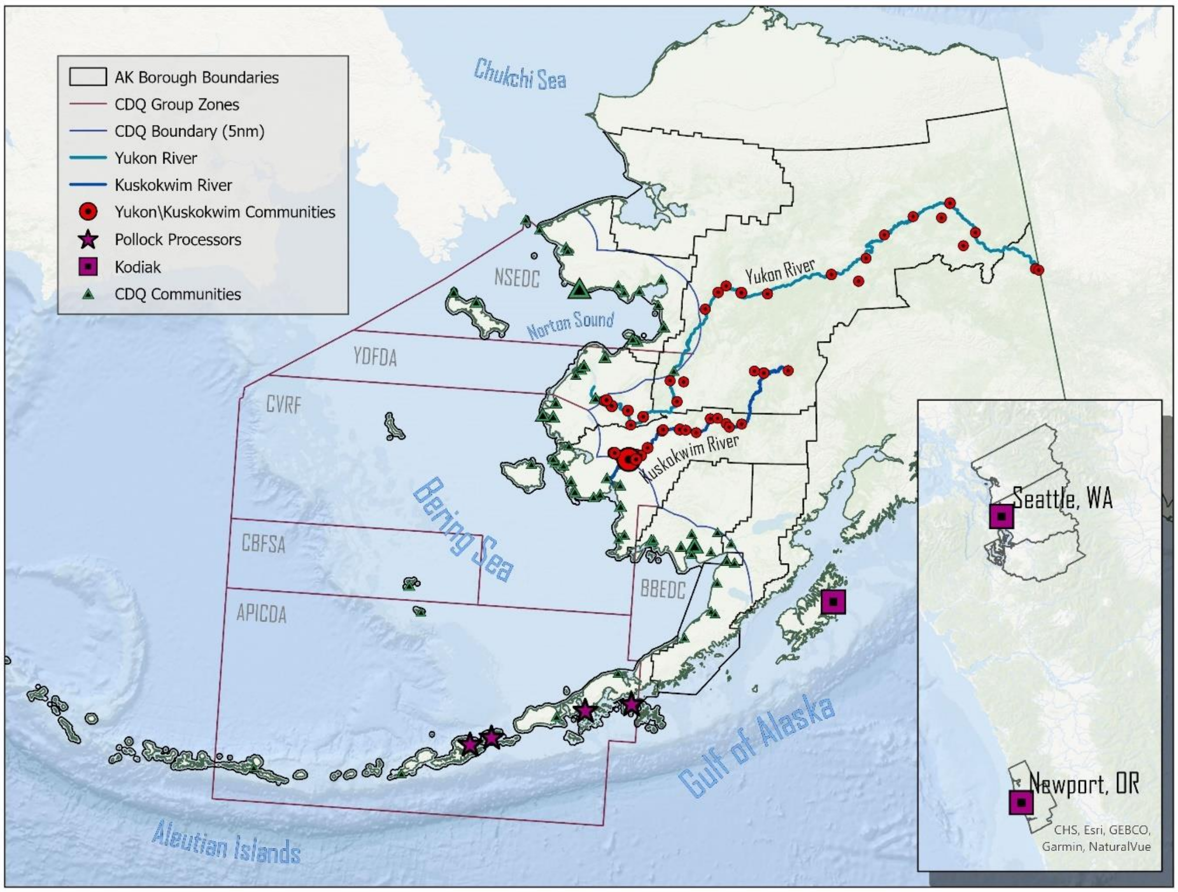


Figure 4-1 Community and regional footprint of the proposed action showing communities engaged in or dependent on B season pollock, CDQ regions, CDQ communities, as well as communities across the Yukon and Kuskokwim River based on community population size

4.1 Bering Sea Pollock Fishery Description

The Bering Sea directed pollock fishery was managed as an open-access fishery prior to 1999. In 1998, Congress enacted the AFA to rationalize the fishery by limiting participation and allocating specific percentages of the Bering Sea pollock directed fishery TAC among the sectors. After first deducting an incidental catch allowance for pollock caught in other groundfish fisheries and 10% of the TAC for the CDQ Program, the AFA allocates 50% of the remaining TAC to the inshore sector; 40% to the CP sector; and 10 % to the mothership sector.

The AFA also allowed for the pollock industry to develop cooperatives. Ten cooperatives were developed as a result of the AFA. Seven inshore cooperatives were formed: the Akutan Catcher Vessel Association, Arctic Enterprise Association, Northern Victor Fleet Cooperative, Peter Pan Fleet Cooperative, Unalaska Fleet Cooperative, UniSea Fleet Cooperative, and the Westward Fleet Cooperative. The Arctic Enterprise Association has not been active since 2008, and the Peter Pan Fleet Cooperative was not active in 2024. Inshore CVs are not required to join a cooperative, and those that do not are managed by NMFS under the inshore open access fishery. Two offshore cooperatives formed, and one mothership cooperative was formed. A purpose of the cooperatives is to further subdivide each sector's pollock allocation among the vessels in the cooperative through private contracts, manage their allocations to ensure individual vessels and companies do not harvest more than their quota of pollock, and facilitate transfers of pollock among their cooperative members and enforce contract provisions.

The Bering Sea pollock TAC is also apportioned among two fishing seasons: 45% to the A season (occurring January 20 to June 10) and 55% to the B season (occurring June 10 to November 1).[80] Regulations at 50 CFR 679.20(a)(5)(i)(B) prohibit reallocations of pollock among the sectors, but NMFS may add any remaining portion of a sector's A season allocation to its B season allocation. Additionally, regulations at 50 CFR 629.20(a)(5)(iii)(B)(4) allow 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 directed pollock fishery in the Bering Sea subarea.

Figure 4-2 shows the distribution of pollock catch during the A and B seasons for each sector from 2011 to 2023. The relative magnitude of pollock catch in an area is shown using a color gradient where higher pollock catch (mt) is shown in yellow or green compared to blue which represents lower pollock catch. Fishing effort in the A season is usually concentrated north and west of Unimak Island, depending on ice conditions and fish distribution. There has historically been fishing effort along the Bering Sea shelf edge and deeper between Unimak Island and the Pribilof Islands, although the general pattern is varied.

[80] Prior to 2017 when Amendment 110 to the BSAI Groundfish FMP, 40% of the Bering Sea pollock TAC was apportioned in the A season and 60% was apportioned in the B season. A purpose of this management change was to provide additional flexibility in the seasonal apportionments of the Bering Sea pollock TAC to allow for more pollock to be harvested if desirable in the A season when Chinook salmon bycatch rates have historically been lower.

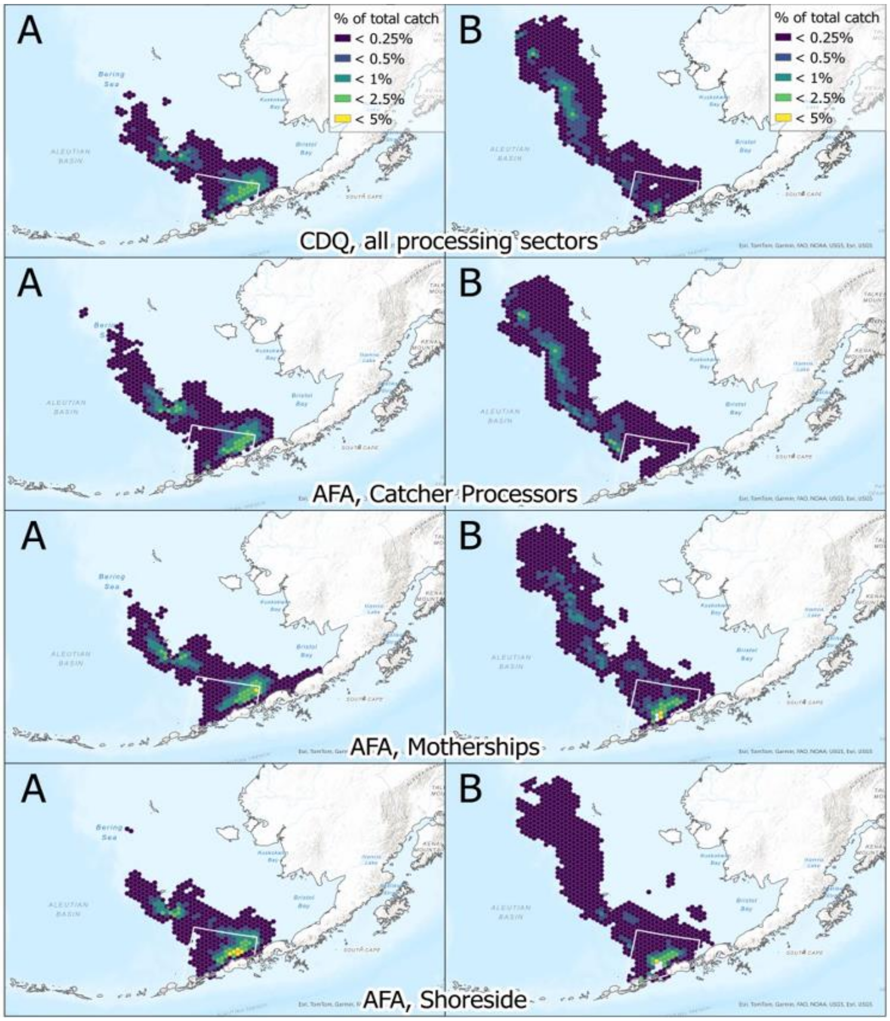


Figure 4-2 Distribution and density of Bering Sea pollock catch during the A season and B season fishery by each sector, 2011–2023

4.1.1 Bering Sea Pollock Fleet

From 2011–2023, the number of vessels participating in the pollock fishery from all sectors ranged from 89 (2023) to 107 (2012) (Table 4-1). The number of vessels participating in each sector has declined over time, but the sectors have harvested nearly all of the TAC during the same period. CDQ pollock has been harvested by CPs, except for 2016 when one CV delivering to a mothership participated in the fishery.

Ports of Delivery

B season pollock deliveries from participants in the inshore sector are made at ports in Unalaska/Dutch Harbor, Akutan, and King Cove. CPs and motherships primarily offload product in Dutch Harbor. Section 4.1.1.4 provides additional information related to fishery engagement and dependence for these communities and others.

Value and Diversification

Table 4-4 and Table 4-5 provide the gross ex-vessel and first wholesale revenue associated with the pollock B season fishery. On average, the B season fishery generated $290 million (in 2022 $) in gross ex-vessel revenue and $906 million (in 2022 $) in gross first wholesale revenue.[81] In addition to Bering Sea pollock, AFA vessels rely on a number of other fisheries for revenue. An AFA vessel's relative reliance on BS pollock can be meaningful when considering the proposed actions, as B season pollock makes up a varying proportion of total revenue for participating vessels and vessels can therefore be impacted by new management measures differently.

The AFA CV fleet is more diversified outside of BS pollock than the CP fleet, but there is wide variation among vessels in both fleets, in part due to their status relative to the AFA sideboards (Table 4-6 and Table 4-7). AFA "sideboards" set different restrictions on participation in other fisheries for AFA-eligible vessels to protect non-AFA participants. Typically, one half of the CVs generate >90% of their annual revenue from AFA pollock fishing (A and B seasons combined; Table 4-6). The other half of the CVs derive revenue from the BSAI Pacific cod trawl fishing (these vessels are part of the newly implemented Pacific Cod Trawl Cooperative, PCTC Program), the Central GOA Rockfish Program, and other GOA fisheries such as pollock and flatfish. In addition, some of the AFA CVs earn revenue fishing in the U.S. west coast (Washington, Oregon, and California), especially in the Pacific whiting fishery.

Of the 16 unique CPs that participated during the 2011-2022 time period, 14 earned 80% or more of their fisheries revenue through AFA and CDQ pollock fishing in the BSAI (A and B seasons combined). Twelve unique CPs also participated in BSAI Pacific cod or yellowfin sole in this time period and 11 unique CPs earned a portion of their revenue in fisheries off the U.S. west coast.

[81] For reference, ex-vessel price (i.e., the market price paid to fishermen for their catch when it is delivered to a processor) is the appropriate metric to understand the significance of the B season fishery for inshore CVs and the first wholesale price (i.e., the market price of the primary processed fishery product when sold by a processor to an entity outside of their affiliate network) is the appropriate metric to understand the scale of revenue entities that support both harvesting and processing earn from the B season fishery. These values include revenue from any other marketable groundfish species that is caught incidentally to pollock.

Table 4-1 Number of vessels by sector participating in the Bering Sea pollock fishery by sector, 2011–2023

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
CDQ	15	16	15	16	16	15	16	15	13	12	11	12	13
CP	15	14	15	16	14	14	14	14	13	13	13	13	13
Inshore	80	81	79	78	79	81	77	73	73	76	74	71	69
Mothership	14	15	14	15	15	15	14	14	15	15	14	13	11
Total	104	107	103	107	102	104	103	99	96	98	97	94	89

Source: NMFS Alaska Region CAS, data compiled by AKFIN.
Notes: Vessels counts are not additive. There is overlap between CVs that are dual-qualified to participate in the inshore and mothership sectors, and the CPs harvesting CDQ pollock and AFA pollock.

Table 4-2 Bering Sea pollock TAC (millions of mt), fishery landings (millions of mt), and percent of TAC utilized, 2011–2023

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TAC	1.25	1.20	1.25	1.27	1.31	1.34	1.35	1.36	1.40	1.42	1.38	1.10	1.30
Landings	1.20	1.19	1.24	1.25	1.29	1.31	1.33	1.34	1.38	1.34	1.35	1.06	1.26
% Utilized	95.8%	100.2%	100.1%	99.2%	98.8%	98.4%	99.1%	98.7%	99.1%	94.2%	98.4%	96.1%	97.5%

Source: NMFS Alaska Region CAS, data compiled by AKFIN.

Table 4-3 Initial B season pollock allocation (mt), fishery landings of B season pollock (mt), and percent of B season allocation utilized from, 2011–2023

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Allocation	730,918	700,560	736,920	745,128	757,704	775,056	713,785	724,049	742,764	757,651	729,025	583,825	687,500
Landings	690,200	711,192	742,343	754,284	783,163	796,512	762,755	759,061	781,837	716,592	753,748	589,619	714,341
% Utilized	94.4%	101.5%	100.7%	101.2%	103.4%	102.8%	106.9%	104.8%	105.3%	94.6%	103.4%	101.0%	103.9%

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

Table 4-4 Gross ex-vessel revenue (in millions of 2022 $) for groundfish harvested during the B season pollock fishery by sector, 2011–2023

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
CDQ	$30.1	$34.2	$30.8	$32.1	$32.0	$29.7	$26.6	$29.7	$29.0	$23.6	$28.2	$27.5	$26.9
CP	$114.3	$118.8	$107.8	$110.8	$111.9	$104.4	$95.1	$103.6	$103.2	$92.6	$97.9	$94.3	$92.6
Inshore	$29.9	$29.7	$27.1	$27.5	$27.8	$25.7	$23.4	$26.2	$25.5	$25.4	$24.7	$24.0	$23.2
Mothership	$137.1	$148.5	$134.5	$138.9	$140.6	$128.9	$121.4	$134.8	$128.6	$124.1	$125.4	$118.3	$119.7
Total	**$311.5**	**$331.2**	**$300.3**	**$309.3**	**$312.3**	**$288.7**	**$266.5**	**$294.3**	**$286.2**	**$265.8**	**$276.3**	**$264.2**	**$262.3**

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

Table 4-5 Gross first wholesale revenue (in millions of 2022 $) for groundfish harvested during the B season pollock fishery by sector, 2011–2023

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
CDQ	$102.8	$111.1	$95.1	$98.7	$100.7	$104.4	$97.4	$92.7	$103.8	$76.6	$90.8	$85.1	$85.2
CP	$389.7	$386.0	$332.2	$342.5	$351.9	$366.3	$346.8	$321.7	$367.4	$298.4	$313.8	$291.9	$293.5
Inshore	$102.1	$95.5	$83.5	$85.1	$87.5	$90.4	$85.6	$81.3	$90.2	$81.2	$78.9	$74.6	$73.8
Mothership	$410.7	$440.0	$393.5	$406.1	$381.0	$397.8	$354.8	$387.4	$414.0	$333.7	$351.9	$346.2	$399.8
Total	**$1,005.3**	**$1,032.7**	**$904.3**	**$932.5**	**$921.1**	**$958.9**	**$884.5**	**$883.0**	**$975.5**	**$789.9**	**$835.5**	**$797.8**	**$852.4**

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

Table 4-6 CVs harvesting AFA by categorical percent of total revenue, 2011–2022 (number of vessels)

Rev as a % of Total	AFA B Season	AFA	BSAI Pcod	GOA Rockfish Program	Other GOA	WOC
<.1%	5	0	28	75	68	67
.1-10%	8	1	23	13	5	8
10-20%	6	7	16	4	4	8
20-30%	3	6	8	1	4	0
30-40%	9	6	1	0	3	0
40-50%	12	6	1	0	4	1
50-60%	45	1	1	0	2	5
60-70%	5	3	3	0	2	2
70-80%	0	5	2	0	1	2
80-90%	0	15	2	0	0	0
90-100%	0	43	8	0	0	0

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT
Notes: other GOA = GOA fishing outside of the Rockfish Program, primarily GOA pollock and flatfish; WOC = WA, OR, CA fisheries

Table 4-7 CPs harvesting AFA by categorical percent of total revenue, 2011–2022 (number of vessels)

Rev as a % of Total	AFA B Season	AFA	B Season CDQ Pollock	CDQ Pollock	AFA + CDQ Pollock	Other BSAI	WOC
<.1%	1	1	2	1	1	5	6
.1-10%	2	2	10	5	2	9	4
10-20%	0	0	2	6	0	0	7
20-30%	1	0	2	2	0	0	0
30-40%	4	0	1	2	0	0	0
40-50%	9	1	0	0	0	0	0
50-60%	0	0	0	1	0	0	0
60-70%	0	3	0	0	0	0	0
70-80%	0	9	0	0	0	0	0
80-90%	0	1	0	0	7	0	0
90-100%	0	0	0	0	7	3	0

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA
Notes: other BSAI = Pacific cod and yellowfin sole; WOC = WA, OR, CA fisheries

4.1.1.1 Bering Sea Pollock Fishery Tax Revenue

The Bering Sea pollock fishery generates tax revenue that is collected by the State of Alaska in the form of a Fisheries Business Tax (FBT) levied on deliveries made to shore-based processing facilities and a Fisheries Resource Landings Tax (FRLT) levied on CP and mothership production. Tax revenue derived from the pollock fishery contributes to State, regional, and local economies.[82]

Figure 4-3 shows the estimated revenue earned from the FBT and FRLT levied on B season pollock from 2011–2023. The estimated taxable value of the FBT ranged between $3.66 million (2022) and $4.61 million (2012). The estimated taxable value of the FRLT levied on B season pollock ranged from $4.40 million (2020) to $5.68 million (2012).

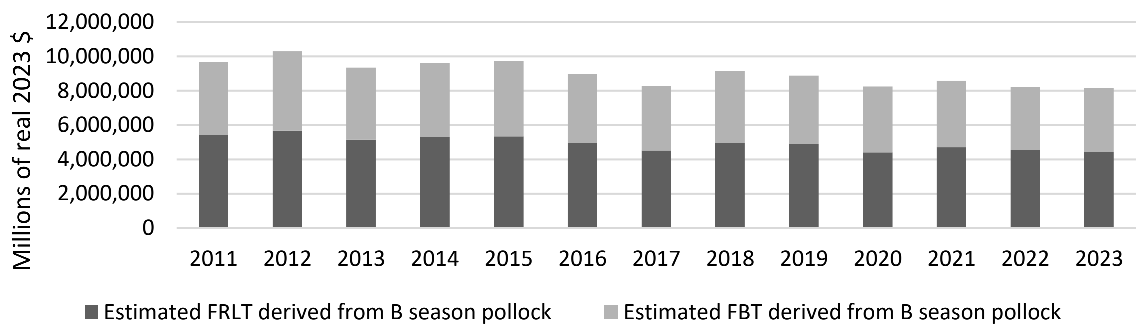


Figure 4-3 Estimates of Fisheries Business Tax (FBT) and Fishery Resource Landing Tax (FRLT) Revenues for B season harvests of AFA and CDQ pollock, 2011–2023

Source: AKFIN.

Incorporated cities and organized boroughs may also levy local taxes on the unprocessed value of fishery resource landings made within the relevant jurisdiction. AFA inshore processors that accepted B season deliveries from 2011–2023 include the Cities of Unalaska, King Cove, and Akutan. The City of Unalaska and King Cove levy a 2% local raw seafood tax. In 2011 and 2012, Akutan levied a 1.0% local tax which was subsequently increased to 1.5% in 2013. Additionally, Akutan and King Cove are located within the Aleutians East Borough, and the Borough levies a local seafood tax of 2.0%. Figure 4-4 shows the estimated taxable value of both State and local taxes levied on B season pollock which ranged from a low of $11.20 million in 2023 to a higher of $13.88 million in 2012.

[82] The Alaska community of Kodiak was excluded from this portion of the analysis because a) there is no AFA qualified processing plant in the community of Kodiak, and b) it is not a common practice for CPs to offload or transfer Bering Sea pollock products processed at-sea in Kodiak (personal communication, J. Bonney). As such, it is not anticipated the City of Kodiak, or the Kodiak Island Borough, would generate a significant amount of fishery-related tax revenue from the Bering Sea pollock fishery.

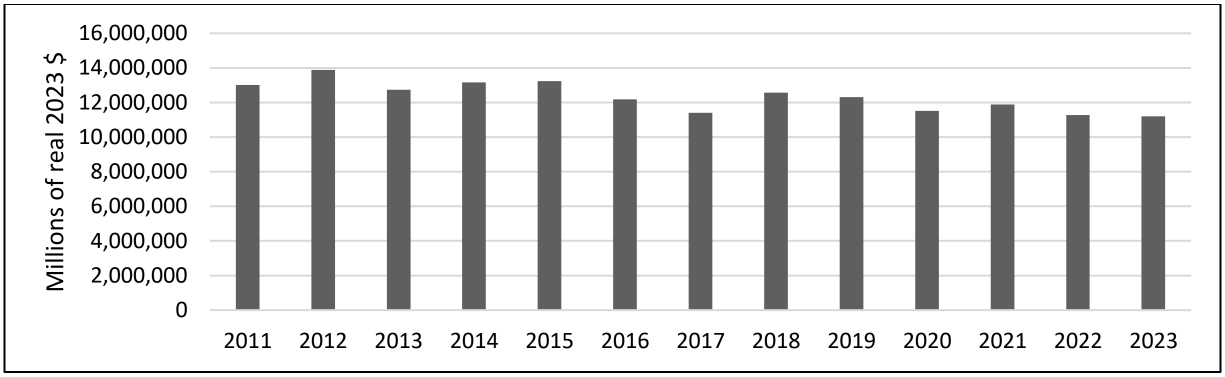


Figure 4-4 Estimated State and local tax revenues (FBT, FRLT, and City Raw Seafood) for Bering Sea pollock, 2011–2023

Source: AKFIN.

The Alaska Department of Revenue deposits all revenue from the FBT and the FRLT into the State's General Fund, and 50% of those revenues are subject to revenue sharing with local governments.[83] Figure 4-5 shows estimates on the State and local taxes levied on B season pollock that have accrued to the City of Unalaska, the City of Akutan, King Cove, and Aleutians East Borough as a community grouping, and the State of Alaska. While the volume of landings made by each cooperative is available in the annual cooperative reports, the value of these landings is not. As such, the analysis treats these data as confidential for communities with a single processing entity.

The community grouping of Akutan, King Cove, and the Aleutians East Borough derived significant public revenues from direct fishery-related taxes levied on deliveries of B season pollock during the baseline period. The estimated revenue generated from the B season pollock fishery for this community grouping ranged between $2.02 million (2023) and $2.60 million (2019). Unalaska also derived substantial public revenues from fishery-related taxes levied on B season pollock, ranging between $5.00 million (2020) and $6.41 million (2012).

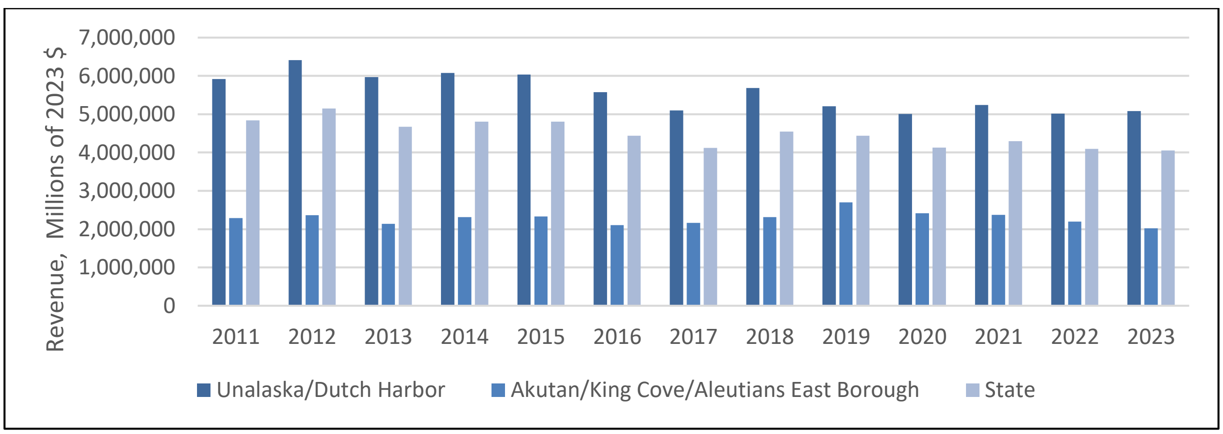


Figure 4-5 Total estimated State and local tax revenues (FBT, FRLT, and City Raw Seafood) generated from the B season pollock fishery by locale, 2011–2023

Source: AKFIN

[83] The Department of Commerce Community and Economic Development first allocates the revenues raised statewide in proportion to the share of statewide pounds of fish and shellfish processed in each of the 19 fisheries management areas (FMA) during the preceding calendar year, and then within an FMA by a formula that may vary by FMA (NMFS 2014).

4.1.1.2 Market Profile for Pollock Products

This section contains information on pollock products and markets, which is relevant to understanding the existing and dynamic conditions for the pollock fishery under the status quo regulation.

Pollock is currently the largest groundfish fishery in the world by volume harvested, with stocks concentrated in the North Pacific Ocean. Pollock are commercially harvested by several countries, but U.S. (Alaska) and Russia are the largest producers by a wide margin. In 2020, Alaskan pollock has accounted for approximately 42% of the global pollock supply, a proportion that has remained stable since 2014 (Abelman et al. 2024). The Alaskan pollock fishery plays an important role in local, regional, state, and national economies alike, and pollock is a valuable product in many global markets.

As highlighted in Table 4-8, in 2023, Alaska pollock harvests yielded approximately 480,860 metric tons of processed product, with a first wholesale value of $1.6 billion. Alaskan pollock is primarily processed into five product types: surimi, fillets, fishmeal, headed & gutted fish, and roe. In 2023, the top products by volume were surimi (39%) and fillets (30%). However, fillets typically provide the most revenue annually of any product type, with surimi as a close second. In 2023, fillets were worth $645 million in gross value, and surimi was worth $577 million. Together, fillets and surimi accounted for 69% of Alaska pollock's production volume and 76% of Alaska pollock's first wholesale value in 2023.

Table 4-8 Summary profile of Alaska pollock wholesale production and markets, 2023

Product Type	Volume		Value	
	Product Volume (1,000 metric tons)	% of Total Pollock Product Volume	Gross Value ($ millions)	% of Total Pollock Product Gross Value
Surimi	185.52	39%	$577	36%
Fillets	142.92	30%	$645	40%
Fishmeal	61.66	13%	$118	7%
Head & Gut	15.78	3%	$19	1%
Roe	14.66	3%	$96	6%
Other	60.32	13%	$149	9%
Total, All Products	**480.86**	100%	$1,604	100%

Source: 2023 BSAI Groundfish Economic SAFE (Abelman et al. 2024), Table 4.16 and Table 4.17

Pollock products occupy many global markets. Processed products are typically delivered to Dutch Harbor, then shipped via cargo vessel to Asia, Europe, and North America for secondary processing or distribution. Europe, Japan, and the U.S. are the primary consumer markets for Alaska pollock. Alaska pollock was among the top five seafoods consumed in the U.S. in 2020. Approximately 21% of Alaska pollock supply goes directly to the domestic market, with the remaining 79% exported for reprocessing or final consumption in other countries (McKinley Research Group 2023). A large portion of Alaska pollock supply re-enters the domestic market after being processed internationally, namely from reprocessing plants in China. Almost 90% of Alaska pollock surimi is sold to export markets. In 2020, Japan and South Korea imported just under 70% of all Alaska pollock surimi production. The remaining markets for surimi included Europe, U.S., Thailand, and China. For Alaska pollock fillets, more than half of production have recently (2016-2020) been sold directly to European markets and about 28% have been sold into domestic markets in that timeframe (Abelman et al. 2024).

Competing supply also exists from other whitefish. Whitefish generally refers to non-oily species, such as cod, pollock, haddock, hake, whiting, and benthic flatfish, such as sole, plaice, flounder, and halibut. Though all whitefish may compete with pollock, farmed whitefish, such as tilapia and pangenesis, are perhaps the most direct competitors to pollock since aquaculture production can be scaled to meet the needs of consumers in a way that wild caught harvests cannot. Though different perceptions of quality and price premiums exist for this range of species, all whitefish are competitors and may be substituted for each other based on price, preference, and availability. For example, Atlantic cod is reported as the preferred whitefish in Europe, likely due to traditional consumption of cod harvests in the North Sea. However, with climate change and overfishing pressure on Atlantic cod, alternative sources of whitefish may be increasingly necessary as substitutions.

4.1.1.3 Alaska Seafood Market Challenges

The Alaska seafood market has been facing exceptional challenges on the local, national, and global scale. These challenges have contributed to "an economic squeeze not seen for decades or longer," according to the Alaskan Seafood Marketing Institute (ASMI 2023). Some of the challenges facing the Alaska seafood market include:

Cost Increases

- **Inflationary Pressures:** Inflationary pressures on fuel, equipment, labor, shipping costs, and cold storage costs, among others, have created significant cost increases for harvesters, processors, and distributors alike. Many global competitors do not face the same cost limits, such as those incurred for product testing, environmentally sound processing, and labor standards (Townsend 2024).
- **Interest Rate Increases:** Higher interest rates have increased costs for both harvesters and processors and have disincentivized additional investment in the industry (Townsend 2024).

Supply/Demand Imbalances

- **Holdover Inventories:** The COVID-19 pandemic generated a shift in consumer demand for seafood and contributed to volatility in prices. Increased supermarket demand for some Alaska species like pollock and crab increased as consumers were preparing more meals at home. In response, supermarkets and seafood suppliers purchased large amounts of frozen seafood and put it in cold storage. With increased inflation and higher consumer prices, supplier ended up with substantial remaining inventory. Historically, retailers would lower prices to clear inventory, but in 2022-2023 retailers transitioned to keeping their new purchases of wholesale supply lower and slowly moved high priced inventory out of cold storage (AFSC 2024).
- **Increased Russian Harvests**: Harvests of pollock, sockeye salmon, and crab from Russia increased in recent years, creating excess supply. Inventories of these products have lingered, which disincentivizes retailers and wholesalers from purchasing additional products McKinley Research Group 2024).
- **Lower Consumer Demand**: Consumer demand for Alaskan seafood has decreased within the U.S. and globally. Nationally, inflationary pressures have contributed to demand decreases for all seafood products. Globally, Alaskan seafood competes with lower-cost products, making it a less attractive option for many consumers.
- **Lower Prices**: The factors affecting supply and demand have resulted in a substantial decline in first wholesale prices between 2022 and 2023 across all major species harvested in Alaska. A recent Alaska Fisheries Science Center economic snapshot report provides more information on the current economic and social conditions in the Alaska Seafood Industry, highlighting dramatic changes in both costs and revenues. The AFSC report cited a 26% decline in wholesale revenue and a 32% decline in ex vessel revenue between 2022 and 2023 (AFSC 2024).

Global Market Conditions

- **Trade Conflicts**: Exports to China, traditionally a key market of Alaska seafood, have decreased substantially due to high tariffs.

- **Geopolitical Factors:** Russia has flooded the market with seafood at rock-bottom prices to fund the war in Ukraine. These products directly compete with Alaskan seafood. Additionally, in response to tariffs in the European Union, a primary market for pollock fillets, Russian seafood companies have shifted a new focus onto Asian surimi markets (Townsend 2024).
- **Strong U.S. Dollar:** In 2023, the strength of the U.S. dollar made Alaskan seafood prices less competitive on a global scale ASMI 2023).

The culmination of these challenges has resulted in difficult economic conditions for Alaskan seafood markets and the processors, harvesters, and communities that participate in them. Over the last year, news about Alaska's fishing industry highlighted the impacts of these challenges, including delays in planned capital investments, temporary closures of shoreside processing operations, companies listing assets for sale, and other impacts and changes in business relationships among entities with full or partial ownership in shoreside processors (AFSC 2024). These headwinds leave the markets for many Alaskan seafood products more vulnerable to marginal changes in operational costs, product quality and value, and net revenues.

To address these market challenges, and help Alaska seafood market participants remain viable, the following policy changes have been proposed and/or enacted:

- **Loan Range Expansion:** Legislation to expand the financial support to fishing communities and businesses was introduced in both the House and Senate in 2023, titled the Fishing Industry Credit Enhancement Act. If passed, this legislation would expand the Farm Credit System to enable businesses that directly assist fishing operations to access a wider range of loans currently available to other agricultural service providers.[84]
- **USDA Commodity Procurement Program:** In 2024, the USDA purchased about 50 million pounds of Alaska seafood, including pink salmon, sockeye salmon, and pollock through the Department's Commodity Credit Corporation. The Commodity Credit Corporation purchases excess agricultural products to stabilize income and prices, which are then used in national food and nutrition assistance programs. An ASMI announcement highlighted the USDA's commitment to purchasing 15 million lbs. of Alaska pollock fish sticks for the National School Lunch Program in 2024, which is substantially larger than purchases in previous years (ASMI 2024).
- **Ban on Russian Seafood Imports:** In 2022, the direct importation of Russian seafood products was banned via executive order. However, Russian seafood products that were reprocessed in third-party countries were still able to enter U.S. markets. A recent expansion on a U.S. ban of Russian seafood imports (Executive Order 14114) took effect May 31, 2024 (Chase 2024) intending to address this loophole. This E.O. may create more space in domestic markets for U.S. seafood, such as pollock. With a new incoming U.S. administration, it is unclear if this E.O. will continue in the same form or if additional trade policy will impact the US seafood market.

4.1.1.4 Communities Engaged in or Dependent on the Pollock Fishery

This portion of the analysis provides information on community engagement and dependence on the B season pollock fishery (2011–2023), based on vessels' registered ownership address or community location of shore-based processing facilities. Appendix 6 contains a series of tables with inter-annual data on community participation and dependence which are synthesized here.

Communities Affiliated with Catcher Processors

The CP sector receives 40% of the Bering Sea pollock directed fishing allowance. Regulations do not require CDQ groups to lease their pollock quota to AFA-eligible CPs, but it is common practice for them

[84] Congress.gov, S.1756 and H.R.4940, *Fishing Industry Credit Enhancement Act of 2023*

to do so.[85] From 2011– 2023, 16 unique CPs participated in the B season fishery, but there has been a decline in participation over time from 15 CPs in 2015 to 11 in 2023. Of these vessels, 15 (92.70%) were registered to owners in Seattle City and one (7.30%) was registered to an owner in Anchorage.

Revenue data for CPs were grouped as "Seattle/Anchorage" for confidentiality. The gross first wholesale revenues CPs earned from AFA pollock harvested in the B season ranged from $302.55 million (2022) to $403.82 million (2011); the revenues earned from CDQ pollock harvested in the B season ranged from $79.38 million (2020) to $107.60 million (2019). CPs earned an average of $450.05 million in gross wholesale revenue from B season pollock (CDQ and AFA harvests combined).

AFA CPs exhibit a high degree of dependence on the B season pollock fishery which accounted for an average of 55.37% of the total gross first wholesale revenues these vessels earned from all other fisheries (gear types and areas). It is more challenging to determine the degree of dependence the Seattle/Anchorage community group may have on B season pollock when viewed through the lens of CP participation because these are larger cities with more diversified economic bases. However, the first wholesale revenues CPs earned from B season pollock accounted for an average of 21.0% of the total revenue earned from the Seattle/Anchorage community fleet (2011–2023). The "community fleet" represents all commercial vessels with an ownership address in the same communities identified by CP ownership address.

Communities Affiliated with Motherships and Floating Processors

The mothership sector receives 10% of the Bering Sea pollock directed fishing allowance. While the sector is composed of both motherships and the CVs that deliver to them at sea, this section provides baseline information for motherships and floating processors.[86]

Four unique floating processors/motherships operated during the B season with registered ownership addresses in Seattle MSA[87] or Dutch Harbor from 2011–2023. The gross wholesale revenue motherships have earned from B season pollock has decreased over time, ranging from $140.71 million in 2011 to a low of $72.85 million in 2020 with a slight increase in 2021 and 2022. On average from 2011–2023, motherships earned $109.70 million in gross first wholesale revenues from B season pollock, which accounted for 58.19% of the total revenues earned by these entities. B season pollock accounted for 32.80% of the total gross first wholesale revenues by the Seattle MSA and Unalaska/Dutch Harbor community processing contingents.

Communities Affiliated with Catcher Vessels

The following section provides baseline participation and dependence information for inshore and mothership CVs. Data are presented together for these CV sectors to streamline information for the reader.

Inshore CVs were primarily registered to ownership addresses in Anchorage, Kodiak City, the Seattle MSA, and Newport. Other communities dispersed throughout Washington, Oregon, and California were also identified but represent a relatively small proportion of participants. The annual average level of

[85] An exception to this harvesting and leasing pattern during the analyzed period occurred in the 2016 B season when one CV delivering to a mothership harvested CDQ pollock. As such, it is not anticipated that a different subset of communities would be identified, if vessels that harvested CDQ pollock were analyzed separately.

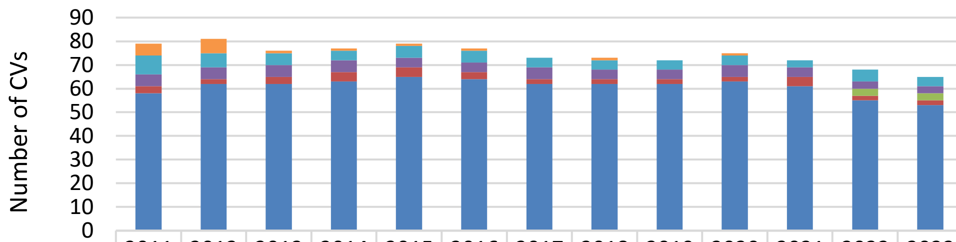
[86] This portion of the analysis includes one floating processor, the *Northern Victor*, that operated outside of the Unalaska City limits from 2011– 2017. The *Northern Victor* is an AFA qualified shore-based processor that receives B season deliveries from inshore CVs in its cooperative. In 2017, Icicle Seafoods moved the *Northern Victor* to Dutch Harbor (inside the Unalaska city limits) and converted it to a stationary processing facility by constructing a dock, permanently mooring the vessel by severing the connection between the engine and propeller and connecting the vessel to shoreside power. The analysts chose to include the Northern Victor in the mothership portion of the analysis because the relationship between this entity and the community of Unalaska was different prior to 2017 and more closely reflected that of a mothership. The SSC recommended the analysts reconsider this choice and move the entity to the shore-based processing component of the analysis, but this would now pose confidentiality issues.

[87] The Seattle MSA is an urban conglomerate in Washington state that includes three of the most populous counties in the state—King, Snohomish, and Pierce.

participation was 74.4 vessels (2011–2023). The majority of ownership was concentrated in the Seattle MSA at 60.9 vessels (81.90% of all inshore CVs). Kodiak City is the Alaska community affiliated with the highest number of inshore CVs.

Mothership CVs had registered ownership addresses in Anchorage, Kodiak City, the Seattle MSA, and Neah Bay, WA. The annual level of participation by CVs ranged from 10 (2023) to 15 (2012 and 2015). Similar to the inshore sector, ownership was concentrated in Seattle MSA at 92.31% of all vessels that participated in this sector. Of all CVs, 8.07% have a registered ownership address in communities based in Oregon or California.

Figure 4-6 shows the number of CVs harvesting B season pollock by community of the vessel's registered ownership address (2011–2023) to provide a sense of scale for the relative concentration of ownership in the Seattle MSA. This figure also shows a downward trend in participation over time, and a shift in CV participation towards Anchorage.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Other OR/Other States	5	6	1	1	1	1	0	1	0	1	0	0	0
Newport	8	6	5	4	5	5	4	4	4	4	3	5	4
Kodiak City	5	5	5	5	4	4	5	4	4	5	4	3	3
Anchorage/Wasilla	0	0	0	0	0	0	0	0	0	0	0	3	3
Other WA	3	2	3	4	4	3	2	2	2	2	4	2	2
Seattle MSA	58	62	62	63	65	64	62	62	62	63	61	55	53

Figure 4-6 Number of CVs harvesting B season pollock by community of the vessel's registered ownership address, 2011–2023

The gross ex-vessel revenues that inshore and mothership CVs earned from B season pollock ranged from $147.14 million (2020) to $183.11 million (2012). Vessels registered in the Seattle MSA earned an average of $141.40 million in gross ex-vessel revenue. This represented 68.08% of the total B season revenue earned by all CVs.

The majority of CVs participating in the inshore and mothership sectors during the B season pollock fishery have a historical ownership address in the Seattle MSA, followed by Newport and Kodiak. The Seattle MSA, Newport, and Kodiak "community fleets" are large and diverse. As such, the relative economic dependence of these communities on the B season pollock fishery varies. For example, the gross ex-vessel revenues earned from B season pollock accounted for approximately 2.81% of the total gross ex-vessel revenues earned from the Kodiak community fleet compared to approximately 20.13% and 20.81% of the Seattle MSA and Newport community fleets, respectively.

Communities Affiliated with Shore-based Processing Facilities

Three Alaska communities participated in the B season fishery as the location of a shore-based processor (2011–2023). Four shore-based processors operated in Unalaska/Dutch Harbor: UniSea Seafoods, Westward Seafoods, Alyeska Seafoods, and the *Northern Victor*[88]; one shore-based processor operated in Akutan: Trident Seafoods in Akutan; and one shore-based processor in King Cove: Peter Pan Seafoods.

[88] The *Northern Victor* was owned by Icicle Seafoods, but the processor was sold to Westward Seafoods in 2022.

Revenue data for communities affiliated with a shore-based processor have been grouped as "Akutan/Dutch Harbor/King Cove" for confidentiality. The gross first wholesale revenues shore-based processors earned from B season pollock ranged from $326.46 million (2017) to $431.73 million (2012). These processors earned an average of $374.21 million in gross wholesale revenue from the B season fishery.

All shore-based processors identified in this analysis are multi-species plants that participate in pollock, Pacific cod, crab, halibut, sablefish and other fisheries. On average from 2011–2023, B season pollock accounted for 43.82% of the gross revenue these processors earned from all fisheries processing activities. There have been shifts in these processors' dependence on pollock in recent years. B season pollock accounted for 50%–60% of the total revenue that four shore-based processors earned from all processing activities in 2021. Prior to 2021, one or two shore-based processors relied on B season pollock for 50% or more of their total revenue in a given year. The relative increase in dependence on the B season fishery in 2021 coincided with the recent Red King Crab and snow crab closures.

Table 4-9 provides additional information on the fisheries these processors participate in, the timing of when these fisheries occur, and an approximate level of employment during these periods.[89] In general, employment levels follow the ebb and flow of peak processing activities. For example, processing activities slow in these plants in mid-April when the Pacific cod fisheries slow and A season pollock is complete. As these processors transition to B-season pollock, employment levels pick up again. Some processors, like Trident's Akutan facility, take small deliveries of halibut and black cod fisheries during the lull between mid-April and early June.

These processing facilities have been designed to use economies of scale in production and move an optimal volume of fish through the processing plant at the most efficient, and cost-effective rate, given the capacity of the facility and expectations of catch and delivery rates from the pollock CV fleet. While cost data are not available for shore-based processors and would be considered confidential, the B season pollock fishery plays an important role in covering the fixed costs of these facilities.[90] Fixed costs for shore-based processing facilities on the Aleutian Peninsula typically include expenses related to infrastructure maintenance, utilities, property taxes, labor, insurance, and equipment depreciation. These costs can vary significantly based on the size and type of facility, location, and operational capacity, but they are generally anticipated to be substantial due to the remote setting and logistical challenges associated with the region.

[89] The SIA prepared for April 2024 contains substantial, additional information on this topic and is incorporated by reference and summary here.
[90] Public comment, Pacific Seafoods Processing Association, April 2024.

Table 4-9 Summary of shore-based processors accepting B season pollock deliveries' participation in other fisheries, the timing of when these fisheries occur, and an approximate level of employment during these periods

Shore-based Processor	Community Location	Species, Timing, Employment			
Trident Seafoods	Akutan	A season pollock, cod, and opilio and bairdi crab	Halibut and black cod	B season pollock, cod, halibut, black cod and herring	Crab
		January to April	March to May	June to October	Mid-October to December
		1,000 to 1,300	200 to 300	800 and 1,200	200 to 250
Peter Pan Seafoods	King Cove	Pacific cod, crab, A season Western GOA and Bering Sea pollock	Salmon, B season pollock	Crab	
		January to mid-April	June to October	October to November	
		400	300	30	
Alyeska Seafoods	Unalaska	Pacific cod	A season pollock, opilio crab, trawl cod fisheries	B season pollock	Crab
		First two weeks of January	Mid-January to April	Late May to October	October to December
		160 to 180	400	220 to 230	75 to 150
UniSea Inc.	Unalaska	Pacific cod, A season pollock, other trawl and crab	Halibut and black cod	B season pollock and crab	Other intermittent deliveries
		January to April	May and June	June to October	October to December
		800	300 to 400	450	440
Westward Seafoods	Unalaska	Pacific cod, crab, pollock and trawl cod	Fixed gear cod, halibut and sablefish	B season pollock	Crab
		January to mid-April	Mid-April to June	June to mid-September	mid-September to mid-November
		530 to 640	190	370	110
Northern Victor	Unalaska	Cod, A season pollock	B season pollock		
		January to mid-April	mid-June to October		
		220	220		

Source: Akutan and Unalaska Community Profiles (Downs & Henry 2023) as well as the Comprehensive Baseline Commercial Fishing Community Profile for King Cove (EDAW 2005).

4.1.1.4.1 Community Context

This portion of the analysis provides additional information on the communities of Akutan, King Cove, Kodiak, Newport, Seattle MSA, and Unalaska. These communities were identified as being *substantially* engaged in or dependent on B season pollock based upon three screening criteria applied to fisheries-dependent data from 2011–2023: a shore-based processor was located in the community during the analyzed period, the community was a primary location of CP and mothership product offloads, and/or the community had a consistent level of participation in the fishery measured by an annual average of more than one vessel with a local ownership address. This approach is consistent with the portion of the National Standard 8 guidelines that state, "to address the sustained participation of fishing communities that will be affected by management measures, the analysis should first identify affected fishing communities and then assess their differing levels of dependence on and engagement in the fishery being regulated (50 CFR 600.345)."

4.1.1.4.1.1 Alaska Communities

Table 4-10 provides indicators on the minority and low-income proportion of the population (referred to as "environmental justice indicators") for Akutan, King Cove, Kodiak City, and Unalaska compared to the State of Alaska as a reference population. This approach is in line with CEQ guidelines (1997) stating an environmental justice analysis should identify population groups within the study area that have minority and/or low-income populations meaningfully greater than a reference population that is used for comparison. For this analysis, population groups were determined to meet these criteria when either the proportion of minority and/or low-income residents exceeds 50% of the area's total population or these populations are greater than 5% above the reference population (EPA 2024). More broadly, the purpose of an environmental justice analysis is to identify whether the proposed alternatives could have disproportionately high and adverse effects on minority populations, low-income populations, and Alaska Native/Indian Tribes (see 40 CFR 1508.1(f)).

Kodiak City had the largest population at 5,581 persons and King Cove had the smallest population at 757 persons. The minority proportion population in these select Alaska communities is meaningfully greater than Alaska's general population, while only Akutan has a low-income population meaningfully greater than Alaska's general population.

Table 4-10 Select environmental justice indicators for Alaska communities engaged in or dependent on B season pollock

Community	CDQ Group	2020 U.S. Census			2022 5-year ACS			
		Total Pop.	**Alaska Native/American Indian Residents as % of Total**	**Minority Residents as % of Total***	**Per capita income**	**Number of households***	**Median household income**	**Low-income residents as percent of total*****
Akutan	APICDA	1,589	3.6%	90.8%	$45,054	58	$28,750	29.9%
King Cove	-	757	43.2%	72.5%	$40,796	358	$79,844	16.4%
Kodiak City	-	5,581	10.9%	67.8%	$36,227	1,768	$76,765	10.7%
Unalaska	APICDA	4,254	4.6%	68.8%	$46,296	796	$104,706	13.2%
Alaska	**-**	**733,391**	**15.2%**	**42.5%**	**$42,828**	**274,574**	**$86,370**	**14.2%**

Source: U.S. 2020 Census and 2022 ACS 5-year estimates.
* The U.S. Census Bureau defines a "minority" as anyone that self-identifies as not single-race white and not Hispanic. Information on race and ethnicity is sourced from the U.S. Census, Demographic and Housing Characteristics. The same definition and data source applies to all other minority population data reported in subsequent tables and is not repeated.
**Defined as any group of people who live in a housing unit.
***Defined as the percentage of people in a particular geography/place whose income in the past 12 months is below the poverty level. The U.S. Census Bureau calculates several different poverty thresholds. As a point of reference, a family of four (two adults and two children) had a poverty threshold of $29,678 in 2022).

Akutan, King Cove, and Unalaska are communities affiliated with the pollock fishery through shore-based processing, noting Unalaska has a wider reach of connections via other sectors. Table 4-11 provides a summary of population and demographic information by housing type (non-group quarters and group quarters) for these communities where B season pollock deliveries were made. The minority proportion population residing in group quarters is used as a proxy for the minority populations working at the shore-based processors in these communities. The minority proportion population residing in group quarters ranges from a low of 54.2% in King Cove to a high of 91.1% Akutan. A relatively small proportion of the population residing in group quarters identified as Alaska Native/American Indian compared to residents living in non-group quarters housing. In Akutan, the traditional village and Unangax̂ population is highly concentrated in one area and generally insulated from commercial groundfish-related activity and its associated non-Native population. In Unalaska, a similar pattern is observed where year-round residents live in the village of Unalaska and seasonal employees live in group quarters servicing the seafood industry (Downs & Henry 2023).

Table 4-11 Population housing type for communities where shoreside processing facilities accepting B season pollock deliveries are located

		Population NOT Living in Group Quarters			Population Living in Group Quarters		
Community	**Total population**	**Total population living outside of group quarters***	**Alaska Native/American Indian residents as percent of total**	**Minority residents as a percent of total**	**Total population living in group quarters**	**Alaska Native/American Indian residents as percent of total**	**Minority residents as a percent of total**
Akutan	1,589	113	43.4%	87.6%	1,476	0.5%	91.1%
King Cove	757	427	71.0%	86.7%	330	7.3%	54.2%
Unalaska	4,254	1,677	10.3%	65.2%	2,577	0.9%	71.2%

Source: 2020 U.S. Census
*Defined as “other noninstitutional facilities," which excludes institutionalized populations, college/university student housing, and military quarters.
**Defined as all persons self-identified as only American Indian and Alaska native alone, not in combination with one or more races.
***Defined as all persons other than those self-identified being in both "white" and "non-Hispanic" census categories.

Local Economy and Links to Commercial and Subsistence Fisheries

All Alaska communities substantially engaged in or dependent on B season pollock are home to federally recognized tribal governments and many year-round residents engage in subsistence activities. Subsistence uses are customary and traditional uses of wild resources for food, clothing, fuel, transportation, construction, art, sharing and customary trade (AS 16.05.258(c)). However, “subsistence” holds many dimensions and is vital to the local economies and cultural practices of many rural and Alaska Native communities (Kawagley 2006:8). This section highlights the fundamental importance of subsistence and the key role of sustained participation in federal fisheries for community wellbeing in these select Alaska communities.

<u>Akutan</u>

Akutan is the traditional site of an Unangax̂ village that has been continually inhabited by the Unangax̂ for at least 8,000 years (Downs & Henry 2023). Unangax̂ residents have historically, and continue to, harvest salmon, Pacific cod, herring, seal, wild cattle, and game birds for subsistence. A 2018 study documented the per-capita harvest by year-round residents in Akutan as 439 pounds, 76% of which was fish (Schmidt & Berman 2018). Salmon harvests contributed the majority of subsistence harvests of fish, but harvest levels fluctuate year-to-year depending on availability.

In terms of commercial fisheries engagement, Akutan is home to a single shore-based processing entity that is the largest seafood production facility in North America and a direct link between Akutan and the pollock fishery. From 2000–2020, the number of active vessels affiliated with Akutan by either ownership or homeport address has ranged between one and six vessels. Fixed gear groundfish and halibut IFQ have accounted for most of the landings from these vessels (Downs & Henry 2023, 18). Pelkey’s Dive Service is the only direct fishery support business active in Akutan in recent years. This operation caters to fishing vessels by changing zincs, clearing fouled propellers, among other services (Downs & Henry 2023). Other Akutan businesses derive benefits from commercial fisheries in less direct ways. For instance, the Akutan Corporation benefits from local processing activities through sales of goods and services to plant employees at the McGlashan Store, the community general store owned by the corporation. Akutan Bay has also been the site of product transfers from at-sea processors to cargo vessels and has resulted in shared state FRLT revenues accruing to the City of Akutan (Downs & Henry 2023).

King Cove

King Cove is an Unangax̂ community that has long been engaged in commercial salmon and groundfish fisheries, and there is a strong relationship between commercial fishing access and subsistence in King Cove. Salmon used for subsistence are sometimes removed from commercial catches while other species are also harvested within the context of commercial fishing. Commercial fishermen have reported harvesting pink and chum salmon and drying them on their boat to bring back home to eat. Salmon strips are valuable gifts, and jarred salmon are used as a high value barter item (Reedy 2019).

Vessels affiliated with King Cove participate in a commercial salmon (drift, driftnet, setnet, and Seine), halibut, cod, among others. Residents have typically delivered catches to the Peter Pan Seafoods plant in the community. The plant is set up to serve smaller vessels but takes deliveries from larger vessels like those participating in the AFA pollock fishery as well (Reedy 2016). However, in January 2024, Peter Pan Seafoods announced the closure of the King Cove facility for the 2024 A pollock season, citing tumultuous markets, high interest rates, and financing challenges combined with the high cost of fuel. More broadly, King Cove has several marine support businesses in pot hauling, pot storage, moorage, boat watchers, and diving/welding.

Kodiak City

Kodiak City is located on Kodiak Island, which has been inhabited for the past 8,000 years by the Alutiiq, or Sugpiaq, peoples. The Alutiiq language is one of the “Esk-Aleut” languages and is closely related to Central Yup’ik.[91] Salmon play a critical role in the subsistence economy for Kodiak Island residents. In Kodiak, as with King Cove, commercial fishing plays an important role in supporting mixed subsistence economies where residents who fish commercially often retain salmon, crab, herring, and other resources for subsistence or personal uses (Brown et al. 2023).[92]

Kodiak City has been involved in large-scale commercial fisheries for over a century. Kodiak residents have been engaged in the groundfish, crab, halibut, black cod, and salmon fisheries. The majority of vessel ownership and processor location is concentrated in Kodiak City, compared to other communities across the Borough. While Kodiak City is the largest commercial fishing port in terms of the volume of seafood landed, the community has long seen fluctuations in the harvest volumes and values for the region’s commercial fisheries. Total volumes landed in the community have been subject to resource shocks in the last five years, including the precipitous drop in Pacific cod abundance since 2015, very low pink salmon returns in 2016 and 2018, and challenging dynamics in the pollock market (McDowell 2021).

Unalaska

Unangax̂ families in Unalaska have historically relied on marine mammals for subsistence, especially Stellar sea lion and seals; salmon have also played an important role in the subsistence economy in this community for thousands of years; the primary salmon species used locally for subsistence is sockeye salmon (Keating et al., 2022). Pacific halibut and cod are the primary nonsalmon fish harvested for subsistence uses among households in the community (Reedy & Maschner 2014). In the past it was common for some households to obtain significant amounts of crab for household use through home pack, “cementing crab as a critical subsistence resource and part of the social economy [and] also the

[91] More information is available at the Alutiiq Museum’s Archeological Repository.

[92] Personal use fishing is similar to subsistence fishing, except that it is fishing with efficient gear for food in nonsubsistence areas, particularly by residents of urbanized areas, or fishing for stocks without customary and traditional uses (Fall 2018).

status and social capital of the providers" (Reedy & Maschner 2014, 375). While residents continue to harvest crab under subsistence regulations, recent closures have likely significantly reduced opportunities for locals to participate in the industry as crew and reduced home pack crab resources (Keating et al. 2022).

The residential fleet is comparatively smaller than the local fleets in other fishing communities, but residents are engaged to varying degrees in the fixed gear groundfish, IFQ halibut, IFQ sablefish, salmon, and local crab fisheries. Pacific cod has been a primary groundfish fishery for local Unalaska vessels. A frequently noted problem in developing markets and long-term relationships with the larger processing entities in the community, however, is that the locally based fleet consists of vessels that are small by Bering Sea standards (typically 18–68' in length). These vessels are more weather dependent compared to larger vessels and have a smaller delivery capacity per trip. These factors make it more challenging for larger plants to accommodate what are, by necessity, relatively small and (in most cases) sporadic deliveries (Downs & Henry 2023).

More broadly, Unalaska's primary commercial economy is based on fishing, seafood processing, and fleet services. This community is home to a wide range of support services including accounting and bookkeeping, banking, cold storage, construction and engineering, diesel sales and service, electrical service and marine electronics, equipment and gear, hydraulic services, logistical support, marine pilots and tugs, trucking, vehicle rental, vessel repair, warehousing, among others. The community is also home to the westernmost container terminal in the United States, acting as an international hub for cargo transshipment. Two rail cranes are located in Unalaska, one at the marine center and one at a privately owned commercial dock (Downs & Henry 2023).

School Enrollment

Appendix 6 provides supplemental figures on K-12 school enrollment trends for Akutan, King Cove, Kodiak City and Kodiak Island Borough schools, and Unalaska. These communities are home to small, geographically isolated populations where commercial fishing plays a meaningful role in the local economy, community wellbeing, and sustainability. Shrinking school enrollments may suggest a population undergoing transition. Alaska requires a minimum of 10 students be enrolled to qualify for state funding, which helps to ensure the school can stay open, and that children in these communities have access to education close to home. Schools serve as central institutions, providing a hub for social activities, events, and community gatherings, all of which help to create a sense of identity and place.

Akutan school enrollment tends to fluctuate with fisheries sector employment. In recent years, total enrollment has been steady at 20 students, but continued state funding is an area of concern for residents. King Cove's enrollment has remained somewhat steady, due in part to dwindling populations and school closures in nearby communities (Reedy 2019). Stable school enrollment is a concern for Kodiak Island Borough communities, which have struggled to keep schools open with declining enrollment in recent years. Larsen Bay School closed in 2018, and Karluk school closed in 2019 due to low enrollment. There is one elementary school and one high school in Unalaska with a total enrollment of 354 students in 2023, up from 342 in 2022. However, the 2023 enrollment is 7% less than the previous 5-year average which includes those years most affected by the COVID-19 pandemic.

Recent Cross-Cutting Challenges Facing Communities

As discussed in Section 4.1.1.3, the Alaska seafood industry is facing widespread challenges that affect fishery participants and communities. More broadly, communities are experiencing adverse socioeconomic impacts due to declines in fishery participation (e.g., Pacific cod, crab, among others) and processing plant closures, in addition to geopolitical tensions that have impacted seafood prices. All of these factors have been compounded to a degree by the residual impacts of the COVID-19 pandemic, which include inflationary pressures, reductions in fishery participation, increased interest rates, and changes in consumer demand.

Three major seafood processing companies –Trident, Peter Pan Seafoods, and OBI – announced seasonal or permanent plant closures in response to some of the cross-cutting challenges facing the seafood industry. Processors play a central role in Alaska's coastal economy as they provide jobs for residents and non-residents that support the livelihoods of local community, contribute to the local economy through wages, taxes, and the purchase of goods, and provide stability through support of other industries like cold storage and equipment maintenance. All major seafood processors that have announced plant sales or closures operate in pollock-dependent communities, and one processor (Peter Pan Seafoods in King Cove) has been an active participant in the B season fishery until the 2024 season.

4.1.1.4.1.2 Pacific Northwest Communities

Table 4-12 provides environmental justice indicators for Newport and the Seattle MSA compared to Oregon and Washington as reference populations. The 2020 U.S. Census recorded the total population of Newport at 10,256 persons and the total population of the Seattle MSA as over 4,000,000 persons. Newport and the Seattle MSA have a proportion of minority residents that mirrors the minority population of the states they are situated in at 29.7% and 42.1%, respectively.

Table 4-12 Select socioeconomic indicators for Newport and Seattle MSA compared to Oregon and Washington

Community	2020 U.S. Census			2022 5-year ACS Estimates			
	Total Pop.	Alaska Native/American Indian residents as percent of total	Minority residents as percent of total *	Number of households	Median household income	Per capita income	Low-income residents as percent of total
Newport	10,256	2.6%	29.7%	4,551	$57,511	$33,541	20.4%
Oregon	**4,237,256**	**1.5%**	**28.3%**	**1,726,340**	**$75,657**	**$41,805**	**15.8%**
Seattle MSA	4,018,762	1.1%	42.1%	537,193	$103,736	$40,911	11.0%
Washington	**7,705,281**	**1.6%**	**36.2%**	**3,079,953**	**$57,511**	**$33,541**	**20.4%**

Source: U.S. 2020 Census and 2022 ACS 5-year estimates.

Local Economy and Links to Fisheries

Newport

Newport is located in Lincoln County, Oregon on the north and south sides of Yaquina Bay. For over 3,000 years, the Yaqo'n people inhabited the coastal area, relying on marine and freshwater resources and developing complex social networks across the land and waterways. Members of the Siletz Tribe may engage in cultural fishing in Euchre Creek Falls, Dewey Creek Falls, and at a site in Rock Creek (Normal et al., 2007).

Commercial fishing is central to the identity of Newport (Package & Conway 2010). Newport is home to a large commercial fleet that participates in a range of local and "distant waters" commercial fisheries in Alaska including salmon, halibut, crab, tuna, shrimp, Dungeness crab, flounder, sole, rockfish, lingcod, and pollock. Vessels that participated in the B season pollock fishery and registered in Newport are a source of local employment. It is common practice for pollock vessels based out of Newport to hire crew from the community, most of which stay with the same boat year-after-year.[93]

More broadly, Newport's fishing economy has long been centered on seafood processing. However, there are residual effects from the Covid-19 pandemic which drove multiple plant closures. In 2000, Newport had four processing plants that employed at least 217 people (Norman et al., 2007), but in 2022, only two seafood processors remained in the community. Employment data are limited due to confidentiality concerns. The community is also a regional hub for the fishing industry with many support sector

[93] Personal communication, H. Mann.

businesses including repair, provisioning, gear manufacturing, financial services, supply services, and new boat building (the Research Group, LLC 2021). In fact, many fishermen make this community their destination because of the support services offered (Package & Conway 2010).

<u>Seattle MSA</u>

Seattle MSA area encompasses the traditional territories of the Suquamish, Duwamish, Muckleshoot, Tuulalip, Puyallup, and Snoqualmie Tribes. The area has been continuously inhabited for thousands of years with expansive trade networks. Tribal and nontribal community members may be engaged in subsistence fishing in the Seattle area, however little information is available. The Muckleshoot Tribe, located southeast of Seattle, in partnership with the Washington Department of Fish and Wildlife is involved with a sockeye salmon counting program on Lake Washington (Norman et al., 2007).

Seattle MSA has long played an integral role in Alaska's commercial fisheries. The Seattle MSA fishing fleet is large and diverse with participants in Alaska groundfish, Pacific Northwest groundfish, crab, and other fisheries (Wise et al., 2023). Seattle is the home port to 300 vessels, of which 226 or 75% participate in Alaska's groundfish, crab, and salmon fisheries (Port of Seattle 2019). In 2017, Seattle MSA's commercial fishing industry supplied 7,200 jobs. Of that, 5,100 individuals worked on fishing vessels and 4,900 of those fished in Alaskan waters. This activity supported over $313 million in labor ($150 million in fishing employment and $163 million in onshore labor).

4.1.1.5 Harvesting and Processing Crew Employment Information

This section provides information on the number of crew persons working onboard AFA vessels prosecuting the Bering Sea pollock fishery and estimates of employees at inshore processing facilities partnered with an AFA inshore cooperative.

Inshore processing plants report their number of employees by month on a quarterly basis to the Alaska Department of Labor and Workforce Development (ADOLWD). ADOLWD compiled the data for this analysis by filtering employment statistics for fish processing facilities in partnership with inshore cooperatives under the AFA. It is important to note that all AFA inshore processing facilities often process multiple species simultaneously, and it is not possible to precisely estimate the proportion of employees engaged in the processing of Bering Sea pollock compared to all other species.

Figure 4-7 summarizes the estimates of total onboard positions on AFA vessels in all sectors by year, as well as the annual average level of employment at AFA inshore processing facilities from 2014–2023. Estimate of total crew positions onboard AFA vessels have remained relatively stable during the analyzed period, although there was a slight decrease from 2014 to 2015. Likewise, estimates of workers at inshore processing facilities have remained relatively stable except for 2020 which coincides with the global COVID-19 pandemic. In 2020, employment levels were lowest in July, August, and September (Quarter 3) at 1,200 persons and October, November, and December (Quarter 4) at 1,045 persons.

Figure 4-8 provides a breakdown of the onboard positions for CPs, motherships, and CVs (inshore and mothership sectors combined) from 2011 to 2023. Across all sectors, the estimated number of positions as remained relatively stable across the analyzed period.

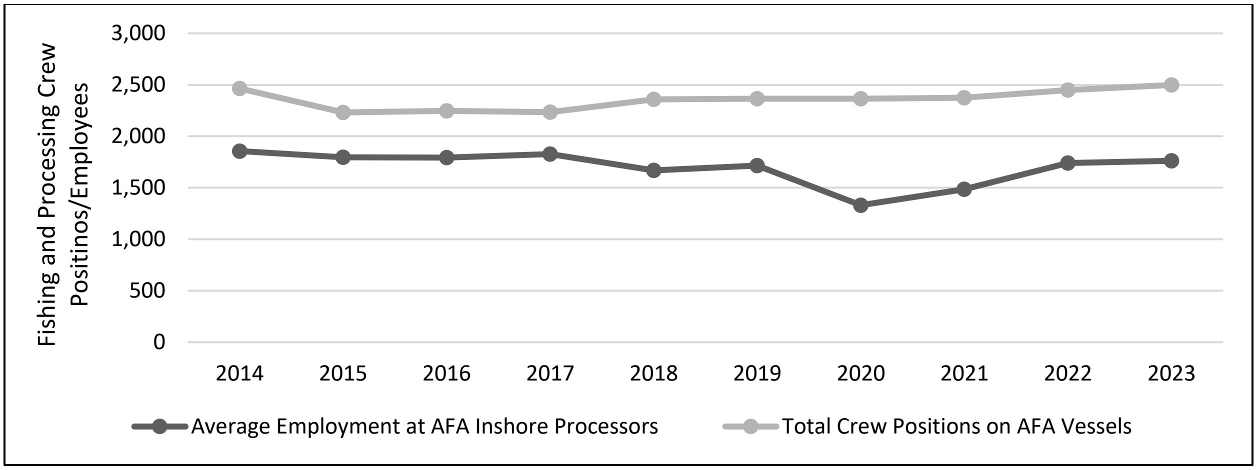


Figure 4-7 Employment on AFA vessels and at AFA inshore processing facilities, 2014–2023
Source: AKFIN and ADOLWD.

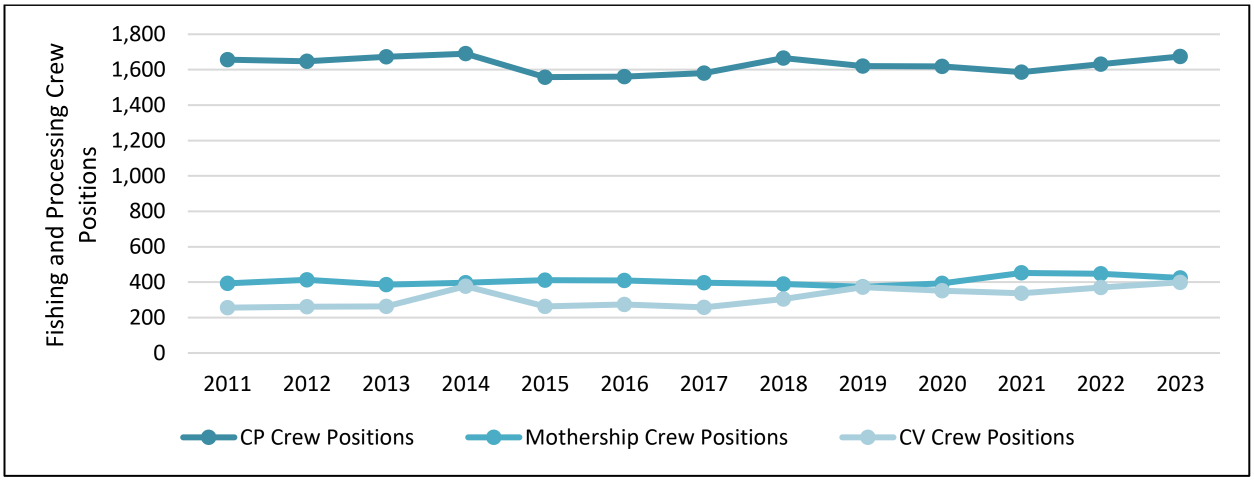


Figure 4-8 Employment on AFA CPs, motherships and CVs, 2011–2023
Source: AKFIN.

4.1.2 The Community Development Quota Program

The CDQ program was implemented in 1992 to provide coastal Western Alaska communities an opportunity to participate and invest in federally managed BSAI fisheries. In doing so, the program was intended to promote economic development in eligible communities, alleviate poverty, and provide other social benefits. The CDQ program allocates a portion of the quota for federally managed fisheries in the BSAI region to six entities known as CDQ groups. The six CDQ groups represent 65 communities, and the groups earn revenue from their allocations. These revenues are then used to make other investments or provide community-related benefits.

4.1.2.1 Revenue from Direct CDQ Pollock Allocations

The CDQ Program receives 10% of the Bering Sea pollock TAC which is sub-allocated among the CDQ groups. Bering Sea pollock is a high volume and high value fishery, and the revenue earned from this allocation has been a large source of each group’s revenue.

Figure 4-9 shows the gross first wholesale revenue associated with CDQ allocations of BS pollock compared with CDQ allocations of BSAI crab, halibut, Pacific cod, and other groundfish. Due to confidentiality restrictions, quantitative information for individual CDQ groups cannot be provided thus these figures are aggregated across all groups. The left-hand figure demonstrates the proportions of gross first wholesale revenue averaged across 2011-2023, whereas the right-hand figure demonstrates the proportions of gross first wholesale revenue for 2023 only. From 2011-2023, CDQ pollock generated an average of $149 million in gross first wholesale revenues annually, across all CDQ groups. As shown in Figure 4-9, this represented 60% of the total gross first wholesale revenues derived from CDQ allocations of species in the BSAI.

The revenues earned from the pollock fishery have played an increasingly important role in recent years as other species, such as snow crab and red king crab have declined. This trend can be observed in the revenue data from 2023 which included crab fishery closures and low crab TACs. In 2023, the relative proportion of first wholesale revenues derived from Bering Sea pollock increased with the decrease in crab revenues, as well as revenues from halibut and Pacific cod. In this year, pollock CDQ accounted for over $162 million and represented 70% of the total revenues from BSAI allocations. Crab CDQ revenues represented 5% of the total gross first wholesale revenues in that year.

One caveat to Figure 4-9 is that the first wholesale values used do not account for the proportion of the wholesale value that may be realized by the groups based on the way in which the CDQ species were harvested. The CDQ groups use different approaches to harvesting their CDQ pollock allocations. One group (i.e., CVRF), has recently harvested the majority of its pollock CDQ on a vessel it fully owns.[94] However, most pollock CDQ is leased to independent or partner companies to be harvested and processed on CPs. In these instances, multi-year contracts are often agreed to in which CP companies will pay a lease fee for the additional pounds of pollock to harvest, process, and market.[95] Compared to the types of direct investments described below, revenue from the leased CDQ allocations are relatively stable and predictable sources of revenue.[96] The CDQ group may be more disconnected from the fluctuations in direct operational costs and market dynamics through leasing arrangements. However, in leasing the quota the group may receive a fraction of the royalties, not the full value of the harvested species. Note that many other species' CDQ represented in Figure 4-9 is also leased, therefore the groups would also only receive a fraction of the gross wholesale values from these species as well.

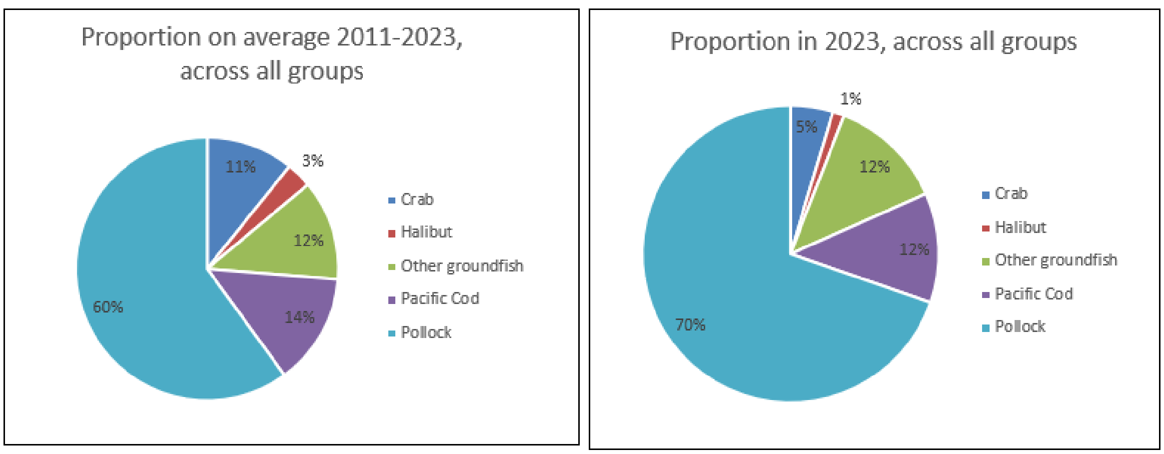


Figure 4-9 Annual average gross first wholesale revenues (millions of $) associated with CDQ allocations by species, 2011–2022

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT; Cdq_activity(11-30-23).

4.1.2.2 Investments into AFA Sectors

All CDQ groups are engaged in the BS pollock fishery through their direct allocation; however, most of the groups are also engaged through other investments into the BS pollock fishery. This context is useful

[94] P. Wilkins, personal communication.
[95] L. Fanning, personal communication.
[96] W. Jones, personal communication.

in understanding the depth and scope in economic impacts that may be incurred from the proposed alternatives should they result in forgone net revenue from reduced pollock harvest or increased costs associated with harvesting.

The AFA requirement that vessel-owning entities be at least 75 percent owned and controlled by U.S. citizens resulted in foreign-owned companies divesting majority ownership interests in vessels engaged in BSAI fisheries, which, in turn, provided CDQ groups greater opportunities to acquire equity interests in those entities than would have otherwise been the case. CDQ groups became sought-after business partners for their political capital as well as their CDQ quota, resulting in financing arrangements being extended to CDQ groups that were not previously available to them.

Expanding ownership interests in AFA vessels is one-way CDQ groups have worked to meet the economic and social goals of the CDQ Program.[97] Investments in subsidiaries, such as limited liability corporations (LLCs), allow CDQ groups to wholly or partially own vessels directly related to fisheries. Ownership of AFA vessels increase the CDQ group/ subsidiary's holdings of quota in the AFA fishery by providing revenue through the direct catch and sale of pollock.

As of July 2024, 5 of the 6 CDQ groups had ownership interests in AFA vessels (Table 4-13). These ownership interests are often highlighted in CDQ groups' Annual Reports but are not systematically updated in aggregate through a data source accessible to analysts. These ownership interests were updated with direct input from CDQ representatives and vary considerably from ownership reported in NMFS CDQ report in 2018. The table demonstrates that 3 CDQ groups (BBEDC, CVRF, and NSEDC) [98] currently have full or part ownership in 3 CPs, 5 CDQ groups (BBEDC, CBSFA, CVRF, NSEDC, and YDFDA) have full or part ownership in 30 of the AFA CVs that actively fish pollock. Two CDQ groups (CVRF and YDFDA) also have an ownership interest in motherships that can process AFA pollock.

Using the ownership percentages from this table and applying it to the pollock allocations associated with each entity, analysts estimated that **28.7% of the total Directed Pollock Fishery (i.e., CDQ + additional AFA pollock quota) is associated with CDQ groups**. There are several important caveats to this calculation. These ownership relationships are more nuanced than conveyed in Table 4-13. In some cases, the CDQ ownership connection is more direct, which can also mean more direct connections to the gross revenue produced by the vessel as well as the fixed and variable costs of pollock fish and chum salmon avoidance. Conversely, some investments are more indirect, in which case royalties and operational decisions may not be as direct. In addition, as described above, CDQ pollock as well as some AFA pollock is typically leased. Therefore, it may not be the case that the CDQ groups receive 28.7% of the total net revenues from the pollock fishery due to these additional factors. However, this estimate demonstrates the additional CDQ groups' investments into and reliance on the AFA fishery above the CDQ allocations.

[97] This type of CDQ group ownership investment growth is not unique to the BS pollock fishery managed under the AFA program. For example, it has also been seen in the context of the BSAI crab rationalization program, where CDQ groups have come to have substantial ownership interest in the non-CDQ portion of the fishery, both in terms of crab vessels and crab quota shares, including processor quota shares, with those types of ownership interests increasing over the course of that program. In addition, investments in harvesting and processing capacity provide revenue stream through contractual agreements to harvest other CDQ group's quota, profit sharing, and chartering commercial fishing vessels to government agencies conducting stock assessment surveys.
[98] Additionally, CBSFA has indirect interest in American Seafoods, which owns several CPs. Given the indirect nature of this ownership structure it was not included in Table 4-14.

Table 4-13 CDQ investments in fishery companies and AFA vessels as of July 2024

CDQ Group	Name of Company	CDQ Ownership	Vessel Name	Vessel Type	Recent Coop
BBEDC	Dona Martita	50.0%	Defender (new vessel)	CV	Westward
			Defender (old vessel)	CV	Unisea
			Alaskan Defender	CV	Westward
			Bering Defender	CV	Westward
			Northern Defender	CV	Unalaska
	Arctic Storm Holding Company	18.3%	Arctic Fjord	CP	PCC
			Neahkahnie	CV	HSCC
			Arctic Storm	CP	PCC
			Sea Storm	CV	HSCC
CBSFA	St. Paul Fishing Company	75.0%	Starlite	CV	Unisea
			Starward	CV	Unisea
		30.0%	Fierce Allegiance	CV	Unisea
CVRF	Coastal Alaska Premier Seafoods	100.0%	Northern Hawk	CP	PCC
	Excellence Seafood LLC	100.0%	California Horizon	CV	Mothership CVs
			Misty Dawn	CV	Mothership CVs
			Morning Star	CV	Mothership CVs
			Papado II	CV	Mothership CVs
	Phoenix Processor LP	7.6%	Excellence	MS	Mothership
			Tenacious	MS	Mothership permit
CVRF (50%) / NSEDC (50%)	BSAI Partners	75.0%	Alaska Rose	CV	Unalaska
		75.0%	Bering Rose	CV	Unalaska
		78.9%	Destination	CV	Unalaska
		51.0%	Great Pacific	CV	Unalaska
		75.0%	Sea Wolf	CV	Unalaska
		75.0%	Ms. Amy & Messiah	CV	Unalaska
	Bering North	75.0%	Progress	CV	Northern Victor
			Sunset Bay	CV	Northern Victor
			Half Moon Bay	CV	Northern Victor
			American Eagle	CV	Northern Victor
			Commodore	CV	Northern Victor
			Hickory Wind	CV	Northern Victor
			Patricia Lee	CV	Northern Victor
			Storm Petrel	CV	Northern Victor
			Ocean Hope 3	CV	CV permit
NSEDC	Glacier Fish Company	71.9%	Alaska Ocean	CP	PCC
YDFDA	Nunam Iqua Harvester	100.0%	Aleutian Challenger	CV	Mothership CVs
	Kotlik Challenger	100.0%	Pacific Challenger	CV	Mothership CVs
	Alakanuk Beauty	75.0%	American Beauty	CV	Mothership CVs
	Emmonak Leader	76.8%	Ocean Leader	CV	Mothership CVs
	Golden Alaska	58.3%	Golden Alaska	MS	Mothership

Source: Personal communication L. Price; J. Kauffman; P. Peyton; A. Drobnica; P. Wilkins; S. Kinneen
Note there are some AFA vessels with CDQ ownership that do not actively fish, but the AFA permits are retained and fished on other vessels. This is the case for the Ocean Hope 3 (Bering North; CVRF/NSEDC) as well as Ms. Amy & Messiah and the Destination (BSAIP; CVRF/NSEDC ownership in the associated AFA permits). This is also the case for the mothership permit assigned to Tenacious. Ownership of these AFA permits and access to their associated pollock continues to provide benefits to these CDQ groups. Additionally, CBSFA has indirect interest in American Seafoods, which owns several CPs. Given the indirect nature of this ownership structure it was not included in this table.

4.1.2.3 CDQ Communities and Regional Economies

The information provided directly above highlights the different ways that CDQ groups and the communities they represent are engaged in or dependent on the Bering Sea pollock fishery, while noting the magnitude of participation and dependence varies. This portion of the analysis provides information on CDQ regional economies, communities, and programmatic benefits.

The CDQ groups and their communities are diverse, spanning the entire length of the Bering Sea coast. CBSFA represents one Unangax̂ community with a total population of 413 persons whereas CVRF represents 20 Yup'ik communities with a total population of 9,691 persons (Table 4-14). The proportion of Alaska Native/American Indian residents is greater than Alaska in most CDQ regions, which encompass the ancestral lands of the Unangax̂, Sugpiaq, Central Yup'ik, the St. Lawrence Island Yup'ik, and Inupiaq peoples. The APICDA region is an exception to trend, but Akutan, Unalaska, and False Pass are home to shore-based processing facilities with a high number of minority workers captured by the U.S. Census at their "usual place of residence." The demographics of the processing workforce can overshadow the small, predominately Alaska Native populations residing within the traditional community footprints. Year-round residents make up a smaller portion of the overall population and many residents are Alaska Native (Downs & Henry 2023).

All CDQ regions have minority and low-income proportion populations meaningfully greater than Alaska. By almost all standards CDQ communities are considered remote and rural. The cost of living in these communities is high because goods have to be transported long distances, usually by air or seasonally by barge, to areas with limited transportation and distribution infrastructures. Among communities on the Aleutian Peninsula, aside from housing, groceries are the largest household expenditure (Reedy 2016). Permanent wage employment in smaller villages is typically scarce and often limited to jobs within local school districts or various tribal-related entities including tribal councils, non-profits, and ANCSA chartered village corporations.

Table 4-14 Select environmental justice indicators for CDQ groups and communities compared to the State of Alaska

CDQ Group	Communities	Total pop.	Alaska Native/ American Indian residents as percent of total	Minority residents as percent of total	Households	Median household income	Per capita income	Low-income residents as percent of total
APICDA	6	2,186	11.8%	92.8%	143	$53,740	$25,996	39.7%
BBEDC	17	5,178	63.4%	70.7%	1,545	$51,717	$32,688	35.6%
CBSFA	1	413	86.7%	88.9%	78	$60,000	$31,903	45.0%
CVRF	20	9,691	95.0%	97.2%	2,044	$40,867	$18,000	35.4%
NSEDC	15	9,207	74.5%	92.1%	2,553	$49,671	$19,695	38.6%
YDFDA	6	3,284	94.5%	97.8%	1,118	$37,901	$13,103	37.9%
All CDQ	**65**	**29,959**	**76.9%**	**90.6%**	**7,481**	**$52,506**	**$22,250**	**37.0%**
Alaska	**-**	**733,391**	**15.2%**	**42.5%**	**274,574**	**$86,370**	**$42,828**	**14.2%**

Source: 2020 U.S. Census and 2022 5-year ACS estimates.

Historically important subsistence resources vary by region and community, depending on their seasonal availability. For example, Unangax̂ communities across the APICDA region have relied on salmon, cod, herring, rockfish, crab, among others. Traditionally used species for St. Paul (CBSFA) residents include seals, halibut, crab, and some groundfish. It is fairly common practice for St. Paul residents harvesting seal and halibut to exchange those resources for salmon with other communities (Wise et al., 2023).

Sugpiaq and Yup'ik communities across BBEDC, CVRF, and YDFDA communities rely on all five species of Pacific salmon found in Alaska. While salmon may be eaten fresh, they are also preserved using traditional methods like drying, smoking, freezing, canning, salting, pickling or fermenting (Brown et al., 2023). Nonsalmon species are also important components of subsistence harvest, especially various species of whitefish (e.g., sheefish, broad whitefish, humpback whitefish, Bering cisco, and least cisco);

other important nonsalmon fishes to the region's communities include herring burbot, Northern pike, and Arctic grayling (Brown et al. 2015). In the Norton Sound region, traditionally used subsistence species include seals, walrus, and beluga whales for communities in the north and fish to the south including chum salmon (Tremayne et al. 2018).

Many communities are characterized by mixed economies that include both a commercial and subsistence component. In a mixed economy, cash income earned from commercial fishing or other wage employment is used to purchase goods like fuel oil, electricity, clothing, as well as other goods necessary for subsistence activities like firearms, ammunition, nets, boats, or snowmachines (Wolfe et al. 2010). Subsistence food production is directed toward meeting the needs of families and communities, not market sale as in commercial production. It is this combination of money from paid employment and subsistence food production that characterizes the mixed, subsistence economies in many areas (Fall 2018).

Commercial fishing and processing are economic mainstays across the CDQ regions. For example, a number of St. Paul residents are involved in commercial fishing as vessel owners, IFQ holders, and/or crew license holders (Himes-Cornell et al., 2013). The local fleet operating out of St. Paul focuses almost exclusively on BSAI halibut fisheries which is a major source of employment, income, and subsistence for the community. Compared to CBSFA's other CDQ groundfish allocations, halibut can be harvested with small boats and provides an opportunity for income to be earned directly by CBSFA members. St. Paul is also a commercial fishing hub that provides support services to a variety of vessels and operation types, and the community is home to one large shore-based processing facility owned by Trident Seafoods. This facility was a major crab processing plant prior to rationalization and has remained so post rationalization.

Kwik'pak Fisheries is a subsidiary of YDFDA and was formed in 2002 to provide economic security to villages on the Yukon River Delta. It has historically processed and exported salmon from Emmonak. Commercial salmon fisheries have not been open in recent years due to Chinook salmon and chum declines, and Kwik'pak Fisheries has not operated as a fish processor since 2020. Prior to recent years, Kwik'pak Fisheries was a top employer for some YDFDA communities including Emmonak and Alakanuk (located eight miles apart from each other). During the plant's peak season, which included salmon and freshwater whitefish, the plant employed a maximum of 185 people (Himes-Cornell et al. 2013).

In the Norton Sound region, shoreside processing has historically taken place in Nome, Saint Michael, Savoonga, and Unalakleet. Norton Sound Seafood Products is a subsidiary of NSEDC with shore-based plants located in Savoonga, Unalakleet, and Nome.99 Norton Sound has the northernmost fisheries for both Pacific herring and red king crab. Residents across the region hold commercial fishing permits (e.g., salmon and herring) issued by the Commercial Fisheries Entry Commission (Himes-Cornell et al. 2013).[100]

4.1.2.4 Social and Economic Benefit Programs

The information provided directly above is important context for understanding the types of social and economic benefits the various groups have worked to provide to their regions and communities. This is an important point, in that the benefits provided by CDQ groups extend beyond their constituent communities. As an example, APICDA's Haginaa Kidul (*Helping to Grow*) Vocational Scholarship is available to residents from the APICDA Communities of Akutan, Atka, False Pass, Nelson Lagoon, Nikolski, St. George and the Aleutian region communities of Adak, Cold Bay, King Cove, Sand Point,

[99] 2022 Arctic-Yukon-Kuskokwim Region Shore-based Processors by Port. Accessed November 26, 2023.
[100] Mining is another economic driver in the region, with some tin and polymetallic resources found in the area and several small gold mines in operation around Nome. Some tourism occurs in conjunction with the Iditarod, the last third of which runs from Unalakleet to Nome within the NSEDC region.

and Unalaska. This portion of the analysis relies on recently available information in CDQ group annual reports (2018–2023), but the groups and the broader social and economic contexts they operate in are dynamic. It is expected that some of this information may be outdated, and the full scope of programs and benefits cannot be adequately captured here.

One of the most tangible benefits the CDQ groups have been able to support are employment opportunities for residents. In 2023, APICDA employed 183 individuals that earned more than $1.6 million in compensation (APICDA 2023); CVRF employed 783 individuals including Board members, youth to work, and intern employees that earned $4.8 million in wages (CVRF 2023); and YDFDA and its subsidiaries employed 396 in-region residents who earned $4.5 million in wages (YDFDA 2022).

BBEDC runs a Seasonal Employment Opportunities Program that provides short-term employment opportunities ranging from 4–16 weeks. In the 2022 seasonal employment cycle, BBEDC employed 26 people earning $189,158 in compensation (BBEDC 2022). Employment opportunities are available with BBEDC partners on pollock boats, longliners, crab boats, multi-species bottom fish boats, floating processors, and at shore-based processing facilities. More broadly, BBEDC assists residents interested in working with fishing companies operating in the Bering Sea. These efforts include help with submitting applications to specific companies, pre-employment screenings, traveling to a job site, and obtaining gear and supplies that are necessary for new hires.

Many CDQ groups provide jobs associated with shore-based fisheries development in their regions. For instance, NSEDC's Norton Sound Seafood Products has operated processing plants and purchasing stations throughout the region that provide commercial fishing and employment opportunities to residents. Norton Sound Seafood Products supported local fishermen through the purchase of four species of salmon, halibut, cod, and red king crab. Operating processing plants in Nome, Unalakleet, and Savoonga; buying stations in Shaktoolik, Golovin, Moses Point (Elim), and Koyuk, and a fleet of tender vessels in 2022. NSEDC's 2023 Annual Report notes 109 seasonal employees processed nearly 1.2 million pounds of fish product in Norton Sound Seafood Product processing plants in Unalakleet, Nome, and Savoonga earning $721,052 in wages; 17 residents from NSEDC member communities were employed at buying stations earning $222,749 in wages.

YDFDA's Kwik'pak Fisheries has provided funding for the Emmonak Tribal Council's fish processing plant. Capital investments in processing equipment have allowed plants to produce processed seafood products for sale in global seafood markets. Kwik'Pak Fisheries did not have commercial operations in 2021 and 2022 as a result of the poor projected salmon run sizes on the Yukon River. However, Kwik'pak workers have transitioned to assisting with the development and expansion of the Youth Agricultural project by developing site upgrades, helping to construct additional greenhouses, among other tasks. In 2022, Kwik'pak Fisheries employed 33 people earning $643,342 in wages (YDFDA 2022).

Alongside employment opportunities in commercial fishing and processing, many CDQ groups employ residents for fisheries research, environmental stewardship, and advocacy efforts. Through partnerships with ADF&G and NOAA, YDFDA provides funding for local technicians to participate in regional fisheries research projects such as salmon and Lamprey test fisheries as well as juvenile salmon outmigration. In 2022, YDFDA employed 39 people across these various research projects who earned a total of $562,076 in wages (YDFDA 2022). NSEDC supports sustainable fisheries management by providing data to partners, ADF&G and NOAA, through projects with the Norton Sound Fisheries Research and Development (NSFR&D) Department. In 2023, NSFR&D projects ranged from salmon sustainability and enumeration, salmon lake fertilization, salmon acoustic tagging, waterways cleanup, salmon restoration and incubation, and halibut tagging. In total, NSFR&D employed 53 people earning wages totaling $494,438 (NSEDC 2023).

BBEDC's Vocational/Technical Training Program aims to help those who are unemployed or under employed gain required certifications or attend trainings to increase employability. The program also works with residents that need training to maintain current certifications or that are mandated by their employer. In 2022, 43 applications were approved giving BBEDC CDQ residents training funding at a total expense of $158,381 (BBEDC 2022). CVRF's Youth to Work Maritime Program has offered local Alaska Native youth opportunities for training and experience in commercial fishing fulfilling requirements for a certificate in nautical skills from the Alaska Vocational Technical Center in Seward; in 2023, 36 students received basic skills training and maritime education (e.g., knots, different roles and stations on ships, and more) (CVRF 2023).

Many CDQ groups have provided financial support for local participation in small boat fisheries. CBSFA has provided the local fleet in St. Paul harvesting opportunities by leasing its CDQ halibut to the fleet. The group also provides support services for these fishermen through its Local Fleet Support program and worked closely with Trident Seafoods to provide halibut processing services. In a typical year, CBSFA purchases the halibut from the local fleet and partners with Trident Seafoods to process and market the fish. Any halibut CDQ not able to be caught by the local fleet is leased to the *F/V Saint Paul* and *F/V Saint Peter*, vessels wholly owned by CBSFA, if the vessels are available at the end of the season (CBSFA 2021).

APICDA has supported the Nelson Lagoon Coho Fishery, a cooperative project between APICDA and Peter Pan Seafoods designed to extend the fall coho fishing season and market access for resident fishermen in Nelson Lagoon. In 2022, this program extended fishing opportunities for five days which allowed fishermen to earn additional income before the end of the season (APICDA 2022).

CDQ groups also provide emergency assistance through access to capital and other resources for fishermen when things go awry during the season. BBEDC has an in-season emergency provision, helping fishers who experience engine or drive train failures during the season to get back on the water. In 2022, BBEDC spent $70,000 helping two resident fishermen replace their engines (BBEDC 2022).

CDQ groups provide benefits to their regions and communities by supporting community development and infrastructure. APICDA awarded member communities a total of $1.8 million in funding, $300,000 per member community, through its Community Development Grant Program in 2023 to support projects. These projects are identified through an inclusive community-wide strategic planning process undertaken annually by leadership from the local tribal government, Alaska Native Corporation, and municipal government with additional engagement from APICDA employees. Some examples of community-specific projects funded by this grant program include job creation and infrastructure development in Atka, Harbor house construction in False Pass, marine debris beach cleanup in Nelson Lagoon (APICDA 2023).

BBEDC operates the Community Block Grant Program which provides BBEDC communities with the opportunity to fund projects that promote sustainable community and regional economic development. With over $116 million in community grants since 2002, the Board of Directors allocated $500,000 per BBEDC community in 2022. Examples of community-specific investments include the purchase of heavy equipment (a loader) for Aleknagkik, Ekwok, and Port Heiden, Tribal facilities or buildings in Dillingham and Levelock, library construction in Egegik, home heating fuel/electric assistance in most BBEDC communities, among others (BBEDC 2022).

CBSFA has supported the Elders Residential Assistance Program which provides annual payments of $4,000 per household to energy suppliers or housing entities on behalf of community elders. Additionally, the Community Internet Service Contribution is a joint venture between Tanadgusix Corporation and CBSFA to increase the local internet speed in Saint Paul (CBSFA 2021).

All CDQ groups have provided post-secondary educational scholarship opportunities to residents. While the CDQ Program is intended to support economic and social development activities in eligible communities, many non-CDQ communities also benefit from an educated and well-trained workforce that is able to work in local, fisheries-based positions. Fishermen and community members from non-CDQ villages utilize the infrastructure, including maintenance and repair facilities, and training available as a result of CDQ revenues. In addition, non-member fishermen contribute catch to CDQ processing plants and residents of non-member communities gain employment in CDQ-related projects.

Several CDQ groups also support salmon assessment and enhancement projects intended to benefit salmon runs throughout western Alaska. For example, NSEDC supports the Norton Sound Fisheries Research and Development program to increase regional knowledge and understanding of fishery resources through salmon enumeration projects, salmon enhancement projects (incubation and salmon lake fertilization), research projects involving salmon, halibut, and cod tagging, among others.

CVRF's People Propel provides financial subsidies for adult resident's purchase of ATVs, outboards, snow machines, and skiffs which offsets the expense of equipment frequently used for work, life, and subsistence. In 2023, CVRF invested $1 million into equipment purchases through its People Propel program benefitting 258 residents (CVRF 2023). Additionally, in a partnership with Honda Motor Company, CVRF has developed Mechanic/Welding Shops in 18 of their communities to service equipment vital to subsistence (e.g., ATVs, snowmachines, boats, etc.) as well as other mechanical household needs. CVRF has hired certified mechanical technicians for these shops and residents can pay for labor and parts or they can rent the space to do their own maintenance (Hughes 2023). In 2023, CVRF announced its acquisition of the All Seasons Honda and Peninsula Ski-Doo dealership in Homer, which will provide the region with technical training, better access to parts, and in-region Honda warranty repair work, meaningfully lengthening the service lives of Honda equipment for residents (CVRF 2023).

4.2 Effects of the Alternatives on the Pollock Industry and Communities

This section examines the potential economic and social impacts of the proposed alternatives on participants in the Bering Sea pollock fishery, CDQ groups, and associated communities, relative to no action (Alternative 1) as a baseline for comparison. This section primarily focuses on the potential cost categories from displaced fishing effort with possible decreases in efficiency, as well as the possibility of reduced gross revenue from a B season closure of a fishery, closure of a fishing area, or reduced product quality. Other impacts that are qualitatively addressed include avoidance costs, potentially adverse effects on crew and processing workers' employment, as well as social and cultural effects within and across communities.

The evaluation of potential costs in this section is designed to meet the requirements of NEPA as well as E.O. 12866, which requires an evaluation of the costs and benefits of the alternatives, to include both quantifiable and qualitative considerations. The analysis for potential benefits is provided under Section 4.2.6 and the relevant subsections. An appropriate scope for a Cost-Benefit Analysis on the marginal impacts of the proposed alternatives compared to the conditions observed under status quo includes the expected impact on net revenue (i.e., profits). This type of analysis requires access to empirical data on cost categories, gross revenue data, and a way to predict the behavioral changes that may influence these variables. The primarily qualitative approach employed in this section is the result of limited available empirical data on cost categories, in addition to the uncertainty of fishing behavior changes in response to the alternatives considered. This analysis includes primarily qualitative descriptions of avoidance costs and the expected effect of the proposed alternatives on the direction of those costs.

While analysts acknowledge the limitations of this approach in providing quantitative information on the magnitude of these marginal changes, which inhibits the ability to calculate expected net benefits, this method was chosen for a number of reasons. The deficiency in operational cost data as well as uncertainty around the specific ways fishing behavior would change means that qualitatively contextualizing the retrospective harvest patterns and associated gross revenues serve as the best available proxy for impacts on net revenue. Additionally, the qualitative discussion can provide context to the types of impacts that may be expected and the directionality of impacts.

The scope and methods used for analyzing the potential costs (i.e., to pollock fishery and associated communities) are different from those used to analyze the potential benefits (i.e., to fishermen, communities, and Tribes across Western and Interior Alaska that are engaged in or dependent on chum salmon fisheries) of the proposed alternatives. These differences reflect the different types and scope of data that are available to the analysts, the varying types of uncertainty that exist, and the analysts' ability to tease out marginal impacts associated with the costs and benefits of the proposed alternatives. Because the regulatory changes being proposed would apply directly to participants in the pollock fishery managed by the Council and NMFS and there is direct-fisheries dependent data available for these participants, alternatives the analysts have a greater ability to describe the nature of the potential costs and the likely direction of these costs. For instance, there is a defined number of pollock vessels participating in each sector to which new chum salmon bycatch regulations would apply and there are data available to quantify these specific vessels' PSC, pollock catch, and revenue earned. Data are not available with a similar level of granularity to determine with any precision the fisheries and communities across Western and Interior Alaska that would indirectly benefit from WAK chum salmon PSC reductions. That being said, there are still uncertainties around the potential costs of the proposed action which are addressed in the relevant sections.

4.2.1 Alternative 1

Under Alternative 1, the current chum salmon bycatch regulations would remain in place (see Section 2.2). These regulations primarily include those that are specified for the salmon bycatch IPAs at 50 CFR 679.21(f)(12)(iii)(E). A primary management tool for chum salmon avoidance is the RHS program that operates during the B season and provides incentives for pollock operators to avoid areas on the fishing grounds with high chum salmon bycatch rates. It is expected that the RHS program would continue to exist as is under Alternative 1 (No Action), as would vessel behavior and any associated costs.

The RHS program closes discrete areas on the pollock fishing grounds to some vessels when chum salmon bycatch rates are unacceptably high, meeting specific thresholds set in the IPAs. The program creates incentives for pollock operators to keep their vessel bycatch rates low to not risk losing access to good pollock fishing areas in a given week. To the extent that the RHS program, or any other provisions within the IPAs, require an operator to alter their fishing pattern, whether in time or space, is likely to impose additional costs on that operator. Thus, even under existing regulations, chum salmon bycatch avoidance measures likely result in **"avoidance costs"** such as increased fuel costs, reductions in harvesting efficiency or product quality as well as the potential for costs associated with longer seasons that may result from more inefficient fishing.

Despite the common occurrence of these types of costs and influence other Council action have likely had on these types of costs (e.g., as predicted in Amendment 91, Amendment 110, and commonly referenced in the Amendment 91 Vessel Masters Survey), systematically teasing out precise costs associated with bycatch avoidance relative to other operational costs remains inherently difficult, even under the status quo. Many of these costs are embedded in the way the fleet operates (for example, in reliance on communication and use of the RHS program data to choose the next fishing location) thus it would be problematic to find an appropriate baseline of comparison.

While regulations on chum bycatch management have not changed since Amendment 110 (2016), each sector's IPA has been amended, and fleet behavior has likely changed in response. In this analysis, any avoidance costs associated with this behavioral change are attributed to status quo regulations, because operational changes associated with these changes have occurred prior to current proposed regulatory changes. However, as described in Section 4.2.3 below, the adoption of Alternative 4 would essentially codify many of the actions that have been specified by amended IPAs, which means additional fleet movement and any associated avoidance costs may persist under Alternative 4.

4.2.1.1 Pollock Communities Under Alternative 1

Section 4.1.1.4 and the relevant subsections provide information on Alaska and Pacific Northwest communities' engagement and participation in the B season pollock fishery under the status quo (2011–2023). Sections 4.1.2.3 and 4.1.2.4 provide information on the regional economies and socioeconomic benefit programs provided by CDQ groups. To streamline information for the reader, that information is not repeated here. Continued chum salmon PSC management under the existing regulations would be expected to result in the social and economic conditions at the local, regional, and state level to continue along current trends described above.

4.2.2 Alternative 2 or 3

Under both Alternative 2 or 3, a chum salmon PSC limit would be chosen and apportioned between the sectors. Two potential direct economic impacts discussed in this section include changes in **avoidance costs**, as described under Alternative 1, and **forgone gross revenue**. **"Forgone gross revenue" refers to the gross revenue from pollock (and other marketable groundfish species caught concurrently) that may have been forgone due to an early closure of the B season.** Considering potentially forgone revenue under a PSC limit has been the primary quantitative method used in many previous bycatch analyses in the North Pacific to scale the expected economic effects on the directly regulated fishing sector.[101] The calculation of forgone gross revenue necessarily relies on retrospective data, **but the broader analysis assumes that if these limits were in place in the future, to the extent possible, *fishing would be altered* prior to meeting these proposed caps. The forgone gross revenue values provide an upper bound to consider along with the qualitative considerations of avoidance activity.**

The relationship between avoidance costs and potentially forgone revenue is illustrated in Figure 4-10. If there is a perceived risk of reaching the PSC limit, **pollock harvesters would be expected to alter their harvest strategies to the extent they are able**, to avoid a closure and minimize losses associated with potentially forgone gross revenue. Because the analysts assume that the fleet would respond to the risk of a closure, it is expected that avoidance costs would occur prior to any potentially forgone revenue[102] (as illustrated in Figure 4-10). However, forgone revenue could occur in addition to avoidance costs if efforts were unsuccessful in avoiding chum salmon. Alternatively, avoidance techniques (with the associated costs) could prevent a sector from reaching the limit, in which case revenue may not be forgone. **The impact of a chum salmon PSC cap under Alternative 2 is dependent on the sector/ vessel's perception of risk and the likelihood that they may reach their apportionment of a chum salmon PSC limit during the B season.**

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[101] For example, estimating 'potentially forgone revenue' or the similar method of relying on retrospective data for a specific area for 'revenue at risk' was the primary quantitate analytical method for the Regulatory Impact Review in Amendment 91 (NPFMC 2009), the chum salmon action in 2012 (NMFS 2012), Amendment 110 (NMFS 2016), and the recent analysis on the Red King Crab Saving Area (NPFMC 2024).

[102] Although the general expectation is that avoidance costs would occur prior to any forgone revenue, some research has demonstrated that the level of avoidance costs may or may not respond in a linear way to a constraining chum salmon PSC limit (e.g., Murphy et al. 2021). Additionally, due to the way chum is encountered on the fishing grounds, it is possible a cooperative could be incurring status quo fishing costs, but suddenly reach their limit due to a "lighting strike" tow. This would essentially be due to misjudging where they were on the risk spectrum.

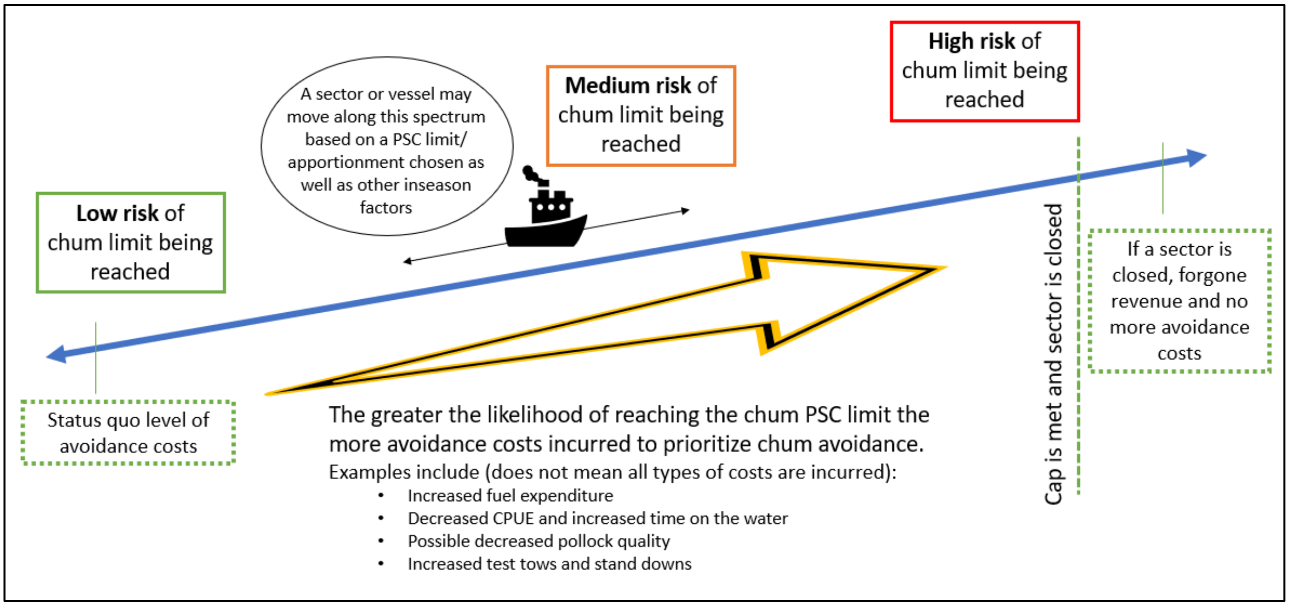

Figure 4-10 Types of costs/ reduced benefits that could occur under a chum salmon PSC limit based on the risk of reaching the limit

The analysis of economic impacts throughout this section is primarily focused at the AFA and CDQ sector-level impacts because there are intrinsic characteristics and practical constraints that are shared among vessels within a sector. However, within a sector, impacts from the proposed actions will also be experienced differently by participating entities. Decisions of whether and how to operate in the B season with chum salmon PSC limit would be made by an AFA company and within the cooperatives. This includes consideration of the risk of a chum PSC limit even before the B season begins. This assessment would be made with imperfect information on catch rates and chum PSC encounters. Although additional seasons operating under a chum salmon PSC limit may provide more insight to the degree of constrain, annual factors (e.g., pollock aggregation, encounters with other PSC species, ocean and weather, etc.) would continue to add uncertainty. If a company perceives the risk of operation to be too great, they may choose to operate differently even prior to incurring any avoidance costs or before a closure results in forgone revenue. This could include consolidation of pollock quota onto other vessels owned by the same company or leased to an unaffiliated vessel within their cooperative. Therefore, pollock could be fully harvested at the sector or cooperative level; while adverse impacts are still experienced for the vessel owner and crew of the vessel that exceeded its vessel-level apportionment. In response to an AP request, Appendix 6, further describes the possible vessel-level impacts of the chum salmon PSC limit, using the inshore sector's apportionment of Chinook PSC as an example of how chum PSC apportioned at the vessel level could have distributional impacts among participants.

The economic impacts of Alternatives 2 and 3 on the pollock fishery are analyzed primarily together in this section, as these mutually exclusive alternatives would both establish a chum salmon PSC limit apportioned by sector. Given the similar structure of the alternatives and thus in expected impacts, the discussion in this section applies to both proposed alternatives, unless noted otherwise. However, section 4.2.2.3 describes more specific impacts and nuances under Alternative 3, which would only establish a chum salmon PSC limit when triggered by a Western Alaska abundance index.

4.2.2.1 Economic Effects of a Chum Salmon PSC Limit on the Offshore Sectors

This section evaluates the potential economic impacts of a chum salmon PSC limit for the offshore sectors, although many of the discussed impacts would also be expected to apply to the inshore sector.[103] The offshore sectors include the motherships and the CVs that deliver to them, as well as the CPs. The CDQ sector is also considered here as all CDQ pollock has recently been fished on offshore vessels. However, additional considerations for the CDQ sector are included under Section 4.2.2.2.2.4 as some CDQ groups have additional investments in inshore CVs.

The CP sector has recently (since 2019) consisted of 13 active vessels and most of the CDQ pollock is typically harvested on 11-13 of these vessels (Table 4-1). These vessels range from 199 ft LOA to 376 ft LOA and 2,750 hp to 9,300 hp. Between 2011- 2022, for the A and B season, they collectively harvested an average of 461,410 mt of pollock each year under the CP allocation and 131,090 mt for the CDQ allocation. Most CPs rely on pollock B season gross revenue for 30-50% of their total fisheries revenue (Table 4-7). Some of the CDQ pollock allocations are leased and harvested on vessels unaffiliated with CDQ groups, and some CDQ is harvested on CPs that are wholly or partially owned by CDQ groups (as described further in this section). In the B season, the pollock tends to be less aggregated and the CP sector typically covers a wide broad area along the continental shelf break. In particular, the CP (and CDQ) sectors have had greater reliance on Cluster 2 and east and northeast of Zhemchug Canyon.

In recent years in the mothership sector, there have been 13-15 CV delivering to three motherships. However, in 2024, two motherships operated. These CVs fish closely together near the mothership, typically delivering one tow at a time. A trip for the mothership fleets typically last between 7 to 12 days before the mothership must return to port to offload. The dual-qualified CVs do not collectively follow a specific pattern to when they deliver inshore versus to the mothership but coordinate their participation with associated processors.[104] Similar to CPs, these vessels can travel further northwest in the Bering Sea. However, as they are not self-contained and movement requires a more coordinated effort. While B season harvest from the mothership sector can extend northeast of Zhemchug Canyon, and dependency on certain areas can be highly variable, these CVs often harvested a substantial portion of their B season pollock in the Unimak area.

4.2.2.1.1 Avoidance Costs

As referenced under Alternative 1, chum salmon bycatch avoidance efforts that require an operator to alter their fishing behavior can result in costs to that operator. With the risk of having a portion of an AFA sector closed for the rest of the B season after a PSC limit is met, the offshore sectors could incur increased costs associated with chum salmon avoidance. Table 4-15 below provides a summary of how these types of costs could manifest under an overall chum salmon PSC limit and any known nuances that could influence the level of impact.[105]

Avoidance costs many vary substantially each year even under status quo and the marginal effect of a chum salmon PSC limit to the types of avoidance costs addressed below are expected to be highly influenced by other factors that are also difficult to predict. High pollock CPUE, cooler years in which chum and pollock are less overlapping, a lower amount of hatchery chum salmon encountered, or encounters of other constraining species on the fishing grounds, and favorable environmental conditions are all examples of factors that may lead to productive pollock fishing in which caps may not result in any marginal impact on avoidance relative to status quo. However, the inverse could also be true (i.e., more potential for adverse impacts) in the presence of unfavorable conditions. **The large number of factors at play results in uncertainty in the magnitude of impacts on operational efficiency; however, the**

[103] The inshore sector has a number of different operational constraints given the limited distance from shore these vessels can travel, and additional impacts result for shoreside processors and communities. Therefore, additional effects for this sector are highlighted in a separate section of the analysis.
[104] J. Henderschedt, personal communication.
[105] Section 6.2.5.2 of the Initial Review Analysis provides a more in-depth description of these types of costs.

direction of impacts is more certain. It is likely that a chum salmon PSC limit will have adverse impacts on operational costs and efficiency if a medium or high degree of risk if perceived.

Table 4-15 Potential avoidance costs that may be incurred under a chum salmon PSC limit

Type of Avoidance Cost	Description of Potential Impact
Decreased operational efficiency	Moving vessels out of areas with known chum encounters would mean additional travel time in which they may not be fishing (and associated opportunity cost of that time). It could also mean vessels could have to move to areas with lower pollock catch per unit effort and poorer pollock flesh quality (which can affect products and value) Cost per unit of catch could increase, which would carry different implications for economic viability and sustained participation for smaller and less efficient vessels. Larger vessels, built for higher throughput may also struggle if moved to areas with low catch rates.
Increased travel costs	Fuel ranks as one of the top operating expenses for the fleet. Since the primary chum avoidance technique is moving vessels out of areas with known chum encounters this could increase fuel expenditures.
Extended seasons	Decreased efficiency due to the factors described above, means that the season could be extended relative to when the TAC may have been caught without a chum salmon PSC limit. A longer fishing season increases all the variable costs of operation (e.g., fuel, costs of crew provisions and other labor expenses, observer fees, lease fees for vessels and equipment, etc.) in addition to a greater risk of Chinook encounters later in the fall.
Increased risks and costs of unknown fishing areas	Moving a vessel from an area of high chum encounters does not guarantee that the area it moves to will have a low chum (or Chinook) encounter rate, particularly if other vessels have not been fishing in this new area. There is also a risk of decreased pollock catch per unit effort when effort is moved which can decrease operational efficiency, and potentially require fishing later in the season. Fishing new areas may require increased test tows which can result in slower fishing and potentially greater costs associated with gear damage. Chum salmon PSC limits would be additive to a portfolio of other PSC limits (i.e., Chinook, herring, crab), existing area closures, and potentially constraining species (e.g., sablefish and sometimes Pacific Ocean Perch) and the cumulative suite of PSC limits and spatial closures may exacerbate the risk of reaching a PSC limit.
Crew impacts	AFA fishing and processing crew are often paid based on shares of an operation's net (or modified gross) revenues. Therefore, increased chum avoidance could adversely affect crew compensation in three ways: 1) additional fuel costs may reduce net revenues unless the company specifically insulates crew from this expense, 2) if a vessel produces lower valued products this will reduce total revenue, and 3) a longer B season can mean a lower pay per day for crew members. If crew compensation is affected in a way that affects employee retention it may impact the level of onboard experience that contributes to safety and productivity. While data is not available to connect crew to communities, reduction in crew compensation can also indirectly impact the communities associated with crew through induced expenditures in communities where these crew are located. If fishing trips are extended and crew members spend more time at sea, this may have a negative effect on crew morale and willingness to maintain employment. Related, there may be increased challenges with recruiting crew and processing workers.
Social and community impacts	Working to avoid reaching the hard cap may increase stress and uncertainty among captains and crew regarding work, catches, and regulatory compliance. As a cap is perceived to be more constraining, or a vessel experiences closures, there may be less social cohesion among crew and/or processing workers. Either of the above impacts resulting from avoidance costs could lead to an attrition of crew, processing workers, among others in the pollock industry as they pursue alternative livelihoods. If vessels fish areas with lower bycatch rates, pollock may be of lower quality such that FRLT revenues would be lower in the City of Unalaska.

4.2.2.1.2 Broader Implications of a B Season Closure for the Offshore Sectors

Avoidance techniques may delay or prevent a closure resulting from a chum salmon PSC limit; however, if the sector is unsuccessful and they are closed early there may be forgone revenue associated with that unharvested pollock. In addition to the direct impacts of a B season closure on possible forgone revenue for offshore sector participants, a B season closure could have a much wider distribution of impacts. Specifically, the adverse effects would extend to pollock communities, the CDQ groups and associated communities, other fisheries, as well as markets and possibly consumers. The type of impacts, as well as the potential magnitude of these are described below.

4.2.2.1.2.1 Potentially Forgone Revenue

This analysis of potentially forgone gross revenue begins with a retrospective examination of when each pollock sector hypothetically would have hit the various chum salmon PSC limits had the limits been in place in each of the years 2011–2023. These tables and figures are intended to provide a frame of reference for impacts related to the chum salmon PSC limits and sector apportionments considered under Alternative 2 and 3. However, as previously stated, these values may be considered an upper bound given the expectation that should a PSC limit be adopted, fishing operations will likely respond to prevent a B season closure.

The approach for forgone gross revenue tables and figures matches the methodology used in the Initial Review Draft Analysis, by using the week-end date in which the sectors' limit would have been met and considers all pollock and resulting revenue after that point in the B season forgone. These tables demonstrate the estimated gross forgone ex-vessel and first wholesale values associated with this closure,[106] under different PSC limits and apportionment scenarios. Relative to the analysis presented in the Initial Review Draft, this version of the analysis covers a broader range of PSC limits (i.e., as the PSC limits for consideration were extended down to 100,000 chum) and with resulting values displayed differently in response to April 2024 SSC comments emphasizing the importance of discussing a lower bound on revenue changes.

For the **CDQ sector**, Table 4-16 demonstrates that a PSC limit of 100,000 may have resulted in B season closures in 5 or 6 of the 13 years, depending on the apportionment selected. Thus, in some years there may have been no forgone revenue, but in the most impacted year they could have had to forgo $77.2 million in gross first wholesale revenue, representing 83% of the CDQ groups' B season gross revenue. Alternatively, a PSC limit of 550,000 may have resulted in B season closures in 2 of the 13 years. This could have resulted more years in which there was no forgone revenue, with the median value of $0 forgone. However, the maximum that may have been forgone in one year was $36.6- $57.5 million, depending on the apportionment selected. This would have represented 38-55% of the CDQ groups' B season gross revenue. **Because the CDQ groups have recently had relatively lower chum salmon PSC rates relative to their apportionment of pollock, the retrospective analysis shows that using the 3-year average apportionment generates the greatest potential for adverse impacts to the CDQ sector and the AFA apportionment has the least potential for adverse impacts to the CDQ sector.**

For the **CP sector**, Table 4-17 demonstrates that a PSC limit of 100,000 chum salmon may have resulted in B season closures in 10 of the 13 years. Thus, in some years there may have been no forgone revenue, but in the most impacted year they could have had to forgo $266.9 –288.6 million in gross first wholesale revenue, depending on the apportionment selected. This would have represented 83-90% of the CP

[106] This section the analysis refers to ex-vessel terms for the CVs and wholesale values for the CPs. Ex-vessel prices are the price received by the CVs from delivery of pollock to a shoreside plant or mothership, thus they are the relevant prices in considering the impacts to the CV fleets. First wholesale prices are the prices received by the first level of inshore processors, or by catcher-processors and motherships. They reflect the value added by the initial processor of the raw catch. They are not, therefore, equivalent to ex-vessel prices. They are the relevant value for CPs as there is no ex-vessel value exchanged in these operations. However, both types of values are included so the reader may compare across sectors in order to understand relative impacts under different PSC apportionments.

sector’s B season gross revenue. Alternatively, a PSC limit of 550,000 chum salmon may have resulted in B season closures in 1–2 of the 13 years. This implies that the sector would not have reached the PSC limit in most of the years, with the median value of $0. However, the maximum that may have been forgone in one year was $2.9 –174.1 million, depending on the apportionment chosen. This would have represented 0.8–50% of the CP sector’s B season gross revenue, depending on the apportionment selected. **This demonstrates that there is a relatively high marginal difference in impacts for the CP sector depending on apportionment chosen. As with the CDQ sector, using the 3-year average apportionment generates the greatest potential adverse impact for the CP sector and the AFA apportionment has the least potential for adverse impacts to the CP sector.**

For the **mothership sector**, Table 4-18 demonstrates that a PSC limit of 100,000 may have resulted in B season closures in 9 of the 13 years, depending on the apportionment selected. Thus, in some years there may have been no forgone revenue, but in the most impacted year the sector could have had to forgo $63.3 million in gross first wholesale revenue, representing 78% of the mothership sectors’ B season revenue in that year. Alternatively, a PSC limit of 550,000 may have resulted in B season closures in 0 or 1 of the 13 years. This implies that the sector would not have reached the PSC limit in most if not all of the years. The maximum amount may have been forgone in one year was $12.9 –27.2 million, depending on the apportionment chosen. This would have represented between 16–33% of the mothership sector’s B season gross revenue, depending on the apportionment selected. **The incremental difference between the potential impact of the apportionment options is less pronounced for the mothership sector than it is for the inshore or CP sector. Using the AFA apportionment has the greatest potential for adverse impacts to the mothership sector and the 5-year average apportionment has the least potential for adverse impacts.**

As highlighted previously, an evaluation of *gross* revenue does not account for the multitude of costs of production and, thus, does not quantify the potential net effects of the proposed action. This is expected to be a meaningful distinction, as some of the AFA fleet’s primary strategies under a chum salmon PSC cap may increase costs associated with avoidance, such as traveling further, using test tows and movement out of areas with higher bycatch rates which may contribute to higher fuel costs and lower operational efficiency.

As the SSC emphasized in the April 2024 minutes, there are years in which the proposed chum salmon PSC limit would not have been met at the sectors-level even with no behavioral changes (e.g., 2012). Moreover, the Council is considering chum salmon PSC limits that include full transferability between cooperatives and sectors. For the reasons described in section 3.2.4.2.6, the analysts do not expect that this would occur in an efficient way. However, the ability to transfer chum salmon PSC, may increase the level of pollock TAC able to be harvested under more constraining limits

Finally, future variation in ocean conditions and the distribution of pollock/chum/Chinook/other constraining species might render recent history a less representative picture. These conditions could be more or less favorable to pollock fishing and the resulting bycatch. It is important to emphasize the level of uncertainty that exists for future conditions and thus the expectations for marginal impact on forgone revenue and avoidance costs.

Overall, there is uncertainty in the success of chum avoidance as a result of implementation of a chum salmon PSC limit and a sectors’ ability to prevent a B season closure. **If the offshore sectors are successful at avoiding chum salmon under a prescribed PSC limit, they could still harvest their full pollock allocation and there may be no potential impact to forgone revenue at the sector-level. If a PSC limit results in an early B season closure, this is expected to have potential adverse economic impacts on the CP and mothership sectors as well as the CDQ groups that rely on the CP vessels to harvest and process their allocation.** This means it could have direct adverse economic effects on the companies that own and maintain the vessels, those that lease their pollock allocation to be harvested on these vessels, and the skippers, fishing and processing crew employed on these vessels.

Table 4-16 Upper bound of pollock potentially left unharvested and associated forgone gross revenue for CDQ sector if chum salmon PSC limits had been in place, 2011- 2023

CDQ Sector			Pollock forgone (mt)				Ex-vessel rev forgone (millions 2022$)				1st wholesale rev forgone (millions 2022$)			
PSC limit	Apportionment	Number of years closed (13 total)	Min	Median	Avg	Max	Min	Median	Avg	Max	Min	Median	Avg	Max
100,000	3-yr average	6	0	0	17,351	63,534	$ -	$ -	$ 6.5	$ 24.8	$ -	$ -	$ 21.6	$ 77.2
	5-yr average	6	0	0	17,083	63,534	$ -	$ -	$ 6.4	$ 24.8	$ -	$ -	$ 21.3	$ 77.2
	AFA	5	0	0	14,755	63,534	$ -	$ -	$ 5.5	$ 24.8	$ -	$ -	$ 18.3	$ 77.2
	Pro-rata	6	0	0	17,083	63,534	$ -	$ -	$ 6.4	$ 24.8	$ -	$ -	$ 21.3	$ 77.2
325,000	3-yr average	3	0	0	11,365	57,635	$ -	$ -	$ 4.2	$ 22.5	$ -	$ -	$ 13.9	$ 70.0
	5-yr average	3	0	0	11,018	53,133	$ -	$ -	$ 4.1	$ 20.7	$ -	$ -	$ 13.5	$ 64.6
	AFA	2	0	0	6,931	48,589	$ -	$ -	$ 2.5	$ 17.9	$ -	$ -	$ 8.6	$ 57.5
	Pro-rata	3	0	0	11,018	53,133	$ -	$ -	$ 4.1	$ 20.7	$ -	$ -	$ 13.5	$ 64.6
550,000	3-yr average	2	0	0	6,931	48,589	$ -	$ -	$ 2.5	$ 17.9	$ -	$ -	$ 8.6	$ 57.5
	5-yr average	2	0	0	5,908	48,589	$ -	$ -	$ 2.1	$ 17.9	$ -	$ -	$ 7.2	$ 57.5
	AFA	2	0	0	2,347	28,221	$ -	$ -	$ 0.8	$ 10.0	$ -	$ -	$ 3.0	$ 36.6
	Pro-rata	2	0	0	5,908	48,589	$ -	$ -	$ 2.1	$ 17.9	$ -	$ -	$ 7.2	$ 57.5

Source: NMFS Alaska Region CAS, data compiled by AKFIN

Table 4-17 Upper bound of pollock potentially left unharvested and associated forgone gross revenue for CP sector if chum salmon PSC limits had been in place, 2011- 2023

CP Sector			Pollock forgone (mt)				Ex-vessel rev forgone (millions 2022$)				1st wholesale rev forgone (millions 2022$)			
PSC limit	Apportionment	Number of years closed (13 total)	Min	Median	Avg	Max	Min	Median	Avg	Max	Min	Median	Avg	Max
100,000	3-yr average	11	0	84,042	94,208	236,646	$ -	$ 34.8	$ 36.4	$ 92.9	$ -	$ 107.5	$ 121.4	$ 288.6
	5-yr average	10	0	84,042	90,735	236,646	$ -	$ 34.8	$ 35.1	$ 92.9	$ -	$ 107.5	$ 117.0	$ 288.6
	AFA	10	0	38,220	67,622	218,962	$ -	$ 15.8	$ 25.7	$ 85.8	$ -	$ 48.9	$ 85.7	$ 266.8
	Pro-rata	10	0	84,042	89,433	236,646	$ -	$ 34.8	$ 34.6	$ 92.9	$ -	$ 107.5	$ 115.3	$ 288.6
325,000	3-yr average	6	0	0	47,803	171,330	$ -	$ -	$ 17.9	$ 67.3	$ -	$ -	$ 60.5	$ 212.1
	5-yr average	5	0	0	29,476	162,802	$ -	$ -	$ 10.9	$ 58.4	$ -	$ -	$ 38.1	$ 212.1
	AFA	2	0	0	13,345	133,877	$ -	$ -	$ 4.8	$ 48.0	$ -	$ -	$ 17.3	$ 174.1
	Pro-rata	5	0	0	29,476	162,802	$ -	$ -	$ 10.9	$ 58.4	$ -	$ -	$ 38.1	$ 212.1
550,000	3-yr average	2	0	0	13,345	133,877	$ -	$ -	$ 4.8	$ 48.0	$ -	$ -	$ 17.3	$ 174.1
	5-yr average	1	0	0	10,298	133,877	$ -	$ -	$ 3.7	$ 48.0	$ -	$ -	$ 13.4	$ 174.1
	AFA	1	0	0	171	2,225	$ -	$ -	$ 0.1	$ 0.8	$ -	$ -	$ 0.2	$ 2.9
	Pro-rata	1	0	0	10,298	133,877	$ -	$ -	$ 3.7	$ 48.0	$ -	$ -	$ 13.4	$ 174.1

Source: NMFS Alaska Region CAS, data compiled by AKFIN

Table 4-18 Upper bound of pollock potentially left unharvested and associated forgone gross revenue for mothership sector if chum salmon PSC limits had been in place, 2011- 2023

Mothership Sector			Pollock forgone (mt)				Ex-vessel rev forgone (millions 2022$)				1st wholesale rev forgone (millions 2022$)			
PSC limit	**Apportionment**	**Number of years closed (13 total)**	Min	Median	Avg	Max	Min	Median	Avg	Max	Min	Median	Avg	Max
100,000	3-yr average	10	0	29,787	26,093	52,088	$ -	$ 11.0	$ 10.1	$ 20.3	$ -	$ 35.0	$ 33.6	$ 63.3
	5-yr average	10	0	29,787	24,963	52,088	$ -	$ 11.0	$ 9.7	$ 20.3	$ -	$ 35.0	$ 32.2	$ 63.3
	AFA	10	0	29,787	26,093	52,088	$ -	$ 11.0	$ 10.1	$ 20.3	$ -	$ 35.0	$ 33.6	$ 63.3
	Pro-rata	10	0	29,787	26,093	52,088	$ -	$ 11.0	$ 10.1	$ 20.3	$ -	$ 35.0	$ 33.6	$ 63.3
325,000	3-yr average	4	0	0	4,681	32,775	$ -	$ -	$ 1.7	$ 12.1	$ -	$ -	$ 5.8	$ 38.8
	5-yr average	4	0	0	4,681	32,775	$ -	$ -	$ 1.7	$ 12.1	$ -	$ -	$ 5.8	$ 38.8
	AFA	4	0	0	4,681	32,775	$ -	$ -	$ 1.7	$ 12.1	$ -	$ -	$ 5.8	$ 38.8
	Pro-rata	4	0	0	4,681	32,775	$ -	$ -	$ 1.7	$ 12.1	$ -	$ -	$ 5.8	$ 38.8
550,000	3-yr average	1	0	0	840	10,914	$ -	$ -	$ 0.3	$ 4.0	$ -	$ -	$ 1.0	$ 12.9
	5-yr average	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	AFA	1	0	0	1,767	22,968	$ -	$ -	$ 0.7	$ 8.5	$ -	$ -	$ 2.1	$ 27.2
	Pro-rata	1	0	0	840	10,914	$ -	$ -	$ 0.3	$ 4.0	$ -	$ -	$ 1.0	$ 12.9

Source: NMFS Alaska Region CAS, data compiled by AKFIN

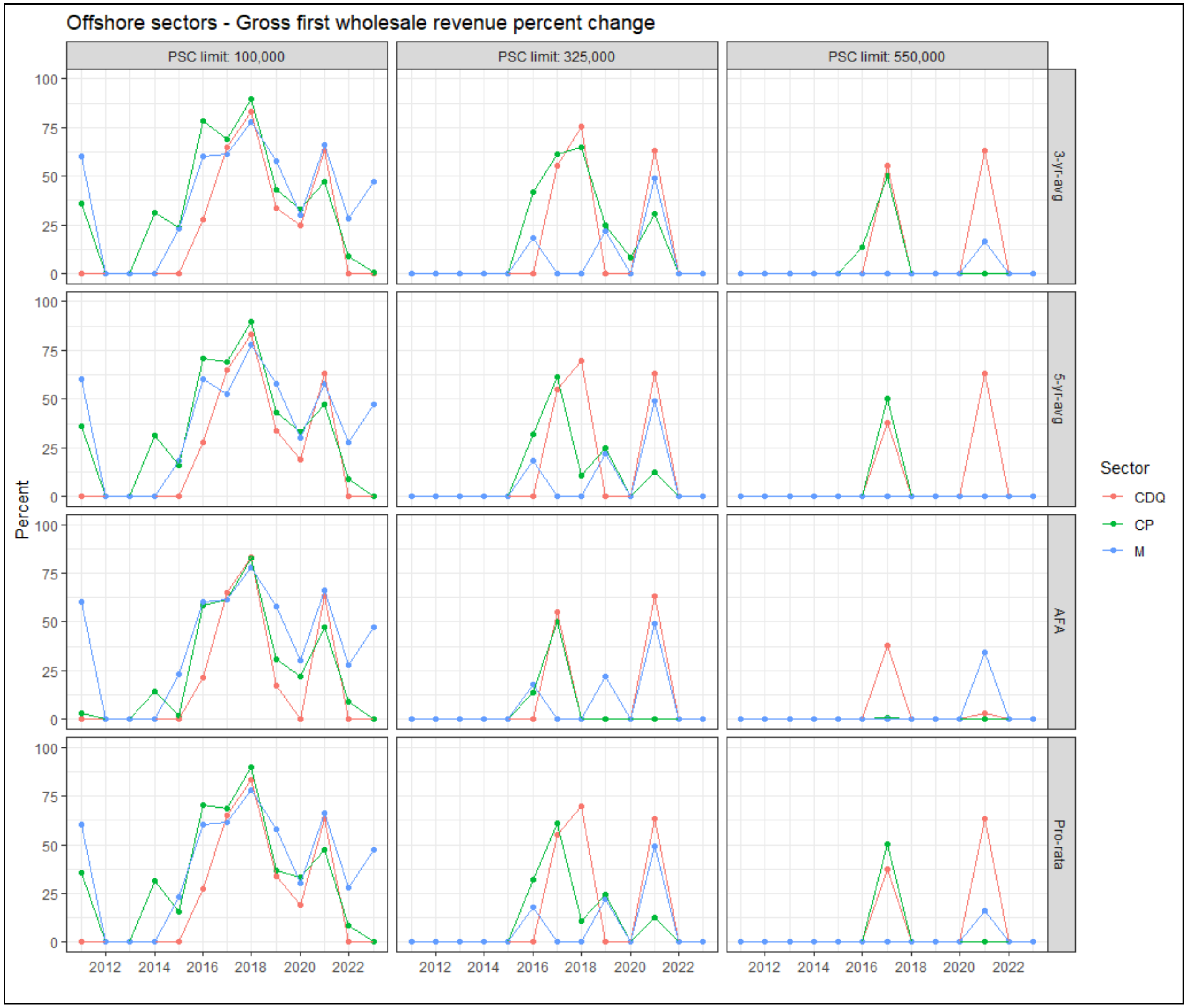

Figure 4-11 Percent of B season gross first wholesale revenue potentially forgone for the offshore sectors if chum salmon PSC limits had been in place, 2011–2023
Source: NMFS Alaska Region CAS, data compiled by AKFIN

4.2.2.1.2.2 Communities Affiliated with the Offshore Sector

Communities engaged in or dependent on the B season pollock fishery through the offshore sectors could experience a variety of social and economic impacts, all of which would occur on a spectrum in terms of their likelihood and severity under Alternatives 2 and 3. CP and mothership CV ownership was concentrated in Seattle MSA. Mothership ownership was split between Seattle MSA and Unalaska. CPs and motherships also primarily offload product in Unalaska. For these reasons, the potential impacts to Seattle MSA and Unalaska are addressed below.

Seattle MSA

Seattle MSA would be indirectly and adversely affected by a fishery closure under Alternatives 2 or 3 if the CP and/or mothership sectors reached the chum salmon PSC limit. The following data summaries provide a sense of scale for the potential forgone revenue for CPs and motherships affiliated with Seattle MSA, but the magnitude of the potential revenue impact would depend on when a sector reached the PSC limit and the amount of pollock forgone.

- **CPs** earned an average of $450.05 million in gross wholesale revenue from B season pollock (2011–2023). This represented 55.37% of these entities' total revenue from B season AFA and CDQ pollock and 21.0% of the total gross first wholesale revenue earned by the Seattle MSA/Anchorage community fleet.
- **Motherships** earned an average $109.70 million in gross first wholesale revenue from B season pollock (2011–2023). This represented 58.19% of these entities' total revenue and 32.8% of the total gross first wholesale revenue earned by the Seattle MSA/Dutch Harbor community fleet.
- **Mothership CVs** earned an average $27.83 million in gross ex vessel revenue form B season pollock (2011–2023). This represented 47.37% these entities' total revenue and 3.0% of the total gross ex-vessel revenue earned by the community fleet. Note, due to confidentiality concerns these revenue data are not specific to only those mothership CVs registered to Seattle MSA. These values represent the gross revenue earned by mothership CVs, of which an average of 92.31% were registered to owners in the Seattle MSA.

The analysis uses vessel's registered ownership address because it is a way to approximate the distribution and magnitude of ownership ties to a particular community and region, but a vessel's homeport location is generally understood to be the community where the vessel spends the majority of its time throughout the year and would likely generate some level of economic activity. All CPs with a registered ownership address in the Seattle MSA also listed the community as its homeport in 2022 and 2023. The majority of CVs associated with Seattle MSA listed Seattle, Newport, Kodiak, and Unalaska/Dutch Harbor as their homeport. These are consistent trends throughout the analyzed period which suggests the potential social and economic effects of the proposed alternatives would be relatively concentrated.

An overall hard cap under Alternative 2 or 3 could result in forgone revenue and/or avoidance costs due to changes in fishing behavior to stay below the hard cap. It is possible that consolidation could occur within the sectors affiliated with Seattle MSA if these new measures for chum salmon PSC result in early closures or repeatedly high avoidance costs. Firms or vessels that are less efficient at avoiding chum salmon may sell or lease to other firms that are more efficient at avoiding chum salmon PSC. It is challenging to discern the degree to which the community would be impacted by potential consolidation as consolidation could occur within Seattle-based firms.

Although vessels and companies affiliated with Seattle MSA could experience potential indirect and adverse effects under Alternative 2 and 3, it is challenging to scale these impacts *to the community,* when the level of economic activity generated by the B season pollock fishery is compared to the economic diversity of Seattle MSA. This community represents a large urban area and its relative dependence on the B season fishery is small compared to the scale of the area's economy. Nevertheless, engagement in commercial fisheries has shaped the social fabric of certain neighborhoods like Ballard where a larger Scandinavian population are involved in the fishing industry, and there are distinct subareas where concentrations of businesses and infrastructure are focused on the community's large and wide-ranging fleet (e.g., Fishermen's Terminal) (NOAA 2014).

Crew and processing workers onboard CPs or motherships affiliated with Seattle MSA could be directly and adversely affected by the avoidance costs incurred prior to a PSC limit being reached, as well as after the PSC limit is met. On average, 1,628 crew positions were available on AFA CPs and 407 were available on motherships (see Section 4.2.2.1.2.2). There are no readily available data to determine the long-term community of residence for AFA skippers, crew, and processing workers. However, crew and processing workers would experience immediate financial hardship as a result of an early B season closure. Repeated B season closures could displace crew and processing workers from the fishery and that they would seek other forms of employment, which may be time-consuming, costly, and/or require additional education and training. Although there may be more alternative employment and income opportunities for displaced crew in a large urban area like Seattle, there may not be comparable employment in earning potential or general job satisfaction (Gatewood & McCay 1990).

Unalaska

Dutch Harbor is the primary location for CP and mothership product transfers and was listed as the ownership address for two motherships during the baseline period (2011–2023). If either the CP or mothership sector experienced an early B season closure due to reaching a chum salmon PSC limit, the City of Unalaska (and the State of Alaska) would potentially forgo tax revenue which includes, but is not limited to, the FRLT. The City of Unalaska derives substantial economic and social benefits from the FRLT levied on B season pollock. Total revenue from the FRLT levied on B season pollock ranged from $2.20 million (2020) to $2.84 million (2012). FRLT revenue accounted for an average of 7.6% of the City's total General Fund revenues (2011–2022). These estimates do not account for revenues derived from taxes and fees from other fishery-related activities in the community that may be paid by vessels or companies.

Table 4-19 Estimated revenue derived from the FRLT levied on B season pollock for the City of Unalaska compared to the City of Unalaska's general fund revenue, 2011–2023

Year	Estimated share of FRLT levied on CPs	Estimated share of FRLT levied on motherships	Estimated share of FRLT levied on CDQ	Total estimated revenue from FRLT levied on B season pollock	City of Unalaska General Fund revenues	B season FRLT revenues as percent of total General Fund revenues
2011	$1,777,071	$464,934	$468,912	$2,710,917	$29,152,912	9.3%
2012	$1,847,184	$461,173	$531,324	$2,839,681	$31,634,417	9.0%
2013	$1,675,655	$421,327	$480,601	$2,577,583	$32,609,892	7.9%
2014	$1,722,688	$427,282	$500,318	$2,650,288	$34,376,971	7.7%
2015	$1,738,731	$431,918	$498,131	$2,668,780	$34,525,170	7.7%
2016	$1,623,461	$398,869	$462,191	$2,484,521	$30,723,626	8.1%
2017	$1,478,499	$363,073	$413,739	$2,255,310	$34,371,441	6.6%
2018	$1,610,992	$406,663	$462,315	$2,479,970	$30,300,957	8.2%
2019	$1,603,820	$396,227	$450,848	$2,450,894	$36,419,248	6.7%
2020	$1,439,418	$395,418	$367,128	$2,201,964	$36,478,643	6.0%
2021	$1,521,878	$384,489	$439,171	$2,345,538	$29,089,571	8.1%
2022	$1,466,661	$373,712	$426,857	$2,267,229	$29,110,249	7.8%
2023	*	*	*	$2,216,994	NA	NA

Source: AKFIN. City of Unalaska, Alaska. Comprehensive Financial Audits, Fiscal Years 2011 through 2023. https://www.commerce.alaska.gov/dcra/admin/Financial Accessed August 28, 2024.

Since the City of Unalaska's economy is primarily centered on the seafood industry, the tax base is subject to change with fluctuations in fishery harvest levels. A potential mitigating factor to some of the fluctuation during the status quo period with respect to seafood taxes has been the relative stability of the pollock fishery. This could change if frequent or erratic B season closures were to occur for the offshore sectors, as well as other the sectors in the fishery with connections to the community. The magnitude of this potential adverse effects would depend on the timing of a closure. General fund revenues support public safety, disaster preparedness efforts, public works and infrastructure like the city's water supply and sewer system, administration, the school district, among others.

More broadly, the community's economy is built on commercial fishing, seafood processing, fleet services, and marine transportation. The historical presence of CP and mothership activity in the community has driven investments into infrastructure such as docks, storage facilities and transportation. The Port of Dutch Harbor is the only deep draft port in the Arctic Region that is ice free year-round, and it has been designated a "port of refuge," providing protection and repair for disabled or distressed vessels that fish or transit the waters surrounding the Aleutian Islands on a daily basis. Unalaska is also the western-most container terminal in the United States and one of the most productive ports for the transshipment of cargo in Alaska. In addition to product shipped domestically to and from this regional hub, products are shipped to ports around the world with weekly shipments headed to Europe and Asia by container and freighter.

4.2.2.1.2.3 Impacts to the CDQ Groups and Communities

CDQ affiliations add depth and complexity to the consideration of social and economic impacts because these groups have both a community-supporting mission, as well as stakeholder status in groundfish harvesting. The CDQ groups vary in the number of communities and residents they represent, the composition of their CDQ and non-CDQ quota portfolios, and the relative scale of fishery and non-fishery portions of their regional economies, among other attributes.

The CDQ groups could be adversely impacted by potential changes to regulations managing chum salmon bycatch in the Bering Sea pollock fishery in multiple ways, two of which are the most direct. First, all

CDQ groups receive programmatic allocations of Bering Sea pollock and would be apportioned an amount of the overall chum salmon PSC limit (Alternative 2 and 3). As discussed in Section 4.1.2.1, recent closures and declining quota in BSAI crab fisheries (i.e., Bristol Bay red king crab and Bering Sea snow crab in particular), have impacted the revenue from both the crab CDQ held by the groups as well as revenues from additional investments in BSAI crab harvesting and processing quota share. In light of these declines, pollock has made up a relatively greater proportion of total revenues in recent years (Figure 4-9).

In addition to representing the largest portion of cash flow from CDQ allocations, the pollock allocations, which are typically leased to vessels in the CP sector, have historically also represented a relatively stable source of revenue for the CDQ groups. Leasing agreements can often be in place for multiple years and may include harvest guarantees. In this way, CDQ groups that lease their pollock CDQ may be somewhat insulated from the annual fluctuations in the operational costs (e.g., vessel maintenance) and the risk associated with global markets.

However, if there was a perceived risk of a B season pollock closure prior to the full harvest of the TAC (i.e., under Alternative 2 or 3), this perception of risk may impact CDQ groups' leverage in negotiating harvesting agreements and lease rates, such that future contracts may not continue on the same terms as the past. If there was a medium to high risk of a B season closure, CDQ representative have expressed concern that AFA companies that lease CDQ pollock may wish to reevaluate what they commit to harvesting. Since a non-CDQ CP company would need to pay a lease fee for access to the CDQ pollock, there may be a focus on harvesting direct allocations of AFA pollock first prior to committing or guaranteeing the harvest of CDQ. CDQ representatives have highlighted concerns that CDQ pollock would be saved to the end of the B season being more likely to be forgone than the pollock quota associated with the vessel owners.[107] CDQ representatives highlighted that even for long-standing leasing relationships, these proposed changes in management structure of the AFA fisheries may trigger reevaluation of harvest agreements or terms may be reconsidered when the harvest contract is up.

Additionally, the apportionment chosen could also influence the risk of reaching the CDQ sector cap and future operational flexibility for harvesting CDQ pollock. Given the relatively lower chum salmon PSC rates from the CDQ and CP sector using the 3-year average or 5-year average, these options under Alternative 2 or 3 would result in a lower apportionment to this sector. While CDQ pollock is typically harvested on CPs, if the CDQ sector wished to lease CDQ pollock to an inshore CV in the future, under these apportionments, it may be more difficult. This reduction in flexibility may also affect the CDQ groups' ability to negotiate harvesting agreements and lease rates, even if the CDQ remains in the CP sector.

In addition to the CDQ pollock allocation, four[108] of the six groups have additional investments in the AFA offshore pollock fisheries outside of their CDQ allocation (as represented in Table 4-13).

- BBEDC has 18.3% ownership in Arctic Storm Holding Company, which includes two CPs (F/V Arctic Fjord and Arctic Storm) as well as two CV (F/V Neahkahnie and Sea Storm) that are part of the High Seas Catcher's Cooperative. These CVs are not actively fishing pollock but earn revenue from leasing their allocation of pollock to the CPs. BBEDC pollock CDQ is typically harvested on the Arctic Storm and the Arctic Fjord.
- CVRF wholly-owns the subsidiary Coastal Alaska Premier Seafoods which 100% owns the CP the F/V Northern Hawk. This new vessel has recently been harvesting and processing the majority of CVRF's pollock CDQ. Additionally, CVRF wholly owns four mothership CVs and has investment in one of the mothership companies (Phoenix Processor Limited Partnership).

[107] S. Ricci, 4/24, NPFMC public testimony.
[108] CBSFA has an indirect ownership in American Seafoods which is not captured here.

- NSEDC along with its wholly-owned subsidiary Siu Alaska Corporation became majority and controlling owners of Glacier Fish Company (71.9% ownership). This company owns and operates the largest pollock fishing vessel, the CP F/V Alaska Ocean. Although this vessel does not typically harvest NSEDC's CDQ allocation, the CDQ group earns revenue from the harvest of this additional allocation of pollock through the partnership.
- YDFDA has investments in the mothership sector, including full or majority ownership in four mothership CVs and 53% holdings of one of the motherships (Golden Alaska).

Thus, if a chum salmon PSC limit results in an early closure of the B season pollock fishery, CDQ groups may see reduced revenues through these investments as well. Like other AFA companies, they would still have their immediate fixed costs such as payments for existing debt payments and vessel insurance, etc. Given these factors, a B season closure, depending on the magnitude, could have adverse impacts on a CDQ group's ability to support their community program (as described in 4.1.2.4) in the same way that they would under status quo.

An early B season closure could have adverse effects on CDQ communities, although the relative magnitude of these impacts is uncertain. Data are limited such that the exact proportion of CDQ groups' revenues and royalties that are derived from the B season pollock fishery cannot be determined. It is also not possible to quantify what proportion of any one program benefit is funded by either the harvest of CDQ pollock or CDQ groups' investments into this fishery.[109]

If a B season closure occurs, the decrease in associated revenue through CDQ groups could decrease the funding available for public services like education, health care, and critical infrastructure. Further, all CDQ groups have worked to provide different employment opportunities, including administrative positions with the group or its subsidiaries, community liaison roles, or jobs on fishing vessels. These employment opportunities may be at risk in the future if there are erratic or frequent B season closures.

At the same time, many communities affiliated with the CDQ program are also engaged in WAK chum salmon fisheries. It is not possible to say whether the potential benefits in terms of chum salmon savings resulting from Alternative 2 or 3 would improve abundance to a degree where less or unrestricted directed fisheries opportunities could be provided would offset the adverse impacts of a B season closure for some CDQ communities. The potential impacts of the proposed action alternatives on communities dependent on subsistence and commercial harvests of chum salmon are discussed within the analysis of potential benefits in Section 4.3.4.2.

4.3.2.1.2.4 Possible Spillover Impacts on Other Fisheries

If the B season pollock fishery was closed early due to meeting a chum PSC limit or there was incentive to consolidate pollock quota, AFA vessels may try to shift effort into other fisheries. If they are successful, this could alleviate some of the financial impacts of leaving pollock quota unharvested or not directly fishing their quota. However, it could also potentially have spillover impacts to historical participants in these fisheries. The AP requested additional consideration of potential spillover impacts that could occur if the B season pollock fishery was closed early due to meeting a chum PSC limit or consolidation of the pollock quota were to occur if operations became less profitable. In response to AP requests, Appendix 6 walks through the most likely opportunities for AFA vessels to move into other BSAI or GOA fisheries based on LLP endorsements, sideboards, season timing and other practical considerations.

[109] Detailed revenue and royalty information was available for the CDQ groups until 2005, but this information is no longer available because the CDQ groups are no longer required to submit such reports to the State of Alaska or NMFS. As such, it is not possible to quantify CDQ groups' total revenues from fishery allocations and other investments, and it is not possible to determine the relative contribution of revenues earned from the Bering Sea pollock fishery (or the B season fishery) to the multiple social and economic programs the groups provide to their communities.

To summarize for the AFA CPs,[110] additional opportunities outside of B season pollock are limited. CPs listed in the AFA are prohibited from fishing in the GOA; therefore, if Bering Sea pollock fishing was less profitable or closed for the B season, CPs would not be able to shift effort into GOA fisheries. In the BSAI, the only fishery that was identified as a potential place for CP spillover is the yellowfin sole trawl limited access fishery. This was identified as a possibility because there has been some variable participation from these vessels over time. However, opportunities in this fishery are still expected to be limited. This fishery is supported by an apportionment shared by AFA CPs, CVs, and non-AFA CVs, and there are typically 1-2 CPs participating. Also, this fishery requires different fishing gear and may require different configuration of the processing factory relative to pollock fishing which is costly to convert. Therefore, participation is unlikely to occur on an ad hoc basis.

4.3.2.1.2.5 Market and Consumer Impacts

If a chum salmon PSC limit was implemented and resulted in repeated or erratic closures in the Bering Sea pollock B season, this could exacerbate the current market challenges described in Section 4.1.1.3. In the U.S. harvesters and processors are facing higher operating costs due to domestic inflation for labor/materials/shipping/storage, high interest rates, high fuel prices, and labor supply shortfalls. Given this multitude of challenging global factors in effect for Alaska seafood markets, including pollock, those that participate in and are affected by these markets may be more vulnerable to the potential adverse economic effects from a B season closure.

For instance, interrupted supply of pollock products, as well as changes in types of products or quality able to be produced could strain existing Asian markets when combined with increased competition from the Russian pollock fishery for these markets. U.S pollock producers are struggling to remain competitive in global markets and to compete against foreign producers that haver lower costs and lower regulatory standards. Russia, which also harvests pollock from the Bering Sea, is the primary competitor to Alaskan pollock in global markets. Russian walleye pollock can be labeled as “Alaska pollock” in many international markets, a labeling practice which can misrepresent the origin of Russian pollock harvests and be misinterpreted by consumers (AFSC 2024). In recent years, Russia has increased its harvest of pollock and flooded the market with product. This oversupply puts downward pressure on the price of Alaskan pollock, especially in markets where Russian and Alaskan products directly compete. Recently, Russia has begun shifting away from European fillet markets that have imposed high tariffs for their imports and begun competing against the U.S. in Asian surimi markets. With very minimal production of surimi prior to 2021, production is expected to reach 115,000 mt by 2027 (Seaman 2023). With the aid of Russian government subsidies, the largest seafood companies in Russia have invested in new fleet of highly efficient vessels allowing them to dramatically increase production of these higher value-added products (Chase 2022).

While the majority of Alaska pollock supply enters export markets, approximately 21% of the supply goes directly to the domestic market (McKinley Research Group 2023). Additionally, a large portion of Alaska pollock supply re-enters the domestic market after being processed internationally, namely from reprocessing plants in China. In part due to foreign competition in other global markets like surimi, domestic markets have become of increasing importance for Alaska pollock producers and harvesters. Some opportunities have increased in recent years, with new commitments by the USDA for purchases of pollock, along with other Alaska seafood for the National School Lunch Program, food banks, and foreign aid programs among other channels. Additionally, a recent expansion on a U.S. ban of Russian seafood imports may create more space in domestic markets for U.S. seafood, such as pollock. However, maintaining new (and existing) domestic markets would be challenging with frequent or erratic closures in the B season.

Impacts to U.S. consumers would be indirect and likely diluted due to global factors. If repeated or erratic B season closures have a more widespread multi-species effect on seafood harvesters and processors,

[110] AFA CVs that deliver to motherships are considered in the spillover impacts section 4.2.2.2.2.5.

paired with U.S. ban of Russian seafood imports, this could impact consumer access to pollock, as well as other Alaska species. If PSC limits do not tip the sustainability of processing operations, U.S. consumers are unlikely to experience large impacts due to the chum salmon PSC limits considered under Alternative 2 or Alternative 3. Bering Sea pollock would continue to enter the market from the A season as well as GOA fisheries. Moreover, other whitefish species, as well as other sources of protein can be competitors in U.S. consumer demand.

4.2.2.2 Economic Effects of a Chum salmon PSC Limit on the Inshore Sector

The inshore sector has included 69-76 active vessels in recent years (2019-2023), operating under six cooperatives, with occasional participation in the open access fishery.[111] These vessels range from 73 ft LOA to 180 ft LOA and 700 hp to 6,600 hp. Between 2011- 2022, for the A and B season combined, the inshore CV collectively harvested an average of 570,473 mt of pollock each year. Most of the inshore CVs rely on pollock B season gross revenue for 40-60% of their total fisheries revenue (Table 4-6), with 62% of the inshore CV relying on AFA fishing for 80% or more of the vessels' total revenue. A trip's worth of catch is typically 2-3 hauls for the inshore CVs, which creates a data lag as salmon caught as bycatch undergo a census count and sampling at the shoreside plant they deliver to. The inshore CV sector's B season harvest is typically concentrated in Unimak and Cluster 1; however, some of the larger CVs frequently harvest in Cluster 2 and further northwest.

4.2.2.2.1 Additional Avoidance Costs

If a chum salmon PSC limit were implemented for the inshore sector and there is a perceived risk of reaching the PSC limit, as described in Section 4.2.2, pollock harvesters would be expected to alter their fishing operations to avoid a closure and to minimize losses associated with potentially forgone gross revenue, to the extent they can. From these operational changes, vessels could incur the avoidance costs described in Table 4-15. However, there are important operational differences between the various sectors that influence their avoidance behaviors and the strategies they can use and as well as the level of impact for the sector. Inshore CVs must stay within a certain proximity to their shoreside processor because of their delivery requirements, meaning they have less flexibility to move to different areas to target pollock. Given these operational differences, Table 4-20 described additional avoidance costs that may specifically affect the inshore vessels.

[111] In 2024, only five cooperatives were operating with ten vessels participating in the open access fishery.

Table 4-20 Potential avoidance costs that may be incurred by the inshore sector under a chum salmon PSC limit in addition to those listed in Table 4-15

Decreased operational efficiency	If traveling further from the port, the quality of the delivered product may go down. This may influence the types of products that can be produced and the ex vessel price received for the product. The inshore sector is constrained with an industry standard of 48 hours between pollock catch and desired delivery in order to produce the freshest quality product.
Travel costs	If the sector has to travel further from shore, fuel costs would increase. If both ex vessel price paid goes down and operational cost go up, these two factors would compound the adverse impact to the inshore fleet.
Gear conflicts and safety at sea	Decreased flexibility in time or space for pollock fishing could possibly contribute to gear conflicts or safety concerns. Inshore vessels may need to travel further from shore which could increase risk if there is a safety issue.
Shoreside processor impacts	Decreased operational efficiencies could lead to lower quality of pollock deliveries, lower volumes of pollock deliveries, or intermittent and slower deliveries. These inefficiencies would increase processor's operating costs such that the economy of scale in its production is lost. A change in pollock quality due to vessels fishing further from port could result in production of lower quality products and lower wholesale prices.
Impacts on communities associated with pollock landings	Communities where shore-based processors are located may see reduced FBT and local raw seafood tax revenues from lower quality product deliveries. In a scenario where harvesters are catching lower quality pollock that can only be processed into certain product forms (such as fishmeal), it is expected the shoreside price and the estimated tax revenue would decrease. It is also possible that shoreside prices decrease as a result of domestic and global market conditions described above, but these dynamics exist outside of the regulatory changes being considered under the proposed management alternatives. In contrast to other avoidance costs, slower or intermittent deliveries that result in crew members spending more time in port could have some level of positive benefits to a community and the support sector businesses within it. Crew members could book accommodations, patron local businesses, seek entertainment, among other activities generating marginally more economic activity.

Similar to the offshore sectors, **a chum salmon PSC limit is expected to have a negative impact on operational costs and efficiency if a risk of a closure is perceived** at the vessel level; however, the associated processor would also conduct their own risk-assessment which could elevate the perception of risk for the CVs. There are significant fixed costs associated with each season at a shore-based processing facility including maintenance, property tax, insurance, transporting processing crew to town and maintaining crew accommodations. Decisions of whether on how to operate must also be made by processors with imperfect information about catch and bycatch rates for the season.

4.2.2.2.2 Broader Implications of a B Season Closures for the Inshore Sector

If the inshore sector is unable to remain under the chum salmon PSC limits, this would result in an early B season closure, which could result in forgone revenue. In addition to the direct implications of forgone revenue, a closure could have wider impacts, extending to shoreside processors, communities, CDQ groups and associated communities, other fisheries, as well as markets and possibly consumers. Note that the market and consumers considerations could also apply for the inshore sector and are not repeated here. The type of impacts, as well as the likelihood and potential magnitude of these are described below.

4.2.2.2.2.1 Potentially Forgone Revenue

The analysis of potentially forgone gross revenue for the inshore sector is conducted in the same manner as section 4.2.2.1.2.1 for the offshore sectors. As previously stated, these values are based off of when the inshore sector hypothetically would have hit the various chum salmon PSC limits had the limits been in place in each of the years 2011-2023. With the expectation that the pollock fleet would react to a chum salmon PSC limit if implemented and alter their operations to the extent they can, in an effort to delay or prevent a B season closure, these values are expected to be an upper bound.

For the **Inshore sector**, Table 4-21 demonstrates that a PSC limit of 100,000 may have resulted in B season closures in 11 of the 13 years. In the most impacted year, this sector could have had to forgo $97.8 - $108 million in gross ex vessel revenue, depending on apportionment selected. At the higher end of the range, this would have represented 73-84% of the CV sector's B season gross revenue. Alternatively, a PSC limit of 550,000 may have resulted in B season closures in 0-1 of the 13 years. This implies that the sector would not have reached the PSC limit in most, if not all of the years, with the median value of $0 forgone. The maximum that may have been forgone in one year was between $0- $54.7 million, depending on the apportionment selected. At the higher range, this would have represented 0 - 44% of the CV sector's B season gross revenue. **This demonstrates the relatively high incremental difference in the potential impacts to the inshore sector depending on apportionment chosen. The retrospective analysis shows using the AFA apportionment has the greatest potential for adverse impacts to the inshore sector and the 3-yr average apportionment has the least potential for adverse impact.**

Table 4-21 Upper bound of pollock potentially left unharvested and associated forgone gross revenue for the inshore sector if chum salmon PSC limits had been in place, 2011- 2023

Inshore Sector			Pollock forgone (mt)				Ex-vessel rev forgone (millions 2022$)				1st wholesale rev forgone (millions 2022$)			
PSC limit	Apportionment	Number of years closed (13 total)	Min	Median	Avg	Max	Min	Median	Avg	Max	Min	Median	Avg	Max
100,000	3-yr average	12	0	130,249	134,968	249,756	$ -	$ 54.6	$ 52.2	$ 97.8	$ -	$ 146.3	$ 153.5	$ 294.3
	5-yr average	12	0	135,011	139,091	249,756	$ -	$ 55.2	$ 53.9	$ 97.8	$ -	$ 146.3	$ 158.6	$ 294.3
	AFA	12	0	142,044	158,061	291,563	$ -	$ 56.0	$ 61.6	$ 108.3	$ -	$ 164.1	$ 181.8	$ 345.8
	Pro-rata	12	0	135,011	139,091	249,756	$ -	$ 55.2	$ 53.9	$ 97.8	$ -	$ 146.3	$ 158.6	$ 294.3
325,000	3-yr average	2	0	0	15,404	172,796	$ -	$ -	$ 5.7	$ 63.5	$ -	$ -	$ 15.9	$ 178.7
	5-yr average	2	0	0	16,560	172,796	$ -	$ -	$ 6.2	$ 63.5	$ -	$ -	$ 17.1	$ 178.7
	AFA	5	0	0	29,854	172,796	$ -	$ -	$ 11.2	$ 63.5	$ -	$ -	$ 31.5	$ 178.7
	Pro-rata	2	0	0	16,560	172,796	$ -	$ -	$ 6.2	$ 63.5	$ -	$ -	$ 17.1	$ 178.7
550,000	3-yr average	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	5-yr average	1	0	0	11,457	148,936	$ -	$ -	$ 4.2	$ 54.7	$ -	$ -	$ 11.8	$ 153.8
	AFA	1	0	0	11,457	148,936	$ -	$ -	$ 4.2	$ 54.7	$ -	$ -	$ 11.8	$ 153.8
	Pro-rata	1	0	0	11,457	148,936	$ -	$ -	$ 4.2	$ 54.7	$ -	$ -	$ 11.8	$ 153.8

Source: NMFS Alaska Region CAS, data compiled by AKFIN

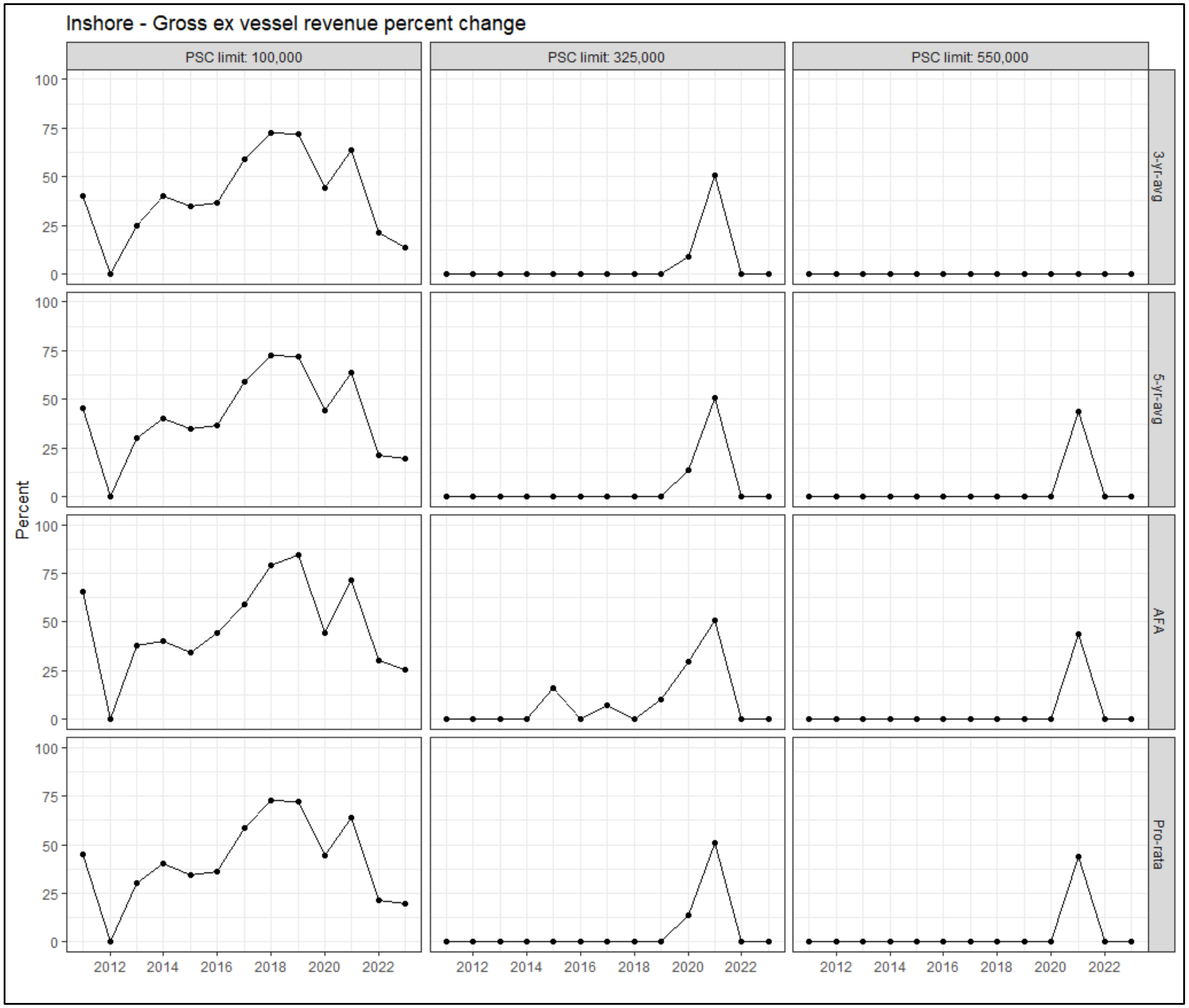

Figure 4-12 Percent of B season gross ex vessel revenue potentially forgone for the inshore sector if chum salmon PSC limits had been in place, 2011–2023

Source: NMFS Alaska Region CAS, data compiled by AKFIN

A constraining chum salmon PSC limit could result in a B season closure for the inshore sector, if the sector as a whole reached the cap. However, the inshore sector's apportionment of the PSC limit will be further divided among the cooperatives and thus it is possible for one or more cooperatives to close prior to the full sector. If pockets of pollock are stranded due to a sector or cooperative meeting their sub-apportionment of chum salmon PSC, they would be prohibited from fishing. Alternative 2 and 3 specify that chum salmon PSC would be transferable, so theoretically it could move between cooperatives. However, as described in Section 3.2.4.2.5, there are reasons to expect chum salmon PSC may not be transferred efficiently throughout the whole AFA fleet when there is a demand for it. Therefore, some cooperatives or vessels may experience forgone revenue even if the whole sector does not.

As described through tables in Section 4.1.1, AFA vessels and companies are not equally reliant on pollock fishing revenue relative to revenue from other fisheries so the marginal impact of the proposed chum salmon PSC limits would fall more heavily on some participants than others. Additionally, companies have different cost portfolios that are not available to the analysts. For instance, fixed costs for maintaining and operating a vessel can be high (e.g., debt payments, insurance, property taxes). In the event that total production is lower under Alternative 2 or 3, fixed costs would be distributed across a smaller volume of product output.

Overall, there is uncertainty about the inshore sectors' ability to prevent a B season closure under a chum salmon PSC limit. **If the inshore cooperatives are successful in chum avoidance under a PSC limit prescribed, they may still harvest their full pollock allocation and there may be no forgone revenue at the sector-level. If a PSC limit results in an early B season closure, this is expected to have adverse economic impacts on the inshore CVs that would otherwise harvest this allocation.** This means it could have direct adverse economic effects on the companies that own and maintain the vessels, those that lease their pollock allocation to be harvested on these vessels, and the skippers, fishing crew employed on these vessels.

4.3.2.2.2.2 Shore-based Processor Impacts

Six physical shore-based processors accepted deliveries of B season pollock from 2011–2023: UniSea, Westward Seafoods, and Alyeska Seafoods and the *Northern Victor* in Unalaska/Dutch Harbor; Trident Seafoods in Akutan; and Peter Pan Seafoods in King Cove. A chum salmon PSC limit under Alternative 2 or 3 could adversely affect shore-based processors if:

- The avoidance measures taken by vessels in a cooperative affiliated with the plant required operators to significantly slow their pace of fishing which could interrupt the flow of deliveries and overall efficiency for the plant, or if the measures result in different type or quality of product able to be made (as discussed above in Section 4.2.2.2.1), or
- An inshore cooperative affiliated with the processor or the inshore sector closed early, such that an amount of pollock remained unharvested.

An early B season closure for specific cooperatives or the inshore sector would have direct and adverse impacts on the shore-based processors listed above and the communities they are located in. An important dimension to understanding this impact is in the perception of risk. If the chum salmon PSC limit under Alternative 2 or 3 is *perceived as likely constraining*, the processor(s) would need to consider this reality prior to the start of the B season. The analysts are emphasizing the perception of a constraining cap because processing companies often work to establish their markets prior to the start of the fishing season. Pollock products (among other seafood products) are fast-moving consumer goods with a limited shelf-life, and restaurants or retail stores require consistent quantities to meet consumer demand. The analysts expect that this would affect processor's operational plans and market strategy, potentially influencing them to make costly decisions with imperfect information.

The Alaska seafood industry is currently facing many seafood market challenges, and a number of processing companies are undergoing transitions (see Section 4.1.1.2 and AFSC 2024). For example, in

2024, multiple processors announced seasonal or permanent plant closures across Alaskan fishing communities. This included the sale of three of Trident's largest processing facilities (Ketchikan, Petersburg, and False Pass), and an uncertain future for their Kodiak plant and two other facilities (South Naknek Diamond NN Cannery and Chignik) not operating in 2024.). Challenging seafood markets, increasing costs, among other factors are likely to continue along current trends under Alternative 1 (No Action). However, a hard cap could exacerbate some of these conditions, including if the cap is *perceived* to be constraining.

Lower wholesale prices and increased shipping costs may also make a processing company more vulnerable than they may otherwise be, when combined with additional changes in operating costs, product quality and value, and the changes in net revenue resulting from a chum salmon PSC limit. The analysts do not have access to data on processor's operating costs, making it unclear what cap level could create speculative B season markets or what level of unharvested pollock as a result of B season closures could tip the sustainability of processing operations. It is possible that consolidation among shoreside processing entities could occur, depending on their ownership structures, market vulnerabilities, and the degree to which harvesting vessels delivering to the processor are able to adapt their fishing behavior under the PSC limit.

It is expected that frequent or erratic B season closures could negatively impact processors' ability to maintain their markets and remain profitable, which would have ripple effects on the other species and fisheries processed at these plants, the companies' partnerships and subsidiaries, as well as their labor forces. The B season pollock is a high-volume fishery that is important to the annual cycle of these plants, and it contributes a substantial portion of the annual gross revenues for all shore-based processors (see Table 3-11). These are multi-species plants that have been adversely affected by the recent Bering Sea snow crab closures, and small Bristol Bay red king crab TAC in recent years. Thus, pollock has become a greater proportion of the total net revenue for most of these processors. Changes in abundance for other key species historically processed by these facilities, among other factors, may limit their ability to diversify product lines.

In addition to species diversification, the regional or operational diversification of one processing company can help to balance out the volatility of seafood markets or support their existing investments. Some companies that own the shore-based processors addressed in this analysis have additional processing facilities in other communities, and these facilities specialize in other species to help diversity a company. Some companies also have part or full ownership in support sector businesses. For instance, UniSea owns the Grand Aleutian Hotel in Unalaska. If these processors' revenues are substantially reduced or unpredictable due to a hard cap that is perceived to be constraining or results in an early closure in the B season, there could be much broader implications for their other partnerships or subsidiaries.

While the high-volume nature of pollock provides processors economies of scale, it has also been a reliable source of revenue because it has been a stable fishery in terms of TAC amounts and full utilization. Some processors have relied on the steady revenue stream provided by pollock to subsidize the cost of other operations. Erratic or frequent early B season closures would likely limit these companies' ability to continue to support facilities in other communities that are less profitable for the company but may be of critical importance to the community in which they are located. In this way, there may be an "invisible" network of adverse economic and social impacts across communities not otherwise engaged in or dependent on pollock.

An important nuance to this discussion is that an early B season closure may not necessarily close a plant, depending on the timing of the closure. These are multispecies plants that may be able to sustain operations for a period of time, relying more on other species to keep the facility running. There is no guarantee a plant could sustain their operations in the face of an early B season closure, and if it could not there would be direct and adverse effects on processing workers. On average, shore-based processing facilities that accepted B season pollock deliveries employed 1,731 persons (see Section 4.1.1.5). It is assumed that not all employees were directly involved in processing pollock at the plant, but it is plausible that all employees would be affected given the important role this fishery plays in maintaining economies of scale and operational efficiencies. Employees at a shore-based facility that closed would face immediate financial hardship. Financial strain created by reduced income could lead to additional stress and anxiety among processing workers and their families.

4.2.2.2.2.2 Impacts to Communities Affiliated with a Shore-based Processing Facility

Unalaska

Relative to Alternative 1, Unalaska would experience direct and adverse impacts from early B season closures if an inshore cooperative or the sector reached the overall hard cap. Four physical shore-based processors accepted B season pollock deliveries and were located in Dutch Harbor from 2011 to 2023.

Table 4-22 provides estimates on the revenue the City of Unalaska earned from direct fisheries-related taxes levied on B season pollock. This includes the City's local raw seafood tax and the City's shared portion of the FBT. While estimates on FRLT revenues earned from the B season pollock fishery were previously provided for the offshore component, those data are also provided so the total estimated value can be compared to the City's general fund revenue. These estimates provide a way to scale the potential adverse effects early B season closures could have on the City of Unalaska, although the relative magnitude would depend on the timing of the closure, the amount of pollock catch forgone, and whether more than one inshore cooperative affiliated with the community reached the limit.

Estimates on the value of the City's local raw seafood tax ranged from $1.36 million (2017) to $1.83 million (2018), and the city's portion of the shared FBT ranged from $1.02 million (2017) to $1.37 million (2018). On average, the estimated revenue earned from all direct fishery-related taxes levied on B season pollock accounted for 16.5% of the City's general fund revenue (2011–2022). These estimates do not account for revenues derived from taxes and fees from activities in the community that are fishing related or may be paid by AFA vessels companies including, but not limited to, property taxes paid by fisheries businesses, fuel transfer tax revenues, and harbor fees.

Table 4-22 Estimated direct fishery related tax revenue earned from B season pollock for the City of Unalaska compared to all general fund revenue

Year	Estimated local raw seafood tax	Estimated revenue share of FBT	Estimated revenue of local raw seafood tax and share of FBT	Estimated revenue from local raw seafood tax, FBT, and FRLT	City of Unalaska general fund	Local raw seafood and share of FBT as % of total general fund	Estimated B season tax revenues as % of total general fund
2011	$1,597,082	$1,197,811	$2,901,004	$5,505,810	$29,152,912	10.0%	18.9%
2012	$1,738,564	$1,303,923	$2,963,970	$5,882,168	$31,634,417	9.4%	18.6%
2013	$1,633,875	$1,225,406	$2,859,088	$5,436,864	$32,609,892	8.8%	16.7%
2014	$1,633,617	$1,225,213	$2,853,411	$5,509,118	$34,376,971	8.3%	16.0%
2015	$1,626,392	$1,219,794	$2,704,213	$5,514,965	$34,525,170	7.8%	16.0%
2016	$1,437,095	$1,077,822	$2,455,718	$4,999,438	$30,723,626	8.0%	16.3%
2017	$1,358,163	$1,018,623	$2,732,584	$4,632,096	$34,371,441	8.0%	13.5%
2018	$1,832,560	$1,374,420	$3,013,308	$5,686,951	$30,300,957	9.9%	18.8%
2019	$1,574,330	$1,180,748	$2,776,896	$5,205,972	$36,419,248	7.6%	14.3%
2020	$1,603,421	$1,202,566	$2,845,571	$5,007,951	$36,478,643	7.8%	13.7%
2021	$1,656,200	$1,242,150	$2,833,609	$5,243,889	$29,089,571	9.7%	18.0%
2022	$1,569,878	$1,177,408	$2,798,959	$5,014,515	$29,110,249	9.6%	17.2%
2023	$1,638,775	$1,229,081	$1,638,775	$5,084,850	NA	NA	NA

Source: AKFIN. City of Unalaska, Alaska. Comprehensive Financial Audits, Fiscal Years 2011 through 2022. https://www.commerce.alaska.gov/dcra/admin/Financial Accessed August 28, 2024.

A reduction in fishery-related tax revenue due to an early B season closures and/or with increased avoidance costs (as described in Section 4.2.2.2.1), would have an adverse effect on funding public services in the community including the port, roads, local school, healthcare facilities, and other essential services. In a community like Unalaska which is heavily reliant on the pollock fishery, a stable tax base is vital for maintaining the quality and availability of these services. Tax revenues also help to create and sustain jobs within the fishing industry as well as other support sectors including hospitality, transportation, or retail.

Section 4.2.2.1.2.2 describes the important role Unalaska plays in the BSAI region as a primary port for support sector businesses and transportation services. That information is provided in the context of community impacts, should one of the offshore sectors close early during a B season and it is not repeated here. However, if the inshore sector and one or more of the offshore sectors closed early, the adverse effects on local businesses would increase in magnitude.

Table 4-9 illustrates the important role pollock plays in the annual processing cycle of the shore-based processors addressed in this analysis. Specific to the community of Unalaska, the local small boat fleet has participated in halibut and sablefish IFQ, fixed gear groundfish, and local crab fisheries on a relatively small scale (Downs & Henry 2023). Deliveries from the local small boat fleet are likely not a major source of income for the plant, but these deliveries have been an important source of income for local fishermen. If these shore-based processors were to close, it is anticipated local fishermen otherwise disconnected from the pollock fishery would be adversely affected.

Akutan and King Cove

Akutan and King Cove are directly engaged in the Bering Sea pollock fishery as the location of shore-based processing facilities. The two communities are grouped here because of that shared characteristic, and because both communities are located within the Aleutians East Borough. These remote communities have local economies built around the seafood industry, making them vulnerable to fluctuations in fish stocks, shifts in global seafood markets, and potential fishery closures resulting from the proposed regulatory changes under Alternative 2 and 3.

The analysis of potential impacts to communities engaged in or dependent on B season pollock under Alternative 2 and 3 includes King Cove because the community participated in the fishery from 2011–2023. However, King Cove's participation and dependence on B season pollock has already changed as the Peter Pan Fleet Cooperative did not file an inshore AFA cooperative permit for the 2024 fishery. While some amount of AFA pollock could be delivered to the plant in the future, the analysis cannot predict if or when this would occur. Vessels that were previously in the Peter Pan Fleet Cooperative fished in the open access fishery (2023 and 2024) to move to a new cooperative. As a result, the analysis does not anticipate Alternative 2 or 3 would negatively affect the community of King Cove unless the processor and cooperative returned to the community.

Akutan/King Cove/Aleutians East Borough have derived economic benefits from taxes levied on B season pollock. The estimated revenue earned by the community grouping from B season pollock fishery ranged between $2.02 million (2023) and $2.70 million (2019). The types of economic and social benefits tax revenues provide to a community were previously discussed in relation to Unalaska, as were the potential adverse effects of a B season closure for a community where a shore-based plant is located, and they are not repeated here for ease of the reader.

Trident is the primary employer in Akutan with 800 to 1,200 employees present at the facility during the B season (Downs & Henry 2023). While workers may be seasonal, and not all employees are directly involved in processing B season pollock, processing workers would be adversely affected by an early B season closure. A plant closure would have direct and adverse effects on the local economy including a loss of jobs and other income opportunities, although alternative or additional employment opportunities would likely be relatively limited in a remote community like Akutan. The City of Akutan and the Aleutians East Borough employ people in administrative and educational roles (among others), but these entities may be limited in their capacity to do so if positions or sufficient funding are not available. These factors may in turn lead to population decline as people leave the community to seek employment opportunities elsewhere. As families leave, youth outmigration would have an impact on the sustainability of the community including school funding.

The important role that high-volume fisheries like pollock play in providing stability to a processor has been previously addressed (see Section 4.2.2.2.2.2). In Akutan, the local small boat fleet has historically made small deliveries of halibut and sablefish to Trident Seafoods. These fisheries are not a significant source of income for the plant, but they have been an important source of income for local fishermen. While local fishermen are engaged in other means of employment beyond commercial fishing, they do depend to varying degrees on fishing as a part of an integrated, plural employment and income strategy in a community that has relatively limited employment and income opportunities (Downs & Henry 2023).

The likelihood and magnitude of the adverse effects a B season closure could have on the community of Akutan (and the Aleutians East Borough) are uncertain. The degree to which this community would be adversely impacted would depend on whether the PSC limit was perceived to be constraining such that the processor would need to adjust its business plan prior to a season starting, and whether or not pollock operators can modify their behavior to avoid reaching the limit. There are also some uncertainties created by dynamics outside of the regulatory changes being considered in this proposed action. Akutan's reliance on the B season pollock fishery could change if Trident Seafoods continues to pursue its "next generation processing plant" in Unalaska's Captains Bay which would replace the Akutan plant.

4.2.2.2.2.3 Impacts to Communities Affiliated with the Inshore Sector by Vessel Registration

Newport and Kodiak

Kodiak and Newport are grouped in this analysis because these communities are the registered ownership location of inshore CVs and not affiliated with the sector by way of a shore-based processor. Kodiak and

Newport could experience adverse effects under Alternatives 2 or 3, and the following data summaries provide a way to scale the potential forgone revenue for CVs affiliated with these communities. The magnitude of potential forgone revenue would depend on when the cap was reached, and the amount of pollock catch forgone.

- Six CVs with a registered ownership address in Kodiak City participated in the B season fishery (2011–2023). Five of these vessels participated in the inshore sector. One vessel is dual qualified and participated in both the inshore and mothership sectors. CVs affiliated with Kodiak City earned an average of $3.55 million in gross ex vessel revenue from B season pollock. This represented 27.57% of these vessels' total revenue and accounted for 2.81% of the total ex vessel revenue earned by the Kodiak community fleet.
- Ten CVs with a registered ownership address in Newport, Oregon participated in the B season pollock fishery (2011–2023). On average, CVs affiliated with Newport earned $5.93 million in gross ex-vessel revenue from B season pollock (2011–2023). This represented 36.84% of these vessels' total revenue and 20.81% of the total ex vessel revenue earned by the Newport community fleet.

The CVs affiliated with these two communities have a relatively high reliance on the B season pollock fishery, and it plays a meaningful role in their business plans. Some vessels rely on AFA pollock to keep their operations busy through the summer months when they may not be able to participate in other fisheries. If CV owners affiliated with these communities perceived a cap would be constraining, they may try to lease their quota to another vessel in their cooperative and pursue salmon tendering contracts to insulate the vessel from the potential adverse effects of an early closure while keeping the boat operating during the summer months. However, it is not anticipated the same opportunity would be available if a vessel decided to fish their pollock quota but was later closed early due to the overlap in the timing of summer salmon fisheries and B season pollock. Tendering contracts have also become increasingly hard to get because challenges with salmon and other seafood markets are causing processors to reduce tendering costs.[112]

Information on where vessels purchase support services, and the long-term residence of crew are not readily available. As such, a vessel's listed homeport can capture some cross-cutting community ties as it indicates where a vessel spends most of its time and generates some level of economic activity. In 2023, all CVs registered in Kodiak also listed the community as its homeport location. CVs registered in Newport listed Newport, Portland, and Unalaska as their homeport communities. In alignment with these homeport data, it has been common for crew working on Kodiak and Newport CVs to be hired from their respective communities as well as the Seattle MSA area and other communities in Oregon. However, specific to Kodiak, current economic conditions like low fish prices and ongoing social transitions have made it challenging to hire and retain crew and resulted in a much wider reach to hire crew.[113] If the inshore sector experienced erratic or frequent B season closures under Alternative 2 or 3, vessel owners and crew would be directly and adversely impacted. The income lost due to an early B season closure could create financial instability.

Many Kodiak and Newport families have been engaged in commercial fisheries for generations, passing down the skills and knowledge of working in the industry. Some Newport CVs are independent, family-owned vessels where family members work as crew. The shared experience can strengthen the social networks within and among families in these communities. There are meaningful kinship ties between Kodiak and Newport. Many fishing families in Kodiak have extended relatives, friends, or business partners in Newport and vice versa. These ties are built around the fishing industry, including that

[112] Personal communication, C. Raddell.
[113] Personal communication, H. Mann and C. Raddell.

Newport (and Lincoln County more broadly) has support sector businesses that can services catcher vessels of a scale not available in Alaska.

Kodiak and Newport each hold an identity as a fishing community, and this social fabric could change if the inshore sector experienced early closures as a result of reaching a hard cap on chum salmon under Alternative 2 or 3. Related to the points discussed above, pollock has provided a sense of stability for shore-based processors but also for vessel owners and their business plans. There are many factors external to the proposed regulatory changes and this impact analysis that discourage younger generations of fishermen from entering the fishery (e.g., rising costs, poor seafood market conditions, access, among others). As younger fishermen weigh the many tradeoffs of entering the industry, the possibility of a constraining hard cap, or actual observed closures for the inshore sector in the future, would likely influence how younger fishermen perceive the viability of buying into the industry or fishery.

Seattle MSA

On average, 74.4 CVs participated in the inshore CV sector and the majority of ownership was concentrated in the Seattle MSA at 60.9 vessels or 81.90% of all vessels that participated in this sector (2011-2023). The potential effects of a B season closure on Seattle MSA were previously described in relation to the offshore components including forgone revenue, impacts to crew, and support sector businesses (see Section 4.2.2.1.2.2), which are expected to be similar in nature for the community if the inshore sector closed early in the B season. However, if the inshore sector and one or more of the offshore components (i.e., CP or mothership) closed early, the adverse effects on the community would increase in magnitude.

4.2.2.2.2.4 Additional Impacts to CDQ Groups and Communities

As described in Section 4.2.2.1.2.3, CDQ groups would be impacted by a closure of the B season in several ways. In addition to the types of impacts described in that section, CDQ groups and their subsidiaries could see reduced revenues through their investments in inshore CVs (or companies that own them, as represented in Table 4-13). This includes:

- BBEDC with 50% ownership in Dona Martita Fisheries, LLC, which owns five inshore CVs. These vessels have been associated with the Unisea and Westward cooperatives.
- CBSFA's wholly-owned subsidiary St Paul Fishing Company, which has 75% ownership in the F/V Starlite and F/V Starward as well as 30% in the F/V Fierce Allegiance. These vessels have been associated with the Unisea cooperative.
- CVRF/NSEDC have two partnerships which each have ownership in inshore CVs and the associated pollock quota. Coastal Villages Pollock (a wholly-owned subsidiary of CVRF) and Siu Alaska Corporation (a wholly-owned subsidiary of NSEDC) are 50-50 owners in BSAI Partners. BSAI Partners is the majority holder (with different percentages among vessels) for pollock allocations from six inshore CVs, four of which have been actively fishing with the Unalaska cooperative. This fleet is managed by Alaska Boat Company. The second CVRF/NSEDC partnership BSAI Ventures, is also 50-50 owned by Coastal Villages Pollock and Siu Alaska Corporation. BSAI Ventures in turn owns 75% of Bering North, LLC which includes nine inshore CVs which have been associated with the Northern Victor cooperative.

If early closures in the B season result in forgone revenue for these vessels (or less efficient operations due to increased chum avoidance), this may reduce the dividends or other types of benefits the CDQ groups may receive through these investments. The way these adverse impacts manifest could be different depending on the ownership relationships and how risk/operational costs are absorbed (or not) through these investments.

The types of impacts to CDQ communities could be the same as those described above under Section 4.2.2.1.2.3 related to the offshore sectors. The 53 communities affiliated with BBEDC, CBSFA, CVRF, and NSEDC may be considered as more exposed to potential adverse effects resulting from a fishery closure, because their groups would receive an allocation of pollock and an apportionment of the hard cap, as well as having additional direct investments into the offshore sectors and the inshore sector.

4.2.2.2.2.5 Possible Spillover Impacts on Other Fisheries

Appendix 6 considers potential spillover impacts on non-AFA fisheries from displaced CV effort (both mothership and inshore CVs). This displaced effort could result from a B season closure or incentives to avoid chum salmon due to the presence of a PSC limit. The appendix walks through the most likely opportunities for AFA CVs to move into other BSAI or GOA fisheries. Essentially, these options are limited and specific by vessel due to LLP endorsements, sideboard exemption status, and sideboard limits.

For instance, **AFA CVs are either subject to GOA sideboards, which establishes a strict limit on participation in these fisheries or they are exempt from GOA sideboards.** Of the 20 permitted CVs that are exempt from GOA sideboards, 17 have been active between 2015-2023 and most of these vessels have had recent consistent participation in both the BS pollock fishery as well as GOA fisheries. This could be, at least in part, due to the restrictions created through the CV inter-cooperative agreement which essentially states that if a GOA exempt vessel fishes in the GOA above the established GOA sideboard amounts, it is not allowed to lease its AFA pollock allocation, or they could risk losing access to their exempt status in the GOA. Thus, if they do not fish their BS pollock, rather than lease it, a GOA exempt vessel could choose to leave it unharvested. **Thus, if the Bering Sea pollock B season closed early or if the uncertainty of an early closure was too great to afford the trip to the Bering Sea, these vessels may choose not to participate in the Bering Sea pollock B season and only fish in the GOA. As some CVs less than 125 ft LOA typically participate in GOA B season pollock (Sept 1- Nov 1) prior to B season in the GOA, this may or may not affect their participation in the GOA.**

For AFA CVs that are sideboarded in GOA, sideboard limits were recently reduced with the implementation of the Pacific cod Trawl Cooperative (PCTC) Program (see Appendix 6 for a table of these reductions). Moreover, vessels wishing to participate in these fisheries must have an LLP with the appropriate endorsements. Of the 96 GOA non-exempt CV permits, currently only 14 non-exempt vessels are endorsed to fish in the Central GOA with trawl gear and 10 are endorsed to fish in the Western GOA with trawl gear. **This means that these vessels specifically might have limited opportunity to expand into GOA due to impacts from the BS pollock B season, but not more than the established sideboards.**

In the **Bering Sea/ Aleutian Islands**, there are unlikely to be many external opportunities for AFA CVs. The BS pollock B season overlaps with the BSAI Pacific cod trawl C season (June 10- Nov 1), which receives 15% of the trawl CV apportionment and can also receive rollovers from the A and B seasons. This fishery has remained a limited access fishery open to all trawl CVs with an LLP license endorsed in the BS and/or AI with trawl gear, which qualifies all AFA CVs. Thus, there is potential opportunity here for AFA CVs that are impacted by chum PSC limits for the BS pollock B season. There is also a potential for spillover impacts on other Pacific cod user groups if participation increases in the Pacific cod C season, as highlighted in Appendix 6. However, fishing for Pacific cod in the C season has been noted as particularly challenging with disaggregated Pacific cod, resulting in higher bycatch. Participation and prosecution of this fishery has been low in recent years, and it is unlikely there would be a large shift to this fishery.

4.2.2.3 Additional Considerations for Alternative 3

Alternative 3 would modify existing regulations to include an overall chum salmon PSC limit during the B season. Alternative 3 has two important distinctions from Alternative 2. One is that a PSC limit would only be in effect if an index of WAK chum salmon abundance did not have returns above its thresholds in the prior year. The second is that the PSC limit can also decrease based on the number of thresholds not met in the prior year.

In general, a chum salmon PSC limit under Alternative 3 would be expected to result in similar economic and social costs to what is described for Alternative 2 in the years a PSC limit would have been in effect. Importantly, and related to this point, the range of potential chum salmon PSC limits under Alternative 3, Option 2 is the same as the range being considered for Alternative 2. The primary distinction between Alternative 3, Option 1 and the range of PSC limits for Alternative 2 is that a lower amount of 75,000 chum salmon is possible.

Considerations Related to Potential Avoidance Costs

The potential impacts of a chum salmon PSC limit under Alternative 3 would depend on the sector/vessel's perception of risk and the likelihood that they may reach their apportionment of a chum salmon PSC limit during the B season. For instance, a 75,000-chum salmon PSC limit evaluated for its potential to close a sector is assumed to be of greater risk as compared to a 100,000-chum salmon PSC limit. In this case, fishing behavior is likely to respond to that perception of risk, which may result in greater avoidance costs. These costs include such as decreased efficiency or product quality, potentially trade-off in other PSC species, as well as potentially forgone revenue if the sector is not successful in chum avoidance. These types of operational changes may also affect crew, CDQ groups through their quota as well as direct investments in AFA, shoreside processors and communities.

In addition to the expected impacts that align with Alternative 2, Alternative 3 includes the possibility of years without a chum salmon PSC limit if the abundance of WAK chum increases above thresholds established by the index. Section 3.2.4.2.4 describes the two options for establishing an index and the number of times that the thresholds would have been exceeded. **Therefore, under Alternative 3, some years may not result in economic impacts because there may be some years in which the chum salmon PSC limits would not be in place.**

Considerations Related to Potentially Forgone Revenue

Section 3.2.4.2.4 demonstrates a 75,000-chum salmon PSC limit would have been possible retrospectively in 2021, 2022, or 2023 if the PSC limit selected when one area fails to meet its threshold was set at 100,000 chum salmon for Alternative 3, Option 1. Table 4-23 extends the Alternative 2 analysis of potentially forgone revenue to a 75,000-chum salmon PSC limit in these years. As stated previously, these retrospective estimates are an upper bound in the analysis for potential forgone revenue at the sector-level, in that the fleet would be expected to change fishing behavior, to the extent they can, to respond to this risk of closure. In 2021, without additional changes in fishing behavior in an effort to avoid the consequences associated with meeting the limit, all sectors would have exceeded all apportionments of a 75,000-chum salmon PSC limit. In this year, CDQ, inshore, and mothership sectors would have left more than 60% of their B season pollock allocation unharvested, without additional changes in fishing. For the inshore sector this could represent up to $89 million in forgone gross ex vessel revenue. For the offshore sectors this could represent up to $46 million, $16 million, and $22 million in forgone gross first wholesale revenue for the CP, mothership and CDQ sectors respectively.

In 2022 and 2023, either due to heightened chum salmon avoidance, improved conditions relative to PSC encounters or both, the impact of this 75,000-chum salmon cap would have been less acute. For instance, in these years, the CDQ pollock may not have been forgone (up to 1% of the B season harvest under some apportionments). However, as previously described, the preseason risk of the PSC limit may motivate changes to fishing strategies. Companies leasing CDQ may consider the overall net returns on the pollock they are harvesting and may adjust their fishing plans accordingly. This is another reason that retrospective fishing patterns may not be fully predictive of the economic effects of future fishing under a chum salmon PSC limit. In addition, Table 4-23 demonstrates that the inshore and mothership sectors could still have a substantial percent of the B season pollock and associated revenues forgone. As described under Alternative 2, prior to any forgone revenue, this risk would be expected to motivate avoidance behavior. Chum avoidance may result in additional operational costs and PSC tradeoffs, as described above.

An early B season closure under Alternative 3 may result in broader implications for shoreside processors, communities, CDQ groups and associated communities, other fisheries, as well as markets and possibly consumers as with Alternative 2. **Similar to Alternative 2, it is expected the economic impacts of chum salmon PSC limits would be either neutral, (if a PSC limit is perceived as a low risk and does not change behavior) or more likely, generate a negative impact for pollock harvesters, processors, CDQ groups, and associated communities if a medium or high degree of risk if perceived and this changes operational patterns or closes the B season early for a sector.**

Table 4-23 Upper bound of pollock left unharvest and associated forgone gross revenue if a 75,000-chum salmon PSC limit had been in place 2021, 2022, and 2023

		Pollock forgone						Ex-vessel rev forgone (millions 2022$)			1st wholesale rev forgone (millions 2022$)		
		2021		2022		2023							
Sector	Apportionment	Mt	% of B season	Mt	% of B season	Mt	% of B season	2021	2022	2023	2021	2022	2023
CDQ	3-yr average	59,756	78%	579	1%		0%	$ 21.97	$ 0.26	$ -	$ 70.71	$ 0.81	$ -
	5-yr average	59,756	78%	579	1%		0%	$ 21.97	$ 0.26	$ -	$ 70.71	$ 0.81	$ -
	AFA	48,589	63%		0%		0%	$ 17.87	$ -	$ -	$ 57.52	$ -	$ -
	Pro-rata	59,756	78%	579	1%		0%	$ 21.97	$ 0.26	$ -	$ 70.71	$ 0.81	$ -
CP	3-yr average	125,523	47%	34,084	16%	26,751	11%	$ 46.45	$ 15.44	$ 9.86	$ 148.83	$ 47.58	$ 31.29
	5-yr average	125,523	47%	18,381	9%	13,570	5%	$ 46.45	$ 8.33	$ 5.00	$ 148.83	$ 25.68	$ 15.87
	AFA	125,523	47%	18,381	9%		0%	$ 46.45	$ 8.33	$ -	$ 148.83	$ 25.68	$ -
	Pro-rata	125,523	47%	18,381	9%	13,570	5%	$ 46.45	$ 8.33	$ 5.00	$ 148.83	$ 25.68	$ 15.87
Inshore	3-yr average	242,240	71%	78,690	30%	85,628	26%	$ 89.29	$ 35.95	$ 30.73	$ 251.14	$ 104.21	$ 105.04
	5-yr average	242,240	71%	78,690	30%	85,628	26%	$ 89.29	$ 35.95	$ 30.73	$ 251.14	$ 104.21	$ 105.04
	AFA	242,240	71%	104,821	40%	85,628	26%	$ 89.29	$ 47.78	$ 30.73	$ 251.14	$ 138.78	$ 105.04
	Pro-rata	242,240	71%	78,690	30%	85,628	26%	$ 89.29	$ 35.95	$ 30.73	$ 251.14	$ 104.21	$ 105.04
Mothership	3-yr average	43,980	66%	15,107	28%	33,315	53%	$ 16.27	$ 6.77	$ 12.32	$ 52.07	$ 20.93	$ 39.16
	5-yr average	43,980	66%	15,107	28%	33,315	53%	$ 16.27	$ 6.77	$ 12.32	$ 52.07	$ 20.93	$ 39.16
	AFA	43,980	66%	15,107	28%	33,315	53%	$ 16.27	$ 6.77	$ 12.32	$ 52.07	$ 20.93	$ 39.16
	Pro-rata	43,980	66%	15,107	28%	33,315	53%	$ 16.27	$ 6.77	$ 12.32	$ 52.07	$ 20.93	$ 39.16

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

4.2.3 Alternative 4

Alternative 4 would add six new provisions at 50 CFR 679.21(f)(12)(iii)(E) as described in Section 2.5. Alternative 4 would codify operational changes the fleet has adopted in recent years in response to Council requests and increased public attention, the expected impacts on costs or efficiencies that may have resulted from of these operational changes are primarily discussed under Alternative 1. As such, **it is likely Alternative 4 would have neutral or slightly increased effects on harvesters' operating costs, compared with status quo. As such, adoption of the IPA provisions under Alternative 4 are expected to incur the lowest cost to the fleet and pollock dependent communities, relative to the other proposed action alternatives.** While operating costs could increase slightly under Alternative 4, it is anticipated the magnitude of these changes would not be to a degree where the effects on a community could be measured.

4.2.4 Alternative 5

Alternative 5 would include an inseason corridor triggered by an area-specific cap. Three inseason corridors are being considered but only one could be selected for implementation. The cap would be apportioned among the sectors just as with Alternative 2 and 3. Chum salmon caught inside the corridor from June 10 to August 31 would count towards the cap. If the corridor closes, a sector may continue to fish outside of that area. After August 31, a sector closed out of pollock fishing in the corridor could fish inside it from September 1 to the end of the B season. The potential effects of inseason corridors on chum salmon and WAK chum salmon under **Alternative 5** are analyzed in depth under Section 3.2.4.4, this section focuses more specifically on the likelihood and magnitude of potential economic impacts that may result from these proposed area closures.

Because the actions would close areas but not directly curtail fishing seasons or catch limits, economic impacts are primarily viewed through the lens of **"revenue at risk"** as opposed to "forgone revenue". This is because the target species could theoretically be recovered elsewhere. **Revenue at risk refers to the gross revenues from pollock (and other marketable groundfish species caught concurrently) that were derived from fishing in the specified corridor area, after the point in the B season when the sector would have hypothetically been closed out of an area, based on retrospective data. Loss of that revenue and associated downstream economic benefits represents an unlikely maximum adverse impact from closed areas.** Fisheries would likely shift effort to other areas and in most cases, it would be expected that this catch would be made up in other areas and/or after the area reopens. An early B season closure of Cluster 1 or Unimak for the inshore or mothership sector are possible exceptions to this assumption.

However, this movement could come at some cost of efficiency, productivity, product quality, time, value of labor, and other opportunity costs. It is expected that a vessel's ability to relocate effort would be constrained by the presence of other fisheries already operating there, operational constraints for CVs that deliver shoreside, the presence of target catch in fishable aggregations, and the presence of other non-target species that must be minimized and to avoid triggering additional constraining regulations. **In general, when fishing effort moves because of regulation, the analysis assumes there is a cost associated with that movement because if that area was optimal or preferred, the fishery would already have been there.**

The sectors have different harvesting patterns in the B season and therefore have different dependency on the areas that may be closed under Alternative 5. Table 3-37 demonstrates the proportion of pollock that has historically been caught within the proposed closure area between 2011-2023. Table 4-24 through Table 4-28 below also indicates the number of years for which each sector would have been temporarily closed out of the area.

4.2.4.1 Economic Effects of a Time/Area Closure on the CP/CDQ Sectors

Cluster 1 and Unimak

As can be seen in Table 3-37 and Table 4-24, the CP fleet, including the CDQ harvest of pollock, has primary been caught outside of Cluster 1, with very little dependency on Unimak.

Some CDQ fishing on CP has occurred within the Unimak area in the past, although it typically represents a small percent of the total CP/CDQ harvest. Between 2011-2023, between 0.0% and 6.6% of the CP/ CDQ pollock was harvested in Unimak each year, expect for 2016 in which 13.7% was harvested in this area. CDQ pollock was caught in Unimak in 8 of the 12 years evaluated in Table 4-24; however, generally CDQ would not have been closed out of this area. Even at a cap of 50,000 chum salmon cap between 2011-2022, the CDQ apportionment of the cap would have only triggered a closure in 2 of the 8 years. This is also notable given 3 of 4 apportionments are based on historical chum bycatch in the area. However, if a Unimak corridor is established, with PSC apportionments based on historical bycatch, this may impact the flexibility for how CDQ pollock could be harvested in the future.

Unimak is fully encompassed within the CVOA and Cluster 1. CPs cannot harvest their pollock allocation inside Unimak because of the limitations placed on CPs by the CVOA. There are a small number of statistical areas where both AFA and CDQ pollock can be harvested by CPs in Cluster 1.

Between 2011 and 2013, between 0.01%-10.8% of the CP/CDQ pollock was harvested in Cluster 1 each year, with 2016 again being an anomaly of 35.6% of the harvest. The limited fishing history and similarly low historical PSC in this area drives low apportionments for the sector. For instance, for the CP sector applying a 50,000-chum salmon cap and a 3 or 5-yr avg apportionment in Cluster 1, they would have been closed out of Cluster 1 in 6 of the 11 years, versus only 1 of the 11 years if they received an AFA or pro rata apportionment. Therefore, because of this limited fishing history, if they chose to fish in this area there could be a high risk of a closure under a cap that uses a 3-year or 5-year average for the apportionment.

However, given the limited effort from these sectors in Cluster 1 and especially Unimak, temporary closures may not represent as great of a consequence for these sectors and may not alter overall fishing patterns because these sectors typically already catch the majority of their pollock outside these areas. Moreover, although the risk can be high depending on the apportionment chosen, compared to the inshore sector that could have more difficulty harvesting its pollock apportionment under a Cluster 1 closure, the CP/ CDQ fleet may not have as strong of an incentive to change fishing behavior prior to reaching a limit. If they were closed out early, CPs would likely travel northwest earlier than they would have otherwise, but they would likely move this direction regardless. **Overall, this means establishing a Cluster 1 or Unimak time/area closure would likely produce minimal changes in CP/CDQ fishing and thus minimal costs to this sector.**

Cluster 2

The CP/ CDQ pollock dependency on Cluster 2 is more variable; between 4.0%-48.7% of total B season CP/CDQ pollock was harvested from this area between 2011-2023. Table 4-24 and Table 4-25 below demonstrate that these sectors may have been closed out of this area in the past, had they not changed fishing patterns. CDQ could have been closed 1-4 of the years (of the 11 years CDQ was caught in Cluster 2) under a 100,000-chum cap or 2-4 of the years under a 50,000-chum cap. The CP sector could have been closed 3-5 of the years (of the 12 years) under a 100,000-chum cap or 6 of the years under a 50,000-chum cap. Again, the degree to which a sector would be incentivized to modify its fishing behavior to avoid reaching its apportionment of the area-specific cap depends on the sector's historical reliance on the area, the cap amount, and the apportionment approach used. **For both CP and CDQ, the AFA apportionment would be expected to generate the least adverse impacts and an apportionment**

based on fishing history (3-year average for CDQ and 5-year average for CP) would generate the greatest adverse impact.

If the CP/CDQ vessels are required to move away from Cluster 2, when they otherwise would have continued to fish in this area, there may be a cost associated with this displaced effort. Similar to the avoidance costs detailed in Section 4.2.2.1.1, this could include decreased operational efficiency, such as additional travel time where the vessel may not have been fishing. It may require them to move out of areas with good pollock aggregation and quality into suboptimal fishing areas. Moreover, these operational constraints will be balanced in addition to the existing area closures and PSC species constraints under which the vessels are operating. Given the variability in harvest in Cluster 2, the impacts to the CP/CDQ carries more uncertainty because they are likely most dependent on conditions of that particular year (pollock aggregation, herring and salmon PSC rates). However, this area is within the corridor of the CPs typical fishing patterns, and therefore it is expected there would be some degree of adverse impact associated with its closure.

Between June - Aug when the CP fleet is not fishing in Cluster 2, they are typically fishing northwest along the shelf edge. Therefore, if the CP/ CDQ vessels were temporarily closed out of Cluster 2, they would be expected to continue fishing northwest. It is possible that they would return to fish in Cluster 2 after the area closure was lifted (i.e., on September 1).

Table 4-24 CDQ pollock forgone and gross ‘revenue at risk’ under the corridor area closures in Alternative 5, 2011- 2023

CDQ Sector			Number of years -		Pollock harvest displaced (mt)				Ex-vessel rev 'at risk' (millions 2022$)				1st wholesale rev 'at risk' (millions 2022$)			
Closure area	PSC limit	Apportionment	Fished in this area	Closure triggered	Min	Median	Avg	Max	Min	Median	Avg	Max	Min	Median	Avg	Max
Cluster 1	200,000	3-yr average	10	2	0	0	1,112	11,123	$ -	$ -	$ 0.4	$ 3.9	$ -	$ -	$ 1.4	$ 14.4
		5-yr average	10	2	0	0	1,112	11,123	$ -	$ -	$ 0.4	$ 3.9	$ -	$ -	$ 1.4	$ 14.4
		AFA	10	2	0	0	1,112	11,123	$ -	$ -	$ 0.4	$ 3.9	$ -	$ -	$ 1.4	$ 14.4
		Pro-rata	10	2	0	0	1,112	11,123	$ -	$ -	$ 0.4	$ 3.9	$ -	$ -	$ 1.4	$ 14.4
	50,000	3-yr average	10	4	0	0	2,826	14,294	$ -	$ -	$ 1.0	$ 5.1	$ -	$ -	$ 3.6	$ 18.4
		5-yr average	10	4	0	0	3,859	14,294	$ -	$ -	$ 1.4	$ 5.1	$ -	$ -	$ 4.9	$ 18.4
		AFA	10	4	0	0	6,037	35,755	$ -	$ -	$ 2.2	$ 13.1	$ -	$ -	$ 7.6	$ 45.8
		Pro-rata	10	4	0	0	2,826	14,294	$ -	$ -	$ 1.0	$ 5.1	$ -	$ -	$ 3.6	$ 18.4
Unimak	200,000	3-yr average	9	1	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		5-yr average	9	1	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		AFA	9	1	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		Pro-rata	9	1	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	50,000	3-yr average	9	2	0	0	602	4,817	$ -	$ -	$ 0.2	$ 1.7	$ -	$ -	$ 0.8	$ 6.2
		5-yr average	9	2	0	0	602	4,817	$ -	$ -	$ 0.2	$ 1.7	$ -	$ -	$ 0.8	$ 6.2
		AFA	9	2	0	0	1,093	8,744	$ -	$ -	$ 0.4	$ 3.2	$ -	$ -	$ 1.4	$ 11.2
		Pro-rata	9	2	0	0	602	4,817	$ -	$ -	$ 0.2	$ 1.7	$ -	$ -	$ 0.8	$ 6.2
Cluster 2	100,000	3-yr average	12	4	0	0	2,493	18,984	$ -	$ -	$ 1.0	$ 7.1	$ -	$ -	$ 3.2	$ 24.5
		5-yr average	12	3	0	0	2,053	18,984	$ -	$ -	$ 0.8	$ 7.1	$ -	$ -	$ 2.6	$ 24.5
		AFA	12	1	0	0	1,582	18,984	$ -	$ -	$ 0.6	$ 7.1	$ -	$ -	$ 2.0	$ 24.5
		Pro-rata	12	2	0	0	1,870	18,984	$ -	$ -	$ 0.7	$ 7.1	$ -	$ -	$ 2.4	$ 24.5
	50,000	3-yr average	12	4	0	0	3,280	27,405	$ -	$ -	$ 1.3	$ 10.2	$ -	$ -	$ 4.2	$ 35.3
		5-yr average	12	4	0	0	2,493	18,984	$ -	$ -	$ 1.0	$ 7.1	$ -	$ -	$ 3.2	$ 24.5
		AFA	12	2	0	0	1,615	18,984	$ -	$ -	$ 0.6	$ 7.1	$ -	$ -	$ 2.1	$ 24.5
		Pro-rata	12	3	0	0	2,053	18,984	$ -	$ -	$ 0.8	$ 7.1	$ -	$ -	$ 2.6	$ 24.5

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

Table 4-25 CP pollock forgone and gross ‘revenue at risk’ under the corridor area closures in Alternative 5, 2011- 2023

CP Sector			Number of years -		Pollock harvest displaced (mt)				Ex-vessel rev 'at risk' (millions 2022$)				1st wholesale rev 'at risk' (millions 2022$)			
Closure area	PSC limit	Apportionment	Fished in this area	Closure triggered	Min	Median	Avg	Max	Min	Median	Avg	Max	Min	Median	Avg	Max
Cluster 1	200,000	3-yr average	12	5	0	0	5,667	57,420	$ -	$ -	$ 2.1	$ 21.0	$ -	$ -	$ 7.3	$ 73.6
		5-yr average	12	3	0	0	3,283	35,686	$ -	$ -	$ 1.2	$ 13.0	$ -	$ -	$ 4.2	$ 45.8
		AFA	12	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		Pro-rata	12	1	0	0	16	178	$ -	$ -	$ 0.0	$ 0.1	$ -	$ -	$ 0.0	$ 0.2
	50,000	3-yr average	12	6	0	80	6,244	57,420	$ -	$ 0.0	$ 2.3	$ 21.0	$ -	$ 0.1	$ 8.1	$ 73.6
		5-yr average	12	6	0	0	5,667	57,420	$ -	$ -	$ 2.1	$ 21.0	$ -	$ -	$ 7.3	$ 73.6
		AFA	12	1	0	0	16	178	$ -	$ -	$ 0.0	$ 0.1	$ -	$ -	$ 0.0	$ 0.2
		Pro-rata	12	1	0	0	3,244	35,686	$ -	$ -	$ 1.2	$ 13.0	$ -	$ -	$ 4.2	$ 45.8
Unimak	200,000	3-yr average	0	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		5-yr average	0	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		AFA	0	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		Pro-rata	0	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	50,000	3-yr average	0	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		5-yr average	0	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		AFA	0	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		Pro-rata	0	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cluster 2	100,000	3-yr average	13	5	0	0	7,052	64,431	$ -	$ -	$ 2.7	$ 24.3	$ -	$ -	$ 9.1	$ 83.5
		5-yr average	13	4	0	0	6,908	64,431	$ -	$ -	$ 2.6	$ 24.3	$ -	$ -	$ 8.9	$ 83.5
		AFA	13	3	0	0	6,501	64,431	$ -	$ -	$ 2.5	$ 24.3	$ -	$ -	$ 8.4	$ 83.5
		Pro-rata	13	4	0	0	7,052	64,431	$ -	$ -	$ 2.7	$ 24.3	$ -	$ -	$ 9.1	$ 83.5
	50,000	3-yr average	13	6	0	0	11,923	77,471	$ -	$ -	$ 4.6	$ 29.1	$ -	$ -	$ 15.3	$ 100.3
		5-yr average	13	6	0	0	10,431	77,471	$ -	$ -	$ 4.0	$ 29.1	$ -	$ -	$ 13.4	$ 100.3
		AFA	13	6	0	0	8,055	77,471	$ -	$ -	$ 3.1	$ 29.1	$ -	$ -	$ 10.3	$ 100.3
		Pro-rata	13	6	0	0	11,026	77,471	$ -	$ -	$ 4.2	$ 29.1	$ -	$ -	$ 14.2	$ 100.3

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

4.2.4.2 Economic Effects of a Time/Area Closure on the Inshore Sector

Cluster 1 and Unimak

Relative to other sectors, the inshore sector would likely be most impacted if they were to experience a Cluster 1 or Unimak closure in the future. These corridor areas are nearest to port and these vessels are inherently constrained by the distance they can travel from port, with an industry standard of delivering pollock within 48 hours of catching it.

Cluster 1 covers a broad area that this sector has historically fished. Between 2011 and 2023, a range of 34.6%-85.5% of this sector's total B season pollock was harvested in Unimak. Within this timeframe between 42.0%-98.3% of its total B season pollock was harvested in Cluster 1. Therefore, while there is variability in annual harvest patterns, there can be heavy reliance on these areas. Because reliance is not necessarily just dictated by strong pollock aggregation but also vessel capacity and processor's delivery requirements, it is expected these areas will continue to be important to this sector in the long-term. **The inshore fleet's heavy reliance on Cluster 1 and Unimak during the B season historically suggests a high degree of consequence for the sector if a closure were to occur in this area in the future.**

The potential for adverse impacts to the inshore sector from a Cluster 1 or Unimak time/area closure is highly dependent on the cap level chosen. For the inshore sector, a 200,000-chum salmon cap in Cluster 1 would not have closed the sector out of this area often (0-1 years out of 13 years, unless using an AFA apportionment). However, a cap at 50,000 chum salmon could have resulted in 10 years of 13 with time/area closures being triggered if the fleet did not change their fishing behavior prior to the closure. Similarly, the inshore fleet would not have closed out of Unimak at a 200,000 cap, unless the AFA apportionment was chosen, but could have had a time/area closure in 9-10 of the 13 years in Unimak if a 50,000-chum cap was chosen.

Similar to the expectations under Alt 2 and 3, the analysts assume that since the inshore fleet frequently has high dependency on Cluster 1 and Unimak (and therefore higher consequence of a closure), the sector would work to avoid the area closure if reaching the cap was perceived to be a risk. Therefore, changes in fishing behavior and associated avoidance costs may occur prior to the cap being met to avoid getting closed out of the area. There is diversity in the size, capacity and horsepower of vessels within the inshore CV sector and cooperative managers may choose to be strategic in directing vessels based on their abilities. For instance, this may include encouraging more catch outside the corridor area from the larger vessels prior to any cap being met, as chum salmon PSC from outside the corridor area would not count towards the cap. These changes in behavior could result in avoidance costs, including many similar types of costs described in Section 4.2.2.2.1. This includes the potential for increased fuel needed to harvest their pollock, diminished product quality due to longer running time, opportunity cost of time while traveling, and generally slower, less efficient operations. **The likelihood of these types of costs being incurred and the magnitude of these potential costs are highly dependent on future fishing conditions, in addition to the limit and apportionment chosen.**

If Cluster 1 or Unimak were to close for the inshore sector, vessels would need to travel outside of these areas in order to continue fishing. Effort would also continue to be constrained by other existing area closures. For example, there is no opportunity for any pollock sector to fish farther east due to the Nearshore Bristol Bay Trawl Closure or directly around the Pribilof Islands which are encompassed in the Pribilof Islands Habitat Conservation Zone. The fleet would not fish directly west, beyond the "shelf edge" where there is a break in the continental shelf. Therefore, if there was a closure of Cluster 1 it is expected the inshore CVs would fish varying distances northwest of Cluster 1, including Cluster 2. If the inshore sector was to be closed out of Unimak, is it expected that they would move to other parts of Cluster 1 outside of Unimak or further northwest.

While the relative intensity of fishing beyond these corridor areas would likely increase with an area closure, the total radius under which the fleet can travel would be expected to remain about the same as these vessels would still need to return to port for processing. Some of the larger inshore CV have routinely fished further northwest of the Pribilof Islands and even beyond Zhemchug Canyon and may respond to an area closure by fishing these areas more intensely. However, smaller inshore CVs, with lower capacity may be more challenged in where they can fish.

In order to reach the outside of Cluster 1, vessels would need to travel approximately 80 nautical miles from Dutch Harbor and approximately 86 nautical miles from Akutan (Figure 4-13). Therefore, fishing would need to take place somewhere beyond this point. Based on historical fishing patterns, all vessels with a length overall (LOA) greater than 120ft have traveled at least 267 miles to make a delivery, while no vessels under 100 ft LOA have made a delivery with a greater distance than 279 miles. From Dutch Harbor and Akutan, 250 miles would mean vessel may not travel further than about the southern end of St George Island or directly east of St Paul Island. Table 4-26 shows the maximum distances vessels have traveled from 2019 to 2023 to make deliveries grouped by vessel length. This represents the range of maximum distances vessels in the length groups have traveled to make a landing.

This vessel-level boundary could be due to a number of reasons, including safety concerns. It may also be due to the need to balance the fuel cost with the potential revenue a vessel may earn given its hold capacity. Depending on the length of a Cluster 1 or Unimak closure, and the future distribution of pollock aggregations in the Bering Sea, it is conceivable that there could be consolidation among some inshore cooperatives, with more pollock quota harvested on larger CVs that have the economies of scale to balance the additional costs of traveling further.

Table 4-26 CV length and maximum distances traveled from port

Vessel Length	2023 Vessels	Min. Maximum Distance by Vessel	Max. Maximum Distance by Vessel
80-90	4	159	255
90-100	13	136	279
100-110	3	197	503
110-120	7	197	512
>120	42	267	537

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

In 2023, 69 CVs delivered shoreside, of those vessels, 42 had over 120 ft LOA. Those vessels typically have a hold capacity over 10,000 cubic feet with 6 of those vessels identified to have a hold capacity of less than 10,000 cubic feet. A vessel with a hold capacity of 10,000 cubic feet could delivery approximately 250 tons of pollock.

While this discussion highlights possible constraints from vessel capacity and movement beyond Cluster 1 and Unimak, it is important to note that vessel captains typically do not make trips of greater distances without knowing higher pollock catches (or catch rates) can be found by traveling those greater distances. There is of course no guarantee that higher pollock catch rates could be realized outside these areas. If equally good fishing cannot be found outside of these closures during the period, vessels may return to port without full loads or standdown to wait for the area to reopen.

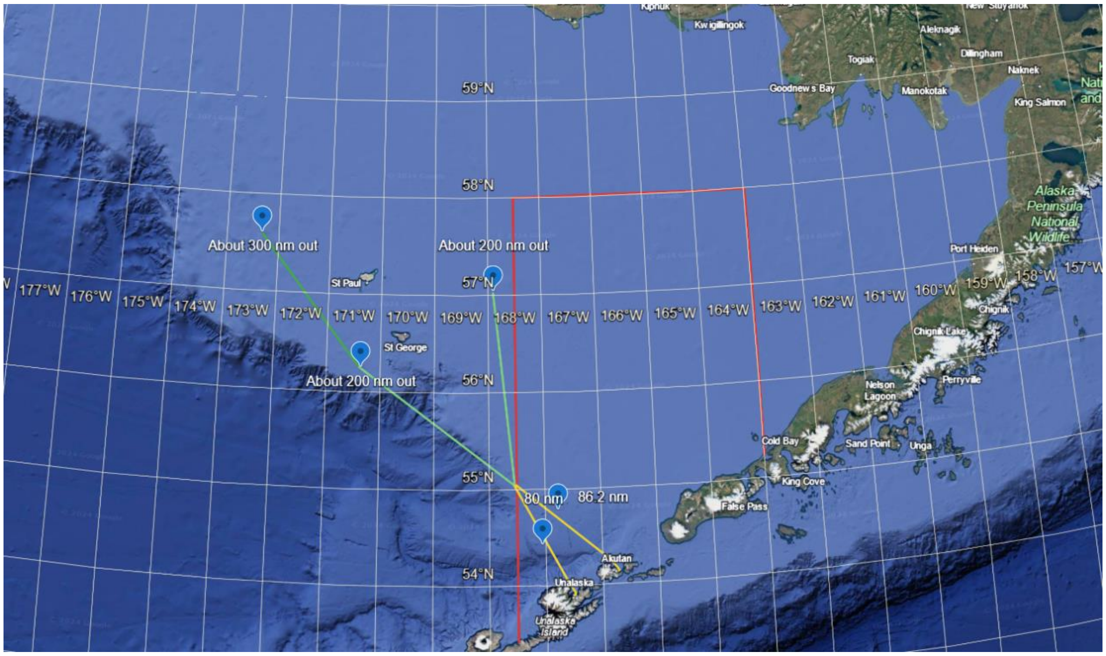

Figure 4-13 Distances from Dutch Harbor and Akutan outside of Cluster 1

A Cluster 1 or Unimak area closure may also result in additional adverse economic impacts for shoreside processors. Vessels in a cooperative stagger their deliveries, so a plant has a consistent flow of fish moving through at any given point in time. The pace of these deliveries is coordinated for efficient and cost-effective plant operations. All vessels would need to travel outside the closed corridor to harvest pollock, and this additional travel time between deliveries could result in interrupted and inefficient processing. Additionally depending on when in the B season a Cluster 1 or Unimak closure took place, it may stretch the season longer than it would have lasted otherwise, which could increase the variable costs of operation, and potentially result in PSC tradeoffs with Chinook later in the season. The overall impacts would be expected to be reduced the closer a closure was to August 31.

Given the inshore sector's heavy historical reliance on Cluster 1 and Unimak, in addition to the operational constraints of the inshore fleet, it is not clear whether the inshore sector would be able to make up all the harvest from Cluster 1 or Unimak outside these areas. This would depend on many factors, including the point in the B season when the closure occurred and how much of the pollock TAC was still unharvested. **Compared to time/area closures considered under Alternative 5, in which analysts generally assume effort would shift and pollock TAC would be harvested elsewhere, an early B season closure of Cluster 1 (or possibly Unimak) by the inshore sector appears to present the greatest risk of leaving pollock unharvested.**

If pollock TAC was left unharvested, adverse impacts from a Unimak or Cluster 1 closure could occur, as demonstrated with the 'revenue at risk' in Table 4-27. As previously stated, the analysts do expect that the inshore fleet would respond to a potential time/area closure prior to hitting the cap, and also seek to redistribute effort in the event of a closure; therefore, these values represent an upper bound from previous years. This table demonstrates that, between 2011- 2022, without additional adjustments to fishing prior to a closure or redistributed effort during a closure, the inshore fleet would have seen its greatest 'revenue at risk' for both a Unimak or Cluster 1 closure in 2019. This could have represented a total gross ex vessel revenue reduction of a maximum of $79 million for a Unimak closure or $80 million for a Cluster 1 closure. These maximum 'revenue at risk' values represented 61% of the total B season pollock ex vessel value as generated from Unimak in 2019 and 63% of the total B season pollock ex vessel value as generated from Cluster 1 in 2019.

Cluster 2

The inshore sector has had variable activity in Cluster 2, ranging from 3.3%-8.5% of its total B season pollock harvested in this area between 2019-2023. The inshore fleet demonstrated effort in Cluster 2 in all 12 years, therefore it is likely a valuable flexibility for some vessels in this sector.

If the inshore fleet was displaced from Cluster 2 between June and Aug, most of the fleet would likely shift more effort into Unimak/ Cluster 1 area, which is where most of the inshore fishing occurs outside of Cluster 2. Some of the larger/ more powerful vessels may choose to fish northwest above Cluster 2. The additional run time could result in additional fuel costs and potentially a reduction in product quality for these vessels.

Table 4-27 Inshore pollock forgone and gross 'revenue at risk' under the corridor area closures in Alternative 5, 2011- 2023

Inshore Sector			Number of years -		Pollock harvest displaced (mt)				Ex-vessel rev 'at risk' (millions 2022$)				1st wholesale rev 'at risk' (millions 2022$)			
Closure area	PSC limit	Apportionment	Fished in this area	Closure triggered	Min	Median	Avg	Max	Min	Median	Avg	Max	Min	Median	Avg	Max
Cluster 1	200,000	3-yr average	13	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		5-yr average	13	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		AFA	13	5	0	0	22,871	107,342	$ -	$ -	$ 8.6	$ 38.4	$ -	$ -	$ 24.5	$ 110.3
		Pro-rata	13	1	0	0	7,394	88,730	$ -	$ -	$ 2.7	$ 32.8	$ -	$ -	$ 7.7	$ 92.0
	50,000	3-yr average	13	11	0	56,699	77,800	202,785	$ -	$ 25.6	$ 29.9	$ 75.3	$ -	$ 78.5	$ 88.9	$ 240.7
		5-yr average	13	11	0	50,933	77,357	202,785	$ -	$ 23.1	$ 29.7	$ 75.3	$ -	$ 70.1	$ 88.3	$ 240.7
		AFA	13	11	0	77,725	93,803	217,504	$ -	$ 34.9	$ 36.2	$ 80.4	$ -	$ 107.4	$ 107.7	$ 258.4
		Pro-rata	13	11	0	56,699	83,079	202,785	$ -	$ 25.6	$ 32.0	$ 75.3	$ -	$ 78.5	$ 95.1	$ 240.7
Unimak	200,000	3-yr average	13	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		5-yr average	13	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		AFA	13	3	0	0	11,287	96,537	$ -	$ -	$ 4.4	$ 35.6	$ -	$ -	$ 12.2	$ 100.2
		Pro-rata	13	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	50,000	3-yr average	13	10	0	42,602	67,103	198,221	$ -	$ 18.3	$ 24.0	$ 73.6	$ -	$ 54.5	$ 77.2	$ 235.3
		5-yr average	13	10	0	42,602	64,789	198,221	$ -	$ 18.3	$ 23.1	$ 73.6	$ -	$ 54.5	$ 74.5	$ 235.3
		AFA	13	11	0	71,232	87,926	212,677	$ -	$ 29.5	$ 31.6	$ 78.6	$ -	$ 96.4	$ 101.9	$ 252.6
		Pro-rata	13	10	0	44,975	72,933	198,221	$ -	$ 18.5	$ 26.0	$ 73.6	$ -	$ 58.7	$ 83.8	$ 235.3
Cluster 2	100,000	3-yr average	13	1	0	0	728	9,459	$ -	$ -	$ 0.3	$ 3.5	$ -	$ -	$ 0.7	$ 9.7
		5-yr average	13	2	0	0	728	9,459	$ -	$ -	$ 0.3	$ 3.5	$ -	$ -	$ 0.7	$ 9.7
		AFA	13	3	0	0	1,056	9,459	$ -	$ -	$ 0.4	$ 3.5	$ -	$ -	$ 1.1	$ 9.7
		Pro-rata	13	2	0	0	728	9,459	$ -	$ -	$ 0.3	$ 3.5	$ -	$ -	$ 0.7	$ 9.7
	50,000	3-yr average	13	3	0	0	1,878	9,801	$ -	$ -	$ 0.7	$ 4.0	$ -	$ -	$ 2.1	$ 11.1
		5-yr average	13	5	0	0	1,889	9,801	$ -	$ -	$ 0.7	$ 4.0	$ -	$ -	$ 2.1	$ 11.1
		AFA	13	5	0	0	3,252	18,029	$ -	$ -	$ 1.3	$ 7.2	$ -	$ -	$ 3.6	$ 20.3
		Pro-rata	13	5	0	0	2,008	9,801	$ -	$ -	$ 0.8	$ 4.0	$ -	$ -	$ 2.2	$ 11.1

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

4.2.4.3 Economic Effects of a Time/Area Closure on the Mothership Sector

Cluster 1 and Unimak

The mothership sector has substantial variation in its annual dependency on Cluster 1 and Unimak pollock fishing in the B season. This fleet has harvested between 11.6% to 90.0% of its B season pollock in Cluster 1 and 8.0% to 61% in Unimak, 2011-2023. The mothership trends somewhat align with the inshore sector trends for Cluster 1 and Unimak. However, since the mothership fleet does not need to return to port to have its pollock processed, the mothership fleet has much more flexibility in movement. Given the variability, the impacts to the mothership fleet carries more uncertainty because they are likely most dependent on conditions of that particular year (pollock aggregation, herring and salmon PSC rates).

Similar to the inshore sector, with a Cluster 1 or Unimak time/area closure the potential for adverse impacts to the mothership sector is highly dependent on the cap level chosen. Although the mothership sector had activity in both areas in all 12 years, with a 200,000-chum salmon cap, the mothership sector would not have triggered the time/area closure in Unimak under any apportionment and only in 2 of the years under a Cluster 1 time/area closure. However, if the mothership sector was apportioned a percent of a 50,000-chum cap for either area between 2011 - 2022, both areas would have had the closure triggered in 6 of the 12 years. This could have resulted in reduced operational flexibly, reduced efficiency and other avoidance cost both prior to and if a closure was triggered. Similar to other sectors, the mothership fleet would be experiencing these costs and reduced flexibility, while also working to balance other operational priorities (e.g., seeking out larger aggregations of pollock and minimizing other PSC species). **The mothership sector impacts appear to be less sensitive than other sectors to the apportionment options across all potential area closures.**

If Cluster 1 or Unimak was closed to the mothership sector, given the same spatial constraints highlighted for the inshore fleet, the mothership vessels would likely travel northwest. It is unclear whether they would travel just outside of Cluster 1 or Unimak or if they would move further north above the Pribilof Islands.

Cluster 2

While the mothership sector has been active in Cluster 2 in all of the 12 years analyzed (2011-2023) and has caught 1.9%-18.0% of its B season pollock in this area between 2019-2023, the time/area closures considered would not have been triggered for this sector in most of the years. Based on past fishery performance, the closure would have been triggered 1 year under a 100,000-chum salmon cap and 2 of the years under a 50,000-chum salmon cap. **Therefore, based on past fishing patterns, it is expected that a Cluster 2 time/area closure would produce minimal changes in mothership fishing and thus minimal costs to the fleet.** If Cluster 2 was closed to the mothership sector, it is difficult to say where they would redistribute effort. In the weeks during June – August when effort is occurring outside these areas, this effort has occurred both close to Unimak as well as further northwest of Cluster 2.

Table 4-28 Mothership pollock forgone and gross ‘revenue at risk’ under the corridor area closures in Alternative 5, 2011- 2023

Mothership Sector			Number of years -		Pollock harvest displaced (mt)				Ex-vessel rev 'at risk' (millions 2022$)				1st wholesale rev 'at risk' (millions 2022$)			
Closure area	PSC limit	Apportionment	Fished in this area	Closure triggered	Min	Median	Avg	Max	Min	Median	Avg	Max	Min	Median	Avg	Max
Cluster 1	200,000	3-yr average	13	2	0	0	1,213	14,964	$ -	$ -	$ 0.4	$ 5.5	$ -	$ -	$ 1.6	$ 19.1
		5-yr average	13	2	0	0	1,213	14,964	$ -	$ -	$ 0.4	$ 5.5	$ -	$ -	$ 1.6	$ 19.1
		AFA	13	2	0	0	1,213	14,964	$ -	$ -	$ 0.4	$ 5.5	$ -	$ -	$ 1.6	$ 19.1
		Pro-rata	13	2	0	0	1,213	14,964	$ -	$ -	$ 0.4	$ 5.5	$ -	$ -	$ 1.6	$ 19.1
	50,000	3-yr average	13	6	0	0	7,391	31,271	$ -	$ -	$ 2.8	$ 11.7	$ -	$ -	$ 9.4	$ 37.1
		5-yr average	13	6	0	0	8,335	35,791	$ -	$ -	$ 3.1	$ 13.4	$ -	$ -	$ 10.6	$ 42.4
		AFA	13	6	0	0	7,923	35,791	$ -	$ -	$ 3.0	$ 13.4	$ -	$ -	$ 10.1	$ 42.4
		Pro-rata	13	6	0	0	7,391	31,271	$ -	$ -	$ 2.8	$ 11.7	$ -	$ -	$ 9.4	$ 37.1
Unimak	200,000	3-yr average	13	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		5-yr average	13	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		AFA	13	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		Pro-rata	13	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	50,000	3-yr average	13	6	0	875	7,401	33,263	$ -	$ -	$ 2.5	$ 12.4	$ -	$ -	$ 8.6	$ 39.4
		5-yr average	13	7	0	875	7,412	33,263	$ -	$ -	$ 2.6	$ 12.4	$ -	$ -	$ 8.7	$ 39.4
		AFA	13	6	0	875	6,764	33,263	$ -	$ -	$ 2.3	$ 12.4	$ -	$ -	$ 7.9	$ 39.4
		Pro-rata	13	6	0	875	7,401	33,263	$ -	$ -	$ 2.5	$ 12.4	$ -	$ -	$ 8.6	$ 39.4
Cluster 2	100,000	3-yr average	13	1	0	0	75	973	$ -	$ -	$ 0.0	$ 0.4	$ -	$ -	$ 0.1	$ 1.2
		5-yr average	13	1	0	0	75	973	$ -	$ -	$ 0.0	$ 0.4	$ -	$ -	$ 0.1	$ 1.2
		AFA	13	1	0	0	75	973	$ -	$ -	$ 0.0	$ 0.4	$ -	$ -	$ 0.1	$ 1.2
		Pro-rata	13	1	0	0	75	973	$ -	$ -	$ 0.0	$ 0.4	$ -	$ -	$ 0.1	$ 1.2
	50,000	3-yr average	13	2	0	0	88	973	$ -	$ -	$ 0.0	$ 0.4	$ -	$ -	$ 0.1	$ 1.2
		5-yr average	13	2	0	0	88	973	$ -	$ -	$ 0.0	$ 0.4	$ -	$ -	$ 0.1	$ 1.2
		AFA	13	2	0	0	88	973	$ -	$ -	$ 0.0	$ 0.4	$ -	$ -	$ 0.1	$ 1.2
		Pro-rata	13	2	0	0	88	973	$ -	$ -	$ 0.0	$ 0.4	$ -	$ -	$ 0.1	$ 1.2

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

4.2.4.4 Effects of Alternative 5 on Communities

This portion of the analysis addresses the potential impacts to communities engaged in or dependent on B season pollock (including CDQ communities) from the inseason corridors being considered under Alternative 5. The subset of communities as well as the nature (or type) of social and economic impacts that could be realized at the community-level are similar to those identified and evaluated under Alternative 2 and 3. As such, the analysis here is streamlined for the reader to focus on the likelihood that the different corridor options, cap amounts, and apportionments would affect communities through their connection to one or more pollock sectors.

The relative impacts of a corridor closure on a community would depend on the number of sectors that are tied to the community (i.e., degree of exposure), the historical reliance of those sectors on the corridor for their pollock catch, the ability of vessels to modify their fishing behavior, as well as the cap amount and the apportionment. The potential for adverse effects would diminish closer to August 31 because a sector would be required to implement adaptive fishing strategies for a lesser amount of time.

Inshore Sector

Newport, Kodiak, Seattle MSA, Akutan, King Cove, and Unalaska are communities affiliated with the inshore sector either by vessel's registered ownership or as the location of a shore-based processing facility that accepted deliveries of B season pollock. Similar to Alternatives 2 and 3, the analysis does not anticipate Alternative 5 would have adverse effects on the community of King Cove unless the processor and cooperative returned to the community.

The retrospective analysis prepared for Alternative 5 indicates the greatest potential for adverse effects on the inshore sector would result from triggered closures in Cluster 1 at the lowest cap amount of 50,000 chum salmon followed by Unimak at the same amount. The largest costs, in terms of revenue at risk, would accrue from a cap of 50,000 chum salmon in Cluster 1 apportioned by the AFA approach. The inshore sector had variable activity in Cluster 2. If Cluster 2 closed during a B season and the inshore fleet was displaced for some amount of time between June 10 and August 31, it is expected the majority of effort would shift towards (or remain in) the Cluster 1 and Unimak areas. Some vessels with greater capacity may fish further northwest above Cluster 2. The additional run time could result in additional fuel costs to the vessel and potentially a reduction in product quality, the latter of which could affect either Akutan or Unalaska through reduced fishery-related tax revenues.

As noted above, if vessels and cooperative managers perceive there is a risk of reaching the area- specific cap, it is expected the CV fleet would slow the pace of fishing trips and deliveries. This strategy would allow cooperative managers to account for the delay in observer data from the plant where the census count of salmon is completed. However, slower deliveries would reduce the efficiency of a plant, potentially resulting in processing stand-downs, which may prove too costly for a processor to withstand over many weeks in a B season or even year-to-year. Akutan and Unalaska would be adversely affected in these scenarios as would the processing labor forces at the plants that may experience temporary loss of pay or job losses if the facility could not maintain its operations.

Seattle MSA, Kodiak, and Newport are affiliated with the inshore sector, but it is challenging to discern the degree to which these communities may be adversely affected by a corridor closure under Alternative 5. For instance, while the majority of CV ownership is concentrated in Seattle MSA, this is a large urban center and the community itself would is not likely to experience adverse effects. That being said, it is expected that all three of these communities could be adversely affected to varying degrees by a corridor closure early in the season (e.g., July 1), and vessels were unable to continue fishing outside of the closed area due to their capacity or because it would be unprofitable for them to do so. This scenario would likely disrupt the business plans of these vessels, some of which do not have other fisheries to turn to in the summer months (see Section 4.2.2.2.2.3).

CP/CDQ

Compared with inshore CVs, CPs and motherships have more operational flexibility to move to new fishing grounds with lower bycatch rates if a corridor under Alternative 5 is closed. The retrospective analysis shows CPs have fished inside Cluster 1 and Cluster 2 in all analyzed years, but a greater proportion of their pollock harvest has been taken in Cluster 2. It is not expected the CP sector would be adversely impacted by a Unimak closure because they are restricted from fishing AFA pollock inside the CVOA during the B season, and the Unimak corridor is fully encompassed within the CVOA. Although CPs are allowed to harvest CDQ pollock inside the CVOA and thus the Unimak area, the CDQ pollock that has been taken inside Unimak represents a relatively small proportion of CP/CDQ harvest.

The CP sector is more likely to experience adverse economic effects from a Cluster 2 closure, and the greatest potential for adverse effects would result from a cap of 50,000 apportioned by either the 3- or 5-year average approaches. However, it is not anticipated that a Cluster 2 closure would have adverse effects on Seattle MSA and Unalaska because it would not directly curtail the B season. A Cluster 2 closure might move CPs out of an area with good pollock aggregation and quality to suboptimal fishing areas, but these vessels have the operational flexibility and capacity to travel further northwest. As such, the target species could be recovered elsewhere such that the communities affiliated with CPs would not be impacted.

Mothership

Seattle MSA and Unalaska are affiliated with the mothership sector, similar to the CP fleet. Similar to the CP sector, it is not anticipated the communities affiliated with the mothership sector would be adversely affected by a corridor closure under Alternative 5The mothership sector has historically fished in all three corridors being considered, but there is substantial variation in the degree to which it relies on Cluster 1 or Unimak. The potential for adverse effects on the mothership sector is greater under the lowest cap amount of 50,000 chum salmon in Cluster 1 or Unimak but the apportionment method is less of a determinant for the magnitude of the impacts compared to other sectors. As noted above, the retrospective analysis indicates a Cluster 2 closure would produce minimal changes in the mothership fleet's fishing behavior and thus minimal costs.

4.2.5 Environmental Justice Considerations for Pollock Dependent Communities

An Environmental Justice analysis evaluates the potential for the proposed alternatives to result in disproportionately high and adverse effects on minority populations, low-income populations, and Alaska Native/Indian Tribes, as defined under 40 CFR 1508.1(f)). This section contains the environmental justice analysis for communities engaged in or dependent on the B season pollock fishery. This includes Akutan, Unalaska, King Cove, Kodiak City, Newport, Seattle MSA, and CDQ communities. Environmental justice concerns for communities that are engaged in or dependent on chum salmon fisheries are addressed separately in Section 4.4.6. That being said, there is a known degree of overlap among CDQ communities because CDQ communities are engaged in or dependent on the pollock fishery as well as chum salmon for subsistence and other uses.

The CEQ (1997) guidelines suggest that where an agency action may affect fish, vegetation, or wildlife, it may also affect subsistence patterns of consumption and indicate the potential for disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, and Alaska Native/Indian Tribes. Some information on subsistence uses for pollock dependent communities is provided in Section 4.1.1.4.1. Additionally, climate change is often an environmental justice issue. People who live in poverty may be particularly vulnerable to the negative economic impacts of climate change because they have fewer financial resources to cope with these effects (EPA 2016). Climate change is affecting coastal communities, including those dependent upon the B season pollock fishery, in increasingly disruptive ways. Communities across the Aleutian Islands and Kodiak Archipelago are expected to experience increased temperatures, precipitation, and summer storminess (Himes-Cornell & Kasperski 2015). A community's reliance on fisheries resources that are impacted by climate change can also determine its relative vulnerability. For instance, Kodiak City (and the Borough more broadly) residents are highly engaged in harvesting and processing in groundfish and crab fisheries. Ocean acidification and species migrations that affect the Gulf of Alaska would likely impact the ability of commercial fishermen (NOAA 2019). Similarly, communities and shore-based processors engaged in the B season pollock fishery have experienced adverse social and economic effects due to recent crab closures and other species declines (Wise et al., 2023).

E.O. 14008 defines "disadvantaged communities" as those that are marginalized and overburdened by a combination of economic, health, and environmental burdens (E.O. 14008). Many populations across rural Alaska would meet these criteria based on a combination of variables including but not limited to high unemployment, underemployment, linguistic isolation, high housing cost burden and substandard housing, high transportation cost burden and/or low transportation access, limited water and sanitation access and affordability, and disproportionate impacts from climate change. However, existing screening tools do not capture many of these characteristics that may present environmental justice concerns.

Akutan, King Cove, Kodiak City, and Unalaska have minority populations meaningfully greater than the general population of Alaska, are home to federally recognized tribes, and many year-round residents engage in subsistence activities. However, the proportion of low-income residents in King Cove, Kodiak City, and Unalaska at 16.4%, 10.7%, and 13.2% respectively are not meaningfully greater than the general population of Alaska at 14.2% (see Table 4-10).

Since some Alaska communities identified as being engaged in or dependent on B season pollock are home to shore-based processors, the analysis also considered the minority proportion of the population living in group quarters housing in these communities. This is used as a proxy indicator for the potential minority population working seasonally at shore-based processors in these communities, which ranged from a low of 54.2% in King Cove to a High of 91.1% in Akutan (Table 4-11).

The minority and low-income populations in Newport and Seattle MSA are similar to the general population of Oregon and Washington, although the proportion of low-income residents in Newport at 20.4% is greater than the reference population in Oregon at 15.8%. Based on these data, Newport and Seattle MSA are not evaluated further in the environmental justice analysis. Although it is generally known that some minorities work onboard CPs and motherships (Downs & Henry 2023), comprehensive and updated data are not available to determine the proportion of minority and low-income workers and crew onboard pollock vessels. It is likely that the demography of at least some crew onboard CVs would reflect the community the vessel is registered to or homeports from. For CVs based out of Kodiak City and Newport, it is common practice for vessels to hire crew from their communities as well as other communities throughout the Pacific Northwest (see Section 4.2.2.2.2.3).

4.2.5.1 Alternative 1

Retaining the existing chum salmon bycatch regulations under Alternative 1 is not expected to have disproportionately high and adverse impacts on the environmental justice populations within communities substantially engaged in or dependent on the B season pollock fishery. The social and cultural systems of the Unangax̂ in Akutan and Unalaska, as well as those of the Sugpiaq, Central Yup'ik, St. Lawrence Island Yup'ik, and Inupiaq people residing in CDQ communities would continue to evolve due to existing forces of change. The economic conditions at the local, regional, and state level are expected to continue along current trends.

4.2.5.2 Alternative 2 and 3

Alternatives 2 and 3 could result in disproportionately high and adverse effects on minority, low-income, and Alaska Native populations in Akutan, Kodiak City, and Unalaska. These regulatory changes could have direct and adverse impacts on the local economies of Akutan and Unalaska through a loss of direct and indirect fishery related tax revenues, income and employment, and reduced spending at support sector businesses. Akutan and Unalaska are home to one or more shore-based processing affiliated with the inshore sector, and Unalaska is also affiliated with the offshore sectors. The labor forces at the processing facilities in these communities are predominantly composed of minority populations. Processing workers displaced from the fishery as a result of erratic or frequent B season closures may be less resilient to the associated economic losses.

The analysis does not expect Alternative 2 or 3 would result in disproportionately high and adverse effects on environmental justice populations in King Cove, unless the processor and cooperative returned to the community (see Section 4.2.2.2.2.2). An early B season closure could result in disproportionately high and adverse effects on the local economy in Kodiak City including the potential for reduced crew employment, income, and/or spending at support sector businesses.

The analysis indicates overall chum salmon PSC limits analyzed at the lowest amounts of 100,000 chum salmon (Alternative 2/Alternative 3, Option 2) and 75,000 (Alternative 3, Option 1) have the greatest potential to result in disproportionally high and adverse impacts to environmental justice populations in Akutan, Unalaska, and Kodiak City. Additionally, the inshore sector would be most affected by the AFA apportionment.

The analysis indicates overall chum salmon PSC limits analyzed at the lowest amounts of 100,000 chum salmon (Alternative 2/Alternative 3, Option 2) and 75,000 (Alternative 3, Option 1) have the greatest potential to result in disproportionally high and adverse impacts to environmental justice populations in Unalaska through the community's connections to the offshore sectors. The CP sector would be most affected by the 3-year average apportionment, and the mothership sector would be most affected by the AFA apportionment.

Alternatives 2 and 3 could result in disproportionately high and adverse effects on minority, low-income, and Alaska Native populations in CDQ communities. All CDQ groups rely on revenue earned from the pollock fishery to support health, safety, and infrastructure needs in the communities they represent. The revenue CDQ groups earn from B season pollock could be reduced if they are unable to fully harvest their CDQ pollock allocation. In addition, five of the six CDQ groups have direct investments in AFA vessels and quota (Section 4.1.2.2) and an early B season closure could reduce benefits from these operations.

If a CDQ group is constrained in its ability to support social and economic programs, lower-income residents in these areas may be less able to adapt to these impacts. In addition, all CDQ groups provide programs that support residents' participation in subsistence activities (see Section 4.1.2.4). Revenue losses for CDQ groups due to B season closures could inadvertently affect residents' access to subsistence resources if the groups determined they could no longer support these programs in the future.

The analysis indicates overall chum salmon PSC limits analyzed at the lowest amounts of 100,000 chum salmon (Alternative 2/Alternative 3, Option 2) and 75,000 (Alternative 3, Option 1) have the greatest potential to result in disproportionally high and adverse impacts to environmental justice populations in CDQ communities. The CDQ sector would be most affected by the 3-year average apportionment.

4.2.5.3 Alternative 4

Modifying the regulations for the salmon bycatch IPAs under Alternative 4 is not expected to have disproportionately high and adverse impacts on the environmental justice populations within communities substantially engaged in or dependent on the B season pollock fishery. As described in Section 4.2.3, the costs incurred by the pollock industry under Alternative 4 are expected to be similar to those that exist under the status quo and would continue if Alternative 1 was selected.

4.2.5.4 Alternative 5

Alternative 5 could result in disproportionately high and adverse impacts on the environmental justice populations in Kodiak City, Akutan, and Unalaska. The potential for adverse impacts is greater for environmental justice populations in Akutan and Unalaska compared to Kodiak City. Akutan and Unalaska are the location of one or more shore-based processing facilities that receive deliveries from inshore CVs. The greatest potential for environmental justice populations in Akutan and Unalaska to experience adverse impacts is under a 50,000-chum salmon cap for Cluster 1 using the AFA apportionment.

4.2.6 Cumulative Effects for Pollock Dependent Communities

Past and present human actions have had cumulative and wide-ranging effects on the health, cultural, economics and well-being of communities that are engaged in or dependent on the pollock fishery, including environmental justice populations dependent on pollock. Some of these effects have been described in other documents incorporated by reference including the AFA Program reviews; other salmon bycatch analyses for Amendment 91 and Amendment 110, and the recent AFSC economic snapshot (i.e., Kasperski 2024; NMFS 2016; NPFMC 2009; NPFMC 2017). Past and present actions highlighted in the preliminary DEIS include climate change, the implementation of the CDQ Program and of AFA, along with associated allocations and provisions, as well as subsequent salmon bycatch amendments.

RFAs that may have a cumulative impact with the proposed actions include authorization and prosecution of the Bering Sea pollock fishery and climate change, described at the beginning of Chapter 3. In addition, pollock dependent communities may be affected by:

U.S. Executive Order 14114. As described in Section 4.1.1.3, a recent expansion on a U.S. ban of Russian seafood imports (Executive Order 14114) took effect May 31, 2024. Russian seafood products were still able to enter US markets prior to this point and therefore the full impact of this E.O. may not be felt yet. However, in the reasonably foreseeable future this E.O. may create more space in domestic markets for U.S. seafood, such as pollock.

Alaska seafood markets have experienced a collection of factors that have impacted overall revenues and increased operational costs. As highlighted in a recent AFSC snapshot report (AFSC 2024), ex-vessel revenues dropped 32 percent ($617 million) and first-wholesale values dropped by $1.2 billion (26 percent) from 2022 to 2023. This shock to the Alaska seafood industry resulted in a loss of more than 38,000 fishing and non-fishing jobs in the United States and a loss of $4.3 billion in total U.S. output (the total dollar value of all goods and services produced) and a total decrease of $269 million in state and local tax revenues. With continuation of high costs and likely increased competition from a modernized Russian pollock fleet that is diversifying into higher value-added products such as filets and surimi, these challenging market conditions for pollock may continue for at least the near future.

Cumulative Effects of the Proposed Actions with RFAs: The impact analysis throughout this section inherently considers past, present, and RFAs that may affect the pollock fishery and associated communities. For instance, this analysis assumes that the Bering Sea pollock fishery would be authorized and continue to be prosecuted and that the economic and market challenges that have been experienced in recent years would continue. Thus, the impact analysis throughout this section provides a comprehensive analysis of cumulative effects, including highlighting areas of uncertainty based on future conditions.

4.3 Western Alaska Chum Salmon Fisheries Description

4.3.1 Description of State Management of Subsistence Chum Salmon Stocks

After conservation, the highest priority for use under both state and federal law is subsistence. Subsistence has a preference over all other consumptive uses of the stock when harvests must be restricted (AS 16.05.258). The state defines subsistence uses of wild resources as noncommercial, customary, and traditional uses for a variety of purposes. These include "direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption" (AS 16.05.940(34)).

Under Alaska's subsistence statute (AS 16.05.258), the BOF must identify fish stocks that are associated with customary and traditional subsistence fisheries. Next, the BOF determines whether there is a harvestable surplus of these stocks. The harvestable surplus is the amount of fish that can be taken by various uses (subsistence, personal use, commercial) after conservation (escapement) is accounted for. If there is a harvestable surplus of these stocks that have been identified as having been customarily and traditionally used, the BOF must determine the amount of the harvestable surplus that is reasonably necessary for subsistence uses. Then, the BOF must adopt regulations that provide reasonable opportunities for these subsistence uses to take place. A "reasonable opportunity" is defined in statute to mean an opportunity that allows a subsistence user to participate in a subsistence fishery that provides a normally diligent participant with a reasonable expectation of success of taking of fish (AS 16.05.258(f)).

The BOF evaluates whether reasonable opportunities are provided for in the existing or proposed regulations by reviewing harvest estimates relative to the "amount reasonably necessary for subsistence use" (ANS) findings as well as subsistence fishing schedules, gear restrictions, and other management considerations. ANS is typically set as a range but is not a consistent metric across all areas. Some areas like the Yukon and Kuskokwim have species-specific ANS ranges for salmon while others like Norton Sound and Bristol Bay lump all salmon species together under a single ANS range. ANS ranges are based on the harvest histories in each area (see Table 4-29). As a run develops, inseason managers will assess what portion of the run can be harvested after accounting for escapement. **If the harvestable surplus is within or higher than the ANS range, other nonsubsistence uses, such as commercial or sport fishing, may be allowed.**

Harvest levels within or above the ANS range typically suggest regulations do provide a reasonable opportunity to harvest a resource for subsistence as long as subsistence patterns have not changed significantly. Subsistence harvests may fall below the lower bound of an ANS range for a number of reasons including changes in species use and relative dependence, weather conditions, or fishing restrictions in a given year. However, a retroactive look at subsistence harvests that fall below the ANS range in a given year or across multiple years can provide additional context to inform understandings of run abundance or stock status. Subsistence harvests below the lower bound of the ANS range may indicate, with other evidence, that there was not reasonable opportunity for subsistence harvests during the season and that subsistence needs may not have been met.

Personal Use Fisheries

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

The Joint Board is required to identify nonsubsistence areas using the 13 criteria outlined in statute, where "dependence upon subsistence is not a principal characteristic of the economy, culture, and way of life of the area or community" (AS 16.05.258(c)). The BOF may not authorize subsistence fisheries in nonsubsistence areas. Personal use fisheries provide opportunities for harvesting fish with gear other than rod and reel in nonsubsistence areas. The Joint Board has identified Ketchikan, Juneau, Anchorage-Matsu-Kenai, Fairbanks, and Valdez as nonsubsistence areas (5 AAC 99.015). In these areas, persons may harvest wild resources for food under personal use or sport fishing regulations; subsistence fisheries are not authorized to occur in nonsubsistence use areas (5 AAC 99.016). Generally, fish may be taken for personal use under authority of a permit issued by ADF&G. ADF&G's Division of Commercial Fisheries manages personal use fisheries, although some personal use fisheries are managed by the Division of Sport Fish.

Table 4-29 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 Salmon	Coho Salmon	Pink Salmon	All Salmon
Kotzebue	None	-	-	-	-	-	-		-
Norton Sound-Port Clarence	1998	-	-	-	-	-	-		96,000-160,000
Nome Subdistrict	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	-	-	-	-	55,000-65,000[114]	-	-	157,000-172,171
Alaska Peninsula	1998	-	-	-	-	-	-	-	34,000 - 56,000

4.3.2 Federal Management of Subsistence Chum Salmon Stocks

Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA) mandates that rural residents of Alaska be given a priority opportunity for customary and traditional subsistence uses, among consumptive uses of fish and wildlife, on federal lands (16 U.S.C. 3114). ANILCA was passed in 1980, and in 1986, the State of Alaska amended its subsistence law to mandate a rural subsistence priority in order to bring the statute into compliance with ANILCA. However, in the 1989 *McDowell* decision, the Alaska Supreme Court ruled that the priority in the state's subsistence law could not be exclusively based on location of residence (i.e., rural residents) under provisions of the Alaska Constitution. Meanwhile, other federal court cases on the state's administration of Title VIII of ANILCA ruled that the state would not be given deference in interpreting federal statute.

These court cases created conflicting rulings; proposed amendments to ANILCA and the Alaska constitution were not adopted to rectify them. As a result, the Secretaries of Interior and Agriculture implemented a parallel regulatory program to assure the rural subsistence priority is applied under ANILCA on federal lands. Both state and federal governments provide subsistence uses on federal public

[114] The ANS finding for Bristol Bay sockeye salmon represents a nested ANS finding for the Kvichak river drainage, from the overall Bristol Bay area finding of 157,000-172,171 salmon (5 AAC 01.336(b)(1)).

lands and waters in Alaska. Federal public lands in Alaska encompass approximately 230 million acres (60%) of the land within the state.

ANILCA defines "public lands" as lands situated "in Alaska" which, after December 2, 1980, are federal lands. Exceptions include 1) those lands selected by or granted to the State of Alaska; 2) lands selected by an Alaska Native Corporation under the Alaska Native Claims Settlement Act (ANCSA); 3) and lands referred to in section 19(b) of ANCSA (16 U.S.C. 3102(3)). The U.S. Supreme Court has ruled that ANILCA's use of "in Alaska" refers to the boundaries of the State of Alaska and concluded that ANILCA does not apply to the outer continental shelf (OCS) region where the NMFS and the Council hold jurisdiction (*Amoco Prod. Co. v. Village of Gambell*, 480 U.S. 531, 546-47 (1987)). In 1992, the Secretaries of the Interior and Agriculture established the Federal Subsistence Board (FSB) and ten Regional Advisory Councils (RACs) to administer this responsibility.[115] Through the FSB, these agencies participate in development of regulations which establish the program structure, determine which Alaska residents are eligible to take specific species for subsistence uses, and establish seasons, harvest limits, and methods and means for subsistence take of species in specific federal areas. The RACs provide recommendations and information to the FSB; review proposed regulations, policies, and management plans; and provide a public forum for subsistence issues. Each RAC consists of regional residents representing subsistence, sport, and commercial fishing and hunting interests.

4.3.3 Subsistence Harvests of Chum Salmon

Of the estimated 34.0 million pounds of wild foods that are annually harvested for subsistence purposes in rural Alaska communities, subsistence fisheries contribute 54% of the total; salmon contribute the majority of this amount at 32.3% of all subsistence harvests of wild foods, although Pacific halibut, herring, and whitefishes also play an important role in subsistence economies (Fall 2018).

Salmon are an important food source, and are central to the customs, traditions, wellbeing, and cultural identities of many rural and Indigenous communities across Alaska including the Unangax̂, Athabascan, Alutiiq, Haida, Inupiaq, Tlingit, Tsimshian, and Yup'ik peoples, among others. This section provides information on historical and recent years' subsistence harvests of salmon, and the role that chum salmon play in the subsistence economies, in the Kotzebue, Norton Sound-Port Clarence, Yukon, Kuskokwim, and Bristol Bay Management Areas which broadly represent Western Alaska.

Table 4-30 provides environmental justice indicators for select Boroughs and Census Areas which broadly represent the Western and Interior Alaska region. Indicators for these areas are compared with Alaska as a reference population. As shown, the total population residing in these areas varies – the Bethel Census Area had the largest population at 18,666 persons in 35 communities and the Bristol Bay Borough had the smallest population at 844 persons in four communities. The minority percentage population is highest in the Kuslivak Census Area at 97.9% but the minority percentage population in all analyzed areas is meaningfully greater than Alaska's general population. The low-income percentage population in the Bristol Bay Borough (9.4% of total) is lower than Alaska's general population. The low-income population components of all other analyzed areas are meaningfully greater than the general population of Alaska, ranging from a low of 20.3% of the population in the Dillingham Census Area to 41.7% of the population in the Kuslivak Census Area. Finally, all areas are associated with Alaska Native tribal governments and other tribal entities.

[115] The FSB's composition includes a chair appointed by the Secretary of the Interior with concurrence of the Secretary of Agriculture; the Alaska Regional Director, U.S. Fish and Wildlife Service; the Alaska Regional Director, National Park Service; the Alaska State Director, Bureau of Land Management; the Alaska Regional Director, Bureau of Indian Affairs; and the Alaska Regional Forester, USDA Forest Service; and two public members representing rural subsistence users. In February 2024, the Secretary of the Interior announced a proposed rule to revise the regulations concerning the composition of the FSB by adding a third public member nominated or recommended by federally recognized tribal governments, requiring that those nominees have personal knowledge of and direct experience with subsistence uses in rural Alaska including Alaska Native subsistence uses (see FR 89 vol. 38 (February 26, 2024)).

Table 4-30 Select environmental justice indicators for select Western and Interior Alaska Census Areas and Boroughs compared to the State of Alaska

Area	Number of communities	2020 U.S. Census					2022 5-Year ACS Estimates			
		Total pop.	Number of Alaska Native/ American Indian residents	Alaska Native/ American Indian residents as % of total	Minority pop.	Minority pop. as % of total	Number of households	Median household income	Per capita income	Low-income residents % of total
Bethel	35	18,666	15,632	83.7%	17,038	91.3%	4,565	$64,094	$25,859	32.8%
Bristol Bay	4	844	305	36.1%	487	57.7%	284	$94,167	$45,499	9.4%
Dillingham	10	4,850	3,453	71.2%	4,080	84.1%	1,384	$94,167	$45,499	20.3%
Kuslilvak	13	8,368	7,946	95.0%	8,195	97.9%	1,864	$69,412	$31,948	41.7%
Lake and Peninsula	18	1,476	994	67.3%	1,179	79.9%	326	$42,663	$17,166	21.6%
Nome	15	10,046	7,556	75.2%	8,653	86.1%	2,786	$70,121	$28,678	29.2%
Northwest Arctic	17	7,793	6,469	83.0%	7,109	91.2%	1,776	$77,647	$32,133	25.5%
Yukon-Koyukuk	38	5,343	3,832	71.7%	4,222	79.0%	2,078	$47,826	$29,382	28.6%
Alaska	-	**733,391**	**111,575**	**15.2%**	**311,633**	**42.5%**	**274,574**	**$88,121**	**$43,054**	**14.2%**

Notes: That Aleutians East Borough and the Aleutians West Census Area are not included in this categorization of impacts is not meant to suggest no minority, low-income, or Alaska Native tribal populations rely on chum salmon for subsistence and other economic uses. These areas are beyond the southern boundary (Bristol Bay) of the CWAK reporting group.

4.3.3.1 Regional Patterns of Subsistence Harvests of Salmon

This section provides information on the patterns of subsistence harvests of salmon in the Kotzebue, Norton Sound-Port Clarence, Yukon, Kuskokwim, and Bristol Bay Management Areas based on ADF&G subsistence salmon harvest information and comprehensive subsistence surveys. Subsistence harvest information is collected via voluntary daily harvest calendars, voluntary postseason household harvest surveys, and mandatory permit programs by the Division of Subsistence or Division of Commercial Fisheries staff, depending on the area. Comprehensive subsistence surveys are door-to-door studies that document all major subsistence harvests in select communities to provide an overall subsistence proxy profile for a region conducted by the Division of Subsistence.[116] These studies are not conducted annually but document all major subsistence harvests in communities to provide an overall subsistence proxy profile for a region and contextualize these data with ethnographic information about subsistence uses by a community.

Kotzebue

Kotzebue District encompasses all waters from Point Hope to Cape Prince of Wales, including those waters draining into the Chukchi Sea. This district includes the subsistence fishing areas used by Point Hope, Kivalina, Noatak, Kotzebue, Kiana, Noorvik, Selawik, Ambler, Shungnak, Kobuk, Buckland, Deering, Shishmaref, and Wales. Kotzebue Sound residents have relied on fish as a key nutritional and cultural resource for thousands of years, and many continue to participate in mixed subsistence economies. The role of salmon in the wild food diet varies from community to community and is driven primarily by salmon abundance. Communities that harvest few salmon typically harvest large numbers of nonsalmon fish, such as sheefish, other whitefishes and Dolly Varden (Brown et al., 2023).

Subsistence harvest estimates for the Kotzebue District are available from 1994–2022. ADF&G Division of Subsistence conducted annual salmon harvest surveys in a select number of Kotzebue District

[116] Data for communities is publicly available at the Community Subsistence Information System website.

communities from 1994–2004. Little systematic or comprehensive subsistence harvest information has been collected since 2004, although there was a three-year effort to collect some harvest monitoring data from 2012 –2014. As such, ADF&G relies on interpolated harvest estimates for a core set of communities. This is the best scientific information available for this region but may warrant some caution when comparing to other Districts and Management Areas.

From 1994–2022, the estimated subsistence harvests of all salmon ranged from 30,888 fish (2003) to 101,426 fish (1996). The annual average level of salmon harvested for subsistence was 58,549 fish (1994 to 2022). Chum salmon is the primary species of salmon harvested by residents in the region. The estimated subsistence harvests of chum salmon ranged from 27,444 fish (2003) to 99,137 fish (1996). In 2022, it was estimated that 53,586 chum salmon were harvested for subsistence in the district, slightly above the most recent 5-year average (2017–2021) of 52,540 chum salmon.

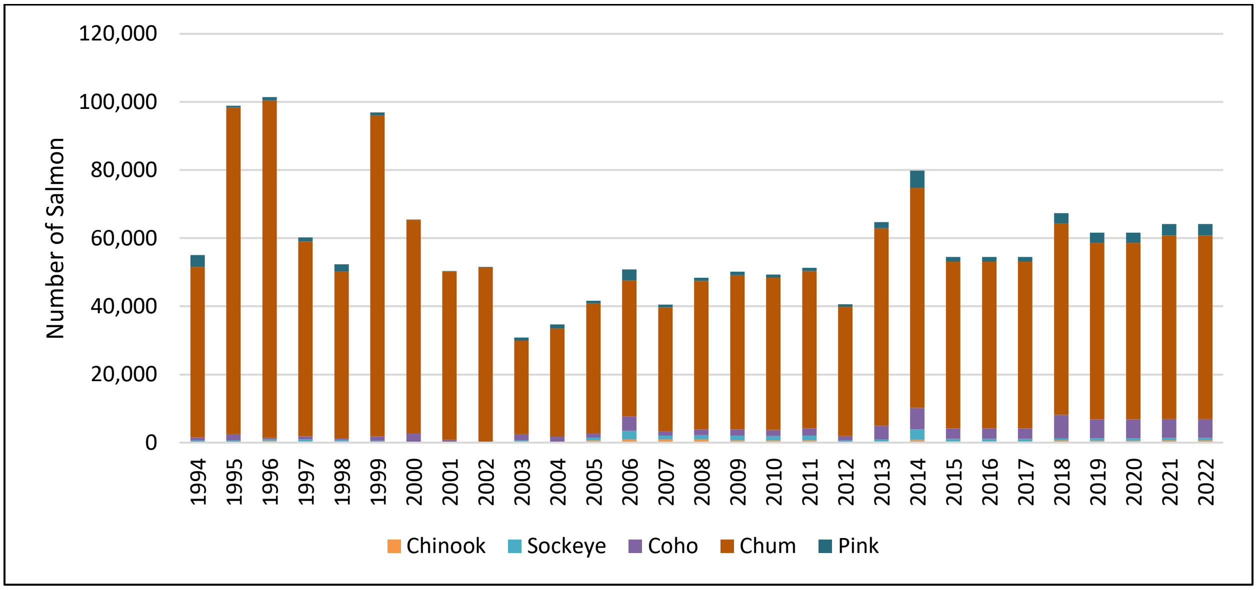

Figure 4-14 Historical estimates of subsistence harvests of all salmon in the Kotzebue District, 1994–2022
Source: ADF&G

Table 4-31 provides information on subsistence harvest data, which are represented in usable (or edible) pounds so subsistence harvests of chum salmon can be compared to other resource categories or species to better understand the subsistence economies within and across communities in the Kotzebue Sound region. Chum salmon play an important role in the subsistence economies and sharing networks of communities in this District. For instance, chum salmon accounted for 84% of the usable pounds of all salmon harvested for subsistence and 13% of the usable pounds of all resources harvested for subsistence by communities in the district. Compared to total resources harvested for subsistence, chum salmon tends to contribute a small proportion of the usable pounds because of the large harvests of marine mammals.

Table 4-31 Usable pounds (lb.) of chum salmon harvested for subsistence compared to all salmon species (lb.) and all subsistence harvests (lb.) for surveyed communities in Kotzebue Sound

Chum Salmon (Usable lb.)	322,162
All Salmon Species (Usable lb.)	382,512
As Percent of Total Salmon Harvests	84%
All Subsistence Harvests (Usable lb.)	2,349,059
Chum as Percent of Total Subsistence Harvest	13%

Source: ADF&G. Includes results from comprehensive subsistence surveys in Kotzebue (2014), Selawik (2011), Kiana (2006), Deering (2013), Noorvik (2012), Shismaref (2014), and Buckland (2018).

Along the Noatak and Kobuk Rivers where chum salmon runs have historically been strong, households' subsistence activities in middle and late summer revolve around catching, drying, and storing salmon. In southern Kotzebue Sound, fewer salmon are taken for subsistence because of small runs. Some fishery participants base their fishing effort out of their village, whereas others move seasonally to fish camps where they stay for several days to several weeks (Menard et al. 2022).

Chum salmon returns have been strong in the region, the timing of the runs widening, and the fish were reported to remain in prime condition later into the season; all of these conditions led to good subsistence and commercial fishing opportunities. However, rainy weather in recent years has made preserving subsistence harvests of chum salmon more difficult (Braem, Mikow & Kostick 2017). While 2024 subsistence harvest estimates are not yet available, the chum salmon run was very low this year. Some fishermen reported their subsistence needs were being met while others indicated that fishing was slow, and their needs may not be met. The 2024 subsistence fishery was hindered by several periods of heavy rain that caused the river systems in the area to experience high water levels (2024 ADF&G Kotzebue Sound Salmon Season Summary).

Norton Sound

The Norton Sound region includes the Port Clarence and Norton Sound Districts. Subsistence salmon fishing has been a major feature of the subsistence economies and ways of life in these region for centuries. Chum and pink salmon are the most abundant salmon species across the region, and Chinook and coho salmon are also present throughout the region but are more common in eastern and southern Norton Sound. Sockeye salmon are found in a few Seward Peninsula streams. In the summer, subsistence fishermen harvest salmon with gillnets or seines in the main Seward Peninsula rivers and in the coastal marine waters. Beach seines are used near the spawning grounds to harvest schooling or spawning salmon and other species of fish. A major portion of the fish taken during the summer months is air dried or smoked.

Subsistence salmon harvest estimates are provided for the Norton Sound and Port Clarence Districts from 1994–2022. Estimates of all salmon harvests for subsistence ranged between 19,331 fish (2021) and 134,050 fish (1996) in the Norton Sound District and between 6,223 fish (1999) and 28,411 fish (2017) in the Port Clarence District (Figure 4-15).

In the Norton Sound District, subsistence harvests of chum salmon ranged between 1,681 fish (2021) and 43,014 fish (1995). The estimated subsistence harvest of 10,961 chum salmon in 2022 was a notable increase from the very low harvest levels observed in 2021 and 2020. In the Port Clarence District, subsistence harvests of chum salmon have ranged between 1,275 fish (2000) and 7,802 fish (2012). The estimated 2022 subsistence harvest of 4,621 chum salmon was an increase from the 2020 and 2021 harvest levels of 2,297 and 1,719 chum salmon, respectively.

Figure 4-15 Historical estimates of subsistence harvests of all salmon in the Norton sound and Port Clarence Districts, 1994–2022

Source: ADF&G

A specific ANS range for chum salmon was established at 3,430–5,716 fish in Subdistrict 1 of the Norton Sound District. Subsistence harvests of chum salmon in Subdistrict 1 have fallen below the lower bound of the ANS range (3,430 chum salmon) since 2016 (Figure 4-16). While subsistence harvests of chum salmon have declined in the region in recent years, this pattern does not appear to be solely driven by declines in chum salmon abundance. Subsistence harvests of chum salmon in Subdistrict 1 (Nome) have been low in recent years, but there have also been strong returns in the region. One explanation is that subsistence permit holders preferred traveling to Pilgrim River to harvest a large run of sockeye salmon instead of chum fishing in Subdistrict 1. A large pink salmon run for an odd-numbered year (2019) in the Nome Subdistrict may have also resulted in gillnets plugged with pink salmon, potentially limiting chum salmon harvests (Menard et al. 2022). These two districts have a history of variation and change in run strength and subsistence opportunities, which motivate fishers to travel to nearby areas for subsistence fishing opportunities, as may be feasible and necessary (Brown et al. 2023).

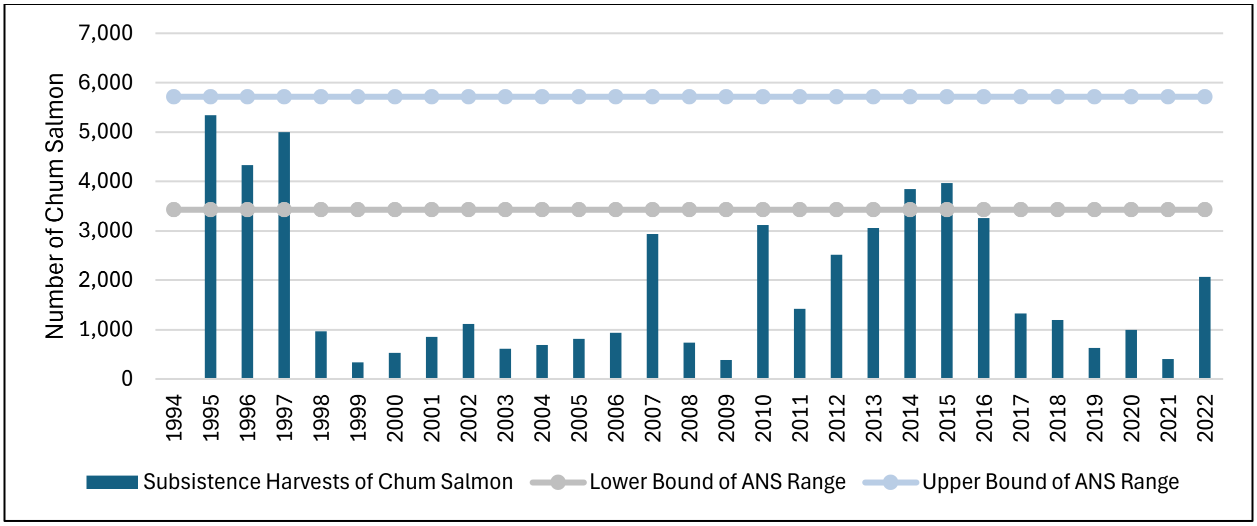

Figure 4-16 Subsistence harvests of chum salmon in District 1 (Nome) compared with ANS range, 1994 –2022
Source: ADF&G

Table 4-32 provides information on subsistence harvest data, which are represented in usable (or edible) pounds so subsistence harvests of chum salmon can be compared to other resource categories or species to better understand the subsistence economies within and across communities in the Norton Sound region. Subsistence harvests of chum salmon accounted for 22% of the total harvest of all species of salmon by weight (pounds or lbs.) and 7% of the total subsistence harvest of all species and resources for these communities.

Table 4-32 Usable pounds (lb.) of chum salmon harvested for subsistence compared with all salmon species (lb.) and all subsistence harvests (lb.) for surveyed communities in Norton Sound

Chum Salmon (Usable lb.)	92,452
All Salmon Species (Usable lb.)	420,112
As Percent of Total Salmon Harvests	22%
All Subsistence Harvests (Usable lb.)	1,215,475
Chum as Percent of Total Subsistence Harvest	7%

Source: ADF&G. Includes results from comprehensive subsistence surveys in Brevig Mission (2006), Elim (2006), Golovin (2012), White Mountain (2006), Teller (2006), Stebbins (2013), Unalakleet (2006), and Koyuk (2006) from the Norton Sound region.

Yukon Area

Residents across the Yukon River drainage have long relied on subsistence harvests of Chinook salmon, summer and fall chum salmon, and coho salmon.[117] Drift gillnets, set gillnets, and fish wheels are the primary gear types used by subsistence fishermen. Fish wheels are a legal subsistence or non-commercial gear type throughout the Yukon drainage, although due to river conditions and the availability of wood, they are used almost exclusively on the upper Yukon and Tanana rivers. Subsistence harvesters typically base their fishing activities from fish camps or from their home communities. Throughout the Yukon Area, extended family groups, typically representing several households, often cooperate to harvest, process, preserve, and store salmon for subsistence uses (Brown et al., 2015). As people work together to

[117] In the Yukon Area, management of coho salmon is tied to fall chum salmon management because of run timing. As such, it is difficult to assess reasons for trends in coho salmon harvests over time, especially considering they are not specifically targeted by a large number of fishing households for subsistence. This is because of their lower abundance compared to fall chum salmon and late run timing. Pink salmon harvests are typically only reported in lower river communities, although the species is included on harvest surveys and catch calendars in all regions of the drainage. Although sockeye salmon are occasionally found in the lower portion of the Yukon River, their numbers are so low that they are not actively managed in the Yukon Area.

harvest and process salmon, they form and strengthen social relationships that connect people within and among families (Trainor et al. 2021).

Subsistence harvest estimates are available for the Yukon Area from 1988–2022.[118] Across the time series, subsistence harvests have declined and dramatically so in recent years. For instance, subsistence harvests of all species of salmon were at their highest level in 1988 at 502,087 fish compared to 6,869 salmon in 2021. The 2022 estimated subsistence harvest of all salmon was 20,911 fish.

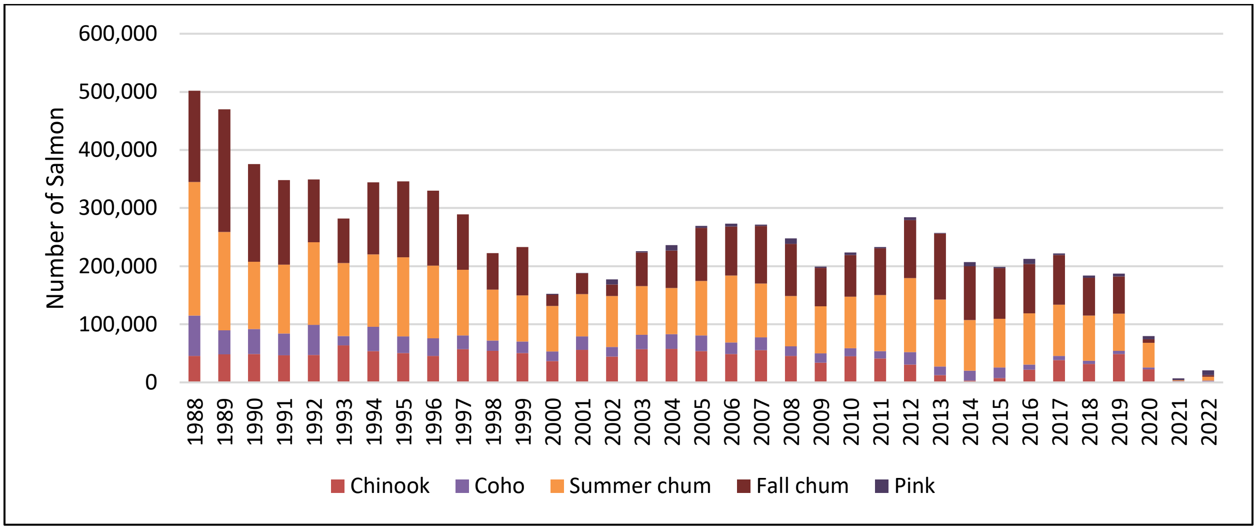

Figure 4-17 Historical estimates of subsistence harvests of all salmon in the Yukon Area, 1988–2022
Source: ADF&G

Summer and fall chum salmon are harvested in greater numbers for subsistence than other species of salmon, although the number of each type of salmon harvested likely does not fully account for other important considerations like the relative size, flavor, drying qualities, or sociocultural significance of salmon. Summer chum salmon do not typically migrate further upriver than the Tanana River drainage and thus contribute in greater magnitude to the total subsistence harvests of salmon in communities across the lower and middle river. Chinook salmon, fall chum, and a small number of coho salmon migrate the full length of the Yukon River into Canada and thus are available to most communities across the Yukon River.

Subsistence harvests of summer chum salmon ranged from 1,234 (2021) and 229,939 (1988) fish. The 2022 subsistence harvest of summer chum salmon was 6,692 fish, an 88% reduction from the recent 5-year average of 54,547 summer chum (2017–2021). The summer chum salmon ANS range is set at 83,500–142,192 summer chum salmon, and there are two distinct periods in which subsistence harvests fell below the lower bound of the ANS range, 1998–2004 and 2018–2022. In between these periods, subsistence harvests of summer chum salmon were relatively stable from 2011 to 2020, and harvests were primarily restricted by efforts to conserve Chinook salmon which co-migrate with summer chum salmon. This pattern changed in 2021 when the summer chum run returned to the Yukon River at a historically low level which continued in 2022–2024.

[118] 1988 – 2022 are the years for which comparable subsistence harvest estimates are available, but an extended time series of subsistence harvests is available in Appendix 6.

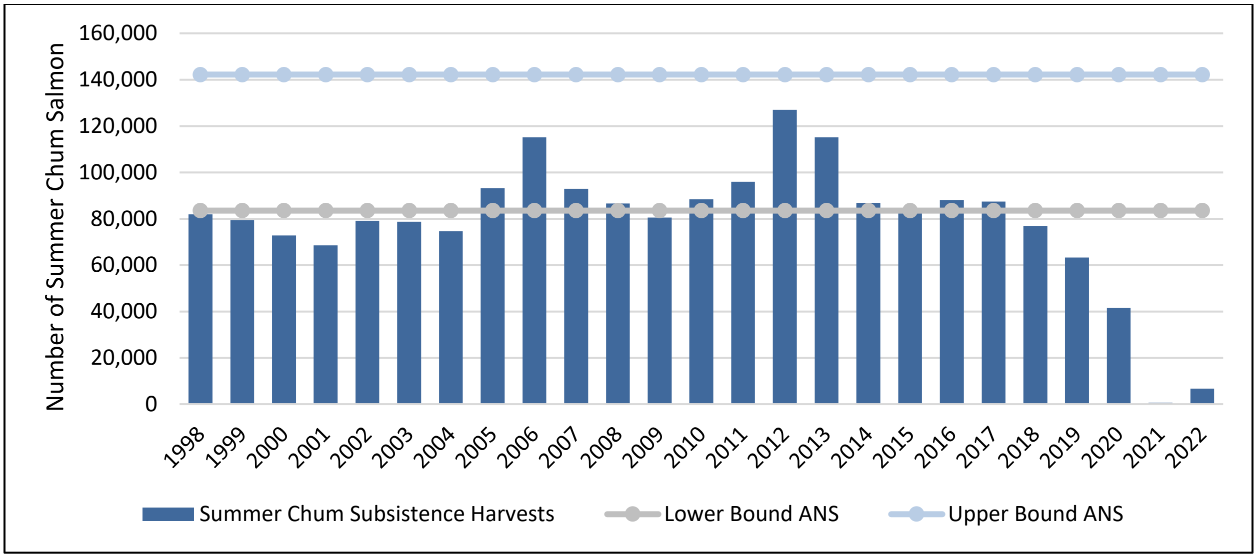

Figure 4-18 Subsistence harvests of summer chum salmon compared with lower and upper bounds of the ANS range, 1998–2022

Source: ADF&G

Subsistence harvests of fall chum ranged between 705 (2021) and 211,303 (1989) fish. The 2022 subsistence harvest of fall chum salmon was 2,766 fish which was well below the recent 5-year average of 44,382 fish (2017–2021). The fall chum salmon ANS range is set at 89,500-167,900 fish and subsistence harvests have fallen below the lower bound of the ANS range in all but five years. The historical time series shows two periods of very low harvests of fall chum salmon, one in 2000–2002 and another in 2020–2022. Subsistence fishing opportunities for fall chum salmon have been limited since 2015 and were closed in 2021, 2022, 2023, and 2024.

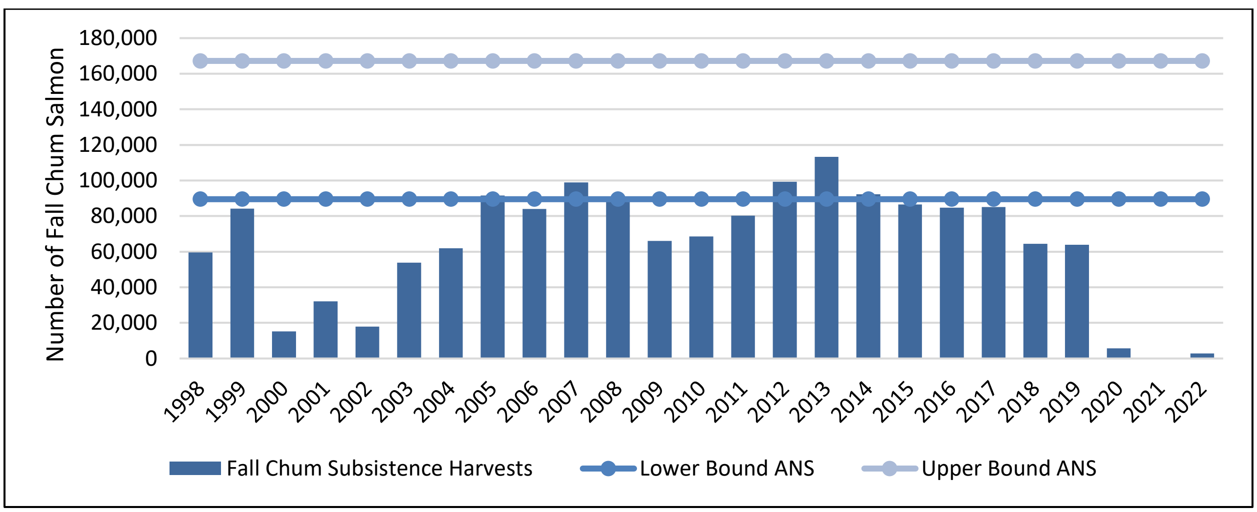

Figure 4-19 Subsistence harvests of fall chum salmon compared with lower and upper bounds of the ANS range, 1998–2022

Source: ADF&G

Chum salmon are important for their nutritional and cultural value for communities across all subregions of the Yukon River. Comprehensive subsistence surveys in 35 communities show summer and fall chum accounted for approximately 69% of the total salmon harvest by weight for study communities in the upper and middle regions and 56% of total salmon harvest by weight for study communities in the lower region. Summer and fall chum accounted for approximately 43% of the total subsistence harvest weight for study communities in the Upper region, 36% of total subsistence harvest weight in the Middle region, and 19% of the total subsistence weight in the lower region. In the lower region of the river there are generally more subsistence resources available, primarily because of marine mammals and higher density moose populations. Subsistence harvests of salmon contribute a relatively smaller proportion of total subsistence harvests for these communities. However, summer chum salmon are harvested in the largest proportion compared to all species of salmon (Table 4-33). Moving upriver there is a gradual shift in the subsistence use towards fall chum salmon. More broadly, among upriver communities, salmon, and chum salmon in particular, play an increasingly important role in the subsistence harvest composition of these communities.

Table 4-33 Usable pounds (lb.) of summer and fall chum salmon harvested for subsistence compared with all salmon species (lb.) and all subsistence harvests (lb.) for surveyed communities in the Yukon

	Upper Region	Middle Region	Lower Region
Summer and Fall Chum (Usable lb.)	210,745	353,411	406,039
All Salmon Species (Usable lb.)	305,034	514,292	730,258
Percent of Total Salmon Harvests	69%	69%	56%
All Subsistence Harvests (Usable lb.)	489,089	970,580	2,127,795
Percent of Total Subsistence Harvest	43%	36%	19%

Source: ADF&G. **Upper River:** Central (2016), Circle (2017), Eagle (2017), Eagle Village (2017), Fort Yukon (2017), Stevens Village (2014), Venetie (2009), Beaver (2011); **Middle River:** Hughes (2014), Huslia (1983), Galena (2010), Kaltag (2018), Manley Hot Springs (2012), Minto (2012), Nenana (2015), Nulato (2010), Rampart (2014), Ruby City (2010), Tanana (2014), Alatna (2011), Allakaket (2011), Bettles (2011); **Lower River:** Alakanuk (1980), Emmonak (2008), Kotlik (1980), Marshall (2010), Mountain Village (2010), Nunam Iqua (Sheldon Point) (1980), Pilot Station (2013), Russian Mission (2011), Scammon Bay (2017), Anvik (2011), Holy Cross (1990), Grayling (2011), Shageluk (2013).

Kuskokwim Area

Kuskokwim Area residents harvest Chinook, chum, sockeye, coho, and pink salmon for subsistence. Salmon harvested for subsistence uses along the lower Kuskokwim River were traditionally prepared by a variety of techniques including drying, smoking, freezing, salting, canning, and fermenting in the ground (Coffing 1991), as they still are today. From June through August, the daily activities of many households revolve around the harvesting, processing, and preserving of salmon for subsistence uses. Most Kuskokwim Area fishermen harvest in the main stem or local tributaries.

Subsistence harvest estimates are provided for the Kuskokwim Area from 1989 to 2022. Subsistence harvests of salmon have declined over recent decades and have been especially low in recent years. Subsistence harvests of all salmon ranged between 383,390 fish (1990) and 117,693 (2021) fish. The 2022 subsistence harvest of salmon was 125,519 fish. This represented a 45% reduction from the historical average harvest of 225,385 fish (1989–2021).

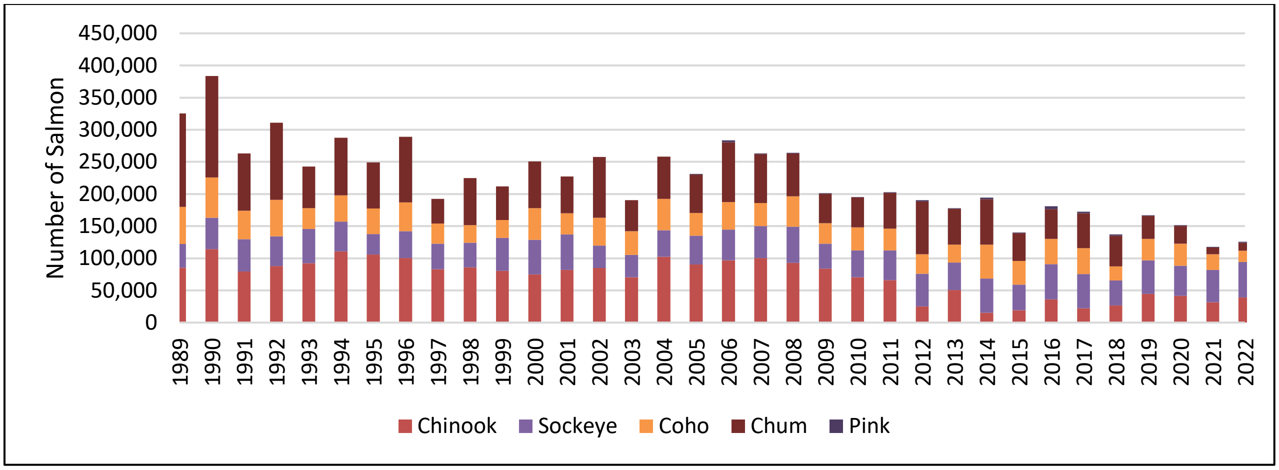

Figure 4-20 Historical estimates of subsistence harvests of salmon in the Kuskokwim Area, 1989–2022
Source: ADF&G

Subsistence harvests of chum salmon ranged between 10,690 (2021) and157,335 fish (1990). The most recent three-year average harvest of 17,228 chum salmon (2020–2022) reflects the recent period of declines and is a 76% reduction from the historical average of 71,702 chum salmon (1989–2019). The 2022 subsistence harvest of chum salmon was 12,844 fish, though it should be noted that the Kuskokwim Area experienced multi-species salmon declines in 2022, with record-low coho salmon abundance and subsequent fishing closures coupled with continued Chinook salmon subsistence harvest restrictions limiting region-wide harvests of these species. The proportional contribution of sockeye harvests to total subsistence harvests has increased in recent years because of the harvest restrictions placed on other species, although the number of sockeye salmon harvested has remained relatively stable.

In 2001, the BOF modified the ANS ranges in the Kuskokwim Management Area to reflect species-specific harvest and use patterns. In 2013, the BOF again modified ANS ranges by species for the Kuskokwim River drainage and other portions of the Kuskokwim Area. The current ANS range for chum salmon is 41,200–116,400 fish in the Kuskokwim River drainage. The estimated subsistence harvests of chum salmon have fallen below the lower bound of the chum salmon ANS range since 2019 (Figure 4-21).

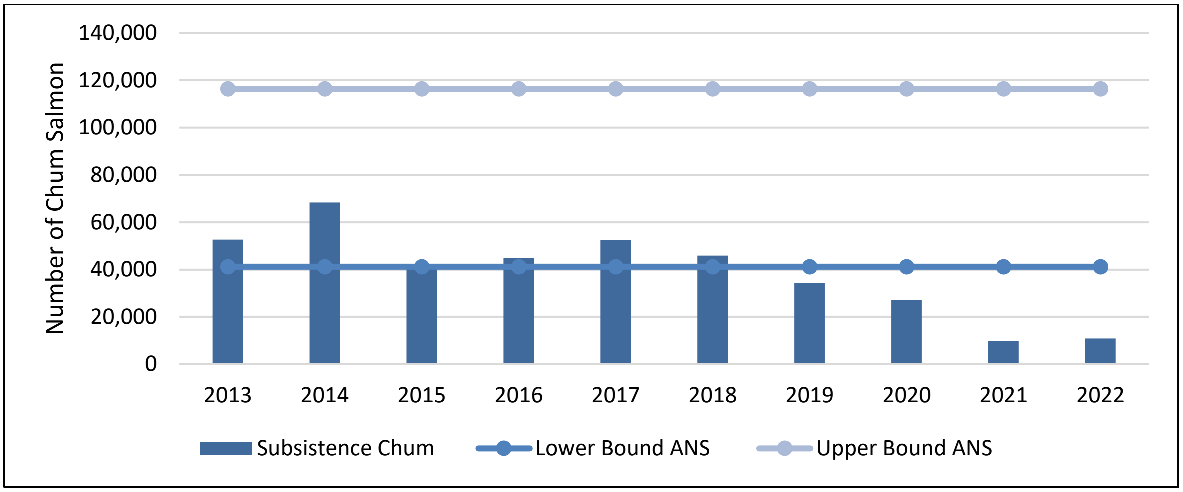

Figure 4-21 Subsistence harvests of chum salmon compared with the lower and upper bounds of the ANS range, 2013–2022

Source: ADF&G

As shown in The alternatives are analyzed against the status quo levels of herring PSC to estimate the potential impacts of additional chum salmon bycatch regulations. The proposed management alternatives to reduce chum salmon bycatch in the pollock fishery would affect fishing behavior, and there could be a wide range of potential interactions with herring. While herring PSC could increase under these proposed regulatory changes for chum salmon bycatch, the estimated impacts would not diminish the protections afforded by the existing PSC limit.

An early B season closure would result in some herring PSC (mt) savings compared to status quo. Under a 100,000-chum salmon PSC limit the estimates on potential reductions ranged from an average of 223 mt to 259 mt depending on the apportionment; estimates on potential herring savings substantially decrease as the chum salmon PSC limit increases. **However, the pollock fleet is likely to change is fishing behavior in response to a chum salmon hard cap which could increase herring PSC prior to or regardless of that hard cap being met (see Section 3.2.4.2.5).**

Alternative 2 and 3 would require the pollock industry to operate under two hard caps during the B season fishery, one for Chinook salmon and the other for chum salmon PSC. The annual herring PSC limit would also be in place. It is assumed the fleet would not want to incur the cost of an early B season closure due to reaching either the Chinook or (potential) chum salmon PSC cap, nor would fishermen want to lose access to the fishing grounds encompassed within the HSAs by triggering their closure. The pollock industry would take measures to avoid all PSC to the extent practicable under this regulatory scenario, although it inherently limits the operational flexibility afforded to the fleet to avoid PSC.

The pollock fleet would need to make inseason management choices on how to carefully balance their operations against these constraining limits. For instance, if a sector was encountering higher herring PSC, operational choices may need to be made on where to move vessels to avoid further herring while also maintaining low chum salmon PSC. Fleet managers have shared that the CV sectors could be moved onto the shelf where herring bycatch has recently been less likely to be encountered, but chum salmon and WAK chum salmon may be more prevalent (see Table 3-30).

Conversely, there could be a scenario where the fleet balances its chum salmon PSC against the overall cap, and their operational choices inadvertently result in the fishery reaching the herring PSC limit. Closing the summer HSAs (because the herring PSC limit was met) would require vessels to move out of the area which encompasses historically productive fishing grounds. Vessels may concentrate their effort on the edge of the closure to continue fishing the most productive grounds and closer to port. This proximity is particularly important for the inshore sector. Based on the location of the summer HSAs, a closure would likely move most CVs into Cluster 2 if the pollock aggregations were good and could sustain fishing. Some vessels would go also go further northwest as able. However, increased fishing inside Cluster 2 poses the risk these CVs would have higher chum salmon bycatch.

CPs are more affected by the Winter HSA. In some recent years, herring bycatch has been higher outside of the Winter HSA compared to within it (Table 3-46). If the pollock fishery exceeded the herring PSC limit while balancing its chum salmon PSC against the overall cap, an unintended consequence may occur as vessels are moved to new grounds with potentially higher herring PSC.

Table 3-46, chum salmon accounted for approximately 26% of the total subsistence salmon harvest by weight for study communities in the lower region, 23% of the total salmon harvest for communities in the middle region, and 14% of the communities in the upper region. Although chum salmon may not contribute the majority of subsistence salmon harvests for communities in the upper region, sockeye salmon do not migrate to the headwaters of the Kuskokwim River, increasing that region's dependence on other salmon species, particularly chum, Chinook, and coho salmon. Chum salmon accounted for the largest proportion of all resources harvested for subsistence in the middle region at 14% which includes the study communities of Aniak, Chuathbaluk, Crooked Creek, Lower Kalskag, Red Devil, Sleetmute, Stony River, and Upper Kalskag.

Table 4-34 Usable pounds (lb.) of chum salmon harvested for subsistence compared with all salmon species (lb.) and all subsistence harvests (lb.) for surveyed communities in the Kuskokwim Area

	Lower Region	Middle Region	Upper Region
Chum (Usable lb.)	369,440	59,411	7,680
All Salmon Species (Usable lb.)	1,422,649	252,908	53,807
Percent of Total Salmon Harvests	26%	23%	14%
All Subsistence Harvests (Usable lb.)	3,517,975	411,137	176,004
Percent of Total Subsistence Harvest	11%	14%	4%

Source: ADF&G Includes **Upper Region:** Lake Minchumina (2002), Lime Village (2007), McGrath (2011), Nikolai (2011), Takotna (2011); **Middle Region:** Aniak (2009), Chuathbaluk (2009), Crooked Creek (2009), Lower Kalskag (2009), Red Devil (2009), Sleetmute (2009), Stony River (2009), Upper Kalskag (2009); **Upper Region:** Lake Minchumina (2002), Lime Village (2007), McGrath (2011), Nikolai (2011), Takotna (2011),

Bristol Bay

The Bristol Bay area consists of all waters of Bristol Bay including drainages enclosed by a line from Cape Newenham on the west side to Cape Menshikof on the Alaska Peninsula on the east. This is the shallowest area of the Bering Sea. Pilot Point village at the mouth of the Ugashik River on the Alaska Peninsula is the most easterly coastal village and Togiak at the mouth of the Togiak River is the most westerly coastal village of Bristol Bay. The major rivers flowing into Bristol Bay from east to west are the Ugashik, Egegik, Naknek, Kvichak, Nushagak and Togiak.

Historically, much of the Bristol Bay Area subsistence harvests has been taken in the Nushagak and the Naknek-Kvichak river drainages. Smaller amounts of salmon are harvested for subsistence in the Togiak River drainage, Egegik River drainage, and the Ugashik River drainage. Many residents continue to preserve large quantities of fish through traditional methods, such as dried and smoked, and frozen, canned, salted, pickled, fermented, and eaten fresh. The vast majority of households in the Bristol Bay Area use fish other than salmon for subsistence purposes. The harvest and use of nonsalmon fish for home use occurs throughout the entire year. Spring fishing begins when river and lake ice break up. During this transition, Bristol Bay residents shift from fishing through the ice for rainbow smelt, northern pike, and Dolly Varden to harvesting these freshwater fish with nets in river sloughs and lake outlets. Spring is important for harvesting Pacific herring and herring spawn on kelp. Also, as early summer approaches, Pacific halibut are targeted in marine waters.

Subsistence harvest estimates are provided for the Bristol Bay Area from 1983–2022. Of the five species of salmon used for subsistence by residents in the Bristol Bay Area, Chinook, sockeye, and coho salmon contribute to the majority of harvests. Subsistence harvests of salmon have ranged from 83,307 (2022) to

217,612 fish (1984). The 2022 subsistence salmon harvest of 83,307 fish was the lowest on record, followed by 96,561 fish in 2020. The decline in the number of permits being issued and returned in recent years may account for the decrease in harvest estimates (Brown et al. 2023).[119]

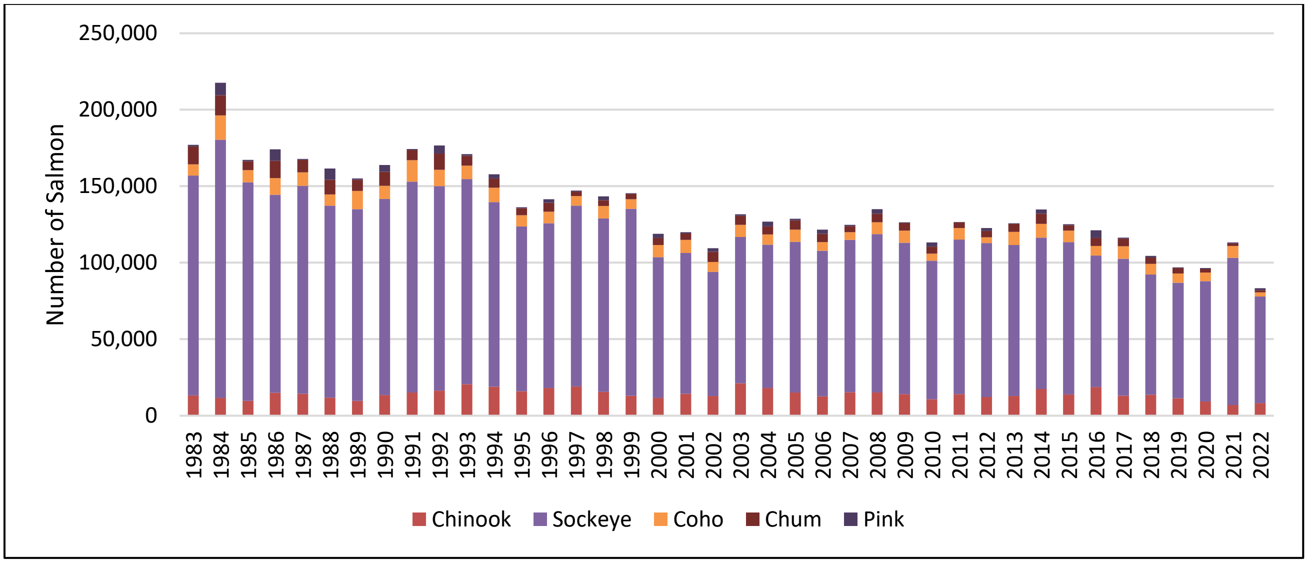

Figure 4-22 Historical estimates of subsistence harvests of salmon in the Bristol Bay area, 1983–2022
Source: ADF&G

Subsistence harvests of chum salmon have ranged from 1,479 (2022) to 13,009 fish (1984). The estimated subsistence harvest of 1,479 chum salmon in 2022 is the lowest on record, 75% less than the historical average of 5,873 (1984–2021). Table 4-35 shows the subsistence harvest composition for 23 communities within the Bristol Bay Area. Chum salmon accounted for approximately 5% of the total salmon harvest by weight for study communities and 3% of the total harvest of resources harvested for subsistence. These trends are largely explained by residents' reliance on other species of salmon, such as sockeye and Chinook salmon. Moose and caribou also accounted for a larger proportion of all subsistence resources harvested by weight.

[119] Since 1983, overall permit returns have averaged between 75% and 95%. However, most reported subsistence harvest totals do not include fish removed for personal use from commercial catches. Also, fish caught later in the season, such as coho salmon and spawning sockeye salmon, may not be documented as consistently as Chinook and prespawn sockeye salmon.

Table 4-35 Usable pounds (lb.) of chum salmon harvested for subsistence compared with all salmon species (lb.) and all subsistence harvests (lb.) for surveyed communities in the Bristol Bay Area

Chum Salmon (Usable lb.)	54,175
All Salmon Species (Usable lb.)	1,039,567
As Percent of Total Salmon Harvests	5%
All Subsistence Harvests (Usable lb.)	1,983,442
Chum as Percent of Total Subsistence Harvest	3%

Source: ADF&G. Includes: Aleknagik (2008), Clarks Point (2008), Dillingham (2021), Ekwok (1987), Igiugig (2005), Iliamna (2004), King Salmon (2007), Kokhanok (2005), Koliganek (2005), Levelock (2005), Manokotak (2008), Naknek (2007), New Stuyahok (2005), Newhalen (2004), Nondalton (2004), Pedro Bay (2004), Pilot Point (2014), Port Alsworth (2004), Port Heidon (2018), South Naknek (2007), Togiak (2008), Twin Hills (2009), Ugashik (2014),

4.3.3.2 Importance of Chum Salmon for Indigenous Peoples in the Yukon and Kuskokwim Regions

This section was co-authored by KRITFC and TCC with contributions from analytical staff. Additional information about the importance of subsistence in rural Western and Interior Alaska can be found in Section 4.3.5 of the April 2024 SIA, which is incorporated by reference here.

Over 27,800 Indigenous Alaska Native people reside in the Yukon and Kuskokwim regions of Alaska (Alaska Department of Labor 2023), home to 98 federally recognized Tribal nations, named in Appendix 7 and 8. All of the citizens of these Tribes are Salmon People, and traditional ways of life, including salmon fishing, are continually practiced supporting the health, wellbeing, and identity of these people.

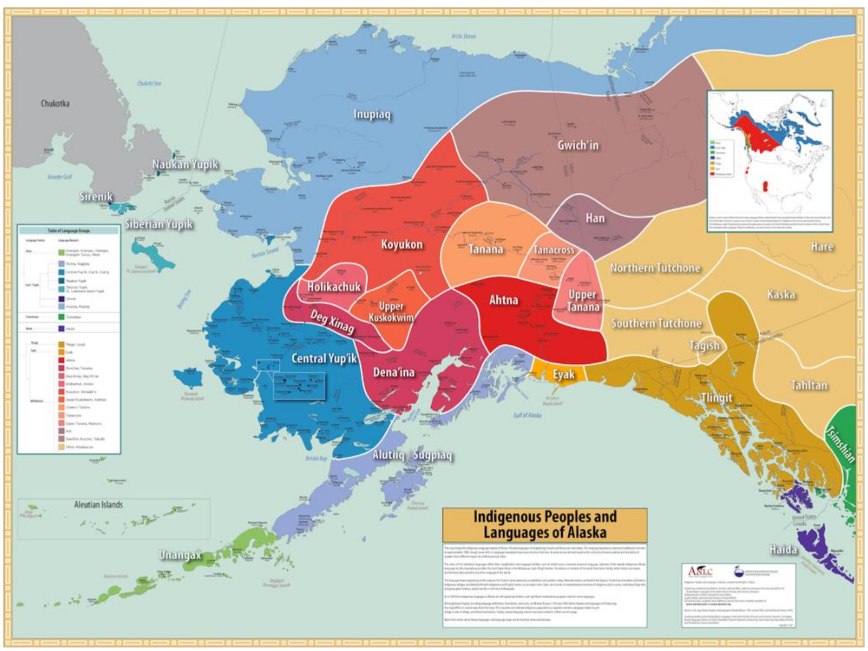

Figure 4-23 Indigenous Peoples and Languages of Alaska.
Source: Krauss et al., 2021. The Alaska Language Center and UAA Institute of Social and Economic Research

Figure 4-23 depicts the traditional ethnolinguistic groups of Alaska. At least 12 traditional languages are spoken within the Yukon-Kuskokwim region of Alaska: Dinjii Zhuh K'yaa (Gwich'in), Hän, Benhti Kokhwt'ana Kenaga' (Lower Tanana), Sahcheeg Xut'een Xneege' (Middle Tanana), Nee'aanèegn' (Upper Tanana), Dihthaad Xt'een Iin Aandeeg' (Tanacross), Dena'inaq', Dinak'i (Upper Kuskokwim), Denaakk'e (Koyukon), Holikachuk, Deg Xinag, Cup'ig (Nunivak Island Yupik), and Yugtun/Cugtun (Central Yup'ik) (ANLPAC 2024). Words and phrases in each of these languages express the centrality of salmon in the lives of their language-bearers. For instance, *neqa* is the Yugtun word for both "fish" (typically referring to salmon) and "food," and *Khii Zhrii*, the Dinjii Zhuh K'yaa word for the month of August, literally translated means "Month of Chum Salmon."

It is important to the co-authors—whose special expertise resides in the Yukon-Kuskokwim region of Alaska—that we note there are other watersheds, Tribal Nations, traditional language speakers, and people who are affected by recent chum salmon declines and impacted by this action. These include the Bristol Bay region, Norton Sound/Bering Strait Region, and Kotzebue Sound regions of Alaska, and First Nations peoples in Canada, the latter of whom rely on returns of fall chum salmon. Information and knowledge from these regions are not included in this section with the same scope and depth, though the following discussion may apply to these regions and people. It is also worth noting that providing information at the regional scale may not fully capture the differential impacts low abundance has on some communities, such as those communities along the Koyukuk River region. These varied and at times intensified impacts are further detailed in Appendices 7 and 8 provided by KRITFC and TCC, respectively.

4.3.3.2.1 Traditional and Modern Salmon Fishing

Traditional chum salmon fishing methods practiced by Indigenous peoples across Western and Interior Alaska, including the Indigenous communities along the Yukon River, Kuskokwim River, and their tributaries, are deeply intertwined with cultural, spiritual, and subsistence traditions, honed over centuries in harmony with the environment. These customary practices reflect the deep connection between Indigenous communities and the natural world.

For instance, Indigenous communities along the Yukon River developed sustainable fishing methods that have endured for generations. Practicing selective fishing techniques to maintain salmon populations across generations, rather than overharvesting or indiscriminately catching fish, Indigenous salmon harvesters used methods such as weirs, traps, and hand-held nets, allowing them to target specific species, sizes, and age classes of salmon. These techniques often focused on harvesting fewer mature fish, ensuring that sufficient numbers could continue upriver to spawn. This selective approach prevented the depletion of salmon populations, maintaining the ecological balance within the river systems.

Apart from the lower stretches of the river, Yukon fishers traditionally harvested salmon in terminal fisheries, meaning salmon were harvested as they approached or reached their tributary spawning grounds at the end of their life cycle. By focusing on sustainable harvest methods, ancestral Indigenous fishers of the Yukon River and its tributaries were able to adapt their practices according to the seasonal abundance of different salmon species. For example, some communities would harvest certain species only during peak runs or only after other species had already successfully spawned, allowing fish stocks to naturally replenish. This level of selectivity was based on an intimate understanding of the salmon life cycle and the river ecosystems.

In the Kuskokwim region, numerous traditional methods for harvesting chum salmon exist, including drift and set gillnets, once hand-woven from materials like cotton, sinew, or tree bark; fish traps and fences; spears; dipnets; and hook-and-line gear. Historically, as on the Yukon, these tools were mainly employed in terminal subsistence fisheries rather than in the main channel of the Kuskokwim, except for the lower stretch of the river where few salmon-bearing tributaries exist. Most contemporary Kuskokwim fishers, when permitted by regulations, use drift and set gillnets made of nylon for both commercial and subsistence chum salmon fishing. There has also been a noticeable shift toward fishing in the main channel of the Kuskokwim, influenced by commercial practices and recent regulations that close subsistence fishing in salmon-bearing tributaries.

For Indigenous communities along the Yukon River, Kuskokwim River, and their tributaries, chum salmon have long been a crucial subsistence resource, providing essential nutrients for the long winter months, as well as material for clothing and fueling dog teams. The harvest of chum salmon holds deep cultural significance and helps communities pass down traditions across generations. Subsistence fishing offsets high food costs in remote areas, where access to store-bought food is limited or prohibitively expensive, and also supports local barter systems, trading salmon for other essential goods such as moose meat and berries.

Salmon fishing plays a central role in the cultural practices of communities across Western and Interior Alaska, with different ceremonies and rituals honoring the fish and fostering community bonds. Salmon is often shared within the community, especially with Elders, reinforcing collective well-being. TK guides sustainable harvesting practices, which account for not only human consumption needs but also the needs of the non-human relatives that rely on salmon, ensuring the long-term health of salmon populations and sustaining ecological biodiversity. Fishers monitor salmon runs closely, adjusting their harvest to protect the species during years of lower abundance. This reciprocal relationship with nature emphasizes environmental stewardship, where only what is needed is taken, ensuring future generations can continue the subsistence way of life.

As this discussion on traditional Indigenous salmon fishing highlights, Indigenous peoples have had long-standing systems for managing salmon populations, which were deeply intertwined with their spiritual and cultural practices and based on respect, reciprocity, and sustainability. The arrival of European settlers and imposed colonial systems disrupted these long-standing Indigenous management practices while also introducing new sociopolitical and economic systems (Atlas 2020). Modern fishery management approaches have been critiqued for using a one-size-fits-all regulatory framework that does not account for the unique ecological conditions of different river systems or the traditional practices of Indigenous communities (Voinot-Baron 2020, 2022).

For example, seasonal fishing closures conflict with Indigenous fishing seasons and cultural practices, leading to tensions and further marginalizing Indigenous fishers from participating in the stewardship of their own lands and waters. The imposition of Western management frameworks that restrict when or how subsistence harvests can take place have criminalized traditional fishing and hunting practices, encouraging Alaska Natives to hide activities or face legal penalties (Stevens and Black 2019). This has caused significant hardship, as salmon and other resources were vital not only for sustenance but also for maintaining cultural and spiritual practices.

Beginning in 2020, WAK chum salmon runs declined dramatically and nearly all river systems had chum salmon run sizes below recent year averages with run sizes similar to those observed in the previous record poor run of 2000. Since 2020, subsistence users along both the Yukon and Kuskokwim rivers have faced severe, if not total, restrictions on chum salmon fishing due to declining stocks. Any discussion of modern fishing in these regions must acknowledge the profound disruption of these vital salmon-human relationships and the traditional seasonal harvest cycles that have sustained these communities for generations.

4.3.3.2.2 Chum Salmon Support Holistic Wellbeing of Indigenous People

Chum salmon play a vital role in the individual, communal, and ecological wellbeing of Indigenous peoples across Western and Interior Alaska (KRITFC 2024). The following discussion explores how chum salmon support the physical health (including food security), emotional and mental wellbeing, cultural integrity, family structures, local economies, livelihoods, and ecosystems of Tribal communities with a particular focus on the Kuskokwim and Yukon regions.

4.3.3.2.2.1 Physical, Mental, and Emotional Health

Chum salmon—and all salmon species—are cornerstones of the physical health of Indigenous communities across Western and Interior Alaska. Salmon are a traditional food that provides essential protein and nutrients. Food security is defined by the U.S. Department of Agriculture (USDA) as “access by all people at all times to enough food for an active, healthy life.” Food security has multiple dimensions, including food production, processing capacity, distribution systems, price, food quality, among others (Hanna et al. 2012). The Inuit Circumpolar Council (ICC 2015: 14, 34-35) prepared a conceptual framework for food security which emphasizes: availability; culture; decision-making power and management; health and wellness; stability, and accessibility. Compared to other U.S. states, Alaska faces unique food security challenges because of its remoteness, limited agricultural production, and high reliance on both locally harvested wild foods and imported foods; therefore, subsistence plays a greater role in supporting food security in the state (Fall 2018; ICC 2015).

Food security, specifically through the lens of subsistence harvests, can be affected by myriad factors. Work in the Bering Strait region by Ahmasuk, Trigg, Magdanz, and Robbins (2008) found food security was affected by the time households were able to spend harvesting, a lack of harvest effort, resources being less available to harvest, and changes in household composition Wolfe et al.'s (2012) research in Yukon River communities found five factors to be significantly related to household salmon production: the cost of fuel; whether the household had the necessary gear; number of harvesters; number of households eating salmon; and the number of people eating salmon.

The nutritional profile of chum salmon makes it an invaluable food source, particularly in Alaska's harsh and remote environments. Chum salmon is a complete protein, offering 20 grams of protein per 100 grams of fish, as well as the B vitamins, potassium, phosphorus, selenium, and omega-3 fatty acids (Chief Andrew Isaac Health Center 2024). The availability and nutrient-density make salmon a dietary staple for many, as it can be harvested, preserved (through smoking, drying, or freezing), and stored for extended periods—crucial during months when fresh food is limited. A diet rich in chum salmon and other traditional foods supports the health of Indigenous Alaskans, who face elevated rates of lifestyle-related conditions like heart disease, diabetes, and stroke (ANTHC 2021a,b). The essential nutrients in salmon play a key role in mitigating these risks. Additionally, chum salmon's high protein-to-energy ratio, low energy density, and low insulinogenic load make it key to a healthy, sustainable diet (Chief Andrew Isaac Health Center 2024).

Chum salmon play a unique dietary role across the Yukon and Kuskokwim regions and are consistently named as a primary food source in Alaska Native communities (ANHB 2004). They are considered "like medicine" to many Elders (Fienup-Riordan et al. 2020:76) because they are less oily and fatty than other species (e.g., Chinook salmon) and thus can feed Elders, people with open wounds or who cannot digest oil-rich salmon, and those who prefer their taste (KRITFC 2021; Moncrieff, Brown & Sill 2009). In addition, the low oil content makes chum salmon an easier resource for processing and drying (Raymond-Yakoubian and Raymond-Yakoubian 2015), which is vital for long-term storage through the winter, as well as for preparing traditional delicacies such as eggamarrluk (half-dried, half-smoked salmon) (KRITFC 2021).

In addition, the acts of fishing (e.g., pulling nets, walking along riverbanks) and harvesting (eg., cutting and hanging fish, maintaining fires) are energy intensive, providing exercise which can minimize the consequences of chronic diet related diseases. The benefits extend beyond physical health as well—both the strenuous activity and the cultural connection cultivated by subsistence practices have been found to reduce depression, substance abuse, and other mental health diseases that are increasingly prevalent in Indigenous communities in Alaska (ANTHC 2021b). Chum salmon thus supports mental and emotional health in Indigenous communities of the Yukon and Kuskokwim rivers. As stated by TCC to the Senate Committee on Indian Affairs:

> *"The act of going to fish camp, preparing camp, fishing, and processing fish is hard, physical activity. From dusk to dawn, families are working. [This] helps families stay busy and maintain focus in the present moment, which is ideal for mental health" (U.S. Senate 2023:18).*

Over the last 10 years, the salmon crisis has contributed to the number of diabetic and pre-diabetic patients due to increased food insecurity and lifestyle changes. Since 2019, TCC has found that the number of diabetic and prediabetic patients in its region has increased by 24.6% and 70%, respectively. This can be directly linked with declines in salmon abundance, harvesting, and consumption (Chief Andrew Isaac Health Center 2024).

4.3.3.2.2.2 Culture, Identity, and Family

Through fostering physical, emotional, and mental health, salmon and salmon fishing ground Indigenous peoples across Western and Interior Alaska in their unique identities, cultures, and places (see Raymond-Yakoubian 2019, for example). The fundamental importance of social relationships built around subsistence have been shared within and across generations by Indigenous residents of the Yukon River, Kuskokwim River, and their tributaries.

The relationship between Alaskan Natives and chum salmon has deep historical and cultural roots. The early Paleoindians in Alaska, traditionally thought of as big-game hunters, likely relied heavily on chum salmon as part of a diverse subsistence strategy that included fishing, hunting, and gathering. Evidence from the Upward Sun River site in the Yukon region of Alaska reveals that Alaskan Natives have been harvesting and consuming chum salmon as far back as 11,500 years ago (Halffman et al. 2015). Chum salmon were particularly important because of their predictable seasonal abundance and their suitability for preservation due to their lower oil content than other salmon species, supporting survival during long winter months. Additionally, the historical importance of chum salmon for Alaskan Natives underscores the rich biodiversity of the Beringia region and suggests that riverine resources were crucial to the economy and diet of these early inhabitants, even during the challenging post-Ice Age environment.

Fishing for salmon as a primary food is a means of practicing cultural values and a source for building and maintaining relationships, which shape and form identity (Raymond-Yakoubian 2019). In this way, salmon may be considered as a "cultural keystone species": a "culturally salient species that shape in a major way the cultural identity of a people, as reflected in the fundamental roles these species have in diet, materials, medicine and/or spiritual practices" (Garibaldi & Turner 2004). Moreover, salmon are considered kin to the Indigenous Peoples of the Yukon and Kuskokwim regions, meaning both salmon and humans have a responsibility to support the well-being of the other.

Many Indigenous peoples across the Yukon and Kuskokwim regions believe that humans and salmon share a mutual awareness. Salmon "are considered sentient creatures possessing intelligence and memory. Like all animals, they are aware of what people think and say about them" (Fienup-Riordan 2020: 11). Therefore, there are protocols for proper behavior and treatment of fish, and salmon are only caught when they willingly gift themselves to fishermen (Fienup-Riordan 2020 et al.; Voinot-Baron 2021). In the Yupiaq worldview, if this reciprocal relationship is not respected, the salmon will not return, meaning that sharing and avoiding waste is crucial (Fienup-Riordan 2020:25). Maintaining cultural connections amongst humans, and between humans and salmon, depends on humans maintaining these reciprocal relationships.

Avoiding waste is perhaps the pinnacle teaching and example of proper behavior and respect toward salmon. Checking set nets and fish wheels often, not catching more fish than can be processed in a timely manner (i.e., before spoilage), avoiding cutting during the hottest parts of the day, fishing during ideal weather, and proper cutting to use all parts of the salmon are all ways to avoid waste (Fienup-Riordan 2020; Ikuta et al. 2013; Moncrieff 2017; Raymond-Yakoubian and Raymond-Yakoubian 2015). Additionally, parts of the salmon that are not eaten, like bones and fins, must be properly disposed of, often through burial, burning, or return to the river, depending on the culture and family; and harvest gear and fish-cutting spaces must be kept clean (Fienup-Riordan et al. 2020). Failure to abide by these teachings, and thus disrespecting salmon, contributes to salmon declines (Fienup-Riordan et al. 2020: 78, 107).

Sharing resources is another hallmark teaching of proper behavior toward fish, and it is widely understood that sharing salmon leads to an increase in its abundance (Fienup-Riordan et al. 2020); builds strong connections between households within and across communities (Ikuta et al. 2016); and provides many benefits to individuals, households, and communities across the state including increased well-being, food security, food diversity, heritage, and cultural identity (Carothers 2021). Sharing is vital to social responsibility as well, as salmon are given to Elders and those who do not have access to fish, which further reinforces social and communal ties. Finally, sharing extends beyond simply exchanging resources to include cooperation in harvesting, processing, and sharing of equipment and knowledge.

It is at fish camp that these teachings, values, and kinship relationships with salmon are passed down to Alaska Native youth of the Yukon and Kuskokwim regions. Summer fish camps have long been a primary place for Indigenous families to gather, heal, learn from Elders, and foment traditional ways of life, and many families have maintained the same fish camp sites for generations (KRITFC 2024). Each person is given age-appropriate chores at fish camp (e.g., young children haul water, older adults supervise smokehouses), and the shared work both fosters responsibility and purpose as well as family unity, continuity, and belonging.

Chum salmon hold a special role at Yukon and Kuskokwim fish camps. They are often the first salmon on which young women will practice heading, gutting, and cutting fish. As shared by an Elder from the Kuskokwim:

> *"When they started bringing in chum salmon, I would try cleaning and cutting… When she handed me a fish to work on, I'd be very happy… That was how we girls learned about caring for fish, and each girl did the same" (Nastasia Larson, quoted in Fienup-Riordan et al. 2020:69).*

Young men, on the other hand, are taught purpose in becoming providers for their families through fishing. Contemporary salmon declines and fishing restrictions are preventing youth from fulfilling a core part of who they are, and Alaska Native youth who are disconnected from cultural practices have reported suffering suicidality and identity and mental health crises (Skewes et al. 2020; Voinot-Baron 2022). Cultural well-being is thus vital to mental and emotional health of regional Indigenous peoples.

Fish camp traditions are changing with declines in salmon abundance and related restrictions on fishing opportunities, increasing fuel prices, a greater dependence on store-bought food, and ties to full-time, year-round work, and many families are moving their fish camp sites and activities to their villages, closer to home (Johnson et al. 2009; KRITFC 2024). In general, fewer families are migrating to fish camps for any extended period, let alone for an entire summer fishing season. As said by one Kuskokwim Elder:

> *"I'm one of the fish campers...but I don't go to fish camp because of the fish closures. There's only maybe 5 in Tunt [who use their] fish camp right now. No, that's not that many." — Adolph Lupie, Tuntutuliak, as quoted in KRITFC (2021:7)*

Whereas in days of abundance, parents and grandparents could spend the summer teaching youth our ways of life, contemporary restrictions mean Indigenous youth "are having to learn core components of our way of life and how to be Real People in 12-hour [fishing] windows" (J. Samuelson, personal communication, September 25, 2024). Many families admit not permitting young children to practice cutting salmon because the few fish harvested are too precious to allow for mistakes.

While it is important to note that the practice of traditional cultures on the Yukon and Kuskokwim are alive and strong today, Alaska Native practitioners are being forced to adapt these traditions, particularly due to declines in traditional foods, climate change, and ongoing legacies of colonization. Drastic changes to, or a loss of fish camps, as well as heightened anxiety to meet subsistence salmon needs in short windows, impact families' abilities to gather, reconcile grievances, and instruct children (KRITFC 2024; Voinot-Baron 2022). Decreases in salmon have also affected families' abilities to share salmon without worry for winter food stores (Brown and Godduhn 2015; Ikuta et al. 2016). The absence of salmon and resulting effects to Indigenous families' abilities to embody millennia-old values and traditions is a leading contributor to social crises in WIAK families and communities. These effects also likely contribute to out-migration of families and population loss in rural regions as families pursue new forms of food security and identity in urban areas (Wolfe et al. 2010:14-15).

The loss of access to salmon and the criminalization of traditional practices have contributed to social issues within Indigenous communities, such as depression, anxiety, and the breakdown of cultural knowledge transmission. Younger generations have faced barriers in continuing the fishing traditions of their ancestors, disconnecting them from their heritage and cultural identity. To address these deep social and cultural losses, Indigenous leaders continue to advocate for the recognition of their rights and the restoration of their traditional stewardship roles (Carothers et al. 2021).

4.3.3.2.2.3 Economies and Livelihoods

Contemporary subsistence uses in rural Alaska occur within a mixed economy, which includes both a subsistence fishing and hunting component and a cash component. Commercial fishing has long played an important role in mixed economies for rural and Alaska Native communities across Alaska (Wolfe 1982; Reedy 2009). Wolfe & Spaeder (2009: 350) describe the connections between subsistence and commercial fishing across Western Alaska (Norton Sound, Kuskokwim, and Yukon areas), emphasizing that commercial fishing uses the same skills and equipment as subsistence fishing and serves to reinforce subsistence practices through providing an additional source of income that can help purchase subsistence gear (e.g., nets, motors, fuel). Fishermen also often retain some salmon from their commercial harvests for subsistence purposes (Brown et al. 2023). With no commercial opportunities for Chinook in the Yukon since 2008, recent commercial opportunities have centered on summer and fall chum salmon, though those too have ceased since 2020.

The combination of money from paid employment and subsistence food production characterizes the mixed subsistence economies in many areas of rural Alaska (Fall 2018). Subsistence food production is directed toward meeting the needs of families and communities, not market sale as in commercial production. In this way, families (or households and communities) will engage economic strategies that use household income (e.g., from commercial fisheries, fur trapping, wage employment, seasonal jobs, and dividends) to support subsistence activities and invest in efficient harvest technologies for subsistence use.

In many Indigenous Yukon and Kuskokwim communities, sled dogs have played an important role in mixed economies and culture as a means of transportation, hauling goods, subsistence hunting, fishing, and trapping, and racing (Andersen 1992). Chum salmon has long been a primary food source for dogs, and fishing for a dog team was a large portion of the annual subsistence harvest for many communities (Duffy et al. 2013; Native Village of Georgetown 2021). As a primary means of transportation and work, it was critical that dog teams were fed good “fuel,” primarily chum salmon. Though the number of sled dogs in rural Alaska communities has declined since the arrival of snow machines in the late 1960s and early 1970s (Ikuta et al. 2013), sled dogs, the caretaking that they require, and mushing are activities that continue to the present and provide a means for intergenerational relationships to form and for knowledge about one’s culture and environment to be shared (LaVine 2010). The decline in salmon, and particularly chum salmon, on the Yukon and Kuskokwim has been a significant shock to many sled dog kennels, whose owners now must find other food sources for their dogs, ranging from Northern pike to expensive manufactured dog food.

During recent chum salmon declines, TCC has facilitated the distribution of fish to Tribal communities along the Yukon River that are unable to engage in subsistence fishing. This is a significant effort that extends well beyond the cost and includes cultural, legal, and logistical complexities as well. On average, the cost to distribute fish, both donated and purchased, to replace forgone subsistence harvests in the TCC region has totaled approximately $1,968,506.82 annually since 2020: TCC has spent an average of $713,866.44 per year to purchase salmon for its Tribal Citizens, and collectively, the Tribes in the TCC region have spent an additional $1,254,640.38 annually on fish distribution.[120] In 2024, for the second summer in a row, all TCC communities have received fish by the end of the season.[121]

In addition, Tribal citizens have incurred higher expenses in recent years from the maintenance of fish camps, especially when unused and facing increased environmental exposure. Without regular in-season maintenance, repair costs have escalated due to the need for significant rebuilding, including high expenses for materials, labor, and transportation to remote locations. Economically, the cost of restoring these camps after long periods of disuse is substantial, ranging from $20,000 to $50,000, depending on their condition and size. This cost includes replacing damaged structures like drying racks, cabins, and access roads. Logistical costs for transporting materials to remote Yukon River areas can add 10-30% to the total expense. Additionally, with fewer locals skilled in traditional construction, communities often need to hire external labor at rates of $35 to $70 per hour, further increasing restoration costs.

Fish camps along the Yukon River face increasing rehabilitation costs as they go unused, with the potential for rebuilding expenses to far exceed initial estimates. However, as discussed above, the cultural and social costs of restricted subsistence harvests go well beyond monetary concerns. The loss of TK and reduced engagement in subsistence activities weaken Alaska Native communities' economic resilience and increase reliance on external food sources. The decline in subsistence fishing has led to unattended camps, making them vulnerable to trespassing, vandalism, and environmental damage. Repairing this damage adds to already high maintenance costs, while the cultural significance of these camps makes their loss emotionally impactful for the communities. Proactive investment is needed to restore the camps and revive subsistence practices.

4.3.3.2.3 Ecosystems and Biodiversity

Alaska Native people across Western and Interior Alaska are deeply interconnected with regional ecosystems and cannot be separated from them. In the Yukon and Kuskokwim regions, Tribal Nations and people are deeply interconnected with regional ecosystems and cannot be separated from them; the health of the people is reflected in that of the ecosystem, and vice versa (Samuelson 2023). As salmon declines are deeply felt in families, cultural exchanges, and economies in the Yukon and Kuskokwim regions, so too are they felt across the ecosystem.

Chum salmon are a nutrient vector between marine and freshwater environments. When salmon return to spawn and die, their carcasses provide a critical influx of marine-derived nutrients to river ecosystems, supporting a wide array of species—from aquatic insects to large predators (Cederholm et al. 1999; Walsh et al. 2020). The recent and dramatic declines in chum salmon populations have likely disrupted this nutrient cycle, leading to nutrient-poor conditions in rivers and streams, which can affect the entire aquatic food web and reduce biodiversity at multiple trophic levels.

For instance, lower chum salmon returns have a direct effect on predators in the Yukon and Kuskokwim regions that rely on salmon as a food source, like bears, eagles, and wolves. Predators face food shortages, particularly as they head into winter, which can result in lower survival rates, diminished population sizes, and their movement into areas with higher food density, including human villages and towns. As stated by one Kuskokwim TK holder:

> *"When the chum returns were good, it was just stink, and fish were everywhere.* ***I*** *don't think people realize the importance they have to the ecosystem. The river's health, the plants. I think of all the bears, and if they have no fish, they're eating berries; but that's not going to hold them off,*

[120] These figures do not include additional costs for specific TCC programs, such as the Elder Nutrition program, and costs of staff labor and benefits to distribute fish. Additionally, many Tribes' distribution program costs have been partially offset by grants, and they face the risk of no longer being able to supplement fish supplies beyond what TCC can provide once this funding ends.

[121] The process of ordering fish begins in late March or early April, with the goal of having fish available by May and completing distribution by August. TCC staff spend 2-4 months per year preparing for the distribution, and when it comes time to distribute the fish, it requires 4-6 staff members working 25-40 hours per week to coordinate all the logistics.

so they have to eat more baby moose; and then we get back to where we are still: trying to conserve moose up here." (Whitworth et al. 2023, in Siddon 2023:133).

Salmon also contribute to the structure of the rivers and streams themselves by digging redds (nests) for their eggs. This process of digging and reshaping gravel beds creates habitat for many other species, such as aquatic insects, other fish species, and amphibians. Lower chum salmon returns reduce the frequency of this natural process, leading to more stable and compacted riverbeds, which may reduce habitat diversity.

Juvenile chum salmon feed on aquatic insects and small forage fish in the river. Chum salmon population declines could lead to an overabundance of certain prey species, which disrupts the balance of predator-prey relationships in the river. The absence of salmon also alters the ecosystem dynamics for other fish species that either depend on the same food sources or depend on chum salmon as prey, leading to imbalances in the river ecosystem and affecting the long-term sustainability of populations which are vital to the diet of other species. For instance, at the Henshaw Creek weir project in the Yukon drainage, the 2021 summer chum salmon escapement of 3,729 fish represented only 2.5% of the annual average escapement from 2000 to 2019. Over this same period, changes in longnose sucker and Northern pike abundance were also noted, highlighted the interdependence of salmon and other species (McKenna 2022).

Across Alaska, the average chum salmon body after 2010 were 2.4% smaller than the average body size obsered prior to 1990 (Oke et al. 2020). Smaller chum salmon today provide roughly 1.11 fewer meals per fish in the Kuskokwim region (10% decline), 1.3 fewer meals per fish in Nenana (11.2% decline), and 1.4 fewer meals per fish in Emmonak (12.5% decline) (Oke et al. 2020).[122] Decreased numbers of fish harvested compounds the loss of meals from shrinking body sizes, and declines in salmon body sizes could decrease fecundity and nutrient transport to and across ecosystems, with additional, consequential adverse effects for human communities.

Over time, as chum salmon return smaller at age, and particularly at times of low abundance, communities are needing to find alternative food sources. Species substitutions may lead to cumulative overharvesting and further reductions in biodiversity. One Kuskokwim TK holder has observed similar trends:

> *"There just weren't any [chum salmon in 2021]. I was having to harvest a lot more reds than I normally would for all of that other stuff...I think a lot more people were just getting a lot more reds. So, then that makes me concerned about the red numbers. If we have to keep doing this and hitting them hard, then maybe, is that going to negatively impact what's spawning, what comes back…? And that was the talk, too, a couple of years ago. I remember as we were having to harvest more chum, people were like, 'Well, you guys are going to have to start watching the chum numbers.' Same with whitefish, people were bringing that up. If we're having to harvest more whitefish, we're going to have to start thinking about watching those species. I guess it all has a ripple effect." (Megan Leary, quoted in KRITFC 2021:7).*

This has been a challenge for many families, as chum salmon especially have been one of the most reliable, abundant salmon species for annual food stores during recent declines of other traditional food sources, like Chinook salmon, caribou, moose, and waterfowl (Godduhn et al. 2020; KRITFC 2021).

4.3.4 State Management of Commercial Chum Salmon Fisheries

Commercial fishing is defined by the State of Alaska as the taking, fishing for, or possession of fish with the intent of disposing of them for profit, or by sale, barter, trade, or in commercial channels (AS 16.05.940 (5)). Commercial fisheries in Alaska fall under a mix of state and federal management

[122] Personal communication, K. Oke.

jurisdictions. In general, the state has management authority for all salmon, herring, and shellfish fisheries, and for groundfish fisheries within three nautical miles of shore.

Management of the commercial salmon fisheries is the responsibility of the ADF&G Division of Commercial Fisheries, under the direction of the BOF. The salmon fisheries are administered through the use of management areas throughout the state and managed under a limited entry system; participants must hold a limited entry permit for a fishery to fish and the number of permits for each fishery is limited. The state originally issued permits to persons with histories of participation in the various salmon fisheries. Permits can be bought and sold.

4.3.4.1 Commercial Harvests of Chum Salmon in Western and Interior Alaska

This section provides information on the commercial chum salmon fisheries in the western Alaska river systems and bay areas, presented by ADF&G management area. This includes commercial chum salmon fisheries that have historically occurred in Kotzebue, Norton Sound,[123] the Yukon River, Kuskokwim River and Bay, and Bristol Bay management areas (see Figure 4-24). In alignment with the subsistence fisheries highlighted in Section 4.3.3, commercial fisheries are the focus of this section because the Council's Purpose and Need statement is specific to Western and Interior Alaska, and these regions broadly align with Coastal WAK and Upper/Middle Yukon genetic reporting groups.

The SIA prepared for the April 2024 Council meeting contains substantial, additional information on commercial harvests of salmon including a longer time series of harvest data and discussion of fishery status broken down by management area and is incorporated by reference here.

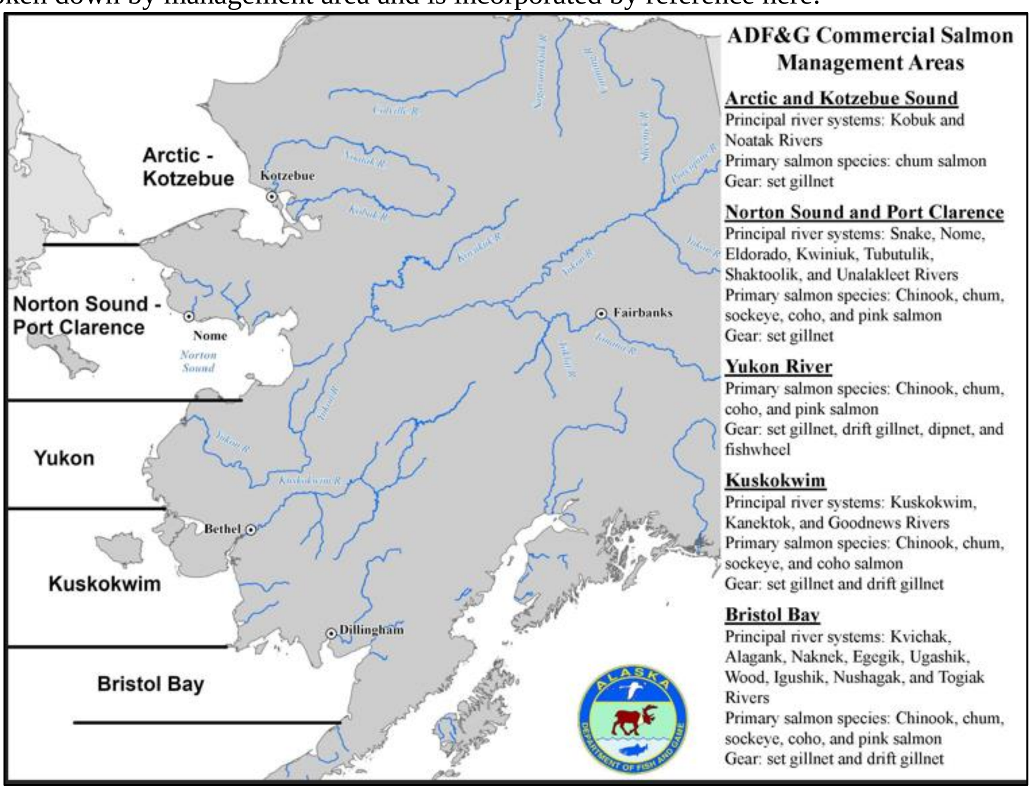

Figure 4-24 ADF&G commercial salmon management areas in Western Alaska
Source: ADF&G personal communication, 1.25.24

[123] The ADF&G management area includes Norton Sound up through Port Clarence; however, the commercial fishery in the Port Clarence District has been closed since 2009 and is therefore not included here.

Summary of Commercial Chum Salmon Fishing Trends

All commercial salmon fisheries within the Western and Interior Alaska management areas have experienced either closures or declining commercial chum salmon harvest trends in recent years. Table 4-36 provides a snapshot of trends in the commercial chum fisheries associated with each ADF&G management region and Figure 4-25 provides a visual representation of more recent (2011-2023) commercial catch.[124] Table 4-36 also demonstrates chum salmon revenue dependence through the percent of total salmon value that is attributable to chum salmon relative to other salmon species in the most recent year the commercial fishery was open (since 2023). The eight Commercial Fisheries Entry Commission (CFEC) permits that cover commercial fishing in these regions do not prescribe the type of salmon species that can be harvested. However, this is influenced by the species composition within each region and the regulatory salmon management plans adopted by the Board of Fisheries, as well as additional management measures ADF&G may put in place to protect species of concern.

The vast majority of commercial salmon harvested in the **Kotzebue** area is chum salmon, due to the relative abundance of this species. For Kotzebue, large declines in commercial harvest have occurred since 2018, when nearly 700,000 chum salmon were caught Table 4-36 and Figure 4-25). Although harvest in the 2022 season was above the 1962-2023 average harvest of 231,196 chum salmon (at 475,624 chum salmon), this year appears to be an anomaly among lower years of harvest. Total chum harvested in 2023 dropped back below average, although processor logistics and capacity likely limited harvest in this year. In 2024, harvest levels continued to drop dramatically (not represented in the tables or figures), with 5,392 total commercial chum salmon harvested which was the poorest harvest since the state started managing the Kotzebue District in 1962, largely driven by poor chum salmon abundance.[125]

Although the **Norton Sound** commercial chum salmon fishery has remained opened in this recent period, along with the commercial harvesters in the Yukon and the Kuskokwim, participants in these fisheries have been experiencing multi-species fishery disasters (as declared by the Secretary of Commerce).[126] Prior to the 2000s, commercial salmon fishing in the area was sporadic due to lack of commercial fish buyers in all subdistricts. Since 2008, markets have been generally stable with a single processor, Norton Sound Seafood Products, operating buying stations in villages across Norton Sound. As demonstrated in Table 4-36, Norton Sound commercial fisheries derived more than 50% of their value from chum salmon in 2023. However, commercial species dependency also includes coho and pink salmon, with the relative proportions shifting over time. Since 2018, harvest of all species in the Norton Sound Area has declined. In 2023, commercial salmon fisheries harvested 15,693 chum salmon (Table 4-36) which further dropped in 2024 to 4,297 chum salmon. This is well below the record high in 1983 of 319,437 chum salmon. The Northern Norton Sound subdistricts generally met their escapement objectives for chum salmon in 2023, but the Southern Norton Sound subdistricts did not and Subdistricts 4, 5, and 6 did not open for commercial fisheries directed at chum salmon.

There are two distinct runs of chum salmon on the **Yukon River**, the summer and fall chum runs. Chum salmon management in the lower river transitions from summer chum salmon management to fall chum salmon management on July 16. Commercial chum salmon closures have been in place for Yukon River summer chum since 2021 and for the fall run since 2022. Chinook salmon timing overlaps with summer run chum salmon and poor Chinook salmon abundance for over a decade has led to reduced commercial fishing opportunities for summer chum salmon to avoid Chinook salmon. The lack of commercial harvest

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[124] Data in this section extends to the 2023 commercial seasons; however, the text has been updated to include consideration of commercial harvest patterns from 2024.

[125] ADF&G 2024 Kotzebue Sound Salmon Season Summary

[126] Disaster determinations were approved by the Secretary of Commerce for the 2019 through 2021 Norton Sound red king crab fisheries, 2020 and 2021 Norton Sound chum and coho salmon fisheries, the 2020 through 2022 Yukon River salmon fisheries, and the 2020 through 2022 Kuskokwim River Chinook, chum and coho salmon fisheries. Positive determinations make these fisheries eligible for disaster assistance from NOAA if funds are appropriated by Congress. A declared fishery disaster must meet specific requirements under the Magnuson-Stevens Fishery Conservation and Management Act.

in recent years is a stark contrast to commercial harvests of 576,700 summer chum salmon in 2018 and 489,702 fall chum salmon in 2017.

Large scale commercial salmon fisheries in the **Kuskokwim Management Area** have not occurred since 2016. Since that time there has been limited commercial opportunity in the Kuskokwim River, with participants needing to secure their own market for their catch prior to fishing, due to the absence of a processor. The opportunities were provided later in the season and directed at coho salmon, after most subsistence salmon fishing was completed. On the other hand, in Kuskokwim Bay, a single processor operated in 2020 and 2021 and a small number of chum salmon were caught during the commercial sockeye salmon directed fishery. Poor chum salmon abundance was observed in 2021-2023 in Kuskokwim River and 2021 and 2022 in Kuskokwim Bay and would not have allowed for a commercial chum salmon fishery in those years.[127]

Commercial salmon fisheries in **Bristol Bay** primarily target sockeye salmon and accounts for the largest sockeye salmon fishery in the world. In 2023, 41 million sockeye salmon were harvested in the commercial fishery. By contrast, in 2023, about 343,000 chum salmon were harvested in the Bristol Bay commercial salmon fishery. In 2024 the sockeye harvest dropped to 31 million and chum harvest dropped to about 250,000 salmon. The chum salmon catch also comprises a small (<1%) proportion of the total value of the fishery. Similar to other management areas, the harvest has dropped considerably relative to the 2018 harvest of 1.6 million chum salmon and it is below the 20-year average of 1.1 million fish.

[127] In 2024 (and some other recent years), some limited commercial salmon fishing periods were opened, despite the low chum salmon returns. These fishing periods are focused during times when coho are known to be running and therefore effort was not "directed" at chum salmon. Additionally in 2024, limited opportunities were made available because no large-scale processors operated, and thus minimal effort expected. If there had been a large-scale processor present, commercial opportunity may not have been provided.

Table 4-36 Comparison of commercial chum salmon harvest and value with historic averages (most recent year included is 2023)

Fisheries Management Area	Most recent year with directed commercial chum fishery (since 2023)	Chum catch in most recent year opened (number of fish)	Chum ex-vessel value in most recent year opened	% of total salmon value chum represents in most recent year opened	10-year average catch from most recent year opened (number of fish)	10-year average ex-vessel value beginning in from most recent year opened	Historic high catch (number of fish)
Kotzebue	2023	141,781	$733,061	100%	385,919	$1,426,326	695,153 (2018)
Norton Sound-Port Clarence[a]	2023	15,693	$62,606	54%	94,609	$430,303	319,437 (1983)
Yukon River Summer Run	2020	13,968	$51,067	99%	386,991	$1,378,825	1,616,682 (1988)
Yukon River Fall Run	2019	268,360	$1,073,146	76%	268,923	$1,304,167	489,702 (2017)
Kuskokwim River	2020[b]	*	*	*	51,194	$129,564	1,318,647 (1988)
Remainder of Kuskokwim Area[c]	2021	5,845	$6,453	1%	21,029	$115,686	133,524 (2010)
Bristol Bay	2023	342,905	$574,777	0%	822,485	$1,478,778	2,243,569 (2006)

Source: ADF&G Annual Management Reports and Season Summaries
* represents confidential data do to less than three individuals making landings.
a = Norton Sound ex-vessel values calculated as the product of total chum salmon lb harvested and the average ex-vessel price.
b = There have been no commercial processors operating on the Kuskokwim River since 2015 and no commercial catcher/sellers targeting chum since 2020. The commercial fishery on the river was closed for chum salmon fishing 2021-2023 due to low abundance. The small amount of commercial harvest between 2016-2020 is catcher/seller only and confidential due to limited participation. Thus, the 10-yr Kuskokwim River average is calculated from 2006-2015.
c = There were no commercial chum salmon fisheries in the Kuskokwim Bay area from 2016-2019 due to a lack of processors, There were no commercial fishery in 2022-2023 due to low abundance of chum salmon. The 10-yr average is calculated from 2012-2021.

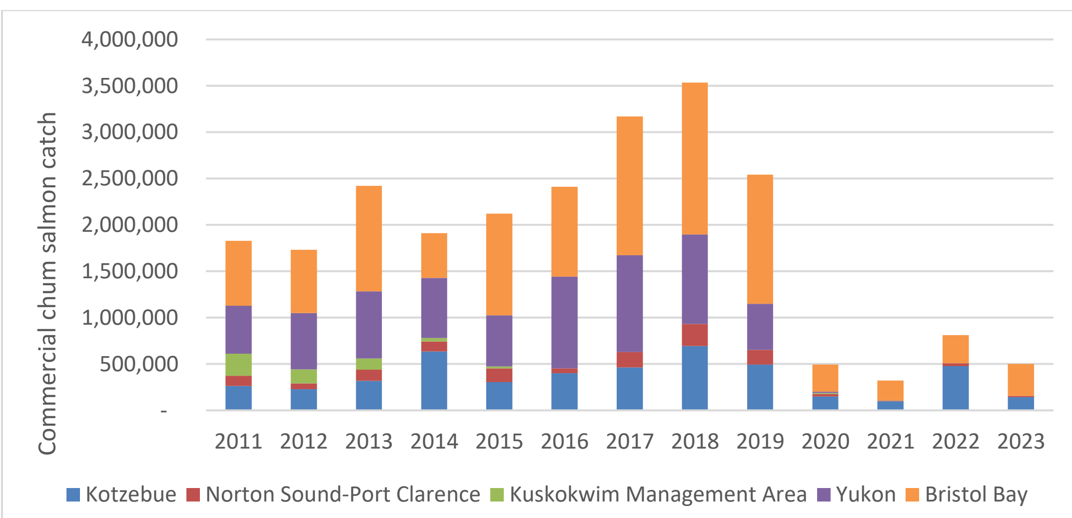

Figure 4-25 Trends in commercial chum harvest, 2011 – 2023
Source: ADF&G Annual Management Reports and Season Summaries

Regional Economics of Commercial Chum Salmon Fishing

Commercial salmon fishing opportunities can play an important and integrated role in the vitality and well-being of communities throughout the ADF&G Management Areas analyzed here. Communities associated with these management areas are considered remote and rural communities by almost all standards and opportunities to generate income are extremely limited. As described in Section 4.3.3.2.2.3 for communities such as these that are engaged in mixed economies, commercial fishing can provide household income for investment into resources that allow for subsistence harvests. Additionally, commercial salmon fishing equipment (e.g., boats, fishwheels, nets, four-wheels) may be used for other subsistence activities well, or depending on the area management, subsistence fishing may occur simultaneously with commercial fishing. **Therefore, the economic impacts from declines in salmon fishing opportunities fit into a larger regional economic and social framework that can have broad and long-term implications for permit holders, households, and communities within the regions.**

Participation in commercial fisheries has been one factor associated with higher subsistence harvest rates, which means that those with access to commercial boats and equipment may also be supporting others in the community as a "super household" (i.e., where a small number of harvesters are responsible for the majority of subsistence harvests). It was noted by residents in the Norton Sound/ Bering Strait region, that jobs can represent a unique challenge in that they provide income that can aid subsistence harvests, but that time required for these jobs can keep people from participating in subsistence (Raymond-Yakoubian & Raymond-Yakoubian 2015). As a seasonal employment opportunity, commercial fishing can provide valuable flexibility for following a year-round subsistence calendar (or the "seasonal round" within a community).

Revenue earned in commercial salmon fishing can also provide for basic necessities that require income. The cost of living is high in rural Western and Interior Alaska. In particular, goods or services that require transportation are expensive or in some cases unavailable. Poverty rates are high in Western and Interior Alaskan communities, many of which overlap with the local permit holder residences for commercial chum salmon fisheries throughout Norton Sound, the Yukon Area, Kuskokwim Management Area, and Bristol Bay). Therefore, joint restrictions for commercial and subsistence salmon harvesting can represent a "double-blow" to a household's access to food with both reductions in a primary source of protein, through subsistence salmon harvests, in addition to disposable income to purchase food at a store. Moreover, if or when a super household is doubly impacted by commercial and subsistence fishing closures, this may have important ripple effects throughout communities in terms of sharing networks, food security, and cultural practices (Wolfe et al. 1982).

Historically, the economic importance of chum salmon commercial fisheries varies by the region of Western and Interior Alaska due to the salmon species available for commercial harvest in addition to the other non-fishing economic opportunities in the permit-holders' community of residence. Employment opportunities are extremely limited in most of these fishing communities within Western and Interior Alaska, although the CDQ groups have invested into their regions and communities by providing seasonal, full-time, and internship employment opportunities for some residents (see Section 4.1.2.4 for more examples).

The April 2024 SIA for the Initial Review demonstrates fishing diversification for several time scales and in the context of both overall harvest levels and value of revenue from chum salmon versus other fisheries revenue. Both a longer and shorter-time series for Kotzebue and Bristol Bay demonstrates consistent patterns in chum dependency for commercial fishing. The Kotzebue commercial gillnet fishery continues to show near total dependence on chum salmon. While the magnitude of chum caught in the Bristol Bay commercial fishery can be high (e.g., 2.2 Mlb in 2006; Table 4-36 in the April 2024 SIA), the relative harvest of chum in this fishery is dwarfed by the magnitude of the commercial sockeye salmon fishery. However, for some commercial fisheries (i.e., Norton Sound, Yukon, Kuskokwim), chum salmon has become relatively more important to total ex-vessel revenue as Chinook salmon is less available. The

Yukon River commercial gillnet fisheries have historically focused on both Chinook and chum salmon, while Norton Sound and the Kuskokwim area have historically been more diversified across several species.

The April 2024 SIA also demonstrates the degree to which these commercial fisheries are primarily prosecuted by local permit holders (Tables 4-57 through Table 4-71). Kotzebue, Norton Sound, the Yukon River, and the Kuskokwim area commercial fisheries are prosecuted by primarily local harvesters, with over 95% of the permit holders residing in local communities for each of these fishery management areas. In contrast, 75.4% of CFEC gillnet permit holders for Bristol Bay are held by non-local residents.

The presence of fish buyers or commercial fishing processors are another important component for commercial fishing opportunities. As described in the April 2024 SIA, processors have not always been available to support commercial operations, including the Kotzebue region in the early 2000s, Norton Sound prior to the 2000s, and in the Kuskokwim region since 2016, and this can greatly limit the scope of commercial fishing operations. Declines in salmon can also contribute to declining processor interest, as it may not be economically feasible to maintain a plant without the necessary economies of scale. Some CDQ groups currently and have historically contributed to available processing capacity. Processing plants can also generate employment opportunities for the residents of associated communities.

Typically, regional economic impact analyses consider the sectors that support an industry of focus and the indirect effects associated with a change in expenditures within that industry resulting from the proposed action or change. Some support services like this exist, particularly in CDQ communities, through the groups' community-based ventures. For example, CVRF has developed Mechanic/Welding shops in 18 of their communities, where residents can employ the services of certified mechanics. However, given the highly local nature of the commercial WAK salmon fisheries (with the exception of the Bristol Bay commercial fisheries), the limited number of businesses in many of these rural communities, and importantly the cultural practice of sharing which may include one's labor (Raymond-Yakoubian 2019), "support sectors" can look different in many of the rural Western and Interior communities. For instance, rather than disposable income exchanged for assistance in preparing fishing gear, in some instances there may be an expectation of a younger family member assisting an older family member.[128] In this way, skills and knowledge may be passed down as well. With limited businesses available to provide for-profit services, developing the skills and knowledge for commercial fishing, boat maintenance, equipment repair, etc. can be another type of value generated without necessarily involving monetary exchange.

Inter-generational commercial operations within fishing families in Western and Interior Alaska can be seen through CFEC permit transfers (CFEC 2022a; CFEC 2022b). For six of the eight permits associated with the Arctic, Yukon, and Kuskokwim management areas, more than 50% of the transfers between 1980 – 2021 for each permit type, were transferred to an immediate family member. The Kuskokwim salmon gillnet permit (S04W) had the greatest percent of total transfers to immediate family members at 72.4%, compared to the statewide level for all fishery permits of 33.6%. Additionally, these Arctic, Yukon, and Kuskokwim salmon permits are sometimes gifted rather than sold at rates ranging from 39.2% of transfers (Upper Yukon Fishwheel; S08P) to 61.2% of transfers (Kuskokwim salmon gillnet permit; S04W)) for all transfers between 1980- 2021. This is relative to 32.5% of all commercial fishery permit transfers statewide that were gifted during the same time period. Bristol Bay permits are transferred at a much higher rate, given the magnitude of the fishery, with 38.7% of all Bristol Bay salmon permits gifted and 35.4% going to immediate family members, during this same time period.

[128] Personal communication, J. Raymond-Yakoubian.

4.3.4.2 South Alaska Peninsula Management Area (Area M)

Western Alaska chum salmon are incidentally caught in other state waters fisheries, including the South Alaska Peninsula Management Area (Area M) commercial salmon fisheries. Section 4.3.4.1 provides information on commercial chum salmon fisheries across Western and Interior Alaska. The Area M fishery is proximate to the affected environment, and while specific aspects of overall State of Alaska salmon fishery management continue to be modified, it is reasonably foreseeable that this fishery will continue in the future.

Chum salmon are harvested alongside sockeye, pink, coho, and Chinook salmon within the South Alaska Peninsula Management area. ADF&G manages commercial salmon fisheries in the South Alaska Peninsula. This management area includes waters from Kupreanof Point west to Scotch Cap on Unimak Island and includes the Unimak District, Bechevin Bay Section of the Northwestern District, Southwestern District, South Central District, and Southeastern District. The 2023 commercial salmon harvest in the South Alaska Peninsula totaled 20,167,684 salmon. The majority of salmon harvested were pink salmon at 85% 17,097,391 fish), followed by sockeye at roughly 9% (1,740,707 fish) and chum salmon at 5% (1,120,863 fish) of the total harvest. Major fish processing operations have historically been located at Sand Point, King Cove, Dutch Harbor, and Akutan.

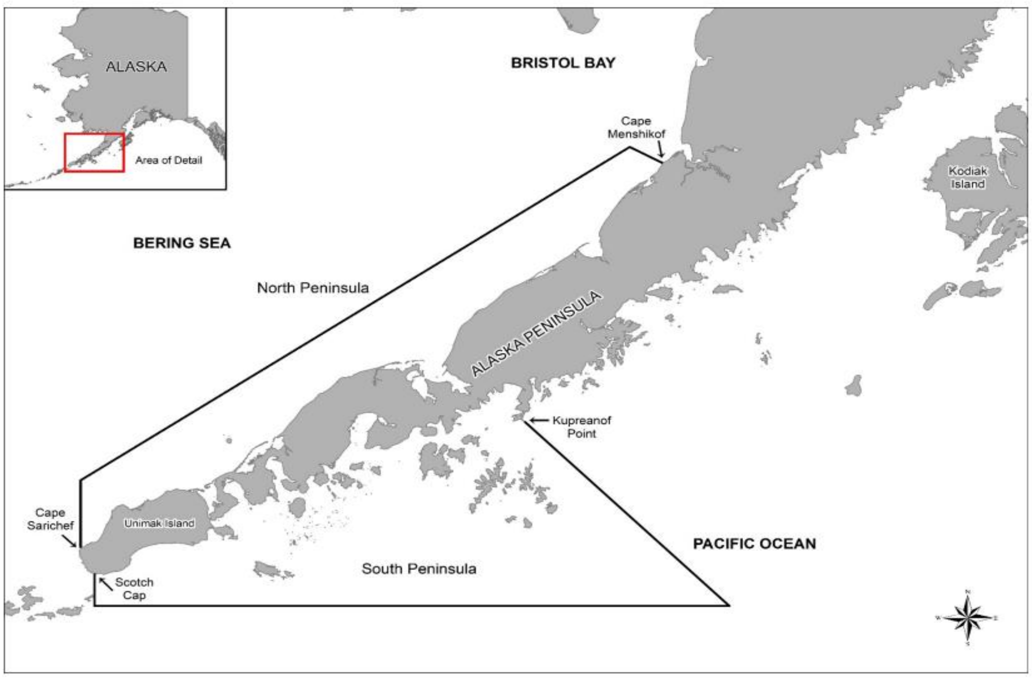

Figure 4-26 Map of Alaska Peninsula Management Area with the North and South Peninsula Defined
Source: ADF&G

Overview of Area M Chum Salmon Harvests

The South Alaska Peninsula fisheries vary by time and space for gear types and are prosecuted in two fishing seasons, a June commercial fishery in the South Unimak and Shumagin Islands and a post-June fishery that covers all waters of the South Alaska Peninsula Management Area (except the Southeastern District Mainland) from July 1 through October 31. Legal fishing gear types in South Peninsula waters include purse seine, drift gillnet and set gillnet.

Table 5-2 provides the number of chum salmon harvested in the June commercial fishery in the South Unimak and Shumigan Islands compared to the annual harvest of chum salmon in the South Alaska Peninsula from 2006 to 2022. As shown, commercial harvests of chum salmon in the June fishery comprise a significant proportion of the annual chum harvest, ranging from 25% in 2006 to 77% in 2014. The numbers of chum salmon harvested ranged from a low 429,703 fish in 2016 to a high of 2,256,363 fish in 2021.

Table 4-37 Number of chum salmon harvested in the South Unimak and Shumigan Islands June fishery compared with annual chum salmon harvests in the South Alaska Peninsula fisheries from 2006 to 2022

Year	June Chum Salmon Harvest	Annual Total Chum Salmon Harvest	June Harvest as Proportion of Annual Total
2006	299,827	1,185,661	25%
2007	297,539	681,087	44%
2008	410,932	814,123	50%
2009	696,775	1,684,944	41%
2010	271,700	792,369	34%
2011	423,335	979,187	43%
2012	395,060	623,967	63%
2013	399,058	952,160	42%
2014	390,139	505,197	77%
2015	178,715	680,167	26%
2016	270,614	429,703	63%
2017	640,891	1,960,576	33%
2018	537,466	998,585	54%
2019	549,072	1,168,952	47%
2020	490,128	915,147	54%
2021	1,168,601	2,256,363	52%
2022	544,097	822,314	66%

Source: ADF&G, Dann et al. (2023) and Fox et al. (2022)

Stock of Origin for Chum Salmon Caught in Area M Commercial Fisheries

The origin of chum salmon stocks harvested in the South Unimak and Shumagin Islands June fishery has long been of interest to fishermen and stakeholders. Various studies have been conducted to identify the origins of chum salmon harvested in the Area M fishery, most notably the Western Alaska Salmon Stock Identification Project (WASSIP) which was completed in 2012, and a new study was designed to estimate stock, age, and length compositions and stock-specific harvests in South Alaska Peninsula fisheries in 2022–2026.

WASSIP was initiated in 2006 and comprehensively sampled commercial and subsistence fisheries for chum and sockeye salmon throughout Western Alaska, from Chignik to Kotzebue over a four-year period (Eggers et al. 2011). Chum salmon sampled in 2007 to 2009 were subsequently analyzed and a genetic baseline reported stock compositions to 9 reporting groups that were defined by a combination of stakeholder interest, population genetic structure, adequate representation of individuals and populations within reporting groups in the baseline, and expected contributions of reporting groups to catch samples: Asia, Kotzebue Sound, Coastal Western Alaska (CWAK), Upper Yukon, Northern District, Northwestern District, South Peninsula, Chignik/Kodiak, and East of Kodiak. Stock compositions and stock-specific harvests and harvest rates from WASSIP were reported in 2012 (Dann et al. 2012a; Habicht et al. 2012a; Munro et al. 2012; Templin et al. 2012).

From 2007–2009, 29%-33% of chum salmon harvested in the South Alaska Peninsula were of CWAK origin (Munro et al. 2012). In 2022, a preliminary study was conducted to estimate harvest rates for Western Alaska and Alaska Peninsula stocks in the 2022 South Alaska Peninsula commercial salmon fisheries, building on the methods developed during WASSIP (Dann et al. 2023). That preliminary study found the relative proportion of CWAK stocks was substantially lower than WASSIP years at 12.8% (see Table 27 in Dann et al. 2023), though stock proportion is known to vary by time (e.g., more CWAK chum salmon were harvested during the June fishery than post-June fishery) and gear type (e.g., the CWAK chum salmon stock proportion was higher in gillnets compared to other gear types, like seines).

4.4 Effects of the Alternatives on Western Alaska Chum Salmon Fisheries

This portion of the analysis is a direct extension of Section 4.4 describing the status quo conditions for subsistence and commercial chum salmon fishermen and communities, as well as the results presented in Section 3.2.4 on potential chum salmon bycatch reductions. Here, the analysis evaluates the potential indirect and positive effects (typically referred to as "benefits" throughout the analysis) that could be realized by chum salmon fishermen, rural and Indigenous communities, and Tribes across Western and Interior Alaska.

Additionally, this portion of the analysis directly addresses E.O. 12866, which requires a thorough consideration of the potential net benefits of the proposed action. This evaluation involves a detailed evaluation of both the expected costs and benefits at a national level, to include both quantifiable and qualitative considerations. Additionally, E.O. 12866, as well as National Standards require consideration of distributional economic and social impacts at a finer scale. As such, this section of the analysis describes benefits at a disaggregated level that allows for an understanding of potential distributional impacts and includes a broader discussion of other impact categories which may not be included in a net benefits calculation but are important for achieving National Standards and consideration in decision-making.

The analysis uses different approaches to evaluate a wide range of potential benefits that could result from the proposed alternatives. One approach compares the potential AEQ chum salmon savings estimates for Alternative 2 and 3 to Yukon River summer and fall chum salmon management plan thresholds for escapement and directed uses (see Section 4.4.2.1 for further detail). The analysis also considers the many intervening variables that are beyond the Council and NMFS's control and could affect whether these potential benefits would be realized. However, an AEQ analysis may not fully capture the importance of a relatively small number of chum salmon returning to their natal systems as a result of reduced bycatch in the pollock fishery (see Appendix 1, 7, and 8 for more detail). Some of these benefits – improved ecosystem wellbeing, maintaining or rebuilding spiritual connections with salmon, among others – cannot be measured in quantitative terms but are no less important for considering the range of potential indirect and positive effects from the proposed alternatives. Both approaches are presented while contextualizing the relevant points of uncertainty.

The approach used to characterize the potential impacts to the Bering Sea pollock fishery is fundamentally different from the approach used to characterize the potential benefits. The proposed action would directly regulate chum salmon bycatch in the Bering Sea pollock fishery. Thus, the quantitative components of the impact analysis conducted to assess potential revenue impacts on the pollock fishery is possible because participants in that fishery are the entities that will be directly regulated under the proposed action. A similar approach to estimating impacts on chum salmon users is not possible because the alternatives do not directly regulate salmon fisheries and, therefore the uncertainty around the potential impacts is different in nature and arguably greater. In addition, there is no way for the analysis to precisely estimate the individual river systems and tributaries that chum salmon caught as bycatch originating from CWAK reporting group may return to, and it would not be appropriate to attribute current bycatch levels or estimated savings in proportion to specific populations and regions. An estimate of total run size and returns is not available, apart from the Yukon summer and fall chum salmon runs.

4.4.1 Alternative 1

Alternative 1 would retain the existing chum salmon bycatch regulations. Information on status quo levels of chum salmon PSC in the pollock fishery is provided in Section 3.2.4.1. To summarize:

The estimated number of chum salmon caught as B season bycatch from the CWAK reporting group ranged from a low of 3,152 fish (2012) to a high of 82,103 fish (2017). Estimates on AEQ CWAK chum salmon removed due to bycatch in the pollock fishery ranged from a low of 11,608 fish (2012) to a high of 69,445 fish (2017).

The estimated number of chum salmon caught as bycatch during the B season pollock fishery from the Upper/Middle Yukon reporting group ranged from a low of 1,022 fish (2019) to a high of 15,495 fish (2017). Estimates on AEQ Upper/Middle Yukon chum salmon bycatch ranged from a low of 2,123 (2020) to 16,429 (2017). The impact of bycatch on the Upper/Middle Yukon reporting group fluctuated annual from 2011 to 2022, averaging 1.0%.

Selection of Alternative 1 would be expected to maintain the level of impact observed under status quo regulations. Conditions may change if the pollock fleet's fishing behavior changed apart from the proposed regulatory changes and this resulted in reduced chum salmon bycatch. Similarly, environmental conditions could change such that WAK chum salmon abundance improves apart from the proposed regulatory changes.

4.4.1.1 Subsistence Chum Salmon Users

This section was co-written by KRITFC and TCC with contributions from analytical staff. IK and TK are holistic *systems* and thus this discussion of the potential effects that could be realized under Alternative 1 does not separate communities of people from non-human beings in a particular ecosystem or environment.

Alternative 1 retains the existing regulations for chum salmon bycatch management and would not change any regulations for chum salmon fisheries in Western and Interior Alaska. This management structure includes a priority for management to first and foremost meet spawning escapement goals in order to sustain salmon resources for future generations. After conservation (escapement), the highest priority use is for subsistence under both state and federal law. Salmon surplus above escapement needs and subsistence uses are made available for other consumptive uses of the stock, such as commercial and sport fishing.

Under Alternative 1, it is expected that the pollock fleet would continue its operations as it has in recent years. While fishing behavior and chum salmon avoidance strategies could change in the future, Alternative 1 represents no regulatory change and therefore does not have inherent benefits to Western and Interior chum salmon users beyond the status quo. In other words, any effect that current operations of the Bering Sea pollock fishery have on current and future years' run returns, the marine ecosystem, and salmon-dependent communities would be expected to continue in the future. Any impacts from these fisheries may be felt in-river along with other impacts on chum salmon, such as those from climate change, other sources of removals, changes in prey availability, and potential impacts from hatchery fish.

Removals of chum salmon due to bycatch in the pollock fishery has coincided with recent years of low abundance, the related restrictions on subsistence harvests of chum salmon, as well as the consequent negative social, cultural, and economic conditions described in Section 4.3.3.2. While chum salmon returns are cyclical, new climate regimes, and the compounding effect of various sources of removals create a foreseeable scenario in which low chum salmon abundance compared with historical levels could persist. TK holders have also noted that chum salmon abundance cycles are decreasing in span; whereas a significant collapse in chum salmon abundance used to occur every 30 years, it now occurs every 20 years.[129]

The sustained conditions of low chum salmon abundance observed under status quo across regions of Western and Interior Alaska may pose a threat to the sustainability of certain regional chum salmon

[129] Personal communication, E. Burk.

populations with potential effects on genetic diversity and the food security of Indigenous communities. Chum salmon declines have imbalanced regional freshwater ecosystems, causing people (and non-human harvesters, such as bears) to seek other sources of nutrition to fill gaps in food security (see Section 4.3.3.2.3). With the potential for continued low chum salmon abundance under status quo, increased harvest of non-chum salmon species—both by human and non-human harvesters—is likely to continue, with compounding effects felt throughout Western and Interior Alaska's freshwater ecosystems.

Additionally, within the Yukon-Kuskokwim region, continued low chum salmon returns would likely lead to low subsistence harvests with resounding implications for Alaska Native and rural communities' ways of life and wellbeing in the region (see Section 4.3.3.2). For Indigenous communities, the loss of chum salmon threatens food security and food sovereignty—the ability to access traditional, culturally significant foods in a sustainable and self-determined way. Continued declines in chum salmon abundance reduces the availability of a key food source, forcing communities to turn to less culturally significant and less nutritious store-bought foods, which are often more expensive and less accessible in remote areas. These dietary changes pose physical health threats for these communities, and these changes erode their cultural connections to the land and water, where salmon fishing has long been a central practice.

Indigenous food security, particularly for salmon species, is tightly linked to biodiversity (Nesbitt & Moore 2016). A decline in a species' diversity in terms of their unique life history traits, including chum salmon, can reduce the stability and temporal access to harvest cycles. Nesbitt and Moore's (2016) study of Canadian origin salmon showed communities with access to a wider diversity of salmon species (and unique subpopulations within a species) tend to experience more stable catches and longer seasons–While the concepts and findings from their study can be applied in understanding biodiversity within the Western Alaska chum salmon populations, it is important to note that Nesbitt & Moore were not directly addressing these stocks. The broader implications on biodiversity and ecosystem-based management that they present can serve as a relevant framework but should not be interpreted as focused on the specific case of Western Alaska chum salmon. Because ecosystems and subsistence Indigenous communities are innately interconnected, ecosystem impacts filter to community level, affecting their health and well-being:

> *"It is key to understand that the health and well-being of our Alaska Native communities on the Kuskokwim is intrinsically linked to the health of our salmon, ecosystems, and economies. When our salmon are healthy, our people, our land, our river, and our non-human relatives are healthy. These health benefits mutually reinforce one another; they are interconnected." (Samuelson 2023:2)*

Conversely, when salmon are unhealthy—in low abundance, riddled with diseases, subject to harvest restrictions—so too are Yukon and Kuskokwim region Indigenous communities and the wider ecosystem upon which these communities depend. With the potential for continued low chum salmon abundance under status quo operations, this reciprocal ecosystem-community wellbeing will likely continue to be disrupted.

4.4.1.2 Commercial Chum Salmon Users

Alternative 1 would not change any regulations for commercial chum salmon fisheries in Western and Interior Alaska. Salmon surplus above escapement needs and subsistence uses are made available for other consumptive uses of the stock, such as commercial and sport fishing.

Under Alternative 1, it is expected that the pollock fleet would continue its operations as it has in recent years. While fishing behavior and chum salmon avoidance strategies could change in the future, Alternative 1 represents no regulatory change and therefore does not have inherent benefits to commercial salmon fisheries in Western and Interior beyond the status quo. Section 4.3.4.1 describes these status quo conditions including the reliance Western and Interior Alaska commercial fisheries have had on chum salmon in recent and historical years, and the restriction resulting from the current stock status. This section demonstrates that **commercial salmon fisheries within the Western and Interior Alaska management areas have experienced either closures or declining commercial chum salmon harvest trends in recent years.**

These chum salmon declines under status quo have further exacerbated the economic impacts of Chinook and coho salmon declines that historically have been caught in regional commercial fisheries. These low commercial catch rates and fishery closures have widespread adverse economic implications for the permit holders and communities they are associated with, including adverse impacts to subsistence activities (e.g., financing nets, boats, gas, and other gear used for subsistence) because of the dynamics of mixed cash-subsistence economies in this region. As demonstrated through residency addresses associated with CFEC commercial fishing permits, these fisheries are highly local fisheries (with Bristol Bay being the exception), and they operate within rural communities that have extremely limited alternative opportunities for generating income.

4.4.2 Alternatives 2 and 3

Alternative 2 would include an overall chum salmon PSC limit set at an amount between 100,000 to 550,000 chum salmon. The PSC limit would be in place each B season, apportioned among the sectors, and fishing must stop if the cap is reached. Alternative 3 would include also include an overall hard cap for chum salmon, except the cap *may* be in effect during a given B season if chum salmon returns across WAK are below their index thresholds (see Section 2.4). Additionally, the cap amount may decrease under Alternative 3, Option 1 as more areas fall below their abundance thresholds. The range of possible caps under Alternative 3, Option 1 is 75,000 to 550,000 chum salmon. Selection of Alternative 2 or 3 would not change any management regulations for chum salmon fisheries in Western and Interior Alaska.

The estimates on potential AEQ CWAK and Upper/Middle Yukon chum salmon savings are retrospective numbers that do not account for the likely future changes in fishing behavior that would occur. If these chum salmon had not been caught as bycatch and returned to their natal river systems, the benefits of these potential savings may be much broader and meaningful to salmon users. For instance, these chum salmon may have returned to their regions of origin to spawn or be caught in directed fisheries (see also Section 4.4.5). Compared to status quo, the potential for WAK chum salmon savings under Alternatives 2 and 3 would depend on the amount the overall hard cap was set at, the apportionment method, the level of overall bycatch in a given year, and the proportion of WAK chum salmon in the total bycatch.

Reductions in chum salmon bycatch would accrue from either a B season closure *or* from vessels changing their fishing behavior to stay below the cap. **Thus, the retrospective estimates on potential total chum salmon PSC reductions do not inherently represent an upper bound for the potential benefits.** Greater chum salmon PSC reductions could be realized in the future as vessels work to stay below a given cap although there are costs to doing so, but the same logic does not inherently apply to estimates of WAK chum salmon savings (see Section 3.2.4.2.5).

4.4.2.1 Scaling the Potential Benefits of Alternatives 2 and 3

The AEQ CWAK and Upper/Middle Yukon chum salmon savings estimates under Alternatives 2 and 3 are compared to in-river management thresholds for the Yukon Area. This is done to evaluate the likelihood these alternatives and options may have indirect and positive benefits on abundance and allows for the potential benefits of Alternatives 2 and 3 to be scaled to some degree to inform decision-making. The Yukon summer and fall chum salmon management plan thresholds are summarized directly below:

- The drainage wide escapement goal for **Yukon summer chum salmon** is 500,000–1,200,00 fish. When the run is estimated to be below 500,000 summer chum salmon, all directed chum salmon fisheries are closed. Subsistence opportunities for summer chum salmon may be provided when the run size is above 500,000 fish and commercial opportunities may be provided when the run size is above 650,000 fish (see 5 AAC 05.362).

- The drainage wide escapement goal for **Yukon fall chum salmon** is 300,000–600,000 fish. When the run size is estimated to be below 300,000 fish, all directed fall chum salmon fisheries are closed. Subsistence opportunities for fall chum salmon may be provided when the run size is above 300,000 fish and commercial opportunities may be provided when the run size is above 550,000 fish (see 5 AAC 01.249).

The analysis used this method of comparison because run reconstructions are available for both the Yukon summer and fall chum salmon stocks. Run reconstruction provides a scientifically defensible way of estimating a run size and are extremely limited for other WAK chum salmon stocks. ADF&G staff have indicated it would not be appropriate to compare AEQ savings estimates to other measures of abundance, such as weir or sonar data. Additionally, the management plans for these stocks use specific thresholds. The Upper/Middle Yukon reporting group aligns with the Yukon fall chum salmon stock, but the CWAK reporting group does not align with the Yukon summer chum salmon stock as this reporting group includes populations that return to river systems in Kotzebue Sound to Bristol Bay. To account for this, estimates on AEQ CWAK chum salmon savings are compared to the Yukon summer chum salmon run using amounts between 25%–100% of the actual estimate.

The retrospective analysis indicates the highest reductions in chum salmon bycatch under the lowest cap amounts. For this reason, this portion of the analysis is only focused on hard caps of 100,000 and 75,000 chum salmon. It can be inferred that the potential benefits would decrease as the hard cap amount increases (see also Table 3-21 and Table 3-22). For Alternative 2, Table 4-38 compares the simplified AEQ CWAK savings estimates under a 100,000 chum salmon hard cap and apportionments at their full amount (100%) and then as reduced amounts to account for uncertainty (75%, 50%, and 25%) to the Yukon summer chum run size and summaries of whether ANS was met and/or other directed fisheries opportunities were provided (2011–2022). Table 4-39 provides the same information for the Upper/Middle Yukon reporting group. These estimates are not adjusted because the AEQ estimates are stock-specific. Table 4-40 and Table 4-41 use the same approach for Alternative 3 applied to a hard cap of 75,000 chum salmon in a limited number of years.

Comparing estimates on AEQ chum salmon savings to management thresholds provides a way to evaluate when the reductions may have resulted in more fish in the river system and/or whether the flow of potential benefits could “reach” escapement numbers and directed fisheries opportunities.

Table 4-38 Comparison of the AEQ CWAK savings estimates and adjustments to 75%, 50%, and 25% of the estimated value for a 100,000-chum salmon PSC limit under Alternative 2 with ADF&G estimated run abundance for Yukon summer chum and markers for directed fisheries opportunities, 2011–2022

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sector Apportionment 1, 3-yr avg.												
Est. AEQ savings	8,564	3,946	5,962	14,651	14,501	30,571	47,862	36,365	33,606	16,440	21,226	24,877
Adj. to 75%	6,423	2,960	4,472	10,988	10,876	22,928	35,897	27,274	25,205	12,330	15,920	18,658
Adj. to 50%	4,282	1,973	2,981	7,326	7,251	15,286	23,931	18,183	16,803	8,220	10,613	12,439
Adj. to 25%	2,141	987	1,491	3,663	3,625	7,643	11,966	9,091	8,402	4,110	5,307	6,219
Sector Apportionment 1, 5-yr avg.												
Est. AEQ savings	9,854	4,540	7,895	15,626	14,211	29,274	46,722	35,986	33,544	16,429	21,150	24,816
Adj. to 75%	7,391	3,405	5,921	11,720	10,658	21,956	35,042	26,990	25,158	12,322	15,863	18,612
Adj. to 50%	4,927	2,270	3,948	7,813	7,106	14,637	23,361	17,993	16,772	8,215	10,575	12,408
Adj. to 25%	2,464	1,135	1,974	3,907	3,553	7,319	11,681	8,997	8,386	4,107	5,288	6,204
Sector Apportionment 1, pro rata												
Est. AEQ savings	9,854	4,540	7,895	15,626	14,239	29,296	47,214	36,276	33,059	16,115	21,158	24,866
Adj. to 75%	7,391	3,405	5,921	11,720	10,679	21,972	35,411	27,207	24,794	12,086	15,869	18,650
Adj. to 50%	4,927	2,270	3,948	7,813	7,120	14,648	23,607	18,138	16,530	8,058	10,579	12,433
Adj. to 25%	2,464	1,135	1,974	3,907	3,560	7,324	11,804	9,069	8,265	4,029	5,290	6,217
Sector Apportionment 1, AFA												
Est. AEQ savings	9,870	4,548	9,547	14,917	12,823	30,389	42,069	31,555	32,434	16,234	21,591	29,978
Adj. to 75%	7,403	3,411	7,160	11,188	9,617	22,792	31,552	23,666	24,326	12,176	16,193	22,484
Adj. to 50%	4,935	2,274	4,774	7,459	6,412	15,195	21,035	15,778	16,217	8,117	10,796	14,989
Adj. to 25%	2,468	1,137	2,387	3,729	3,206	7,597	10,517	7,889	8,109	4,059	5,398	7,495
Run size	**2,406,000**	**2,479,900**	**3,349,600**	**2,467,600**	**1,978,400**	**2,581,500**	**3,635,100**	**2,074,700**	**1,689,400**	**763,200**	**156,130**	**478,690**
Subsistence?	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**No**	**No**
ANS met?	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Commercial?	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**No**	**No**

Table 4-39 Comparison of AEQ Upper/Middle Yukon savings estimates for a 100,000-chum salmon PSC limit under Alternative 2 with ADF&G estimated run abundances for Yukon fall chum and markers for directed fisheries opportunities, 2011–2022

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sector Apportionment 1, 3-yr avg.												
Est. AEQ savings	4,263	985	705	1,337	2,280	6,999	11,553	5,079	1,431	1,379	3,207	1,374
Sector Apportionment 1, 5-yr avg.												
Est. AEQ savings	4,905	1,134	925	1,474	2,196	6,696	11,308	5,031	1,427	1,376	3,195	1,370
Sector Apportionment 1, pro rata												
Est. AEQ savings	4,905	1,134	925	1,474	2,203	6,701	11,441	5,065	1,425	1,369	3,203	1,374
Sector Apportionment 1, AFA												
Est. AEQ savings	4,913	1,136	1,108	1,470	2,020	7,019	9,969	4,451	1,306	1,289	3,255	1,594
Run size	**1,244,141**	**1,089,200**	**1,215,809**	**956,669**	**828,453**	**1,390,329**	**2,315,883**	**1,114,684**	**802,964**	**184,233**	**95,249**	**242,465**
Subsistence?	**Yes**	**Yes**	**Yes**	**Yes**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**Limited**	**No**	**No**
ANS met?	**No**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Commercial?	**Yes**	**Yes**	**Limited**	**Limited**	**Yes**	**Yes**	**Yes**	**Yes**	**Limited**	**No**	**No**	**No**

Table 4-40 Comparison of the AEQ CWAK savings estimates and adjustments to 75%, 50%, and 25% of the estimated value for a 75,000-chum salmon PSC limit under Alternative 3 with ADF&G estimated run abundances for Yukon River summer chum salmon and markers for directed fisheries opportunities, 2021 and 2022

Year	2021	2022
Sector Apportionment 1, 3-yr avg.		
Est. AEQ savings	24,124	35,318
Adj. to 75%	18,093	26,489
Adj. to 50%	12,062	17,659
Adj. to 25%	6,031	8,830
Sector Apportionment 2, 5-yr avg.		
Est. AEQ savings	24,068	31,813
Adj. to 75%	18,051	23,860
Adj. to 50%	12,034	15,907
Adj. to 25%	6,017	7,953
Sector Apportionment 3, pro rata		
Est. AEQ savings	24,068	31,813
Adj. to 75%	18,051	23,860
Adj. to 50%	12,034	15,907
Adj. to 25%	6,017	7,953
Sector Apportionment 4, AFA		
Est. AEQ savings	23,260	32,055
Adj. to 75%	17,445	24,041
Adj. to 50%	11,630	16,028
Adj. to 25%	5,815	8,014
Run size	**156,130**	**478,690**
Subsistence?	**No**	**No**
ANS met?	**No**	**No**
Commercial?	**No**	**No**

Table 4-41 Comparison of the AEQ Upper/Middle Yukon savings estimates for a 75,000-chum salmon PSC limit under Alternative 3 with chum salmon savings under a cap of 75,000 chum salmon under Alternative 3 with ADF&G estimated run abundances for Yukon River fall chum salmon and markers for directed fisheries opportunities, 2021 and 2022

Year	2021	2022
	Sector Apportionment 1, 3-yr avg.	
Est. AEQ savings	3,627	1,854
	Sector Apportionment 2, 5-yr avg.	
Est. AEQ savings	3,625	1,711
	Sector Apportionment 3, pro rata	
Est. AEQ savings	3,625	1,711
	Sector Apportionment 4, AFA	
Est. AEQ savings	3,512	1,697
Run size	**95,249**	**242,465**
Subsistence?	**No**	**No**
ANS met?	**No**	**No**
Commercial?	**No**	**No**

The Yukon summer and fall chum salmon runs were at their highest levels during the analyzed period in 2017. The estimates on AEQ CWAK savings were also highest in 2017 at 47,862 chum salmon and 11,552 AEQ Upper/Middle Yukon salmon for Alternative 2. The 2017 Yukon summer chum salmon run was 3,635,100 fish. This run size was well above the drainage wide escapement goal of 500,000–1,200,000 summer chum. The 2017 Yukon fall chum salmon run was 2,315,583 fish and also well above the drainage wide escapement goal of 300,000–600,000 fish. There were limited directed fishing opportunities for summer and fall chum salmon in 2017, despite each run exceeding the lower bound of the drainage wide escapement goal (i.e., 500,000) and the management thresholds to provide directed fishing opportunities (i.e., subsistence and then all other uses).

Inseason and in-river salmon fisheries management is highly dynamic. Managers will consider several external factors as a run builds while assessing the possibility of providing directed fishing opportunities. Some of these factors include the preseason run forecast, the prior year's escapement, information provided by regional Local and Traditional Knowledge holders and others, how fishermen are preparing, and the need to conserve other species such as Chinook salmon. In 2017, limited directed fishing opportunities were provided due to conservation measures to protect poor Chinook salmon runs which co-migrate with summer chum salmon. The commercial summer chum salmon fishery was hindered by limited buyer capacity. Inseason managers will constantly evaluate the information as it becomes available on a daily basis to assess whether more or less fishing opportunities can be provided. This risk assessment is not static and can be influenced by many pieces of information as the season goes on.

In other years when chum salmon abundance was very low there could be different implications. The estimates on AEQ CWAK chum salmon savings in 2022 were approximately 25,000 fish under all apportionments except the AFA split. The AFA apportionment was estimated to result in potential savings near 30,000 chum salmon. The 2022 Yukon summer chum salmon run was 478,690 fish. At these levels, the Yukon summer chum salmon run may have looked marginal for meeting the lower bound of the escapement goal of 500,000 fish; managers may have started the fishing season with subsistence fisheries closed or severely restricted with the intention of changing management strategies with additional inseason information. However, this assessment is likely over-attributing the potential benefits to the Yukon summer chum salmon stock. Not all of the AEQ CWAK chum salmon savings presented above (i.e., 25,000 or 30,000 fish) would be expected to return to the Yukon as summer chum. Some of these fish would return to their regions of origin which extend from Kotzebue Sound to Bristol Bay.

The lowest year of return for Yukon fall chum salmon was 2021 at 95,249 fish. The highest estimate on AEQ savings for this reporting group would have occurred in 2021 under a 100,000-chum salmon cap and the AFA apportionment at 3,255 fish. This estimate indicates the alternative and options may not have changed the outcome for directed fishing opportunities in these years but could have resulted in more chum salmon returning to their natal river system and generally improved conservation towards meeting escapement.

The retrospective analysis on Alternative 3 indicates potential savings would be less than what could be expected under Alternative 2. This is due to the fact that a hard cap would not have been in effect in all years retrospectively. Additionally, a hard cap of 75,000 chum salmon under Alternative 3, Option 1 would only have been in effect in a limited number of years. For those limited years, the AEQ CWAK chum salmon were highest in 2021 at 35,318 fish; the estimates on AEQ Upper/Middle Yukon chum salmon were highest in 2022 at 3,627 fish.

Nevertheless, the retrospective estimates on chum salmon savings are based upon prior years' environmental conditions and the current bycatch management regulations. It is possible greater chum salmon savings could be realized in the future compared to status quo. The potential for chum salmon savings due to added bycatch measures may be of importance in supporting recovery of Western and Interior Alaska chum salmon stocks in times of critically low abundance. At the same time, it should be noted there is a degree of uncertainty in whether overall hard caps would result in lower WAK chum salmon bycatch compared to status quo and thus benefits to WAK chum almon river systems and users (see also Section 3.2.4.2.5). The fleet may be able to use different tools to stay below a cap but doing so would not necessarily also guarantee a lower proportion or number of WAK chum salmon in the overall bycatch. As such, the potential benefits that could be realized by Western and Interior Alaska chum under Alternative 2 or 3 would depend on the amount of the hard cap selected, the apportionment used, the future behavior and avoidance strategies used by pollock fishermen, the overall bycatch level and the proportion of WAK chum salmon in the bycatch in a given year.

4.4.3 Alternative 4

Alternative 4 would modify the current regulations for the salmon bycatch IPAs and would not change any management regulations for chum salmon fisheries in Western and Interior Alaska. The analysis cannot precisely quantify the potential PSC reductions that have been achieved in recent years under the IPA measures. Compared to the 2021 level of bycatch of 545,901 chum salmon, the 2022 B season bycatch was a 55% reduction, the 2023 B season an 80% reduction, and the 2024 B season was a 94% reduction. These reductions may not be solely attributable to the recent IPA changes, but without modifying the existing regulations to require these measures continue to be used in the future, it would be possible for the contracts to be modified and less stringent avoidance efforts could be used in the future.

4.4.4 Alternative 5

The analysis of how Alternative 5 may impact chum and WAK chum salmon is contained in Section 3.2.4.4. The following section is an extension of that analysis, through the consideration of potential impacts to Western and Interior Alaska chum salmon users.

The degree to which Alternative 5 could result in potential indirect and positive effects to Western and Interior Alaska chum salmon users depends on the corridor where chum salmon avoidance would be prioritized (i.e., which option is considered or selected for implementation), the corridor cap amount and apportionment, how pollock fishing behavior responds to the corridor and cap, and where pollock catch would be moved to if the corridor closed inseason. While Alternatives 2, 3, and 5 all include some form of a chum salmon PSC limit (or cap), these caps do not function similarly. A sector that meets its corridor cap under Alternative 5 could continue to fish outside the area and the analysis assumes they will do so if they are able.

Alternative 5 could result in varied outcomes for Western and Interior Alaska chum salmon users. When the corridors are compared against one another, prioritizing chum salmon avoidance in Cluster 2 poses the least risk to creating adverse outcomes for chum and WAK chum salmon bycatch as well as Chinook salmon bycatch. The potential for chum salmon savings under a Cluster 2 corridor would result from fishermen proactively avoiding the area as they are able to do so and/or carefully monitoring their PSC inside the corridor. Historical data indicates the potential for high chum salmon bycatch rates to be encountered here. Reaching a Cluster 2 cap would pose a consequence of fishermen losing potentially important operational flexibilities. Cluster 2 poses a low risk for creating adverse impacts to chum and WAK chum salmon PSC compared to Cluster 1 and Unimak because lesser amounts of pollock catch would be moved out of the area (based on the retrospective estimates.

It is possible that prioritizing avoidance in the Cluster 1 and Unimak corridors would have high potential for chum and WAK chum salmon bycatch reductions compared to status quo. This potential would likely only be realized if vessels continue to fish in these areas, are able to reduce their PSC compared to status quo, and are not displaced out of the corridor. These reductions would primarily accrue from the inshore and mothership CV sectors. There is also a high risk that chum and WAK chum salmon bycatch savings would not be realized if CV effort is moved outside the corridors. The potential adverse effects would be exacerbated if the corridor closed earlier in the window of June 10 to August 31. If the corridor caps result in a longer season for the pollock sector, this could also risk increasing Chinook salmon bycatch.

4.4.5 Broader Implications of WAK Chum Salmon Savings

To the extent that any proposed alternative reduces WAK chum salmon bycatch from current levels, the management change could increase the likelihood that WAK chum salmon return to their regions of origin with positive impacts towards conservation. Over time, higher abundance could provide more harvest opportunities, a higher likelihood of attaining harvest goals, support for Tribal food sovereignty and security, restoring human-salmon-ecosystem relationships for many across Western and Interior Alaska. The subsequent sections describe a diverse range of potential social, cultural, and economic effects that could be realized, should WAK chum salmon savings be realized under the proposed action alternatives.

4.4.5.1 Passive Use Benefits

Passive use benefits, also referred to as non-use, or existence value, may occur when there is real and measurable utility (i.e., benefit) from the knowledge that relatively unique natural assets, even if utilized sustainably, will continue to exist in perpetuity. Fundamentally, passive use value reflects the utility an individual derives from knowing that the resource of interest (e.g., chum salmon) exists in a given state of being, even when no use is ever expected to be made of it by the holder of the value. Therefore, if the management measures adopted through the alternatives result in reduced WAK chum salmon bycatch and increased WAK chum salmon returns, the magnitude of returns are not the critical factor in whether this type of benefit can manifest. Unlike subsistence and commercial fisheries, which require a certain threshold to be met before the benefits of increased chum returns can be experienced, passive use benefits may be derived from an action alternative that reduces WAK chum salmon bycatch regardless of the magnitude of that reduction.

The concept of passive-use value is well established in economic theory, supported by a growing body of empirical literature, increasingly employed in both public and private valuation analyses, and accepted by most as a legitimate, appropriate, and necessary aspect of natural resource policy and management decision-making. It should be noted that this economic terminology and lens may not be in alignment with indigenous world views; however, there may be overlap in the concepts involved.

In the current context, WAK chum salmon clearly demonstrate non-use value because they contribute not only to the existence and productivity of many living assets for which both market and non-market values exist (e.g., commercial salmon fisheries, Steller sea lions, sea birds, and toothed whales of various species), but also the social fabric, identity, and culture of Native and non-native peoples throughout Alaska, the Pacific Northwest, and Canada. Although described through a different lens (i.e., not through economic theory but through expression of values and principles), this concept has been communicated through considerable expressions of public interest and concern during this and previous Council actions on salmon bycatch.

To the best of the analysts' knowledge, there has been no study published to date concerning the passive-use value of changes in chum salmon run sizes. The analysts have not included any suggestion of the potential magnitude of non-use impacts, choosing instead only to identify their likely existence. This is fully consistent with requirements contained in E.O. 12866 and NOAA Fisheries Guidance for Preparation of Economic Impact Analyses.

4.4.5.2 Directed Use Opportunities for Chum Salmon Fisheries

Should the proposed action alternatives reduce WAK chum salmon bycatch in the pollock fishery, abundance may improve. If abundance improves to levels where escapement needs are met, managers could provide less restricted or unrestricted directed fishing opportunities, there could be positive and indirect effects for subsistence users in the form of longer fishing periods or fewer restrictions on eligible gear types. Should harvest opportunities become less restricted, the costs associated with subsistence fishing trips could be reduced compared to what they are now. Not all households can afford to take multiple small trips to accommodate restricted fishing schedules.

Additional flexibility in the timing and duration of subsistence harvesting opportunities could support traditional practices of fishing for chum salmon when they present themselves (see Section 4.3.3.2.1). This may also be more aligned with when fish are in better condition (Godduhn et al. 2020: 57). The weather across WAK turns wet and rainy as the summer months go on, which can spoil fish drying on racks and flies are more present (Ikuta et al. 2013). These are complicated dynamics, however. Inseason managers aim to provide balanced opportunities across the timing of a run, and restrictions on target opportunities for chum salmon in June and July may be an effort to conserve Chinook salmon.

Although improvements in WAK chum salmon abundance beyond escapement would first and foremost be prioritized for subsistence uses, the magnitude of the returning run size allows the State of Alaska to determine whether there is expected surplus above escapement and subsistence needs to allow for directed commercial fisheries opportunities. To the extent that the proposed measures result in savings of WAK chum to a level where abundance improves beyond the amounts required to meet escapement and subsistence harvest needs, there could be positive and indirect effects on commercial fishers within some of these management areas.

Section 4.3.4.1 emphasizes how cash income is often earned in the commercial harvesting portion of the salmon fishery and used to support subsistence activities. In some cases, especially with the high cost of fuel, subsistence activities may be reduced if commercial harvesting income is lacking. Even a few hundred fish that are made available to commercial harvesters in-river due to “chum salmon savings” under the alternatives in question may provide a family or multiple families with just enough cash income to afford more time at fish camp to meet their subsistence needs for the coming winter. Though it is not possible to quantify exactly what effect the chum salmon savings estimated under the alternatives would have on commercial harvesters in any particular river system it is important to recognize that even a few hundred fish, and a few hundred dollars from those fish, may be critically important in many villages throughout Western and Interior Alaska.

4.4.5.3 Western and Interior Alaskan Communities Engaged in or Dependent on Chum Salmon

If the proposed measures result in savings of WAK chum salmon to a level where additional directed harvest is available, there could be positive and indirect effects for communities that rely on chum salmon **(** Section 4.4.5.3 and 4.4.5.3.3). However, **the analysis cannot determine with any precision which community may receive some indirect benefits from potential bycatch reductions, in terms of improved harvest opportunities and broader economic, social, and cultural benefits**. Given the potential intervening variables, and particularly the unknown distribution of CWAK chum salmon bycatch from coastal Western Alaska river systems, it is not possible to identify these salmon to their rivers of origin in order to understand which communities may benefit. Even for communities that rely on the Yukon River fall chum stock, which directly aligns with the genetic reporting group for Upper/Middle Yukon, analysts cannot further disaggregate where these returning chum salmon may be intercepted.

Chum salmon are the most widely harvested species of salmon by residents in the Kotzebue Area and play a meaningful role in the total subsistence salmon harvests in the Norton Sound region. In the Yukon Area, summer and fall chum salmon contribute in larger proportion to the subsistence economies of communities in the Upper and Middle Regions. Fall chum salmon play an increasingly important role in the Upper region communities of Central, Circle, Eagle, Eagle Village, Fort Yukon, Stevens Village, Venetie, and Beaver because summer chum and coho salmon do not migrate the full length of the river. (see Table 4-33).

In the Kuskokwim Region, chum salmon plays a larger role in terms of the proportion of total subsistence salmon harvests for communities in the lower region. However, while chum salmon may not contribute the majority of subsistence salmon harvests for communities in the upper region, sockeye salmon do not migrate to the headwaters of the Kuskokwim River, increasing that region’s dependence on other salmon species, particularly chum, Chinook, and coho salmon. Chum salmon accounted for the largest proportion of all resources harvested for subsistence in the middle region at 14%. These communities include Aniak, Chuathaluk, Crooked Creek, Lower Kalskag, Red Devil, Sleetmute, Stony River, and Upper Kalskag.Section 4.3.4.1 (as well as the April 2024 SIA) describes regional trends in commercial chum harvests including a suite of tables that demonstrate patterns of community and regional (i.e., local versus non-local) engagement and dependence on commercial chum salmon fisheries in Western and Interior

Alaska. This includes trends in the number of active permits holders and value for each of the eight commercial permit types and for each community where permit holders reside, from 2011-2022. As shown in these tables, Kotzebue, Norton Sound, the Yukon River, and the Kuskokwim area commercial fisheries are prosecuted by primarily local harvesters, with over 95% of the permit holders residing in local communities for each of these fishery management areas. In contrast, 75.4% of CFEC gillnet permit holders for Bristol Bay are held by non-local residents. Some communities with the greatest number of CFEC permits include: Kotzebue, Unalakleet, Shaktoolik, Elim, Emmonak, Kotlik, St Mary's, Mountain Village, Alakanuk, Pilot Station, Marshall, Quinhagak, Bethel, Akiachak, Tuntutuliak, Dillingham, Togiak, and Naknek. However, especially given the small population in some Western and Interior communities, for communities with a lower overall count of commercial fishing permits, those few permits may still represent an important opportunity for income.

4.4.5.3.1 Mixed Economies and Cultural Identity

This section addresses the positive and indirect benefits that could be realized within and across the mixed economies and sharing networks of rural Alaska communities, as well as the traditional practices which foster cultural identity for many Indigenous communities across Western and Interior Alaska. These benefits could be realized if abundance improves, and harvest goals are able to be met as a result of the proposed alternatives.

Many rural communities are connected to one another through extensive (broad and deep) sharing networks (Trainor et al. 2021; Hutchinson-Scarborough et al. 2016). Sharing chum salmon and other subsistence resources supports meeting households' food security needs and provides a means for expressing culturally held values. As an example, in the Tanana region "…salmon is given to individual elders, Elders' residences and people who do not have access or ability to fish. Almost all the fishermen interviewed stated that the first salmon caught were given away to share the taste of the first fish and bring luck to the fishermen" (Moncrieff 2007).

Section 4.3.3.2 describes the central role that fish camps play in teaching values and sharing kinship relationships with salmon are passed down to Alaska Native youth in the Yukon and Kuskokwim regions, although similar experiences are likely relevant to other areas of Western and Interior Alaska as well. When people are working together to harvest, cut, and process fish, they are connected at that moment to each other and their ancestors (Trainor et al. 2021). Each person has an age-appropriate chore that fosters responsibility, purpose, unity, and belonging. Equally important are the physical health benefits provided by the hard work of catching, cutting, and preserving fish.

4.4.5.3.2 Ecosystem

As noted elsewhere in this preliminary DEIS, an AEQ analysis may not fully capture the potential indirect and positive effects that a relatively small number of chum salmon returning to their regions of origin may have on population viability as well as ecosystem and community wellbeing. This perspective has been shared by cooperating agencies to this analysis, KRITFC and TCC, and more information can be found in Appendix 7 and Appendix 8. A consideration being raised is that it is possible Western and Interior Alaska chum salmon populations have unique spatial and or/temporal separation resulting in genetically distinct populations. These are referred to as "discrete spawning populations."

Western and Interior Alaska salmon populations, including those on the Yukon and Kuskokwim Rivers, vary in their productivity, carrying capacity, and life history characteristics. These factors may contribute to their sustainability and resilience to climate change. Recent work on the variation and life history characteristics among eight geographically and genetically distinct Chinook salmon populations within the Canadian portion of the Yukon River found population diversity supports species' viability and fishery stability (Connors et al. 2022). In particular, genetic divergence was correlated with run timing and spatial distributions of these Chinook salmon populations (Connors et al. 2022).

If assumptions are made that similar characteristics could apply to discrete populations of WAK chum salmon, potential reductions in WAK chum salmon bycatch could have a much broader scope of indirect benefits. Additional input from Tribal entities also describes the importance of potentially returning chum salmon, such that very small numbers of returning fish may be of importance for Tribal food sovereignty and security (see Appendix 1). More broadly, and not inherently related to the concept of discrete spawning populations, there could be positive and indirect benefits for Western and Interior Alaska ecosystems that are related to human communities.

These points are raised so they can be considered in the full scope of potential benefits resulting from the proposed action. The analysis must also note, however, that subpopulations of WAK chum salmon with unique life history characteristics (e.g., size and productivity) cannot currently be identified in the pollock fishery's bycatch.[130]

4.4.5.3.3 Potential Benefits of the Proposed Action to Yukon and Kuskokwim Indigenous Ways of Life

This section was co-written by KRITFC and TCC with minor contributions from analytical staff.

A meaningful reduction in WAK chum salmon bycatch compared to status quo levels as a result of one or more of the action alternatives could increase WAK chum salmon abundance.

It is difficult to overemphasize the broader potential benefits that even a very few number of chum salmon returning to the Yukon and Kuskokwim Rivers as well as their tributaries offer regional communities and ecosystems. Female chum salmon typically lay 2,400 to 3,100 eggs, with some carrying as many as 4,000 eggs (Buklis 2024). One successful spawning event may procreate thousands of future spawners, thus contributing to the rebuilding and sustainability of these stocks, including discrete spawning populations (see Appendix 7).

Over time, this could allow for increased harvest opportunities, a higher likelihood of attaining harvest goals, support for Tribal food sovereignty and security, and a restoration of the human-salmon-ecosystem relationships on the Yukon and Kuskokwim rivers (see Section 4.3.3.2) as well as elsewhere in the WAK region. These effects could in turn contribute to the viability of future chum salmon fisheries, as well as to the integrity of Yukon and Kuskokwim Indigenous communities and ecosystems as a whole, because each salmon that returns and successfully spawns may help rebuild populations and imbue climate resilience into the genetics of future chum salmon.

Indigenous communities in the Yukon and Kuskokwim regions would be positively affected in a profound way should chum salmon abundance recover to historical or near historical levels. Abundant chum salmon populations would increase both the opportunities for harvest and the amount of chum salmon harvested, restoring communities' unique relationships with salmon and their holistic well-being that is so dependent upon salmon and salmon fishing (see Section 4.3.3.24.4). Though other factors affect traditional ways of life in the region (e.g. increased use of technology, climate change, legacies of colonization), and contemporary subsistence communities will always represent a synthesis between traditional and modern ways of life, subsistence fishing restrictions have inarguably affected Indigenous people's ability to embrace and share traditional practices. Increased abundance leading to increased harvest opportunities would provide the option for younger generations to learn these practices and would encourage families to continue fish camps that foster important intergenerational exchanges and learning.

In addition, subsistence harvest of salmon is vital to health in the region—from nutritional value to the exercise fishing and processing provides to the mental and spiritual well-being engendered by learning

[130]Beyond the CWAK and Upper/Middle Yukon genetic reporting groups, little genetic divergence exists among chum salmon spawning collections, with the currently available genetic marker sets, within Western and Interior Alaska river systems. This may be due to the species colonization from a single glacial refugia into dynamic watershed that were transiently interconnected over the last ~1200 generations. Among the large river systems (lower Yukon and Kuskokwim) chum salmon likely formed large metapopulations less affected by the diversifying effect of genetic drift.

these traditional practices from Elders in the community (KRITFC 2024; see Section 4.3.3.2.2.1). Chum salmon also support regional ecosystem health and provide for resilient populations of other traditional foods, directly linking salmon abundance with ecosystem health and community well-being (see Section 4.3.3.2.3). Therefore, an action alternative that meaningfully reduces chum salmon bycatch would engender a variety of substantive benefits for Salmon People and ecosystems.

4.4.6 Environmental Justice Considerations for Western and Interior Alaska

An Environmental Justice analysis evaluates the potential for the proposed alternatives to result in disproportionately high and adverse effects on minority populations, low-income populations, and Alaska Native/Indian Tribes, as defined under 40 CFR 1508.1(f)). This section contains the environmental justice analysis in relation to the regions that are engaged in or dependent on Western and Interior Alaska chum salmon fisheries. Given the geographic scope of Western and Interior Alaska, it is infeasible to complete an analysis at the community-level. Appendices 7 and 8 provided by KRITFC and TCC have relevant information for communities specific to their regions.

The minority proportion population in all analyzed areas that encompass Western and Interior Alaska is meaningfully greater than Alaska's general population and highest in the Kuslivak Census Area at 97.9%. The low-income percentage population in the Bristol Bay Borough (9.4% of total) is lower than Alaska's general population. However, the low-income population components of all other analyzed areas are meaningfully greater than the general population of Alaska, ranging from a low of 20.3% of the population in the Dillingham Census Area to 41.7% of the population in the Kuslivak Census Area (see Table 4-30).

The CEQ (1997) guidelines suggest that where an agency action may affect fish, vegetation, or wildlife, it may also affect subsistence patterns of consumption and indicate the potential for disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, and Alaska Native/Indian Tribes. Subsistence patterns are covered in detail in Section 4.3.3.1. According to Section 4.3.3.2, the social and cultural values related to subsistence are a key area for the exploration of environmental justice. In addition, a primary concern of Tribal representatives expressed during public scoping at the Council's meetings was the importance of harvesting salmon for maintaining family relationships, through the transmission of knowledge from Elders to youths, including teaching the kinship relations held by salmon and people (see also Appendices 7 and 8).

Climate Change

Climate change is often an environmental justice issue. People who live in poverty may be particularly vulnerable to the negative economic impacts of climate change because they have fewer financial resources to cope with these effects (EPA 2016). Alaska Natives living in rural areas also may be especially vulnerable to climate-related effects due to their economic, nutritional, and cultural dependence on subsistence food sources (EPA 2016). Poverty often amplifies the impacts of a loss of subsistence resources. For example, if subsistence harvests decrease or subsistence-related travel costs increase, lower-income households may be unable to spend more money on fuel and other subsistence-related expenses like fishing gear, or they may be less able to purchase commercially sold food sources, thereby increasing food insecurity.

Many Alaska Natives across Western and Interior Alaska, including the Inupiaq, St. Lawrence Island Yup'ik, Cup'ik, Gwich'in, Athabascan, Unangax̂, among others, are disproportionately affected by climate change. The effects of climate change are more pronounced in these regions, where subsistence activities are often dependent on ice, wind, and permafrost. Climate change has resulted in a reduction of sea ice, which has exacerbated coastal erosion, less predictable weather, less stable spring shore ice for fishing or harvesting marine mammals, early breakups that have hampered geese hunting, and more. All of these issues create significant concerns for many Alaska Natives because they are threatening their way of life (Brinkman et al. 2016).

Additionally, as highlighted in Appendix 8-3, provided by TCC, communities are experiencing increased unpredictability in salmon runs, requiring longer travel and effort to meet subsistence needs, leading to higher costs and labor demands. Declines in salmon abundance limit opportunities for intergenerational knowledge transfer of traditional fishing practices, threatening cultural continuity. This situation exacerbates food insecurity as households increasingly depend on less nutritious, store-bought alternatives. Upriver communities are particularly vulnerable, as salmon may not reach these areas due to declining populations and altered migration routes. Over time, climate change is anticipated to have an increasingly adverse effect on how residents can access and use the land and harvest sufficient foods to meet food security times. Reduced opportunities for participation in subsistence harvesting, processing, distribution, and ceremonies from decreased harvests will continue to have adverse effects on culture by weakening social ties and knowledge of cultural traditions (see Appendix 8-3, provided by TCC).

4.4.6.1 Alternative 1

Environmental justice concerns exist for minority, low-income, and Alaska Native tribal populations in the Bethel Census Area, Bristol Bay Borough, Dillingham Census Area, Kuslivak Census Area, Lake and Peninsula Borough, Nome Census Area, Northwest Arctic Borough, and the Yukon-Koyukuk Area. Chum salmon play a critical role in the economies, cultures, and subsistence ways of life for rural and Alaska Native communities, as described in Section 4.3.3.2.

The recent declines in WAK chum salmon abundance have had a disproportionate and adverse effect on environmental justice populations in these areas compared to the general population of Alaska, particularly for those whose members directly harvest the resources and/or acquire chum salmon through sharing networks. Section 3.2.4.1.4.2 provides information on the potential impact of bycatch removals of WAK chum salmon. An impact rate can only be calculated for the Yukon fall chum salmon stock (Upper/Middle Yukon reporting group), and it was estimated the impact of bycatch on the Yukon fall run genetic group averaged approximately 1% from 2011 to 2022.

All of the proposed action alternatives represent different management measures aimed at reducing chum salmon bycatch, with a particular focus on chum salmon originating from WAK river systems to the extent practicable. Thus**, compared to status quo, environmental justice concerns could improve for minority, low-income, and Tribal populations that are engaged in or depend on chum salmon fisheries.**

4.4.6.2 Alternatives 2 and 3

Alternative 2 or 3 are not likely to have disproportionately high and adverse effects on low-income, minority, and Alaska Native Tribal populations that rely on WAK chum salmon fisheries. The degree to which environmental justice concerns may improve under Alternatives 2 or 3 would depend on the amount and apportionment of the overall hard cap, the ability of pollock fishermen to change their behavior in response to a hard cap, the overall bycatch level in a given year, and the proportion of WAK chum salmon in the total bycatch.

A unique function of Alternatives 2 and 3 compared to other proposed alternatives is that they include a regulatory hard cap. The cap would specify an upper bound on the total number of chum salmon that could be incidentally caught by the pollock fishery during the B season. However, the majority of the total bycatch is not attributed to WAK river systems. WAK chum salmon have accounted for an average of 18.6% of the total bycatch from 2011–2023. As such, there is a degree of uncertainty in whether these alternatives would mitigate existing concerns for environmental justice populations reliant upon WAK chum salmon fisheries. As compared to Alternative 2, Alternative 3 would have less potential to mitigate existing environmental justice concerns because an overall hard cap would not necessarily be in effect during each B season. The retrospective analysis shows a hard cap would have been in effect in a limited number of years (3 to 6 years under Option 1 or 4 to 5 years under Option 2).

The analysis indicates the highest reductions in AEQ chum salmon occurred under a 100,000-chum salmon PSC limit using the 3-year average apportionment. If abundance improves to levels where escapement needs are met, managers may be able to provide less or unrestricted directed fishing opportunities such that harvest levels are met. This has the potential to improve and restore the unique and important relationships Indigenous communities hold with salmon as Indigenous peoples' wellbeing is wholistically bound to salmon fishing (see Section 4.3.3.2 and Section 4.4.5.3.3).

4.4.6.3 Alternative 4

Alternative 4 would modify existing regulations for the salmon bycatch IPAs and require new measures for chum salmon avoidance. Each IPA has been voluntarily amended in recent years to incorporate some of the six regulatory provisions being considered under Alternative 4. The analysis cannot say the degree to which lower bycatch levels in recent years (2022–2024) were solely the result of specific IPA changes, rather than or in addition to environmental conditions, where good aggregations of pollock were found, among other factors. However, if the new IPA measures that have been implemented in recent years and align with the proposed regulatory changes have played a meaningful role in the fleet's ability to achieve lower chum salmon bycatch in recent years, Alternative 4 would mitigate the existing concerns for environmental justice populations engaged in or dependent on WAK chum salmon fisheries.

4.4.6.4 Alternative 5

Alternative 5 would include an inseason corridor triggered by an area-specific chum salmon PSC limit. Three corridor areas are currently being considered but only one could be selected for implementation. When the corridors are compared against one another, prioritizing chum salmon avoidance in Cluster 2 poses the least risk to creating adverse outcomes for chum and WAK chum salmon bycatch as well as Chinook salmon bycatch. It is possible that prioritizing avoidance in the Cluster 1 and Unimak corridors could have the greatest potential for chum and WAK chum salmon bycatch reductions, if vessels continue to fish in these areas and are able to successfully minimize bycatch compared to status quo. There is also a high risk that those benefits for WAK chum salmon will not be realized if effort is displaced outside these areas. If the corridor caps result in a longer season for the pollock sector, this could also risk increasing Chinook salmon bycatch relative to status quo levels.

4.4.7 Cumulative Effects for Chum Salmon Dependent Communities

Past and present human actions have had cumulative and wide-ranging effects on the health, cultures, and economies of communities that are engaged in or dependent on the chum salmon fisheries in Western and Interior Alaska, including environmental justice communities dependent on chum salmon. Section 4.3.3 and Section 4.3.4.1 provides information on these subsistence and commercial fisheries and Section 4.3 covers many human actions that have affected these communities and individuals. In addition, information relative to cumulative effects was included in the report prepared by KRITFC for the Kuskokwim River region (Appendix 7) and TCC for the Yukon River (Appendix 8) and have been described in other documents (e.g., KRITFC 2021, 2022, 2023; NMFS & ADF&G 2024).

In Appendix 7 and 8, KRITFC and TCC emphasize that while the focus of this action is on the Bering Sea pollock trawl fishery, and NMFS and the Council are responsible for minimizing bycatch in only this fishery, the impacts from all sources of WAK chum salmon removals in the Bering Sea are not siloed in terms of how they are experienced in river by those that value and depend on these salmon. All factors related to WAK chum salmon declines, including removals by the Bering Sea pollock trawl fishery, are deeply interconnected with chum salmon dependent communities' experiences. Moreover, cooperating agencies have expressed concern about how these factors may compound with one another, accumulating and quickening the depletion of WAK chum salmon.

In addition, information provided by KRITFC and TCC as Tribal cooperating agencies raise concerns about systemic exclusions of Alaska Native communities and knowledge systems from meaningful participation in decision-making despite their reliance on chum salmon for cultural, subsistence, and economic needs (see Appendix 7.5.D, Appendix 8-2 and 8-5). These concerns highlighted in the appendices view that the exclusion of TK from decision-making processes has undermined effective resource management and perpetuates historical inequities. These dynamics are perceived to be part of the cumulative effects for communities that are engaged in or dependent on the chum salmon fisheries.

RFAs that may have a cumulative impact with the proposed actions include authorization and prosecution of the Bering Sea pollock fishery and climate change, described at the beginning of Chapter 3. In addition, chum salmon dependent communities may be affected by:

South Alaska Peninsula Management Area (Area M). As described in Section 4.3.4.2, some amount of Western Alaska WAK chum salmon has been caught in the South Alaska Peninsula Management Area (Area M) commercial salmon fisheries since at least 1980. The Area M fishery is proximate to the action area, and while specific aspects of overall State of Alaska salmon fishery management continue to be modified, it is reasonably foreseeable that this fishery will continue in the future.

Hatchery releases of chum and other salmon. Hatchery production of chum, pink and other salmon is an RFA that may affect WAK chum salmon (as described in Section 3.2.2.1) through competition for food and habitat (AYK SSI 2024; Ruggerone et al. 2021). Hatchery salmon releases began during the 1950s, but the numbers of salmon released into the North Pacific Ocean increased during the 1970s and has peaked at around 5 billion salmon each year from 1987 to present (Figure 2 of NMFS & ADF&G 2024). Overall, Japan, the United States, and Russia release the highest number of hatchery chum salmon into the ocean each year when compared with Canada and Korea. Annual hatchery pink salmon releases in the North Pacific average 1.35 billion since 1990, and as of 2023, Alaska has produced 74% of hatchery pink salmon (NPAFC 2024).

Improved WAK chum salmon genetics analyses and modeling. As described in Section 3.2.4.5 and in Appendix 7, Attachments 1-3, a number of research projects are underway, aiming to provide better information on the spatial distribution and genetics of WAK chum salmon bycatch. This information could aid the pollock sectors in efforts to minimize WAK chum salmon bycatch as well as providing greater resolution for genetic information in understanding the impacts of bycatch, thus, positively affect chum salmon dependent communities.

Subsistence and commercial chum salmon fisheries management. ADF&G is responsible for managing commercial, subsistence, sport, and personal use salmon fisheries, as described in Section 3.2.3. Additionally, within federal waters of the Kuskokwim and during periods of conservation concern, USFWS and KRITFC are responsible for co-managing rural subsistence salmon fisheries (see Appendix 7.3.C). This management system, which prioritizes subsistence before other consumptive uses, is expected to be a broad RFA. The chum salmon run declines in recent years have resulted in some management areas not meeting some or all escapement goals as well as restrictive management actions on commercial, sport, and subsistence harvests of chum salmon as described in Section 3.2.3. Subsistence fishing has been limited or closed on the Kuskokwim River since 2021, and limited or closed for the Yukon summer and fall run since 2020 (Section 4.3.3). It is likely that state, federal, and Tribal managers will continue to issue in-river chum salmon fishing restrictions until populations rebuild, and that fishers may additionally voluntarily restrict their harvests to support conservation efforts.

Cumulative Effects of the Proposed Actions with RFAs: The management structure for Western and Interior Alaska chum salmon fisheries will not be affected by the proposed action (i.e., a priority for management to meet spawning escapement goals; that the highest priority for use is subsistence under state and federal law; and that salmon surplus above escapement needs and subsistence uses are made available for other consumptive uses of the stock). The direct and indirect effects of Alternatives 2 through 5 are intended to *reduce* chum PSC and WAK chum PSC in the pollock fishery to the extent practicable, as compared to Alternative 1. To the extent these action alternatives are able to achieve this objective, as evaluated in detail in Section 3.2.4, the proposed alternatives being considered in this Federal action under NMFS's authority are not anticipated to have adverse cumulative effects on chum and WAK chum salmon or those communities and Tribes that depend on these resources. However, action alternatives with minimal or perverse outcomes for to WAK chum salmon would not aid in supporting the restoration of salmon stocks or communities' well-being when considered cumulatively with other factors.

5 Combined Effects of the Alternatives

This chapter describes how the proposed alternatives could work in combination with one another. These interactions would influence both the direction and magnitude of the potential impacts. The proposed alternatives would create different incentives for fishermen to avoid chum salmon which are expected to influence future fishing behavior in response to the proposed management changes (i.e., Alternatives 2 through 5). Figure 5-1 portrays the incentive structure under each alternative and how they could work in combination.

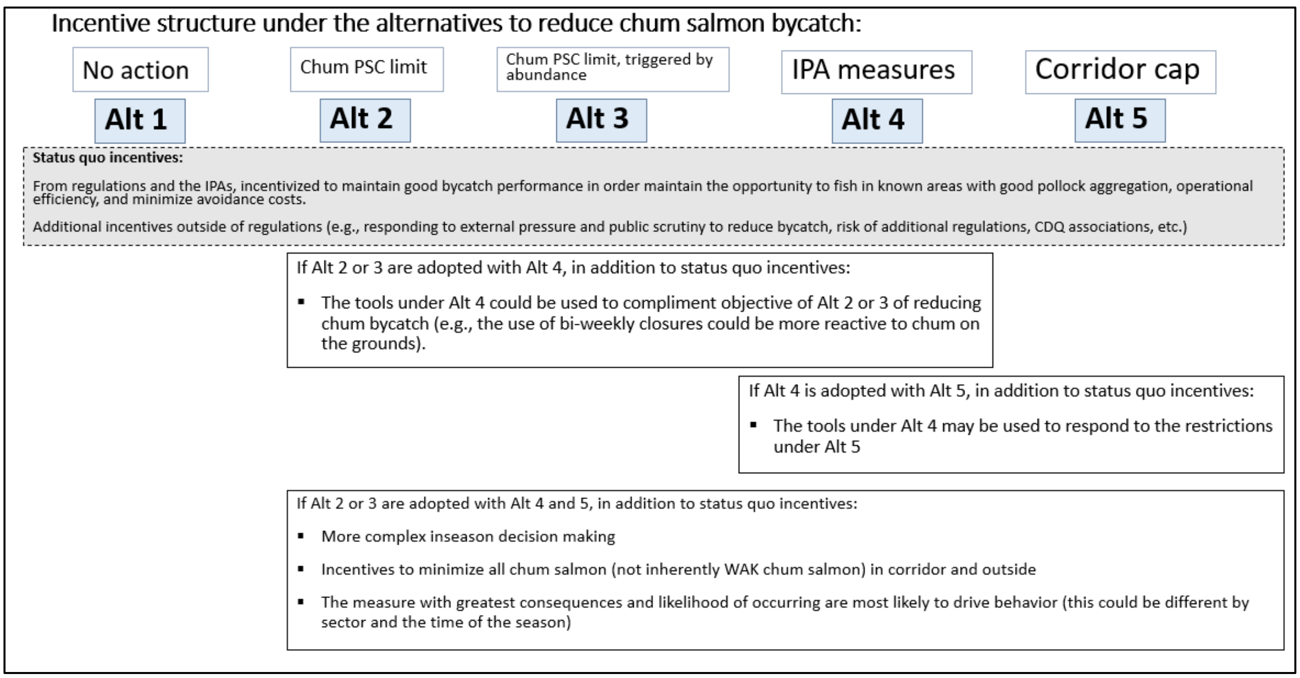

Figure 5-1 Incentive structure under a combination of the alternatives

5.1 Chum and WAK Chum Salmon Bycatch

Impacts to Chum and WAK Chum salmon PSC Under Alternative 2 or 3 in Addition to Alternative 5 Chum salmon PSC

Alternatives 2 and 3 would include an overall hard cap that sets an upper bound on the number of chum salmon that could be taken as bycatch during each B season. All chum salmon caught as bycatch throughout the duration of the B season accrue towards that limit. If a sector or the fleet met the overall hard cap, the season would end early because fishing must stop. The chum salmon PSC limits being considered under Alternative 5 are not overall caps but rather they are associated with an inseason corridor. Chum salmon that are caught as bycatch inside the corridor from June 10 to August 31 would accrue to the corridor-specific cap. If a sector reached its apportionment of the corridor-specific cap at some point between June 10 and August 31, that corridor would close to the sector. Vessels would be required to move out of the area, but fishing could continue outside.

Alternative 5 may be selected in conjunction with Alternative 2 or 3. This regulatory scenario would require the pollock fishery to balance its operations under two different chum salmon PSC limits. These dynamics would likely drive more complex inseason decision-making for the fleet. Selecting both alternatives could layer on different fishing strategies; but would generally be expected to incentive minimizing chum salmon bycatch.

Fishing sectors would consider both the risk and consequence of each chum salmon PSC limit at the start of the B season and as fishing progressed throughout the season. An overall chum salmon PSC limit presents the greater consequence of the two types of limits as it would halt fishing immediately and potentially early. An overall hard cap would also be felt similarly across the sectors if a closure were to occur. The impact of a corridor closure would be dissimilar across the sectors. The magnitude of impact would depend on a sector's historical reliance on the area, when the cap was met, and where vessels may be able to move to. In some cases, the lack of historical dependence on the fishing grounds encompassed within the corridor would have relatively low consequences and therefore may be unlikely to drive behavior (e.g., the Unimak corridor poses a low risk to CPs harvesting AFA pollock). In these instances, a sector would primarily be motivated by the overall PSC limit. Conversely, if a sector has heavily relied on a corridor for their pollock catch and thus the area closing poses a high consequence (e.g., Cluster 1 poses a high risk to the inshore sector), the sector would respond first to the higher risk PSC limit.

A sector's assessment of risk and consequence against two different chum salmon PSC limits would also take into consideration where strong aggregations of quality pollock and avoiding other PSC species. The pollock fishery currently operates under two constraining PSC limits—the Chinook salmon hard caps that would close the pollock fishery in the A or B season if the cap is met and the herring PSC limit that triggers the HSAs closing if the trawl fishery meets that limit during the calendar year. This regulatory scenario means the pollock industry would need to balance operations against multiple PSC species that impose constraints (see Section 3.5).

Regardless of which chum salmon PSC limit is driving behavior, either an overall chum salmon PSC limit or a corridor-specific PSC limit, adopting both in combination would likely have a positive impact on chum salmon bycatch by decreasing levels compared to status quo. This would result as the pollock industry changes its fishing/avoidance behavior to ensure its chum salmon PSC stays below the combination of caps. A combination of PSC limits may decrease some of the uncertainty associated with the potential impacts of Alternative 5 on chum salmon. As an example, prioritizing chum salmon avoidance in Cluster 1 could result in more inshore CVs fishing outside of Cluster 1 (and Unimak) to ensure any chum salmon PSC encountered would not accrue toward the Cluster 1 chum salmon cap. This could result in neutral or increased PSC if those vessels were to fish in Cluster 2 or other outside areas with higher chum salmon bycatch rates. However, if a Cluster 1 corridor was selected alongside an overall cap under Alternative 2 or 3, the Cluster 1 corridor-specific limit would incentivize careful monitoring of chum salmon bycatch rates, and the overall chum salmon PSC limit would function as a ceiling for which chum bycatch may not exceed anywhere.

There is a degree of uncertainty in whether the combination of chum salmon PSC limits under Alternatives 2 or 3 and 5 would reduce WAK chum salmon bycatch compared to status quo or one of the alternatives being implemented alone. WAK chum salmon have accounted for an average of 18.6% of the pollock fishery's bycatch (2011–2023) which presents an avoidance challenge. The pollock fleet may decide to move out of certain areas because lower bycatch rates could be realized in new fishing grounds. Areas with lower bycatch rates may help the fleet to avoid reaching a chum salmon PSC limit, but it may not result in a lower proportion or number of WAK chum salmon in the total bycatch. Reducing chum salmon bycatch to the lowest levels observed in the time series could reduce the number WAK chum salmon caught as bycatch in the pollock fishery (e.g., 2012, 2013, and 2023), but the proportion of WAK chum salmon in the total bycatch would still be variable.

The Alternative 5 corridor locations and closure window are based on historical salmon bycatch genetics data that indicate the time and areas WAK chum salmon are encountered in higher proportions. Nevertheless, the proportion of WAK chum salmon and the total level of bycatch encountered in each corridor varies each year. Potential reductions in WAK chum salmon bycatch would also depend on fishing behavior, overall chum salmon bycatch encounters, and the proportion of WAK chum salmon encountered in a given year.

Alternative 2 or 3 in Addition to Alternative 4 and/or Alternative 5

The Council may also select Alternative 4 in combination with Alternative 2 or 3 and/or 5. This scenario would include additional regulatory provisions for the IPAs, an overall chum salmon PSC limit, and a corridor-specific chum salmon PSC limit. The provisions under Alternative 4 could be used as tools to reduce bycatch under Alternatives 2, 3 and/or 5. For example, the use of bi-weekly hotspot closures (Provision 2) would help the pollock industry be more reactive to chum salmon encounters on the pollock grounds. Additionally, if more vessels are using salmon excluders and this decreases chum salmon catch (Provision 3), it may help the sector remain under their chum salmon PSC limit. Establishing thresholds for stat areas with "very high" chum salmon bycatch rates and closing those areas to all vessels in addition to regularly identified RHS closures could potentially reduce chum salmon PSC (Provision 6).

As noted above, an overall chum salmon PSC limit (Alternatives 2 and 3) provides pollock fishermen an incentive to avoid all chum salmon regardless of their stock of origin to avoid reaching the cap. IPA representatives have indicated they would respond to Provision 1 of Alternative 4 by completing a weekly assessment on whether areas are more likely to have higher proportions of WAK chum salmon in the overall bycatch. When hotspot closures need to be prioritized, deference would be given to those areas more likely to have higher proportions of WAK chum salmon. This provision would also require the fleet to use the best available information as it evolves. As such, this measure in response to Provision 1 of Alternative 4 could provide a mechanism to prioritize WAK chum salmon avoidance through the IPAs while operating under an overall hard cap.

5.2 Pollock Industry

Effects of Alternative 2 or 3 in Addition to Alternative 5

Compared to Alternative 1 or a scenario where Alternative 2, 3, or 5 are selected in isolation, selecting a combination of these alternatives would increase the potential direct and adverse impacts on the pollock industry. The magnitude of that potential impact would depend on the amount and the apportionment of the chum salmon PSC limits, the corridor area, vessels' ability to change their fishing behavior and operations to stay below the cap, and future environmental conditions affecting pollock aggregations and salmon bycatch encounters. The magnitude of potential impacts would also be tied to the sector's assessment of the risk and consequence associated with the different management measures, which would likely drive their fishing/avoidance behavior.

Consider the following scenario where a Cluster 1 corridor with a 50,000-chum salmon PSC limit and an overall 100,000-chum salmon PSC limit were selected. The inshore sector would be most impacted by a Cluster 1 corridor and the cap being set at the lowest amount because of their reliance on this area in addition to their need to return to port after each trip. Prior to the start of the B season, individual vessels and cooperative managers would consider the risk these two caps may pose to their operations. It is expected that this regulatory scenario would be perceived as having both high risk and high consequence. The retrospective analysis indicates the inshore sector would have met its apportionment of a 50,000-chum PSC limit in Cluster 1 in 11 of 13 years, resulting in up to 63% of total B season gross ex vessel 'revenue at risk'. Compared to a corridor cap being individually selected, this revenue may be more likely to be genuinely forgone. In one of the 11 years when the inshore sector would have met the Cluster 1 corridor cap of 50,000 chum salmon, the sector would still need to balance its bycatch against the remaining amount of the overall chum salmon PSC limit. The analysis indicates the inshore sector's B season would have closed early in 12 of the 13 years under an overall PSC limit of 100,000 chum salmon.

It is difficult to predict how vessels and processors may react to what is perceived high risk/ high consequence regulatory scenario for the B season fishery. As described in Section 3.2.4.2.5, this scenario is inherently different than what has been observed with cooperative management under a Chinook salmon PSC limit, which appears to provide enough operational flexibility for vessels to avoid Chinook PSC and still harvest their pollock. Companies may estimate they will not recover their fixed operating costs and choose not to fish in the B season. Quota may be consolidated onto fewer, better performing vessels. Alternatively, it may be that operations will continue with current avoidance strategies (e.g., test tows, communication, and fleet movement), with a high likelihood of a mid-season closure. As described in Section 4.2.2.2.1, shoreside processors will also conduct their own risk assessment, as the fixed costs associated with opening and operating these facilitates are substantial. There may be a scenario where processor decisions drive B season opportunities for inshore CVs.

The combination of Alternative 2 or 3 and 5 would likely have the greatest potential for adverse impacts on the inshore sector including smaller inshore CVs, depending the corridor selected (i.e., Unimak or Cluster 1). These vessels would continue to be constrained in how far from shore they can travel. Under a Cluster 1 or Unimak corridor cap alone this is also the case. However, layering on an overall PSC limit may require more avoidance techniques (e.g., additional movement) and smaller/ lower capacity vessels do not have as much flexibility in locations in order to avoid reaching one of the PSC limits.

If the sector determines that one or both types of the PSC limits are not of high risk, or the corridor cap is not of high consequence, the adverse impacts may look more like the evaluation of Alternative 2/3 alone. For example, the mothership sector does not have substantial historical effort in Cluster 2 and would have only been closed out in 1-2 of the years considered without additional behavioral changes. Therefore, if this corridor was adopted in combination with an overall limit, this sector may respond to and therefore be most impacted by an overall chum salmon PSC limit.

If the combination of Alternative 2 or 3 and 5 were adopted, this would likely result in more complex avoidance decisions and increased avoidance costs. These types of avoidance costs are described in Section 4.2.2.1.1 and Section 4.2.2.2.1 and include costs such as impacts on operational efficiency as vessels move more often/further and potentially into less desirable pollock fishing, increased fuel costs, increased variable costs from possibly extended seasons, impacts to crew compensation and less efficient processing for shoreside and onboard plants. Additionally, if the PSC limits are met at the sector level, there may be forgone revenue up to levels described in Sections 4.2.2.1.2.1 and 4.2.2.2.2.1 and a wider distribution of adverse impacts for pollock communities, processors, the CDQ groups and associated communities, other fisheries, as well as markets and possibly consumers.

If Alternative 3 were adopted in combination with Alternative 5 it would essentially dampen the effect of an overall chum salmon PSC limit, as this limit would be in place less often than under Alternative 2. However, it also presents the possibility of a lower overall cap (75,000 chum salmon), which could increase the magnitude of impact if it went into place.

Alternative 2 or 3 in Addition to Alternative 4 and/or Alternative 5

Since the IPAs have been recently amended to include measures that respond to most of the provisions being considered under Alternative 4, it is not anticipated these regulatory changes would increase costs to the fleet outside of those evaluated for each alternative individually.

6 Management Considerations

None of the proposed alternatives would require a modification to the status quo NMFS approach to monitoring, management, and enforcement of salmon bycatch in the Bering Sea pollock fishery.

6.1 Monitoring

6.1.1 Alternative 1

To support the Council's salmon bycatch management goals, NMFS has implemented a comprehensive monitoring program to collect data on salmon bycatch in the Bering Sea pollock fishery. This program, which allows for accurate and precise estimation of all salmon bycatch including chum salmon, was first implemented in 2011 under Amendment 91 to the Groundfish FMP, refined in 2016 under Amendment 110, and further refined in 2024 under Amendment 126 with the adoption of an electronic monitoring (EM) program that includes Bering Sea pollock trawl fishery catcher vessels.

NMFS collects a broad range of salmon bycatch data from the Bering Sea pollock fishery, including a count and species identification of all salmon bycatch. For Chinook and chum salmon, tissue samples are taken from a subsample to determine the relative stock composition of the bycatch (i.e., proportion of chum salmon PSC from each identifiable genetic group). Bycatch monitoring is accomplished through the following requirements for observer coverage or participation in electronic monitoring for all vessels and shoreside processors (see also Table 6-1 and the following sections):

- Two observers and compliance cameras on CPs and motherships enables monitoring of all hauls.
- Salmon must be sorted so that all are counted and to enable biological sampling. Every vessel must retain all salmon bycatch; at-sea discard of salmon is prohibited before the number of salmon has been determined by an observer and the collection of scientific data or biological samples from the salmon has been completed (see 50 CFR 679.7(k)(8)).Catcher vessels must retain and deliver all salmon species for counting by observers at the dock.
- Either an observer or EM system on all catcher vessels delivering to shoreside processors. Catcher vessels must retain and deliver all salmon species for counting by observers at the dock.
- Catch Monitoring and Control Plans annually approved by NMFS staff outline how each shoreside processor must allow fishery observers to collect monitoring data (see 50 CFR 679.28(g)).

Table 6-1 Summary of salmon bycatch monitoring in the BSAI pollock fishery

<table>
<tr><th>Fishery</th><th>Observer monitoring</th><th>Salmon discard prohibition</th><th>Salmon accounting</th><th>Salmon biologicals</th></tr>
<tr><td>Catcher Processor (CPs)[1]</td><td>✓
Two At-sea observers on every fishing trip (200%)</td><td rowspan="4">✓
All salmon discards are prohibited</td><td rowspan="4">✓
All salmon are counted and identified to species</td><td rowspan="4">✓
Biological information, including genetic samples, on Chinook and chum salmon</td></tr>
<tr><td>Motherships[1]</td><td>✓
Two At-sea observers on every fishing trip (200%)</td></tr>
<tr><td>Catcher vessels[2] delivering to shoreside processors (non-EM)</td><td>✓
At-sea and shoreside observers (100%) and shoreside observers monitoring all offloads</td></tr>
<tr><td>Catcher vessels[2] delivering to shoreside processors (EM)</td><td>✓
At-sea video recording of all fishing activity and shoreside observers monitoring all offloads</td></tr>
</table>

[1] CPs and Motherships have two observers onboard, this is sometimes referred to as “200% observer coverage”.
[2] For all vessels delivering to a shoreside processor, salmon accounting and biological data are collected by shoreside observers.

The following two sections provide more detail on the monitoring of CPs, motherships, and catcher vessels. These monitoring requirements apply for all salmon PSC (i.e., Chinook and chum). For more information on the use of observer coverage, electronic technologies, and CMCPs to support salmon accounting, please see:

- www.fisheries.noaa.gov/s3/2023-08/Salmon-Bycatch-Flyer.pdf
- www.fisheries.noaa.gov/alaska/sustainable-fisheries/catch-weighing-and-monitoring-alaska
- www.fisheries.noaa.gov/alaska/resources-fishing/electronic-monitoring-alaska

Monitoring on Catcher/Processors and motherships

CPs and motherships have two fishery observers onboard each vessel to enable every haul to be monitored, 24 hours a day, every day. Once onboard, each haul is immediately deposited into one of several fish holds. When the vessel is ready to begin processing, fish are released from bins to flow over a series of conveyor belts through the factory.

Multiple regulatory requirements help ensure that the observers on a CP or mothership vessel can account for all salmon bycatch during fishing operations.

Sorting of catch, including salmon, occurs after total catch is weighed on the flow scale. Crew on the sorting line must immediately put all salmon into the designated salmon storage container and keep it there until the observer has the opportunity to collect all necessary information from the salmon (see 50 CFR 679.21(f)(15)(ii)).

NMFS approved video monitoring systems in the vessel factories ensure that sorters place all salmon into the designated salmon storage container and do not remove them (50 CFR 679.7(k)(8)). A digital display of real time footage depicting catch sorting and salmon handling is available to observers during all fishing operations (see 50 CFR 679.28(e)(1)(viii)).

The CVs that deliver to motherships are not required to have observers onboard. This is because CV catch is not brought onboard the vessel, instead the catch is brought to the surface and left unsorted in the trawl codend while the CV is traveling to the mothership. The codened is then transferred directly to the mothership and all the catch sorting and salmon counting occurs on the mothership, as described above.

Monitoring on catcher vessels delivering to shoreside processors

CVs delivering to shoreside processors are split into two groups: CVs with at-sea observers and CVs with EM. CVs with at-sea observers are required to carry one observer on every trip (i.e., 100% observer coverage).

CVs may select to voluntarily participate in the EM program and, instead of at-sea observers, the vessels are required to carry EM systems ensure compliance during fishing activity while CVs are at sea. CVs must have their EM systems active for the duration of the fishing trip and video is reviewed by an EM review service provider. The EM program ensures that the CV delivers unsorted catch to the shoreside processor, at which point observers at the shoreside processor count all salmon and randomly take biological samples. The at-sea compliance monitoring using EM allows for unbiased observer data collection at the shoreside processor for each trip (see 50 CFR 679.51(g)).

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 ensure the full accounting of salmon for every pollock offload. Observers at the shoreside processor monitor every offload. Any salmon encountered on the sorting line must be immediately put into a salmon bycatch storage bin and kept there until the observer can identify, count, weigh, and collect the required biological information from the salmon.

6.1.2 Alternative 2

Alternative 2 would require no change to the status quo NMFS comprehensive approach to collecting salmon bycatch data. NMFS would modify 50 CFR 679.21 to incorporate an overall chum salmon PSC limit. NMFS would further apportion the PSC limit among CDQ groups, inshore cooperatives and, where applicable, the inshore open access fishery. PSC apportionments require comprehensive monitoring because of the economic incentives created by this system to underreport or misreport catch. However, because requirements were already put in place to enable management of apportionments of Chinook salmon PSC limits, no changes to the existing comprehensive monitoring program would be necessary.

Only those salmon caught during the B season fishery and accounted for in the non-Chinook catch accounting category would accrue to the PSC limit. While the non-Chinook catch accounting category includes sockeye, pink, coho, and chum salmon, over 99% of the salmon bycatch in this category are chum salmon. Although, using the updated catch accounting system, it would be possible to separate chum salmon from the other three species of salmon in the non-Chinook category, doing so would likely require regulatory changes and a system redesign. As such, NMFS recommends that the non-Chinook catch accounting category be unchanged under Alternative 2 and the rest of the action alternatives.

Table 6-2 Annual number of salmon, by species, caught as bycatch in the non-Chinook catch accounting category in the BSAI pollock fishery, 2011–2023

Year	Sockeye	Coho	Pink	Chum	Total	% Chum
2011	27	32	202	191,174	191,435	99.86%
2012	16	9	42	22,116	22,183	99.70%
2013	9	39	94	125,174	125,316	99.89%
2014	22	24	50	219,346	219,442	99.96%
2015	89	37	988	236,638	237,752	99.53%
2016	34	34	144	342,789	343,001	99.86%
2017	150	53	926	466,549	467,678	99.76%
2018	87	9	125	294,841	295,062	99.86%
2019	185	169	1,600	345,928	347,882	99.86%
2020	228	125	385	342,887	343,625	99.79%
2021	48	60	385	545,549	546,042	99.91%
2022	16	34	47	242,278	242,375	99.96%
2023	32	136	108	112,027	112,303	99.75%

Source: NMFS Alaska Region CAS.

NMFS would manage a chum salmon PSC limit similar to the manner in which it manages the regulations that prohibit entities from exceeding their Chinook salmon PSC limit. Vessel operators, IPA managers, AFA cooperative managers, and NMFS monitor their Chinook salmon PSC, and vessels must stop fishing prior to exceeding their PSC limit. NMFS reports any cooperative or CDQ group that exceeds its PSC allocation to NOAA's Office of Law Enforcement. This approach provides for more timely enforcement than NMFS-managed closures. By issuing an apportionment to a cooperative or CDQ group along with a prohibition to exceed that apportionment, the cooperative or CDQ group can monitor their bycatch in near real-time and cease pollock fishing immediately.

Regardless of which Alternative 2 option or suboption is selected, NMFS management scheme would not change.

6.1.3 Alternative 3

Alternative 3 would require no change to the status quo NMFS comprehensive approach to collecting salmon bycatch data. However, under Alternative 3, NMFS would rely on ADF&G to evaluate whether area index thresholds for "low WAK chum salmon abundance" are met. The information ADF&G would use would depend on the area index suboption. Under Alternative 3, an overall chum salmon PSC limit would be in effect during the B season fishery based on indices of the prior year's chum salmon abundance. All non-Chinook salmon taken as bycatch during the B season would accrue to the limit (which would be within the range specified in Alternative 2).

By October 1 of each year, ADF&G would inform NMFS whether each area index threshold had been reached, which would allow NMFS to determine which, if any, of the chum salmon bycatch limits should be imposed during the following season. This timing would accommodate the Council's annual October meeting where preliminary groundfish harvest specifications (including PSC limits) are set. If a chum salmon bycatch limit had been triggered, following Council action in October, NMFS would publish the limit with the proposed rule for the preliminary BSAI groundfish harvest specifications.

Regardless of which Alternative 3 option or suboption is selected, NMFS management scheme would not change.

6.1.4 Alternative 4

Alternative 4 would require no change to the status quo NMFS comprehensive approach to collecting salmon bycatch data. It would require modifications to the three IPAs, which are legal contracts that create incentives for salmon bycatch avoidance. The IPAs were implemented under Amendment 91 alongside the Chinook salmon 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. As of the 2024 fishing season, all participants in the Bering Sea pollock fishery are members of the IPAs.[131] Under Alternative 4, industry must add up to six new industry-proposed elements to the IPAs, each of which are intended to further avoid chum salmon bycatch in areas and times of highest proportion of Western Alaska and Upper/Middle Yukon chum salmon stocks, and analyze chum salmon avoided and operational tradeoffs.

NMFS must review and approve all IPAs and IPA amendments (see 50 CFR 679.21(f)(12)). NMFS may disapprove a proposed IPA or amendment to an IPA for the reasons outlined in 50 CFR 679.21(f)(12)(v)(D), including if the IPA fails to contain a description of the required IPA elements. The rules outline how the IPA representative can address a NMFS disapproval of an IPA, such as through revising it or initiating an administrative appeal (see 50 CFR 679.21(f)(12)(v)(D)). IPA representatives must provide a publicly available annual report of IPA performance to the Council (see 50 CFR 679.21(f)(13)).[132]

Regardless of whether any of the six proposed IPA elements are added to the list of required elements under 50 CFR 679.21(f)(12)(iii)(E), NMFS management of the IPAs would not change. The IPA managers would be required to ensure that the IPAs address the new elements, modifying IPA provisions where necessary. They would be required to submit all changes to the IPAs to NMFS, which would then perform its review under 50 CFR 679.21(f)(12)(v) and approve or disapprove. All vessels that are members of the IPAs would then be required to comply with the amended IPA provisions. The IPAs would continue to provide annual reports to the Council on IPA performance.

6.1.5 Alternative 5

Alternative 5 would require no change to the status quo NMFS comprehensive approach to collecting salmon bycatch data. NMFS would continue to monitor all salmon bycatch. Under Alternative 5, a chum salmon PSC limit would be applied to a designated area. All non-Chinook salmon (i.e., chum salmon) caught within the area from June 10 to August 31 would count towards the limit. This date range reflects the period when the majority of chum salmon bycatch has been encountered on the pollock fishing grounds and when WAK chum salmon are typically encountered in higher proportions. The area-specific PSC limits would be apportioned among the pollock fishing sectors using the same options and suboptions as Alternative 2. Further apportionments to cooperative and CDQ groups would also be as provided in Alternative 2.

Under all options and suboptions presented for Alternative 5, NMFS would manage a time/area chum salmon PSC limit similar to the fashion it manages the Chinook salmon PSC limit. That is, cooperatives and CDQ groups will monitor their chum salmon PSC (as does NMFS) between June 10 and August 31 and must ensure that their vessels stop fishing prior to exceeding their chum salmon PSC limit within that period. When the chum salmon PSC limit is reached, pollock fishing must cease until after August 31**.** NMFS reports any overages to NOAA’s Office of Law Enforcement. Apportionment of PSC limits to cooperatives and CDQ groups accompanied by a regulatory prohibition against exceeding such limits allows for more timely management than NMFS-managed closures by publication of notices in the

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[131] The IPAs and amendments can be accessed here.
[132] The most recent IPA reports to the Council (April 2024) can be found at https://meetings.npfmc.org/Meeting/Details/3039, under agenda item C2, Salmon Bycatch.

Federal Register. The cooperative or CDQ group can monitor their bycatch in near real-time and require their vessels to cease fishing immediately.

6.1.6 Transfer Provisions

The Council's rationale for incorporating transfer provisions is that they can provide vessels, cooperatives, and fishing sectors more flexibility to utilize their B season pollock allocation. Absent a transfer, once an overage occurs, all vessels fishing on behalf of the entity may complete the trip that they are on but may not start another fishing trip. Chum salmon PSC under Alternatives 2, 3, and 5 would be transferable in the same fashion as for Chinook salmon PSC (see 50 CFR 679.21(f)(8)(i)). Transfer provisions for chum salmon PSC would apply under any combination of options or suboptions under Alternatives 2, 3 and 5.

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

Regulations would also allow for post-delivery transfers of chum salmon PSC. If the amount of chum salmon caught as bycatch in the B season pollock fishery exceeds an entity's apportionment, the entity (e.g., a cooperative or a CDQ group) would be eligible to receive a transfer of chum salmon PSC from an entity with surplus PSC to cover the overage. The entity may not transfer chum salmon PSC greater than that required to balance the account to zero.

6.1.7 Inshore Open Access Fishery

For AFA vessels not in a cooperative (i.e., inshore open access fishery), the status quo NMFS approach to collecting salmon bycatch data would remain unchanged. In historically rare occasions, inshore AFA catcher vessels do not join a cooperative (see 2.3). In this event, by rule, they are part of a NMFS-managed inshore open access fishery. NMFS continues to monitor all salmon bycatch in the inshore open access fishery.

For Alternatives 2, 3, and 5, which have a chum salmon PSC limit, NMFS would manage chum salmon PSC apportionment in the inshore open access fishery in the same manner as it does for Chinook salmon PSC apportionment (see 50 CFR 679.21(f)(10)). NMFS would apportion the amount of chum salmon PSC to any vessels in the inshore open access fishery, but any such PSC would not be transferable. NMFS would monitor the chum salmon PSC in the inshore open access fishery and close the fishery prior to the apportioned PSC being reached.

While the majority of AFA vessels are both in a cooperative and an IPA, participation in a cooperative is different from participation in an IPA. In all years in which one or more AFA vessels are in the inshore open access fishery and not a cooperative, every eligible vessel has still participated in an IPA. This means that even when AFA vessels have not been in a cooperative, they have chosen to join an IPA and be subject to the IPAs salmon avoidance requirements.

6.2 Enforcement

Under all alternatives, no changes to the existing enforcement tools are anticipated to be necessary. Under alternatives 2, 3, and 5, each cooperative and CDQ group, along with NMFS, would monitor its apportionment of the overall non-Chinook salmon PSC limit. If a cooperative or CDQ group reaches or exceeds its apportionment, NMFS would notify the Office of Law Enforcement (OLE). Enforcement officers use Vessel Monitoring Systems (VMS), which are required to be used on all vessels participating in the Bering Sea pollock fishery, to monitor vessel activity and indicate that fishing activity may be occurring where prohibited. Enforcement officers would use these same VMS systems to determine if a vessel fishing for a cooperative or CDQ group that has exceeded its PSC apportionment continues to fish. However, VMS data only provides spatial data of where a vessel operates; it does not collect data on the target or reveal in which fishery a vessel is operating. Therefore, VMS data, logbook data and observer data are also used to identify noncompliance.

If OLE determines that a vessel is fishing for pollock in a closed area under Alternative 5 or after the apportioned PSC for the vessel's cooperative or CDQ group has been exceeded under Alternative 2 or 3, the vessel will be subject to the appropriate enforcement remedy under 50 CFR 600.740.

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8 References

8.1 Documents Incorporated by Reference

Bering Sea Salmon PSC Analyses

Bering Sea Chum Salmon Bycatch Preliminary Draft Environmental Impact Statement (NPFMC 2024). The Preliminary Draft EIS on Bering Sea Chum Salmon Bycatch Management prepared for the Council's April 2024 meeting contains substantial, additional information directly related to this analysis.

April 2024 Social Impact Assessment. The SIA prepared for the Council's April 2024 meeting contains substantial additional information on communities engaged in or dependent on the Bering Sea pollock fishery as well as rural and Alaska Native communities across Western and Interior Alaska that rely on chum salmon for subsistence and commercial livelihoods. That SIA has been synthesized throughout this preliminary DEIS to streamline the analysis for the reader.

Bering Sea Chinook Salmon Bycatch Management Final Environmental Impact Statement/Regulatory Impact Review for Amendment 91 to the FMP for Groundfish of the BSAI (Chinook EIS/RIR, NPFMC/NMFS 2009) provides decision-makers and the public with an evaluation of the environmental, economic, and social effects of management measures for Chinook salmon bycatch in the BSAI management areas, and it is referenced for an understanding of the impacts on salmon bycatch management in the Bering Sea pollock fishery.

Environmental Assessment/Regulatory Impact Review for Amendment 110 to the FMP for Groundfish of the BSAI (NMFS 2016). This EA/RIR provides decision-makers and the public with information on the environmental, economic, and social effects of Chinook and chum salmon bycatch management in the Bering Sea pollock fishery.

Community-Related Data

Annual Community Engagement and Participation Overview (ACEPO). ACEPO is an annual report that provides an overview of communities that are substantially engaged in the harvesting and processing of groundfish or crab fisheries off Alaska. The ACEPO also contains detailed community sketches, some of which are used to describe communities that are substantially engaged in or dependent on the Bering Sea pollock fishery.

Community Profile Updates: Akutan and Unalaska, Alaska. Akutan and Unalaska/Dutch Harbor are communities identified in this SIA as being substantially engaged in or dependent on the Bering Sea pollock fishery. The Baseline Commercial Fishing Community Profiles for Akutan and Unalaska were updated in 2023 and the relevant information for these communities is summarized and incorporated throughout Chapter 4.

Baseline Community Commercial Fishing Community Profile Updates: Akutan and Unalaska, Alaska. The report (2005) provides information central to the understanding of community engagement in, and dependence on, the range of federally managed commercial fisheries.

EFH Documents

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

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

EFH 5-year Review Summary Report (Harrington et.al, *In prep*). The EFH 5-year Review summary report contains the updates to new environmental and habitat data, improving the models to map EFH, updating the model to evaluate fishery impacts on EFH, updating the assessment of non-fishing impacts on EFH, and assessing information gaps and research needs.

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

Seabirds

In addition to the information cited in the Seabirds section, the analysis of effects of Bering Sea Aleutian Island groundfish fisheries on seabirds found in the following NMFS, Council and USFWS documents are incorporated by references:

Section 3.7 of the 2004 Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (NMFS 2004) provides background on seabirds in the action area and their interactions with the fisheries. https://alaskafisheries.noaa.gov/sites/default/files/pseis0604-chpt_3_7.pdf.

Section 6.3 of the Supplemental Information Report (NMFS 2015) provides background on seabirds in the action area and their interactions with the fisheries. https://www.npfmc.org/wpcontent/PDFdocuments/fmp/Final_SIR_2015.pdf.

The annual Ecosystem Status Reports have a chapter on seabirds: https://www.fisheries.noaa.gov/alaska/ecosystems/ecosystem-status-reports-gulf-alaska-bering-sea-and-aleutian-islands.

The NMFS Alaska Seabird Bycatch webpage: https://www.fisheries.noaa.gov/alaska/bycatch/seabird-bycatch-alaska.

The BSAI and GOA groundfish FMPs each contain an “Appendix I” dealing with marine mammal and seabird populations that interact with the fisheries. The FMPs may be accessed from the Council’s home page at https://www.npfmc.org/fisheries-issues/fisheries/bsai-groundfish-fisheries/.

Washington Sea Grant has several publications on seabird takes, and technologies and practices for reducing them: https://wsg.washington.edu/seabird-bycatch-prevention-in-fisheries/

The seabird component of the environment affected by the groundfish FMPs is described in detail in Section 3.7 of the PSEIS (NMFS 2004) and updated in the PSEIS Supplemental Information Report (NPFMC and NMFS 2015).

Seabirds and fishery impacts are also described in Chapter 9 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007). https://www.fisheries.noaa.gov/resource/document/alaska-groundfish-harvest-specifications-environmental-impact-statement-eis

U.S. Fish and Wildlife Service (USFWS). 2021. Biological Opinion on the Proposed Modification of the EPA General Permit AKG524000 for Offshore Seafood Processors in Alaska and on the NMFS Groundfish Fishery for the Gulf of Alaska, Bering Sea, and Aleutians Islands. Anchorage, AK: 80 pp. Document available at https://ecos.fws.gov/tails/pub/document/18939343.

NMFS. 2020. Programmatic Biological Assessment on the Effects of the Fishery Management Plans for Alaska Groundfish Fisheries on the Endangered Short-tailed Albatross, the Threatened

Alaska-breeding Population of Steller's Eider, and the Threatened Spectacled Eider (*Polysticta stelleri*). https://media.fisheries.noaa.gov/2021-11/AK-Groundfish-Seabird-BA-March-2020.pdf

Seabird Bycatch and Mitigation Efforts in Alaska Fisheries Summary Report: 2007 through 2015 (Eich et al. 2016). https://repository.library.noaa.gov/view/noaa/12695

Seabird Bycatch Estimates for Alaska Groundfish Fisheries 2016 through 2017 (Eich et al. 2018). https://doi.org/10.25923/vb9g-s503.

Seabird Bycatch Estimates for Alaska Groundfish Fisheries: 2019 (Krieger et al. 2020). https://www.fisheries.noaa.gov/national/bycatch/seabirds.

Seabird Bycatch Estimates for Alaska Groundfish Fisheries Annual Report: 2020 (Krieger and Eich 2021). https://repository.library.noaa.gov/view/noaa/32076

The Alaska Migratory Bird Co-Management Council website. https://www.alaskamigratorybirds.com/index.php (last visited Nov. 6, 2024)

USFWS Migratory Bird Management program: http://alaska.fws.gov/mbsp/mbm/index.htm.

8.2 Other References and Citations

Abelman, A., A. Abolhassani, M. Dalton, R. Dame, B. Garber-Yonts, A. Harley, S. Kasperski, J. Lee, D. Lew, C. Seung, M Szymkowiak, and S Wise. 2024. Stock assessment and fishery evaluation report for the groundfish fisheries of the Gulf of Alaska and Bering Sea/Aleutian Islands area: Economic status of the groundfish fisheries off Alaska, 2023.

Ahmasuk, A., Trigg, E., Magdanz, J., & Robbins, B. (2008). Bering Strait region local and traditional knowledge pilot project: A comprehensive subsistence use study of the Bering Strait Region. *North Pacific Research Board Project Final Report*, *643*.

Alaska Fisheries Science Center (AFSC). 2024. Alaska Seafood Snapshot. August 24, 2024.

Alaska Department of Labor. 2023. Alaska Population Estimates. Available at https://live.laborstats.alaska.gov/data-pages/alaska-population-estimates.

Alaska Seafood Marketing Institute (ASMI). 2023. "Extraordinary circumstances". October 25, 2023.

ASMI. 2024. "USDA release bids to purchase over 1.7 million cases of canned wild Alaska salmon and 15 million pounds of wild Alaska pollock" February 20, 2024.

Aleutian Pribilof Islands Community Development Corporation (APICDA). (2023). 2022 Annual Report. https://assets.adobe.com/id/urn:aaid:sc:US:83c7837f-76b8-4084-b698-d90143421e03?view=published

Anderson, A. J., Claiborne, A. M., & Smith, W. (2023). Validation of age estimates for Chum and Sockeye salmon derived from otolith and scale analysis. *Fisheries Research*, *259*, 106556.

ANLPAC. 2024. Ayaruq: 2024 Action Plan for Alaska Native Languages. https://drive.google.com/file/d/16r-eMsxbvAw0Be2-ali75c9uyZHT6pcb/view.

Atlas, W., et al. "Indigenous Systems of Management for Culturally and Ecologically Resilient Pacific Salmon (Oncorhynchus spp.) Fisheries." Bioscience, 71 (2020): 186 - 204. https://doi.org/10.1093/biosci/biaa144.

Barry, P., Kondzela, C., Whittle, J., D'Amelio, K., Karpan, K., Nicolls, D., Larson, W. 2023. Genetic stock composition analysis of chum salmon from the prohibited species catch of the 2022 Bering Sea walleye pollock trawl fishery, preliminary report

Batten, S. D., G. T. Ruggerone, and I. Ortiz. 2018. Pink salmon induce a trophic cascade in plankton populations in the southern Bering Sea and around the Aleutian Islands. Fisheries Oceanography 27:548–559. https://doi.org/10.1111/fog.12276

Bash, J., Berman, C., Bolton, S. (2001). Effects of turbidity and suspended solids on salmonids. Washington State Transportation Center. Research Project T1803, Task 42. Beechie, T. J., Fogel,

C., Nicol, C., Jorgensen, J., Timpane-Padgham, B., Kiffney, P. (2022). How does habitat restoration influence resilience of salmon populations to climate change? Ecosphere, 125. DOI: 10.1002/ecs2.4402.
Bejder L., A. Samuels, H. Whitehead, H. Finn, and S. Allen. 2009. Impact assessment research: use and misuse of habituation, sensitisation and tolerance in describing wildlife responses to anthropogenic stimuli. Marine Ecology Progress Series 395: 177–185.
Belchik, M., D. Hillemeier, and R. M. Pierce. 2004. The Klamath River fish kill of 2002; analysis of contributing factors. Yurok Tribal Fisheries Program, Final Report. 42 p.
Bicknell, A.W.J., Oro, D., Camphuysen, K.J.). and Votier, S.C. (2013), Potential consequences of discard reform for seabird communities. J Appl Ecol, 50: 649-658. https://doi.org/10.1111/1365-2664.12072
Bigg, M. A. 1969. The harbor seal in British Columbia. Bull. Fish. Res. Board Can. 172:1-33.
Bolling, Z. M., Wright, S. K., Teerlink, S. S., Lyman, E. G. 2023. Killer Whale Entanglements in Alaska: Summary Report 1991-2022. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-f/AKR-32, 45 p.
Boveng, P. L., J. L. Bengtson, T. W. Buckley, M. F. Cameron, S. P. Dahle, B. P. Kelly, B. A. Megrey, J. E. Overland, and N. J. Williamson. 2009. Status review of the spotted seal (Phoca largha). U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-200, 153 p.
Boveng, P. L., J. M. London, and J. M. Ver Hoef. 2012. Distribution and abundance of harbor seals in Cook Inlet, Alaska. Task III: Movements, marine habitat use, diving behavior, and population structure, 2004-2006. Final Report. BOEM Report 2012-065. Bureau of Ocean Energy Management, Alaska Outer Continental Shelf Region, Anchorage, AK. 58 p.
Braem, N.M., E.H. Mikow, and M.L. Kostick, editors. (2017). Chukchi Sea and Norton Sound Observation Network: Harvest and use of wild resources in 9 communities in Arctic Alaska, 2012-2014. ADF&G Division of Subsistence, Technical Paper No. 403.
Braham, H. W., J. J. Burns, G. A. Fedoseev, and B. D. Krogman. 1984. Habitat partitioning by ice-associated pinnipeds: distribution and density of seals and walruses in the Bering Sea, April 1976, p. 25-47. In F. H. Fay and G. A. Fedoseev (eds.), Soviet-American cooperative research on marine mammals. Vol. 1. Pinnipeds. U.S. Dep. Commer., NOAA Tech. Rep. NMFS-12.
Brinkman, T. J., Hansen, W. D., Chapin, F. S., Kofinas, G., BurnSilver, S., & Rupp, T. S. (2016). Arctic communities perceive climate impacts on access as a critical challenge to availability of subsistence resources. *Climatic Change*, *139*, 413-427.
Bristol Bay Economic Development Corporation (BBEDC). (2022). 2022 Annual Report. Https://bbedc.com/wp-content/uploads/2024/06/BBEDC-2022-AR-ALL_FINAL_WEB.pdf
Brown, C.L., B. M. McDavid, C. F. Moncrief, A. Trainor, and J.S. Magdanz. 2017. Customary trade and barter as part of a continuum of exchange practices in 3 upper Yukon River region communities: Fort Yukon, Manley Hot Springs, and Venetie. Alaska Department of Fish and Game Division of Subsistence, Technical Paper, No. 437, Fairbanks.
Brown, C.L.; Tim Bembenic; Molly Brown; Helen Cold; Jesse Coleman; Emily Donaldson; Jacob Egelhoff; Bronwyn Jones; Jacqueline M. Keating; Lauren A. Sill; Morgan Urquia; Chance Wilcox; Terri Barnett. 2023. Alaska Subsistence and Personal Use Salmon Fisheries 2020 Annual Report. ADF&G Division of Subsistence, Technical Paper No. 494.
Brownell, R. L., Jr., W. A. Walker and K. A. Forney. 1999. Pacific white-sided dolphin, Lagenorhynchus obliquidens Gill, 1865. Pages 57-84 In: Ridgway, S. H. and R. Harrison (eds.), Handbook of Marine Mammals, Vol. 6. Academic Press, San Diego.
Buklis, S.L. 2024. Chum Salmon. Wildlife Notebook Series: Alaska Department of Fish and Game. https://www.adfg.alaska.gov/static/education/wns/chum_salmon.pdf.
Burns, J. J. 1967. The Pacific bearded seal. Alaska Department of Fish and Game, Pittman-Robertson Project Report W-6-R and W-14-R. 66 p.

Burns, J. J. 1970. Remarks on the distribution and natural history of pagophilic pinnipeds in the Bering and Chukchi seas. J. Mammal. 51:445-454.

Burns, J. J. 1981. Bearded seal-Erignathus barbatus Erxleben, 1777, p. 145-170. In S. H. Ridgway and R. J. Harrison (eds.), Handbook of Marine Mammals. Vol. 2. Seals. Academic Press, New York.

Burns, J. J., and K. J. Frost. 1979. The natural history and ecology of the bearded seal, Erignathus barbatus. Alaska Department of Fish and Game. 77 p.

Calkins, D. G. 1998. Prey of Steller sea lions in the Bering Sea. Biosphere conservation: for nature, wildlife, and humans 1(1):33–44.

Call, K. A., and T. R. Loughlin. 2005. An ecological classification of Alaskan Steller sea lion (*Eumetopias jubatus*) rookeries: A tool for conservation/management. Fisheries Oceanography 14(Supplement 1):212–222

Cameron, M. F., J. L. Bengtson, P. L. Boveng, J. K. Jansen, B. P. Kelly, S. P. Dahle, E. A. Logerwell, J. E. Overland, C. L. Sabine, G. T. Waring, and J. M. Wilder. 2010. Status review of the bearded seal *(Erignathus barbatus*). U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-211, 246 p

Cameron, M. F., K. J. Frost, J. M. Ver Hoef, G. A. Breed, A. V. Whiting, J. Goodwin, and P. L. Boveng. 2018. Habitat selection and seasonal movements of young bearded seals (*Erignathus barbatus*) in the Bering Sea. PLoS ONE 13(2):e0192743. DOI: dx.doi.org/10.1371/journal.pone.0192743 .

Carey, M. P., von Biela, V. R., Dunker, A., Keith, K. D., Schelske, M., Lean, C., & Zimmerman, C. E. (2021). Egg retention of high-latitude sockeye salmon (Oncorhynchus nerka) in the Pilgrim River, Alaska, during the Pacific marine heatwave of 2014–2016. Polar Biology, 44(8), 16431654. https://doi.org/10.1007/s00300-021-02902-8

Carothers, C., J. Black, S. J. Langdon, R. Donkersloot, D. Ringer, J. Coleman, E. R. Gavenus, W. Justin, M. Williams, F. Christiansen, C. Stevens, B. Woods, S. Clark, P. M. Clay, L. Mack, J. Raymond-Yakoubian, A. Akall'eq Sanders, B. L. Stevens, and A. Whiting. 2021. Indigenous peoples and salmon stewardship: a critical relationship. Ecology and Society 26(1):16. https://doi.org/10.5751/ ES-11972-260116.

Carretta, James V., Justin Greenman, Kristin Wilkinson, Lauren Saez, Dan Lawson, and Justin Viezbicke. 2023. Sources of human-related injury and mortality for U.S. Pacific West Coast marine mammal stock assessments, 2017-2021. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-690. https://doi.org/10.25923/qwf2-9b97

Castellote, M., K. M. Stafford, A. D. Neff, and W. Lucey. 2015. Acoustic monitoring and prey association for beluga whale, Delphinapterus leucas, and harbor porpoise, *Phocoena phocoena*, off two river mouths in Yakutat Bay, Alaska. Mar. Fish. Rev. 77(1):1-10.

Cederholm, C.J., Kunze, M.D., Murota, T., and Sibatani, A. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries Management/Habitat 24(10): 6-15.

Central Bering Sea Fishermen's Association (CBSFA). (2021). 2021 Annual Report. https://cbsfa.com/pdf/2021_annual_report_web.pdf

Chase, C. 2022. "Danish Company receives "giant" order from Russian Fishery Company for new equipment." Seafood Source. January 17, 2022.

Chase, C. 2024. "US extends deadline for Russia-origan seafood to enter country." Seafood Source. February 21, 2024.

Chief Andrew Isaac Health Center – Diabetes & WIC Department (2024), "Discussion of Nutritional Value of Chum Salmon", verbal, 10 Sept. 2024.

Connors, Brendan M., M. Siegle, J. Harding, S. Rossi, B. A. Staton, M. Jones, M.J. Bradford, R. Brown, B.Bechtol, B.Doherty, S. Cox, and B. J. G. Sutherland. 2022. Chinook salmon diversity contributes to fishery stability and trade-offs with mixed-stock harvest. Ecological Applications. 2022;32: e2709. https://onlinelibrary.wiley.com/r/eap pg 1 of 17 https://doi.org/10.1002/eap.2709.

Coastal Villages Region Fund (CVRF). (2023). 2023 Annual Report. https://coastalvillages.org/about-us/annual-reports/
de Jong, K., T. N. Forland, M. C. P. Amorim, G. Rieucau, H. Slabbekoorn, and L. D. Sivle. 2020. Predicting the effects of anthropogenic noise on fish reproduction. Reviews in Fish Biology and Fisheries 30: 245-268.
Downs, M. & A. Henry (2023). Baseline Commercial Fishing Community Profile Updates: Akutan and Unalaska, Alaska.
Edwards, Martin, and Anthony J. Richardson. "Impact of climate change on marine pelagic phenology and trophic mismatch." Nature 430.7002 (2004): 881-884.
Eisner, L. B., J. M. Napp, K. L. Mier, A. I. Pinchuk, and A. G. Andrews III. 2014. Climate-mediated changes in zooplankton community structure for the eastern Bering Sea. Deep Sea Research PartII: Topical Studies in Oceanography 109: 157-171. https://doi.org/10.1016/j.dsr2.2014.03.004
Ellison, W. T., B. L. Southall, C. W. Clark, and A. S. Frankel. 2012. A new context-based approach to assess marine mammal behavioral responses to anthropogenic sounds. Conservation Biology 26: 21–28.
Environmental Protection Agency (EPA). 2024. Technical Guidance for Assessing Environmental Justice in Regulatory Analysis, Second Edition.
EPA. (2016). Promising Practices for EJ Methodologies in NEPA Reviews. Report of the Federal Interagency Working Group on Environmental Justice & NEPA Committee.
Fall, J. A., Braem, N. S., Brown, C. L., Hutchinson-Scarbrough, L. B., Koster, D. S., & Krieg, T. M. (2013). Continuity and change in subsistence harvests in five Bering Sea communities: Akutan, Emmonak, Savoonga, St. Paul, and Togiak. *Deep sea research part II: topical studies in oceanography*, 94, 274-291.
Fall, J. A., Hutchinson-Scarbrough, L. B., Jones, B. E., Kukkonen, M., Lemons, T., Godduhn, A., ... & Sill, L. (2018). *Alaska subsistence and personal use salmon fisheries 2015 annual report*. Alaska Department of Fish and Game, Division of Subsistence.
Fall, J. (2018). *Subsistence in Alaska: A year 2017 update*. https://www.adfg.alaska.gov/static/home/subsistence/pdfs/subsistence_update_2017.pdf
Farley, E. (2009). AYK: Factors Affecting Chum Growth & Condition - Parts 1 and 2. https://www.aykssi.org/wp-content/uploads/610-Farley-FR.pdf
Farley Jr., E., E. Yasumiishi, J.M. Murphy, W. Strasburger, F. Sewall, K. Howard, S. Garcia, and J. Moss. 2024. Critical periods in the marine life history of juvenile western Alaska chum salmon in a changing climate. *Marine Ecology Progress Series*: 149-160.
Fienup-Riordan, A. (2000). Hunting tradition in a changing world: Yup'ik lives in Alaska today. Rutgers University Press.
Fienup-Riordan, A. (2020). Nunakun-gguq Ciutengqertut/They say they have ears through the ground: Animal essays from southwest Alaska. University of Alaska Press.
Gatewood, J., & McCay, B. (1990). Comparison of job satisfaction in six New Jersey fisheries: implications for management. *Human Organization*, *49*(1), 14-25.
Godduhn, Anna R., David M. Runfola, Christopher R. McDevitt, Gulfaya Rakhmetova, Helen S. Cold, and Caroline L. Brown. 2020. “Patterns and Trends of Subsistence Salmon Harvest and Use in the Kuskokwim River Drainage, 1990–2016.” Fairbanks: Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 468. http://www.adfg.alaska.gov/techpap/TP 468.pdf.
Halffman, C.M., B.A. Potter, H.J. McKinney, B.P. Finney, A.T. Rodrigues, D.Y. Yan, and B.M. Kemp. 2015. Early human use of anadromous salmon in North America at 11,500 y ago. Proc. Natl. Acad. Sci. USA, 2015 Oct 6; 112(40): 12344–12348. https://doi.org/10.1073%2Fpnas.1509747112.
Hastings, K. K., L. A. Jemison, G. W. Pendleton, K. L. Raum-Suryan, and K. W. Pitcher. 2017. Natal and breeding philopatry of female Steller sea lions in southeastern Alaska. PLoS ONE 13(4):e0196412. DOI: dx.doi.org/10.1371/journal.pone.0176840 .

Hastings, K. K., K. J. Frost, M. A. Simpkins, G. W. Pendleton, U. G. Swain, and R. J. Small. 2004.

Hastings, K. K., M J Rehberg, G. M. O'Corry-Crowe, G. W. Pendleton, L. A. Jemison, and T. S. Gelatt. 2019. Demographic consequences and characteristics of recent population mixing and colonization in Steller sea lions, *Eumetopias jubatus*. J. Mammal. DOI: dx.doi.org/10.1093/jmammal/gyz192 .

Hastings, K. K., Rehberg, M. J., O'Corry-Crowe, G. M., Pendleton, G. W., Jemison, L. A., & Gelatt, T. S. 2020. Demographic consequences and characteristics of recent population mixing and colonization in Steller sea lions, *Eumetopias jubatus*. Journal of Mammalogy, 101(1), 107-120.

Haynie, Alan C., and Lisa Pfeiffer. 2013. Climatic and economic drivers of the Bering Sea walleye pollock (Theragra chalcogramma) fishery: implications for the future. *Canadian Journal of Fisheries and Aquatic Sciences* 70.6: 841-853.

Heptner, L. V. G., K. K. Chapskii, V. A. Arsen'ev, and V. T. Sokolov. 1976. Bearded seal. *Erignathus barbatus* (Erxleben, 1777), p. 166-217. In L. V. G. Heptner, N. P. Naumov, and J. Mead (eds.), Mammals of the Soviet Union. Volume II, Part 3--Pinnipeds and Toothed Whales, Pinnipedia and Odontoceti. Vysshaya Shkola Publishers, Moscow, Russia. (Translated from Russian by P. M. Rao, 1996, Science Publishers, Inc., Lebanon, NH.)

Herman-Mercer, N.M., Laituri, M., Massey, M., Matkin, E., Toohey, R.C., Elder, K., Schuster, P.F., Mutter, E. 2019. Vulnerability of subsistence systems due to social and environmental change: A case study in the Yukon-Kuskokwim delta, Alaska. Arctic 72(3): 258-272. https://doi.org/10.14430/arctic68867.

Himes-Cornell, A. H. 2013. Community Profiles for North Pacific Fisheries-Alaska.https://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/communities/profiles.php

Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. *Fisheries Research*, *162*, 1-11.

Hobbs, R. C., and J. M. Waite. 2010. Abundance of harbor porpoise (Phocoena phocoena) in three Alaskan regions, corrected for observer errors due to perception bias and species misidentification, and corrected for animals submerged from view. Fish. Bull., U.S. 108(3):251-267.

Holland, D.S. 2010. Markets, pooling and insurance for managing bycatch in fisheries. Ecological Economics 70, 121-133.

Holland, D.S & Jannot J.E. 2012. Bycatch risk pool for the US West Coast groundfish fishery. Ecological Economics 78, 132-147.

Herman-Mercer, N.M., Laituri, M., Massey, M., Matkin, E., Toohey, R.C., Elder, K., Schuster, P.F., Mutter, E. 2019. Vulnerability of subsistence systems due to social and environmental change: A case study in the Yukon-Kuskokwim delta, Alaska. Arctic 72(3): 258-272. https://doi.org/10.14430/arctic68867.

Hyrenbach K. D., Z. McGinnis, K. Page, D. Rapp, F. D. Horgen, J. M. Lynch. 2020. Assessment of plastic ingestion by pole-caught pelagic predatory fish from O'ahu, Hawai'i. Aquatic Conservation: Marine Freshwater Ecosystems: 2020; 1-12. http://doi.org/10.1002/aqc.3507

Ianelli, J., T. Honkalehto, S. Wassermann, A. McCarthy, S. Steinessen, C. McGilliard, and E. Siddon. 2024. Assessment of walleye pollock in the eastern Bering Sea. North Pacific Fishery Management Council, Anchorage, AK.

Jemison, L. A., G. W. Pendleton, L. W. Fritz, K. K. Hastings, J. M. Maniscalco, A. W. Trites, and T. S. Gelatt. 2013. Inter-population movements of Steller sea lions in Alaska, with implications for population separation. PLoS ONE 8(8):e70167.

Jemison, L. A., G. W. Pendleton, K. K. Hastings, J. M. Maniscalco, and L. W. Fritz. 2018. Spatial distribution, movements, and geographic range of Steller sea lions (Eumetopias jubatus) in Alaska. PLoS ONE 13(12):e0208093. DOI: dx.doi.org/10.1371/journal.pone.0208093 .

Jimbo, M., D. Mizuguchi, H. Shirakawa, K. Tsujii, A. Fujiwara, K. Miyashita, and Y. Mitani. 2019. Seasonal variations in the call presence of bearded seals in relation to sea ice in the southern Chukchi Sea. Polar Biol. 42:1953. DOI: dx.doi.org/10.1007/s00300-019-02569-2 .

Johnson, M. L., C. H. Fiscus, B. T. Stenson, and M. L. Barbour. 1966. Marine mammals, p. 877-924. In N. J. Wilimovsky and J. N. Wolfe (eds.), Environment of the Cape Thompson Region, Alaska. U.S. Atomic Energy Commission, Oak Ridge, TN.

Jones, L. A., E. R. Schoen, R. Shaftel, C. J. Cunningham, S. Mauger, D. J. Rinella, and A. St. Saviour. 2020. Watershed-scale climate influences productivity of Chinook salmon populations across southcentral Alaska. Global Change Biology 26: 4919-4936.

Jones T, Parrish JK, Lindsey J, Wright C and others (2024) Marine bird mass mortality events as an indicator of the impacts of ocean warming. Mar Ecol Prog Ser 737:161-181. https://doi.org/10.3354/meps14330

Joy, P., S. Dressel, S. Miller, C. Brown, J. Erickson. 2023. Herring. Togiak Herring Population Trends. In In: Siddon, E. 2023. Ecosystem Status Report 2023:
Eastern Bering Sea, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management
Council, 1007 West 3rd Ave., Suite 400, Anchorage, Alaska 99501.

Kaler, R., and K. Kuntz. 2022. Sidebar – Alaskan Seabird Die-offs. Oceanography. Volume 35, pages 156-157. https://tos.org/oceanography/assets/docs/35-kaler.pdf

Kasperski, S. 2024. Alaska Seafood Snapshot Pre-publication version. Alaska Fisheries Science Center. Seattle, WA. Accessed from: https://www.fisheries.noaa.gov/s3//2024-10/ak-seafood-industry-snapshot-10-31-2024-afsc.pdf

Kawagley, A. O. (2006). A Yupiaq worldview: A pathway to ecology and spirit. Waveland Press.

Keating, J. M., Sill, L. A., & Koster, D. (2022). The Harvest and Use of Wild Resources, Unalaska, Alaska, 2020.

Kelly, B. P. 1988. Bearded seal, Erignathus barbatus, p. 77-94. In J. W. Lentfer (ed.), Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations. Marine Mammal Commission, Washington, DC.

Kelly, B. P., J. L. Bengtson, P. L. Boveng, M. F. Cameron, S. P. Dahle, J. K. Jansen, E. A. Logerwell, J. E. Overland, C. L. Sabine, G. T. Waring, and J. M. Wilder. 2010a. Status review of the ringed seal (Phoca hispida). U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-212, 250 p.

Kelly, B. P., O. H. Badajos, M. Kunnasranta, J. R. Moran, M. Martinez-Bakker, D. Wartzok, and P. Boveng. 2010b. Seasonal home ranges and fidelity to breeding sites among ringed seals. Polar Biol. 33:1095-1109.

King, J. E. 1983. Seals of the World. 2nd edition. British Museum (Natural History) and Oxford University Press, London, UK. 240 p.

Kondzela, C. M., Whittle, J. A., Marvin, C. T., Murphy, J. M., Howard, K.G. , Borba, B.M., Farley Jr., E.V., Templin, W.D., & Guyon, J.R. 2016. Genetic analysis identifies consistent proportions of seasonal life history types in Yukon River juvenile and adult chum salmon. N. Pac. Anadr. Fish Comm. Bull. 6: 439–450.

Kuskokwim River Inter-Tribal Fish Commission (KRITFC). 2021. 2021 Kuskokwim River Salmon Situation Report. Alaska: Bethel.

KRITFC. 2023. 2022 Kuskokwim River Salmon Situation Report. Alaska: Bethel.

KRITFC. 2024. 2023 Kuskokwim River Salmon Situation Report. Alaska: Bethel.

Lander, R. H., and H. Kajimura. 1982. Status of northern fur seals. FAO Fisheries Series 5:319-345.

Lander, M. E., B. S. Fadely, T. S. Gelatt, J. T. Sterling, D. S. Johnson, and N. A. Pelland. 2020. Mixing it up in Alaska: Habitat use of adult female Steller sea lions reveals a variety of foraging strategies. Ecosphere 11(2):e03021.

Lefebvre, K. A., L. Quakenbush, E. Frame, K. Burek Huntington, G. Sheffield, R. Stimmelmayr, A. Bryan, P. Kendrick, H. Ziel, T. Goldstein, J. A. Snyder, T. Gelatt, F. Gulland, B. Dickerson, and V. Gill. 2016. Prevalence of algal toxins in Alaskan marine mammals foraging in a changing arctic and subarctic environment. Harmful Algae 55:13-24. DOI: dx.doi.org/10.1016/j.hal.2016.01.007 .

Linnenschmidt, M., J. Teilmann, T. Akamatsu, R. Dietz, and L. A. Miller. 2013. Biosonar, dive, and foraging activity of satellite tracked harbor porpoises (Phocoena phocoena). Mar. Mammal Sci. 29(2):77-97.

Lowry, L. F., K. J. Frost, J. M. Ver Hoef, and R. A. DeLong. 2001. Movements of satellite-tagged subadult and adult harbor seals in Prince William Sound, Alaska. Mar. Mammal Sci. 17:835-861.

Lowry, L. F., K. J. Frost, R. Davis, D. P. DeMaster, and R. S. Suydam. 1998. Movements and behavior of satellite-tagged spotted seals (Phoca largha) in the Bering and Chukchi Seas. Polar Biol. 19:221-230.

Lowry, L. F., V. N. Burkanov, K. J. Frost, M. A. Simpkins, A. Springer, D. P. DeMaster, and R. Suydam. 2000. Habitat use and habitat selection by spotted seals (Phoca largha) in the Bering Sea. Can. J. Zool. 78:1959-1971.

MacIntyre, K. Q., K. M. Stafford, C. L. Berchok, and P. L. Boveng. 2013. Year-round acoustic detection of bearded seals (Erignathus barbatus) in the Beaufort Sea relative to changing environmental conditions, 2008-2010. Polar Biol. 36(8):1161-1173.

MacIntyre, K. Q., K. M. Stafford, P. B. Conn, K. L. Laidre, and P. L. Boveng. 2015. The relationship between sea ice concentration and the spatio-temporal distribution of vocalizing bearded seals (Erignathus barbatus) in the Bering, Chukchi, and Beaufort seas from 2008 to 2011. Prog. Oceanogr. 136:241-249. DOI: dx.doi.org/10.1016/j.pocean.2015.05.008 .

Magdanz, J. S., Tahbone, S., Ahmasuk, A., Koster, D. S., & Davis, B. L. 2007. Customary trade and barter in fish in the Seward Peninsula area, Alaska. *Alaska Department of Fish and Game Division of Subsistence Technical Paper*, (328).

Manning, T. H. 1974. Variation in the skull of the bearded seal, Erignathus barbatus (Erxleben). Biological Papers of the University of Alaska 16:1-21.

McKenna, B. 2022. Abundance and run timing of adult salmon in Henshaw Creek, Kanuti National Wildlife Refuge, Alaska, 2021 (FIS 20-204). Tanana Chiefs Conference, Fisheries Program.

McKinley Research Group. 2023. Alaska Seafood Overview of the global supply chain. Prepared for Alaska Seafood Marketing Institute. March 2023.

McKinley Research Group. 2024. The Economic value of Alaska’s Seafood Industry. Prepared for Alaska Seafood Marketing Institute. April 2024.

Jones T, Parrish JK, Lindsey J, Wright C and others (2024) Marine bird mass mortality events as an indicator of the impacts of ocean warming. Mar Ecol Prog Ser 737:161-181. https://doi.org/10.3354/meps14330

Murphy Jr, R., Estabrooks, A., Gauvin, J., Gray, S., Kroska, A. C., Wolf, N., & Harris, B. P. 2021. Using mental models to quantify linear and non-linear relationships in complex fishery systems. *Marine Policy*, *132*, 104695.

Myers KW, Armstrong JL, Kaeriyama M. 2009. High seas distribution, biology, and ecology of Arctic-Yukon-Kuskokwim salmon: direct information from high seas tagging experiments, 1954– 2006. Am Fish Soc Symp 70: 201– 239.

National Marine Fisheries Service (NMFS). 1993. Final conservation plan for the northern fur seal (*Callorhinus ursinus*). Prepared by the National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA, and the Office of Protected Resources, National Marine Fisheries Service, Silver Spring, MD. 80 p.

National Marine Fisheries Service (NMFS). 2005. Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska: Volume 1. National Marine Fisheries Service, Alaska Region, 1124 p. https://repository.library.noaa.gov/view/noaa/17391

National Marine Fisheries Service (NMFS). 2007. Alaska Groundfish Harvest Specifications Final Environmental Impact Statement. Available online: https://repository.library.noaa.gov/view/noaa/20073

National Marine Fisheries Service (NMFS). 2015. Supplemental Information Report for the 2004 Alaska Groundfish Fisheries Programmatic Environmental Impact Statement. https://repository.library.noaa.gov/view/noaa/19481

National Marine Fisheries Service (NMFS). 2021. Seabird Bycatch Estimates for Alaska Groundfish Fisheries: 2020. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-F/AKR-25, 40 p. 10.25923/a0fb-nt02 (Table 8) https://repository.library.noaa.gov/view/noaa/46629

National Marine Fisheries Service (NMFS). 2024. 2024 Seabird Report to the North Pacific Fishery Management Council. https://meetings.npfmc.org/CommentReview/DownloadFile?p=cf9e8c9d-8fa2-4599-8684-9d51e224f5cf.pdf&fileName=B2%20NMFS%20Seabird%20Report.pdf (last visited Nov. 6. 2024)

Native Village of Georgetown. 2021. Traditional ecological knowledge of the middle Kuskokwim. Alaska: Anchorage.

Nelson, R. K. 1981. Harvest of the sea: coastal subsistence in modern Wainwright. North Slope Borough, Barrow, AK. 125 p.

Nevins, H., D. Hyrenbach, C. Keiper, J. Stock, M. Hester, and J. Harvey. 2005. Seabirds as Indicators of Plastic Pollution in the North Pacific. PAPER for Plastic Debris Rivers to the Sea Conference 2005. September 7-9, 2005, Redondo Beach, CA. https://www.researchgate.net/publication/242708597_Seabirds_as_indicators_of_plastic_pollution_in_the_Nort h_Pacific

NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020).

North Pacific Fishery Management Council (NPFMC). 2009. Bering Sea Chinook Salmon Bycatch Management Volume II Final Regulatory Impact Review. December 2009.

North Pacific Fishery Management Council (NPFMC). 2012. EA/RIR Bering Sea Chum Salmon PSC Measures. NPFMC 605 W. 4th Ave, Anchorage, AK 99501.

NPFMC. 2017. American Fisheries Act Program Review Final Report. Prepared by Northern Economics. July 2017. Anchorage, AK.

Norman, K., Sepez, J., Lazrus, H., Milne, N., Package, C., Russell, S., ... & Vaccaro, I. (2007). Community Profiles for West Coast and North Pacific Fisheries. *Washington, Oregon, California, and other US States. Silver Spring, MD: NOAA*, 1-617.Pollnac, R.B. and JJ Poggie. 2006. Job satisfaction in the fishery in two southeast Alaskan towns. *Human Organization* 65(3): 329-339.

Norton Sound Economic Development Corporation (NSEDC). 2023. 2023 Annual Report. https://coastalvillages.org/about-us/annual-reports/

Nyman, T., M. Valtonen, J. Aspi, M. Ruokonen, M. Kunnasranta, and J. U. Palo. 2014. Demographic histories and genetic diversities of Fennoscandian marine and landlocked ringed seal subspecies. Ecol. Evol. 4:3420-3434.

O'Corry-Crowe, G., R. Suydam, L. Quakenbush, B. Potgieter, L. Harwood, D. Litovka, T. Ferrer, J. Citta, V. Burkanov, K. Frost, and B. Mahoney. 2018. Migratory culture, population structure and stock identity in North Pacific beluga whales (Delphinapterus leucas). PLoS ONE 13(3):e0194201.

Ognev, S. I. 1935. Mammals of the U.S.S.R. and Adjacent Countries. Vol. 3. Carnivora (Fissipedia and Pinnipedia). Gosudarst. Izdat. Biol. Med. Lit., Moscow. (Translated from Russian by Israel Program for Scientific Translations, 1962. 741 p.)

Oke, K. B., Cunningham, C. J., Westley, P. A. H., et al. 2020. Recent declines in salmon body size impact ecosystems and fisheries. *Nature Communications*, 11(4155). https://doi.org/10.1038/s41467-020-17726-z

Package, C. & F. Conway (2010). Long form fishing community profile, Newport, Oregon.
Package-Ward, C., & Himes-Cornell, A. (2014). Utilizing oral histories to understand the social networks of Oregon fishermen in Alaska. *Human Organization*, 73(3), 277-288.
Padula, V., A. H. Beaudreau, B. Hagedorn, D. Causey. 2020. Plastic-derived contaminants in Aleutian Archipelago seabirds with varied foraging strategies. Marine Pollution Bulletin, 158: 10pp. https://doi.org/10.1016/j.marpolbul.2020.111435
Piatt J. F., J. K. Parrish, H. M. Renner, S.K. Schoen, T. T. Jones, M.L. Arimitsu, K. J. Kuletz, B. Bodenstein, M. Garcı´aReyes, R. S. Duerr, R. M. Corcoran, R. S. A. Kaler , G. J. McChesney, R. T. Golightly, H. A. Coletti, R. M. Suryan, H. K. Burgess, J. Lindsey, K. Lindquist, P. M. Warzybok, J. Jahncke, J. Roletto, and W. J. Sydeman. 2020. Extreme mortality and reproductive failure of common murres resulting from the northeast Pacific marine heatwave of 2014-2016. PLOS ONE. Volume 15. e0226087. https://doi.org/10.1371/journal.pone.0226087
Pitcher, K. W., and D. C. McAllister. 1981. Movements and haulout behavior of radio-tagged harbor seals, Phoca vitulina. Can. Field-Nat. 95:292-297.
Poloczanska, Elvira S., et al. "Responses of marine organisms to climate change across oceans." Frontiers in Marine Science 3 (2016): 62.
Rapp, D. C., S. M. Youngrena, P. Hartzell, and K. D. Hyrenbacha. 2017. Community-wide patterns of plastic ingestion in seabirds breeding at French Frigate Shoals, Northwestern Hawaiian Islands. Marine Pollution Bulletin 123: 269-278. https://doi.org/10.1016/j.marpolbul.2017.08.04
Raum-Suryan, K. L, K. W. Pitcher, D. G. Calkins, J. L. Sease, and T. R. Loughlin. 2002. Dispersal, rookery fidelity, and metapopulation structure of Steller sea lions (Eumetopias jubatus) in an increasing and a decreasing population in Alaska. Mar. Mammal Sci. 18(3):746-764.
Raymond-Yakoubian, J. (2013). When the fish come, we go fishing: Local ecological knowledge of Nonsalmon fish used for subsistence in the Bering Strait region. Kawerak Incorporated.
Raymond-Yakoubian, B., & Raymond-Yakoubian, J. (2015). Always taught not to waste: traditional knowledge and Norton Sound/Bering Strait salmon populations. Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative Project, 1333.
Reedy-Maschner, K. (2009). Entangled livelihoods: Economic integration and diversity in the Western Arctic. *Alaska Journal of Anthropology*, *7*(2), 135-146.
Reedy, K. (2016). Island Networks: Aleutian Islands Salmon and Other Subsistence Harvests. *Final Report to the Alaska FisheriesResource Monitoring Program*, 12-450.
Rice, D. W. (1998). Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy. Special Publication, (4).
Robinson, D., & Tappen, S. 2024. Processing Sales and Closures; How Plant Changes May Affect Seafood Processing Jobs. Alaska Department of Labor, *April 2024 Alaska Economic Trends*. https://live.laborstats.alaska.gov/trends-magazine/2024/April/cost-increases-slowed-considerably-in-2023
Ruggerone, G. T., & Agler, B. A. 2008. 2008 Arctic Yukon Kuskokwim Sustainable Salmon Initiative Project Product: Retrospective Analyses of AYK Chum & Coho Salmon by. https://www.aykssi.org/wp-content/uploads/614-Ruggerone-FR.pdf
Rapp, D. C., S. M. Youngrena, P. Hartzell, and K. D. Hyrenbacha. 2017. Community-wide patterns of plastic ingestion in seabirds breeding at French Frigate Shoals, Northwestern Hawaiian Islands. Marine Pollution Bulletin 123: 269-278. https://doi.org/10.1016/j.marpolbul.2017.08.04
Salo, E. O. 1991. Life history of chum salmon (Oncorhynchus keta). *Pacific salmon life histories*, 231-309.
Samuelson, Jonathan. 2023. Senate Committee on Indian Affairs—Field hearing: The impact of the historic salmon declines on the health and well-being of Alaska Native communities along Arctic, Yukon, and Kuskokwim rivers. Witness Statement. https://www.indian.senate.gov/wp-content/uploads/2023-11-10-FHRG-Testimony-Samuelson.pdf

Scheffer, V. B. 1958. Seals, Sea Lions and Walruses: A Review of the Pinnipedia. Stanford University Press, Palo Alto, CA. 179 p.
Scheffer, V. B., and J. W. Slipp. 1944. The harbor seal in Washington State. Am. Midland Nat. 32:373-416.
Seaman, T. 2023. “Russia targets 115,000t of surimi by 2027, aims to ‘squeeze’ US out of Asia.” Undercurrrent News. November 7, 2023.
Shaughnessy, P. D., and F. H. Fay. 1977. A review of the taxonomy and nomenclature of North Pacific harbour seals. J. Zool. (Lond.) 182:385-419.
Siddon, E. 2023. Ecosystem Status Report 2023: Eastern Bering Sea. Stock Assessment and Fishery Evaluation report, North Pacific Fishery Management Council, 1007 West 3rd Ave., Suite 400, Anchorage, Alaska 99501. https://apps-afsc.fisheries.noaa.gov/Plan_Team/2023/EBSecosys.pdf
Simpkins, M. A., L. M. Hiruki-Raring, G. Sheffield, J. M. Grebmeier, and J. L. Bengtson. 2003. Habitat selection by ice-associated pinnipeds near St. Lawrence Island, Alaska in March 2001. Polar Biol. 26:577-586.
Sinclair, E. H., W. A. Walker, and P. J. Gearin. 2019. The diet of free-ranging male Steller sea lions (Eumetopias jubatus) in the eastern Bering Sea: a retrospective analysis based on stomach contents of an endangered pinniped. Canadian Journal of Zoology 97(3):195–202
Skewes, M.C., Gameon, J. A., Grubin, F., DeCou, C.R., and Whitcomb, L. 2020. Beliefs about causal factors for suicide in rural Alaska Native communities and recommendations for prevention. Transcultural Psychiatry 59(1), 78-92.
Smith, T. G. 1981. Notes on the bearded seal, Erignathus barbatus, in the Canadian Arctic. Department of Fisheries and Oceans, Arctic Biological Station, Can. Tech. Rep. Fish. Aquat. Sci. No. 1042. 49 p.
Springer, A. M., and G. B. van Vliet. 2014. Climate change, pink salmon, and the nexus between bottom-up and top-down forcing in the subarctic Pacific Ocean and Bering Sea. Proceedings of the National Academy of Sciences 111:E1880–E1888. https://doi.org/10.1073/pnas.1319089111
Stevens, C., and Black, J. 2019. I am a criminal: Criminalization of Indigenous fishing practices. Accessed 23 September 2024. https://alaskasalmonandpeople.org/region/yukon/.
Stram, D. & J. Ianelli 2015. Evaluating the efficacy of salmon bycatch measures using fishery-dependent data. *ICES Journal of Marine Science* 72(4), 1173-1180.
Swain, U., J. Lewis, G. Pendleton, and K. Pitcher. 1996. Movements, haul-out, and diving behaviour of harbor seals in Southeast Alaska and Kodiak Island, p. 59-144. In Annual Report: harbor seal investigations in Alaska, NOAA Grant NA57FX0367. Division of Wildlife Conservation, Alaska Department of Fish and Game, Douglas, AK.
Sweeney, K., K. Luxa, B. Birkemeier, and T. Gelatt. 2019. Results of Steller sea lion surveys in Alaska, June-July 2019. Memorandum to the Record, December 6, 2019. Available from Marine Mammal Laboratory, AFSC, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115.
Sweeney, K., K. Luxa, B. Birkemeier, and T. Gelatt. 2023. Results of Steller sea lion surveys in Alaska, June-July 2021. Memorandum to the Record, April 2023. Available from Marine Mammal Laboratory, AFSC, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115
Taylor, S.G. 2008. Climate warming causes phenological shift in Pink Salmon, Oncorhynchus gorbuscha, behavior at Auke Creek, Alaska. Global Change Biology 14: 229-235.
The Research Group, LLC. 2021 Fishing Industry Economic Activity Trends in the Newport, Oregon Area, Update 2019. Technical Report. Prepared for Midwater Trawlers Cooperative and Lincoln County Board of Commissioners. June 2021.
Tide, C. and Eich, A.M. 2022. Seabird Bycatch Estimates for Alaska Groundfish Fisheries: 2021. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-F/AKR-25, 46 p. https://repository.library.noaa.gov/view/noaa/46629.

Tojo, N., Kruse, G. H., & Funk, F. C. (2007). Migration dynamics of Pacific herring (Clupea pallasii) and response to spring environmental variability in the southeastern Bering Sea. *Deep Sea Research Part II: Topical Studies in Oceanography*, *54*(23-26), 2832-2848.

Tremayne, A. H., Darwent, C. M., Darwent, J., Eldridge, K. A., & Rasic, J. T. (2018). Iyatayet revisited: A report on renewed investigations of a stratified middle-to-late Holocene coastal campsite in Norton Sound, Alaska. *Arctic Anthropology*, *55*(1), 1-23.

Townsend, L. 2024. “The outlook for commercial fisheries.” Alaska Public Media, July 24, 2024.

U.S. Fish and Wildlife Service (USFWS). 2009. Short-tailed albatross (*Phoebastria albatrus*) 5-Year review: Summary and evaluation. Anchorage, AK. 78pp.

U.S. Fish and Wildlife Service (USFWS). 2021. Biological Opinion on the Proposed Modification of the EPA General Permit AKG524000 for Offshore Seafood Processors in Alaska and on the NMFS Groundfish Fishery for the Gulf of Alaska, Bering Sea, and Aleutians Islands (Consultation 07CAAN00-2020-F-0349). March 2021. 82pp.

U.S. Senate, Committee on Indian Affairs. 2023. The impact of the historic salmon declines on the health and well-being of Alaska Native communities along Arctic, Yukon, and Kuskokwim Rivers (S. Hrg. 118-234). U.S. Government Publishing Office. https://www.indian.senate.gov/wp-content/uploads/CHRG-118shrg54782.pdf.

Voinot-Baron, W. 2020. A bitter taste of fish: the temporality of salmon, settler colonialism, and the work of well¬being in a Yupiaq fishing village. Ecology and Society, 25(2).

Voinot-Baron, W. 2022. A sociality of being snagged: care and awakening among salmon in southwest Alaska. Alaska Journal of Anthropology, 20(1-2):20-32.

Walsh, J.C., Pendray, J.E., Godwin, S.C., Artelle, K.A., Kindsvater, H.K., Field, R.D., Harding, J.N., Swain, N.R., Reynolds, J.D. 2020. Relationships between Pacific salmon and aquatic and terrestrial ecosystems: implications for ecosystem-based management. Ecology 101(9).

Westlake, R. L., and G. M. O’Corry-Crowe. 2002. Macrogeographic structure and patterns of genetic diversity in harbor seals (Phoca vitulina) from Alaska to Japan. J. Mammal. 83:1111-1126.

Westley, P. A. H. 2020. Documentation of en route mortality of summer chum salmon in the Koyukuk River, Alaska and its potential linkage to the heatwave of 2019. Ecology and Evolution, 10(19), 10296–10304. https://doi.org/10.1002/ece3.6751

Wilson, W., 2024. Fighting for Our Lives in King Cove. Anchorage Daily News. Available online: https://www.adn.com/opinions/2024/05/26/opinion-fighting-for-our-lives-in-king-cove/

Wise, S., Kasperski, S., Abelman, A., Lee, J., Parks, M., & Reynolds, J. (2022). Annual Community Engagement and Participation Overview. *Report from the Economic and Social Sciences Program of the Alaska Fisheries Science Center*.

Whitworth, K. T. Vicente, A.Magel, K. Howard, V. von Biela, M, Williams, and P. Chambers, 2023. Contribution title. In: Siddon, E. 2023. Ecosystem Status Report 2023: Eastern Bering Sea, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, 1007 West 3rd Ave., Suite 400, Anchorage, Alaska 99501.

Womble, J. N., and M. F. Sigler. 2006. Seasonal availability of abundant, energy-rich prey influences the abundance and diet of a marine predator, the Steller sea lion Eumetopias jubatus. Marine Ecology Progress Series 325:281–293.

Womble, J. N., M. F. Sigler, and M. F. Willson. 2009. Linking seasonal distribution patterns with prey availability in a central-place forager, the Steller sea lion. Journal of Biogeography 36(3):439–451.

Womble, J. N. 2012. Foraging ecology, diving behavior, and migration patterns of harbor seals (Phoca vitulina richardii) from a glacial fjord in Alaska in relation to prey availability and oceanographic features. Ph.D. Dissertation, Oregon State University.

Womble, J. N., and S. M. Gende. 2013. Post-breeding season migrations of a top predator, the harbor seal (Phoca vitulina richardii), from a marine protected area in Alaska. PLoS ONE 8(2):e55386.

Yasumiishi, E. M., et al. 2020. "Climate-related changes in the biomass and distribution of small pelagic fishes in the eastern Bering Sea during late summer, 2002–2018." Deep Sea Research Part II: Topical Studies in Oceanography 181 (2020): 104907.

Yukon Delta Fishery Development Association (YDFDA). (2022). 2022 Annual Report. https://ydfda.org/reports

Young, N. C., Brower, A. A., Muto, M. M., Freed, J. C., Angliss, R. P., Friday, N. A., Boveng, P. L., Brost, B. M., Cameron, M. F., Crance, J. L., Dahle, S. P., Fadely, B. S., Ferguson, M. C., Goetz, K. T., London, J. M., Oleson, E. M., Ream, R. R., Richmond, E. L., Shelden, K. E. W., Sweeney, K. L., Towell, R. G., Wade, P. R., Waite, J. M., and Zerbini, A. N. 2023. Alaska marine mammal stock assessments, 2022. U.S. Department of Commerce, NOAA Technical Memorandum NMFSAFSC-474, 316 p.

Zaleski, M., T. S. Smeltz, S. Rheinsmith, J. L. Pirtle, and G. A. Harrington. In prep. 2022 Evaluation of the Fishing Effects on Essential Fish Habitat. U.S. Dep. Commer., NOAA Tech. Memo. NMFSF/AKR-29, 205 p.

Zuray, S., Kocan, R., and Hershberger, P. 2012. Synchronous Cycling of Ichthyophoniasis with Chinook Salmon Density Revealed during the Annual Yukon River Spawning Migration. Transactions of The American Fisheries Society, 141: 615-623. https://doi.org/10.1080/00028487.2012.683476.

von Biela, V. R., Sergeant, C. J., Carey, M. P., Liller, Z., Russell, C., Quinn-Davidson, S., ... & Zimmerman, C. E. (2022). Premature mortality observations among Alaska's Pacific Salmon during record heat and drought in 2019. Fisheries, 47(4), 157-168.