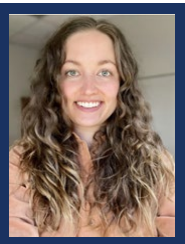
# C2 Bering Sea Chum Salmon Bycatch

February 2025, Presentation to the Scientific and Statistical Committee

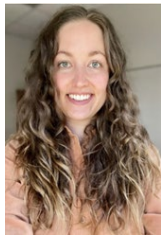
Dr. Kate Haapala, Sarah Marrinan, and Dr. Patrick Barry



# Information Available for the C2 Agenda Item

**Information available to the SSC:**

- Preliminary Draft Environmental Impact Statement (preliminary DEIS)
  - Revised and synthesized from April 2024 preliminary DEIS and SIA
    - National Marine Fisheries Service is the lead federal agency
    - Three Cooperating Agencies providing special expertise: Alaska Department of Fish & Game (ADF&G), Kuskokwim River Inter-Tribal Fish Commission (KRITFC), and Tanana Chiefs Conference (TCC)
- Appendices to the preliminary DEIS
- Staff presentation
- Action memo
- Addendum

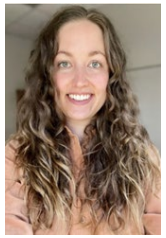


# Purpose and Need for the Proposed Action

Section 1.1

**The Council is considering new management alternatives to minimize chum salmon bycatch in the Bering Sea pollock fishery**

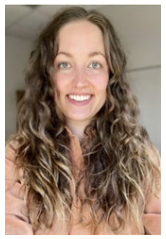
- **Purpose:** reduce chum salmon bycatch to the extent practicable with a focus on Western Alaska (WAK) chum salmon bycatch
  - Maintain priority objectives of the Chinook salmon bycatch avoidance program
  - Balance National Standards
- **Need:** proposed changes are being considered in light of recent and ongoing declines in WAK chum salmon



# SSC Action Under the C2 Agenda Item

**Determine if the revised analysis is sufficient to inform the Council's decision-making to recommend publication of the draft EIS for final action**

- Response to SSC comments and requests from April 2024
- New methods used in this iteration of the impact analysis
- Raising a new analytical issue related to abundance indices under Alternative 3



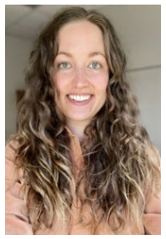
# Summary of Potential Council Actions

The Council may determine:

1. Whether it would like to modify the current range of action alternatives, and if so, how
2. Whether to request additional analytical review through an additional Council meeting
3. Whether to recommend the analysis be released for publication by NMFS as the draft EIS.
    a. The Council can recommend publication whether the alternatives are modified or not

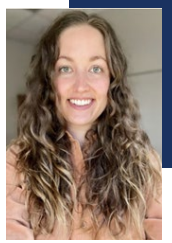
# Outline for Remainder of the Presentation

1. Alternatives
    a. New information on Bethel Test Fishery as available data source
2. Methods and Approach Used in the Impact Analysis
3. Response to SSC Comments and Requests
    a. Highlighting new changes to the analysis
4. Alternative 5 Impact Analysis – new alternative added in April 2024
5. Summary Overview of Key Takeaways



Dutch Harbor, ASMI Industry and Partner Use

# Alternatives (Chapter 2)



# Alternatives Under Consideration



**Alternative 1: No Action**

**Alternative 2: Overall chum salmon PSC limit**

- Cap amounts: 100,000 - 550,000 chum, sector apportionments

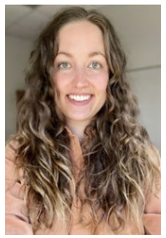
**Alternative 3: Overall chum salmon PSC limit with abundance indices**

- Cap + abundance indices – two options for indices under consideration

**Alternative 4: Changes to IPA regulations**

**Alternative 5: Inseason corridors triggered by area-specific PSC limits**

- Three corridor options under consideration

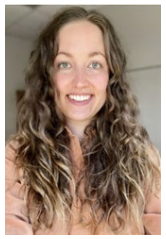


Alternatives 2–4 only in effect during the B season fishery, June 10 – November 1

# Alternative 3, Hard Cap with Abundance Indices

Section 2.4

- Alternative 3 includes overall chum salmon hard caps with abundance indices
  - Hard cap *may* be in place during the B season, depending on whether chum salmon returns exceed their thresholds
- Two mutually exclusive options for indices being considered
  - Three-area index (Option 1) and the Yukon Area index (Option 2)
    - Cap range for Alternative 3, Option 1: 75,000 –550,000
    - Cap range for Alternative 3, Option 2: 100,000 –550,000 (*i.e.,* the same as Alt. 2)
    - Sector apportionments and transferability provisions are the same as Alt. 2



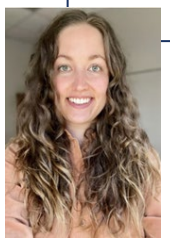
# Existing Data Sources for the Three-area Index

Section 2.4.1

| Area | Available Data | Thresholds |
|---|---|---|
| **Yukon** | Run reconstructions for Yukon summer and fall chum salmon | 1,713,300 or 2,718,400 chum |
| **Kuskokwim** | Bethel test fishery cumulative CPUE | 2,800 or 5,200 chum |
| **Norton Sound** | Standardized index of escapements for the Snake, Nome, Eldorado, Kwiniuk and North Rivers + total harvest for Norton Sound | 57,300 or 91,500 chum |

Thresholds are the 25th and 50th percentile values of each data source representing area abundance, 1992-2022

Thresholds are a Council decision point - only one would be selected for implementation



*CV estimates are available for the Yukon summer and fall chum runs and the Kuskokwim Sonar in addendum - Response to SSC request from April 2024*

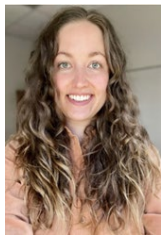
# Alternative Data Sources for the Kuskokwim Area

Appendix 2, pgs. 13-14 and Appendix 7, pg. 33

**New information indicates funding to operate the Bethel Test Fishery is uncertain beginning in 2025**

**ADFG and KRITFC have identified other available data sources and their advantages/disadvantages**

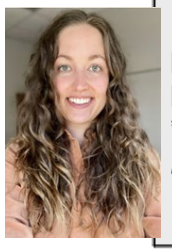
a) Kuskokwim Sonar
b) Kogrukluk River weir
c) Other weirs: Kwethluk River, Salmon River (Aniak), George River, Takotna River
d) Total harvest: commercial, subsistence, test fisheries, and recreational
e) Drainage wide run reconstruction – *not currently available*



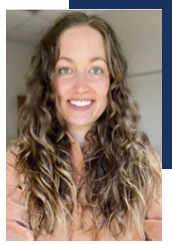
# Alternative Data Sources for the Kuskokwim Area

Appendix 2, pgs. 13-14

| Alternative data source | Summary of advantages | Summary of disadvantages |
|---|---|---|
| **Kuskokwim Sonar** | Reliable funding; estimates abundance past Bethel; uses standard methods as the Yukon and Kenai Rivers; correlates well with LKTK; information is available to the public; and may be used to inform future run reconstruction model. | Short time series (2018-present); has not operated in high run years but has operated in record low (2021) to above average (2018); values likely to change based on further evaluation of biases in species apportionment; future drainagewide telemetry (2026 and 2027) may assist bias investigation and potential corrections. |
| **Kogrukluk River Weir** | Long time series (1976-present); reliable funding; annual escapements correlate well with drainage wide Kuskokwim River sonar index; Kogrukluk has the only chum escapement goal for the Kuskokwim River; data is available to the public. | Single river system is a partial index of abundance and not representative of total drainagewide abundance; if combined with total drainagewide abundance, potential for double counting; environmental factors (e.g., flooding) may prevent weir from providing reliable estimates in that year. |
| **Other Weirs (Kwethluk, Salmon, George, and Takotna Rivers)** | Projects have long time series; various agencies plan to operate in the future; information is available to the public. | Projects are currently funded through competitive grants; partial index of abundance and not representative of drainagewide abundance; if combined with total drainagewide abundance, potential for double counting; environmental factors (e.g., flooding) may prevent weir from providing reliable estimates in that year. |
| **Total Harvest (Commercial, Subsistence, Test Fisheries and Recreational)** | Long time-series; collected annually and plans to continue to in the future; information is available to the public.; in-season lower river subsistence harvest estimates produced by KRITFC are available post-season in early fall. | Commercial harvests influenced by other factors besides abundance; subsistence and commercial harvests influenced by management decisions; partial index of abundance and not representative of drainagewide abundance; if combined with total drainagewide abundance, potential for double counting; commercial harvest estimates are confidential in years with less than three permit holders; river-wide subsistence/commercial harvest estimates from ADF&G not available post-season in early fall. |
| **Drainagewide Run Reconstruction **Not Presently Available**** | Would provide estimates on total abundance; potential for long time-series (1976-present); statistical model used for run reconstruction has been published and can easily be reproduced; uses multiple assessments and is consequently less vulnerable to unforeseen circumstances; analogous to the run reconstruction used for Chinook 3-area index. | Has not been peer reviewed or updated since 2008; not currently being used by ADF&G, KRITFC, or USFWS; Drainage wide telemetry planned for 2026 and 2027 which may assist in correcting Kuskokwim River sonar bias and scaling run reconstruction models. |




# Response to Over-arching SSC Comments and Methods Used



# Treatment of Uncertainty

**This analysis represents the preliminary stages of an EIS**

- NEPA regulations require the disclosure and assessment of uncertainty around potential impacts (40 CFR 1501.3(d)(2)(iv))

  ***"..the degree to which the potential effects on the human environment are highly uncertain."***

- Not required to come to a finding of significance on resource components, such as in an EA
- Uncertainties are present throughout the analysis under all resource components and human dimensions impacts
- The nature of the uncertainty varies widely, and is therefore deliberately addressed differently across resource components

**February 2025 iteration of the preliminary DEIS** sought to more clearly identify and describe the uncertainty related to the methodology, assumptions, and conclusions drawn throughout impacts analyses.

Response to SSC comments, pg. 9

# Retrospective Analysis

Much of the analysis relies on the same retrospective data and methods for consideration of chum salmon PSC limits (Alternative 2 and 3, with consideration under Alternative 5)

- Used catch and bycatch data (2011-2023) and compared to the details of the chum salmon PSC limits and apportionments to determine the week-end date when the pollock sector hypothetically would have closed (see also Section 5.2 from the April analysis, incorporated by reference).

- These estimates are an **anchor point** for consideration of potential future impacts.
- Retrospective values are focused on potential impacts from an overall limit or corridor limit being met, but important impacts are ***likely*** to occur prior to/regardless of whether a closure occurs.
- These estimates are meant to be considered along with other qualitative dynamics highlighted throughout the analysis, including the nature, magnitude and direction of uncertainty in impacts related to likely behavioral changes.

Response to SSC comments, pg. 9

# Incentive Structure Under the Proposed Alternatives

| No action | Chum PSC limit | Chum PSC limit, triggered by abundance | IPA measures | Corridor cap |
|---|---|---|---|---|
| **Alt 1** | **Alt 2** | **Alt 3** | **Alt 4** | **Alt 5** |

Regulatory and non-regulatory status quo incentives (e.g., IPA requirements, responding to outside pressure, CDQ associations, etc.)

***In addition to status quo incentives:***

Harvesters will be incentivized to avoid **all** chum salmon to prevent a fishery closure or having to take more severe measures (e.g., fleet consolidation) to catch pollock. Strength of incentive depends on vessel/cooperative-level assessment of risk and the likelihood of hitting the limit:

- **Low risk:** Alt 2 and Alt 3 provide limited incentives on their own to fish differently.
- **Medium risk:** incentives are factored into complex inseason decisions.
- **High Risk:** there will be a strong incentive to avoid (all) chum.

Similar to status quo incentives.

Some new components, but all codified in regulations.

***In addition to status quo incentives:***

If the area is important to operations, harvesters will not want to risk being closed out.

Strength of incentives depends an assessment of the **likelihood** and **consequences** of hitting the cap. Consequences vary by sector.

Does not necessarily incentivize Western Alaska chum avoidance but may provide it if the area closures have higher rates of Western Alaska chum.

Modified from Figure 1-5, page 16



Response to SSC comments, pg. 13

# Uncertainty - Lower and Upper Bounds for Alt 2/3 Impact Analysis

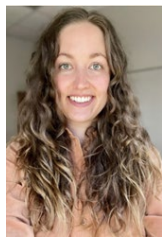
| | |
|---|---|
| **Chum salmon** | Retrospective estimates are **lower bound on chum salmon savings** in the future. Fishing behavior changes in response to these limits could further reduce chum salmon PSC. |
| **WAK chum salmon** | Given the behavior changes that could occur, and the inter-annual variation in the proportion of WAK chum in total bycatch, the retrospective estimates are **not a lower or upper bound on WAK chum salmon savings** in the future. WAK chum PSC could be higher or lower (or the same) as a result of this action. |
| **Chinook and herring PSC** | Retrospective estimates from potential closures are expected to be an **upper bound on Chinook and herring PSC savings** as a result of this action. Chinook salmon and herring PSC savings could be less or even negative as a result of the chum salmon avoidance incentives in this action prior to a closure/ if a closure does not occur. Beyond an early closure, the additional constraints from chum salmon PSC limit do not present any inherent benefits to Chinook or herring avoidance. |
| **Pollock fishery** | Retrospective estimates are an **upper bound of gross revenue impacts**. Behavior changes could delay or prevent a closure, resulting in lower revenue impacts. However, avoidance may result in operational costs and distributional impacts. Additionally, a B season closure may result in broader social and economic implications beyond revenue estimates, as described qualitatively. |
| **WAK chum salmon users** | Given the pollock fleet behavior changes that could occur, estimates are **not a lower or upper bound on WAK chum salmon saving** in the future. WAK chum PSC could be higher or lower (or the same) as a result of this action. This analysis also provides qualitative description of broader implications of additional subsistence/ commercial harvesting opportunity for communities, mixed economies, cultural identities, ecosystem, and Indigenous ways of life that would be considered under potential benefits. |

- Still not possible to provide an upper bound on the potential benefits from decreasing WAK chum salmon bycatch, because our anchor points (retrospective estimates), are not necessarily upper or lower bounds for WAK chum salmon savings estimates. (Section 3.2.4.2.5 in Feb 2025 analysis pg.118)

Response to SSC comments, pg. 9

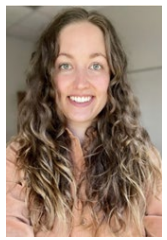
# Methods Used Across Alternatives - 1

| Alternative | Approach to Impact Analysis by Category | | | |
|---|---|---|---|---|
| | **Chum salmon** | **WAK Chum Salmon and Users** | **Other PSC species** | **Pollock Fishery** |
| **Alt 1: no action** | Total chum salmon PSC based on observer census data.<br><br>Sector, spatial, temporal breakouts.<br><br>RHS program closures, size, and frequency. | Simplified AEQ estimates for CWAK and Upper/Middle Yukon reporting groups.<br><br>Impact rate for Upper/Middle Yukon.<br><br>Scale CWAK removals due to bycatch to other sources.<br><br>Short description of current conditions for subsistence and commercial chum fisheries.<br><br>Ecosystem and community impacts under recent declines. | <u>Chinook</u><br>Annual Chinook salmon PSC, seasonal breakouts, and sector-level interannual data.<br><br>AEQ and Impact rate under status quo for coastal WAK and Upper Yukon.<br><br><u>Herring</u><br>Herring PSC with seasonal breakouts. | Quantitative information on vessel participation, and revenue earned from B season pollock.<br><br>Description of avoidance costs that may occur currently relative to the existing management measures. Reference to the possibility for increased avoidance costs under IPA changes.<br><br>Information on community participation by way of shore-based processor location, vessels' registered ownership address, fisheries-related tax revenues, description of support sectors, among other topics. |
| **Alt 2: chum cap** | Quantitative analysis on potential chum salmon savings using retrospective data on week-end date closures. Analyzed cap amounts of 100k, 325k, and 550k.<br><br>Qualitative description on the incentives for avoidance created by the alternative, and the potential operational strategies that could be used. | Quantitative analysis on potential WAK chum salmon savings using retrospective data.<br><br>Quantitative comparison of potential AEQ salmon savings for CWAK and Upper/Middle Yukon reporting groups to Yukon summer and fall chum salmon run size + markers for directed fisheries.<br><br>Description of uncertainties and potentially intervening variables associated with the scaling.<br><br>Qualitative analysis of the broader implications and benefits that could be realized for ecosystem and Indigenous communities' wellbeing, food security, among other topics. | <u>Chinook</u><br>Quantitative estimates on potential PSC reductions due to early B season closures.<br><br>Evaluated average weekly bycatch rates. Additional qualitative description on the likelihood for Chinook PSC to increase based on diverted pollock catch.<br><br><u>Herring</u><br>Quantitative estimates on potential PSC reductions due to early B season closures.<br><br>Qualitative description of potential operational tradeoffs and evaluated different fleet movement scenarios. Further considered PSC rates inside/outside savings areas to highlight potential for unintended consequences. | Quantitative estimates on the amount of potentially forgone pollock under different cap amounts and apportionments. Presented first in the Environmental Assessment, but estimates on forgone catch are directly related to estimates on potentially forgone revenue.<br><br>Quantitative analysis on potentially forgone revenue using retrospective data on week-end date closures.<br><br>Qualitative analysis of behavior changes in response to alternative and related avoidance costs. Additional qualitative analysis on the relationship of avoidance costs + potential early closure.<br><br>Qualitative description of broader implications of avoidance costs and/or an early closure on markets, shore-based processors, crew, and communities. |

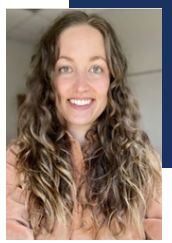


# Methods Used Across Alternatives - 2

| Alternative | Chum salmon | WAK Chum Salmon and Users | Other PSC species | Pollock Fishery |
|---|---|---|---|---|
| **Alt 3: chum cap w/ abundance trigger** | Same as Alternative 2, but a cap amount of 75,000 chum was analyzed under Alternative 3, Option 1. Alternative 3, Option 2 cap range is the same as Alternative 2. | Analyzed in tandem with Alternative 2.<br><br>Additional tables comparing AEQ savings estimates to scaling tables made for Alt 3 if the PSC limit become 75k. | Same as Alternative 2.<br><br>Description of the potential unintended consequences (i.e., adverse impacts) qualitatively described as less than what would be expected under Alternative 2. | Analyzed in tandem with Alternative 2. Some additional considerations for Alternative 3, including separate forgone revenue during limited number of years a cap of 75,000 chum could have been possible. Qualitative description on the potential for adverse effects to be less than Alternative 2 across years, marginally greater in an individual year depending on cap and apportionment. |
| **Alt 4: IPA measures** | Qualitative and quantitative assessment for provisions to have the potential to reduce chum PSC.<br><br>Sector/IPA-specific analysis by provision as possible.<br><br>Compared PSC rates, analysis of retrospective data on fleet movement, Similarly, compared PSC in 2022, 2023, and 2024 to 2021. | Similar to analysis used for total chum PSC reductions but additional genetic stock composition estimates applied when relevant.<br><br>Brief description of potential benefit, pointing back to analysis of potential WAK chum salmon savings under Alt 4. | Qualitatively addressed for each species. Impacts are estimated to be best approximated by the status quo. Chum avoidance measures designed by IPAs and in effect in recent years. More broadly, IPAs have been in effect since 2010 and include priority provisions for Chinook avoidance. | Qualitative description of potential impacts on avoidance costs. Impacts are estimated to be best approximated by status quo. Little potential for adverse effects. |
| **Alt 5: time/area closures** | Initially developed Fleet Movement Model moving catch to outside areas, but several cases where no fishing occurred outside historically.<br><br>Quantitative evaluation of sector's historical dependence on each corridor, amount of pollock catch displaced, weekly chum and WAK chum PSC rates and pollock catch by sector and corridor combined with a qualitative description on likely movement scenarios. | Quantitative evaluation of potential impacts using the same methods as total chum PSC + genetic stock composition estimates by corridor/time period. Additional assessment of sector's WAK chum PSC rates.<br><br>Impacts to chum salmon users is a direct extension of the impact analysis for WAK chum PSC. Qualitative description of the potential broader implications of reduced chum salmon PSC for Western and Interior Alaska ecosystems and communities is the same as Alternatives 2 and 3. | <u>Chinook</u><br>Similar methods to chum with a greater emphasis on likelihood of pollock catch being diverted to later weeks in the B season.<br><br><u>Herring</u><br>Qualitatively address operational tradeoffs.<br><br>Spatial analysis to create movement scenarios based on the potential operational tradeoffs that may be presented, and the distribution of chum and herring PSC encounters. | Quantitative evaluation of sector's dependence on the fishing grounds inside each area, as well as a quantitative evaluation of potential "revenue at risk."<br><br>Qualitative assessment of how like they may be to change behavior and include costs relative to historical reliance on that area.<br><br>Impact analysis for communities focuses on likelihood of potential impacts based on a corridor closure, and a community's connections to a fishery. |

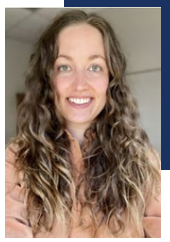



# Additional and Specific Responses to SSC Requests



Response to SSC comments

# Part 1. Unintended Consequences



# Impacts on Western Alaska Chum Salmon Bycatch

- Global change - acknowledging uncertainty in the potential outcomes for WAK chum salmon bycatch
- Genetic stock composition estimates provided at different spatiotemporal scales (*i.e.*, B season, fishing grounds, cluster areas, Early/Late period)
- Considered the **incentive structure** provided by the alternative, **likelihood** of different alternatives/options to have unintended outcomes

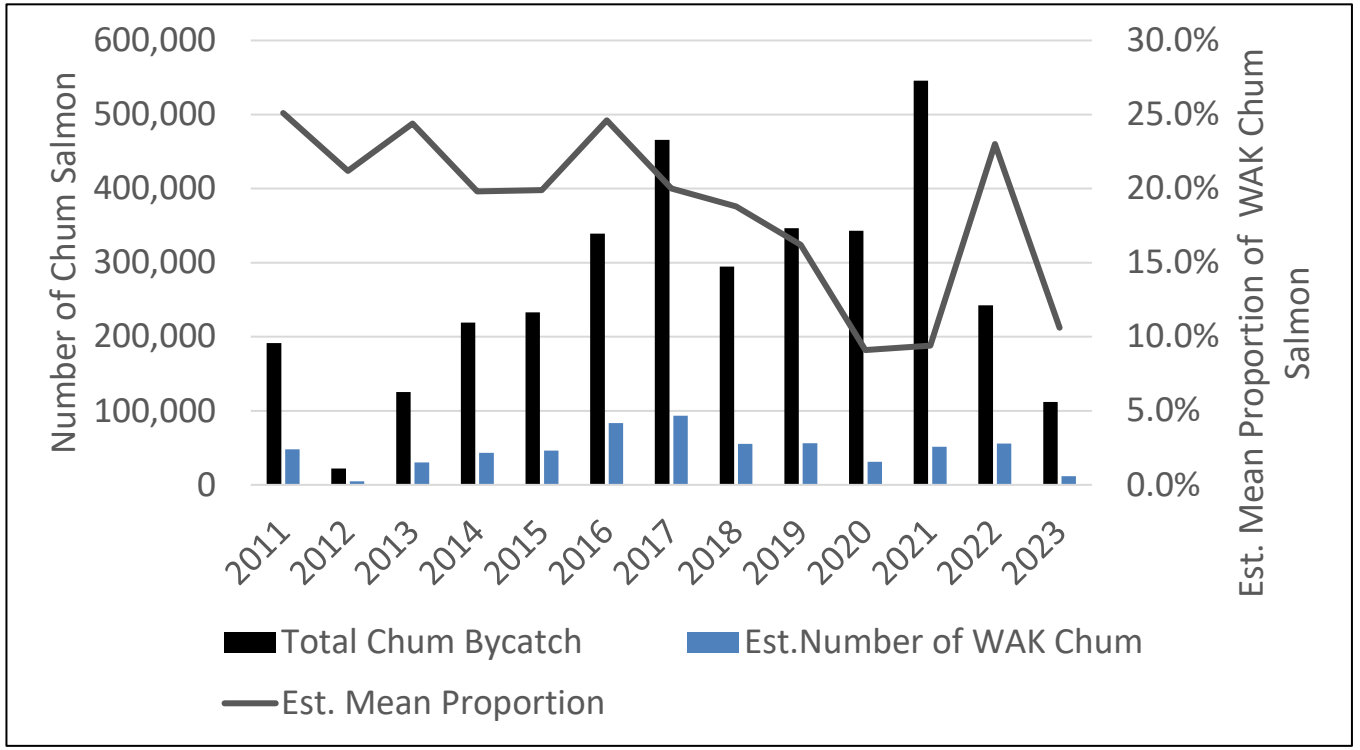
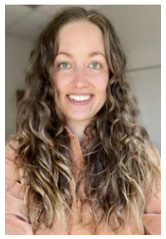



**Figure 3-17 Comparison of the total B season chum salmon bycatch, estimated number of WAK chum salmon, and estimated mean proportion of WAK chum salmon in the overall bycatch from 2011–2023**



Response to SSC comments, pg. 7

# Impacts on Chinook Bycatch

Chinook outcomes expressed as a range positive, neutral, or adverse (Sections 3.3.2)

- Alternatives to reduce chum salmon PSC do not provide incentives for Chinook and herring PSC avoidance
- Greater emphasis on temporal dynamics of Chinook salmon PSC (Sections 3.3.2 and 3.3.4)
    - Chinook salmon bycatch rates increase in September and October

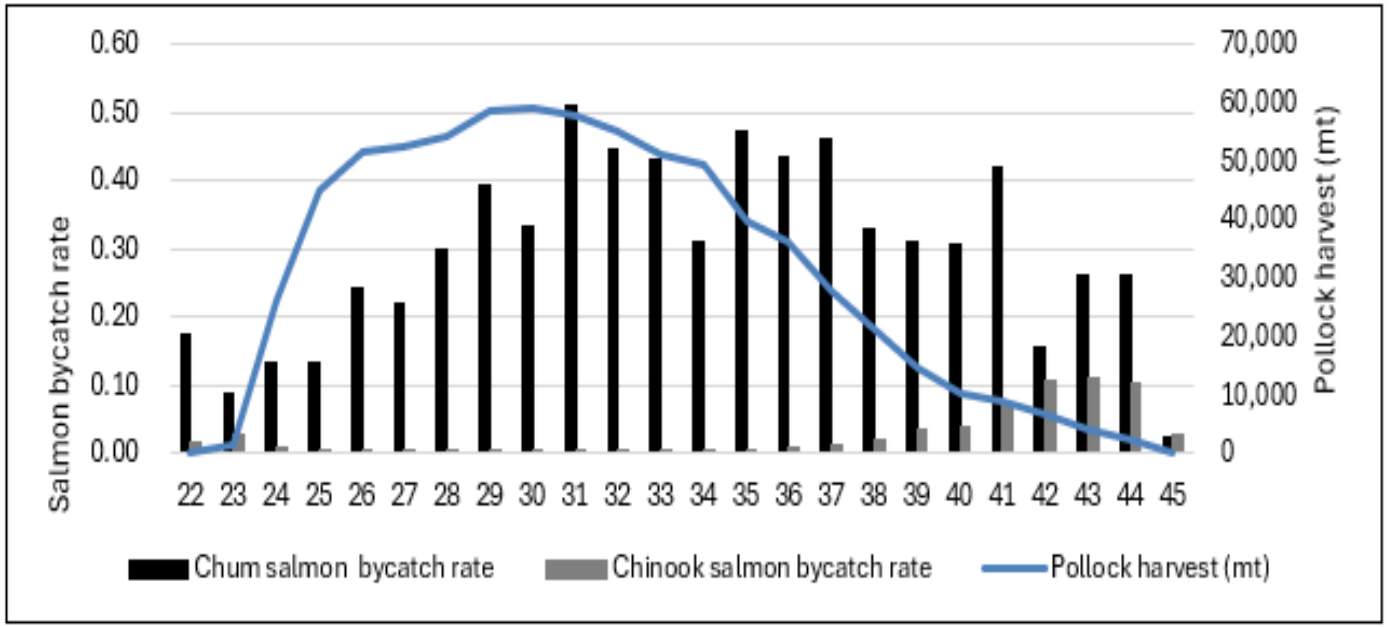
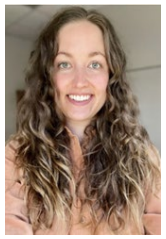



Figure 3-29 Comparison of the weekly fleet-wide weekly average chum salmon bycatch rate, Chinook salmon bycatch rate, and pollock harvest (mt), 2011–2023



Response to SSC comments, pgs. 9 and 10

# Impacts on Herring Bycatch

- Herring outcomes expressed as a range – positive, neutral, or adverse (Sections 3.3.2)
- Greater emphasis on potential operational trade-offs and spatial interactions with herring PSC (Sections  3.4.1.2, 3.4.2.5, and 3.5)
- Evaluated different fleet movement scenarios in response to hard caps
- Herring PSC managed under time/area closures triggered by a PSC limit
  - PSC typically higher in B season compared to A season
  - Herring PSC rates inside Winter Savings Area have been lower than other areas in recent years (Section 3.4.1.2)

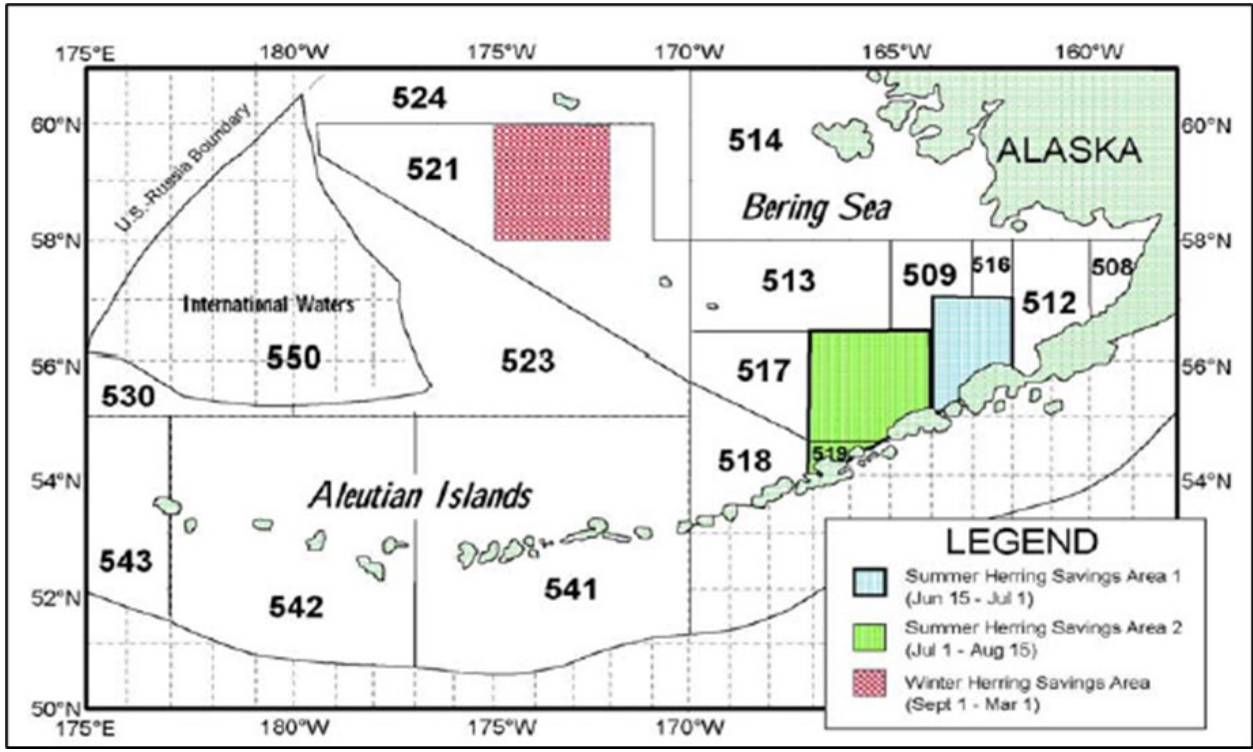
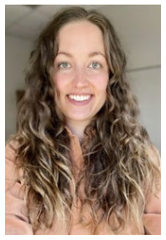
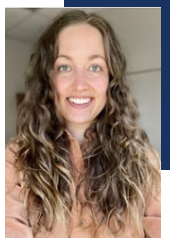



**Figure 3-32 Herring Savings Areas**



Response to SSC comments, pg. 10

# Part 2. Quantitative and Qualitative Analyses



# Simplified Chum Salmon Adult Equivalents Analysis

Dr. Pat Barry

# Simplified AEQ (Appendix 4 p110-126)

***Motivation: How many chum salmon (from Western Alaska) caught as bycatch would have returned to natal systems?***

- Discounts natural mortality
- Accounts for maturation schedule

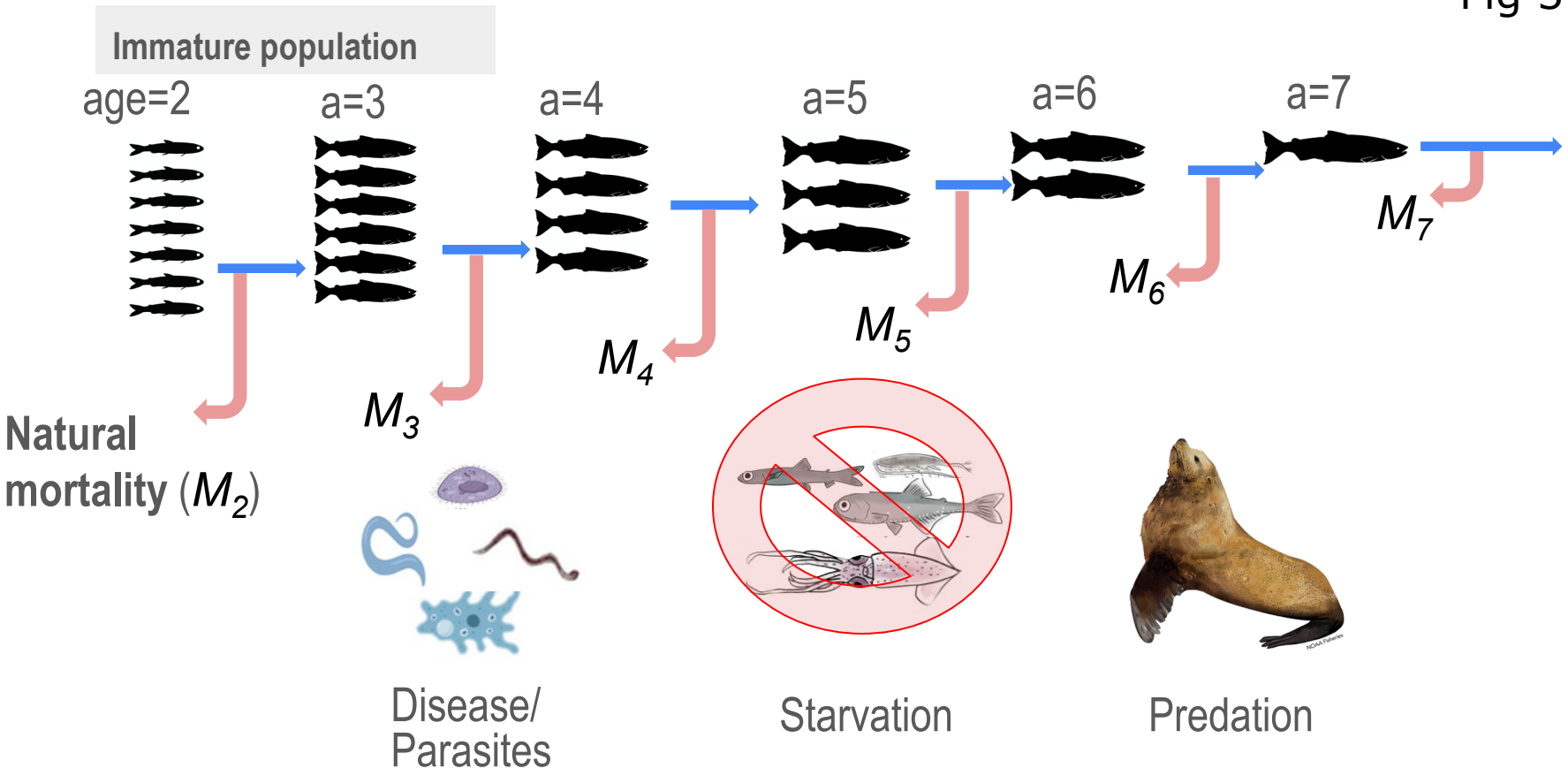
Developed for Chinook Salmon (Ianelli & Stram 2015)

- Applied to chum salmon in 2012 analysis (NPFMC 2012)

SSC, Council, & public request for *simplified* chum salmon AEQ

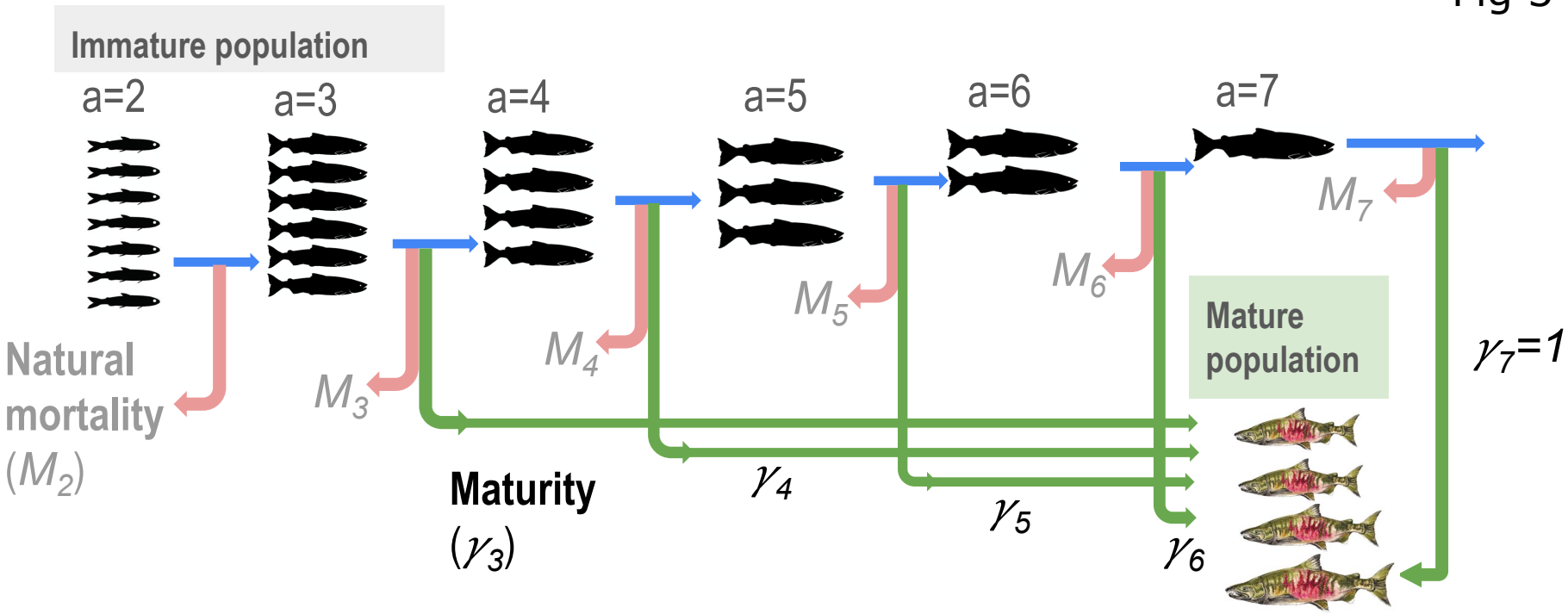
# Conceptual Model of AEQ (adapted from Defilippo et al.)

Fig 3-14; Pg 96 DEIS



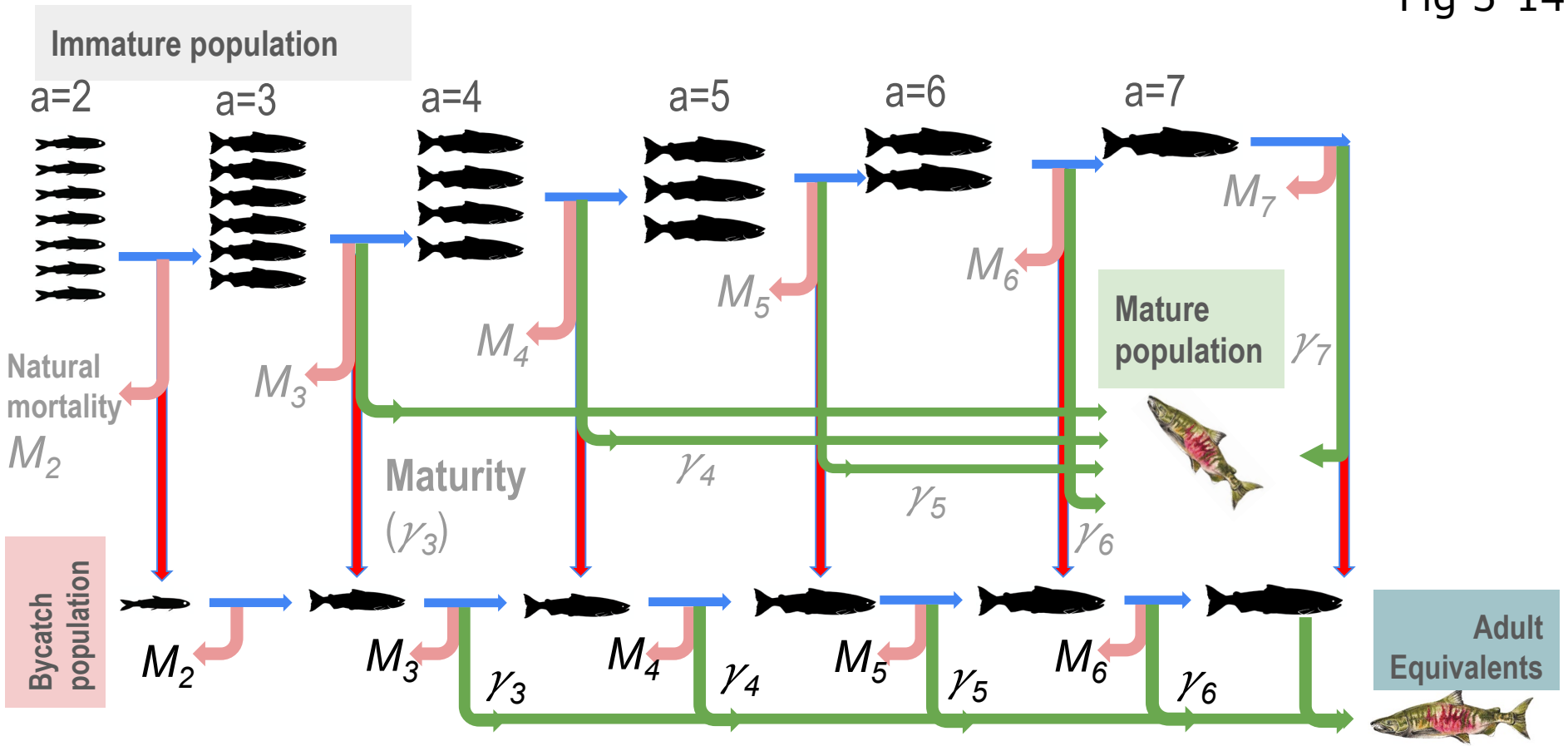

# Conceptual Model of AEQ (adapted from Defilippo et al.)

Fig 3-14; Pg 96 DEIS




# Conceptual Model of AEQ (adapted from Defilippo et al.)

Fig 3-14; Pg 96 DEIS




# AEQ Model (Ianelli and Stram 2015)

$$AEQ_t = \sum_{a=2}^{7} C_{t,a}\,\gamma_a + \sum_{j=2}^{6}\sum_{a=j+1}^{7}\left[\gamma_a C_{t-(a-j),j}\Pi_{i=j}^{a-1}(1-\gamma_i)s_a\right]$$

Current years bycatch that is expected to mature at a given age

Prior years bycatch that survived and expected to mature at a given age

C = catch
$\gamma$ = proportion of fish that mature

C = catch
1-$\gamma$ = proportion of fish that don't mature
S = proportion of fish surviving

# Mortality & Maturation

## Mortality (M)

Table A4-4; Pg 118

- likely large interannual variability
- Used values from prior analysis (Scenario 2 NPFMC 2012)

## Maturation ($\gamma$)

- In-river age composition data (Berry and Larson 2021, Yukon JTC 2024)

| System | Source | Age 2 | Age 3 | Age 4 | Age 5 | Age 6 | Age 7 |
|---|---|---|---|---|---|---|---|
| WAK - Summer | Goodnews (middle fork) 2014-2018 | 0.0 | 5.1 | 64.5 | 28.3 | 2.2 | 0.0 |
| WAK - Summer | Kanektok 2002-2015 | 0.0 | 1.3 | 57.7 | 38.8 | 2.1 | 0.0 |
| WAK - Summer | Salmon River Aniak 2014-2018 | 0.0 | 2.0 | 57.6 | 38.7 | 1.8 | 0.0 |
| WAK - Summer | George River 2014-2018 | 0.0 | 3.1 | 64.7 | 29.8 | 2.3 | 0.1 |
| WAK - Summer | Tatlawiksuk 2014-2018 | 0.2 | 3.6 | 59.0 | 34.0 | 3.2 | 0.1 |
| WAK - Summer | Kogrukluk 2014-2018 | 0.0 | 3.0 | 56.8 | 38.2 | 2.0 | 0.0 |
| | Avg. | 0.0 | 3.0 | 60.0 | 34.6 | 2.3 | 0.0 |
| Yukon - Fall | 2014 | 0.0 | 6.1 | 80.2 | 13.4 | 0.3 | 0.0 |
| Yukon - Fall | 2015 | 0.0 | 3.8 | 85.0 | 11.1 | 0.1 | 0.0 |
| Yukon - Fall | 2016 | 0.0 | 7.7 | 85.6 | 6.2 | 0.6 | 0.0 |
| Yukon - Fall | 2017 | 0.0 | 3.8 | 59.1 | 36.0 | 1.2 | 0.0 |
| Yukon - Fall | 2018 | 0.0 | 0.4 | 75.3 | 23.0 | 1.3 | 0.0 |
| | Avg. | 0.0 | 4.3 | 77.0 | 17.9 | 0.7 | 0.0 |

# Mortality & Maturation

Table A4-5; Pg 119

- Stock Specific values for Yukon-Fall and WAK-Summer

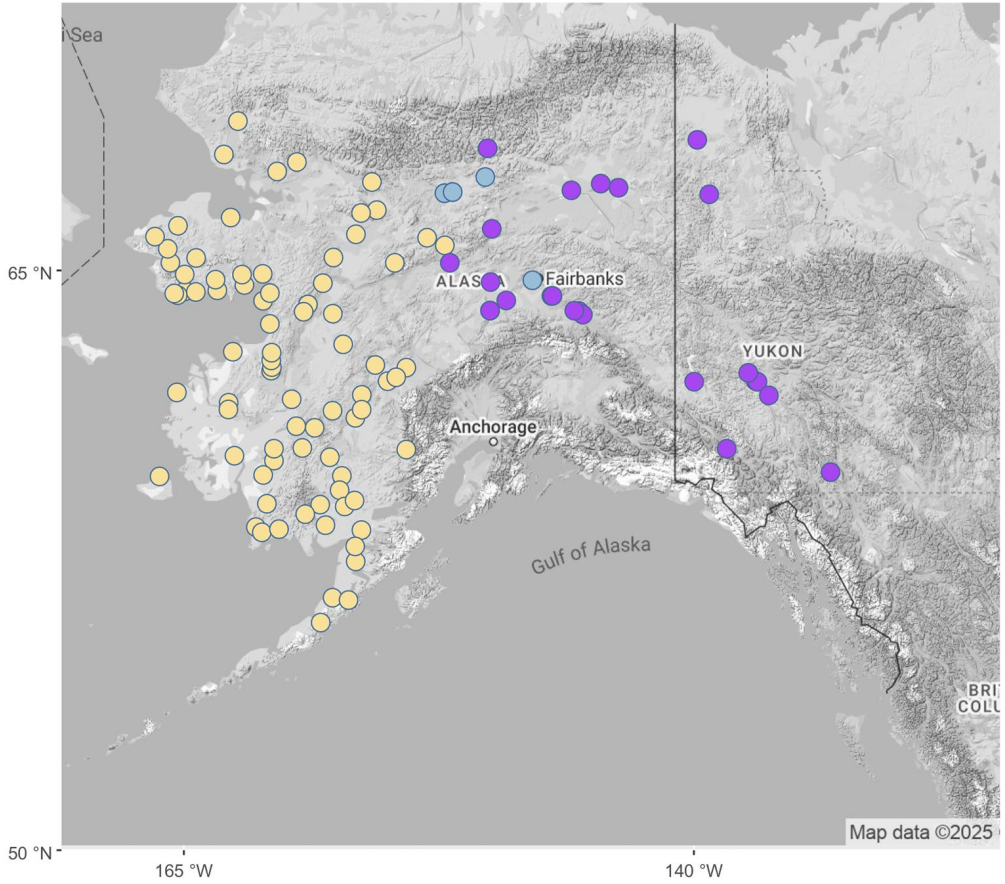
| Stock | Age | $\gamma_a$ | $M_a$ | $S_a$ | Stock | Age | $\gamma_a$ | $M_a$ | $S_a$ |
|---|---|---|---|---|---|---|---|---|---|
| Yukon-Fall | 1 | 0.000 | 0.40 | 0.670 | WAK-Summer | 1 | 0.000 | 0.40 | 0.670 |
| | 2 | 0.000 | 0.30 | 0.741 | | 2 | 0.000 | 0.30 | 0.741 |
| | 3 | 0.035 | 0.20 | 0.819 | | 3 | 0.023 | 0.20 | 0.819 |
| | 4 | 0.780 | 0.15 | 0.861 | | 4 | 0.581 | 0.15 | 0.861 |
| | 5 | 0.959 | 0.10 | 0.905 | | 5 | 0.931 | 0.10 | 0.905 |
| | 6 | 1.000 | 0.05 | 0.951 | | 6 | 0.991 | 0.05 | 0.951 |
| | 7 | 1.000 | 0.00 | 1.000 | | 7 | 1.000 | 0.00 | 1.000 |

# WAK-Summer & Yukon-Fall Genetic Groups

Reanalysis of genetic data with management based baseline

5 Up/Mid Yukon pops classified as Summer run:

- Henshaw Creek Late
- S. Fork Koyukuk R.
- Jim R.
- Chena R.
- Salcha R.

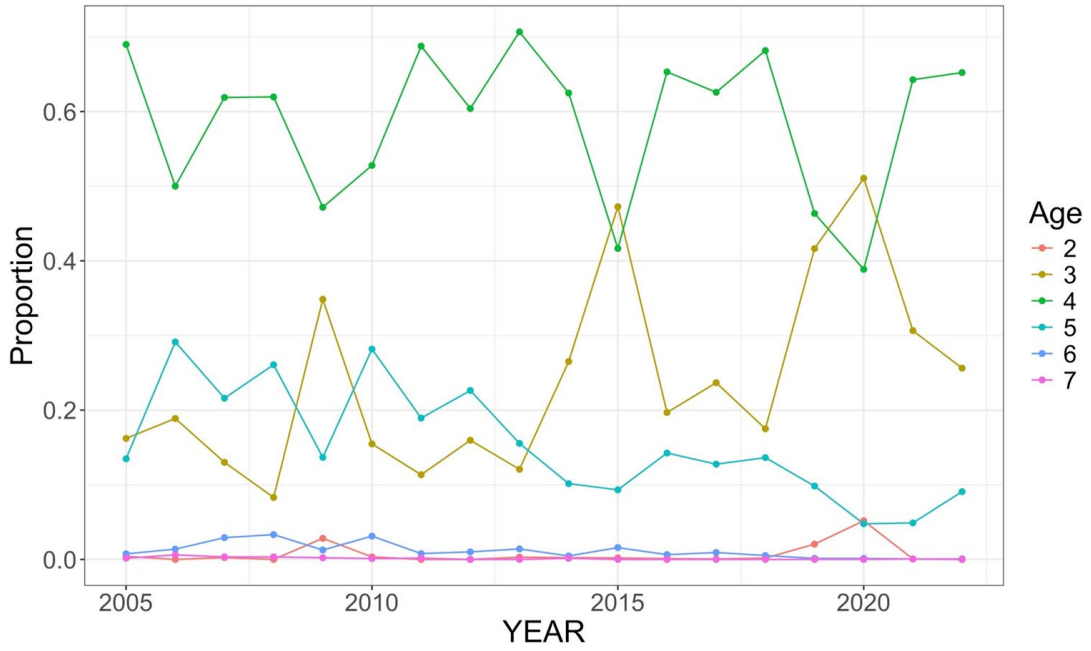



# Annual bycatch at age ($C_{t,a}$)

- Observers provide census of salmon caught
- 27,518 chum salmon aged 2005-2022

Fig A4-2; Pg 115

Table A4-2; Pg 115




| | Age | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | 2 | 3 | 4 | 5 | 6 | 7 | Total Bycatch |
| 2006 | 0 | 57,485 | 152,244 | 88,721 | 4,200 | 1,837 | 304,487 |
| 2007 | 198 | 10,283 | 48,911 | 17,073 | 2,307 | 264 | 79,036 |
| 2008 | 0 | 1,224 | 9,128 | 3,842 | 489 | 49 | 14,732 |
| 2009 | 1,281 | 15,810 | 21,406 | 6,203 | 573 | 101 | 45,374 |
| 2010 | 44 | 2,050 | 6,990 | 3,731 | 413 | 15 | 13,243 |
| 2011 | 0 | 21,703 | 131,551 | 36,227 | 1,502 | 334 | 191,317 |
| 2012 | 0 | 3,539 | 13,393 | 5,017 | 224 | 0 | 22,173 |
| 2013 | 370 | 15,108 | 88,430 | 19,451 | 1,756 | 0 | 125,115 |
| 2014 | 509 | 58,030 | 136,761 | 22,228 | 1,018 | 339 | 218,885 |
| 2015 | 443 | 110,113 | 97,106 | 21,727 | 3,695 | 0 | 233,084 |
| 2016 | 361 | 66,765 | 221,586 | 48,359 | 2,165 | 0 | 339,236 |
| 2017 | 287 | 110,287 | 291,514 | 59,452 | 4,308 | 0 | 465,848 |
| 2018 | 511 | 51,586 | 200,897 | 40,179 | 1,532 | 0 | 294,705 |
| 2019 | 7,102 | 144,406 | 160,741 | 34,089 | 473 | 0 | 346,811 |
| 2020 | 17,746 | 175,188 | 133,325 | 16,381 | 455 | 0 | 343,095 |
| 2021 | 361 | 167,304 | 350,833 | 26,682 | 361 | 361 | 545,902 |
| 2022 | 0 | 62,084 | 158,040 | 22,003 | 183 | 0 | 242,310 |

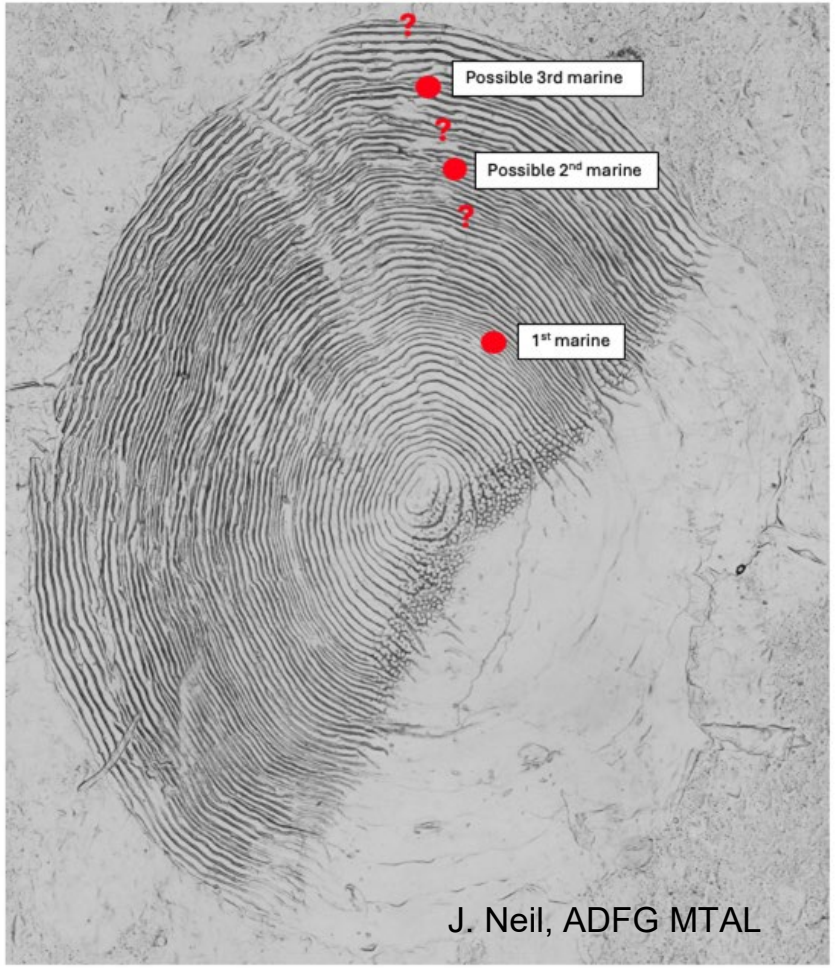
# Uncertainty in age estimation

Scale Reading

- AFSC: 2005-2019
- ADFG MTAL: 2020-2022

Example Scale - Age 4, 5, 6?

- Checks or false growth zone
- Edge reabsorption




J. Neil, ADFG MTAL

# Annual bycatch at age by stock group ($C_{t,a,r}$)

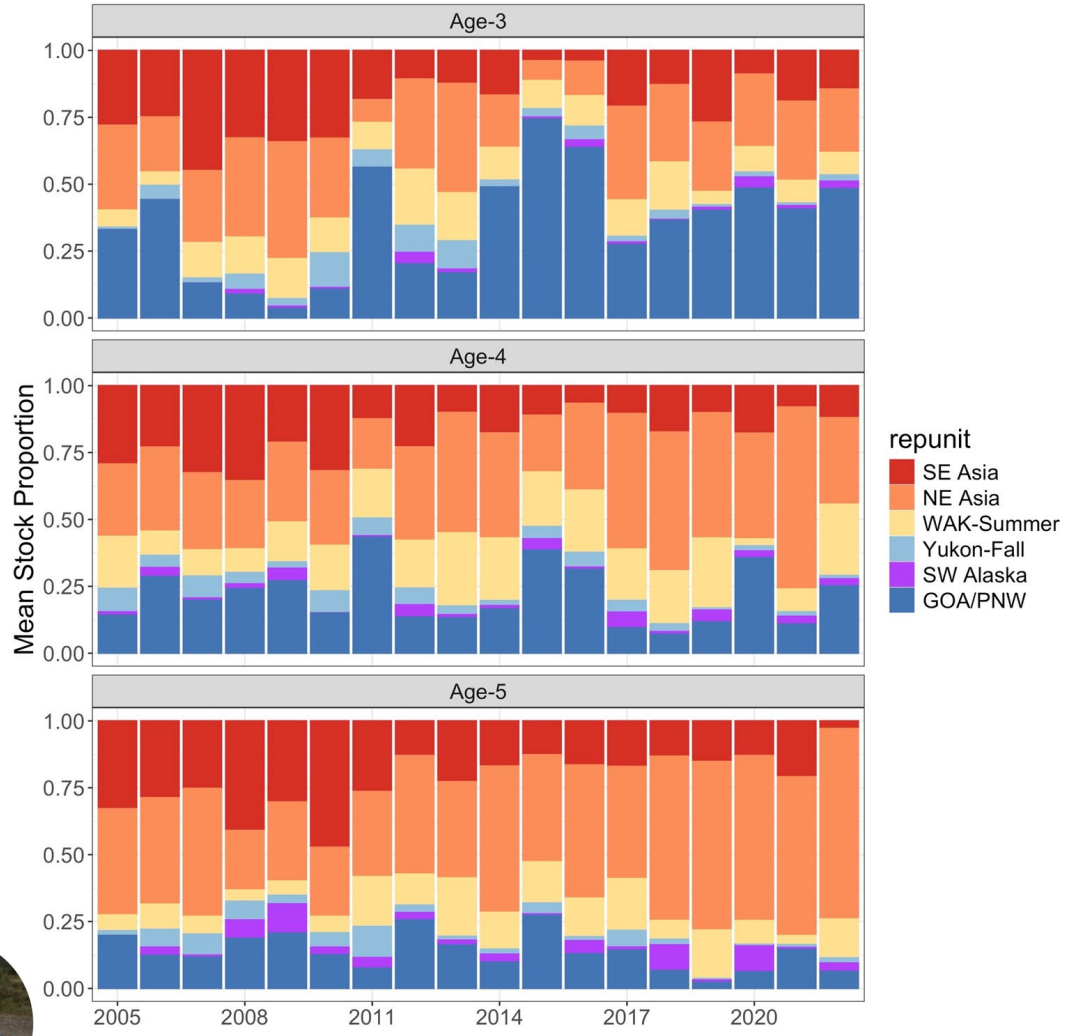
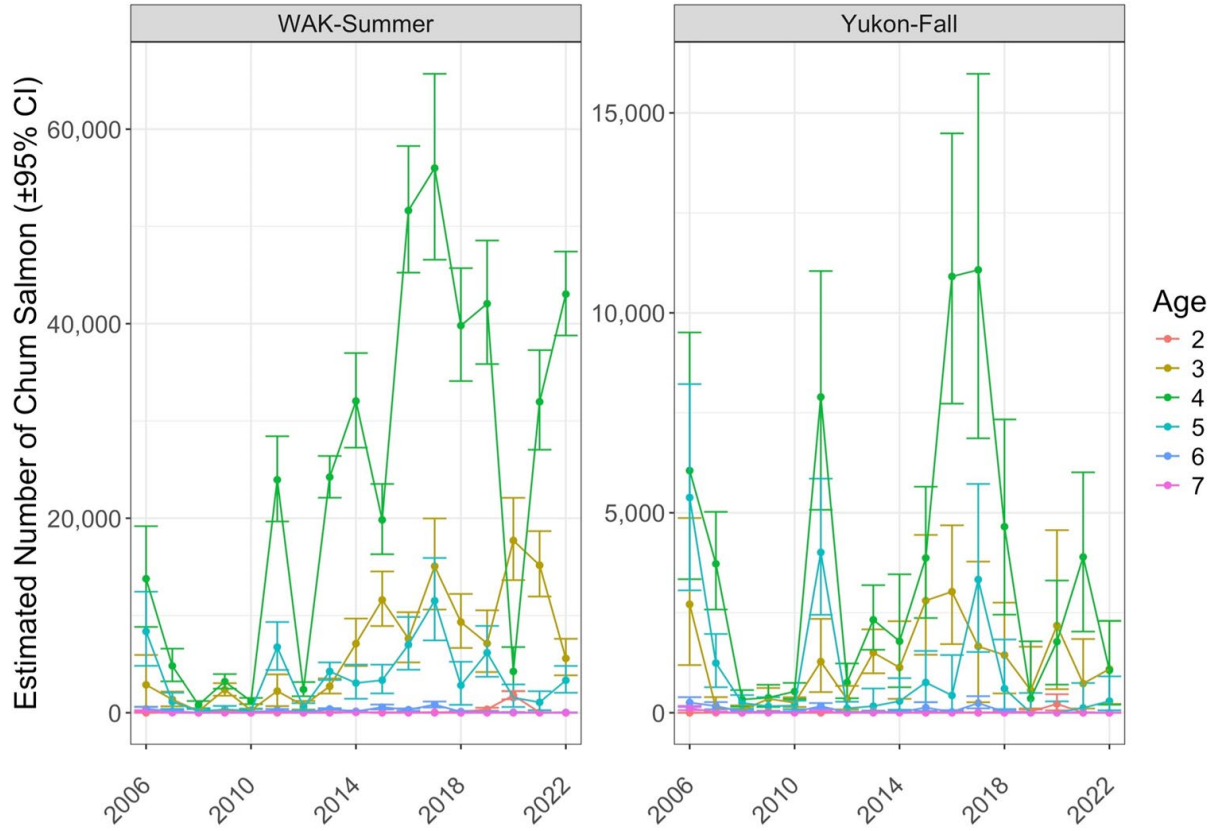


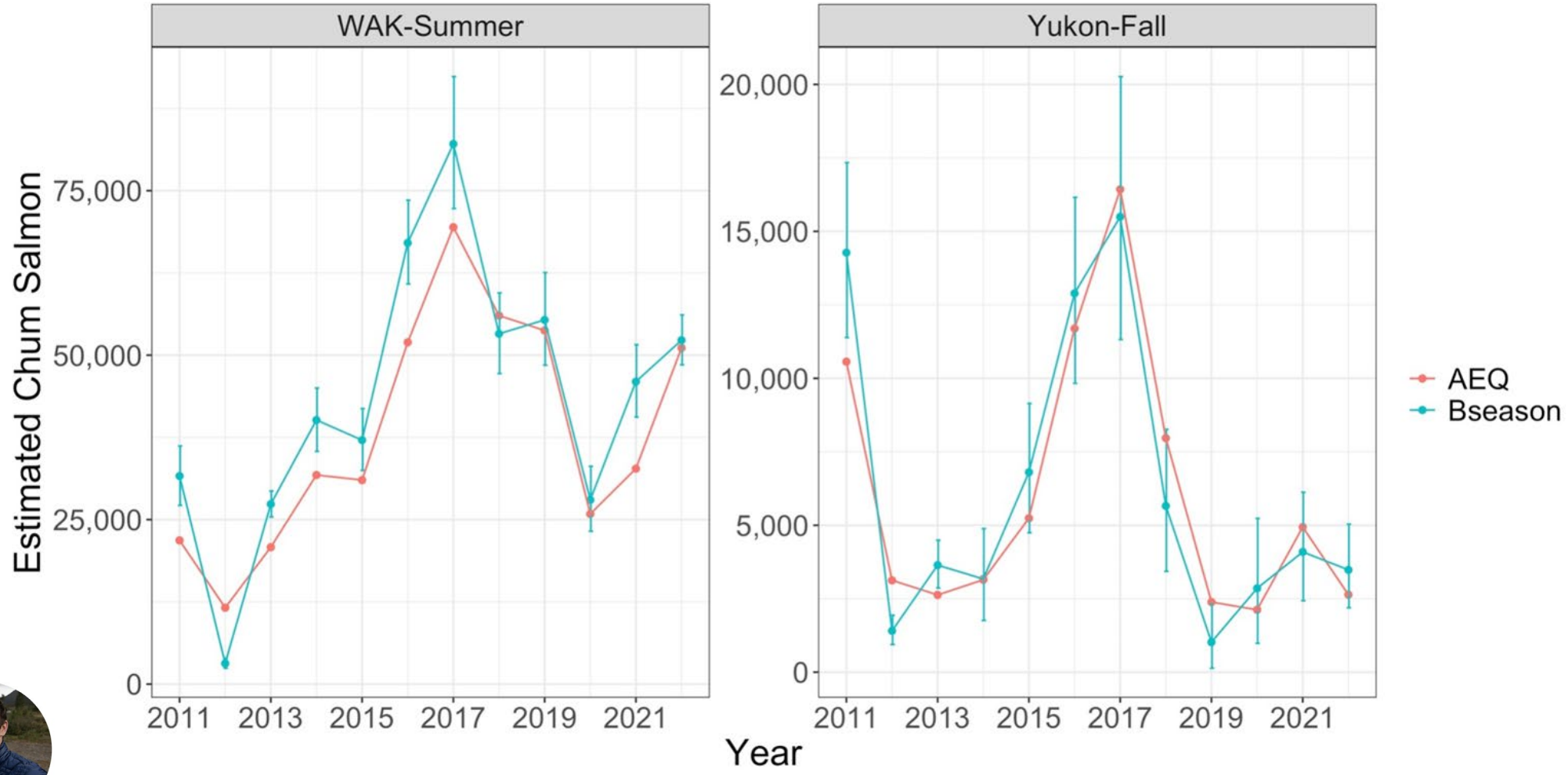

Fig A-1; Pg 113

Fig A-3; Pg 116



# AEQ compared to B season bycatch

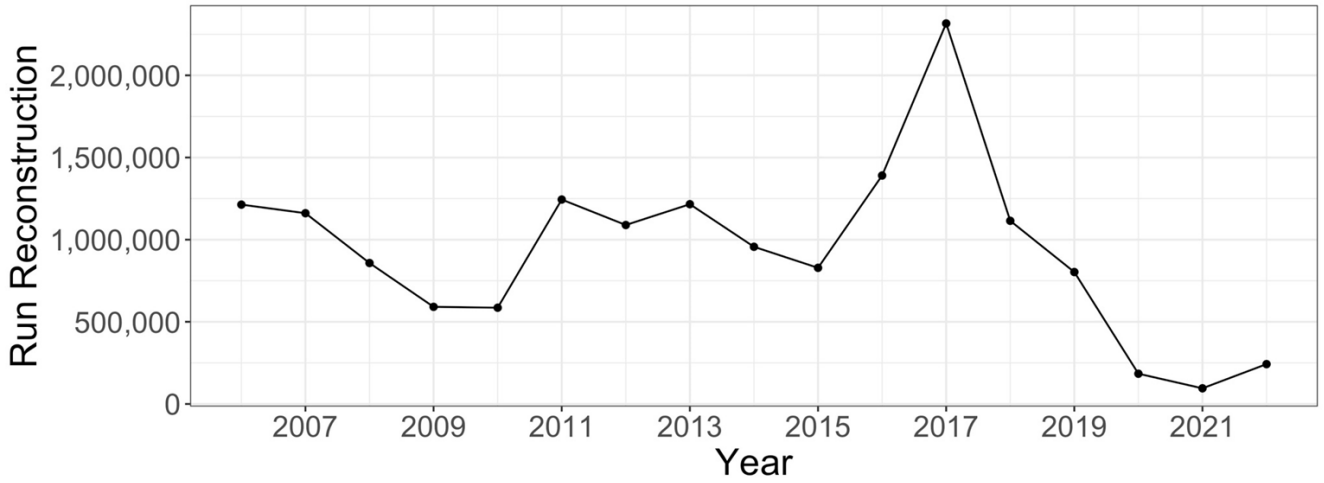
Fig A4-5; Pg 120

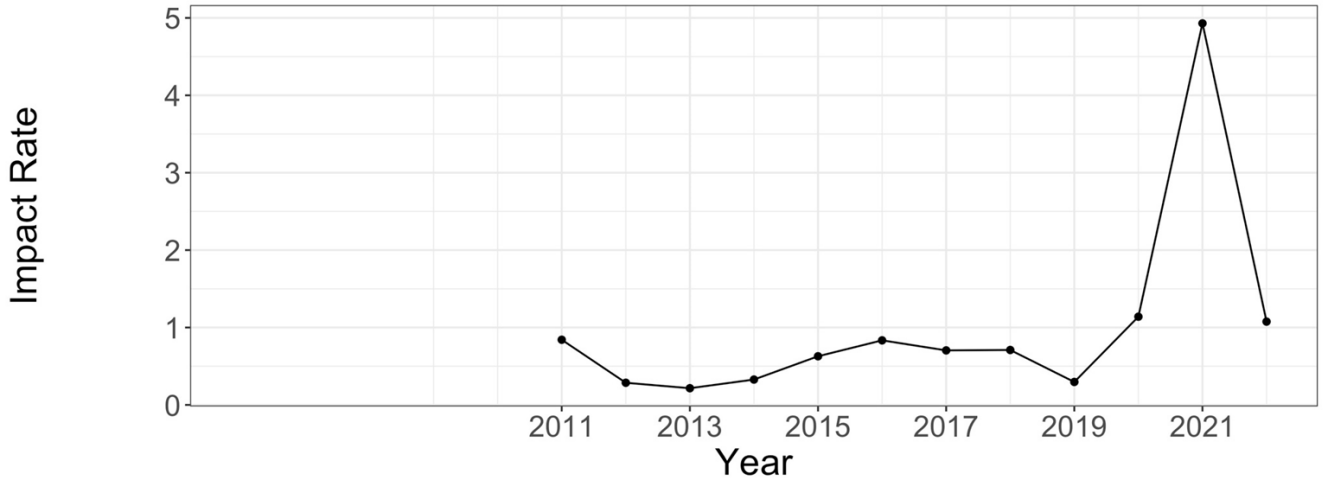



# Impact Rate: Yukon-Fall

Run reconstruction available for Yukon-Fall run

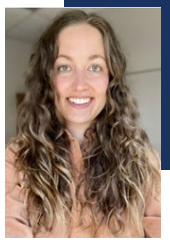
Fig A4-8; Pg 124




$$IR = AEQ_{r,y}/\left(AEQ_{r,y} + S_{r,y}\right)$$

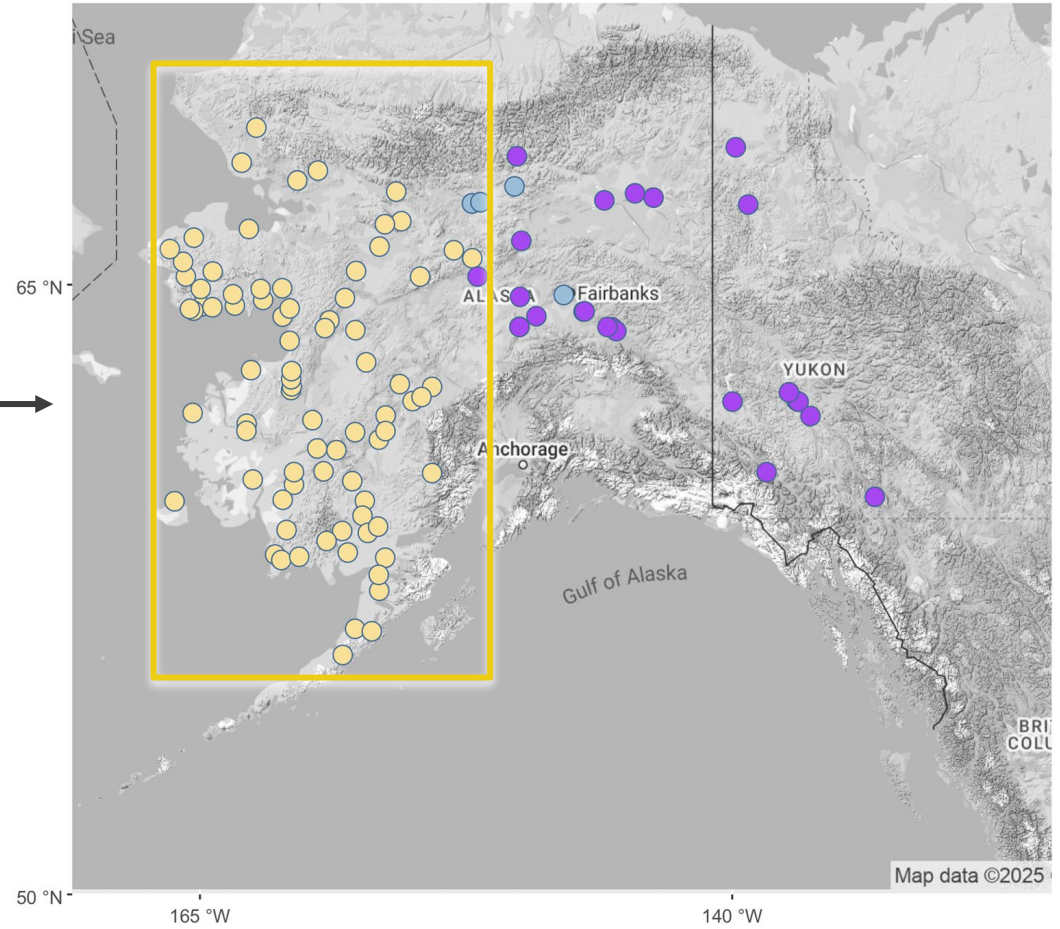
# Additional Requests for Quantitative and Qualitative Analyses

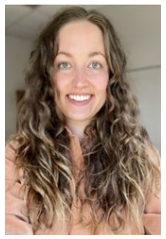


# Scaling CWAK Bycatch Under the Status Quo

Section 3.2.4.1.2

No composite run size available to complete an impact rate



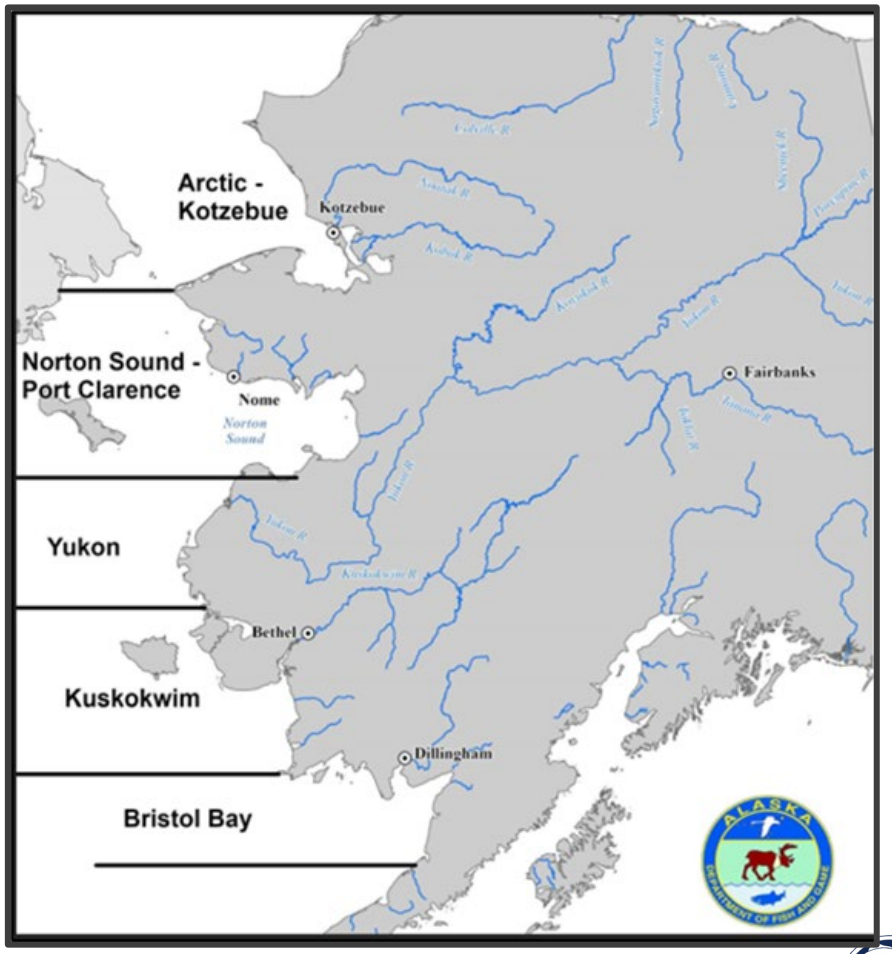



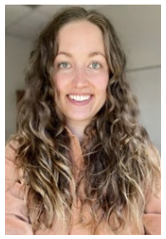
Response to SSC comments, pg. 12

# Scaling AEQ CWAK Bycatch Under the Status Quo - 2

Section 3.2.4.1.2

- Purpose was to contextualize PSC removals of chum salmon attributed to the CWAK reporting group – not intended to be used as an impact rate
- Compared AEQ CWAK estimates to commercial + subsistence harvests in Kotzebue, Norton Sound, Yukon, Kuskokwim, and Bristol Bay (2011-2022)
- Harvest levels reflect factors beyond abundance



Response to SSC comments, pg. 12

# Scaling AEQ CWAK Bycatch Under the Status Quo -3

Section 3.2.4.1.2

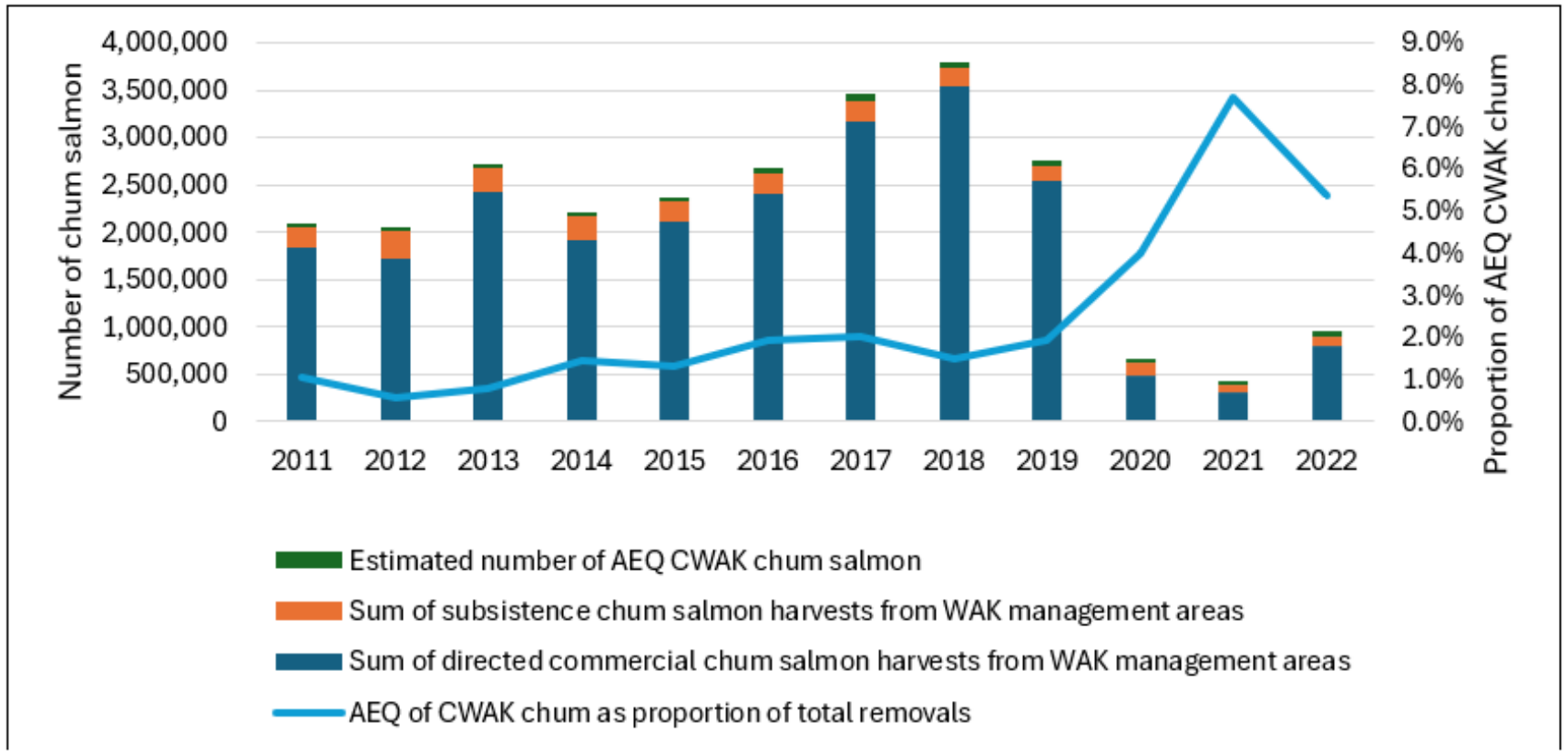
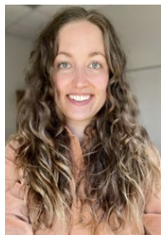
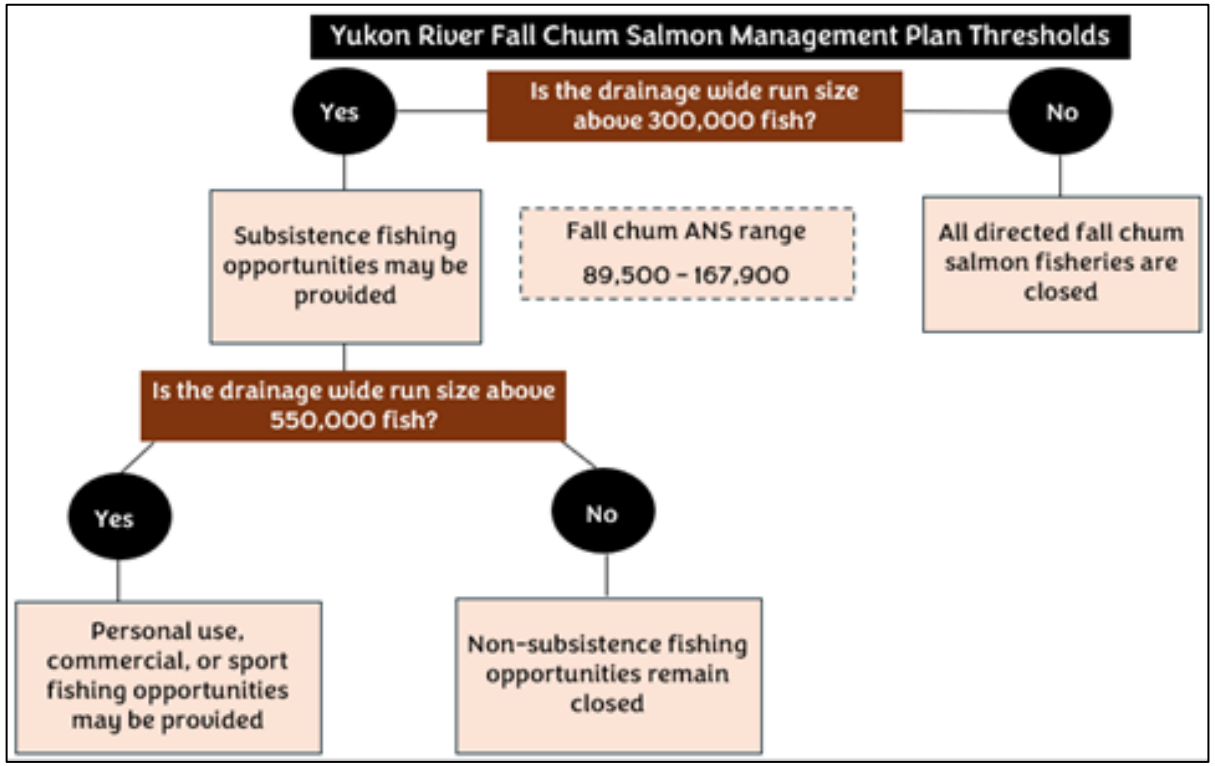


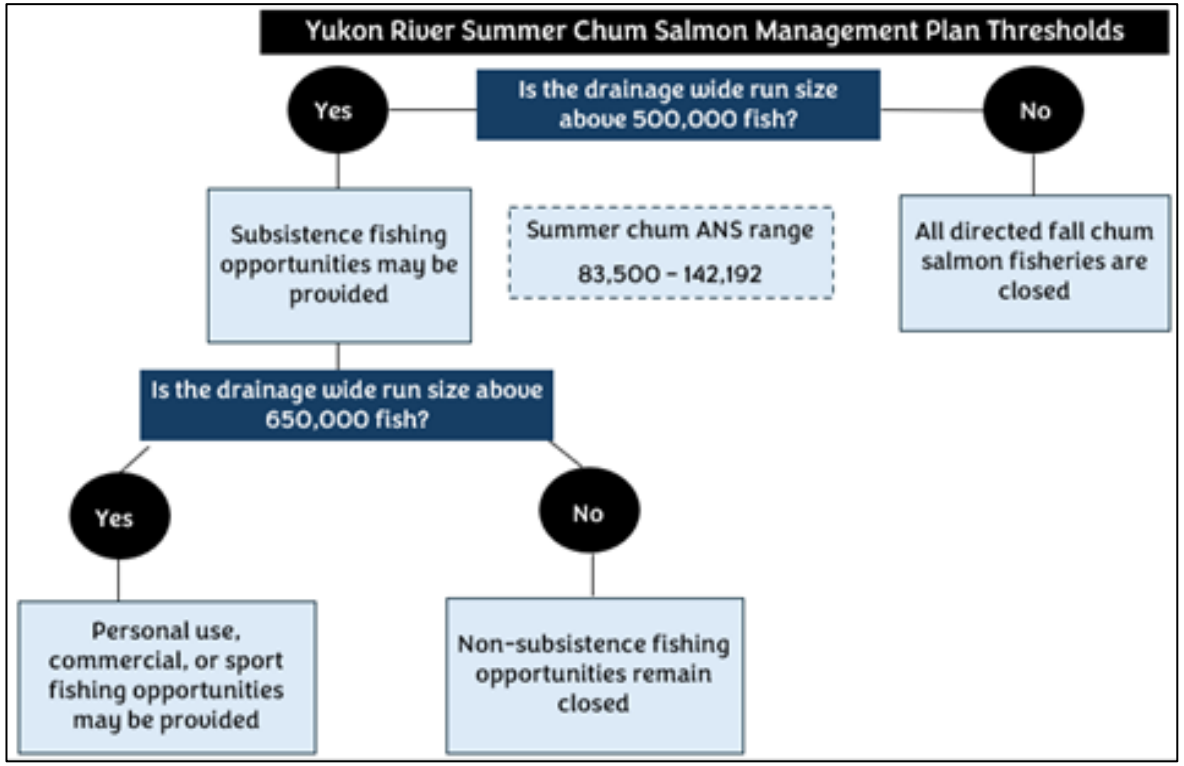

**Figure 3-16 Comparison of simplified AEQ CWAK chum salmon estimates to subsistence and commercial harvests of WAK chum, 2011–2022**



Response to SSC comments, pg. 12

# Understanding Conservation Benefits




Response to SSC comments, pg. 10

# Understanding Conservation Benefits, Alternatives 2 and 3

| | 100,000 cap | 3-year avg | 5-year avg | pro rata | AFA | In-river markers | |
|---|---|---|---|---|---|---|---|
| 2017 | Est. CWAK AEQ savings | 47,862 | 46,722 | 47,214 | 42,069 | Run size | 3,635,100 |
| | Adj. to 75% | 35,897 | 35,042 | 35,411 | 31,552 | Subsistence? | Limited |
| | Adj. to 50% | 23,931 | 23,361 | 23,607 | 21,035 | ANS met? | No |
| | Adj. to 25% | 11,966 | 11,681 | 11,804 | 10,517 | Commercial? | Limited |
| 2021 | 100,000 cap | 3-year avg | 5-year avg | pro rata | AFA | In-river markers | |
| | Est. CWAK AEQ savings | 21,226 | 21,150 | 21,158 | 21,591 | Run size | 156,130 |
| | Adj. to 75% | 15,920 | 15,863 | 15,869 | 16,193 | Subsistence? | No |
| | Adj. to 50% | 10,613 | 10,575 | 10,579 | 10,796 | ANS met? | No |
| | Adj. to 25% | 5,307 | 5,288 | 5,290 | 5,398 | Commercial? | No |

Adjusted Table 4-38 and 4-39 to show years with highest and lowest run size

| | 100,000 cap | Est. Up/Mid Yukon Savings | In-river markers | |
|---|---|---|---|---|
| 2017 | 3-year avg | 11,553 | Run size | 2,315,883 |
| | 5-year avg | 11,308 | Subsistence? | Limited |
| | pro rata | 11,441 | ANS met? | No |
| | AFA | 9,969 | Commercial? | Yes |
| | 100,000 cap | Est. Up/Mid Yukon Savings | In-river markers | |
| 2021 | 3-year avg | 3,207 | Run size | 95,249 |
| | 5-year avg | 3,195 | Subsistence? | No |
| | pro rata | 3,203 | ANS met? | No |
| | AFA | 3,255 | Commercial? | No |

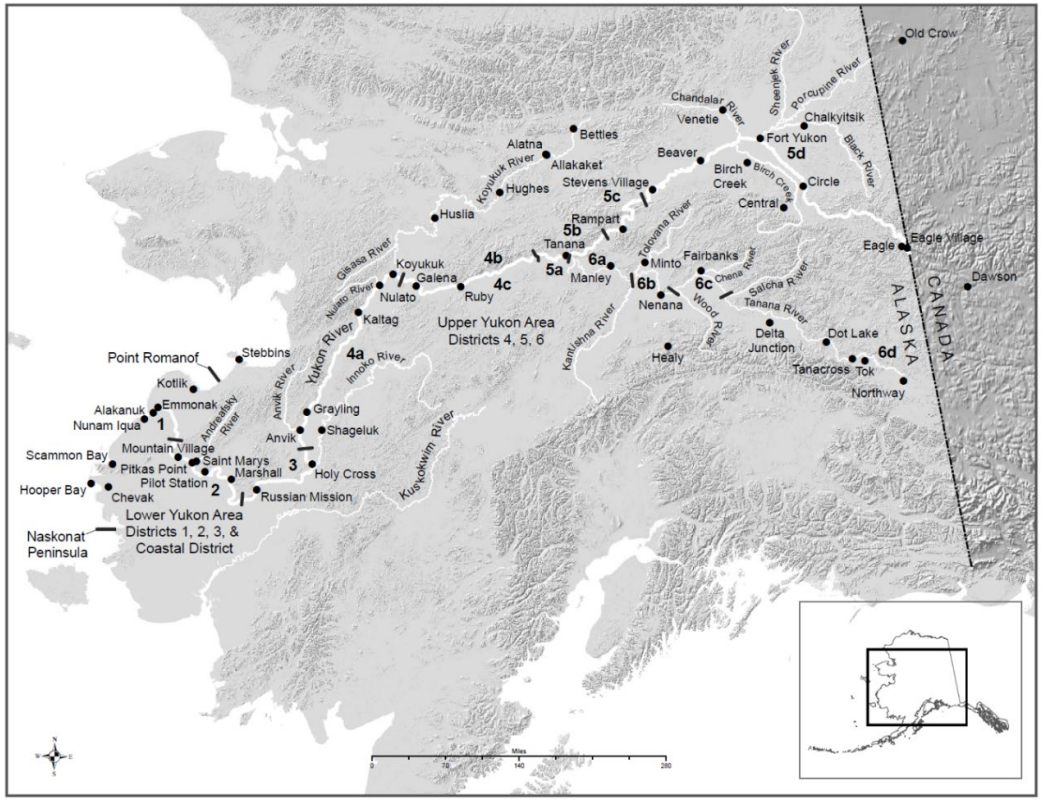
- *Would bycatch reductions have made a difference for escapement or directed fishing opportunities?*
- Section 4.4.2.1 addresses the flow of benefits and intervening variables under Alternatives 2 and 3 and with AEQ savings estimates
- These estimates are a **frame of reference** for CWAK and Upper/ Middle Yukon chum salmon savings under lowest PSC limit (not a lower or upper bound) relative to run sizes
- Upper/Middle AEQ chum salmon estimates aligns with Yukon Fall run
- CWAK AEQ chum salmon estimates cover a broader range than Yukon summer, so a range of 100%- 25% is provided.
- May not fully capture the importance of a small number of returning fish due to bycatch reductions overtime



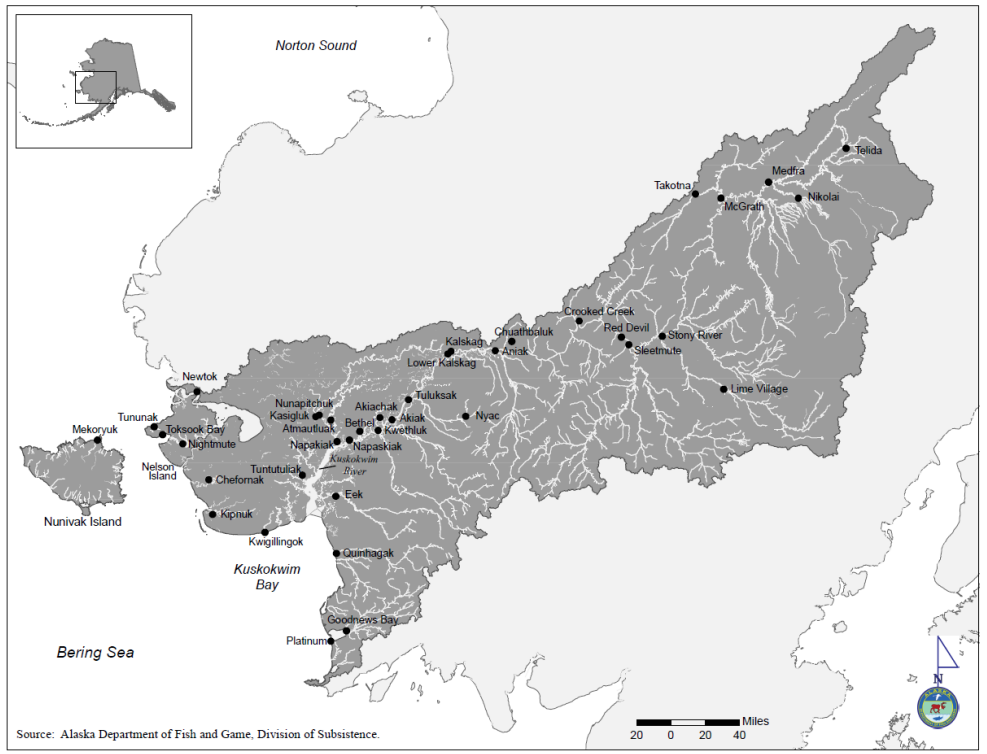
Response to SSC comments, pg. 10

# Understanding Conservation Benefits

***SSC comment:*** *"... no quantitative work related to potential impacts on salmon-dependent communities is provided. The high uncertainty in estimating returns on their own does not mean that estimates of an upper bound couldn't still be useful within this broader context. The upper limit could support more synthesis of potentially impacted communities. - Pg. 9."*




Yukon area and communities (Figure 4-22 in April SIA)




Kuskokwim Area and communities (Figure 4-26 in April SIA)

Response to SSC comments, pg 9

# Impacts to Pollock Industry

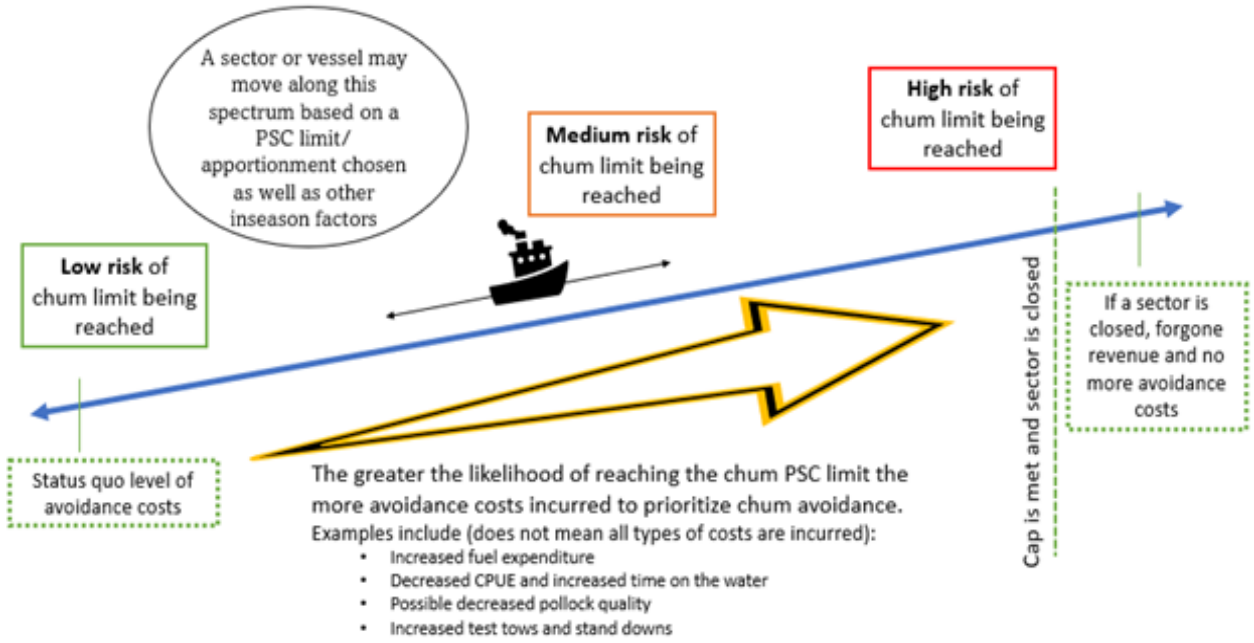
**SSC comment:** *"Regarding the examination of how a potential shutdown due to the WAK chum salmon bycatch limit being reached is expected to impact revenue and cost relative to the status quo, the SSC is concerned that simultaneously focusing on decreased revenue and increased costs is unrealistic. …"* (pg. 10)

- Figure 4-10 in the analysis describes expected relationship between avoidance costs and potentially forgone revenue.

**SSC comment:** *"The SSC emphasizes the importance of discussing a lower bound on revenue changes. Low revenue impacts for some fleets would be consistent with prior years where fleets were not close to the cap…."* (pg. 11)

- Retrospective data is presented differently, including minimal values and figures to demonstrate inter-annual variability.

**SSC comment:** *"the SSC is also concerned with the status quo/Alternative 1 for the CP fleet as this appears to include industry actions already implemented to avoid WAK chum salmon. The SSC suggests consideration of whether 2022 is an appropriate year to include in the retrospective analysis."* (pg. 11)




- Analysis is required to compare proposed actions to Alt 1 status quo regulations. Although IPAs have been modified by all sectors, these changes were adopted without additional regulatory action.

Response to SSC comments

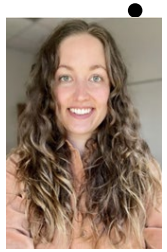
# SSC Requests for Additional Evaluation of Alternative 4

**Alternative 4 would modify existing regulations for the salmon bycatch IPAs**

- Add six provisions for chum salmon avoidance → IPAs would be modified to incorporate responsive measures
    - IPA representatives submitted proposals February 2024 and Council modified Alternative 4 in April 2024
    - CP IPA was amended in 2022 and the Inshore SSIP and MSSIP were amended in 2024

**Specific requests**

- Put Alternative 4 into context with the other alternatives and how they could work together
- Consider recent IPA changes and how the sectors may be doing or responding differently
- Further analysis to the extent practicable on the predictability of PSC and pollock catch encounters

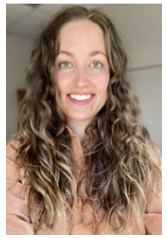


Response to SSC comments, pg. 14

# Alternative 4, Evaluation

Section 3.2.4.3

| Provision | Assessment |
|---|---|
| **1. Describe the use of historical genetic information** | **Yes –** Explicit consideration of likelihood that WAK chum could be avoided, but may not always need to prioritize closures |
| **2. Evaluate closures more than once per week** | **Yes –** Reduces the chance that PSC rates would increase without a response |
| **3. Require excluder devices be used throughout B season** | **No –** CP and MSSIP currently require and common practice for Inshore SSIP to use, but it would *update regs to align with current practices* |
| **4. Require outlier provisions** | **Yes –** Incentive to perform equal or better than peers to not lose operational flexibility in future years. |
| **5. Weekly reports to WAK chum salmon users** | **No –** Focused on information sharing. |
| **6. Prohibit fishing in areas with very high bycatch rates** | **Yes –** Prohibits fishing in areas with "very high" PSC rates in addition to regular RHS closures. WAK chum savings depends on where the very high rate area is located and where vessels move to |



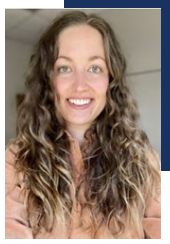
**Provisions have the potential to reduce bycatch compared to status quo**

- Recent years' bycatch reductions have *coincided* with IPA changes
  - From 2021 B season bycatch of 545,901 chum:
  - 2022 B season was a 55% reduction
  - 2023 B season was an 80% reduction
  - 2024 B season was a 95% reduction
- Other factors likely affecting reductions, ***but without modifying regulations, IPAs could be changed in the future***

Response to SSC comments, pg. 14

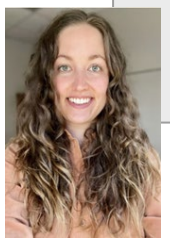
Response to SSC comments

# Part 5. Social Impact Assessment



# Responses to SSC Comments on the Social Impact Assessment

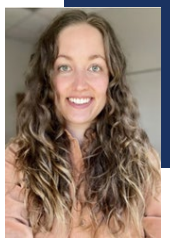
| | SSC Comments | Analytical Sections Addressing Requests |
|---|---|---|
| **Regulatory Context** | National Standard 4, 6, other laws, policies, and EOs | PSC limit does not constitute an allocation of fishing privileges and thus the action is not judged under NS 4; Section 1.4; National Standards addressed in iteration prepared for final action |
| | Potential for intervening variables to affect benefits | Sections 4.4.2 - 4.4.5, global change throughout impact analysis for chum salmon users |
| **Community and Regional Participation** | Synthesis of community demographic and socioeconomic indicators, community matrix, and map of engagement | All comments addressed - Tables 4-10, 4-11, 4-14, 4-30; matrix in Table 1-6 up front in Exec. Summary; Map in Figure 4-1. |
| | Crew data | New section in 4.1.1.5 for harvesting and processing employment |
| | Factors creating uncertainty for processors | Section 4.1.1.3 on market conditions and lingering COVID effects, Section 4.1.1.4 on processor's participation in other fisheries, Section 4.1.1.4.1.1 on cross cutting challenges. |
| **CDQ Program** | CDQ vessel ownership, harvest diversification, and revenue mong AFA and CDQ; bargaining power; proportion of CPs harvesting CDQ | Section 4.2.2.1.2.3 (pgs. 232-234), Section 4.2.2.2.4 (pgs. 247-248), Section 4.1.1. (pgs. 193-104) with table 4-1 and 4-7. Does not provide median CDQ catch per vessel but does demonstrate % of total revenue dependence |



Response to SSC comments, pgs. 16-18

Dutch Harbor, ASMI Industry and Partner Use

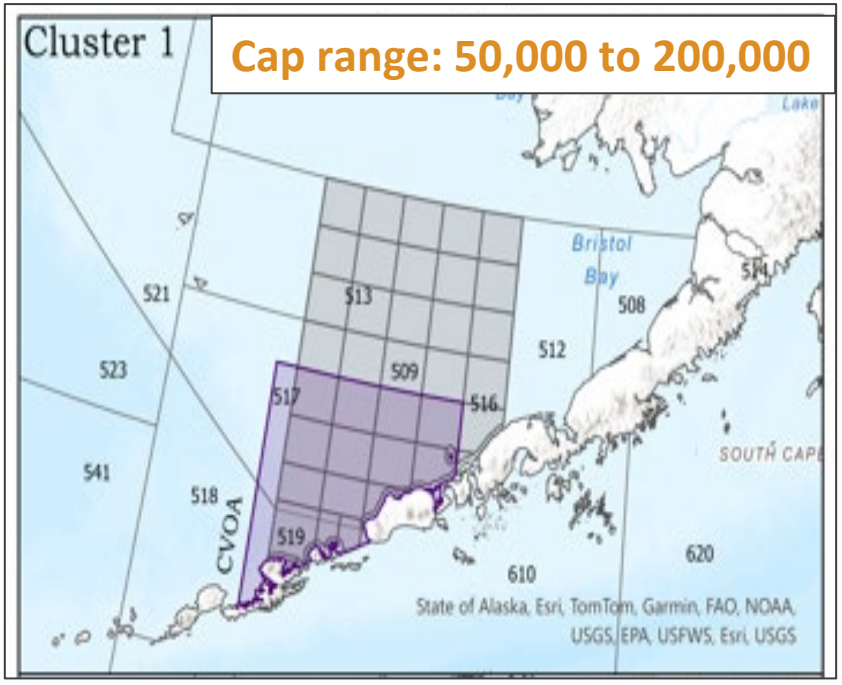
# Alternative 5 Impact Analysis

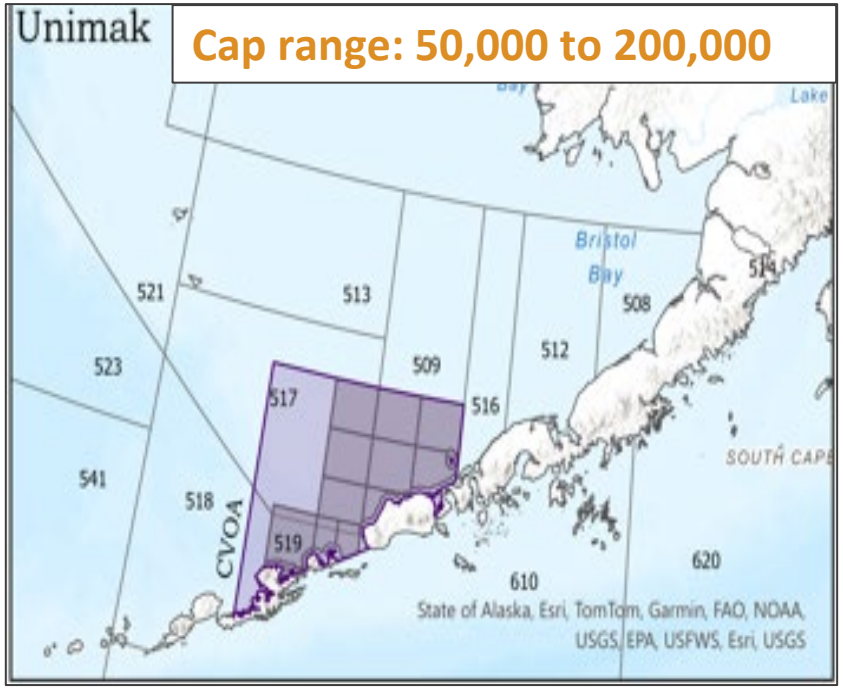


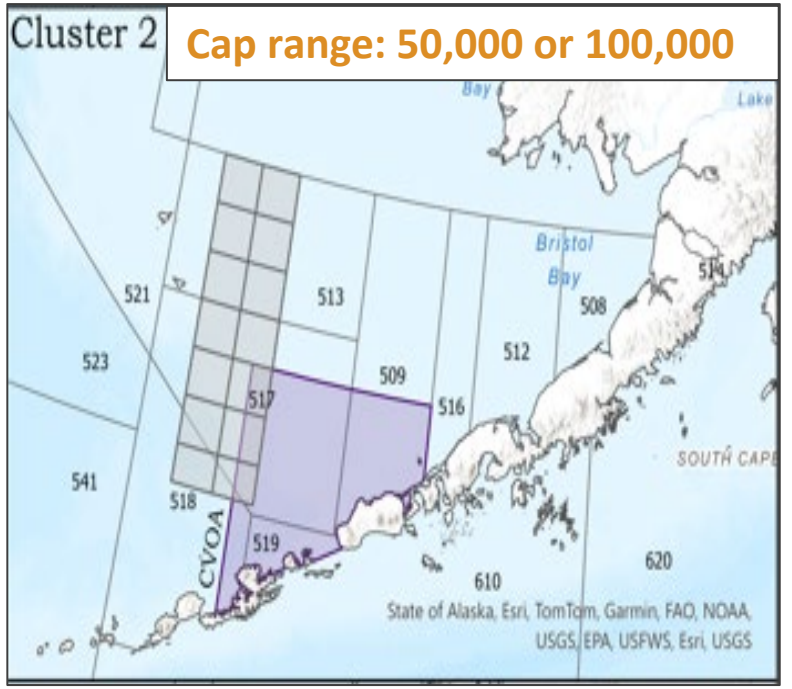
# Description of Alternative 5

Section 2.6

- Three time/area closures triggered by PSC limits ranging from 50,000–200,000 chum , and only one may be selected for implementation. Apportionments are the same as Alt. 2 and 3.
- Chum salmon caught inside the corridor from June 10–August 31 count towards PSC limit
- If the PSC limit is met, NMFS would close the area until September 1, but vessels may continue fishing outside



# Fleet Movement Model - Approaches Considered

Section 3.2.4.4.1.1

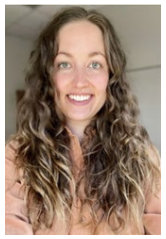
Analysts explored (but did not move forward) two other approaches in the development phase of this model based on SSC feedback from prior models developed for the Bristol Bay Red King Crab Analyses:

**(1) PSC-based method:** Relies on an assumption that harvesting prioritizes minimizing bycatch alone and would not take into account pollock CPUE, timing of fishing, or operational costs of moving to these areas

- *SSC's June 2023 minutes noted key uncertainties in how displaced fleets would relocate effort outside of a closed area and recommended alternative approaches*

**(1) CPUE-based method: data limitations**

- Would have excluded data for pollock trawl catcher vessels carrying electronic monitoring because observers sample at the offload (not at-sea). Currently, CAS does not include vessel level information on haul locations and times (needed to calculated CPUE) for this portion of the fleet.
- Additionally, limited data would result in redistributing effort (minutes of pollock fishing) from areas inside of a corridor to areas outside of a corridor and create artificially high PSC.
  - *SSC's February 2024 minutes:*
    - *If CPUE is higher outside of a closure area relative to inside then the displaced effort is higher than what was needed inside alone and this results in an overestimation of PSC; with lower CPIE the TAC would be under utilized*
    - *Evaluation of effort displacement is heavily reliant on at-sea observer coverage*



# Fleet Movement Model -Approach Used

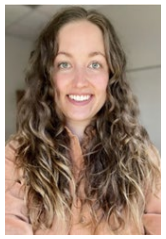
Section 3.2.4.4.1.1

**Proportional Approach:** Redistributes  pollock catch (mt), chum salmon PSC, and Chinook salmon PSC from a corridor that closed to a sector to all stat areas outside the corridor that had catch, in proportion to the catch that occurred.

**Data:** Estimates of pollock catch and chum and chinook salmon PSC counts from 2011 to 2023 were obtained from NMFS Catch Accounting System. Data were summarized at the spatial scale of the ADF&G statistical-area.

**Design:** this model approach had three main steps -

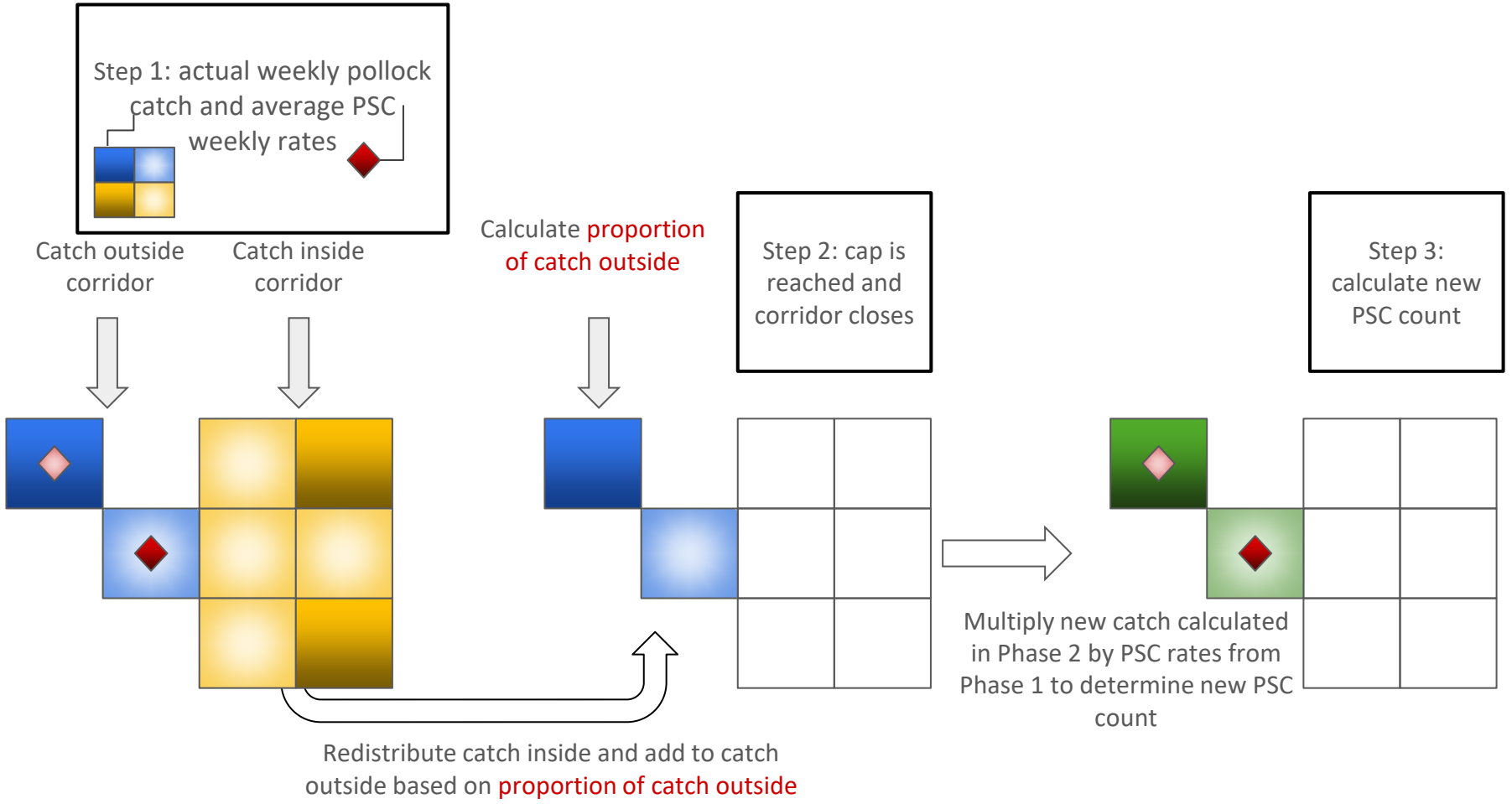
1. Determine the weekly pollock catch per stat area and weekly PSC rate per stat area (count of salmon per metric ton of groundfish);
2. For a week where a closure would have occurred under an option and a cap, determine the proportion of catch outside of the corridor and add the catch that incurred inside the corridor in proportion to the catch that occurred in stat areas outside of the corridor; and

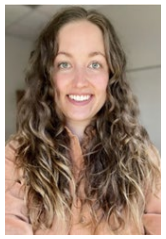


Multiply the PSC rates that occurred outside of the corridor by the new catch (existing catch + displaced catch) to determine the new PSC counts.

# Fleet Movement Model - Catch Displacement

Section 3.2.4.4.1.1



# Fleet Movement Model - Primary Challenge

Section 3.2.4.4.1.1

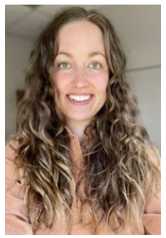
**Main issue:** there were weeks where there was no pollock harvest in a stat area outside of a closed corridor so there was nowhere to move catch to (Table 3-33, page 131).

**Takeaway:** the results from a model that relies on retrospective catch and PSC rate data cannot be used as a predictor of fishing behavior or where the fleet may shift effort to in the event of a closure.

**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% | - | - | - |

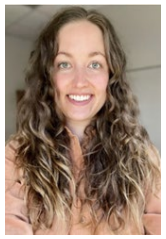
Source: NMFS Alaska Region CAS.



# Other Approaches to Impact Analysis

Section 3.2.4.4.1.3

1. Historical dependence on fishing grounds inside corridor
2. Spatial and temporal distribution of chum PSC, pollock catch, and WAK chum PSC
3. Years when caps would have been met, date, and the amount of pollock catch displaced
4. Regulatory, capacity, and environmental constraints



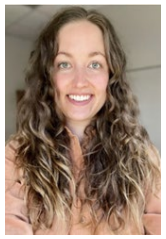
# Proportion of Catch Inside Each Corridor (Dependence)

Section 3.2.4.4.1.3

Table 3-36 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

| | Cluster 1 | | | Unimak | | | Cluster 2 | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | 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.



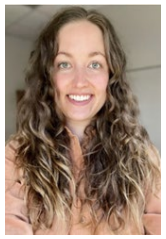
# Comparing Chum Salmon PSC and Pollock Catch

Section 3.2.4.4.1.3

**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.

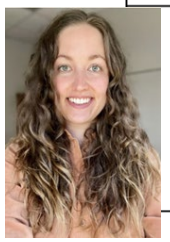


# Pollock Catch Displaced

Section 3.2.4.4.1.3

| 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 | | | | |

| 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 | | | | | | | | |



# Chum and WAK Chum Salmon PSC

Section 3.2.4.4.1.3

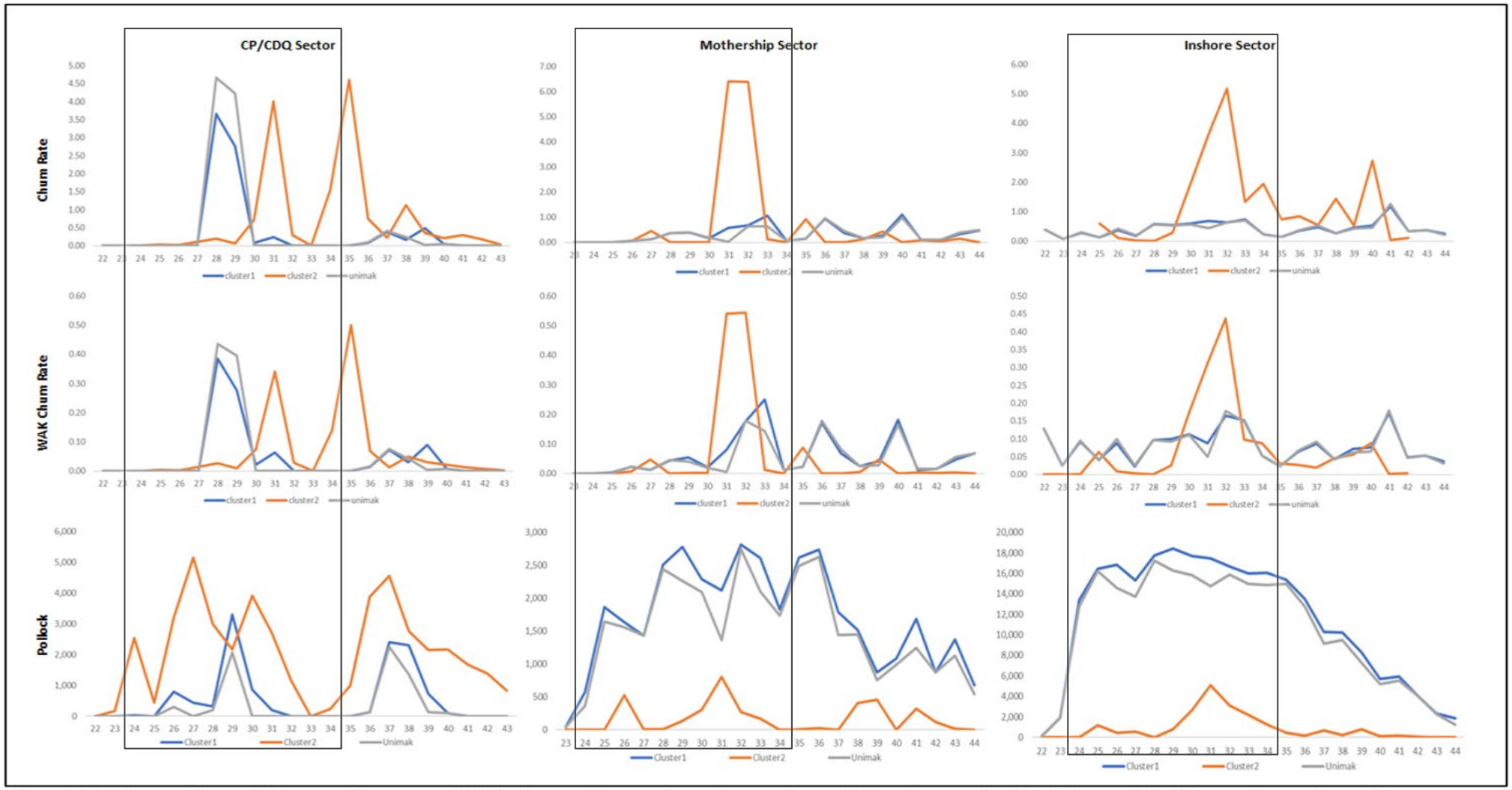
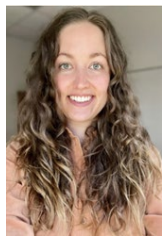



**Figure 3-22 Comparison of the weekly average WAK chum salmon rates, chum salmon PSC rates, and pollock harvest (mt) by sector and corridor under Alternative 5, 2019–2023**

Notes: CP and CDQ are combined.

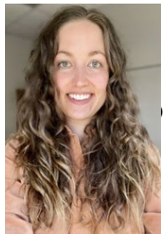


# Factors Likely to Affect Movement Behavior

Section 3.2.4.4.1.3

- CPs, and motherships to a lesser degree, have greater flexibility to move northwest
- CPs are prohibited from fishing AFA pollock inside the CVOA during the B season
- Inshore CVs must meet processor delivery requirements and some small vessels have limited capacity
- Nearshore Bristol Bay Trawl Closure prohibits all pollock vessels from fishing further east
- Pollock vessels cannot fish around the Pribilof Islands encompassed in the Pribilof Islands Habitat Conservation Zone

Fleet would not fish further directly west off of the “shelf edge”



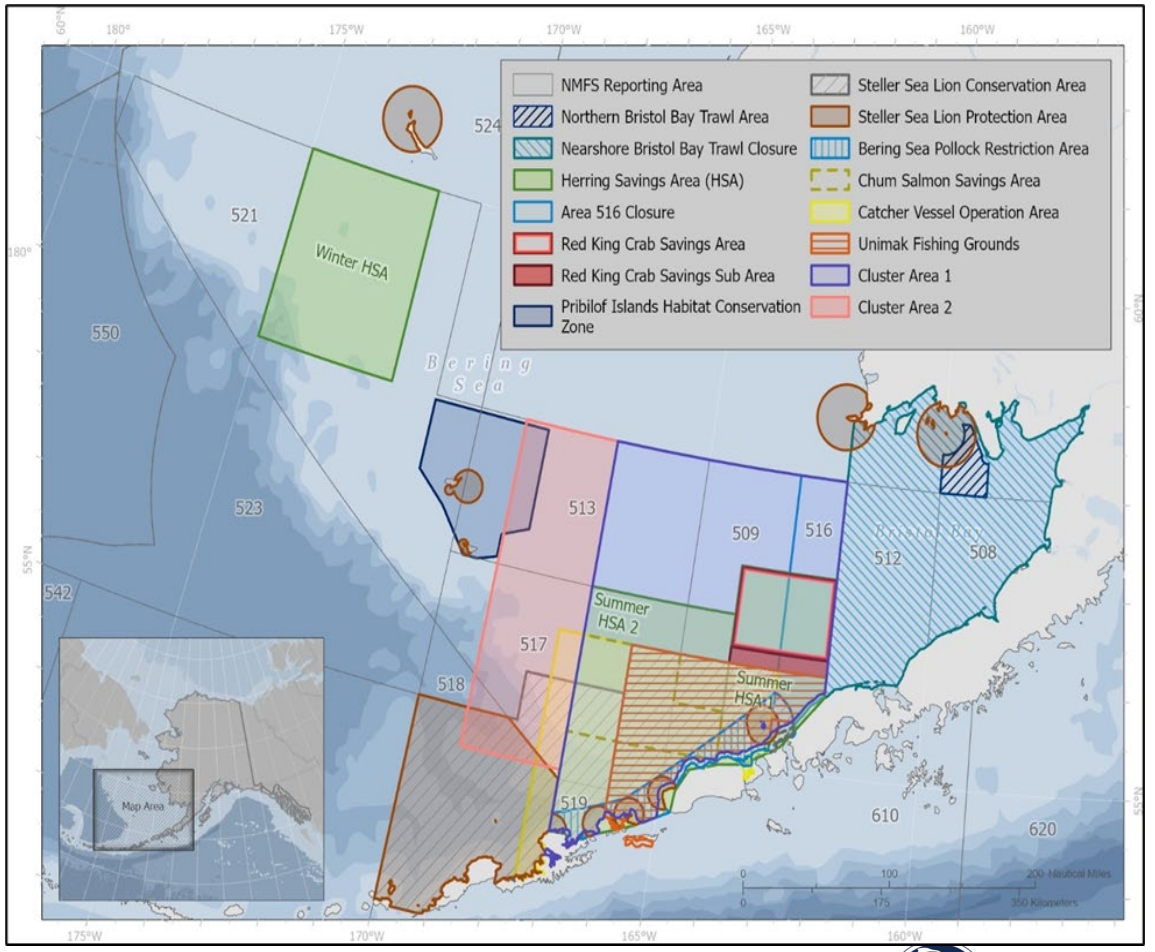



**Figure 3-23 Inseason corridor areas under Alternative 5 and other relevant groundfish management area boundaries in the Bering Sea**

# Anticipated Responses/Movement Scenarios

Section 3.2.4.4.1.3

| Corridor | Period | CP/CDQ | Mothership | Inshore |
|---|---|---|---|---|
| Cluster 1 | **Pre closure** | Avoid area as able | • Mothership CVs may fish outside as able<br>• Inshore cooperatives may also encourage larger CVs to fish outside as able<br>• Both would execute very careful PSC accounting | |
| | **Post closure** | Move to Cluster 2 but more likely further northwest | • Motherships have variable fishing history but trend similar to inshore CVs<br>• Greater flexibility to move<br>• Given variability, movement influenced by conditions in that year | • Many may move to Cluster 2 with some larger vessels moving further northwest<br>• Vessels would target areas available to them with known conditions (pollock aggregations and PSC) |
| Unimak | **Pre closure** | No CP pollock harvest, avoid area as able for CDQ | Same as Cluster 1 | |
| | **Post closure** | Unlikely to be affected, move further northwest | Move to a portion of Cluster 1, then to Cluster 2 and further northwest as able | |
| Cluster 2 | **Pre closure** | • All sectors/vessels would avoid due to the extent practicable because of historically high PSC rates<br>• Careful PSC monitoring to not risk losing operational flexibilities provided by accessing fishing grounds | | |
| | **Post closure** | Move further northwest | Move vessels into Cluster 1 or Unimak, some potentially further northwest | |

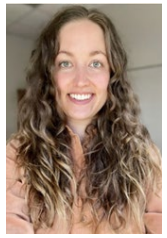
# Implications for Chum and WAK Chum Salmon PSC

The corridors present different possibilities for potential benefits and unintended consequences

- Higher numbers of chum caught in Cluster 1/Unimak, but the bycatch rates are low.

  ***high concentrations of pollock and catch***

- Bycatch rates are higher in Cluster 2 compared to Cluster 1/Unimak
- Large amounts of pollock moving from Cluster 1/Unimak to Cluster 2 presents a greater risk of potentially higher chum and WAK chum PSC



| | Resource Category | Chum Salmon Bycatch | WAK Chum Salmon Bycatch |
|---|---|---|---|
| **Alt 5: time/area closures** | **Cluster 1** | **Benefit Scenario:** vessels are stay below the cap inside Cluster 1, resulting in chum and WAK chum salmon savings.<br><br>**Unintended Consequence:** Some CVs fish outside of Cluster 1 (potentially in Cluster 2), or the cap is met, and CVs move to Cluster 2 where higher chum salmon bycatch. | |
| | **Unimak** | **Benefit Scenario:** Similar to Cluster 1 as Unimak is fully embedded within.<br><br>**Unintended Consequence:** Similar risk to Cluster 1 but potentially less because vessels *could* fish on the edge, inside Cluster 1; may not be feasible pending aggregations of pollock and other PSC considerations. | |
| | **Cluster 2** | **Benefit Scenario:** Sectors may proactively avoid fishing in area with historically high bycatch rates and/or carefully monitor PSC when fishing inside.<br><br>**Unintended Consequence**: Low risk to creating adverse outcomes compared to status quo and other corridors. Vessels expected to target fishing in historically common areas | **Benefit Scenario:** Lower proportion of WAK chum inside Cluster 2 compared to Cluster 1 and Unimak, but proactively avoiding and/or monitoring chum bycatch.<br><br>**Unintended Consequence** Similar to total chum salmon PSC. |

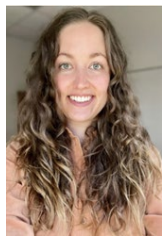
# Chinook Bycatch, Alternative 5

Section 3.3.4

**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.



# Chinook Bycatch, Alternative 5

Section 3.3.4

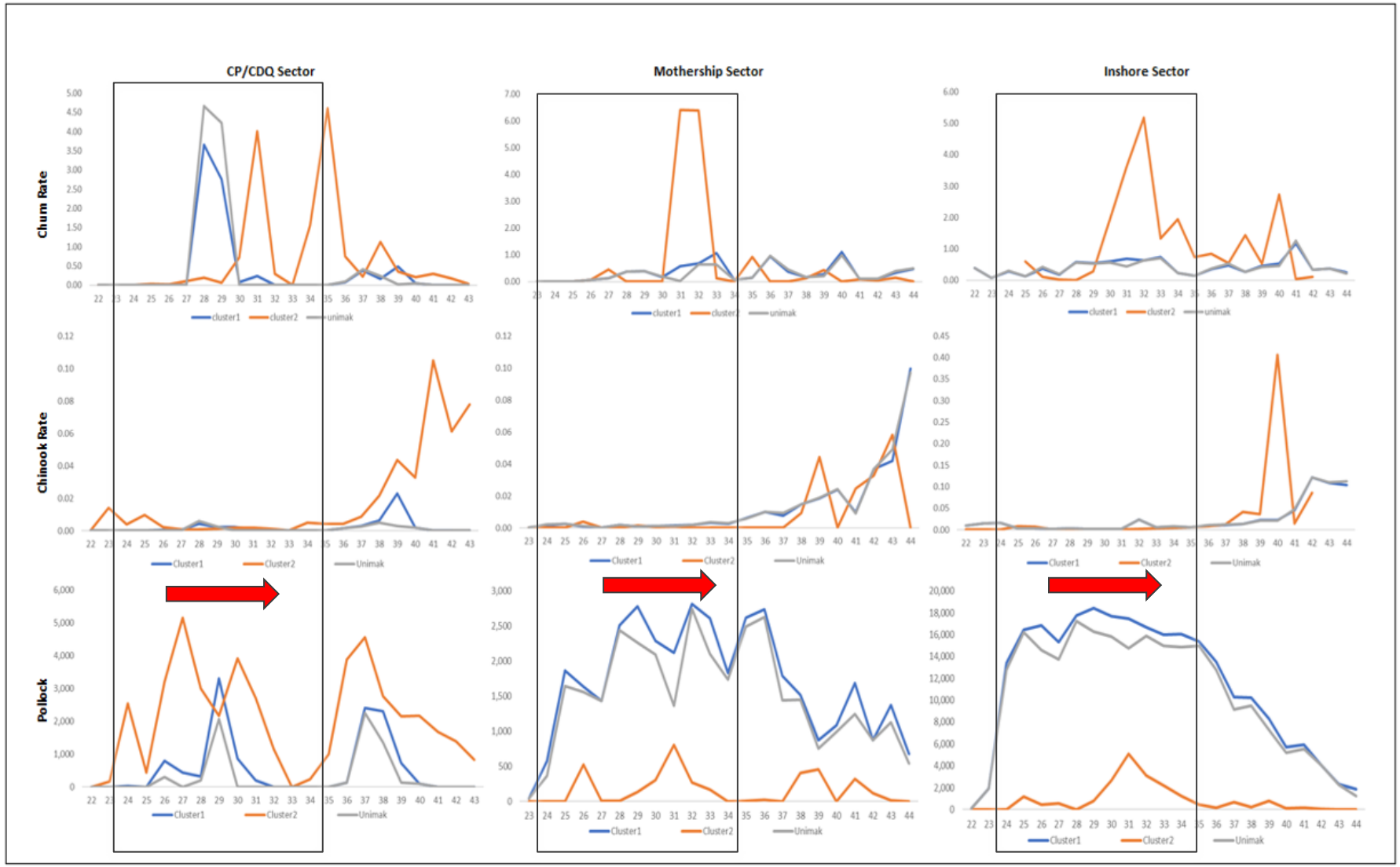
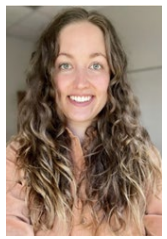



**Figure 3-30 Distribution of the average weekly chum salmon PSC rate, Chinook salmon PSC rate, and pollock harvest (mt) for each corridor area by sector, 2019–2023**

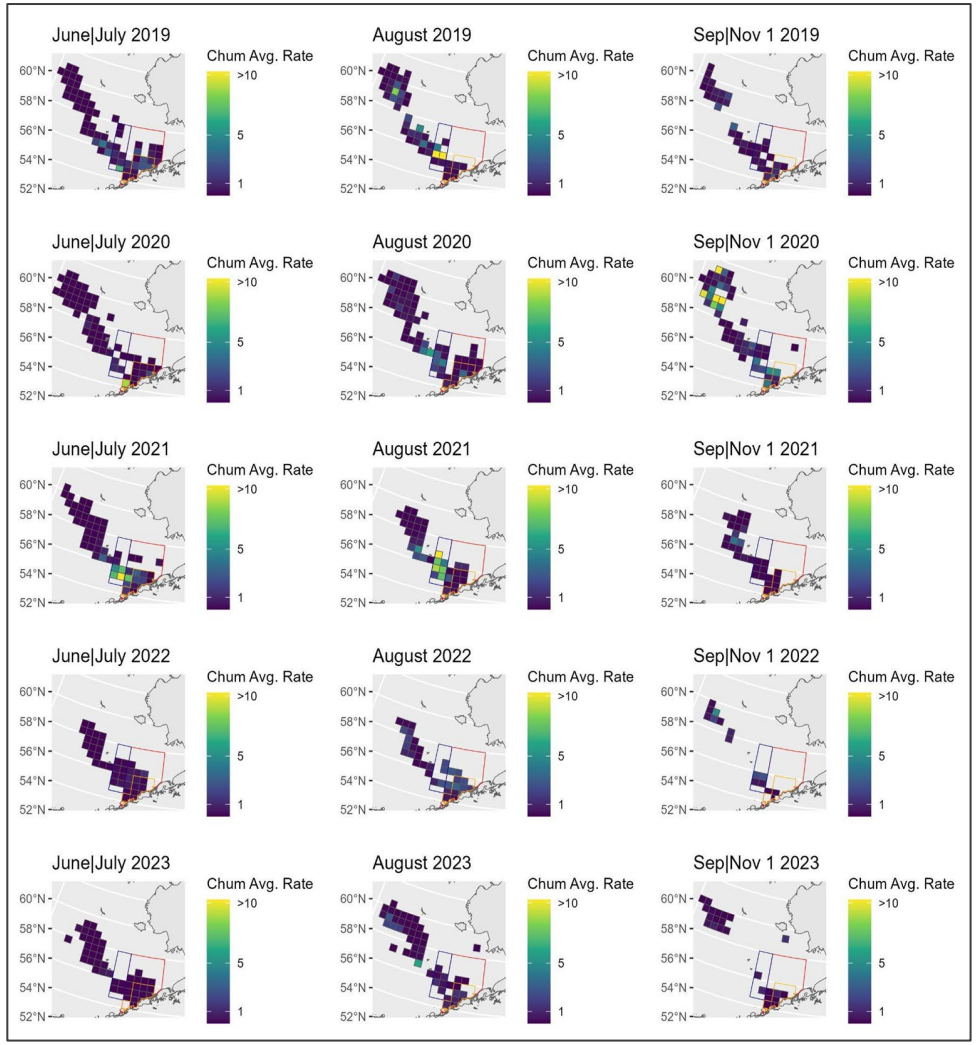


# Herring Bycatch, Alternative 5

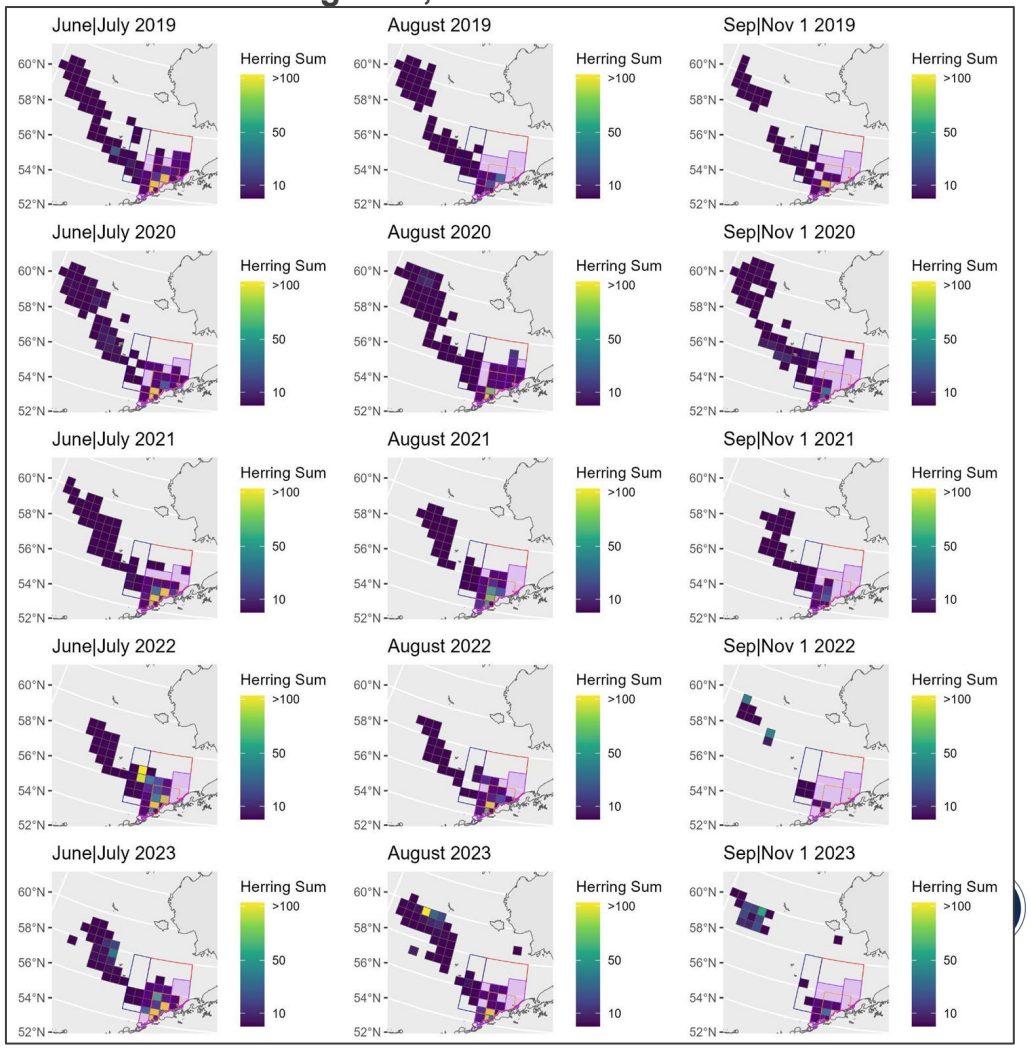


- High degree of uncertainty in the outcomes for herring PSC
  - Each year is slightly different, with varying temporal and spatial patterns for each PSC species
    - Operational responses to chum, Chinook, and herring PSC would require complicated inseason decision-making

**Fleet-wide chum salmon PSC rates, 2019-2023**




**Fleet-wide herring PSC, 2019-2023**



# Social and Economic Impacts of Alternative 5 – Pollock Industry

Pollock sectors are expected to weigh the **risk** of corridor closures, but also the **consequences.**

1. Evaluated historical reliance of each sector, as well as operational constraints
   - Inshore and mothership sectors have high reliance on **Cluster 1** and **Unimak**
   - Inshore sector has less flexibility in how far from port they can travel (48-hour delivery standard) and smaller inshore CV disproportionately impacted from a **Cluster 1** or **Unimak** closure
   - CP/ CDQ have more reliance on **Cluster 2** than the other areas
2. Described impacts prior to corridor closures being met and impacts if the closures were met.
   - If the closure represents a high consequence for the sector, likely change behavior, to the extent they can, prior to closure
   - Depending on the cap, likely the case for inshore and mothership sectors in **Cluster 1** and **Unimak**.
3. Estimated "Revenue at risk" associated with potentially unharvested pollock - presents an ***unlikely*** upper bound for the likelihood of closures and the magnitude of revenue impacts.
   - Unharvested pollock may be possible for the inshore sector with a **Cluster 1** or **Unimak** cap, depending on cap.
   - Unharvested pollock could adversely impact associated harvesters, processors, crew, CDQ groups, and disrupt market opportunities.

**Approach for Communities (Section 4.2.4.4):**

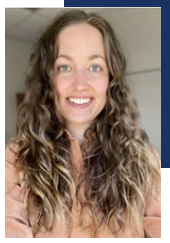
- Based on analysis of pollock sectors, similar types of impacts as Alt. 2 and 3, considered the likelihood for adverse effects

# Social and Economic Impacts of Alternative 5 - WAK Chum Salmon Users

Alternative 5 could have varied outcomes for those dependent on WAK chum salmon.

- Highlights **likelihood for positive outcomes** and **risk of potential adverse effects** (i.e., more WAK chum salmon caught)
- Depends on the corridor, cap amount and apportionment selected, as well as the pollock fleet's response
  - **Cluster 1** and **Unimak**: possible high benefits, but also high risk for adverse effects
  - **Cluster 2**: possible low/medium benefits, but lower risk of adverse effects
- Also considered the potential impacts to Chinook salmon PSC
  - If corridor caps result in longer seasons due to increased chum salmon avoidance techniques or increased travel, may increase Chinook bycatch
- **If** WAK chum salmon savings are realized, there could be much **broader implications and benefits (**Section 4.4.5)
  - Any amount of increased WAK chum salmon returns may result in passive use or ecosystem benefits, including cumulative and longer-term impacts.
  - Directed use opportunities for subsistence and commercial fishing and associated communities would be based on meeting escapement goals and dynamic in season management. If there is an opportunity for subsistence or commercial fishing, even a few hundred fish could have a positive impact.
  - If bycatch reduction efforts contribute to longer-term viability of the stock, could support a profoundly positive effect on the human-salmon-ecosystem relationship, Indigenous values and culture, food security and food sovereignty and the resilience of communities in Western and Interior Alaska.


# Overview of Key Takeaways from the Impact Analysis



# Incentive Structure Under a Combination of Alternatives

| No action | Chum PSC limit | Chum PSC limit, triggered by abundance | IPA measures | Corridor cap |
|---|---|---|---|---|
| **Alt 1** | **Alt 2** | **Alt 3** | **Alt 4** | **Alt 5** |

Regulatory and non-regulatory status quo incentives (e.g., IPA requirements, responding to outside pressure, CDQ associations, etc.)

If Alt 2 or 3 are adopted with Alt 4, in addition to status quo incentives:

- The tools under Alt 4 could be used to compliment objective of Alt 2 or 3 of reducing chum bycatch (e.g., the use of bi-weekly closures could be more reactive to chum on the grounds).

If Alt 4 is adopted with Alt 5, in addition to status quo incentives:

- The tools under Alt 4 may be used to respond to the restrictions under Alt 5

If Alt 2 or 3 are adopted with Alt 4 and 5, in addition to status quo incentives:

- More complex inseason decision making
- Incentives to minimize all chum salmon (not inherently WAK chum salmon) in corridor and outside
- The measure with greatest consequences and likelihood of occurring are most likely to drive behavior (this could be different by sector and the time of the season)

Modified from Figure 5-1, page 319

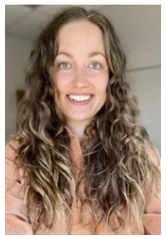
# Potential Benefits Under a Combination of Alternatives Chapter 5

## Alternatives 2 or 3 + 5

- Reduce chum salmon bycatch compared to status quo
- May decrease some of the uncertainty of potential adverse impacts of Alternative 5 on chum salmon
  - *E.g.,* Cluster 1 corridor + overall hard cap

## Alternatives 2 or 3 + 4 *and/or* 5

- IPA measures in response to Alternative 4 provisions could be used as tools to reduce bycatch under the other alternatives
  - *E.g.,* bi-weekly evaluation of RHS closures
  - *E.g.,* closing stat areas with very high bycatch rates



# Potential Costs Under a Combination of Alternatives



## Alternatives 2 or 3 + 5

- Greater cost to industry than stand alone alternatives **if** the corridor closure presents high consequences for the sector
  - If not, similar impacts to an overall PSC limit
  - If so, more avoidance techniques and more complex decision-making which could lead to increased PSC trade-offs

## Alternatives 2 or 3 + 4 *and/or* 5

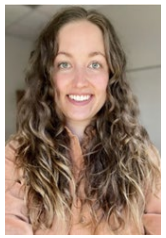
- Generally, these avoidance techniques may aid the industry attempts to remain under overall PSC limits or corridor-specific caps
- Adding on Alternative 4 unlikely to increase costs relative to the standalone alternative

# Summary of PSC and Policy Tradeoffs

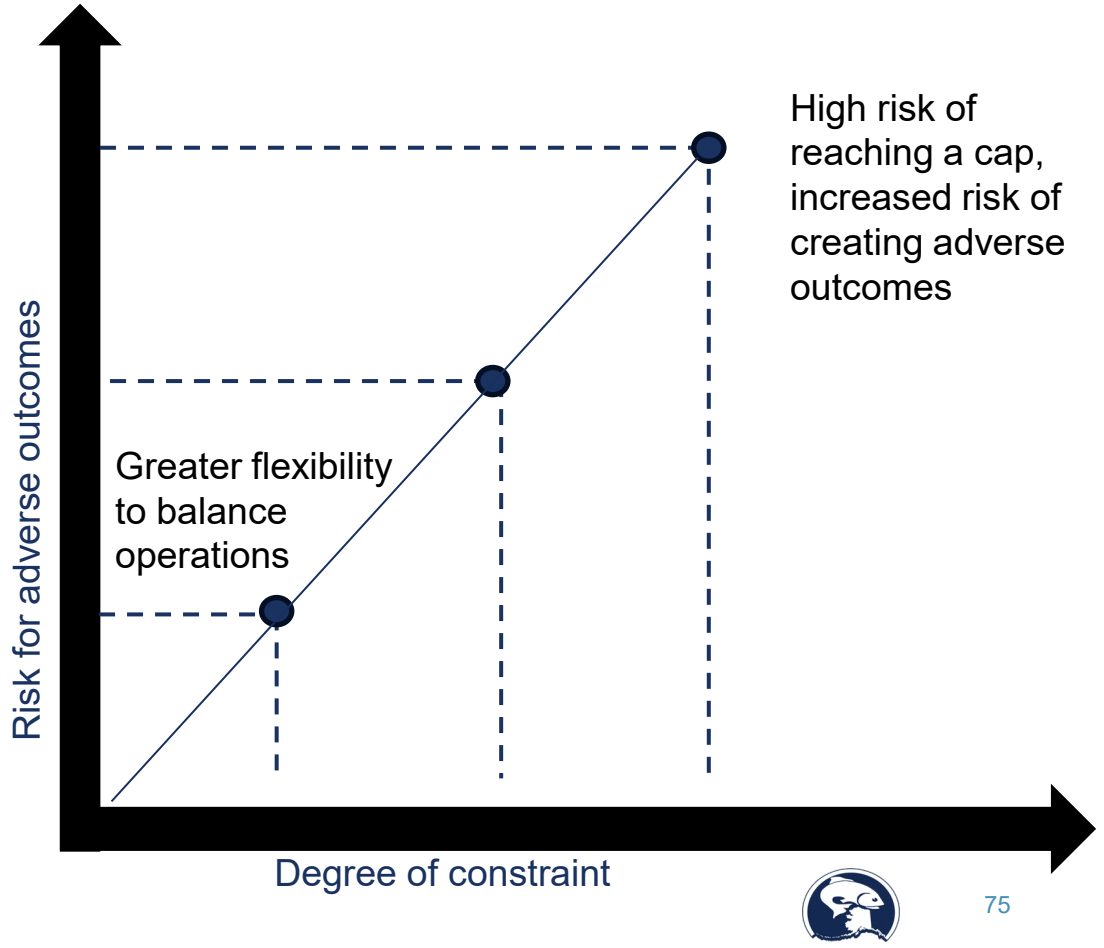
Section 3.5

**Alternatives 2, 3, and 5 would require the pollock industry to balance its operations against multiple, constraining limits**

- Vessels would change their fishing behavior in response to PSC limits:
  - Move to new areas with lower bycatch rates
  - Use more frequent test tows
  - Slow the pace of fishing to account for each haul or offload
  - Cooperative may issue a stand down
- Behavior changes could divert pollock catch later into the B season

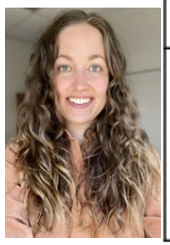


Move to new areas with potentially unknown PSC encounters or rates



# Reference Table for Potential PSC Tradeoffs

| Category | Potential for positive outcomes compared to status quo | Potential for negative outcomes compared to status quo |
|---|---|---|
| **Total Chum** | All proposed action alternatives *could* reduce total chum salmon PSC.<br>Highest fleet-wide savings estimated under a 100,000-chum hard cap and pro-rata split (Alternative 2). Alternative 3 savings are less than what is expected under Alternative 2.<br>Majority of Alternative 4 provisions expected to reduce total chum PSC.<br>All inseason corridors have the potential to reduce chum salmon bycatch compared to status quo. Prioritizing avoidance in Cluster 1 at low cap amount may result in greatest reductions, *if the cap is not met*. | Alternatives 2 and 3 would not increase total chum PSC because of the function of the hard cap.<br>Alternative 4 is not expected to increase total chum PSC compared to status quo, but no associated caps.<br>The analysis indicates this outcome is more likely if avoidance is prioritized in Cluster 1 followed by Unimak, particularly if CVs move to Cluster 2 and then further northwest. Closure of these corridors to CVs is more likely at low cap amounts of 50,000 chum salmon. |
| **WAK Chum** | Uncertain whether a hard cap under Alternatives 2 and 3 would reduce WAK chum bycatch. The analysis indicates this is more likely if bycatch can be reduced to the lowest observed levels during the status quo period (i.e., 2011, 2013, and 2023) and relatively similar proportions are observed in the future.<br>Alternative 4 would likely result in neutral or positive outcomes for WAK chum PSC.<br>Prioritizing avoidance in Cluster 1 followed by Unimak at low cap amount may result in greatest reductions, *if the cap is not met*. | Alternative 2 and 3 could result in increased WAK chum salmon PSC, depending on the cap amount and apportionment. All other factors being equal, more likely in a scenario where the fleet is reacting to a hard cap that may be constraining and moving to areas with low rates and potential higher mixtures of WAK chum in the total bycatch.<br>Alternative 5 implications for WAK chum are the same as those identified for total chum PSC under Alternatives 2 and 3. |
| **Chinook** | Chinook salmon PSC savings are only expected to occur if the B season were to close early under Alternatives 2 or 3. | All other factors being equal, the analysis indicates hard caps set at the low amount under Alternative 2 are more likely to increase Chinook bycatch compared to status quo. Likelihood of adverse impacts to Chinook under Alternative 3 are less than what is expected under Alternative 2.<br>The analysis of Alternative 5 indicates increased Chinook salmon PSC more likely if Cluster 1 or Unimak corridors closed to CVs and equally good catch rates could not be made up outside the area. |
| **Herring** | PSC savings are only expected to occur if the B season were to close early under Alternatives 2 or 3. | Outcomes for herring PSC under Alternatives 2, 3, and 5 are uncertain. The analysis expects vessels to avoid herring, but inseason choices will need to be made to balance operations against multiple PSC species. Herring PSC would still be constrained by existing limit. Caps set at low amounts for Alternative 2, 3, and 5 increase potential for negative impacts to herring. |



# Questions?

**THANK YOU!**
Contributors and persons consulted, pg. 330-331