Genetic Stock Composition Analysis of Chum Salmon from the Prohibited Species Catch of the 2024 Bering Sea Walleye Pollock Trawl Fishery

Preliminary Report

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Executive Summary[1]

We analyzed genetic stock compositions of chum salmon (*Oncorhynchus keta*) prohibited species catch (PSC) samples collected from the 2024 walleye pollock (*Gadus chalcogrammus*) fishery in the Bering Sea. Samples were genotyped for 84 single nucleotide polymorphism markers from which stock contributions were estimated using a range-wide chum salmon baseline developed by the Alaska Department of Fish and Game. The chum salmon PSC in the 2024 B season was 32,081[1] fish, substantially lower than the 10-year average of 315,536. In addition to the drastic reduction in overall bycatch, the proportion of Western Alaska fish in the bycatch was 8.3%, much reduced from the long-term average of 14.8%. An estimated 2,658 (1,988-3,387) chum salmon originating from Western Alaska were captured as bycatch which was lower than the long-term mean of 38,458 chum salmon from 2011 to 2023. The overall proportion of the Upper/Middle Yukon reporting group has increased over the last four years, now comprising 4.8% of the bycatch; however, with the decease in bycatch numbers the estimated number of Upper/Middle Yukon fish decreased from 2,544 (1,859-3,407) in 2023 to 1,547 (1,042-2,150) in 2024. The proportion of the Southwest Alaska reporting group remained low, accounting for 2% of the bycatch in both 2023 and 2024, with an estimated 627 (300-1,036) chum salmon caught in 2024. In aggregate, Western Alaska, Upper/Middle Yukon, and Southwest Alaska comprised 15.1% of the bycatch which when multiplied by the total bycatch expands to 16,827 chum salmon. The North East Asia reporting group comprised the largest proportion of the bycatch (32.0%) while the Eastern Gulf of Alaska / Pacific Northwest reporting group, which is often one of the largest contributors, increased in relative proportion in 2024, comprising 28.6% of the bycatch. The SE Asia reporting group has increased in relative proportion the last two years. In 2024, this group comprised 24.4% of the bycatch, the largest value for this genetic group of the time series. Consistent with historic trends, the highest proportion and number of Western Alaska chum salmon were from mixtures in the southeastern portion of the pollock fishing grounds. The average bycatch location of the catcher processor sector remained shifted northwest relative to most prior years (2023 being the main exception), while the average location of bycatch from the mothership sectors was more typical of the historic distribution. The shoreside sectors bycatch on average came from a similar location as it has historically. Because of the differences in fleet distributions, the Western Alaska reporting group makes up a larger proportion of the shoreside and mothership sectors' bycatch.

[1] *Disclaimer* - These represent preliminary analyses of the 2024 chum salmon genetic data. All estimates are likely to change slightly with the inclusion of additional genetic samples and the release of debriefed observer data. Numerous plot in this report display fishery information. All data are non-confidential. Data have been aggregated and any data point with fewer than three unique vessels has been removed.

Catch Summary

Temporal Trends

The chum salmon prohibited species catch (PSC), referred to as "bycatch" throughout this report, in the Bering Sea walleye pollock trawl fishery was 32,081 fish in 2024 (Figure 1). This was 280,412 fewer fish than the 10-year average of 315,536 (SD 125,273). As is typical, over 97% of the bycatch of chum salmon occurred in the B season (10 June through 1 November). This was the third year in which chum salmon bycatch has declined since the second greatest bycatch of chum salmon in 2021.

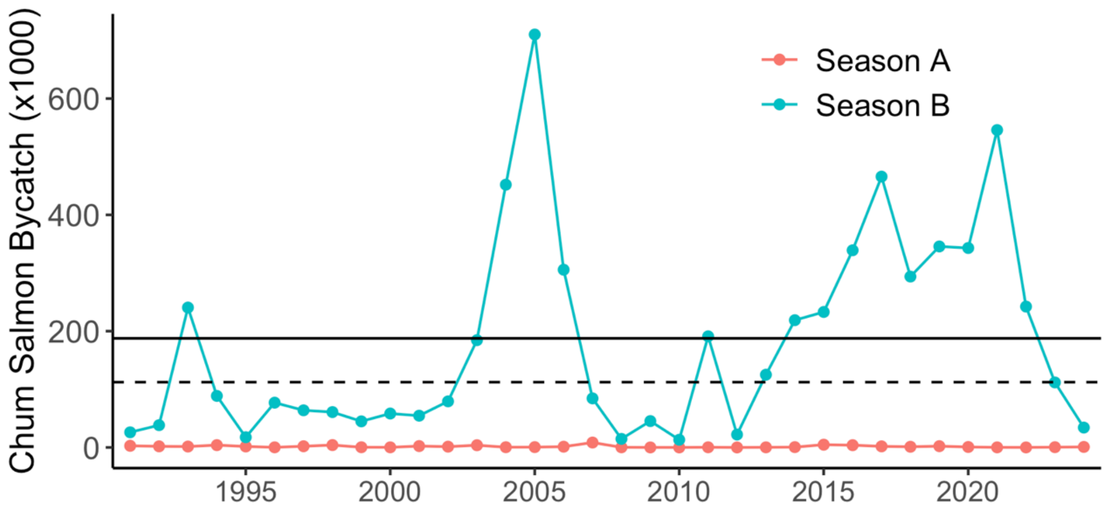

Figure 1: Chum salmon prohibited species catch (PSC) for the A and B seasons from the Bering Sea pollock-directed trawl fisheries. The solid horizontal line represents the mean PSC and the dashed line represents the median PSC from 1991 to 2023.

Within the B season, the chum salmon bycatch was bimodal, characterized by two peaks. The first smaller peak occurred in late June / early July (statistical week 27), while the second larger peak occurred in mid-August (statistical week 33; Figure 2 top panel). These two weeks accounted for 28% of the total bycatch. Relative to prior years, the timing of the bycatch was slightly early, with 50% of the bycatch occurring prior to week 31 (Figure 2: bottom panel).

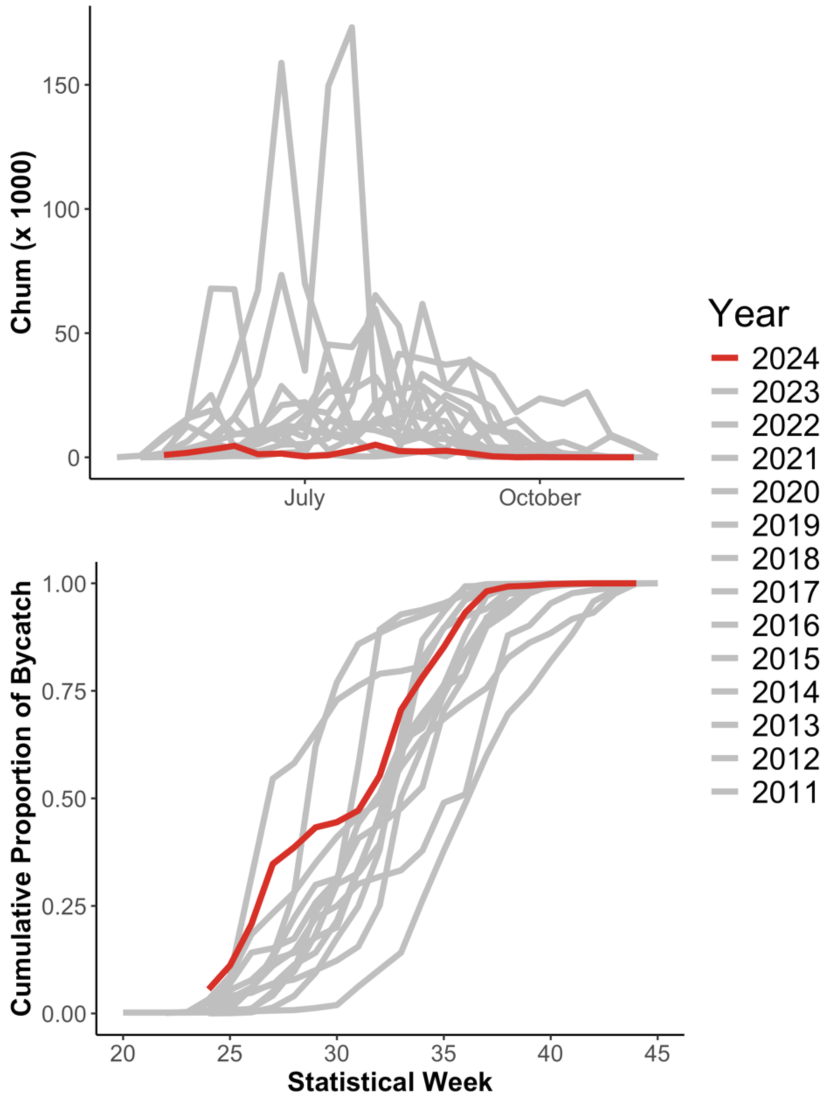

Figure 2: Number of chum salmon caught during the B-season (top) and cumulative proportion of chum salmon catch (bottom) from the Bering Sea pollock trawl fishery by statistical week for years 2011 to 2024.

Spatial Trends

The geographical distribution of the 2024 chum salmon bycatch was similar to the average spatial location of prior years (Figure 3). Of the spatial clusters previously defined by the Alaska Fisheries Science Center (AFSC) Auke Bay Laboratory (ABL) Genetics Program the greatest number of chum salmon bycatch were encountered clusters 1 and 2; with the highest bycatch coming from Alaska Department of Fish and Game (ADF&G) statistical area 645501; however, areas 655430 and 685530 were of similar magnitude. Combined, these three statistical areas account for 38% of the total bycatch.

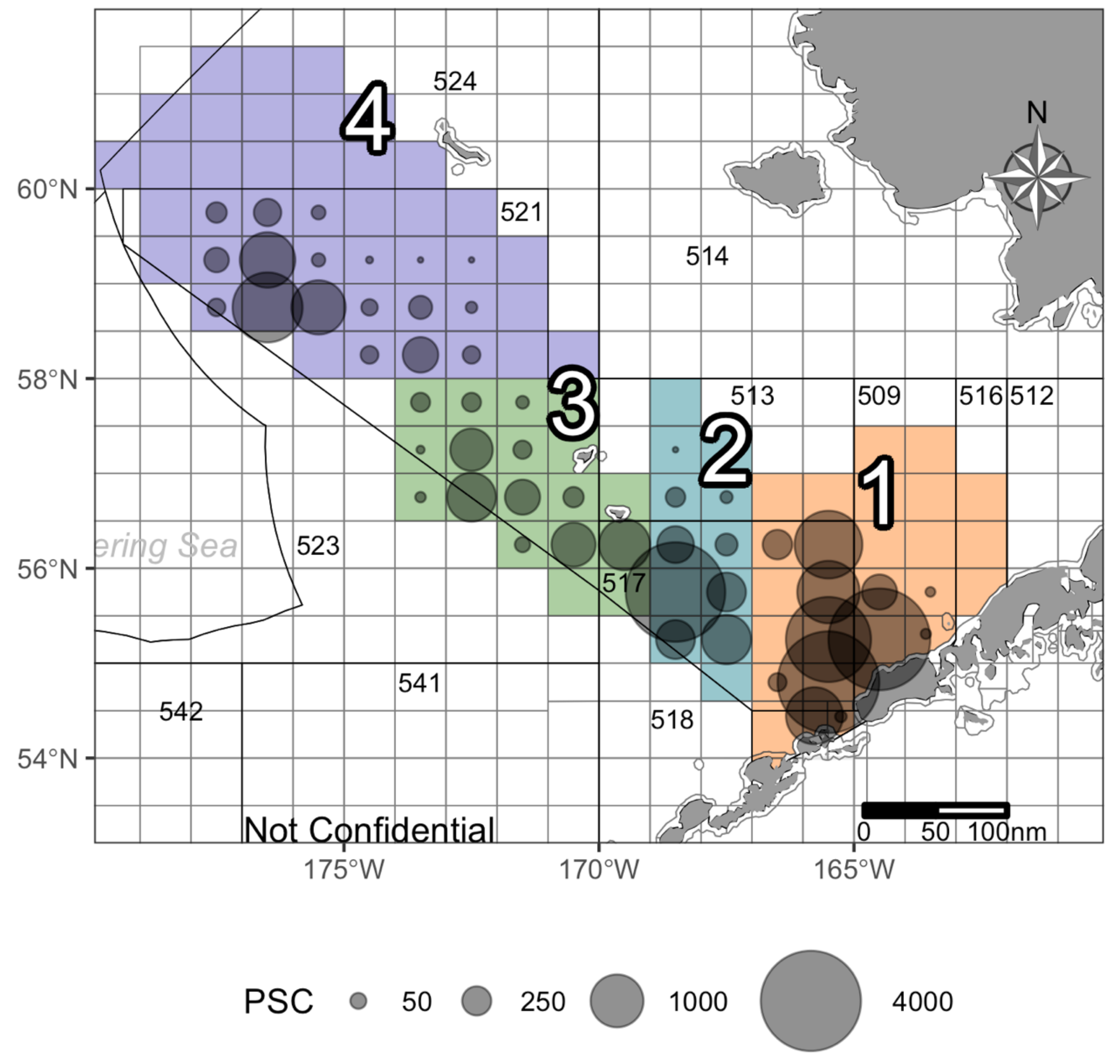

Figure 3: Spatial distribution of chum salmon bycatch caught in the 2023 Bering Sea B-season pollock fishery. ADF&G statistical areas are highlighted based on the four geographic strata assigned in prior genetic analyses.

To evaluate bycatch hotspots, areas where there were large catches of chum salmon relative to total pollock catch, we calculated the bycatch rates, number of chum salmon per metric ton of pollock harvested (chum/mt. pollock) for each of the ADF&G statistical areas (Figure 4). The average bycatch rate was 0.05 chum/mt. pollock - with a low of less than 0.001 and a high of 0.28 chum/mt. pollock. With six of the seven largest bycatch rates occurring within cluster 1, 50.8% of the bycatch came from cluster 1. Despite the overall lower bycatch in cluster 2, 20.2% of the total, cluster 2 had a similar overall bycatch rate (0.7 compared to 0.8 for cluster 1) because less than half as much pollock was harvested in cluster 2.

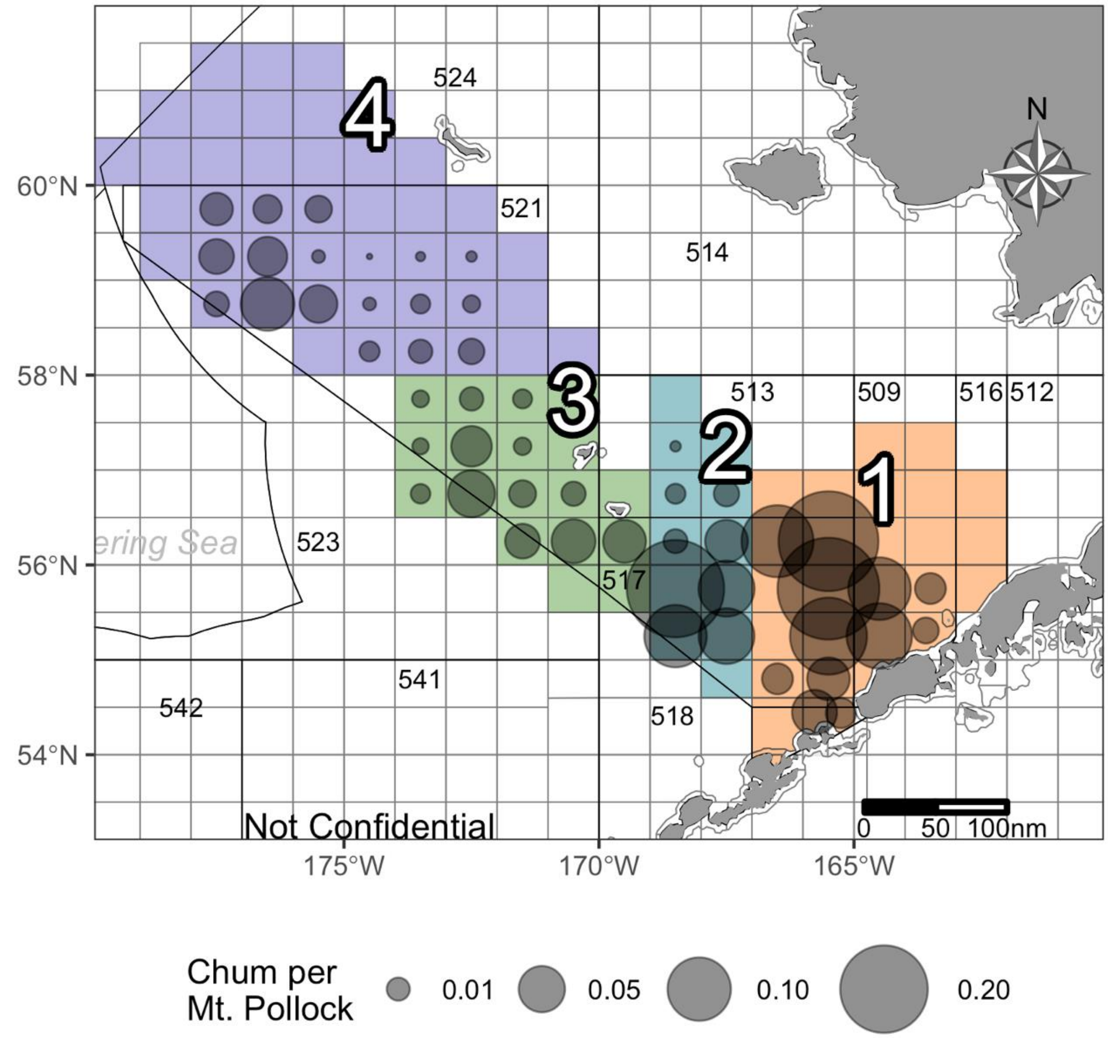

Figure 4: Spatial distribution of chum salmon bycatch rates, calculated as total chum salmon bycatch divided by total metric tons of pollock harvested, in the 2024 Bering Sea B-season pollock fishery. ADF&G statistical areas are highlighted based on the four geographic strata assigned in prior genetic analyses.

To evaluate shifts in the distribution of the chum salmon bycatch the centroid (center of the bycatch) was calculated for each year by sector. The spatial arrangement of the centroid was investigated for associations with a variety of environmental covariates including the Pacific Decadal Oscillation (PDO), warm pool, sea ice extent, and eastern Bering Sea surface temperature (shown). Climate data were downloaded from NOAA's Physical Science Laboratory climate indicies data repository: (https://psl.noaa.gov/data/climateindices/).

In 2024, the average location of the catcher processor sector's bycatch was shifted northwest relative to prior years, with the exception of 2023. The mothership sector, while similar to the CP last year, was more similar to its historic location. The shoreside sector's average location of bycatch encounter was not substantially different from prior years (Figure 5; left column). The mean Eastern Bering Sea temperature in 2024 was 4.05°C, slightly cooler than the average from 2011-2023 (4.76°C). Prior analyses have indicated that in years with lower sea surface temperatures in the Eastern Bering Sea the centroid of the shoreside sector, and to a lesser extent the mothership sector, is further on the shelf (Figure 5; right column). While 2024 adds a new observation for a cooler year, few cold years (2011-2013) contribute to this observation and most occur early in the time series.

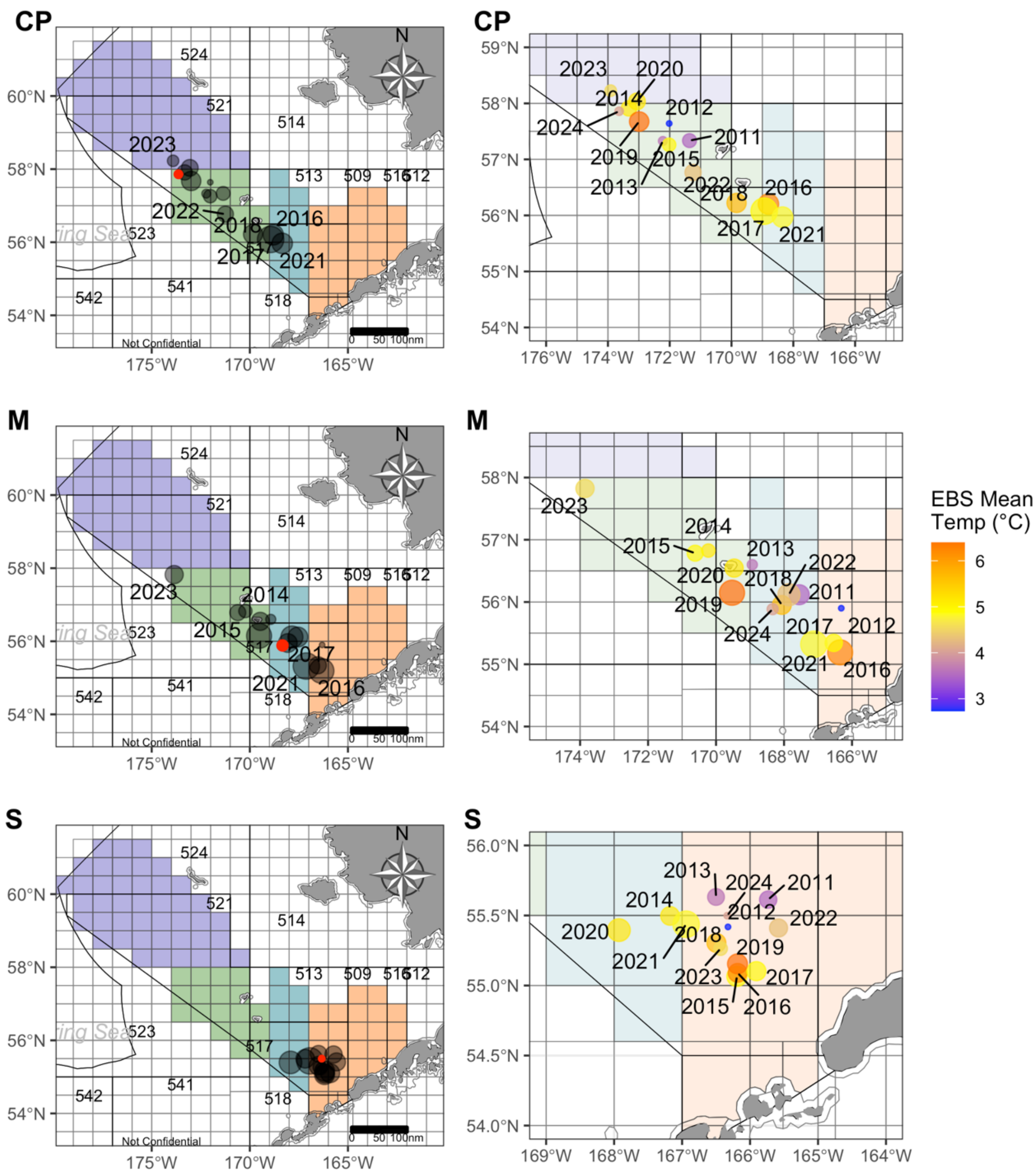

Figure 5: Change in the spatial distribution of chum salmon bycatch as measured by the centroid of the bycatch by sector; catcher-processor (CP), mothership (M) and shoreside (S). Point sizes reflect the relative size of the bycatch. The left column highlights the most recent year, 2024 (red) over all genetic report cluster areas, while the right column zooms into the sectors spatial extend with points colored by the mean sea surface temperature (°C).

Bycatch Genotyping Summary

Data from the AFSC Fisheries Monitoring and Analysis North Pacific Observer Program (Observer Program), total chum salmon bycatch, and genetic sample information were downloaded from the AFSC schema in the Alaska Fisheries Information Network (AKFIN) database. The ABL Genetics Program received 1,023 genetic samples from the Bering Sea and Aleutian Islands (BSAI) from the A and B seasons as well as 606 samples from the Gulf of Alaska (GOA) that were collected by the Observer Program in 2024. Due to the accelerated time frame of this reporting cycle, the GOA chum salmon samples were analyzed and will not be presented in detail in this report, but will be evaluated in the annual technical memorandum. Consistent with previous reporting, nearly all chum bycatch samples from the GOA are from the Eastern Gulf of Alaska / Pacific Northwest reporting group (90.3%, 85.1-94.5% CI), while Western Alaska was 0.5% (0-2.2% CI) and Upper Middle Yukon was 0% (0-0.7%).

After inventorying the genetic samples, the genetics lab determined that there was sufficient capacity to genotype all of the samples that were received. DNA from 975 genetic samples from the B season, 95.3% of the total genetic samples collected by the Observer Program, was extracted and amplified for the 84-SNP locus GTseq panel (Appendix II Table A1). Samples that were not genotyped for greater than 80% of the GTseq panel (minimum of 68 loci) were omitted from analyses. Of the 975 samples amplified, 924 were of adequate quality to include (94.8% of the total sample).

We re-amplified and genotyped 11.3% of samples for quality control (QC). The scores of these QC samples were compared with the scores from the originally genotyped samples to estimate the genotyping error rates. The average agreement over loci was 99.3%, and the average agreement among individuals was also high (99.6%), indicating high genotyping accuracy and correct sample organization. This ensured that the GTseq assay was consistent and provided confidence that the mixtures we analyzed contained the correct genetic samples.

Genetic Stock Composition

Stock composition analyses for the 2024 chum salmon samples were performed with the Bayesian conditional mixed stock analysis (MSA) approach with bootstrapping over reporting groups implemented in the R package *rubias* (Moran and Anderson 2019). Details of the method are described in Appendix II. Mixture genotypes were compared to an updated version of the WASSIP baseline [DeCovich et al. (2012); data provided by ADF&G and populations listed in Appendix II Table A2] in which populations were grouped into regional reporting groups that were consistent with prior analyses based on the Fisheries and Oceans Canada (DFO) chum salmon microsatellite baseline (Beacham et al. 2009).

Overall Trends

Western Alaska comprised 8.3% of the bycatch, the same as in 2023, but less than the long-term average (14.8% from 2011-2023), and similar to years 2020 and 2021 (8.0% and 8.9% respectively; Figure 6). Both Southwest Alaska and Upper/Middle Yukon groups comprised relatively minor portions of the bycatch, 2.0% and 4.8% respectively. Consistent with prior years, Asia stocks comprised a substantial fraction (56.4%) of the chum salmon bycatch in the B season (Table1, Figure 6). The contribution from the Northeast Asia reporting group (32%) was a decrease from last year, but similar to 2020 and 2022. There is a clear pattern of contribution between the Northeast Asia and Eastern Gulf of Alaska / Pacific Northwest reporting groups (Figure 6) with a strong negative correlation (; $r = -0.85$). In 2024, the decrease in proportion of Northeast Asia was mirrored by an increase for the Eastern Gulf of Alaska / Pacific Northwest group from 18.7% to 28.6%. The Southeast Asia reporting group also showed a substantial increase in relative proportion in the bycatch since 2022. Historically the Southeast Asia group has averaged 14.8% of the bycatch, but comprised 24.4% in 2024.

Table 1: Regional stock composition estimates of chum salmon from the 2022 Bering Sea, B-season pollock fishery (PSC = 32,081; n = 896). The estimated number of chum salmon bycatch, the 95% CI for the estimated number, mean proportion, 95% credible intervals, median estimate, P = 0 statistic (the probability that a stock composition estimate is effectively zero [Munro et al. 2012]), and the Gelman-Rubin shrink factor (SF).

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	7,832	6,923-8,773	0.244	0.216	0.273	0.00	1.00
NE Asia	10,254	9,242-11,295	0.320	0.288	0.352	0.00	1.00
W Alaska	2,658	1,988-3,387	0.083	0.062	0.106	0.00	1.00
Up/Mid Yukon	1,547	1,042-2,150	0.048	0.032	0.067	0.00	1.00
SW Alaska	627	300-1,036	0.020	0.009	0.032	0.00	1.00
E GOA/PNW	9,161	8,213-10,142	0.286	0.256	0.316	0.00	1.00

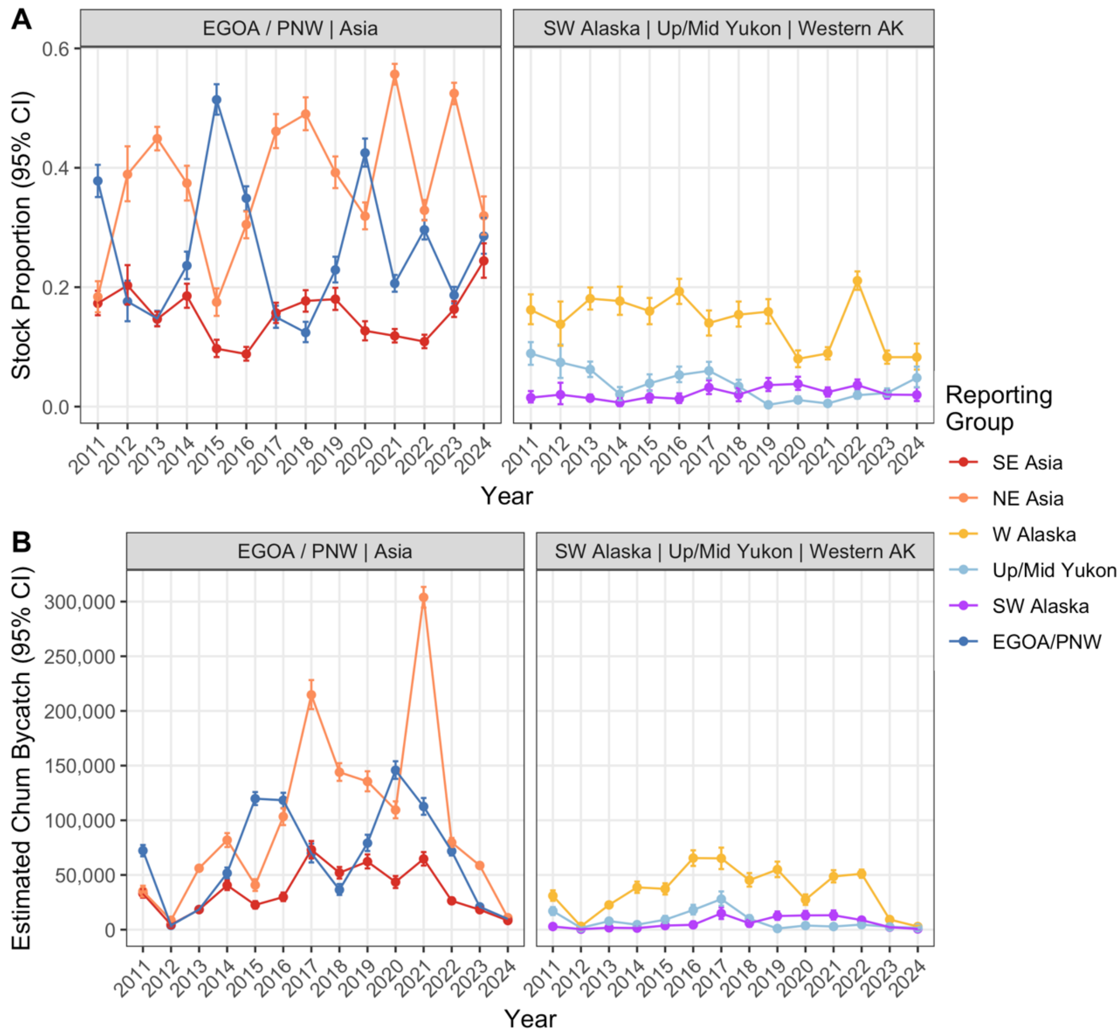

Figure 6: Annual bycatch estimates of B season chum salmon PSC from 2011 to 2024. (A) stock proportions with 95% credible intervals, (B) Estimated number of chum salmon with 95% credible intervals.

Temporal Trends

The B season was divided into early (pre week 30), middle (weeks 30-34) and late (post week 34) time periods to evaluate whether regional group contributions changed through the season. As is fairly typical, the majority of the bycatch occurred in the early and middle time periods with a shift in the catch composition among the time periods for several reporting groups. The Western Alaska reporting group was highest in the early and middle periods (8.5% and 8.3% respectively; Figure 7) dropping to 6.3% by the late period; however, all credible intervals overlapped. Similarly, the mixture proportions of the Upper/Middle Yukon and Eastern Gulf of Alaska / Pacific Northwest reporting groups were greatest during the early period, and decreased in the middle and late periods. The difference in proportions for the Upper/Middle Yukon between early and both middle and late were not as pronounced, with credible intervals overlapping for all time periods. There was a steep decline in stock proportions for the Eastern Gulf of Alaska / Pacific Northwest reporting group falling from 39.2% in the early period to 23.0% and 14.4% in the middle and late periods respectively. The Southwest Alaska and Northeast Asia groups displayed opposite trends, increasing in relative proportion from the early to middle and late periods.

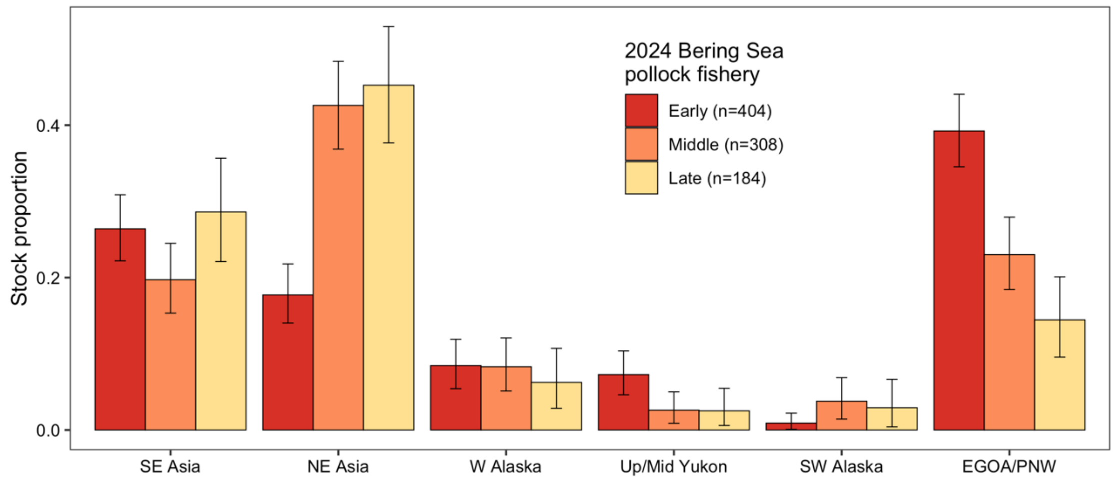

Figure 7: Stock composition estimates for the chum salmon bycatch from the Early, Middle, and Late periods of the 2024 Bering Sea, B-season pollock fishery. Sample sizes for each mixture provided in the figure legend.

The Southwest Alaska reporting group increased in contribution to bycatch from the early to the middle period, from 0.9% to 3.8%. Similarly, the NE Asia reporting group increased from a low of 17.7% in the early to a high of 45.2% in the late period. Contrary to prior years, the Southeast Asia reporting group displayed no temporal trend, with an average contribution of 24.9% across periods with overlapping credible intervals among time periods (Figure 7).

While there is substantial intra-year variability in the trends observed among the three time periods there are some general trends (Figure 8). Typically, Southeast Asia comprises a larger proportion of earlier bycatch while Northeast Asia comprises a smaller proportion of early bycatch. Western Alaska typically comprises a smaller proportion of the late bycatch, although has substantial variability among years in both the early and middle periods. The Early period typically is the largest proportion of the Upper/Middle Yukon regional group, while Southwest Alaska displays a minor decrease from early to middle and late periods, but also typically has the lowest contribution and variability among periods. The Eastern Gulf of Alaska / Pacific Northwest reporting group increases in relative proportion from the early and middle to the late period.

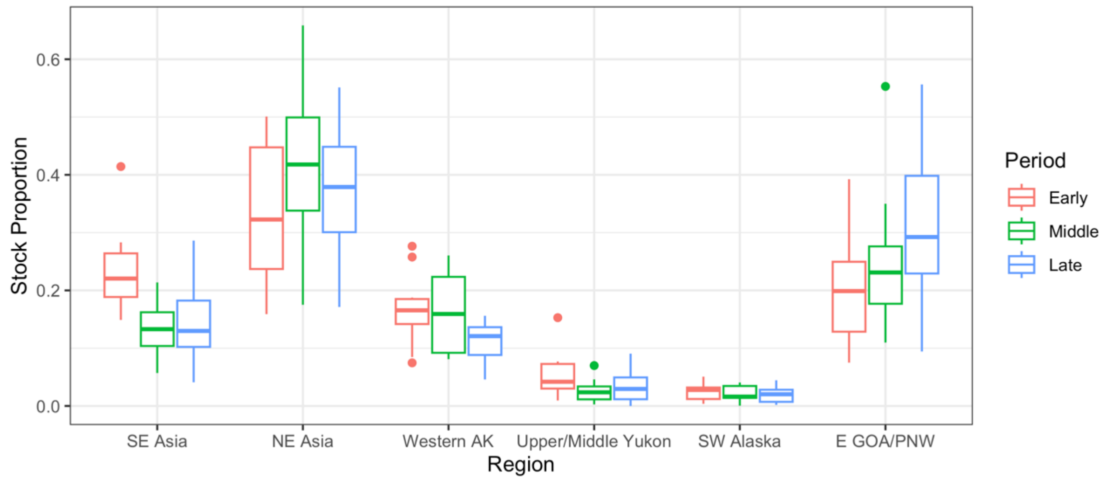

Figure 8: Boxplot of mean stock composition estimates for the chum salmon bycatch from the Early, Middle, and Late periods from 2011-2024 Bering Sea, B-season pollock fishery.

It should be noted that the boxplot (Figure 8) compares the annual mean estimate and ignores the uncertainty (credible intervals) that surround the point estimates. It is not uncommon for means to differ, but credible intervals to overlap (*e.g.*, Southeast Asia in all time periods in 2024; Figure 7).

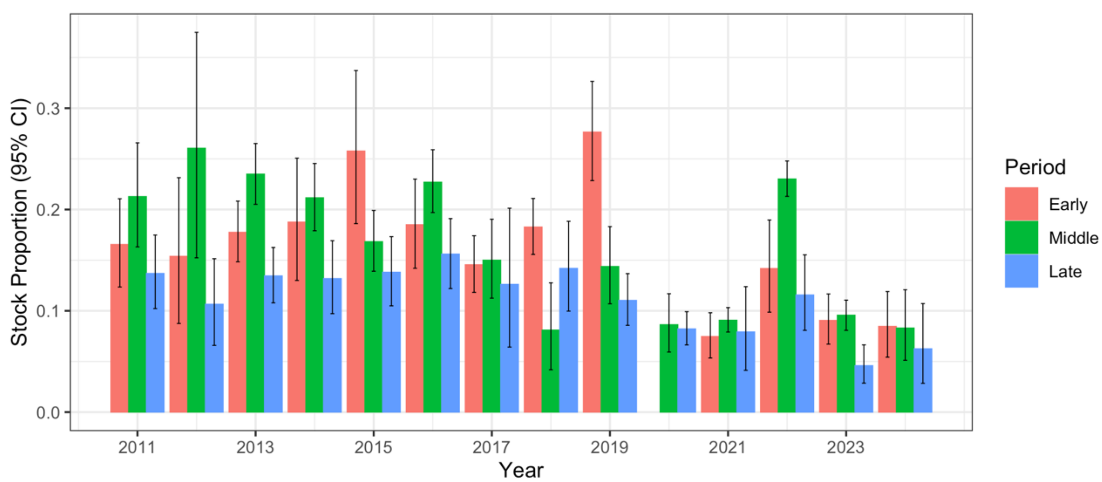

Figure 9: Mean stock composition estimates for the Western Alaska reportion group from the Early, Middle, and Late periods from 2011-2024 Bering Sea, B-season pollock fishery.

When we compare the estimates of the Western Alaska reporting group from 2011 to 2024 we see substantial overlap in the credible intervals for some year/period combinations owning to low sample sizes (Figure 9). However, there is a fairly consistent signal of Western Alaska comprising a smaller proportion of the bycatch in the late period compared to the early or middle periods. In 8 out of the last 14 years the estimates from the early or middle period were greater than the late period with non-overlapping credible intervals.

Spatial Trends

Analyses where the bycatch has been divided into mixtures based on longitude, with 170°W as the dividing line, have historically shown that the relative contribution of the Western Alaska, Upper/Middle Yukon, Southwestern Alaska, and Eastern Gulf of Alaska / Pacific Northwest reporting groups generally increases closer to the Alaska Peninsula (East of 170°W). In 2024, this was true for the Western Alaska and Eastern Gulf of Alaska / Pacific Northwest reporting groups while the 95% credible intervals for the Upper/Middle Yukon and Southwest Alaska overlapped (Figure 10).

The relative contribution of the Asia reporting groups, alternatively, are generally larger for mixtures west of 170°W. This was true for both of the Asia reporting groups in 2024. The Southeast Asia reporting group comprised 38.5% of the bycatch west of 170°W and 20.1% of the bycatch east of 170°W. The NE Asia reporting group comprised 47.3% of the bycatch west of 170°W and 26.8% of the bycatch east of 170°W (Figure 10).

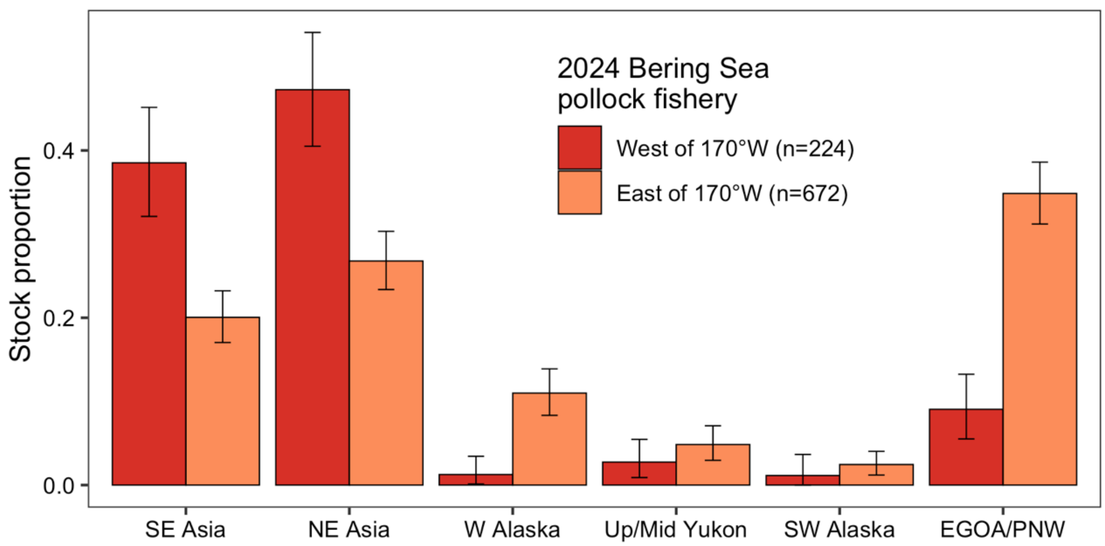

Figure 10: Stock composition estimates for the chum salmon bycatch from the 2024 Bering Sea, B-season pollock fishery from the U.S. waters of the Bering Sea west of 170°*W and the southeastern Bering Sea east of* 170°*W.*

Spatiotemporal Trends

The ABL genetics program has previously separated the Bering Sea into finer-scale spatial strata (4 clusters of ADF&G statistical areas based on the zones defined in Haynie and Pfeiffer 2013) to evaluate economic and climate drivers of the fishery), and incorporated temporal stratification (early and late) to evaluate the spatio-temporal stock specific contributions. With the large reduction in bycatch this year, only three strata could be analyzed: cluster 1 early and clusters 2 and 4 late (Figure 11). There was a lack of temporal contrast within clusters. Comparisons between clusters 2 and 4 in the late period demonstrated consistent patterns as the analyses contrasting East and West of 170°.

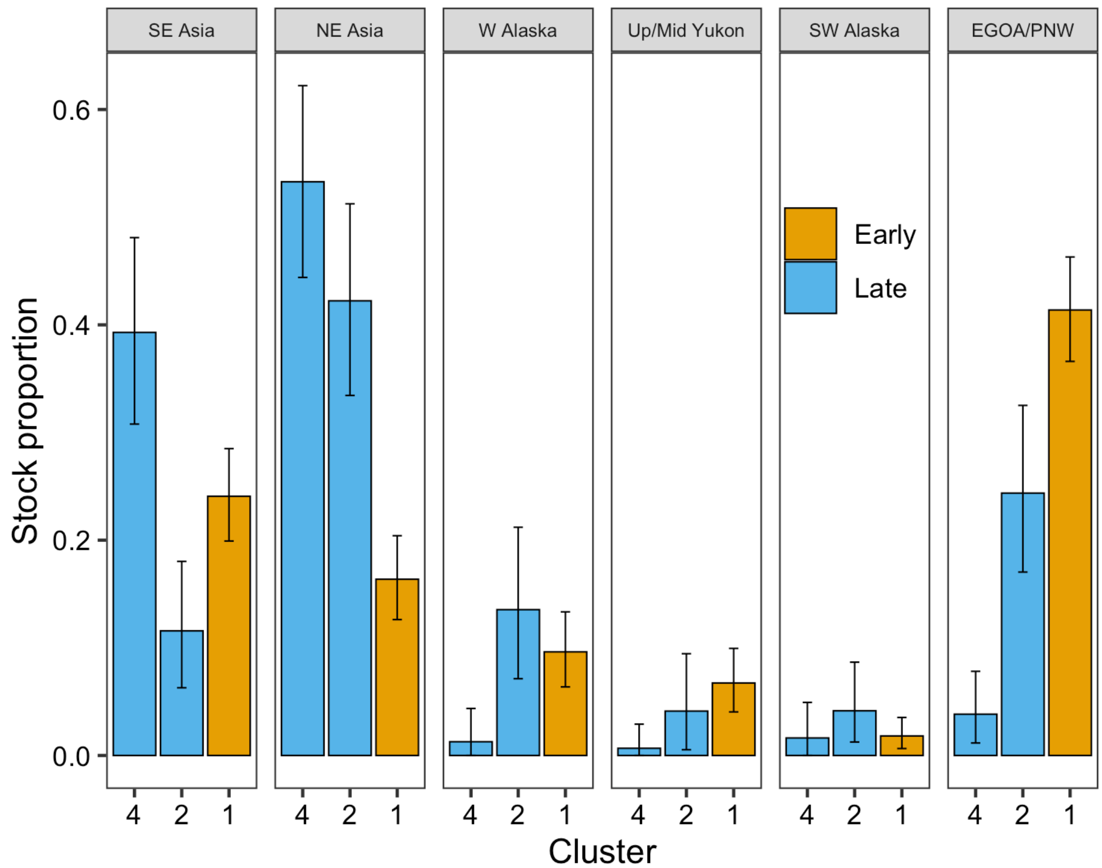

Figure 11: Stock composition estimates for the chum salmon collected from four spatial clusters along the continental shelf edge during Early (Weeks 24-32) and Late (Weeks 33-43) time periods of the 2024 Bering Sea, B-season pollock fishery. Clusters are ordered from west (cluster 4) to east (cluster 1).

Sector Trends

Reporting group contributions to the 2024 chum salmon bycatch from each fishing sector were generally consistent with historic patterns. The Western Alaska regional group comprised a larger proportion of the shoreside and mothership sectors' bycatch (9.7% and 12.3% respectively) compared to the catcher processor sector (1.9%; Figure 12A). The total number of Western Alaska chum salmon caught by the shoreside sector (1,914) was

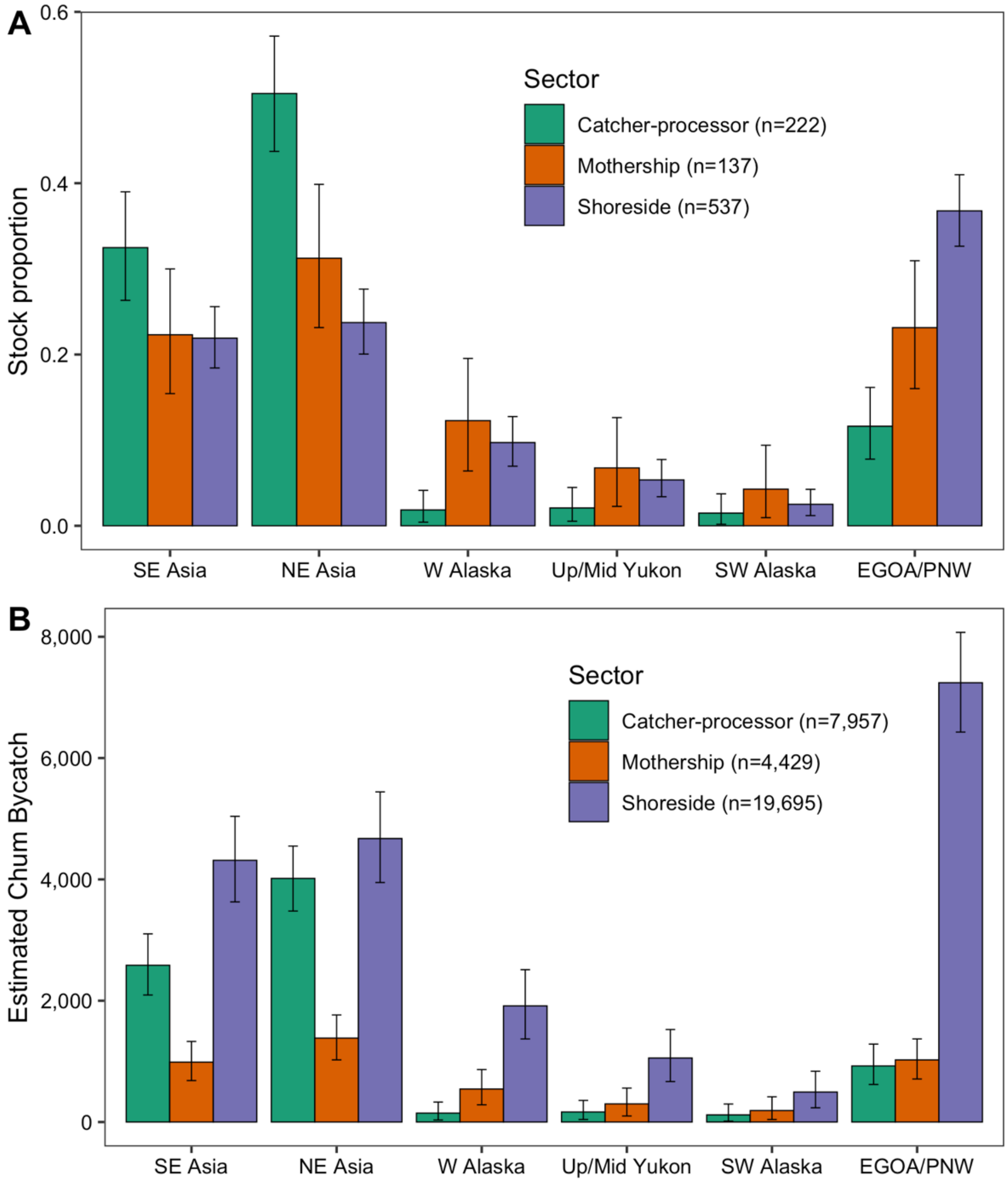

Figure 12: Stock composition estimates for the chum salmon bycatch from the 2024 Bering Sea, B-season pollock fishery from the catcher-processor, shoreside, and mothership fishing sectors. Sample sizes for mixture analysis given in legend. Proportions in top panel; numbers of fish in bottom panel.

greater than that caught by the catcher-processor (147) or mothership sector (543). The overall proportion of the Upper/Middle Yukon group was similar across sectors (all credible intervals overlapped); however, the estimated number of Upper/Middle Yukon chum salmon from the shoreside sector was on average 822 chum salmon more than the catcher-processor and mothership sectors (Figure 12B). Additionally, despite the overlapping credible intervals for Southwest Alaska reporting group proportional estimates, because the shoreside sector had a larger total bycatch, they caught on average 341 more Southwest Alaska origin chum salmon than the catcher processor and mothership sectors.

As is typical, the catcher processor sector, which fishes further to the west and encounters most of its chum salmon bycatch in clusters 4, 3, and 2, had a higher proportion of both Asia regional groups than the shoreside sector. Typically, the proportion of Asia reporting groups to the mothership sectors bycatch is intermediate to the catcher processor and shoreside sector; however, this year the Southeast Asia proportions were more similar to the catcher processor sector. The overlap in stock composition between the shoreside and mothership sectors likely reflects the similarities in where the majority of their bycatch was encountered (Figure 5).

Kotzebue Sound

In spite of the declines observed for other Coastal Western Alaska regions, commercial harvest data from 2001 to 2018 suggested that Kotzebue Sound chum salmon populations may be less effected by the driver of these declines. While the total number of permits were reduced relative to the highs in the early 1980s, the recent harvest of of chum salmon has been some of the largest commercial harvests on record (Figure 13); however, harvest per permit in 2020, 2021 and 2023 were near the long-term average. In 2024, total harvest was the lowest since the state of Alaska started managing the Kotzebue District.

Recently ABL switched to a new genetic marker panel and baseline that permitted an evaluation of Kotzebue Sound as a reporting group distinct from the rest of Western Alaska (DeCovich et al. 2012). The Kotzebue reporting group now consists of 11 populations: Kelly River, Noatak River, Kobuk River (3 collections), Inmachuk River, Serpentine River, Nuluk River, American River, Agiapuk River, and Belt Creek.

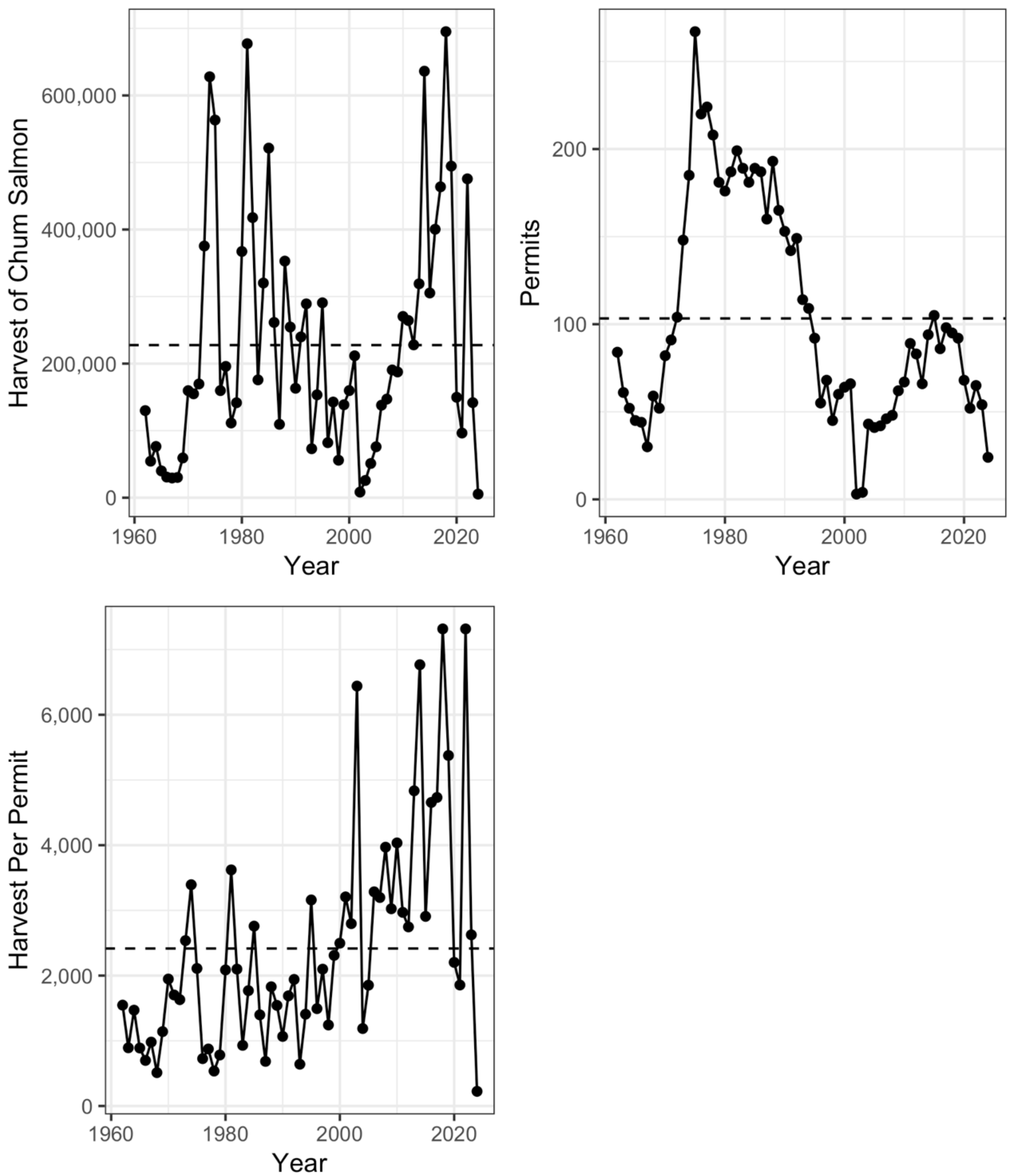

Figure 13: Kotzebue District chum salmon catch from 1962 - 2024. Long-term means denoted with horizontal dashed line. Source: *https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/norton_kotzebue/2024_kotzebue_salmon_summary.pdf*

In 2024, Kotzebue Sound represented a small proportion of the B-season bycatch. The Kotzebue Sound region comprised 0.5% (0.2-1.8% CI) of the chum salmon bycatch (Figure 14). When multiplied by the total bycatch of 32,081 for the B-season, the number of Kotzebue Sound chum salmon was 175 chum salmon (73-579 CI). With the collections from Kotzebue Sound removed from the Western Alaska reporting group, the contribution of Western Alaska to the B-season bycatch dropped from 8.3% to 7.9%. When multiplied by the total bycatch for the B-season, the total number of Western Alaska chum salmon caught as bycatch decreases from 2,658 (1,988-3,387 CI) to 2,414 (1,686-3,159 CI) chum salmon.

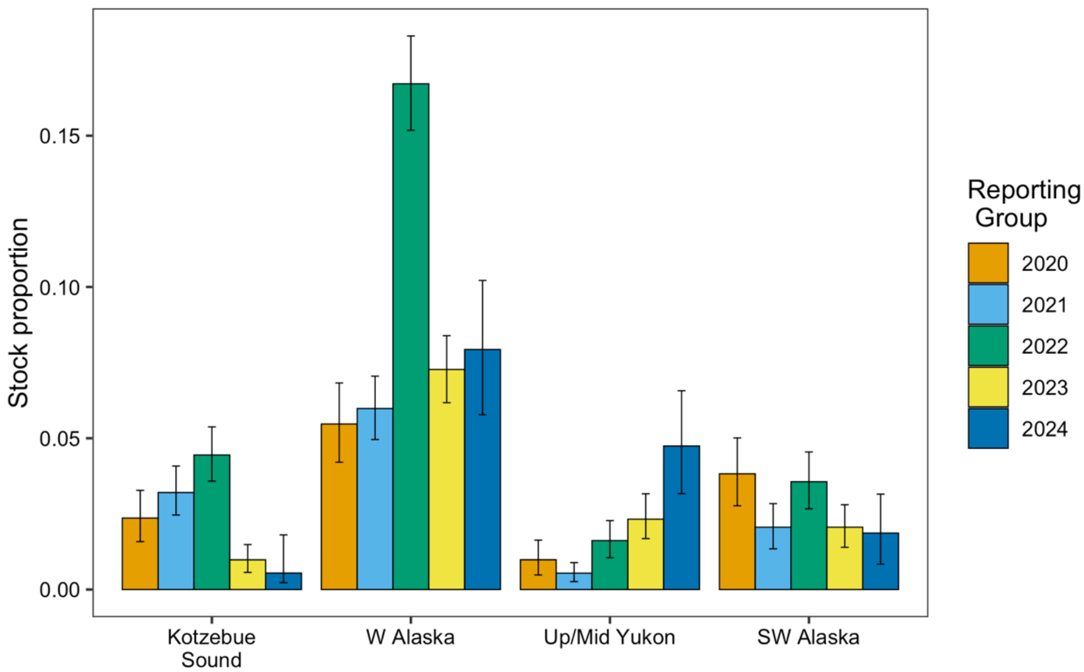

Figure 14: Comparisons of stock composition estimates for Alaska reporting groups (with Kotzebue Sound broken out) from chum salmon bycatch in the Bering Sea, B-season pollock fishery from 2020 to 2024.

There was a substantial increase in the contribution of Kotzebue Sound reporting group between 2020 and 2022, but that in 2023 and 2024, the contribution dropped (Figure 14). In 2020, Kotzebue sound was 2.4% (1.6 - 3.3%) and by 2022 it increased to 4.4% (3.6-5.4%). In 2024, its contribution declined to 0.5% (0.2-1.8%) The increasing contribution of the Kotzebue Sound reporting group to the bycatch observed between 2020 and 2022 may reflect the same increase observed in the commercial harvest per permit between 2021 and 2022 (Figure 13) as we see both a drop in harvest per permit and the regions relative contribution to the bycatch in 2023 and 2024.

Summary of Coastal Western Alaska and Upper Middle Yukon stocks

In 2024 there was a marked reduction in the total bycatch of chum salmon, while the proportion of Western Alaska chum salmon remained similar to 2023, but lower than the long term average. In 2024, 2,658 (1,988-3,387 CI) Western Alaska chum salmon were caught in the pollock fishery during the B-season. Additionally, 1,547 (1,042-2,150 CI) Upper / Middle Yukon and 627 (300-1,032 CI) Southwest Alaska chum salmon were caught. Combined, these three reporting groups accounted for 15.1% which when multiplied by the total bycatch expands to 4,833 chum salmon.

The Western Alaska reporting group was encountered in its highest proportions East of 170°W as has been the historic trend. Both the Upper/Middle Yukon and Southwest Alaska regional groups contributed relatively little to the overall bycatch with no strong spatial or temporal trends in their encounter (overlapping credible intervals); however Upper/Middle Yukon represents an increasing proportion of the bycatch since 2021.

As a result of different fleet distributions, the relative proportion of Western Alaska chum salmon encountered by the catcher-processor compared to the mothership and shoreside sectors differed substantially. In 2024, the catcher-processor sector encountered much of its bycatch further north and west than the mothership and shoreside sectors. Because of these spatial differences in chum salmon bycatch distribution, the Western Alaska reporting group comprised a larger proportion of the shoreside and motherships sectors' bycatch (9.7 and 12.3% respectively) compared to the catcher-processor sector (1.9%). The relative proportion of Upper/Middle Yukon and Southwest Alaska were similar across sectors, averaging 4.7% and 2.8% for each reporting group, respectively. With a greater proportion of Western Alaska chum salmon in their bycatch and a larger overall bycatch, the shoreside sector caught substantially more Western Alaska chum salmon (1,914) than either the mothership (543) or the catcher processor (147) sectors.

Acknowledgements

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Appendix I - GSI Estimates

Regional stock composition estimates of chum salmon samples from the 2024 Bering Sea, B-season pollock trawl fishery.

B-season (PSC = 32,081; n = 896)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	7,832	6,923-8,773	0.244	0.216	0.273	0.00	1.00
NE Asia	10,254	9,242-11,295	0.320	0.288	0.352	0.00	1.00
W Alaska	2,658	1,988-3,387	0.083	0.062	0.106	0.00	1.00
Up/Mid Yukon	1,547	1,042-2,150	0.048	0.032	0.067	0.00	1.00
SW Alaska	627	300-1,036	0.020	0.009	0.032	0.00	1.00
E GOA/PNW	9,161	8,213-10,142	0.286	0.256	0.316	0.00	1.00

East of 170° (PSC = 23,747; n = 672)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	4,761	4,046-5,515	0.201	0.170	0.232	0.00	1.00
NE Asia	6,360	5,550-7,204	0.268	0.234	0.303	0.00	1.00
W Alaska	2,611	1,979-3,299	0.110	0.083	0.139	0.00	1.00
Up/Mid Yukon	1,151	704-1,683	0.048	0.030	0.071	0.00	1.00
SW Alaska	583	285-959	0.025	0.012	0.040	0.00	1.00
E GOA/PNW	8,278	7,411-9,168	0.349	0.312	0.386	0.00	1.00

West of 170° (PSC = 8,334; n = 224)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	3,210	2,677-3,763	0.385	0.321	0.451	0.00	1.00
NE Asia	3,938	3,375-4,509	0.473	0.405	0.541	0.00	1.00
W Alaska	105	11-287	0.013	0.001	0.034	0.00	1.00
Up/Mid Yukon	229	75-455	0.028	0.009	0.055	0.00	1.00
SW Alaska	95	0-305	0.011	0.000	0.037	0.08	1.00
E GOA/PNW	755	460-1,104	0.091	0.055	0.132	0.00	1.00

Catcher-processor (PSC = 7,957; n = 222)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	2,584	2,094-3,103	0.325	0.263	0.390	0.00	1.00
NE Asia	4,016	3,478-4,549	0.505	0.437	0.572	0.00	1.00
W Alaska	147	34-330	0.019	0.004	0.041	0.00	1.00
Up/Mid Yukon	166	43-356	0.021	0.005	0.045	0.00	1.00
SW Alaska	118	14-297	0.015	0.002	0.037	0.00	1.00
E GOA/PNW	925	619-1,285	0.116	0.078	0.162	0.00	1.00

Mothership (PSC = 4,429; n = 137)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	987	684-1,328	0.223	0.154	0.300	0.00	1.00
NE Asia	1,383	1,025-1,766	0.312	0.231	0.399	0.00	1.00
W Alaska	543	284-865	0.123	0.064	0.195	0.00	1.00
Up/Mid Yukon	299	100-560	0.068	0.023	0.126	0.00	1.00
SW Alaska	189	42-416	0.043	0.010	0.094	0.00	1.00
E GOA/PNW	1,024	710-1,371	0.231	0.160	0.309	0.00	1.00

Shoreside (PSC = 19,695; n = 537)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	4,314	3,629-5,040	0.219	0.184	0.256	0.00	1.00
NE Asia	4,672	3,949-5,443	0.237	0.200	0.276	0.00	1.00
W Alaska	1,914	1,370-2,512	0.097	0.070	0.128	0.00	1.00
Up/Mid Yukon	1,055	668-1,525	0.054	0.034	0.077	0.00	1.00
SW Alaska	494	235-838	0.025	0.012	0.043	0.00	1.00
E GOA/PNW	7,242	6,428-8,072	0.368	0.326	0.410	0.00	1.00

Cluster 1 Early (PSC = 12,821; n = 394)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	3,087	2,554-3,654	0.241	0.199	0.285	0.00	1.00
NE Asia	2,099	1,618-2,618	0.164	0.126	0.204	0.00	1.00
W Alaska	1,233	817-1,710	0.096	0.064	0.133	0.00	1.00
Up/Mid Yukon	863	519-1,275	0.067	0.040	0.099	0.00	1.00
SW Alaska	232	83-453	0.018	0.006	0.035	0.00	1.00
E GOA/PNW	5,305	4,693-5,937	0.414	0.366	0.463	0.00	1.00

Cluster 2 Late (PSC = 4,759; n = 122)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	550	299-858	0.116	0.063	0.180	0.00	1.00
NE Asia	2,009	1,592-2,439	0.422	0.334	0.512	0.00	1.00
W Alaska	644	339-1,009	0.135	0.071	0.212	0.00	1.00
Up/Mid Yukon	196	25-450	0.041	0.005	0.095	0.00	1.00
SW Alaska	197	59-412	0.041	0.012	0.087	0.00	1.00
E GOA/PNW	1,159	811-1,547	0.244	0.170	0.325	0.00	1.00

Cluster 4 Late (PSC = 4,684; n = 128)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	1,840	1,442-2,253	0.393	0.308	0.481	0.00	1.00
NE Asia	2,496	2,080-2,914	0.533	0.444	0.622	0.00	1.00
W Alaska	59	0-205	0.013	0.000	0.044	0.09	1.00
Up/Mid Yukon	31	0-136	0.007	0.000	0.029	0.20	1.00
SW Alaska	76	0-231	0.016	0.000	0.049	0.05	1.00
E GOA/PNW	179	54-366	0.038	0.012	0.078	0.00	1.00

Early (PSC = 13,367; n = 404)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	3,529	2,967-4,127	0.264	0.222	0.309	0.00	1.00
NE Asia	2,369	1,876-2,912	0.177	0.140	0.218	0.00	1.00
W Alaska	1,130	725-1,591	0.085	0.054	0.119	0.00	1.00
Up/Mid Yukon	971	617-1,387	0.073	0.046	0.104	0.00	1.00
SW Alaska	120	11-295	0.009	0.001	0.022	0.01	1.00
E GOA/PNW	5,245	4,618-5,890	0.392	0.345	0.441	0.00	1.00

Middle (PSC = 11,531; n = 308)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	2,273	1,769-2,825	0.197	0.153	0.245	0.00	1.00
NE Asia	4,911	4,250-5,579	0.426	0.369	0.484	0.00	1.00
W Alaska	957	590-1,393	0.083	0.051	0.121	0.00	1.00
Up/Mid Yukon	300	101-577	0.026	0.009	0.050	0.00	1.00
SW Alaska	434	165-792	0.038	0.014	0.069	0.00	1.00
E GOA/PNW	2,653	2,127-3,221	0.230	0.184	0.279	0.00	1.00

Late (PSC = 7,183; n = 184)

Region	Est. num.	Est. CI	Mean	2.5%	97.5%	P=0	SF
SE Asia	2,055	1,588-2,562	0.286	0.221	0.357	0.00	1.00
NE Asia	3,250	2,706-3,803	0.452	0.377	0.529	0.00	1.00
W Alaska	449	204-770	0.063	0.028	0.107	0.00	1.00
Up/Mid Yukon	180	43-393	0.025	0.006	0.055	0.00	1.00
SW Alaska	209	29-477	0.029	0.004	0.066	0.00	1.00
E GOA/PNW	1,037	687-1,444	0.144	0.096	0.201	0.00	1.00

Appendix II - GSI Methods

Sequencing libraries are prepared using the Genotyping-in-Thousands by Sequencing (GT-seq) protocol (Campbell 2015). PCR is performed on extracted DNA with primers that amplify 84 SNP loci in the WASSIP chum panel (DeCovich et al. 2012; Table A1). These PCR products are then indexed in a barcoding PCR, normalized using SequalPrep plates (Invitrogen) and each 96 well plate is subsequently pooled. Next, a double-sided bead size selection is performed using AMPure XP beads (Beckman Coulter), using ratios of beads to library of 0.5x to remove non-target larger fragments and then 1.2x to retain the desired amplicon. Libraries are sequenced on a MiSeq (Illumina) using a single 150-cycle lane run with 2×75 bp paired-end (PE) chemistry. PE reads for each individual are joined with FLASH2 (Magoč & Salzberg, 2011; https://github.com/dstreett/FLASH2). Merged reads are are genotyped with the R package GTscore (McKinney; https://github.com/gjmckinney/GTscore). Individuals with low quality multilocus genotypes (<80% of loci scored) are discarded. We re-genotype 5% of all project individuals as quality control measures.

Mixtures were created by separating sampled fish into spatial and temporal groups from observer data from the AKFIN database. Genetic stock identification was performed with the conditional genetic stock identification model in the R package rubias (Moran and Anderson 2019). As described previously (Gray 2010), with minor changes to regional group names, baseline populations, listed in Table A2, were grouped into six regions: Southeast Asia (SE Asia), Northeast Asia (NE Asia), Western Alaska (W Alaska), Upper/Middle Yukon (Up/Mid Yukon), Southwest Alaska (SW Alaska), and the Eastern GOA/Pacific Northwest (EGOA/PNW). For all estimates, the Dirichlet prior parameters for the stock proportions were defined by region to be $1/(GC_g)$, where C_g is the number of baseline populations in region g, and G is the number of regions. To ensure convergence to the posterior distribution, six separate MCMC chains of 100,000 iterations (burn-in of 50,000) of the non-bootstrapped model were run, which each chain starting at disparate values of stock proportions; configured such that for each chain 95% of the mixture came from a single designated reporting group (with probability equally distributed among the populations within that reporting group) and the remaining 5% equally distributed among remaining reporting groups.The convergence of chains for each reporting group estimate was assessed with the Gelman-Rubin statistic (Gelman 1992) estimated with the gelman.diag function in the coda library (Plummer 2006) within R. Once chain convergence was confirmed, inference was conducted with the conditional genetic stock identification model with bootstrapping over reporting groups (MCMC chains of 100,000 iterations, burn-in of 50,000, 100 bootstrap iterations).

The stock composition estimates were summarized by the mean, standard deviation, median, 95% credible interval (2.5th and 97.5th percentile of the MCMC iterates in the posterior output), and $P = 0$, which is the probability that a stock composition estimate is effectively zero (Munro et al. 2012). The $P = 0$ statistic is the frequency of the last half of the MCMC iterates of each chain for which the individual regional contribution to the mixture was less than a threshold of $0.5E^{-6}$. This statistic may be more useful than the credible interval for assessing the presence or absence of minor stocks.

Appendix II Table A1: Single nucleotide polymorphisms included in the 84-SNP panel used for stock composition analysis of chum salmon bycatch samples from the 2023 Bering Sea B-season pollock trawl fishery.

Locus	Ploidy	SNPpos	Allele1	Allele2	Probe1	Probe2	Primer	Primer Conc. (uM)
Oke_ACOT-100	2	1	C	G	CTTCCGCTCTCTACTCC	TTCCGCTCTGTACTCC	TCAGGGACGATAAAGGGATCATCTT	0.2000
Oke_ATP5L-105	2	1	C	G	AGTATATTGAGATGAATCCCAC	ATATTGAGATGAATGCCAC	GTGCACACCAATCCATTTCTGAAT	0.2500
Oke_AhR1-78	2	1	G	A	CAGCCTCGGTGCCAT	TCAGCCTCAGTGCCAT	AGCAGAACCAGCACCTACAG	0.2000
Oke_CATB-60	2	1	C	T	CAGGAACGGGTATGAG	CAGGAACGAGTATGAG	GCTTCTATGGGTCCTACTACCGTAT	0.2500
Oke_CD81-108	2	1	G	T	TCCGGCATGTCCCAG	TCCGGCATTTCCCAG	CAGTATCATCATACAGCACAGATACAACA	0.2500
Oke_CD81-173	2	1	A	C	CAGTCACAGAGAGTCAC	AGTCACAGCGAGTCAC	GATGACTGGAGTCAGCTTGCA	0.2000
Oke_CKS-389	2	1	G	A	AAATGAATGATAATGTGTTCTG	AAATGAATGATAATATGTTCTG	GGGCCATTCTCTGAGTTCAGT	0.2500
Oke_CKS1-94	2	1	G	T	TCTGGATAAATTTGTGTATTC	TTCTGGATAAATTTTTGTATTC	TCTTCGACATGTTTAATCGAACAGAAGT	0.2500
Oke_DCXR-87	2	1	A	T	CCTGTTTGTTGAAACCGTA	CCTGTTTGTTGTAACCGTA	GTCACCCAGAACAATAGAATGAGTCT	0.2500
Oke_FANK1-166	2	1	C	T	CTACAGCCCGGCTGTG	CTACAGCCCAGCTGTG	ACTCACGTGTGGTAGAGACAGA	0.2500
Oke_FBXL5-61	2	1	G	A	TCTGAGGGAAACTGC	TCTGAGGAAAACTGC	TGGTGTGTAACGTCAGTGACTTAAG	0.3000
Oke_GHII-3129	2	1	G	A	CAGGGCGACTCTAT	ACAGGGCAACTCTAT	GTCAAGCTGATACCACTCAAATCTCA	0.3000
Oke_GPDH-191	2	1	T	A	CGGAGCCACTTCCAGTA	CGGAGCCACTACCAGTA	CCTGTACCTATAGGGCAACTTCAC	0.2000
Oke_GPH-105	2	1	T	G	CCAGTAATTGGTATTTTGA	CCAGTAATTGGTCTTTTGA	CAGATCAACCCTGGAAAAATATCTGATGT	0.2500
Oke_HP-182	2	1	A	C	AGAAAAGGTGAGCTAGTATG	AAAAGGTGAGCTCGTATG	CCGATGACTCCAAAGAAGTTGCT	0.2500
Oke_IL8r2-406	2	1	T	G	AAACACAAAACCCC	AAACACAAACCCCC	GGATGGACATTCACAGTCTGGTT	0.2000
Oke_KPNA2-87	2	1	T	A	ACAGAACAGAAACAGTG	AACAGAACAGTAACAGTG	AGGCAGCCAGGTAAGTCAGTA	0.1875
Oke_LAMP2-186	2	1	A	G	CTAACTTTACAAAGACACTGC	AACTTTACAAAGGCACTGC	TTCTAGCCATGACCCAATGAAAGG	0.2500
Oke_MLRN-63	2	1	G	A	CTGGTGATTGACGATCC	CTGGTGATTAACGATCC	CCATTTCAGCATTGCCAGATTTGAAA	0.2500
Oke_Moesin-160	2	1	T	G	CATTTTGTAATTCTAATTTTAAGC	ATTTTGTAATTCTAATGTTAAGC	TTTCAGCAAATGAAGAGAACATCAAACTG	0.2500
Oke_NUPR1-70	2	1	G	T	TATGAGGACGGGTCACA	TATGAGGACTGGTCACA	AGACGGTGAACTCTGCTGTAGA	0.3000
Oke_PPA2-635	2	1	C	T	TTGCCTCCCCCGCTC	TTATTGCCTCTCCCGCTC	ACACAACTGACCATATTGACTTTCGA	0.2500
Oke_RFC2-618	2	1	G	A	CAGCTCCTGGACTCA	CAGCTCCTAGACTCA	GACAATGTGTTAGTGTAGGCTTCACT	0.2000
Oke_RH1op-245	2	1	C	T	AGTGGTGAAGCCTC	TAGTGGTAAAGCCTC	TGGCCGATCTCTTCATGGTAATC	0.2500
Oke_RS27-81	2	1	G	A	TGTCCAGGCGTCATGA	TGTCCAGGCATCATGA	GCAACAAAGTGGACTATCACATTGAA	0.3000
Oke_RSPRY1-106	2	1	A	T	TAGTCTCTTTACATAATCTC	TAGTCTCTTTACTTAATCTC	GTCCTCCCTATTCTTCCACTTACCT	0.2500
Oke_TCP1-78	2	1	A	G	ATACTGCTCCAGAGACG	CTGCTCCAGGGACG	CTCCAGGGCATCAGCAAATG	0.2000
Oke_Tf-278	2	1	C	A	ATTTTACAGTTGACATTCAA	TTTTACAGTTGAAATTCAA	GCCACAATTGTAATTCTAGATCCAGAGT	0.2500
Oke_U1008-83	2	1	A	G	CCGTTCTCTTCTTGGACAC	CGTTCTCTTCCTGGACAC	GTCACCAAACATCCTGCGAATG	0.3000
Oke_U1010-251	2	1	A	G	ATAGAGGTGAGCATTGACAT	TAGAGGTGAGCACTGACAT	CACCTCAATCAATCAAATGTATTTATAAAGCCA	0.1875
Oke_U1012-241	2	1	C	G	ATGGAAAAAGAACTGTTTACT	ATGGAAAAAGAACTCTTTACT	GCAGAGGTTATACCCATTTTAGATGCA	0.2500
Oke_U1015-255	2	1	A	G	CAAACACACACAGAGCC	AACACACGCAGAGCC	CAGAGTGCAGAGTAATACGCATACA	0.2500
Oke_U1016-154	2	1	C	T	CCATGTTTGCGGTATGT	CCATGTTTGCAGTATGT	GCAGGTTGCTAAGTCATGTTACACA	0.3000
Oke_U1017-52	2	1	C	T	AGAGAGTTGTCGTTCATC	AGAGAGTTGTCATTCATC	TGGCAATGGGATGTCAAGTTATGA	0.3000
Oke_U1018-50	2	1	C	T	CTGGGCACGTACAGCT	CTGGGCACATACAGCT	TCCAGGTTGCTGACAATGTAAAAGT	0.3000
Oke_U1022-139	2	1	A	G	CTGGAACATGAAGCAAA	TGGAACATGGAGCAAA	AACATTAAAACTGTGGTTTTGACCTCTTG	0.2500
Oke_U1023-147	2	1	A	C	CATCAGGGAAAGCCTACAAA	AGGGAAAGCCGACAAA	TCTTAAAATGGAGAGAGCGATTAATGAAGG	0.2500
Oke_U1024-113	2	1	A	G	CCAGAAACAACTTAATTAT	CAGAAACAACTCAATTAT	CATGCTGGTGAATTATTGGACAATGT	0.2500
Oke_U1025-135	2	1	G	T	ACTTAGTCTATTTGTAACTTT	ACTTAGTCTATTTTTAACTTT	GGCTAGGGTTCTATTTGGACCAT	0.2500
Oke_U2007-190	2	1	C	G	CTAAAAGCTGAGAATAAAT	AAAGCTGACAATAAAT	ACAGGCTGTGATGAGTTAACAATGTAAA	0.2500
Oke_U2011-107	2	1	G	T	TTCTGTGAGAGATTTAG	TTTCTGTGAGATATTTAG	CCGTTTCTGTCAGACTCTGGTAAA	0.1250
Oke_U2015-151	2	1	C	T	AATTGATCACGATCATTC	ATTGATCACAATCATTC	GCATTTTATCCTCAAACTTTTCAACTGACA	0.2500

Appendix II Table A1

Locus	Ploidy	SNPpos	Allele1	Allele2	Probe1	Probe2	Primer	Primer Conc. (uM)
Oke_U2025-86	2	1	G	A	ACTTTTTTGTCGTTTTTTT	ACTTTTTTGTCATTTTTTT	AAATCCCCATGGAGAAACACAATGA	0.2000
Oke_U2029-79	2	1	C	T	AGGTGTACTGAAGAGAC	AGGTGTACTAAAGAGAC	GGTTTGATTTCGTCGCGATTTGA	0.2500
Oke_U2032-74	2	1	G	A	CAATAAAGTGCTAGGTGTCC	CAATAAAGTGCTAAGTGTCC	GCTATTCCAATGTAAATCCTGTACTGTGT	0.2000
Oke_U2034-55	2	1	C	T	ATGTCAAATCACGCTGATG	ATGTCAAATCACACTGATG	GGGAAGAAAAGCCTACCATAAACAG	0.2500
Oke_U2035-54	2	1	G	A	CACCAATAACGTCCTAATC	CACCAATAACATCCTAATC	CGCCAATAACGCTCCAACAAC	0.2500
Oke_U2041-84	2	1	G	T	CAGATCCGGTGTATGC	ACAGATCCTGTGTATGC	CCAGACCATGTGCTTGTTTGTCATA	0.2500
Oke_U2043-51	2	1	G	A	TCTGGAGGCGTATTGG	CTGGAGGCATATTGG	CACAAACCTACTACAGACAGCAGTT	0.2000
Oke_U2048-91	2	1	A	C	CAGCCTCATAAGATGTTTA	CAGCCTCATAAGCTGTTTA	AGTTGGGTCTTAAAGATGATCATTTGCT	0.2000
Oke_U2050-101	2	1	C	T	AATTGATCTACAGCTGCACG	AATTGATCTACAACTGCACG	CTCTGAGTGTCACAATCACATATCGT	0.2000
Oke_U2053-60	2	1	C	T	CACACATATGAGATGCC	CACACATATAAGATGCC	TCTGCTTTTGTCGTCTCACCAA	0.1875
Oke_U2054-58	2	1	C	T	ATGCCCAATTACGTCAGCA	TGCCCAATTACATCAGCA	CGTCTCATTCAGCTCTTTGATGTC	0.2000
Oke_U2056-90	2	1	G	T	CGAAGTGATGAAGGTGACAA	CGAAGTGATGAATGTGACAA	CCATCACGTCACCATTACACTGT	0.1875
Oke_U2057-80	2	1	A	G	CACGTTTTCTCTTTTCTC	ACGTTTTCTCCTTTCTC	GCAGTTGTCATGGCAGTAAGG	0.2500
Oke_U212-87	2	1	C	A	CTTGTGACATTCCTCTCT	CTTGTGACATTACTCTCT	TTGATTCATACTCAAGGTGAGCAGATT	0.2500
Oke_U302-195	2	1	C	A	TTGTCAAAGGAATCATTT	TGTCAAAGGAATAATTT	GACCCTCAGCTATTTTAAGAACCTCAA	0.2500
Oke_U504-228	2	1	A	G	TGGCTCAAACTTG	TTGGCTCGAACTTG	CTTAACTCAGTCACACCAACTCACT	0.2500
Oke_U506-110	2	1	C	T	TTGTAAGTTGTGGCTAAAA	TTGTAAGTTGTGACTAAAA	CGTGGTTGGTTTCATTGACTCTCA	0.2000
Oke_U507-286	2	1	T	G	CTGCTGTTCATAAAAGTA	CTGCTGTTCATACAAGTA	TGGTCATAGCTTGCACTGTACAAA	0.3000
Oke_U509-219	2	1	C	T	CCTCTCTGCAGGGCT	CCCTCTCTACAGGGCT	GCACCCCACCTGGCTT	0.1250
Oke_arf-319	2	1	T	C	CTGTGTGAATTGCCTC	CTGTGTGAACTGCCTC	TGCAGAAACTGATCATTGGTAGTGG	0.1875
Oke_azin1-90	2	1	C	T	CCTTTATCTGAGGAACTG	CCTTTATCTGAAGAACTG	GGGAATAGTGTCATTTGGGATGCAT	0.2500
Oke_brd2-118	2	1	C	T	ATGACGAAGCTCTCC	ATGACGAAACTCTCC	CTCAAGCCCTCCACACTCA	0.2000
Oke_brp16-65	2	1	C	T	ACGTTGCCTGTCCAC	ACGTTGCCTATCCAC	TCCACGTCACTCAGCATGATG	0.2500
Oke_ccd16-77	2	1	A	C	CCAGCCCCCTCTGAAA	AGCCCCCGCTGAAA	TGTCTTCAGAATCCAATGCTTTCCT	0.1875
Oke_e2ig5-50	2	1	C	T	CATCTTTGTATCTGTGCCATT	TCATCTTTGTATCTATGCCATT	GCACTGCTCATTCTGTCACATG	0.2500
Oke_eif4g1-43	2	1	G	T	CTGAGATTCTTCATCTTTTAC	TGAGATTCTTCATATTTTAC	GCACCCAACAGTTCATCATGTAAGT	0.2500
Oke_f5-71	2	1	C	T	CAGGTGCGTGCAGTAA	TCAGGTGCATGCAGTAA	CTCAAATTTCCCTTTGACATCAATTCATCA	0.2500
Oke_gdh1-62	2	1	C	T	TTCTGTGTCCCGTGACCT	CTGTGTCCCATGACCT	CCACGTGATACAGGGAGATGTG	0.2000
Oke_glrx1-78	2	1	C	T	TGGGCATTTAGAGTTTATT	TGGGCATTTAGAATTTATT	CGCTCCGTCCAGTGATGTC	0.2500
Oke_il-1racp-67	2	1	G	A	CGTACGAGATGTAGATGT	CGTACGAGATATAGATGT	AATTGCTCCTCCTCGCTATTTCTC	0.2000
Oke_mgll-49	2	1	A	T	ATTTATGGGTGTTCCCC	TTATGGGAGTTCCCC	ACATTGTAATCTGTATTAGTCCAATGCAGAC	0.2500
Oke_nc2b-148	2	1	A	C	TTTAGTTCTAGTCAAAAGTAG	TAGTTCTAGTCCAAAGTAG	CCAGCCTATTTCCTTTAGTGCATATGA	0.2500
Oke_pgap-111	2	1	C	T	AGCTAGCAGGCTAAAG	AGCTAGCAAGCTAAAG	TGCAGATCTCAATTTGAACGACCTAT	0.2000
Oke_psmd9-57	2	1	C	T	CATTGGCGGTGTAACG	TCATTGGCAGTGTAACG	ACTGTAGTGACTGCATTTCATATTGCT	0.2000
Oke_rab5a-117	2	1	C	T	CAGCTGTTTTTCTTGTAGCCT	AGCTGTTTTTCTTATAGCCT	GGGAATAACAGTCATTGCAGCATTT	0.2000
Oke_ras1-249	2	1	T	G	CACCAAGGTAAAAAT	CCAAGGGAAAAAT	GGATGACTAAGAGCGACTGTATGTG	0.2500
Oke_serpin-140	2	1	A	T	CAAGAACTGACCTTAGACAC	AAGAACTGACCTTTGACAC	TCCACAGTGAGTAATAAAGTTGCACAT	0.2000
Oke_slc1a3a-86	2	1	C	T	CCCAACGCGGTGATG	CCCAACGCAGTGATG	TGTCTTCATCTGTGGACTCCTACA	0.3000
Oke_sylc-90	2	1	A	T	ATATCTTTGAGACTAGATTAA	CTTTGAGACAAGATTAA	TTGAGGAAACCACTGGTCTTACAAG	0.1875
Oke_thic-84	2	1	C	T	ATGGAATGACAGCAATGT	ATGGAATGACAACAATGT	GCTGCTGTCTTAAACCACATTCTACA	0.2500
Oke_u200-385	2	1	G	T	CATTATCTCCCTGAATGTA	CATTATCTCCATGAATGTA	CCCATAATTTTGCAACCCTAGTCACA	0.2000
Oke_u217-172	2	1	T	C	CACTCTTACAAAAACA	CACTCTTACGAAAACA	GGATGGAAGAAGTTAGTTGTGTCAGA	0.3000

Appendix II Table A2: Chum salmon populations in the Alaska Department of Fish and Game (ADF&G) single nucleotide baseline. The baseline consists of 42,071 chum salmon from 382 populations arranged into six genetic reporting groups used in this report.

Population	Reporting Group	Samples	Population	Reporting Group	Samples
Abashiri River	SE Asia	79	Ozerki Hatchery - Bistraya River broodstock	NE Asia	93
Chitose River	SE Asia	108	Palana River	NE Asia	140
Gakko River	SE Asia	78	Paratunka River	NE Asia	94
Kushiro River	SE Asia	79	Penzhina River	NE Asia	43
Namdae River	SE Asia	90	Pymta River	NE Asia	147
Nishibetsu River	SE Asia	80	Tauy River	NE Asia	41
Sasanai River	SE Asia	77	Tym River	NE Asia	53
Shari River	SE Asia	75	Udarnitza River	NE Asia	44
Shinzunai River	SE Asia	80	Utka River	NE Asia	40
Teshio River	SE Asia	78	Vorovskaya River	NE Asia	101
Tokachi River	SE Asia	78	Beaver Creek	W Alaska	110
Tokoro River	SE Asia	69	Upper Nushagak River	W Alaska	97
Tokushibetsu River	SE Asia	80	Agiapuk River	W Alaska	114
Tsugaruishi River	SE Asia	80	Alagnak River	W Alaska	176
Yurappu River - early	SE Asia	80	American River	W Alaska	86
Yurappu River - late	SE Asia	80	Andreafsky River	W Alaska	180
Amur River	NE Asia	90	Aniak River	W Alaska	92
Belogolovaya River	NE Asia	45	Yellow River	W Alaska	80
Bistraya River	NE Asia	66	Swift River	W Alaska	94
Bolshaya River	NE Asia	93	Belt Creek	W Alaska	69
Hailula River	NE Asia	48	Big River	W Alaska	94
Hairusova River	NE Asia	85	Black River	W Alaska	93
Kalininka River	NE Asia	89	Blue Violet Creek - Meshik	W Alaska	74
Kamchatka River	NE Asia	49	Whale Mountain Creek	W Alaska	95
Kanchalan River	NE Asia	77	Big Creek	W Alaska	69
Kol River	NE Asia	123	Pumice Creek	W Alaska	189
Kulkuty River	NE Asia	49	California Creek	W Alaska	88
Magadan (Magadanka River?)	NE Asia	77	Chuilnak River	W Alaska	92
Naiba - Sakhalin Island	NE Asia	54	Clear Creek	W Alaska	94
Oklan River	NE Asia	75	Dakli River	W Alaska	53
Ola River	NE Asia	78	Eldorado River	W Alaska	122
Ossora River	NE Asia	87	Fish River	W Alaska	92

Appendix II Table A2 continued

Population	Reporting Group	Samples	Population	Reporting Group	Samples
George River	W Alaska	95	Osviak River	W Alaska	121
Gisasa River	W Alaska	106	Otter Creek	W Alaska	61
Goodnews River	W Alaska	275	Pikmiktalik River	W Alaska	95
Henshaw Creek - early	W Alaska	94	Pilgrim River	W Alaska	75
Holokuk River	W Alaska	103	Rodo River	W Alaska	69
Huslia River	W Alaska	95	Salmon River	W Alaska	95
Inmachuk River	W Alaska	91	Kobuk River - Selby Slough	W Alaska	90
Iowithla River	W Alaska	95	Serpentine River	W Alaska	82
Kaltag River	W Alaska	92	South Fork Koyukuk River - Early	W Alaska	90
Kanektok River	W Alaska	94	South Fork Kuskokwim River	W Alaska	95
Kasigluk River	W Alaska	68	Shaktoolik River	W Alaska	94
Kelly River (Noatak R)	W Alaska	95	Snake River	W Alaska	172
Kobuk River - at Kiana	W Alaska	95	Solomon River	W Alaska	144
Kisaralik River	W Alaska	93	Stony River	W Alaska	150
Klutuspak Creek	W Alaska	70	Stuyahok River	W Alaska	281
Kobuk River - Salmon River (Mile 4)	W Alaska	99	Sunshine Creek	W Alaska	47
Kogrukluk River	W Alaska	95	Takotna River	W Alaska	136
Kokwok River	W Alaska	131	Tatlawiksuk River	W Alaska	243
Koyuk River	W Alaska	43	Togiak River	W Alaska	262
Kwethluk River	W Alaska	143	Tolstoi Creek	W Alaska	95
Kwiniuk River	W Alaska	94	Tozitna River	W Alaska	92
Mekoryuk River	W Alaska	104	Tubutulik River	W Alaska	135
Hot Springs Creek	W Alaska	174	Tuluksak River	W Alaska	92
Melozitna River	W Alaska	91	Unalakleet River	W Alaska	237
Mulchatna River	W Alaska	91	Ungalik River	W Alaska	147
Necons River	W Alaska	133	Wandering Creek	W Alaska	50
Niukluk River	W Alaska	93	Windy Fork Kuskokwim River	W Alaska	93
Noatak River	W Alaska	92	Innoko River	W Alaska	85
Nome River	W Alaska	94	American River - NE Kodiak	SW Alaska	95
Nulato River	W Alaska	189	Dog Bay Creek	SW Alaska	95
Nuluk River	W Alaska	48	Alligator Hole	SW Alaska	183
Nunsatuk River	W Alaska	92	Main Creek	SW Alaska	85

Appendix II Table A2 continued

Population	Reporting Group	Samples	Population	Reporting Group	Samples
Barling Bay Creek - early	SW Alaska	92	Braided Creek - Meshik	SW Alaska	94
Barling Bay Creek - late	SW Alaska	78	Midway Creek	SW Alaska	94
Barling Bay Creek - middle	SW Alaska	288	Moffett Creek	SW Alaska	95
Bear Bay Creek	SW Alaska	187	Nakalilok River	SW Alaska	95
Belkofski River	SW Alaska	87	Natalia Bay Creek	SW Alaska	95
Big River	SW Alaska	95	Cape Seniavin	SW Alaska	96
Big Sukhoi	SW Alaska	189	Northeast Creek	SW Alaska	94
Canoe Bay River	SW Alaska	186	Sapsuk River	SW Alaska	144
Chichagof Bay	SW Alaska	180	Right Head Moller Bay	SW Alaska	95
Coal Creek	SW Alaska	94	Ocean Beach	SW Alaska	78
Coleman Creek	SW Alaska	95	Olds River	SW Alaska	93
Coxcomb Creek	SW Alaska	89	Pass Creek	SW Alaska	94
Deadman River	SW Alaska	95	Pauls Lake	SW Alaska	45
Deer Valley	SW Alaska	91	Peterson Lagoon	SW Alaska	181
Delta Creek	SW Alaska	95	Portage Creek	SW Alaska	190
Dog Salmon Creek	SW Alaska	65	NE Portage Creek	SW Alaska	94
Dry Bay River	SW Alaska	71	Right Head Moller Bay	SW Alaska	94
Eagle Harbor	SW Alaska	94	Rough Creek	SW Alaska	77
Foster Creek	SW Alaska	182	Ruby's Lagoon	SW Alaska	92
Frosty Creek	SW Alaska	190	Rudy Creek	SW Alaska	93
Hidden Basin Creek	SW Alaska	95	Russel Creek	SW Alaska	280
Ilnik River	SW Alaska	49	Russian Creek	SW Alaska	185
Ivanof River	SW Alaska	181	Sandy Cove	SW Alaska	186
Joshua Green River	SW Alaska	92	Shoe Creek	SW Alaska	95
Kaiugnak Lagoon	SW Alaska	93	Sitkinak Island	SW Alaska	93
Karluk Lagoon	SW Alaska	83	Smokey Hollow Creek	SW Alaska	86
Kiavak Portage	SW Alaska	76	Spiridon River	SW Alaska	89
Kizhuyak River	SW Alaska	174	Saint Catherine Cove	SW Alaska	171
Kujulik River	SW Alaska	93	Stepovak Bay	SW Alaska	143
Lawrence Valley Creek	SW Alaska	190	Stepovak River	SW Alaska	94
Little John Lagoon	SW Alaska	172	Sturgeon River	SW Alaska	109
Meshik River	SW Alaska	78	Traders Cove	SW Alaska	76

Appendix II Table A2 continued

Population	Reporting Group	Samples	Population	Reporting Group	Samples
Uganik River	SW Alaska	175	Porcupine River	Up/Mid Yukon	92
Volcano Bay	SW Alaska	95	Pelly River	Up/Mid Yukon	84
Kitoi Bay Hatchery	SW Alaska	194	Salcha River - Early	Up/Mid Yukon	150
Plenty Bear Creek - Meshik	SW Alaska	138	Salcha River - Late	Up/Mid Yukon	45
Aniakchak River	SW Alaska	94	South Fork Koyukuk River - Late	Up/Mid Yukon	92
Kialagvik Creek	SW Alaska	177	Sheenjek River	Up/Mid Yukon	266
AlagogshakCreek	SW Alaska	94	Tanana River	Up/Mid Yukon	95
Chiginagak Bay River	SW Alaska	159	Tatchun River	Up/Mid Yukon	176
North Fork Creek	SW Alaska	71	Teslin River	Up/Mid Yukon	178
Amber Bay	SW Alaska	89	Toklat River	Up/Mid Yukon	182
Gull Cape Creek	SW Alaska	186	Toklat River - Sushana River	Up/Mid Yukon	94
Wiggly Creek - Cinder River	SW Alaska	177	24 Mile - Chilkat River	EGOA/PNW	85
West Kiliuda Creek	SW Alaska	87	Admiralty Creek	EGOA/PNW	64
Zachary Bay	SW Alaska	76	Akwe River	EGOA/PNW	103
Zachar River	SW Alaska	66	Alouette River	EGOA/PNW	95
Seventeenmile Slough	Up/Mid Yukon	90	Alsek River	EGOA/PNW	84
Big Creek	Up/Mid Yukon	100	Pybus Bay	EGOA/PNW	59
Black River - fall	Up/Mid Yukon	88	Bag Harbor (Haida Gwaii)	EGOA/PNW	49
Bluff Cabin Creek	Up/Mid Yukon	99	Beartrap Creek	EGOA/PNW	582
Big Salt River	Up/Mid Yukon	69	Big Mission Creek	EGOA/PNW	56
Chandalar River	Up/Mid Yukon	148	Big Qualicum River	EGOA/PNW	72
Chena River	Up/Mid Yukon	254	Black Bay	EGOA/PNW	128
Clearwater Creek	Up/Mid Yukon	78	Brown's Peak Creek	EGOA/PNW	94
Delta River	Up/Mid Yukon	149	Carmen Lake	EGOA/PNW	67
Donjek River	Up/Mid Yukon	60	Carroll Creek - Summer run	EGOA/PNW	201
Fishing Branch	Up/Mid Yukon	477	Chilkat River - mainstem	EGOA/PNW	76
Henshaw Creek - late	Up/Mid Yukon	60	Chunilna Creek	EGOA/PNW	83
Jim River	Up/Mid Yukon	278	Coco Harbor	EGOA/PNW	99
Kantishna River	Up/Mid Yukon	94	Constantine Creek	EGOA/PNW	499
Kluane River	Up/Mid Yukon	163	Conuma River	EGOA/PNW	96
Middle Fork Koyukuk River	Up/Mid Yukon	178	Cruz Cove	EGOA/PNW	50
Minto Slough	Up/Mid Yukon	169	Dewatto River - fall run	EGOA/PNW	74

Appendix II Table A2 continued

Population	Reporting Group	Samples	Population	Reporting Group	Samples
Disappearance Creek - fall run	EGOA/PNW	310	Kalama Creek	EGOA/PNW	56
Donkey Bay	EGOA/PNW	98	Karta River	EGOA/PNW	56
Dosewillips River - summer run	EGOA/PNW	88	Keta River	EGOA/PNW	45
Dry Bay Creek	EGOA/PNW	94	Keta Creek	EGOA/PNW	95
East Alsek River	EGOA/PNW	85	Kitasoo Creek	EGOA/PNW	169
Ecstall	EGOA/PNW	50	Kitimat River	EGOA/PNW	104
Elwha River	EGOA/PNW	93	Kitwanga River	EGOA/PNW	74
Fish Creek - summer	EGOA/PNW	187	Klahini River - Unuk River	EGOA/PNW	50
Fish Creek - early	EGOA/PNW	131	Klehini River	EGOA/PNW	92
Fish Creek - late	EGOA/PNW	49	Lagoon Creek - fall run	EGOA/PNW	172
Ford Arm Lake - fall	EGOA/PNW	95	Lake Creek	EGOA/PNW	95
Gail Creek	EGOA/PNW	94	Lauras Creek	EGOA/PNW	95
Game Creek	EGOA/PNW	44	Little Creek - fall run	EGOA/PNW	95
Gastineau	EGOA/PNW	40	Lilliwaup Creek - summer	EGOA/PNW	45
Goldstream River	EGOA/PNW	95	Lilliwaup Creek - fall	EGOA/PNW	92
Grays River - fall run	EGOA/PNW	93	Long Bay	EGOA/PNW	159
Gunnuk Creek Hatchery	EGOA/PNW	95	Lover's Cove	EGOA/PNW	50
Hamilton Creek - fall run	EGOA/PNW	78	Little Qualicum River	EGOA/PNW	98
Hamma Hamma River	EGOA/PNW	197	Lower Skagit River - fall run	EGOA/PNW	91
Harding River	EGOA/PNW	58	Little Susitna River	EGOA/PNW	134
Harris River	EGOA/PNW	65	DIPAC Macaulay Salmon Hatchery - Andrew Creek	EGOA/PNW	294
Herman Creek	EGOA/PNW	94	Mace Creek (Haida Gwaii)	EGOA/PNW	48
Heerman Creek	EGOA/PNW	47	Medvejie Hatchery - Andrew Creek Stock	EGOA/PNW	147
Hidden Falls Hatchery - summer run	EGOA/PNW	95	Mill Creek	EGOA/PNW	82
Hidden Inlet	EGOA/PNW	82	Mole River	EGOA/PNW	89
Hood Bay	EGOA/PNW	133	McNeil River	EGOA/PNW	108
Humpback Creek	EGOA/PNW	94	Nahmint River	EGOA/PNW	96
I-205 Seeps - fall run	EGOA/PNW	72	Nakat Inlet - summer	EGOA/PNW	95
Inch Creek	EGOA/PNW	181	Nakwasina River	EGOA/PNW	93
Iniskin River	EGOA/PNW	94	Nanaimo River	EGOA/PNW	77
Jimmycomelately Creek - summer run	EGOA/PNW	92	North Arm Creek	EGOA/PNW	132
Johns Creek - summer run	EGOA/PNW	92	North Creek - fall run	EGOA/PNW	95