Genetic Stock Composition Analysis of the Chinook Salmon (*Oncorhynchus tshawytscha*) Bycatch from the 2021 and 2022 Bering Sea Pollock Trawl Fishery

by
C. M. Guthrie III, P. D. Barry,
Hv. T. Nguyen, C. L. D'Amelio, K. Karpan
and
W. A. Larson

Auke Bay Laboratories
Alaska Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
17109 Pt. Lena Loop Road
Juneau, AK 99801
(907) 789-6093
Chuck.Guthrie@NOAA.GOV

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ABSTRACT

Genetic analysis of Chinook salmon (*Oncorhynchus tshawytscha*) captured as bycatch in the 2020 Bering Sea-Aleutian Island (BSAI) trawl fishery for walleye pollock (*Gadus chalcogrammus*) was undertaken to determine the overall stock composition of the bycatch and examine variation in stock compositions across space and time. Samples were genotyped for 37 single nucleotide polymorphism (SNP) DNA markers and stock compositions were estimated using a SNP baseline developed by the Alaska Department of Fish and Game (ADF&G). Genetic samples were collected using a systematic random sampling protocol where one out of every 10 Chinook salmon encountered was sampled. Based on analysis of 1,195 (2021) and 461 (2022) Chinook salmon bycatch samples, Coastal Western Alaska was the largest contributor (51%) in 2021 and in 2022 comprising 40% of the bycatch, one of the two largest contributors in 2022 along with North Alaska Peninsula (44%). In 2021 there were smaller contributions from North Alaska Peninsula (28%), British Columbia (7%), and West Coast US (5%), while in 2022 there were smaller contributions from British Columbia (7%), Northwest GOA (1%) and West Coast US (5%). The proportional contribution of Western Alaska stocks was higher in 2021 and lower in 2022 than the average over the last ten years (2011-2020; 45%) and the proportion of Middle Yukon stocks was about average in 2021 (2%) but below average in 2022 (0%), while Upper Yukon (2.2%) was below average in both 2021 (0%) and 2022 (0%). In total, the estimated numbers of chinook salmon from Coastal Western Alaska stocks in 2021 and 2022 were 7,088 (6,566-7,606 95% CI), and 2,553 (2,222-2891 95% CI) respectively. These estimates were lower than the 10-year (2011-2020) average (9,149) and 2021 represented the 4th lowest catch, while 2022 was the lowest catch in the last 12 years. The estimated numbers of chinook salmon from the Middle Yukon were 260 (27-478 95% CI) in 2021 and 0 (0-26 95% CI) in 2022 while

the estimates from the Upper Yukon were 28 (1-102 95% CI), and 4 (0-35 95% CI) chinook salmon. The estimated number of fish from North Alaska Peninsula was 3,878 (3,450-4,313 95% CI) in 2021 and 2,762 (2,422-3,100 95% CI). In general, the contributions of southern stocks (British Columbia and West Coast US) were lower than average in 2021 and 2022 declining since 2018, contributions from Western Alaska were below average, contributions from North Alaska Peninsula were above average, and all other stock groups were similar to their 10-year average.

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INTRODUCTION

Pacific salmon (*Oncorhynchus* spp.) are prohibited species in the federally managed Bering Sea groundfish fisheries, which are subject to management rules (NPMFC 2017a) that are in part designed to reduce prohibited species catch, hereafter referred to as "bycatch". It is important to understand the stock composition of Pacific salmon caught in these fisheries, which take place in areas that are known feeding habitat for multiple brood years of Chinook salmon (*Oncorhynchus tshawytscha*) from many different localities in North America and Asia (Myers et al. 2007, Davis et al. 2009). Chinook salmon are economically valuable and highly prized in commercial, subsistence, and sport fisheries. Determining the geographic origin of salmon caught in federally managed fisheries is essential to understanding the effects that fishing has on Chinook salmon stock groups, especially those with conservation concerns (NPFMC 2017a). This report provides genetic stock identification results for the Chinook salmon bycatch samples collected from the Bering Sea walleye pollock (pollock; *Gadus chalcogrammus*) trawl fishery. National Marine Fisheries Service (NMFS) geographical statistical areas (NMFS area) associated with the Bering Sea groundfish fishery (NMFS areas 509-524) and Alaska Department of Fish and Game (ADF&G) statistical areas grids[1] (Fig. 1) are used to describe the spatial distribution of the Chinook salmon bycatch and genetic samples.

Amendment 91 to the North Pacific Fishery Management Council (NPFMC) Fishery Management Plan (FMP) for groundfish of the Bering Sea Aleutian Island (BSAI) Management Area was enacted in 2010 and included retention of all salmon caught in the pollock fishery. In 2011, a systematic random sampling design recommended by Pella and Geiger (2009) was

[1] http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/chart03_bs.pdf

implemented by the Alaska Fisheries Science Center's (AFSC) Fisheries Monitoring and Analysis Division's (FMA) North Pacific Groundfish and Halibut Observer Program (Observer Program) to collect genetic samples from one out of every 10 Chinook salmon encountered as bycatch in the Bering Sea pollock fishery.

In 2021 and 2022, genetic samples were collected by the Observer Program from the Chinook salmon caught as bycatch in the Bering Sea pollock fishery. The number of available samples and the unbiased sampling methodology facilitated the extrapolation of the sample stock composition to the overall Chinook bycatch from the Bering Sea pollock trawl fishery in 2021 and 2022. Samples were collected from both the Bering Sea "A" season which started 01/01/21&22 and ended 06/09/2021&22, and the Bering Sea "B" season which started 6/10/21&22 and ended 12/31/2021&22. Stock composition analyses were performed using the single nucleotide polymorphism (SNP) baseline provided by ADF&G (Templin et al. 2011), the same baseline that was used previously to estimate stock composition of samples from the 2005-2020 Chinook salmon bycatch (NMFS 2009; Guyon et al. 2010a,b; Guthrie et al. 2012-2022; Larson et al. 2013).

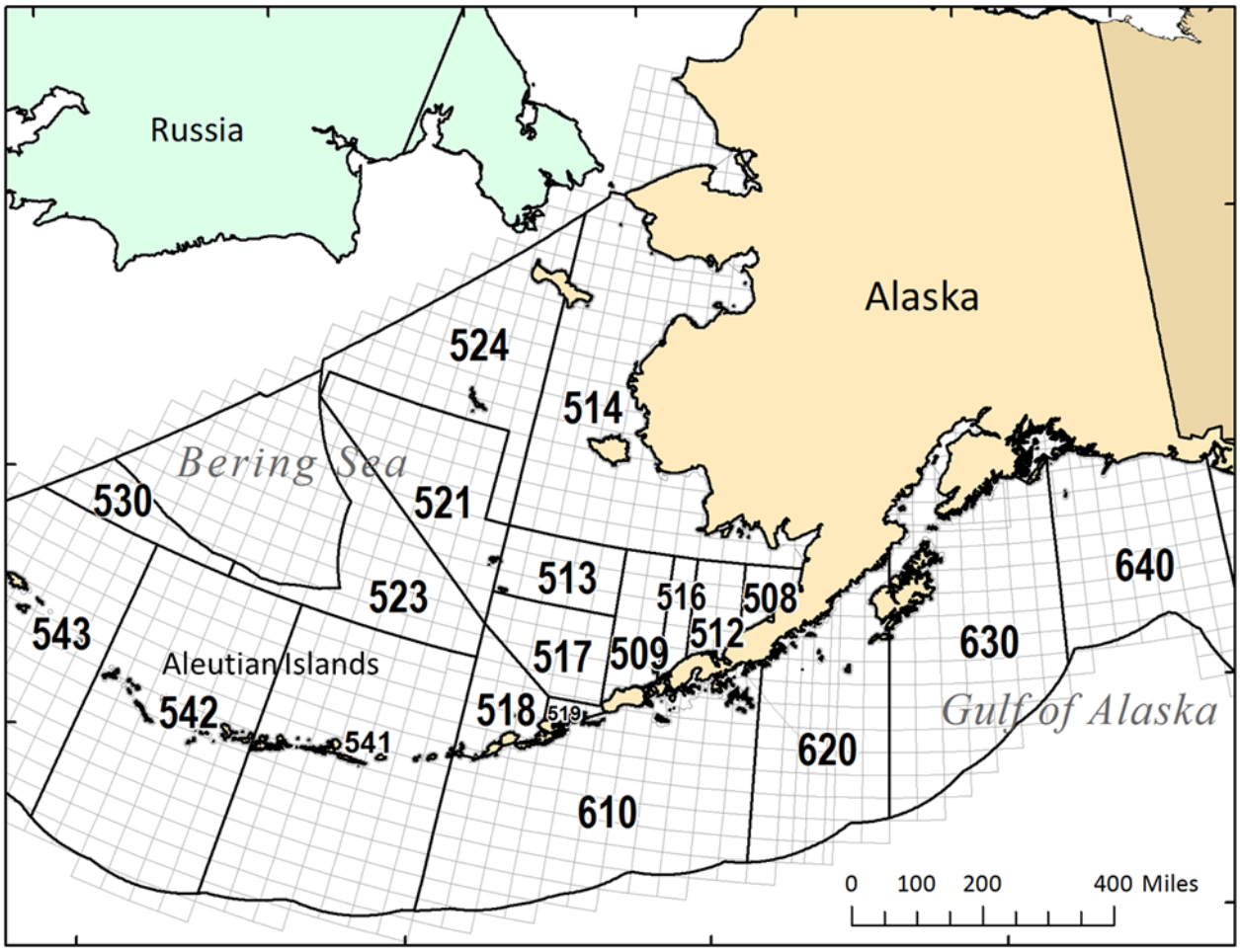

Figure 1. – NMFS (outlined in black) and ADF&G (outlined in light gray) statistical areas associated with the Bering Sea and Gulf of Alaska groundfish fisheries.

SAMPLE DISTRIBUTION

Samples were collected from Chinook salmon bycatch by the Observer Program for analysis at AFSC's Auke Bay Laboratories (ABL). Axillary process tissues and 3-4 scales were stored in coin envelopes which were labeled, frozen, and shipped to ABL for analysis. Scales were collected as an additional source for ageing and a backup for genetic analysis.

In 2021 and 2022 respectively, an estimated 13,784 and 6,337 Chinook salmon were taken in the bycatch of BSAI pollock trawl fisheries (NMFS 2021). The Chinook salmon bycatch estimates are below the historical average (34,192) between 1991 and 2020, and far below the

highest overall Chinook bycatch in 2007 when an estimated 122,195 fish were taken (Fig. 2). Of the total 2021 and 2022 bycatch respectively, 9,503 and 5,185 were from the trawl "A" season while 4,281 and 1,152 were from the "B" season. For the genetic analysis, the "B" season started on 6/01/21&22 (Statistical Week 23) because most of the "A" season samples were collected by May first. This difference is reflected in Appendix 2.

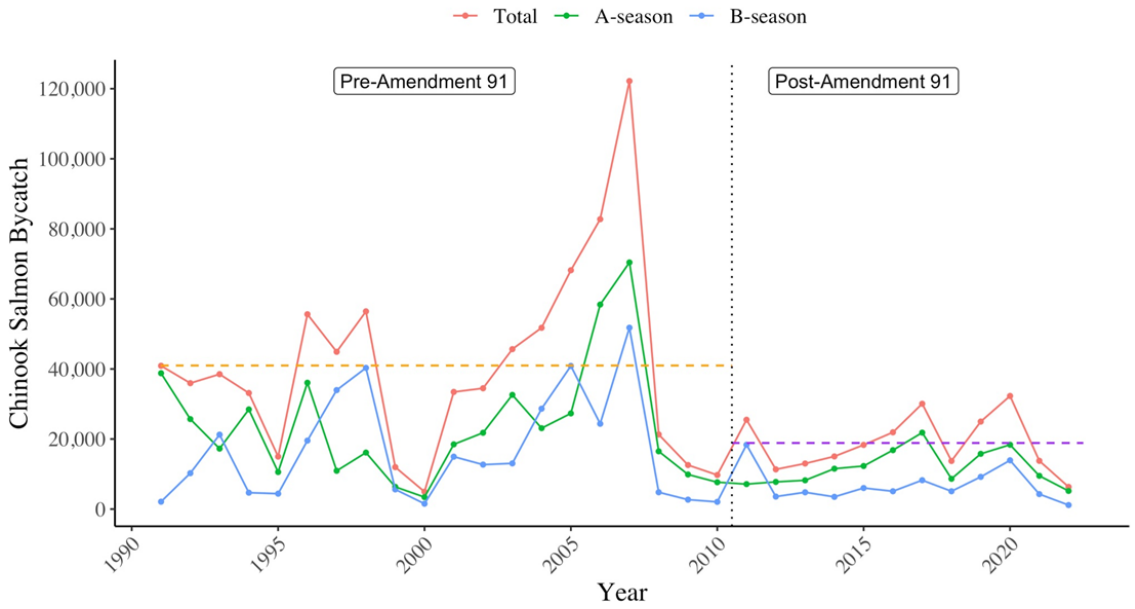

Figure 2. -- Annual "A" and "B" season estimates for the Chinook salmon bycatch from the Bering Sea pollock trawl fishery (NMFS 2022). The yellow (40,976) dashed line shows the average bycatch before Amendment 91 and the purple (18,864) shows the average after.

In 2021, there were 1,337 genetic samples received from the Bering Sea Chinook salmon bycatch collected by the Observer Program; of those samples, 1,195 were successfully genotyped for an overall genotyped sampling rate of 8.7% ("A" season N = 834 fish, 8.8% sampling rate; "B" season N = 461 fish, 8.4% sampling rate). In 2022, there were 564 genetic samples received and of those 461 were successfully genotyped for an overall genotyping rate of 7.3% ("A" season N = 380 fish, 7.3% sampling rate; "B" season N = 81 fish, 7.0% sampling rate)

Potential biases primarily introduced through spatial and temporal aspects of genetic sample collection from the bycatch are well documented and have the potential to affect resulting

stock composition estimates (Pella and Geiger 2009). The distributions of 2021 and 2022 Chinook salmon bycatch genetic samples were evaluated by comparing the collection of genetic samples with the overall bycatch distribution (Fig. 3). The temporal distribution of samples collected and successfully genotyped was evaluated across the two fishing seasons (Fig. 3). The sample spatial distribution was compared with the total bycatch by NMFS statistical area (NMFS area) over time (Fig. 3). While there was minor over- and under-sampling, genetic samples were generally spatially and temporally representative of the total Chinook bycatch (Fig. 3), since most under- and oversampled collections are from small bycatch collections.

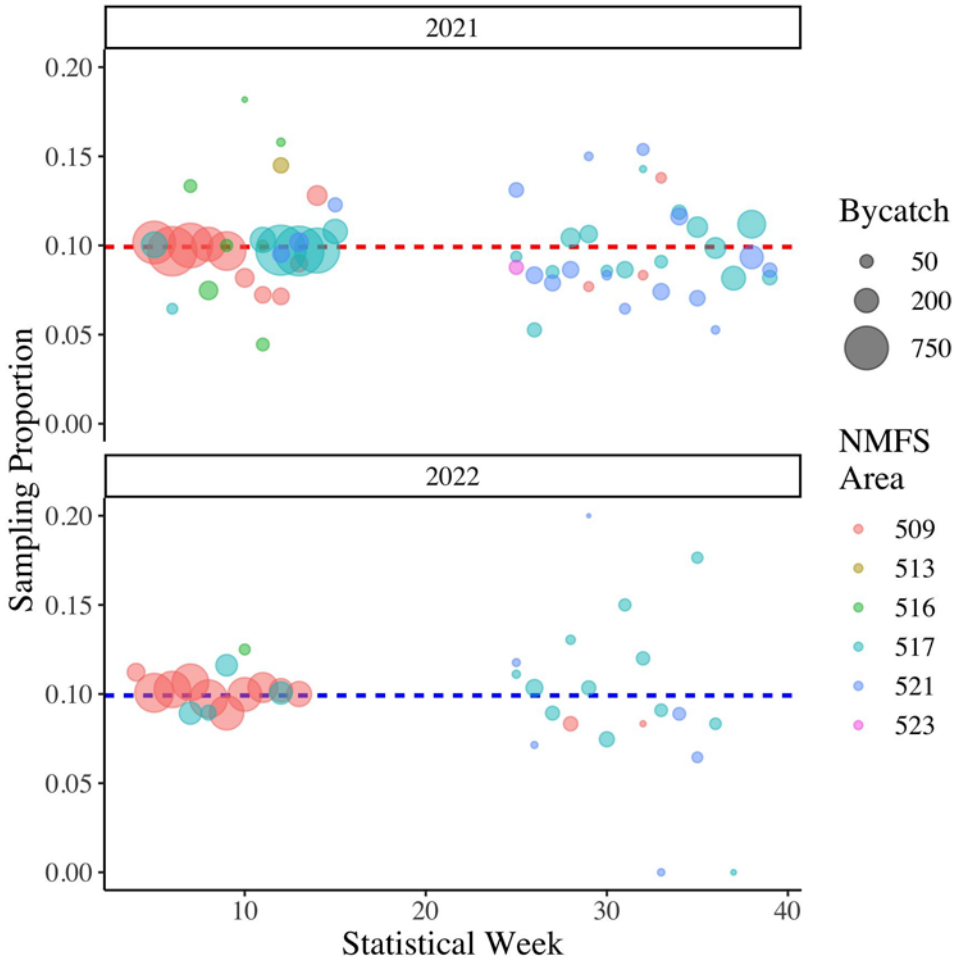

Figure 3. -- Proportion of Bering Sea Chinook salmon bycatch sampled for genetic analysis by statistical week and NMFS Statistical Areas. The size of the circles corresponds to the number of

bycatch fish. Weeks 4-18 correspond to the groundfish "A" season, whereas weeks 24-44 correspond to the "B" season. Sample sizes smaller than five not shown.

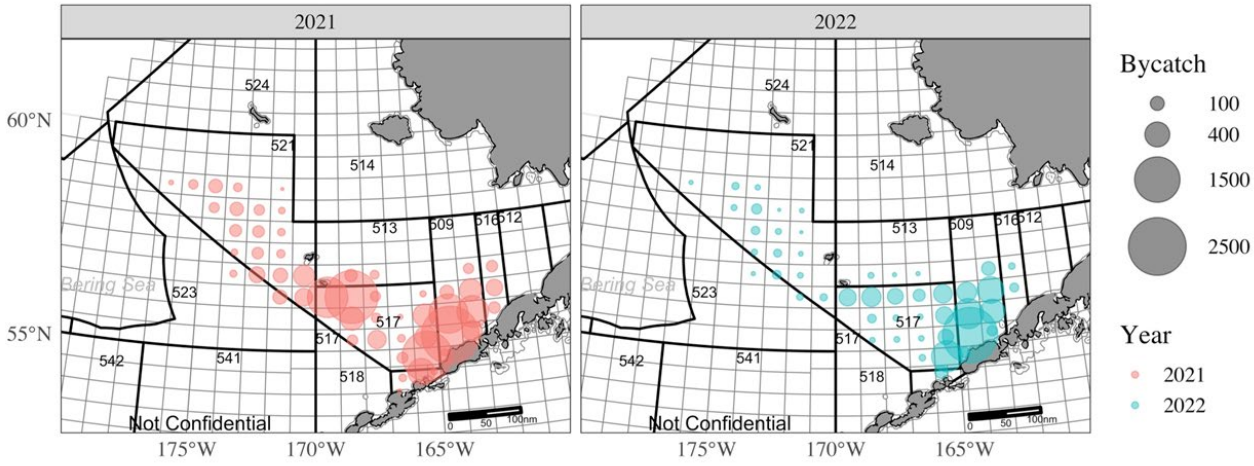

Figure 4. -- Spatial Distribution of 2021 and 2022 Chinook Salmon bycatch. Circles represent the amount of total bycatch in each ADFG groundfish statistical area. (NMFS 2023).

GENETIC STOCK COMPOSITION - PROCEDURE

DNA was extracted from axillary process tissues with Machery-Nagel kits (Allentown, PA) or by chelex extractions. SNP genotyping was performed using Genotyping-in-Thousands by Sequencing (GTseq; Campbell et al. 2015) chemistry that uses short-read sequencing on an Illumina platform to interrogate the 37 SNP DNA markers represented in the Chinook salmon baseline (Templin et al. 2011; Appendix 5. The SNP baseline contains genetic information for 172 of Chinook salmon grouped into 11 geographic regions (also known as stock groups or reporting groups; Appendix 1). Proof tests performed previously have shown the baseline to be suitable for stock composition analysis using the regional reporting groups defined in Appendix 1 (Templin et al. 2011).

Sequencing libraries were prepared using the GT-seq protocol (Campbell, et al. 2015). PCR was performed on extracted DNA with primers that amplify 37 SNP loci (Templin et al. 2011). These PCR products were then indexed in a barcoding PCR, normalized using SequalPrep plates (Invitrogen) and each 96 well plate was subsequently pooled after Sequel prep

normalization. Next, a double-sided bead size selection was 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 were 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 were joined with FLASH2 (Magoč & Salzberg, 2011; https://github.com/dstreett/FLASH2). Merged reads were genotyped with the R package GTscore (McKinney; https://github.com/gjmckinney/GTscore). Individuals with low quality multilocus genotypes (< 80% of loci scored) were discarded. We re-genotype 3% 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). For all estimates, the Dirichlet prior parameters for the stock proportions were defined by region to be 1/(GCg), where Cg is the number of baseline populations in region g, and G is the number of regions. To ensure convergence to the posterior distribution, 11 separate MCMC chains of 70,000 iterations (burn-in of 35,000) of the non-bootstrapped model were run, with 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 and Rubin 1992) estimated with the gelman.diag function in the *coda* library (Plummer et al. 2006) within R. Once chain convergence was confirmed, inference was conducted with the conditional genetic

stock identification model with bootstrapping over reporting groups (70,000 MCMC iterations, burn-in of 35,000, 100 bootstrap iterations).

GENETIC STOCK COMPOSITION - RESULTS

In 2021 “A” and “B” seasons combined, 81% of the bycatch samples were estimated to be from Alaska river systems flowing into the Bering Sea (Appendix 1, Reg. Num. numbers 2-5) with the Coastal Western Alaska region contributing the most (51%), followed by the North Alaska Peninsula (28%). Fifteen percent of all of the samples were from the southern (Appendix 1, Reg. Num. numbers 6, 9-11) regions, with the British Columbia (7%) region contributing the most, followed by the West Coast US (5%), and Coastal Southeast Alaska (3%) regions (Appendix 2, Fig. 6).

In 2022 “A” and “B” seasons combined, 84% of the bycatch samples were estimated to be from Alaska river systems flowing into the Bering Sea (Appendix 1, Reg. Num. numbers 2-5) with the Coastal Western Alaska and North Alaska Peninsula regions contributing the most (~40%). Fourteen percent of all of the samples were from the southern (Appendix 1, Reg. Num. numbers 6, 9-11) regions, with the British Columbia (7%) region contributing the most, followed by the West Coast US (5%), and Coastal Southeast Alaska (2%) regions (Appendix 3, Fig. 6).

The stock composition results indicate that 90% of the 2021 and 96% of the 2022 Chinook salmon samples from the “A” season originated from Alaska river systems flowing into the Bering Sea. In 2021 the largest contributions were from Coastal Western Alaska region (50%) and the North Alaska Peninsula (38%). Ten percent were from southern regions with British Columbia (6%) contributing the most, followed by Coastal Southeast Alaska (2%) (Appendix 2, fig. 6). In 2022 the largest “A” season contributions were from the North Alaska

Peninsula (52%) followed by Coastal Western Alaska region (44%). The largest contribution from southern origin stocks was British Columbia (4%) (Appendix 3, fig. 6).

In the 2021 season, 62% percent of the “B” season samples originated from Alaska river systems flowing into the Bering Sea with the largest contribution from Coastal Western Alaska region (58%), while 38% were from southern regions; British Columbia (10%), West Coast US (13%), Northwest GOA (8%) and Coastal Southeast Alaska (7%) regions (Appendix 2, Fig. 5). The 2022 was different, 72% were from southern regions; West Coast US (31%), British Columbia (22%), Coastal Southeast Alaska (13%) and Northeast GOA (4%) regions, while 28% originated from Alaska river systems flowing into the Bering Sea with the largest contributions from Coastal Western Alaska region (20%) and the North Alaska Peninsula (8%) (Appendix 3, fig. 6).

Using information from the ANSWERS tool provided by AKFIN (NMFS 2022), geographical (ADF&G statistical areas) aggregations were developed to investigate how stock compositions might vary among smaller areas of interest to the NPFMC. It should be noted that some of these strata overlap, with some samples being used in multiple analyses.

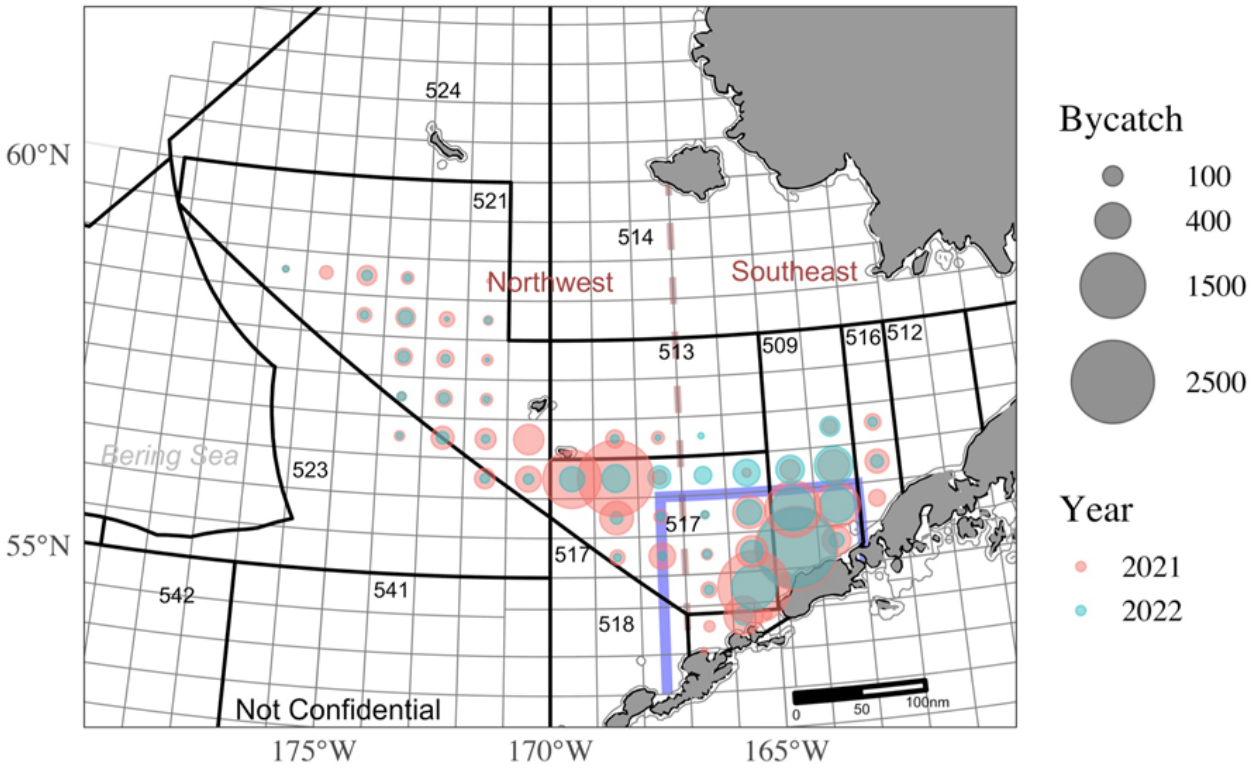

Figure 5. -- Location of sample strata used in comparative stock composition estimates from the 2021-2 Bering Sea Chinook salmon bycatch. Circles represent the amount of total bycatch in each stratum. The red dashed line delineates the Northwest and Southeast strata, while the solid blue line shows the boundary of the CVOA (NMFS 2022).

The "A" season estimates were developed for overlapping strata with sufficient numbers of samples (Appendix 2; Figs. 4, 5); Catcher Vessel Operation Area (CVOA) (Figs. 4, 5), NMFS Statistical Area 509 (Figs. 1, 5), Southeast Bering (Figs. 4, 5), and Northwest Bering (Figs. 4, 5). Over 87% of the Chinook salmon bycatch in the CVOA, NMFS Area 509 and Southeast Bering strata during the "A" season were from Alaska river systems flowing into the Bering Sea in 2021 and 2022. In 2021, for the CVOA, NMFS area 509, and Southeast Bering Sea during the "A" season, most fish were from Coastal Western Alaska (48%, 50%, and 47%, respectively); however, in 2022, North Alaska Peninsula comprised the largest portion of the bycatch (54%, 53% and 53%). The largest southern components for CVOA, NMFS Area 509 and Southeast

Bering Sea during the "A" season was British Columbia on average contributing (7%, 5% and 6%, respectively.

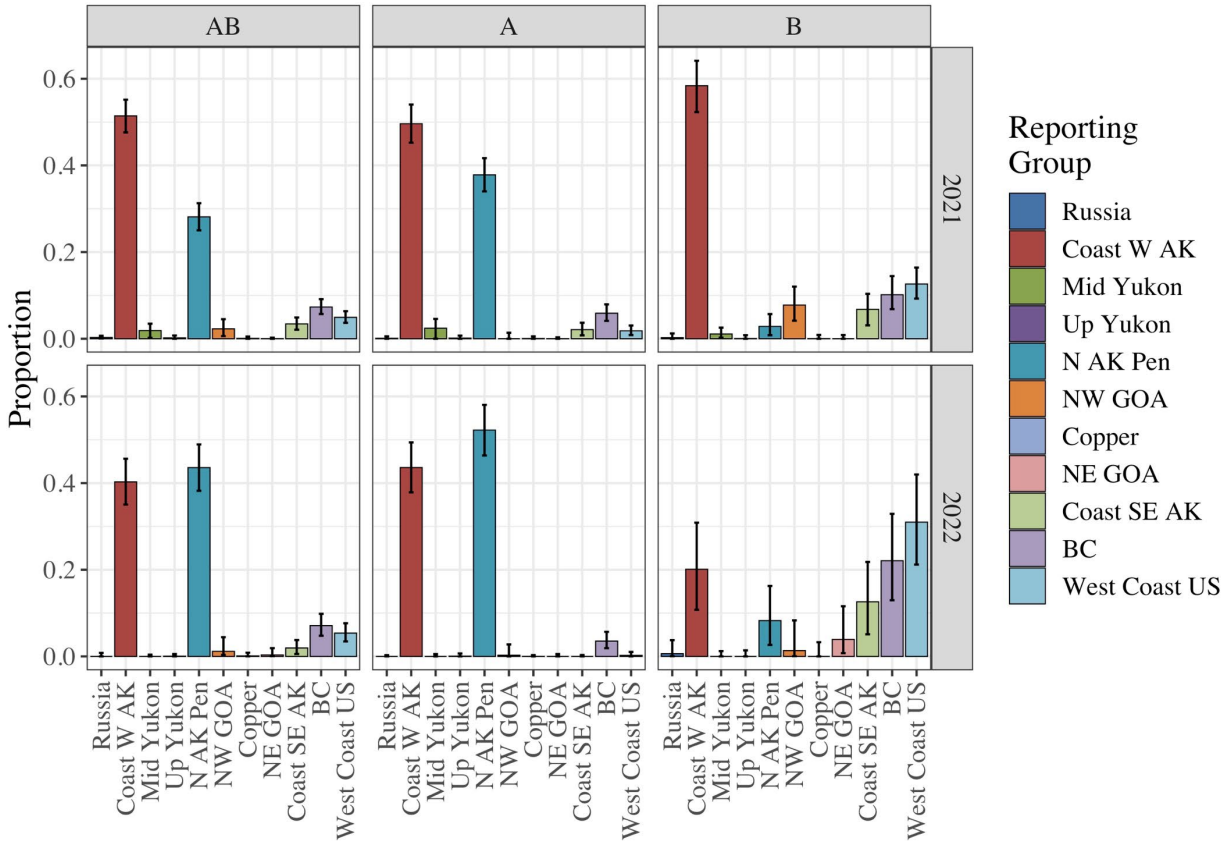

Figure 6. -- Stock composition estimates with 95% credible intervals of the 2021 BSAI Chinook salmon bycatch for overall (1,195 samples) "A" and "B" seasons; 2022 BSAI Chinook salmon bycatch for overall (461 samples) "A" and "B" seasons; (NMFS 2021)

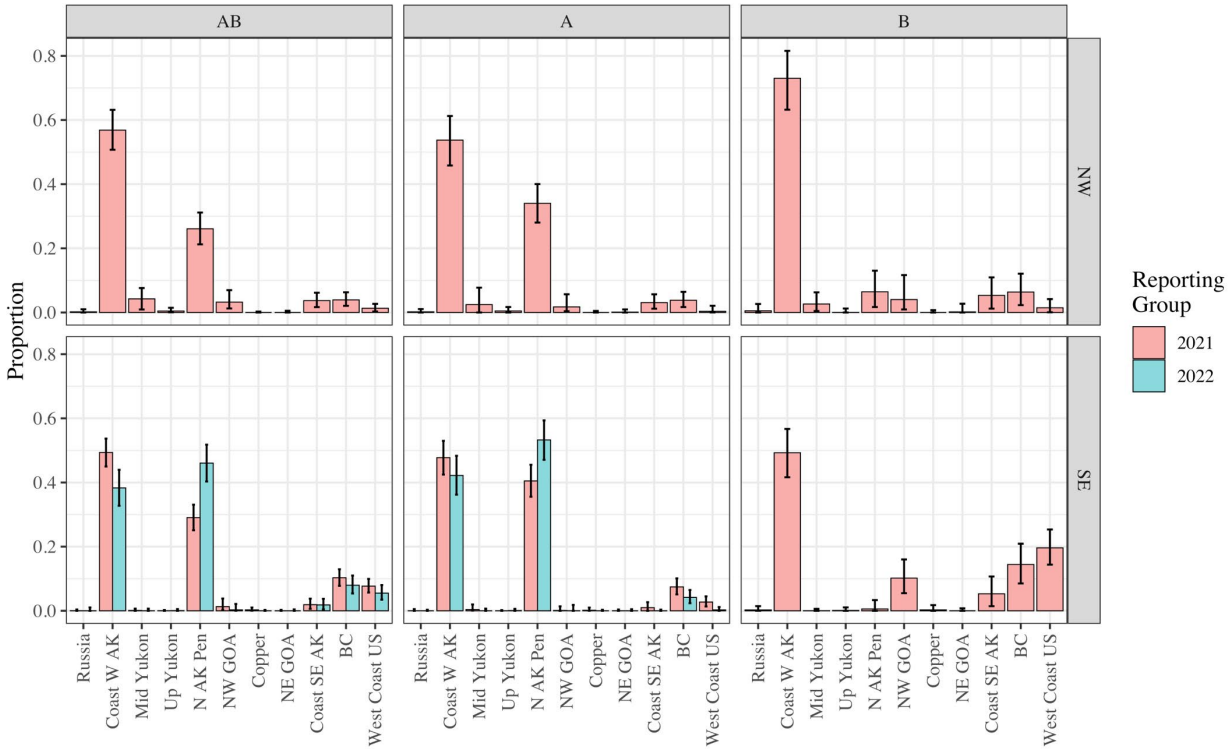

Figure 7. -- Stock composition estimates with 95% credible intervals of the 2021 BSAI Chinook bycatch Northwest Bering strata overall (473 samples), "A" and "B" seasons; and Southeast Bering overall (722 samples) "A and "B" seasons; 2022 Southeast Bering overall (403 samples samples) and "A" seasons (NMFS 2022).

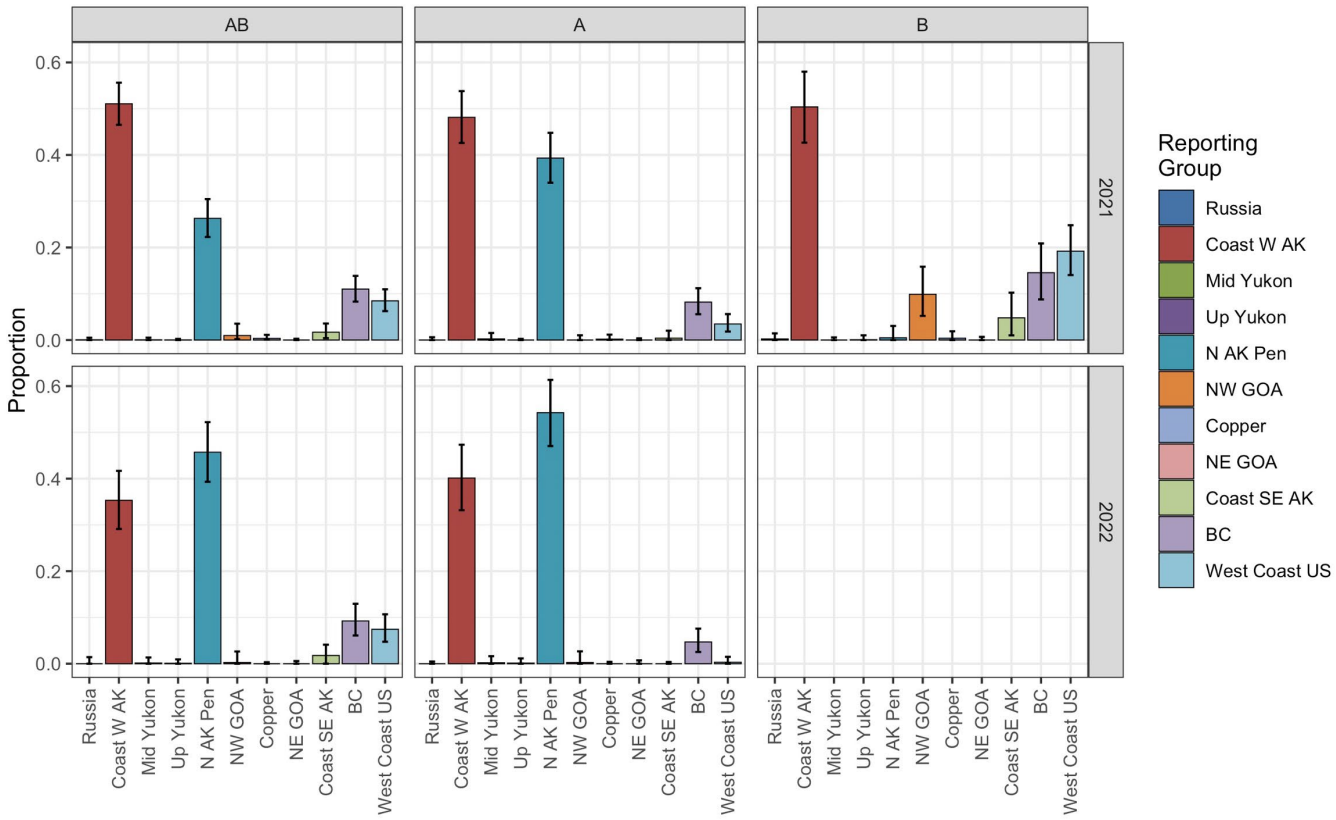

Figure 8. -- Stock composition estimates with 95% credible intervals of the BSAI Chinook salmon bycatch strata 2021 CVOA overall (656 samples), "A" and "B" season; 2022 CVOA overall (310 samples), and "A" season (NMFS 2022)

There are fewer "B" season samples, and historically the major difference between the two seasons is a decrease in the relative contribution of the North Alaska Peninsula and an increase in southern origin stocks. This was true for both 2021 and 2022 (Figs. 6-9).

For the "B" season, stock composition estimates were developed for CVOA (Figs. 4, 5) and Southeast Bering (Figs. 4, 5) (NMFS 2021) only for 2021. Fifty-two percent of the "B" season stock composition estimates for the CVOA and Southeast Bering were from Coastal Western Alaska (Fig. 5, Appendix 2) while ~19% in both 2021 and 2022 was from West Coast US. It is important to note that CVOA is a subsection of the Southeast Bering where most of the bycatch occurs.

Both the CVOA and Southeast Bering "B" season samples had a higher proportion of fish from southern regions (49 and 50% respectively) than the "B" season overall (37%). The stock compositions were highly variable in the CVOA and Southeast Bering across the seasons. It is notable that the contribution from the West Coast US region increased from 4% to 19% for CVOA and from 2% to 19% in the Southeast Bering strata from the "A" and "B" seasons while the contribution from the Northern Alaska Peninsula region decreased from 39% to 1% in the CVOA and from 41% to 1% in the Southeast Bering strata in the same time frame.

COMPARISON WITH PREVIOUS ESTIMATES

Most of the Chinook salmon bycatch in occurred during the "A" season, 69% in 2021 and 82% in 2022 (Fig. 2), which is similar to most previous years since 2011. As in most previous years (with the exception of 2017), stock compositions from the analysis of the 2021 (89%) and 2022 85% "A" season Chinook salmon bycatch showed that the majority of fish originated from river systems flowing into the Bering Sea (Fig. 9). The Coastal Western Alaska region was the largest contributor in the 2021 and was tied for the largest in 2022 "A" season, consistent with every year except 2017. The "B" season stock composition estimates from Coastal Western Alaska in 2021 (58%) was higher than 2018 and 2019 (~30%) while 2022 was lower at 20% closer to 2016 and 2017 when Coastal Western Alaska stock proportions were closer to 15% (Fig. 9, Appendix 3). The estimated relative contributions from these more southern regions in the "B" season previously increased from a low of 20% in 2011 to a high of 86% in 2017, declining to 63% in 2018, and bumping up slightly to 67% in 2019, then dropping to 41% in 2020 and 38% in 2021, followed by a large increase to 72% in 2022 (Fig. 9, Appendix 3).

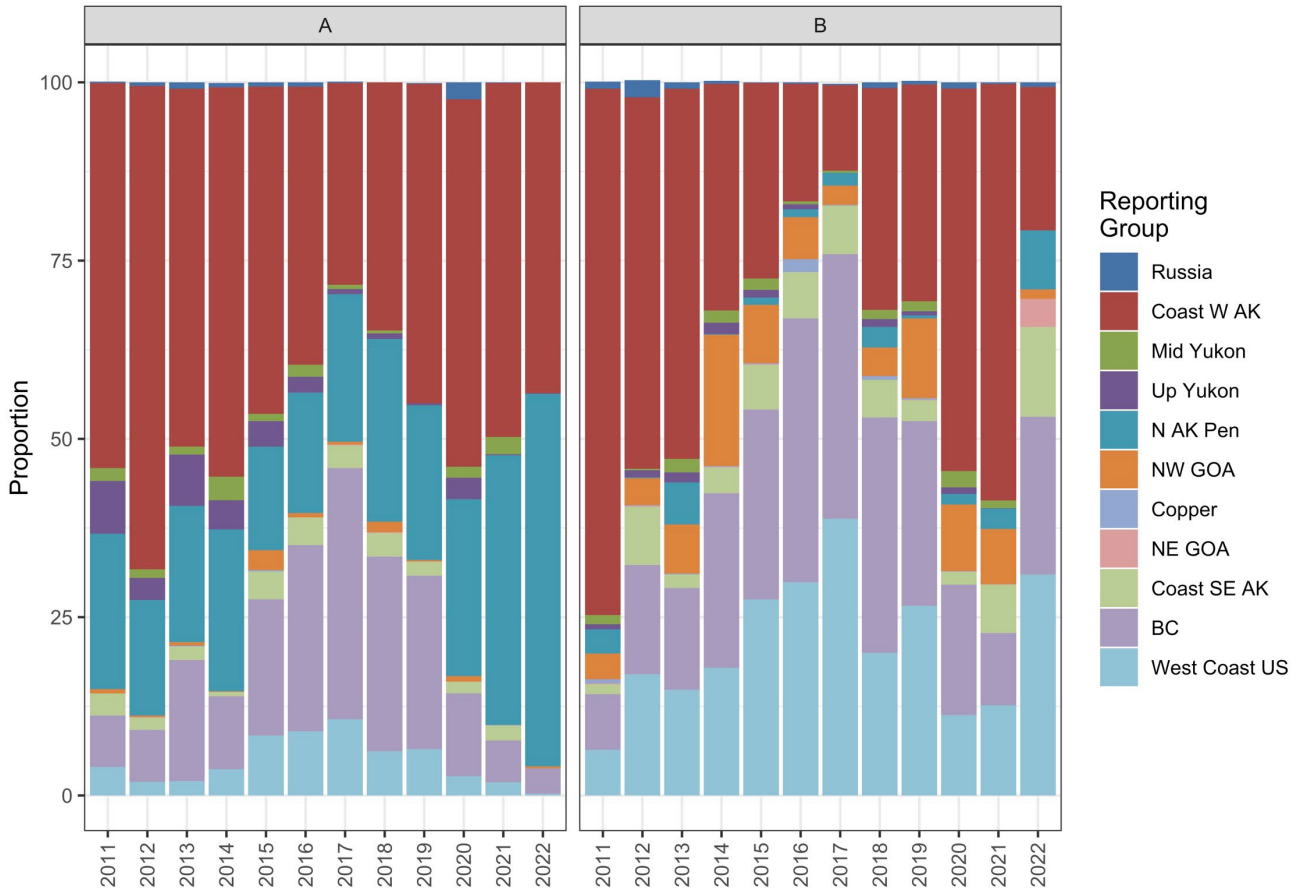

Figure 9. -- Annual "A" season (left) and "B" season (right) genetic stock composition estimates for 2011-2022 from the Bering Sea Chinook salmon bycatch.

When the stock compositions were analyzed on a yearly basis, the Coastal Western Alaska region shows variable contributions over time, but it was generally trending downward from 2011 until 2017, and from 2018 to 2020 it trended upward, and 2021 to 2022 is trending downward again (Fig. 10). The 2021 and 2022 North Alaska Peninsula region contributions increased to 28% and 44% respectively which was above average compared to previous years (Fig. 7). The Upper and Middle Yukon River, GOA, and Coastal Southeast Alaska contributions continued to be low in 2021 and 2022, while contributions from the British Columbia and West Coast US regions have generally decreased from 2019 to 2022 (Fig. 7).

The estimated numbers of Chinook salmon caught as bycatch from Coastal Western Alaska stocks has varied from a high of 17,421 in 2011 to a low of 2,553 in 2022 (Fig. 7, Appendices 2, 3). Total catches of Coastal Western Alaska stocks were relatively stable from 2012 to 2018 and were consistently below 8,000 fish. In 2019, the catch increased slightly to near 10,000. In 2020 the catch further increased to nearly 17,000, close to the high in 2011, but started to drop substantially to 7,088 in 2021 and 2,553 in 2022. Catches from the North Alaska Peninsula stock group have been relatively consistent over the last decade, ranging from ~2,500 to 5,000, despite a high proportion in 2022. Catches of southern stocks from British Columbia and the US West Coast peaked in 2017 at ~15,000 fish but generally range between 5,000 and 10,000. Catches of these two stocks continued to be low in 2021 and 2022. It is important to note these catch estimates represent the removals by region in each year but they cannot be used as is to represent any trends in the impact rates to particular regions over time because the amount of bycatch and areas fished vary. Stock-specific impacts are best estimated with adult equivalency models (Ianelli and Stram 2015).

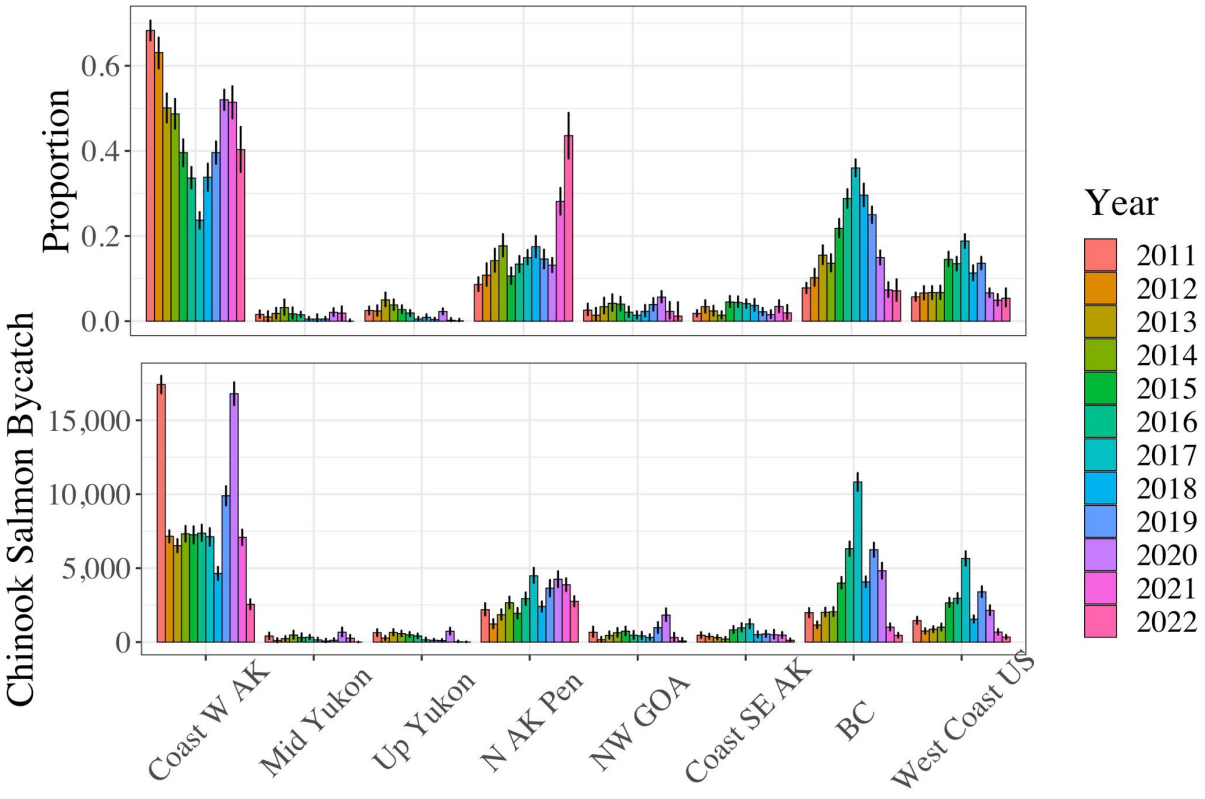

Figure 10. -- Annual (2011-2022) stock composition estimates with 95% credible intervals from the Bering Sea Chinook salmon bycatch (Top). Annual (2011-2022) bycatch estimates in numbers of fish with 95% credible intervals from the Bering Sea Chinook salmon bycatch (Bottom). Regions with low catches, Russia (Avg. N = 128) Copper (Avg. N = 19), and Northeast GOA (Avg. N = 6) were omitted.

AGE COMPOSITION ANALYSIS

Ageing Methods

Obtaining ages is important for parameterizing adult equivalency models and can also provide information on specific cohorts that can be used to better understand stock composition trends. The AFSC genetics program received paired genetic and scale samples from the Observer program. Scales were removed from sample envelopes and cleaned of dried slime and grit by moistening the scale with RO water and gently rubbing the scale between thumb and forefinger. Clean scales were then moistened and the sculptured side of the scale was mounted up on the scale gum card. Acetate impressions of each card of scales were made with a PHI PW22OH

scale press. All acetate impressions were delivered to the ADF&G Mark Tag and Age Lab (MTA Lab) for age estimation. All age estimates are stored in the AKFIN database with paired observer information.

BSAI Ages

Of the 1,307 scales from the 2021 chinook bycatch 607 were successfully read by the ADF&G MTA Lab. Of the 454 scales collected and pressed from the 2022 chinook salmon bycatch, 219 scales were successfully read by the ADF&G MTA Lab (Fig. 8). It should be noted that not all of the 2022 scales have been pressed as of this report. Additional scale ages may become available in the future. The most common freshwater age was 1 (72% in 2021 and 51% in 2022), followed by age 0 (28% in 2021 and 49% in 2022) whereas the most common saltwater age was 2 (44%) in 2021 and 3 (48%) in 2022. Of the three-, four-, and five-year-old fish caught in the BSAI trawl fishery in 2021, the majority were from Coastal Western Alaska (45.4%, 52.9%, and 56.1%, respectively). In 2022 only an estimate of age 4 fish could be made, with Coastal Western Alaska comprising a similar proportion (51%). Middle and Upper Yukon stock groups contributed a relatively small amount, with the largest contribution of Middle Yukon stocks to the age-4 and age-5 mixtures (1% and 7% in 2021). For the 2021 and 2022 age specific collections, the Upper Yukon stock groups largest proportion was 1% to the 2021 age-5 group, which was a substantial reduction from the 2020 estimate.

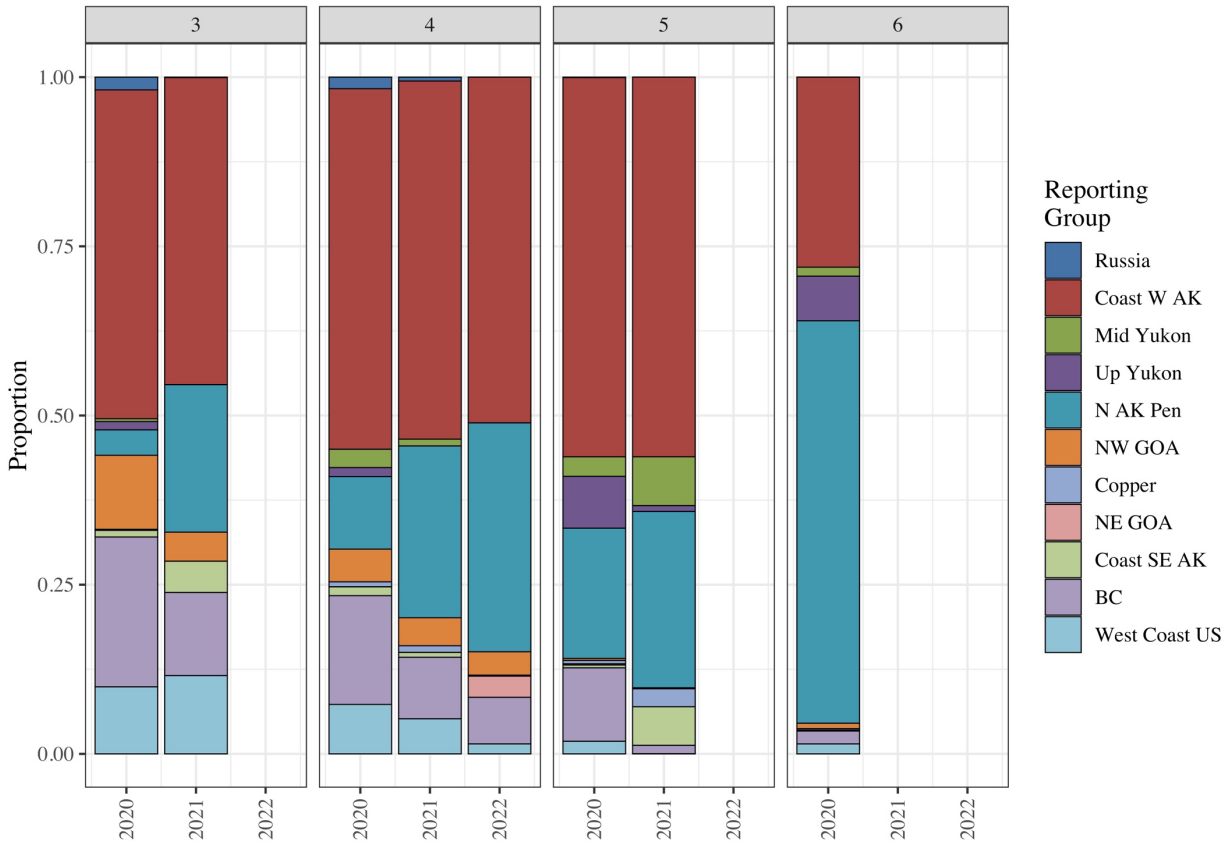

Figure 10. -- Stock Composition of the four age classes of Bering Sea Chinook salmon bycatch. The number of successfully aged samples is below the respective bars.

SUMMARY

Stock composition estimates of the Chinook salmon bycatch inform pollock and salmon fishery managers of the biological effects of the incidental take of salmon in the trawl fishery (Ianelli and Stram 2015). The incidental harvest of Chinook salmon in the Bering Sea pollock fishery averaged 34,192 salmon per year between 1991 and 2020 (30-year average), with a peak of 121,195 in 2007 and a low of 4,961 in 2000 (Fig. 2; NMFS 2021). The Bering Sea Chinook salmon bycatch has abated somewhat in more recent years. The incidental harvest between 1991 and 2010 averaged 40,976 and after the implementation Amendment 91 between 2011 and 2020 the average dropped to 20,624 (Fig.2; NMFS 2021). In 2021 a total of 13,784 and in 2022 a total

of 6,337 Chinook salmon were caught, both are below the 30-year average, and the 10-year post-Amendment 91 average.

Sampling Issues

With the implementation of systematic random sampling, 2022 is the twelfth year from which representative samples have been collected from the Chinook salmon bycatch. Systematic random sampling represents a substantial effort on the part of the Observer Program to develop standardized protocols for collecting sets of samples from numerous observers both at sea and in shore-based processing plants, the results of which are clearly apparent in the representative nature of the sample sets (Figs. 3). The number of successfully genotyped Chinook salmon from the Bering Sea bycatch samples was 1,195 in 2021 and 461 in 2022 corresponding to an effective overall sampling rate in 2021 of 8.7% and in 2022 of 7.3%,

Stock Composition Estimates

The proportions of Chinook salmon originating from Alaska rivers flowing into the Bering Sea accounted for most of the catches in early post-amendment 91 years, but southern regions have accounted for larger and larger proportions in more recent years with a maximum in 2017, where southern stocks accounted for more than half of the bycatch. While the 2018-2022 data may signal a change to this pattern, with Chinook salmon originating from Alaska rivers flowing into the Bering Sea accounting for more than two-thirds of the bycatch in 2021 and 2022 (Appendices 2,3,4). The stock composition of the Chinook salmon bycatch from the 2021 and 2022 “A” season differed from the “B” season, demonstrating temporal changes (Appendix 2; Figs. 5 and 6). This was especially apparent for the North Alaska Peninsula region (38% to 3%) in 2021 and (52% to 8%) in 2022. The largest contributor to both “A” and “B” season fisheries was the Coastal Western Alaska region which increased slightly in 2021 from “A” to “B” (50%

to 58%), while in 2022 decreased by half from “A” to “B” (44% to 20%) while the West Coast US increased from effectively 0 to 31%.

Spatial analysis showed that the stock compositions varied within season depending upon where the salmon were caught. For example, during the “B” season a higher proportion of Coastal Western Alaska Chinook salmon were intercepted in the northwestern area of the Bering Sea, and a higher proportion of southern origin Chinook salmon were intercepted in the southeastern area of the Bering Sea (Fig. 5). Analysis of bycatch by age indicated that fish from the Coastal Western Alaska region were encountered at similar rates across the primary ages (3, 4, 5). Fish from southern stocks (NW GOA, British Columbia, and West Coast US) were encountered more frequently at younger ages.

Application of Estimates

Stock composition estimates for the 2021 and 2022 Bering Sea Chinook salmon bycatch were mostly representative of the overall bycatch for this year and are presented in relative contributions as well as estimated numbers of fish. The extent to which any salmon stock group is impacted by the bycatch of the Bering Sea trawl fishery is dependent on many stock-specific factors including 1) the overall numbers of the stock in the bycatch, 2) the ages of the salmon caught in the bycatch by stock group, 3) the ages of the returning salmon by stock group, and 4) the total annual run-size of the affected stock groups. Because the effect of stock-specific numbers of Chinook salmon in the bycatch is moderated by several factors, a higher contribution of a particular stock group in one year does not necessarily imply greater impact than a smaller estimate the next.

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APPENDICES

Appendix 1. -- Chinook salmon populations in the ADF&G SNP baseline with the regional designations used in the analyses of this report. S. = South, R. = River, H. = Hatchery, and L. = Lake.

Population name	Reg Num.	Region	Population name	Reg Num.	Region
Bistraya River	1	Russia	Henshaw Creek	3	Mid Yukon
Bolshaya River	1	Russia	Kantishna River	3	Mid Yukon
Kamchatka River late	1	Russia	Salcha River	3	Mid Yukon
Pakhatcha River	1	Russia	Sheenjek River	3	Mid Yukon
Andreafsky River	2	Coast W AK	S. Fork Koyukuk River	3	Mid Yukon
Aniak River	2	Coast W AK	Big Salmon River	4	Up Yukon
Anvik River	2	Coast W AK	Blind River	4	Up Yukon
Arolik River	2	Coast W AK	Chandindu River	4	Up Yukon
Big Creek	2	Coast W AK	Klondike River	4	Up Yukon
Cheeneetnuk River	2	Coast W AK	Little Salmon River	4	Up Yukon
Eek River	2	Coast W AK	Mayo River	4	Up Yukon
Gagaryah River	2	Coast W AK	Nisutlin River	4	Up Yukon
George River	2	Coast W AK	Nordenskiold River	4	Up Yukon
Gisasa River	2	Coast W AK	Pelly River	4	Up Yukon
Golsovia River	2	Coast W AK	Stewart River	4	Up Yukon
Goodnews River	2	Coast W AK	Takhini River	4	Up Yukon
Kanektok River	2	Coast W AK	Tatchun Creek	4	Up Yukon
Kisaralik River	2	Coast W AK	Whitehorse Hatchery	4	Up Yukon
Kogrukluk River	2	Coast W AK	Black Hills Creek	5	N AK Pen
Kwethluk River	2	Coast W AK	King Salmon River	5	N AK Pen
Mulchatna River	2	Coast W AK	Meshik River	5	N AK Pen
Naknek River	2	Coast W AK	Milky River	5	N AK Pen
Nushagak River	2	Coast W AK	Nelson River	5	N AK Pen
Pilgrim River	2	Coast W AK	Steelhead Creek	5	N AK Pen
Salmon R. -Pitka Fork	2	Coast W AK	Anchor River	6	NW GOA
Stony River	2	Coast W AK	Ayakulik River	6	NW GOA
Stuyahok River	2	Coast W AK	Benjamin Creek	6	NW GOA
Takotna River	2	Coast W AK	Chignik River	6	NW GOA
Tatlawiksuk River	2	Coast W AK	Crescent Creek	6	NW GOA
Togiak River	2	Coast W AK	Crooked Creek	6	NW GOA
Tozitna River	2	Coast W AK	Deception Creek	6	NW GOA
Tuluksak River	2	Coast W AK	Deshka River	6	NW GOA
Unalakleet River	2	Coast W AK	Funny River	6	NW GOA
Beaver Creek	3	Mid Yukon	Juneau Creek	6	NW GOA
Chandalar River	3	Mid Yukon	Karluk River	6	NW GOA
Chena River	3	Mid Yukon	Kasilof River mainstem	6	NW GOA

Population name	Reg Num.	Region	Population name	Reg Num.	Region
Kenai River mainstem	6	NW GOA	Kowatua River	9	Coast SE AK
Killey Creek	6	NW GOA	Little Tatsemenie River	9	Coast SE AK
Ninilchik River	6	NW GOA	Macaulay Hatchery	9	Coast SE AK
Prairie Creek	6	NW GOA	Medvejie Hatchery	9	Coast SE AK
Slikok Creek	6	NW GOA	Nakina River	9	Coast SE AK
Talachulitna River	6	NW GOA	Tahltan River	9	Coast SE AK
Willow Creek	6	NW GOA	Unuk R.-Deer Mountain H.	9	Coast SE AK
Bone Creek	7	Copper	Unuk River - LPW	9	Coast SE AK
E. Fork Chistochina River	7	Copper	Upper Nahlin River	9	Coast SE AK
Gulkana River	7	Copper	Big Qualicum River	10	BC
Indian River	7	Copper	Birkenhead River spring	10	BC
Kiana Creek	7	Copper	Bulkley River	10	BC
Manker Creek	7	Copper	Chilko River summer	10	BC
Mendeltna Creek	7	Copper	Clearwater River summer	10	BC
Otter Creek	7	Copper	Conuma River	10	BC
Sinona Creek	7	Copper	Damdochax Creek	10	BC
Tebay River	7	Copper	Ecstall River	10	BC
Tonsina River	7	Copper	Harrison River	10	BC
Big Boulder Creek	8	NE GOA	Kateen River	10	BC
Kelsall River	8	NE GOA	Kincolith Creek	10	BC
King Salmon River	8	NE GOA	Kitimat River	10	BC
Klukshu River	8	NE GOA	Klinaklini River	10	BC
Situk River	8	NE GOA	Kwinageese Creek	10	BC
Tahini River	8	NE GOA	Louis River spring	10	BC
Tahini River - Pullen Creek H.	8	NE GOA	Lower Adams River fall	10	BC
Andrews Creek	9	Coast SE AK	Lower Atnarko River	10	BC
Blossom River	9	Coast SE AK	Lower Kalum River	10	BC
Butler Creek	9	Coast SE AK	Lower Thompson River fall	10	BC
Chickamin River	9	Coast SE AK	Marble Creek	10	BC
Chickamin River-LPW	9	Coast SE AK	Middle Shuswap R. summer	10	BC
Chickamin R.Whitman L. H.	9	Coast SE AK	Morkill River summer	10	BC
Clear Creek	9	Coast SE AK	Nanaimo River	10	BC
Cripple Creek	9	Coast SE AK	Nechako River summer	10	BC
Crystal Lake Hatchery	9	Coast SE AK	Nitinat River	10	BC
Dudidontu River	9	Coast SE AK	Oweegee Creek	10	BC
Genes Creek	9	Coast SE AK	Porteau Cove	10	BC
Hidden Falls Hatchery	9	Coast SE AK	Quesnel River summer	10	BC
Humpy Creek	9	Coast SE AK	Quinsam River	10	BC
Kerr Creek	9	Coast SE AK	Robertson Creek	10	BC
Keta River	9	Coast SE AK	Salmon River summer	10	BC
King Creek	9	Coast SE AK	Sarita River	10	BC

Population name	Reg Num.	Region	Population name	Reg Num.	Region
Stuart River summer	10	BC	Lower Deschutes R. fall	11	West Coast US
Sustut River	10	BC	Lyons Ferry H. summer/fall	11	West Coast US
Torpy River summer	10	BC	Makah National Fish H. fall	11	West Coast US
Wannock River	10	BC	McKenzie River spring	11	West Coast US
Alsea River fall	11	West Coast US	Sacramento River winter	11	West Coast US
Carson Hatchery spring	11	West Coast US	Siuslaw River fall	11	West Coast US
Eel River fall	11	West Coast US	Soos Creek Hatchery fall	11	West Coast US
Forks Creek fall	11	West Coast US	Upper Skagit River summer	11	West Coast US
Hanford Reach	11	West Coast US			
Klamath River	11	West Coast US			

Appendix 2. -- Regional Rubias stock composition percentage estimates, standard deviations (SD), 95% credible intervals (CI), and estimated numbers of Chinook salmon from the the 2021 Bering Sea pollock trawl fisheries.Sample sizes are adjacent to the stratum designation. Total catch is the census for each stratum from AKFIN reports (NMFS 2023). Estimated numbers of fish for aged fish are for only the number of fish aged.

	"A" Season (N=834)				"B" Season (N=361)				Bering Sea all (N=1,195)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	9	0.1	0.16	(0.0,0.6)	10	0.2	0.35	(0.0,1.2)	40	0.3	0.16	(0.1,0.7)
Coast W AK	4,702	49.6	2.26	(45.3,54.0)	2,516	58.4	3.01	(52.3,64.2)	7,088	51.4	1.92	(47.6,55.2)
Mid Yukon	231	2.4	1.19	(0.0,4.6)	47	1.1	0.61	(0.2,2.6)	260	1.9	0.87	(0.2,3.5)
Up Yukon	14	0.1	0.21	(0.0,0.7)	2	0.0	0.24	(0.0,0.8)	28	0.2	0.21	(0.0,0.7)
N AK Pen	3,583	37.8	1.96	(34.0,41.7)	123	2.9	1.26	(0.8,5.7)	3,878	28.1	1.61	(25.0,31.3)
NW GOA	0	0.0	0.38	(0.0,1.4)	335	7.8	2.02	(4.2,12.0)	315	2.3	1.05	(0.6,4.5)
Copper	5	0.0	0.16	(0.0,0.6)	1	0.0	0.25	(0.0,0.9)	11	0.1	0.15	(0.0,0.5)
NE GOA	1	0.0	0.10	(0.0,0.3)	0	0.0	0.31	(0.0,0.9)	2	0.0	0.08	(0.0,0.2)
Coast SE AK	200	2.1	0.74	(0.8,3.7)	292	6.8	1.81	(3.1,10.4)	472	3.4	0.72	(2.1,4.9)
BC	558	5.9	0.97	(4.1,7.9)	438	10.2	1.93	(6.8,14.5)	1,009	7.3	0.87	(5.7,9.1)
West Coast US	173	1.8	0.57	(0.9,3.1)	544	12.6	1.83	(9.3,16.4)	679	4.9	0.69	(3.7,6.3)
Total Catch	9,475				4,309				13,784			

	CVOA "A" (N=430)				CVOA "B" (N=226)				CVOA (N=656)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.17	(0.0,0.6)	7	0.2	0.41	(0.0,1.4)	4	0.1	0.14	(0.0,0.5)
Coast W AK	2,375	48.1	2.85	(42.6,53.8)	1,376	50.4	3.91	(42.7,58.0)	3,913	51.1	2.33	(46.5,55.6)
Mid Yukon	12	0.2	0.41	(0.1,1.5)	0	0.0	0.18	(0.0,0.6)	3	0.0	0.15	(0.0,0.5)
Up Yukon	0	0.0	0.09	(0.0,0.3)	2	0.1	0.29	(0.0,1.0)	2	0.0	0.08	(0.0,0.2)
N AK Pen	1,941	39.3	2.76	(34.0,44.8)	13	0.5	0.88	(0.0,3.0)	2,016	26.3	2.09	(22.3,30.5)
NW GOA	0	0.0	0.31	(0.0,1.0)	270	9.9	2.73	(5.2,15.8)	75	1.0	1.01	(0.2,3.5)
Copper	10	0.2	0.31	(0.1,1.2)	11	0.4	0.54	(0.0,1.9)	28	0.4	0.30	(0.1,1.1)
NE GOA	0	0.0	0.12	(0.0,0.4)	0	0.0	0.25	(0.0,0.7)	0	0.0	0.10	(0.0,0.3)
Coast SE AK	20	0.4	0.60	(0.0,2.0)	131	4.8	2.44	(1.0,10.2)	130	1.7	0.81	(0.4,3.6)
BC	405	8.2	1.44	(5.6,11.2)	397	14.5	3.11	(8.8,20.9)	844	11.0	1.42	(8.3,13.9)
West Coast US	171	3.5	0.98	(1.8,5.6)	525	19.2	2.75	(14.0,24.8)	649	8.5	1.20	(6.3,11.0)
Total Catch	4,934				2,731				7,665			

	NW Bering S. "A"(N=339)				NW Bering S. "B" (N=132)				NW Bering S. (N=473)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	8	0.2	0.30	(0.0,1.1)	8	0.5	0.76	(0.0,2.6)	11	0.2	0.29	(0.0,1.0)
Coast W AK	2,056	53.7	3.98	(45.8,61.3)	1,176	73.0	4.70	(63.2,81.6)	3,091	56.8	3.18	(50.7,63.2)
Mid Yukon	94	2.5	2.37	(0.0,7.7)	43	2.6	1.53	(0.5,6.3)	230	4.2	1.82	(0.9,7.6)
Up Yukon	18	0.5	0.49	(0.0,1.7)	0	0.0	0.38	(0.0,1.2)	25	0.5	0.40	(0.1,1.5)
N AK Pen	1,302	34.0	3.06	(28.0,40.0)	104	6.4	2.92	(1.7,13.0)	1,419	26.1	2.53	(21.2,31.2)
NW GOA	67	1.7	1.56	(0.4,5.7)	65	4.0	3.21	(0.9,11.7)	175	3.2	1.65	(1.2,7.0)
Copper	0	0.0	0.16	(0.0,0.5)	0	0.0	0.24	(0.0,0.7)	0	0.0	0.10	(0.0,0.3)
NE GOA	4	0.1	0.27	(0.0,0.9)	3	0.2	0.84	(0.0,2.7)	0	0.0	0.17	(0.0,0.5)
Coast SE AK	118	3.1	1.16	(1.2,5.7)	86	5.3	2.52	(1.2,10.9)	201	3.7	1.15	(1.7,6.1)
BC	146	3.8	1.22	(1.7,6.4)	103	6.4	2.55	(2.3,12.1)	214	3.9	1.09	(2.1,6.3)
West Coast US	14	0.4	0.61	(0.0,2.1)	24	1.5	1.09	(0.1,4.2)	72	1.3	0.61	(0.3,2.7)
Total Catch	3,827				1,611				5,438			

	SE Bering S. "A" (N=495)				SE Bering S. "B" (N=227)				SE Bering S. (N=722)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.15	(0.0,0.5)	7	0.3	0.41	(0.0,1.5)	1	0.0	0.11	(0.0,0.4)
Coast W AK	2,714	47.8	2.68	(42.5,53.0)	1,329	49.3	3.86	(41.6,56.7)	4,118	49.3	2.23	(45.0,53.7)
Mid Yukon	22	0.4	0.52	(0.1,2.0)	0	0.0	0.19	(0.0,0.6)	7	0.1	0.19	(0.0,0.7)
Up Yukon	0	0.0	0.07	(0.0,0.2)	2	0.1	0.31	(0.0,1.1)	1	0.0	0.07	(0.0,0.2)
N AK Pen	2,301	40.5	2.55	(35.6,45.5)	15	0.6	0.95	(0.0,3.3)	2,425	29.1	2.04	(25.1,33.1)
NW GOA	4	0.1	0.39	(0.0,1.4)	275	10.2	2.70	(5.5,16.0)	108	1.3	1.06	(0.3,3.8)
Copper	9	0.2	0.27	(0.0,1.0)	8	0.3	0.51	(0.0,1.8)	25	0.3	0.27	(0.1,1.0)
NE GOA	0	0.0	0.13	(0.0,0.4)	0	0.0	0.28	(0.0,0.8)	0	0.0	0.10	(0.0,0.3)
Coast SE AK	55	1.0	0.72	(0.0,2.7)	143	5.3	2.46	(1.4,10.7)	160	1.9	0.82	(0.6,3.8)
BC	423	7.4	1.27	(5.1,10.1)	389	14.4	3.22	(8.5,20.9)	860	10.3	1.31	(7.8,12.9)
West Coast US	155	2.7	0.82	(1.3,4.5)	530	19.6	2.80	(14.4,25.4)	642	7.7	1.09	(5.7,9.9)
Total Catch	5,684				2,698				8,346			

Appendix 2. -- Continued

	Area 509 "A" (N=400)				Area 509 (N=431)				Bering Sea Age 3 (N=155)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.08	(0.0,0.2)	0	0.0	0.08	(0.0,0.2)	0	0.1	0.44	(0.0,1.5)
Coast W AK	2,280	50.1	2.86	(44.5,55.7)	2,340	46.9	2.77	(41.5,52.4)	70	45.4	4.57	(36.4,54.4)
Mid Yukon	2	0.0	0.20	(0.0,0.6)	1	0.0	0.17	(0.0,0.5)	0	0.0	0.22	(0.0,0.6)
Up Yukon	1	0.0	0.10	(0.0,0.3)	1	0.0	0.09	(0.0,0.3)	0	0.0	0.20	(0.0,0.6)
N AK Pen	1,934	42.5	2.82	(37.0,48.1)	1,949	39.1	2.72	(33.8,44.4)	34	21.8	4.81	(12.7,31.3)
NW GOA	0	0.0	0.42	(0.0,1.5)	5	0.1	0.62	(0.0,2.2)	7	4.3	4.08	(0.0,13.3)
Copper	4	0.1	0.31	(0.0,1.1)	5	0.1	0.31	(0.0,1.1)	0	0.0	0.29	(0.0,0.9)
NE GOA	0	0.0	0.18	(0.0,0.6)	0	0.0	0.14	(0.0,0.4)	0	0.0	0.33	(0.0,1.0)
Coast SE AK	16	0.4	0.52	(0.0,1.8)	55	1.1	0.71	(0.1,2.8)	7	4.6	2.13	(1.1,9.4)
BC	278	6.1	1.26	(3.8,8.8)	470	9.4	1.49	(6.7,12.5)	19	12.3	3.12	(6.9,19.0)
West Coast US	35	0.8	0.54	(0.0,2.1)	163	3.3	0.94	(1.7,5.3)	18	11.6	2.84	(6.5,17.6)
Total Catch	4,550				4,989				155			

	Bering Sea Age 4 (N=234)				Bering Sea Age 5 (N=128)				West of 170 "B" (N=87)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	1	0.6	0.63	(0.0,2.2)	0	0.0	0.26	(0.0,0.8)	0	0.0	0.35	(0.0,1.0)
Coast W AK	124	52.9	4.09	(44.9,60.9)	72	56.1	6.54	(43.7,69.3)	774	76.4	5.52	(64.5,86.2)
Mid Yukon	2	1.0	0.79	(0.0,3.0)	9	7.2	4.46	(0.0,16.3)	40	3.9	2.26	(0.7,9.3)
Up Yukon	0	0.0	0.13	(0.0,0.4)	1	0.9	0.92	(0.1,3.4)	0	0.0	0.54	(0.0,1.7)
N AK Pen	59	25.4	3.67	(18.5,32.9)	33	26.1	4.43	(17.9,35.1)	100	9.8	3.91	(3.5,18.6)
NW GOA	10	4.1	2.55	(0.9,9.7)	0	0.1	0.83	(0.0,2.7)	10	1.0	2.04	(0.0,7.3)
Copper	2	1.0	0.66	(0.3,2.7)	3	2.7	2.24	(0.7,8.1)	0	0.0	0.36	(0.0,1.1)
NE GOA	0	0.0	0.26	(0.0,0.6)	0	0.0	0.60	(0.0,2.1)	9	0.9	2.64	(0.0,9.4)
Coast SE AK	2	0.7	1.22	(0.0,4.1)	7	5.7	2.60	(1.2,11.4)	38	3.8	2.82	(0.0,10.4)
BC	21	9.1	2.23	(5.2,13.9)	2	1.2	1.59	(0.1,5.5)	42	4.2	2.48	(0.8,10.2)
West Coast US	12	5.2	1.54	(2.6,8.6)	0	0.0	0.28	(0.0,0.9)	0	0.0	0.32	(0.0,1.0)
Total Catch	234				128				1,013			

	West of 170 (N=119)			
Region	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.24	(0.0,0.7)
Coast W AK	1,062	75.6	4.66	(65.9,84.0)
Mid Yukon	62	4.4	2.25	(1.1,9.8)
Up Yukon	19	1.4	1.37	(0.2,5.1)
N AK Pen	174	12.4	3.55	(6.3,20.1)
NW GOA	12	0.8	1.42	(0.2,5.2)
Copper	0	0.0	0.28	(0.0,0.8)
NE GOA	0	0.0	0.90	(0.0,2.9)
Coast SE AK	33	2.3	1.89	(0.0,6.8)
BC	42	3.0	1.81	(0.6,7.4)
West Coast US	0	0.0	0.24	(0.0,0.7)
Total Catch	1,405			

Appendix 3. -- Regional Rubias stock composition percentage estimates, standard deviations (SD), 95% credible intervals (CI), and estimated numbers of Chinook salmon from the the 2022 Bering Sea pollock trawl fisheries.Sample sizes are adjacent to the stratum designation. Total catch is the census for each stratum from AKFIN reports (NMFS 2023). Estimated numbers of fish for aged fish are for only the number of fish aged.

	"A" Season (N=380)				"B" Season (N=81)				Bering Sea all (N=461)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.10	(0.0,0.3)	7	0.6	1.06	(0.0,3.8)	0	0.0	0.23	(0.0,0.8)
Coast W AK	2,252	43.6	2.95	(37.9,49.4)	232	20.1	5.14	(10.8,30.9)	2,553	40.3	2.68	(35.1,45.6)
Mid Yukon	0	0.0	0.17	(0.0,0.5)	0	0.0	0.41	(0.0,1.2)	0	0.0	0.13	(0.0,0.4)
Up Yukon	4	0.1	0.20	(0.0,0.7)	0	0.0	0.47	(0.0,1.4)	4	0.1	0.16	(0.0,0.6)
N AK Pen	2,698	52.2	2.97	(46.4,58.1)	95	8.3	3.53	(2.7,16.3)	2,762	43.6	2.74	(38.2,48.9)
NW GOA	15	0.3	0.77	(0.0,2.8)	16	1.3	2.32	(0.1,8.3)	74	1.2	1.20	(0.4,4.4)
Copper	0	0.0	0.10	(0.0,0.3)	0	0.0	0.95	(0.0,3.3)	8	0.1	0.24	(0.0,0.9)
NE GOA	0	0.0	0.19	(0.0,0.5)	45	3.9	3.20	(0.7,11.6)	22	0.3	0.52	(0.1,1.9)
Coast SE AK	0	0.0	0.11	(0.0,0.3)	145	12.6	4.30	(5.1,21.8)	123	1.9	0.82	(0.6,3.8)
BC	184	3.6	0.97	(1.9,5.7)	254	22.1	5.14	(13.0,32.9)	451	7.1	1.29	(4.8,9.8)
West Coast US	13	0.2	0.29	(0.0,1.0)	357	31.0	5.34	(21.2,42.0)	341	5.4	1.08	(3.5,7.7)
Total Catch	5,165				1,152				6,337			

	CVOA "A" (N=256)				CVOA (N=310)				Bering Sea Age 4 (N=73)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.17	(0.0,0.5)	0	0.0	0.40	(0.0,1.4)	0	0.0	0.41	(0.0,1.2)
Coast W AK	1,492	40.1	3.63	(33.2,47.3)	1,597	35.3	3.23	(29.1,41.7)	37	51.1	6.91	(37.3,64.5)
Mid Yukon	7	0.2	0.46	(0.0,1.6)	6	0.1	0.38	(0.0,1.3)	0	0.0	0.42	(0.0,1.2)
Up Yukon	5	0.1	0.33	(0.0,1.1)	4	0.1	0.27	(0.0,0.9)	0	0.0	0.41	(0.0,1.3)
N AK Pen	2,018	54.3	3.65	(47.0,61.3)	2,067	45.7	3.29	(39.3,52.2)	25	33.8	6.52	(21.3,46.7)
NW GOA	10	0.3	0.74	(0.0,2.7)	12	0.3	0.75	(0.0,2.6)	3	3.4	4.59	(0.5,16.1)
Copper	0	0.0	0.15	(0.0,0.4)	0	0.0	0.11	(0.0,0.3)	0	0.2	1.11	(0.0,3.9)
NE GOA	0	0.0	0.24	(0.0,0.7)	0	0.0	0.19	(0.0,0.6)	2	3.1	2.92	(1.1,11.1)
Coast SE AK	0	0.0	0.13	(0.0,0.4)	80	1.8	1.04	(0.0,4.1)	0	0.0	0.69	(0.0,2.2)
BC	175	4.7	1.29	(2.5,7.6)	418	9.2	1.75	(6.1,13.0)	5	6.9	2.92	(2.3,13.6)
West Coast US	12	0.3	0.43	(0.0,1.5)	336	7.4	1.53	(4.7,10.7)	1	1.5	1.51	(0.0,5.4)
Total Catch	3,719				4,521				73			

	Area 509 "A" (N=306)				Area 509 (N=310)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.13	(0.0,0.4)	0	0.0	0.12	(0.0,0.3)
Coast W AK	1,752	43.4	3.27	(37.1,49.9)	1,735	41.6	3.22	(35.3,47.9)
Mid Yukon	0	0.0	0.25	(0.0,0.9)	1	0.0	0.26	(0.0,0.9)
Up Yukon	3	0.1	0.22	(0.0,0.7)	2	0.1	0.21	(0.0,0.7)
N AK Pen	2,096	52.0	3.31	(45.4,58.4)	2,214	53.0	3.25	(46.6,59.3)
NW GOA	2	0.1	0.67	(0.0,2.4)	7	0.2	0.67	(0.0,2.4)
Copper	0	0.0	0.13	(0.0,0.4)	1	0.0	0.12	(0.0,0.4)
NE GOA	0	0.0	0.17	(0.0,0.5)	0	0.0	0.17	(0.0,0.5)
Coast SE AK	0	0.0	0.13	(0.0,0.4)	0	0.0	0.16	(0.0,0.5)
BC	167	4.1	1.15	(2.2,6.7)	203	4.9	1.24	(2.7,7.6)
West Coast US	13	0.3	0.36	(0.0,1.3)	13	0.3	0.37	(0.0,1.3)
Total Catch	4,033				4,176			

	SE Bering S. "A" (N=344)				SE Bering S. (N=403)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.12	(0.0,0.3)	0	0.0	0.29	(0.0,1.0)
Coast W AK	1,985	42.2	3.10	(36.2,48.3)	2,124	38.3	2.87	(32.7,44.0)
Mid Yukon	0	0.0	0.20	(0.0,0.7)	0	0.0	0.19	(0.0,0.6)
Up Yukon	3	0.1	0.18	(0.0,0.6)	2	0.0	0.15	(0.0,0.5)
N AK Pen	2,506	53.3	3.13	(47.1,59.3)	2,553	46.0	2.91	(40.3,51.8)
NW GOA	1	0.0	0.52	(0.0,1.8)	16	0.3	0.58	(0.0,2.1)
Copper	0	0.0	0.11	(0.0,0.3)	0	0.0	0.09	(0.0,0.3)
NE GOA	0	0.0	0.17	(0.0,0.5)	0	0.0	0.15	(0.0,0.4)
Coast SE AK	0	0.0	0.12	(0.0,0.4)	101	1.8	0.85	(0.4,3.7)
BC	197	4.2	1.06	(2.4,6.5)	442	8.0	1.42	(5.4,11.0)
West Coast US	13	0.3	0.32	(0.0,1.2)	306	5.5	1.17	(3.5,8.0)
Total Catch	4,704				5,544			

Appendix 4. -- Regional Rubias (2020) and BAYES stock composition percentage estimates and estimated numbers of previous years of Chinooksalmon fromthe Bering Sea pollock trawl fisheries. The BAYES mean estimates are also provided with standard deviations (SD), andhe 95% credible intervals (CI). Sample sizes are adjacent to stratum designation. Total catch is the actual catch for that year.

2020	"A" Season (N=1,371)				"B" Season (N=1,243)				Bering Sea all (N=3,241)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	435	2.4	0.48	(1.5,3.4)	123	0.9	0.28	(0.4,1.5)	552	1.7	0.30	(1.2,2.3)
Coast W AK	9,469	51.5	1.64	(48.3,54.7)	7,467	53.6	1.68	(50.3,56.9)	16,796	52.0	1.21	(49.6,54.4)
Mid Yukon	281	1.5	0.49	(0.7,2.6)	318	2.3	0.73	(1.0,3.8)	670	2.1	0.47	(1.2,3.0)
Up Yukon	557	3.0	0.54	(2.1,4.2)	130	0.9	0.41	(0.3,1.8)	729	2.3	0.36	(1.6,3.0)
N AK Pen	4,553	24.8	1.41	(22.1,27.6)	208	1.5	0.48	(0.7,2.5)	4,247	13.1	0.84	(11.5,14.8)
NW GOA	143	0.8	0.53	(0.3,2.1)	1,295	9.3	1.12	(7.2,11.6)	1,825	5.7	0.68	(4.4,7.1)
Copper	0	0.0	0.11	(0.0,0.4)	7	0.0	0.08	(0.0,0.3)	0	0.0	0.06	(0.0,0.2)
NE GOA	3	0.0	0.10	(0.0,0.3)	12	0.1	0.15	(0.0,0.5)	14	0.0	0.10	(0.0,0.3)
Coast SE AK	297	1.6	0.55	(0.7,2.8)	249	1.8	0.73	(0.5,3.3)	497	1.5	0.47	(0.7,2.6)
BC	2,138	11.6	1.01	(9.7,13.6)	2,548	18.3	1.25	(15.9,20.8)	4,824	14.9	0.84	(13.3,16.6)
West Coast US	494	2.7	0.47	(1.9,3.7)	1,569	11.3	0.95	(9.5,13.2)	2,141	6.6	0.52	(5.7,7.7)
Total Catch	18,369				13,925				32,294			
2019	"A" Season (N=1499)				"B" Season (N=811)				Bering Sea all (N=2,310)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	8	0.1	0.09	(0.0,0.3)	47	0.5	0.27	(0.1,1.1)	60	0.2	0.13	(0.1,0.6)
Coast W AK	7,055	44.8	1.67	(41.5,48.1)	2,812	30.4	1.88	(26.8,34.1)	9,901	39.6	1.32	(37.0,42.2)
Mid Yukon	6	0.0	0.11	(0.0,0.4)	126	1.4	0.57	(0.5,2.6)	122	0.5	0.21	(0.2,1.0)
Up Yukon	39	0.3	0.20	(0.0,0.7)	55	0.6	0.35	(0.0,1.4)	105	0.4	0.18	(0.1,0.8)
N AK Pen	3,420	21.7	1.50	(18.8,24.7)	32	0.4	0.48	(0.0,1.6)	3,635	14.6	1.12	(12.4,16.8)
NW GOA	36	0.2	0.37	(0.0,1.3)	1,036	11.2	1.43	(8.5,14.1)	964	3.9	0.73	(2.5,5.4)
Copper	3	0.0	0.07	(0.0,0.2)	17	0.2	0.25	(0.0,0.9)	10	0.0	0.09	(0.0,0.3)
NE GOA	2	0.0	0.05	(0.0,0.1)	6	0.1	0.21	(0.0,0.7)	5	0.0	0.07	(0.0,0.2)
Coast SE AK	318	2.0	0.55	(1.0,3.2)	264	2.9	0.75	(1.5,4.4)	550	2.2	0.43	(1.4,3.1)
BC	3,827	24.3	1.18	(22.0,26.7)	2,392	25.9	1.60	(22.8,29.1)	6,236	25.0	0.96	(23.1,26.9)
West Coast US	1,025	6.5	0.67	(5.3,7.9)	2,461	26.6	1.59	(23.5,29.8)	3,395	13.6	0.74	(12.2,15.1)
Total Catch	15,738				9,246				24,984			
2018	"A" Season (N=827)				"B" Season (N=470)				Bering Sea all (N=1,297)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.03	(0.0,0.1)	41	0.8	0.46	(0.1,1.9)	43	0.3	0.19	(0.0,0.8)
Coast W AK	2,974	34.8	2.01	(31.0,38.8)	1,613	31.1	2.50	(26.2,36.0)	4,635	33.8	1.64	(30.6,37.0)
Mid Yukon	36	0.4	0.51	(0.0,1.7)	65	1.3	1.14	(0.0,3.8)	62	0.5	0.51	(0.0,1.6)
Up Yukon	69	0.8	0.38	(0.2,1.7)	55	1.1	0.79	(0.0,2.8)	122	0.9	0.31	(0.4,1.6)
N AK Pen	2,187	25.6	1.86	(22.1,29.3)	153	2.9	1.05	(1.2,5.2)	2,395	17.5	1.29	(15.0,20.0)
NW GOA	126	1.5	0.84	(0.1,3.3)	209	4.0	1.34	(1.8,7.0)	312	2.3	0.69	(1.1,3.8)
Copper	2	0.0	0.06	(0.0,0.2)	26	0.5	0.37	(0.0,1.4)	33	0.2	0.16	(0.0,0.6)
NE GOA	6	0.1	0.20	(0.0,0.6)	2	0.0	0.20	(0.0,0.5)	4	0.0	0.09	(0.0,0.3)
Coast SE AK	279	3.3	0.79	(1.9,5.0)	273	5.3	1.66	(2.2,8.7)	509	3.7	0.70	(2.4,5.2)
BC	2,333	27.3	1.62	(24.2,30.6)	1,715	33.0	2.56	(28.1,38.1)	4,060	29.6	1.35	(27.0,32.3)
West Coast US	526	6.2	0.89	(4.5,8.0)	1,039	20.0	1.91	(16.4,23.9)	1,550	11.3	0.91	(9.6,13.1)
Total Catch	8,535				5,191				13,726			
2017	"A" Season (N=1,866)				"B" Season (N=753)				Bering Sea all (N=2,619)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	35	0.2	0.12	(0.0,0.5)	19	0.2	0.19	(0.0,0.7)	54	0.2	0.10	(0.1,0.4)
Coast W AK	6,118	28.3	1.23	(25.9,30.8)	1,019	12.0	1.33	(9.5,14.7)	7,113	23.7	0.99	(21.7,25.6)
Mid Yukon	136	0.6	0.26	(0.2,1.2)	29	0.3	0.33	(0.0,1.1)	162	0.5	0.21	(0.2,1.0)
Up Yukon	156	0.7	0.27	(0.3,1.3)	1	0.0	0.04	(0.0,0.1)	162	0.5	0.20	(0.2,1.0)
N AK Pen	4,465	20.7	1.15	(18.5,23.0)	154	1.8	0.59	(0.8,3.1)	4,490	14.9	0.87	(13.3,16.7)
NW GOA	78	0.4	0.39	(0.0,1.4)	231	2.7	0.79	(1.3,4.4)	406	1.4	0.45	(0.6,2.3)
Copper	2	0.0	0.04	(0.0,0.1)	10	0.1	0.18	(0.0,0.6)	3	0.0	0.03	(0.0,0.1)
NE GOA	13	0.1	0.12	(0.0,0.4)	2	0.0	0.08	(0.0,0.2)	9	0.0	0.07	(0.0,0.3)
Coast SE AK	691	3.2	0.54	(2.2,4.3)	575	6.8	1.24	(4.5,9.3)	1,221	4.1	0.52	(3.1,5.1)
BC	7,609	35.2	1.18	(32.9,37.6)	3,141	37.1	2.01	(33.2,41.0)	10,812	36.0	1.03	(34.0,38.0)
West Coast US	2,303	10.7	0.75	(9.2,12.2)	3,291	38.8	1.87	(35.2,42.5)	5,642	18.8	0.81	(17.2,20.4)
Total Catch	21,603				8,473				30,076			

Appendix 4. -- Continued

2016	"A" Season (N=1,488)				"B" Season (N=422)				Bering Sea all (N=1,910)			
Region	Est. #	Mean	SD	95% PI	Est. #	Mean	SD	95% PI	Est. #	Mean	SD	95% PI
Russia	108	0.6	0.25	(0.2,1.2)	12	0.2	0.24	(0.0,0.9)	114	0.5	0.19	(0.2,1.0)
Coast W AK	6,570	39.0	1.46	(36.2,41.9)	843	16.5	2.14	(12.5,20.8)	7,372	33.6	1.28	(31.2,36.2)
Mid Yukon	283	1.7	0.40	(1.0,2.5)	18	0.4	0.60	(0.0,2.0)	327	1.5	0.34	(0.9,2.2)
Up Yukon	365	2.2	0.43	(1.4,3.1)	34	0.7	0.48	(0.0,1.8)	406	1.9	0.35	(1.2,2.6)
N AK Pen	2,839	16.9	1.17	(14.6,19.2)	56	1.1	0.72	(0.0,2.8)	2,927	13.4	0.96	(11.5,15.3)
NW GOA	94	0.6	0.46	(0.0,1.6)	298	5.9	1.54	(3.1,9.1)	458	2.1	0.62	(1.0,3.4)
Copper	3	0.0	0.06	(0.0,0.2)	90	1.8	0.73	(0.6,3.4)	75	0.3	0.18	(0.1,0.8)
NE GOA	2	0.0	0.07	(0.0,0.2)	2	0.0	0.13	(0.0,0.3)	2	0.0	0.07	(0.0,0.1)
Coast SE AK	663	3.9	0.72	(2.6,5.4)	333	6.5	1.70	(3.6,10.2)	971	4.4	0.64	(3.3,5.8)
BC	4,394	26.1	1.26	(23.7,28.6)	1,888	37.0	2.68	(31.8,42.3)	6,312	28.8	1.14	(26.6,31.0)
West Coast US	1,506	9.0	0.81	(7.4,10.6)	1,524	29.9	2.33	(25.4,34.5)	2,960	13.5	0.82	(11.9,15.1)
Total Catch	16,828				5,098				21,926			
2015	"A" Season (N=1,181)				"B" Season (N=576)				Bering Sea all (N=1,757)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	75	0.6	0.29	(0.2,1.3)	5	0.1	0.20	(0.0,0.7)	93	0.5	0.21	(0.2,1.0)
Coast W AK	5,644	45.9	1.87	(42.2,49.5)	1,651	27.4	2.36	(22.9,32.1)	7,256	39.6	1.60	(36.4,42.7)
Mid Yukon	119	1.0	0.76	(0.0,2.7)	97	1.6	0.67	(0.6,3.2)	304	1.7	0.71	(0.6,3.2)
Up Yukon	448	3.6	0.68	(2.4,5.1)	65	1.1	0.55	(0.2,2.3)	502	2.7	0.48	(1.9,3.7)
N AK Pen	1,785	14.5	1.33	(12.0,17.2)	60	1.0	0.85	(0.0,3.0)	1,943	10.6	1.00	(8.7,12.6)
NW GOA	349	2.8	0.82	(1.4,4.6)	496	8.2	1.95	(4.6,12.3)	724	4.0	0.83	(2.5,5.7)
Copper	21	0.2	0.36	(0.0,1.3)	3	0.1	0.12	(0.0,0.4)	11	0.1	0.18	(0.0,0.7)
NE GOA	2	0.0	0.10	(0.0,0.2)	4	0.1	0.22	(0.0,0.7)	4	0.0	0.11	(0.0,0.3)
Coast SE AK	475	3.9	0.72	(2.6,5.4)	381	6.3	1.39	(3.8,9.3)	828	4.5	0.67	(3.3,5.9)
BC	2,355	19.1	1.21	(16.8,21.6)	1,603	26.6	2.06	(22.6,30.7)	3,998	21.8	1.08	(19.7,24.0)
West Coast US	1,030	8.4	0.84	(6.8,10.1)	1,659	27.5	1.95	(23.8,31.4)	2,665	14.5	0.88	(12.9,16.3)
Total Catch	12,304				6,025				18,329			
2014	"A" Season (N=1,066)				"B" Season (N=319)				Bering Sea all (N=1,385)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	74	0.6	0.26	(0.2,1.2)	13	0.4	0.50	(0.0,1.7)	96	0.6	0.23	(0.3,1.2)
Coast W AK	6,301	54.6	2.17	(50.4,58.8)	1,109	31.8	3.09	(25.8,37.9)	7,314	48.7	1.79	(45.2,52.2)
Mid Yukon	380	3.3	1.24	(1.2,5.9)	58	1.7	0.98	(0.1,3.9)	484	3.2	0.91	(1.5,5.1)
Up Yukon	477	4.1	0.79	(2.7,5.8)	55	1.6	0.86	(0.3,3.6)	564	3.8	0.66	(2.6,5.1)
N AK Pen	2,624	22.7	1.58	(19.7,25.9)	3	0.1	0.31	(0.0,1.0)	2,666	17.7	1.35	(15.2,20.4)
NW GOA	16	0.1	0.32	(0.0,1.1)	642	18.4	2.68	(13.4,23.9)	630	4.2	1.00	(2.4,6.3)
Copper	1	0.0	0.05	(0.0,0.1)	5	0.1	0.37	(0.0,1.3)	5	0.0	0.09	(0.0,0.3)
NE GOA	1	0.0	0.05	(0.0,0.1)	3	0.1	0.32	(0.0,1.1)	3	0.0	0.08	(0.0,0.2)
Coast SE AK	68	0.6	0.36	(0.0,1.4)	124	3.6	1.41	(1.3,6.7)	207	1.4	0.43	(0.6,2.3)
BC	1,174	10.2	0.98	(8.3,12.2)	855	24.5	2.59	(19.6,29.7)	2,049	13.6	1.01	(11.7,15.7)
West Coast US	422	3.7	0.63	(2.5,5.0)	624	17.9	2.21	(13.8,22.4)	1,013	6.7	0.76	(5.2,8.3)
Total Catch	11,539				3,492				15,031			
2013	"A" Season (N=792)				"B" Season (N=454)				Bering Sea all (N=1,246)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	74	0.9	0.40	(0.4,1.7)	43	0.9	0.50	(0.2,2.0)	117	0.9	0.30	(0.4,1.5)
Coast W AK	4,135	50.2	2.20	(46.0,54.5)	2,490	51.9	2.80	(46.4,57.3)	6,530	50.1	1.80	(46.7,53.5)
Mid Yukon	91	1.1	0.60	(0.0,2.6)	91	1.9	1.00	(0.4,4.2)	235	1.8	0.70	(0.6,3.1)
Up Yukon	593	7.2	1.10	(5.1,9.4)	67	1.4	0.90	(0.0,3.4)	652	5.0	0.80	(3.5,6.7)
N AK Pen	1,573	19.1	1.80	(15.7,22.8)	283	5.9	1.50	(3.4,9.0)	1,851	14.2	1.40	(11.6,17.0)
NW GOA	41	0.5	0.70	(0.0,2.4)	331	6.9	1.80	(3.5,10.7)	443	3.4	1.00	(1.8,5.5)
Copper	8	0.1	0.10	(0.0,0.5)	5	0.1	0.30	(0.0,0.9)	13	0.1	0.20	(0.0,0.7)
NE GOA	0	0.0	0.10	(0.0,0.4)	0	0.0	0.20	(0.0,0.4)	0	0.0	0.10	(0.0,0.3)
Coast SE AK	157	1.9	0.70	(0.8,3.4)	91	1.9	1.10	(0.1,4.5)	313	2.4	0.60	(1.3,3.6)
BC	1,400	17.0	1.40	(14.2,19.8)	686	14.3	1.90	(10.8,18.2)	2,020	15.5	1.10	(13.4,17.8)
West Coast US	165	2.0	0.60	(1.0,3.3)	710	14.8	1.70	(11.6,18.2)	873	6.7	0.80	(5.2,8.2)
Total Catch	8,237				4,797				13,034			

Appendix 4. -- Continued

2012	"A" Season (N=759)				"B" Season (N=352)				Bering Sea all (N=1,111)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	42	0.5	0.27	(0.2,1.2)	86	2.4	0.83	(1.1,4.3)	126	1.1	0.32	(0.6,1.8)
Coast W AK	5,266	67.8	2.22	(63.4,72.1)	1,863	52.1	2.92	(46.3,57.7)	7,152	63.1	1.83	(59.4,66.6)
Mid Yukon	92	1.2	0.82	(0.0,3.1)	6	0.2	0.32	(0.0,1.1)	115	1.0	0.59	(0.0,2.3)
Up Yukon	241	3.1	0.82	(1.6,4.8)	35	1.0	0.64	(0.1,2.5)	271	2.4	0.60	(1.3,3.7)
N AK Pen	1,256	16.2	1.88	(12.7,20.0)	3	0.1	0.25	(0.0,0.8)	1,227	10.8	1.35	(8.3,13.6)
NW GOA	19	0.2	0.35	(0.0,1.2)	135	3.8	1.44	(1.3,6.9)	155	1.4	0.73	(0.2,3.1)
Copper	2	0.0	0.12	(0.0,0.3)	2	0.1	0.17	(0.0,0.5)	2	0.0	0.07	(0.0,0.2)
NE GOA	6	0.1	0.26	(0.0,0.9)	2	0.1	0.20	(0.0,0.6)	6	0.1	0.17	(0.0,0.6)
Coast SE AK	128	1.7	0.78	(0.3,3.4)	292	8.2	1.84	(4.5,11.9)	381	3.4	0.73	(2.0,4.9)
BC	568	7.3	1.12	(5.2,9.6)	547	15.3	2.24	(11.2,20.0)	1,159	10.2	1.01	(8.3,12.3)
West Coast US	146	1.9	0.51	(1.0,3.0)	609	17.0	2.09	(13.1,21.3)	749	6.6	0.78	(5.1,8.2)
Total Catch	7,765				3,579				11,344			
2011	"A" Season (N=695)				"B" Season (N=1,778)				Bering Sea all (N=2,473)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	12	0.2	0.16	(0.0,0.6)	184	1.0	0.25	(0.6,1.6)	196	0.8	0.19	(0.5,1.2)
Coast W AK	3,856	54.0	2.28	(49.6,58.5)	13,549	73.8	1.28	(71.3,76.2)	17,421	68.3	1.16	(66.0,70.6)
Mid Yukon	127	1.8	0.76	(0.6,3.6)	233	1.3	0.46	(0.5,2.2)	411	1.6	0.46	(0.8,2.5)
Up Yukon	526	7.4	1.12	(5.3,9.7)	119	0.7	0.35	(0.1,1.4)	627	2.5	0.47	(1.6,3.4)
N AK Pen	1,556	21.8	1.94	(18.1,25.7)	628	3.4	0.65	(2.2,4.8)	2,201	8.6	0.81	(7.1,10.3)
NW GOA	41	0.6	0.60	(0.0,2.2)	654	3.6	0.89	(2.0,5.5)	663	2.6	0.67	(1.4,4.1)
Copper	1	0.0	0.07	(0.0,0.2)	105	0.6	0.30	(0.0,1.2)	69	0.3	0.24	(0.0,0.8)
NE GOA	1	0.0	0.09	(0.0,0.2)	26	0.1	0.24	(0.0,0.8)	13	0.1	0.12	(0.0,0.4)
Coast SE AK	218	3.1	0.86	(1.6,4.9)	259	1.4	0.46	(0.6,2.4)	459	1.8	0.41	(1.1,2.6)
BC	515	7.2	1.13	(5.1,9.6)	1,425	7.8	0.71	(6.4,9.2)	1,984	7.8	0.62	(6.6,9.0)
West Coast US	283	4.0	0.78	(2.6,5.6)	1,181	6.4	0.61	(5.3,7.7)	1,461	5.7	0.49	(4.8,6.7)
Total Catch	7,137				18,362				25,504			

Appendix 4. -- 37 SNP DNA markers represented in the Chinook salmon baseline

Locus	Ploidy	SNPpos	Allele1	Allele2	Probe1	Probe2	Primer	Primer Conc. (uM)
Ots_AsnRS-60	2	1	T	C	TGAGTCCCTGACCAGC	AGTCCCCGACCAGC	CCGACGCCTCACTGAGT	0.16
Ots_E2-275	2	1	A	G	CCCCCATATTGCTG	CCCCACATTGCTG	GGTGCCACTTTAGTATAGCTGCTTA	0.16
Ots_ETIF1A	2	1	A	C	CAACTGAAGAAAATAATATG	CTGAAGAAAAGAATATG	TCTGAACTCACCAAAGGAACACTTG	0.16
Ots_FARSLA-220	2	1	G	A	CCTTGGATGGGATGTG	CCTTGGATAGGATGTG	GTTCGTGGGATTGTTCAATGTTCAT	0.16
Ots_FGF6A	2	1	G	T	CACGATTAGCAATGAACAA	CACGATTAGCAATTAACAA	TCAAAAATGTCTATCCAACAAATACTCTGAAAAATATTG	0.16
Ots_GH2	2	1	A	T	TGACTCTCAGCA[TA]CTG	TGACTCTCTGCA[TA]CTG	GCGTACTGAGCCTGGATGACA	0.08
Ots_GPDH-338	2	1	G	A	CCACTACTTAACGTGCTTT	CCACTACTTAACATGCTTT	CACTAAATATTCCTTATCATTTCATACTAAGTCTGAAGAA	0.32
Ots_GPH-318	2	1	C	T	ATCAAGCTGACGAACCA	CAAGCTGACAAACCA	GGTGATAACAGGTGTTGCACCAA	0.08
Ots_GST-207	2	1	C	T	ATGAGAGAGTCTTTCTCTGTT	ATGAGAGAGTCTTTTTCTGTT	GGAGAACATGCATCACCATTCAAG	0.16
Ots_GST-375	2	1	C	T	TTTCTTGTAGGCGTCAGAG	TCTTGTAGGCATCAGAG	CAGCCCGTCCCAAAATCAAG	0.16
Ots_GTH2B-550	2	1	C	G	ATAACATCTGCAGCATTAA	ATAACATGTGCAGCATTAA	CACAGGAAGGACGTGTTTTGATG	0.32
Ots_hnRNPL-533	2	1	A	T	CATTTACCAGTTCTCACACAC	TTTACCAGTTCACACACAC	TCTTTGATATTGAGCTCATAAAAGCAAGGT	0.16
Ots_HSP90B-100	2	1	C	T	TCTATGGTGTGATTCATT	TTCTATGGTGTAATTCATT	CACCTTAGTTCCACGCAACATG	0.16
Ots_IGF-I.1-76	2	1	A	T	CTGCCTAGTTAAATAAAATA	CTGCCTAGTTAAATTAAATA	GGTAGGCCGTCAGTGTAAAATAAGT	0.32
Ots_Ikaros-250	2	1	G	A	ACAGAAGATTTTCGGCTGC	ACAGAAGATTTTCGACTGC	GAGGCTGACTTGGACTTTGC	0.16
Ots_LEI-292	2	1	G	A	CATCATGTCAGGCCTG	ATCATGTCAAGCCTG	CACCTGAACCTCCACTGTGT	0.16
Ots_LWSop-638	2	1	T	C	TTTAACAAGAAAATTATACATTTC	CAAGAAAGTTATACATTTC	CAATTACTCTTTCTCAGCCCTGTGT	0.16
Ots_MHC1	2	1	G	A	CATCATCCCGTGAGCAG	TCATCATCCCATGAGCAG	GTCCACATTCTCCAGTACATGTATGG	0.16
Ots_MHC2	2	1	T	G	CTGGAGCGTTTCTGTA	CTGGAGCGTGTCTGTA	GTCCTCAGCTGGGTCAAGAG	0.16
Ots_NOD1	2	1	C	G	CCAACGGCGACTTG	CCAACGCCGACTTG	GTGCTGCAGGAACCATGTG	0.08
Ots_P450	2	1	T	A	CCCCGAAGTACTTTT	CCCGAAGAACTTTT	TGAGCGAGATTTATCAAACTGTCAAAGA	0.32
Ots_Prl2	2	1	A	G	ATGTATTGTTCATTTAATG	TGTATTGTTCGTTTAATG	CCTGGTCTGTTTGTGATCAAGATG	0.16
Ots_RAG3	2	1	C	T	CTCTACAGTATGAACTATG	CTCTACAATATGAACTATG	CATTTCCACGAAAAGCCAGATGAC	0.32
Ots_RFC2-558	2	1	A	-	TGCATGTAACAAATAACAT	TGCATGTAACATAACAT	AAGGTCTACTCCGGTTGTATTCGGT	0.08
Ots_S7-1	2	1	T	C	TACAGGAGATAAGGTCGCA	CAGGAGATAGGGTCGCA	TGCCATCATAAACAACCTAACAAGTAACT	0.32
Ots_SClkF2R2-135	2	1	A	T	ATTCAAAGTCAAATTTT	ATTCAAAGTCTAATTTT	CCAAATACAGACCAGCTACTTGTGT	0.16
Ots_SERPC1-209	2	1	A	T	CATTCAGCTTTTTTTC	ATTCAGCATTTTTTC	CTAAGTTCTTCCTGCCTAATGTGGAT	0.16
Ots_SL	2	1	A	G	TCAAAGATATGATTCAATTAA	AAGATATGGTTCAATTAA	AATATTGGCTTTCTGAGAATGCATTTGG	0.16
Ots_SWS1op-182	2	1	T	A	ATGTACTTTAACGATTCATTT	ATGTACTTTAACGTTTCATTT	TCAAAGACATCGAACACAAGAACGA	0.32
Ots_TAPBP	2	1	C	T	CAGCTGTCCAGTTCTG	CAGTTGTCCAGTTCTG	TTTCTCATCCTTCTCTCTTCCAGTCT	0.08
Ots_Tnsf	2	1	A	G	TGCTCCAGATCTC	TGCTCCAGGTCTC	GCCAATACGGGTTCTGAACTGT	0.16
Ots_u202-161	2	1	T	A	AGCTAGTGCTTAGCAGCTA[AC]	AGCTAGTGCATAGCAGCTA[AC]	CACTTTTGACTTTACATGGAACTTAACTCAT	0.32
Ots_u211-85	2	1	C	T	TCCCAAAGTCGAGTGTG	CCCAAAGTCAAGTGTG	TGGTGAGAGCAGCTTTAAATGTCTT	0.16
Ots_U212-158	2	1	G	A	CTGGAAGAAGGCCTC	CTGGAAAAAGGCCTC	CCCCATATGAGACGCTACAGTAATG	0.16
Ots_u4-92	2	1	T	C	CTGTGTTGAATTTAACATAAT	TCTGTGTTGAATTTAACGTAAT	ATCCAAGGAGCCCCATTAAAGATTT	0.16
Ots_u6-75	2	1	C	T	TTAGTCAACTGTTGTTTTT	TTAGTCAACTGTTATTTTT	GAAAAAGTAAAGTAAAAGTAAAGTATTATACCACTAAAGACAAT	0.32
Ots_zP3b-215	2	1	G	T	CCAAATATCCTACCCGTGATG	CAAATATCCTACCAGTGATG	TGCTGAGGACCATCTGCAATTC	0.16