Genetic Stock Composition Analysis of Chinook Salmon (*Oncorhynchus tshawytscha*) Bycatch Samples from the 2020 Gulf of Alaska Trawl Fisheries

by
C. M. Guthrie III,
Hv. T. Nguyen, K. D'Amelio, K. Karpan, P. D. Barry,
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

A genetic analysis of samples from the Chinook salmon (*Oncorhynchus tshawytscha*) Prohibited Species Catch (bycatch) of the 2020 Gulf of Alaska (GOA) trawl fisheries for walleye pollock (*Gadus chalcogrammus*) and rockfish (*Sebastes* spp.) was undertaken to determine stock composition. Samples were genotyped for 37 single nucleotide polymorphism (SNP) DNA markers and results were estimated using the Alaska Department of Fish and Game's (ADF&G) SNP baseline. In 2020, genetic samples were collected from Chinook salmon taken in the bycatch of the GOA pollock trawl fisheries using a simple random sample protocol with trip being the primary unit. Based on analysis of 2,669 Chinook salmon samples from a total bycatch of 10,867 fish, British Columbia (45%), West Coast US (40%), and Coastal Southeast Alaska (14%) stock groups were the largest contributors. In 2020, genetic samples from the bycatch of the GOA rockfish catcher vessel fishery were collected by the fishing industry with a census sampling protocol. Based on genotyping the entirety of the fishery's Chinook salmon bycatch (1,106 fish), the West Coast US had the largest contribution (72%), with a smaller contribution from British Columbia (18%), and minor contributions (≤ 2%) from other stock groups. The stock composition estimates for Chinook salmon bycatch samples collected from federally managed trawl fisheries in the GOA continue to show that the vast majority of Chinook salmon that are encountered originate from three stock groups that are located South and East of the Alaska Peninsula. This pattern is consistent for samples analyzed across finer-scale area and time strata within the GOA.

CONTENTS

INTRODUCTION

The Gulf of Alaska (GOA) is known as a feeding habitat for multiple brood years of Chinook salmon (*Oncorhynchus tshawytscha*) originating from many different localities in North America and Asia. Determining the stock composition of bycatch in federally managed fisheries is essential to understanding the effects that these fisheries have on Chinook salmon stock groups. This report provides genetic stock identification results for Chinook salmon Prohibited Species Catch (hereafter, bycatch) samples collected in the GOA from the trawl fisheries for walleye pollock (*Gadus chalcogrammus*) and catcher vessel (CV) trawl fisheries for rockfish (*Sebastes* spp.). The National Marine Fisheries Service (NMFS) and Alaska Department of Fish and Game (ADF&G) geographical statistical areas associated with the groundfish fishery (Fig. 1) are used to describe the spatial distribution of the Chinook salmon bycatch and genetic samples. All analyses used a single nucleotide polymorphism (SNP) baseline provided by ADF&G (Templin et al. 2011; Appendix 1), the same baseline used to estimate previous stock compositions of samples from the Chinook salmon bycatch of the federally managed GOA trawl fisheries (Guthrie et al. 2013, 2016-21; Guyon et al. 2014, 2015a,b; Larson et al. 2013). For additional information regarding background and methodology refer to the Chinook salmon bycatch report prepared previously for the 2008 Bering Sea trawl fishery (Guyon et al. 2010).

The objective of this report is to present stock composition estimates for samples collected from the bycatch of the 2020 GOA federal trawl fisheries. Stock composition estimates have been applied to bycatch numbers; however, it is important to understand the limitations of each sample set for applying estimates to the entire bycatch or comparing estimates among sample sets or years.

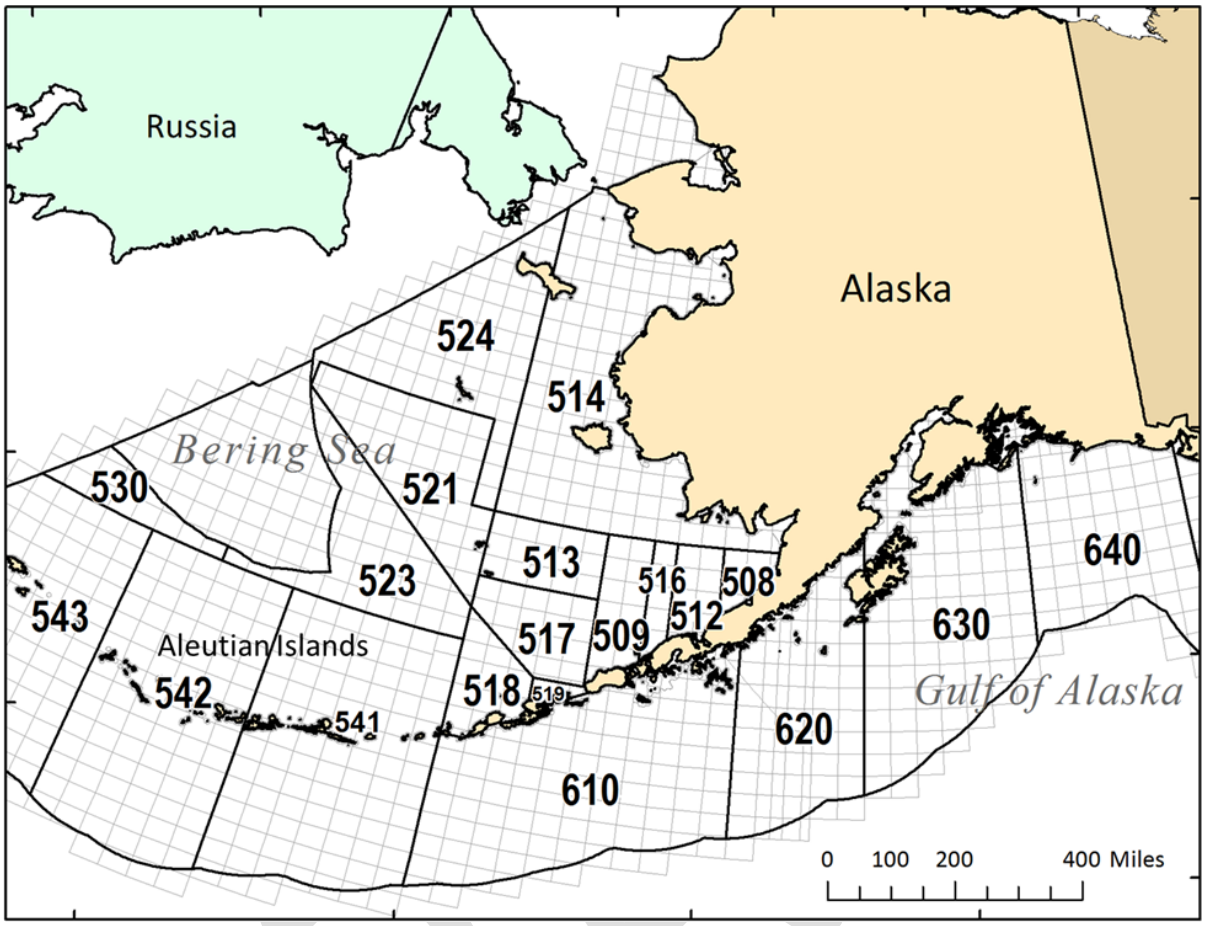

Figure 1. -- NMFS (outlined in black) and ADF&G (outlined in light gray) statistical areas associated with the Bering Sea and Gulf of Alaska (Areas 610-640) groundfish fisheries.

SAMPLE DISTRIBUTION

GOA Pollock Trawl Fishery

Amendment 93 to the GOA groundfish fishery management plan required industry to retain all Chinook salmon caught as bycatch in the GOA pollock trawl fishery. This retention requirement was aimed at providing observers with complete access to the bycatch to support genetic stock composition analyses. However, Amendment 93 did not mandate complete observer coverage, and not all GOA pollock trips were observed at-sea. Consequently, the North Pacific Groundfish and Halibut Observer Program (Observer Program) lacked the ability to

know in advance the times and locations of all GOA pollock deliveries. Recognizing these limitations in the GOA, starting in 2014, the Observer Program implemented a simple random sampling protocol with respect to trip for the collection of genetic samples in the GOA (Faunce et al. 2014). This method randomly samples from trips and censuses the salmon bycatch encountered in each associated delivery to the processor (Faunce 2015). Samples of axillary process tissue for genetic analysis were collected throughout 2020 from the GOA bottom and midwater pollock trawl fishery. Tissues were stored in coin envelopes that were labeled, frozen, and shipped to the AFSC's Auke Bay Laboratories (ABL). Scales were collected as an additional source of tissue for genetic analysis, and for ageing.

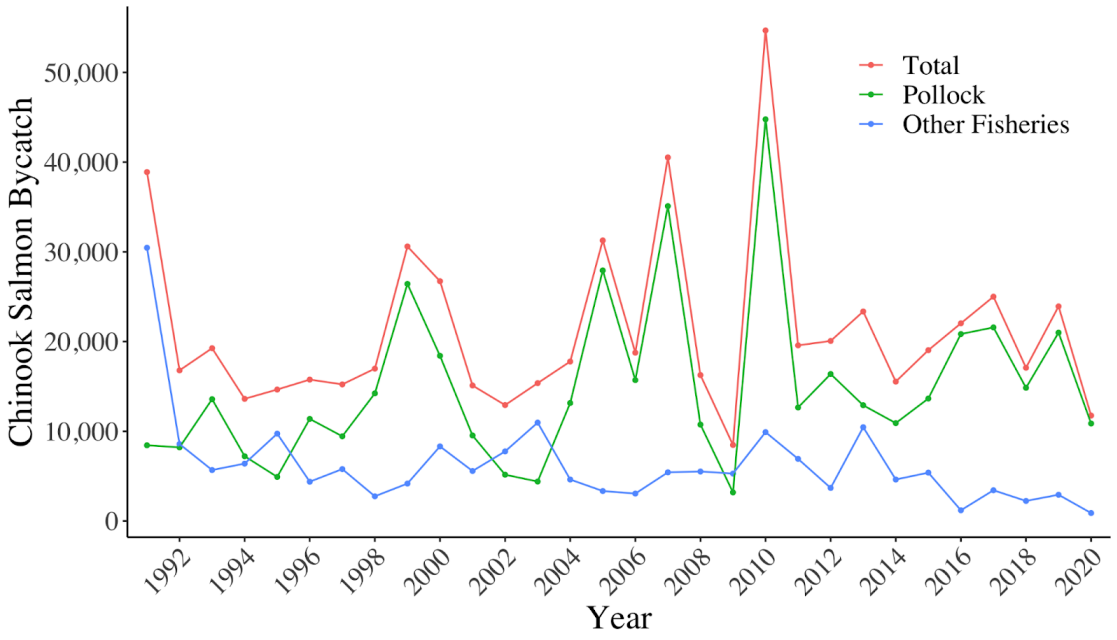

Figure 2. -- Yearly estimated Chinook salmon bycatch in the Gulf of Alaska pollock and non-pollock trawl fisheries (NMFS 2021).

In 2020, an estimated 10,867 Chinook salmon were caught in the GOA pollock trawl fisheries (NMFS 2021), which is about one quarter of the highest overall Chinook bycatch of 40,441 in 2010 and below the historical average between 1991-2019 of 15,058 (Fig. 2). The genotyped (genetic) sample set for the 2020 Chinook salmon bycatch was 2,669 fish which

equates to 25% of the estimated catch of the pollock trawl fishery. Potential spatial and temporal biases associated with the 2020 Chinook salmon GOA bycatch sample sets were evaluated visually by comparing the genetic sample distribution with the estimated overall bycatch distribution. The distributions of the numbers of samples and overall bycatch were similar by week and by statistical area and week (Fig. 3). The sampling rate (Fig. 3) was variable, but mostly over 10%, with a mean realized sampling proportion of 14%. There was some bias where large catches had large sampling rates, particularly for NMFS area 620 and small catches had variable sampling rates (Fig. 3).

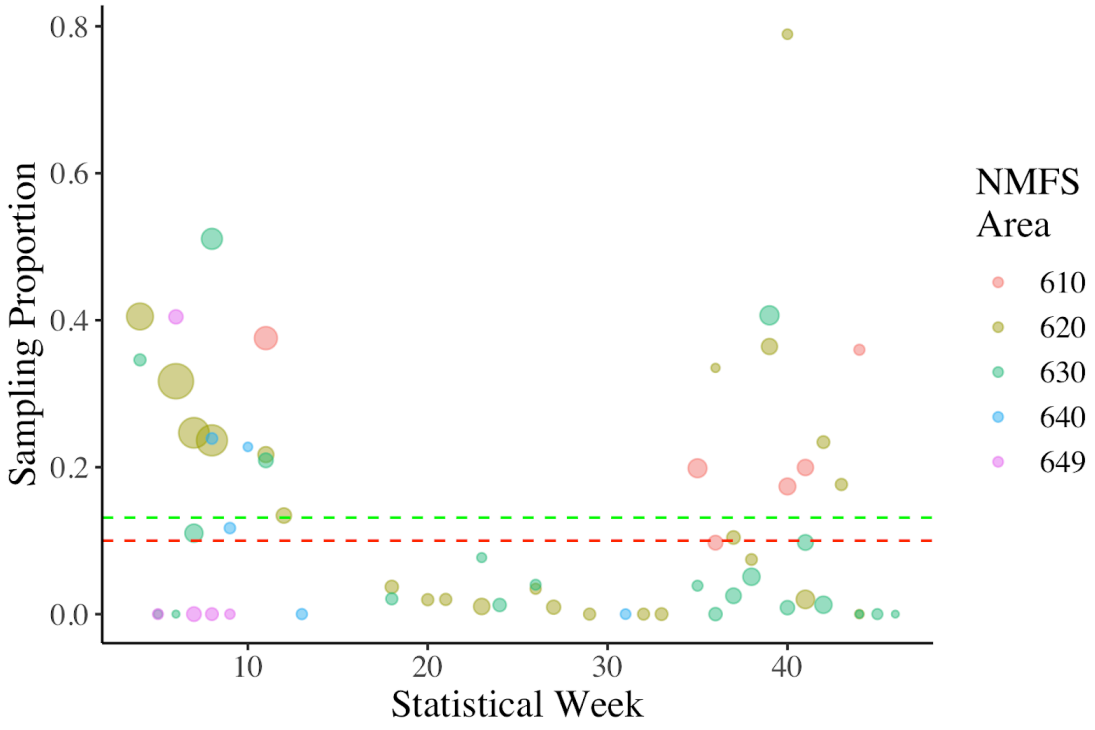

Figure 3. -- Proportion of GOA Chinook salmon bycatch sampled for genetic analysis by statistical week and NMFS Statistical Areas. The size of the circles corresponds to the number of fish caught. The green line is the realized mean sampling proportion over NMFS areas and statistical weeks, and the red line is the target of 10%.

GOA Rockfish CV Trawl Fishery

Samples were collected from the Chinook salmon bycatch of the federally managed 2020 GOA CV rockfish trawl fishery by the Alaska Groundfish Data Bank (AGDB) for analysis at the ABL. Although there was no requirement for sample collection, the AGDB implemented a census approach in 2013 (Guyon et al. 2015b, Guthrie et al. 2016, Guthrie et al. 2017, Guthrie et al. 2018, Guthrie et al. 2019, Guthrie et al. 2020 and Guthrie et al. 2021) whereby genetic samples and biological information were collected from every Chinook salmon encountered in the bycatch. Between 3 May and 15 November 2020 (NMFS statistical week numbers 19-47), genetic samples were collected from 1,123 Chinook salmon. Because samples were taken from the entire bycatch, the sample distribution is the bycatch distribution. Bycatch enumeration by statistical week is shown in Figure 4 and the sample collection area is approximated in Figure 5

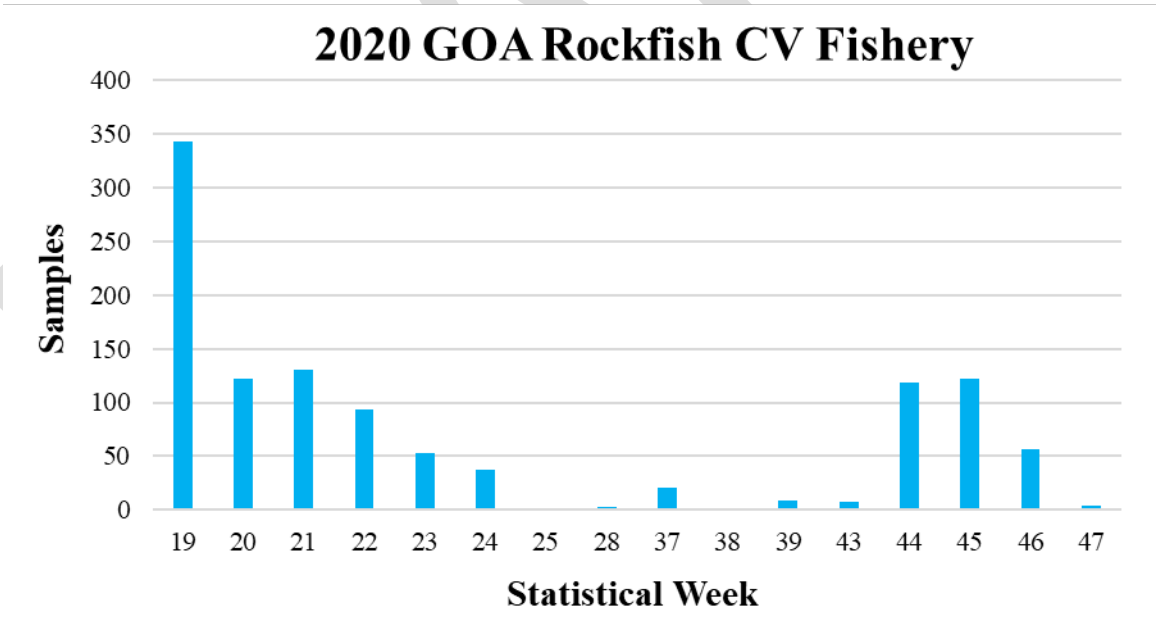

Figure 4. -- Genetic samples collected by Alaska Groundfish Data Bank from the census of the Chinook salmon bycatch in the 2020 Gulf of Alaska rockfish catcher vessel (CV) trawl fishery by statistical week.

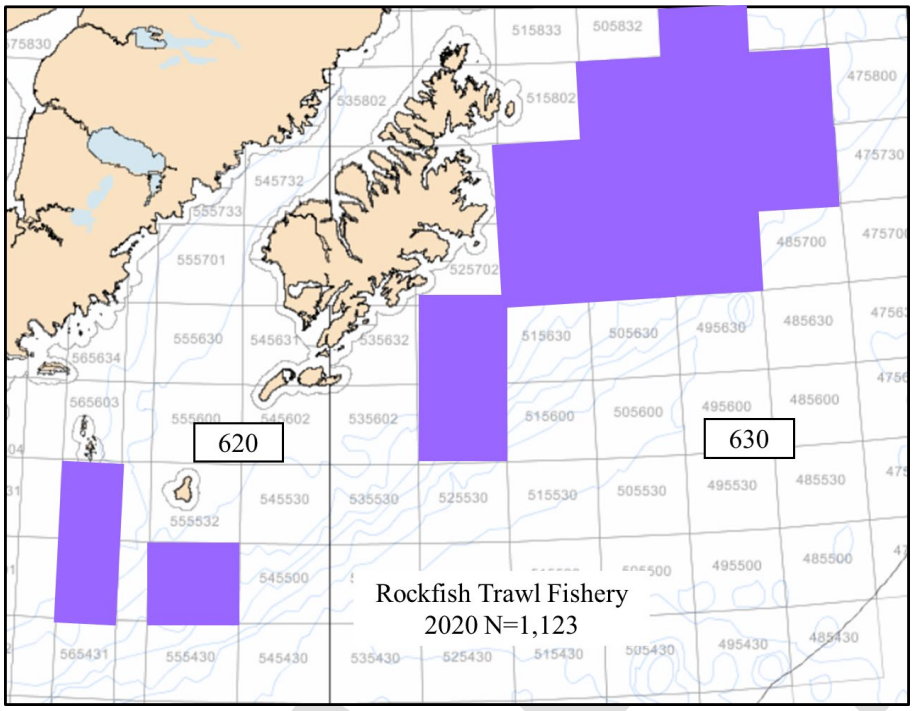

Figure 5. -- Relative location (shaded) of the 1,123 Chinook salmon bycatch samples collected in NMFS Statistical Area 630/620 by Alaska Groundfish Data Bank in the 2020 Gulf of Alaska rockfish trawl fishery.

GENETIC STOCK COMPOSITION - PROCEDURE

DNA was extracted from axillary process tissues with Machery-Nagel kits. SNP genotyping was performed using genotyping in the 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 populations 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 Genotyping-in-Thousands by Sequencing (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 individuals as quality control measures. A total of 2,669 of 2,752 (97%) of samples from the Chinook salmon bycatch from the 2020 GOA pollock trawl fishery were successfully genotyped for 30 or more of the 37 SNP loci, and 1,106 of 1,123 samples received (98%) were successfully genotyped for 30 or more of the 37 SNP loci from the 2020 GOA rockfish CV trawl fishery. The successfully genotyped samples had genetic information for an average of 36 of 37 markers.

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 group 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 (ie. flat over reporting groups). To ensure convergence to the

posterior distribution, 11 separate 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 group 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 and 100 bootstrap iterations).

Estimated numbers of fish caught from each stock group were calculated from the mean of the posterior distribution of stock composition estimates and the estimated total bycatch of Chinook salmon.

GENETIC STOCK COMPOSITION - RESULTS

GOA Pollock Trawl Fishery

The stock composition results indicate that almost 100% of the 2,669 samples from the GOA originated from 3 regions South and East of the Alaska Peninsula with the British Columbia region contributing the most (45%), followed by the West Coast US (40%), and Coastal Southeast Alaska (13%) regions (Appendix 2). For the past seven years (2014-2020) the Observer Program has implemented a simple random sampling protocol with respect to trip for the collection of genetic samples. The stock composition estimates in 2020 were very similar to estimates from the previous 6 years with the exception of an uptick of fish from Northwest GOA region in 2019 that we did not observe in 2020 (Fig. 6).

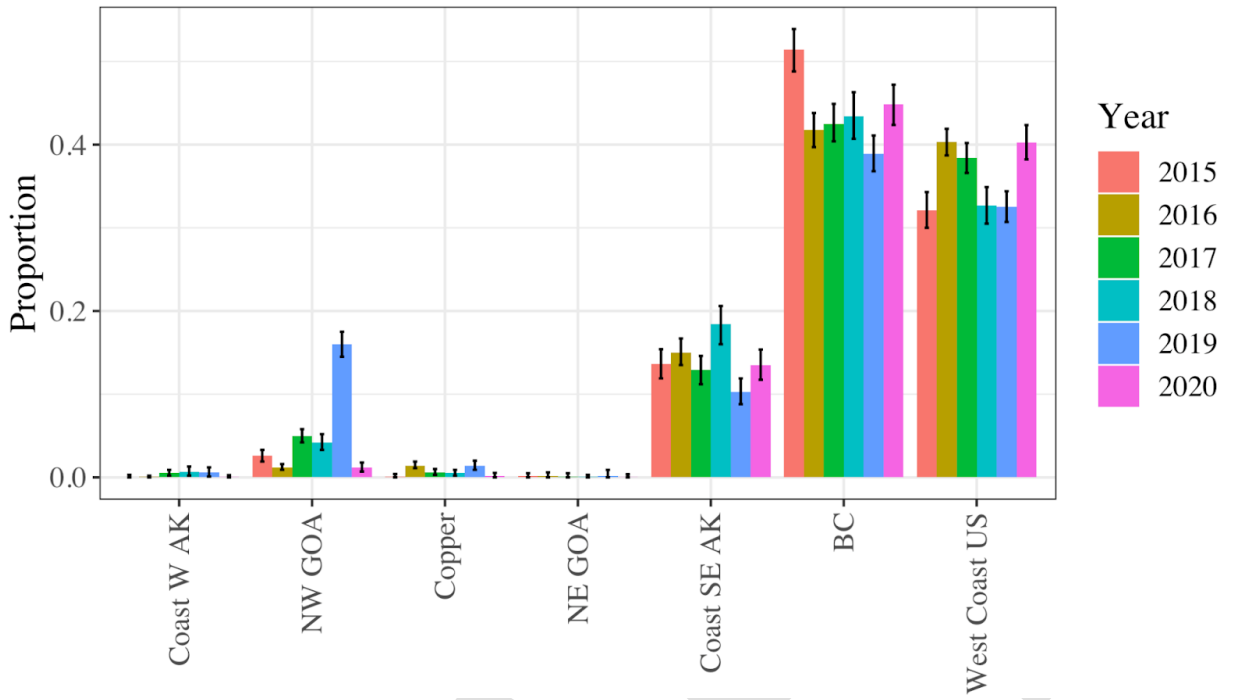

Figure 6. -- Yearly stock composition estimates (2014-2020) with 95% credible intervals of Chinook salmon bycatch based on available genetic samples from the Gulf of Alaska (GOA) pollock trawl fishery. The same genetic baseline and general regional groupings were used in all analyses.

Using information from the ANSWERS tool provided by AKFIN (NMFS 2022), geographical (ADF&G statistical areas) aggregations were developed to provide stock compositions with greater spatial precision than the existing NMFS statistical areas (Fig. 7). We analyzed 7 additional (other than overall and rockfish) bycatch sample strata (Appendix 2) South of Shumagin Islands Early (statistical week 11), Late (statistical weeks 35-44), and overall (Fig. 10); Shelikof Strait (Fig. 7); and Southeast Kodiak Island Early (statistical weeks 4-11), Late (statistical weeks 35-42), and overall (Fig. 7).

The largest stock composition contributions in the Shumagin Islands overall (Fig. 7) were Chinook salmon from British Columbia (70%), with smaller contributions from the West Coast US (16%), Coastal Southeast Alaska (15%) and Northwest GOA (4%) (Appendix 2; Fig. 8). The Early and Late season Shumagin Islands strata exhibited temporal differences in stock

composition estimates. British Columbia accounted for 82% and 52% of the bycatch in the Early and Late seasons, respectively, while the West Coast US contributed 9% and 27%, respectively,

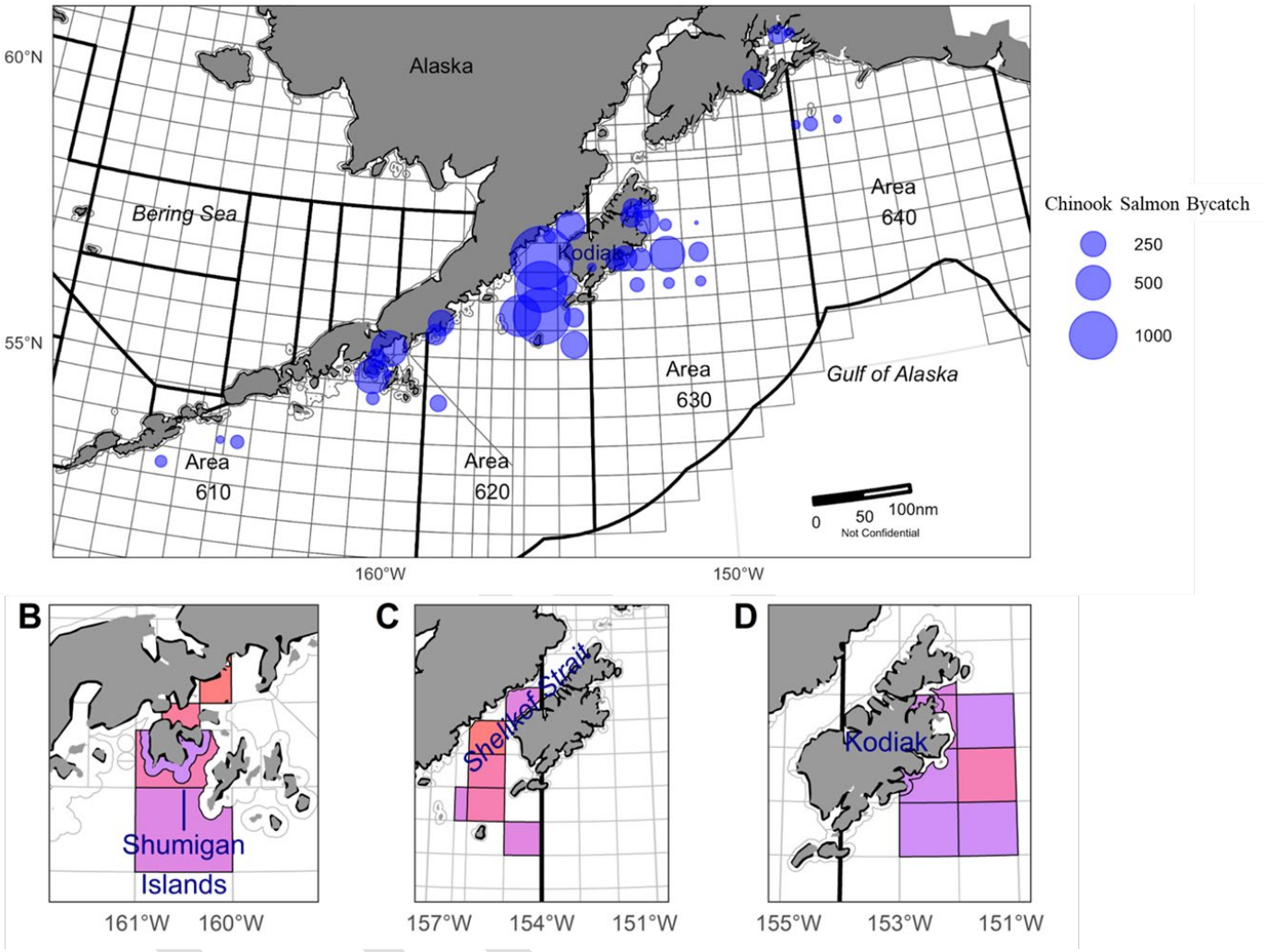

Figure 7. -- Location of sample strata used in comparative stock composition estimates from the 2020 Gulf of Alaska Chinook salmon bycatch. Circles represent the amount of total bycatch (A). Locations (shaded) of the strata used: (B) Shumagin Islands (n=305); (C) Shelikof Strait (n=1,519); (D) Southeast Kodiak Island. (NMFS 2020).

in the Early and Late seasons, respectively (Appendix 2; Fig 9). Contributions from Coastal Southeast Alaska were similar between Shumagin Islands Early and Late (8% and 9%) while Northwest GOA increased from 0 to 11% (Appendix 2, Fig. 9). For Shelikof Strait overall (Fig. 7), West Coast US contributed the most (50%), followed by the British Columbia (34%), and Coastal Southeast Alaska (16%); Appendix 2; Fig. 8). For the Southeast Kodiak Island overall

stratum (Fig. 7), the largest contribution was from British Columbia (59%), followed by the West Coast US (25%) and Coastal Southeast Alaska (15%) (Appendix 2; Fig. 8). There were temporal differences in stock composition estimates between the Early and Late strata (Fig.9): British Columbia decreased (74% to 34%), West Coast US increased (14% to 44%), and Coastal Southeast Alaska increased (12% to 19%) for the Early and Late strata, respectively (Fig. 9).

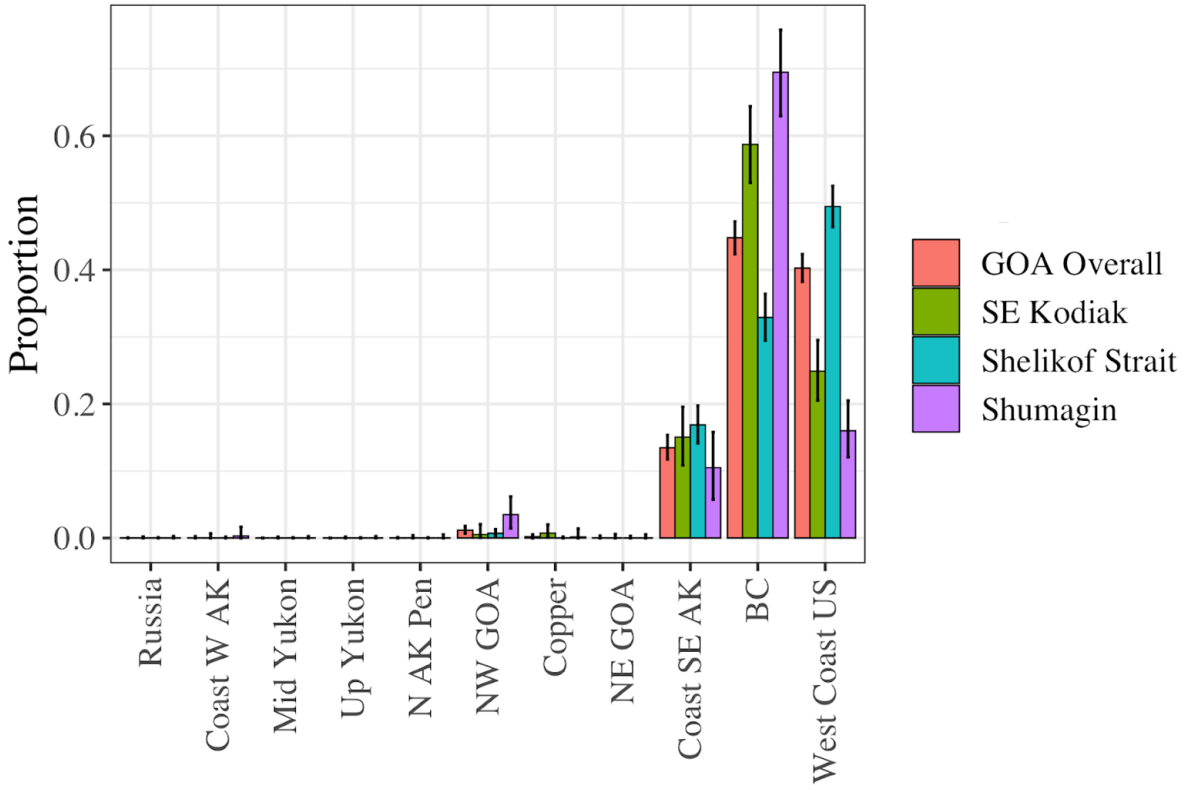

Figure 8. -- Stock composition estimates with 95% credible intervals of Chinook salmon bycatch samples from four area strata from the 2020 GOA pollock trawl fishery: GOA overall (2,883 samples); Shumagin Islands overall (n=305); Shelikof Strait overall (n=1,519); and Southeast Kodiak Island overall (n=463).

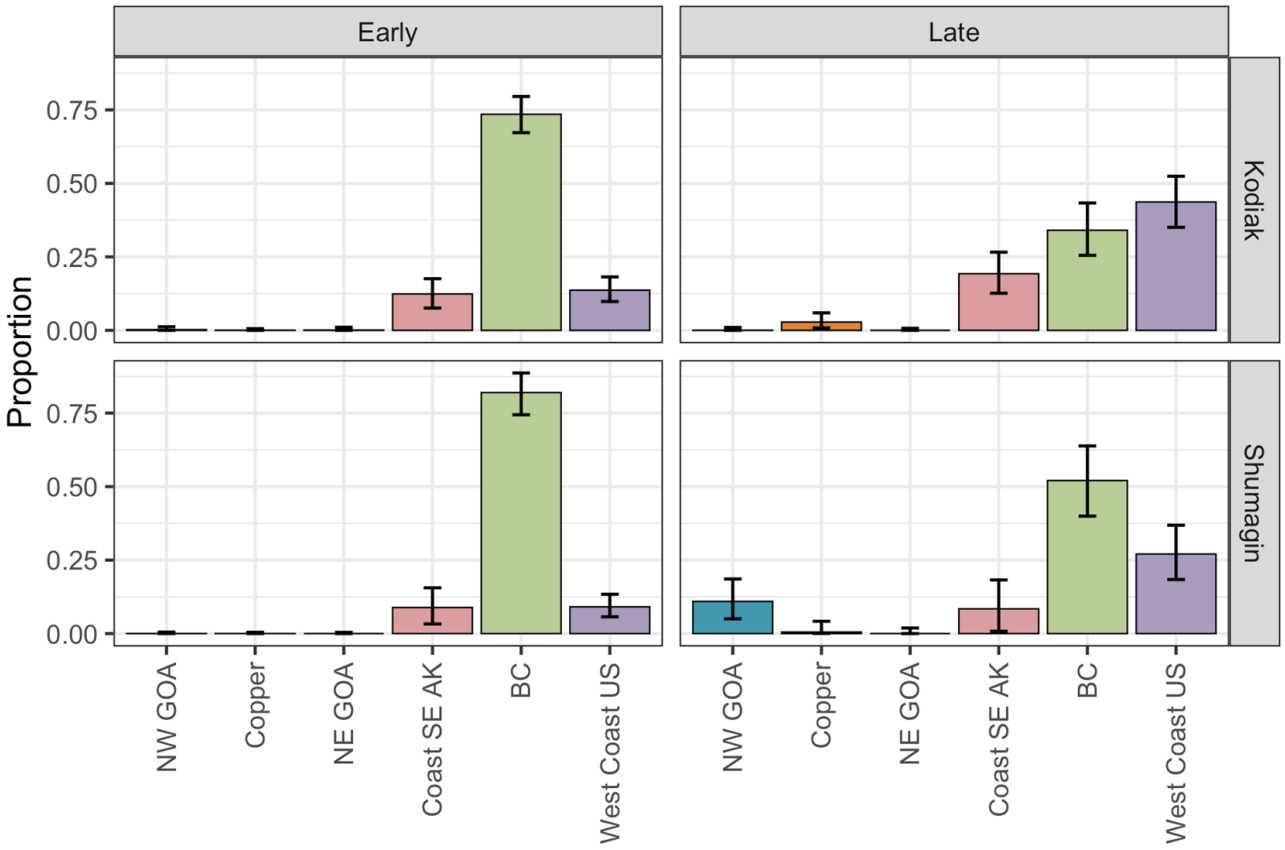

Figure 9. -- Stock composition estimates with 95% credible intervals for samples from the Southeast Kodiak Island area (Early time strata n= 205, Late strata n=100), and from the Shumagin Islands area and time strata (Early n=298, Late n=165).

Comparison of Strata Stock Composition and Catch Estimates from Previous Years

Stock composition estimates from strata where there were available data were compared across years. The Shumagin Late stratum (Appendices 2 and 3; Fig. 10) showed an interesting pattern in alternating years; British Columbia was most prevalent at 61% in 2015, 67% in 2017, and 52% in both 2019-2020; while in 2016 and 2018 British Columbia and the 2016 West Coast US had similar proportions all at 42%; with West Coast US at 51% in 2018. The stock composition estimates for Shelikof Strait (Appendices 2 and 3; Fig. 11) and Southeast Kodiak strata (Appendices 2 and 3; Fig. 12) were similar across all years.

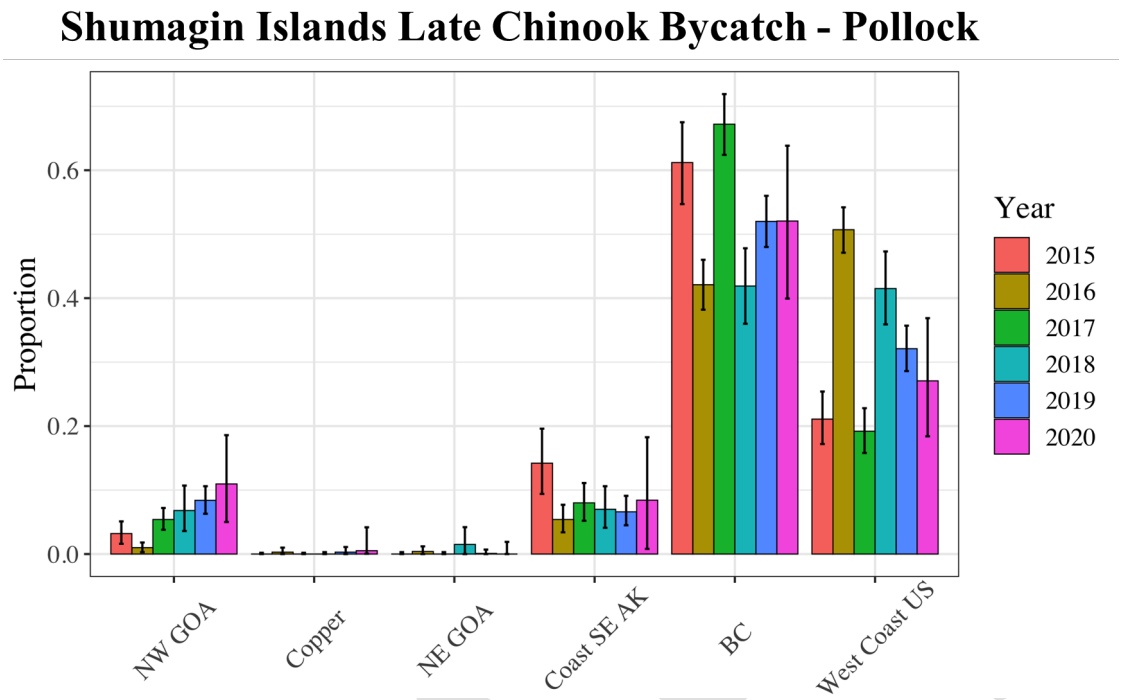

Figure 10. -- Stock composition estimates with 95% credible intervals of Chinook salmon bycatch samples from Shumagin Islands Late (Fig. 7) stratum for 2015-2020 (Appendix 3) from the Gulf of Alaska pollock trawl fishery.

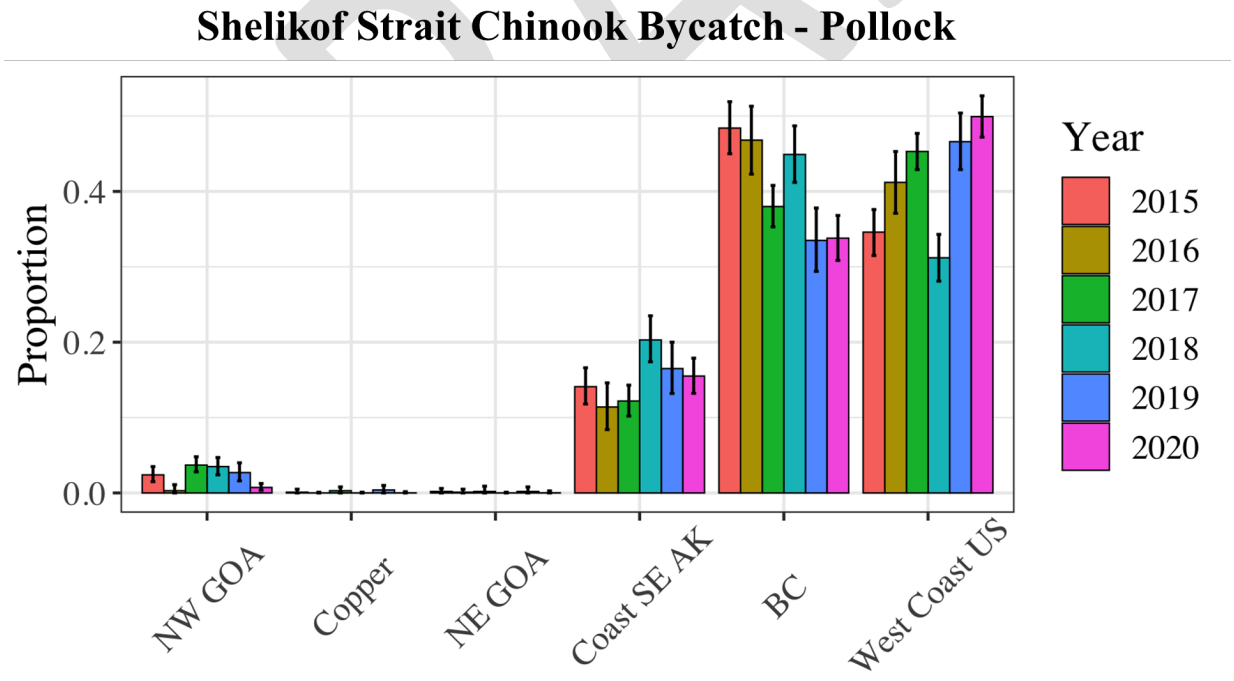

Figure 11. -- Stock composition estimates with 95% credible intervals of Chinook salmon bycatch samples from the Shelikof (Fig. 7) stratum for 2015-2020 (Appendix 3) from the Gulf of Alaska pollock trawl fishery.

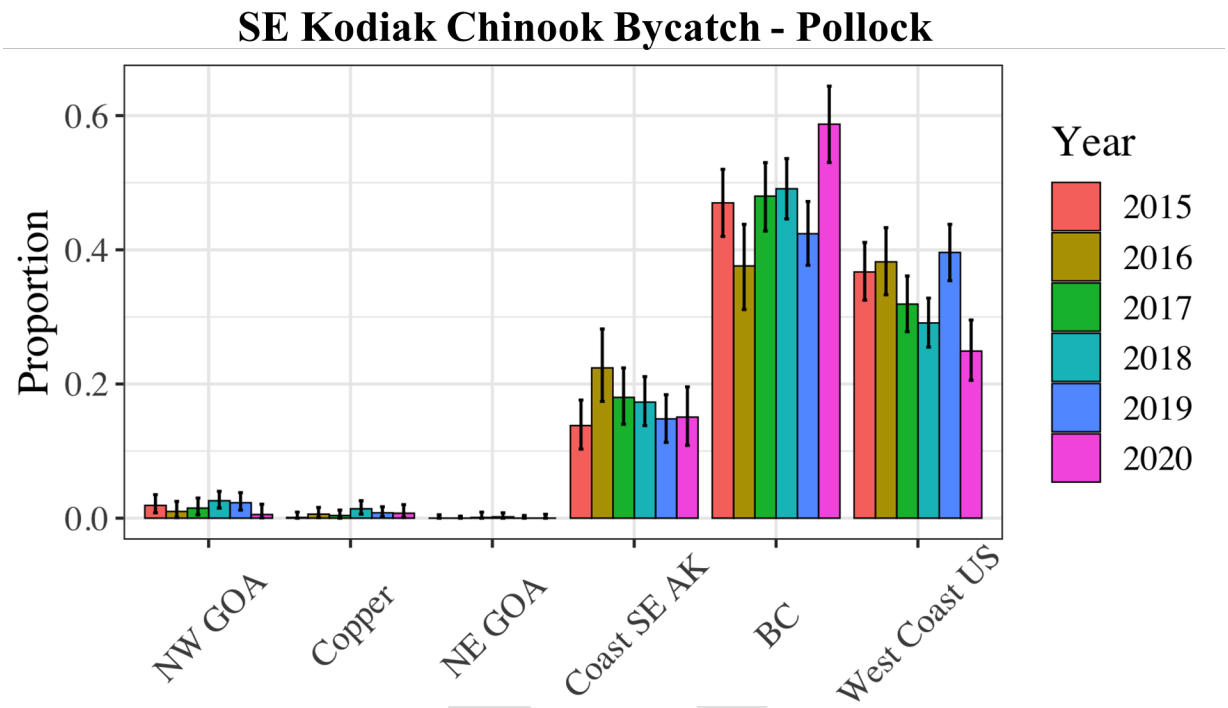

Figure 12. -- Stock composition estimates with BAYES 95% credible intervals of Chinook salmon bycatch samples from Southeast Kodiak (Fig. 7) stratum for 2015-2020 (Appendix 3) from the Gulf of Alaska pollock trawl fishery.

Gulf of Alaska Rockfish CV Trawl Fishery

The stock composition results indicate that almost all of the Chinook salmon samples successfully genotyped from the bycatch of the 2020 GOA rockfish CV trawl fishery originated from regions three South and East of the Alaska Peninsula (99.9%) which include West Coast US (72%), British Columbia (18%), and Coastal Southeast Alaska (3%) (Appendix 2). When comparing stock group estimates across all years (2013-2020), these three stock groups consistently accounted for over 99% of the bycatch (Fig. 13). For the two highest contributors, British Columbia and West Coast US, the relative proportions in 2020 were most similar to those in 2014, 2015 and 2019, and differed slightly from the estimates in 2013, 2016, 2017 and 2018. Temporal differences were also examined in the 2020 rockfish fishery for Early (statistical weeks 19-28), and Late (statistical weeks 37-47) time periods. (Appendix 4; Fig. 14). When

comparing Early and Late, the West Coast US fish made up a higher proportion of the early mixtures, while British Columbia increased in the late season (Appendix 3; Fig. 14). This pattern of a greater proportion of West Coast US fish earlier in the season with an increase of British Columbia fish late in the season also holds true for previous (2013-2019) years (Appendix 4; Fig.14).

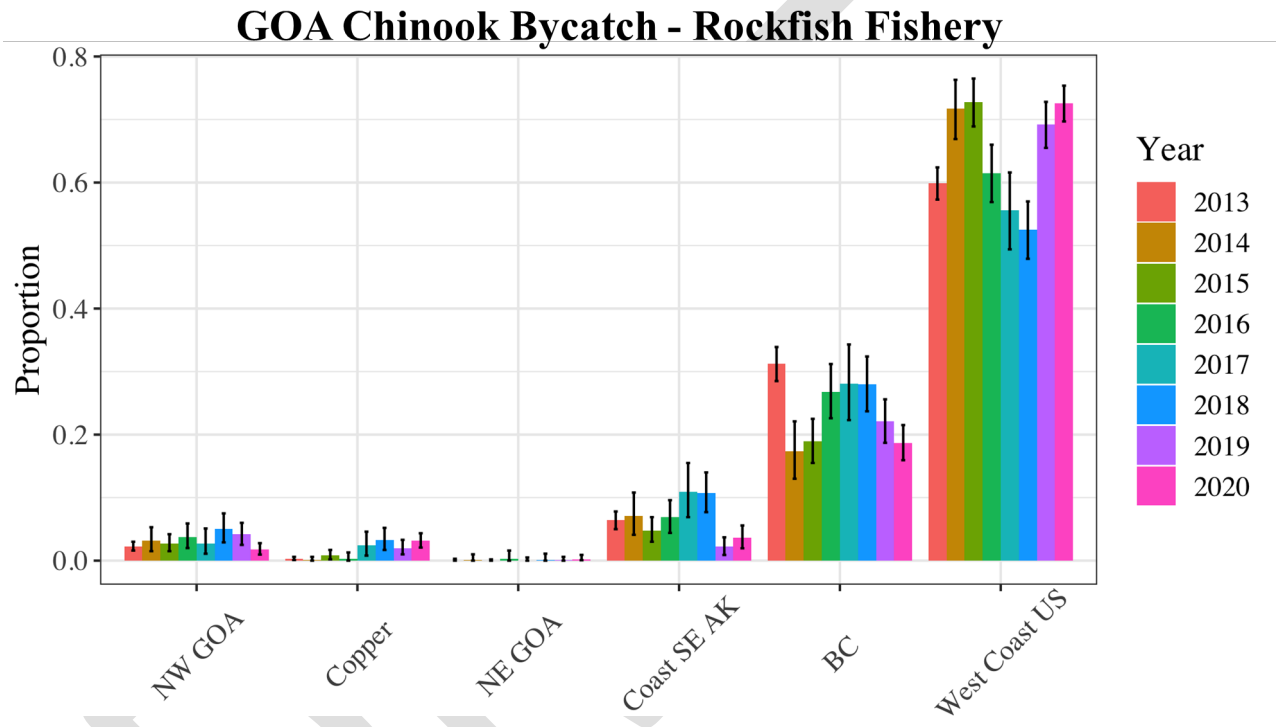

Figure 13. -- Stock composition estimates with 95% credible intervals of Chinook salmon bycatch from the 2013-2020 Gulf of Alaska rockfish CV trawl fishery.

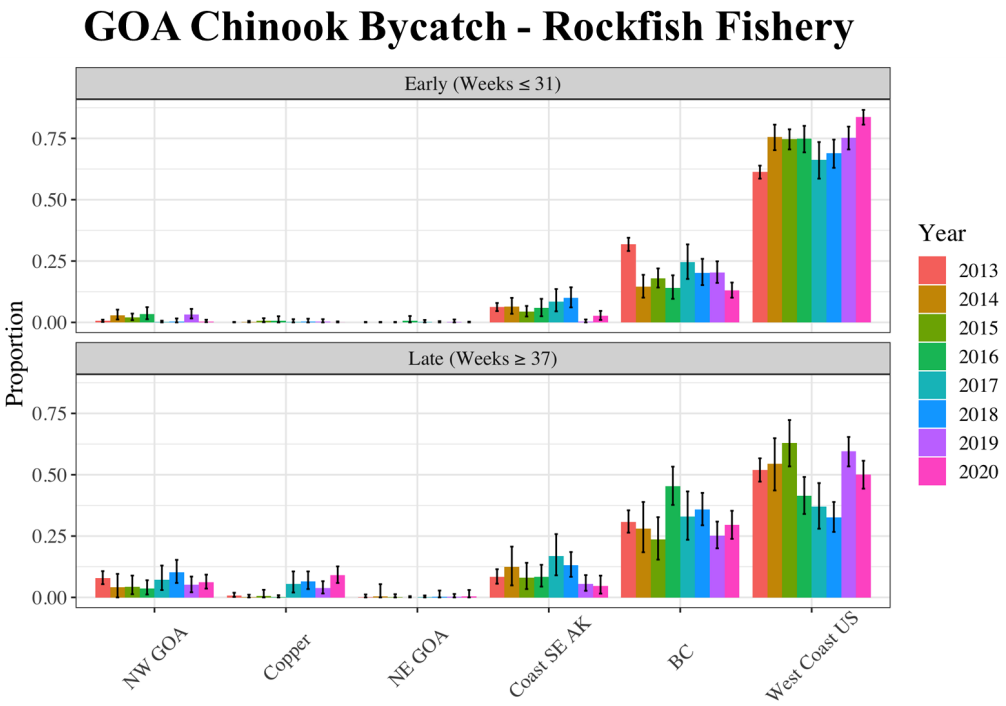

Figure 14. -- Stock composition estimates with 95% BAYES credible intervals of Chinook salmon bycatch from the 2013-2020 Gulf of Alaska rockfish CV trawl fishery Early (statistical weeks 18-31) and Late (statistical weeks 37-47).

AGE COMPOSITION ANALYSIS

Aging 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 DK20SP 16X20 Automatic Digital Swinger. 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.

GOA Ages

Of the 2,309 scales that were pressed, 1,319 scales were successfully read by the ADF&G MTA Lab (Fig. 15). The most common freshwater and saltwater zone error codes were inverted scales and scales from the wrong species. The most common freshwater age was 0 (51.6%), followed by age 1 (47.6%) whereas the most common saltwater ages were 2 (69.9%), 1 (15.0%), and 3 (13.7%). The southernmost reporting groups of British Columbia and West Coast US comprised over 76% of each age mixture. Coastal Southeast Alaska was the third most abundant reporting group, comprising 22.4% of the age-4 mixture. Only the NW GOA reporting group contributed more than 1% to any other mixture, 1.6% of the age-3 bycatch.

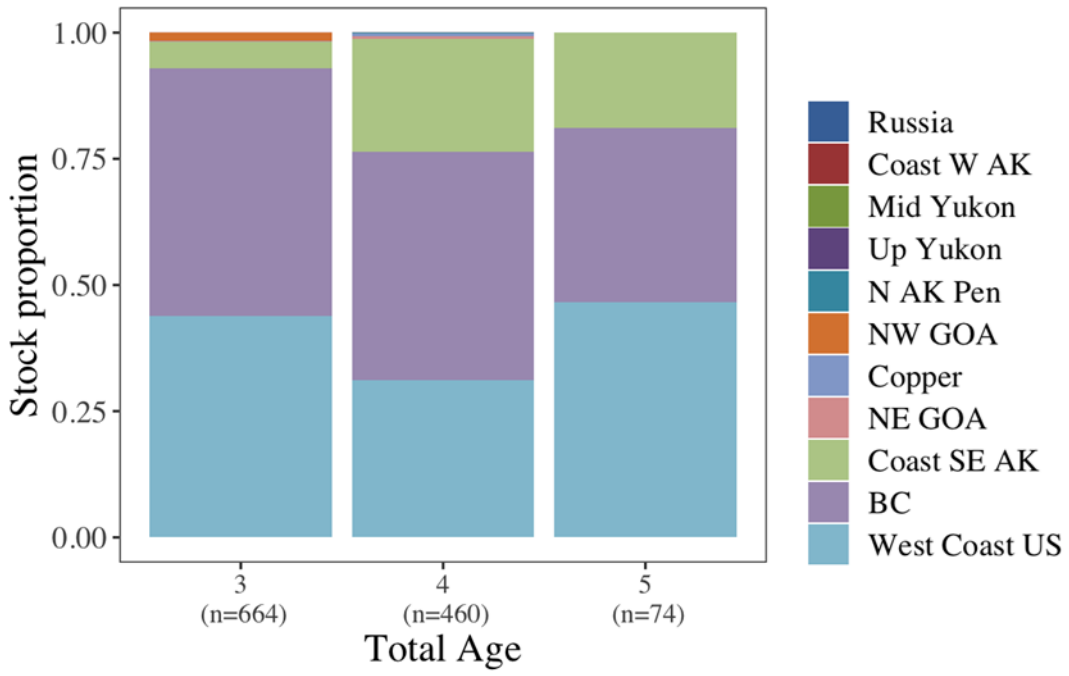

Figure 15. – Stock Composition of the four age classes of Bering Sea Chinook salmon bycatch. The number of successfully aged is below the respective bars.

SUMMARY

The Chinook salmon bycatch from federally managed groundfish fisheries in the GOA averaged 21,561 salmon per year during 1991-2019, with an estimated peak of 54,326 in 2010. In 2020, the largest component of the Chinook salmon bycatch in the GOA was from the pollock trawl fishery with an estimated 10,867 fish. An additional 886 fish were estimated to be from other fisheries, including the rockfish trawl fisheries, bringing the GOA 2020 Chinook salmon bycatch total to an estimated 11,753 fish, nearly half the long term average.

Stock composition estimates of the Chinook salmon bycatch help pollock and salmon fishery managers understand the biological effects of the incidental take of salmon in the trawl fishery. However, results should be interpreted judiciously; the limitations of these analyses are summarized below.

Sampling Issues

Due to efforts from the Observer Program and the many observers who collected samples, the number of available samples from the 2019 GOA pollock trawl fishery was 25% of the total bycatch. The samples in 2020 were collected in variable proportions to the overall bycatch (Fig. 3), with differences in spatial and temporal distributions (Figs. 3). A similar sampling protocol has been in place since 2014; comparisons with stock composition estimates prior to 2014 should be interpreted with caution.

Similar to the 2013-2019 GOA rockfish CV trawl fisheries, the fishing industry conducted a census approach in 2020 to collect genetic samples from every Chinook salmon encountered. Consequently, the reported stock composition can be considered the overall stock

composition for that fishery with the stipulation that samples were provided outside of the NMFS Observer Program (Appendices 2-4).

Stock Composition Estimates

The stock composition estimates for Chinook salmon bycatch samples collected from federally managed trawl fisheries in the GOA continue to show that the vast majority of Chinook salmon that are encountered originate from regions South and East of the Alaska Peninsula. This pattern also holds for samples analyzed across finer-scale area and time strata within the GOA, including bycatch collected from the Shumagin Islands, Shelikof Strait, and Southeast Kodiak Island.

Application of Estimates

The extent to which any salmon stock group is impacted by the bycatch of the GOA trawl fisheries is dependent on many factors including 1) the overall number of fish caught as bycatch, 2) the age of the salmon caught in the bycatch, 3) the age of the returning salmon, and 4) the total run size of the affected stock groups taking into account lag time for maturity and returning to the river. As such, 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
Stuart River summer	10	BC
Sustut River	10	BC
Torpy River summer	10	BC
Wannock River	10	BC
Alsea River fall	11	West Coast US
Carson Hatchery spring	11	West Coast US
Eel River fall	11	West Coast US
Forks Creek fall	11	West Coast US
Hanford Reach	11	West Coast US
Klamath River	11	West Coast US
Lower Deschutes R. fall	11	West Coast US
Lyons Ferry H. summer/fall	11	West Coast US
Makah National Fish H. fall	11	West Coast US
McKenzie River spring	11	West Coast US
Sacramento River winter	11	West Coast US
Siuslaw River fall	11	West Coast US
Soos Creek Hatchery fall	11	West Coast US
Upper Skagit River summer	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 2020 GOA pollock fishery, different strata of the pollock fishery, and the rockfish trawl fishery. Sample sizes are adjacent to stratum designation. Total catch is the estimated catch from AKFIN reports (NMFS 2020). GOA, pollock (upper, left) encompasses other strata except the rockfish trawl fishery. Stock composition estimates may not sum to 100% and stock-specific catch estimates may not sum to the total catch due to rounding error. Note: for smaller sample sets, the estimated numbers of fish from small contributors may be higher than for the overall GOA. The estimated number of age class fish aged are derived fom the number of fish aged.

	Gulf of Alaska, pollock (N=2,883)				GOA Age 3 (N=664)				GOA Age 4 (N=460)				GOA Age 5 (N=74)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.02	(0.0,0.1)	0	0.0	0.05	(0.0,0.2)	0	0.0	0.14	(0.0,0.5)	0	0.0	0.37	(0.0,1.1)
Coast W AK	3	0.0	0.08	(0.0,0.3)	0	0.0	0.15	(0.0,0.5)	0	0.0	0.11	(0.0,0.4)	0	0.0	0.38	(0.0,1.1)
Mid Yukon	0	0.0	0.01	(0.0,0.0)	0	0.0	0.05	(0.0,0.1)	0	0.0	0.07	(0.0,0.2)	0	0.0	0.37	(0.0,1.1)
Up Yukon	0	0.0	0.01	(0.0,0.0)	0	0.0	0.04	(0.0,0.1)	0	0.0	0.06	(0.0,0.2)	0	0.0	0.36	(0.0,1.1)
N AK Pen	1	0.0	0.04	(0.0,0.1)	0	0.0	0.06	(0.0,0.2)	0	0.0	0.10	(0.0,0.3)	0	0.0	0.39	(0.0,1.1)
NW GOA	128	1.2	0.28	(0.7,1.8)	11	1.6	0.55	(0.7,2.9)	0	0.0	0.11	(0.0,0.3)	0	0.0	0.44	(0.0,1.4)
Copper	22	0.2	0.16	(0.0,0.5)	1	0.1	0.18	(0.0,0.6)	3	0.6	0.43	(0.1,1.7)	0	0.0	0.40	(0.0,1.2)
NE GOA	2	0.0	0.10	(0.0,0.4)	1	0.1	0.22	(0.0,0.8)	2	0.5	0.74	(0.0,2.5)	0	0.0	0.41	(0.0,1.2)
Coast SE AK	1,464	13.5	0.93	(11.7,15.4)	34	5.1	1.46	(2.3,8.1)	103	22.4	2.56	(17.5,27.5)	14	18.8	6.08	(8.1,31.3)
BC	4,870	44.8	1.24	(42.4,47.2)	326	49.1	2.43	(44.4,53.9)	208	45.1	2.95	(39.4,50.9)	26	34.6	7.26	(21.3,49.2)
West Coast US	4,377	40.3	1.05	(38.2,42.4)	291	43.9	2.08	(39.8,48.0)	143	31.2	2.27	(26.9,35.7)	34	46.6	6.19	(34.7,59.0)
Total Catch	10,867				664				460				74			

	SE Kodiak I. Early (N=298)				Southeast Kodiak I. Late (N=165)				Southeast Kodiak Island (N=463)				Shelikof Strait (N=1,519)			
Region	Est. #	Mean	SD	95% CI	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)	0	0.0	0.18	(0.0,0.5)	0	0.0	0.08	(0.0,0.2)	0	0.0	0.03	(0.0,0.1)
Coast W AK	1	0.1	0.25	(0.0,0.9)	0	0.0	0.28	(0.0,0.8)	0	0.0	0.19	(0.0,0.7)	0	0.0	0.03	(0.0,0.1)
Mid Yukon	0	0.0	0.10	(0.0,0.3)	0	0.0	0.19	(0.0,0.5)	0	0.0	0.06	(0.0,0.2)	0	0.0	0.02	(0.0,0.1)
Up Yukon	0	0.0	0.09	(0.0,0.3)	0	0.0	0.18	(0.0,0.5)	0	0.0	0.06	(0.0,0.2)	0	0.0	0.02	(0.0,0.1)
N AK Pen	0	0.0	0.12	(0.0,0.4)	2	0.1	0.42	(0.0,1.5)	0	0.0	0.12	(0.0,0.4)	0	0.0	0.02	(0.0,0.1)
NW GOA	2	0.2	0.35	(0.0,1.2)	0	0.0	0.36	(0.0,1.0)	12	0.5	0.61	(0.0,2.1)	43	0.7	0.23	(0.4,1.3)
Copper	0	0.0	0.18	(0.0,0.6)	38	2.8	1.34	(0.8,5.9)	17	0.7	0.55	(0.1,2.0)	0	0.0	0.05	(0.0,0.2)
NE GOA	1	0.1	0.29	(0.0,1.1)	0	0.0	0.24	(0.0,0.7)	0	0.0	0.17	(0.0,0.6)	1	0.0	0.08	(0.0,0.3)
Coast SE AK	113	12.4	2.56	(7.6,17.6)	260	19.3	3.57	(12.6,26.6)	341	15.1	2.22	(10.9,19.6)	919	15.5	1.20	(13.2,17.9)
BC	672	73.5	3.15	(67.2,79.6)	460	34.1	4.56	(25.5,43.3)	1,330	58.7	2.90	(53.0,64.4)	2,003	33.8	1.53	(30.9,36.8)
West Coast US	125	13.7	2.13	(9.8,18.2)	590	43.7	4.43	(35.0,52.4)	564	24.9	2.29	(20.5,29.5)	2,959	49.9	1.39	(47.2,52.7)
Total Catch	914				1,350				2,264				5,926			

	Shumagin Islands Early (N=205)				Shumagin Islands Late (N=100)				Shumagin Islands (N=305)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.14	(0.0,0.4)	0	0.0	0.29	(0.0,0.8)	0	0.0	0.10	(0.0,0.3)
Coast W AK	0	0.0	0.15	(0.0,0.4)	5	0.8	1.36	(0.0,4.7)	4	0.3	0.48	(0.0,1.7)
Mid Yukon	0	0.0	0.13	(0.0,0.4)	0	0.0	0.29	(0.0,0.8)	0	0.0	0.09	(0.0,0.3)
Up Yukon	0	0.0	0.14	(0.0,0.4)	0	0.0	0.29	(0.0,0.8)	0	0.0	0.09	(0.0,0.3)
N AK Pen	0	0.0	0.15	(0.0,0.4)	1	0.2	0.89	(0.0,3.0)	0	0.0	0.17	(0.0,0.5)
NW GOA	0	0.0	0.17	(0.0,0.5)	77	11.0	3.47	(5.0,18.6)	46	3.5	1.21	(1.5,6.2)
Copper	0	0.0	0.14	(0.0,0.4)	4	0.5	1.15	(0.1,4.2)	2	0.2	0.39	(0.0,1.4)
NE GOA	0	0.0	0.14	(0.0,0.4)	0	0.0	0.61	(0.0,1.9)	0	0.0	0.19	(0.0,0.5)
Coast SE AK	53	8.9	3.15	(3.3,15.6)	59	8.4	4.45	(0.8,18.3)	137	10.5	2.57	(5.7,15.8)
BC	494	82.0	3.65	(74.4,88.6)	365	52.1	6.14	(39.9,63.8)	906	69.5	3.28	(63.0,75.8)
West Coast US	55	9.1	1.96	(5.7,13.4)	190	27.1	4.72	(18.4,36.9)	209	16.0	2.15	(12.1,20.5)
Total Catch	602				702				1,304			

Appendix 2. -- Continued

	Rockfish Trawl Early (N=772)				Rockfish Trawl Late (N=334)				Rockfish Trawl Fishery (N=1,106)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.00	(0.0,0.1)	0	0.0	0.10	(0.0,0.3)	0	0.0	0.00	(0.0,0.1)
Coast W AK	1	0.1	0.20	(0.0,0.6)	0	0.1	0.30	(0.0,1.2)	1	0.1	0.10	(0.0,0.5)
Mid Yukon	0	0.0	0.00	(0.0,0.1)	0	0.0	0.10	(0.0,0.3)	0	0.0	0.00	(0.0,0.1)
Up Yukon	0	0.0	0.10	(0.0,0.2)	0	0.0	0.10	(0.0,0.3)	0	0.0	0.00	(0.0,0.1)
N AK Pen	0	0.0	0.00	(0.0,0.1)	0	0.0	0.10	(0.0,0.3)	0	0.0	0.00	(0.0,0.1)
NW GOA	2	0.3	0.30	(0.0,1.0)	22	6.4	1.50	(3.6,9.6)	21	1.9	0.50	(1.1,2.9)
Copper	0	0.1	0.10	(0.0,0.4)	28	8.4	1.80	(5.2,12.1)	35	3.1	0.60	(2.1,4.3)
NE GOA	0	0.0	0.10	(0.0,0.3)	2	0.7	1.00	(0.1,3.5)	1	0.1	0.20	(0.0,0.8)
Coast SE AK	24	3.0	0.90	(1.2,4.9)	17	4.9	1.90	(1.5,9.0)	48	4.3	0.90	(2.5,6.2)
BC	113	14.4	1.60	(11.4,17.6)	107	31.5	3.00	(25.7,37.5)	204	18.2	1.40	(15.5,21.1)
West Coast US	644	82.2	1.50	(79.0,85.1)	163	48.1	3.00	(42.1,54.1)	812	72.3	1.40	(69.4,75.0)
Total Catch	784				339				1,123			

Appendix 3. -- Regional BAYES stock composition percentage estimates, standard deviations (SD), 95% credible intervals (CI), and estimated numbers of Chinook salmon from the 2015-19 GOA pollock fishery, and different strata of the pollock fishery.Sample sizes are adjacent to stratum designation. Total catch is the estimated catch from AKFIN reports (NMFS 2021). GOA, pollock (left) encompasses other strata. Stock composition estimates may not sum to 100% and stock-specific catch estimates may not sum to the total catch due to rounding error. Note: for smaller sample sets, the estimated numbers of fish from small contributors may be higher than for the overall GOA.

2019	Gulf of Alaska, pollock (N=2,883)				Shumagin Islands Late (N=726)				Shelikof Strait (N=806)				Southeast Kodiak Island (N=598)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.01	(0.0,0.0)	0	0.0	0.03	(0.0,0.0)	0	0.0	0.02	(0.0,0.0)	0	0.0	0.03	(0.0,0.0)
Coast W AK	120	0.6	0.29	(0.1,1.2)	19	0.3	0.35	(0.0,1.2)	2	0.1	0.12	(0.0,0.4)	2	0.1	0.17	(0.0,0.6)
Mid Yukon	0	0.0	0.01	(0.0,0.0)	1	0.0	0.03	(0.0,0.1)	0	0.0	0.03	(0.0,0.1)	0	0.0	0.04	(0.0,0.1)
Up Yukon	0	0.0	0.01	(0.0,0.0)	1	0.0	0.04	(0.0,0.1)	0	0.0	0.03	(0.0,0.1)	0	0.0	0.05	(0.0,0.1)
N AK Pen	4	0.0	0.06	(0.0,0.2)	15	0.2	0.33	(0.0,1.1)	0	0.0	0.03	(0.0,0.1)	0	0.0	0.07	(0.0,0.2)
NW GOA	3,353	16.0	0.76	(14.5,17.5)	506	8.4	1.10	(6.3,10.6)	98	2.7	0.61	(1.6,4.0)	50	2.3	0.68	(1.2,3.8)
Copper	298	1.4	0.29	(0.9,2.0)	19	0.3	0.32	(0.0,1.1)	14	0.4	0.26	(0.0,1.0)	17	0.8	0.40	(0.2,1.7)
NE GOA	46	0.2	0.23	(0.0,0.9)	4	0.1	0.21	(0.0,0.7)	7	0.2	0.22	(0.0,0.8)	1	0.0	0.13	(0.0,0.4)
Coast SE AK	2,165	10.3	0.79	(8.8,11.9)	400	6.6	1.16	(4.5,9.1)	602	16.5	1.74	(13.2,20.0)	318	14.8	1.82	(11.3,18.4)
BC	8,167	38.9	1.10	(36.8,41.1)	3,144	52.0	2.03	(48.0,56.0)	1,223	33.5	2.13	(29.4,37.8)	916	42.4	2.42	(37.7,47.2)
West Coast US	6,828	32.5	0.96	(30.7,34.4)	1,939	32.1	1.82	(28.6,35.7)	1,700	46.6	1.92	(42.9,50.4)	854	39.6	2.15	(35.4,43.8)
Total Catch	20,983				6,047				3,647				2,159			
2018	Gulf of Alaska, pollock (N=2,226)				Shumagin Islands Late (N=328)				Shelikof Strait (N=1,089)				Southeast Kodiak Island (N=703)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	9	0.1	0.06	(0.0,0.2)	0	0.0	0.07	(0.0,0.1)	1	0.0	0.03	(0.0,0.1)	0	0.0	0.02	(0.0,0.0)
Coast W AK	99	0.7	0.27	(0.2,1.3)	35	1.1	0.93	(0.0,3.2)	3	0.1	0.11	(0.0,0.4)	8	0.2	0.28	(0.0,1.0)
Mid Yukon	0	0.0	0.01	(0.0,0.0)	1	0.0	0.08	(0.0,0.2)	0	0.0	0.02	(0.0,0.1)	0	0.0	0.04	(0.0,0.1)
Up Yukon	0	0.0	0.02	(0.0,0.1)	2	0.1	0.18	(0.0,0.6)	1	0.0	0.03	(0.0,0.1)	0	0.0	0.04	(0.0,0.1)
N AK Pen	1	0.0	0.03	(0.0,0.1)	3	0.1	0.29	(0.0,1.0)	1	0.0	0.06	(0.0,0.2)	0	0.0	0.05	(0.0,0.1)
NW GOA	628	4.2	0.49	(3.3,5.2)	219	6.8	1.81	(3.6,10.7)	191	3.5	0.59	(2.4,4.7)	101	2.6	0.65	(1.5,4.0)
Copper	67	0.5	0.18	(0.2,0.9)	1	0.0	0.11	(0.0,0.3)	1	0.0	0.03	(0.0,0.1)	55	1.4	0.52	(0.6,2.6)
NE GOA	7	0.1	0.09	(0.0,0.3)	48	1.5	1.20	(0.0,4.2)	1	0.0	0.04	(0.0,0.1)	6	0.2	0.24	(0.0,0.8)
Coast SE AK	2,728	18.4	1.17	(16.0,20.6)	224	7.0	1.68	(4.1,10.6)	1,115	20.3	1.55	(17.4,23.5)	662	17.3	1.84	(13.8,21.1)
BC	6,433	43.4	1.43	(40.7,46.3)	1,343	41.9	3.00	(36.0,47.8)	2,462	44.9	1.93	(41.2,48.7)	1,876	49.1	2.32	(44.6,53.6)
West Coast US	4,846	32.7	1.12	(30.5,34.9)	1,331	41.5	2.91	(35.9,47.3)	1,707	31.2	1.57	(28.1,34.3)	1,113	29.1	1.86	(25.5,32.8)
Total Catch	14,820				3,207				5,481				3,822			
2017	Gulf of Alaska, pollock (N=3,571)				Shumagin Islands Late (N=712)				Shelikof Strait (N=1,922)				Southeast Kodiak Island (N=540)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	6	0.0	0.03	(0.0,0.1)	0	0.0	0.02	(0.0,0.0)	0	0.0	0.01	(0.0,0.0)	0	0.0	0.03	(0.0,0.0)
Coast W AK	96	0.5	0.18	(0.2,0.9)	3	0.1	0.16	(0.0,0.6)	22	0.2	0.25	(0.0,0.9)	3	0.1	0.24	(0.0,0.9)
Mid Yukon	0	0.0	0.01	(0.0,0.0)	0	0.0	0.03	(0.0,0.1)	0	0.0	0.01	(0.0,0.0)	0	0.0	0.04	(0.0,0.1)
Up Yukon	0	0.0	0.01	(0.0,0.0)	0	0.0	0.05	(0.0,0.2)	0	0.0	0.02	(0.0,0.0)	0	0.0	0.05	(0.0,0.2)
N AK Pen	0	0.0	0.02	(0.0,0.1)	0	0.0	0.07	(0.0,0.2)	1	0.0	0.03	(0.0,0.1)	1	0.1	0.20	(0.0,0.7)
NW GOA	1,065	5.0	0.41	(4.2,5.8)	137	5.4	0.88	(3.8,7.2)	415	3.7	0.50	(2.8,4.8)	37	1.5	0.64	(0.5,3.0)
Copper	137	0.6	0.18	(0.3,1.0)	1	0.0	0.06	(0.0,0.2)	35	0.3	0.21	(0.0,0.8)	9	0.4	0.35	(0.0,1.2)
NE GOA	13	0.1	0.13	(0.0,0.5)	1	0.0	0.10	(0.0,0.3)	23	0.2	0.29	(0.0,0.9)	2	0.1	0.24	(0.0,0.9)
Coast SE AK	2,762	12.9	0.86	(11.2,14.6)	202	8.0	1.51	(5.2,11.1)	1,359	12.2	1.04	(10.2,14.3)	440	18.0	2.12	(14.0,22.4)
BC	9,096	42.5	1.14	(40.4,44.9)	1,700	67.2	2.42	(62.4,71.9)	4,234	38.0	1.41	(35.3,40.8)	1,172	48.0	2.61	(42.8,53.0)
West Coast US	8,215	38.4	0.92	(36.6,40.2)	486	19.2	1.80	(15.8,22.8)	5,041	45.3	1.24	(42.9,47.7)	779	31.9	2.14	(27.8,36.1)
Total Catch	21,392				2,529				11,130				2,443			

Appendix 3. -- Continued

2016	Gulf of Alaska, pollock (N=4,962)				Shumagin Islands Late (N=896)				Shelikof Strait (N=608)				Southeast Kodiak Island (N=2,997)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	8	0.0	0.03	(0.0,0.1)	0	0.0	0.02	(0.0,0.0)	0	0.0	0.03	(0.0,0.0)	1	0.0	0.04	(0.0,0.1)
Coast W AK	10	0.1	0.07	(0.0,0.2)	9	0.3	0.28	(0.0,1.0)	8	0.3	0.32	(0.0,1.1)	7	0.1	0.14	(0.0,0.5)
Mid Yukon	0	0.0	0.00	(0.0,0.0)	0	0.0	0.03	(0.0,0.1)	0	0.0	0.04	(0.0,0.1)	1	0.0	0.05	(0.0,0.1)
Up Yukon	0	0.0	0.01	(0.0,0.0)	0	0.0	0.03	(0.0,0.1)	0	0.0	0.05	(0.0,0.1)	2	0.0	0.06	(0.0,0.2)
N AK Pen	0	0.0	0.01	(0.0,0.0)	0	0.0	0.03	(0.0,0.1)	0	0.0	0.04	(0.0,0.1)	1	0.0	0.05	(0.0,0.1)
NW GOA	247	1.2	0.18	(0.9,1.6)	32	1.0	0.38	(0.3,1.8)	11	0.3	0.33	(0.0,1.1)	123	1.0	0.63	(0.1,2.5)
Copper	296	1.4	0.21	(1.1,1.9)	8	0.3	0.28	(0.0,1.0)	0	0.0	0.05	(0.0,0.1)	74	0.6	0.41	(0.1,1.6)
NE GOA	41	0.2	0.15	(0.0,0.6)	13	0.4	0.33	(0.0,1.2)	2	0.1	0.15	(0.0,0.5)	4	0.0	0.12	(0.0,0.3)
Coast SE AK	3,080	15.0	0.81	(13.5,16.7)	179	5.4	1.11	(3.4,7.7)	365	11.4	1.59	(8.4,14.6)	2,660	22.4	2.75	(17.4,28.2)
BC	8,602	41.8	1.07	(39.7,43.8)	1,409	42.1	1.98	(38.2,46.0)	1,506	46.8	2.29	(42.3,51.3)	4,462	37.6	3.24	(31.1,43.8)
West Coast US	8,301	40.3	0.82	(38.7,41.9)	1,695	50.7	1.83	(47.1,54.2)	1,325	41.2	2.08	(37.1,45.3)	4,525	38.2	2.56	(33.3,43.3)
Total Catch	20,589				3,347				3,217				11,858			

2015	Gulf of Alaska, pollock (N=2,414)				Shumagin Islands Late (N=450)				Shelikof Strait (N=1,143)				Southeast Kodiak Island (N=566)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.01	(0.0,0.0)	0	0.0	0.07	(0.0,0.2)	0	0.0	0.02	(0.0,0.0)	0	0.0	0.03	(0.0,0.1)
Coast W AK	5	0.0	0.08	(0.0,0.3)	5	0.2	0.29	(0.0,1.0)	10	0.2	0.21	(0.0,0.7)	7	0.3	0.36	(0.0,1.2)
Mid Yukon	0	0.0	0.02	(0.0,0.0)	0	0.0	0.05	(0.0,0.1)	1	0.0	0.04	(0.0,0.1)	0	0.0	0.05	(0.0,0.1)
Up Yukon	0	0.0	0.01	(0.0,0.0)	1	0.0	0.06	(0.0,0.2)	1	0.0	0.02	(0.0,0.1)	0	0.0	0.05	(0.0,0.2)
N AK Pen	3	0.0	0.05	(0.0,0.2)	1	0.0	0.11	(0.0,0.3)	1	0.0	0.03	(0.0,0.1)	2	0.1	0.20	(0.0,0.7)
NW GOA	353	2.6	0.36	(1.9,3.3)	100	3.2	0.89	(1.6,5.1)	156	2.4	0.51	(1.5,3.5)	44	1.9	0.70	(0.8,3.5)
Copper	16	0.1	0.10	(0.0,0.4)	1	0.0	0.06	(0.0,0.2)	8	0.1	0.14	(0.0,0.5)	3	0.1	0.24	(0.0,0.9)
NE GOA	23	0.2	0.13	(0.0,0.5)	1	0.0	0.10	(0.0,0.3)	12	0.2	0.17	(0.0,0.6)	1	0.0	0.16	(0.0,0.5)
Coast SE AK	1,857	13.6	0.90	(11.9,15.4)	451	14.2	2.64	(9.4,19.6)	904	14.1	1.23	(11.8,16.6)	309	13.8	1.88	(10.3,17.6)
BC	6,990	51.4	1.30	(48.8,53.9)	1,944	61.2	3.27	(54.7,67.5)	3,098	48.4	1.77	(45.0,51.9)	1,057	47.0	2.54	(42.0,52.0)
West Coast US	4,365	32.1	1.11	(30.0,34.3)	671	21.1	2.11	(17.2,25.4)	2,211	34.6	1.57	(31.5,37.6)	824	36.7	2.18	(32.5,41.1)
Total Catch	13,612				3,175				6,400				2,247			

Appendix 3. -- Continued

2015	Gulf of Alaska, pollock (N=2,414)				Shumagin Islands Late (N=450)				Shelikof Strait (N=1,143)				Southeast Kodiak Island (N=566)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.01	(0.0,0.0)	0	0.0	0.07	(0.0,0.2)	0	0.0	0.02	(0.0,0.0)	0	0.0	0.03	(0.0,0.1)
Coast W AK	5	0.0	0.08	(0.0,0.3)	5	0.2	0.29	(0.0,1.0)	10	0.2	0.21	(0.0,0.7)	7	0.3	0.36	(0.0,1.2)
Mid Yukon	0	0.0	0.02	(0.0,0.0)	0	0.0	0.05	(0.0,0.1)	1	0.0	0.04	(0.0,0.1)	0	0.0	0.05	(0.0,0.1)
Up Yukon	0	0.0	0.01	(0.0,0.0)	1	0.0	0.06	(0.0,0.2)	1	0.0	0.02	(0.0,0.1)	0	0.0	0.05	(0.0,0.2)
N AK Pen	3	0.0	0.05	(0.0,0.2)	1	0.0	0.11	(0.0,0.3)	1	0.0	0.03	(0.0,0.1)	2	0.1	0.20	(0.0,0.7)
NW GOA	353	2.6	0.36	(1.9,3.3)	100	3.2	0.89	(1.6,5.1)	156	2.4	0.51	(1.5,3.5)	44	1.9	0.70	(0.8,3.5)
Copper	16	0.1	0.10	(0.0,0.4)	1	0.0	0.06	(0.0,0.2)	8	0.1	0.14	(0.0,0.5)	3	0.1	0.24	(0.0,0.9)
NE GOA	23	0.2	0.13	(0.0,0.5)	1	0.0	0.10	(0.0,0.3)	12	0.2	0.17	(0.0,0.6)	1	0.0	0.16	(0.0,0.5)
Coast SE AK	1,857	13.6	0.90	(11.9,15.4)	451	14.2	2.64	(9.4,19.6)	904	14.1	1.23	(11.8,16.6)	309	13.8	1.88	(10.3,17.6)
BC	6,990	51.4	1.30	(48.8,53.9)	1,944	61.2	3.27	(54.7,67.5)	3,098	48.4	1.77	(45.0,51.9)	1,057	47.0	2.54	(42.0,52.0)
West Coast US	4,365	32.1	1.11	(30.0,34.3)	671	21.1	2.11	(17.2,25.4)	2,211	34.6	1.57	(31.5,37.6)	824	36.7	2.18	(32.5,41.1)
Total Catch	13,612				3,175				6,400				2,247			

Appendix 4. -- Regional BAYES stock composition percentage estimates, standard deviations (SD), 95% credible intervals (CI), and estimated numbers of Chinook salmon from the 2013-19 GOA rockfish trawl fishery. Genotyped sample sizes are adjacent to the year designation.

2019	Rockfish Trawl Early (N=398)				Rockfish Trawl Late (N=288)				Rockfish Trawl Fishery (N=686)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.04	(0.0,0.1)	0	0.0	0.05	(0.0,0.1)	0	0.0	0.02	(0.0,0.0)
Coast W AK	1	0.2	0.40	(0.0,1.4)	2	0.6	0.86	(0.0,3.0)	2	0.3	0.43	(0.0,1.5)
Mid Yukon	0	0.0	0.06	(0.0,0.2)	0	0.0	0.08	(0.0,0.2)	0	0.0	0.03	(0.0,0.1)
Up Yukon	0	0.0	0.09	(0.0,0.3)	0	0.0	0.09	(0.0,0.3)	0	0.0	0.04	(0.0,0.1)
N AK Pen	0	0.0	0.12	(0.0,0.4)	0	0.0	0.19	(0.0,0.6)	0	0.0	0.05	(0.0,0.1)
NW GOA	14	3.3	1.00	(1.6,5.5)	15	5.1	1.60	(2.1,8.5)	29	4.2	0.89	(2.5,6.0)
Copper	1	0.4	0.37	(0.0,1.3)	11	3.8	1.28	(1.6,6.6)	14	2.0	0.61	(1.0,3.3)
NE GOA	0	0.1	0.34	(0.0,1.2)	1	0.2	0.40	(0.0,1.4)	1	0.1	0.17	(0.0,0.6)
Coast SE AK	1	0.3	0.33	(0.0,1.2)	16	5.5	1.63	(2.7,9.1)	15	2.2	0.72	(0.9,3.7)
BC	82	20.3	2.25	(16.1,24.9)	73	25.2	2.79	(20.0,30.9)	153	22.1	1.75	(18.7,25.6)
West Coast US	306	75.3	2.37	(70.5,79.8)	172	59.5	3.07	(53.4,65.4)	481	69.2	1.88	(65.5,72.8)
Total Catch	406				289				695			
2018	Rockfish Trawl Early (N=268)				Rockfish Trawl Late (N=231)				Rockfish Trawl Fishery (N=499)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.06	(0.0,0.1)	0	0.0	0.07	(0.0,0.1)	0	0.0	0.03	(0.0,0.1)
Coast W AK	0	0.1	0.20	(0.0,0.7)	2	0.7	0.95	(0.0,3.3)	1	0.3	0.42	(0.0,1.5)
Mid Yukon	0	0.0	0.08	(0.0,0.2)	0	0.0	0.11	(0.0,0.3)	0	0.0	0.05	(0.0,0.1)
Up Yukon	0	0.0	0.10	(0.0,0.3)	0	0.0	0.12	(0.0,0.4)	0	0.0	0.06	(0.0,0.2)
N AK Pen	0	0.0	0.13	(0.0,0.3)	1	0.3	0.64	(0.0,2.3)	1	0.2	0.37	(0.0,1.3)
NW GOA	1	0.3	0.47	(0.0,1.6)	24	10.3	2.41	(5.9,15.3)	25	5.0	1.18	(2.9,7.5)
Copper	1	0.4	0.42	(0.0,1.5)	15	6.6	1.86	(3.4,10.6)	17	3.3	0.89	(1.7,5.2)
NE GOA	0	0.0	0.17	(0.0,0.5)	1	0.3	0.78	(0.0,2.8)	0	0.1	0.32	(0.0,1.1)
Coast SE AK	27	10.0	2.08	(6.1,14.3)	31	13.2	2.58	(8.4,18.5)	54	10.7	1.62	(7.7,14.0)
BC	55	20.2	2.70	(15.2,25.9)	84	35.9	3.38	(29.4,42.6)	141	28.0	2.22	(23.7,32.4)
West Coast US	187	68.9	2.91	(63.0,74.5)	76	32.6	3.14	(26.7,38.9)	264	52.5	2.32	(47.9,57.0)
Total Catch	271				233				504			
2017	Rockfish Trawl Early (N=173)				Rockfish Trawl Late (N=107)				Rockfish Trawl Fishery (N=280)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.09	(0.0,0.1)	0	0.0	0.18	(0.0,0.3)	0	0.0	0.07	(0.0,0.1)
Coast W AK	1	0.3	0.54	(0.0,1.9)	0	0.2	0.51	(0.0,1.7)	0	0.1	0.21	(0.0,0.7)
Mid Yukon	0	0.0	0.14	(0.0,0.3)	0	0.1	0.21	(0.0,0.6)	0	0.0	0.08	(0.0,0.2)
Up Yukon	0	0.0	0.16	(0.0,0.5)	0	0.1	0.25	(0.0,0.8)	0	0.0	0.10	(0.0,0.3)
N AK Pen	0	0.0	0.11	(0.0,0.3)	0	0.1	0.44	(0.0,1.2)	0	0.0	0.15	(0.0,0.4)
NW GOA	0	0.1	0.21	(0.0,0.7)	8	7.2	2.60	(3.0,13.0)	8	2.7	1.03	(1.1,5.1)
Copper	0	0.2	0.36	(0.0,1.3)	6	5.5	2.24	(2.0,10.6)	7	2.4	0.95	(0.8,4.6)
NE GOA	0	0.1	0.31	(0.0,1.0)	0	0.1	0.38	(0.0,0.8)	0	0.0	0.22	(0.0,0.5)
Coast SE AK	16	8.5	2.33	(4.5,13.6)	18	16.8	4.31	(9.0,25.8)	33	10.9	2.21	(6.9,15.5)
BC	46	24.5	3.62	(17.7,31.8)	36	32.9	5.06	(23.5,43.2)	84	28.1	3.07	(22.3,34.3)
West Coast US	126	66.3	3.79	(58.6,73.5)	40	37.0	4.77	(28.0,46.6)	166	55.6	3.11	(49.4,61.6)
Total Catch	190				109				299			
2016	Rockfish Trawl Early (N=302)				Rockfish Trawl Late (N=191)				Rockfish Trawl Fishery (N=493)			
Region	Est. #	Mean	SD	95% PI	Est. #	Mean	SD	95% PI	Est. #	Mean	SD	95% PI
Russia	0	0.0	0.06	(0.0,0.1)	0	0.0	0.08	(0.0,0.1)	0	0.0	0.04	(0.0,0.1)
Coast W AK	1	0.5	0.57	(0.0,2.0)	2	0.9	1.01	(0.0,3.6)	3	0.5	0.55	(0.0,1.9)
Mid Yukon	0	0.0	0.07	(0.0,0.2)	0	0.0	0.17	(0.0,0.4)	0	0.0	0.05	(0.0,0.1)
Up Yukon	0	0.0	0.09	(0.0,0.3)	0	0.0	0.15	(0.0,0.5)	0	0.0	0.06	(0.0,0.2)
N AK Pen	0	0.0	0.17	(0.0,0.5)	0	0.0	0.20	(0.0,0.6)	0	0.0	0.10	(0.0,0.3)
NW GOA	10	3.4	1.25	(1.3,6.2)	7	3.6	1.50	(1.2,7.0)	19	3.7	1.00	(2.0,5.9)
Copper	2	0.7	0.75	(0.0,2.5)	0	0.1	0.29	(0.0,0.9)	1	0.3	0.37	(0.0,1.3)
NE GOA	2	0.6	0.73	(0.0,2.6)	0	0.0	0.21	(0.0,0.5)	1	0.3	0.44	(0.0,1.6)
Coast SE AK	18	5.9	1.77	(2.5,9.6)	16	8.4	2.28	(4.4,13.3)	34	6.9	1.34	(4.4,9.6)
BC	43	14.1	2.45	(9.6,19.2)	87	45.4	3.99	(37.7,53.3)	133	26.8	2.20	(22.6,31.2)
West Coast US	228	74.9	2.74	(69.3,80.1)	79	41.4	3.86	(34.0,49.1)	305	61.5	2.32	(56.9,66.0)
Total Catch	304				192				496			

Appendix 4. -- Continued

2015	Rockfish Trawl Early (N=524)				Rockfish Trawl Late (N=111)				Rockfish Trawl Fishery (N=635)			
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)	0	0.0	0.15	(0.0,0.2)	0	0.0	0.03	(0.0,0.0)
Coast W AK	0	0.1	0.21	(0.0,0.7)	0	0.2	0.43	(0.0,1.4)	0	0.1	0.13	(0.0,0.5)
Mid Yukon	0	0.0	0.04	(0.0,0.1)	0	0.0	0.20	(0.0,0.5)	0	0.0	0.03	(0.0,0.1)
Up Yukon	0	0.0	0.05	(0.0,0.2)	0	0.1	0.24	(0.0,0.7)	0	0.0	0.04	(0.0,0.1)
N AK Pen	0	0.0	0.06	(0.0,0.2)	0	0.1	0.25	(0.0,0.6)	0	0.0	0.05	(0.0,0.1)
NW GOA	11	2.1	0.70	(0.9,3.6)	5	4.4	1.99	(1.3,8.9)	17	2.7	0.70	(1.5,4.2)
Copper	4	0.7	0.41	(0.1,1.7)	1	0.6	0.89	(0.0,3.1)	5	0.8	0.39	(0.2,1.7)
NE GOA	0	0.0	0.08	(0.0,0.2)	0	0.1	0.48	(0.0,1.3)	0	0.0	0.07	(0.0,0.2)
Coast SE AK	23	4.4	1.10	(2.4,6.7)	9	8.0	2.75	(3.4,14.1)	31	4.8	1.01	(3.0,6.9)
BC	95	18.0	1.97	(14.2,22.0)	26	23.6	4.42	(15.4,32.7)	121	18.9	1.79	(15.5,22.5)
West Coast US	394	74.7	2.08	(70.5,78.7)	70	63.0	4.83	(53.4,72.3)	464	72.8	1.92	(68.9,76.5)
Total Catch	527				111				638			

2014	Rockfish Trawl Early (N=299)				Rockfish Trawl Late (N=99)				Rockfish Trawl Fishery (N=435)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	1	0.2	0.30	(0.0,1.0)	0	0.0	0.18	(0.0,0.3)	1	0.1	0.23	(0.0,0.8)
Coast W AK	1	0.3	0.41	(0.0,1.5)	0	0.3	0.63	(0.0,2.2)	1	0.3	0.37	(0.0,1.3)
Mid Yukon	0	0.0	0.07	(0.0,0.2)	0	0.1	0.23	(0.0,0.6)	0	0.0	0.06	(0.0,0.1)
Up Yukon	0	0.0	0.09	(0.0,0.3)	0	0.1	0.27	(0.0,0.8)	0	0.0	0.07	(0.0,0.2)
N AK Pen	0	0.0	0.12	(0.0,0.3)	0	0.1	0.31	(0.0,0.7)	0	0.0	0.12	(0.0,0.3)
NW GOA	10	2.9	1.04	(1.2,5.2)	6	4.2	2.38	(0.0,9.6)	15	3.2	0.96	(1.5,5.3)
Copper	0	0.1	0.17	(0.0,0.6)	0	0.1	0.38	(0.0,1.1)	0	0.1	0.19	(0.0,0.6)
NE GOA	0	0.0	0.10	(0.0,0.2)	1	0.5	1.43	(0.0,5.4)	0	0.1	0.27	(0.0,1.0)
Coast SE AK	21	6.4	1.68	(3.5,10.0)	17	12.4	4.01	(4.9,20.7)	33	7.1	1.70	(4.1,10.8)
BC	48	14.5	2.37	(10.1,19.4)	38	28.1	5.22	(18.4,38.9)	82	17.4	2.32	(13.0,22.1)
West Coast US	252	75.6	2.65	(70.2,80.6)	73	54.4	5.44	(43.6,64.9)	336	71.7	2.41	(66.9,76.3)
Total Catch	333				135				468			

2013	Rockfish Trawl Early (N=1,550)				Rockfish Trawl Late (N=231)				Rockfish Trawl Fishery (N=2,029)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.01	(0.0,0.0)	0	0.0	0.03	(0.0,0.1)	0	0.0	0.01	(0.0,0.0)
Coast W AK	1	0.1	0.10	(0.0,0.4)	0	0.1	0.12	(0.0,0.4)	1	0.0	0.05	(0.0,0.2)
Mid Yukon	0	0.0	0.01	(0.0,0.0)	0	0.0	0.05	(0.0,0.1)	0	0.0	0.01	(0.0,0.0)
Up Yukon	0	0.0	0.02	(0.0,0.1)	0	0.0	0.06	(0.0,0.2)	0	0.0	0.02	(0.0,0.1)
N AK Pen	0	0.0	0.02	(0.0,0.0)	0	0.0	0.07	(0.0,0.2)	0	0.0	0.02	(0.0,0.0)
NW GOA	10	0.6	0.23	(0.2,1.1)	40	7.9	1.35	(5.4,10.7)	47	2.2	0.36	(1.6,3.0)
Copper	0	0.0	0.06	(0.0,0.2)	4	0.8	0.47	(0.2,1.9)	5	0.3	0.13	(0.1,0.6)
NE GOA	0	0.0	0.07	(0.0,0.2)	0	0.1	0.36	(0.0,1.2)	0	0.0	0.08	(0.0,0.3)
Coast SE AK	99	6.2	0.85	(4.6,7.9)	43	8.4	1.52	(5.6,11.5)	134	6.4	0.73	(5.0,7.8)
BC	508	31.8	1.39	(29.1,34.5)	157	30.8	2.33	(26.4,35.5)	660	31.3	1.37	(28.5,33.9)
West Coast US	981	61.3	1.35	(58.6,63.9)	265	52.0	2.40	(47.2,56.7)	1,263	59.9	1.31	(57.3,62.4)
Total Catch	1,601				510				2,111			

Appendix 5. -- 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