Genetic Stock Composition Analysis of Chinook Salmon (*Oncorhynchus tshawytscha*) Bycatch Samples from the 2021 and 2022 Gulf of Alaska pollock Trawl Fisheries

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ABSTRACT

A genetic analysis of samples from the Chinook salmon (*Oncorhynchus tshawytscha*) Prohibited Species Catch (bycatch) of the 2021 and 2022 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 mixture proportions were estimated using the Alaska Department of Fish and Game's (ADF&G) SNP baseline. In 2021 and 2022, 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. In 2021 based on analysis of 1,494 Chinook salmon samples from a total bycatch of 10,595 fish, British Columbia (52%), West Coast US (27%), and Coastal Southeast Alaska (14%) stock groups were the largest contributors; and similarly in 2022 based on analysis of 1,948 Chinook salmon samples from a total bycatch of 13,173 fish, British Columbia (48%), West Coast US (30%), and Coastal Southeast Alaska (16%) stock groups were the largest contributors. 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 referred to as bycatch) samples collected in the GOA from the trawl fisheries for walleye pollock (*Gadus chalcogrammus*). 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, 2016-22; 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 2021 and 2022 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.

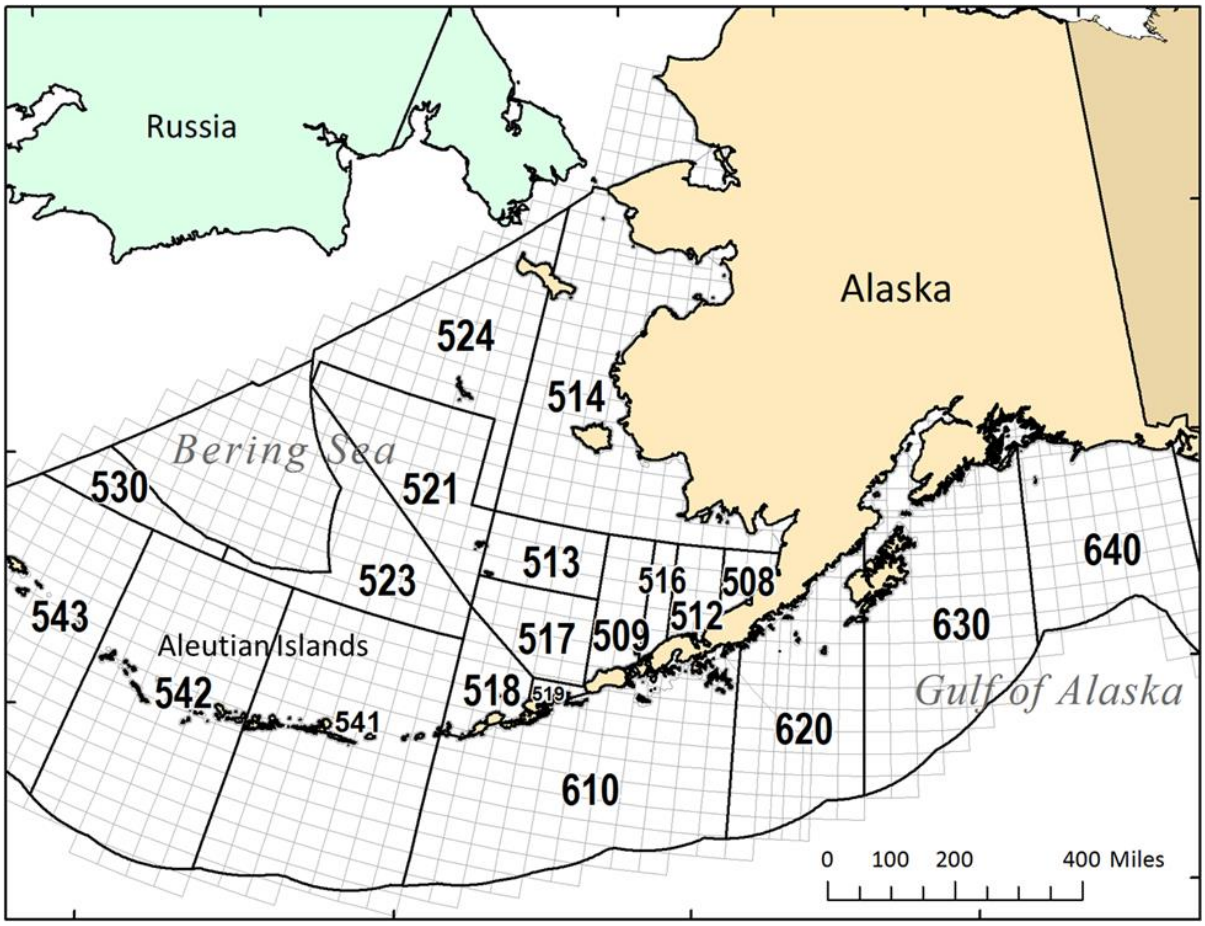

Figure 1. -- NMFS (outlined in black) and ADF&G (outlined in light gray) statistical areas associated with the Bering Sea and Gulf of Alaska (Areas 610-640) groundfish fisheries.

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 2021 and 2022 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.

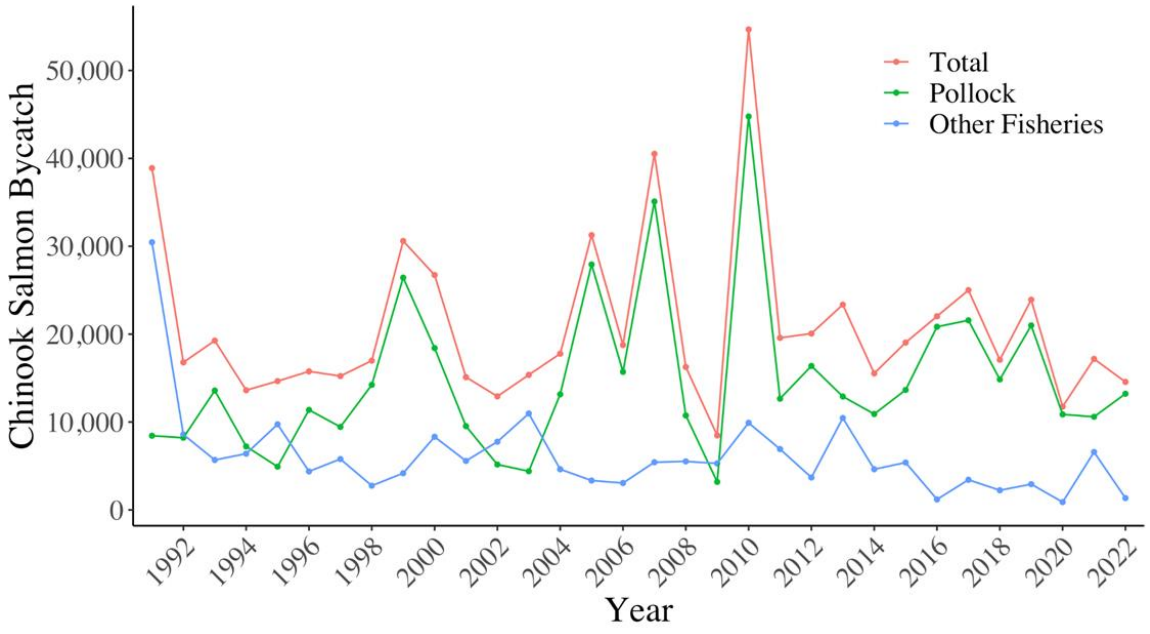

Figure 2. -- Yearly estimated Chinook salmon bycatch in the Gulf of Alaska pollock and non-pollock trawl fisheries (NMFS 2022).

An estimated 10,595 in 2021 and 13,173 in 2022 Chinook salmon were caught in the GOA pollock trawl fisheries (NMFS 2021), which were less than one-third of the highest overall

Chinook bycatch of 40,441 in 2010 and below the historical average between 1991-2020 of 12,918 (Fig. 2). The genotyped (genetic) sample set for the Chinook salmon bycatch was 1,494 in 2021 and 1,948 in 2022 fish which equates to 14% in 2021 and 15% in 2022 of the estimated catch of the pollock trawl fishery. Potential spatial and temporal biases associated with the 2021 and 2022 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 was variable, but mostly over 10% (Fig. 3). 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).

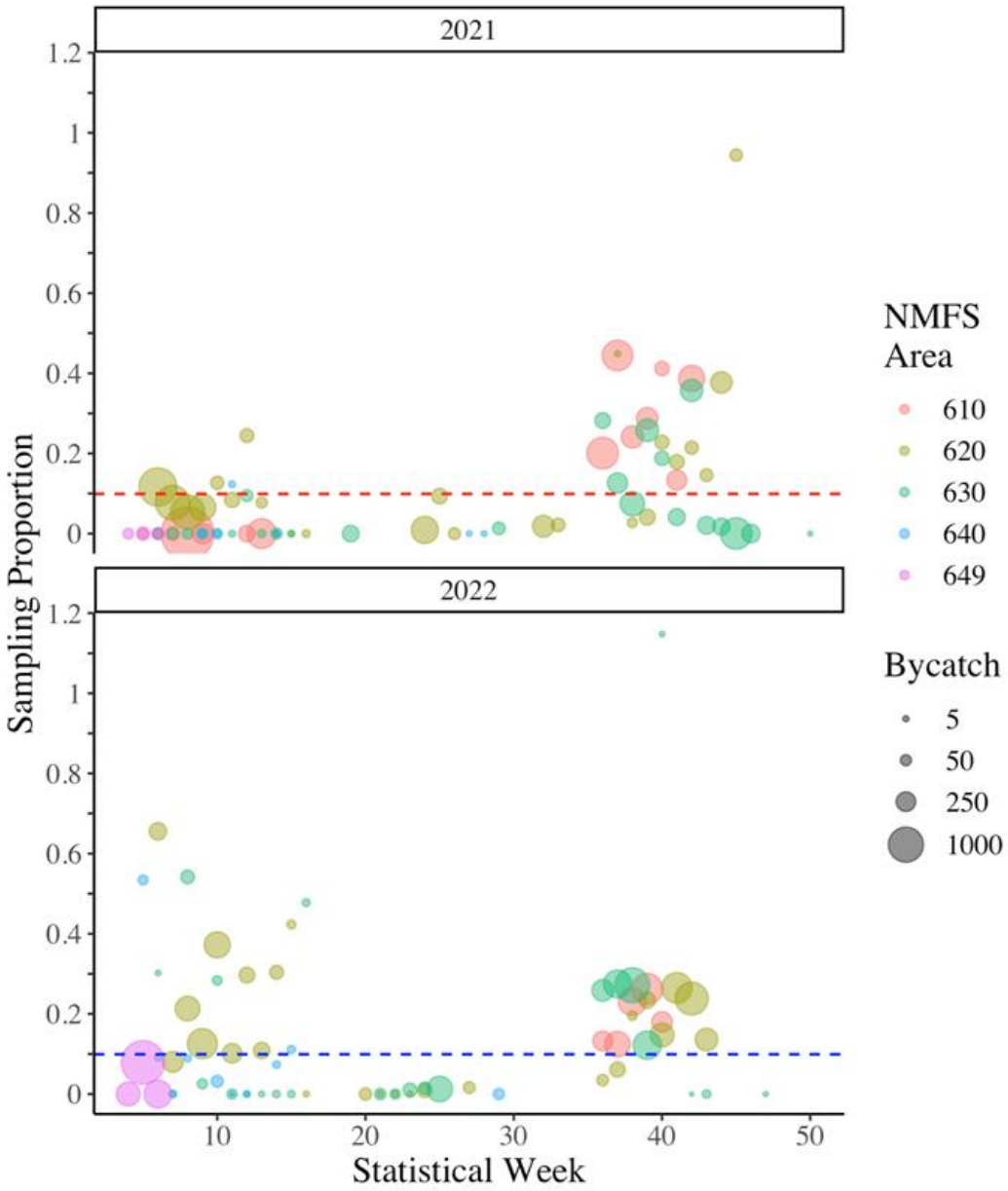

Figure 3. -- Proportion of GOA Chinook salmon bycatch sampled for genetic analysis by statistical week and NMFS Statistical Areas. The size of the circles corresponds to the estimated number of chinook salmon bycatch. The sampling rate exceeded 1 for one NMFS area and week because the total number of genetic samples exceeded the estimated bycatch as estimates are made on a haul level. The dashed lines is the target of 10% (NMFS 2022).

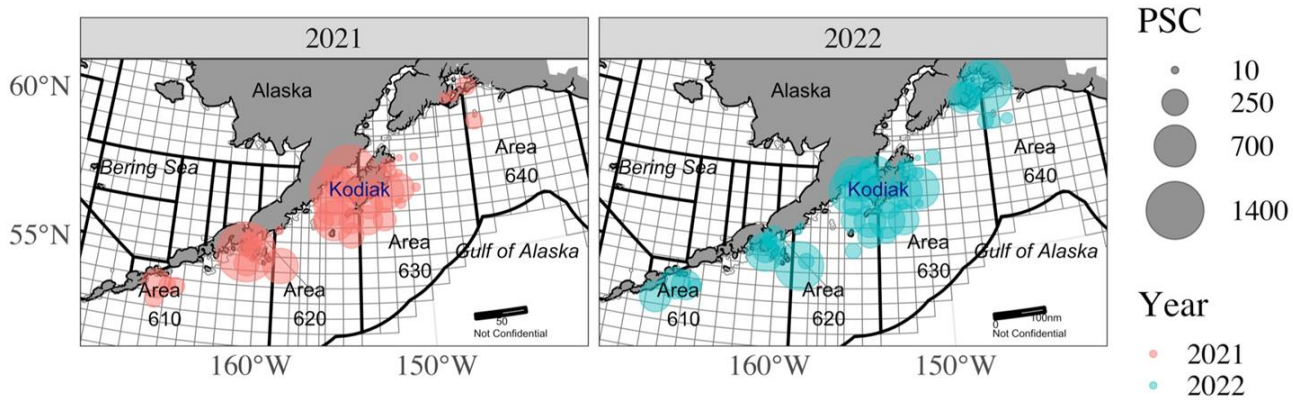

Figure 4. -- Spatial Distribution of 2021 and 2022 GOA Chinook salmon bycatch. The size of the circles corresponds to the number of fish caught.

GENETIC STOCK COMPOSITION - PROCEDURE

DNA was extracted from axillary process tissues with Machery-Nagel (Allentown, PA) kits. 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 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 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 0.5× to remove non-target larger fragments and then 1.2× 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/(GCg), where Cg is the number of baseline populations in region g, and G is the number of regions (i.e., 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 from observer data within AFKIN.

GENETIC STOCK COMPOSITION - RESULTS

GOA Pollock Trawl Fishery

The stock composition results indicate that almost all of the samples from the GOA in both 2021 and 2022 originated from three regions South and East of the Alaska Peninsula. In both 2021 and 2022 93% of the bycatch was comprised of British Columbia region (52% in 2021 and 48% in 2022), West Coast US (27% in 2021 and 30% in 2022), and Coastal Southeast Alaska (14% in 2021 and 16% in 2022; Appendix 2). For the past nine years (2014-2022) 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 2021 and 2022 were similar to estimates from the previous 7 years (Fig. 6).

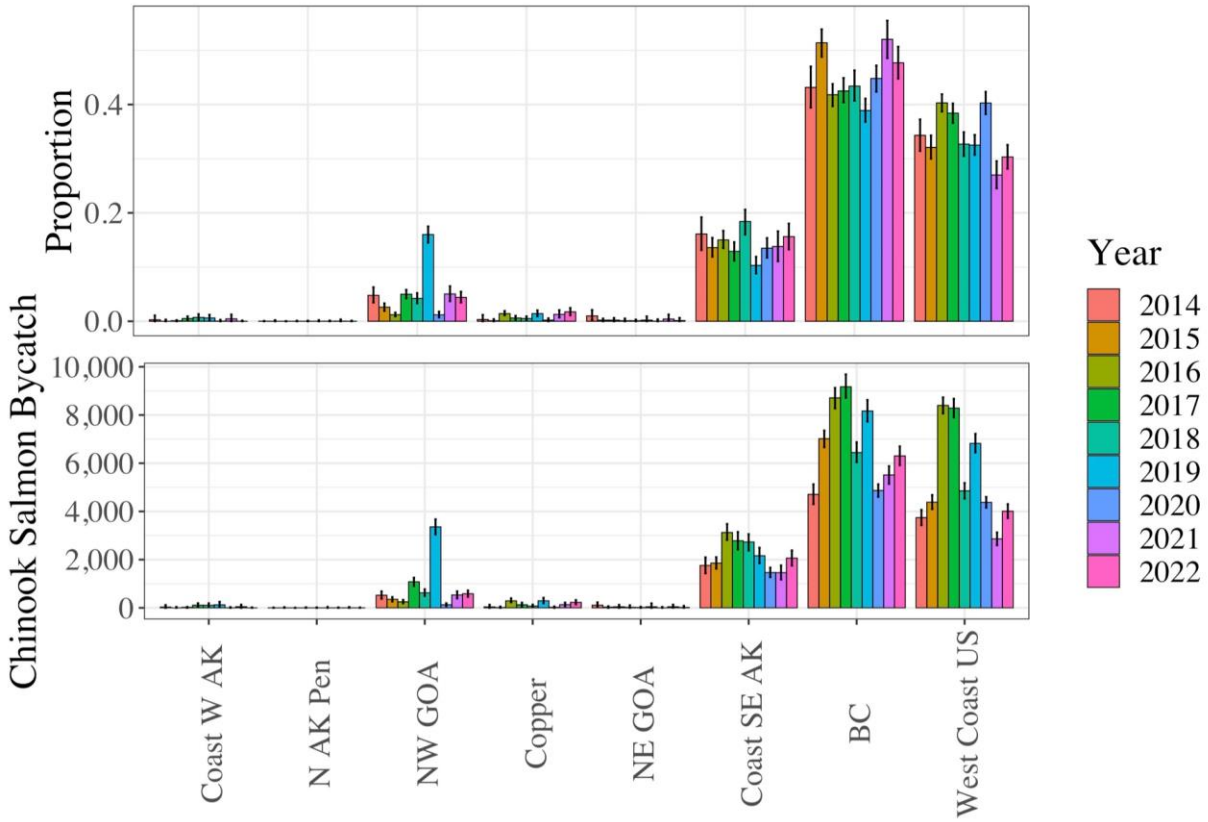

Figure 6. -- Yearly stock composition estimates (2014-2022) with 95% credible intervals of Chinook salmon bycatch based on available genetic samples from the Gulf of Alaska (GOA) pollock trawl fishery. The same genetic baseline and general regional groupings were used in all analyses.

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 seven additional (other than overall) bycatch sample strata (Appendix 2). South of Shumagin Islands Early (prior to statistical week 30), Late (post-statistical week 29), and overall (Fig. 10); Shelikof Strait (Fig. 7); and Southeast Kodiak Island Early (pre-statistical weeks 21), Late (post-statistical week 20), and overall (Fig. 7).

The largest stock composition contributions in the Shumagin Islands overall (Fig. 7) were Chinook salmon from British Columbia (64% in 2021 and 59% in 2022), with smaller contributions from the West Coast US (25% in 2021 and 22% in 2022), Coastal Southeast Alaska (8.5% in 2021 and 13% in 2022; 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%, in the Early and Late seasons, respectively (Appendix 2; Fig 9). No temporal stratified (Early vs. Late) for Shumagin Islands could be made.

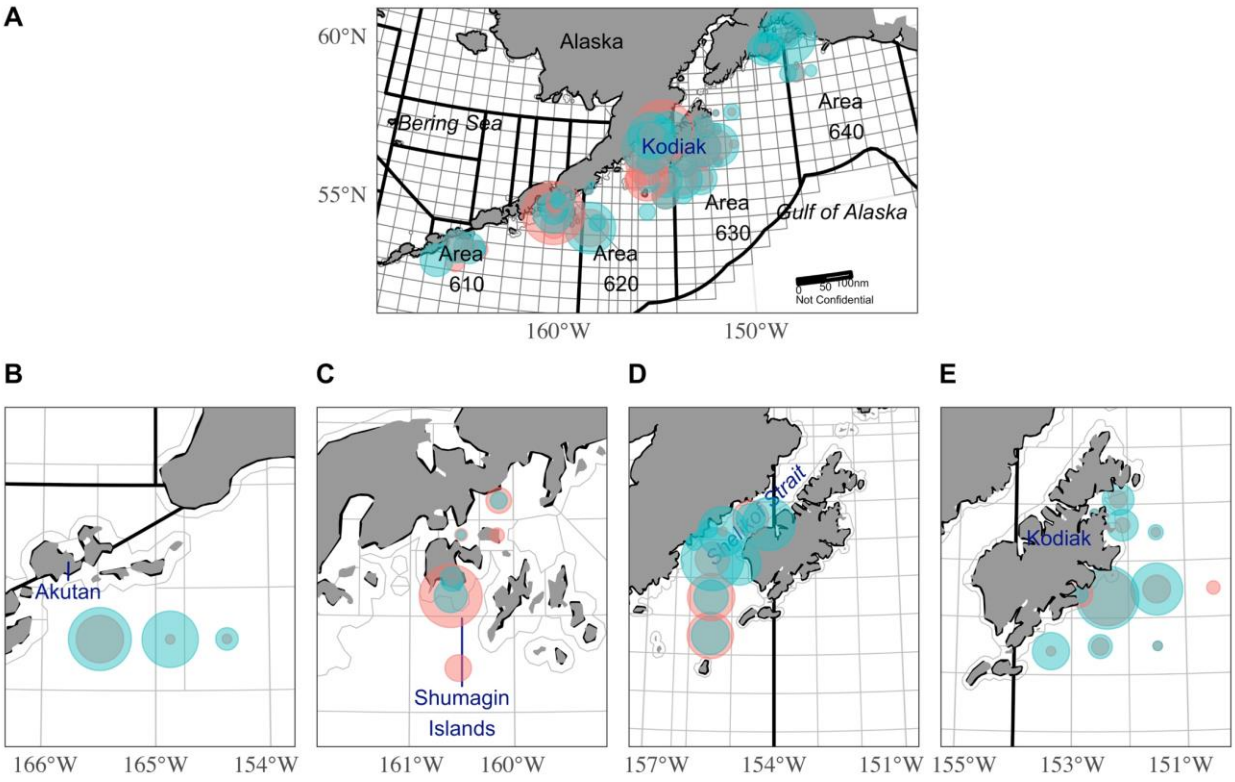

Figure 7. -- Location of sample strata used in comparative stock composition estimates from the 2021 (red) and 2022 (blue) Gulf of Alaska Chinook salmon bycatch. Circles represent the amount of total bycatch (A). Locations (shaded) of the strata used with sample size: (B) S. of Akutan Island (2022 n = 214) (C) Shumagin Islands late (2021 n = 831, 2022 n=1194); (D) Shelikof Strait (2021 n = 325, 2022 n=563); (E) Southeast Kodiak Island (2021 n = 274, 2022 n=344; NMFS 2022).

For the Southeast Kodiak Island overall stratum (Fig. 7), the largest contribution was from British Columbia (55% in 2021 and 49% in 2022), followed by the West Coast US (26% in 2021 and 27% in 2022) and Coastal Southeast Alaska (15% in 2021 and 17% in 2022; Appendix 2; Fig. 8). No Early and Late comparisons could be made for Kodiak Island for either 2021 or 2022.

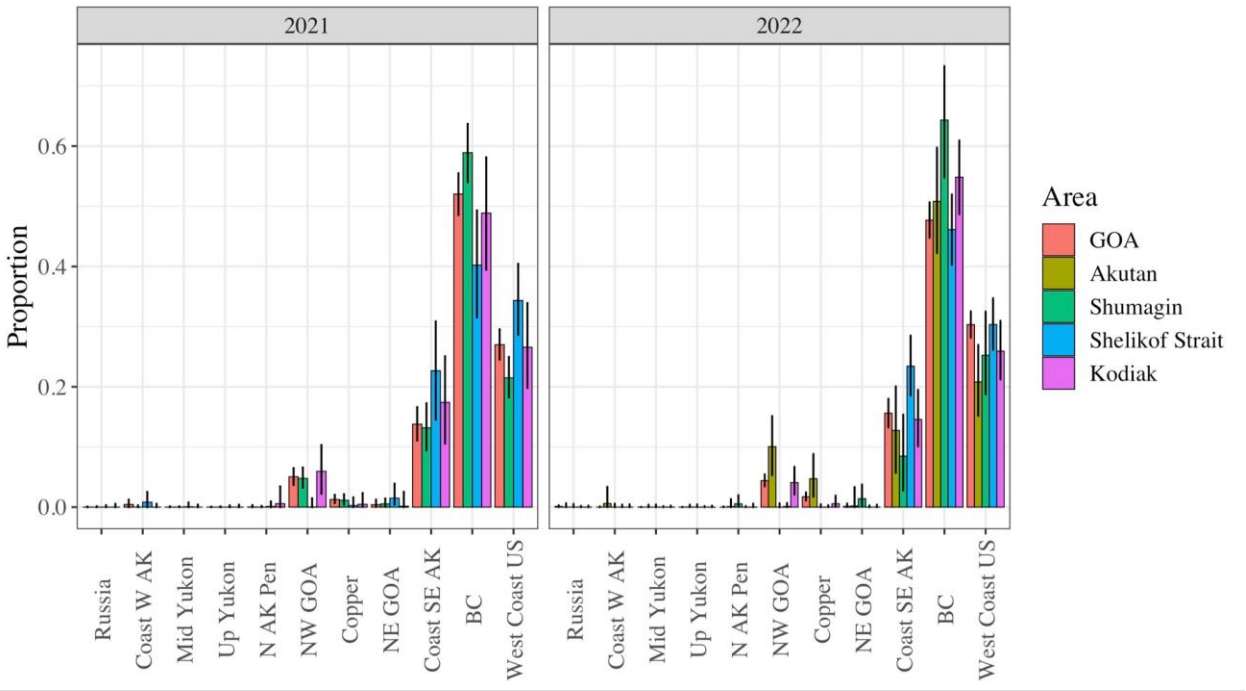

Figure 8. -- Stock composition estimates with 95% credible intervals of Chinook salmon bycatch samples from four area strata from the 2021 and 2022 GOA pollock trawl fishery: GOA overall (2021 1,745, 2022 n=1959 samples); Shumagin Islands late (2021 n = 831, 2022 n=1194); Shelikof Strait (2021 n = 325, 2022 n=563); Southeast Kodiak Island (2021 n= 274, 2022 n=344)..

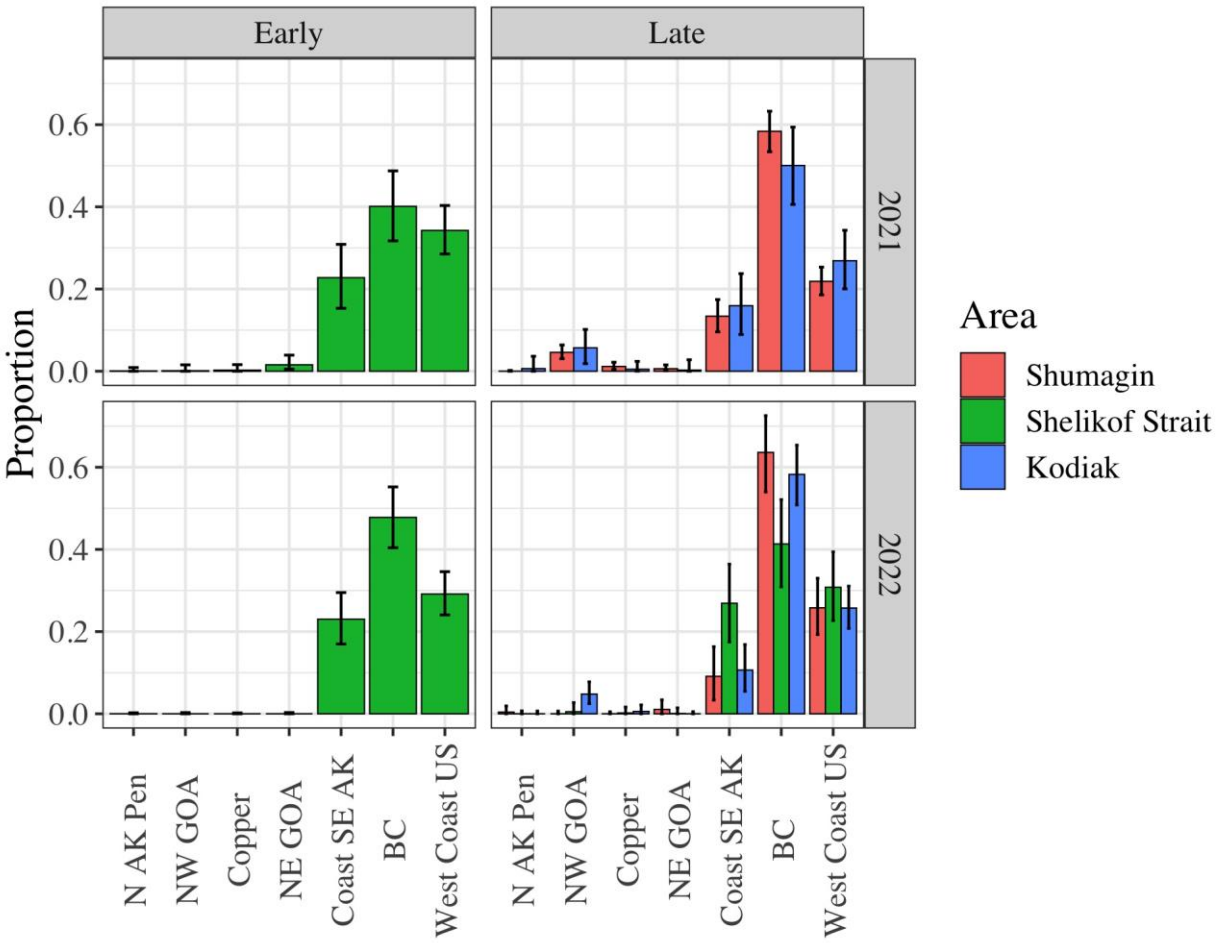

Figure 9. -- Stock composition estimates with 95% credible intervals for samples from the Southeast Kodiak Island strata (Late 2021 n = 268, 2022 n=303), Shelikof Strait strata (Early 2021 n=323, 2022 Early n=408 and Late n=155).and from the Shumagin Islands Late strata (2021 n=831, 2022 n=1,194).

The stock composition for Shelikof Strait was dominated by the same three stocks, however, the proportions were slightly more even. The British Columbia regional group was the largest proportion (40% in 2021 and 46% in 2022), followed by West Coast US (34% in 2021 and 30% in 2022), and Coastal Southeast Alaska (23% in both 2021 and 2022). A comparison could be made for Shelikof early and late time strata; however, no differences were observed.

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), prior to 2020, showed an interesting pattern of the British Columbia and West Coast US cycling from high to lower proportions in alternating years. British Columbia was most prevalent at 61% in 2015, 67% in 2017, and 52% in 2020; while in 2016 and 2018 British Columbia and the 2018 West Coast US had similar proportions all at 42%; with West Coast US alternated from ~20% in 2015 and 2017, to ~45% in 2016 and 2018. That pattern stopped in 2020, and since 2018 the proportion of chinook salmon from the British Columbia regional group has been generally increasing. The stock composition estimates for Shelikof Strait (Appendices 2 and 3; Fig. 11) shows a slight increase in the Southeast Alaska regional group over time while the West Coast regional group contribution has decreased, albeit with high variability among years. Within the Southeast Kodiak strata (Appendices 2 and 3; Fig. 12) there appears to be a slight increase in the British Columbia and associated decrease in West Coast US regional group proportions through time.

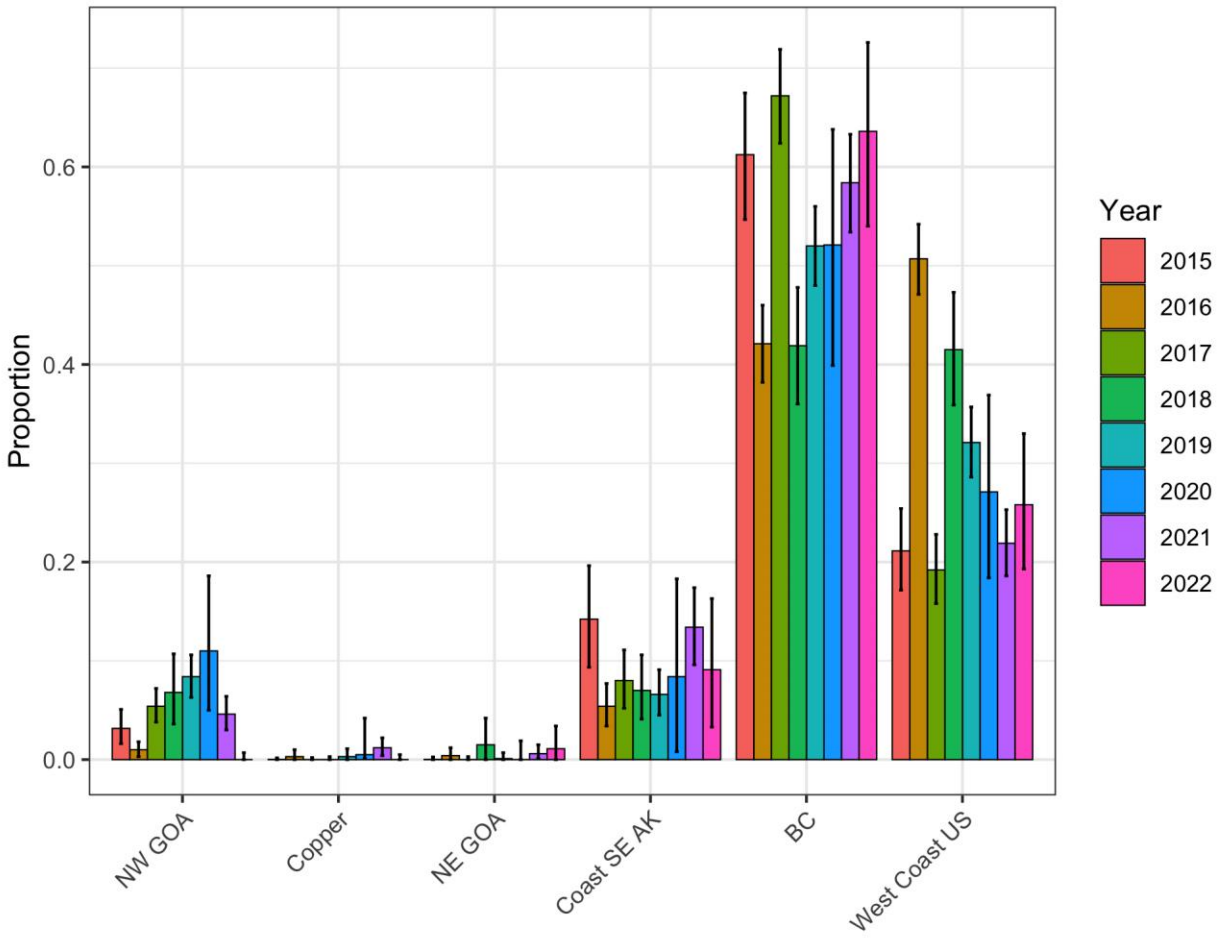

Figure 10. -- Stock composition estimates with 95% credible intervals of Chinook salmon bycatch samples from Shumagin Islands Late (Fig. 7) stratum for 2015-2022 (Appendix 2-4) from the Gulf of Alaska pollock trawl fishery.

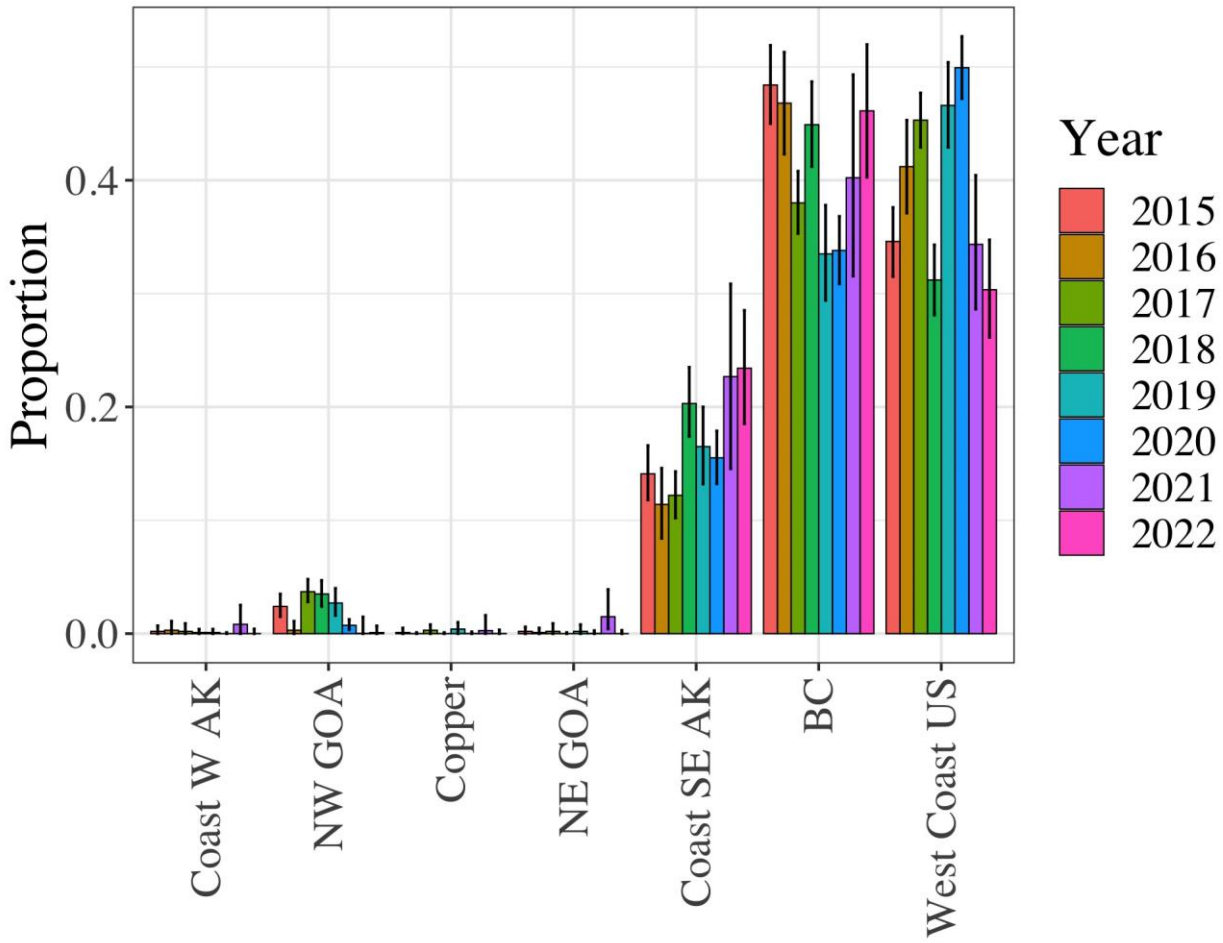

Figure 11. -- Stock composition estimates with 95% credible intervals of Chinook salmon bycatch samples from the Shelikof (Fig. 7) stratum for 2015-2022 (Appendix 32-4) from the Gulf of Alaska pollock trawl fishery.

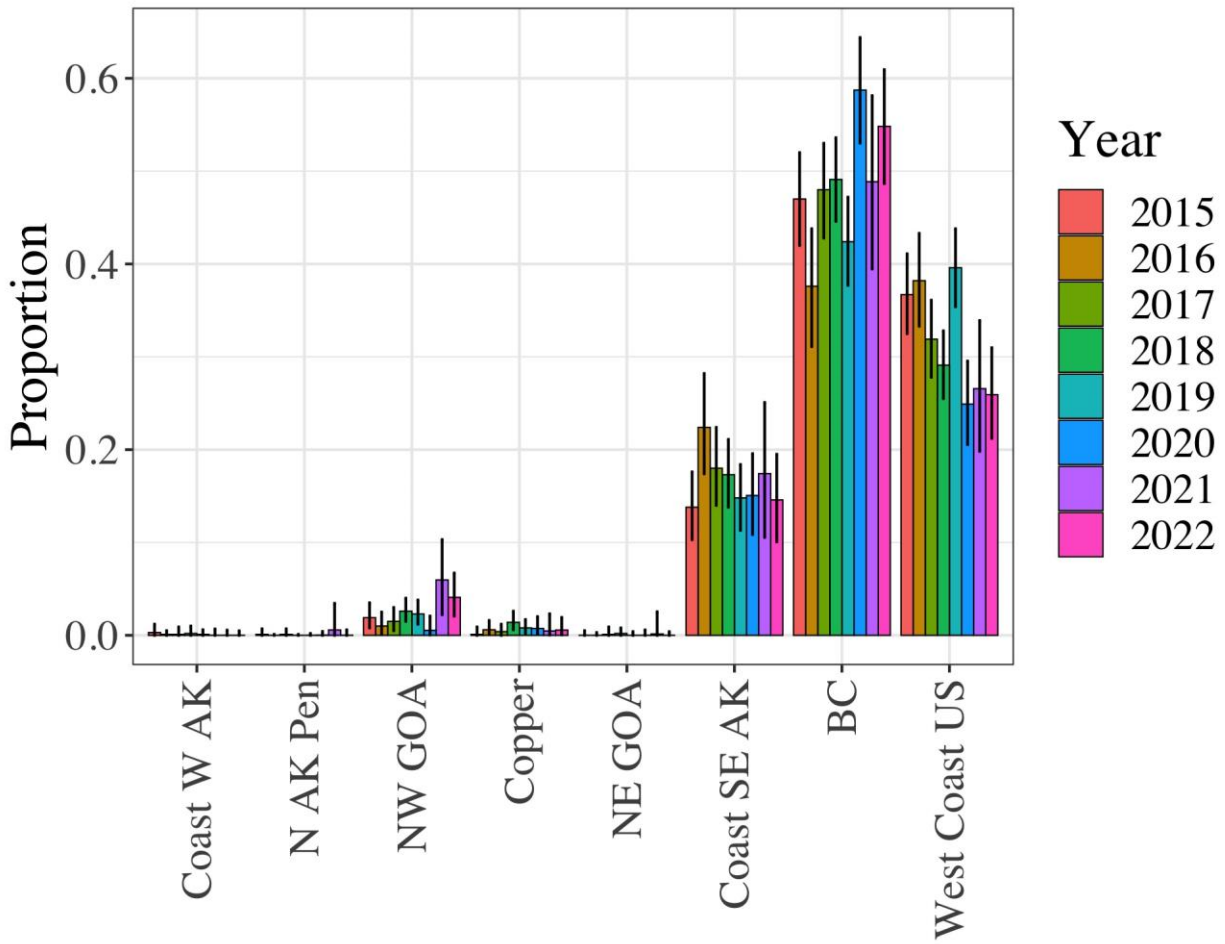

Figure 12. -- Stock composition estimates with BAYES 95% credible intervals of Chinook salmon bycatch samples from Southeast Kodiak (Fig. 7) stratum for 2015-2022 (Appendix 2-4) from the Gulf of Alaska pollock trawl fishery.

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 distilled 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.

GOA Ages

Of the scales that were pressed, 1872 in 2021 and 575 in 2022, 1,075 and 327 were successfully read by the ADF&G MTA Lab (Fig. 14), respectively. The most common freshwater age was 0 (64% in 2021 and 82% in 2022), followed by age 1 (36% in 2021 and 18% in 2022). The most common saltwater age in 2021 was age-1 (55%), but age-2 in 2022 (76%). Interestingly, 13 chinook salmon were age-0 saltwater in 2021. The southernmost stock groups of British Columbia and West Coast US comprised over 58% of each age mixture. Coastal Southeast Alaska was the third most abundant stock group, comprising 16% of age-3 mixtures and 32% of age-4 mixtures. Both the NW GOA and NE GOA stock groups were minor contributors to the age-4 mixtures (6.8% combined in 2021).

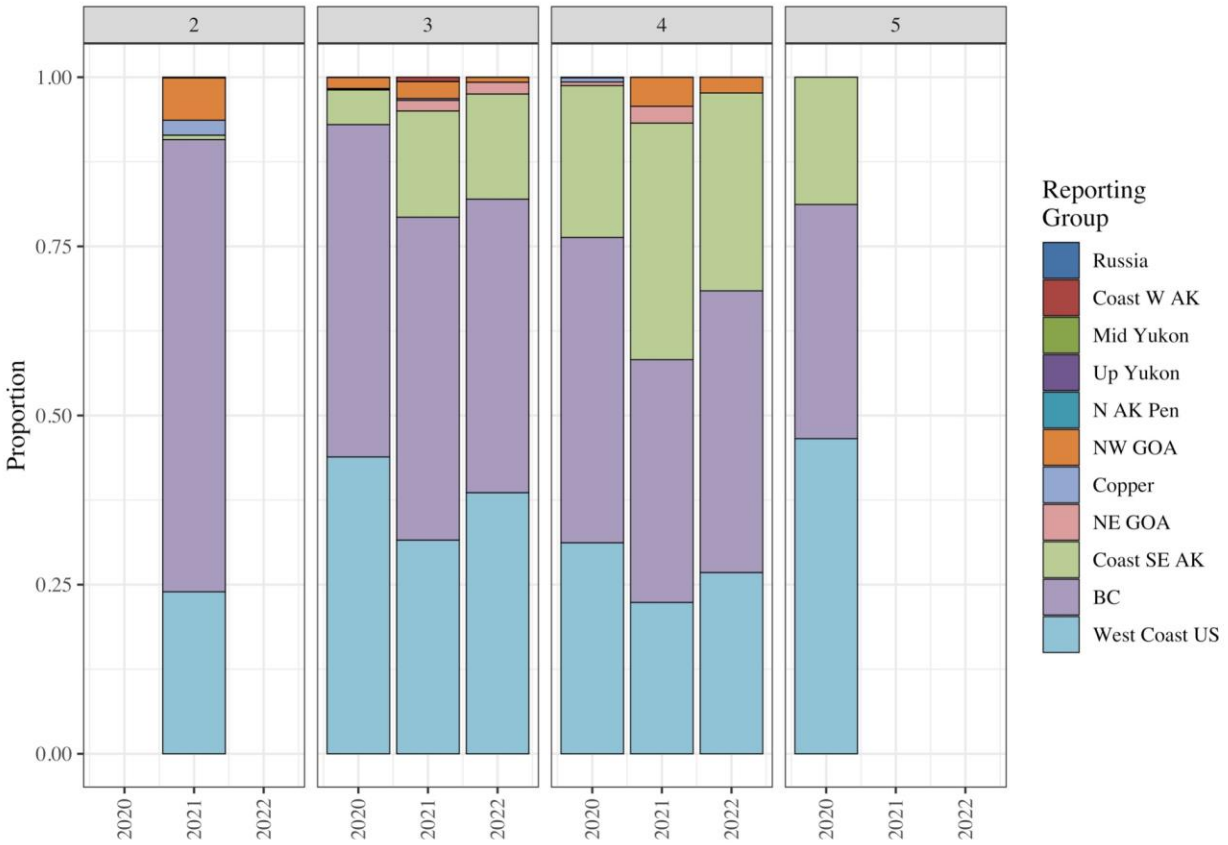

Figure 14. -- Stock composition of the four age classes of GOA Chinook salmon bycatch.

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 genetic samples analyzed from the 2021 and 2022 GOA pollock trawl fishery was ~15% of the total bycatch. The samples in 2021 and 2022 were collected in variable proportions to the overall bycatch (Fig. 3), with differences in spatial and temporal distributions (Fig. 3). A similar sampling protocol has been in place since 2014; comparisons with stock composition estimates prior to 2014 should be interpreted with caution.

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

ACKNOWLEDGMENTS

We are grateful for the help from the AFSC's Fisheries Monitoring and Analysis Division, and the many participating observers who provided genetic samples. Thanks to Rob Ames, Camille Kohler, and Bob Ryznar for developing AKFIN Answer reports that helped us develop new strata for genetic analyses. We also appreciate the work of Bev Agler, Jodi Neil and the rest of the MTA Lab staff for conducting age analysis accurately and efficiently, and Dave Nicolls, ABL, for mounting and pressing the scales.

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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 BAYES stock composition percentage estimates, standard deviations (SD), 95% credible intervals (CI), and estimated numbers of Chinook salmon from the 2021 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 2023). GOA, pollock (upper, left) encompasses other strata. Stock composition estimates may not sum to 100% and stock-specific catch estimates may not sum to the total 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=1,494)				GOA Age 2 (N=281)				GOA Age 3 (N=355)				GOA Age 4 (N=141)			
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	0.10	(0.0,0.3)	0	0.0	0.09	(0.0,0.3)	0	0.0	0.21	(0.0,0.6)
Coast W AK	47	0.4	0.34	(0.0,1.2)	0	0.0	0.15	(0.0,0.4)	2	0.6	0.53	(0.0,2.0)	0	0.0	0.46	(0.0,1.6)
Mid Yukon	0	0.0	0.04	(0.0,0.1)	0	0.0	0.10	(0.0,0.3)	0	0.0	0.14	(0.0,0.4)	0	0.0	0.31	(0.0,1.0)
Up Yukon	0	0.0	0.02	(0.0,0.1)	0	0.0	0.10	(0.0,0.3)	0	0.0	0.08	(0.0,0.2)	0	0.0	0.20	(0.0,0.6)
N AK Pen	2	0.0	0.09	(0.0,0.3)	0	0.1	0.32	(0.0,1.1)	0	0.0	0.15	(0.0,0.5)	0	0.0	0.22	(0.0,0.7)
NW GOA	535	5.0	0.71	(3.7,6.5)	18	6.2	1.50	(3.6,9.5)	9	2.5	1.00	(0.9,4.7)	6	4.3	1.78	(1.5,8.3)
Copper	135	1.3	0.35	(0.7,2.1)	6	2.2	0.97	(0.7,4.4)	1	0.3	0.44	(0.0,1.6)	0	0.0	0.25	(0.0,0.7)
NE GOA	43	0.4	0.32	(0.1,1.2)	0	0.0	0.23	(0.0,0.8)	6	1.6	0.84	(0.4,3.6)	3	2.5	1.84	(0.0,6.8)
Coast SE AK	1,461	13.8	1.41	(11.1,16.6)	2	0.6	1.33	(0.0,4.5)	56	15.7	3.61	(9.3,23.2)	49	35.0	5.50	(24.3,45.8)
BC	5,512	52.0	1.77	(48.6,55.5)	188	66.8	3.34	(60.0,73.1)	169	47.7	4.30	(39.2,55.8)	51	35.9	5.43	(25.6,46.7)
West Coast US	2,861	27.0	1.29	(24.5,29.6)	67	23.9	2.72	(18.8,29.5)	112	31.6	2.74	(26.3,37.0)	32	22.4	3.53	(16.0,29.7)
Total Catch	10,595				281				355				141			

	Southeast Kodiak I. Late (N=198)				Southeast Kodiak Island (N=204)				Shelikof Strait Early (N=296)				Shelikof Strait (N=298)			
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	0.19	(0.0,0.6)	0	0.0	0.17	(0.0,0.5)	0	0.0	0.10	(0.0,0.3)	0	0.0	0.11	(0.0,0.3)
Coast W AK	0	0.0	0.19	(0.0,0.6)	0	0.0	0.19	(0.0,0.6)	33	0.8	0.68	(0.0,2.5)	34	0.8	0.69	(0.0,2.5)
Mid Yukon	0	0.0	0.15	(0.0,0.5)	0	0.0	0.14	(0.0,0.4)	2	0.0	0.22	(0.0,0.8)	2	0.1	0.22	(0.0,0.8)
Up Yukon	0	0.0	0.14	(0.0,0.4)	0	0.0	0.14	(0.0,0.4)	0	0.0	0.10	(0.0,0.3)	0	0.0	0.09	(0.0,0.3)
N AK Pen	9	0.6	1.05	(0.0,3.6)	10	0.6	1.00	(0.0,3.4)	2	0.1	0.26	(0.0,0.9)	4	0.1	0.27	(0.0,0.9)
NW GOA	83	5.7	2.12	(1.8,10.2)	100	6.0	2.05	(2.2,10.3)	4	0.1	0.44	(0.0,1.5)	1	0.0	0.42	(0.0,1.5)
Copper	7	0.5	0.68	(0.0,2.4)	8	0.5	0.66	(0.0,2.3)	11	0.3	0.46	(0.0,1.6)	11	0.3	0.46	(0.0,1.6)
NE GOA	4	0.3	0.77	(0.0,2.8)	2	0.1	0.72	(0.0,2.5)	64	1.6	0.98	(0.5,3.9)	62	1.5	0.99	(0.4,3.9)
Coast SE AK	233	15.9	3.78	(8.9,23.7)	293	17.4	3.71	(10.6,25.1)	925	22.8	4.03	(15.3,30.9)	942	22.7	4.20	(14.5,30.9)
BC	731	50.1	4.80	(40.6,59.4)	822	48.9	4.74	(39.5,58.1)	1,630	40.1	4.40	(31.7,48.8)	1,671	40.2	4.57	(31.5,49.3)
West Coast US	393	26.9	3.63	(20.0,34.3)	447	26.6	3.62	(19.8,33.9)	1,392	34.3	3.01	(28.5,40.3)	1,427	34.3	3.02	(28.6,40.4)
Total Catch	1,461				1,683				4,064				4,154			

	Shumagin Islands Late/All (N=745)				Central GOA (N=697)				Western GOA (N=796)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	0	0.0	0.05	(0.0,0.1)	0	0.0	0.05	(0.0,0.2)	0	0.0	0.05	(0.0,0.1)
Coast W AK	0	0.0	0.09	(0.0,0.3)	17	0.2	0.29	(0.0,1.0)	16	0.5	0.64	(0.0,2.1)
Mid Yukon	0	0.0	0.04	(0.0,0.1)	0	0.0	0.09	(0.0,0.3)	0	0.0	0.07	(0.0,0.2)
Up Yukon	0	0.0	0.04	(0.0,0.1)	0	0.0	0.04	(0.0,0.1)	0	0.0	0.04	(0.0,0.1)
N AK Pen	0	0.0	0.06	(0.0,0.2)	14	0.2	0.33	(0.0,1.2)	0	0.0	0.07	(0.0,0.2)
NW GOA	97	4.6	0.86	(3.0,6.4)	345	4.7	0.96	(2.9,6.7)	161	5.5	1.01	(3.6,7.6)
Copper	25	1.2	0.45	(0.4,2.2)	68	0.9	0.40	(0.3,1.9)	57	2.0	0.59	(0.9,3.3)
NE GOA	13	0.6	0.37	(0.1,1.5)	7	0.1	0.29	(0.0,1.0)	19	0.7	0.47	(0.1,1.9)
Coast SE AK	283	13.4	2.01	(9.6,17.4)	1,310	17.9	2.20	(13.7,22.3)	344	11.7	1.96	(7.9,15.6)
BC	1,234	58.4	2.51	(53.4,63.3)	3,211	43.8	2.58	(38.8,48.9)	1,697	57.7	2.48	(52.9,62.7)
West Coast US	462	21.9	1.73	(18.6,25.3)	2,351	32.1	1.92	(28.4,36.0)	645	21.9	1.68	(18.7,25.3)
Total Catch	2,114				7,323				2,940			

Appendix 3. -- Regional BAYES stock composition percentage estimates, standard deviations (SD), 95% credible intervals (CI), and estimated numbers of Chinook salmon from the 2022 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 2023). GOA, pollock (upper, left) encompasses other strata. Stock composition estimates may not sum to 100% and stock-specific catch estimates may not sum to the total 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=1,948)				South of Akutan (N=214)				GOA Age 3 (N=141)				GOA Age 4 (N=73)			
Region	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI	Est. #	Mean	SD	95% CI
Russia	15	0.1	0.08	(0.0,0.3)	0	0.0	0.20	(0.0,0.7)	0	0.0	0.25	(0.0,0.7)	0	0.0	0.36	(0.0,1.1)
Coast W AK	0	0.0	0.04	(0.0,0.1)	4	0.6	0.99	(0.0,3.4)	0	0.0	0.61	(0.0,2.2)	0	0.0	0.47	(0.0,1.5)
Mid Yukon	0	0.0	0.02	(0.0,0.0)	0	0.0	0.13	(0.0,0.4)	0	0.0	0.23	(0.0,0.7)	0	0.0	0.38	(0.0,1.1)
Up Yukon	0	0.0	0.02	(0.0,0.0)	0	0.0	0.13	(0.0,0.4)	0	0.0	0.27	(0.0,0.8)	0	0.0	0.38	(0.0,1.1)
N AK Pen	0	0.0	0.03	(0.0,0.1)	1	0.1	0.39	(0.0,1.3)	0	0.0	0.35	(0.0,1.1)	0	0.0	0.58	(0.0,1.7)
NW GOA	581	4.4	0.51	(3.4,5.5)	74	10.0	2.51	(5.3,15.2)	1	0.7	1.24	(0.0,4.3)	2	2.3	1.82	(0.3,7.0)
Copper	227	1.7	0.35	(1.1,2.5)	35	4.7	1.82	(1.7,8.8)	0	0.0	0.23	(0.0,0.7)	0	0.0	0.37	(0.0,1.1)
NE GOA	16	0.1	0.17	(0.0,0.6)	1	0.2	0.90	(0.0,3.4)	2	1.7	1.49	(0.5,5.4)	0	0.0	0.43	(0.0,1.3)
Coast SE AK	2,057	15.6	1.22	(13.2,18.0)	94	12.7	3.70	(5.7,20.1)	22	15.5	3.76	(8.5,23.3)	21	29.2	6.93	(16.6,43.9)
BC	6,283	47.7	1.51	(44.8,50.7)	376	50.8	4.48	(42.2,59.8)	61	43.4	5.00	(33.8,53.4)	30	41.6	7.35	(27.2,56.0)
West Coast US	3,995	30.3	1.13	(28.1,32.6)	154	20.8	3.03	(15.2,27.0)	54	38.6	4.51	(30.0,47.6)	20	26.8	5.04	(17.6,37.3)
Total Catch	13,173				741				141				73			

	Shelikof Strait Early (N=397)				Shelikof Strait Late (N=155)				Shelikof Strait (N=552)				Shumagin I. Late/All (N=187)			
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	0.07	(0.0,0.2)	0	0.0	0.23	(0.0,0.7)	0	0.0	0.07	(0.0,0.2)	0	0.0	0.17	(0.0,0.5)
Coast W AK	0	0.0	0.08	(0.0,0.2)	2	0.2	0.57	(0.0,2.0)	0	0.0	0.12	(0.0,0.4)	0	0.0	0.20	(0.0,0.6)
Mid Yukon	0	0.0	0.07	(0.0,0.2)	0	0.0	0.18	(0.0,0.5)	0	0.0	0.05	(0.0,0.2)	0	0.0	0.15	(0.0,0.4)
Up Yukon	0	0.0	0.07	(0.0,0.2)	0	0.0	0.20	(0.0,0.6)	0	0.0	0.05	(0.0,0.2)	0	0.0	0.15	(0.0,0.5)
N AK Pen	0	0.0	0.08	(0.0,0.2)	0	0.0	0.25	(0.0,0.7)	0	0.0	0.06	(0.0,0.2)	5	0.4	0.54	(0.0,1.9)
NW GOA	0	0.0	0.10	(0.0,0.3)	4	0.5	0.77	(0.0,2.7)	3	0.1	0.20	(0.0,0.7)	0	0.0	0.21	(0.0,0.7)
Copper	0	0.0	0.07	(0.0,0.2)	2	0.2	0.48	(0.0,1.6)	0	0.0	0.10	(0.0,0.3)	0	0.0	0.17	(0.0,0.5)
NE GOA	0	0.0	0.10	(0.0,0.3)	1	0.1	0.45	(0.0,1.4)	0	0.0	0.09	(0.0,0.3)	13	1.1	0.93	(0.0,3.4)
Coast SE AK	602	23.0	3.20	(17.0,29.5)	228	26.9	4.80	(17.5,36.4)	811	23.4	2.55	(18.5,28.5)	109	9.1	3.34	(3.3,16.3)
BC	1,250	47.8	3.78	(40.4,55.2)	350	41.3	5.40	(30.9,52.1)	1,598	46.1	2.98	(40.3,52.0)	759	63.6	4.77	(54.0,72.6)
West Coast US	763	29.2	2.69	(24.1,34.6)	261	30.8	4.30	(22.7,39.4)	1,051	30.3	2.19	(26.1,34.7)	308	25.8	3.50	(19.3,33.0)
Total Catch	2,616				848				3,464				1,194			

	Southeast Kodiak I. Late (N=303)				Southeast Kodiak Island (N=344)				Central GOA (N=1515)				Western GOA (N=416)			
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	0.10	(0.0,0.3)	0	0.0	0.09	(0.0,0.3)	11	0.1	0.10	(0.0,0.4)	0	0.0	0.11	(0.0,0.3)
Coast W AK	0	0.0	0.17	(0.0,0.5)	0	0.0	0.15	(0.0,0.5)	0	0.0	0.03	(0.0,0.1)	6	0.2	0.49	(0.0,1.7)
Mid Yukon	0	0.0	0.10	(0.0,0.3)	0	0.0	0.09	(0.0,0.3)	0	0.0	0.02	(0.0,0.1)	0	0.0	0.07	(0.0,0.2)
Up Yukon	0	0.0	0.10	(0.0,0.3)	0	0.0	0.08	(0.0,0.2)	0	0.0	0.02	(0.0,0.1)	0	0.0	0.07	(0.0,0.2)
N AK Pen	0	0.0	0.21	(0.0,0.7)	0	0.0	0.18	(0.0,0.6)	0	0.0	0.03	(0.0,0.1)	4	0.2	0.30	(0.0,1.1)
NW GOA	72	4.8	1.36	(2.5,7.8)	70	4.1	1.19	(2.1,6.7)	331	4.1	0.57	(3.1,5.3)	123	5.3	1.34	(2.8,8.0)
Copper	9	0.6	0.62	(0.0,2.1)	10	0.6	0.54	(0.1,1.9)	120	1.5	0.38	(0.8,2.3)	62	2.7	0.93	(1.1,4.7)
NE GOA	0	0.0	0.16	(0.0,0.5)	0	0.0	0.13	(0.0,0.4)	0	0.0	0.16	(0.0,0.6)	10	0.4	0.55	(0.0,2.0)
Coast SE AK	160	10.6	2.94	(5.5,16.8)	251	14.6	2.42	(10.1,19.5)	1,364	17.0	1.36	(14.3,19.6)	280	12.0	2.58	(6.7,16.9)
BC	876	58.3	3.75	(50.8,65.4)	943	54.8	3.13	(48.7,60.9)	3,653	45.4	1.66	(42.2,48.7)	1,306	56.2	3.31	(49.9,63.0)
West Coast US	387	25.7	2.64	(20.8,31.1)	446	25.9	2.49	(21.2,31.0)	2,568	31.9	1.29	(29.4,34.5)	535	23.0	2.24	(18.8,27.6)
Total Catch	1,504				1,720				8,046				2,325			

Appendix 2. -- Continued

	GOA Inside (N=121)			
Region	Est. #	Mean	SD	95% CI
Russia	1	0.0	0.24	(0.0,0.7)
Coast W AK	0	0.0	0.31	(0.0,1.0)
Mid Yukon	1	0.1	0.39	(0.0,1.3)
Up Yukon	18	0.7	0.82	(0.0,2.9)
N AK Pen	1	0.0	0.26	(0.0,0.8)
NW GOA	0	0.0	0.22	(0.0,0.7)
Copper	1	0.0	0.25	(0.0,0.7)
NE GOA	8	0.3	0.66	(0.0,2.3)
Coast SE AK	800	30.6	4.59	(21.7,39.8)
BC	1,159	44.3	5.40	(34.0,55.2)
West Coast US	628	24.0	4.34	(16.1,33.1)
Total Catch	2,616			

Appendix 4. -- Regional Rubias (2020) or BAYES stock composition percentage estimates, standard deviations (SD), 95% credible intervals (CI), and estimated numbers of Chinook salmon from the 2015-20 GOA pollock fishery, and different strata of the pollock fishery.Sample sizes are adjacent to stratum l designation. Totacatch is the estimated catch from AKFIN reports (NMFS 2023). GOA, pollock (left) encompasses other strata. Stock composition estimates maynot 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.

2020	Gulf of Alaska, pollock (N=2,752)				Shumagin Islands Late (N=100)				Shelikof Strait (N=1,519)				Southeast Kodiak Island (N=463)			
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	0.29	(0.0,0.8)	0	0.0	0.03	(0.0,0.1)	0	0.0	0.08	(0.0,0.2)
Coast W AK	3	0.0	0.08	(0.0,0.3)	5	0.8	1.36	(0.0,4.7)	0	0.0	0.03	(0.0,0.1)	0	0.0	0.19	(0.0,0.7)
Mid Yukon	0	0.0	0.01	(0.0,0.0)	0	0.0	0.29	(0.0,0.8)	0	0.0	0.02	(0.0,0.1)	0	0.0	0.06	(0.0,0.2)
Up Yukon	0	0.0	0.01	(0.0,0.0)	0	0.0	0.29	(0.0,0.8)	0	0.0	0.02	(0.0,0.1)	0	0.0	0.06	(0.0,0.2)
N AK Pen	1	0.0	0.04	(0.0,0.1)	1	0.2	0.89	(0.0,3.0)	0	0.0	0.02	(0.0,0.1)	0	0.0	0.12	(0.0,0.4)
NW GOA	128	1.2	0.28	(0.7,1.8)	77	11.0	3.47	(5.0,18.6)	43	0.7	0.23	(0.4,1.3)	12	0.5	0.61	(0.0,2.1)
Copper	22	0.2	0.16	(0.0,0.5)	4	0.5	1.15	(0.1,4.2)	0	0.0	0.05	(0.0,0.2)	17	0.7	0.55	(0.1,2.0)
NE GOA	2	0.0	0.10	(0.0,0.4)	0	0.0	0.61	(0.0,1.9)	1	0.0	0.08	(0.0,0.3)	0	0.0	0.17	(0.0,0.6)
Coast SE AK	1,464	13.5	0.93	(11.7,15.4)	59	8.4	4.45	(0.8,18.3)	919	15.5	1.20	(13.2,17.9)	341	15.1	2.22	(10.9,19.6)
BC	4,870	44.8	1.24	(42.4,47.2)	365	52.1	6.14	(39.9,63.8)	2,003	33.8	1.53	(30.9,36.8)	1,330	58.7	2.90	(53.0,64.4)
West Coast US	4,377	40.3	1.05	(38.2,42.4)	190	27.1	4.72	(18.4,36.9)	2,959	49.9	1.39	(47.2,52.7)	564	24.9	2.29	(20.5,29.5)
Total Catch	10,867				702				5,926				2,264			
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			

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